APPENDIX G

WATER QUALITY MANAGEMENT PLAN

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Preliminary Water Quality Management Plan (PWQMP)

Project Name:

Katella Ave Industrial

6400 Katella Ave, Cypress CA 90630

Prepared for:

Duke Realty

200 Spectrum Center Drive, Suite 1600

Irvine, CA, 92618

949-797-7038

Prepared by:

WestLAND Group,Inc.

4150 Concours St Suite 100

Ontario, CA 91764

(909) 989-9789

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

Prepared: **03/24/2020**

Revised: **07/02/2020**

Project Owner's Certification

Permit/Application No.		Grading Permit No.	
Tract/Parcel Map No.		Building Permit No.	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract)			

This Water Quality Management Plan (WQMP) has been prepared for Duke Realty. The WQMP is intended to comply with the requirements of the local NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the 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: Adam Schmid			
Title	Senior Development Services Manager		
Company	Duke Reality		
Address	200 Spectrum Center Drive, Suite 1600, Irvine, CA 92618		
Email	adam.schmid@dukerealty.com		
Telephone #	949-797-7038		
Signature		Date	

Project Engineer's Certification

Permit/Application No.		Grading Permit No.	
Tract/Parcel Map No.		Building Permit No.	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract)			

I, _Glenn M. Chung certify that this 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	Glenn M. Chung		
Company	WestLAND Group. Inc.		
Email	GChung@westlandgroup.net		
Telephone #	(909) 989-9789		
Signature		Date	

Registered Engineer's Seal

Contents

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Attachments

Section I Discretionary Permit(s) and Water Quality Conditions

Provide discretionary permit and water quality information. *Refer to Section 2.1 in the Technical Guidance Document (TGD) available from the Orange County Stormwater Program (ocwatersheds.com).*

Project Infomation			
Permit/Application No.	TBD	Tract/Parcel Map No.	TBD
Additional Information/ Comments:	APN: 224-261-04		
Water Quality Conditions			
Water Quality Conditions (list verbatim)			
Watershed-Based Plan Conditions			
Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS.	At this time, there are no approved WIHMPs and TMDLs for the Anaheim Bay-Huntington Harbor watershed of which the Bolsa Chica Channel is a tributary.		

Section II Project Description

II.1 Project Description

Provide a detailed project description including:

- Project areas;
- Land uses; Industrial/ Commercial
- Land cover; Loading Docks, Paved Parking, Industrial Building, Drive Aisle, Side Walk, Landscape
- Design elements; Existing Grades, Landscape, Edge Conditions, Drainage, Landscaped Areas
- A general description not broken down by drainage management areas (DMAs).

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

Description of Proposed Project		
Development Category (Verbatim from WQMP):	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.	
Project Area (ft^2): 971,630	Number of Dwelling Units: ___________	SIC Code: 4214
Narrative Project Description:	The entire project site is bounded by Katella Ave to the North, Holder Street to the East, and the Stanton Storm Channel to the South. The existing site is developed and will be completely demolished. The proposed development will consist of two (2) warehouse buildings located in the north and south areas of the site that will be used for industrial purposes. Each building will have its own dedicated parking areas and loading docks. The buildings will be surrounded by pavement in the parking, drive areas and landscape planters. In addition, a storm drain system will be used in conjunction with an underground CMP detention system and biotreatment BMP to treat the stormwater runoff from the entire site.	

<table>
<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>6.25 acres</td><td>28%</td><td>16.05 acres</td><td>72%</td></tr>
<tr><td>Post-Project Conditions</td><td>3.10 acres</td><td>14%</td><td>19.20 acres</td><td>86%</td></tr>
<tr><td>Drainage Patterns/Connections</td><td colspan="4"><u>Existing Conditions:</u>
An exhibit for the existing conditions had been prepared and may be found in Attachment F in which drainage boundaries can be seen. The existing site has been divided into four drainage areas. Current site drainage sheet flows to nearby gutters, catch basins, and parkway drains. In the northeastern portion of the site (DA1), water runoff will sheet flow and be routed to the storm drain system along Holder Street (7'x4' RCB) through a connection point towards the northeast. In the western portion of the site (DA2), water runoff will sheet flow and be routed to the storm drain system in the southwest portion of the site (42" RCP). In the southeastern portion (DA3) of the site, water runoff will sheet flow and be routed to the storm drain system along Holder Street (7'x4' RCB) through a connection point towards the southeast. Both the 7'x4' RCB Storm Drain along Holder Street and the 42" RCP Storm Drain along the southwest portion of the site outlet to the Stanton Storm Channel. The Stanton Storm Channel discharges to the Bolsa Chica Channel and Anaheim Bay.

<u>Proposed Conditions:</u>
An exhibit for the proposed condition had been developed to determine drainage boundaries and can be found in Attachment F. Seven tributary areas have been implemented to better determine the BMPs that would best mitigate runoff for the proposed development. Each drainage sub-area contains catch basins with filter inserts for pre-treatment where runoff will sheet flow to and be collected. Once the runoff is collected via catch basin, the runoff is routed to an Underground CMP Detention System in the southwest portion of the site. The Underground Detention System is not the point of termination. The water is then directed to a pump where it will be pumped into a Modular Wetland System for biotreatment. Treated water will be directed into the final pump location which will then discharge to the existing 42" storm drain towards the southwest portion of the site. The existing 42" storm drain discharges into the Stanton Storm Channel which discharges to the Bolsa Chica Channel and Anaheim Bay. In the event of high flows, an emergency overflow has been integrated that routes the water directly to the second pump.

As previously stated, the existing and proposed condition were divided into subareas. The areas can be seen on Table 1.1 and Table 1.2 on page 6 of the PWQMP Report. The tables include tributary areas, pervious/impervious areas as well as the percentages where both conditions may be compared.</td></tr>
</table>

Table 1.1: Proposed condition sub-area drainage information.

Drainage Area	Tributary Area (SF)	Impervious Area (SF)	Impervious Area (%)	Pervious Area (SF)	Pervious Area (%)
A	139,838	111,188	80	28,650	20
B	127,357	119,257	94	8,100	6
C	127,691	111,965	88	15,726	12
D	207,784	185,324	89	22,460	11
E	108,881	100,543	92	8,338	8
F	113,140	97,146	86	15,994	14
G	146,939	110,965	76	35,974	24

Table 1.2: Existing condition sub-area drainage information.

Drainage Area	Tributary Area (SF)	Impervious Area (SF)	Impervious Area (%)	Pervious Area (SF)	Pervious Area (%)
DA1 DMA1	211,826	129,346	61	82,480	39
DA2 DMA1	302,640	243,994	81	58,646	19
DA2 DMA2	386,644	315,519	82	71,125	18
DA3 DMA1	70,521	10,413	15	60,108	85

II.2 Potential Stormwater Pollutants

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

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	Driveways, Rooftops, Sidewalks, Paved areas & landscape
Nutrients	E	N	Fertilizers, Waste, & Garbage
Heavy Metals	E	N	Cars, Trucks & Parking Areas
Pathogens (Bacteria/Virus)	E	N	Wild Bird and Pet Waste, Garbage
Pesticides	E	N	Landscape Area
Oil and Grease	E	N	Leaking Vehicles & Parking Areas
Toxic Organic Compounds	E	N	Cars & Trucks
Trash and Debris	E	N	Poorly managed Trash Container & Parking area

II.3 Hydrologic Conditions of Concern

Determine if streams located downstream from the project area are determined to be potentially susceptible to hydromodification impacts. *Refer to Section 2.2.3.1 in the TGD for* NOC *or Section 2.2.3.2 for* <SOC>.

☐ No – Show map

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

HCOCs are considered to exist as the streams located downstream from the project are determined to be potentially susceptible to hydromodification impacts per map figure 2 of TGD (see map attached in Attachment E).

In addition, post-development runoff volume for the 2-yr, 24-hr storm exceeds the pre-development runoff volume for the 2-yr, 24-hr storm by more than 5 percent per calculations in Attachment E.

II.4 Post Development Drainage Characteristics

Describe post development drainage characteristics. *Refer to Section 2.2.4 in the TGD.*

An exhibit for the proposed condition had been developed to determine drainage boundaries and can be found in Attachment F. Seven tributary areas have been implemented to better determine the BMPs that would best mitigate runoff for the proposed development. Each drainage sub-area contains catch basins with filter inserts for pre-treatment where runoff will sheet flow to and be collected. Once the runoff is collected via catch basin, the runoff is routed to an Underground CMP Detention System in the southwest portion of the site. The Underground Detention System is not the point of termination. The water is then directed to a pump where it will be pumped into a Modular Wetland System for biotreatment. Treated water will be directed into the final pump location which will then discharge to the existing 42" storm drain towards the southwest portion of the site. The existing 42" storm drain discharges into the Stanton Storm Channel. In the event of high flows, an emergency overflow has been integrated that routes the water directly to the second pump.

II.5 Property Ownership/Management

Describe property ownership/management. *Refer to Section 2.2.5 in the TGD.*

Property Owner:

Adam Schmid

Duke Realty

200 Spectrum Center Drive, Suite 1600,

Irvine, CA 92618

949-797-7038

Site to be managed and maintained by the Property Owner. This includes maintenance of all BMPs, catch Basins inspections, maintenance of Underground Detention System and Modular Wetland System, irrigation and landscaping, until the property is sold or transferred.

No infrastructure to will be transferred to Public Agencies

Section III Site Description

III.1 Physical Setting

Fill out table with relevant information. *Refer to Section 2.3.1 in the TGD.*

Planning Area/ Community Name	Cypress Corporate Center Specific Plan
Location/Address	6400 Katella avenue, Cypress, CA 90630
Land Use	Industrial building with parking lot
Zoning	Planned community zone (PC2)
Acreage	22.3 ac
Predominant Soil Type	A

III.2 Site Characteristics

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

Precipitation Zone	0.85 inches
Topography	The site topography ranges from 42± feet mean sea level (msl) in the east-central area, to 35± feet msl in the southeastern area of the site. The paved areas of the site gently slope downward to the west, at gradients of 1± percent in the southwestern and east-central areas to gradients of 2 to 3± percent near the northwestern corner of the site. The vacant area east of the warehouse slopes downward to the southeast at a gradient of less than 1± percent.
Drainage Patterns/Connections	The existing site drainage is generally directed as sheet flow to gutters and on-site catch basin. The flow leaves the site through three discharge points: 1. Through a 42" RCP towards the southwestern portion of the site, 2. To an existing catch basin towards the northeastern end of the site which connects to a 7'x4' RCB along Holder Street, and 3. To an existing catch basin towards the

	southeastern portion of the site which connects to a 7′x4′ RCB. Both the 42″ RCP and 7′x4′ RCB discharges to the Stanton Storm Channel.
Soil Type, Geology, and Infiltration Properties	Soil type A

Site Characteristics (continued)	
Hydrogeologic (Groundwater) Conditions	5 to $6^1/_2$ ± feet below ground surface
Geotechnical Conditions (relevant to infiltration)	The soil type is group A which have a high infiltration rate.
Off-Site Drainage	The offsite drainage is directed through an existing 7' x 4' RCB Storm Drain along Holder street and discharge in Stanton Storm Channel, no off-site run-on is anticipated to convey into the site.
Utility and Infrastructure Information	The Site has an existing private water system connected at existing 10" water line at Katella avenue, and sewer system discharging to an existing MH at Katella avenue. The existing utilities is intent to be removed and replaced with new system.

III.3 Watershed Description

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

Receiving Waters	Bolsa Chica Channel, Anaheim Bay
303(d) Listed Impairments	Bolsa Chica Channel: Ammonia (Unionized), Indicator Bacteria, and pH Anaheim Bay: Nickel, PCBs, and Toxicity
Applicable TMDLs	Bolsa Chica Channel: None Anaheim Bay: None
Pollutants of Concern for the Project	Suspended Solid/Sediments, Nutrients, Heavy Metals, Pathogens (Bacteria/virus), Pesticides, Oil & Grease, Toxic Organic Compounds, trash & debris
Environmentally Sensitive and Special Biological Significant Areas	N/A

Section IV Best Management Practices (BMPs)

IV. 1 Project Performance Criteria

Describe project performance criteria. Several steps must be followed in order to determine what performance criteria will apply to a project. These steps include:

- If the project has an approved WIHMP or equivalent, then any watershed specific criteria must be used and the project can evaluate participation in the approved regional or sub-regional opportunities. The local Permittee planning or NPDES staff should be consulted regarding the existence of an approved WIHMP or equivalent.
- Determine applicable hydromodification control performance criteria. *Refer to Section 7.II-2.4.2.2 of the Model WQMP.*
- Determine applicable LID performance criteria. *Refer to Section 7.II-2.4.3 of the Model WQMP.*
- Determine applicable treatment control BMP performance criteria. *Refer to Section 7.II-*3.2.2 *of the Model WQMP.*
- Calculate the LID design storm capture volume for the project. *Refer to Section 7.II-2.4.3 of the Model WQMP.*

<table>
<tr><td colspan="2">(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?</td><td>YES ☐</td><td>NO ☒</td></tr>
<tr><td>If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities.</td><td colspan="3"></td></tr>
</table>

Project Performance Criteria (continued)

If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	• Post-development runoff volume for the two-year frequency storm does not exceed that of the predevelopment condition by more than five percent, and • Time of concentration of post-development runoff for the two-year storm event is not less than that for the predevelopment condition by more than five percent
List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	• 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. • LID BMP's must be designed to: o Biotreat, on-site, additional runoff, as feasible, up to 80 percent average annual capture efficiency (cumulative, retention, plus bio-treatment), and if necessary • On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV
List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP)	LID Performance will be met through Biotreatment provided on-site
Calculate LID design storm capture volume for Project.	Redevelopment Project, 85th percentile, 24-hr storm depth = 0.85 inches Drainage Area = 22.3 Acres Imperviousness = 86% Design Infiltration Rate = 0 DCV = (22.3 AC)x(0.86*0.75+0.15)x(0.85 in)x(43,560 sf/ac)x(1/12 in/ft) = 54,757 cu-ft

IV.2. SITE DESIGN AND DRAINAGE PLAN

Describe site design and drainage plan including

- A narrative of site design practices utilized or rationale for not using practices;
- A narrative of how site is designed to allow BMPs to be incorporated to the MEP
- A table of DMA characteristics and list of LID BMPs proposed in each DMA.
- Reference to the WQMP plot plan.
- Calculation of Design Capture Volume (DCV) for each drainage area.
- A listing of GIS coordinates for LID and Treatment Control BMPs (unless not required by local jurisdiction).

Refer to Section 2.4.2 in the TGD.

Site Planning

The proposed site will be redeveloped and the impervious ratio will increase. A geotechnical report had been compiled which served as information choosing which BMP's would be best utilized. Groundwater was determined to be 5-6.5' below finished surface which then eliminated infiltration BMP options. A BMP has been placed into the southwestern portion of the site to which onsite flows will be routed towards. The offsite drainage is directed through an existing 7' x 4' RCB Storm Drain at Holder street and discharged in Stanton Storm Channel, so no off-site run-on is anticipated to convey into the site. Due to the contaminated soils, hydrologic source controls that promote natural infiltration were not incorporated into the proposed development.

Protect & Restore Natural Areas

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

Minimize Land Disturbance

The entire site will essentially be redeveloped. The current site is an industrial site which stored, processed and transported chemicals. The site will be redeveloped entirely to better support the daily activities for future day to day operations. The site design BMP's considered for the proposed development were considered based off of current and proposed conditions to ensure all proposed infrastructure is designed efficiently. Landscaping will be provided throughout the redevelopment area as planters and islands throughout the site.

Minimize Impervious Area

Impervious areas will be minimized to the maximum extent practicable. The proposed site requires large areas for loading docks. Landscape was implemented where feasible and was considered to its maximum extent during the design process.

IV.3 LID BMP SELECTION AND PROJECT CONFORMANCE ANALYSIS

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

IV.3.1 Hydrologic Source Controls

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

Name	Included?
Localized on-lot infiltration	☐
Impervious area dispersion (e.g. roof top disconnection)	☒
Street trees (canopy interception)	☐
Residential rain barrels (not actively managed)	☐
Green roofs/Brown roofs	☐
Blue roofs	☐
Impervious area reduction (e.g. permeable pavers, site design)	☒
Other: Re-vegetate disturbed areas (Including planting and preservation of drought tolerant vegetation, Site Design)	☒
Other: Maximize natural infiltration capacity; Including improvement and maintenance of soil	☒
Other: Minimize impervious areas	☒
Other:	☐
Other:	☐
Other:	☐
Other:	☐
Other:	☐

The proposed BMPs are designed to be able to capture and treat the full DCV, so calculations for the HSCs are not required. However, the following HSCs have been selected for use on this project:

Impervious Area Dispersion
Where feasible, runoff from rooftops will be directed towards pervious areas.

Impervious Area Reduction
Impervious areas will be reduced to the maximum extent possible, and landscape was implemented where feasible.

Re-vegetate disturbed areas
Disturbed area will be revegetated to stabilize the soil and reduce runoff.

Maximize natural infiltration capacity
The landscape and soil will be maintained to maximize the natural infiltration capacity.

Minimize impervious areas
Impervious areas will be minimized to the maximum extent practicable. The proposed site requires large areas for loading docks. Landscape was implemented where feasible and was considered to its maximum extent during the design process.

IV.3.2 Infiltration BMPs

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

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:	☐

Show calculations below to demonstrate if the LID Design Strom Capture Volume can be met with infiltration BMPs. If not document how much can be met with infiltration and document why it is not feasible to meet the full volume with infiltration BMPs.

Infiltration BMPs are not considered feasible for the proposed project site due to high ground water levels. Ground water is reported to be approximately 5-6.5 feet below finished surface therefore concluding infiltration will not be a feasible option for the project site. Refer to the Geotechnical Report in Attachment B and Table 2.7 in Attachment E for more information.

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, describe any evapotranspiration, rainwater harvesting BMPs. <Delete or leave blank if not used>

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:	☐

Show calculations below to demonstrate if the LID Design Strom Capture Volume can be met with evapotranspiration, rainwater harvesting BMPs in combination with infiltration BMPs. If not document how much can be met with either infiltration BMPs, evapotranspiration, rainwater harvesting BMPs, or a combination, and document why it is not feasible to meet the full volume with either of these BMPs categories.

Rainwater harvesting BMPs are not feasible for this project. Refer to worksheet J in Attachment E for more information.

IV.3.4 Biotreatment BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, and/or evapotranspiration and rainwater harvesting BMPs, describe biotreatment BMPs. Include sections for selection, suitability, sizing, and infeasibility, as applicable. <Delete or leave blank if not used>

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: Modular Wetland System	☒
Other: Underground Detention System	☒

Show calculations below to demonstrate if the LID Design Strom Capture Volume can be met with infiltration, evapotranspiration, rainwater harvesting and/or biotreatment BMPs. If not document how much can be met with either infiltration BMPs, evapotranspiration, rainwater harvesting BMPs, or a combination, and document why it is not feasible to meet the full volume with either of these BMPs categories.

Infiltration and rainwater harvesting BMPs are not feasible for this project per Table 2.7 and Worksheet J in Attachment E. Therefore, the Biotreatment BMPs (Underground CMP Detention System and Modular Wetland System) will need to meet the entire DCV.

V_{MWS} = 55,570 cu-ft per calculations in Attachment E for an MWS-L-8-24 with an HGL Height of 6.5 feet.

V_{CMP} = 54,840 cu-ft per manufacturer calculations in Attachment E.

The volumes for both the MWS and Underground CMP Detention System are able to accommodate the entire DCV of 54,757 cu-ft. For DCV calculations, please refer to Worksheet B in Attachment E.

IV.3.5 Hydromodification Control BMPs

Hydromodification Control BMPs	
BMP Name	**BMP Description**
Modular Wetland System	BIO-7: Proprietary Biotreatment
Underground Detention System	Proprietary Underground Detention System

HCOC Calculation Summary Table:

Pre-Development Condition:

Drainage Area	Area (ac)	Peak Runoff Q_2 (cfs)	T_c (min.)	2-yr, 24-hr. Runoff Volume (cu-ft)
DA1 DMA1	4.86	9.57	5.14	0
DA2 DMA1	6.95	8.37	11.87	44,775
DA2 DMA2	8.88	11.61	10.34	37,614
DA3 DMA1	1.62	2.73	6.70	2,618
Total				85,007

Post-Development Condition:

Drainage Area	Area (ac)	Peak Runoff Q_2 (cfs)	T_c (min.)	2-yr, 24-hr. Runoff Volume (cu-ft)
A	3.21	5.01	7.66	20,647
B	2.92	4.52	7.75	19,489
C	2.93	5.38	5.79	19,240
D	4.77	8.93	5.61	31,442
E	2.50	5.19	4.69	0
F	2.60	4.92	5.51	16,997
G	3.37	6.29	5.63	21,506
Total:				129,321

HCOC Required Volume

Post-Development Runoff Volume 2-yr, 24-hr (cu-ft)	0.95*Post-Development Runoff Volume 2yr, 24-hr (cu-ft)	Pre-Development Runoff Volume 2-yr, 24-hr (cu-ft)	HCOC Required Volume V_{HCOC} (cu-ft)
129,321	122,855	85,007	37,848

Note:

1. Volume Reduction needed to meet HCOC Requirement: V_{HCOC} = (Post-Volume)*0.95 – (Pre-Volume)
2. Total Design Capture Volume (Section IV.1) = 54,757 > Total HCOC Required Volume = 37,848 cu-ft
3. In this case, DCV is the controlling stormwater design volume
4. Refer to Attachment E for calculations for Q_2, T_c, and Volume

IV.3.6 Regional/Sub-Regional LID BMPs

Regional/Sub-Regional LID BMPs

IV.3.7 Treatment Control BMPs

Treatment Control BMPs	
BMP Name	**BMP Description**
Catch Basin Filter Insert	PRE-2: Catch Basin Insert

Table 4.1: BMP Filter Sizing (Refer to Catch Basin Map in Attachment F)

DMA	Q_2 (cfs)	# Catch Basins	Q_2 at each catch Basin (cfs)	Model	$Q_{BMP\ Capacity}$ (cfs)
A	5.00	2	2.50	BIO-GRATE-MLS-18-18-18	2.51
B	4.52	2	2.26	BIO-GRATE-MLS-18-18-18	2.51
C	5.38	2	2.69	BIO-GRATE-MLS-18-18-18	2.51
D	8.93	4	2.23	BIO-GRATE-MLS-18-18-18	2.51
E	5.19	5	1.04	BIO-GRATE-MLS-18-18-18	2.51
F	4.92	2	2.46	BIO-GRATE-MLS-18-18-18	2.51
G	6.92	3	2.31	BIO-GRATE-MLS-18-18-18	2.51

IV.3.8 Non-structural Source Control BMPs

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

Non-Structural Source Control BMPs

Identifier	Name	Check One		If not applicable, state brief reason
		Included	Not Applicable	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	
N6	Local Industrial Permit Compliance	☒	☐	
N7	Spill Contingency Plan	☐	☒	No spill contingency expected
N8	Underground Storage Tank Compliance	☐	☒	No tanks exist
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous material in the site
N10	Uniform Fire Code Implementation	☒	☐	
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☒	☐	
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	No Gasoline outlet exist

IV.3.9 Structural Source Control BMPs

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

Structural Source Control BMPs

Identifier	Name	Check One		If not applicable, state brief reason
		Included	Not Applicable	
S1	Provide storm drain system stenciling and signage	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	No Hazardous material need to be storaged
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	☐	☒	The site has no slope
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☒	Not applicable
S6	Dock areas	☒	☐	
S7	Maintenance bays	☐	☒	No maintenance should be performed in the site
S8	Vehicle wash areas	☐	☒	No car wash in the site
S9	Outdoor processing areas	☐	☒	don't exist
S10	Equipment wash areas	☐	☒	No equipment wash will be performed in the site
S11	Fueling areas	☐	☒	No fueling should be performed in the site
S12	Hillside landscaping	☐	☒	The site is level
S13	Wash water control for food preparation areas	☐	☒	No food prepartaion should be performed in the site
S14	Community car wash racks	☐	☒	No car wash should be performed in the site

IV.4 ALTERNATIVE COMPLIANCE PLAN (IF APPLICABLE)

IV.4.1 Water Quality Credits

Determine if water quality credits are applicable for the project. *Refer to Section 3.1 of the Model WQMP for description of credits and Appendix VI of the TGD for calculation methods for applying 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>☐Redevelopment projects that reduce the overall impervious footprint of the project site.</td><td colspan="3">☐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"></td></tr>
</table>

IV.4.2 Alternative Compliance Plan Information

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

Section V Inspection/Maintenance Responsibility for BMPs

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

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
Education for Property Owners, Tenants and Occupants	Property Owner/ POA	The current property owner/POA shall be familiar with the contents of the WQMP and the County & City Ordinance and brochures and furnish copies of city and County BMP factsheets to all future property owners.	Education materials should be kept onsite for reference.
Activity Restriction	Property Owner/ POA	Property owners and their tenants or occupants shall not be allowed to discharge chemicals, chemical residues, wastewater or other prohibited discharges listed in the City stormwater Ordinance, to the outside, paved areas of the site; or store chemicals or other pollutant sources in a non-spill contained or covered facilities as stipulated in the CC&Rs.	The property owners / POA shall control the discharge of stormwater pollutants from this site.
Common Area Landscape Management	Property Owner/ POA/ Tenants	Maintain landscape area vegetation, slope protection and grades, adjacent to hardscape and prevent discharges of landscape maintenance waste into storm drains.	Weekly

BMP Maintenance	Property Owner/ POA/ Tenants	The POA shall inspect for standing water in the water retention/infiltration basins, 48 hours after storm events. BMP maintenance shall be performed per the manufacturer recommendations, as needed to restore free drainage.	Quarterly and within 48 hours following a significant storm event to verify there is no standing water in the chambers and minimize stagnation and vector issues
Title 22 CCR Compliance	Property Owner/ POA	The proposed development does not include the use of hazardous materials. The POA will file appropriate hazardous mater ial disclosures, if any storage is conducted, an d must comply with all Title 22 CCR, Chapter 2 9 regulations.	Yearly and when new tenants occupy the facility
Spill Contingency Plan	Tenants	Building operators shall prepare specific plans based on materials on site for the cleanup of spills. Plans shall mandate stock piling of cleanup materials, notification of agencies, disposal, documentation, etc.	Shall be implemented with new tenants and updated yearly to comply with new standards.
Uniform Fire Code Implementation	Property Owner/ POA	The current owners or the future POA shall require all fire code requirements to be implemented at this project site.	Yearly and when new tenants occupy the facility
Common Area Litter Control	Property Owner/ POA	The property owners, POA and their contractor shall pick up litter and sweep and clean the existing trash enclosure weekly. Litter control shall be enforced in order to remove potential stormwater contamination before anticipated storm events. The HOA shall contract with a refuse company to have the dumpsters emptied on a weekly basis, at a minimum.	Trash pickup once per week. Trash enclosure should be kept clean from litter and be swept on a weekly basis.

Employee Training	Property Owner/ POA/ Tenants	The POA shall require all maintenance contractors to train their employees in stormwater BMP implementation. Tenants shall also ensure all new employees are trained at the start of their employment.	Yearly and when new tenants occupy the facility
Housekeeping of Loading Docks	Property Owner/ POA/ Tenants	Sweep and clear debris from dock areas to remove potential stormwater contaminates especially prior to anticipated storms.	Monthly/ Weekly during rainy season which begins Oct 1st (October 1st – May)
Common Area Catch Basin Inspection	Property Owner/ POA	The on-site catch basins shall be inspected monthly during the rainy season which begins Oct 1st (October 1st -May) and before and after each storm to ensure proper operation. The HOA shall contract with a qualified landscape contractor to inspect and clean out accumulation of trash, litter and sediment and check for evidence of illegal dumping of waste materials into on-site drains.	Quarterly inspections during the rainy season which begins Oct 1st (October 1st-May) and before and after each storm to ensure proper operation.
Street Sweeping Private Streets and Parking Lots	Property Owner/ POA	Street sweeping shall be implemented within streets and pavement areas.	Bi-Weekly
Provide Storm Drain System Stenciling and Signage	Property Owner/ POA	A painted message "No Dumping-Drains to River" shall be placed on each catch basin at the end of construction. The message shall be inspected and repainted.	Twice Annually

Design and Construct Trash and Waste Storage Areas to Reduce Pollutant Introduction	Construction Superintendent	The trash enclosure is designed to divert all flows around the dumpsters. Trash enclosure shall comply with CASQA SD-32 and shall have doors and a solid roof.	During Construction
Use Efficient Irrigation Systems & Landscape Design	Property Owner/ POA	The irrigation system will include devices to prevent low head drainage, overspray and run off through the use of pressure regulating devices, check valves, rain shutoff valves, flow sensors, pressure drop sensors, proper spacing, low precipitation emission devices and ET or weather-based controllers. Landscape and irrigation shall be consistent with the State Model Water Efficient Landscape Ordinance and the city landscape standards. Plants installed will be arranged according to similar hydrozones and meet the required water budget for the site.	Inspected Weekly after each landscape procedure
Protect Slopes and Channels and Provide Energy Dissipation	Construction Superintendent/ Property Owner/ POA	All slopes shall be hard lined, rip rapped or vegetated to provide erosion protection and prevent sediment transport.	During Construction/ Post Construction
Loading Docks	Property Owner/ POA/ Tenants	Sweep and clear debris from dock areas to remove potential stormwater contaminates prior to anticipated storms. Litter control and clean up procedures are required to reduce the amount of pollutants.	Weekly

BioClean Modular Wetland System (1 EA)	Property Owner/ POA	Remove trash from screening device, remove sediment from separation chamber, replace cartridge filter media, replace drain down filter media, trim vegetation. Refer to manufacturer's maintenance plan.	Prior to the start of the rainy season which begins Oct 1st, at the end of the rainy season (May), and Twice Annually/ Follow Manufactures Maintenance Plan
EBARA Submersible Sump/Drainage Pump (2 EA)	Property Owner/POA	Remove accumulated trash and wipe off water and dirt. Refer to manufacturer's maintenance plan.	Quarterly and within 48 hours following a significant storm event
Contech Underground CMP Detention System (1 EA)	Property Owner/POA	Cleaning of accumulated trash, debris, and sediment as determined by inspections. Cleaning is recommended during dry weather. Systems should be cleaned when inspection reveals that accumulated sediment or trash is clogging the discharge orifice. See manufacturer recommendations for additional maintenance activities.	Quarterly and after a significant storm event to verify there is no standing water in the chambers
BioClean Catch Basin Filter Inserts (20 EA)	Property Owner/POA	Visually inspect filter for debris buildup. Removal can be accomplished by vac-truck or other equally effective method. See manufacturer recommendations for additional maintenance activities.	Quarterly and within 48 hours following a significant storm event

The annual cost of maintenance for the proposed BMPs is estimated to be around: $4,480

BioClean Modular Wetland System: $1,400

BioClean Catch Basin Filter Inserts: 20 ea x $79 = $1,580

Pumps: $250 + 2 ea x $200 ($500 for one (1) replacement pump every 2.5 years) = $650

Underground CMP Detention System: $250 + $600 ($3000 every 5-10 years) = $850

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 <optional – delete if not used>

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 (ocwatersheds.com) for a library of materials available. For the copy submitted to the Permittee, only attach the educational materials specifically applicable to the project. Other materials specific to the project may be included as well and must be attached.

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

Attachment A

Educational Materials

Engine and Parts Cleaning

- Clean parts in a self-contained unit, solvent sink, or parts washer to prevent solvents and grease from entering a sewer or storm drain.
- Allow parts to drain over a contained area, rather than allowing materials to drip or spill onto the floor. Never discharge the rinse solution into the storm drain or sanitary sewer system.
- Inspect part-washing units daily for leaks and make repairs immediately.
- Use water-based cleaning solutions instead of solvents. Recycle used solutions through a licensed hazardous waste hauler.
- Avoid using hose-off degreasers and never allow runoff to enter the street, gutter or storm drain. Instead, brush off loose debris and use damp rags to wipe down parts. Clean used rags through a rag service or dispose of them as hazardous waste.

Storage

- Materials and waste such as vehicle parts, fuels, solvents, batteries and oils should be stored off the ground and in areas where they will not be exposed to rainwater.
- Contain cracked batteries to prevent hazardous spills.
- If possible, provide overhead coverage for all outside hazardous materials or waste storage areas. If overhead coverage is not available, cover stored materials with an impervious material prior to a rain event.
- Label waste containers and drums in accordance with all local, state and federal laws and regulations. This will also help remind employees to separate wastes and to recycle them.
- Store liquid waste (hazardous or otherwise) in covered, labeled containers.

Waste Recycling and Disposal

- When possible, recycle and reuse solvents, paints, oil filters, antifreeze, motor oil, batteries, metal scraps, water-based paints, used tires, paper, cardboard, container glass, aluminum, tin, water and lubricants. For a list of recycling locations in your area, visit **www.ciwmb.ca.gov/recycle**.
- Combining different types of hazardous waste will limit your recycling options and can be dangerous. A licensed hazardous waste hauler can provide information on hazardous waste storage and disposal costs.

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common automotive activities can lead to water pollution if you are not careful. Automotive work areas must be maintained to ensure that oil, gas, antifreeze, lubricants, grease and other fluids do not enter the street, gutter or storm drain. Rain or other water could wash the materials into the storm drain and eventually into our waterways and the ocean. In addition, hazardous waste must not be poured into the sanitary sewer (sinks and toilets).

You would never dump vehicle fluids 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 automotive work. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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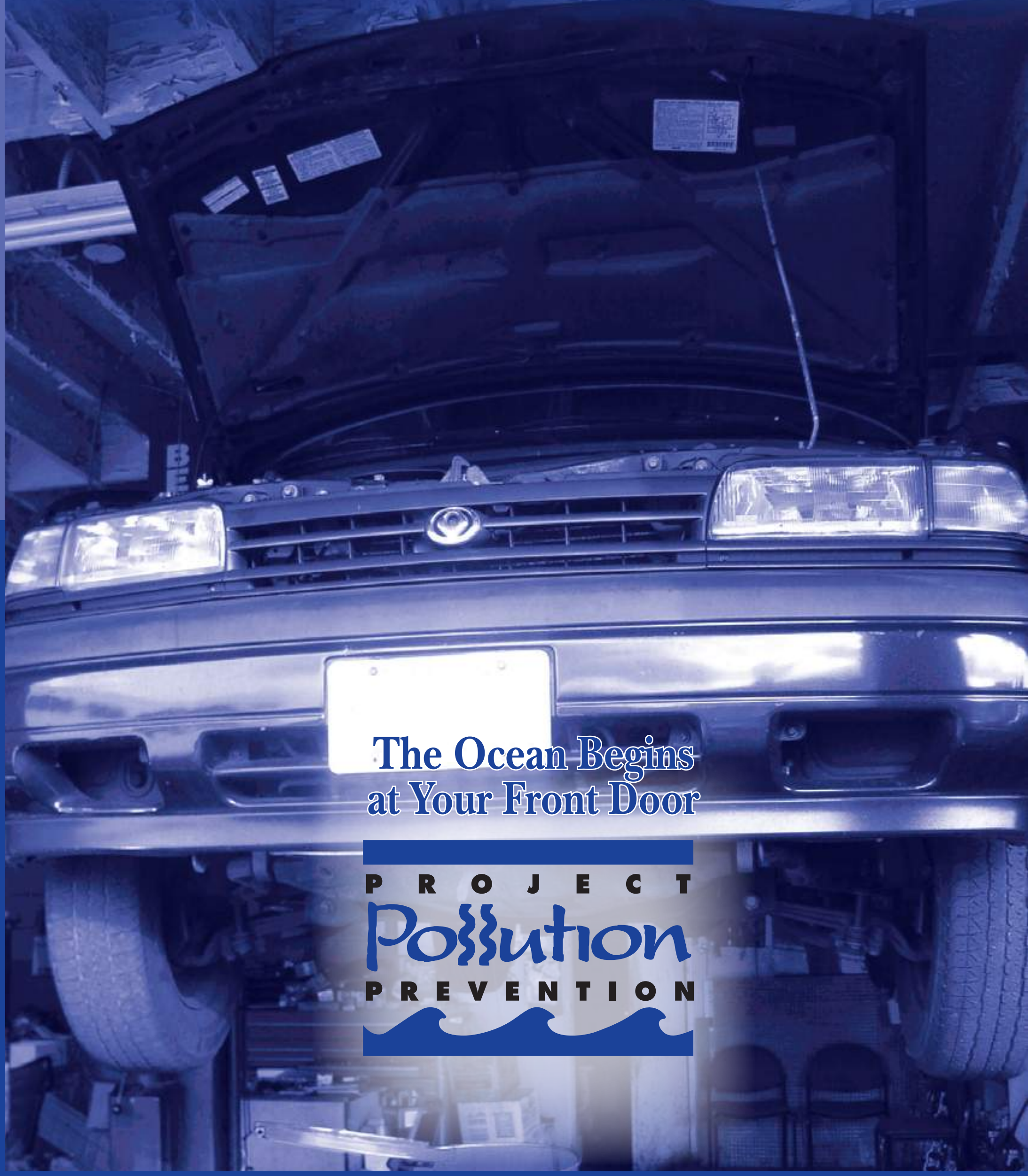
Help Prevent Ocean Pollution:

Tips for the Automotive Industry



The Ocean Begins at Your Front Door

PROJECT POLLUTION PREVENTION

Tips for the Automotive Industry

Local, state and federal laws prohibit businesses from allowing anything but rain to enter the storm drains. To help the automotive industry comply with requirements for reducing pollution and protecting water quality, this brochure describes the Best Management Practices (BMPs) and pollution prevention tips you and your employees should follow. Your compliance with these requirements will be examined during future inspections. Failure to comply may result in criminal prosecution or monetary fines. Please review this information and incorporate these practices into your daily activities.

Work Site

- Locate the storm drains on or near your property. Do not allow materials to flow into these drains.
- Examine your business for sources of pollution.
- Perform automotive projects under cover and in a controlled area.
- Identify specific activities with the potential to cause spills or release pollutants such as oil, grease, fuel, etc. Post signs and train employees on how to prevent and clean up spills during these activities.
- Sweep or vacuum the shop floor daily.
- 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, toilet or landscaped area. Never dispose of water in a parking lot, street, gutter or storm drain.
- Use non-toxic cleaning products whenever possible.

Preventing Leaks and Spills

- Train employees on how to properly clean up spills and waste.
- Document employee training.
- Keep a spill kit with absorbent materials in the work area.
- Empty drip pans into a labeled, sealed container, before they are full.
- Check equipment, wipe up spills and repair leaks on a daily basis.
- Place large pans under wrecked cars until all fluids are drained.
- Promptly dispose of collected fluids into a hazardous waste drum.
- To learn more, visit: **www.ocwatersheds.com/StormWater/documents_bmp_existing_development.asp#ind**

Cleaning Spills

- Clean up spills immediately by using absorbents 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 spilled 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 **(714) 567-6363** or visit **www.ocwatersheds.com** to fill out an incident report.
- Report emergencies to 911.

Fueling Areas

- Operate fueling areas so that spills can be contained and runoff cannot carry spills into the street, gutter or storm drain.
- Service drain filters beneath the fueling canopy and replace absorbents annually.
- Post signs instructing customers not to overfill or top-off gas tanks.

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.

Body Repair and Painting

- Clean work areas using dry methods. Use a shop vacuum or broom to sweep up dust, metal and debris. Consider investing in a sander with an attached vacuum system to capture dust at the source.
- Do not vacuum flammable liquids. Allow wet debris to dry overnight on the shop floor and sweep or vacuum it the next day. Liquid must not be discharged into the storm drain system.
- Paint only in approved, enclosed areas equipped with vacuum hoods and filters.
- Minimize paint and thinner waste by carefully calculating needs based on surface area and by using the proper sprayer cup size.

- Collect water used to control over-spray or dust in the paint booth and recycle or dispose of it properly.
- Clean spray guns in a self-contained unit and recycle or properly dispose of the cleaning solution.
- Prevent all washwater from entering the street, gutter or storm drain.

Vehicle and Equipment Cleaning

- Wash vehicles and equipment in designated areas. Never discharge washwater into the street, gutter or storm drain.
- Contact your local sewer agency for information on discharging to the sanitary sewer. Oil/water separators and washwater recycling systems may have special discharge requirements.
- Use a spray nozzle or rinse bucket to conserve water and minimize wastewater.
- Consider the use of a washwater recycling system to minimize wastewater from washing cars.
- Use a commercial car wash facility whenever possible.

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. Materials and excess concrete or mortar can be blown or washed into the storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

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

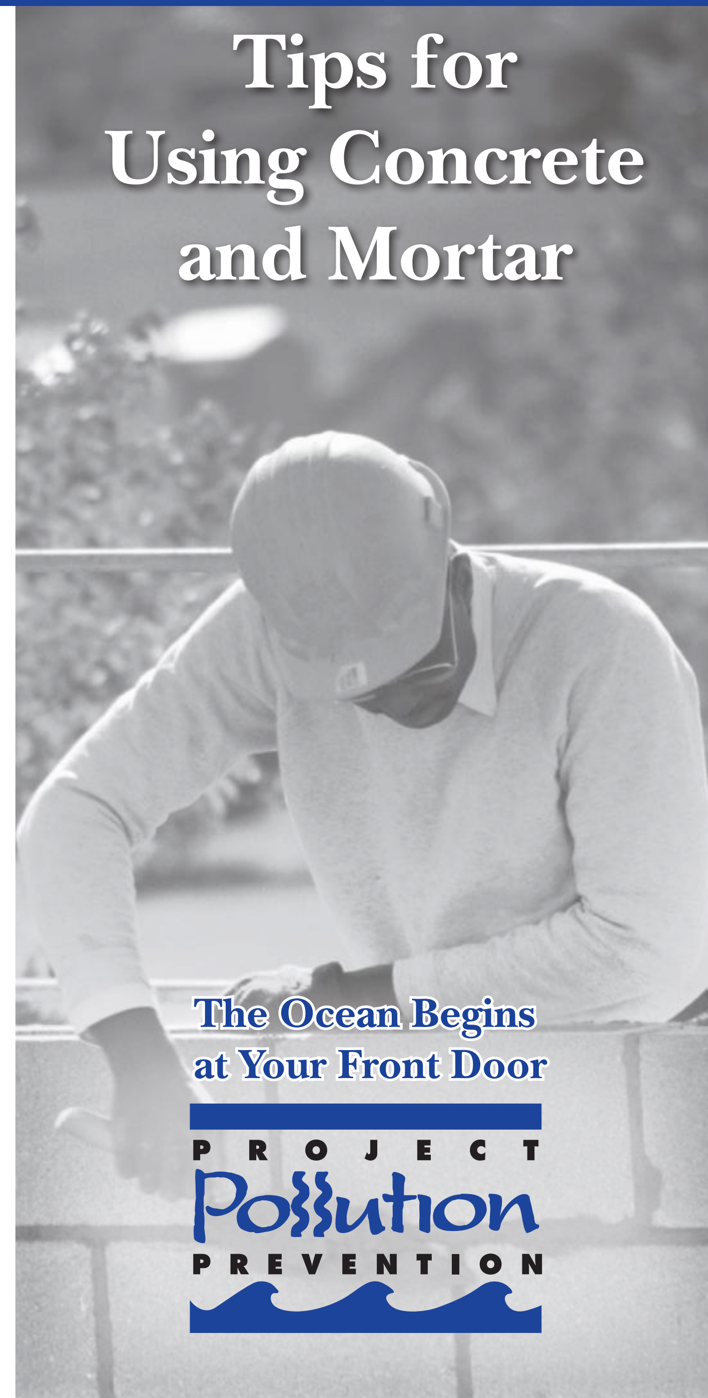
For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com.

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

For emergencies, dial 911.

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

Tips for Using Concrete and Mortar



The Ocean Begins at Your Front Door

PROJECT POLLUTION PREVENTION

Tips for Using Concrete and Mortar

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

Before the Project

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

During the Project

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

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

Clean-Up

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

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

Spills

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

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

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

Preventing water pollution at your commercial/industrial site

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

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

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

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

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

For emergencies, dial 911.

RECYCLE USED OIL

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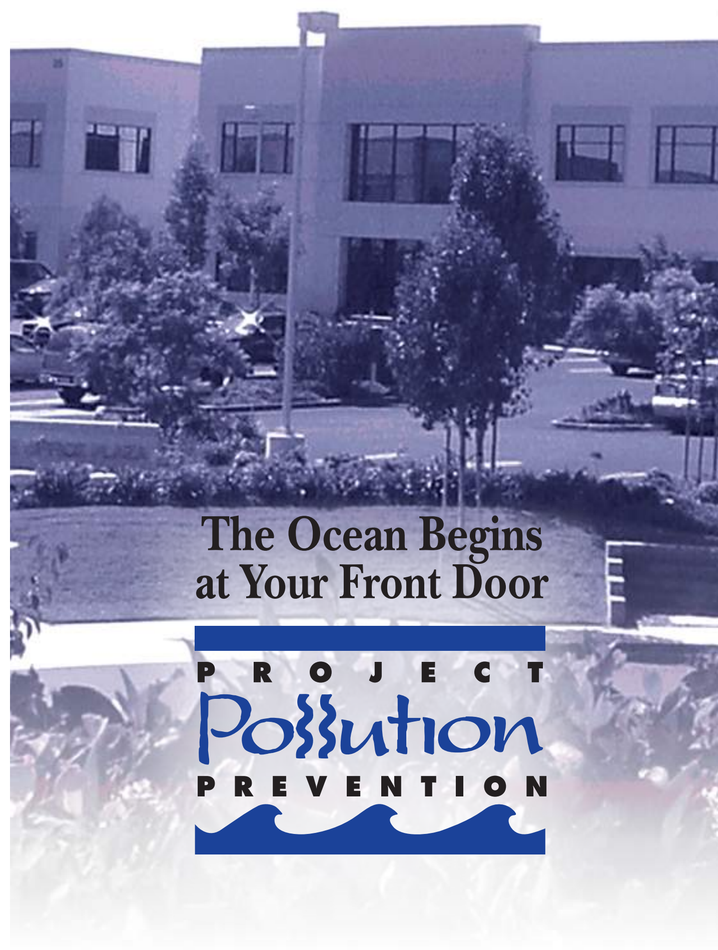
Help Prevent Ocean Pollution:

Proper Maintenance Practices for Your Business



Proper Maintenance Practices for your Business

Landscape Maintenance

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

Building Maintenance

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

NEVER DISPOSE OF ANYTHING IN THE STORM DRAIN.

- Recycle paints, solvents and other materials. For more information about recycling and collection centers, visit **www.oclandfills.com**.
- Store materials indoors or under cover and away from storm drains.
- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry, carpet, plastic, pipes, drywall, rocks, dirt, and green waste. For a listing of construction and demolition recycling locations in your area, visit **www.ciwmb.ca.gov/recycle.**
- Properly label materials. Familiarize employees with Material Safety Data Sheets.

PROJECT Pollution PREVENTION

Attachment B

Geotechnical Report

GEOTECHNICAL INVESTIGATION
TWO PROPOSED WAREHOUSES

SWC Katella Avenue and Holder Street
Cypress, California
For
Greenlaw Partners

SoCalGeo
SOUTHERN
CALIFORNIA
GEOTECHNICAL
A California Corporation

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

October 3, 2019

Greenlaw Partners
c/o Duke Realty
200 Spectrum Center Drive, Suite 1600
Irvine, California 92618

Attention: Mr. Mikheel Davankar

Project No.: **19G186-1**

Subject: **Geotechnical Investigation**
Two Proposed Warehouses
SWC Katella Avenue and Holder Street
Cypress, California

Gentlemen:

In accordance with your request, we have conducted a geotechnical investigation at the subject site. We are pleased to present this report summarizing the conclusions and recommendations developed from our investigation.

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

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Senior Engineer

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1.0 EXECUTIVE SUMMARY

Presented below is a brief summary of the conclusions and recommendations of this investigation. Since this summary is not all inclusive, it should be read in complete context with the entire report.

Geotechnical Design Considerations

- The borings encountered artificial fill soils and native alluvium. The fill soils extend to depths of 2½ to 4± feet and are considered to consist of undocumented fill soils. Some of the native alluvial soils possess low strengths and densities and the results of consolidation testing indicate that some of these soils are compressible.
- All of the borings encountered groundwater at depths of 5 to 6½± feet. The static groundwater table at this site is considered to be present at a depth of 5 to 6½± at the time of subsurface exploration.
- The subject site is located within an area mapped as a liquefaction hazard zone by the state of California. Our site-specific liquefaction evaluation included four (4) CPT soundings advanced to depths of 60 to 70± feet. Potentially liquefiable soils were encountered at all of the CPT locations.
- The potential liquefaction-induced settlements at the boring CPT locations range between 1.8 and 3.6± inches.
- Potentially liquefiable soils were encountered at depths ranging between 5 and 50± feet. Some of the potentially liquefiable strata are present at relatively shallow depths of about 5 to 12± feet. The foundation loads of the new structures are expected to influence the potentially liquefiable soils present at these depths. Additionally, based on the presence of compressible soils with the upper 22± feet, static settlements are expected to be in excess of the tolerable limits.
- The most feasible method of mitigating potential static and dynamic settlements at this site is considered to be remedial grading of the near surface soils in conjunction with ground improvement of the compressible and potentially liquefiable soils located beneath the groundwater table. Based on the groundwater levels and the soil conditions, techniques such as deep soil mixing or grout injection are considered the most applicable for ground improvement. A specialty contractor should be contacted for specifics of design build ground improvement methods.
- This report presents recommendations for the use conventional shallow foundations, assuming that the liquefiable and compressible soils within at least the upper 12 feet below existing grades, 12 feet below proposed building pad grade, and at least 10 feet below the proposed foundation bearing grade. Within the influence zones of any foundations. The overexcavation should also extend to a depth of at least 2 times the footing width below the foundation bearing grade. Overexcavation and recompaction of the near-surface fill and alluvial soils should be performed within the upper 4± feet below existing site grades.

Site Preparation

- Demolition of the some of the existing structures and pavements will be required in order to facilitate construction of the new buildings. Demolition should also include all utilities and any other subsurface improvements that will not remain in place for use with the new development. Debris resultant from demolition should be disposed of offsite. Concrete and asphalt debris may be pulverized to a maximum 2-inch particle size, well mixed with the on-site soils, and incorporated into new structural fills, or it may be crushed into miscellaneous base (CMB). Alternatively, concrete and asphalt debris may be crushed to particles sizes of 2 to 4 inches and used to stabilize overexcavation subgrades.

- Initial site preparation should include stripping of the existing grass, trees, and weed growth present in some areas the site. Stripping should also include removal of any tree root masses. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.
- Remedial grading is recommended to be performed within the new building pad areas to remove the existing fill soils (which extend to depths of 2½ to 4± feet at the boring locations) in their entirety. Additionally, overexcavation should extend to a depth of 4 feet below existing grade and to a depth of at least 3 feet below proposed pad grade.
- After overexcavation has been completed, the resulting subgrade soils should be evaluated by the geotechnical engineer to identify any additional soils that should be overexcavated, moisture conditioned (or air dried), and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill.
- The new parking area subgrade soils are recommended to be scarified to a depth of 12± inches, thoroughly moisture conditioned and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Building Foundations

- Conventional shallow foundations, supported in newly placed compacted fill.
- 2,000 lbs/ft^2 maximum allowable soil bearing pressure. A greater foundation bearing pressure may be allowed based on the ground improvement technique used.
- Minimum longitudinal steel reinforcement within strip footings: Six (6) No. 5 rebars (3 top and 3 bottom) due to the presence of liquefiable soils. Additional reinforcement may be necessary for structural considerations.

Building Floor Slab

- Conventional Slab-on-Grade, 6 inches thick.
- Modulus of Subgrade Reaction: k = 100 psi/in
- Reinforcement consisting of No. 3 rebars at 18 inches on center in both directions due to the presence of liquefiable soils. The actual floor slab reinforcement should be determined by the structural engineer, based on the imposed slab loading.

Pavements

ASPHALT PAVEMENTS (R = 30)					
Materials	**Thickness (inches)**				
	Automobile Parking (TI = 4.0)	Automobile Drive Lanes (TI = 5.0)	Truck Traffic		
			(TI = 6.0)	(TI = 7.0)	(TI = 8.0)
Asphalt Concrete	3	3	3½	4	5
Aggregate Base	3	6	8	10	11
Compacted Subgrade	12	12	12	12	12

PORTLAND CEMENT CONCRETE PAVEMENTS			
Materials	**Thickness (inches)**		
	Automobile and Light Truck Traffic (TI = 5.0 & 6.0)	Truck Traffic	
		(TI = 7.0)	(TI = 8.0)
PCC	5	5½	6½
Compacted Subgrade (95% minimum compaction)	12	12	12

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in accordance with our Proposal No. 19P324, dated August 16, 2019. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to provide criteria for preparing the design of the building foundations, building floor slabs, and parking lot pavements along with site preparation recommendations and construction considerations for the proposed development. Based on the location of this site, this investigation also included a site-specific liquefaction evaluation. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical investigation.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located at the southwest corner of Katella Avenue and Holder Street in Cypress, California. The site is bounded to the north by Katella Avenue, to the east by Holder Street, to the south by the Stanton Storm Channel, and to the west by three commercial/industrial buildings.

The site consists of a rectangular-shaped parcel, 22.3± acres in size. The site is presently occupied by Mitsubishi Motors and developed with an office building, three (3) commercial/industrial buildings, and a warehouse. The office building is located in the northern portion of the site and is 3-stories in height with a footprint area of approximately 60,000 ft^2. The three (3) commercial/industrial buildings, ranging from 10,800± ft^2 to 25,000± ft^2 in size, are located in the west-central areas of the site. A warehouse building, 140,000± ft^2 in size is present in the southwestern area of the site. Dock high doors and a truck well are located along the northern wall of the warehouse building. A tennis court is present in the southeastern area of the site. The ground surface cover surrounding the buildings generally consists of asphaltic concrete pavements in the parking and drive lanes, Portland cement concrete pavements in the loading dock areas, and landscape planters throughout the site. However, the ground surface cover on the north side of the office building consists of turf grass and in the southeastern portion of the site, east of the warehouse building, the ground surface cover consists of exposed soil with sparse to moderate grass and weed growth.

Detailed topographic information was not available at the time of this report. However, based on topographic information obtained from Google Earth, the site topography ranges from 42± feet mean sea level (msl) in the east-central area, to 35± feet msl in the southeastern area of the site. The paved areas of the site gently slope downward to the west, at gradients of 1± percent in the southwestern and east-central areas to gradients of 2 to 3± percent near the northwestern corner of the site. The vacant area east of the warehouse slopes downward to the southeast at a gradient of less than 1± percent.

3.2 Proposed Development

Based on site plan provided to our office by the client, the proposed development will consist of two (2) warehouse buildings, 237,920± ft^2 and 234,720± ft^2 in size located in the north and south areas of the site. Dock-high doors will be constructed along the south side of the northern warehouse and along the north side of the southern warehouse. An alternative site plan was also provided to our office, indicating that the proposed development may also consist of reusing the existing warehouse located in the southwest portion of the site, and remainder of the site will be redeveloped as a parking lot for automobiles and trucks.

The buildings will be surrounded by asphaltic concrete pavements in the automobile parking and drive areas, and Portland cement concrete pavements in the truck traffic areas. Areas of landscaped planters and concrete flatwork are expected throughout the site.

Detailed structural information is not currently available. It is assumed that the new buildings will be of concrete tilt-up construction, typically supported on a conventional shallow foundation system, with a slab-on-grade floor(s). Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 7 kips per linear foot, respectively.

No significant amounts of below grade construction, such as basements or crawl spaces, are expected to be included in the proposed development. Based on the assumed topography, cuts and fills up to 1 to 3± feet are expected to be necessary to achieve the proposed site grades.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of eight (8) borings advanced to depths of 15 to 51½± feet below existing site grades. Boring Nos. B-1 and B-6 were extended to a depth of 50 to 51½± feet as part of the liquefaction evaluation. In addition to the borings, four (4) Cone Penetration Test (CPT) soundings were advanced to depths of 60 to 70± feet at the site as part of the liquefaction evaluation.

Hollow Stem Auger Borings

The borings were advanced with hollow-stem augers, by a conventional truck-mounted drilling rig. Representative bulk and relatively undisturbed soil samples were taken during drilling. Relatively undisturbed samples were taken with a split barrel "California Sampler" containing a series of one inch long, 2.416± inch diameter brass rings. This sampling method is described in ASTM Test Method D-3550. Samples were also taken using a 1.4± inch inside diameter split spoon sampler, in general accordance with ASTM D-1586. Both of these samplers are driven into the ground with successive blows of a 140-pound weight falling 30 inches. The blow counts obtained during driving are recorded for further analysis. Bulk samples were collected in plastic bags to retain their original moisture content. The relatively undisturbed ring samples were placed in molded plastic sleeves that were then sealed and transported to our laboratory.

Cone Penetration Test (CPT) Soundings

The CPT soundings were performed by Kehoe Testing and Engineering (KTE) under the supervision of a member of our staff. The cone system used for this project was manufactured by Vertek. The CPT soundings were performed in general accordance with ASTM standards (D-5778). The cone penetrometers were pushed using a 30-ton CPT rig. The instruments used during the CPT soundings recorded the cone tip resistance, sleeve friction, and dynamic core pressure at 2.5-centimeter depth intervals. The CPT soundings were advanced to depths of 50± feet. It should be noted that prior to performing the CPT sounding at CPT-4, a portable coring rig equipped with a 5-inch-diameter diamond-tipped core barrel was used to core through the existing PCC pavements. A more complete description of the CPT program as well as the results of the data interpretation are provided in the report prepared by KTE, enclosed in Appendix F of this report. The CPT soundings do not result in any recovered soil samples. However, correlations have been developed that utilize the cone resistance and the sleeve friction to estimate the soil type that is present at each 2.5-centimeter interval in the subsurface profile. These soil classifications are presented graphically on the CPT output forms enclosed in Appendix F.

The data generated by the cone penetrometer equipment has been interpreted by KTE using CPeT-IT, V2.3.18, published by Geologismiki Geotechnical Software. The CPeT-IT program output as well as more details regarding the interpretation procedure are presented a report prepared by KTE, which is provided in Appendix F of this report.

General

The approximate locations of the borings and CPT soundings are indicated on the Boring and CPT Location Plan, included as Plate 2 in Appendix A of this report. The Boring Logs, which illustrate the conditions encountered at the boring locations, as well as the results of some of the laboratory testing, are included in Appendix B.

4.2 Geotechnical Conditions

Pavements

Asphaltic concrete pavements were present at the ground surface at all of the boring locations, with the exception of Boring Nos. B-5 and B-6. At the boring locations, the pavement section consists of 3 to 4± inches of asphaltic concrete, underlain by 4 to 5± inches of aggregate base.

Artificial Fill

Artificial fill soils were encountered beneath the pavements at Boring Nos. B-4, B-7, and B-8, and at the ground surface of Boring No. B-5, extending to depths of 2½ to 4± feet below the existing site grades. The fill soils generally consist of silty fine sand with occasional trace to little clay content. However, some of the fill soils encountered at Boring No. B-7 consisted of medium dense to very stiff fine sandy clay to clayey fine sand. The fill soils possess a mottled and disturbed appearance, resulting in their classification as artificial fill.

The soils encountered directly beneath the pavements at Boring Nos. B-2 and at the ground surface at Boring No. B-6, extending to depths of 2½ and 5½± feet respectively, were classified at possible fill. These soils possess variable densities and a slightly disturbed appearance, but they also possess similar compositions to some of the native alluvium encountered at the site and lack obvious indicators of fill, such as artificial debris or extensive mottling/disturbance, resulting in their classification as possible fill.

Alluvium

Native alluvial soils were encountered at the ground surface or beneath the pavements and/or fill materials at all of the boring locations. The native alluvial soils encountered at the boring and CPT locations generally consist of interbedded layers of sands, silts, and clays. In general, loose to medium dense fine sand and silty sand layers were encountered within the upper 4 to 6½± feet at most of the boring and CPT locations. These sand and silty sand layers are generally underlain by interbedded strata of very loose to medium dense silty sands, clayey sands, sandy silts, and very soft to very stiff silty clays, sandy clays, and clayey silts, extending to depths. At depths greater than 33± feet, occasional dense sand layers were encountered at the boring locations.

Groundwater

Free water was encountered during drilling at all of the boring locations between 5 to 8½± feet below ground surface. Delayed groundwater level readings were taken at Boring Nos. B-1, B-3, and B-6 at times ranging between 2½ to 4½± hours after the completion of these borings. At these boring locations, water was present at depths between 5 and 6½± feet below ground surface during the final measurement. Delayed readings were not practical at some of the other borings due to caving within the open boreholes after the augers were withdrawn. Based on the moisture contents of the recovered soil samples and the delayed water measurements taken within the open boreholes, the static groundwater table is considered to have been present at depths of 5 to 6½± feet below the existing site grades at the time of subsurface exploration.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the historic groundwater depths in this area is CGS Open File Report 98-10, which indicates that the historic high groundwater level for the site was 11± feet below the ground surface.

We attempted to research more recent water level data at the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. However, the nearest monitoring well is located approximately 6,767± feet north of the site. The well data available for this location is not consistent with the water levels measured at this site, so this well is considered irrelevant for the subject site. Water level readings within this monitoring well indicates high groundwater levels of 48½± feet (March, 2019) below the ground surface.

5.0 LABORATORY TESTING

The soil samples recovered from the subsurface exploration were returned to our laboratory for further testing to determine selected physical and engineering properties of the soils. The tests are briefly discussed below. It should be noted that the test results are specific to the actual samples tested, and variations could be expected at other locations and depths.

Classification

All recovered soil samples were classified using the Unified Soil Classification System (USCS), in accordance with ASTM D-2488. The field identifications were then supplemented with additional visual classifications and/or by laboratory testing. The USCS classifications are shown on the Boring Logs and are periodically referenced throughout this report.

Dry Density and Moisture Content

The density has been determined for selected relatively undisturbed ring samples. These densities were determined in general accordance with the method presented in ASTM D-2937. The results are recorded as dry unit weight in pounds per cubic foot. The moisture contents are determined in accordance with ASTM D-2216, and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Consolidation

Selected soil samples have been tested to determine their consolidation potential, in accordance with ASTM D-2435. The testing apparatus is designed to accept either natural or remolded samples in a one-inch high ring, approximately 2.416 inches in diameter. Each sample is then loaded incrementally in a geometric progression and the resulting deflection is recorded at selected time intervals. Porous stones are in contact with the top and bottom of the sample to permit the addition or release of pore water. The samples are typically inundated with water at an intermediate load to determine their potential for collapse or heave. The results of the consolidation testing are plotted on Plates C-1 through C-8 in Appendix C of this report.

Soluble Sulfates

Representative samples of the near-surface soils were submitted to a subcontracted analytical laboratory for determination of soluble sulfate content. Soluble sulfates are naturally present in soils, and if the concentration is high enough, can result in degradation of concrete which comes into contact with these soils. The results of the soluble sulfate testing are presented below and are discussed further in a subsequent section of this report.

Sample Identification	Soluble Sulfates (%)	Severity	Class
B-3 @ 0 to 5 feet	<0.001	Not Applicable	S0
B-4 @ 0 to 5 feet	0.023	Not Applicable	S0

Corrosivity Testing

Representative bulk samples of the near-surface soils were submitted to a subcontracted analytical laboratory for determination of electrical resistivity, pH, and chloride concentrations. The resistivity of the soils is a measure of their potential to attack buried metal improvements such as utility lines. The results of the resistivity and pH testing are presented below:

Sample Identification	Resistivity (ohm-cm)	pH	Chlorides (mg/kg)
B-3 @ 0 to 5 feet	5200	8.6	8.9
B-4 @ 0 to 3 feet	1,520	8.3	68

Expansion Index

The expansion potential of the on-site soils was determined in general accordance with ASTM D-4829 as required by the California Building Code (CBC). The testing apparatus is designed to accept a 4-inch diameter, 1-in high, remolded sample. The sample is initially remolded to 50± 1 percent saturation and then loaded with a surcharge equivalent to 144 pounds per square foot. The sample is then inundated with water, and allowed to swell against the surcharge. The resultant swell or consolidation is recorded after a 24-hour period. The results of the EI testing are as follows:

Sample Identification	Expansion Index	Expansive Potential
B-4 @ 0 to 5 feet	8	Very Low

Maximum Dry Density and Optimum Moisture Content

A representative bulk sample was tested for its maximum dry density and optimum moisture content. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557. These tests are generally used to compare the in-situ densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil type or soil mixes may be necessary at a later date. The results of the testing are plotted on Plate C-9 in Appendix C of this report.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our review, field exploration, laboratory testing and geotechnical analysis, the proposed development is considered feasible from a geotechnical standpoint. The recommendations contained in this report should be taken into the design, construction, and grading considerations.

The recommendations are contingent upon all grading and foundation construction activities being monitored by the geotechnical engineer of record. The recommendations are provided with the assumption that an adequate program of client consultation, construction monitoring, and testing will be performed during the final design and construction phases to verify compliance with these recommendations. Maintaining Southern California Geotechnical, Inc., (SCG) as the geotechnical consultant from the beginning to the end of the project will provide continuity of services. The geotechnical engineering firm providing testing and observation services shall assume the responsibility of Geotechnical Engineer of Record.

The Grading Guide Specifications, included as Appendix D, should be considered part of this report, and should be incorporated into the project specifications. The contractor and/or owner of the development should bring to the attention of the geotechnical engineer any conditions that differ from those stated in this report, or which may be detrimental for the development.

6.1 Seismic Design Considerations

The subject site is located in an area which is subject to strong ground motions due to earthquakes. The performance of a site specific seismic hazards analysis was beyond the scope of this investigation. However, numerous faults capable of producing significant ground motions are located near the subject site. Due to economic considerations, it is not generally considered reasonable to design a structure that is not susceptible to earthquake damage. Therefore, significant damage to structures may be unavoidable during large earthquakes. The proposed structures should, however, be designed to resist structural collapse and thereby provide reasonable protection from serious injury, catastrophic property damage and loss of life.

Faulting and Seismicity

Research of available maps indicates that the subject site is not located within an Alquist-Priolo Earthquake Fault Zone. Furthermore, SCG did not identify any evidence of faulting during the geotechnical investigation. Therefore, the possibility of significant fault rupture on the site is considered to be low.

The potential for other geologic hazards such as seismically induced settlement, tsunamis, inundation, seiches, flooding, and subsidence affecting the site is considered low.

Seismic Design Parameters

The California Building Code (CBC) provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of the structure including the structural system and height. The seismic design parameters presented below are based on the soil profile and the proximity of known faults with respect to the subject site.

Based on standards in place at the time of this report, the proposed development is expected to be designed in accordance with the requirements of the 2016 edition of the California Building Code (CBC). However, it is also possible that the proposed development may be designed using the 2019 CBC, which will be adopted on January 1, 2020. Therefore, this report provides design parameters for both the 2016 CBC and the 2019 CBC. Other design consultants should verify the version of the code under which the proposed development will be submitted.

The 2016 and 2019 CBC Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool, a web-based software application available at the website www.seismicmaps.org. This software application calculates seismic design parameters in accordance with several building code reference documents, including ASCE 7-10 and ASCE 7-16, upon which the 2016 CBC and 2019 CBC are based, respectively. The application utilizes a database of risk-targeted maximum considered earthquake (MCE_R) site accelerations at 0.01-degree intervals for each of the code documents. The tables below were created using data obtained from the application. The output generated from this program is included as Plates E-1A (2016 CBC) and E-1B (2019 CBC) in Appendix E of this report. Based on this output, the following parameters may be utilized for the subject site:

2016 CBC SEISMIC DESIGN PARAMETERS

Parameter		**Value**
Mapped Spectral Acceleration at 0.2 sec Period	S_S	1.484
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.541
Site Class	---	D*
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.484
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	0.812
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	0.989
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.541

*The 2016 and 2019 CBC require that Site Class F be assigned to any profile containing soils vulnerable to potential failure or collapse under seismic loading, such as liquefiable soils. For Site Class F, the site coefficients are to be determined in accordance with Section 11.4.7 of ASCE 7-10/ASCE 7-16. However, Section 20.3.1 of ASCE 7-10/ASCE 7-16 indicates that for sites with structures having a fundamental period of vibration equal to or less than 0.5 seconds, the site coefficient factors (F_a and F_v) may be determined using the standard procedures. Based on the proposed construction, we expect that the proposed building and building addition will possess periods of vibration less than 0.5 seconds. The seismic design parameters tabulated above were calculated using the site coefficient factors for Site Class D, assuming that the fundamental period of both of the structures is less than 0.5 seconds. However, the results of the liquefaction evaluation indicate that the subject site is underlain by potentially liquefiable soils. Therefore, if the proposed structure has a fundamental period greater than 0.5 seconds, a site-specific seismic hazards analysis will be required and additional subsurface exploration will be necessary.

The 2019 CBC requires that a site-specific ground motion study be performed in accordance with Section 11.4.8 of ASCE 7-16 for Site Class D sites with a mapped S_1 value greater than 0.2. However, Section 11.4.8 of ASCE 7-16 also indicates an exception to the requirement for a site-specific ground motion hazard analysis for certain structures on Site Class D sites. The commentary for Section 11 of ASCE 7-16 (Page 534 of Section C11 of ASCE 7-16) indicates that "In general, this exception effectively limits the requirements for site-specific hazard analysis to very tall and or flexible structures at Site Class D sites." **Based on our understanding of the proposed development, the seismic design parameters presented below were calculated assuming that the exception in Section 11.8.4 applies to the proposed structures at this site. However, the structural engineer should verify that this exception is applicable to the proposed structures.** Based on the exception, the spectral response accelerations presented below were calculated using the site coefficients (F_a and F_v) from Tables 1613.2.3(1) and 1613.2.3(2) presented in Section 16.4.4 of the 2019 CBC.

2019 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped MCE_R Acceleration at 0.2 sec Period	S_S	1.440
Mapped MCE_R Acceleration at 1.0 sec Period	S_1	0.510
Site Class	---	D*
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.440
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	0.913
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	0.960
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.609

*Please refer to the note located beneath the 2016 CBC Seismic Design Parameters table.

It should be noted that the site coefficient F_v and the parameters S_{M1} and S_{D1} were not included in the SEAOC/OSHPD Seismic Design Maps Tool output for the 2019 CBC. We calculated these parameters-based on Table 1613.2.3(2) in Section 16.4.4 of the 2019 CBC using the value of S_1 obtained from the Seismic Design Maps Tool, assuming that a site-specific ground motion hazards analysis is not required for the proposed buildings at this site.

Ground Motion Parameters

For the liquefaction evaluation, we utilized a site acceleration consistent with maximum considered earthquake ground motions, as required by the 2016 CBC. The peak ground acceleration (PGA_M) was determined in accordance with Section 11.8.3 of ASCE 7-10. The parameter PGA_M is the maximum considered earthquake geometric mean (MCE_G) PGA, multiplied by the appropriate site coefficient from Table 11.8-1 of ASCE 7-10. The web-based software application SEAOC/OSHPD Seismic Design Maps Tool (described in the previous section) was used to determine PGA_M, based on ASCE 7-10 as the building code reference document. A portion of the program output is included as Plate E-1A in Appendix E of this report. As indicated on Plate E-1A, the PGA_M for this site is 0.541g. An associated earthquake magnitude was obtained from the USGS Unified Hazard Tool, Interactive Deaggregation application available on the USGS website. The deaggregated modal magnitude is 7.3, based on the peak ground acceleration and soil classification D for a return period of 3,134 years.

It should be noted that the 2019 CBC requires that different ground motion parameters be used for the liquefaction evaluation. Therefore, if this project will be designed in accordance with the 2019 CBC, the ground motion parameters and the liquefaction evaluation should be updated to the 2019 standards.

Liquefaction

Research of the Los Alamitos Quadrangle, California 7.5 Minute Seismic Hazard Zone Map, published by the California Geological Survey, indicates that the site is located in a designated liquefaction hazard zone. Therefore, the scope of this investigation included a detailed liquefaction evaluation in order to determine the site-specific liquefaction potential.

Liquefaction is the loss of strength in generally cohesionless, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors which influence the potential for liquefaction include groundwater table elevation, soil type and plasticity characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d_{50}) grain size in the range of 0.075 to 0.2 mm (Seed and Idriss, 1971). Non-sensitive clayey (cohesive) soils which possess a plasticity index of at least 18 (Bray and Sancio, 2006) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

The liquefaction analysis was conducted in accordance with the requirements of Special Publication 117A (CDMG, 2008), and currently accepted practice (SCEC, 1997). The liquefaction potential of the subject site was evaluated using the empirical method developed by Boulanger and Idriss (Boulanger and Idriss, 2008, 2014). This method predicts the earthquake-induced liquefaction potential of the site based on a given design earthquake magnitude and peak ground acceleration at the subject site. This procedure essentially compares the cyclic resistance ratio (CRR) [the cyclic stress ratio required to induce liquefaction for a cohesionless soil stratum at a given depth] with the earthquake-induced cyclic stress ratio (CSR) at that depth from a specified design earthquake (defined by a peak ground surface acceleration and an associated earthquake moment magnitude). CRR is determined as a function of the corrected SPT N-value $(N_1)_{60\text{-}cs}$, adjusted for fines content and/or the corrected CPT tip stress, $q_{c1N\text{-}cs}$. The factor of safety against liquefaction is defined as CRR/CSR. Based on Special Publication 117A, a factor of safety of at least 1.3 is required in order to demonstrate that a given soil stratum is non-liquefiable. Additionally, in accordance with Special Publication 117A, clayey soils which do not meet the criteria for liquefiable soils defined by Bray and Sancio (2006), loose soils with a plasticity index (PI) less than 12 and moisture content greater than 85 percent of the liquid limit, are considered to be insusceptible to liquefaction. Non-sensitive soils with a PI greater than 18 are also considered non-liquefiable.

The liquefaction potential for the on-site soils was evaluated using data obtained at the four (4) CPT locations. This data was analyzed using the computer program Cliq V2.2.1.11, which was developed by Geologismiki, copyright 2006. The analysis method is based on Boulanger and Idriss 2014. The liquefaction potential of the site was analyzed utilizing a PGA_M of 0.611g for a magnitude 7.3 seismic event. A copy of the program output is presented in Appendix H of this report. As part of the liquefaction evaluation, Boring Nos. B-1 and B-6 were extended to depths of 50± feet in order to provide samples for laboratory testing and correlation with the results of the CPT.

If liquefiable soils are identified, the potential settlements that could occur as a result of liquefaction are determined using the equation for volumetric strain due to post-cyclic reconsolidation (Yoshimine et. al, 2006). This procedure uses an empirical relationship between the induced cyclic shear strain and the cyclic resistance ratio to determine the expected volumetric strain of saturated sands subjected to earthquake shaking.

Conclusions and Recommendations

The results of the liquefaction analysis have identified potentially liquefiable soils at all four (4) of the CPT soundings performed at the site. Soils which are located above the historic groundwater table or possess factors of safety of at least 1.3 are considered non-liquefiable. Several clayey strata located below the ground water table are also considered to be non-liquefiable due to their cohesive characteristics and the results of the Atterberg limits testing with respect to the criteria of Bray and Sancio (2006). Settlement analyses were conducted for each of the potentially liquefiable strata. The results of the dynamic settlement analyses are included the CLIQ program output in Appendix H and are presented below:

- CPT-1: 2.71± inches
- CPT-2: 3.59± inches
- CPT-3: 2.90± inches
- CPT-4: 1.85± inches

Based on these total settlements, differential settlements of up to 2± inches should be expected to occur during a liquefaction inducing seismic event. The estimated differential settlement could be assumed to occur across a distance of 50 feet, indicating a maximum angular distortion of about 0.003 inches per inch.

Shallow Liquefiable Layers

The majority of the liquefaction induced settlement is projected to occur at depths of less than 22± feet and all of the borings and CPTs identified liquefiable soils between depths of 5 and 15± feet below the existing site grades. Based on these considerations, we expect that liquefiable soils will be present within the influence zones of new foundations. Additionally, based on Ishihara's criteria, liquefaction of the near surface soils could result in surface manifestations, including sand boils.

The consequences of soil liquefaction occurring within the zone of influence of a foundation can result in the loss of bearing capacity and/or punching failure. An isolated column footing with typical structural loads could settle rapidly during a liquefaction inducing seismic event. The magnitude of the settlement below a loaded column can be much higher than the dynamic settlements presented above for free-field conditions.

The presence of groundwater at depths of 5 to 6½± feet will make remedial grading impractical to mitigate liquefiable soils present within the foundation influence zones of the new structures. Extensive dewatering would be required to facilitate overexcavation and recompaction of the existing soils present in the foundation influence zones.

Based on the presence of shallow liquefiable soil layers, we do not recommend that the new buildings be supported on conventional shallow foundations without mitigation of the near surface liquefaction potential of the soils within the building areas. Therefore, we recommend that ground improvement techniques be used to improve the near surface soils present within the influence of any foundation elements. Designing the proposed buildings to remain completely undamaged during a major seismic event is not considered to be economically feasible. The ground improvement program should be designed to mitigate potentially liquefiable soil layers within the foundation influence zones. Additional geotechnical design considerations regarding the recommended ground improvement, such as the presence of compressible soils below the ground water table, are discussed in a subsequent section of this report.

Any utility connections to the structures should be designed to withstand the estimated dynamic settlements. It should also be noted that minor to moderate repairs, including releveling, restoration of utility connections, repair of damaged drywall and stucco, etc., would likely be required after occurrence of a major earthquake.

The use of shallow foundation systems in conjunction with the recommend ground improvement, as described in this report, is typical for buildings of these types, where they are underlain by the extent of liquefiable soils encountered at this site. The post-liquefaction damage that could occur within the buildings is expected to be typical of similar buildings in the vicinity of this project. Other geotechnical and structural options are available, including the use of deep foundations such as driven piles, and drilled piers, but are considered to be less economically feasible.

Lateral Spreading

No significant slopes or free faces are present at within several hundred feet the subject site, with the exception of a concrete lined drainage channel located about 40± feet south of the southern property line of the subject site. Based on the fact that the only slopes near the subject site are covered with concrete, lateral spreading is not considered to be a significant design concern for this project.

6.2 Geotechnical Design Considerations

General

Some of the borings encountered artificial fill soils and soils classified as possible fill, extending to depths of 3 to 4½± feet at the boring locations. These soils possess variable densities and strengths and some of these foils possess a disturbed, mottled appearance. Additionally, no documentation regarding the placement and compaction of the existing fill soil soils has been provided to our office. The fill soils are therefore considered to be undocumented fill. The fill soils are underlain by native alluvium which possesses variable strengths and composition. Based on the results of laboratory testing, some of the native alluvial soils possess very unfavorable consolidation characteristics and relatively low strengths.

The results of our site-specific liquefaction evaluation indicate that some potentially liquefiable soil layers are present between depths of 5 and 15± feet. These liquefiable layers are expected to be located within the foundation influence zone of a building supported by conventional shallow foundations. As discussed in the previous section, liquefaction can result in a loss of bearing capacity and excessive settlements of foundation elements supported on liquefiable soils. Therefore, liquefiable layers present within the influence zone of any new building foundations should mitigated if conventional shallow foundations will be used for the proposed buildings at this site.

Based on the presence of undocumented fill materials and low strength, compressible and potentially liquefiable soils, the near surface soils, in their present condition, are not considered suitable for support of the foundations and floor slabs of the new structures. The presence of shallow groundwater, present at depths as shallow as 5 to 6½± feet will make remedial grading of the compressible native alluvium impractical without extensive dewatering.

Based on conversations with the client, we understand that consideration is being given to the use of ground improvement techniques at this site. The grading and foundation design parameters provided in the subsequent sections of this report assume that the soils in at least the upper 12± feet below existing site grades will be improved using ground improvement techniques.

<u>Settlement</u>

The recommended ground improvement measures will improve the highly compressible alluvium and the liquefiable soils present within the foundation influence zones of the new buildings. The native soils that will remain in place below the recommended depth of ground improvement will not be subject to significant load increases from the foundations of the new structures. Provided that the ground improvement and recommended remedial grading is completed, the post-construction settlements of the proposed structures are expected to be within tolerable limits for conventional shallow foundations.

<u>Soluble Sulfates</u>

The results of the soluble sulfate testing, as discussed in Section 5.0 of this report, indicate soluble sulfate concentrations of up to 0.023 percent. These concentrations are considered to be negligible or "not applicable" with respect to the American Concrete Institute (ACI) Publication 318-05 <u>Building Code Requirements for Structural Concrete and Commentary</u>, Section 4.3. Therefore, specialized concrete mix designs are not considered to be necessary, with regard to sulfate protection purposes. It is, however, recommended that additional soluble sulfate testing be conducted at the completion of rough grading to verify the soluble sulfate concentrations of the soils which are present at the proposed building pad grades.

Corrosion Potential

The results of the electrical resistivity and pH testing indicate that two samples of the on-site soils have resistivities of 1,520 and 5,200 ohm-cm and pH values of 8.3 and 8.6. These test results have been evaluated in accordance with guidelines published by the Ductile Iron Pipe Research Association (DIPRA). The DIPRA guidelines consist of a point system by which characteristics of the soils are used to quantify the corrosivity characteristics of the site. Resistivity and pH are two of the five factors that enter into the evaluation procedure. Relative soil moisture content as well as redox potential and sulfides are also included. Although redox potential and sulfide testing were not part of the scope of services for this project, we have evaluated the corrosivity characteristics of the on-site soils using resistivity, pH and moisture content. Based on these factors, and utilizing the DIPRA procedure, **some of the on-site soils are considered to be corrosive to ductile iron pipes and other buried metal improvements. Therefore, it is expected that polyethylene encasement will be required for iron pipes.** If a more detailed evaluation is desired, redox potential and sulfide content should be determined for the on-site soils. Since SCG does not practice in the area of corrosion engineering, it is recommended that the client contact a corrosion engineer to provide a more thorough evaluation.

Expansion

The near surface soils at this site generally consist of silty sands. Laboratory testing performed on a representative sample of these materials indicate that they possess a very low expansion potential (EI =8). Based on the very low expansive classification, no design considerations related to expansive soils are considered warranted for this site.

Shrinkage/Subsidence

Removal and recompaction of the near-surface native fill soils is estimated to result in an average shrinkage of 12 to 18 percent. However, the estimated shrinkage of the individual soil layers at the site is highly variable, locally ranging from 4 to 22 percent shrinkage. It should be noted that the potential shrinkage estimate is based on dry density testing performed on small-diameter samples taken at the boring locations. If a more accurate and precise shrinkage estimate is desired, SCG can perform a shrinkage study involving several excavated test-pits where in-place densities are determined using in-situ testing methods instead of laboratory density testing on small-diameter samples. Please contact SCG for details and a cost estimate regarding a shrinkage study, if desired.

Minor ground subsidence is expected to occur in the soils below the zone of removal, due to settlement and machinery working. The subsidence is estimated to be 0.1± feet.

These estimates are based on previous experience and the subsurface conditions encountered at the boring locations. The actual amount of subsidence is expected to be variable and will be dependent on the type of machinery used, repetitions of use, and dynamic effects, all of which are difficult to assess precisely.

Grading and Foundation Plan Review

As discussed previously, detailed foundation plans and grading plans were not available at the time of this report. It is therefore recommended that we be provided with copies of the plans, when they become available, for review with regard to the conclusions, recommendations, and assumptions contained within this report.

6.3 Site Grading Recommendations

The grading recommendations presented below are based on the subsurface conditions encountered at the boring locations and our understanding of the proposed development. We recommend that all grading activities be completed in accordance with the Grading Guide Specifications included as Appendix D of this report, unless superseded by site-specific recommendations presented below.

Demolition and Site Stripping

The proposed development will require demolition of the existing pavements and structures. Additionally, any existing improvements that will not remain in place for use with the new development should be removed in their entirety. This should include all utilities, and any other subsurface improvements associated with the existing pavements. Existing improvements which are to remain in place with the new development should be protected from damage by construction traffic.

Debris resultant from demolition should be disposed of offsite. Concrete and asphalt debris may be re-used within compacted fills, provided they are pulverized to a maximum particle size of less than 2 inches, and thoroughly mixed with the on-site soils. Existing asphalt and concrete materials may also be crushed into miscellaneous base (CMB) and re-used at the site. Alternatively, concrete and asphalt debris may be crushed to particle sizes of 2 to 4 inches and used to stabilize unstable overexcavation subgrades.

Detailed structural information regarding the existing buildings has not been provided to our office. Therefore, the foundation systems supporting the existing building are presently unknown by SCG. If the existing buildings are supported on deep foundation systems, the deep foundation elements located within the proposed building areas should be cut off at a depth of at least 2 feet below the bottom of the planned overexcavation. Where drilled pier foundations are encountered within proposed pavement areas, they should be cut off at a depth of at least 2 feet below the proposed pavement subgrade or at a depth of at least 1 foot below the bottom of any planned utilities.

Demolition of some landscape planters is also expected to be required. Any vegetation or organic soils within these planters should be disposed of off-site. Turf grass and other grass and weed growth should be stripped from the site in its entirety. Removal of some trees may also be required. Where trees are removed, the removal should also include any associated root masses. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

Ground Improvement

Ground improvement is recommended to mitigate the potential settlements of compressible native alluvial soils present within the influence zones of new foundations as well as a portion of the potential the dynamic settlements of the near-surface liquefiable soils. Based on the groundwater levels and the soil conditions, techniques such as deep soil mixing or grout injection are considered the most applicable for ground improvement. A specialty contractor should be contacted for specifics of design-build ground improvement methods. Ground improvement should be designed to mitigate potential liquefiable soil layers and compressible soils present within at least the upper 12 feet below existing site grades and should also extend to a depth of at least 10 feet below proposed foundation bearing grades. The depth of ground improvement should also extend to a depth equal to 2 times the width of the proposed footings, below the foundation bearing grade. The actual design of the ground improvement method should be performed by the design-build contractor who is specialized and experienced with these methods. Ground improvement methods are designed and implemented by specialty contractors on a design–build basis where the contractors are ultimately fully responsible for the effectiveness of their mitigation measures over the life of the project.

Treatment of Existing Soils: Building Pads

Remedial grading should be performed within the proposed building pad areas in order to remove the near surface fill soils and a portion of the existing potentially compressible/collapsible native alluvium. The ground improvement contractor should determine whether or not the overexcavation should be performed before the ground improvement measures are implemented. It is recommended that the overexcavation extend to a depth of at least 4 feet below existing grade, and to a depth of at least 4 feet below proposed grade (if practical based on groundwater conditions), whichever is greater. Within the influence zones of the new foundations, the overexcavation should extend to a depth of at least 3 feet below proposed foundation bearing grade. The overexcavation should also extend to a depth sufficient to remove all undocumented fill soils.

The overexcavation areas should extend at least 5 feet beyond the building perimeter, and to an extent equal to the depth of fill below the new foundations. If the proposed structure incorporates any exterior columns (such as for a canopy or overhang) the area of overexcavation should also encompass these areas.

Following completion of the overexcavation, the subgrade soils within the overexcavation areas should be evaluated by the geotechnical engineer to verify their suitability to serve as the structural fill subgrade, as well as to support the foundation loads of the new structure. This evaluation should include proofrolling and probing to identify any soft, loose or otherwise unstable soils that must be removed. Some localized areas of deeper excavation may be required if additional fill materials or loose, porous, overly moist, or low-density native soils are encountered at the base of the overexcavation.

Based on conditions encountered at the exploratory boring locations, very moist soils will be encountered at or near the base of the recommended overexcavation. Stabilization of the exposed overexcavation subgrade soils may be necessary. Scarification and air drying of these materials may be sufficient to obtain a stable subgrade. However, if highly unstable soils are identified, and if the construction schedule does not allow for delays associated with drying, mechanical stabilization, usually consisting of coarse crushed stone or geotextile, could be necessary. In this event, the geotechnical engineer should be contacted for supplementary recommendations. Typically, an unstable subgrade can be stabilized using a suitable geotextile fabric, such as Mirafi 580I, HP 570 or HP 270, and/or a 12 to 18-inch thick layer of coarse (2 to 4 inch particle size) crushed stone. Crushed asphalt and concrete debris resultant from demolition could also be used as a subgrade stabilization material. Other options, including lime treatment, are also available.

After a suitable overexcavation subgrade has been achieved, the exposed soils should be scarified to a depth of at least 12 inches, and moisture conditioned to 0 to 4 percent above optimum moisture content. The subgrade soils should then be recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill, provided that they are dried to within 0 to 4 percent above the optimum moisture content. The use of an imported select fill material may be desirable if the construction schedule does not allow for drying of the on-site soils.

Treatment of Existing Soils: Retaining Walls and Site Walls

The existing soils within the areas of proposed retaining and non-retaining site walls should be overexcavated to a depth of at least 3 feet below foundation bearing grade and replaced as compacted structural fill as discussed above for the proposed building pad. Any undocumented fill soils within any of these foundation areas should be removed in their entirety. The overexcavation areas should extend at least 5 feet beyond the foundation perimeters, and to an extent equal to the depth of fill below the new foundations. Erection pads are considered to be part of the foundation system, and therefore these overexcavation recommendations apply to erection pads also. The overexcavation subgrade soils should be evaluated by the geotechnical engineer prior to scarifying, moisture conditioning, and recompacting the upper 12 inches of exposed subgrade soils, as discussed for the building areas. The previously excavated soils may then be replaced as compacted structural fill.

If the full lateral extent of overexcavation is not achievable for the proposed walls, foundation elements must be redesigned using a lower bearing pressure. If the vertical extent of the overexcavation can not be completed due to the presence of groundwater, ground improvement may be necessary for these retaining walls. The geotechnical engineer of record should be contacted for recommendations pertaining to either of these conditions.

Treatment of Existing Soils: Parking Areas

Based on economic considerations, overexcavation of the existing soils in the new parking and drive areas is not considered warranted, with the exception of areas where lower strength, or unstable soils are identified by the geotechnical engineer during grading. Subgrade preparation in the new parking and drive areas should initially consist of removal of all soils disturbed during stripping and demolition operations.

The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. Any such materials should be removed to a level of firm and unyielding soil. The exposed subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to at least 0 to 4 percent above optimum, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength surficial soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

The grading recommendations presented above for the proposed parking area assume that the owner and/or developer can tolerate minor amounts of settlement within the proposed parking areas. The grading recommendations presented above do not completely mitigate the extent of the existing fill soils and low strength alluvium in the parking areas. As such, settlement and associated pavement distress could occur. Typically, repair of such distressed areas involves significantly lower costs than completely mitigating these soils at the time of construction. If the owner cannot tolerate the risk of such settlements, the parking and drive areas should be mitigated in a manner similar to that described for the building pads.

Fill Placement

- Fill soils should be placed in thin (6± inches), near-horizontal lifts, moisture conditioned to 0 to 4 percent above the optimum moisture content, and compacted. **Drying of some the onsite soils will be required before placement and compaction as fill.**
- On-site soils may be used for fill provided they are cleaned of any debris to the satisfaction of the geotechnical engineer.
- All grading and fill placement activities should be completed in accordance with the requirements of the 2016 CBC and the grading code of the city of Cypress.
- All fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Fill soils should be well mixed.
- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

Imported Structural Fill

All imported structural fill should consist of very low expansive (EI < 20), well graded soils possessing at least 10 percent fines (that portion of the sample passing the No. 200 sieve). Additional specifications for structural fill are presented in the Grading Guide Specifications, included as Appendix D.

Utility Trench Backfill

In general, all utility trench backfill should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by the city of Cypress. All utility trench backfills should be witnessed by the geotechnical engineer. The trench backfill soils should be compaction tested where possible; probed and visually evaluated elsewhere.

Utility trenches which parallel a footing, and extending below a 1h:1v plane projected from the outside edge of the footing should be backfilled with structural fill soils, compacted to at least 90 percent of the ASTM D-1557 standard. Pea gravel backfill should not be used for these trenches.

6.4 Construction Considerations

Excavation Considerations

The near surface soils in the upper 5± feet generally consist of sands, silty sands, sandy silts, and occasional clayey sands and sandy clays. Some of these materials may be subject to caving within shallow excavations. Where caving occurs within shallow excavations, flattened excavation slopes may be sufficient to provide excavation stability. On a preliminary basis, temporary excavation slopes should be made no steeper than 2:1v. **The contractor should take all necessary precautions during grading and foundation construction to prevent damage to structures and improvements which are adjacent to the proposed development.** Deeper excavations may require some form of external stabilization such as shoring or bracing. Maintaining adequate moisture content within the near-surface soils will improve excavation stability. All excavation activities on this site should be conducted in accordance with Cal-OSHA regulations.

Moisture Sensitive Subgrade Soils

The near surface soils possess appreciable silt content and occasional clay content and will become unstable if exposed to significant moisture infiltration or disturbance by construction traffic. If grading occurs during a period of relatively wet weather, an increase in subgrade instability should also be expected. The site should, therefore, be graded to prevent ponding of surface water and to prevent water from running into excavations.

As discussed in Section 6.3 of this report, unstable subgrade soils are likely to be encountered at the base of the overexcavations within the proposed building and addition areas. The extent of unstable subgrade soils will to a large degree depend on methods used by the contractor to avoid adding additional moisture to these soils or disturbing soils which already possess high moisture contents. If grading occurs during a period of relatively wet weather, an increase in subgrade instability should also be expected.

If the construction schedule dictates that site grading will occur during a period of wet weather, allowances should be made for costs and delays associated with drying the on-site soils or import of a drier, less moisture sensitive fill material. Grading during wet or cool weather may also increase the depth of overexcavation in the pad areas as well as the need for and/or the thickness of the crushed stone stabilization layer, discussed in Section 6.3 of this report.

Groundwater

Based on the conditions encountered in the borings, the groundwater table is considered to have existed at a depth of 5 to 6½± feet at the time of subsurface exploration. Therefore, based on the current groundwater depths, we excavations extending to depths of 5 feet or more may encounter the water table. Dewatering will likely be required in excavations of grater than 5 feet below the existing site grades.

6.5 Foundation Design and Construction

Based on the preceding grading recommendations, it is assumed that the new building pad will be underlain by newly placed structural fill soils placed within 4 feet of the existing site grades. Additionally, the compressible native alluvium present beneath the groundwater table will be improved using ground improvement techniques. Based on this subsurface profile, the proposed structure may be supported on shallow foundations.

Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,000 lbs/ft^2. A greater foundation bearing pressure may be allowed based on the ground improvement technique used.

- Minimum wall/column footing width: 14 inches/24 inches.

- Minimum longitudinal steel reinforcement within strip footings: Six (6) No. 5 rebars (3 top and 3 bottom) due to the presence of liquefiable soils.

- Minimum foundation embedment: 12 inches into suitable structural fill soils, and at least 18 inches below adjacent exterior grade. Interior column footings may be placed immediately beneath the floor slab.

- It is recommended that the perimeter building foundations be continuous across all exterior doorways. Any flatwork adjacent to the exterior doors should be doweled into the perimeter foundations in a manner determined by the structural engineer.

The allowable bearing pressures presented above may be increased by 1/3 when considering short duration wind loads. However, based on the presence of shallow liquefiable soils, we do not recommend an increase in the allowable bearing capacity for seismic loads. The minimum steel reinforcement recommended above is based on standard geotechnical practice. Additional rigidity may be necessary for structural considerations. The actual design of the foundations should be determined by the structural engineer.

Foundation Construction

The foundation subgrade soils should be evaluated at the time of overexcavation, as discussed in Section 6.3 of this report. It is further recommended that the foundation subgrade soils be evaluated by the geotechnical engineer immediately prior to steel or concrete placement. Soils suitable for direct foundation support should consist of newly placed structural fill compacted at least 90 percent of the ASTM D-1557 maximum dry density. Any unsuitable materials should be removed to a depth of suitable bearing compacted structural fill, with the resulting excavations backfilled with compacted fill soils. As an alternative, lean concrete slurry (500 to 1,500 psi) may be used to backfill such isolated overexcavations.

The foundation subgrade soils should also be properly moisture conditioned to 0 to 4 percent above the Modified Proctor optimum, to a depth of at least 12 inches below bearing grade. Since it is typically not feasible to increase the moisture content of the floor slab and foundation subgrade soils once rough grading has been completed, care should be taken to maintain the moisture content of the building pad subgrade soils throughout the construction process.

Estimated Foundation Settlements

Post-construction total and differential static settlements of shallow foundations designed and constructed in accordance with the previously presented recommendations are estimated to be less than 1.0 and 0.5 inches, respectively, under static conditions. Differential movements are expected to occur over a 30-foot span, thereby resulting in an angular distortion of less than 0.002 inches per inch. These settlements are in addition to the liquefaction-induced settlements previously discussed in Section 6.1 of this report. However, the likelihood of these two settlements combining is considered remote. The static settlements are expected to occur in a relatively short period of time after the building loads being applied to the foundations, during and immediately subsequent to construction. It should be noted that the projected potential dynamic settlement is related to a major seismic event and a conservative historic high groundwater level.

Lateral Load Resistance

Lateral load resistance will be developed by a combination of friction acting at the base of foundations and slabs and the passive earth pressure developed by footings below grade. The following friction and passive pressure may be used to resist lateral forces:

- Passive Earth Pressure: 240 lbs/ft^3
- Friction Coefficient: 0.27

These are allowable values, and include a factor of safety. When combining friction and passive resistance, the passive pressure component should be reduced by one-third. These values assume that footings will be poured directly against compacted structural fill. The maximum allowable passive pressure is 2,500 lbs/ft^2.

6.6 Floor Slab Design and Construction

Subgrades which will support new floor slabs should be prepared in accordance with the recommendations contained in the ***Site Grading Recommendations*** section of this report. Based on the anticipated grading which will occur at this site, and based on the design considerations presented in Section 6.1 of this report, the floor of the proposed structure may be constructed as a conventional slab-on-grade supported on newly placed structural fill, extending to a depth of at least 4 feet below proposed finished pad grade. Based on geotechnical considerations, the floor slab may be designed as follows:

- Minimum slab thickness: 6 inches

- Modulus of Subgrade Reaction: k = 100 psi/in.

- Minimum slab reinforcement: Minimum slab reinforcement: No. 3 bars at 16 inches on-center, in both directions, due to the presence of potentially liquefiable and low expansive soils at the site. The actual floor slab reinforcement should be determined by the structural engineer, based on the imposed loading, and the liquefaction-induced settlements.

- Slab underlayment: If moisture sensitive floor coverings will be used then minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire slab area where such moisture sensitive floor coverings are expected. The moisture vapor barrier should meet or exceed the Class A rating as defined by ASTM E 1745-97 and have a permeance rating less than 0.01 perms as described in ASTM E 96-95 and ASTM E 154-88. A polyolefin material such as Stego® Wrap Vapor Barrier or equivalent will meet these specifications. The moisture vapor barrier should be properly constructed in accordance with all applicable manufacturer specifications. Given that a rock free subgrade is anticipated and that a capillary break is not required, sand below the barrier is not required. The need for sand and/or the amount of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview. Where moisture sensitive floor coverings are not anticipated, the vapor barrier may be eliminated.

- Moisture condition the floor slab subgrade soils to 2 to 4 percent above the Modified Proctor optimum moisture content, to a depth of 12 inches. The moisture content of the floor slab subgrade soils should be verified by the geotechnical engineer within 24 hours prior to concrete placement.

- Proper concrete curing techniques should be utilized to reduce the potential for slab curling or the formation of excessive shrinkage cracks.

The actual design of the floor slabs should be completed by the structural engineer to verify adequate thickness and reinforcement. The steel reinforcement recommendations presented above are based on standard geotechnical practice, given the magnitude of predicted liquefaction-induced settlements, and the structure type proposed for the site. Additional rigidity may be necessary for structural considerations, or to resist the effects of the liquefaction-induced differential settlements discussed in Section 6.1.

6.7 Retaining Wall Design and Construction

Although not indicated on the site plan, some small (less than 6 feet in height) retaining walls may be required to facilitate the new site grades and in loading docks. The parameters recommended for use in the design of these walls are presented below.

Retaining Wall Design Parameters

Based on the soil conditions encountered at the boring locations, the following parameters may be used in the design of new retaining walls for this site. We have provided parameters assuming the use of on-site soils for retaining wall backfill. The near-surface soils generally consist of silty sands, sands and occasional fine sandy silts. Based on their classification, these materials are expected to possess a friction angle of at least 29 degrees when compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Soils consisting of silty clays and clayey silts likely possess lower strengths and should not be used to backfill retaining walls.

If desired, SCG could provide design parameters for an alternative select backfill material behind the retaining walls. The use of select backfill material could result in lower lateral earth pressures. In order to use the design parameters for the imported select fill, this material must be placed within the entire active failure wedge. This wedge is defined as extending from the heel of the retaining wall upwards at an angle of approximately 60° from horizontal. If select backfill material behind the retaining wall is desired, SCG should be contacted for supplementary recommendations.

RETAINING WALL DESIGN PARAMETERS

Design Parameter		Soil Type
		On-site Silty Sands and fine Sands
Internal Friction Angle (ϕ)		29°
Unit Weight		125 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	44 lbs/ft^3
	Active Condition (2h:1v backfill)	73 lbs/ft^3
	At-Rest Condition (level backfill)	64 lbs/ft^3

The walls should be designed using a soil-footing coefficient of friction of 0.27 and an equivalent passive pressure of 240 lbs/ft^3. The structural engineer should incorporate appropriate factors of safety in the design of the retaining walls.

The active earth pressure may be used for the design of retaining walls that do not directly support structures or support soils that in turn support structures and which will be allowed to deflect. The at-rest earth pressure should be used for walls that will not be allowed to deflect such as those which will support foundation bearing soils, or which will support foundation loads directly.

Where the soils on the toe side of the retaining wall are not covered by a "hard" surface such as a structure or pavement, the upper 1 foot of soil should be neglected when calculating passive resistance due to the potential for the material to become disturbed or degraded during the life of the structure.

Seismic Lateral Earth Pressures

In addition to the lateral earth pressures presented in the previous section, retaining walls which are more than 6 feet in height should be designed for a seismic lateral earth pressure, in accordance with the 2016 CBC. Based on the current site plan, it is not expected that any walls in excess of 6 feet in height will be required for this project. If any such walls are proposed, our office should be contacted for supplementary design recommendations.

Retaining Wall Foundation Design

The retaining wall foundations should be supported within newly placed compacted structural fill, extending to a depth of at least 3 feet below the proposed bearing grade. Foundations to support new retaining walls should be designed in accordance with the general Foundation Design Parameters presented in a previous section of this report.

Backfill Material

Retaining wall backfill soils should consist of imported select structural fill possessing an expansion index less than 20. All backfill material placed within 3 feet of the back wall face should have a particle size no greater than 3 inches. The retaining wall backfill materials should be well graded.

It is recommended that a minimum 1 foot thick layer of free-draining granular material (less than 5 percent passing the No. 200 sieve) be placed against the face of the retaining walls. This material should extend from the top of the retaining wall footing to within 1 foot of the ground surface on the back side of the retaining wall. This material should be approved by the geotechnical engineer. In lieu of the 1 foot thick layer of free-draining material, a properly installed prefabricated drainage composite such as the MiraDRAIN 6000XL (or approved equivalent), which is specifically designed for use behind retaining walls, may be used. If the layer of free-draining material is not covered by an impermeable surface, such as a structure or pavement, a 12-inch thick layer of a low permeability soil should be placed over the backfill to reduce surface water migration to the underlying soils. The layer of free draining granular material should be separated from the backfill soils by a suitable geotextile, approved by the geotechnical engineer.

All retaining wall backfill should be placed and compacted under engineering-controlled conditions in the necessary layer thicknesses to ensure an in-place density between 90 and 93 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D1557). Care should be taken to avoid over-compaction of the soils behind the retaining walls, and the use of heavy compaction equipment should be avoided.

Subsurface Drainage

As previously indicated, the retaining wall design parameters are based upon drained backfill conditions. Consequently, some form of permanent drainage system will be necessary in conjunction with the appropriate backfill material. Subsurface drainage may consist of either:

- A weep hole drainage system typically consisting of a series of 4-inch diameter holes in the wall situated slightly above the ground surface elevation on the exposed side of the wall and at an approximate 8-foot on-center spacing. The weep holes should include a 2 cubic foot pocket of open graded gravel, surrounded by an approved geotextile fabric, at each weep hole location.

- A 4-inch diameter perforated pipe surrounded by 2 cubic feet of gravel per linear foot of drain placed behind the wall, above the retaining wall footing. The gravel layer should be wrapped in a suitable geotextile fabric to reduce the potential for migration of fines. The footing drain should be extended to daylight or tied into a storm drainage system.

Weep holes or a footing drain will not be required for building stem walls.

6.8 Pavement Design Parameters

Site preparation in the pavement area should be completed as previously recommended in the ***Site Grading Recommendations*** section of this report. The subsequent pavement recommendations assume proper drainage and construction monitoring, and are based on either PCA or CALTRANS design parameters for a twenty (20) year design period. However, these designs also assume a routine pavement maintenance program to obtain the anticipated 20-year pavement service life.

Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of scarified, thoroughly moisture conditioned and recompacted existing soils. The near surface soils generally consist of silty fine sands, fine sands, and occasional fine sandy silts. These soils are generally considered to possess fair to good pavement support characteristics with an estimated R-values ranging from 30 to 40. The subsequent pavement design is therefore based upon an assumed R-value of 30. Any fill material imported to the site should have support characteristics equal to or greater than that of the on-site soils and be placed and compacted under engineering controlled conditions. It is recommended that R-value testing be performed after completion of rough grading. Depending upon the results of the R-value testing, it may be feasible to use thinner pavement sections in some areas of the site.

Asphaltic Concrete

Presented below are the recommended thicknesses for new flexible pavement structures consisting of asphaltic concrete over a granular base. The pavement designs are based on the traffic indices (TI's) indicated. The client and/or civil engineer should verify that these TI's are representative of the anticipated traffic volumes. If the client and/or civil engineer determine that the expected traffic volume will exceed the applicable traffic index, we should be contacted for supplementary recommendations. The design traffic indices equate to the following approximate daily traffic volumes over a 20-year design life, assuming six operational traffic days per week.

Traffic Index	No. of Heavy Trucks per Day
4.0	0
5.0	1
6.0	3
7.0	11
8.0	35

For the purpose of the traffic volumes indicated above, a truck is defined as a 5-axle tractor trailer unit with one 8-kip axle and two 32-kip tandem axles. All of the traffic indices allow for 1,000 automobiles per day.

ASPHALT PAVEMENTS (R = 30)					
Materials	**Thickness (inches)**				
	Automobile Parking (TI = 4.0)	Automobile Drive Lanes (TI = 5.0)	Truck Traffic		
			(TI = 6.0)	(TI = 7.0)	(TI = 8.0)
Asphalt Concrete	3	3	3½	4	5
Aggregate Base	3	6	8	10	11
Compacted Subgrade	12	12	12	12	12

The aggregate base course should be compacted to at least 95 percent of the ASTM D-1557 maximum dry density. The asphaltic concrete should be compacted to at least 95 percent of the Marshall maximum density, as determined by ASTM D-2726. The aggregate base course may consist of crushed aggregate base (CAB) or crushed miscellaneous base (CMB), which is a recycled gravel, asphalt and concrete material. The gradation, R-Value, Sand Equivalent, and Percentage Wear of the CAB or CMB should comply with appropriate specifications contained in the current edition of the "Greenbook" Standard Specifications for Public Works Construction.

Portland Cement Concrete

The preparation of the subgrade soils within concrete pavement areas should be performed as previously described for proposed asphalt pavement areas. The minimum recommended thicknesses for the Portland Cement Concrete pavement sections are as follows:

PORTLAND CEMENT CONCRETE PAVEMENTS			
Materials	**Thickness (inches)**		
	Automobile and Light Truck Traffic (TI = 5.0 & 6.0)	Truck Traffic	
		(TI = 7.0)	(TI = 8.0)
PCC	5	5½	6
Compacted Subgrade (95% minimum compaction)	12	12	12

The concrete should have a 28-day compressive strength of at least 3,000 psi. The maximum joint spacing within all of the PCC pavements is recommended to be equal to or less than 30 times the pavement thickness.

7.0 GENERAL COMMENTS

This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, civil engineer, and/or structural engineer. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur. The client(s)' reliance upon this report is subject to the Engineering Services Agreement, incorporated into our proposal for this project.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and sample depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted.

The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

8.0 REFERENCES

California Division of Mines and Geology (CDMG), "Guidelines for Evaluating and Mitigating Seismic Hazards in California," State of California, Department of Conservation, Division of Mines and Geology, Special Publication 117A, 2008.

Idriss, I. M. and Boulanger, R.W., "Soil Liquefaction During Earthquakes", Earthquake Engineering Research Institute, 2008.

National Research Council (NRC), "Liquefaction of Soils During Earthquakes," Committee on Earthquake Engineering, National Research Council, Washington D. C., Report No. CETS-EE-001, 1985.

Seed, H. B., and Idriss, I. M., "Simplified Procedure for Evaluating Soil Liquefaction Potential using field Performance Data," Journal of the Soil Mechanics and Foundations Division, American Society of Civil Engineers, September 1971, pp. 1249-1273.

Sadigh, K., Chang, C. –Y., Egan, J. A., Makdisi. F., Youngs, R. R., "*Attenuation Relationships for Shallow Crustal Earthquakes Based on California Strong Motion Data*", Seismological Research Letters, Seismological Society of America, Volume 68, Number 1, January/ February 1997, pp. 180-189.

Southern California Earthquake Center (SCEC), University of Southern California, "Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California," Committee formed 1997.

Tokimatsu K., and Seed, H. B., "Evaluation of Settlements in Sands Due to Earthquake Shaking," Journal of the Geotechnical Engineering Division, American society of Civil Engineers, Volume 113, No. 8, August 1987, pp. 861-878.

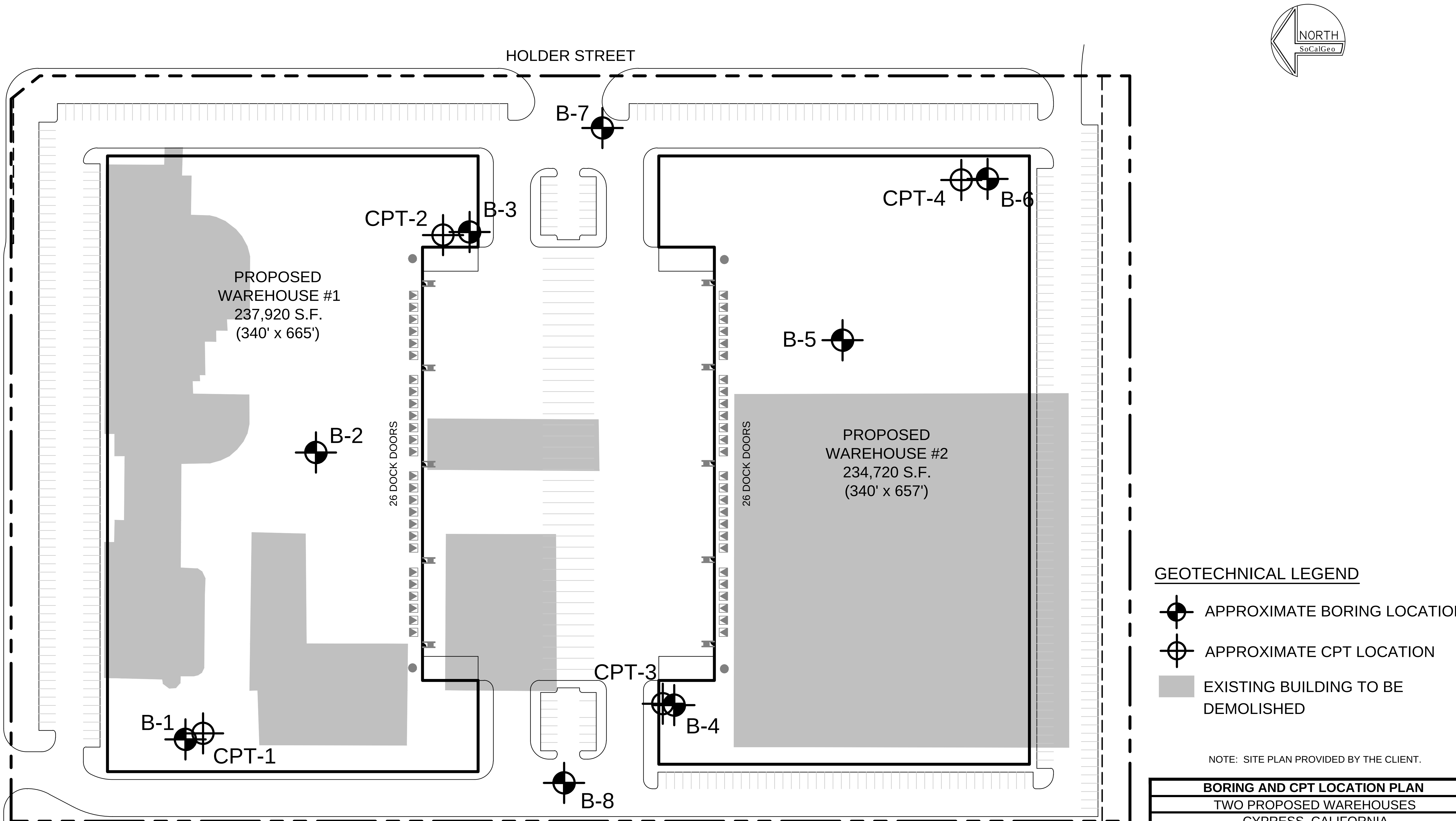
Tokimatsu, K. and Yoshimi, Y., "*Empirical Correlations of Soil Liquefaction Based on SPT N-value and Fines Content,"* Seismological Research Letters, Eastern Section Seismological Society Of America, Volume 63, Number 1, p. 73.

Youd, T. L. and Idriss, I. M. (Editors), "Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils," Salt Lake City, UT, January 5-6 1996, NCEER Technical Report NCEER-97-0022, Buffalo, NY.

APPENDIX A

SOURCE: LOS ANGELES COUNTY
THOMAS GUIDE, 2013

SITE LOCATION MAP	
TWO PROPOSED WAREHOUSES	
CYPRESS, CALIFORNIA	
SCALE: 1" = 2400'	SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JH CHKD: RGT	
SCG PROJECT 19G186-1	
PLATE 1	



BORING AND CPT LOCATION PLAN

TWO PROPOSED WAREHOUSES

CYPRESS, CALIFORNIA

SCALE: 1" = 100'

DRAWN: JH
CHKD: RGT

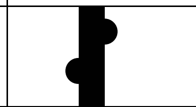
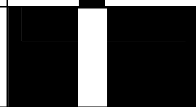
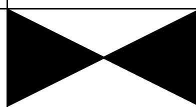
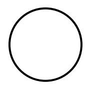
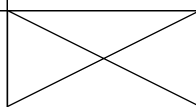
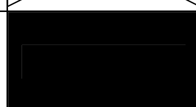
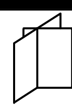
SCG PROJECT
19G186-1

PLATE 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX B

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3” indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

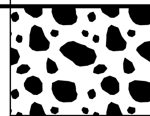
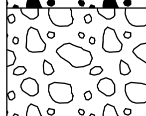
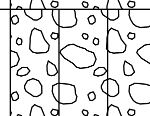
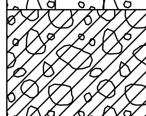
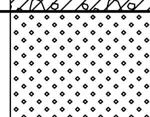
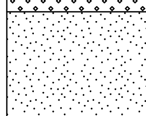
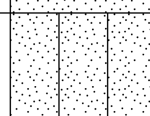
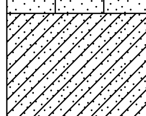
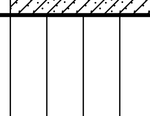
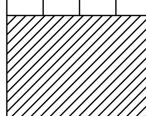
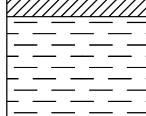
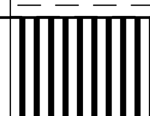
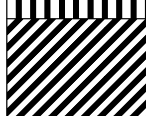
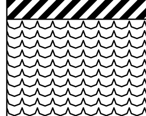
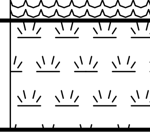
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-1

JOB NO.: 19G186	DRILLING DATE: 8/28/19	WATER DEPTH: 5 feet
PROJECT: Two Proposed Warehouses	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 5 feet
LOCATION: Cypress, California	LOGGED BY: Jamie Hayward	READING TAKEN: 4½ hours After Comp.

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					4± inches Asphaltic concrete; 5± inches of Aggregate base							
		31			ALLUVIUM: Light Gray fine Sand, trace Silt, medium dense-damp	111	6					
		21			Light Gray Brown Silty fine Sand, medium dense-damp	107	4					
5		8			Light Gray Brown fine to medium Sand, trace to little Silt, loose-wet	98	17			5		
		5	1.5		Gray Brown Silt, little Clay, soft-wet	92	29			95		
10		3			Gray Brown Silty fine Sand, very loose-wet	98	27			18		
		4			Gray Brown Silty fine Sand to fine Sandy Silt, some Clay, very loose-wet		26			47		
15		1			Thinly interbedded lenses of Gray Brown Silty fine Sand and Clayey Silt, very loose/very soft-wet		29			85		
		3			Gray to Gray Brown fine Sandy Clay, soft-wet	98	26			65		
		5					25			52		
20		8				78	27 24			69 67		
		11			Gray Silty Clay, little fine Sand, medium stiff-wet	103	24			77		
25		9					22 24	32	19	78		
		8				105	22					
		9			Gray Brown Silty Clay, medium stiff to stiff-wet @ 29 feet, little to some fine Sand		31 23	46	23	70		
30		8			@ 30 feet, little fine Sand, loose	93	29			82		
		36			Gray Silty fine Sand, dense-wet		19 21					

TBL 19G186.GPJ SOCALGEO.GDT 10/3/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-1

JOB NO.: 19G186
PROJECT: Two Proposed Warehouses
LOCATION: Cypress, California

DRILLING DATE: 8/28/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: 5 feet
CAVE DEPTH: 5 feet
READING TAKEN: 4½ hours After Comp.

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	(Continued)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					Gray Silty fine Sand, dense-very moist							
	X	18			@ 38.5 feet, little Clay, medium dense		31					
40					Interbedded lenses of Gray Silty Clay and Silty fine Sand, medium dense/very stiff-wet		30					
					Gray Brown Silty fine Sand, medium dense-wet							
	X	17					33			30		
45					Gray Silt, medium dense-wet		30			98		
					Gray fine Sand, little Silt, dense-wet							
	X	36					26					
50					Gray fine to medium Sand, trace Silt, dense-wet		21					
					Boring Terminated at 50'							

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-2

JOB NO.: 19G186	DRILLING DATE: 8/29/19	WATER DEPTH: 5 feet
PROJECT: Two Proposed Warehouses	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 5½ feet
LOCATION: Cypress, California	LOGGED BY: Jamie Hayward	READING TAKEN: At Completion

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION — SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					4± inches Asphaltic concrete; 4± inches of Aggregate base							
		33			POSSIBLE FILL: Dark Gray Brown Silty fine Sand to fine Sandy Silt, trace fine Gravel, trace Iron oxide staining, medium dense-moist to very moist	102	13					
		18	3.0		ALLUVIUM: Interbedded lenses of fine Sandy Clay and fine Sand, medium dense/very stiff-very moist	115	17					
5		9			Gray Brown to Dark Gray Brown Silty fine Sand, little Clay, loose-wet	100	23					
		8	1.5		Dark Gray Brown Silty Clay, trace Iron oxide staining, stiff-wet	94	28					
10		12			Gray Brown Silty fine Sand, loose-wet		24					
		6			Gray Brown fine Sand, loose-wet		24					
15		12			Interbedded lenses of Gray Brown Silty fine Sand and Silty Clay, loose/medium stiff to stiff-wet	99	24					
					Gray Brown Silty fine Sand, trace Clay, medium dense-wet		24					
20		7			Gray Brown fine Sand, trace Silt, loose-wet	95	24					
25		5					25					

Boring Terminated at 26.5'

TBL 19G186.GPJ SOCALGEO.GDT 10/3/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-3

JOB NO.: 19G186
PROJECT: Two Proposed Warehouses
LOCATION: Cypress, California

DRILLING DATE: 8/29/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: 5 feet
CAVE DEPTH: 13 feet
READING TAKEN: 5½ hours After Comp.

SURFACE ELEVATION: --- MSL

FIELD RESULTS: DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	DESCRIPTION	LABORATORY RESULTS: DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
				3± inches Asphaltic concrete; 4± inches of Aggregate base							
		10		ALLUVIUM: Gray Brown fine Sand, trace medium Sand, very loose to medium dense-very moist		14					
		2				23					
			2.0	Gray Brown Silty Clay, occasional thin fine Sand lenses, very soft/very loose-wet		34					
5		3									No Sample Recovered
		3				37					
		3		Dark Brown to Dark Gray Brown fine Sandy Silt, very loose-wet	89	39					
		10	1.0	Dark Brown Silty Clay, medium stiff-wet		30					
10											
				Dark Gray Brown fine Sandy Clay, medium stiff-wet							
		5				25					
15		23		Dark Gray Silty fine Sand, medium dense-wet	106	22					
				Dark Gray Silty Clay, very soft-wet							
		1				32					
20		6		Gray Brown Silty fine Sand, trace to little Clay, loose-wet	92	31					
				Dark Gray Brown fine Sandy Clay to Silty Clay, medium stiff-wet							
		7				24					
25		15		Gray Brown Silty fine Sand, medium dense-wet	102	26					

Boring Terminated at 26'

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 19G186	DRILLING DATE: 8/29/19	WATER DEPTH: 5½ feet
PROJECT: Two Proposed Warehouses	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 5½ feet
LOCATION: Cypress, California	LOGGED BY: Jamie Hayward	READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					4± inches Asphaltic concrete; 4± inches of Aggregate base							
		24			FILL: Dark Gray Brown Silty fine Sand, trace to little Clay, mottled, very stiff-very moist	111	17					EI = 8 @ 0 to 5 feet
		15			ALLUVIUM: Light Gray fine Sand, medium dense-moist	98	7					
5		10	2.0		Dark Gray Brown fine Sandy Clay, medium stiff-very moist to wet	99	20					
					Light Gray fine Sand, loose-wet							
		6			Dark Gray Brown Silty Clay, little fine Sand, medium stiff-wet	96	26					
		13			Gray Brown Silty fine Sand, trace Clay, loose to medium dense-wet	97	26					
10												
		10					28					
15		10				100	25					
					Brown to Gray Brown fine Sand, trace Silty, very loose-wet							
		2					31					
20					Gray Brown Silty Clay, soft to stiff-wet		30					
		14				90	34					
					Gray Silty fine Sand to fine Sandy Silt, loose-wet							
		14			Dark Gray Brown Silty Clay, stiff-wet	100	25					
25		13			Dark Gray fine Sand Clay, stiff-wet	100	25					

Boring Terminated at 26'

TBL 19G186.GPJ SOCALGEO.GDT 10/3/19

BORING NO. B-5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 19G186
PROJECT: Two Proposed Warehouses
LOCATION: Cypress, California

DRILLING DATE: 8/28/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: 7 feet
CAVE DEPTH: 12½ feet
READING TAKEN: At Completion

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION (SURFACE ELEVATION: --- MSL)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
		45			FILL: Brown to Gray Brown fine Sandy Silt, little Clay, mottled, dense-moist to very moist	117	14					
		22			ALLUVIUM: Gray Brown Silty fine Sand, trace Iron oxide staining, medium dense-very moist	116	14					
5		11			Gray fine Sand, trace to little Silt, trace medium Sand, loose-very moist to wet	96	14					
		8			Gray Brown fine Sandy Silt, trace Clay, loose-wet	95	26					
10		14										No Sample Recovered
		9			Gray Brown Silty fine Sand, loose-wet		27					
15		13				100	23					
20		12				89	31					

Boring Terminated at 20'

TBL 19G186.GPJ SOCALGEO.GDT 10/3/19

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-6

JOB NO.: 19G186
PROJECT: Two Proposed Warehouses
LOCATION: Cypress, California

DRILLING DATE: 8/28/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: 6½ feet
CAVE DEPTH: 23 feet
READING TAKEN: 2½ hours After Comp.

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					SURFACE ELEVATION: --- MSL							
					POSSIBLE FILL: Gray Brown Silty fine Sand, trace to little Clay, loose to medium dense-damp to very moist							
		18				108	5					
		14				101	18					
5		14				99	13			28		
					ALLUVIUM: Gray Brown Silty fine to medium Sand, loose-moist to very moist							
					Gray Brown Silty Clay to Clayey Silt, medium stiff-wet							
		7				87	33			94		
					Gray Brown Clayey fine Sand to fine Sandy Clay, loose/medium stiff-wet							
		6				97	25					
10												
		7					23			62		
					Dark Gray Brown Silty fine Sand, loose-wet							
15		14				106	20					
					Gray to Gray Brown Silty Clay, little fine Sand, trace Iron oxide staining, medium stiff to stiff-wet							
		8					27	36	20	85		
20		7	1.5			97	27					
		12	2.0			100	22					
					Gray Brown Silty fine Sand to fine Sandy Silt, 3 inch Silty Clay layer, medium dense-wet							
25		17					22			70		
30		21			Gray Brown fine to medium Sand, medium dense-wet		25					
					Gray Brown fine Sandy Silt, trace Clay, medium dense-wet		22			74		

TBL 19G186.GPJ SOCALGEO.GDT 10/3/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-6

JOB NO.: 19G186
PROJECT: Two Proposed Warehouses
LOCATION: Cypress, California

DRILLING DATE: 8/28/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: 6½ feet
CAVE DEPTH: 23 feet
READING TAKEN: 2½ hours After Comp.

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION (Continued)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
	X	11			Gray Brown fine Sandy Silt, trace Clay, medium dense-wet		29					
40	X	16					26			80		
			1.0		Gray Brown Silty Clay to Clayey Silt, little fine Sand, medium stiff to stiff-wet		23			87		
45	X	47					26					
					Gray Brown fine to medium Sand, dense-wet		21					
50	X	26			@ 50 feet, 3 inch Gray Silty Clay layer		21					

Boring Terminated at 51½'

TBL 19G186.GPJ SOCALGEO.GDT 10/3/19

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-7

JOB NO.: 19G186
PROJECT: Two Proposed Warehouses
LOCATION: Cypress, California

DRILLING DATE: 8/28/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: 5½ feet
CAVE DEPTH: 7½ feet
READING TAKEN: At Completion

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					4± inches Asphaltic concrete; 4± inches of Aggregate base							
	X	17			FILL: Gray Brown Silty fine Sand, trace Iron oxide staining, mottled, medium dense-very moist		15					
			2.5		FILL: Dark Gray Clayey fine Sand to fine Sandy Clay, hydrocarbon odor, medium dense to very stiff-very moist		12					
	X	11			ALLUVIUM: Gray Brown Silty fine Sand, mottled, medium dense-very moist		17					
5	X	11			Gray Brown Silty Clay, trace Iron oxide staining, stiff-wet		35					
	X	12			Gray Brown Silty fine Sand to fine Sandy Silt, little Clay, little Iron oxide staining, medium dense-wet		25					
10					Interbedded lenses of Gray Brown fine Sandy Silt and Silty Clay, trace Iron oxide staining, loose/medium stiff-wet							
	X	6					28					
15	■	6				99	25					

Boring Terminated at 16'

BORING NO. B-8

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 19G186	DRILLING DATE: 8/29/19	WATER DEPTH: 6 feet
PROJECT: Two Proposed Warehouses	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 6 feet
LOCATION: Cypress, California	LOGGED BY: Jamie Hayward	READING TAKEN: At Completion

SURFACE ELEVATION: --- MSL

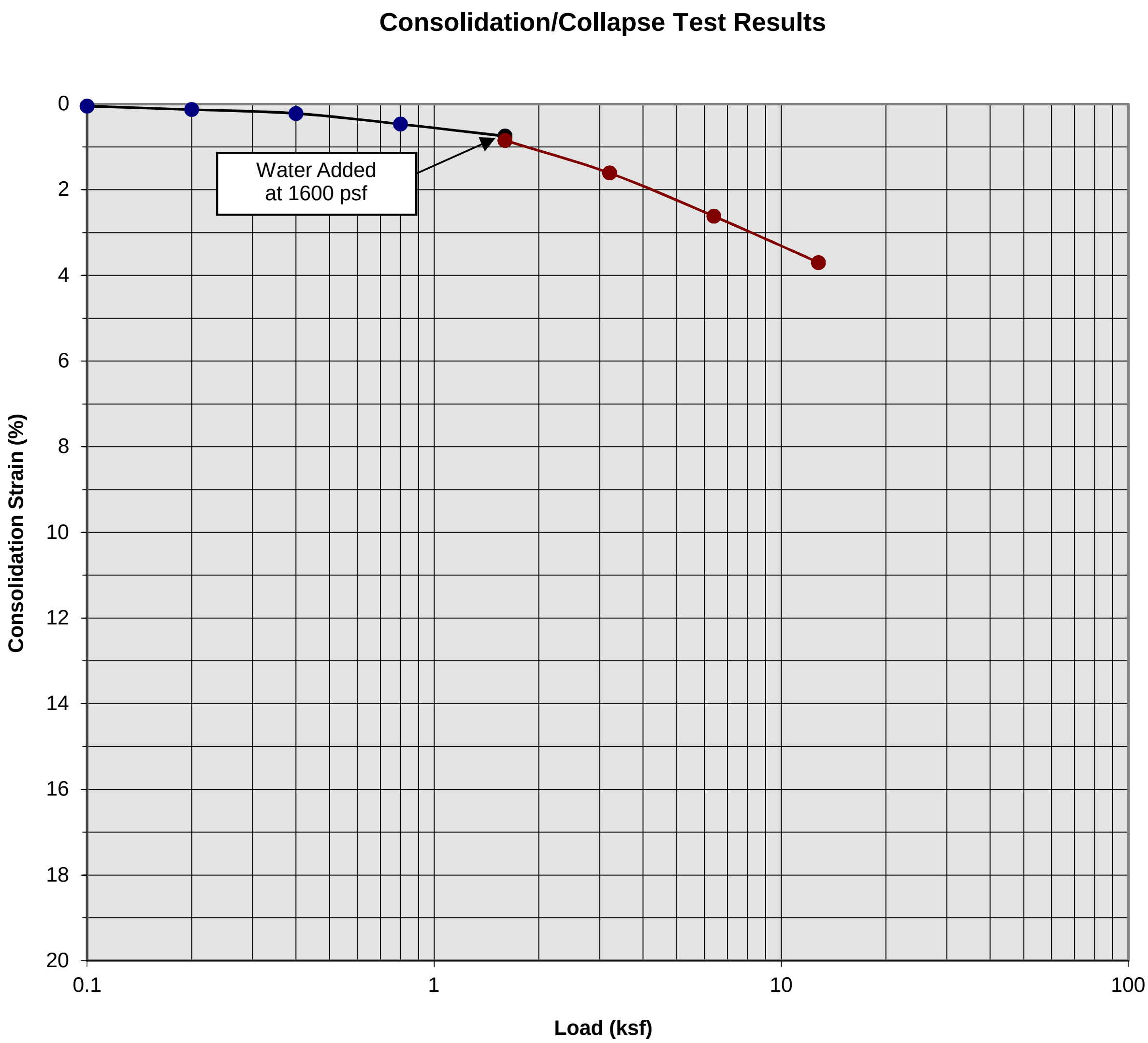
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					4± inches Asphaltic concrete; 4± inches of Aggregate base							
		22			FILL: Dark Gray Silty fine Sand, little Clay, medium dense-moist to very moist		12					
		10			@ 3.5 feet, trace Clay		15					
					ALLUVIUM: Dark Gray Silty Clay, little fine Sand, stiff-very moist		21					
5							11					
					Light Gray Brown fine Sand, medium dense-very moist to wet							
		5	1.5		Dark Gray Silty Clay, medium stiff-wet		25					
		6	1.5		Dark Gray Silty Clay to Clayey Silt, medium stiff-wet	99	25					
		12			Dark Gray Silty fine Sand, little Clay, medium dense-wet		23					
					Gray Brown fine Sand, little Silt, medium dense-wet		26					
10												
		11					27					
15												

Boring Terminated at 15'

TBL 19G186.GPJ SOCALGEO.GDT 10/3/19

TEST BORING LOG

APPENDIX C



Classification: Light Gray Brown Silty fine Sand

Boring Number:	B-1	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	20
Depth (ft)	3 to 4	Initial Dry Density (pcf)	106.2
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	109.9
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.10

Two Proposed Warehouses
Cypress, California
Project No. 19G186-1
PLATE C- 1

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
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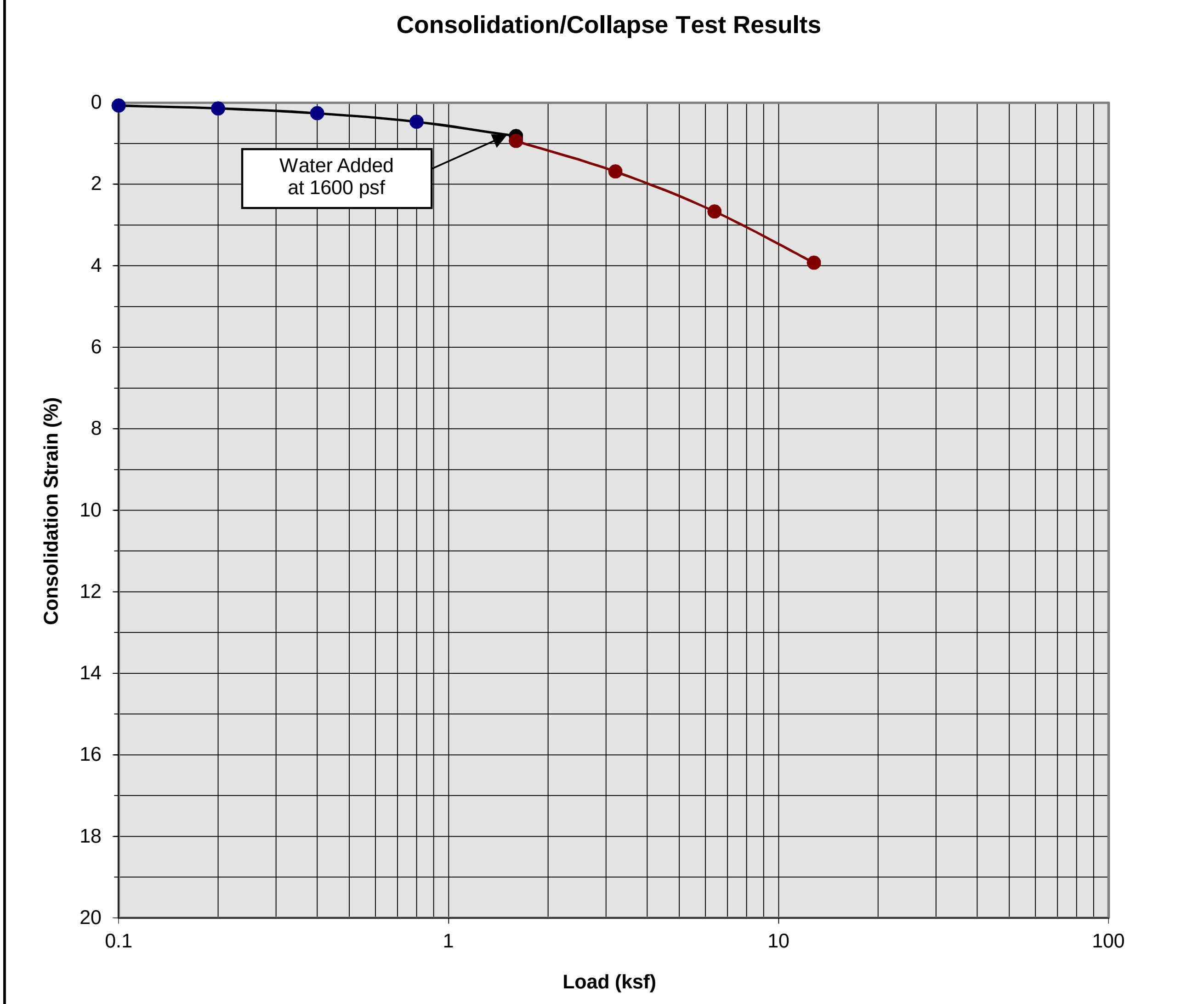
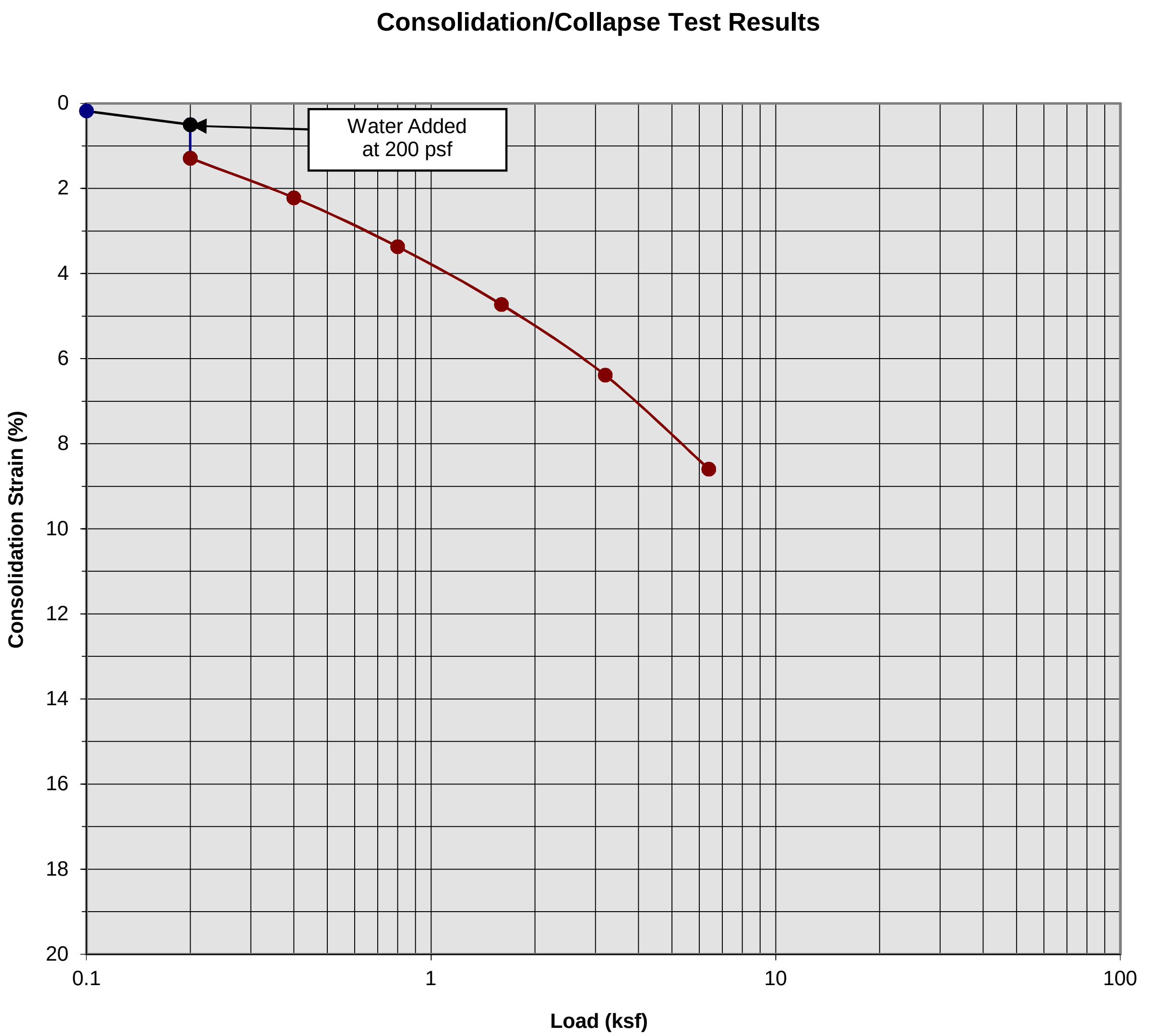


Classification: Light Gray Brown fine to medium Sand, trace to little Silt

Boring Number:	B-1	Initial Moisture Content (%)	17
Sample Number:	---	Final Moisture Content (%)	22
Depth (ft)	5 to 6	Initial Dry Density (pcf)	98.4
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	98.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.12

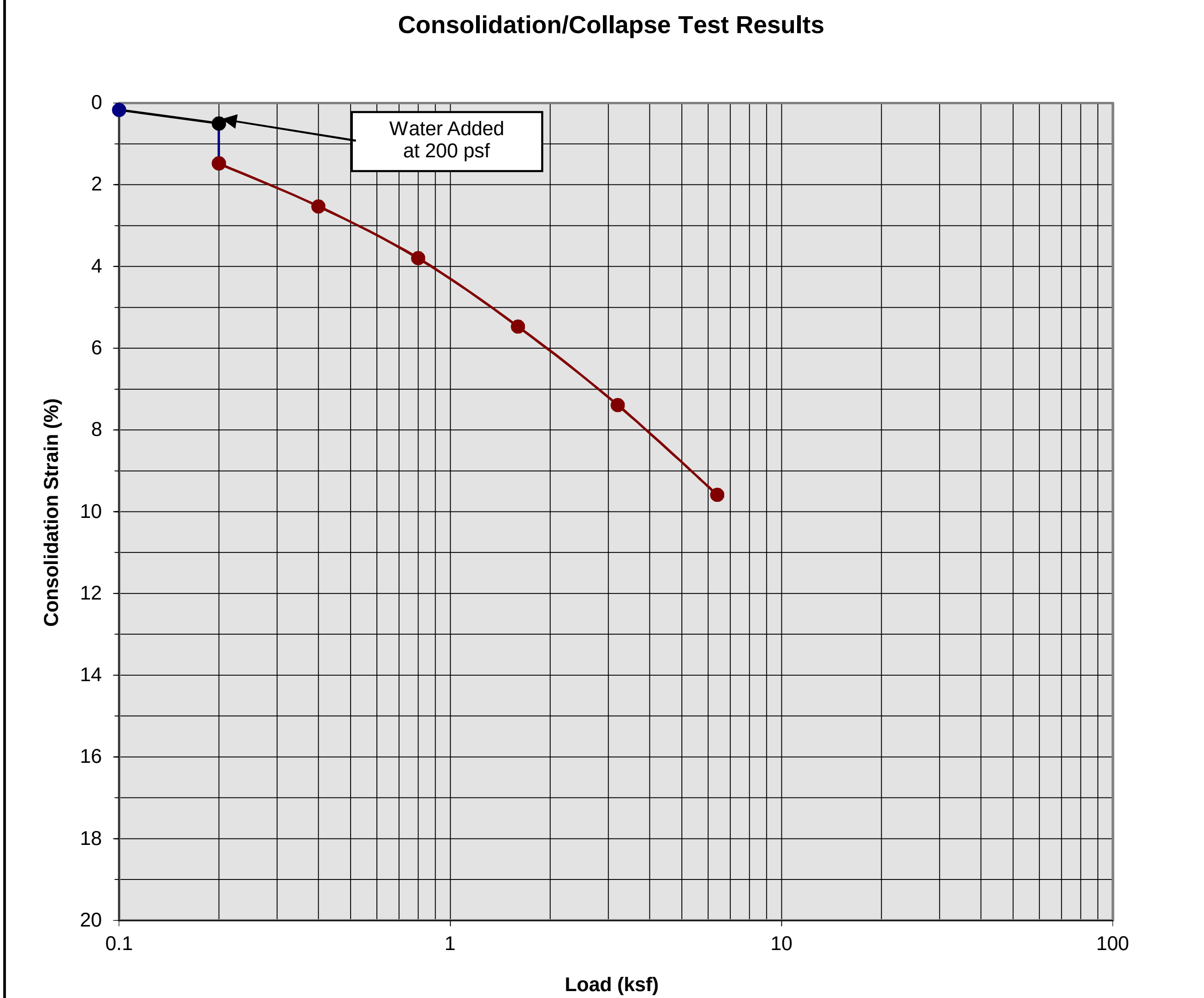


Classification: Gray Brown Silt, little Clay

Boring Number:	B-1	Initial Moisture Content (%)	30
Sample Number:	---	Final Moisture Content (%)	27
Depth (ft)	7 to 8	Initial Dry Density (pcf)	93.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	92.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.36

Two Proposed Warehouses
Cypress, California
Project No. 19G186-1
PLATE C- 3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Classification: Gray Brown Silty fine Sand

Boring Number:	B-1	Initial Moisture Content (%)	27
Sample Number:	---	Final Moisture Content (%)	22
Depth (ft)	9 to 10	Initial Dry Density (pcf)	98.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	84.3
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.67

Two Proposed Warehouses
Cypress, California
Project No. 19G186-1
PLATE C- 4

SOUTHERN CALIFORNIA GEOTECHNICAL
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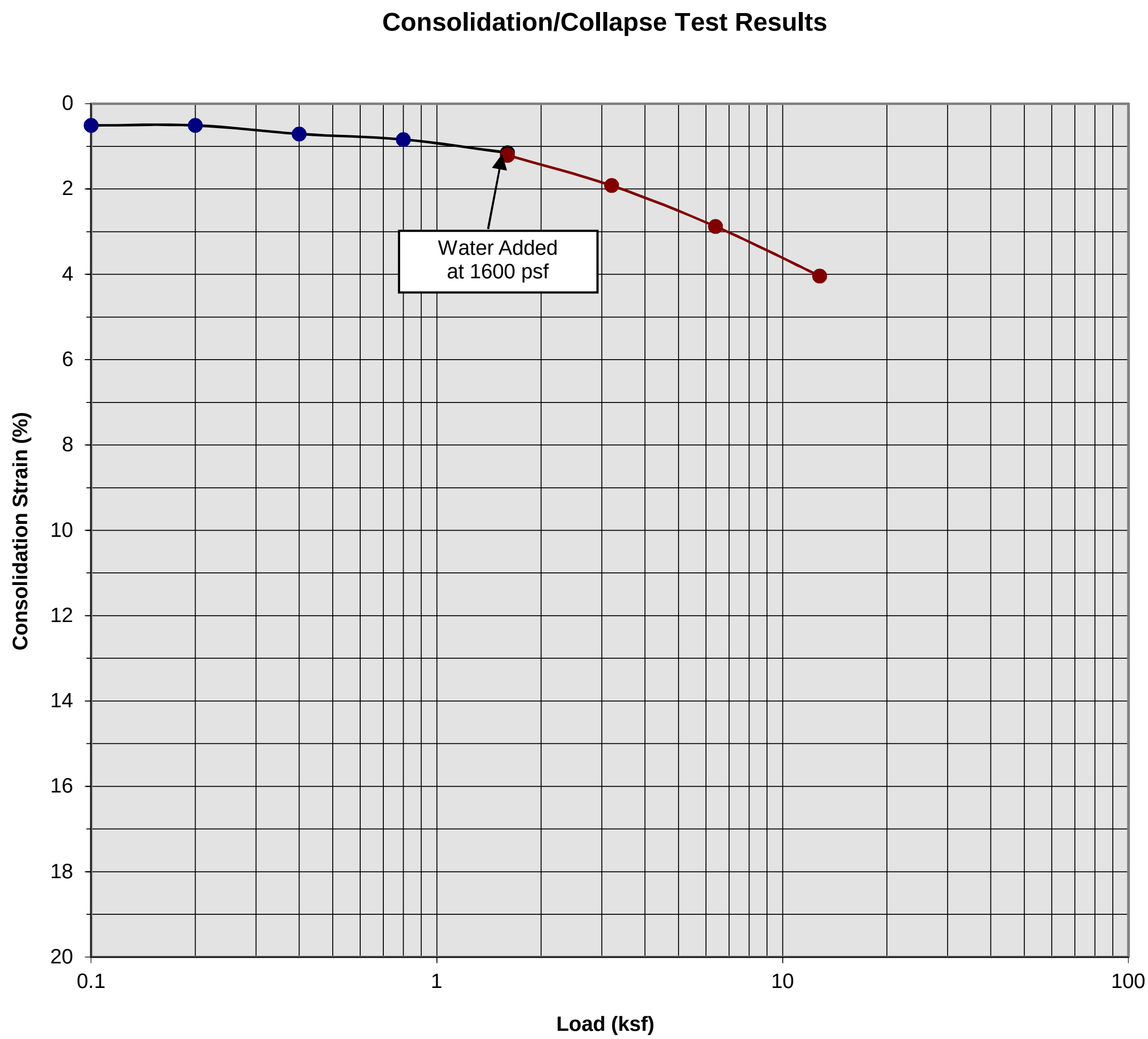

Classification: POSSIBLE FILL: Gray Brown Silty Fine Sand

Boring Number:	B-6	Initial Moisture Content (%)	18
Sample Number:	---	Final Moisture Content (%)	26
Depth (ft)	3 to 4	Initial Dry Density (pcf)	96.6
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	99.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.06

Two Proposed Warehouses
Cypress, California
Project No. 19G186-1
PLATE C- 5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
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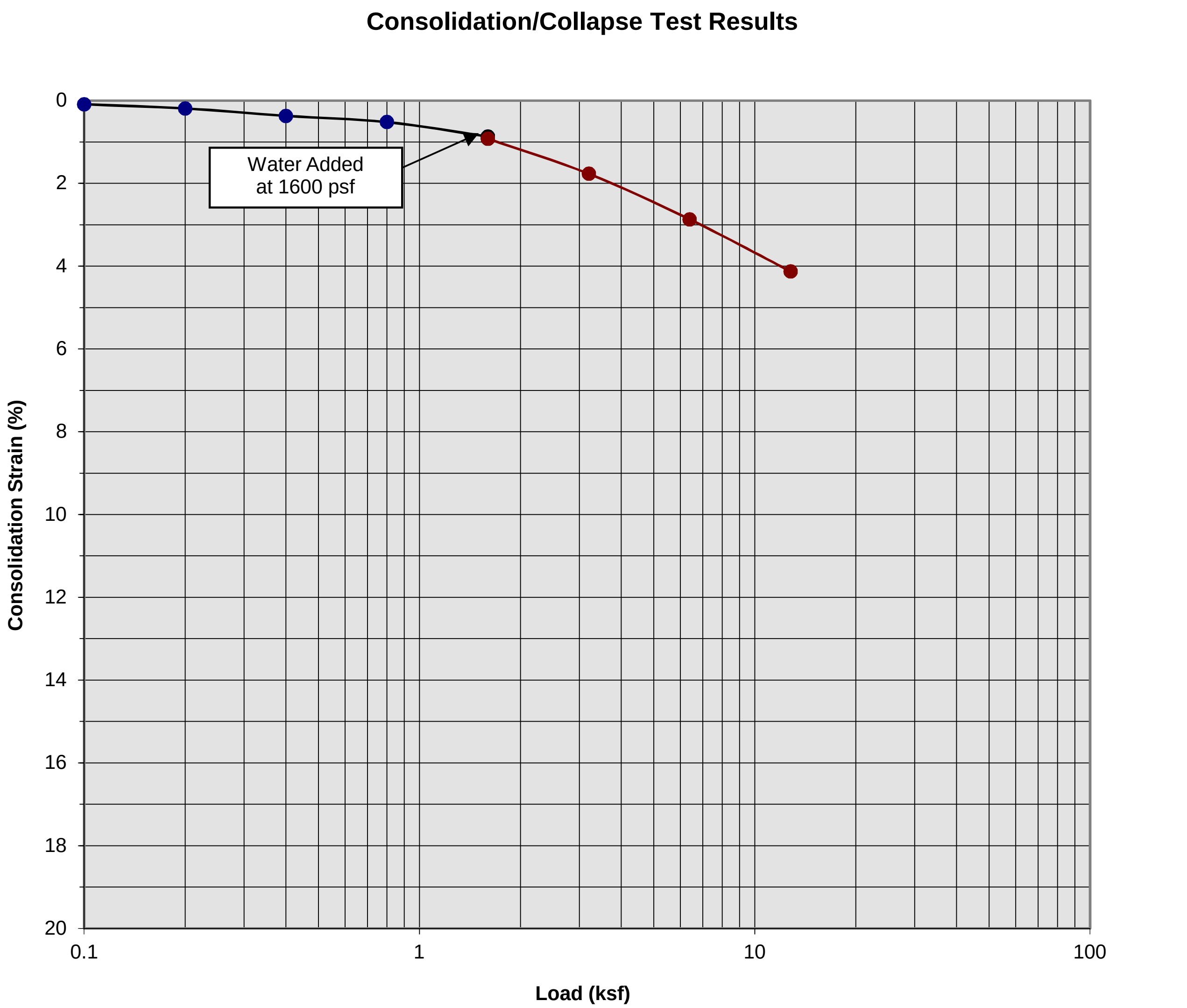
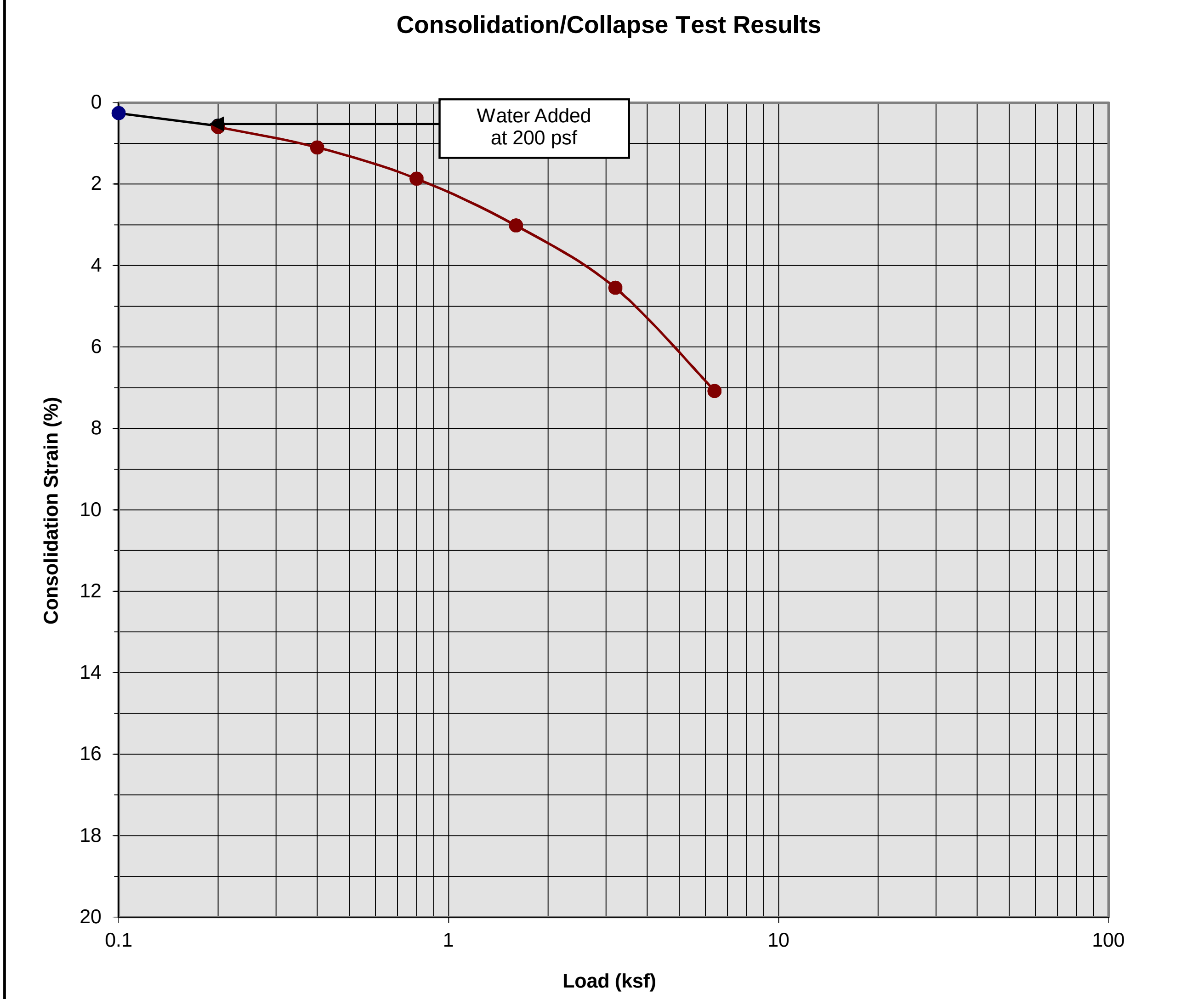


Classification: Silty fine to medium Sand

Boring Number:	B-6	Initial Moisture Content (%)	13
Sample Number:	---	Final Moisture Content (%)	17
Depth (ft)	5 to 6	Initial Dry Density (pcf)	99.2
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	103.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.05

Two Proposed Warehouses
Cypress, California
Project No. 19G186-1
PLATE C- 6

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Classification: Gray Brown Silty Clay to Clayey Silt

Boring Number:	B-6	Initial Moisture Content (%)	33
Sample Number:	---	Final Moisture Content (%)	31
Depth (ft)	7 to 8	Initial Dry Density (pcf)	88.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	76.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.15

Two Proposed Warehouses
Cypress, California
Project No. 19G186-1
PLATE C- 7

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
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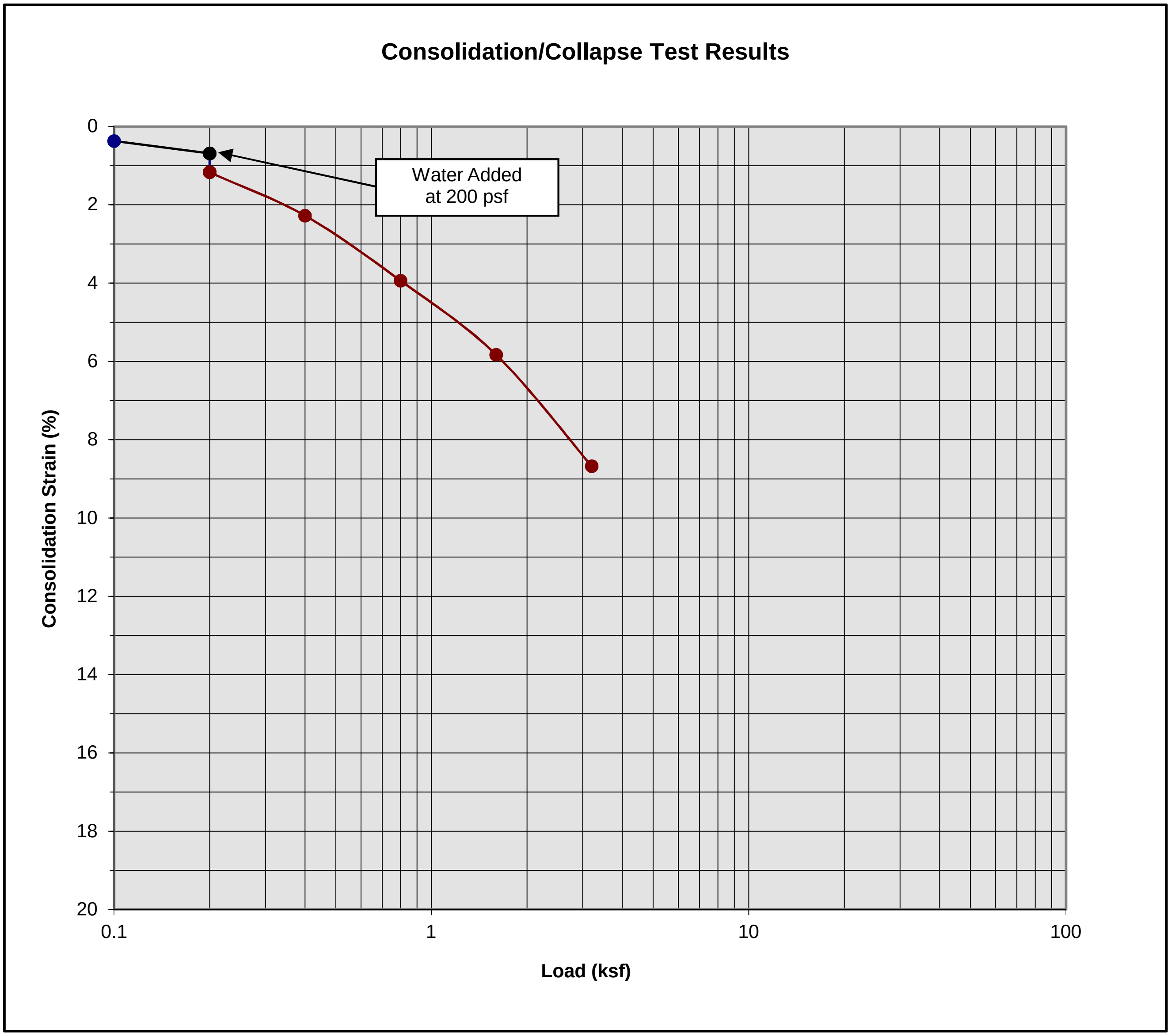
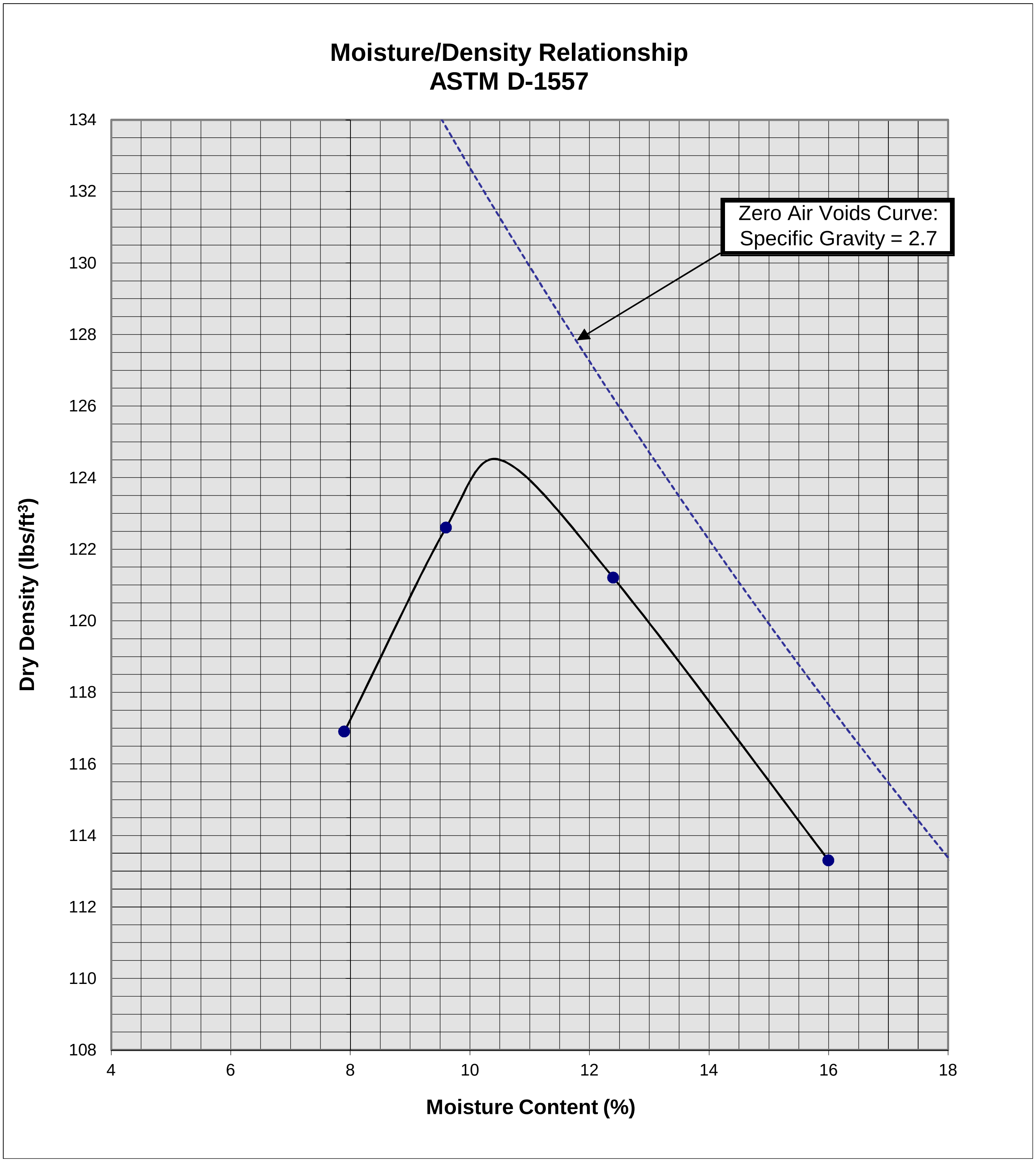


Classification: Gray Brown Clayey fine Sand to fine Sandy Clay

Boring Number:	B-6	Initial Moisture Content (%)	26
Sample Number:	---	Final Moisture Content (%)	22
Depth (ft)	9 to 10	Initial Dry Density (pcf)	97.6
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	97.3
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.89

Two Proposed Warehouses
Cypress, California
Project No. 19G186-1
PLATE C- 8

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Soil ID Number	B-6 @ 0-5'
Optimum Moisture (%)	10.5
Maximum Dry Density (pcf)	124.5
Soil Classification	Gray Brown Silty fine Sand, trace to little Clay

Two Proposed Warehouses
Cypress, California
Project No. 19G186-1
PLATE C-9

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
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APPENDIX D

GRADING GUIDE SPECIFICATIONS

These grading guide specifications are intended to provide typical procedures for grading operations. They are intended to supplement the recommendations contained in the geotechnical investigation report for this project. Should the recommendations in the geotechnical investigation report conflict with the grading guide specifications, the more site specific recommendations in the geotechnical investigation report will govern.

General

- The Earthwork Contractor is responsible for the satisfactory completion of all earthwork in accordance with the plans and geotechnical reports, and in accordance with city, county, and applicable building codes.

- The Geotechnical Engineer is the representative of the Owner/Builder for the purpose of implementing the report recommendations and guidelines. These duties are not intended to relieve the Earthwork Contractor of any responsibility to perform in a workman-like manner, nor is the Geotechnical Engineer to direct the grading equipment or personnel employed by the Contractor.

- The Earthwork Contractor is required to notify the Geotechnical Engineer of the anticipated work and schedule so that testing and inspections can be provided. If necessary, work may be stopped and redone if personnel have not been scheduled in advance.

- The Earthwork Contractor is required to have suitable and sufficient equipment on the job-site to process, moisture condition, mix and compact the amount of fill being placed to the approved compaction. In addition, suitable support equipment should be available to conform with recommendations and guidelines in this report.

- Canyon cleanouts, overexcavation areas, processed ground to receive fill, key excavations, subdrains and benches should be observed by the Geotechnical Engineer prior to placement of any fill. It is the Earthwork Contractor's responsibility to notify the Geotechnical Engineer of areas that are ready for inspection.

- Excavation, filling, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working surface. The Geotechnical Engineer must be informed of springs or water seepage encountered during grading or foundation construction for possible revision to the recommended construction procedures and/or installation of subdrains.

Site Preparation

- The Earthwork Contractor is responsible for all clearing, grubbing, stripping and site preparation for the project in accordance with the recommendations of the Geotechnical Engineer.

- If any materials or areas are encountered by the Earthwork Contractor which are suspected of having toxic or environmentally sensitive contamination, the Geotechnical Engineer and Owner/Builder should be notified immediately.

- Major vegetation should be stripped and disposed of off-site. This includes trees, brush, heavy grasses and any materials considered unsuitable by the Geotechnical Engineer.

- Underground structures such as basements, cesspools or septic disposal systems, mining shafts, tunnels, wells and pipelines should be removed under the inspection of the Geotechnical Engineer and recommendations provided by the Geotechnical Engineer and/or city, county or state agencies. If such structures are known or found, the Geotechnical Engineer should be notified as soon as possible so that recommendations can be formulated.

- Any topsoil, slopewash, colluvium, alluvium and rock materials which are considered unsuitable by the Geotechnical Engineer should be removed prior to fill placement.

- Remaining voids created during site clearing caused by removal of trees, foundations basements, irrigation facilities, etc., should be excavated and filled with compacted fill.

- Subsequent to clearing and removals, areas to receive fill should be scarified to a depth of 10 to 12 inches, moisture conditioned and compacted

- The moisture condition of the processed ground should be at or slightly above the optimum moisture content as determined by the Geotechnical Engineer. Depending upon field conditions, this may require air drying or watering together with mixing and/or discing.

Compacted Fills

- Soil materials imported to or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable in the opinion of the Geotechnical Engineer. Unless otherwise approved by the Geotechnical Engineer, all fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as “contaminated,” and shall be very low to non-expansive with a maximum expansion index (EI) of 50. The top 12 inches of the compacted fill should have a maximum particle size of 3 inches, and all underlying compacted fill material a maximum 6-inch particle size, except as noted below.

- All soils should be evaluated and tested by the Geotechnical Engineer. Materials with high expansion potential, low strength, poor gradation or containing organic materials may require removal from the site or selective placement and/or mixing to the satisfaction of the Geotechnical Engineer.

- Rock fragments or rocks less than 6 inches in their largest dimensions, or as otherwise determined by the Geotechnical Engineer, may be used in compacted fill, provided the distribution and placement is satisfactory in the opinion of the Geotechnical Engineer.

- Rock fragments or rocks greater than 12 inches should be taken off-site or placed in accordance with recommendations and in areas designated as suitable by the Geotechnical Engineer. These materials should be placed in accordance with Plate D-8 of these Grading Guide Specifications and in accordance with the following recommendations:

  - Rocks 12 inches or more in diameter should be placed in rows at least 15 feet apart, 15 feet from the edge of the fill, and 10 feet or more below subgrade. Spaces should be left between each rock fragment to provide for placement and compaction of soil around the fragments.

  - Fill materials consisting of soil meeting the minimum moisture content requirements and free of oversize material should be placed between and over the rows of rock or concrete. Ample water and compactive effort should be applied to the fill materials as they are placed in order that all of the voids between each of the fragments are filled and compacted to the specified density.

- Subsequent rows of rocks should be placed such that they are not directly above a row placed in the previous lift of fill. A minimum 5-foot offset between rows is recommended.

- To facilitate future trenching, oversized material should not be placed within the range of foundation excavations, future utilities or other underground construction unless specifically approved by the soil engineer and the developer/owner representative.

- Fill materials approved by the Geotechnical Engineer should be placed in areas previously prepared to receive fill and in evenly placed, near horizontal layers at about 6 to 8 inches in loose thickness, or as otherwise determined by the Geotechnical Engineer for the project.

- Each layer should be moisture conditioned to optimum moisture content, or slightly above, as directed by the Geotechnical Engineer. After proper mixing and/or drying, to evenly distribute the moisture, the layers should be compacted to at least 90 percent of the maximum dry density in compliance with ASTM D-1557-78 unless otherwise indicated.

- Density and moisture content testing should be performed by the Geotechnical Engineer at random intervals and locations as determined by the Geotechnical Engineer. These tests are intended as an aid to the Earthwork Contractor, so he can evaluate his workmanship, equipment effectiveness and site conditions. The Earthwork Contractor is responsible for compaction as required by the Geotechnical Report(s) and governmental agencies.

- Fill areas unused for a period of time may require moisture conditioning, processing and recompaction prior to the start of additional filling. The Earthwork Contractor should notify the Geotechnical Engineer of his intent so that an evaluation can be made.

- Fill placed on ground sloping at a 5-to-1 inclination (horizontal-to-vertical) or steeper should be benched into bedrock or other suitable materials, as directed by the Geotechnical Engineer. Typical details of benching are illustrated on Plates D-2, D-4, and D-5.

- Cut/fill transition lots should have the cut portion overexcavated to a depth of at least 3 feet and rebuilt with fill (see Plate D-1), as determined by the Geotechnical Engineer.

- All cut lots should be inspected by the Geotechnical Engineer for fracturing and other bedrock conditions. If necessary, the pads should be overexcavated to a depth of 3 feet and rebuilt with a uniform, more cohesive soil type to impede moisture penetration.

- Cut portions of pad areas above buttresses or stabilizations should be overexcavated to a depth of 3 feet and rebuilt with uniform, more cohesive compacted fill to impede moisture penetration.

- Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure that excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below grade walls must be properly tested and approved by the Geotechnical Engineer with consideration of the lateral earth pressure used in the design.

Foundations

- The foundation influence zone is defined as extending one foot horizontally from the outside edge of a footing, and proceeding downward at a ½ horizontal to 1 vertical (0.5:1) inclination.

- Where overexcavation beneath a footing subgrade is necessary, it should be conducted so as to encompass the entire foundation influence zone, as described above.

- Compacted fill adjacent to exterior footings should extend at least 12 inches above foundation bearing grade. Compacted fill within the interior of structures should extend to the floor subgrade elevation.

Fill Slopes

- The placement and compaction of fill described above applies to all fill slopes. Slope compaction should be accomplished by overfilling the slope, adequately compacting the fill in even layers, including the overfilled zone and cutting the slope back to expose the compacted core

- Slope compaction may also be achieved by backrolling the slope adequately every 2 to 4 vertical feet during the filling process as well as requiring the earth moving and compaction equipment to work close to the top of the slope. Upon completion of slope construction, the slope face should be compacted with a sheepsfoot connected to a sideboom and then grid rolled. This method of slope compaction should only be used if approved by the Geotechnical Engineer.

- Sandy soils lacking in adequate cohesion may be unstable for a finished slope condition and therefore should not be placed within 15 horizontal feet of the slope face.

- All fill slopes should be keyed into bedrock or other suitable material. Fill keys should be at least 15 feet wide and inclined at 2 percent into the slope. For slopes higher than 30 feet, the fill key width should be equal to one-half the height of the slope (see Plate D-5).

- All fill keys should be cleared of loose slough material prior to geotechnical inspection and should be approved by the Geotechnical Engineer and governmental agencies prior to filling.

- The cut portion of fill over cut slopes should be made first and inspected by the Geotechnical Engineer for possible stabilization requirements. The fill portion should be adequately keyed through all surficial soils and into bedrock or suitable material. Soils should be removed from the transition zone between the cut and fill portions (see Plate D-2).

Cut Slopes

- All cut slopes should be inspected by the Geotechnical Engineer to determine the need for stabilization. The Earthwork Contractor should notify the Geotechnical Engineer when slope cutting is in progress at intervals of 10 vertical feet. Failure to notify may result in a delay in recommendations.

- Cut slopes exposing loose, cohesionless sands should be reported to the Geotechnical Engineer for possible stabilization recommendations.

- All stabilization excavations should be cleared of loose slough material prior to geotechnical inspection. Stakes should be provided by the Civil Engineer to verify the location and dimensions of the key. A typical stabilization fill detail is shown on Plate D-5.

- Stabilization key excavations should be provided with subdrains. Typical subdrain details are shown on Plates D-6.

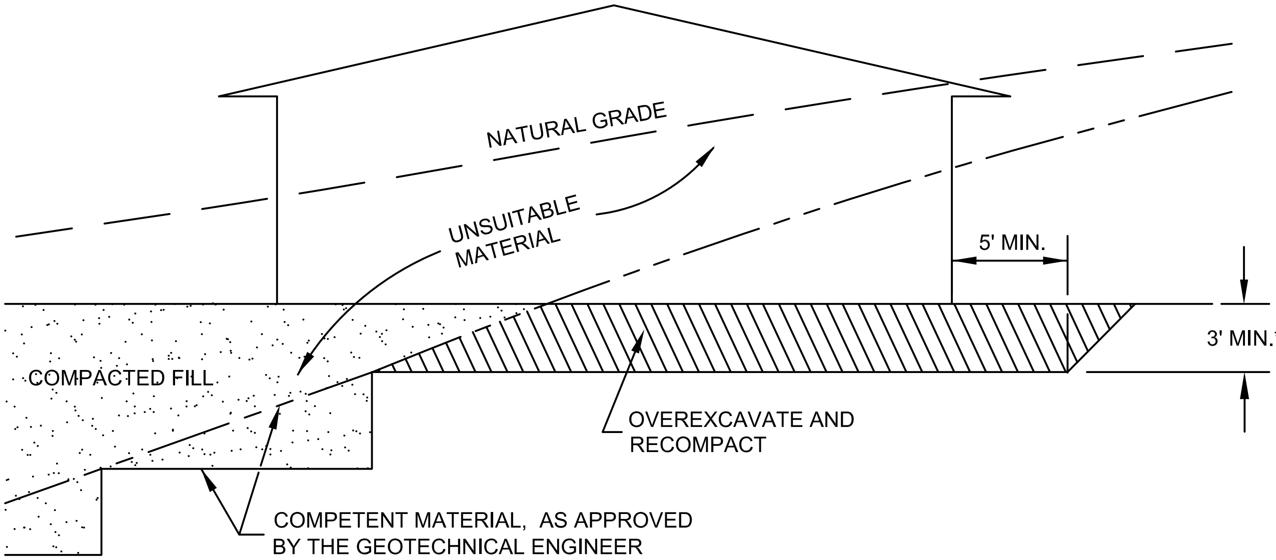
Subdrains

- Subdrains may be required in canyons and swales where fill placement is proposed. Typical subdrain details for canyons are shown on Plate D-3. Subdrains should be installed after approval of removals and before filling, as determined by the Soils Engineer.

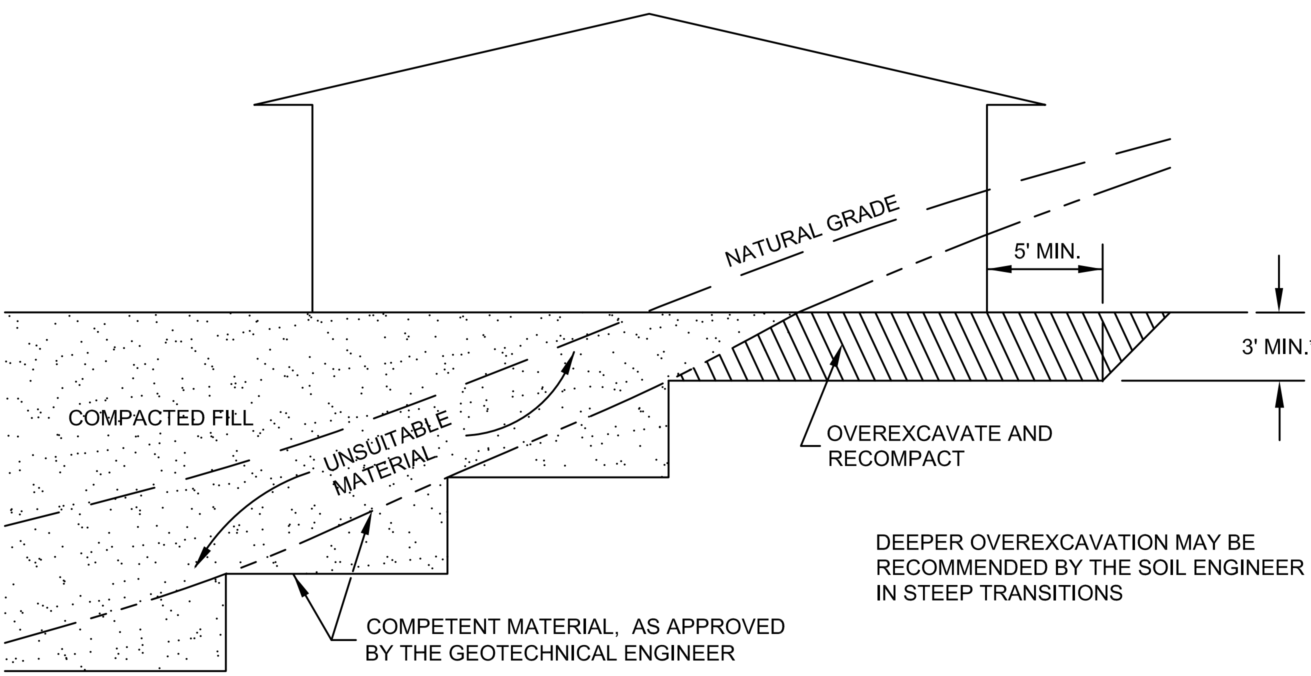
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

- Filter material for subdrains should conform to CALTRANS Specification 68-1.025 or as approved by the Geotechnical Engineer for the specific site conditions. Clean ¾-inch crushed rock may be used provided it is wrapped in an acceptable filter cloth and approved by the Geotechnical Engineer. Pipe diameters should be 6 inches for runs up to 500 feet and 8 inches for the downstream continuations of longer runs. Four-inch diameter pipe may be used in buttress and stabilization fills.

CUT LOT



CUT/FILL LOT (TRANSITION)



DEEPER OVEREXCAVATION MAY BE RECOMMENDED BY THE SOIL ENGINEER IN STEEP TRANSITIONS

*SEE TEXT OF REPORT FOR SPECIFIC RECOMMENDATION.
ACTUAL DEPTH OF OVEREXCAVATION MAY BE GREATER.

TRANSITION LOT DETAIL

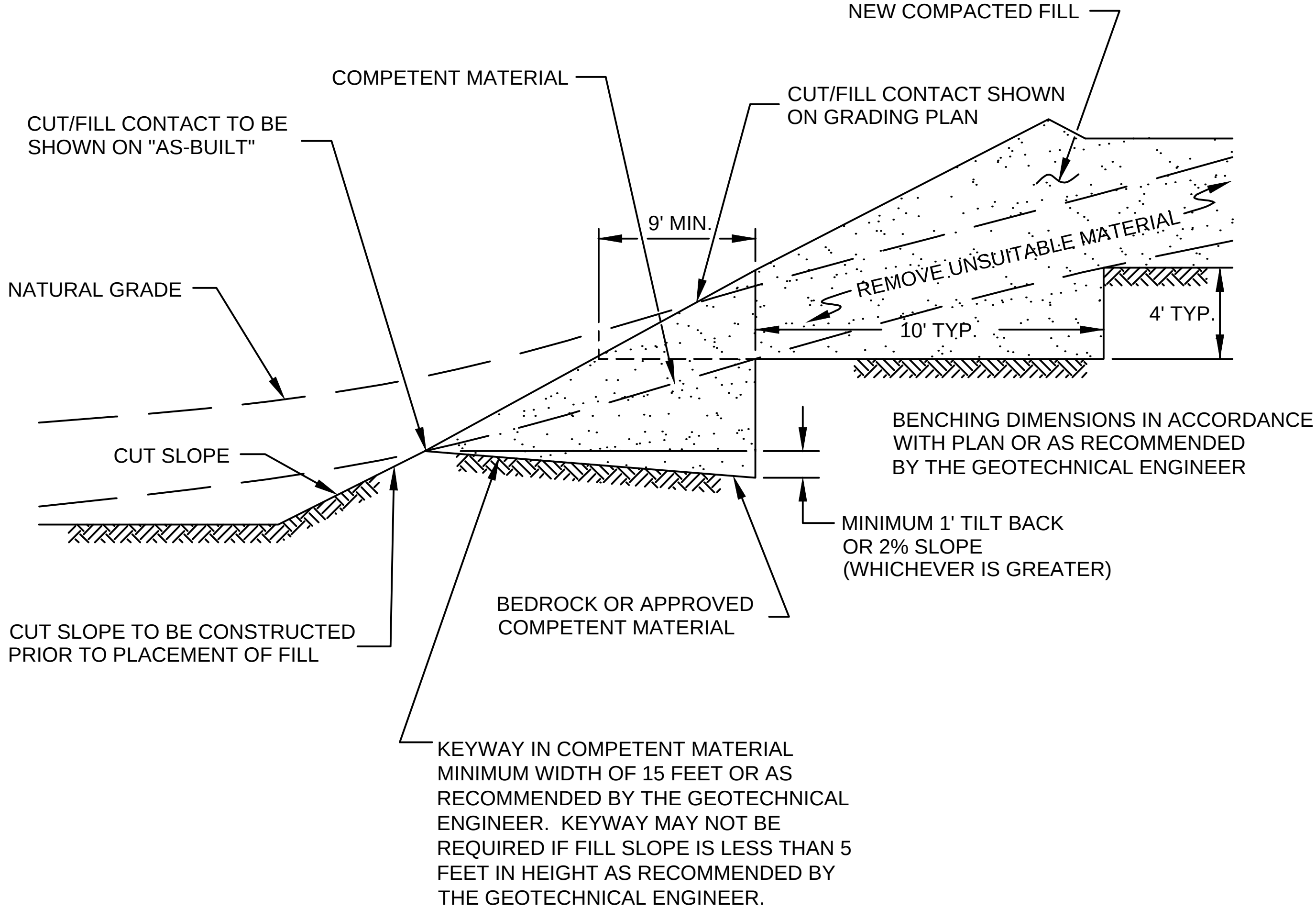
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL



FILL ABOVE CUT SLOPE DETAIL

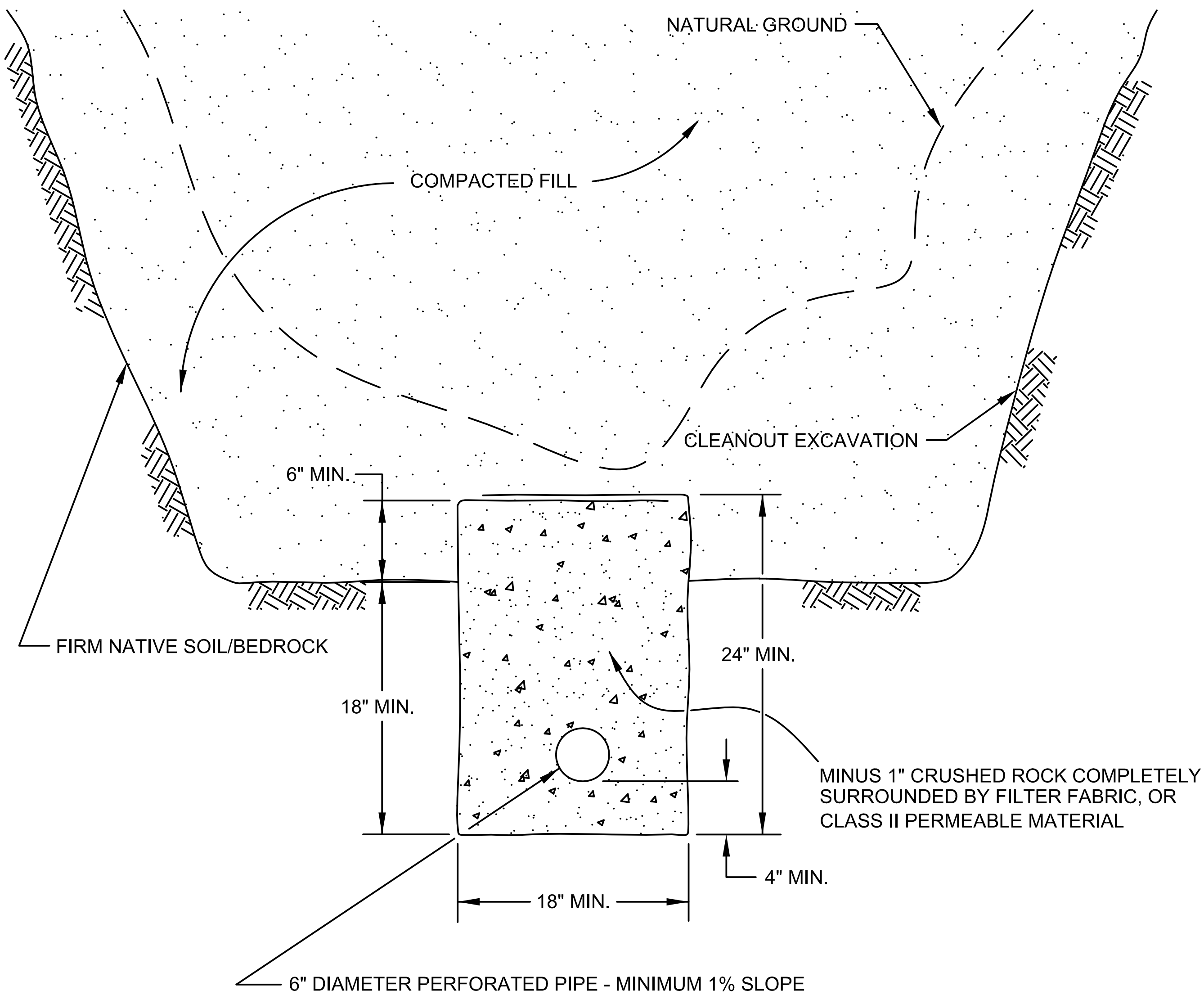
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



PIPE MATERIAL	DEPTH OF FILL OVER SUBDRAIN
ADS (CORRUGATED POLETHYLENE)	8
TRANSITE UNDERDRAIN	20
PVC OR ABS: SDR 35	35
SDR 21	100

SCHEMATIC ONLY
NOT TO SCALE

CANYON SUBDRAIN DETAIL

GRADING GUIDE SPECIFICATIONS

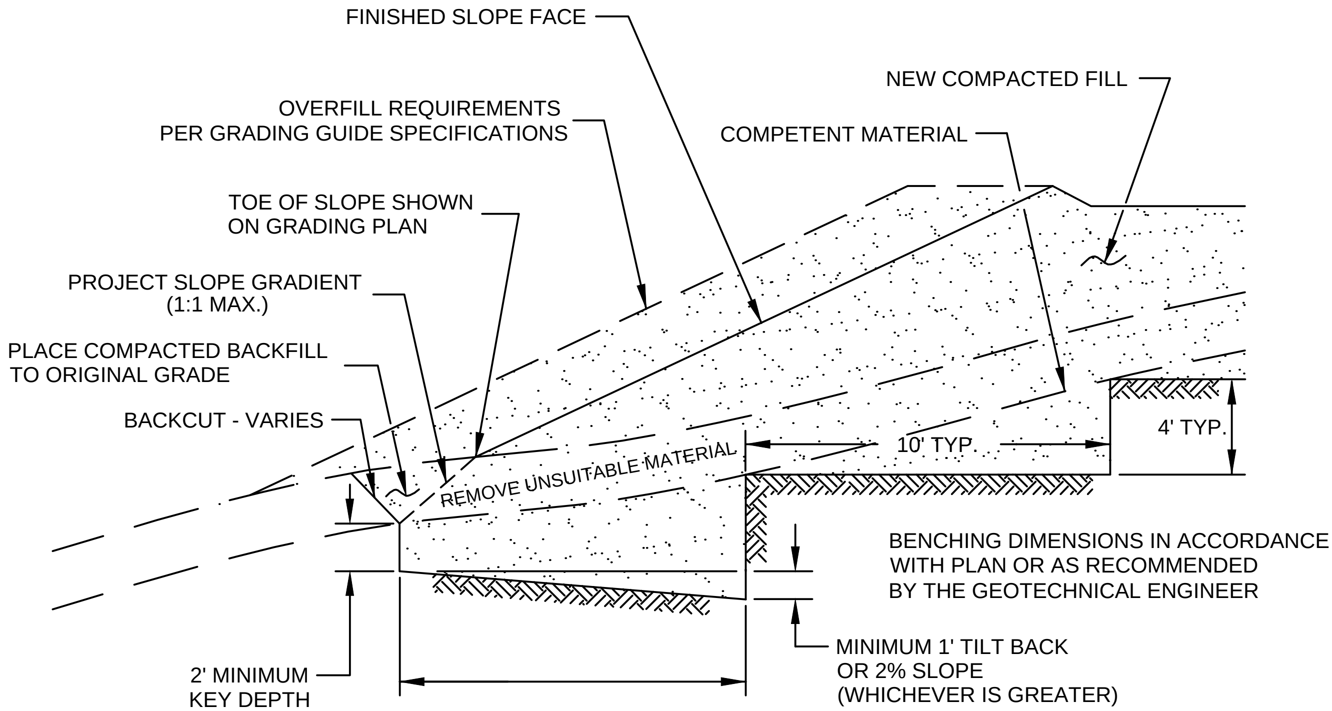
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-3

SoCalGeo

SOUTHERN
CALIFORNIA
GEOTECHNICAL



KEYWAY IN COMPETENT MATERIAL. MINIMUM WIDTH OF 15 FEET OR AS RECOMMENDED BY THE GEOTECHNIAL ENGINEER. KEYWAY MAY NOT BE REQUIRED IF FILL SLOPE IS LESS THAN 5' IN HEIGHT AS RECOMMENDED BY THE GEOTECHNICAL ENGINEER.

NOTE:
BENCHING SHALL BE REQUIRED WHEN NATURAL SLOPES ARE EQUAL TO OR STEEPER THAN 5:1 OR WHEN RECOMMENDED BY THE GEOTECHNICAL ENGINEER.

FILL ABOVE NATURAL SLOPE DETAIL

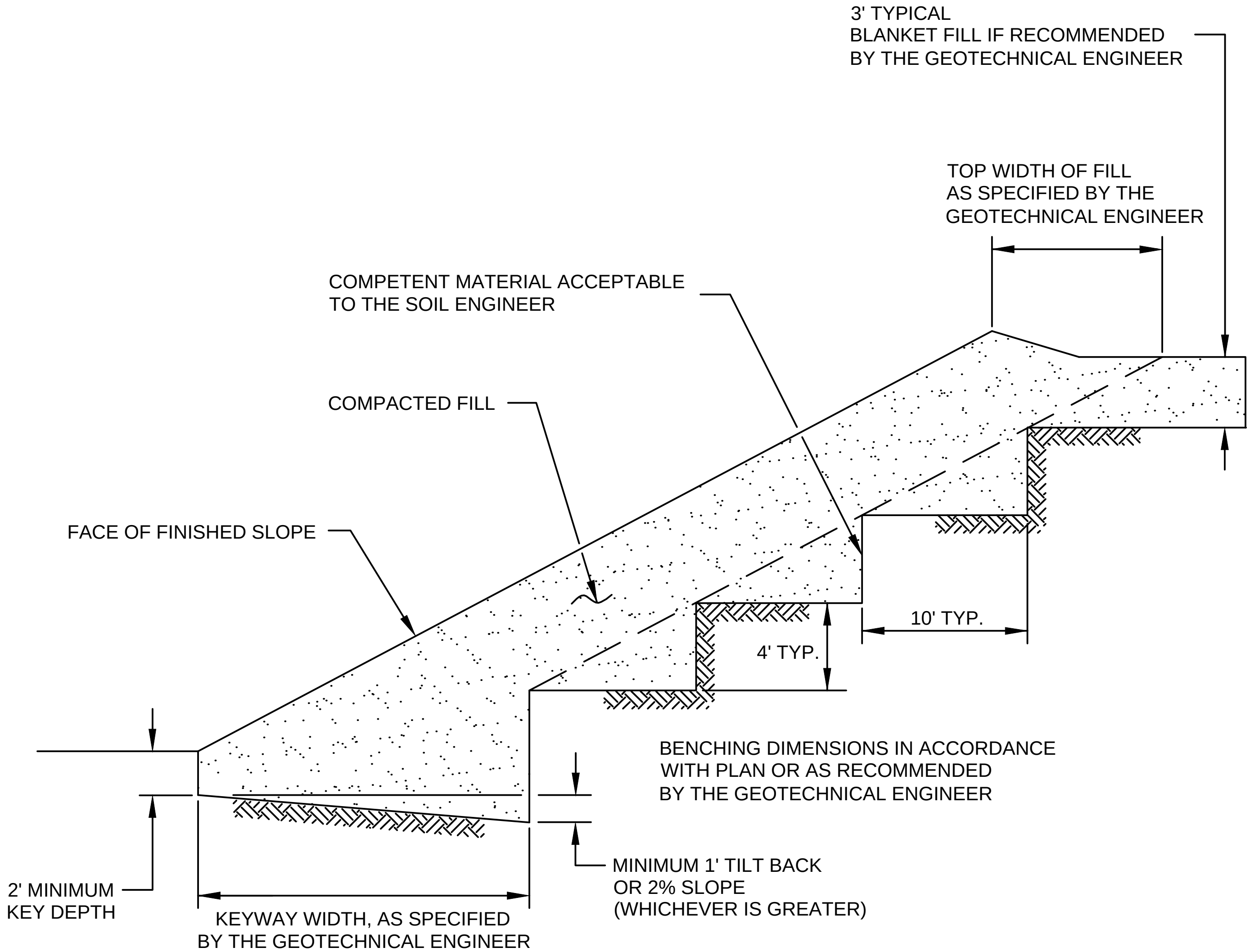
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



STABILIZATION FILL DETAIL

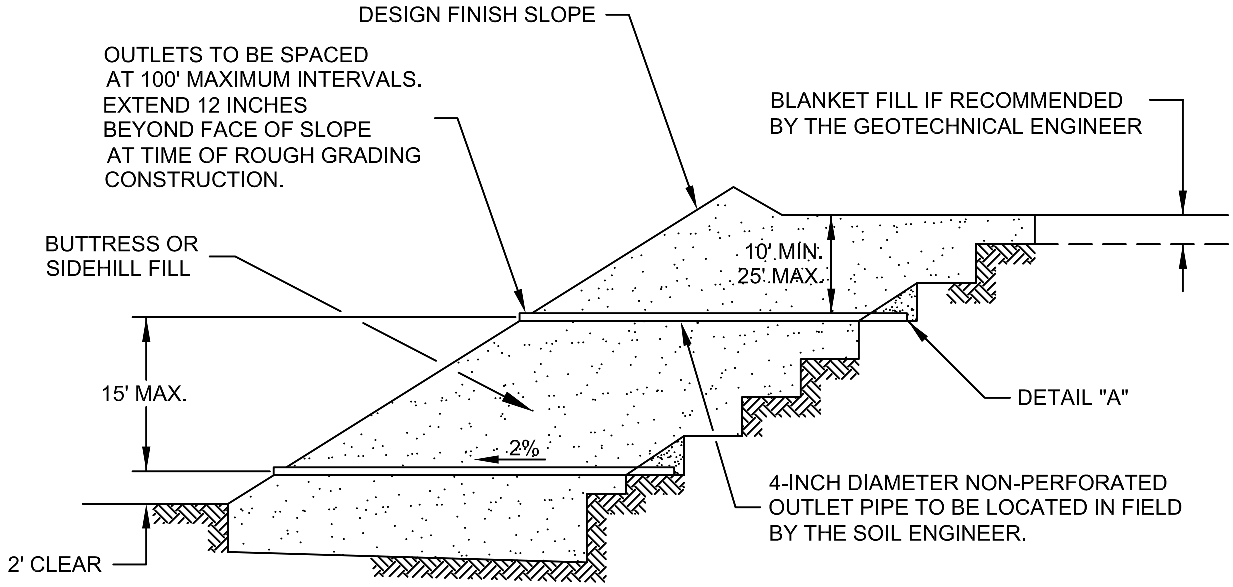
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-5

SOUTHERN CALIFORNIA GEOTECHNICAL



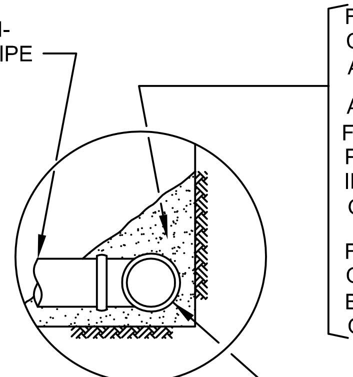
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50



DETAIL "A"

NOTES:
1. TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON-SITE SOIL.

SLOPE FILL SUBDRAINS

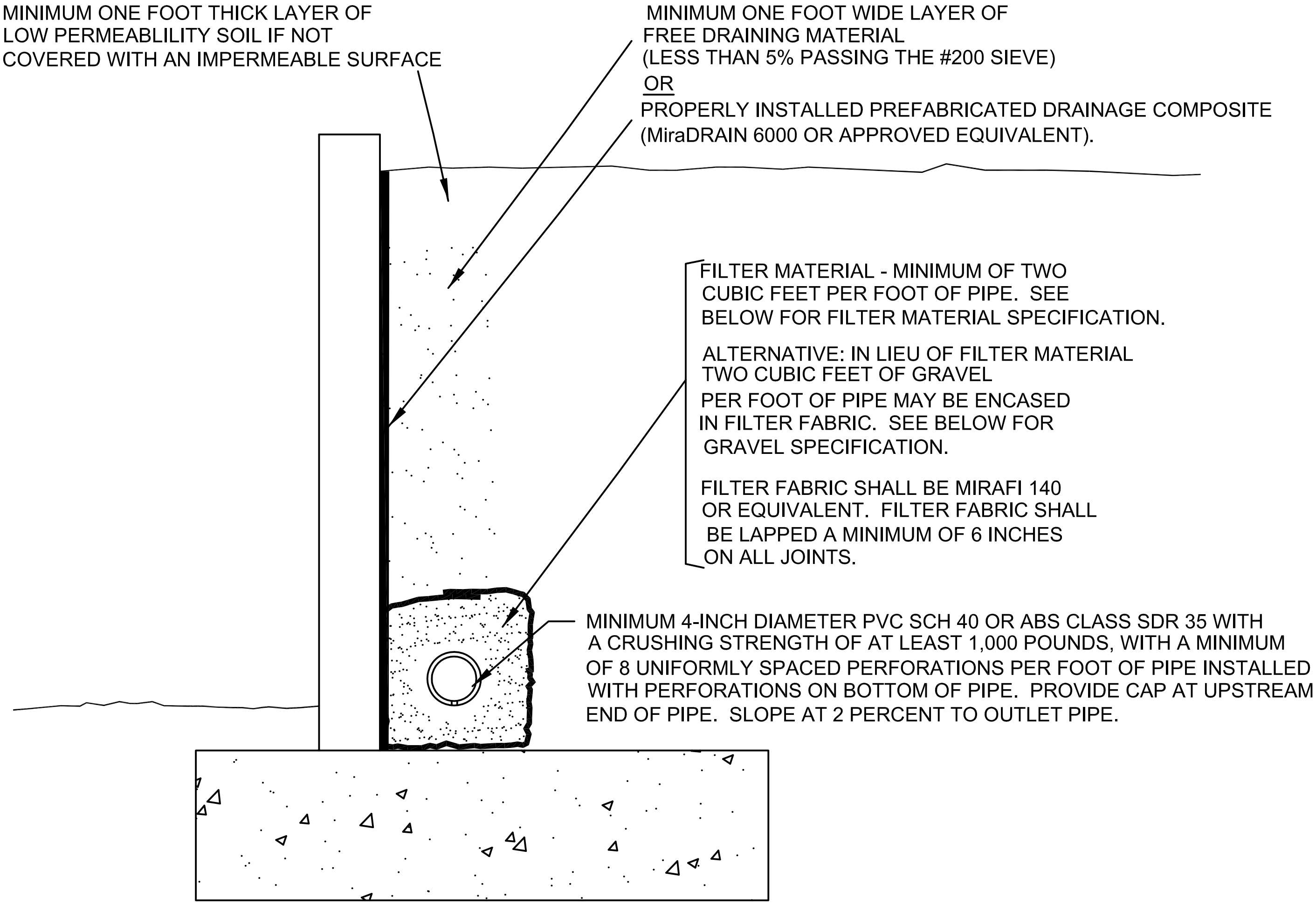
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-6

SOUTHERN CALIFORNIA GEOTECHNICAL



"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50

RETAINING WALL BACKDRAINS

GRADING GUIDE SPECIFICATIONS

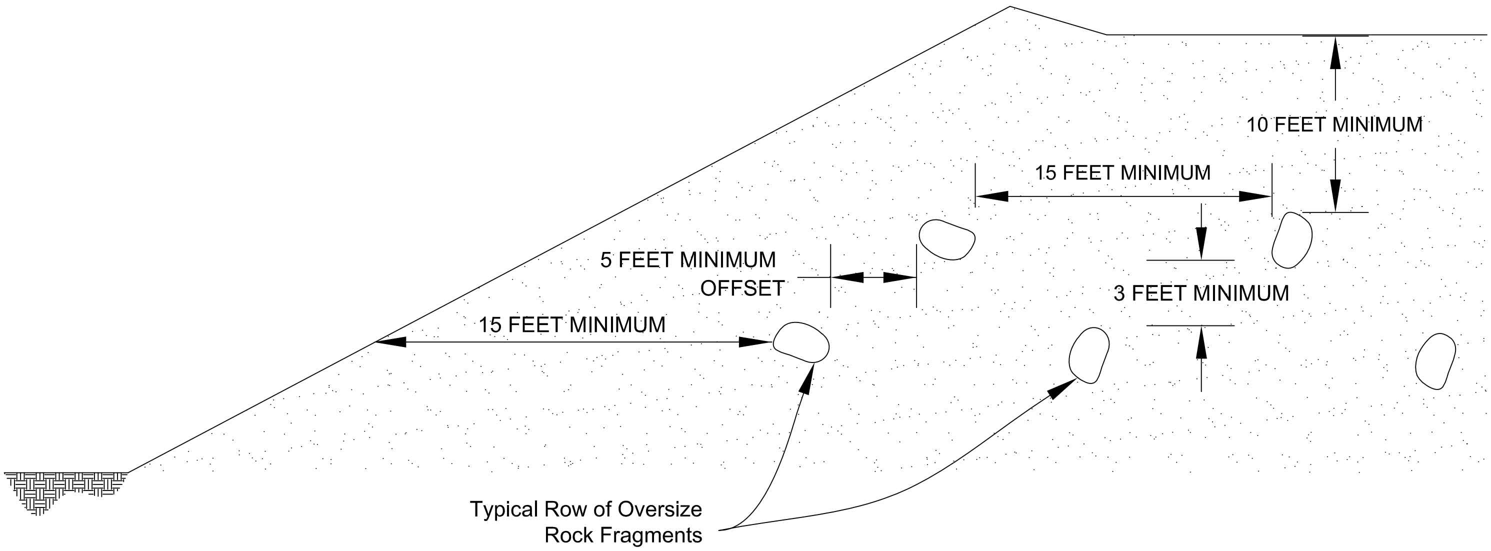
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

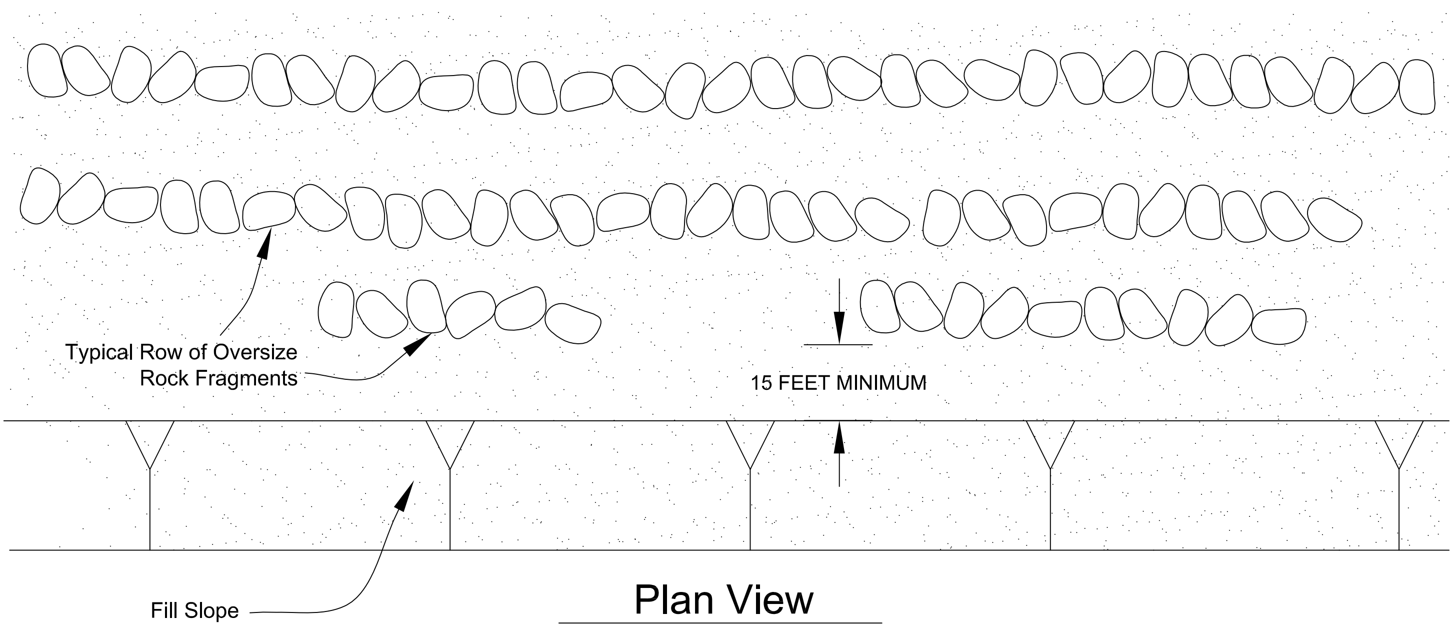
PLATE D-7

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



Section View



Plan View

PLACEMENT OF OVERSIZED MATERIAL

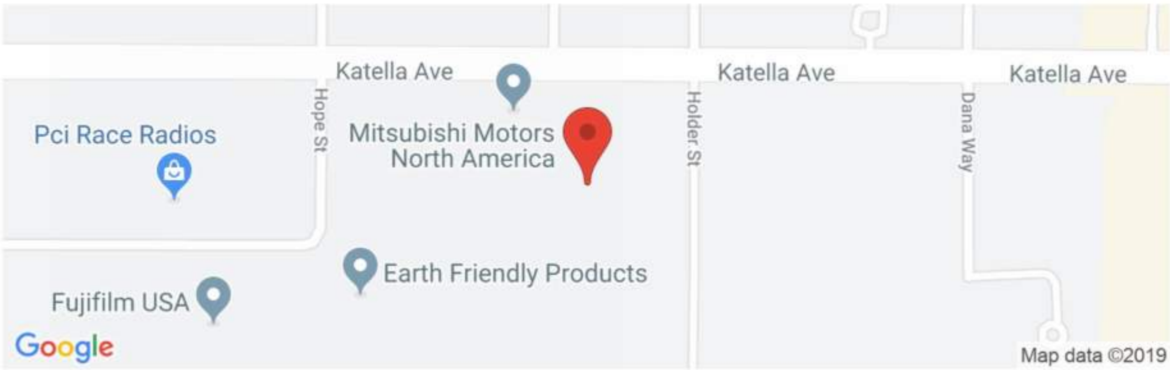
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE	SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: PM CHKD: GKM	
PLATE D-8	

APPENDIX E

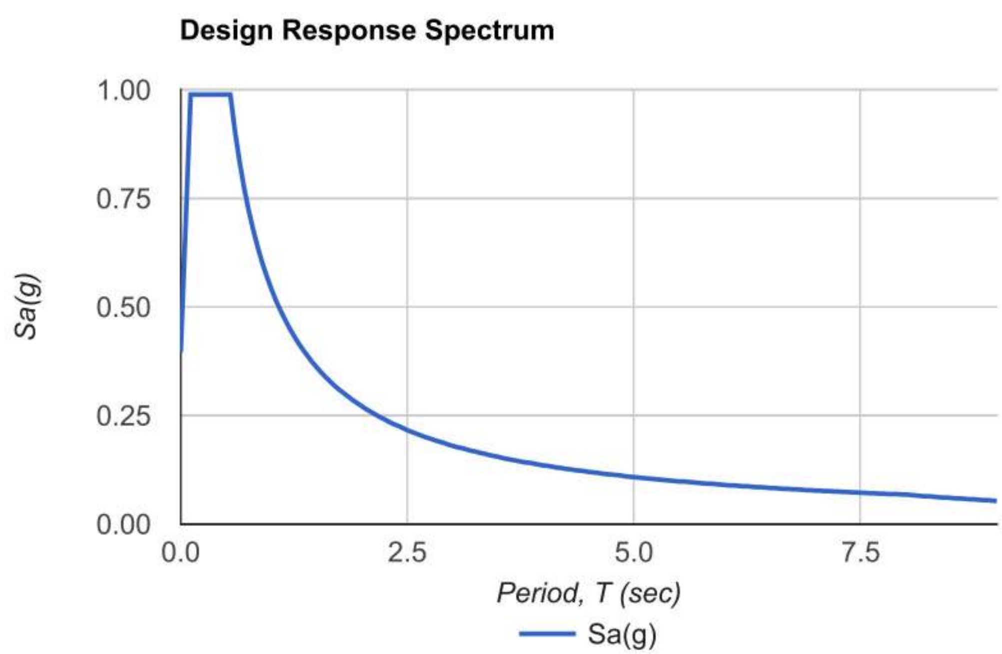
OSHPD

Latitude, Longitude: 33.801729, -118.020989



Date	9/4/2019, 1:07:27 PM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description	Type	Value	Description
S_S	1.484	MCE_R ground motion. (for 0.2 second period)	SDC	D	Seismic design category
S_1	0.541	MCE_R ground motion. (for 1.0s period)	F_a	1	Site amplification factor at 0.2 second
S_{MS}	1.484	Site-modified spectral acceleration value	F_v	1.5	Site amplification factor at 1.0 second
S_{M1}	0.812	Site-modified spectral acceleration value	PGA	0.541	MCE_G peak ground acceleration
S_{DS}	0.989	Numeric seismic design value at 0.2 second SA	F_{PGA}	1	Site amplification factor at PGA
S_{D1}	0.541	Numeric seismic design value at 1.0 second SA	PGA_M	0.541	Site modified peak ground acceleration



SOURCE: SEAOC/OSHPD Seismic Design Maps Tool
<https://seismicmaps.org/>

SEISMIC DESIGN PARAMETERS - 2016 CBC

TWO PROPOSED WAREHOUSES

CYPRESS, CALIFORNIA

DRAWN: JH
CHKD: RGT

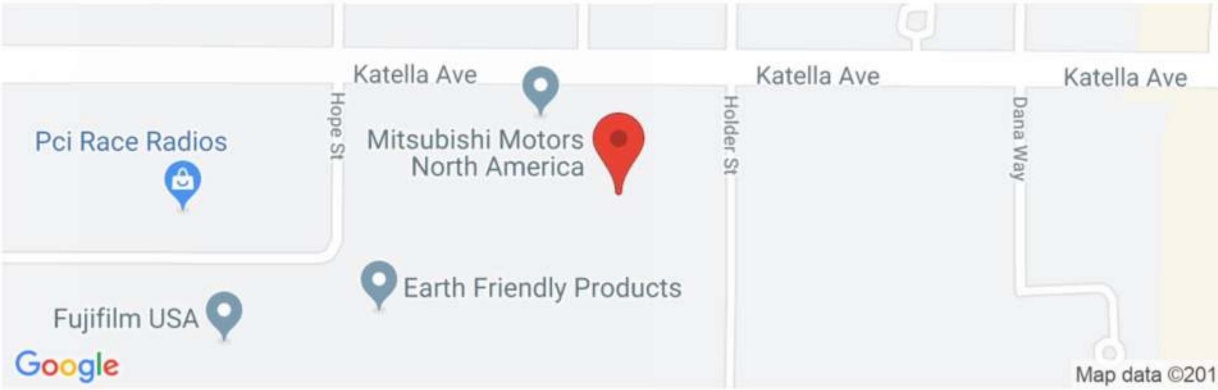
SCG PROJECT
19G186-1

PLATE E-1A

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL

OSHPD

Latitude, Longitude: 33.801729, -118.020989



Date	9/13/2019, 9:41:27 AM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.44	MCE_R ground motion. (for 0.2 second period)
S_1	0.51	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.44	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.96	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.617	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.678	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.44	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.579	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.465	Factored deterministic acceleration value. (0.2 second)
S1RT	0.51	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.557	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.835	Factored deterministic acceleration value. (1.0 second)
PGAd	0.998	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.912	Mapped value of the risk coefficient at short periods
C_{R1}	0.916	Mapped value of the risk coefficient at a period of 1 s

SOURCE: SEAOC/OSHPD Seismic Design Maps Tool
<https://seismicmaps.org/>

SEISMIC DESIGN PARAMETERS - 2019 CBC

TWO PROPOSED WAREHOUSES

CYPRESS, CALIFORNIA

DRAWN: JH
CHKD: RGT

SCG PROJECT
19G186-1

PLATE E-1B

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX F

SUMMARY

OF

CONE PENETRATION TEST DATA

Project:

6400 Katella Avenue
Cypress, CA
August 27, 2019

Prepared for:

Mr. Daryl Kas
Southern California Geotechnical, Inc.
22885 E. Savi Ranch Parkway, Ste E
Yorba Linda, CA 92887
Office (714) 685-1115 / Fax (714) 685-1118

Prepared by:

KTE

KEHOE TESTING & ENGINEERING
5415 Industrial Drive
Huntington Beach, CA 92649-1518
Office (714) 901-7270 / Fax (714) 901-7289
www.kehoetesting.com

TABLE OF CONTENTS

SUMMARY

OF

CONE PENETRATION TEST DATA

1. INTRODUCTION

This report presents the results of a Cone Penetration Test (CPT) program carried out for the project located at 6400 Katella Avenue in Cypress, California. The work was performed by Kehoe Testing & Engineering (KTE) on August 27, 2019. The scope of work was performed as directed by Southern California Geotechnical, Inc. personnel.

2. SUMMARY OF FIELD WORK

The fieldwork consisted of performing CPT soundings at four locations to determine the soil lithology. A summary is provided in **TABLE 2.1**.

LOCATION	DEPTH OF CPT (ft)	COMMENTS/NOTES:
CPT-1	65	
CPT-2	70	
CPT-3	65	
CPT-4	60	

TABLE 2.1 - Summary of CPT Soundings

3. FIELD EQUIPMENT & PROCEDURES

The CPT soundings were carried out by **KTE** using an integrated electronic cone system manufactured by Vertek. The CPT soundings were performed in accordance with ASTM standards (D5778). The cone penetrometers were pushed using a 30-ton CPT rig. The cone used during the program was a 15 cm^2 cone and recorded the following parameters at approximately 2.5 cm depth intervals:

- Cone Resistance (qc)
- Sleeve Friction (fs)
- Dynamic Pore Pressure (u)
- Inclination
- Penetration Speed
- Pore Pressure Dissipation (at selected depths)

The above parameters were recorded and viewed in real time using a laptop computer. Data is stored at the KTE office for up to 2 years for future analysis and reference. A complete set of baseline readings was taken prior to each sounding to determine temperature shifts and any zero load offsets. Monitoring base line readings ensures that the cone electronics are operating properly.

4. CONE PENETRATION TEST DATA & INTERPRETATION

The Cone Penetration Test data is presented in graphical form in the attached Appendix. These plots were generated using the CPeT-IT program. Penetration depths are referenced to ground surface. The soil classification on the CPT plots is derived from the attached CPT Classification Chart (Robertson) and presents major soil lithologic changes. The stratigraphic interpretation is based on relationships between cone resistance (qc), sleeve friction (fs), and penetration pore pressure (u). The friction ratio (Rf), which is sleeve friction divided by cone resistance, is a calculated parameter that is used along with cone resistance to infer soil behavior type. Generally, cohesive soils (clays) have high friction ratios, low cone resistance and generate excess pore water pressures. Cohesionless soils (sands) have lower friction ratios, high cone bearing and generate little (or negative) excess pore water pressures.

The CPT data files have also been provided. These files can be imported in CPeT-IT (software by GeoLogismiki) and other programs to calculate various geotechnical parameters.

It should be noted that it is not always possible to clearly identify a soil type based on qc, fs and u. In these situations, experience, judgement and an assessment of the pore pressure data should be used to infer the soil behavior type.

If you have any questions regarding this information, please do not hesitate to call our office at (714) 901-7270.

Sincerely,

KEHOE TESTING & ENGINEERING

Steven P. Kehoe
President

09/03/19-hh-0871

APPENDIX

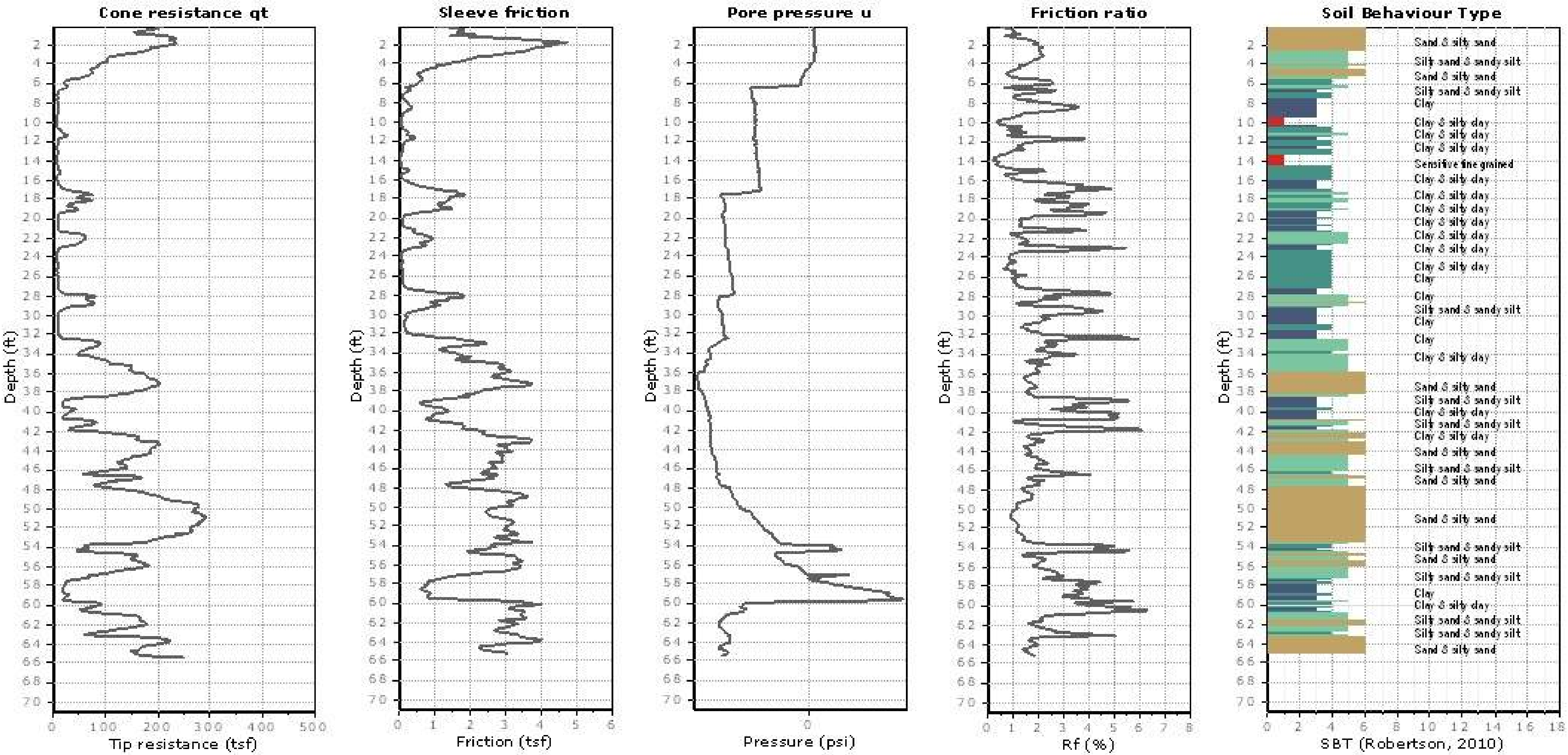
Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: Southern California Geotechnical

Location: 6400 Katella Ave, Cypress, CA

CPT-1

Total depth: 65.49 ft, Date: 8/27/2019



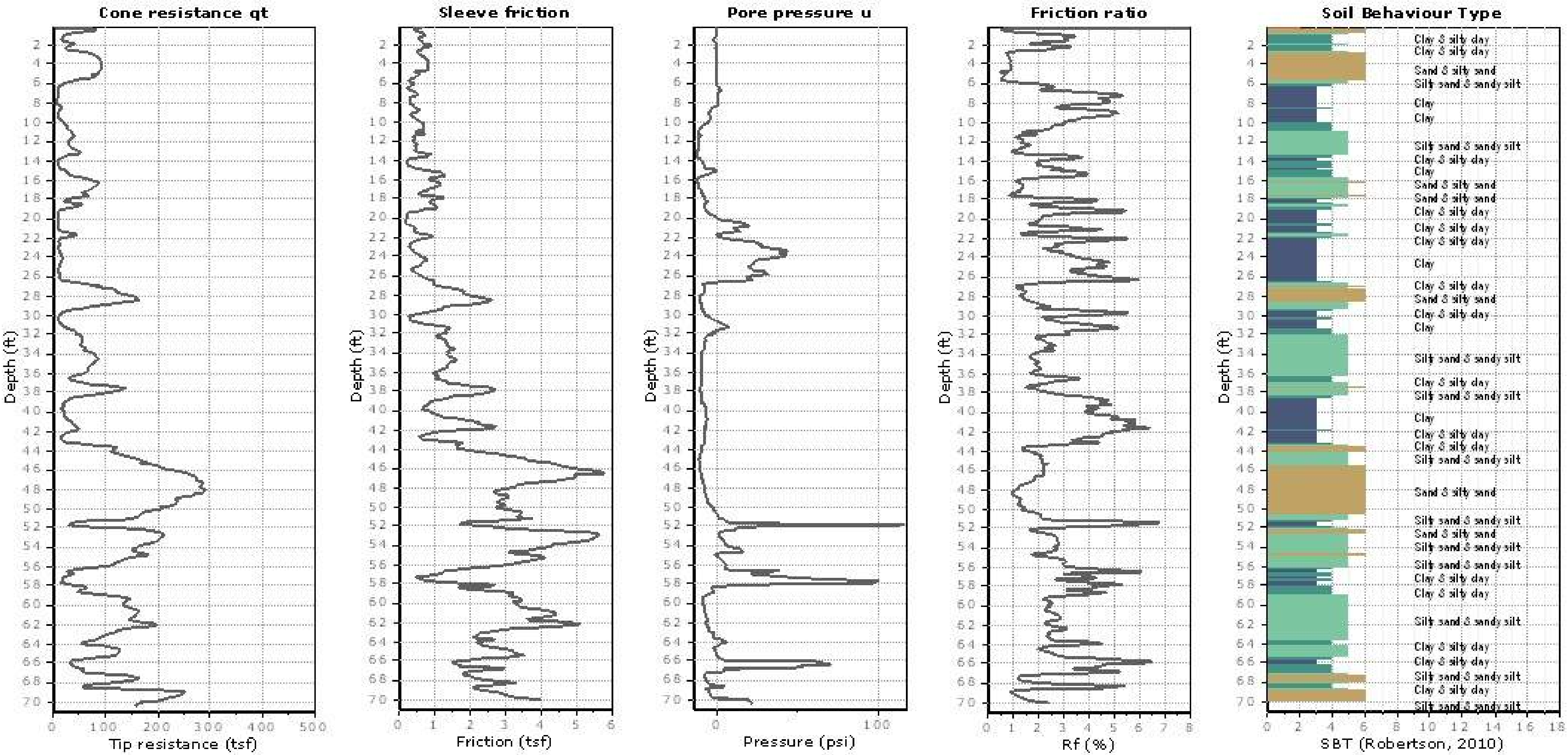
Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: Southern California Geotechnical

Location: 6400 Katella Ave, Cypress, CA

CPT-2

Total depth: 70.43 ft, Date: 8/27/2019



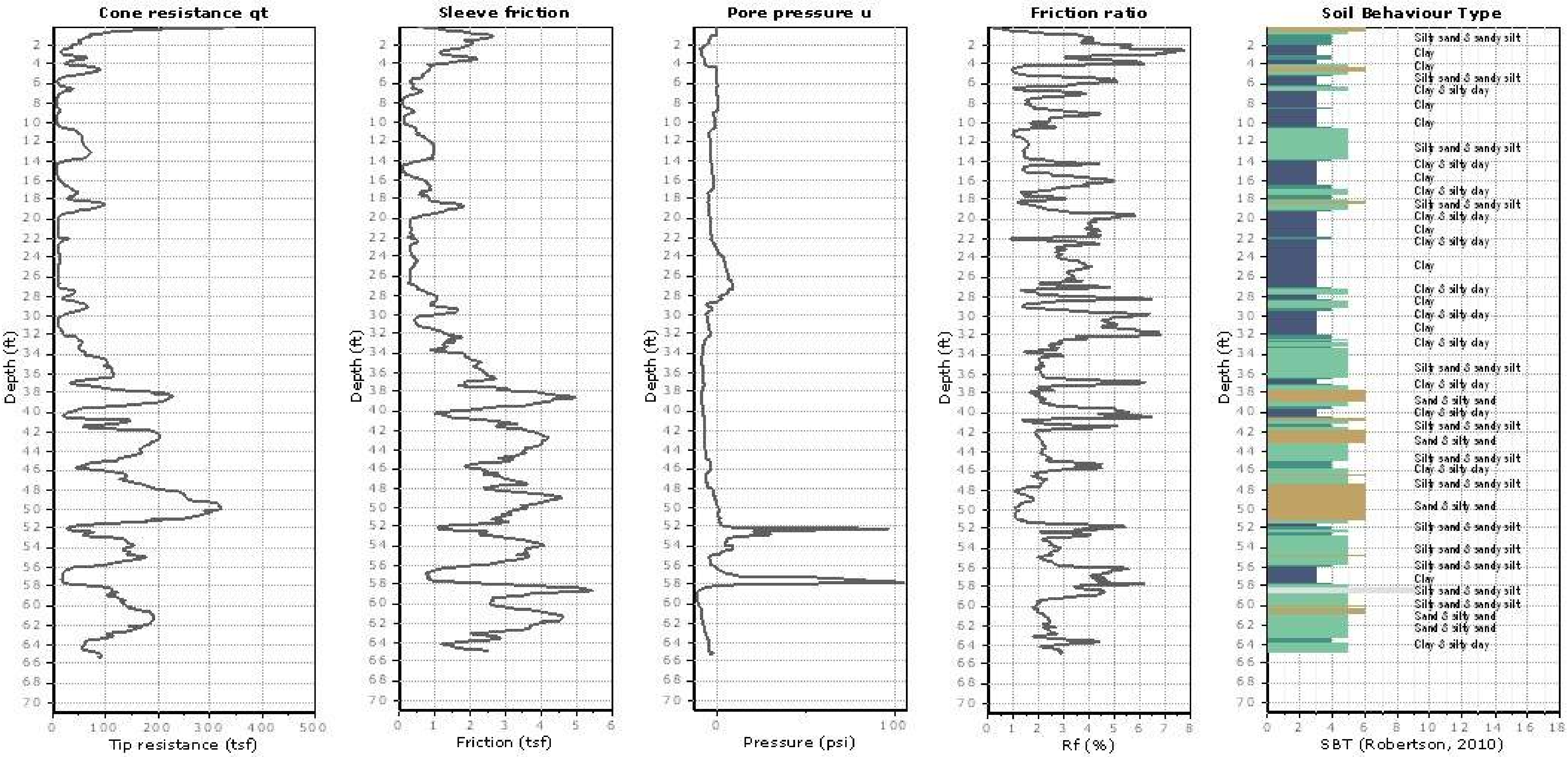
Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: **Southern California Geotechnical**

Location: **6400 Katella Ave, Cypress, CA**

CPT-3

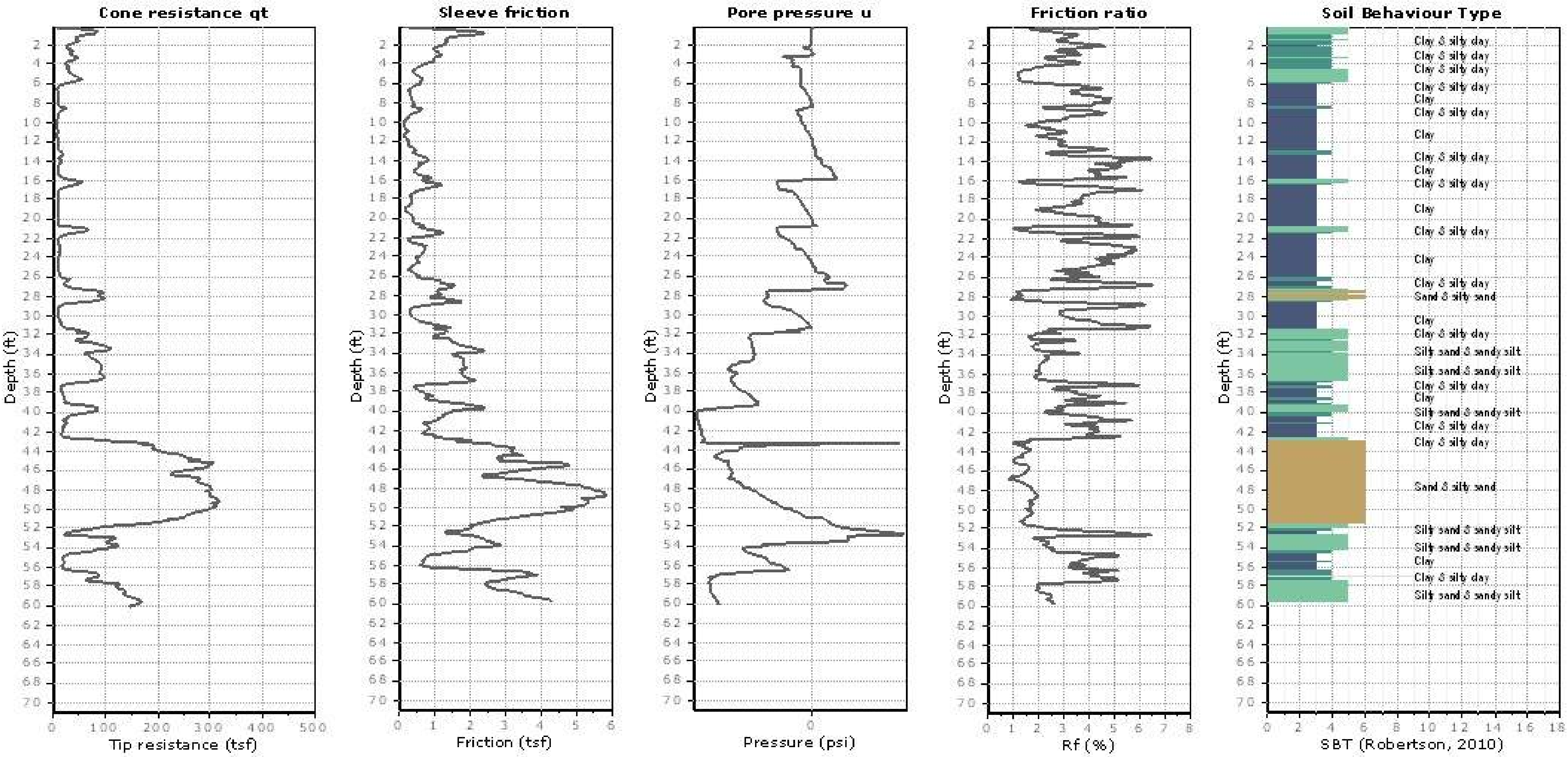
Total depth: 65.30 ft, Date: 8/27/2019



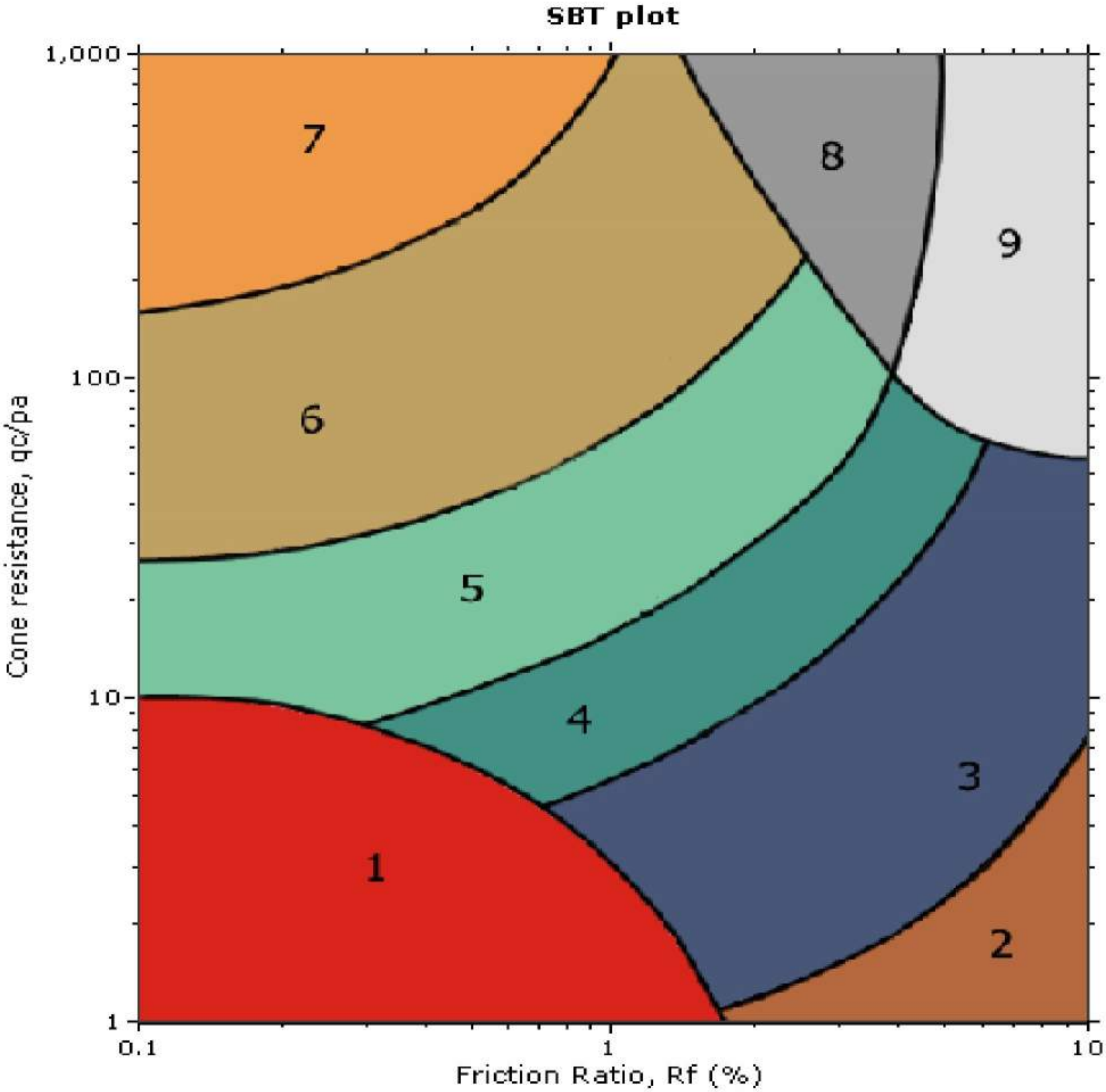
Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: **Southern California Geotechnical**
Location: **6400 Katella Ave, Cypress, CA**

CPT-4
Total depth: 60.13 ft, Date: 8/27/2019

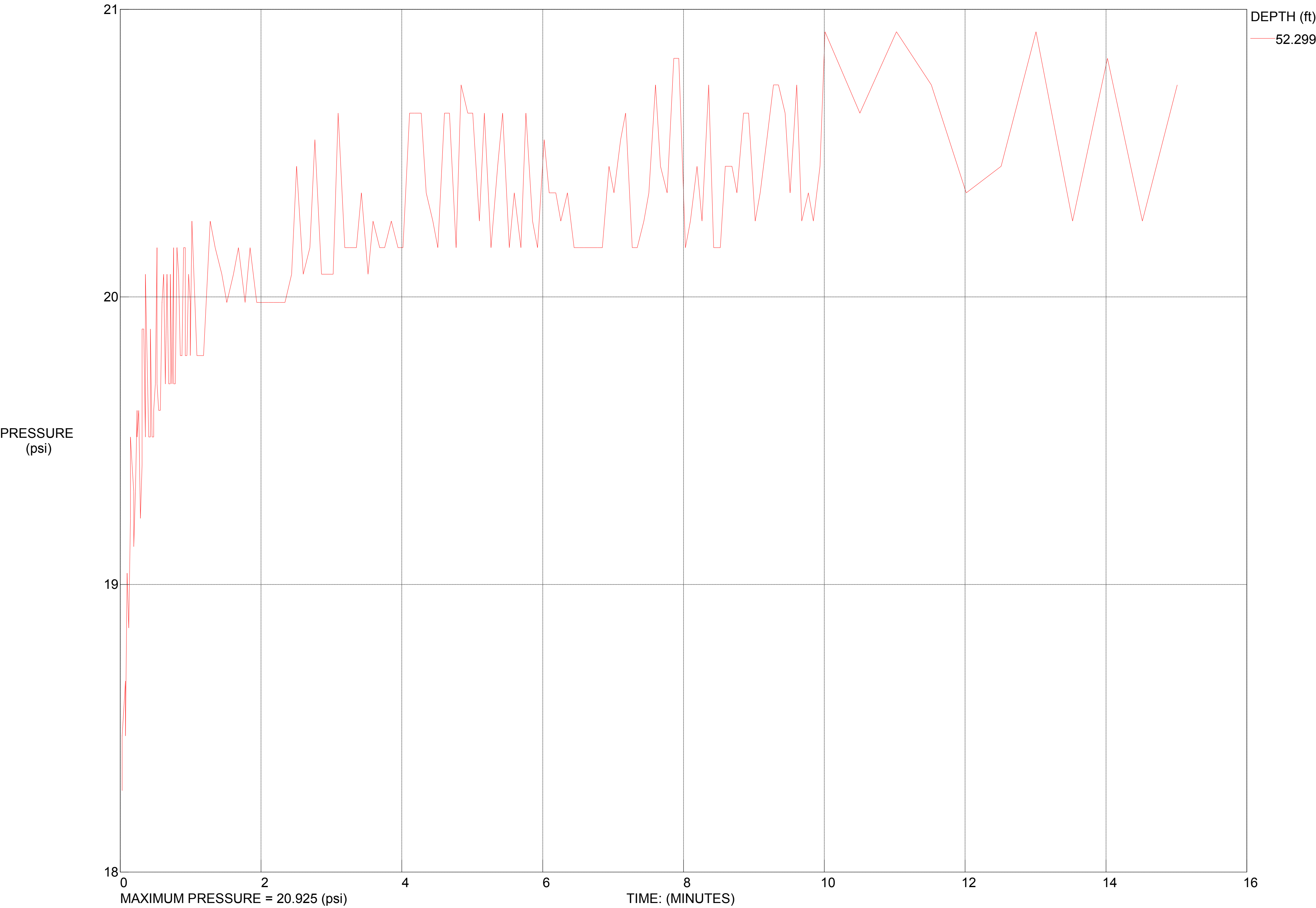


Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

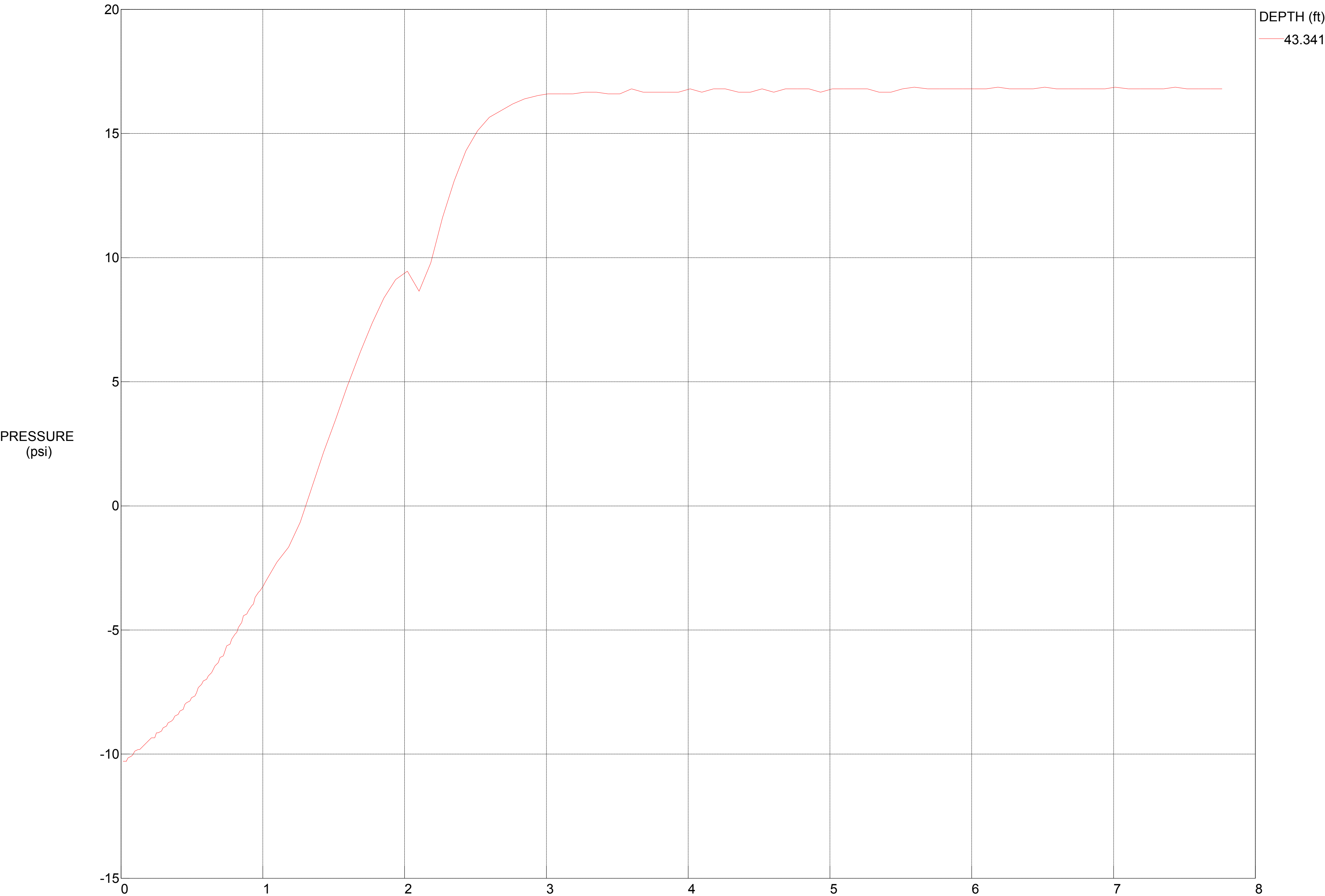


SBT legend

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



MAXIMUM PRESSURE = 20.925 (psi)
HYDROSTATIC PRESSURE = 22.672 (psi), WATER TABLE: 0.00 ft



MAXIMUM PRESSURE = 16.876 (psi)
HYDROSTATIC PRESSURE = N/A (psi), WATER TABLE: UNDEFINED

APPENDIX G

TABLE OF CONTENTS

Southern California Geotechnical, Inc.
714-685-1115
info@socalgeo.com
www.socalgeo.com

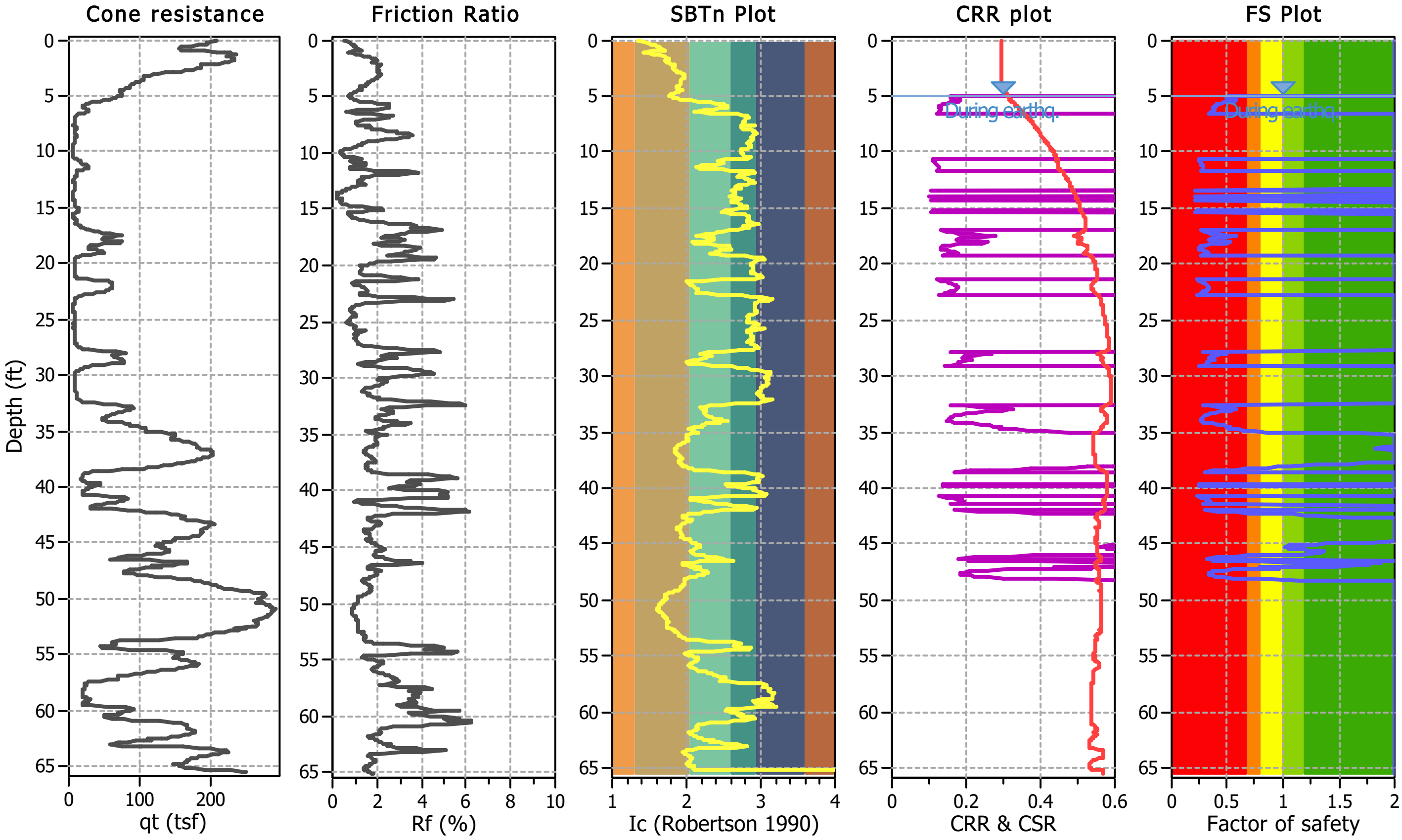
LIQUEFACTION ANALYSIS REPORT

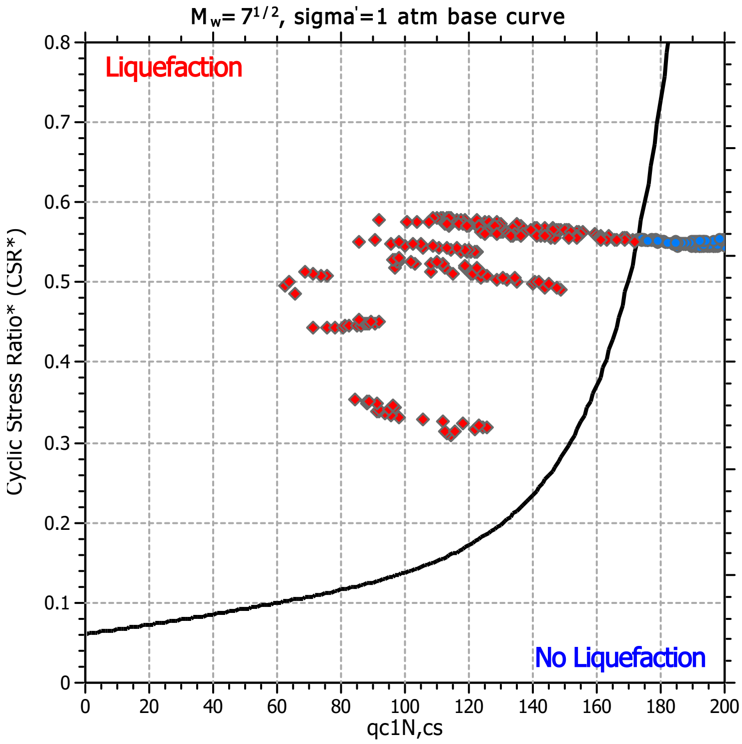
Project title : Proposed Commercial/Industrial Development   Location : Cypress, CA

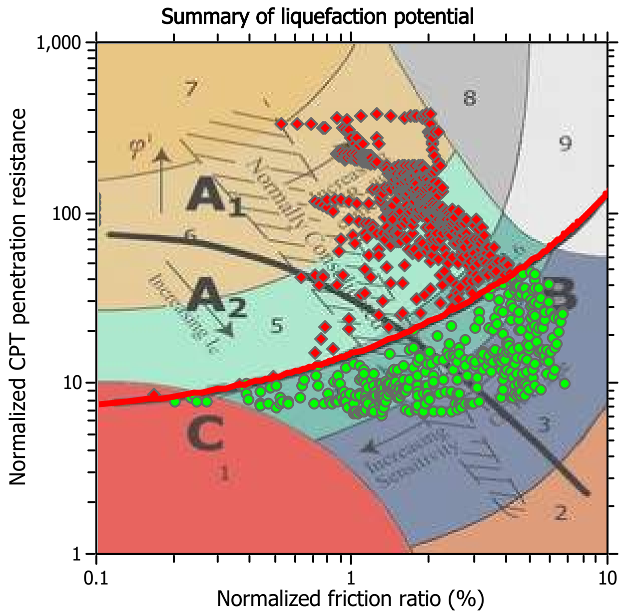
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applie	Yes
Points to test:	Based on Ic value	Average results interva	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method base
Peak ground acceleration:	0.54	Unit weight calculation	Based on SBT	K_σ applied:	Yes		

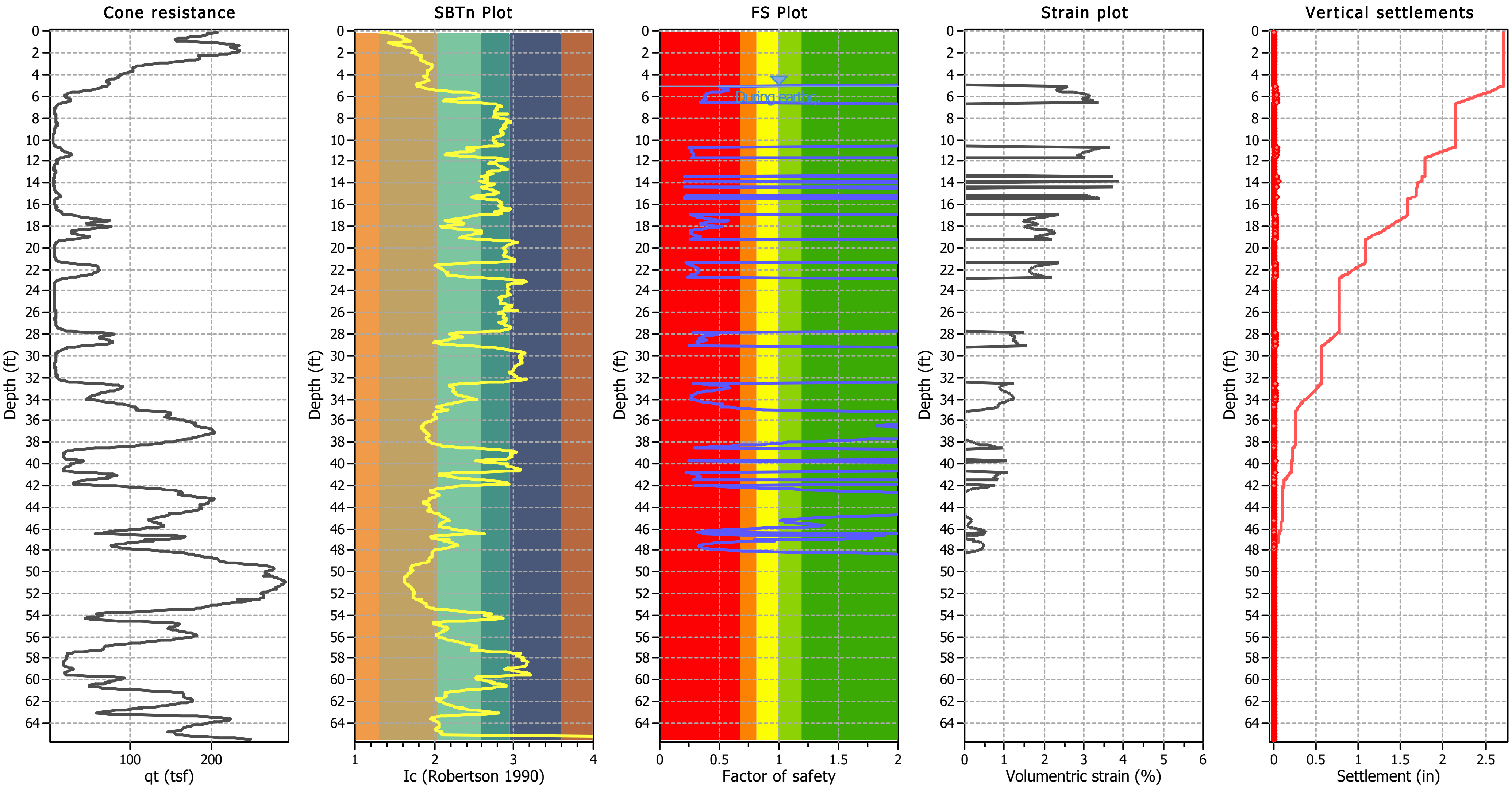






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

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 due to soil liquefaction ::

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
5.01	114.55	0.52	2.55	0.92	0.03
5.12	112.67	0.50	2.59	0.91	0.02
5.27	122.18	0.56	2.37	0.91	0.02
5.41	125.42	0.58	2.30	0.91	0.02
5.54	118.32	0.52	2.44	0.91	0.02
5.65	105.73	0.44	2.74	0.90	0.02
5.80	95.71	0.40	3.03	0.90	0.02
5.93	91.79	0.38	3.15	0.90	0.03
6.05	91.84	0.37	3.14	0.90	0.02
6.19	96.58	0.39	2.98	0.90	0.02
6.33	90.94	0.36	3.16	0.89	0.03
6.45	88.33	0.35	3.24	0.89	0.02
6.58	84.54	0.34	3.38	0.89	0.03
6.70	18.65	2.00	0.00	0.89	0.00
6.84	15.49	2.00	0.00	0.88	0.00
6.98	13.82	2.00	0.00	0.88	0.00
7.09	12.31	2.00	0.00	0.88	0.00
7.23	10.65	2.00	0.00	0.88	0.00
7.35	11.07	2.00	0.00	0.88	0.00
7.49	11.47	2.00	0.00	0.87	0.00
7.62	9.69	2.00	0.00	0.87	0.00
7.76	14.11	2.00	0.00	0.87	0.00
7.88	15.34	2.00	0.00	0.87	0.00
8.01	14.51	2.00	0.00	0.86	0.00
8.14	13.27	2.00	0.00	0.86	0.00
8.27	13.42	2.00	0.00	0.86	0.00
8.40	14.38	2.00	0.00	0.86	0.00
8.54	16.45	2.00	0.00	0.86	0.00
8.68	16.03	2.00	0.00	0.85	0.00
8.82	13.42	2.00	0.00	0.85	0.00
8.95	12.03	2.00	0.00	0.85	0.00
9.06	11.34	2.00	0.00	0.85	0.00
9.19	10.93	2.00	0.00	0.84	0.00
9.34	9.96	2.00	0.00	0.84	0.00
9.48	9.00	2.00	0.00	0.84	0.00
9.61	8.58	2.00	0.00	0.84	0.00
9.74	8.71	2.00	0.00	0.83	0.00
9.85	8.43	2.00	0.00	0.83	0.00
9.99	8.43	2.00	0.00	0.83	0.00
10.13	8.16	2.00	0.00	0.83	0.00
10.25	8.58	2.00	0.00	0.83	0.00
10.38	9.54	2.00	0.00	0.82	0.00
10.51	10.06	2.00	0.00	0.82	0.00
10.64	13.50	2.00	0.00	0.82	0.00
10.79	75.66	0.25	3.46	0.82	0.03
10.89	80.62	0.26	3.24	0.82	0.02
11.03	82.30	0.26	3.17	0.81	0.02
11.16	86.38	0.27	3.02	0.81	0.02

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
5.06	113.17	0.51	2.58	0.91	0.01
5.19	115.40	0.51	2.52	0.91	0.02
5.34	124.59	0.57	2.32	0.91	0.02
5.48	122.97	0.55	2.35	0.91	0.02
5.59	111.91	0.48	2.59	0.91	0.02
5.73	98.42	0.41	2.95	0.90	0.03
5.84	93.79	0.39	3.09	0.90	0.02
6.00	91.54	0.38	3.16	0.90	0.02
6.13	94.71	0.38	3.04	0.90	0.03
6.25	96.56	0.39	2.98	0.89	0.02
6.39	88.35	0.35	3.24	0.89	0.02
6.51	88.48	0.35	3.23	0.89	0.02
6.65	22.25	2.00	0.00	0.89	0.00
6.78	16.85	2.00	0.00	0.89	0.00
6.89	14.65	2.00	0.00	0.88	0.00
7.04	12.85	2.00	0.00	0.88	0.00
7.17	11.20	2.00	0.00	0.88	0.00
7.29	11.20	2.00	0.00	0.88	0.00
7.43	11.20	2.00	0.00	0.87	0.00
7.56	12.16	2.00	0.00	0.87	0.00
7.68	13.27	2.00	0.00	0.87	0.00
7.82	14.65	2.00	0.00	0.87	0.00
7.95	15.20	2.00	0.00	0.87	0.00
8.07	13.96	2.00	0.00	0.86	0.00
8.21	14.03	2.00	0.00	0.86	0.00
8.34	14.11	2.00	0.00	0.86	0.00
8.48	16.18	2.00	0.00	0.86	0.00
8.62	16.03	2.00	0.00	0.85	0.00
8.76	14.65	2.00	0.00	0.85	0.00
8.87	12.85	2.00	0.00	0.85	0.00
9.01	11.89	2.00	0.00	0.85	0.00
9.15	11.07	2.00	0.00	0.84	0.00
9.25	10.51	2.00	0.00	0.84	0.00
9.39	9.69	2.00	0.00	0.84	0.00
9.53	8.58	2.00	0.00	0.84	0.00
9.66	8.58	2.00	0.00	0.84	0.00
9.81	8.58	2.00	0.00	0.83	0.00
9.94	8.43	2.00	0.00	0.83	0.00
10.04	8.43	2.00	0.00	0.83	0.00
10.18	8.52	2.00	0.00	0.83	0.00
10.32	9.13	2.00	0.00	0.83	0.00
10.44	9.69	2.00	0.00	0.82	0.00
10.58	10.99	2.00	0.00	0.82	0.00
10.71	71.55	0.24	3.65	0.82	0.03
10.83	78.42	0.26	3.34	0.82	0.02
10.97	81.41	0.26	3.21	0.81	0.03
11.10	84.84	0.27	3.07	0.81	0.03
11.23	87.32	0.27	2.98	0.81	0.03

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
11.29	88.30	0.28	2.94	0.81	0.02	11.37	88.99	0.28	2.92	0.81	0.03
11.43	90.76	0.28	2.86	0.81	0.02	11.50	91.81	0.28	2.82	0.81	0.03
11.56	89.30	0.28	2.90	0.80	0.02	11.62	85.32	0.27	3.02	0.80	0.02
11.69	20.41	2.00	0.00	0.80	0.00	11.75	17.28	2.00	0.00	0.80	0.00
11.82	15.26	2.00	0.00	0.80	0.00	11.89	14.49	2.00	0.00	0.80	0.00
11.95	15.37	2.00	0.00	0.80	0.00	12.02	15.48	2.00	0.00	0.80	0.00
12.08	16.21	2.00	0.00	0.80	0.00	12.15	15.81	2.00	0.00	0.79	0.00
12.21	14.93	2.00	0.00	0.79	0.00	12.27	12.39	2.00	0.00	0.79	0.00
12.34	11.75	2.00	0.00	0.79	0.00	12.44	10.33	2.00	0.00	0.79	0.00
12.50	9.55	2.00	0.00	0.79	0.00	12.56	9.03	2.00	0.00	0.79	0.00
12.62	9.53	2.00	0.00	0.79	0.00	12.68	8.87	2.00	0.00	0.79	0.00
12.75	9.49	2.00	0.00	0.78	0.00	12.82	9.99	2.00	0.00	0.78	0.00
12.88	10.74	2.00	0.00	0.78	0.00	12.95	12.12	2.00	0.00	0.78	0.00
13.01	12.99	2.00	0.00	0.78	0.00	13.07	12.48	2.00	0.00	0.78	0.00
13.13	11.46	2.00	0.00	0.78	0.00	13.20	10.57	2.00	0.00	0.78	0.00
13.26	11.45	2.00	0.00	0.78	0.00	13.32	10.81	2.00	0.00	0.77	0.00
13.39	65.49	0.21	3.74	0.77	0.03	13.46	9.92	2.00	0.00	0.77	0.00
13.53	9.15	2.00	0.00	0.77	0.00	13.60	8.91	2.00	0.00	0.77	0.00
13.66	8.39	2.00	0.00	0.77	0.00	13.72	8.38	2.00	0.00	0.77	0.00
13.79	8.38	2.00	0.00	0.77	0.00	13.89	62.37	0.20	3.87	0.76	0.05
13.92	8.48	2.00	0.00	0.76	0.00	13.99	8.99	2.00	0.00	0.76	0.00
14.06	8.58	2.00	0.00	0.76	0.00	14.13	8.43	2.00	0.00	0.76	0.00
14.19	8.81	2.00	0.00	0.76	0.00	14.26	9.30	2.00	0.00	0.76	0.00
14.32	9.80	2.00	0.00	0.76	0.00	14.38	64.05	0.20	3.73	0.76	0.03
14.44	10.28	2.00	0.00	0.76	0.00	14.51	10.01	2.00	0.00	0.75	0.00
14.57	9.99	2.00	0.00	0.75	0.00	14.64	9.98	2.00	0.00	0.75	0.00
14.70	10.33	2.00	0.00	0.75	0.00	14.78	11.53	2.00	0.00	0.75	0.00
14.84	12.11	2.00	0.00	0.75	0.00	14.91	12.93	2.00	0.00	0.75	0.00
14.97	14.10	2.00	0.00	0.75	0.00	15.05	16.33	2.00	0.00	0.75	0.00
15.11	17.62	2.00	0.00	0.74	0.00	15.17	19.03	2.00	0.00	0.74	0.00
15.22	75.90	0.22	3.13	0.74	0.02	15.30	74.05	0.22	3.20	0.74	0.03
15.37	71.22	0.21	3.31	0.74	0.03	15.42	68.93	0.21	3.41	0.74	0.02
15.50	12.33	2.00	0.00	0.74	0.00	15.55	10.39	2.00	0.00	0.74	0.00
15.63	9.28	2.00	0.00	0.74	0.00	15.69	8.90	2.00	0.00	0.73	0.00
15.76	8.77	2.00	0.00	0.73	0.00	15.82	8.75	2.00	0.00	0.73	0.00
15.88	9.11	2.00	0.00	0.73	0.00	15.95	9.93	2.00	0.00	0.73	0.00
16.02	10.40	2.00	0.00	0.73	0.00	16.09	11.56	2.00	0.00	0.73	0.00
16.15	13.31	2.00	0.00	0.73	0.00	16.21	13.76	2.00	0.00	0.73	0.00
16.28	13.26	2.00	0.00	0.72	0.00	16.35	13.12	2.00	0.00	0.72	0.00
16.41	12.86	2.00	0.00	0.72	0.00	16.48	14.23	2.00	0.00	0.72	0.00
16.56	17.64	2.00	0.00	0.72	0.00	16.60	19.90	2.00	0.00	0.72	0.00
16.67	21.46	2.00	0.00	0.72	0.00	16.73	20.95	2.00	0.00	0.72	0.00
16.81	22.01	2.00	0.00	0.72	0.00	16.87	24.64	2.00	0.00	0.71	0.00
16.95	30.84	2.00	0.00	0.71	0.00	17.00	96.80	0.26	2.36	0.71	0.01
17.09	107.93	0.29	2.11	0.71	0.02	17.14	114.84	0.32	1.97	0.71	0.01
17.23	123.55	0.36	1.82	0.71	0.02	17.29	128.99	0.39	1.74	0.71	0.01
17.35	135.06	0.43	1.65	0.71	0.01	17.41	143.86	0.51	1.53	0.70	0.01
17.47	148.77	0.57	1.47	0.70	0.01	17.55	147.21	0.55	1.49	0.70	0.01

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
17.61	139.78	0.47	1.58	0.70	0.01	17.67	132.12	0.41	1.68	0.70	0.01
17.73	125.53	0.36	1.77	0.70	0.01	17.80	120.71	0.34	1.84	0.70	0.02
17.87	121.04	0.34	1.83	0.70	0.01	17.93	130.82	0.40	1.68	0.70	0.01
18.00	140.80	0.48	1.55	0.69	0.01	18.06	144.95	0.52	1.50	0.69	0.01
18.13	141.60	0.48	1.53	0.69	0.01	18.19	134.29	0.42	1.62	0.69	0.01
18.26	123.90	0.35	1.77	0.69	0.01	18.32	112.39	0.30	1.96	0.69	0.02
18.39	103.04	0.27	2.14	0.69	0.02	18.45	98.37	0.26	2.25	0.69	0.02
18.51	97.20	0.25	2.27	0.69	0.02	18.57	96.83	0.25	2.28	0.69	0.02
18.64	96.25	0.25	2.29	0.68	0.02	18.73	102.09	0.27	2.15	0.68	0.02
18.79	107.82	0.28	2.03	0.68	0.01	18.86	112.15	0.30	1.94	0.68	0.02
18.92	118.50	0.32	1.83	0.68	0.01	18.99	122.29	0.34	1.76	0.68	0.01
19.06	118.46	0.32	1.82	0.68	0.01	19.12	110.03	0.29	1.97	0.68	0.02
19.19	98.28	0.26	2.21	0.67	0.02	19.25	28.27	2.00	0.00	0.67	0.00
19.31	22.51	2.00	0.00	0.67	0.00	19.36	18.16	2.00	0.00	0.67	0.00
19.43	14.61	2.00	0.00	0.67	0.00	19.49	12.45	2.00	0.00	0.67	0.00
19.56	10.61	2.00	0.00	0.67	0.00	19.64	10.05	2.00	0.00	0.67	0.00
19.71	9.83	2.00	0.00	0.67	0.00	19.77	9.61	2.00	0.00	0.67	0.00
19.84	9.38	2.00	0.00	0.66	0.00	19.89	9.37	2.00	0.00	0.66	0.00
19.96	9.36	2.00	0.00	0.66	0.00	20.02	9.36	2.00	0.00	0.66	0.00
20.08	9.02	2.00	0.00	0.66	0.00	20.18	8.89	2.00	0.00	0.66	0.00
20.24	8.67	2.00	0.00	0.66	0.00	20.30	8.66	2.00	0.00	0.66	0.00
20.35	8.66	2.00	0.00	0.66	0.00	20.43	8.65	2.00	0.00	0.65	0.00
20.49	8.75	2.00	0.00	0.65	0.00	20.56	8.74	2.00	0.00	0.65	0.00
20.62	8.73	2.00	0.00	0.65	0.00	20.68	8.94	2.00	0.00	0.65	0.00
20.74	9.14	2.00	0.00	0.65	0.00	20.80	9.24	2.00	0.00	0.65	0.00
20.90	9.64	2.00	0.00	0.65	0.00	20.96	9.95	2.00	0.00	0.64	0.00
21.02	10.36	2.00	0.00	0.64	0.00	21.08	10.87	2.00	0.00	0.64	0.00
21.15	11.28	2.00	0.00	0.64	0.00	21.21	12.10	2.00	0.00	0.64	0.00
21.28	14.18	2.00	0.00	0.64	0.00	21.34	19.04	2.00	0.00	0.64	0.00
21.41	85.86	0.22	2.38	0.64	0.02	21.46	95.52	0.24	2.14	0.64	0.01
21.52	100.09	0.25	2.04	0.64	0.02	21.61	105.46	0.27	1.93	0.63	0.02
21.68	110.51	0.28	1.83	0.63	0.01	21.74	114.45	0.30	1.76	0.63	0.01
21.80	117.48	0.31	1.71	0.63	0.01	21.87	119.23	0.31	1.68	0.63	0.01
21.93	120.72	0.32	1.66	0.63	0.01	21.99	122.09	0.33	1.63	0.63	0.01
22.06	122.77	0.33	1.62	0.63	0.01	22.12	122.55	0.33	1.62	0.63	0.01
22.18	121.85	0.33	1.63	0.62	0.01	22.27	120.21	0.32	1.65	0.62	0.02
22.33	118.50	0.31	1.67	0.62	0.01	22.40	116.08	0.30	1.71	0.62	0.01
22.45	112.87	0.29	1.76	0.62	0.01	22.52	108.45	0.27	1.83	0.62	0.02
22.59	104.89	0.26	1.89	0.62	0.02	22.65	102.24	0.26	1.94	0.62	0.01
22.72	97.87	0.24	2.02	0.61	0.02	22.78	90.63	0.23	2.18	0.61	0.02
22.84	24.27	2.00	0.00	0.61	0.00	22.91	18.88	2.00	0.00	0.61	0.00
22.97	14.76	2.00	0.00	0.61	0.00	23.05	11.62	2.00	0.00	0.61	0.00
23.10	11.01	2.00	0.00	0.61	0.00	23.17	9.77	2.00	0.00	0.61	0.00
23.23	9.27	2.00	0.00	0.61	0.00	23.33	9.04	2.00	0.00	0.60	0.00
23.39	8.74	2.00	0.00	0.60	0.00	23.45	8.52	2.00	0.00	0.60	0.00
23.52	8.22	2.00	0.00	0.60	0.00	23.58	7.91	2.00	0.00	0.60	0.00
23.64	7.70	2.00	0.00	0.60	0.00	23.70	7.48	2.00	0.00	0.60	0.00
23.77	7.38	2.00	0.00	0.60	0.00	23.82	7.38	2.00	0.00	0.60	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
23.92	7.37	2.00	0.00	0.59	0.00	23.97	7.36	2.00	0.00	0.59	0.00
24.04	7.36	2.00	0.00	0.59	0.00	24.10	7.45	2.00	0.00	0.59	0.00
24.17	7.44	2.00	0.00	0.59	0.00	24.23	7.43	2.00	0.00	0.59	0.00
24.30	7.53	2.00	0.00	0.59	0.00	24.36	7.72	2.00	0.00	0.59	0.00
24.42	7.92	2.00	0.00	0.59	0.00	24.48	8.32	2.00	0.00	0.59	0.00
24.55	8.91	2.00	0.00	0.58	0.00	24.63	9.01	2.00	0.00	0.58	0.00
24.70	8.80	2.00	0.00	0.58	0.00	24.76	8.49	2.00	0.00	0.58	0.00
24.82	8.48	2.00	0.00	0.58	0.00	24.88	8.48	2.00	0.00	0.58	0.00
24.95	8.47	2.00	0.00	0.58	0.00	25.01	8.47	2.00	0.00	0.58	0.00
25.07	8.26	2.00	0.00	0.58	0.00	25.14	8.35	2.00	0.00	0.57	0.00
25.22	7.84	2.00	0.00	0.57	0.00	25.29	7.74	2.00	0.00	0.57	0.00
25.35	7.43	2.00	0.00	0.57	0.00	25.42	7.32	2.00	0.00	0.57	0.00
25.48	7.61	2.00	0.00	0.57	0.00	25.54	8.21	2.00	0.00	0.57	0.00
25.61	8.40	2.00	0.00	0.57	0.00	25.67	8.50	2.00	0.00	0.56	0.00
25.73	8.68	2.00	0.00	0.56	0.00	25.79	7.49	2.00	0.00	0.56	0.00
25.87	9.44	2.00	0.00	0.56	0.00	25.94	9.84	2.00	0.00	0.56	0.00
25.99	10.13	2.00	0.00	0.56	0.00	26.05	10.02	2.00	0.00	0.56	0.00
26.14	9.32	2.00	0.00	0.56	0.00	26.20	9.12	2.00	0.00	0.56	0.00
26.27	9.11	2.00	0.00	0.55	0.00	26.33	9.10	2.00	0.00	0.55	0.00
26.39	9.09	2.00	0.00	0.55	0.00	26.46	9.09	2.00	0.00	0.55	0.00
26.52	8.68	2.00	0.00	0.55	0.00	26.58	8.67	2.00	0.00	0.55	0.00
26.64	8.67	2.00	0.00	0.55	0.00	26.73	9.05	2.00	0.00	0.55	0.00
26.79	9.43	2.00	0.00	0.55	0.00	26.86	10.10	2.00	0.00	0.54	0.00
26.92	10.49	2.00	0.00	0.54	0.00	26.98	10.27	2.00	0.00	0.54	0.00
27.04	10.17	2.00	0.00	0.54	0.00	27.11	9.97	2.00	0.00	0.54	0.00
27.17	10.53	2.00	0.00	0.54	0.00	27.23	10.81	2.00	0.00	0.54	0.00
27.33	11.37	2.00	0.00	0.54	0.00	27.39	12.22	2.00	0.00	0.54	0.00
27.45	13.64	2.00	0.00	0.53	0.00	27.51	15.90	2.00	0.00	0.53	0.00
27.57	18.33	2.00	0.00	0.53	0.00	27.63	20.57	2.00	0.00	0.53	0.00
27.70	24.19	2.00	0.00	0.53	0.00	27.76	31.20	2.00	0.00	0.53	0.00
27.85	113.74	0.28	1.48	0.53	0.01	27.91	132.36	0.36	1.26	0.53	0.01
27.97	145.43	0.47	1.13	0.53	0.01	28.03	146.69	0.48	1.12	0.53	0.01
28.10	142.22	0.44	1.15	0.52	0.01	28.15	135.02	0.38	1.22	0.52	0.01
28.22	129.70	0.35	1.27	0.52	0.01	28.28	133.55	0.37	1.23	0.52	0.01
28.35	126.92	0.33	1.30	0.52	0.01	28.41	130.51	0.35	1.26	0.52	0.01
28.51	135.40	0.38	1.20	0.52	0.01	28.57	134.93	0.38	1.21	0.52	0.01
28.62	131.92	0.36	1.23	0.51	0.01	28.71	124.92	0.32	1.31	0.51	0.01
28.76	123.48	0.32	1.32	0.51	0.01	28.83	124.89	0.32	1.30	0.51	0.01
28.89	126.03	0.33	1.29	0.51	0.01	28.96	123.11	0.31	1.32	0.51	0.01
29.02	114.01	0.28	1.42	0.51	0.01	29.08	103.93	0.25	1.57	0.51	0.01
29.15	34.56	2.00	0.00	0.51	0.00	29.21	29.56	2.00	0.00	0.50	0.00
29.27	25.19	2.00	0.00	0.50	0.00	29.33	22.72	2.00	0.00	0.50	0.00
29.40	19.96	2.00	0.00	0.50	0.00	29.46	16.84	2.00	0.00	0.50	0.00
29.56	13.35	2.00	0.00	0.50	0.00	29.62	12.23	2.00	0.00	0.50	0.00
29.68	10.66	2.00	0.00	0.50	0.00	29.74	9.73	2.00	0.00	0.50	0.00
29.80	9.18	2.00	0.00	0.49	0.00	29.89	8.89	2.00	0.00	0.49	0.00
29.92	8.79	2.00	0.00	0.49	0.00	30.02	8.78	2.00	0.00	0.49	0.00
30.08	8.77	2.00	0.00	0.49	0.00	30.14	8.76	2.00	0.00	0.49	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
30.21	8.67	2.00	0.00	0.49	0.00	30.27	8.84	2.00	0.00	0.49	0.00
30.34	8.83	2.00	0.00	0.49	0.00	30.39	8.83	2.00	0.00	0.48	0.00
30.45	8.82	2.00	0.00	0.48	0.00	30.51	8.72	2.00	0.00	0.48	0.00
30.61	8.35	2.00	0.00	0.48	0.00	30.67	8.25	2.00	0.00	0.48	0.00
30.74	8.15	2.00	0.00	0.48	0.00	30.80	8.15	2.00	0.00	0.48	0.00
30.86	8.14	2.00	0.00	0.48	0.00	30.92	8.13	2.00	0.00	0.48	0.00
30.99	8.22	2.00	0.00	0.47	0.00	31.04	8.30	2.00	0.00	0.47	0.00
31.13	8.21	2.00	0.00	0.47	0.00	31.19	8.38	2.00	0.00	0.47	0.00
31.26	8.64	2.00	0.00	0.47	0.00	31.31	8.90	2.00	0.00	0.47	0.00
31.37	9.26	2.00	0.00	0.47	0.00	31.43	9.43	2.00	0.00	0.47	0.00
31.53	9.87	2.00	0.00	0.47	0.00	31.59	9.86	2.00	0.00	0.46	0.00
31.65	9.86	2.00	0.00	0.46	0.00	31.71	9.85	2.00	0.00	0.46	0.00
31.78	9.84	2.00	0.00	0.46	0.00	31.84	10.10	2.00	0.00	0.46	0.00
31.90	10.00	2.00	0.00	0.46	0.00	31.96	10.61	2.00	0.00	0.46	0.00
32.05	11.67	2.00	0.00	0.46	0.00	32.11	11.92	2.00	0.00	0.46	0.00
32.16	12.01	2.00	0.00	0.45	0.00	32.25	15.79	2.00	0.00	0.45	0.00
32.31	17.71	2.00	0.00	0.45	0.00	32.37	20.16	2.00	0.00	0.45	0.00
32.44	25.82	2.00	0.00	0.45	0.00	32.50	36.15	2.00	0.00	0.45	0.00
32.56	114.18	0.27	1.25	0.45	0.01	32.63	128.98	0.34	1.10	0.45	0.01
32.70	140.57	0.42	1.00	0.45	0.01	32.77	148.22	0.49	0.94	0.44	0.01
32.81	151.83	0.53	0.91	0.44	0.00	32.88	154.55	0.57	0.89	0.44	0.01
32.96	154.99	0.58	0.88	0.44	0.01	33.04	153.94	0.56	0.89	0.44	0.01
33.10	151.05	0.52	0.90	0.44	0.01	33.15	148.94	0.50	0.92	0.44	0.00
33.22	143.73	0.44	0.95	0.44	0.01	33.29	136.54	0.39	1.01	0.44	0.01
33.36	129.99	0.34	1.06	0.43	0.01	33.43	124.72	0.32	1.10	0.43	0.01
33.48	122.39	0.31	1.12	0.43	0.01	33.55	119.05	0.29	1.16	0.43	0.01
33.62	116.27	0.28	1.18	0.43	0.01	33.69	113.64	0.27	1.21	0.43	0.01
33.77	112.13	0.27	1.22	0.43	0.01	33.81	111.51	0.27	1.23	0.43	0.01
33.88	109.92	0.26	1.24	0.43	0.01	33.94	112.93	0.27	1.20	0.42	0.01
34.02	108.59	0.26	1.25	0.42	0.01	34.09	113.59	0.27	1.19	0.42	0.01
34.13	117.78	0.29	1.14	0.42	0.01	34.20	126.42	0.33	1.05	0.42	0.01
34.27	135.25	0.38	0.98	0.42	0.01	34.34	141.45	0.42	0.93	0.42	0.01
34.41	145.99	0.47	0.89	0.42	0.01	34.45	147.75	0.49	0.88	0.42	0.00
34.52	150.63	0.52	0.86	0.41	0.01	34.60	151.18	0.53	0.85	0.41	0.01
34.68	150.16	0.51	0.85	0.41	0.01	34.72	151.66	0.53	0.84	0.41	0.00
34.79	155.59	0.59	0.82	0.41	0.01	34.86	159.46	0.65	0.72	0.41	0.01
34.93	163.52	0.74	0.59	0.41	0.01	34.99	168.56	0.87	0.42	0.41	0.00
35.05	168.93	0.88	0.41	0.41	0.00	35.11	185.56	1.69	0.06	0.40	0.00
35.19	192.88	2.00	0.00	0.40	0.00	35.27	195.76	2.00	0.00	0.40	0.00
35.34	196.85	2.00	0.00	0.40	0.00	35.37	196.66	2.00	0.00	0.40	0.00
35.44	195.11	2.00	0.00	0.40	0.00	35.52	192.55	2.00	0.00	0.40	0.00
35.60	191.47	2.00	0.00	0.40	0.00	35.63	190.98	2.00	0.00	0.40	0.00
35.70	193.69	2.00	0.00	0.39	0.00	35.77	197.66	2.00	0.00	0.39	0.00
35.85	202.16	2.00	0.00	0.39	0.00	35.92	204.60	2.00	0.00	0.39	0.00
35.99	205.03	2.00	0.00	0.39	0.00	36.03	204.44	2.00	0.00	0.39	0.00
36.10	202.09	2.00	0.00	0.39	0.00	36.17	198.02	2.00	0.00	0.39	0.00
36.25	192.79	2.00	0.00	0.39	0.00	36.32	189.88	2.00	0.00	0.38	0.00
36.35	188.41	1.92	0.01	0.38	0.00	36.43	187.27	1.82	0.03	0.38	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
36.51	187.82	1.87	0.02	0.38	0.00	36.58	190.26	2.00	0.00	0.38	0.00
36.65	195.36	2.00	0.00	0.38	0.00	36.71	200.48	2.00	0.00	0.38	0.00
36.80	205.99	2.00	0.00	0.38	0.00	36.83	208.26	2.00	0.00	0.38	0.00
36.90	212.31	2.00	0.00	0.37	0.00	36.97	215.88	2.00	0.00	0.37	0.00
37.04	219.42	2.00	0.00	0.37	0.00	37.10	222.69	2.00	0.00	0.37	0.00
37.15	224.09	2.00	0.00	0.37	0.00	37.21	225.35	2.00	0.00	0.37	0.00
37.29	225.35	2.00	0.00	0.37	0.00	37.36	222.63	2.00	0.00	0.37	0.00
37.44	219.62	2.00	0.00	0.37	0.00	37.48	213.22	2.00	0.00	0.36	0.00
37.55	198.18	2.00	0.00	0.36	0.00	37.62	193.93	2.00	0.00	0.36	0.00
37.69	190.20	2.00	0.00	0.36	0.00	37.76	186.28	1.74	0.04	0.36	0.00
37.81	184.29	1.59	0.07	0.36	0.00	37.87	181.96	1.44	0.11	0.36	0.00
37.95	179.54	1.30	0.15	0.36	0.00	38.03	174.65	1.07	0.23	0.36	0.00
38.06	173.53	1.03	0.26	0.35	0.00	38.13	171.19	0.95	0.31	0.35	0.00
38.20	168.19	0.86	0.38	0.35	0.00	38.28	160.28	0.67	0.60	0.35	0.01
38.32	154.96	0.58	0.70	0.35	0.00	38.39	145.95	0.47	0.75	0.35	0.01
38.46	133.69	0.37	0.82	0.35	0.01	38.53	118.23	0.29	0.94	0.35	0.01
38.59	39.41	2.00	0.00	0.35	0.00	38.66	31.55	2.00	0.00	0.34	0.00
38.72	25.71	2.00	0.00	0.34	0.00	38.81	20.92	2.00	0.00	0.34	0.00
38.88	18.27	2.00	0.00	0.34	0.00	38.92	18.02	2.00	0.00	0.34	0.00
38.99	17.85	2.00	0.00	0.34	0.00	39.05	17.04	2.00	0.00	0.34	0.00
39.13	16.24	2.00	0.00	0.34	0.00	39.20	16.06	2.00	0.00	0.34	0.00
39.28	15.74	2.00	0.00	0.33	0.00	39.31	15.96	2.00	0.00	0.33	0.00
39.38	16.58	2.00	0.00	0.33	0.00	39.45	18.14	2.00	0.00	0.33	0.00
39.53	19.22	2.00	0.00	0.33	0.00	39.60	22.98	2.00	0.00	0.33	0.00
39.64	28.56	2.00	0.00	0.33	0.00	39.70	100.62	0.24	1.04	0.33	0.01
39.77	100.61	0.24	1.04	0.33	0.01	39.84	35.26	2.00	0.00	0.32	0.00
39.92	30.42	2.00	0.00	0.32	0.00	39.99	26.70	2.00	0.00	0.32	0.00
40.06	24.09	2.00	0.00	0.32	0.00	40.09	23.69	2.00	0.00	0.32	0.00
40.16	23.66	2.00	0.00	0.32	0.00	40.24	22.47	2.00	0.00	0.32	0.00
40.31	19.88	2.00	0.00	0.32	0.00	40.38	17.91	2.00	0.00	0.32	0.00
40.45	16.96	2.00	0.00	0.31	0.00	40.52	16.25	2.00	0.00	0.31	0.00
40.59	15.91	2.00	0.00	0.31	0.00	40.63	16.30	2.00	0.00	0.31	0.00
40.70	20.01	2.00	0.00	0.31	0.00	40.78	91.83	0.22	1.08	0.31	0.01
40.84	107.55	0.26	0.92	0.31	0.01	40.88	112.44	0.27	0.87	0.31	0.00
40.95	116.84	0.29	0.84	0.31	0.01	41.02	123.04	0.31	0.79	0.30	0.01
41.10	127.26	0.33	0.76	0.30	0.01	41.16	123.75	0.32	0.78	0.30	0.01
41.23	129.68	0.35	0.74	0.30	0.01	41.29	127.92	0.34	0.74	0.30	0.01
41.37	122.99	0.31	0.77	0.30	0.01	41.41	120.10	0.30	0.79	0.30	0.00
41.48	113.23	0.28	0.84	0.30	0.01	41.55	42.03	2.00	0.00	0.30	0.00
41.61	33.41	2.00	0.00	0.29	0.00	41.68	27.51	2.00	0.00	0.29	0.00
41.76	27.67	2.00	0.00	0.29	0.00	41.84	26.14	2.00	0.00	0.29	0.00
41.87	27.83	2.00	0.00	0.29	0.00	41.94	36.12	2.00	0.00	0.29	0.00
42.01	119.20	0.30	0.77	0.29	0.01	42.08	139.54	0.41	0.65	0.29	0.01
42.15	155.00	0.58	0.57	0.29	0.00	42.19	161.38	0.69	0.47	0.28	0.00
42.26	169.56	0.89	0.28	0.28	0.00	42.33	175.28	1.10	0.18	0.28	0.00
42.41	177.66	1.20	0.14	0.28	0.00	42.47	178.85	1.26	0.13	0.28	0.00
42.55	184.78	1.61	0.05	0.28	0.00	42.59	187.30	1.81	0.02	0.28	0.00
42.66	193.55	2.00	0.00	0.28	0.00	42.73	199.35	2.00	0.00	0.28	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
42.79	202.61	2.00	0.00	0.27	0.00	42.86	206.21	2.00	0.00	0.27	0.00
42.94	211.90	2.00	0.00	0.27	0.00	43.01	217.08	2.00	0.00	0.27	0.00
43.05	219.06	2.00	0.00	0.27	0.00	43.12	222.29	2.00	0.00	0.27	0.00
43.18	223.40	2.00	0.00	0.27	0.00	43.25	223.28	2.00	0.00	0.27	0.00
43.33	221.98	2.00	0.00	0.27	0.00	43.41	218.48	2.00	0.00	0.26	0.00
43.44	210.84	2.00	0.00	0.26	0.00	43.51	192.18	2.00	0.00	0.26	0.00
43.58	190.79	2.00	0.00	0.26	0.00	43.65	192.87	2.00	0.00	0.26	0.00
43.72	196.92	2.00	0.00	0.26	0.00	43.78	199.78	2.00	0.00	0.26	0.00
43.84	201.79	2.00	0.00	0.26	0.00	43.91	202.67	2.00	0.00	0.26	0.00
43.98	202.85	2.00	0.00	0.25	0.00	44.05	203.48	2.00	0.00	0.25	0.00
44.12	204.71	2.00	0.00	0.25	0.00	44.19	206.10	2.00	0.00	0.25	0.00
44.23	206.72	2.00	0.00	0.25	0.00	44.30	203.15	2.00	0.00	0.25	0.00
44.37	191.13	2.00	0.00	0.25	0.00	44.44	192.72	2.00	0.00	0.25	0.00
44.51	193.92	2.00	0.00	0.25	0.00	44.58	194.17	2.00	0.00	0.24	0.00
44.62	189.48	2.00	0.00	0.24	0.00	44.71	189.92	2.00	0.00	0.24	0.00
44.77	189.26	1.98	0.00	0.24	0.00	44.85	186.40	1.74	0.03	0.24	0.00
44.91	183.73	1.54	0.05	0.24	0.00	44.98	181.04	1.38	0.08	0.24	0.00
45.02	179.38	1.29	0.10	0.24	0.00	45.10	176.54	1.15	0.13	0.24	0.00
45.17	174.14	1.05	0.16	0.23	0.00	45.24	173.03	1.01	0.18	0.23	0.00
45.31	173.66	1.04	0.17	0.23	0.00	45.38	174.18	1.06	0.16	0.23	0.00
45.41	174.08	1.05	0.16	0.23	0.00	45.49	177.40	1.19	0.12	0.23	0.00
45.56	178.26	1.23	0.11	0.23	0.00	45.63	180.36	1.34	0.08	0.23	0.00
45.70	181.01	1.38	0.08	0.23	0.00	45.77	180.27	1.34	0.08	0.22	0.00
45.81	179.55	1.30	0.09	0.22	0.00	45.89	176.55	1.15	0.12	0.22	0.00
45.95	168.93	0.88	0.22	0.22	0.00	46.02	160.89	0.69	0.37	0.22	0.00
46.09	153.71	0.57	0.44	0.22	0.00	46.16	144.02	0.45	0.47	0.22	0.00
46.20	136.97	0.40	0.50	0.22	0.00	46.27	123.56	0.32	0.55	0.22	0.00
46.35	134.50	0.38	0.50	0.21	0.00	46.41	48.34	2.00	0.00	0.21	0.00
46.49	132.63	0.37	0.51	0.21	0.00	46.55	161.50	0.70	0.34	0.21	0.00
46.59	175.40	1.10	0.13	0.21	0.00	46.66	188.19	1.88	0.01	0.21	0.00
46.73	184.96	1.63	0.04	0.21	0.00	46.80	186.25	1.73	0.03	0.21	0.00
46.87	186.92	1.78	0.02	0.21	0.00	46.94	185.59	1.68	0.03	0.20	0.00
47.00	182.61	1.47	0.06	0.20	0.00	47.06	165.65	0.79	0.25	0.20	0.00
47.12	171.73	0.97	0.17	0.20	0.00	47.19	162.97	0.73	0.30	0.20	0.00
47.26	153.80	0.57	0.40	0.20	0.00	47.34	145.26	0.47	0.43	0.20	0.00
47.38	141.20	0.43	0.44	0.20	0.00	47.44	134.04	0.38	0.46	0.20	0.00
47.51	128.45	0.34	0.48	0.19	0.00	47.58	124.82	0.33	0.49	0.19	0.00
47.65	125.27	0.33	0.49	0.19	0.00	47.73	128.86	0.35	0.47	0.19	0.00
47.79	133.16	0.37	0.45	0.19	0.00	47.84	136.45	0.39	0.44	0.19	0.00
47.93	143.46	0.45	0.41	0.19	0.00	47.99	151.41	0.54	0.38	0.19	0.00
48.07	161.07	0.69	0.31	0.19	0.00	48.11	166.44	0.81	0.22	0.18	0.00
48.18	176.10	1.14	0.11	0.18	0.00	48.25	185.01	1.64	0.03	0.18	0.00
48.32	192.39	2.00	0.00	0.18	0.00	48.39	198.95	2.00	0.00	0.18	0.00
48.43	201.94	2.00	0.00	0.18	0.00	48.50	206.98	2.00	0.00	0.18	0.00
48.57	211.65	2.00	0.00	0.18	0.00	48.65	214.50	2.00	0.00	0.18	0.00
48.71	216.08	2.00	0.00	0.17	0.00	48.78	217.96	2.00	0.00	0.17	0.00
48.83	219.31	2.00	0.00	0.17	0.00	48.90	220.77	2.00	0.00	0.17	0.00
48.97	220.48	2.00	0.00	0.17	0.00	49.04	218.58	2.00	0.00	0.17	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
49.10	215.35	2.00	0.00	0.17	0.00	49.15	212.71	2.00	0.00	0.17	0.00
49.22	209.73	2.00	0.00	0.17	0.00	49.29	212.34	2.00	0.00	0.16	0.00
49.36	218.83	2.00	0.00	0.16	0.00	49.43	225.93	2.00	0.00	0.16	0.00
49.50	232.29	2.00	0.00	0.16	0.00	49.57	237.37	2.00	0.00	0.16	0.00
49.65	239.18	2.00	0.00	0.16	0.00	49.68	239.87	2.00	0.00	0.16	0.00
49.75	239.17	2.00	0.00	0.16	0.00	49.82	237.01	2.00	0.00	0.16	0.00
49.89	233.79	2.00	0.00	0.15	0.00	49.96	231.31	2.00	0.00	0.15	0.00
50.03	228.91	2.00	0.00	0.15	0.00	50.07	229.26	2.00	0.00	0.15	0.00
50.14	230.03	2.00	0.00	0.15	0.00	50.21	231.77	2.00	0.00	0.15	0.00
50.28	233.37	2.00	0.00	0.15	0.00	50.36	226.49	2.00	0.00	0.15	0.00
50.43	237.25	2.00	0.00	0.15	0.00	50.46	238.91	2.00	0.00	0.14	0.00
50.53	241.98	2.00	0.00	0.14	0.00	50.60	243.00	2.00	0.00	0.14	0.00
50.66	244.85	2.00	0.00	0.14	0.00	50.73	247.45	2.00	0.00	0.14	0.00
50.81	249.27	2.00	0.00	0.14	0.00	50.88	250.46	2.00	0.00	0.14	0.00
50.95	251.08	2.00	0.00	0.14	0.00	50.99	248.97	2.00	0.00	0.14	0.00
51.06	249.01	2.00	0.00	0.13	0.00	51.13	246.61	2.00	0.00	0.13	0.00
51.20	244.92	2.00	0.00	0.13	0.00	51.27	244.47	2.00	0.00	0.13	0.00
51.34	242.46	2.00	0.00	0.13	0.00	51.38	241.25	2.00	0.00	0.13	0.00
51.45	238.53	2.00	0.00	0.13	0.00	51.52	238.32	2.00	0.00	0.13	0.00
51.58	239.11	2.00	0.00	0.13	0.00	51.66	236.61	2.00	0.00	0.12	0.00
51.73	231.77	2.00	0.00	0.12	0.00	51.80	227.19	2.00	0.00	0.12	0.00
51.87	223.58	2.00	0.00	0.12	0.00	51.94	220.64	2.00	0.00	0.12	0.00
52.00	221.58	2.00	0.00	0.12	0.00	52.04	221.68	2.00	0.00	0.12	0.00
52.11	224.40	2.00	0.00	0.12	0.00	52.18	224.28	2.00	0.00	0.12	0.00
52.24	224.17	2.00	0.00	0.11	0.00	52.32	224.04	2.00	0.00	0.11	0.00
52.39	222.79	2.00	0.00	0.11	0.00	52.46	220.41	2.00	0.00	0.11	0.00
52.52	217.70	2.00	0.00	0.11	0.00	52.57	206.68	2.00	0.00	0.11	0.00
52.64	211.66	2.00	0.00	0.11	0.00	52.71	211.45	2.00	0.00	0.11	0.00
52.78	210.92	2.00	0.00	0.11	0.00	52.85	209.44	2.00	0.00	0.10	0.00
52.92	206.47	2.00	0.00	0.10	0.00	52.95	204.58	2.00	0.00	0.10	0.00
53.03	200.19	2.00	0.00	0.10	0.00	53.10	193.72	2.00	0.00	0.10	0.00
53.17	189.24	2.00	0.00	0.10	0.00	53.24	190.71	2.00	0.00	0.10	0.00
53.31	195.06	2.00	0.00	0.10	0.00	53.37	199.56	2.00	0.00	0.10	0.00
53.44	201.82	2.00	0.00	0.09	0.00	53.48	201.09	2.00	0.00	0.09	0.00
53.55	191.47	2.00	0.00	0.09	0.00	53.62	174.62	2.00	0.00	0.09	0.00
53.70	147.45	2.00	0.00	0.09	0.00	53.76	55.34	2.00	0.00	0.09	0.00
53.83	46.15	2.00	0.00	0.09	0.00	53.90	46.38	2.00	0.00	0.09	0.00
53.96	46.90	2.00	0.00	0.09	0.00	54.01	48.07	2.00	0.00	0.08	0.00
54.08	51.26	2.00	0.00	0.08	0.00	54.15	45.70	2.00	0.00	0.08	0.00
54.22	38.40	2.00	0.00	0.08	0.00	54.29	34.34	2.00	0.00	0.08	0.00
54.36	35.13	2.00	0.00	0.08	0.00	54.43	41.62	2.00	0.00	0.08	0.00
54.47	48.44	2.00	0.00	0.08	0.00	54.53	132.73	2.00	0.00	0.08	0.00
54.61	150.82	2.00	0.00	0.07	0.00	54.67	160.44	2.00	0.00	0.07	0.00
54.74	166.59	2.00	0.00	0.07	0.00	54.81	174.29	2.00	0.00	0.07	0.00
54.89	183.61	2.00	0.00	0.07	0.00	54.96	188.02	2.00	0.00	0.07	0.00
55.00	188.80	2.00	0.00	0.07	0.00	55.07	188.20	2.00	0.00	0.07	0.00
55.13	187.05	2.00	0.00	0.07	0.00	55.20	186.38	2.00	0.00	0.06	0.00
55.27	186.62	2.00	0.00	0.06	0.00	55.34	189.27	2.00	0.00	0.06	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
55.42	192.95	2.00	0.00	0.06	0.00	55.45	194.98	2.00	0.00	0.06	0.00
55.52	199.02	2.00	0.00	0.06	0.00	55.58	202.20	2.00	0.00	0.06	0.00
55.65	204.75	2.00	0.00	0.06	0.00	55.72	204.47	2.00	0.00	0.06	0.00
55.78	202.77	2.00	0.00	0.05	0.00	55.85	204.18	2.00	0.00	0.05	0.00
55.93	205.06	2.00	0.00	0.05	0.00	56.00	204.10	2.00	0.00	0.05	0.00
56.04	202.93	2.00	0.00	0.05	0.00	56.11	195.36	2.00	0.00	0.05	0.00
56.20	193.14	2.00	0.00	0.05	0.00	56.26	188.46	2.00	0.00	0.05	0.00
56.33	182.74	2.00	0.00	0.05	0.00	56.37	179.46	2.00	0.00	0.04	0.00
56.43	172.31	2.00	0.00	0.04	0.00	56.51	164.80	2.00	0.00	0.04	0.00
56.58	156.75	2.00	0.00	0.04	0.00	56.65	148.31	2.00	0.00	0.04	0.00
56.72	138.89	2.00	0.00	0.04	0.00	56.79	128.98	2.00	0.00	0.04	0.00
56.86	120.25	2.00	0.00	0.04	0.00	56.89	117.35	2.00	0.00	0.04	0.00
56.96	115.94	2.00	0.00	0.03	0.00	57.03	116.24	2.00	0.00	0.03	0.00
57.10	115.75	2.00	0.00	0.03	0.00	57.16	114.59	2.00	0.00	0.03	0.00
57.23	110.88	2.00	0.00	0.03	0.00	57.30	102.69	2.00	0.00	0.03	0.00
57.37	31.72	2.00	0.00	0.03	0.00	57.45	23.03	2.00	0.00	0.03	0.00
57.48	19.99	2.00	0.00	0.03	0.00	57.55	17.10	2.00	0.00	0.02	0.00
57.62	16.51	2.00	0.00	0.02	0.00	57.69	16.69	2.00	0.00	0.02	0.00
57.76	16.55	2.00	0.00	0.02	0.00	57.83	15.66	2.00	0.00	0.02	0.00
57.90	14.95	2.00	0.00	0.02	0.00	57.98	14.62	2.00	0.00	0.02	0.00
58.01	14.68	2.00	0.00	0.02	0.00	58.07	14.55	2.00	0.00	0.02	0.00
58.14	14.16	2.00	0.00	0.01	0.00	58.21	13.33	2.00	0.00	0.01	0.00
58.28	12.70	2.00	0.00	0.01	0.00	58.36	12.63	2.00	0.00	0.01	0.00
58.43	12.50	2.00	0.00	0.01	0.00	58.50	12.55	2.00	0.00	0.01	0.00
58.53	12.55	2.00	0.00	0.01	0.00	58.60	12.66	2.00	0.00	0.01	0.00
58.66	12.91	2.00	0.00	0.01	0.00	58.73	13.41	2.00	0.00	0.00	0.00
58.80	14.46	2.00	0.00	0.00	0.00	58.87	17.03	2.00	0.00	0.00	0.00
58.93	20.24	2.00	0.00	0.00	0.00	59.00	20.99	2.00	0.00	0.00	0.00
59.08	19.71	2.00	0.00	0.00	0.00	59.15	17.30	2.00	0.00	0.00	0.00
59.22	14.84	2.00	0.00	0.00	0.00	59.29	13.65	2.00	0.00	0.00	0.00
59.32	13.65	2.00	0.00	0.00	0.00	59.39	13.64	2.00	0.00	0.00	0.00
59.45	13.63	2.00	0.00	0.00	0.00	59.52	14.74	2.00	0.00	0.00	0.00
59.58	22.37	2.00	0.00	0.00	0.00	59.66	39.84	2.00	0.00	0.00	0.00
59.73	126.16	2.00	0.00	0.00	0.00	59.79	137.24	2.00	0.00	0.00	0.00
59.86	139.52	2.00	0.00	0.00	0.00	59.93	137.75	2.00	0.00	0.00	0.00
60.00	133.06	2.00	0.00	0.00	0.00	60.07	60.28	2.00	0.00	0.00	0.00
60.11	59.10	2.00	0.00	0.00	0.00	60.17	52.08	2.00	0.00	0.00	0.00
60.24	55.17	2.00	0.00	0.00	0.00	60.32	50.10	2.00	0.00	0.00	0.00
60.39	41.55	2.00	0.00	0.00	0.00	60.45	36.11	2.00	0.00	0.00	0.00
60.52	35.99	2.00	0.00	0.00	0.00	60.59	35.87	2.00	0.00	0.00	0.00
60.66	44.09	2.00	0.00	0.00	0.00	60.70	48.83	2.00	0.00	0.00	0.00
60.77	57.07	2.00	0.00	0.00	0.00	60.84	136.69	2.00	0.00	0.00	0.00
60.91	153.55	2.00	0.00	0.00	0.00	60.98	170.24	2.00	0.00	0.00	0.00
61.05	183.00	2.00	0.00	0.00	0.00	61.11	191.34	2.00	0.00	0.00	0.00
61.19	195.23	2.00	0.00	0.00	0.00	61.22	196.43	2.00	0.00	0.00	0.00
61.30	197.75	2.00	0.00	0.00	0.00	61.37	197.78	2.00	0.00	0.00	0.00
61.43	198.05	2.00	0.00	0.00	0.00	61.50	198.10	2.00	0.00	0.00	0.00
61.57	198.30	2.00	0.00	0.00	0.00	61.65	197.24	2.00	0.00	0.00	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
61.72	193.50	2.00	0.00	0.00	0.00	61.76	190.96	2.00	0.00	0.00	0.00
61.82	192.49	2.00	0.00	0.00	0.00	61.89	195.45	2.00	0.00	0.00	0.00
61.96	197.91	2.00	0.00	0.00	0.00	62.03	198.76	2.00	0.00	0.00	0.00
62.10	197.27	2.00	0.00	0.00	0.00	62.17	192.42	2.00	0.00	0.00	0.00
62.24	187.61	2.00	0.00	0.00	0.00	62.28	185.20	2.00	0.00	0.00	0.00
62.35	180.15	2.00	0.00	0.00	0.00	62.41	174.63	2.00	0.00	0.00	0.00
62.48	168.59	2.00	0.00	0.00	0.00	62.55	152.68	2.00	0.00	0.00	0.00
62.62	155.06	2.00	0.00	0.00	0.00	62.68	146.43	2.00	0.00	0.00	0.00
62.76	137.37	2.00	0.00	0.00	0.00	62.82	127.55	2.00	0.00	0.00	0.00
62.89	52.59	2.00	0.00	0.00	0.00	62.93	48.93	2.00	0.00	0.00	0.00
63.00	43.52	2.00	0.00	0.00	0.00	63.07	41.67	2.00	0.00	0.00	0.00
63.13	54.99	2.00	0.00	0.00	0.00	63.19	146.83	2.00	0.00	0.00	0.00
63.28	192.52	2.00	0.00	0.00	0.00	63.34	203.99	2.00	0.00	0.00	0.00
63.41	211.77	2.00	0.00	0.00	0.00	63.48	215.25	2.00	0.00	0.00	0.00
63.55	219.28	2.00	0.00	0.00	0.00	63.59	222.35	2.00	0.00	0.00	0.00
63.66	228.46	2.00	0.00	0.00	0.00	63.73	230.94	2.00	0.00	0.00	0.00
63.80	231.01	2.00	0.00	0.00	0.00	63.87	228.13	2.00	0.00	0.00	0.00
63.94	222.86	2.00	0.00	0.00	0.00	64.00	216.39	2.00	0.00	0.00	0.00
64.08	208.74	2.00	0.00	0.00	0.00	64.12	205.19	2.00	0.00	0.00	0.00
64.19	199.37	2.00	0.00	0.00	0.00	64.26	194.23	2.00	0.00	0.00	0.00
64.33	189.76	2.00	0.00	0.00	0.00	64.39	186.58	2.00	0.00	0.00	0.00
64.46	180.69	2.00	0.00	0.00	0.00	64.54	174.80	2.00	0.00	0.00	0.00
64.57	173.90	2.00	0.00	0.00	0.00	64.64	173.45	2.00	0.00	0.00	0.00
64.71	174.04	2.00	0.00	0.00	0.00	64.77	169.75	2.00	0.00	0.00	0.00
64.85	173.84	2.00	0.00	0.00	0.00	64.92	175.80	2.00	0.00	0.00	0.00
64.99	178.85	2.00	0.00	0.00	0.00	65.03	181.16	2.00	0.00	0.00	0.00
65.10	188.74	2.00	0.00	0.00	0.00	65.17	138.91	2.00	0.00	0.00	0.00
65.25	153.18	2.00	0.00	0.00	0.00	65.31	167.71	2.00	0.00	0.00	0.00
65.39	183.07	2.00	0.00	0.00	0.00	65.45	195.65	2.00	0.00	0.00	0.00
65.49	199.50	2.00	0.00	0.00	0.00						

Total estimated settlement: 2.71

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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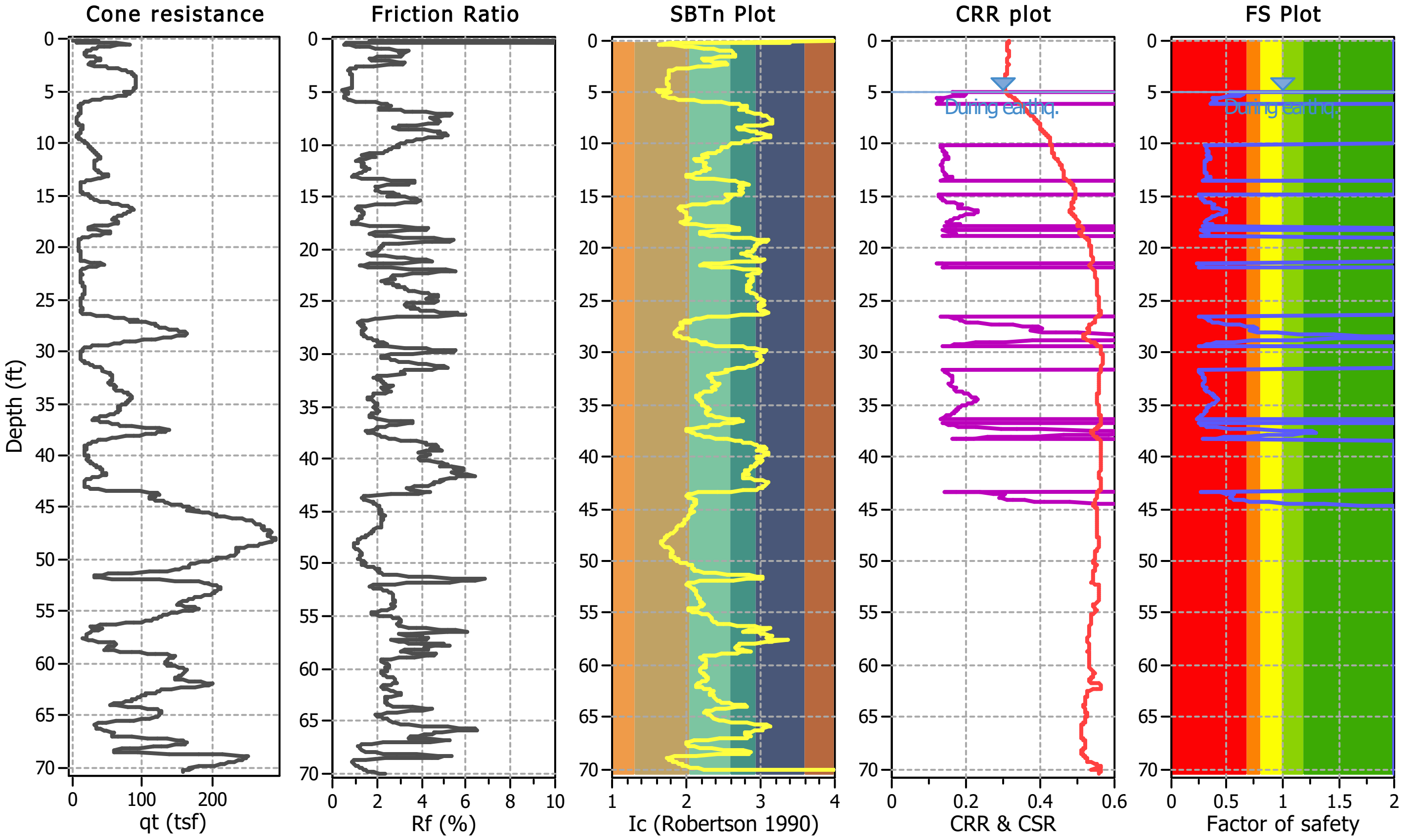
LIQUEFACTION ANALYSIS REPORT

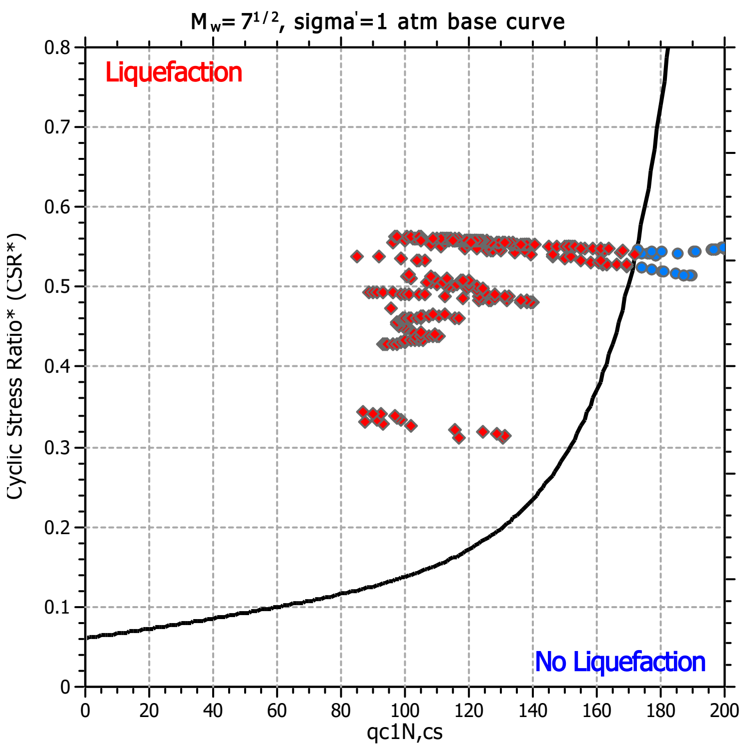
Project title : Proposed Commercial/Industrial Development   Location : Cypress, CA

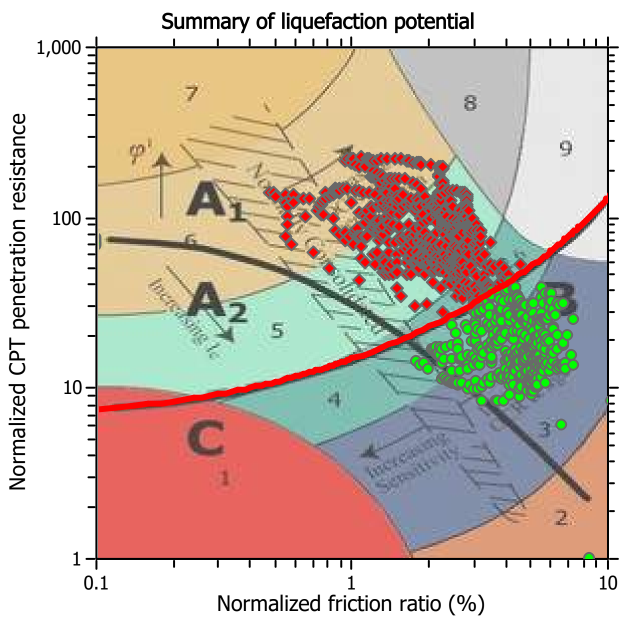
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.54	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

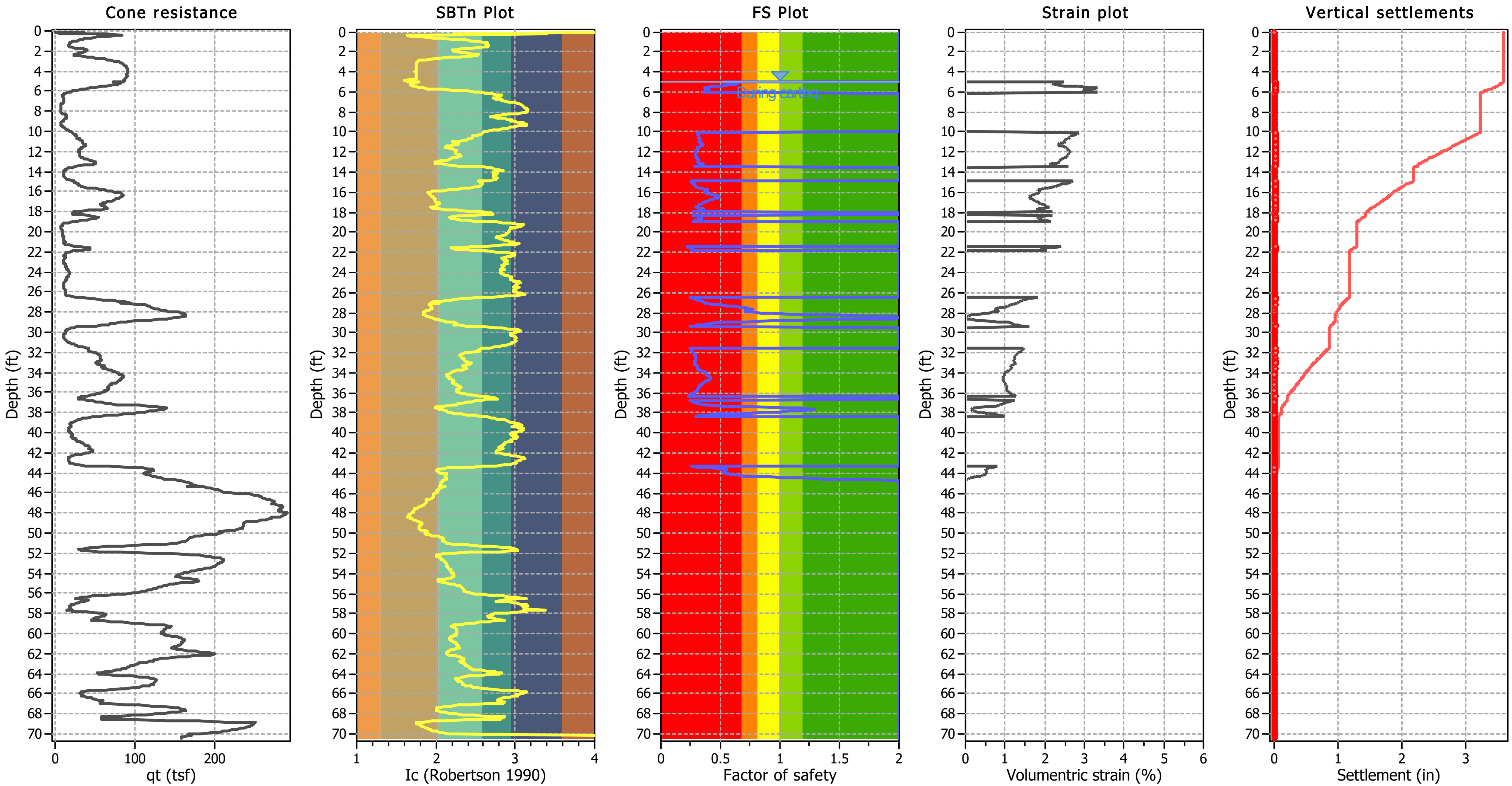






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

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 due to soil liquefaction ::

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
5.06	116.71	0.53	2.50	0.91	0.02	5.13	130.43	0.64	2.22	0.91	0.02
5.19	131.12	0.64	2.20	0.91	0.02	5.28	129.05	0.62	2.23	0.91	0.02
5.34	124.50	0.57	2.32	0.91	0.02	5.39	115.81	0.51	2.51	0.91	0.01
5.47	102.14	0.43	2.85	0.91	0.03	5.53	93.31	0.39	3.12	0.91	0.02
5.61	87.39	0.37	3.33	0.90	0.03	5.67	91.28	0.38	3.18	0.90	0.02
5.72	98.47	0.41	2.95	0.90	0.02	5.80	97.79	0.40	2.96	0.90	0.03
5.86	96.86	0.40	2.99	0.90	0.02	5.94	92.51	0.38	3.13	0.90	0.03
6.00	89.98	0.37	3.21	0.90	0.02	6.06	86.84	0.36	3.32	0.90	0.02
6.13	24.84	2.00	0.00	0.90	0.00	6.19	21.40	2.00	0.00	0.90	0.00
6.26	18.91	2.00	0.00	0.89	0.00	6.32	17.26	2.00	0.00	0.89	0.00
6.38	15.60	2.00	0.00	0.89	0.00	6.45	15.33	2.00	0.00	0.89	0.00
6.50	15.33	2.00	0.00	0.89	0.00	6.59	16.29	2.00	0.00	0.89	0.00
6.65	17.80	2.00	0.00	0.89	0.00	6.72	18.22	2.00	0.00	0.89	0.00
6.78	17.67	2.00	0.00	0.89	0.00	6.83	18.49	2.00	0.00	0.88	0.00
6.90	18.36	2.00	0.00	0.88	0.00	6.99	17.38	2.00	0.00	0.88	0.00
7.04	16.98	2.00	0.00	0.88	0.00	7.11	16.15	2.00	0.00	0.88	0.00
7.17	14.91	2.00	0.00	0.88	0.00	7.23	14.22	2.00	0.00	0.88	0.00
7.29	13.11	2.00	0.00	0.88	0.00	7.35	12.42	2.00	0.00	0.88	0.00
7.44	11.31	2.00	0.00	0.87	0.00	7.50	10.91	2.00	0.00	0.87	0.00
7.57	10.49	2.00	0.00	0.87	0.00	7.63	10.22	2.00	0.00	0.87	0.00
7.68	10.22	2.00	0.00	0.87	0.00	7.74	10.22	2.00	0.00	0.87	0.00
7.82	10.22	2.00	0.00	0.87	0.00	7.89	10.22	2.00	0.00	0.87	0.00
7.95	10.22	2.00	0.00	0.87	0.00	8.03	10.35	2.00	0.00	0.86	0.00
8.09	10.62	2.00	0.00	0.86	0.00	8.16	12.00	2.00	0.00	0.86	0.00
8.22	14.77	2.00	0.00	0.86	0.00	8.29	19.33	2.00	0.00	0.86	0.00
8.34	20.42	2.00	0.00	0.86	0.00	8.42	22.77	2.00	0.00	0.86	0.00
8.48	24.15	2.00	0.00	0.86	0.00	8.54	23.75	2.00	0.00	0.86	0.00
8.61	22.22	2.00	0.00	0.85	0.00	8.68	20.29	2.00	0.00	0.85	0.00
8.74	19.87	2.00	0.00	0.85	0.00	8.81	18.07	2.00	0.00	0.85	0.00
8.87	17.95	2.00	0.00	0.85	0.00	8.94	16.42	2.00	0.00	0.85	0.00
9.00	15.04	2.00	0.00	0.85	0.00	9.08	12.56	2.00	0.00	0.85	0.00
9.14	12.00	2.00	0.00	0.85	0.00	9.20	11.31	2.00	0.00	0.84	0.00
9.27	11.04	2.00	0.00	0.84	0.00	9.32	11.04	2.00	0.00	0.84	0.00
9.41	12.69	2.00	0.00	0.84	0.00	9.46	14.35	2.00	0.00	0.84	0.00
9.53	15.60	2.00	0.00	0.84	0.00	9.58	17.26	2.00	0.00	0.84	0.00
9.66	19.46	2.00	0.00	0.84	0.00	9.72	21.34	2.00	0.00	0.84	0.00
9.79	23.10	2.00	0.00	0.83	0.00	9.85	24.71	2.00	0.00	0.83	0.00
9.94	28.43	2.00	0.00	0.83	0.00	10.00	31.36	2.00	0.00	0.83	0.00
10.07	93.06	0.30	2.87	0.83	0.02	10.12	93.51	0.30	2.85	0.83	0.02
10.18	94.39	0.30	2.82	0.83	0.02	10.25	95.94	0.31	2.77	0.83	0.02
10.31	97.69	0.31	2.72	0.83	0.02	10.38	99.00	0.32	2.68	0.82	0.02
10.44	99.85	0.32	2.65	0.82	0.02	10.50	100.25	0.32	2.63	0.82	0.02
10.57	100.24	0.32	2.63	0.82	0.02	10.66	101.57	0.32	2.59	0.82	0.03
10.71	102.88	0.33	2.55	0.82	0.02	10.77	104.39	0.33	2.51	0.82	0.02
10.85	105.72	0.33	2.48	0.82	0.02	10.92	104.39	0.33	2.51	0.81	0.02
10.98	102.89	0.32	2.54	0.81	0.02	11.03	105.16	0.33	2.48	0.81	0.02
11.11	107.26	0.34	2.43	0.81	0.02	11.17	108.71	0.34	2.39	0.81	0.02
11.23	110.05	0.35	2.36	0.81	0.02	11.31	110.49	0.35	2.34	0.81	0.02

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
11.37	109.63	0.34	2.36	0.81	0.02	11.44	105.27	0.33	2.46	0.81	0.02
11.50	101.97	0.31	2.54	0.81	0.02	11.57	100.91	0.31	2.56	0.80	0.02
11.64	100.58	0.31	2.56	0.80	0.02	11.70	100.10	0.31	2.57	0.80	0.02
11.77	99.21	0.30	2.59	0.80	0.02	11.83	98.27	0.30	2.61	0.80	0.02
11.89	97.80	0.30	2.62	0.80	0.02	11.96	97.37	0.30	2.63	0.80	0.02
12.02	97.29	0.29	2.63	0.80	0.02	12.09	97.47	0.29	2.62	0.80	0.02
12.15	97.60	0.29	2.62	0.79	0.02	12.22	98.55	0.30	2.59	0.79	0.02
12.28	98.88	0.30	2.57	0.79	0.02	12.37	99.19	0.30	2.56	0.79	0.03
12.43	99.37	0.30	2.55	0.79	0.02	12.49	99.37	0.30	2.55	0.79	0.02
12.55	100.01	0.30	2.53	0.79	0.02	12.62	101.48	0.30	2.49	0.79	0.02
12.67	102.15	0.30	2.47	0.79	0.02	12.74	104.05	0.31	2.42	0.78	0.02
12.81	104.91	0.31	2.39	0.78	0.02	12.89	105.44	0.31	2.38	0.78	0.02
12.94	105.41	0.31	2.38	0.78	0.01	13.01	104.99	0.31	2.38	0.78	0.02
13.07	107.62	0.32	2.32	0.78	0.02	13.13	110.86	0.33	2.25	0.78	0.02
13.20	115.53	0.35	2.15	0.78	0.02	13.26	116.70	0.36	2.12	0.78	0.02
13.35	112.27	0.34	2.20	0.77	0.02	13.39	108.65	0.32	2.28	0.77	0.01
13.49	95.78	0.28	2.59	0.77	0.03	13.54	29.52	2.00	0.00	0.77	0.00
13.60	26.17	2.00	0.00	0.77	0.00	13.66	23.85	2.00	0.00	0.77	0.00
13.72	21.52	2.00	0.00	0.77	0.00	13.79	17.38	2.00	0.00	0.77	0.00
13.85	17.60	2.00	0.00	0.77	0.00	13.94	16.04	2.00	0.00	0.76	0.00
13.99	16.03	2.00	0.00	0.76	0.00	14.06	16.02	2.00	0.00	0.76	0.00
14.12	15.99	2.00	0.00	0.76	0.00	14.18	15.03	2.00	0.00	0.76	0.00
14.26	15.01	2.00	0.00	0.76	0.00	14.33	15.45	2.00	0.00	0.76	0.00
14.39	16.14	2.00	0.00	0.76	0.00	14.45	16.35	2.00	0.00	0.76	0.00
14.51	16.32	2.00	0.00	0.75	0.00	14.58	16.88	2.00	0.00	0.75	0.00
14.64	17.53	2.00	0.00	0.75	0.00	14.72	19.10	2.00	0.00	0.75	0.00
14.78	20.21	2.00	0.00	0.75	0.00	14.84	22.47	2.00	0.00	0.75	0.00
14.91	88.76	0.25	2.71	0.75	0.02	14.97	89.88	0.25	2.67	0.75	0.02
15.04	91.02	0.26	2.63	0.75	0.02	15.10	93.37	0.26	2.56	0.74	0.02
15.17	96.31	0.27	2.48	0.74	0.02	15.23	98.71	0.28	2.42	0.74	0.02
15.29	100.07	0.28	2.38	0.74	0.02	15.36	101.27	0.28	2.35	0.74	0.02
15.45	104.58	0.29	2.26	0.74	0.03	15.49	106.17	0.30	2.23	0.74	0.01
15.58	112.56	0.32	2.09	0.74	0.02	15.64	117.93	0.34	1.99	0.73	0.01
15.70	123.00	0.37	1.90	0.73	0.01	15.76	126.87	0.39	1.83	0.73	0.01
15.82	126.48	0.39	1.84	0.73	0.01	15.89	124.63	0.38	1.86	0.73	0.01
15.95	124.45	0.37	1.86	0.73	0.01	16.02	123.59	0.37	1.87	0.73	0.01
16.08	123.05	0.37	1.88	0.73	0.01	16.15	127.96	0.39	1.80	0.73	0.01
16.21	131.59	0.42	1.74	0.73	0.01	16.30	136.28	0.46	1.67	0.72	0.02
16.37	138.34	0.47	1.64	0.72	0.01	16.42	139.56	0.48	1.62	0.72	0.01
16.48	139.75	0.49	1.62	0.72	0.01	16.54	139.30	0.48	1.62	0.72	0.01
16.61	138.06	0.47	1.64	0.72	0.01	16.67	136.34	0.45	1.66	0.72	0.01
16.77	132.72	0.42	1.70	0.72	0.02	16.80	131.34	0.41	1.72	0.72	0.01
16.88	128.10	0.39	1.77	0.71	0.02	16.95	125.02	0.37	1.81	0.71	0.01
17.01	122.31	0.36	1.85	0.71	0.01	17.07	122.53	0.36	1.84	0.71	0.02
17.13	119.60	0.34	1.89	0.71	0.01	17.20	115.10	0.32	1.97	0.71	0.02
17.26	114.01	0.32	1.98	0.71	0.01	17.36	112.76	0.31	2.00	0.71	0.02
17.42	109.98	0.30	2.05	0.70	0.02	17.45	107.97	0.29	2.09	0.70	0.01
17.52	106.71	0.29	2.11	0.70	0.02	17.62	116.43	0.33	1.92	0.70	0.02

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
17.68	122.39	0.35	1.82	0.70	0.01	17.75	124.39	0.36	1.79	0.70	0.01
17.80	119.95	0.34	1.85	0.70	0.01	17.86	111.84	0.31	1.99	0.70	0.01
17.92	101.73	0.27	2.20	0.70	0.01	18.01	30.00	2.00	0.00	0.69	0.00
18.05	28.45	2.00	0.00	0.69	0.00	18.14	26.85	2.00	0.00	0.69	0.00
18.20	27.33	2.00	0.00	0.69	0.00	18.25	31.41	2.00	0.00	0.69	0.00
18.31	100.54	0.27	2.20	0.69	0.02	18.38	109.66	0.30	2.01	0.69	0.01
18.47	117.68	0.33	1.86	0.69	0.02	18.53	119.97	0.34	1.82	0.69	0.01
18.59	119.98	0.34	1.82	0.68	0.01	18.65	117.99	0.33	1.85	0.68	0.01
18.74	112.95	0.31	1.93	0.68	0.02	18.80	107.84	0.29	2.03	0.68	0.01
18.86	101.40	0.27	2.15	0.68	0.02	18.92	32.94	2.00	0.00	0.68	0.00
18.98	26.22	2.00	0.00	0.68	0.00	19.05	20.98	2.00	0.00	0.68	0.00
19.10	17.65	2.00	0.00	0.68	0.00	19.19	13.57	2.00	0.00	0.67	0.00
19.25	11.78	2.00	0.00	0.67	0.00	19.32	11.35	2.00	0.00	0.67	0.00
19.36	10.59	2.00	0.00	0.67	0.00	19.45	10.16	2.00	0.00	0.67	0.00
19.51	9.94	2.00	0.00	0.67	0.00	19.57	10.14	2.00	0.00	0.67	0.00
19.63	9.92	2.00	0.00	0.67	0.00	19.71	10.12	2.00	0.00	0.67	0.00
19.77	10.22	2.00	0.00	0.66	0.00	19.83	10.21	2.00	0.00	0.66	0.00
19.90	10.29	2.00	0.00	0.66	0.00	19.98	10.39	2.00	0.00	0.66	0.00
20.04	10.47	2.00	0.00	0.66	0.00	20.10	10.57	2.00	0.00	0.66	0.00
20.16	10.77	2.00	0.00	0.66	0.00	20.22	10.87	2.00	0.00	0.66	0.00
20.29	10.74	2.00	0.00	0.66	0.00	20.37	11.98	2.00	0.00	0.65	0.00
20.44	12.59	2.00	0.00	0.65	0.00	20.49	13.30	2.00	0.00	0.65	0.00
20.55	12.97	2.00	0.00	0.65	0.00	20.63	13.05	2.00	0.00	0.65	0.00
20.69	13.55	2.00	0.00	0.65	0.00	20.76	13.73	2.00	0.00	0.65	0.00
20.81	13.82	2.00	0.00	0.65	0.00	20.89	13.38	2.00	0.00	0.65	0.00
20.95	14.18	2.00	0.00	0.64	0.00	21.02	13.34	2.00	0.00	0.64	0.00
21.07	13.13	2.00	0.00	0.64	0.00	21.13	12.00	2.00	0.00	0.64	0.00
21.22	12.69	2.00	0.00	0.64	0.00	21.28	15.61	2.00	0.00	0.64	0.00
21.34	21.50	2.00	0.00	0.64	0.00	21.41	85.01	0.22	2.41	0.64	0.02
21.47	91.61	0.24	2.23	0.64	0.02	21.54	98.99	0.25	2.06	0.63	0.02
21.60	104.34	0.27	1.95	0.63	0.02	21.67	106.24	0.27	1.91	0.63	0.02
21.74	104.05	0.27	1.95	0.63	0.02	21.80	98.57	0.25	2.06	0.63	0.02
21.87	31.46	2.00	0.00	0.63	0.00	21.94	25.11	2.00	0.00	0.63	0.00
22.00	20.48	2.00	0.00	0.63	0.00	22.07	17.11	2.00	0.00	0.63	0.00
22.14	15.52	2.00	0.00	0.62	0.00	22.20	14.51	2.00	0.00	0.62	0.00
22.26	13.89	2.00	0.00	0.62	0.00	22.33	13.19	2.00	0.00	0.62	0.00
22.39	13.47	2.00	0.00	0.62	0.00	22.45	13.56	2.00	0.00	0.62	0.00
22.52	14.33	2.00	0.00	0.62	0.00	22.59	14.62	2.00	0.00	0.62	0.00
22.65	14.11	2.00	0.00	0.62	0.00	22.72	13.10	2.00	0.00	0.61	0.00
22.79	12.80	2.00	0.00	0.61	0.00	22.85	12.79	2.00	0.00	0.61	0.00
22.92	12.08	2.00	0.00	0.61	0.00	22.98	12.07	2.00	0.00	0.61	0.00
23.05	12.05	2.00	0.00	0.61	0.00	23.12	12.04	2.00	0.00	0.61	0.00
23.18	12.72	2.00	0.00	0.61	0.00	23.23	13.80	2.00	0.00	0.61	0.00
23.33	13.65	2.00	0.00	0.60	0.00	23.36	14.53	2.00	0.00	0.60	0.00
23.45	14.89	2.00	0.00	0.60	0.00	23.52	15.55	2.00	0.00	0.60	0.00
23.56	15.54	2.00	0.00	0.60	0.00	23.65	15.61	2.00	0.00	0.60	0.00
23.72	16.45	2.00	0.00	0.60	0.00	23.78	17.40	2.00	0.00	0.60	0.00
23.84	17.38	2.00	0.00	0.60	0.00	23.90	18.03	2.00	0.00	0.59	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
23.96	18.67	2.00	0.00	0.59	0.00	24.02	19.13	2.00	0.00	0.59	0.00
24.11	19.57	2.00	0.00	0.59	0.00	24.18	19.64	2.00	0.00	0.59	0.00
24.24	19.43	2.00	0.00	0.59	0.00	24.30	18.93	2.00	0.00	0.59	0.00
24.36	18.15	2.00	0.00	0.59	0.00	24.42	17.18	2.00	0.00	0.59	0.00
24.48	16.60	2.00	0.00	0.59	0.00	24.54	16.29	2.00	0.00	0.58	0.00
24.64	15.98	2.00	0.00	0.58	0.00	24.70	15.59	2.00	0.00	0.58	0.00
24.76	15.18	2.00	0.00	0.58	0.00	24.83	14.69	2.00	0.00	0.58	0.00
24.88	14.02	2.00	0.00	0.58	0.00	24.94	13.24	2.00	0.00	0.58	0.00
25.03	12.37	2.00	0.00	0.58	0.00	25.07	12.36	2.00	0.00	0.58	0.00
25.16	11.50	2.00	0.00	0.57	0.00	25.20	11.49	2.00	0.00	0.57	0.00
25.29	11.48	2.00	0.00	0.57	0.00	25.35	11.75	2.00	0.00	0.57	0.00
25.41	12.21	2.00	0.00	0.57	0.00	25.47	11.44	2.00	0.00	0.57	0.00
25.54	11.99	2.00	0.00	0.57	0.00	25.60	12.54	2.00	0.00	0.57	0.00
25.67	12.53	2.00	0.00	0.56	0.00	25.73	13.35	2.00	0.00	0.56	0.00
25.80	14.09	2.00	0.00	0.56	0.00	25.87	14.44	2.00	0.00	0.56	0.00
25.94	14.24	2.00	0.00	0.56	0.00	26.00	13.94	2.00	0.00	0.56	0.00
26.06	13.56	2.00	0.00	0.56	0.00	26.12	12.71	2.00	0.00	0.56	0.00
26.19	13.43	2.00	0.00	0.56	0.00	26.25	13.33	2.00	0.00	0.56	0.00
26.32	16.08	2.00	0.00	0.55	0.00	26.38	20.29	2.00	0.00	0.55	0.00
26.44	26.84	2.00	0.00	0.55	0.00	26.51	96.21	0.24	1.84	0.55	0.02
26.61	108.14	0.27	1.63	0.55	0.02	26.64	111.39	0.28	1.58	0.55	0.01
26.74	118.79	0.31	1.47	0.55	0.02	26.80	122.63	0.32	1.42	0.55	0.01
26.86	125.38	0.34	1.38	0.54	0.01	26.92	126.63	0.34	1.36	0.54	0.01
26.98	127.73	0.35	1.35	0.54	0.01	27.04	130.30	0.36	1.32	0.54	0.01
27.11	134.13	0.39	1.27	0.54	0.01	27.17	139.45	0.43	1.22	0.54	0.01
27.26	146.25	0.49	1.15	0.54	0.01	27.31	150.29	0.54	1.11	0.54	0.01
27.39	155.12	0.61	1.07	0.54	0.01	27.45	158.19	0.67	0.98	0.53	0.01
27.50	160.45	0.71	0.86	0.53	0.01	27.56	162.10	0.75	0.77	0.53	0.01
27.64	162.95	0.76	0.73	0.53	0.01	27.71	162.13	0.75	0.77	0.53	0.01
27.78	161.17	0.72	0.81	0.53	0.01	27.83	160.48	0.71	0.85	0.53	0.01
27.89	160.36	0.71	0.86	0.53	0.01	27.97	163.19	0.77	0.71	0.53	0.01
28.03	166.00	0.84	0.59	0.52	0.00	28.09	169.63	0.95	0.46	0.52	0.00
28.17	174.64	1.13	0.31	0.52	0.00	28.23	177.68	1.28	0.23	0.52	0.00
28.28	180.83	1.45	0.15	0.52	0.00	28.36	184.72	1.72	0.07	0.52	0.00
28.41	187.56	1.95	0.01	0.52	0.00	28.51	189.90	2.00	0.00	0.52	0.00
28.56	189.68	2.00	0.00	0.52	0.00	28.61	187.70	1.97	0.01	0.52	0.00
28.70	181.18	1.47	0.14	0.51	0.00	28.76	174.42	1.12	0.31	0.51	0.00
28.81	169.55	0.94	0.45	0.51	0.00	28.89	160.94	0.72	0.80	0.51	0.01
28.96	152.11	0.56	1.04	0.51	0.01	29.01	146.12	0.49	1.09	0.51	0.01
29.09	137.46	0.41	1.16	0.51	0.01	29.16	129.61	0.36	1.24	0.51	0.01
29.21	126.04	0.34	1.27	0.50	0.01	29.29	119.36	0.31	1.34	0.50	0.01
29.34	112.37	0.28	1.43	0.50	0.01	29.42	99.99	0.25	1.61	0.50	0.02
29.48	28.55	2.00	0.00	0.50	0.00	29.55	24.72	2.00	0.00	0.50	0.00
29.60	20.89	2.00	0.00	0.50	0.00	29.68	16.97	2.00	0.00	0.50	0.00
29.75	15.38	2.00	0.00	0.50	0.00	29.81	14.50	2.00	0.00	0.49	0.00
29.88	13.45	2.00	0.00	0.49	0.00	29.94	13.26	2.00	0.00	0.49	0.00
30.01	12.65	2.00	0.00	0.49	0.00	30.07	12.28	2.00	0.00	0.49	0.00
30.13	12.01	2.00	0.00	0.49	0.00	30.20	11.83	2.00	0.00	0.49	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
30.26	11.82	2.00	0.00	0.49	0.00	30.32	11.81	2.00	0.00	0.49	0.00
30.41	11.11	2.00	0.00	0.48	0.00	30.47	11.10	2.00	0.00	0.48	0.00
30.53	11.26	2.00	0.00	0.48	0.00	30.60	11.42	2.00	0.00	0.48	0.00
30.66	11.92	2.00	0.00	0.48	0.00	30.72	12.52	2.00	0.00	0.48	0.00
30.79	12.68	2.00	0.00	0.48	0.00	30.87	13.95	2.00	0.00	0.48	0.00
30.92	15.14	2.00	0.00	0.48	0.00	30.99	16.48	2.00	0.00	0.47	0.00
31.05	17.92	2.00	0.00	0.47	0.00	31.11	19.60	2.00	0.00	0.47	0.00
31.20	23.40	2.00	0.00	0.47	0.00	31.26	24.90	2.00	0.00	0.47	0.00
31.32	26.49	2.00	0.00	0.47	0.00	31.38	28.99	2.00	0.00	0.47	0.00
31.44	31.17	2.00	0.00	0.47	0.00	31.50	33.83	2.00	0.00	0.47	0.00
31.59	100.81	0.25	1.48	0.46	0.01	31.64	102.75	0.25	1.45	0.46	0.01
31.70	103.56	0.25	1.43	0.46	0.01	31.77	103.28	0.25	1.43	0.46	0.01
31.83	103.10	0.25	1.43	0.46	0.01	31.90	103.11	0.25	1.43	0.46	0.01
31.98	109.73	0.27	1.34	0.46	0.01	32.04	110.24	0.27	1.33	0.46	0.01
32.12	111.59	0.28	1.31	0.46	0.01	32.18	112.90	0.28	1.29	0.45	0.01
32.24	113.57	0.28	1.28	0.45	0.01	32.31	114.76	0.29	1.26	0.45	0.01
32.37	115.28	0.29	1.25	0.45	0.01	32.43	115.92	0.29	1.24	0.45	0.01
32.50	115.67	0.29	1.24	0.45	0.01	32.57	115.44	0.29	1.24	0.45	0.01
32.63	115.74	0.29	1.23	0.45	0.01	32.70	116.09	0.29	1.23	0.45	0.01
32.75	116.88	0.29	1.22	0.44	0.01	32.83	115.71	0.29	1.22	0.44	0.01
32.89	114.46	0.29	1.24	0.44	0.01	32.94	113.37	0.28	1.25	0.44	0.01
33.02	111.70	0.28	1.26	0.44	0.01	33.07	111.26	0.28	1.26	0.44	0.01
33.15	112.52	0.28	1.25	0.44	0.01	33.20	114.34	0.29	1.22	0.44	0.01
33.28	119.15	0.30	1.17	0.44	0.01	33.34	120.33	0.31	1.15	0.43	0.01
33.40	120.04	0.31	1.15	0.43	0.01	33.48	119.54	0.31	1.15	0.43	0.01
33.54	118.69	0.30	1.16	0.43	0.01	33.63	119.78	0.31	1.14	0.43	0.01
33.68	121.92	0.32	1.12	0.43	0.01	33.76	125.32	0.33	1.08	0.43	0.01
33.82	127.03	0.34	1.07	0.43	0.01	33.86	128.59	0.35	1.05	0.43	0.01
33.92	130.79	0.36	1.03	0.43	0.01	34.01	133.10	0.37	1.00	0.42	0.01
34.06	133.65	0.38	1.00	0.42	0.01	34.15	133.33	0.38	1.00	0.42	0.01
34.21	133.97	0.38	0.99	0.42	0.01	34.26	134.98	0.39	0.98	0.42	0.01
34.35	137.22	0.40	0.96	0.42	0.01	34.40	138.17	0.41	0.95	0.42	0.01
34.48	138.81	0.42	0.94	0.42	0.01	34.54	138.74	0.41	0.94	0.41	0.01
34.62	138.27	0.41	0.94	0.41	0.01	34.67	137.57	0.41	0.94	0.41	0.01
34.72	137.00	0.40	0.95	0.41	0.01	34.81	135.12	0.39	0.96	0.41	0.01
34.86	133.83	0.38	0.96	0.41	0.01	34.91	132.46	0.37	0.97	0.41	0.01
35.00	130.63	0.36	0.99	0.41	0.01	35.04	129.28	0.35	0.99	0.41	0.01
35.13	127.05	0.34	1.01	0.40	0.01	35.18	125.74	0.33	1.02	0.40	0.01
35.24	124.65	0.33	1.03	0.40	0.01	35.31	123.81	0.32	1.03	0.40	0.01
35.37	122.79	0.32	1.04	0.40	0.01	35.45	121.76	0.31	1.04	0.40	0.01
35.53	122.76	0.32	1.03	0.40	0.01	35.58	120.74	0.31	1.05	0.40	0.01
35.63	121.36	0.31	1.04	0.40	0.01	35.72	119.68	0.31	1.05	0.39	0.01
35.77	118.67	0.30	1.06	0.39	0.01	35.85	116.88	0.29	1.07	0.39	0.01
35.90	115.62	0.29	1.08	0.39	0.01	35.96	113.95	0.28	1.10	0.39	0.01
36.03	111.24	0.28	1.12	0.39	0.01	36.09	108.53	0.27	1.15	0.39	0.01
36.16	104.72	0.26	1.19	0.39	0.01	36.22	101.73	0.25	1.22	0.39	0.01
36.30	96.83	0.24	1.28	0.38	0.01	36.35	32.86	2.00	0.00	0.38	0.00
36.43	29.65	2.00	0.00	0.38	0.00	36.48	28.13	2.00	0.00	0.38	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
36.57	26.52	2.00	0.00	0.38	0.00	36.62	27.45	2.00	0.00	0.38	0.00
36.70	33.11	2.00	0.00	0.38	0.00	36.75	97.61	0.24	1.24	0.38	0.01
36.82	104.22	0.25	1.16	0.38	0.01	36.88	108.87	0.27	1.10	0.37	0.01
36.96	114.53	0.29	1.04	0.37	0.01	37.04	119.40	0.30	0.99	0.37	0.01
37.09	123.31	0.32	0.96	0.37	0.01	37.17	131.27	0.36	0.89	0.37	0.01
37.21	138.04	0.41	0.84	0.37	0.00	37.29	150.77	0.53	0.76	0.37	0.01
37.34	156.41	0.62	0.72	0.37	0.00	37.41	162.75	0.74	0.54	0.37	0.00
37.49	172.79	1.02	0.27	0.36	0.00	37.53	176.30	1.17	0.20	0.36	0.00
37.60	178.47	1.27	0.16	0.36	0.00	37.67	178.93	1.29	0.15	0.36	0.00
37.74	176.79	1.19	0.19	0.36	0.00	37.82	174.32	1.08	0.23	0.36	0.00
37.87	171.89	0.99	0.28	0.36	0.00	37.94	167.40	0.85	0.39	0.36	0.00
38.01	160.64	0.69	0.60	0.36	0.01	38.06	154.70	0.59	0.71	0.35	0.00
38.14	145.25	0.47	0.76	0.35	0.01	38.20	136.27	0.40	0.82	0.35	0.00
38.28	121.99	0.32	0.92	0.35	0.01	38.33	114.76	0.29	0.98	0.35	0.01
38.40	41.96	2.00	0.00	0.35	0.00	38.47	36.55	2.00	0.00	0.35	0.00
38.55	32.57	2.00	0.00	0.35	0.00	38.60	30.31	2.00	0.00	0.35	0.00
38.67	27.12	2.00	0.00	0.34	0.00	38.73	25.32	2.00	0.00	0.34	0.00
38.80	23.23	2.00	0.00	0.34	0.00	38.86	22.29	2.00	0.00	0.34	0.00
38.93	20.13	2.00	0.00	0.34	0.00	38.98	18.50	2.00	0.00	0.34	0.00
39.06	16.89	2.00	0.00	0.34	0.00	39.11	16.11	2.00	0.00	0.34	0.00
39.19	15.33	2.00	0.00	0.34	0.00	39.25	17.45	2.00	0.00	0.33	0.00
39.33	18.27	2.00	0.00	0.33	0.00	39.38	17.96	2.00	0.00	0.33	0.00
39.45	16.35	2.00	0.00	0.33	0.00	39.51	15.35	2.00	0.00	0.33	0.00
39.59	13.74	2.00	0.00	0.33	0.00	39.64	13.74	2.00	0.00	0.33	0.00
39.72	13.72	2.00	0.00	0.33	0.00	39.78	13.71	2.00	0.00	0.33	0.00
39.85	14.46	2.00	0.00	0.32	0.00	39.91	15.50	2.00	0.00	0.32	0.00
39.97	16.70	2.00	0.00	0.32	0.00	40.03	18.04	2.00	0.00	0.32	0.00
40.09	19.24	2.00	0.00	0.32	0.00	40.16	19.45	2.00	0.00	0.32	0.00
40.22	18.83	2.00	0.00	0.32	0.00	40.31	17.98	2.00	0.00	0.32	0.00
40.38	17.96	2.00	0.00	0.32	0.00	40.44	18.26	2.00	0.00	0.31	0.00
40.50	19.14	2.00	0.00	0.31	0.00	40.57	20.64	2.00	0.00	0.31	0.00
40.63	21.59	2.00	0.00	0.31	0.00	40.70	22.55	2.00	0.00	0.31	0.00
40.77	22.91	2.00	0.00	0.31	0.00	40.83	24.17	2.00	0.00	0.31	0.00
40.89	26.71	2.00	0.00	0.31	0.00	40.96	29.18	2.00	0.00	0.31	0.00
41.05	30.58	2.00	0.00	0.30	0.00	41.11	31.01	2.00	0.00	0.30	0.00
41.17	32.12	2.00	0.00	0.30	0.00	41.23	33.31	2.00	0.00	0.30	0.00
41.29	34.18	2.00	0.00	0.30	0.00	41.35	35.96	2.00	0.00	0.30	0.00
41.42	37.22	2.00	0.00	0.30	0.00	41.48	37.19	2.00	0.00	0.30	0.00
41.54	36.64	2.00	0.00	0.30	0.00	41.61	36.30	2.00	0.00	0.29	0.00
41.68	40.95	2.00	0.00	0.29	0.00	41.74	41.30	2.00	0.00	0.29	0.00
41.80	40.74	2.00	0.00	0.29	0.00	41.87	39.57	2.00	0.00	0.29	0.00
41.97	36.06	2.00	0.00	0.29	0.00	42.03	32.21	2.00	0.00	0.29	0.00
42.09	27.70	2.00	0.00	0.29	0.00	42.16	23.67	2.00	0.00	0.29	0.00
42.23	20.92	2.00	0.00	0.28	0.00	42.29	18.55	2.00	0.00	0.28	0.00
42.32	17.43	2.00	0.00	0.28	0.00	42.41	15.07	2.00	0.00	0.28	0.00
42.47	14.10	2.00	0.00	0.28	0.00	42.53	13.66	2.00	0.00	0.28	0.00
42.60	13.65	2.00	0.00	0.28	0.00	42.66	13.64	2.00	0.00	0.28	0.00
42.73	13.63	2.00	0.00	0.28	0.00	42.79	14.05	2.00	0.00	0.27	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
42.85	14.63	2.00	0.00	0.27	0.00	42.95	15.20	2.00	0.00	0.27	0.00
42.98	15.77	2.00	0.00	0.27	0.00	43.08	18.45	2.00	0.00	0.27	0.00
43.14	21.07	2.00	0.00	0.27	0.00	43.19	25.16	2.00	0.00	0.27	0.00
43.26	31.63	2.00	0.00	0.27	0.00	43.32	104.83	0.26	0.81	0.27	0.01
43.38	120.91	0.31	0.70	0.26	0.01	43.47	140.71	0.43	0.59	0.26	0.01
43.53	147.57	0.50	0.55	0.26	0.00	43.60	151.43	0.54	0.54	0.26	0.00
43.66	152.35	0.55	0.53	0.26	0.00	43.72	151.80	0.55	0.53	0.26	0.00
43.78	151.05	0.54	0.53	0.26	0.00	43.84	151.35	0.54	0.53	0.26	0.00
43.92	149.85	0.52	0.53	0.26	0.01	43.97	151.16	0.54	0.52	0.25	0.00
44.05	153.18	0.57	0.51	0.25	0.00	44.10	155.11	0.59	0.50	0.25	0.00
44.18	158.59	0.65	0.45	0.25	0.00	44.26	161.09	0.70	0.41	0.25	0.00
44.30	163.47	0.75	0.35	0.25	0.00	44.37	168.34	0.87	0.25	0.25	0.00
44.43	173.03	1.03	0.18	0.25	0.00	44.50	177.36	1.21	0.12	0.25	0.00
44.56	180.53	1.37	0.09	0.24	0.00	44.63	185.59	1.70	0.03	0.24	0.00
44.70	190.64	2.00	0.00	0.24	0.00	44.76	195.94	2.00	0.00	0.24	0.00
44.83	200.47	2.00	0.00	0.24	0.00	44.89	204.91	2.00	0.00	0.24	0.00
44.96	207.11	2.00	0.00	0.24	0.00	45.03	208.29	2.00	0.00	0.24	0.00
45.09	210.39	2.00	0.00	0.24	0.00	45.17	212.28	2.00	0.00	0.23	0.00
45.22	214.62	2.00	0.00	0.23	0.00	45.29	218.54	2.00	0.00	0.23	0.00
45.35	210.59	2.00	0.00	0.23	0.00	45.42	223.74	2.00	0.00	0.23	0.00
45.49	228.60	2.00	0.00	0.23	0.00	45.55	232.07	2.00	0.00	0.23	0.00
45.62	236.22	2.00	0.00	0.23	0.00	45.68	238.44	2.00	0.00	0.23	0.00
45.75	240.53	2.00	0.00	0.22	0.00	45.80	242.24	2.00	0.00	0.22	0.00
45.87	245.46	2.00	0.00	0.22	0.00	45.94	250.13	2.00	0.00	0.22	0.00
46.01	254.00	2.00	0.00	0.22	0.00	46.07	254.00	2.00	0.00	0.22	0.00
46.13	254.00	2.00	0.00	0.22	0.00	46.21	254.00	2.00	0.00	0.22	0.00
46.28	254.00	2.00	0.00	0.22	0.00	46.33	254.00	2.00	0.00	0.21	0.00
46.40	254.00	2.00	0.00	0.21	0.00	46.47	254.00	2.00	0.00	0.21	0.00
46.53	254.00	2.00	0.00	0.21	0.00	46.60	254.00	2.00	0.00	0.21	0.00
46.66	254.00	2.00	0.00	0.21	0.00	46.73	254.00	2.00	0.00	0.21	0.00
46.80	254.00	2.00	0.00	0.21	0.00	46.86	254.00	2.00	0.00	0.21	0.00
46.93	254.00	2.00	0.00	0.20	0.00	47.00	254.00	2.00	0.00	0.20	0.00
47.05	254.00	2.00	0.00	0.20	0.00	47.12	254.00	2.00	0.00	0.20	0.00
47.19	254.00	2.00	0.00	0.20	0.00	47.26	253.64	2.00	0.00	0.20	0.00
47.33	250.85	2.00	0.00	0.20	0.00	47.39	248.82	2.00	0.00	0.20	0.00
47.46	246.14	2.00	0.00	0.20	0.00	47.52	244.91	2.00	0.00	0.19	0.00
47.57	243.34	2.00	0.00	0.19	0.00	47.64	241.58	2.00	0.00	0.19	0.00
47.71	241.05	2.00	0.00	0.19	0.00	47.78	241.58	2.00	0.00	0.19	0.00
47.84	244.17	2.00	0.00	0.19	0.00	47.91	246.10	2.00	0.00	0.19	0.00
47.97	248.35	2.00	0.00	0.19	0.00	48.03	251.28	2.00	0.00	0.19	0.00
48.11	250.17	2.00	0.00	0.18	0.00	48.18	249.23	2.00	0.00	0.18	0.00
48.24	246.42	2.00	0.00	0.18	0.00	48.31	245.40	2.00	0.00	0.18	0.00
48.37	242.52	2.00	0.00	0.18	0.00	48.43	231.41	2.00	0.00	0.18	0.00
48.50	231.13	2.00	0.00	0.18	0.00	48.57	228.82	2.00	0.00	0.18	0.00
48.64	224.91	2.00	0.00	0.18	0.00	48.69	219.71	2.00	0.00	0.17	0.00
48.76	213.59	2.00	0.00	0.17	0.00	48.83	208.28	2.00	0.00	0.17	0.00
48.89	205.30	2.00	0.00	0.17	0.00	48.97	203.36	2.00	0.00	0.17	0.00
49.03	203.17	2.00	0.00	0.17	0.00	49.10	202.68	2.00	0.00	0.17	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
49.16	201.40	2.00	0.00	0.17	0.00	49.23	200.25	2.00	0.00	0.17	0.00
49.29	199.22	2.00	0.00	0.16	0.00	49.35	197.77	2.00	0.00	0.16	0.00
49.42	196.76	2.00	0.00	0.16	0.00	49.48	197.25	2.00	0.00	0.16	0.00
49.54	196.21	2.00	0.00	0.16	0.00	49.62	196.02	2.00	0.00	0.16	0.00
49.67	197.58	2.00	0.00	0.16	0.00	49.74	199.57	2.00	0.00	0.16	0.00
49.83	200.05	2.00	0.00	0.16	0.00	49.87	197.19	2.00	0.00	0.15	0.00
49.96	191.04	2.00	0.00	0.15	0.00	50.01	189.06	2.00	0.00	0.15	0.00
50.07	189.58	2.00	0.00	0.15	0.00	50.14	194.31	2.00	0.00	0.15	0.00
50.20	198.40	2.00	0.00	0.15	0.00	50.26	201.18	2.00	0.00	0.15	0.00
50.33	201.75	2.00	0.00	0.15	0.00	50.40	202.06	2.00	0.00	0.15	0.00
50.46	202.48	2.00	0.00	0.14	0.00	50.55	201.96	2.00	0.00	0.14	0.00
50.61	201.92	2.00	0.00	0.14	0.00	50.68	201.17	2.00	0.00	0.14	0.00
50.73	200.34	2.00	0.00	0.14	0.00	50.81	198.14	2.00	0.00	0.14	0.00
50.86	195.98	2.00	0.00	0.14	0.00	50.95	191.38	2.00	0.00	0.14	0.00
51.00	187.96	2.00	0.00	0.14	0.00	51.08	181.71	2.00	0.00	0.13	0.00
51.14	173.33	2.00	0.00	0.13	0.00	51.19	160.56	2.00	0.00	0.13	0.00
51.26	136.87	2.00	0.00	0.13	0.00	51.33	50.19	2.00	0.00	0.13	0.00
51.40	39.68	2.00	0.00	0.13	0.00	51.45	33.06	2.00	0.00	0.13	0.00
51.53	26.76	2.00	0.00	0.13	0.00	51.59	23.85	2.00	0.00	0.13	0.00
51.65	22.57	2.00	0.00	0.12	0.00	51.73	24.76	2.00	0.00	0.12	0.00
51.79	30.11	2.00	0.00	0.12	0.00	51.84	41.57	2.00	0.00	0.12	0.00
51.91	128.11	2.00	0.00	0.12	0.00	51.99	164.68	2.00	0.00	0.12	0.00
52.04	178.07	2.00	0.00	0.12	0.00	52.12	191.57	2.00	0.00	0.12	0.00
52.18	198.68	2.00	0.00	0.12	0.00	52.24	207.54	2.00	0.00	0.11	0.00
52.31	217.79	2.00	0.00	0.11	0.00	52.38	223.02	2.00	0.00	0.11	0.00
52.45	232.17	2.00	0.00	0.11	0.00	52.51	238.71	2.00	0.00	0.11	0.00
52.57	244.12	2.00	0.00	0.11	0.00	52.63	247.67	2.00	0.00	0.11	0.00
52.69	249.57	2.00	0.00	0.11	0.00	52.76	250.68	2.00	0.00	0.11	0.00
52.83	250.38	2.00	0.00	0.10	0.00	52.90	249.41	2.00	0.00	0.10	0.00
52.97	247.56	2.00	0.00	0.10	0.00	53.02	246.62	2.00	0.00	0.10	0.00
53.09	245.59	2.00	0.00	0.10	0.00	53.17	244.45	2.00	0.00	0.10	0.00
53.22	243.16	2.00	0.00	0.10	0.00	53.30	242.03	2.00	0.00	0.10	0.00
53.35	240.64	2.00	0.00	0.10	0.00	53.43	237.38	2.00	0.00	0.09	0.00
53.50	232.51	2.00	0.00	0.09	0.00	53.57	226.43	2.00	0.00	0.09	0.00
53.63	222.22	2.00	0.00	0.09	0.00	53.70	217.01	2.00	0.00	0.09	0.00
53.76	214.27	2.00	0.00	0.09	0.00	53.83	209.43	2.00	0.00	0.09	0.00
53.90	205.61	2.00	0.00	0.09	0.00	53.95	204.05	2.00	0.00	0.09	0.00
54.03	202.06	2.00	0.00	0.08	0.00	54.07	200.46	2.00	0.00	0.08	0.00
54.14	196.09	2.00	0.00	0.08	0.00	54.21	195.08	2.00	0.00	0.08	0.00
54.27	192.59	2.00	0.00	0.08	0.00	54.36	192.60	2.00	0.00	0.08	0.00
54.40	193.56	2.00	0.00	0.08	0.00	54.47	196.31	2.00	0.00	0.08	0.00
54.55	198.27	2.00	0.00	0.08	0.00	54.63	197.73	2.00	0.00	0.07	0.00
54.66	199.02	2.00	0.00	0.07	0.00	54.73	200.90	2.00	0.00	0.07	0.00
54.79	202.05	2.00	0.00	0.07	0.00	54.88	201.24	2.00	0.00	0.07	0.00
54.93	199.53	2.00	0.00	0.07	0.00	54.99	196.34	2.00	0.00	0.07	0.00
55.08	190.70	2.00	0.00	0.07	0.00	55.13	187.35	2.00	0.00	0.07	0.00
55.19	184.36	2.00	0.00	0.06	0.00	55.25	181.32	2.00	0.00	0.06	0.00
55.33	177.08	2.00	0.00	0.06	0.00	55.38	174.87	2.00	0.00	0.06	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
55.47	171.56	2.00	0.00	0.06	0.00	55.52	168.71	2.00	0.00	0.06	0.00
55.61	165.10	2.00	0.00	0.06	0.00	55.66	163.02	2.00	0.00	0.06	0.00
55.71	161.13	2.00	0.00	0.06	0.00	55.80	157.49	2.00	0.00	0.05	0.00
55.85	154.07	2.00	0.00	0.05	0.00	55.93	148.91	2.00	0.00	0.05	0.00
55.98	143.88	2.00	0.00	0.05	0.00	56.06	133.61	2.00	0.00	0.05	0.00
56.12	123.86	2.00	0.00	0.05	0.00	56.17	46.12	2.00	0.00	0.05	0.00
56.27	34.09	2.00	0.00	0.05	0.00	56.33	28.78	2.00	0.00	0.05	0.00
56.39	23.87	2.00	0.00	0.04	0.00	56.46	19.77	2.00	0.00	0.04	0.00
56.52	18.55	2.00	0.00	0.04	0.00	56.57	19.87	2.00	0.00	0.04	0.00
56.63	26.42	2.00	0.00	0.04	0.00	56.72	29.47	2.00	0.00	0.04	0.00
56.78	26.06	2.00	0.00	0.04	0.00	56.84	22.67	2.00	0.00	0.04	0.00
56.90	20.38	2.00	0.00	0.04	0.00	56.96	18.79	2.00	0.00	0.03	0.00
57.02	16.77	2.00	0.00	0.03	0.00	57.11	14.34	2.00	0.00	0.03	0.00
57.17	13.64	2.00	0.00	0.03	0.00	57.23	13.27	2.00	0.00	0.03	0.00
57.28	12.52	2.00	0.00	0.03	0.00	57.37	12.48	2.00	0.00	0.03	0.00
57.42	12.48	2.00	0.00	0.03	0.00	57.48	12.44	2.00	0.00	0.03	0.00
57.58	13.17	2.00	0.00	0.02	0.00	57.62	9.02	2.00	0.00	0.02	0.00
57.70	14.32	2.00	0.00	0.02	0.00	57.76	15.05	2.00	0.00	0.02	0.00
57.83	18.84	2.00	0.00	0.02	0.00	57.88	26.29	2.00	0.00	0.02	0.00
57.97	39.08	2.00	0.00	0.02	0.00	58.03	43.44	2.00	0.00	0.02	0.00
58.09	45.42	2.00	0.00	0.02	0.00	58.16	45.85	2.00	0.00	0.01	0.00
58.22	44.34	2.00	0.00	0.01	0.00	58.28	42.03	2.00	0.00	0.01	0.00
58.36	39.61	2.00	0.00	0.01	0.00	58.42	37.26	2.00	0.00	0.01	0.00
58.48	34.34	2.00	0.00	0.01	0.00	58.54	36.97	2.00	0.00	0.01	0.00
58.63	32.39	2.00	0.00	0.01	0.00	58.68	36.70	2.00	0.00	0.01	0.00
58.74	43.38	2.00	0.00	0.00	0.00	58.81	49.88	2.00	0.00	0.00	0.00
58.88	130.29	2.00	0.00	0.00	0.00	58.94	141.38	2.00	0.00	0.00	0.00
59.01	150.51	2.00	0.00	0.00	0.00	59.06	159.05	2.00	0.00	0.00	0.00
59.14	172.65	2.00	0.00	0.00	0.00	59.21	177.22	2.00	0.00	0.00	0.00
59.26	179.92	2.00	0.00	0.00	0.00	59.32	181.25	2.00	0.00	0.00	0.00
59.41	180.01	2.00	0.00	0.00	0.00	59.46	178.24	2.00	0.00	0.00	0.00
59.52	176.56	2.00	0.00	0.00	0.00	59.61	175.25	2.00	0.00	0.00	0.00
59.66	175.07	2.00	0.00	0.00	0.00	59.72	174.62	2.00	0.00	0.00	0.00
59.78	173.67	2.00	0.00	0.00	0.00	59.86	171.30	2.00	0.00	0.00	0.00
59.92	171.43	2.00	0.00	0.00	0.00	59.98	171.54	2.00	0.00	0.00	0.00
60.06	174.38	2.00	0.00	0.00	0.00	60.12	177.01	2.00	0.00	0.00	0.00
60.18	173.56	2.00	0.00	0.00	0.00	60.24	181.98	2.00	0.00	0.00	0.00
60.33	186.44	2.00	0.00	0.00	0.00	60.39	189.09	2.00	0.00	0.00	0.00
60.44	191.27	2.00	0.00	0.00	0.00	60.53	194.24	2.00	0.00	0.00	0.00
60.59	195.81	2.00	0.00	0.00	0.00	60.64	196.97	2.00	0.00	0.00	0.00
60.73	197.56	2.00	0.00	0.00	0.00	60.78	197.48	2.00	0.00	0.00	0.00
60.85	197.38	2.00	0.00	0.00	0.00	60.90	196.88	2.00	0.00	0.00	0.00
60.98	196.55	2.00	0.00	0.00	0.00	61.04	196.27	2.00	0.00	0.00	0.00
61.11	195.75	2.00	0.00	0.00	0.00	61.18	194.09	2.00	0.00	0.00	0.00
61.24	191.85	2.00	0.00	0.00	0.00	61.30	189.28	2.00	0.00	0.00	0.00
61.38	185.47	2.00	0.00	0.00	0.00	61.44	184.29	2.00	0.00	0.00	0.00
61.50	184.20	2.00	0.00	0.00	0.00	61.57	187.23	2.00	0.00	0.00	0.00
61.64	191.31	2.00	0.00	0.00	0.00	61.69	196.87	2.00	0.00	0.00	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
61.77	206.19	2.00	0.00	0.00	0.00	61.83	213.13	2.00	0.00	0.00	0.00
61.90	222.83	2.00	0.00	0.00	0.00	61.96	228.06	2.00	0.00	0.00	0.00
62.02	230.95	2.00	0.00	0.00	0.00	62.09	229.14	2.00	0.00	0.00	0.00
62.15	224.41	2.00	0.00	0.00	0.00	62.23	212.81	2.00	0.00	0.00	0.00
62.29	203.90	2.00	0.00	0.00	0.00	62.34	194.24	2.00	0.00	0.00	0.00
62.42	181.10	2.00	0.00	0.00	0.00	62.48	173.61	2.00	0.00	0.00	0.00
62.54	167.88	2.00	0.00	0.00	0.00	62.62	162.58	2.00	0.00	0.00	0.00
62.68	160.54	2.00	0.00	0.00	0.00	62.76	158.06	2.00	0.00	0.00	0.00
62.81	154.73	2.00	0.00	0.00	0.00	62.86	151.19	2.00	0.00	0.00	0.00
62.93	144.31	2.00	0.00	0.00	0.00	63.01	142.45	2.00	0.00	0.00	0.00
63.07	139.63	2.00	0.00	0.00	0.00	63.12	136.92	2.00	0.00	0.00	0.00
63.21	134.28	2.00	0.00	0.00	0.00	63.26	132.34	2.00	0.00	0.00	0.00
63.34	130.16	2.00	0.00	0.00	0.00	63.40	128.62	2.00	0.00	0.00	0.00
63.48	126.01	2.00	0.00	0.00	0.00	63.54	124.71	2.00	0.00	0.00	0.00
63.59	123.11	2.00	0.00	0.00	0.00	63.67	119.47	2.00	0.00	0.00	0.00
63.72	50.04	2.00	0.00	0.00	0.00	63.79	44.42	2.00	0.00	0.00	0.00
63.85	40.06	2.00	0.00	0.00	0.00	63.91	36.19	2.00	0.00	0.00	0.00
63.99	37.22	2.00	0.00	0.00	0.00	64.05	42.50	2.00	0.00	0.00	0.00
64.13	121.20	2.00	0.00	0.00	0.00	64.18	131.14	2.00	0.00	0.00	0.00
64.24	135.69	2.00	0.00	0.00	0.00	64.31	142.18	2.00	0.00	0.00	0.00
64.41	149.61	2.00	0.00	0.00	0.00	64.46	153.15	2.00	0.00	0.00	0.00
64.50	155.90	2.00	0.00	0.00	0.00	64.59	159.52	2.00	0.00	0.00	0.00
64.64	160.74	2.00	0.00	0.00	0.00	64.70	161.24	2.00	0.00	0.00	0.00
64.77	161.03	2.00	0.00	0.00	0.00	64.83	160.83	2.00	0.00	0.00	0.00
64.91	160.90	2.00	0.00	0.00	0.00	64.97	160.73	2.00	0.00	0.00	0.00
65.03	160.42	2.00	0.00	0.00	0.00	65.12	157.62	2.00	0.00	0.00	0.00
65.16	155.84	2.00	0.00	0.00	0.00	65.24	149.02	2.00	0.00	0.00	0.00
65.30	145.04	2.00	0.00	0.00	0.00	65.36	140.68	2.00	0.00	0.00	0.00
65.45	61.89	2.00	0.00	0.00	0.00	65.49	57.39	2.00	0.00	0.00	0.00
65.58	41.72	2.00	0.00	0.00	0.00	65.64	33.24	2.00	0.00	0.00	0.00
65.70	27.83	2.00	0.00	0.00	0.00	65.75	24.08	2.00	0.00	0.00	0.00
65.81	21.22	2.00	0.00	0.00	0.00	65.91	21.02	2.00	0.00	0.00	0.00
65.95	20.42	2.00	0.00	0.00	0.00	66.02	21.71	2.00	0.00	0.00	0.00
66.08	21.64	2.00	0.00	0.00	0.00	66.16	20.80	2.00	0.00	0.00	0.00
66.22	21.32	2.00	0.00	0.00	0.00	66.28	23.15	2.00	0.00	0.00	0.00
66.34	25.93	2.00	0.00	0.00	0.00	66.42	29.51	2.00	0.00	0.00	0.00
66.48	31.30	2.00	0.00	0.00	0.00	66.55	32.08	2.00	0.00	0.00	0.00
66.62	36.60	2.00	0.00	0.00	0.00	66.68	39.77	2.00	0.00	0.00	0.00
66.74	38.45	2.00	0.00	0.00	0.00	66.81	38.10	2.00	0.00	0.00	0.00
66.88	38.08	2.00	0.00	0.00	0.00	66.95	37.69	2.00	0.00	0.00	0.00
67.02	44.54	2.00	0.00	0.00	0.00	67.08	123.65	2.00	0.00	0.00	0.00
67.14	138.39	2.00	0.00	0.00	0.00	67.20	147.38	2.00	0.00	0.00	0.00
67.26	153.02	2.00	0.00	0.00	0.00	67.34	157.29	2.00	0.00	0.00	0.00
67.40	159.18	2.00	0.00	0.00	0.00	67.47	162.04	2.00	0.00	0.00	0.00
67.52	164.91	2.00	0.00	0.00	0.00	67.61	166.86	2.00	0.00	0.00	0.00
67.66	167.28	2.00	0.00	0.00	0.00	67.73	167.44	2.00	0.00	0.00	0.00
67.79	167.03	2.00	0.00	0.00	0.00	67.86	165.01	2.00	0.00	0.00	0.00
67.93	161.52	2.00	0.00	0.00	0.00	67.99	156.24	2.00	0.00	0.00	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
68.06	149.37	2.00	0.00	0.00	0.00	68.14	134.52	2.00	0.00	0.00	0.00
68.19	55.90	2.00	0.00	0.00	0.00	68.25	46.92	2.00	0.00	0.00	0.00
68.32	38.93	2.00	0.00	0.00	0.00	68.39	38.84	2.00	0.00	0.00	0.00
68.45	38.81	2.00	0.00	0.00	0.00	68.51	38.75	2.00	0.00	0.00	0.00
68.58	131.38	2.00	0.00	0.00	0.00	68.64	158.88	2.00	0.00	0.00	0.00
68.71	170.42	2.00	0.00	0.00	0.00	68.77	162.85	2.00	0.00	0.00	0.00
68.85	177.59	2.00	0.00	0.00	0.00	68.90	183.06	2.00	0.00	0.00	0.00
68.97	181.25	2.00	0.00	0.00	0.00	69.03	182.08	2.00	0.00	0.00	0.00
69.13	181.73	2.00	0.00	0.00	0.00	69.18	183.00	2.00	0.00	0.00	0.00
69.23	185.98	2.00	0.00	0.00	0.00	69.30	190.57	2.00	0.00	0.00	0.00
69.38	196.52	2.00	0.00	0.00	0.00	69.44	200.91	2.00	0.00	0.00	0.00
69.49	204.75	2.00	0.00	0.00	0.00	69.56	205.99	2.00	0.00	0.00	0.00
69.64	205.97	2.00	0.00	0.00	0.00	69.69	207.90	2.00	0.00	0.00	0.00
69.75	211.58	2.00	0.00	0.00	0.00	69.83	213.90	2.00	0.00	0.00	0.00
69.89	213.04	2.00	0.00	0.00	0.00	69.95	205.52	2.00	0.00	0.00	0.00
70.02	195.27	2.00	0.00	0.00	0.00	70.08	129.41	2.00	0.00	0.00	0.00
70.15	125.26	2.00	0.00	0.00	0.00	70.21	121.52	2.00	0.00	0.00	0.00
70.31	117.59	2.00	0.00	0.00	0.00	70.37	117.12	2.00	0.00	0.00	0.00
70.43	118.08	2.00	0.00	0.00	0.00						

Total estimated settlement: 3.59

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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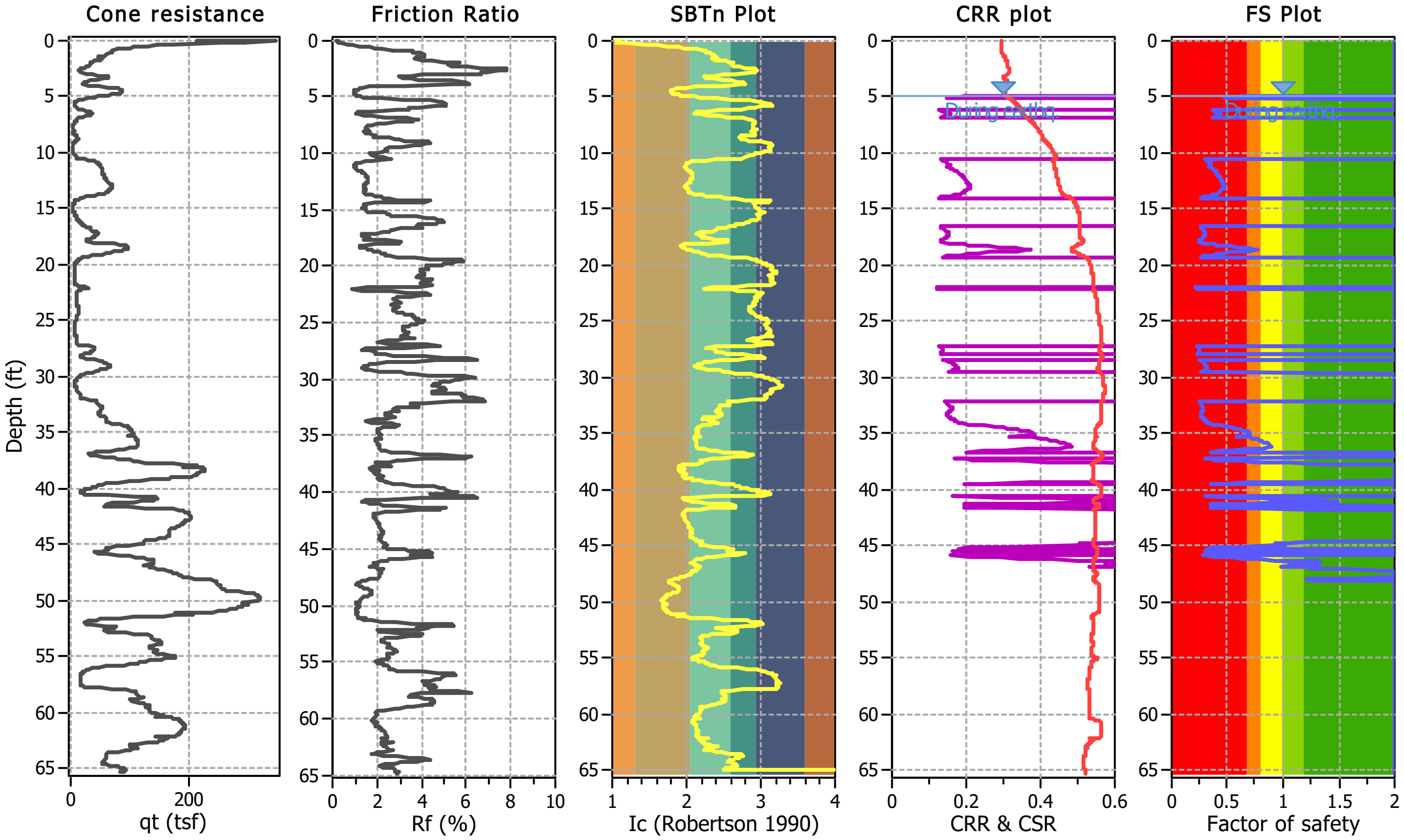
LIQUEFACTION ANALYSIS REPORT

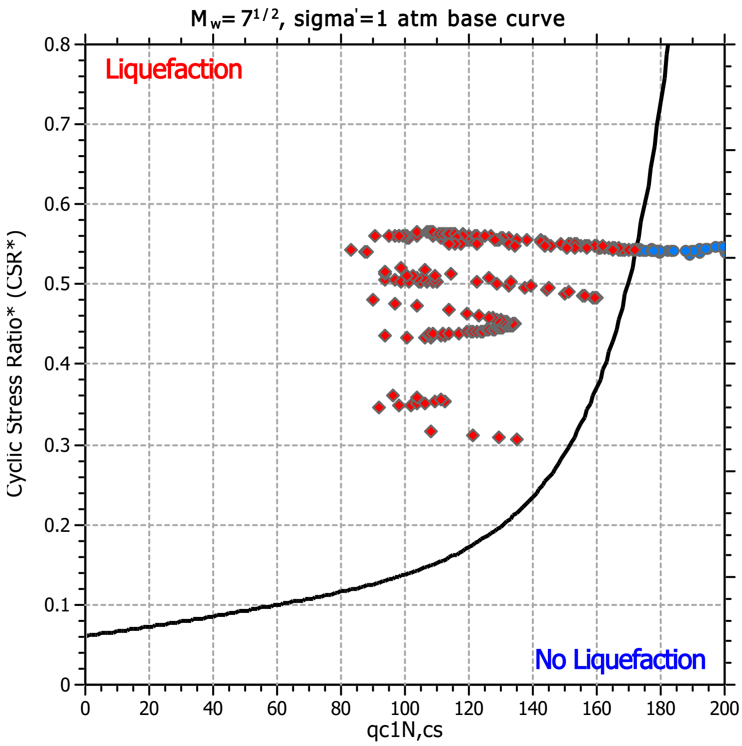
Project title : Proposed Commercial/Industrial Development   Location : Cypress, CA

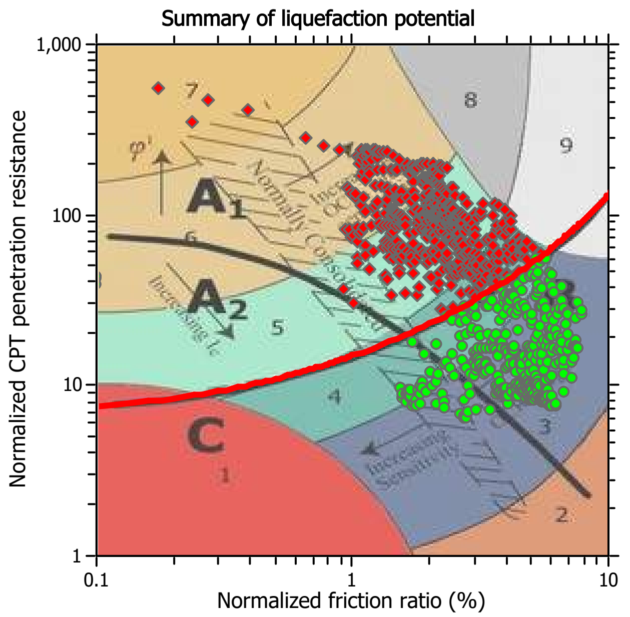
CPT file : CPT-3

Input parameters and analysis data

Analysis method:	**B&I (2014)**	**G.W.T. (in-situ):**	**5.00 ft**	**Use fill:**	**No**	**Clay like behavior applied:**	**Sands only**
Fines correction method:	**B&I (2014)**	**G.W.T. (earthq.):**	**5.00 ft**	**Fill height:**	**N/A**	**Limit depth applie**	**Yes**
Points to test:	**Based on Ic value**	**Average results interva**	**1**	**Fill weight:**	**N/A**	**Limit depth:**	**50.00 ft**
Earthquake magnitude M_w:	**7.30**	**Ic cut-off value:**	**2.60**	**Trans. detect. applied:**	**No**	**MSF method:**	**Method base**
Peak ground acceleration:	**0.54**	**Unit weight calculation**	**Based on SBT**	**K_σ applied:**	**Yes**		

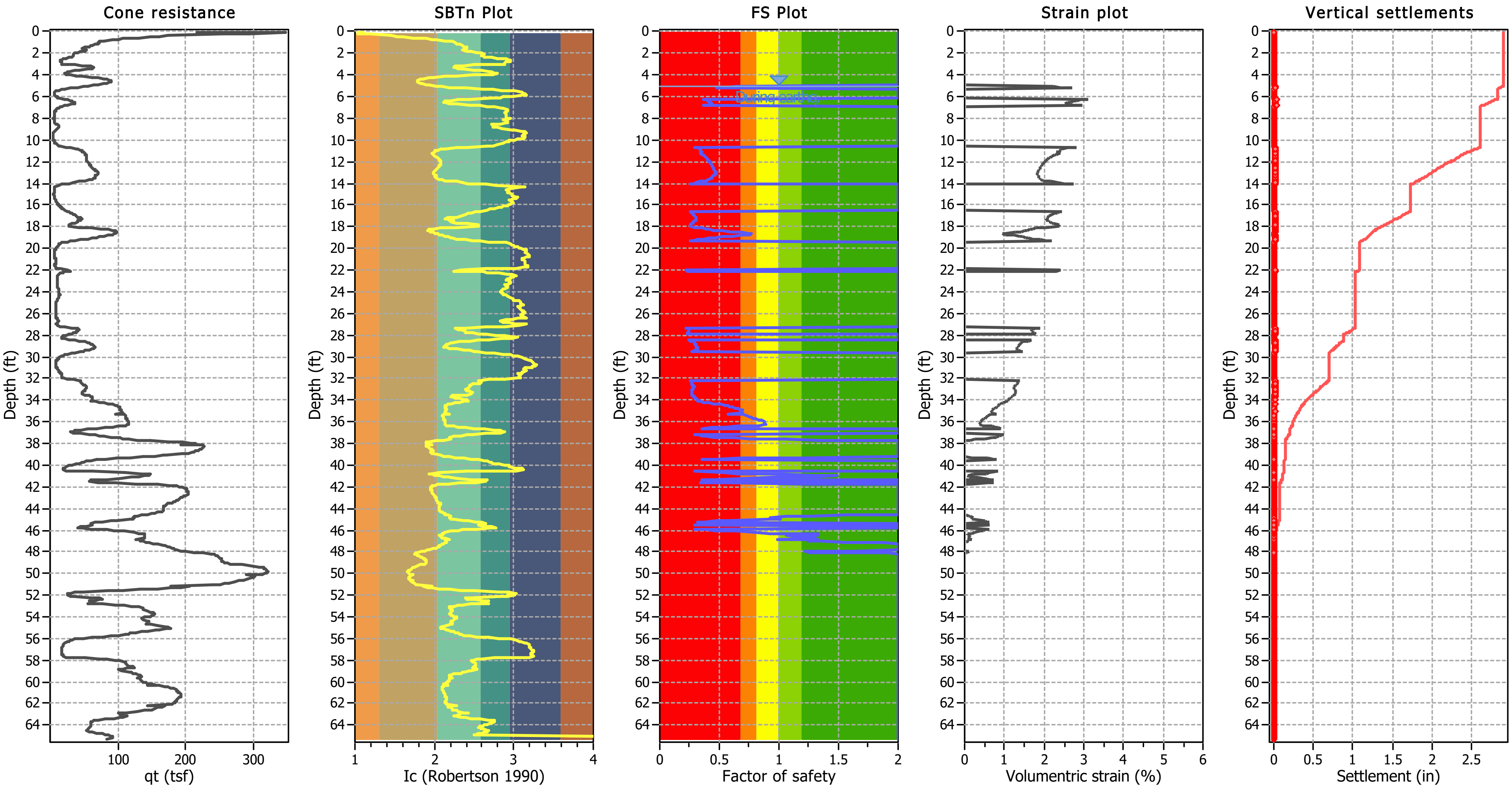






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

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 due to soil liquefaction ::

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
5.01	134.72	0.70	2.14	0.92	0.02	5.06	129.42	0.63	2.24	0.91	0.01
5.12	121.26	0.56	2.40	0.91	0.02	5.19	108.24	0.47	2.70	0.91	0.02
5.28	33.56	2.00	0.00	0.91	0.00	5.33	26.65	2.00	0.00	0.91	0.00
5.38	21.40	2.00	0.00	0.91	0.00	5.47	16.71	2.00	0.00	0.91	0.00
5.52	15.05	2.00	0.00	0.91	0.00	5.60	11.87	2.00	0.00	0.91	0.00
5.67	11.05	2.00	0.00	0.90	0.00	5.72	10.64	2.00	0.00	0.90	0.00
5.80	10.36	2.00	0.00	0.90	0.00	5.87	11.33	2.00	0.00	0.90	0.00
5.93	13.40	2.00	0.00	0.90	0.00	5.99	15.60	2.00	0.00	0.90	0.00
6.05	17.40	2.00	0.00	0.90	0.00	6.12	18.51	2.00	0.00	0.90	0.00
6.18	22.09	2.00	0.00	0.90	0.00	6.26	92.18	0.37	3.12	0.89	0.03
6.32	98.41	0.39	2.92	0.89	0.02	6.39	101.71	0.40	2.82	0.89	0.02
6.45	103.71	0.41	2.76	0.89	0.02	6.52	106.32	0.42	2.68	0.89	0.02
6.57	109.52	0.43	2.60	0.89	0.02	6.63	112.20	0.44	2.53	0.89	0.02
6.70	111.35	0.43	2.55	0.89	0.02	6.78	103.76	0.40	2.74	0.89	0.03
6.85	96.09	0.37	2.96	0.88	0.02	6.91	29.27	2.00	0.00	0.88	0.00
6.97	24.31	2.00	0.00	0.88	0.00	7.03	20.29	2.00	0.00	0.88	0.00
7.09	18.36	2.00	0.00	0.88	0.00	7.18	15.33	2.00	0.00	0.88	0.00
7.24	14.22	2.00	0.00	0.88	0.00	7.30	12.98	2.00	0.00	0.88	0.00
7.37	12.02	2.00	0.00	0.88	0.00	7.42	11.05	2.00	0.00	0.87	0.00
7.48	10.49	2.00	0.00	0.87	0.00	7.57	9.95	2.00	0.00	0.87	0.00
7.63	9.67	2.00	0.00	0.87	0.00	7.70	9.80	2.00	0.00	0.87	0.00
7.76	9.67	2.00	0.00	0.87	0.00	7.82	9.53	2.00	0.00	0.87	0.00
7.90	9.53	2.00	0.00	0.87	0.00	7.96	9.53	2.00	0.00	0.87	0.00
8.01	8.98	2.00	0.00	0.86	0.00	8.09	10.22	2.00	0.00	0.86	0.00
8.15	10.22	2.00	0.00	0.86	0.00	8.21	10.07	2.00	0.00	0.86	0.00
8.30	9.95	2.00	0.00	0.86	0.00	8.36	9.95	2.00	0.00	0.86	0.00
8.42	10.64	2.00	0.00	0.86	0.00	8.49	12.71	2.00	0.00	0.86	0.00
8.54	16.02	2.00	0.00	0.86	0.00	8.60	18.09	2.00	0.00	0.85	0.00
8.69	20.16	2.00	0.00	0.85	0.00	8.76	20.98	2.00	0.00	0.85	0.00
8.81	21.55	2.00	0.00	0.85	0.00	8.87	20.44	2.00	0.00	0.85	0.00
8.93	18.78	2.00	0.00	0.85	0.00	9.02	15.05	2.00	0.00	0.85	0.00
9.06	14.22	2.00	0.00	0.85	0.00	9.15	11.46	2.00	0.00	0.84	0.00
9.21	10.49	2.00	0.00	0.84	0.00	9.26	9.53	2.00	0.00	0.84	0.00
9.33	8.56	2.00	0.00	0.84	0.00	9.42	8.02	2.00	0.00	0.84	0.00
9.48	8.02	2.00	0.00	0.84	0.00	9.54	7.87	2.00	0.00	0.84	0.00
9.60	7.73	2.00	0.00	0.84	0.00	9.66	7.33	2.00	0.00	0.84	0.00
9.74	7.33	2.00	0.00	0.83	0.00	9.80	7.33	2.00	0.00	0.83	0.00
9.86	7.45	2.00	0.00	0.83	0.00	9.92	8.15	2.00	0.00	0.83	0.00
9.98	8.71	2.00	0.00	0.83	0.00	10.07	9.80	2.00	0.00	0.83	0.00
10.13	9.95	2.00	0.00	0.83	0.00	10.19	10.49	2.00	0.00	0.83	0.00
10.25	11.33	2.00	0.00	0.83	0.00	10.31	12.56	2.00	0.00	0.83	0.00
10.40	15.96	2.00	0.00	0.82	0.00	10.45	17.34	2.00	0.00	0.82	0.00
10.52	20.01	2.00	0.00	0.82	0.00	10.57	23.26	2.00	0.00	0.82	0.00
10.64	93.81	0.30	2.81	0.82	0.02	10.70	100.87	0.32	2.61	0.82	0.02
10.79	106.42	0.34	2.46	0.82	0.03	10.84	107.84	0.34	2.43	0.82	0.01
10.91	107.86	0.34	2.42	0.82	0.02	10.97	107.62	0.34	2.42	0.81	0.02
11.04	109.01	0.35	2.39	0.81	0.02	11.10	111.26	0.35	2.34	0.81	0.02
11.16	112.33	0.36	2.31	0.81	0.02	11.23	107.64	0.34	2.41	0.81	0.02

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
11.30	108.92	0.34	2.38	0.81	0.02	11.36	111.77	0.35	2.31	0.81	0.02
11.42	113.98	0.36	2.26	0.81	0.02	11.50	117.12	0.38	2.19	0.81	0.02
11.58	119.30	0.39	2.15	0.80	0.02	11.62	120.38	0.39	2.12	0.80	0.01
11.68	121.25	0.40	2.11	0.80	0.01	11.75	122.38	0.40	2.08	0.80	0.02
11.85	123.67	0.41	2.05	0.80	0.02	11.91	124.47	0.41	2.04	0.80	0.02
11.99	125.44	0.42	2.02	0.80	0.02	12.03	125.87	0.42	2.01	0.80	0.01
12.08	126.46	0.42	2.00	0.80	0.01	12.15	127.30	0.43	1.98	0.79	0.02
12.24	128.18	0.43	1.96	0.79	0.02	12.30	128.77	0.44	1.95	0.79	0.01
12.36	129.29	0.44	1.94	0.79	0.01	12.42	129.74	0.44	1.93	0.79	0.01
12.47	130.13	0.44	1.92	0.79	0.01	12.57	130.93	0.45	1.90	0.79	0.02
12.63	131.31	0.45	1.89	0.79	0.01	12.69	131.67	0.45	1.88	0.78	0.01
12.75	132.02	0.46	1.88	0.78	0.01	12.82	132.47	0.46	1.87	0.78	0.01
12.88	133.04	0.46	1.86	0.78	0.02	12.93	133.48	0.47	1.85	0.78	0.01
13.02	134.17	0.47	1.83	0.78	0.02	13.09	134.26	0.47	1.83	0.78	0.01
13.14	134.03	0.47	1.83	0.78	0.01	13.20	133.52	0.46	1.84	0.78	0.01
13.28	132.18	0.45	1.85	0.77	0.02	13.35	131.16	0.44	1.87	0.77	0.01
13.40	130.49	0.44	1.87	0.77	0.01	13.47	129.81	0.43	1.88	0.77	0.02
13.55	128.68	0.42	1.90	0.77	0.02	13.61	127.77	0.42	1.91	0.77	0.01
13.67	125.94	0.40	1.94	0.77	0.01	13.73	123.01	0.39	1.98	0.77	0.01
13.79	119.07	0.36	2.05	0.77	0.02	13.85	113.91	0.34	2.15	0.77	0.01
13.94	104.03	0.30	2.36	0.76	0.02	14.00	97.01	0.28	2.53	0.76	0.02
14.06	89.72	0.26	2.73	0.76	0.02	14.11	24.43	2.00	0.00	0.76	0.00
14.20	17.97	2.00	0.00	0.76	0.00	14.27	10.23	2.00	0.00	0.76	0.00
14.32	9.39	2.00	0.00	0.76	0.00	14.38	9.01	2.00	0.00	0.76	0.00
14.44	9.00	2.00	0.00	0.76	0.00	14.53	9.00	2.00	0.00	0.75	0.00
14.59	8.98	2.00	0.00	0.75	0.00	14.65	8.85	2.00	0.00	0.75	0.00
14.70	8.49	2.00	0.00	0.75	0.00	14.79	8.59	2.00	0.00	0.75	0.00
14.86	8.47	2.00	0.00	0.75	0.00	14.91	8.21	2.00	0.00	0.75	0.00
14.97	7.86	2.00	0.00	0.75	0.00	15.06	7.85	2.00	0.00	0.74	0.00
15.12	7.95	2.00	0.00	0.74	0.00	15.18	7.94	2.00	0.00	0.74	0.00
15.24	8.05	2.00	0.00	0.74	0.00	15.29	8.40	2.00	0.00	0.74	0.00
15.38	8.97	2.00	0.00	0.74	0.00	15.45	9.77	2.00	0.00	0.74	0.00
15.51	10.92	2.00	0.00	0.74	0.00	15.56	11.94	2.00	0.00	0.74	0.00
15.65	12.48	2.00	0.00	0.73	0.00	15.71	13.48	2.00	0.00	0.73	0.00
15.77	14.03	2.00	0.00	0.73	0.00	15.84	14.57	2.00	0.00	0.73	0.00
15.90	15.35	2.00	0.00	0.73	0.00	15.97	16.77	2.00	0.00	0.73	0.00
16.03	17.86	2.00	0.00	0.73	0.00	16.09	19.95	2.00	0.00	0.73	0.00
16.16	21.01	2.00	0.00	0.73	0.00	16.23	21.97	2.00	0.00	0.73	0.00
16.29	23.91	2.00	0.00	0.72	0.00	16.35	26.15	2.00	0.00	0.72	0.00
16.42	27.84	2.00	0.00	0.72	0.00	16.48	28.64	2.00	0.00	0.72	0.00
16.54	28.91	2.00	0.00	0.72	0.00	16.62	93.60	0.26	2.47	0.72	0.02
16.68	96.69	0.26	2.39	0.72	0.02	16.74	99.02	0.27	2.32	0.72	0.02
16.81	101.25	0.28	2.27	0.72	0.02	16.89	104.08	0.28	2.20	0.71	0.02
16.93	104.86	0.29	2.18	0.71	0.01	17.03	107.19	0.29	2.13	0.71	0.03
17.09	109.03	0.30	2.09	0.71	0.01	17.16	109.01	0.30	2.08	0.71	0.02
17.22	109.03	0.30	2.08	0.71	0.02	17.28	109.93	0.30	2.06	0.71	0.01
17.35	110.30	0.30	2.05	0.71	0.02	17.41	109.29	0.30	2.07	0.70	0.02
17.46	106.08	0.29	2.13	0.70	0.01	17.53	105.45	0.29	2.14	0.70	0.02

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
17.59	103.85	0.28	2.17	0.70	0.02	17.65	102.32	0.28	2.20	0.70	0.02
17.72	100.54	0.27	2.24	0.70	0.02	17.81	93.87	0.25	2.39	0.70	0.02
17.88	93.80	0.25	2.39	0.70	0.02	17.93	93.75	0.25	2.39	0.70	0.02
18.00	93.61	0.25	2.39	0.69	0.02	18.07	109.25	0.30	2.03	0.69	0.02
18.13	122.72	0.35	1.80	0.69	0.01	18.19	128.63	0.39	1.70	0.69	0.01
18.26	132.24	0.41	1.65	0.69	0.01	18.32	137.68	0.45	1.58	0.69	0.01
18.39	144.34	0.52	1.49	0.69	0.01	18.45	150.08	0.59	1.43	0.69	0.01
18.52	155.57	0.68	1.29	0.69	0.01	18.58	158.76	0.74	1.04	0.69	0.01
18.65	160.10	0.77	0.95	0.68	0.01	18.71	159.23	0.75	1.01	0.68	0.01
18.78	156.29	0.69	1.23	0.68	0.01	18.84	151.34	0.61	1.40	0.68	0.01
18.91	145.29	0.53	1.46	0.68	0.01	18.97	139.35	0.46	1.53	0.68	0.01
19.04	133.04	0.41	1.61	0.68	0.01	19.10	126.04	0.37	1.70	0.68	0.01
19.19	114.43	0.31	1.88	0.67	0.02	19.25	106.06	0.28	2.04	0.67	0.01
19.31	98.70	0.26	2.19	0.67	0.02	19.37	31.06	2.00	0.00	0.67	0.00
19.44	25.28	2.00	0.00	0.67	0.00	19.50	20.98	2.00	0.00	0.67	0.00
19.57	18.30	2.00	0.00	0.67	0.00	19.63	17.26	2.00	0.00	0.67	0.00
19.70	16.30	2.00	0.00	0.67	0.00	19.75	15.16	2.00	0.00	0.67	0.00
19.82	13.91	2.00	0.00	0.66	0.00	19.89	12.55	2.00	0.00	0.66	0.00
19.95	11.60	2.00	0.00	0.66	0.00	20.01	10.77	2.00	0.00	0.66	0.00
20.08	9.81	2.00	0.00	0.66	0.00	20.15	9.28	2.00	0.00	0.66	0.00
20.21	9.17	2.00	0.00	0.66	0.00	20.28	9.05	2.00	0.00	0.66	0.00
20.35	9.04	2.00	0.00	0.66	0.00	20.41	9.03	2.00	0.00	0.65	0.00
20.50	8.61	2.00	0.00	0.65	0.00	20.57	8.49	2.00	0.00	0.65	0.00
20.64	8.27	2.00	0.00	0.65	0.00	20.70	8.26	2.00	0.00	0.65	0.00
20.76	8.36	2.00	0.00	0.65	0.00	20.83	8.87	2.00	0.00	0.65	0.00
20.89	9.37	2.00	0.00	0.65	0.00	20.95	9.76	2.00	0.00	0.64	0.00
21.01	9.95	2.00	0.00	0.64	0.00	21.07	9.74	2.00	0.00	0.64	0.00
21.13	9.73	2.00	0.00	0.64	0.00	21.20	9.72	2.00	0.00	0.64	0.00
21.26	9.71	2.00	0.00	0.64	0.00	21.36	9.58	2.00	0.00	0.64	0.00
21.39	9.48	2.00	0.00	0.64	0.00	21.49	9.16	2.00	0.00	0.64	0.00
21.55	8.95	2.00	0.00	0.63	0.00	21.62	8.94	2.00	0.00	0.63	0.00
21.68	9.33	2.00	0.00	0.63	0.00	21.74	10.22	2.00	0.00	0.63	0.00
21.80	11.52	2.00	0.00	0.63	0.00	21.85	13.52	2.00	0.00	0.63	0.00
21.92	17.20	2.00	0.00	0.63	0.00	22.01	82.84	0.22	2.43	0.63	0.03
22.08	87.34	0.23	2.30	0.63	0.02	22.15	87.81	0.23	2.29	0.62	0.02
22.19	23.68	2.00	0.00	0.62	0.00	22.26	22.47	2.00	0.00	0.62	0.00
22.33	18.32	2.00	0.00	0.62	0.00	22.39	15.84	2.00	0.00	0.62	0.00
22.45	14.15	2.00	0.00	0.62	0.00	22.52	12.65	2.00	0.00	0.62	0.00
22.58	12.83	2.00	0.00	0.62	0.00	22.65	12.32	2.00	0.00	0.62	0.00
22.73	12.31	2.00	0.00	0.61	0.00	22.80	11.80	2.00	0.00	0.61	0.00
22.86	12.28	2.00	0.00	0.61	0.00	22.92	12.67	2.00	0.00	0.61	0.00
22.98	12.26	2.00	0.00	0.61	0.00	23.05	12.05	2.00	0.00	0.61	0.00
23.11	12.14	2.00	0.00	0.61	0.00	23.18	12.12	2.00	0.00	0.61	0.00
23.24	12.40	2.00	0.00	0.61	0.00	23.30	12.87	2.00	0.00	0.61	0.00
23.39	13.34	2.00	0.00	0.60	0.00	23.45	13.04	2.00	0.00	0.60	0.00
23.51	13.03	2.00	0.00	0.60	0.00	23.57	13.50	2.00	0.00	0.60	0.00
23.63	13.09	2.00	0.00	0.60	0.00	23.70	13.95	2.00	0.00	0.60	0.00
23.76	14.14	2.00	0.00	0.60	0.00	23.82	14.79	2.00	0.00	0.60	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
23.89	15.16	2.00	0.00	0.60	0.00	23.98	15.72	2.00	0.00	0.59	0.00
24.05	15.89	2.00	0.00	0.59	0.00	24.11	15.97	2.00	0.00	0.59	0.00
24.17	15.95	2.00	0.00	0.59	0.00	24.23	16.02	2.00	0.00	0.59	0.00
24.29	15.91	2.00	0.00	0.59	0.00	24.35	15.70	2.00	0.00	0.59	0.00
24.41	15.40	2.00	0.00	0.59	0.00	24.48	15.10	2.00	0.00	0.59	0.00
24.57	14.12	2.00	0.00	0.58	0.00	24.63	13.25	2.00	0.00	0.58	0.00
24.69	13.24	2.00	0.00	0.58	0.00	24.76	13.22	2.00	0.00	0.58	0.00
24.82	12.26	2.00	0.00	0.58	0.00	24.88	11.38	2.00	0.00	0.58	0.00
24.97	10.80	2.00	0.00	0.58	0.00	25.03	10.79	2.00	0.00	0.58	0.00
25.10	10.39	2.00	0.00	0.57	0.00	25.16	9.90	2.00	0.00	0.57	0.00
25.22	9.89	2.00	0.00	0.57	0.00	25.28	9.98	2.00	0.00	0.57	0.00
25.34	10.06	2.00	0.00	0.57	0.00	25.40	10.34	2.00	0.00	0.57	0.00
25.49	10.04	2.00	0.00	0.57	0.00	25.55	9.94	2.00	0.00	0.57	0.00
25.62	9.74	2.00	0.00	0.57	0.00	25.68	9.63	2.00	0.00	0.56	0.00
25.75	9.44	2.00	0.00	0.56	0.00	25.79	9.24	2.00	0.00	0.56	0.00
25.89	9.13	2.00	0.00	0.56	0.00	25.95	9.12	2.00	0.00	0.56	0.00
26.01	9.30	2.00	0.00	0.56	0.00	26.07	9.48	2.00	0.00	0.56	0.00
26.14	9.56	2.00	0.00	0.56	0.00	26.20	9.46	2.00	0.00	0.56	0.00
26.26	9.36	2.00	0.00	0.55	0.00	26.35	9.63	2.00	0.00	0.55	0.00
26.39	9.34	2.00	0.00	0.55	0.00	26.45	10.92	2.00	0.00	0.55	0.00
26.54	11.83	2.00	0.00	0.55	0.00	26.59	12.66	2.00	0.00	0.55	0.00
26.67	13.85	2.00	0.00	0.55	0.00	26.72	13.56	2.00	0.00	0.55	0.00
26.79	12.90	2.00	0.00	0.55	0.00	26.85	11.87	2.00	0.00	0.54	0.00
26.91	11.58	2.00	0.00	0.54	0.00	26.97	10.55	2.00	0.00	0.54	0.00
27.03	10.72	2.00	0.00	0.54	0.00	27.11	12.28	2.00	0.00	0.54	0.00
27.18	16.12	2.00	0.00	0.54	0.00	27.24	23.58	2.00	0.00	0.54	0.00
27.31	90.71	0.23	1.90	0.54	0.02	27.37	98.19	0.24	1.75	0.54	0.01
27.44	100.57	0.25	1.71	0.53	0.01	27.50	101.00	0.25	1.70	0.53	0.01
27.60	100.57	0.25	1.70	0.53	0.02	27.63	100.09	0.25	1.71	0.53	0.01
27.71	99.12	0.24	1.72	0.53	0.02	27.78	98.15	0.24	1.73	0.53	0.01
27.83	96.78	0.24	1.75	0.53	0.01	27.90	94.81	0.23	1.79	0.53	0.01
27.96	30.43	2.00	0.00	0.53	0.00	28.03	25.40	2.00	0.00	0.53	0.00
28.09	21.51	2.00	0.00	0.52	0.00	28.18	18.71	2.00	0.00	0.52	0.00
28.23	17.43	2.00	0.00	0.52	0.00	28.30	19.12	2.00	0.00	0.52	0.00
28.36	23.73	2.00	0.00	0.52	0.00	28.42	30.02	2.00	0.00	0.52	0.00
28.48	98.06	0.24	1.70	0.52	0.01	28.54	104.02	0.26	1.59	0.52	0.01
28.63	111.47	0.28	1.48	0.51	0.02	28.72	114.68	0.29	1.43	0.51	0.02
28.75	115.71	0.29	1.41	0.51	0.01	28.82	117.48	0.30	1.39	0.51	0.01
28.88	118.21	0.30	1.38	0.51	0.01	28.95	118.73	0.30	1.37	0.51	0.01
29.01	119.40	0.31	1.36	0.51	0.01	29.08	119.97	0.31	1.35	0.51	0.01
29.14	121.81	0.32	1.32	0.51	0.01	29.20	122.85	0.32	1.31	0.51	0.01
29.27	122.77	0.32	1.31	0.50	0.01	29.37	120.71	0.31	1.33	0.50	0.02
29.43	116.84	0.30	1.37	0.50	0.01	29.50	112.82	0.28	1.42	0.50	0.01
29.56	108.74	0.27	1.47	0.50	0.01	29.62	38.50	2.00	0.00	0.50	0.00
29.69	32.75	2.00	0.00	0.50	0.00	29.75	27.16	2.00	0.00	0.50	0.00
29.81	22.96	2.00	0.00	0.49	0.00	29.87	20.07	2.00	0.00	0.49	0.00
29.93	18.31	2.00	0.00	0.49	0.00	29.99	16.81	2.00	0.00	0.49	0.00
30.08	14.17	2.00	0.00	0.49	0.00	30.15	12.48	2.00	0.00	0.49	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
30.21	11.86	2.00	0.00	0.49	0.00	30.28	10.63	2.00	0.00	0.49	0.00
30.34	9.92	2.00	0.00	0.49	0.00	30.40	9.74	2.00	0.00	0.48	0.00
30.46	9.64	2.00	0.00	0.48	0.00	30.52	9.55	2.00	0.00	0.48	0.00
30.61	9.27	2.00	0.00	0.48	0.00	30.67	9.00	2.00	0.00	0.48	0.00
30.74	8.99	2.00	0.00	0.48	0.00	30.80	8.99	2.00	0.00	0.48	0.00
30.86	9.24	2.00	0.00	0.48	0.00	30.91	9.76	2.00	0.00	0.48	0.00
30.98	9.92	2.00	0.00	0.47	0.00	31.07	11.55	2.00	0.00	0.47	0.00
31.13	11.70	2.00	0.00	0.47	0.00	31.20	12.04	2.00	0.00	0.47	0.00
31.26	12.28	2.00	0.00	0.47	0.00	31.32	12.79	2.00	0.00	0.47	0.00
31.39	13.98	2.00	0.00	0.47	0.00	31.45	14.91	2.00	0.00	0.47	0.00
31.50	15.24	2.00	0.00	0.47	0.00	31.58	17.10	2.00	0.00	0.46	0.00
31.65	17.26	2.00	0.00	0.46	0.00	31.71	17.49	2.00	0.00	0.46	0.00
31.77	17.90	2.00	0.00	0.46	0.00	31.84	17.97	2.00	0.00	0.46	0.00
31.89	17.69	2.00	0.00	0.46	0.00	31.98	19.37	2.00	0.00	0.46	0.00
32.03	25.11	2.00	0.00	0.46	0.00	32.10	34.03	2.00	0.00	0.46	0.00
32.16	103.90	0.25	1.41	0.45	0.01	32.23	106.57	0.26	1.37	0.45	0.01
32.29	107.53	0.26	1.35	0.45	0.01	32.35	108.15	0.26	1.34	0.45	0.01
32.42	109.21	0.27	1.32	0.45	0.01	32.50	109.42	0.27	1.31	0.45	0.01
32.58	109.64	0.27	1.31	0.45	0.01	32.63	112.04	0.28	1.28	0.45	0.01
32.69	114.61	0.28	1.24	0.45	0.01	32.75	115.54	0.29	1.23	0.44	0.01
32.81	114.84	0.29	1.24	0.44	0.01	32.88	114.29	0.28	1.24	0.44	0.01
32.97	112.44	0.28	1.26	0.44	0.01	33.03	111.23	0.27	1.27	0.44	0.01
33.10	110.62	0.27	1.27	0.44	0.01	33.16	109.63	0.27	1.28	0.44	0.01
33.22	108.74	0.27	1.29	0.44	0.01	33.28	108.06	0.26	1.29	0.44	0.01
33.35	108.09	0.26	1.29	0.43	0.01	33.42	108.57	0.27	1.28	0.43	0.01
33.49	110.41	0.27	1.25	0.43	0.01	33.55	112.16	0.28	1.23	0.43	0.01
33.62	112.82	0.28	1.22	0.43	0.01	33.69	114.03	0.28	1.20	0.43	0.01
33.75	115.90	0.29	1.18	0.43	0.01	33.80	118.14	0.30	1.15	0.43	0.01
33.87	119.75	0.30	1.13	0.43	0.01	33.95	121.79	0.31	1.11	0.42	0.01
34.01	122.49	0.32	1.10	0.42	0.01	34.08	122.76	0.32	1.09	0.42	0.01
34.14	126.97	0.34	1.05	0.42	0.01	34.20	132.46	0.37	1.00	0.42	0.01
34.26	138.37	0.41	0.95	0.42	0.01	34.32	142.83	0.45	0.92	0.42	0.01
34.41	148.59	0.51	0.87	0.42	0.01	34.47	151.49	0.54	0.85	0.42	0.01
34.53	153.41	0.57	0.84	0.41	0.01	34.60	154.81	0.59	0.83	0.41	0.01
34.65	156.32	0.61	0.81	0.41	0.01	34.72	157.34	0.63	0.78	0.41	0.01
34.80	159.21	0.66	0.73	0.41	0.01	34.85	159.85	0.68	0.71	0.41	0.00
34.91	160.77	0.69	0.68	0.41	0.01	35.03	160.33	0.69	0.69	0.41	0.01
35.06	160.47	0.69	0.69	0.41	0.00	35.13	160.86	0.70	0.67	0.40	0.01
35.19	160.97	0.70	0.66	0.40	0.01	35.24	153.75	0.57	0.81	0.40	0.01
35.31	160.74	0.69	0.67	0.40	0.01	35.40	162.38	0.73	0.60	0.40	0.01
35.47	162.62	0.73	0.59	0.40	0.00	35.53	163.57	0.75	0.55	0.40	0.00
35.57	164.00	0.76	0.54	0.40	0.00	35.66	164.72	0.78	0.51	0.40	0.01
35.72	165.75	0.81	0.48	0.39	0.00	35.78	166.71	0.83	0.45	0.39	0.00
35.85	167.09	0.84	0.43	0.39	0.00	35.91	167.42	0.85	0.42	0.39	0.00
35.97	168.26	0.88	0.40	0.39	0.00	36.03	168.47	0.88	0.39	0.39	0.00
36.13	168.55	0.88	0.39	0.39	0.00	36.19	168.71	0.89	0.38	0.39	0.00
36.25	168.19	0.87	0.40	0.39	0.00	36.32	166.74	0.83	0.44	0.38	0.00
36.38	164.05	0.76	0.52	0.38	0.00	36.44	159.10	0.66	0.68	0.38	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
36.51	152.18	0.55	0.78	0.38	0.01	36.57	142.28	0.44	0.84	0.38	0.01
36.64	130.08	0.35	0.92	0.38	0.01	36.70	50.74	2.00	0.00	0.38	0.00
36.76	40.82	2.00	0.00	0.38	0.00	36.82	34.20	2.00	0.00	0.38	0.00
36.89	30.76	2.00	0.00	0.37	0.00	36.95	28.44	2.00	0.00	0.37	0.00
37.04	31.08	2.00	0.00	0.37	0.00	37.10	41.27	2.00	0.00	0.37	0.00
37.17	118.22	0.30	1.00	0.37	0.01	37.22	124.92	0.33	0.94	0.37	0.01
37.29	130.42	0.36	0.89	0.37	0.01	37.35	134.99	0.39	0.86	0.37	0.01
37.41	143.38	0.45	0.80	0.37	0.01	37.50	156.74	0.62	0.70	0.36	0.01
37.56	163.70	0.76	0.50	0.36	0.00	37.63	173.40	1.04	0.25	0.36	0.00
37.69	180.17	1.36	0.13	0.36	0.00	37.75	189.30	2.00	0.00	0.36	0.00
37.82	200.37	2.00	0.00	0.36	0.00	37.89	208.31	2.00	0.00	0.36	0.00
37.95	218.02	2.00	0.00	0.36	0.00	38.01	226.04	2.00	0.00	0.36	0.00
38.07	227.75	2.00	0.00	0.35	0.00	38.13	234.58	2.00	0.00	0.35	0.00
38.20	236.35	2.00	0.00	0.35	0.00	38.26	240.02	2.00	0.00	0.35	0.00
38.33	245.73	2.00	0.00	0.35	0.00	38.39	250.26	2.00	0.00	0.35	0.00
38.48	253.19	2.00	0.00	0.35	0.00	38.53	253.55	2.00	0.00	0.35	0.00
38.60	254.00	2.00	0.00	0.35	0.00	38.67	254.00	2.00	0.00	0.34	0.00
38.73	249.35	2.00	0.00	0.34	0.00	38.79	241.68	2.00	0.00	0.34	0.00
38.86	240.55	2.00	0.00	0.34	0.00	38.92	238.32	2.00	0.00	0.34	0.00
38.98	234.47	2.00	0.00	0.34	0.00	39.05	220.61	2.00	0.00	0.34	0.00
39.12	216.57	2.00	0.00	0.34	0.00	39.19	206.31	2.00	0.00	0.34	0.00
39.26	192.80	2.00	0.00	0.33	0.00	39.32	177.31	1.21	0.17	0.33	0.00
39.39	160.08	0.68	0.57	0.33	0.00	39.45	143.50	0.45	0.72	0.33	0.01
39.51	129.65	0.35	0.81	0.33	0.01	39.57	53.51	2.00	0.00	0.33	0.00
39.64	48.35	2.00	0.00	0.33	0.00	39.73	43.59	2.00	0.00	0.33	0.00
39.78	41.47	2.00	0.00	0.33	0.00	39.85	38.82	2.00	0.00	0.32	0.00
39.91	34.43	2.00	0.00	0.32	0.00	39.97	29.28	2.00	0.00	0.32	0.00
40.03	24.93	2.00	0.00	0.32	0.00	40.10	21.65	2.00	0.00	0.32	0.00
40.17	20.35	2.00	0.00	0.32	0.00	40.25	18.36	2.00	0.00	0.32	0.00
40.31	16.69	2.00	0.00	0.32	0.00	40.38	16.61	2.00	0.00	0.32	0.00
40.43	17.35	2.00	0.00	0.31	0.00	40.49	19.89	2.00	0.00	0.31	0.00
40.55	30.36	2.00	0.00	0.31	0.00	40.62	116.35	0.29	0.85	0.31	0.01
40.71	151.00	0.54	0.64	0.31	0.01	40.77	159.16	0.66	0.55	0.31	0.00
40.83	165.22	0.79	0.39	0.31	0.00	40.89	172.76	1.02	0.23	0.31	0.00
40.95	179.06	1.29	0.13	0.31	0.00	41.02	182.51	1.49	0.08	0.30	0.00
41.08	179.61	1.32	0.12	0.30	0.00	41.14	171.98	0.99	0.24	0.30	0.00
41.21	162.16	0.72	0.46	0.30	0.00	41.29	142.44	0.45	0.66	0.30	0.01
41.35	129.22	0.35	0.73	0.30	0.01	41.41	51.99	2.00	0.00	0.30	0.00
41.48	128.54	0.35	0.73	0.30	0.01	41.54	49.76	2.00	0.00	0.30	0.00
41.61	128.25	0.35	0.73	0.29	0.01	41.67	152.92	0.56	0.60	0.29	0.00
41.74	177.67	1.22	0.14	0.29	0.00	41.83	200.13	2.00	0.00	0.29	0.00
41.88	208.79	2.00	0.00	0.29	0.00	41.94	213.92	2.00	0.00	0.29	0.00
42.01	217.01	2.00	0.00	0.29	0.00	42.07	218.98	2.00	0.00	0.29	0.00
42.14	222.66	2.00	0.00	0.29	0.00	42.20	224.39	2.00	0.00	0.28	0.00
42.26	225.81	2.00	0.00	0.28	0.00	42.35	227.98	2.00	0.00	0.28	0.00
42.42	229.25	2.00	0.00	0.28	0.00	42.47	230.30	2.00	0.00	0.28	0.00
42.53	231.44	2.00	0.00	0.28	0.00	42.59	232.33	2.00	0.00	0.28	0.00
42.66	233.18	2.00	0.00	0.28	0.00	42.72	233.59	2.00	0.00	0.28	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
42.82	233.11	2.00	0.00	0.27	0.00	42.88	231.84	2.00	0.00	0.27	0.00
42.94	230.03	2.00	0.00	0.27	0.00	42.99	228.57	2.00	0.00	0.27	0.00
43.05	227.28	2.00	0.00	0.27	0.00	43.12	226.41	2.00	0.00	0.27	0.00
43.18	225.47	2.00	0.00	0.27	0.00	43.24	224.72	2.00	0.00	0.27	0.00
43.33	223.13	2.00	0.00	0.27	0.00	43.39	221.90	2.00	0.00	0.26	0.00
43.45	220.54	2.00	0.00	0.26	0.00	43.51	218.55	2.00	0.00	0.26	0.00
43.57	216.28	2.00	0.00	0.26	0.00	43.64	214.59	2.00	0.00	0.26	0.00
43.73	209.55	2.00	0.00	0.26	0.00	43.77	207.96	2.00	0.00	0.26	0.00
43.84	207.43	2.00	0.00	0.26	0.00	43.90	207.40	2.00	0.00	0.26	0.00
43.97	207.34	2.00	0.00	0.25	0.00	44.03	207.35	2.00	0.00	0.25	0.00
44.11	206.50	2.00	0.00	0.25	0.00	44.17	206.37	2.00	0.00	0.25	0.00
44.24	206.37	2.00	0.00	0.25	0.00	44.30	205.44	2.00	0.00	0.25	0.00
44.38	202.80	2.00	0.00	0.25	0.00	44.45	199.10	2.00	0.00	0.25	0.00
44.50	194.82	2.00	0.00	0.25	0.00	44.57	189.72	2.00	0.00	0.24	0.00
44.63	183.83	1.58	0.05	0.24	0.00	44.69	178.59	1.27	0.11	0.24	0.00
44.76	173.83	1.06	0.16	0.24	0.00	44.84	170.07	0.93	0.22	0.24	0.00
44.90	171.52	0.98	0.19	0.24	0.00	44.96	172.45	1.01	0.18	0.24	0.00
45.02	169.73	0.92	0.22	0.24	0.00	45.08	153.25	0.57	0.48	0.24	0.00
45.16	145.41	0.48	0.50	0.23	0.00	45.22	132.51	0.37	0.56	0.23	0.00
45.28	122.30	0.32	0.60	0.23	0.00	45.35	50.18	2.00	0.00	0.23	0.00
45.41	49.83	2.00	0.00	0.23	0.00	45.48	117.33	0.30	0.62	0.23	0.00
45.57	115.48	0.29	0.63	0.23	0.01	45.62	44.37	2.00	0.00	0.23	0.00
45.68	37.23	2.00	0.00	0.23	0.00	45.74	34.04	2.00	0.00	0.22	0.00
45.81	38.33	2.00	0.00	0.22	0.00	45.87	113.66	0.29	0.63	0.22	0.00
45.95	134.42	0.39	0.52	0.22	0.01	46.00	143.57	0.46	0.48	0.22	0.00
46.07	150.34	0.53	0.45	0.22	0.00	46.13	157.18	0.63	0.41	0.22	0.00
46.23	165.16	0.79	0.27	0.22	0.00	46.28	169.87	0.92	0.20	0.22	0.00
46.34	175.11	1.11	0.13	0.21	0.00	46.40	179.63	1.32	0.08	0.21	0.00
46.46	179.70	1.33	0.08	0.21	0.00	46.52	173.73	1.06	0.14	0.21	0.00
46.62	175.83	1.14	0.12	0.21	0.00	46.68	177.76	1.23	0.10	0.21	0.00
46.73	179.20	1.30	0.08	0.21	0.00	46.80	179.17	1.30	0.08	0.21	0.00
46.86	171.69	0.98	0.16	0.21	0.00	46.92	179.62	1.32	0.08	0.20	0.00
47.01	177.93	1.24	0.10	0.20	0.00	47.07	180.17	1.35	0.07	0.20	0.00
47.12	183.58	1.56	0.04	0.20	0.00	47.19	187.81	1.88	0.01	0.20	0.00
47.25	192.66	2.00	0.00	0.20	0.00	47.31	197.33	2.00	0.00	0.20	0.00
47.40	203.15	2.00	0.00	0.20	0.00	47.46	206.25	2.00	0.00	0.20	0.00
47.52	208.72	2.00	0.00	0.19	0.00	47.58	210.56	2.00	0.00	0.19	0.00
47.67	211.40	2.00	0.00	0.19	0.00	47.73	203.17	2.00	0.00	0.19	0.00
47.79	194.25	2.00	0.00	0.19	0.00	47.84	190.69	2.00	0.00	0.19	0.00
47.91	184.63	1.63	0.03	0.19	0.00	47.97	177.39	1.21	0.09	0.19	0.00
48.05	178.33	1.26	0.08	0.19	0.00	48.10	188.15	1.91	0.01	0.18	0.00
48.19	199.75	2.00	0.00	0.18	0.00	48.25	204.24	2.00	0.00	0.18	0.00
48.32	206.79	2.00	0.00	0.18	0.00	48.38	210.50	2.00	0.00	0.18	0.00
48.44	216.30	2.00	0.00	0.18	0.00	48.50	222.61	2.00	0.00	0.18	0.00
48.59	232.38	2.00	0.00	0.18	0.00	48.65	237.90	2.00	0.00	0.18	0.00
48.71	243.19	2.00	0.00	0.17	0.00	48.77	246.47	2.00	0.00	0.17	0.00
48.83	249.09	2.00	0.00	0.17	0.00	48.89	251.00	2.00	0.00	0.17	0.00
48.99	252.71	2.00	0.00	0.17	0.00	49.04	252.82	2.00	0.00	0.17	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
49.10	250.65	2.00	0.00	0.17	0.00	49.17	247.20	2.00	0.00	0.17	0.00
49.23	247.26	2.00	0.00	0.17	0.00	49.28	254.00	2.00	0.00	0.16	0.00
49.37	254.00	2.00	0.00	0.16	0.00	49.43	254.00	2.00	0.00	0.16	0.00
49.50	254.00	2.00	0.00	0.16	0.00	49.56	254.00	2.00	0.00	0.16	0.00
49.61	254.00	2.00	0.00	0.16	0.00	49.69	254.00	2.00	0.00	0.16	0.00
49.76	254.00	2.00	0.00	0.16	0.00	49.82	254.00	2.00	0.00	0.16	0.00
49.88	254.00	2.00	0.00	0.15	0.00	49.94	254.00	2.00	0.00	0.15	0.00
50.02	254.00	2.00	0.00	0.15	0.00	50.08	254.00	2.00	0.00	0.15	0.00
50.14	245.36	2.00	0.00	0.15	0.00	50.22	254.00	2.00	0.00	0.15	0.00
50.28	254.00	2.00	0.00	0.15	0.00	50.36	253.95	2.00	0.00	0.15	0.00
50.41	252.04	2.00	0.00	0.15	0.00	50.48	247.01	2.00	0.00	0.14	0.00
50.53	247.00	2.00	0.00	0.14	0.00	50.62	239.49	2.00	0.00	0.14	0.00
50.68	234.81	2.00	0.00	0.14	0.00	50.76	228.41	2.00	0.00	0.14	0.00
50.79	226.90	2.00	0.00	0.14	0.00	50.87	219.56	2.00	0.00	0.14	0.00
50.94	214.38	2.00	0.00	0.14	0.00	50.99	206.80	2.00	0.00	0.14	0.00
51.05	198.43	2.00	0.00	0.13	0.00	51.12	189.81	2.00	0.00	0.13	0.00
51.21	184.97	2.00	0.00	0.13	0.00	51.26	187.81	2.00	0.00	0.13	0.00
51.33	189.69	2.00	0.00	0.13	0.00	51.39	186.08	2.00	0.00	0.13	0.00
51.45	173.94	2.00	0.00	0.13	0.00	51.51	155.45	2.00	0.00	0.13	0.00
51.58	135.14	2.00	0.00	0.13	0.00	51.69	38.35	2.00	0.00	0.12	0.00
51.72	34.03	2.00	0.00	0.12	0.00	51.78	28.12	2.00	0.00	0.12	0.00
51.84	22.41	2.00	0.00	0.12	0.00	51.91	19.03	2.00	0.00	0.12	0.00
51.98	21.98	2.00	0.00	0.12	0.00	52.05	19.26	2.00	0.00	0.12	0.00
52.11	21.56	2.00	0.00	0.12	0.00	52.17	24.57	2.00	0.00	0.12	0.00
52.24	105.89	2.00	0.00	0.11	0.00	52.30	118.69	2.00	0.00	0.11	0.00
52.37	123.86	2.00	0.00	0.11	0.00	52.45	121.96	2.00	0.00	0.11	0.00
52.51	50.65	2.00	0.00	0.11	0.00	52.57	44.17	2.00	0.00	0.11	0.00
52.64	114.76	2.00	0.00	0.11	0.00	52.72	42.87	2.00	0.00	0.11	0.00
52.78	113.68	2.00	0.00	0.11	0.00	52.84	126.00	2.00	0.00	0.10	0.00
52.90	140.83	2.00	0.00	0.10	0.00	52.96	152.18	2.00	0.00	0.10	0.00
53.02	161.08	2.00	0.00	0.10	0.00	53.11	170.83	2.00	0.00	0.10	0.00
53.17	175.38	2.00	0.00	0.10	0.00	53.23	177.87	2.00	0.00	0.10	0.00
53.32	179.54	2.00	0.00	0.10	0.00	53.35	179.94	2.00	0.00	0.10	0.00
53.47	184.50	2.00	0.00	0.09	0.00	53.49	186.26	2.00	0.00	0.09	0.00
53.55	189.70	2.00	0.00	0.09	0.00	53.61	192.61	2.00	0.00	0.09	0.00
53.68	194.19	2.00	0.00	0.09	0.00	53.75	195.75	2.00	0.00	0.09	0.00
53.82	195.26	2.00	0.00	0.09	0.00	53.88	193.88	2.00	0.00	0.09	0.00
53.94	190.62	2.00	0.00	0.09	0.00	54.02	183.54	2.00	0.00	0.08	0.00
54.08	180.41	2.00	0.00	0.08	0.00	54.14	178.39	2.00	0.00	0.08	0.00
54.20	178.22	2.00	0.00	0.08	0.00	54.27	179.99	2.00	0.00	0.08	0.00
54.35	184.53	2.00	0.00	0.08	0.00	54.40	186.10	2.00	0.00	0.08	0.00
54.47	186.67	2.00	0.00	0.08	0.00	54.56	184.39	2.00	0.00	0.08	0.00
54.60	183.82	2.00	0.00	0.07	0.00	54.68	183.67	2.00	0.00	0.07	0.00
54.73	187.84	2.00	0.00	0.07	0.00	54.80	193.65	2.00	0.00	0.07	0.00
54.89	200.03	2.00	0.00	0.07	0.00	54.92	201.54	2.00	0.00	0.07	0.00
55.01	206.08	2.00	0.00	0.07	0.00	55.07	206.47	2.00	0.00	0.07	0.00
55.12	204.11	2.00	0.00	0.07	0.00	55.22	196.03	2.00	0.00	0.06	0.00
55.25	192.71	2.00	0.00	0.06	0.00	55.34	182.97	2.00	0.00	0.06	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
55.39	176.08	2.00	0.00	0.06	0.00	55.46	168.96	2.00	0.00	0.06	0.00
55.54	161.26	2.00	0.00	0.06	0.00	55.59	157.77	2.00	0.00	0.06	0.00
55.65	153.83	2.00	0.00	0.06	0.00	55.74	145.09	2.00	0.00	0.06	0.00
55.80	135.88	2.00	0.00	0.05	0.00	55.86	124.05	2.00	0.00	0.05	0.00
55.91	45.54	2.00	0.00	0.05	0.00	55.97	36.12	2.00	0.00	0.05	0.00
56.07	27.00	2.00	0.00	0.05	0.00	56.13	23.05	2.00	0.00	0.05	0.00
56.17	22.27	2.00	0.00	0.05	0.00	56.25	19.65	2.00	0.00	0.05	0.00
56.31	17.81	2.00	0.00	0.05	0.00	56.39	15.59	2.00	0.00	0.04	0.00
56.45	14.90	2.00	0.00	0.04	0.00	56.52	14.02	2.00	0.00	0.04	0.00
56.58	13.51	2.00	0.00	0.04	0.00	56.66	13.19	2.00	0.00	0.04	0.00
56.72	13.01	2.00	0.00	0.04	0.00	56.79	12.69	2.00	0.00	0.04	0.00
56.84	12.43	2.00	0.00	0.04	0.00	56.89	12.49	2.00	0.00	0.04	0.00
56.99	12.42	2.00	0.00	0.03	0.00	57.05	12.17	2.00	0.00	0.03	0.00
57.10	12.16	2.00	0.00	0.03	0.00	57.15	12.16	2.00	0.00	0.03	0.00
57.22	11.97	2.00	0.00	0.03	0.00	57.32	12.33	2.00	0.00	0.03	0.00
57.38	12.01	2.00	0.00	0.03	0.00	57.43	12.01	2.00	0.00	0.03	0.00
57.48	12.00	2.00	0.00	0.03	0.00	57.55	12.24	2.00	0.00	0.02	0.00
57.64	12.96	2.00	0.00	0.02	0.00	57.70	15.35	2.00	0.00	0.02	0.00
57.76	23.50	2.00	0.00	0.02	0.00	57.81	35.81	2.00	0.00	0.02	0.00
57.90	118.86	2.00	0.00	0.02	0.00	57.97	130.66	2.00	0.00	0.02	0.00
58.02	141.25	2.00	0.00	0.02	0.00	58.08	149.32	2.00	0.00	0.02	0.00
58.17	156.15	2.00	0.00	0.01	0.00	58.23	158.27	2.00	0.00	0.01	0.00
58.29	159.45	2.00	0.00	0.01	0.00	58.35	160.12	2.00	0.00	0.01	0.00
58.43	161.08	2.00	0.00	0.01	0.00	58.49	161.56	2.00	0.00	0.01	0.00
58.55	164.29	2.00	0.00	0.01	0.00	58.61	169.00	2.00	0.00	0.01	0.00
58.66	171.72	2.00	0.00	0.01	0.00	58.75	161.64	2.00	0.00	0.00	0.00
58.82	153.57	2.00	0.00	0.00	0.00	58.88	148.17	2.00	0.00	0.00	0.00
58.93	151.12	2.00	0.00	0.00	0.00	59.02	149.79	2.00	0.00	0.00	0.00
59.08	160.18	2.00	0.00	0.00	0.00	59.13	163.15	2.00	0.00	0.00	0.00
59.19	164.72	2.00	0.00	0.00	0.00	59.28	164.75	2.00	0.00	0.00	0.00
59.34	165.19	2.00	0.00	0.00	0.00	59.41	167.10	2.00	0.00	0.00	0.00
59.46	168.03	2.00	0.00	0.00	0.00	59.54	167.09	2.00	0.00	0.00	0.00
59.59	163.02	2.00	0.00	0.00	0.00	59.65	167.25	2.00	0.00	0.00	0.00
59.73	166.05	2.00	0.00	0.00	0.00	59.79	166.14	2.00	0.00	0.00	0.00
59.86	166.70	2.00	0.00	0.00	0.00	59.91	167.50	2.00	0.00	0.00	0.00
60.00	168.95	2.00	0.00	0.00	0.00	60.06	170.16	2.00	0.00	0.00	0.00
60.13	172.40	2.00	0.00	0.00	0.00	60.17	175.98	2.00	0.00	0.00	0.00
60.26	181.49	2.00	0.00	0.00	0.00	60.31	175.78	2.00	0.00	0.00	0.00
60.37	188.13	2.00	0.00	0.00	0.00	60.46	195.61	2.00	0.00	0.00	0.00
60.52	199.94	2.00	0.00	0.00	0.00	60.58	204.04	2.00	0.00	0.00	0.00
60.64	207.57	2.00	0.00	0.00	0.00	60.70	210.53	2.00	0.00	0.00	0.00
60.78	213.49	2.00	0.00	0.00	0.00	60.85	214.90	2.00	0.00	0.00	0.00
60.91	216.41	2.00	0.00	0.00	0.00	60.98	217.93	2.00	0.00	0.00	0.00
61.03	219.24	2.00	0.00	0.00	0.00	61.11	222.13	2.00	0.00	0.00	0.00
61.17	223.75	2.00	0.00	0.00	0.00	61.24	225.00	2.00	0.00	0.00	0.00
61.32	224.88	2.00	0.00	0.00	0.00	61.36	224.50	2.00	0.00	0.00	0.00
61.44	222.91	2.00	0.00	0.00	0.00	61.50	221.56	2.00	0.00	0.00	0.00
61.56	220.49	2.00	0.00	0.00	0.00	61.62	219.92	2.00	0.00	0.00	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
61.71	219.08	2.00	0.00	0.00	0.00	61.77	214.78	2.00	0.00	0.00	0.00
61.83	213.05	2.00	0.00	0.00	0.00	61.88	213.88	2.00	0.00	0.00	0.00
61.97	211.83	2.00	0.00	0.00	0.00	62.03	209.92	2.00	0.00	0.00	0.00
62.09	207.27	2.00	0.00	0.00	0.00	62.14	181.60	2.00	0.00	0.00	0.00
62.22	199.67	2.00	0.00	0.00	0.00	62.29	196.45	2.00	0.00	0.00	0.00
62.34	193.67	2.00	0.00	0.00	0.00	62.41	191.68	2.00	0.00	0.00	0.00
62.49	188.49	2.00	0.00	0.00	0.00	62.55	185.50	2.00	0.00	0.00	0.00
62.62	181.63	2.00	0.00	0.00	0.00	62.67	175.79	2.00	0.00	0.00	0.00
62.74	166.49	2.00	0.00	0.00	0.00	62.82	149.70	2.00	0.00	0.00	0.00
62.88	140.81	2.00	0.00	0.00	0.00	62.94	147.32	2.00	0.00	0.00	0.00
63.03	138.56	2.00	0.00	0.00	0.00	63.08	143.56	2.00	0.00	0.00	0.00
63.14	146.43	2.00	0.00	0.00	0.00	63.21	147.40	2.00	0.00	0.00	0.00
63.28	144.10	2.00	0.00	0.00	0.00	63.33	141.18	2.00	0.00	0.00	0.00
63.39	134.92	2.00	0.00	0.00	0.00	63.46	125.07	2.00	0.00	0.00	0.00
63.52	49.56	2.00	0.00	0.00	0.00	63.61	44.50	2.00	0.00	0.00	0.00
63.67	43.25	2.00	0.00	0.00	0.00	63.73	41.69	2.00	0.00	0.00	0.00
63.79	41.58	2.00	0.00	0.00	0.00	63.85	41.54	2.00	0.00	0.00	0.00
63.93	41.49	2.00	0.00	0.00	0.00	63.99	41.83	2.00	0.00	0.00	0.00
64.05	41.52	2.00	0.00	0.00	0.00	64.11	103.53	2.00	0.00	0.00	0.00
64.20	101.40	2.00	0.00	0.00	0.00	64.26	100.82	2.00	0.00	0.00	0.00
64.31	100.68	2.00	0.00	0.00	0.00	64.38	38.39	2.00	0.00	0.00	0.00
64.44	37.46	2.00	0.00	0.00	0.00	64.52	37.13	2.00	0.00	0.00	0.00
64.58	38.92	2.00	0.00	0.00	0.00	64.64	42.30	2.00	0.00	0.00	0.00
64.70	111.56	2.00	0.00	0.00	0.00	64.78	119.68	2.00	0.00	0.00	0.00
64.84	123.77	2.00	0.00	0.00	0.00	64.90	127.04	2.00	0.00	0.00	0.00
64.98	64.18	2.00	0.00	0.00	0.00	65.04	65.53	2.00	0.00	0.00	0.00
65.10	66.06	2.00	0.00	0.00	0.00	65.16	66.46	2.00	0.00	0.00	0.00
65.23	65.83	2.00	0.00	0.00	0.00	65.30	59.81	2.00	0.00	0.00	0.00

Total estimated settlement: 2.90

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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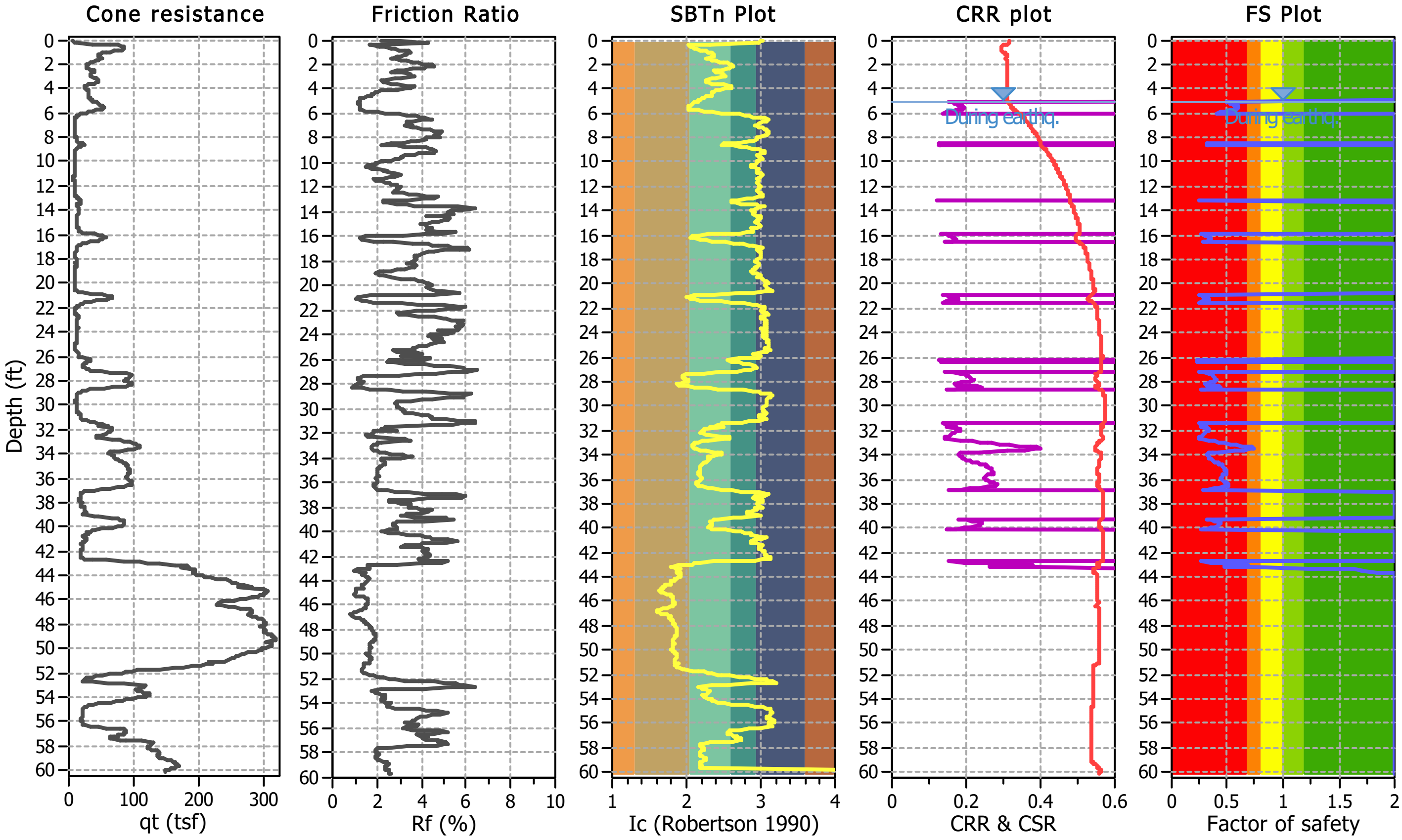
LIQUEFACTION ANALYSIS REPORT

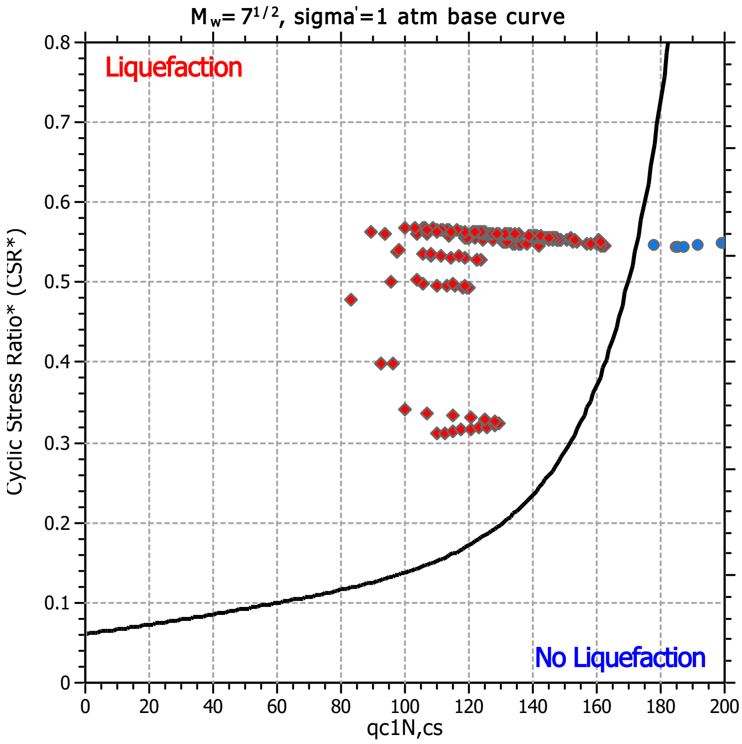
Project title : Proposed Commercial/Industrial Development   Location : Cypress, CA

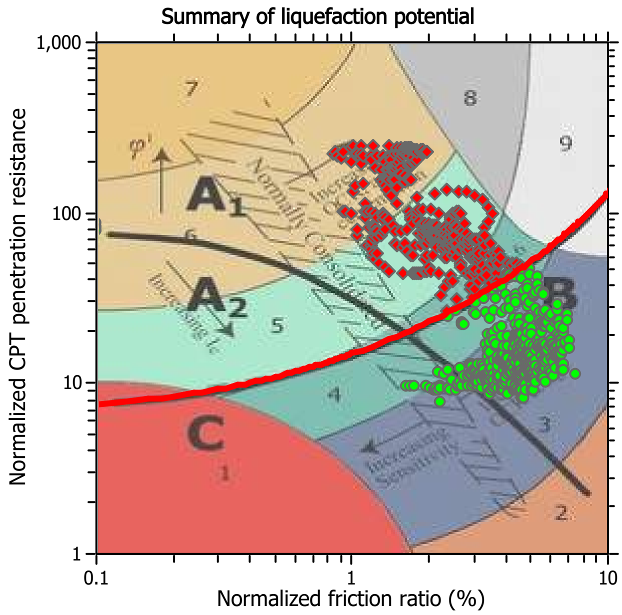
CPT file : CPT-4

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 ft	**Use fill:**	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 ft	**Fill height:**	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interva	1	**Fill weight:**	N/A	Limit depth applie	Yes
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	**Trans. detect. applied:**	No	Limit depth:	50.00 ft
Peak ground acceleration:	0.54	Unit weight calculation	Based on SBT	**K_σ applied:**	Yes	MSF method:	Method base

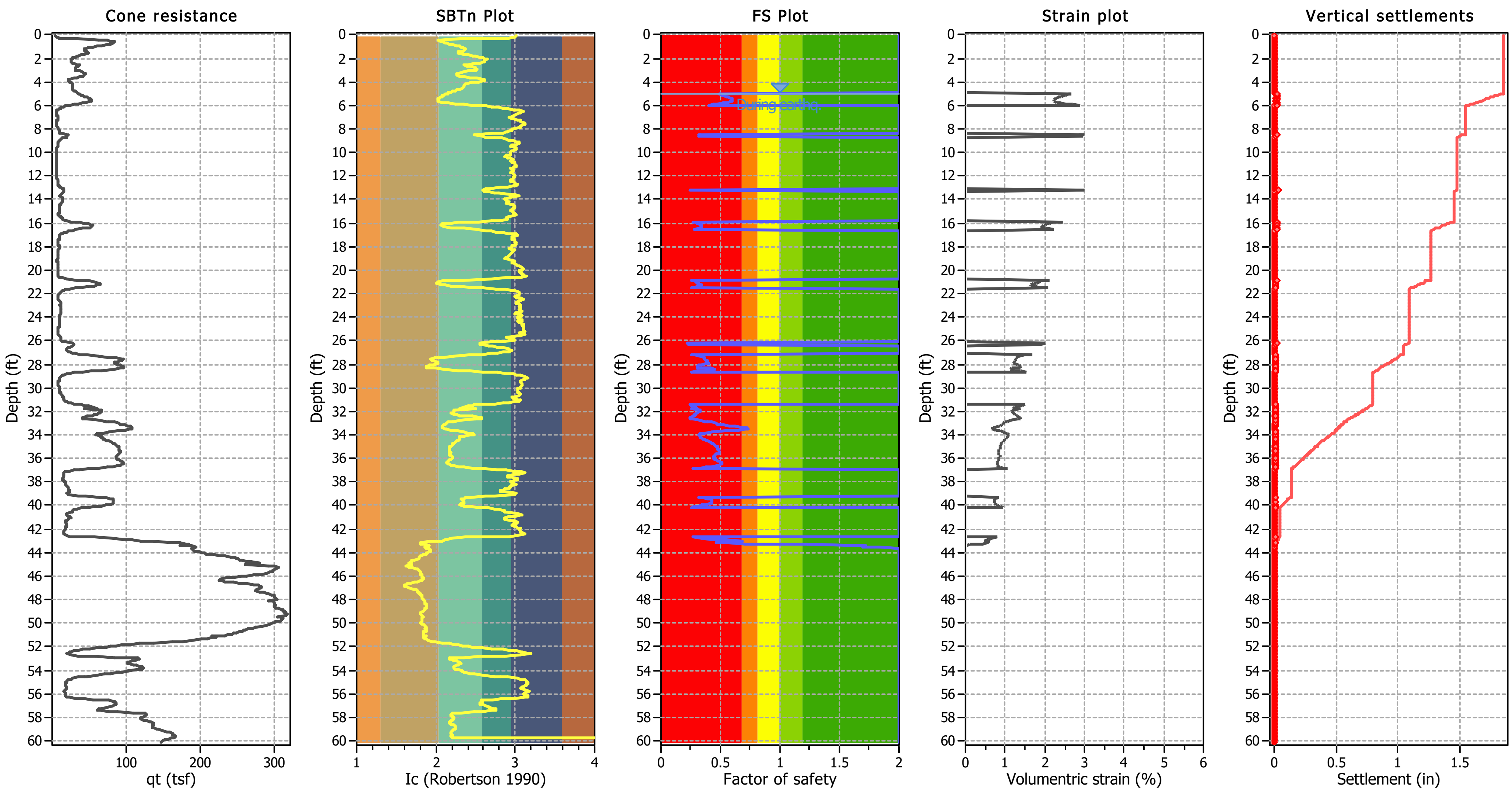






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

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 due to soil liquefaction ::

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
5.01	109.93	0.49	2.67	0.92	0.02	5.07	112.74	0.50	2.59	0.91	0.02
5.14	115.18	0.51	2.53	0.91	0.02	5.20	117.72	0.53	2.47	0.91	0.02
5.26	120.52	0.54	2.41	0.91	0.02	5.33	123.31	0.56	2.35	0.91	0.02
5.39	125.79	0.58	2.29	0.91	0.02	5.46	127.82	0.59	2.25	0.91	0.02
5.52	129.01	0.60	2.23	0.91	0.02	5.59	129.09	0.60	2.22	0.91	0.02
5.65	127.91	0.59	2.24	0.90	0.02	5.72	124.95	0.56	2.30	0.90	0.02
5.79	120.75	0.52	2.38	0.90	0.02	5.85	114.69	0.48	2.51	0.90	0.02
5.92	107.10	0.44	2.69	0.90	0.02	5.98	99.83	0.40	2.89	0.90	0.02
6.06	30.51	2.00	0.00	0.90	0.00	6.10	26.64	2.00	0.00	0.90	0.00
6.18	21.67	2.00	0.00	0.90	0.00	6.24	19.33	2.00	0.00	0.89	0.00
6.31	16.84	2.00	0.00	0.89	0.00	6.37	14.49	2.00	0.00	0.89	0.00
6.44	12.42	2.00	0.00	0.89	0.00	6.50	10.91	2.00	0.00	0.89	0.00
6.57	10.49	2.00	0.00	0.89	0.00	6.63	10.35	2.00	0.00	0.89	0.00
6.70	10.64	2.00	0.00	0.89	0.00	6.76	11.33	2.00	0.00	0.89	0.00
6.83	12.29	2.00	0.00	0.88	0.00	6.90	13.25	2.00	0.00	0.88	0.00
6.97	14.36	2.00	0.00	0.88	0.00	7.03	14.36	2.00	0.00	0.88	0.00
7.09	14.07	2.00	0.00	0.88	0.00	7.18	13.38	2.00	0.00	0.88	0.00
7.22	12.71	2.00	0.00	0.88	0.00	7.31	12.15	2.00	0.00	0.88	0.00
7.35	12.08	2.00	0.00	0.88	0.00	7.43	12.02	2.00	0.00	0.87	0.00
7.49	11.33	2.00	0.00	0.87	0.00	7.55	11.33	2.00	0.00	0.87	0.00
7.63	11.33	2.00	0.00	0.87	0.00	7.68	11.46	2.00	0.00	0.87	0.00
7.76	12.29	2.00	0.00	0.87	0.00	7.81	12.71	2.00	0.00	0.87	0.00
7.90	13.25	2.00	0.00	0.87	0.00	7.95	14.91	2.00	0.00	0.87	0.00
8.03	15.46	2.00	0.00	0.86	0.00	8.09	16.02	2.00	0.00	0.86	0.00
8.15	16.56	2.00	0.00	0.86	0.00	8.23	17.13	2.00	0.00	0.86	0.00
8.28	17.13	2.00	0.00	0.86	0.00	8.36	17.67	2.00	0.00	0.86	0.00
8.42	22.64	2.00	0.00	0.86	0.00	8.49	92.28	0.32	2.98	0.86	0.03
8.55	96.38	0.33	2.85	0.86	0.02	8.60	92.47	0.32	2.97	0.85	0.02
8.69	31.40	2.00	0.00	0.85	0.00	8.75	26.51	2.00	0.00	0.85	0.00
8.80	22.78	2.00	0.00	0.85	0.00	8.88	19.87	2.00	0.00	0.85	0.00
8.94	18.09	2.00	0.00	0.85	0.00	9.00	16.02	2.00	0.00	0.85	0.00
9.07	14.36	2.00	0.00	0.85	0.00	9.14	13.25	2.00	0.00	0.85	0.00
9.22	12.71	2.00	0.00	0.84	0.00	9.27	12.71	2.00	0.00	0.84	0.00
9.32	12.71	2.00	0.00	0.84	0.00	9.41	13.11	2.00	0.00	0.84	0.00
9.47	13.25	2.00	0.00	0.84	0.00	9.53	12.71	2.00	0.00	0.84	0.00
9.60	11.60	2.00	0.00	0.84	0.00	9.66	11.18	2.00	0.00	0.84	0.00
9.74	10.49	2.00	0.00	0.83	0.00	9.79	10.49	2.00	0.00	0.83	0.00
9.85	10.49	2.00	0.00	0.83	0.00	9.91	10.35	2.00	0.00	0.83	0.00
9.99	10.35	2.00	0.00	0.83	0.00	10.05	10.35	2.00	0.00	0.83	0.00
10.12	10.22	2.00	0.00	0.83	0.00	10.18	10.22	2.00	0.00	0.83	0.00
10.25	10.49	2.00	0.00	0.83	0.00	10.31	10.64	2.00	0.00	0.83	0.00
10.37	10.64	2.00	0.00	0.82	0.00	10.44	10.64	2.00	0.00	0.82	0.00
10.51	10.64	2.00	0.00	0.82	0.00	10.58	10.64	2.00	0.00	0.82	0.00
10.64	10.62	2.00	0.00	0.82	0.00	10.71	11.39	2.00	0.00	0.82	0.00
10.77	11.77	2.00	0.00	0.82	0.00	10.83	12.01	2.00	0.00	0.82	0.00
10.90	11.86	2.00	0.00	0.82	0.00	10.96	11.71	2.00	0.00	0.81	0.00
11.03	11.17	2.00	0.00	0.81	0.00	11.11	11.01	2.00	0.00	0.81	0.00
11.18	10.47	2.00	0.00	0.81	0.00	11.25	9.92	2.00	0.00	0.81	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
11.31	9.90	2.00	0.00	0.81	0.00	11.37	9.89	2.00	0.00	0.81	0.00
11.43	9.88	2.00	0.00	0.81	0.00	11.50	9.86	2.00	0.00	0.81	0.00
11.56	10.50	2.00	0.00	0.80	0.00	11.64	11.26	2.00	0.00	0.80	0.00
11.70	11.63	2.00	0.00	0.80	0.00	11.75	11.74	2.00	0.00	0.80	0.00
11.83	11.71	2.00	0.00	0.80	0.00	11.89	11.69	2.00	0.00	0.80	0.00
11.96	11.55	2.00	0.00	0.80	0.00	12.02	11.53	2.00	0.00	0.80	0.00
12.08	11.77	2.00	0.00	0.80	0.00	12.16	11.75	2.00	0.00	0.79	0.00
12.22	11.73	2.00	0.00	0.79	0.00	12.29	11.96	2.00	0.00	0.79	0.00
12.35	12.08	2.00	0.00	0.79	0.00	12.41	12.18	2.00	0.00	0.79	0.00
12.49	12.15	2.00	0.00	0.79	0.00	12.54	12.38	2.00	0.00	0.79	0.00
12.62	12.73	2.00	0.00	0.79	0.00	12.68	13.09	2.00	0.00	0.79	0.00
12.76	13.68	2.00	0.00	0.78	0.00	12.81	14.39	2.00	0.00	0.78	0.00
12.87	15.49	2.00	0.00	0.78	0.00	12.94	16.93	2.00	0.00	0.78	0.00
13.00	18.98	2.00	0.00	0.78	0.00	13.08	21.62	2.00	0.00	0.78	0.00
13.13	23.27	2.00	0.00	0.78	0.00	13.22	82.97	0.25	3.00	0.78	0.03
13.26	25.18	2.00	0.00	0.78	0.00	13.32	24.53	2.00	0.00	0.77	0.00
13.41	22.35	2.00	0.00	0.77	0.00	13.46	20.53	2.00	0.00	0.77	0.00
13.55	17.71	2.00	0.00	0.77	0.00	13.60	17.21	2.00	0.00	0.77	0.00
13.65	16.10	2.00	0.00	0.77	0.00	13.72	16.67	2.00	0.00	0.77	0.00
13.81	19.47	2.00	0.00	0.77	0.00	13.86	19.79	2.00	0.00	0.77	0.00
13.94	21.28	2.00	0.00	0.76	0.00	14.00	21.60	2.00	0.00	0.76	0.00
14.07	21.20	2.00	0.00	0.76	0.00	14.13	20.58	2.00	0.00	0.76	0.00
14.19	19.97	2.00	0.00	0.76	0.00	14.27	18.31	2.00	0.00	0.76	0.00
14.33	17.93	2.00	0.00	0.76	0.00	14.40	16.95	2.00	0.00	0.76	0.00
14.46	16.33	2.00	0.00	0.75	0.00	14.51	15.73	2.00	0.00	0.75	0.00
14.59	15.46	2.00	0.00	0.75	0.00	14.65	15.62	2.00	0.00	0.75	0.00
14.72	15.53	2.00	0.00	0.75	0.00	14.78	15.39	2.00	0.00	0.75	0.00
14.83	15.37	2.00	0.00	0.75	0.00	14.91	14.65	2.00	0.00	0.75	0.00
14.97	14.98	2.00	0.00	0.75	0.00	15.05	14.01	2.00	0.00	0.74	0.00
15.11	13.99	2.00	0.00	0.74	0.00	15.16	13.97	2.00	0.00	0.74	0.00
15.24	13.25	2.00	0.00	0.74	0.00	15.30	13.46	2.00	0.00	0.74	0.00
15.38	15.06	2.00	0.00	0.74	0.00	15.43	16.19	2.00	0.00	0.74	0.00
15.49	17.65	2.00	0.00	0.74	0.00	15.57	18.97	2.00	0.00	0.74	0.00
15.63	19.40	2.00	0.00	0.74	0.00	15.68	20.37	2.00	0.00	0.73	0.00
15.76	24.03	2.00	0.00	0.73	0.00	15.82	28.40	2.00	0.00	0.73	0.00
15.88	95.49	0.26	2.46	0.73	0.02	15.95	105.86	0.29	2.21	0.73	0.02
16.01	109.90	0.31	2.12	0.73	0.01	16.09	112.88	0.32	2.06	0.73	0.02
16.17	115.79	0.33	2.00	0.73	0.02	16.23	117.97	0.34	1.96	0.72	0.01
16.27	119.50	0.34	1.93	0.72	0.01	16.37	120.15	0.35	1.92	0.72	0.02
16.43	118.69	0.34	1.94	0.72	0.01	16.47	115.05	0.32	2.00	0.72	0.01
16.56	103.79	0.28	2.22	0.72	0.02	16.62	35.40	2.00	0.00	0.72	0.00
16.69	29.71	2.00	0.00	0.72	0.00	16.76	25.59	2.00	0.00	0.72	0.00
16.80	22.41	2.00	0.00	0.72	0.00	16.87	19.76	2.00	0.00	0.71	0.00
16.96	15.98	2.00	0.00	0.71	0.00	17.02	15.07	2.00	0.00	0.71	0.00
17.06	14.89	2.00	0.00	0.71	0.00	17.14	15.03	2.00	0.00	0.71	0.00
17.20	15.01	2.00	0.00	0.71	0.00	17.29	13.99	2.00	0.00	0.71	0.00
17.36	13.53	2.00	0.00	0.71	0.00	17.42	12.51	2.00	0.00	0.70	0.00
17.48	12.16	2.00	0.00	0.70	0.00	17.55	11.82	2.00	0.00	0.70	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
17.61	11.57	2.00	0.00	0.70	0.00
17.73	11.54	2.00	0.00	0.70	0.00
17.85	11.96	2.00	0.00	0.70	0.00
18.01	12.90	2.00	0.00	0.69	0.00
18.14	12.87	2.00	0.00	0.69	0.00
18.26	12.29	2.00	0.00	0.69	0.00
18.38	12.26	2.00	0.00	0.69	0.00
18.53	12.22	2.00	0.00	0.69	0.00
18.67	11.98	2.00	0.00	0.68	0.00
18.77	11.41	2.00	0.00	0.68	0.00
18.91	10.85	2.00	0.00	0.68	0.00
19.06	10.39	2.00	0.00	0.68	0.00
19.20	9.60	2.00	0.00	0.67	0.00
19.30	10.01	2.00	0.00	0.67	0.00
19.45	10.84	2.00	0.00	0.67	0.00
19.55	11.13	2.00	0.00	0.67	0.00
19.69	10.84	2.00	0.00	0.67	0.00
19.83	10.65	2.00	0.00	0.66	0.00
19.98	10.83	2.00	0.00	0.66	0.00
20.11	11.54	2.00	0.00	0.66	0.00
20.21	11.09	2.00	0.00	0.66	0.00
20.35	10.86	2.00	0.00	0.66	0.00
20.49	10.71	2.00	0.00	0.65	0.00
20.63	13.20	2.00	0.00	0.65	0.00
20.74	23.94	2.00	0.00	0.65	0.00
20.90	105.54	0.27	1.96	0.65	0.02
21.00	111.18	0.29	1.85	0.64	0.01
21.14	119.00	0.32	1.72	0.64	0.01
21.26	123.93	0.34	1.64	0.64	0.01
21.40	116.99	0.31	1.74	0.64	0.01
21.53	98.34	0.25	2.08	0.64	0.02
21.66	22.24	2.00	0.00	0.63	0.00
21.79	16.88	2.00	0.00	0.63	0.00
21.93	13.42	2.00	0.00	0.63	0.00
22.06	11.26	2.00	0.00	0.63	0.00
22.19	10.52	2.00	0.00	0.62	0.00
22.32	10.20	2.00	0.00	0.62	0.00
22.45	9.96	2.00	0.00	0.62	0.00
22.59	12.06	2.00	0.00	0.62	0.00
22.72	14.82	2.00	0.00	0.61	0.00
22.85	15.87	2.00	0.00	0.61	0.00
22.99	14.04	2.00	0.00	0.61	0.00
23.11	14.41	2.00	0.00	0.61	0.00
23.24	14.08	2.00	0.00	0.61	0.00
23.39	14.43	2.00	0.00	0.60	0.00
23.52	13.61	2.00	0.00	0.60	0.00
23.65	14.56	2.00	0.00	0.60	0.00
23.77	13.74	2.00	0.00	0.60	0.00

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
17.67	11.56	2.00	0.00	0.70	0.00
17.79	11.53	2.00	0.00	0.70	0.00
17.94	12.82	2.00	0.00	0.70	0.00
18.07	12.89	2.00	0.00	0.69	0.00
18.20	12.86	2.00	0.00	0.69	0.00
18.32	12.06	2.00	0.00	0.69	0.00
18.45	12.14	2.00	0.00	0.69	0.00
18.60	12.32	2.00	0.00	0.68	0.00
18.73	11.64	2.00	0.00	0.68	0.00
18.84	11.07	2.00	0.00	0.68	0.00
18.98	10.83	2.00	0.00	0.68	0.00
19.13	9.72	2.00	0.00	0.68	0.00
19.24	9.48	2.00	0.00	0.67	0.00
19.37	10.53	2.00	0.00	0.67	0.00
19.52	11.04	2.00	0.00	0.67	0.00
19.62	11.02	2.00	0.00	0.67	0.00
19.77	10.55	2.00	0.00	0.66	0.00
19.91	10.52	2.00	0.00	0.66	0.00
20.05	11.24	2.00	0.00	0.66	0.00
20.15	11.53	2.00	0.00	0.66	0.00
20.28	10.97	2.00	0.00	0.66	0.00
20.43	10.73	2.00	0.00	0.65	0.00
20.56	11.13	2.00	0.00	0.65	0.00
20.68	17.73	2.00	0.00	0.65	0.00
20.83	97.70	0.25	2.13	0.65	0.02
20.93	108.01	0.28	1.91	0.65	0.01
21.07	114.43	0.30	1.80	0.64	0.01
21.20	122.53	0.34	1.66	0.64	0.01
21.33	122.48	0.33	1.66	0.64	0.01
21.46	108.24	0.28	1.88	0.64	0.01
21.59	28.14	2.00	0.00	0.63	0.00
21.72	19.22	2.00	0.00	0.63	0.00
21.86	14.65	2.00	0.00	0.63	0.00
21.99	12.29	2.00	0.00	0.63	0.00
22.13	10.53	2.00	0.00	0.62	0.00
22.26	10.31	2.00	0.00	0.62	0.00
22.39	9.88	2.00	0.00	0.62	0.00
22.52	10.76	2.00	0.00	0.62	0.00
22.65	13.05	2.00	0.00	0.62	0.00
22.79	15.30	2.00	0.00	0.61	0.00
22.91	14.77	2.00	0.00	0.61	0.00
23.04	13.64	2.00	0.00	0.61	0.00
23.17	14.29	2.00	0.00	0.61	0.00
23.30	13.96	2.00	0.00	0.61	0.00
23.45	13.92	2.00	0.00	0.60	0.00
23.58	13.88	2.00	0.00	0.60	0.00
23.71	14.63	2.00	0.00	0.60	0.00
23.83	13.13	2.00	0.00	0.60	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
23.91	12.92	2.00	0.00	0.59	0.00	23.96	13.20	2.00	0.00	0.59	0.00
24.03	12.89	2.00	0.00	0.59	0.00	24.10	12.68	2.00	0.00	0.59	0.00
24.16	12.18	2.00	0.00	0.59	0.00	24.23	12.17	2.00	0.00	0.59	0.00
24.29	12.15	2.00	0.00	0.59	0.00	24.36	13.01	2.00	0.00	0.59	0.00
24.42	12.90	2.00	0.00	0.59	0.00	24.49	12.68	2.00	0.00	0.58	0.00
24.55	12.67	2.00	0.00	0.58	0.00	24.61	12.18	2.00	0.00	0.58	0.00
24.68	11.77	2.00	0.00	0.58	0.00	24.74	11.67	2.00	0.00	0.58	0.00
24.81	11.17	2.00	0.00	0.58	0.00	24.87	10.77	2.00	0.00	0.58	0.00
24.94	10.46	2.00	0.00	0.58	0.00	25.00	10.36	2.00	0.00	0.58	0.00
25.07	10.25	2.00	0.00	0.58	0.00	25.16	10.04	2.00	0.00	0.57	0.00
25.20	9.75	2.00	0.00	0.57	0.00	25.29	9.73	2.00	0.00	0.57	0.00
25.36	9.72	2.00	0.00	0.57	0.00	25.42	9.71	2.00	0.00	0.57	0.00
25.49	10.47	2.00	0.00	0.57	0.00	25.54	11.23	2.00	0.00	0.57	0.00
25.61	11.88	2.00	0.00	0.57	0.00	25.67	14.34	2.00	0.00	0.56	0.00
25.73	14.80	2.00	0.00	0.56	0.00	25.79	14.40	2.00	0.00	0.56	0.00
25.86	14.39	2.00	0.00	0.56	0.00	25.92	14.37	2.00	0.00	0.56	0.00
25.99	14.35	2.00	0.00	0.56	0.00	26.05	16.79	2.00	0.00	0.56	0.00
26.12	21.17	2.00	0.00	0.56	0.00	26.22	89.27	0.22	2.00	0.56	0.02
26.28	93.54	0.23	1.91	0.55	0.01	26.34	93.96	0.23	1.89	0.55	0.01
26.41	31.37	2.00	0.00	0.55	0.00	26.44	29.69	2.00	0.00	0.55	0.00
26.51	26.90	2.00	0.00	0.55	0.00	26.60	24.37	2.00	0.00	0.55	0.00
26.66	22.13	2.00	0.00	0.55	0.00	26.73	22.15	2.00	0.00	0.55	0.00
26.78	22.13	2.00	0.00	0.55	0.00	26.85	22.14	2.00	0.00	0.54	0.00
26.92	23.94	2.00	0.00	0.54	0.00	26.99	27.20	2.00	0.00	0.54	0.00
27.05	30.80	2.00	0.00	0.54	0.00	27.12	35.19	2.00	0.00	0.54	0.00
27.19	103.45	0.25	1.67	0.54	0.01	27.25	113.53	0.28	1.52	0.54	0.01
27.32	124.63	0.33	1.37	0.54	0.01	27.38	130.64	0.36	1.30	0.54	0.01
27.43	131.54	0.37	1.29	0.54	0.01	27.52	131.07	0.37	1.29	0.53	0.01
27.59	131.94	0.37	1.28	0.53	0.01	27.65	133.58	0.38	1.26	0.53	0.01
27.69	134.53	0.39	1.24	0.53	0.01	27.76	135.53	0.39	1.23	0.53	0.01
27.83	135.73	0.40	1.23	0.53	0.01	27.89	136.18	0.40	1.22	0.53	0.01
27.96	133.35	0.38	1.25	0.53	0.01	28.03	127.74	0.35	1.30	0.52	0.01
28.09	122.01	0.32	1.37	0.52	0.01	28.16	119.89	0.31	1.39	0.52	0.01
28.23	118.75	0.30	1.40	0.52	0.01	28.29	119.84	0.31	1.38	0.52	0.01
28.35	138.09	0.41	1.18	0.52	0.01	28.41	142.02	0.45	1.14	0.52	0.01
28.52	132.10	0.37	1.24	0.52	0.02	28.57	119.66	0.31	1.37	0.52	0.01
28.64	106.64	0.26	1.55	0.51	0.01	28.70	32.56	2.00	0.00	0.51	0.00
28.76	25.72	2.00	0.00	0.51	0.00	28.83	20.98	2.00	0.00	0.51	0.00
28.89	18.21	2.00	0.00	0.51	0.00	28.95	15.87	2.00	0.00	0.51	0.00
29.01	13.71	2.00	0.00	0.51	0.00	29.08	12.98	2.00	0.00	0.51	0.00
29.15	11.81	2.00	0.00	0.51	0.00	29.20	11.61	2.00	0.00	0.51	0.00
29.27	10.80	2.00	0.00	0.50	0.00	29.34	10.61	2.00	0.00	0.50	0.00
29.42	10.51	2.00	0.00	0.50	0.00	29.48	10.15	2.00	0.00	0.50	0.00
29.54	9.96	2.00	0.00	0.50	0.00	29.61	9.77	2.00	0.00	0.50	0.00
29.68	9.77	2.00	0.00	0.50	0.00	29.74	9.76	2.00	0.00	0.50	0.00
29.80	9.92	2.00	0.00	0.49	0.00	29.87	10.18	2.00	0.00	0.49	0.00
29.93	10.35	2.00	0.00	0.49	0.00	30.00	10.61	2.00	0.00	0.49	0.00
30.06	11.39	2.00	0.00	0.49	0.00	30.13	11.55	2.00	0.00	0.49	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
30.19	11.72	2.00	0.00	0.49	0.00	30.26	11.97	2.00	0.00	0.49	0.00
30.32	11.96	2.00	0.00	0.49	0.00	30.39	11.86	2.00	0.00	0.48	0.00
30.45	12.47	2.00	0.00	0.48	0.00	30.51	12.27	2.00	0.00	0.48	0.00
30.58	12.79	2.00	0.00	0.48	0.00	30.68	14.08	2.00	0.00	0.48	0.00
30.74	15.63	2.00	0.00	0.48	0.00	30.81	17.02	2.00	0.00	0.48	0.00
30.87	17.17	2.00	0.00	0.48	0.00	30.92	17.15	2.00	0.00	0.48	0.00
30.99	17.06	2.00	0.00	0.47	0.00	31.05	16.95	2.00	0.00	0.47	0.00
31.11	18.31	2.00	0.00	0.47	0.00	31.17	20.45	2.00	0.00	0.47	0.00
31.24	23.19	2.00	0.00	0.47	0.00	31.30	27.03	2.00	0.00	0.47	0.00
31.37	31.21	2.00	0.00	0.47	0.00	31.46	99.81	0.24	1.50	0.47	0.02
31.52	105.73	0.26	1.41	0.47	0.01	31.59	112.19	0.28	1.33	0.46	0.01
31.65	117.44	0.29	1.26	0.46	0.01	31.71	120.94	0.31	1.22	0.46	0.01
31.76	106.12	0.26	1.40	0.46	0.01	31.84	124.55	0.32	1.17	0.46	0.01
31.90	124.94	0.33	1.17	0.46	0.01	31.97	124.61	0.32	1.17	0.46	0.01
32.03	123.47	0.32	1.18	0.46	0.01	32.10	121.38	0.31	1.20	0.46	0.01
32.15	118.57	0.30	1.22	0.46	0.01	32.25	116.52	0.29	1.24	0.45	0.01
32.32	113.86	0.28	1.27	0.45	0.01	32.35	113.40	0.28	1.27	0.45	0.01
32.44	109.95	0.27	1.31	0.45	0.01	32.50	106.13	0.26	1.36	0.45	0.01
32.57	103.33	0.25	1.39	0.45	0.01	32.62	103.42	0.25	1.39	0.45	0.01
32.69	108.53	0.26	1.32	0.45	0.01	32.77	124.99	0.33	1.13	0.44	0.01
32.83	131.67	0.36	1.06	0.44	0.01	32.88	135.45	0.39	1.03	0.44	0.01
32.94	140.79	0.43	0.98	0.44	0.01	33.04	144.91	0.47	0.95	0.44	0.01
33.07	146.23	0.48	0.94	0.44	0.00	33.17	150.35	0.53	0.91	0.44	0.01
33.22	153.52	0.57	0.88	0.44	0.01	33.28	156.99	0.62	0.83	0.44	0.01
33.35	160.04	0.68	0.75	0.43	0.01	33.41	161.75	0.71	0.68	0.43	0.00
33.48	162.55	0.73	0.64	0.43	0.01	33.53	161.41	0.71	0.69	0.43	0.00
33.60	158.36	0.65	0.79	0.43	0.01	33.66	152.81	0.56	0.87	0.43	0.01
33.76	140.71	0.43	0.95	0.43	0.01	33.82	132.38	0.37	1.02	0.43	0.01
33.89	125.70	0.33	1.07	0.43	0.01	33.95	122.65	0.32	1.10	0.42	0.01
34.01	123.40	0.32	1.09	0.42	0.01	34.07	125.18	0.33	1.07	0.42	0.01
34.13	126.37	0.33	1.06	0.42	0.01	34.19	126.73	0.33	1.05	0.42	0.01
34.26	127.59	0.34	1.04	0.42	0.01	34.32	129.38	0.35	1.02	0.42	0.01
34.41	131.53	0.36	1.00	0.42	0.01	34.47	133.27	0.37	0.98	0.42	0.01
34.54	135.81	0.39	0.96	0.41	0.01	34.61	138.62	0.41	0.94	0.41	0.01
34.66	139.43	0.42	0.93	0.41	0.01	34.72	140.85	0.43	0.92	0.41	0.01
34.78	141.82	0.44	0.91	0.41	0.01	34.84	143.29	0.45	0.89	0.41	0.01
34.93	144.71	0.46	0.88	0.41	0.01	34.99	144.14	0.46	0.88	0.41	0.01
35.05	145.94	0.48	0.87	0.41	0.01	35.12	146.02	0.48	0.87	0.40	0.01
35.18	146.29	0.48	0.86	0.40	0.01	35.25	146.49	0.48	0.86	0.40	0.01
35.30	146.76	0.48	0.85	0.40	0.01	35.40	146.98	0.49	0.85	0.40	0.01
35.46	147.25	0.49	0.85	0.40	0.01	35.52	147.58	0.49	0.84	0.40	0.01
35.59	146.67	0.48	0.84	0.40	0.01	35.65	144.78	0.46	0.86	0.40	0.01
35.71	143.76	0.45	0.86	0.39	0.01	35.77	143.31	0.45	0.86	0.39	0.01
35.84	142.81	0.45	0.86	0.39	0.01	35.91	142.76	0.44	0.86	0.39	0.01
35.99	142.52	0.44	0.86	0.39	0.01	36.05	143.44	0.45	0.85	0.39	0.01
36.11	144.30	0.46	0.84	0.39	0.01	36.18	145.44	0.47	0.83	0.39	0.01
36.24	146.57	0.48	0.82	0.39	0.01	36.31	147.96	0.50	0.81	0.38	0.01
36.37	148.72	0.51	0.80	0.38	0.01	36.43	148.94	0.51	0.80	0.38	0.01

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
36.49	148.38	0.50	0.80	0.38	0.01	36.55	147.30	0.49	0.81	0.38	0.01
36.62	145.44	0.47	0.82	0.38	0.01	36.71	140.57	0.43	0.84	0.38	0.01
36.77	134.28	0.38	0.89	0.38	0.01	36.84	124.49	0.32	0.96	0.38	0.01
36.90	111.54	0.27	1.08	0.37	0.01	36.96	35.74	2.00	0.00	0.37	0.00
37.02	27.37	2.00	0.00	0.37	0.00	37.09	21.95	2.00	0.00	0.37	0.00
37.15	17.73	2.00	0.00	0.37	0.00	37.21	15.27	2.00	0.00	0.37	0.00
37.30	15.22	2.00	0.00	0.37	0.00	37.35	15.21	2.00	0.00	0.37	0.00
37.43	15.15	2.00	0.00	0.37	0.00	37.48	15.38	2.00	0.00	0.36	0.00
37.55	15.21	2.00	0.00	0.36	0.00	37.61	14.33	2.00	0.00	0.36	0.00
37.68	13.70	2.00	0.00	0.36	0.00	37.75	13.36	2.00	0.00	0.36	0.00
37.80	13.75	2.00	0.00	0.36	0.00	37.89	14.84	2.00	0.00	0.36	0.00
37.94	15.92	2.00	0.00	0.36	0.00	38.01	16.84	2.00	0.00	0.36	0.00
38.07	16.44	2.00	0.00	0.35	0.00	38.13	16.04	2.00	0.00	0.35	0.00
38.19	16.38	2.00	0.00	0.35	0.00	38.26	16.32	2.00	0.00	0.35	0.00
38.33	19.19	2.00	0.00	0.35	0.00	38.40	19.73	2.00	0.00	0.35	0.00
38.46	19.67	2.00	0.00	0.35	0.00	38.52	19.65	2.00	0.00	0.35	0.00
38.62	19.59	2.00	0.00	0.35	0.00	38.67	20.27	2.00	0.00	0.34	0.00
38.73	21.81	2.00	0.00	0.34	0.00	38.79	22.27	2.00	0.00	0.34	0.00
38.85	21.55	2.00	0.00	0.34	0.00	38.94	18.50	2.00	0.00	0.34	0.00
38.99	19.73	2.00	0.00	0.34	0.00	39.05	20.80	2.00	0.00	0.34	0.00
39.14	33.27	2.00	0.00	0.34	0.00	39.18	40.51	2.00	0.00	0.34	0.00
39.27	123.73	0.32	0.86	0.33	0.01	39.33	131.09	0.36	0.80	0.33	0.01
39.39	135.62	0.39	0.77	0.33	0.01	39.45	139.22	0.41	0.75	0.33	0.01
39.51	141.18	0.43	0.73	0.33	0.01	39.57	141.26	0.43	0.73	0.33	0.01
39.66	140.75	0.43	0.73	0.33	0.01	39.72	140.69	0.43	0.73	0.33	0.00
39.79	140.39	0.42	0.73	0.33	0.01	39.85	139.04	0.41	0.73	0.32	0.01
39.92	134.57	0.38	0.76	0.32	0.01	39.98	128.72	0.35	0.79	0.32	0.01
40.03	121.83	0.31	0.84	0.32	0.01	40.10	114.46	0.28	0.89	0.32	0.01
40.16	106.72	0.26	0.96	0.32	0.01	40.25	35.23	2.00	0.00	0.32	0.00
40.31	30.98	2.00	0.00	0.32	0.00	40.38	27.36	2.00	0.00	0.32	0.00
40.44	25.27	2.00	0.00	0.31	0.00	40.50	24.34	2.00	0.00	0.31	0.00
40.56	24.70	2.00	0.00	0.31	0.00	40.62	23.54	2.00	0.00	0.31	0.00
40.70	18.80	2.00	0.00	0.31	0.00	40.76	17.35	2.00	0.00	0.31	0.00
40.83	17.63	2.00	0.00	0.31	0.00	40.89	19.51	2.00	0.00	0.31	0.00
40.96	21.85	2.00	0.00	0.31	0.00	41.02	22.89	2.00	0.00	0.30	0.00
41.11	21.65	2.00	0.00	0.30	0.00	41.17	20.05	2.00	0.00	0.30	0.00
41.23	18.82	2.00	0.00	0.30	0.00	41.29	17.53	2.00	0.00	0.30	0.00
41.35	16.47	2.00	0.00	0.30	0.00	41.41	16.00	2.00	0.00	0.30	0.00
41.47	16.15	2.00	0.00	0.30	0.00	41.56	17.03	2.00	0.00	0.30	0.00
41.61	18.15	2.00	0.00	0.29	0.00	41.67	18.13	2.00	0.00	0.29	0.00
41.76	17.36	2.00	0.00	0.29	0.00	41.82	16.75	2.00	0.00	0.29	0.00
41.88	16.21	2.00	0.00	0.29	0.00	41.95	15.52	2.00	0.00	0.29	0.00
42.00	15.37	2.00	0.00	0.29	0.00	42.06	15.29	2.00	0.00	0.29	0.00
42.15	14.75	2.00	0.00	0.29	0.00	42.21	14.29	2.00	0.00	0.28	0.00
42.28	14.05	2.00	0.00	0.28	0.00	42.33	13.98	2.00	0.00	0.28	0.00
42.40	13.74	2.00	0.00	0.28	0.00	42.46	14.76	2.00	0.00	0.28	0.00
42.55	17.87	2.00	0.00	0.28	0.00	42.61	20.83	2.00	0.00	0.28	0.00
42.67	29.62	2.00	0.00	0.28	0.00	42.73	110.05	0.27	0.80	0.28	0.01

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
42.80	128.99	0.35	0.67	0.27	0.01	42.86	142.60	0.44	0.60	0.27	0.00
42.92	151.87	0.54	0.56	0.27	0.00	42.99	160.71	0.69	0.46	0.27	0.00
43.05	146.17	0.48	0.58	0.27	0.00	43.14	145.31	0.47	0.58	0.27	0.01
43.20	152.86	0.56	0.54	0.27	0.00	43.25	161.52	0.70	0.43	0.27	0.00
43.34	177.99	1.23	0.13	0.27	0.00	43.39	184.76	1.63	0.05	0.26	0.00
43.45	185.92	1.71	0.03	0.26	0.00	43.52	185.66	1.69	0.04	0.26	0.00
43.59	187.50	1.84	0.02	0.26	0.00	43.65	191.97	2.00	0.00	0.26	0.00
43.72	200.03	2.00	0.00	0.26	0.00	43.78	205.17	2.00	0.00	0.26	0.00
43.85	208.23	2.00	0.00	0.26	0.00	43.91	208.92	2.00	0.00	0.26	0.00
43.98	207.84	2.00	0.00	0.25	0.00	44.03	205.91	2.00	0.00	0.25	0.00
44.10	205.57	2.00	0.00	0.25	0.00	44.18	204.44	2.00	0.00	0.25	0.00
44.25	205.95	2.00	0.00	0.25	0.00	44.31	208.77	2.00	0.00	0.25	0.00
44.38	213.89	2.00	0.00	0.25	0.00	44.44	217.47	2.00	0.00	0.25	0.00
44.51	219.65	2.00	0.00	0.25	0.00	44.59	222.13	2.00	0.00	0.24	0.00
44.65	222.02	2.00	0.00	0.24	0.00	44.71	225.63	2.00	0.00	0.24	0.00
44.77	231.03	2.00	0.00	0.24	0.00	44.83	237.65	2.00	0.00	0.24	0.00
44.89	248.05	2.00	0.00	0.24	0.00	44.96	241.65	2.00	0.00	0.24	0.00
45.02	228.70	2.00	0.00	0.24	0.00	45.09	254.00	2.00	0.00	0.24	0.00
45.15	254.00	2.00	0.00	0.23	0.00	45.21	254.00	2.00	0.00	0.23	0.00
45.28	254.00	2.00	0.00	0.23	0.00	45.37	254.00	2.00	0.00	0.23	0.00
45.43	254.00	2.00	0.00	0.23	0.00	45.49	254.00	2.00	0.00	0.23	0.00
45.56	254.00	2.00	0.00	0.23	0.00	45.62	254.00	2.00	0.00	0.23	0.00
45.67	254.00	2.00	0.00	0.23	0.00	45.74	254.00	2.00	0.00	0.22	0.00
45.83	252.71	2.00	0.00	0.22	0.00	45.89	245.14	2.00	0.00	0.22	0.00
45.95	236.39	2.00	0.00	0.22	0.00	46.01	228.58	2.00	0.00	0.22	0.00
46.07	221.35	2.00	0.00	0.22	0.00	46.13	215.81	2.00	0.00	0.22	0.00
46.20	210.10	2.00	0.00	0.22	0.00	46.27	204.71	2.00	0.00	0.22	0.00
46.34	201.29	2.00	0.00	0.21	0.00	46.40	199.57	2.00	0.00	0.21	0.00
46.46	201.43	2.00	0.00	0.21	0.00	46.54	211.25	2.00	0.00	0.21	0.00
46.60	219.29	2.00	0.00	0.21	0.00	46.66	228.07	2.00	0.00	0.21	0.00
46.73	236.97	2.00	0.00	0.21	0.00	46.80	243.20	2.00	0.00	0.21	0.00
46.87	244.72	2.00	0.00	0.21	0.00	46.92	246.18	2.00	0.00	0.20	0.00
46.98	245.82	2.00	0.00	0.20	0.00	47.07	240.60	2.00	0.00	0.20	0.00
47.12	240.35	2.00	0.00	0.20	0.00	47.18	239.31	2.00	0.00	0.20	0.00
47.26	238.54	2.00	0.00	0.20	0.00	47.31	243.65	2.00	0.00	0.20	0.00
47.39	250.19	2.00	0.00	0.20	0.00	47.46	254.00	2.00	0.00	0.20	0.00
47.51	254.00	2.00	0.00	0.19	0.00	47.59	254.00	2.00	0.00	0.19	0.00
47.65	254.00	2.00	0.00	0.19	0.00	47.73	254.00	2.00	0.00	0.19	0.00
47.78	254.00	2.00	0.00	0.19	0.00	47.85	254.00	2.00	0.00	0.19	0.00
47.91	254.00	2.00	0.00	0.19	0.00	47.98	254.00	2.00	0.00	0.19	0.00
48.05	254.00	2.00	0.00	0.19	0.00	48.11	254.00	2.00	0.00	0.18	0.00
48.16	254.00	2.00	0.00	0.18	0.00	48.23	254.00	2.00	0.00	0.18	0.00
48.30	254.00	2.00	0.00	0.18	0.00	48.37	254.00	2.00	0.00	0.18	0.00
48.43	254.00	2.00	0.00	0.18	0.00	48.50	254.00	2.00	0.00	0.18	0.00
48.56	254.00	2.00	0.00	0.18	0.00	48.63	254.00	2.00	0.00	0.18	0.00
48.69	254.00	2.00	0.00	0.17	0.00	48.76	254.00	2.00	0.00	0.17	0.00
48.82	254.00	2.00	0.00	0.17	0.00	48.89	254.00	2.00	0.00	0.17	0.00
48.96	254.00	2.00	0.00	0.17	0.00	49.02	254.00	2.00	0.00	0.17	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
49.09	254.00	2.00	0.00	0.17	0.00	49.16	254.00	2.00	0.00	0.17	0.00
49.22	254.00	2.00	0.00	0.17	0.00	49.28	254.00	2.00	0.00	0.16	0.00
49.35	254.00	2.00	0.00	0.16	0.00	49.42	254.00	2.00	0.00	0.16	0.00
49.49	254.00	2.00	0.00	0.16	0.00	49.54	254.00	2.00	0.00	0.16	0.00
49.61	254.00	2.00	0.00	0.16	0.00	49.68	254.00	2.00	0.00	0.16	0.00
49.75	254.00	2.00	0.00	0.16	0.00	49.81	254.00	2.00	0.00	0.16	0.00
49.88	254.00	2.00	0.00	0.15	0.00	49.94	254.00	2.00	0.00	0.15	0.00
50.02	254.00	2.00	0.00	0.15	0.00	50.08	254.00	2.00	0.00	0.15	0.00
50.14	254.00	2.00	0.00	0.15	0.00	50.21	254.00	2.00	0.00	0.15	0.00
50.29	254.00	2.00	0.00	0.15	0.00	50.34	254.00	2.00	0.00	0.15	0.00
50.41	252.90	2.00	0.00	0.15	0.00	50.46	249.18	2.00	0.00	0.14	0.00
50.55	246.22	2.00	0.00	0.14	0.00	50.60	244.30	2.00	0.00	0.14	0.00
50.66	241.69	2.00	0.00	0.14	0.00	50.74	228.79	2.00	0.00	0.14	0.00
50.81	219.15	2.00	0.00	0.14	0.00	50.87	217.43	2.00	0.00	0.14	0.00
50.92	216.55	2.00	0.00	0.14	0.00	51.01	211.81	2.00	0.00	0.14	0.00
51.05	207.78	2.00	0.00	0.13	0.00	51.12	202.46	2.00	0.00	0.13	0.00
51.19	195.21	2.00	0.00	0.13	0.00	51.26	190.25	2.00	0.00	0.13	0.00
51.31	188.17	2.00	0.00	0.13	0.00	51.38	187.22	2.00	0.00	0.13	0.00
51.46	185.73	2.00	0.00	0.13	0.00	51.52	182.51	2.00	0.00	0.13	0.00
51.58	178.11	2.00	0.00	0.13	0.00	51.66	168.10	2.00	0.00	0.12	0.00
51.72	156.87	2.00	0.00	0.12	0.00	51.78	148.05	2.00	0.00	0.12	0.00
51.85	138.60	2.00	0.00	0.12	0.00	51.91	132.52	2.00	0.00	0.12	0.00
51.98	127.18	2.00	0.00	0.12	0.00	52.05	121.32	2.00	0.00	0.12	0.00
52.11	113.00	2.00	0.00	0.12	0.00	52.17	39.31	2.00	0.00	0.12	0.00
52.24	31.22	2.00	0.00	0.11	0.00	52.30	26.67	2.00	0.00	0.11	0.00
52.37	22.55	2.00	0.00	0.11	0.00	52.44	19.88	2.00	0.00	0.11	0.00
52.50	18.27	2.00	0.00	0.11	0.00	52.57	16.68	2.00	0.00	0.11	0.00
52.63	15.75	2.00	0.00	0.11	0.00	52.71	18.89	2.00	0.00	0.11	0.00
52.76	27.14	2.00	0.00	0.11	0.00	52.83	108.21	2.00	0.00	0.10	0.00
52.89	130.32	2.00	0.00	0.10	0.00	52.96	152.74	2.00	0.00	0.10	0.00
53.03	155.29	2.00	0.00	0.10	0.00	53.10	155.52	2.00	0.00	0.10	0.00
53.16	153.99	2.00	0.00	0.10	0.00	53.23	150.83	2.00	0.00	0.10	0.00
53.28	148.43	2.00	0.00	0.10	0.00	53.36	146.32	2.00	0.00	0.10	0.00
53.42	146.31	2.00	0.00	0.09	0.00	53.49	149.54	2.00	0.00	0.09	0.00
53.56	153.99	2.00	0.00	0.09	0.00	53.62	157.32	2.00	0.00	0.09	0.00
53.68	160.27	2.00	0.00	0.09	0.00	53.75	163.81	2.00	0.00	0.09	0.00
53.82	165.19	2.00	0.00	0.09	0.00	53.88	163.54	2.00	0.00	0.09	0.00
53.94	159.41	2.00	0.00	0.09	0.00	54.02	148.95	2.00	0.00	0.08	0.00
54.07	148.10	2.00	0.00	0.08	0.00	54.14	139.67	2.00	0.00	0.08	0.00
54.20	133.77	2.00	0.00	0.08	0.00	54.29	126.20	2.00	0.00	0.08	0.00
54.35	119.90	2.00	0.00	0.08	0.00	54.41	111.16	2.00	0.00	0.08	0.00
54.49	36.46	2.00	0.00	0.08	0.00	54.53	32.29	2.00	0.00	0.08	0.00
54.60	26.69	2.00	0.00	0.07	0.00	54.67	21.29	2.00	0.00	0.07	0.00
54.74	19.06	2.00	0.00	0.07	0.00	54.81	16.79	2.00	0.00	0.07	0.00
54.88	15.49	2.00	0.00	0.07	0.00	54.95	14.77	2.00	0.00	0.07	0.00
54.99	14.32	2.00	0.00	0.07	0.00	55.06	13.49	2.00	0.00	0.07	0.00
55.13	13.48	2.00	0.00	0.07	0.00	55.20	13.47	2.00	0.00	0.06	0.00
55.27	13.46	2.00	0.00	0.06	0.00	55.34	13.83	2.00	0.00	0.06	0.00

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

Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$q_{c1N,cs}$	FS	e_v (%)	DF	Settlement (in)
55.40	14.21	2.00	0.00	0.06	0.00	55.47	14.70	2.00	0.00	0.06	0.00
55.52	14.69	2.00	0.00	0.06	0.00	55.60	14.18	2.00	0.00	0.06	0.00
55.66	13.41	2.00	0.00	0.06	0.00	55.74	12.58	2.00	0.00	0.06	0.00
55.79	12.38	2.00	0.00	0.05	0.00	55.85	12.32	2.00	0.00	0.05	0.00
55.92	13.07	2.00	0.00	0.05	0.00	55.98	13.50	2.00	0.00	0.05	0.00
56.04	13.69	2.00	0.00	0.05	0.00	56.11	13.61	2.00	0.00	0.05	0.00
56.17	13.73	2.00	0.00	0.05	0.00	56.25	14.79	2.00	0.00	0.05	0.00
56.30	17.08	2.00	0.00	0.05	0.00	56.37	23.10	2.00	0.00	0.04	0.00
56.46	32.77	2.00	0.00	0.04	0.00	56.50	41.97	2.00	0.00	0.04	0.00
56.58	125.20	2.00	0.00	0.04	0.00	56.63	130.99	2.00	0.00	0.04	0.00
56.70	134.57	2.00	0.00	0.04	0.00	56.79	135.33	2.00	0.00	0.04	0.00
56.86	136.29	2.00	0.00	0.04	0.00	56.91	136.23	2.00	0.00	0.04	0.00
56.96	134.44	2.00	0.00	0.03	0.00	57.02	62.52	2.00	0.00	0.03	0.00
57.10	56.99	2.00	0.00	0.03	0.00	57.16	57.42	2.00	0.00	0.03	0.00
57.23	50.99	2.00	0.00	0.03	0.00	57.29	47.42	2.00	0.00	0.03	0.00
57.36	46.09	2.00	0.00	0.03	0.00	57.42	48.57	2.00	0.00	0.03	0.00
57.49	57.27	2.00	0.00	0.03	0.00	57.55	134.78	2.00	0.00	0.02	0.00
57.62	152.91	2.00	0.00	0.02	0.00	57.71	162.82	2.00	0.00	0.02	0.00
57.75	163.40	2.00	0.00	0.02	0.00	57.84	162.16	2.00	0.00	0.02	0.00
57.88	161.00	2.00	0.00	0.02	0.00	57.96	158.81	2.00	0.00	0.02	0.00
58.01	157.53	2.00	0.00	0.02	0.00	58.09	157.85	2.00	0.00	0.02	0.00
58.14	157.95	2.00	0.00	0.01	0.00	58.22	160.39	2.00	0.00	0.01	0.00
58.28	162.83	2.00	0.00	0.01	0.00	58.35	166.13	2.00	0.00	0.01	0.00
58.40	168.57	2.00	0.00	0.01	0.00	58.47	171.44	2.00	0.00	0.01	0.00
58.56	173.44	2.00	0.00	0.01	0.00	58.60	173.70	2.00	0.00	0.01	0.00
58.68	173.36	2.00	0.00	0.01	0.00	58.76	173.56	2.00	0.00	0.00	0.00
58.80	174.08	2.00	0.00	0.00	0.00	58.88	175.95	2.00	0.00	0.00	0.00
58.93	177.49	2.00	0.00	0.00	0.00	59.01	180.28	2.00	0.00	0.00	0.00
59.07	182.65	2.00	0.00	0.00	0.00	59.14	186.75	2.00	0.00	0.00	0.00
59.21	191.62	2.00	0.00	0.00	0.00	59.26	194.70	2.00	0.00	0.00	0.00
59.34	199.07	2.00	0.00	0.00	0.00	59.40	200.10	2.00	0.00	0.00	0.00
59.47	200.84	2.00	0.00	0.00	0.00	59.52	203.20	2.00	0.00	0.00	0.00
59.59	204.88	2.00	0.00	0.00	0.00	59.67	204.59	2.00	0.00	0.00	0.00
59.72	203.54	2.00	0.00	0.00	0.00	59.80	129.27	2.00	0.00	0.00	0.00
59.87	125.14	2.00	0.00	0.00	0.00	59.92	122.51	2.00	0.00	0.00	0.00
60.00	118.95	2.00	0.00	0.00	0.00	60.04	117.33	2.00	0.00	0.00	0.00
60.13	116.31	2.00	0.00	0.00	0.00						

Total estimated settlement: 1.85

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

Attachment C

Maintenance Covenant

Attachment D

O&M Plan

Operations and Maintenance (O&M) Plan

for

Katella Industrial

6400 Katella Ave, Cypress CA 90630

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
Education for Property Owners, Tenants and Occupants	Property Owner/ POA	The current property owner/POA shall be familiar with the contents of the WQMP and the County & City Ordinance and brochures and furnish copies of city and County BMP factsheets to all future property owners.	Education materials should be kept onsite for reference.
Activity Restriction	Property Owner/ POA	Property owners and their tenants or occupants shall not be allowed to discharge chemicals, chemical residues, wastewater or other prohibited discharges listed in the City stormwater Ordinance, to the outside, paved areas of the site; or store chemicals or other pollutant sources in a non-spill contained or covered facilities as stipulated in the CC&Rs.	The property owners / POA shall control the discharge of stormwater pollutants from this site.
Common Area Landscape Management	Property Owner/ POA/ Tenants	Maintain landscape area vegetation, slope protection and grades, adjacent to hardscape and prevent discharges of landscape maintenance waste into storm drains.	Weekly
BMP Maintenance	Property Owner/ POA/ Tenants	The POA shall inspect for standing water in the water retention/infiltration basins, 48 hours after storm events. BMP maintenance shall be performed per the manufacturer recommendations, as needed to restore free drainage.	Quarterly and within 48 hours following a significant storm event to verify there is no standing water in the chambers and minimize stagnation and vector issues

Title 22 CCR Compliance	Property Owner/ POA	The proposed development does not include the use of hazardous materials. The POA will file appropriate hazardous mater ial disclosures, if any storage is conducted, an d must comply with all Title 22 CCR, Chapter 2 9 regulations.	Yearly and when new tenants occupy the facility
Spill Contingency Plan	Tenants	Building operators shall prepare specific plans based on materials on site for the cleanup of spills. Plans shall mandate stock piling of cleanup materials, notification of agencies, disposal, documentation, etc.	Shall be implemented with new tenants and updated yearly to comply with new standards.
Uniform Fire Code Implementation	Property Owner/ POA	The current owners or the future POA shall require all fire code requirements to be implemented at this project site.	Yearly and when new tenants occupy the facility
Common Area Litter Control	Property Owner/ POA	The property owners, POA and their contractor shall pick up litter and sweep and clean the existing trash enclosure weekly. Litter control shall be enforced in order to remove potential stormwater contamination before anticipated storm events. The HOA shall contract with a refuse company to have the dumpsters emptied on a weekly basis, at a minimum.	Trash pickup once per week. Trash enclosure should be kept clean from litter and be swept on a weekly basis.
Employee Training	Property Owner/ POA/ Tenants	The POA shall require all maintenance contractors to train their employees in stormwater BMP implementation. Tenants shall also ensure all new employees are trained at the start of their employment.	Yearly and when new tenants occupy the facility

Housekeeping of Loading Docks	Property Owner/ POA/ Tenants	Sweep and clear debris from dock areas to remove potential stormwater contaminates especially prior to anticipated storms.	Monthly/ Weekly during rainy season which begins Oct 1st (October 1st – May)
Common Area Catch Basin Inspection	Property Owner/ POA	The on-site catch basins shall be inspected monthly during the rainy season which begins Oct 1st (October 1st -May) and before and after each storm to ensure proper operation. The HOA shall contract with a qualified landscape contractor to inspect and clean out accumulation of trash, litter and sediment and check for evidence of illegal dumping of waste materials into on-site drains.	Quarterly inspections during the rainy season which begins Oct 1st (October 1st-May) and before and after each storm to ensure proper operation.
Street Sweeping Private Streets and Parking Lots	Property Owner/ POA	Street sweeping shall be implemented within streets and pavement areas.	Bi-Weekly
Provide Storm Drain System Stenciling and Signage	Property Owner/ POA	A painted message "No Dumping-Drains to River" shall be placed on each catch basin at the end of construction. The message shall be inspected and repainted.	Twice Annually
Design and Construct Trash and Waste Storage Areas to Reduce Pollutant Introduction	Construction Superintendent	The trash enclosure is designed to divert all flows around the dumpsters. Trash enclosure shall comply with CASQA SD-32 and shall have doors and a solid roof.	During Construction

Use Efficient Irrigation Systems & Landscape Design	Property Owner/ POA	The irrigation system will include devices to prevent low head drainage, overspray and run off through the use of pressure regulating devices, check valves, rain shutoff valves, flow sensors, pressure drop sensors, proper spacing, low precipitation emission devices and ET or weather-based controllers. Landscape and irrigation shall be consistent with the State Model Water Efficient Landscape Ordinance and the city landscape standards. Plants installed will be arranged according to similar hydrozones and meet the required water budget for the site.	Inspected Weekly after each landscape procedure
Protect Slopes and Channels and Provide Energy Dissipation	Construction Superintendent/ Property Owner/ POA	All slopes shall be hard lined, rip rapped or vegetated to provide erosion protection and prevent sediment transport.	During Construction/ Post Construction
Loading Docks	Property Owner/ POA/ Tenants	Sweep and clear debris from dock areas to remove potential stormwater contaminates prior to anticipated storms. Litter control and clean up procedures are required to reduce the amount of pollutants.	Weekly
BioClean Modular Wetland System (1 EA)	Property Owner/ POA	Remove trash from screening device, remove sediment from separation chamber, replace cartridge filter media, replace drain down filter media, trim vegetation. Refer to manufacturer's maintenance plan.	Prior to the start of the rainy season which begins Oct 1st, at the end of the rainy season (May), and Twice Annually/ Follow Manufactures Maintenance Plan

EBARA Submersible Sump/Drainage Pump (2 EA)	Property Owner/POA	Remove accumulated trash and wipe off water and dirt. Refer to manufacturer's maintenance plan.	Quarterly and within 48 hours following a significant storm event
Contech Underground CMP Detention System (1 EA)	Property Owner/POA	Cleaning of accumulated trash, debris, and sediment as determined by inspections. Cleaning is recommended during dry weather. Systems should be cleaned when inspection reveals that accumulated sediment or trash is clogging the discharge orifice. See manufacturer recommendations for additional maintenance activities.	Quarterly and after a significant storm event to verify there is no standing water in the chambers
BioClean Catch Basin Filter Inserts (20 EA)	Property Owner/POA	Visually inspect filter for debris buildup. Removal can be accomplished by vac-truck or other equally effective method. See manufacturer recommendations for additional maintenance activities.	Quarterly and within 48 hours following a significant storm event

Required Permits

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

- Permits for connection to sanitary sewer
- Permits from California Department of Fish and Game
- Encroachment permits

If no permits are required, a statement to that effect should be made.

Responsible Party

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 LID Plan. The contact information for the entity responsible is below:

Name: ______________________________

Company: ______________________________

Title: ______________________________

Address 1: ______________________________

Address 2: ______________________________

Phone Number: ______________________________

Email: ______________________________

Forms to Record BMP Implementation, Maintenance, and Inspection

The form that will be used to record implementation, maintenance, and inspection of BMPs is attached. All records must be made available for review upon request.

RECORD OF BMP IMPLEMENTATION, MAINTENANCE, AND INSPECTION

Today's Date: ______________________________

Name of Person Performing Activity (Printed): ______________________________

Signature: ______________________________

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

PRE-2: Catch Basin Insert Fact Sheet

Catch basin inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris and may include sorbent media (oil absorbent pouches) to remove floating oils and grease. Catch basin inserts are selected specifically based upon the orientation of the inlet and the expected sediment and debris loading.

Also known as:
- *Drop Inlet Filters*
- *Catch Basin Filters*

Catch Basin Insert (DrainPac™)

Opportunity Criteria

- Catch basin inserts come in such a wide range of configurations that it is practically impossible to generalize the expected performance. Inserts should mainly be used for catching coarse sediments and floatable trash and are effective as pretreatment in combination with other types of structures that are recognized as water quality treatment BMPs. Trash and large objects can greatly reduce the effectiveness of catch basin inserts with respect to sediment and hydrocarbon capture.
- Catch basin inserts are applicable for drainage area that include parking lots, vehicle maintenance areas, and roadways with catch basins that discharge directly to a receiving water.

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 of catch basin inserts.

☐ Catch basin inserts can be installed with specific media for pollutants of concern.

Proprietary Manufacturer / Supplier Websites

- Table XIV.2 is a list of manufacturers that provide catch basin inserts. The inclusion of these manufacturers does not represent an endorse of their products. Other devices and manufacturers may be acceptable for pretreatment.

Table XIV.2: Proprietary Catch Basin Insert Manufacturer Websites

Device	Manufacturer	Website
AbTech Industries Ultra-Urban Filter™	AbTech Industries	www.abtechindustries.com
Aquashield Aqua-Guardian™ Catch Basin Insert	Aquashield™ Inc.	www.aquashieldinc.com
Bowhead StreamGuard™	Bowhead Environmental & Safety, Inc.	http://www.shopbowhead.com/
Contech® Triton Catch Basin Filter™	Contech® Construction Products Inc.	www.contech-cpi.com
Contech® Triton Curb Inlet Filter™	Contech® Construction Products Inc.	www.contech-cpi.com

Table XIV.2: Proprietary Catch Basin Insert Manufacturer Websites

Device	Manufacturer	Website
Contech® Triton Basin StormFilter™	Contech® Construction Products Inc.	www.contech-cpi.com
Contech® Curb Inlet StormFilter™	Contech® Construction Products Inc.	www.contech-cpi.com
Curb Inlet Basket	SunTree Technologies Inc.	www.suntreetech.com
Curb Inlet Grates	EcoSense International™	http://www.ecosenseint.com/
DrainPac™	United Storm Water, Inc.	http://www.unitedstormwater.com
Grate Inlet Skimmer Box	SunTree Technologies Inc.	www.suntreetech.com
KriStar FloGard+PLUS®	KriStar Enterprises Inc.	www.kristar.com
KriStar FloGard®	KriStar Enterprises Inc.	www.kristar.com
KriStar FloGard LoPro Matrix Filter®	KriStar Enterprises Inc.	www.kristar.com
Nyloplast Storm-PURE Catch Basin Insert	Nyloplast Engineered Surface Drainage Products	www.nyloplast-us.com
StormBasin®	FabCo® Industries Inc.	www.fabco-industries.com
Stormdrain Solutions Interceptor	FabCo® Industries Inc.	www.fabco-industries.com
Stormdrain Solutions Inceptor®	Stormdrain Solutions	www.stormdrains.com
StormPod®	FabCo® Industries Inc.	www.fabco-industries.com
Stormwater Filtration Systems	EcoSense International™	http://www.ecosenseint.com/
Ultra-CurbGuard®	UltraTech International Inc.	www.spillcontainment.com
Ultra-DrainGuard®	UltraTech International Inc.	www.spillcontainment.com
Ultra-GrateGuard®	UltraTech International Inc.	www.spillcontainment.com
Ultra-GutterGuard®	UltraTech International Inc.	www.spillcontainment.com
Ultra-InletGuard®	UltraTech International Inc.	www.spillcontainment.com

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

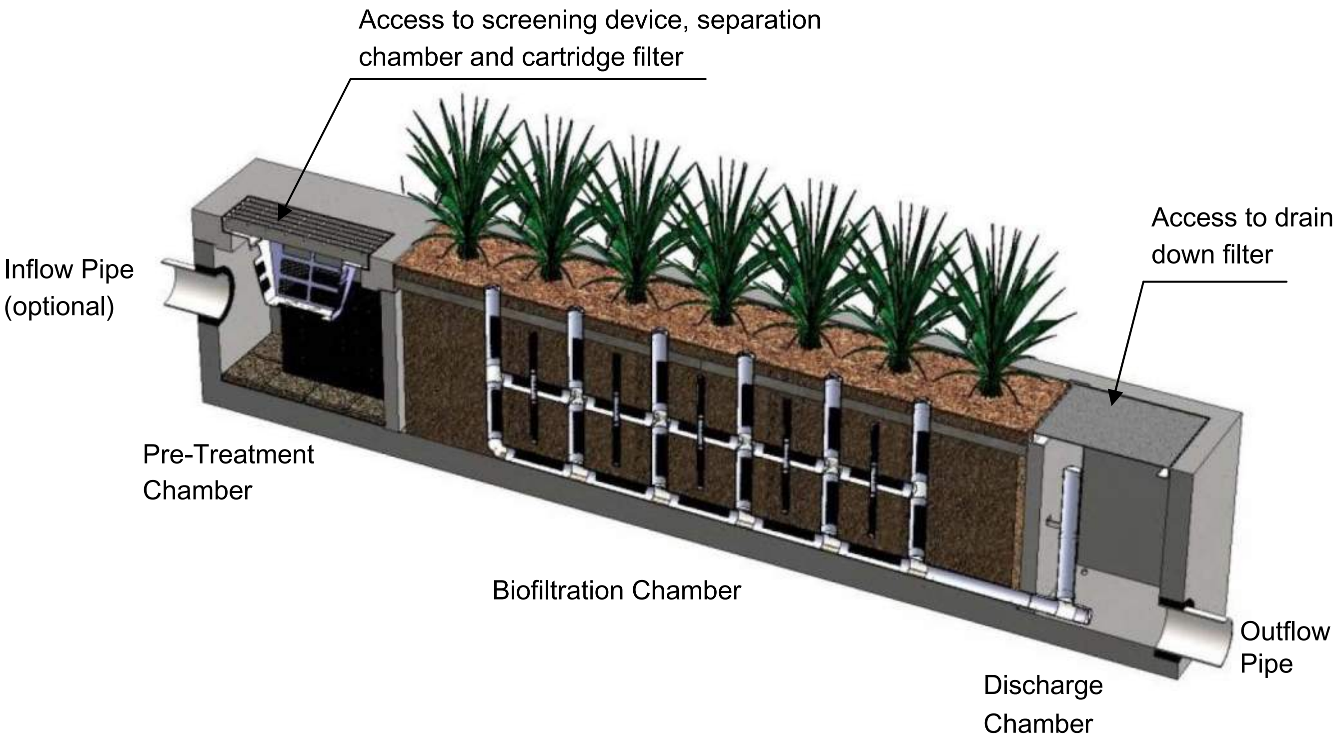
- Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: **http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850**
- Los Angeles County Stormwater BMP Design and 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**

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.

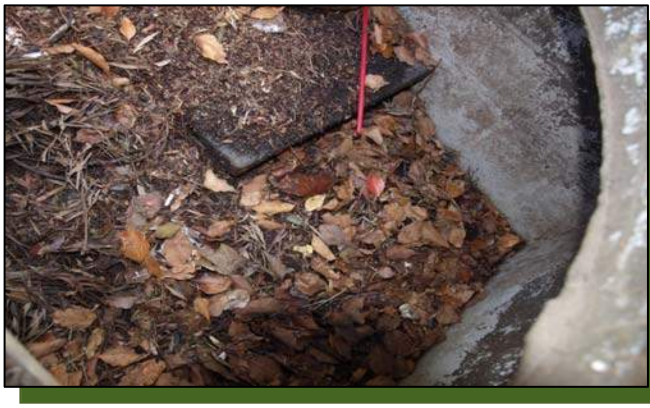
Maintenance Procedure Illustration

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.

<u>Trim Vegetation</u>

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

Inspection Form

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

www.modularwetlands.com

Inspection Report
Modular Wetlands System

Project Name ______________________________

Project Address ______________________________
(city) (Zip Code)

Owner / Management Company ______________________________

Contact ______________________ Phone ( ) –

Inspector Name ______________________ Date ___/___/_____ Time __________ AM / PM

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

Weather Condition ______________________ Additional Notes ______________________

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

Inspection Checklist

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

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

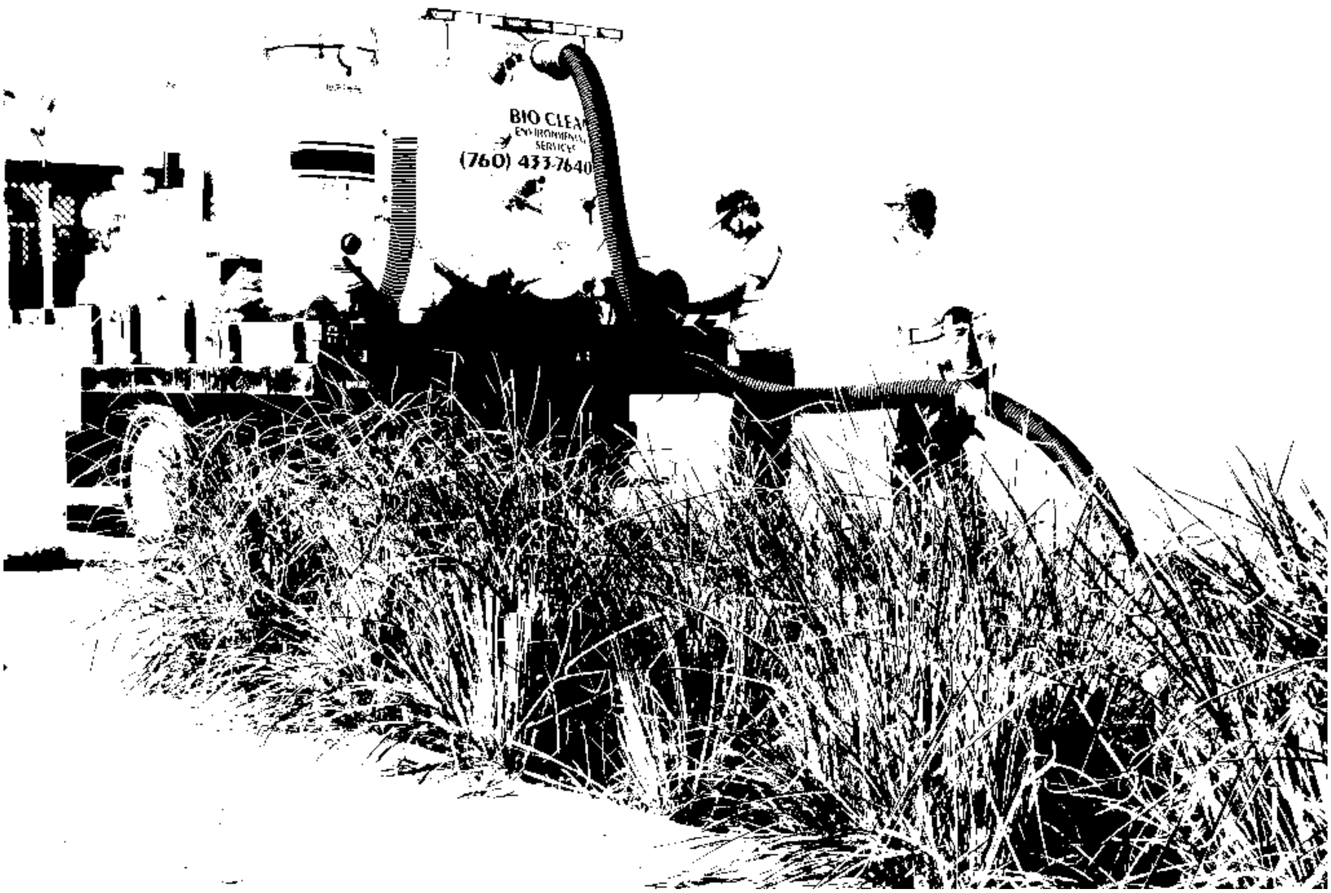
Waste:	Yes	No
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

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

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: ______________________________

Maintenance Report



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

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

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

Project Name ____________________

Project Address ____________________ (city) (Zip Code)

Owner / Management Company ____________________

Contact ____________________ Phone (   )   –

Inspector Name ____________________ Date ____ / ____ / ______ Time ________ AM / PM

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

Weather Condition ____________________ Additional Notes ____________________

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:

Contech® CMP Detention Inspection and Maintenance Guide

Underground stormwater detention and infiltration systems must be inspected and maintained at regular intervals for purposes of performance and longevity.

Inspection

Inspection is the key to effective maintenance of CMP detention systems and is easily performed. Contech recommends ongoing, annual inspections. Sites with high trash load or small outlet control orifices may need more frequent inspections. The rate at which the system collects pollutants will depend more on-site specific activities rather than the size or configuration of the system.

Inspections should be performed more often in equipment washdown areas, in climates where sanding and/or salting operations take place, and in other various instances in which one would expect higher accumulations of sediment or abrasive/corrosive conditions. A record of each inspection is to be maintained for the life of the system.

Maintenance

CMP detention systems should be cleaned when an inspection reveals accumulated sediment or trash is clogging the discharge orifice. Accumulated sediment and trash can typically be evacuated through the manhole over the outlet orifice. If maintenance is not performed as recommended, sediment and trash may accumulate in front of the outlet orifice. Manhole covers should be securely seated following cleaning activities. Contech suggests that all systems be designed with an access/inspection manhole situated at or near the inlet and the outlet orifice. Should it be necessary to get inside the system to perform maintenance activities, all appropriate precautions regarding confined space entry and OSHA regulations should be followed.

Annual inspections are best practice for all underground systems. During this inspection if evidence of salting/de-icing agents is observed within the system, it is best practice for the system to be rinsed, including above the spring line soon after the spring thaw as part of the maintenance program for the system.

Maintaining an underground detention or infiltration system is easiest when there is no flow entering the system. For this reason, it is a good idea to schedule the cleanout during dry weather.

The foregoing inspection and maintenance efforts help ensure underground pipe systems used for stormwater storage continue to function as intended by identifying recommended regular inspection and maintenance practices. Inspection and maintenance related to the structural integrity of the pipe or the soundness of pipe joint connections is beyond the scope of this guide.

CMP DETENTION SYSTEMS

ENGINEERED SOLUTIONS

CMP MAINTENANCE GUIDE 10/19 PDF

Model EPD, Optima

PRO Drainer™

Submersible Sump/Drainage Pump

Operating Instructions, Installation & Maintenance Manual

***Note:** UL and CSA listed; Model Optima UL certified only.*

EBARA Fluid Handling EBARA International Corporation

Thank you for purchasing this EBARA Stainless Steel Sump Pump. We hope you are pleased with your purchase and that our pumps will provide you with long service life and exceptional performance.

To ensure satisfactory service life, there are several considerations regarding proper installation, operation and power source. Please review the recommendations outlined within the installation and operation manual.

Please contact your supplier (supplying dealer or contractor) if service is necessary or if you have any questions or need further assistance.

Please retain the following information for your records and to help expedite service:

Purchase Date: ______________________________

Purchased From: ______________________________

____

Serial No: ______________________________
(Located on the pump nameplate)

Note: For assistance locating the serial number and name plate, please refer to page 17 of your owner's manual.

EBARA Fluid Handling **www.pumpsebara.com**
1651 Cedar Line Drive • Rock Hill, SC 29730 • (803) 327-5005 • (803) 327-5097 *(fax)*

Important Safeguards

To reduce risk of injury, ***always*** follow these instructions and safety precautions when using this pump and to maintain warranty.

Read All Instructions Prior to Installation

(SAVE THESE INSTRUCTIONS)

Installation/Operation:

- Never lift or carry pump by the electrical cord. Use a chain or rope affixed on handle to install/remove pump. To reduce potential damage to the pump from inadvertent lifting by the electrical cord, please refer to “Proper Lifting” located on the following page.
- Pump(s) are able to operate whether fully or partially submerged (*please refer to Typical Installation Diagram, page 14*). Pump must be shutdown if sump, pit or pond level drops below the motor housing.
- Pump is designed to pump clean water (maximum temperature of 122°F) with suspended solids up to 3/8 of an inch. Larger solids will clog the suction strainer plate leading to dry running and subsequent failure (***Note:*** *Pumping sand, gravel, and other hard debris will shorten the life of the pump)*. Elevate the pump with bricks or other support above the sump, pit or pond bottom if debris is present. Consult dealer for other fluids.
- Clean filter basin when cleaning inlet filter media when pump is shutdown.
- If used with a float switch, the float must have a full range of motion to operate properly without obstruction. Consult dealer for minimum dimensions required for proper float operation.
- Pump should be mounted upright only (vertical). Never lay the pump on its side.

Electrical Requirements:

- Pump must be operated with a GFI breaker of at least 20 amps.
- High OR Low Voltage can damage the pump. Power from your utility or generator set cannot be more or less than ±5% of the rated voltage on the pump.
- Maximum distance from power source and pump must not exceed 100 feet using 16/3 electrical cables. This distance is from the breaker box and includes the pump cord. If the run is longer, consult a qualified electrician or your dealer.
- Lightning strikes can destroy the capacitor in your pump. Ensure proper protection is provided.
- Consult operator manual for other operation and application information.

Important Safeguards

Proper Lifting:

A separate chain or rope should be attached to the handle for normal lifting.

Please note that this will help prevent damage due to inadvertent lifting of the pump by the power cord.

Rope attached to automatic pump for lifting and installation.

Rope attached to manual pump for lifting and installation.

Contents

General Application Information

The Sump and Installation

If your basement does not currently have a sump installed, it would be necessary to check local plumbing codes as to the acceptable type of sump that may be used. Materials commonly specified are: clay tile, fiberglass, steel, concrete and polyethylene. It may be necessary to cut a hole in the basement floor and excavate for the sump. Plumbing and electrical contractors could advise you on proper installations of drain tiles, sump, pump and electrical service. EBARA recommends that a solid sump base be provided. The sump is fed by drain tile placed around the outside and/or inside basement walls at the footings. In applications where a gravel base must be used to relieve hydraulic pressure under the basement floor, be sure to provide a permanent and solid base for the pump (bricks or a steel plate). A sump cover capable of supporting 200 pounds should be employed to contain odors and for obvious safety reasons.

Electrical Installation

Electrical service for any sump pump installation must be grounded and separately fused or breakered directly from the entrance box with a single grounding type receptacle at the pump. The receptacle should not be less than four feet above the basement floor for

General Application Information *(cont.)*

safety reasons. You should never touch a sump pump or discharge piping while the pump is connected to electrical power and water is present. The pump should be disconnected from the electrical source before handling in all cases.

Discharge Piping Installation

To assure the maximum performance from your sump pump, the discharge pipe size and piping fittings should not be smaller than the discharge port of the pump. Smaller pipe will add to friction losses and reduce the capacity of the pump. Normally accepted materials are galvanized pipe, rigid plastic pipe or acceptable flexible pipe or hose. A piece of flexible hose between the pump discharge and the discharge piping will provide for ease in alignment, reduce vibration and noise, and will act as a union when it is necessary to remove the pump. Where the discharge pipe is long, a check valve is often employed to prevent the water from flowing back into the sump when the pump turns off. If the discharge is directed into a sanitary sewer, a suitable anti-siphon device or a free flow check valve should be inserted in the line to prevent backflow into the pit. Sump pumps are not designed to handle raw sewage. Do not attempt to adapt one for this type of application. A sewage ejector pump especially designed to handle solids must be used.

Pump Installation

When the sump, electrical and discharge plumbing installation is complete and ready for the pump, clean all solid debris from the pit. Complete the plumbing connection to the pump and then plug the pump into the electrical outlet. A few extra minutes to test the sump pump installation are now in order. Fill the sump with water, note the turn on and turn off level of the pump, and the pumping cycle. This will allow you to calculate the approximate discharge flow of the pump system. If everything is operating properly, install the sump cover.

Pump Selection

The pump should be of sufficient capacity and head to satisfy anticipated use requirements. Capacity is determined by a fixture unit value if effluent is drained to sump basin. Your local Wholesaler can assist you in fixture unit values.
Basement perimeter water intrusion varies by area and region. Typically a 1/3 HP or 1/2 HP DRAINAGE PUMP WILL EVACUATE MOST HOME SUMP PITS.
Commercial and industrial drainage applications require that calculations of pumping volume and pumping head be performed to determine the proper size pump is applied.
NOTE: Pumping volume may vary seasonally due to rainfall and area run-off.

General Application Information *(cont.)*

Basin and Cover

The basin should not be less than 18 inches in diameter and 24 inches deep.
Larger diameters are advisable in instances of increased pump capacity requirements:

Required Pump Capacity	Minimum Basin Diameter
up to 35 GPM	18"
over 35 GPM	24"
over 60 GPM	30"
over 100 GPM	36"
over 150 GPM	48"

The basin should be located such that all water flows into the basin due to gravity. Outdoor installations should be at a sufficient depth to ensure protection from freezing.

Note: Optima-3SS1 and EPD-3SS1 slimline automatic can operate in a 12" diameter basin or 8" x 8" square basin.

Maintenance Tips

- **Every three or four months:**
  1) Clean the pump screen or inlet opening. If your sump collects the discharge from an automatic washing machine, cleaning will be required more often. (Before removing the pump be sure to disconnect the unit from electrical power; and reconnect after completion of cleaning);
  2) Pour enough water into the sump to cycle the pump and assure its proper functioning.
- **Annually:**
  Remove and clean the pump. Clean the sump pit also.

Safety Information and Introduction

⚠ WARNING

Before handling this pump, always disconnect the power first.

This pump should only be serviced by a qualified person or a factory trained person.

⚠ CAUTION

This instruction manual includes necessary items for installation, operation and maintenance. Read this manual carefully to ensure correct installation, operation and maintenance.

Be sure to keep this instruction manual on hand for future reference.

Specifications

⚠ CAUTION

Be careful not to exceed the given specifications in the use of your products.

Check the nameplate for your pump's head (HEAD), discharge volume (CAPACITY), speed (SPEED), motor voltage and current. Other specifications are noted in the chart below:

ITEM NO.	MODEL	DISCHARGE	MOTOR	MOTOR		WEIGHT
MANUAL OPERATION		DIA. INCH	OUTPUT (HP)	PHASE	VOLTAGE	
Optima-3MS1	32Z707U6.3S/A	1 1/4	1/3	1	115	11
EPD-3MS1	32P707U6.3S/A	1 1/4	1/3	1	115	11
EPD-5MS1	40P707U6.6S	1 1/2	1/2	1	115	27
EPD-5MT2	40P707U6.62	1 1/2	1/2	3	230	27
EPD-5MT4	40P707U6.64	1 1/2	1/2	3	460	27
EPD-7MS1	40P707U6.9S	1 1/2	3/4	1	115	28
EPD-7MT2	40P707U6.92	1 1/2	3/4	3	230	28
EPD-7MT4	40P707U6.94	1 1/2	3/4	3	460	28
EPD-10MT2	40P707U61.12	1 1/2	1	3	230	31
EPD-10MT4	40P707U61.14	1 1/2	1	3	460	31
EPD-15MT2	40P707U61.32	1 1/2	1 1/2	3	230	31
EPD-15MT4	40P707U61.34	1 1/2	1 1/2	3	460	31

20 FT POWER CORDS – AVAILABLE ON MOST MODELS

ITEM NO.	MODEL	DISCHARGE	MOTOR	MOTOR		WEIGHT
AUTOMATIC OPERATION		DIA. INCH	OUTPUT (HP)	PHASE	VOLTAGE	
Optima-3AS1	32Z707AU6.3S/A	1 1/4	1/3	1	115	11
EPD-3AS1	32P707AU6.3S/A	1 1/4	1/3	1	115	11
EPD-5AS1	40P707AU6.6S	1 1/2	1/2	1	115	27
EPD-7AS1	40P707AU6.9S	1 1/2	3/4	1	115	27

20 FT POWER CORDS – AVAILABLE ON MOST MODELS

ITEM NO.	MODEL	DISCHARGE	MOTOR	MOTOR		WEIGHT
SLIMLINE AUTOMATIC OPERATION		DIA. INCH	OUTPUT (HP)	PHASE	VOLTAGE	
Optima-3SS1	32Z707SU6.35S/A	1 1/4	1/3	1	115	11
EPD-3SS1	32P707SU6.35S/A	1 1/4	1/3	1	115	11

20 FT POWER CORDS – AVAILABLE ON MOST MODELS

Tools Needed

- Screw driver
- Pipe wrench
- Adjustable wrench (medium-large)
- Hacksaw with 24-tooth blade for cutting plastic pipe
- Knife or round file for smoothing inside of all plastic pipe connections

Materials Needed

- PVC or ABS pipe cement *(read manufacturer's instructions carefully)*
- PVC or ABS pipe;
  – $1\frac{1}{4}$" for Optima-3 & EPD-3
  – $1\frac{1}{2}$" for EPD-5,7,10 & 15
- PVC adapter
  – $1\frac{1}{4}$" for Optima-3 & EPD-3
  – $1\frac{1}{2}$" for EPD-5, 7, 10 & 15
- In line check valve
- Sump basin 18" or larger diameter plastic, fiberglass or concrete.
  (See page 2 for minimum diameter basin size by pump capacity.)
- Optional: gate valve
  (see installation drawing on page 6)

Installation Instructions

Step 1 Inspection: Your pump has been carefully packaged to prevent damage during shipping. However, occasional damage does occur due to rough handling. Carefully inspect the pump for damage that could cause it to fail.

Step 2: Attach desired length of PVC or ABS discharge pipe to pump outlet, using PVC adapter ($1\frac{1}{4}$" pipe and adapter for Optima-3 & EPD-3 $1\frac{1}{2}$" for EPD-5, 7, 10 & 15). Make sure open end of pipe will be above top of basin.

Step 3: Clear sump basin of any water, debris or sediment.

Step 4: Lower pump into basin.

Step 5: Attach in line check valve to discharge pipe 12" to 18" above pump discharge with arrow pointing away from the pump (with the flow). Connect other end of check valve securely to drain pipe and tighten clamps.
Note: Do not put check valve directly into pump discharge opening.

Step 6: Drill a 1/8" relief hole in the discharge pipe 5" above pipe connection to pump.

Step 7: Plug in pump and fill sump basin with water to test unit. Pump should turn on at 13" to 14" water level. Allow pump to go through several ON-OFF cycles to assure satisfactory operation.
Note: If pump does not operate properly, see the troubleshooting checklist on page 12.

Septic Tank Installation
The PRO•DRAINER pumps can be used to pump septic tank effluent, but must be installed as follows:
- Install pump in separate compartment at the discharge side of the septic tank. Never install pump in main tank where sludge collects.
- Use with a junction box.

WARNING: Sump basin must be vented in accordance with local plumbing codes. These pumps are not designed for and CANNOT be installed in locations classified as hazardous in accordance with the National Electric Code, ANSI/NEPA 70-1984.

Electrical information – Single Phase *(Refer to page 16 for Three phase information)*

- Pumps are 115 V, 60 Hz and are grounded to prevent electrical shock.

WARNING: Risk of electric shock—this pump is supplied with a grounding conductor and grounding-type attachment plug. To reduce the risk of electric shock, be certain that it is connected only to a properly grounded, grounding-type receptacle.

- Use a separate 20 amp circuit breaker or 20 amp fuse block with the pump.
- **Do not** use an extension cord with the pump.
- **Do not** cut off the ground pin or use an adapter fitting.
- **Do not** work on the pump or switch until any or all power cords are unplugged.

IMPORTANT INSTRUCTIONS BEFORE INSTALLATION

Failure to follow these instructions may cause serious bodily injury and/or property damage.

1. Before installing or servicing your pump, BE CERTAIN pump power source is disconnected.
2. Installation and electrical wiring must adhere to state and local codes and must be complete before priming pump. Check appropriate community agencies, or contact local electrical and pump professionals.
3. **CALL AN ELECTRICIAN WHEN IN DOUBT.** Pump should be connected to a separate 20 amp circuit breaker or 20 amp fuse block. Plugging into existing outlets may cause low voltage at motor, causing blown fuses, tripping of motor overload, or burned out motor.
4. Do not connect pump to a power supply until permanently grounded. For maximum safety, ground pump to a circuit equipped with a fault interrupter device.
5. Voltage of power supply must match the voltage of the pump.
6. Before installing pump, clear sump basin of any water, debris, or sediment.

   WARNING: Sump basin must be vented in accordance with local plumbing codes. EBARA PRO•DRAINERS are not designed for and CANNOT be installed in locations classified as hazardous in the National Electric Code, ANSI/NFPA 70.
7. The sump basin should be between 18" and 24" in diameter and made of plastic, fiberglass, or concrete.
8. The following may cause severe damage to pump and will void warranty:
   - Using an extension cord.
   - Cutting off the ground pin or using an adapted fitting.
   - Working on pump or switch while plugged in.
   - Removing motor housing, unscrewing impeller, or otherwise removing impeller seal.

PIPING

Plastic PVC pipe is shown in the illustrations, but galvanized steel or copper pipe may be used if desired. All piping must be clean and free of all foreign matter to prevent clogging. Use thread compound on all threaded joints unless specified otherwise.

Submersible Pump Installation

Refer to the installation illustration on the following page for the following instructions. Be certain sump basin is clean and all power to pump is shut off. If pump fails to operate properly after installation, refer to the troubleshooting checklist on page 12 or contact EBARA.

General Materials Needed

- One can PVC cement (read instructions carefully)
- One can thread compound (read instructions carefully)
- One male PVC adapter: 1¼" for ⅓ HP; 1½" for ½, ¾, 1 & 1½ horsepower models.
- Enough rigid PVC pipe and couplings to reach from bottom of sump basin to discharge: 1¼" for ⅓ HP; 1½" for ½, ¾, 1 & 1½ horsepower models.
- One Check Valve.

Tools Needed for all pump installations:
Pipe wrench, slot screwdriver, 24-tooth hacksaw, knife or round file.

Step 1 – Thread male PVC adaptor into pump discharge opening.

Step 2 – Cement a 15" piece of PVC pipe to adaptor. Use appropriate diameter piping. Drill a 1/8" relief hole in the pipe 5" above pump connection. This hole prevents pump from air-locking.

Step 3 – Clamp Check Valve to top of 15" PVC pipe with water flow arrow pointing away from pump.

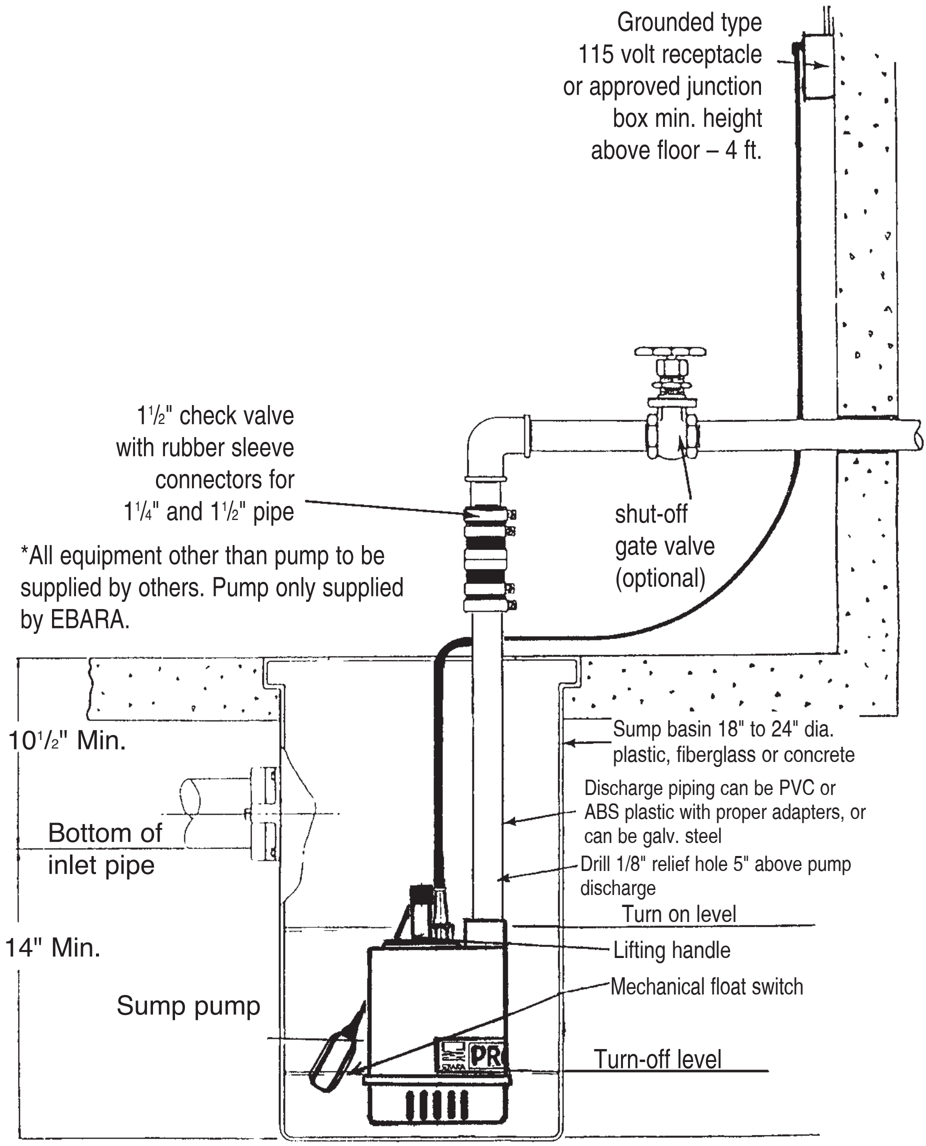
Step 4 – Lower pump into basin. Clamp needed PVC discharge pipe and fittings to open end of Check Valve.

Step 5 – Plug in pump and fill sump basin with water. Pump should turn on at 13" to 14" water level. Perform several ON-OFF cycles to assure satisfactory operation.

Performance Table (Capacity in Gallons per Minute)

ITEM NO \ TOTAL HEAD		5	10	15	20	25	30	35	40	45	50	55
Optima-3 1/3 HP	GPM	40	33	25	14							
EPD-3 1/3 HP	GPM	45	38	31	20	7						
EPD-5 1/2 HP	GPM		66	67	49	40	29	17				
EPD-7 3/4 HP	GPM				63	54	45	35	25	14		
EPD-10 1 HP	GPM				74	65	56	46	36	26	15	
EPD-15 1½ HP	GPM				85	77	68	58	48	38	26	15

PRO Drainer Submersible (Typical) Installation Diagram

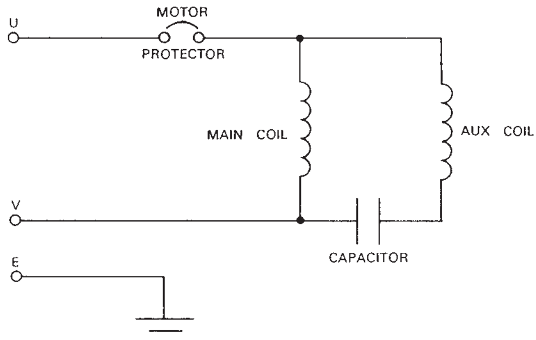


Note: Optima-3SS1 and EPD-3SS1 slimline automatic can operate in a 12'' diameter basin or 8'' x 8'' square basin.

Motor Wiring Diagram

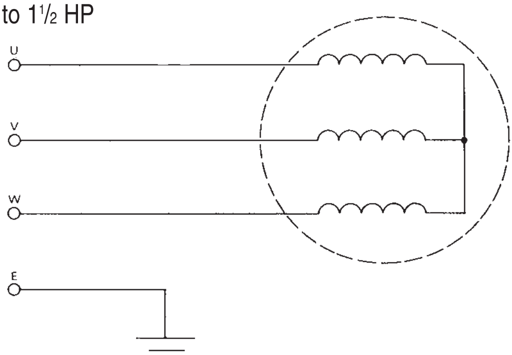
Manual Operation Type Output (Single Phase)

- Output 1/3 to 3/4 HP



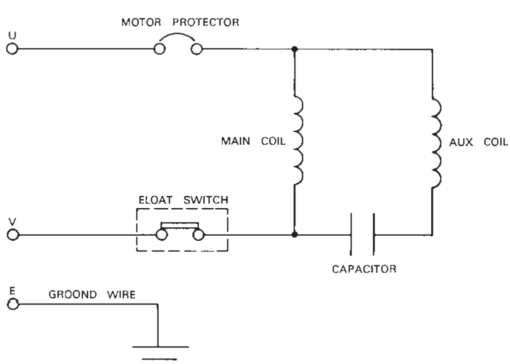
Manual Operation Type Output (Three Phase)

- Output 1/2 to 1 1/2 HP



Automatic Operation Type Output (Single Phase)

- Output 1/3 to 3/4 HP



Electrical Wiring – Three Phase

⚠ WARNING

Check that the power is locked off and disconnected before working on pump. All electric work should be performed by a qualified electrician and all national and local electrical codes must be observed.

(1) Wiring
  a) Wire as indicated for the appropriate start system as shown in Fig. 4
  b) Loose connections will stop the pump. Make sure all electrical connections are secure.

MOTOR WIRING DIAGRAM

- Model P707U
- Output $^1/_2$ to $1^1/_2$ HP

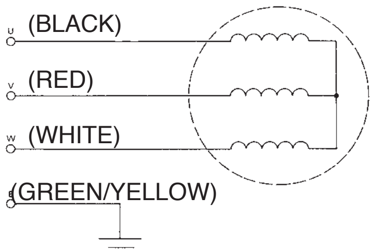


Fig. 4

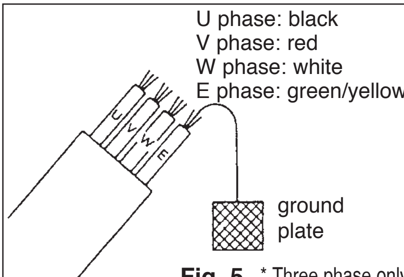


Fig. 5 * Three phase only

NOTE:

Use with approved motor control that matches motor input in full load amperes with overload element(s) selected or adjusted in accordance with control instructions.

Utiliser un démarreur approuvé convenant au courant á pleine charge du moteur et dont les éléments thermiques sont réglés ou choisis conformément aux instructions qui l'accompagnent.

(2) Cable
  a) Never let the end of the cable contact water.
  b) If the cable is extended, do not immerse the splice in water.
  c) Fasten the cable to the discharge piping with tape or vinyl strips.
  d) Install the cable so that it will not overheat. Overheating is caused by coiling the cable and exposing it to direct sunlight.

(3) Grounding
  As shown in Fig. 5 ground the green/yellow wire (label E). Under no circumstances should the green/yellow wire be connected to the power supply.

(4) Use short circuit breakers to prevent danger of electrical shock.

OPERATION

1. Before starting the pump:

(1) Check water level.

SPECIAL NOTICE

for Cord Connected Pumps

EBARA EPD / Optima PRO Drainer pumps are NOT designed for and **CANNOT be installed** in any location classified as ***hazardous*** by the National Electric Code ANSI/NFPA 70.

- Connection devices shall provide for a watertight connection to the power supply and provide adequate strain relief for the cord.
- Installation of the box shall be a Listed watertight connection box used with a Listed, liquid-tight fitting suitable for the cord.
- Connection boxes should be sized in accordance with National Electric Code specifications and installed as intended for the application.
- All connection devices are to be provided by the installer.
- Only qualified personnel shall service and install the pump.

Specifications

Model **Optima-3AS1**
EPD-3AS1
Optima-3SS1
EPD-3SS1
EPD-5AS1 and EPD-7AS1

Automatic Operation Pumps Performance: ISO 2548

	Standard	Optional
Discharge Size	1/3 HP – 1 1/4 inch 1/2 HP and 3/4 HP – 1 1/2 inch	
Range of HP	1/3, 1/2, and 3/4 HP	
Range of Performance	Capacity 2.7 to 72 GPM Head 9.3 to 57 feet	
Limitation Maximum Water Temperature	122°F/50°C	
Solids	3/8" Spherical (2% by concentration)	
Speed	3600 RPM	
Materials		
Casing	304L Stainless Steel	
Impeller	304L Stainless Steel*	
Shaft	303 Stainless Steel	
Motor Frame	304L Stainless Steel	
Fasteners	304L Stainless Steel	
Shaft Seal (Double)**		
Material – Upper Side	NBR Fitted Carbon/Ceramic 1/2, 3/4, 1, and 1 1/2 HP	
Material – Lower Side	NBR Fitted SiC/SiC 1/2, 3/4, 1, and 1 1/2 HP	
Impeller Type	Semi-Open	
Bearing	Sealed Ball Bearing	
Motor	Air-filled, Insulation Class F, 2 Pole, Rated Continuous Duty– Permanent Split Capacitor	
Single Phase	115 Volt	
Motor Protection	Built-in Motor Protection with Auto Reset	
Power Cord	UL/CSA SJTow-A with ECS No. 250 capplug with grounding pin – 20 Ft. Length Rated 15 Amp 125V – NEMA 5-15P	
Automatic Float Switch	Mechanical Float	

* ITEM NO. Optima-3AS1 – Impeller material is Thermo Plastic-Noryl GFN2

** Optima-3 & EPD-3 – 1/3 HP Shaft Seal is single mechanical seal (lower side) and 1 lip seal (upper side)
– Mechanical Seal material: Carbon/Ceramic/FPM

Specifications

Model Optima-3MS1
EPD-3MS1
EPD-5 to 15

Manual Operation Pumps Performance: ISO 2548

	Standard	Optional
Discharge Size	1/3 HP – 1 1/4 inch 1/2 HP through 1 1/2 HP – 1 1/2 inch	
Range of HP	1/3, 1/2, 3/4, 1, and 1 1/2 HP	
Range of Performance	Capacity 2.7 to 86 GPM Head 9.3 to 61 feet	
Limitation		
Maximum Water Temperature	122°F/50°C	
Solids	3/8" Spherical	
Speed	3600 RPM	
Materials		
Casing	304L Stainless Steel	
Impeller	304L Stainless Steel*	
Shaft	303 Stainless Steel	
Motor Frame	304L Stainless Steel	
Fasteners	304L Stainless Steel	
Shaft Seal (Double)**		
Material – Upper Side	NBR Fitted Carbon/Ceramic 1/2, 3/4, 1, and 1 1/2 HP	
Material – Lower Side	NBR Fitted SiC/SiC 1/2, 3/4, 1, and 1 1/2 HP	
Impeller Type	Semi-Open	
Bearing	Sealed Ball Bearing	
Motor	Air-filled, Insulation Class F, 2 Pole, Rated Continuous Duty–Permanent Split Capacitor	
Single Phase	115 V	
Three Phase	230V or 460V	
Motor Protection†	Built-in Motor Protection with Auto Reset (Single Phase Only)	
Power Cord		
Single Phase	UL/CSA SJTOW-A with ECS No. 250 cap plug with grounding pin – 20 Ft. Length Rated 15 Amp 125V – NEMA 5-15P	
Three Phase	UL/CSA STOW-A water resistant, stripped end jacket removed 2" and conductor stripped 5/8" – 20 Ft. length	

* ITEM NO. Optima-3AS1 – Impeller material is Thermo Plastic-Noryl GFN2

** Optima-3 & EPD-3 – 1/3 HP Shaft Seal is single mechanical seal (lower side) and 1 lip seal (upper side)
– Mechanical Seal material: Carbon/Ceramic/FPM

† Three Phase models require user to provide motor protection

Nameplate & Model No./Item No. Explanation

NAME PLATE

EBARA PUMP			
No. (Serial Number) ①			
Model ②			
CAP.	USGPM	③	⑤
HEAD	FT	④	⑥
⑦ PHASE INDUCTION MOTOR			
⑧ kW	⑨ HP	60 Hz	
⑩	V	⑪	A
POLE 2	INS. CLASS F	MAX. AMB. 122° F	
MOTOR MODEL ⑫			
EBARA INTERNATIONAL CORPORATION ROCK HILL, SOUTH CAROLINA			

EBARA

EPD SERIES PRO•DRAINER

ITEM No. DESIGNATION:

EXAMPLE: EPD 3 M S 1

- EPD – EBARA PUMP TYPE
- 3 – HORSEPOWER
  - 3 = 1/3 HP
  - 5 = 1/2 HP
  - 7 = 3/4 HP
  - 10 = 1 HP
  - 15 = 1½ HP
- M
  - M – MANUAL
  - A – AUTOMATIC
  - S – SLIMLINE AUTOMATIC
- S
  - S – SINGLE PHASE
  - T – THREE PHASE
- 1
  - 1 = 115 VOLT
  - 2 = 230 VOLT
  - 4 = 460 VOLT

MODEL No. DESIGNATION:

EXAMPLE: 32 Z707 A U 6.3 S

- 32 – OUTLET DIA. IN MM
  - 32 MM – 1¼ INCH
  - 40 MM – 1½ INCH
- Z707 – MODEL
  - P707
  - Z707
- A
  - A: AUTOMATIC
  - NON: MANUAL
  - S: SLIMLINE AUTOMATIC
- 6.3
  - 6.3 : 60HZ – 1/3 HP
  - 6.6 : 60HZ – 1/2 HP
  - 6.9 : 60HZ – 3/4 HP
  - 61.1 : 60HZ – 1 HP
  - 61.3 : 60HZ – 1½ HP
- S

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫
Optima-3MS1	32Z707U6.3S/A	40	5	5	23	1	0.3	1/3	115	4	SM
Optima-3AS1	32Z707AU6.3S/A										SA
Optima-3SS1	32Z707SU6.3S/A										
EPD-3MS1	32P707U6.3S/A	45	5	5	25						SM
EPD-3AS1	32P707AU6.3S/A										SA
EPD-3SS1	32P707SU6.3S/A										
EPD-5MS1	40P707U6.6S	73	10	40	30		0.6	1/2		9	SM
EPD-5AS1	40P707AU6.6S										SA
EPD-5MT2	40P707U6.62					3			230	3.1	SM
EPD-5MT4	40P707U6.64								460	1.55	SM
EPD-7MS1	40P707U6.9S	58.5	30	16	50	1	0.9	3/4	115	12.0	SM
EPD-7AS1	40P707AU6.9S										SA
EPD-7MT2	40P707U6.92					3			230	3.8	SM
EPD-7MT4	40P707U6.94								460	2	SM
EPD-10MT2	40P707U61.12	83.5	20	27	50		1.1	1	230	4.8	SM
EPD-10MT4	40P707U61.14								460	2.5	SM
EPD-15MT2	40P707U61.32	81.5	30	42	50		1.3	1½	230	5.3	SM
EPD-15MT4	40P707U61.34								460	2.7	SM

Troubleshooting Checklist

PROBLEM	POSSIBLE CAUSES
Pump does not run or hums.	• Line circuit breaker is off, or fuse is blown or loose. • Water level in sump has not reached turn-on level as indicated in installation drawing. • Pump cord is not making contact in receptacle. • Float is stuck. It should operate freely in basin. • If all of the above are OK, then the motor winding may be open.
Pump runs but does not deliver water.	• Check valve is installed backwards. Arrow on valve should point in direction of flow. • Discharge shut-off valve (if used) may be closed. • Pump is air-locked. Start and stop several times by plugging and unplugging cord. Check for clogged vent hole in pump case. • Impeller or volute openings are fully or partially clogged. Remove pump and clean. • Inlet holes in pump base are clogged. Remove pump and clean the openings. • Vertical pumping distance is too high. Reduce distance or resize pump.
Pump runs and pumps out sump, but does not stop.	• Float is stuck in up position. Be sure float operates freely in basin. • Defective float switch.
Pump runs but delivers only a small amount of water.	• Pump is air-locked. Start and stop several times by plugging and unplugging cord. Check for clogged vent hole in pump case. • Vertical pumping distance is too high. Reduce distance or resize pump. • Inlet holes in pump base are clogged. Remove pump and clean the openings. • Impeller or volute openings is fully or partially clogged. Remove pump and clean.
Fuse blows or circuit breaker trips when pump starts.	• Pump impeller is partially clogged with tar or paint, causing motor to run slow and overload. Remove pump and clean. • Pump impeller is partially clogged with tar or paint, causing motor to run slow and overload. Remove pump and clean. • Motor stator may be defective. • Fuse size or circuit breaker may be too small. • Impeller or volute openings are fully or partially clogged. Remove pump and clean.
Motor runs for a short time, then stops.	• Inlet holes in pump base are clogged. Remove pump and clean the openings. • Pump impeller is partially clogged with tar or paint, causing motor to run slow and overload. Remove pump and clean. • Motor stator may be defective. • Impeller or volute openings are fully or partially clogged. Remove pump and clean.

Maintenance and Service

WARNING: Pump warranty becomes void if you remove motor housing, unscrew impeller, or otherwise remove impeller seal.
If pump does not operate properly, follow the steps shown under Troubleshooting.
For any work on pump or switch, always unplug power cord(s). Do not just turn off circuit breaker or unscrew fuse.

Cleaning float

If pump becomes inoperative because of trash accumulation on the float, remove pump from sump and clean float switch.
Wipe all water and dirt from the pump and float switch.
Be sure float switch operates freely after cleaning.

Cleaning impeller and volute case

Remove screws that hold lower base to housing.
CAUTION: Do not remove motor housing or unscrew impeller. Use screwdriver to pry base from housing. Pry in several places.
Be sure impeller turns freely after cleaning. Clean out holes in the pump base and wash thoroughly before replacing.

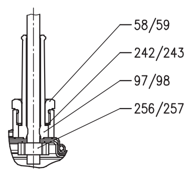
Manufacturing Year and Month

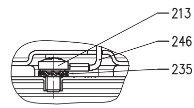
YEAR	INDICATION
2002	C
2003	D
2004	E
2005	F
2006	G
2007	H
2008	J
2009	K
2010	L
2011	M
2012	N
2013	O
2014	P
2015	Q

MONTH	INDICATION
JAN.	1
FEB.	2
MAR.	3
APR.	4
MAY	5
JUN.	6
JUL.	7
AUG.	8
SEP.	9
OCT.	X
NOV.	Y
DEC.	Z

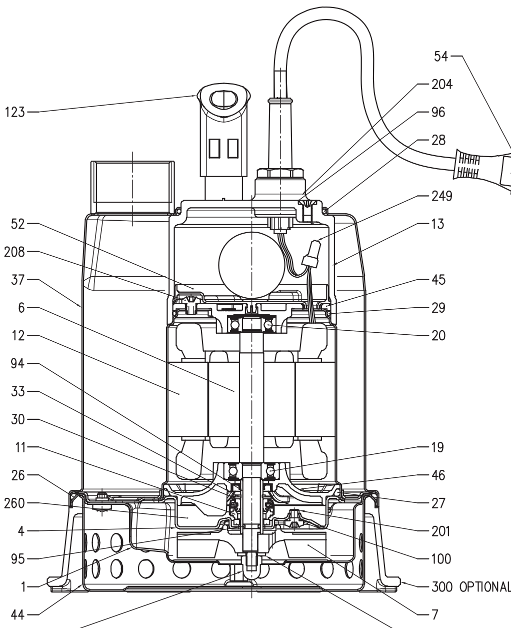
Sectional View – Optima-3MS1

Manual Type Output

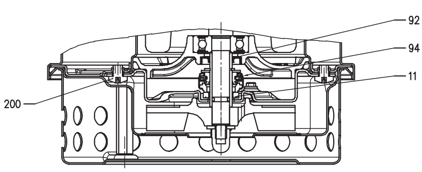


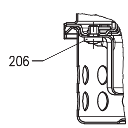


Ground Wire

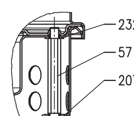


Optima-3MS1





Suction Cover

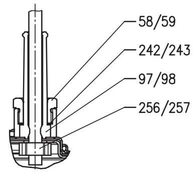


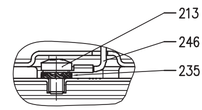
Strainer

Refer to page 29 for Material Details.

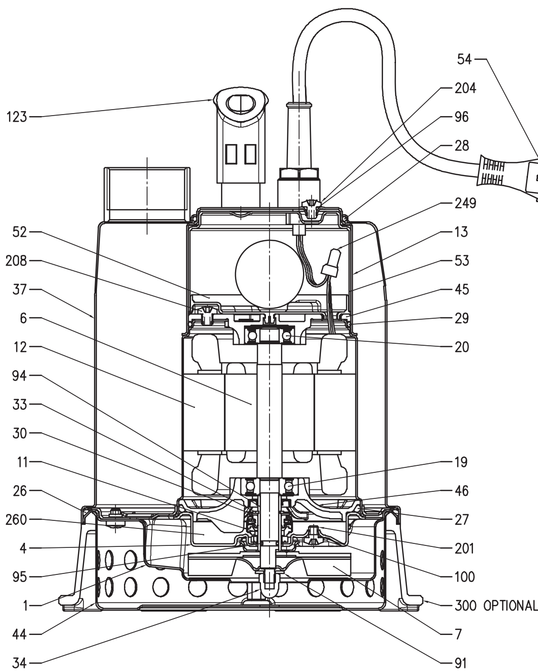
Sectional View – EPD-3MS1

Manual Type Output

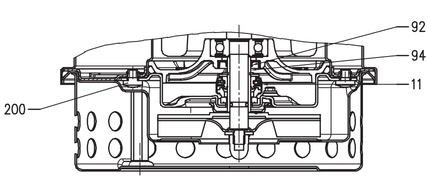


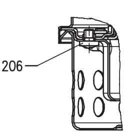


Ground Wire

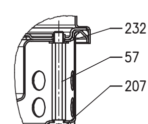


EPD-3MS1





Suction Cover

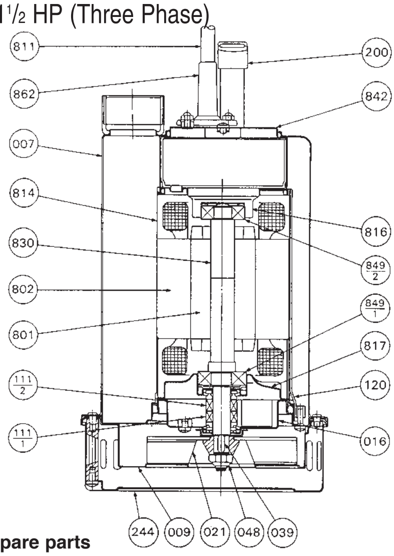


Strainer

Refer to page 31 for Material Details.

Sectional View – P707U / EPD-5MT2(4), 7MT2(4), 10MT2(4), 15MT2(4)

Manual Type Output 1/2 to 1 1/2 HP (Three Phase)

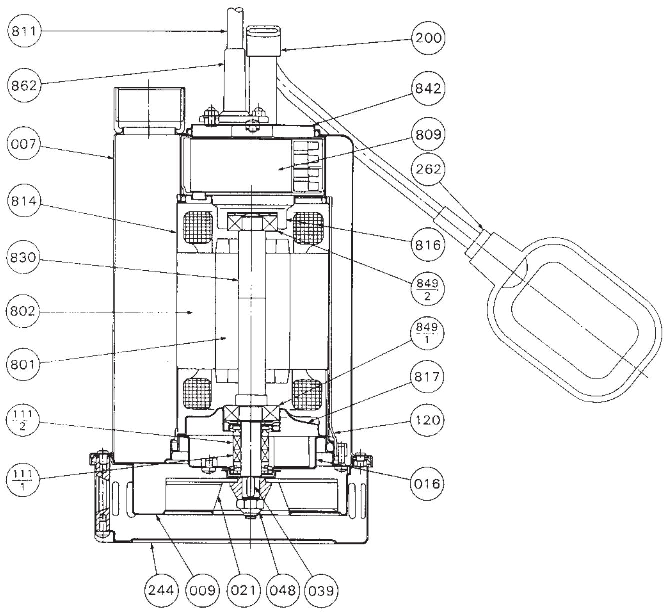


* **Recommended spare parts**

Part No. No.	Part Name	Material	ASTM, AISI Code	No. for 1 Unit
007	Outer Casing	304 Stainless	AISI 304	1
009	Inner Casing	304 Stainless	AISI 304	1
016	Seal Cover	304 Stainless	AISI 304	1
021	Impeller	304 Stainless	AISI 304	1
039	Key	304 Stainless	AISI 304	1
048	Impeller Nut	304 Stainless	AISI 304	1 set
*111-1	Mechanical Seal	—		1 set
*111-2	Mechanical Seal	—		1 set
120	Connection Band	304 Stainless	AISI 304	
200	Lifting Hanger	304 Stainless	AISI 304	1
244	Strainer	304 Stainless	AISI 304	1
801	Rotor	—		1
802	Stator	—		1
811	Submersible Cable	SOW-A/SO		1
814	Motor Frame	304 Stainless	AISI 304	1
816	Bracket	304 Stainless	AISI 304	1
817	Bracket	304 Stainless	AISI 304	1
830	Shaft	303 Stainless	AISI 303	1
842	Motor Cover			1
*849-1	Ball Bearing	—		1
*849-2	Ball Bearing	—		1
862	Cable Foot	NBR		1

Sectional View

Automatic Type Output 1/2 to 3/4 HP (Single Phase)



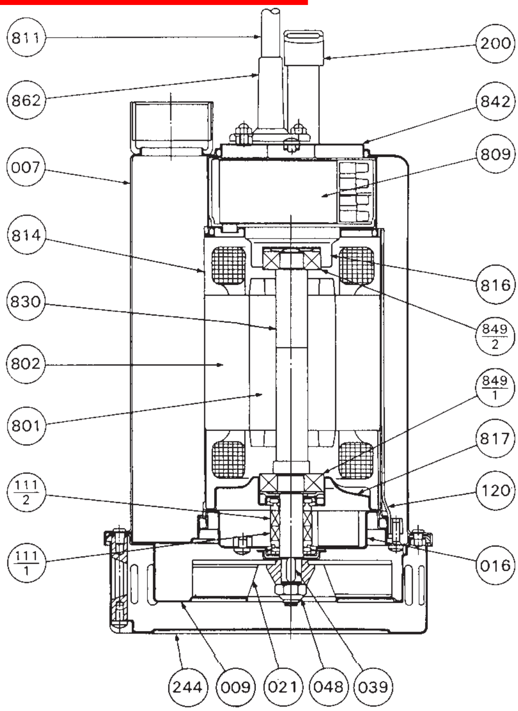
*** Recommended spare parts**

Part No.	Part Name	Material	ASTM, AISI Code	No. for 1 Unit
007	Outer Casing	304 Stainless	AISI 304	1
009	Suction Cover	304 Stainless	AISI 304	1
016	Seal Cover	304 Stainless	AISI 304	1
021	Impeller	304 Stainless	AISI 304	1
039	Key	304 Stainless	AISI 304	1
048	Impeller Nut	304 Stainless	AISI 304	1 set
*111-1	Mechanical Seal	—		1 set
*111-2	Mechanical Seal	—		1 set
120	Connection Band	304 Stainless	AISI 304	
200	Lifting Hanger	304 Stainless	AISI 304	1
244	Strainer	304 Stainless	AISI 304	1
262	Float Switch	—		1

Part No.	Part Name	Material	ASTM, AISI Code	No. for 1 Unit
801	Rotor	—		1
802	Stator	—		1
809	Capacitor	—		1
811	Submersible Cable	—		1
814	Motor Frame	304 Stainless	AISI 304	1
816	Bracket	304 Stainless	AISI 304	1
817	Bracket	304 Stainless	AISI 304	1
830	Shaft	303 Stainless	AISI 303	1
842	Motor Cover			1
*849-1	Ball Bearing	—		1
*849-2	Ball Bearing	—		1
862	Cable Boot	NBR		1

Sectional View

Manual Type Output 1/2 to 3/4 HP (Single Phase)



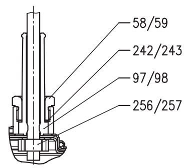
* **Recommended spare parts**

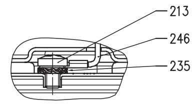
Part No.	Part Name	Material	ASTM, AISI Code	No. for 1 Unit
007	Outer Casing	304 Stainless	AISI 304	1
009	Inner Casing	304 Stainless	AISI 304	1
016	Seal Cover	304 Stainless	AISI 304	1
021	Impeller	304 Stainless	AISI 304	1
039	Key	304 Stainless	AISI 304	1
048	Impeller Nut	304 Stainless	AISI 304	1 set
*111-1	Mechanical Seal	—		1 set
*111-2	Mechanical Seal	—		1 set
120	Connection Band	304 Stainless	AISI 304	1
200	Lifting Hanger	304 Stainless	AISI 304	1
244	Strainer	304 Stainless	AISI 304	1
801	Rotor	—		1

Part No.	Part Name	Material	ASTM, AISI Code	No. for 1 Unit
802	Stator	—		1
809	Capacitor	—		1
811	Submersible Cable	—		1
814	Motor Frame	304 Stainless	AISI 304	1
816	Bracket	304 Stainless	AISI 304	1
817	Bracket	304 Stainless	AISI 304	1
830	Shaft	303 Stainless	AISI 303	1
842	Motor Cover			1
*849-1	Ball Bearing	—		1
*849-2	Ball Bearing	—		1
862	Cable Boot	NBR		1

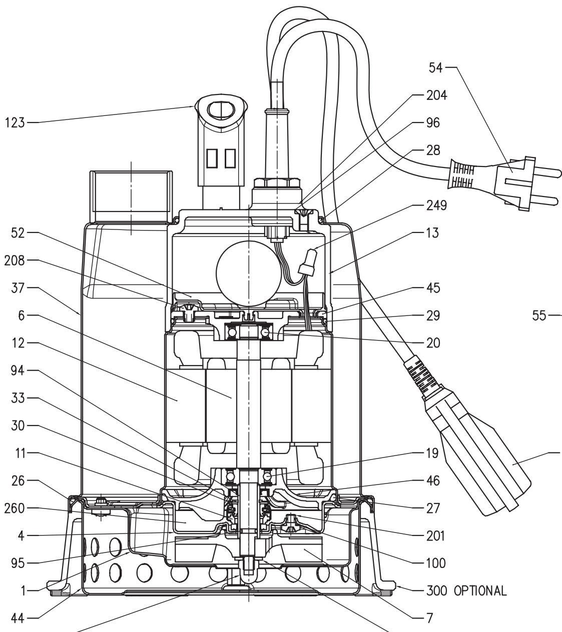
Sectional View – Optima-3AS1, 3SS1

Automatic Type Output

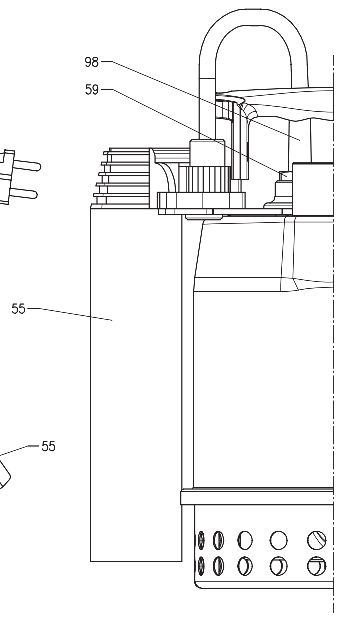




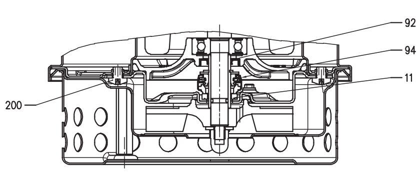
Ground Wire

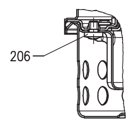


Optima-3AS1

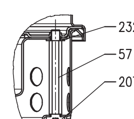


Optima-3SS1





Suction Cover

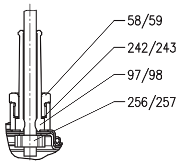


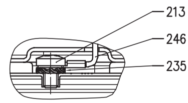
Strainer

Sectional View – Optima-3AS1, 3SS1, 3MS1

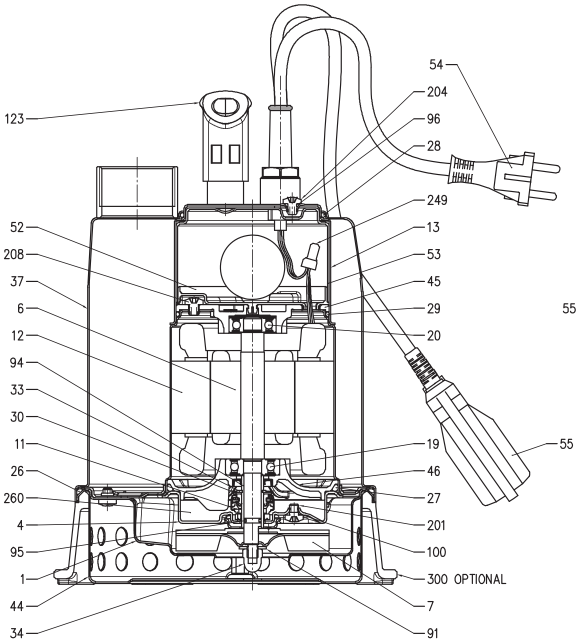
N°	PART NAME	MATERIAL	STANDARD	Qty.
1	Suction cover	EN 1.4301 (AISI 304)	-	1
4	Casing cover	EN 1.4301 (AISI 304)	-	1
6	Shaft with rotor	EN 1.4305 (AISI 303)	-	1
7	Impeller	PPE+PS-HI-GF20	-	1
11	Mechanical seal		-	1
12	Motor frame with stator	EN 1.4301 (AISI 304)	-	1
13	Motor cover	PP-GF30	-	1
19	Lower ball bearing	-	-	1
20	Upper ball bearing	-	-	1
21	Adjusting ring	-	-	1
23	Capacitor	-	-	1
26	O-ring	NBR	-	1
27	O-ring	NBR	-	1
28	O-ring	NBR	-	1
29	O-ring	NBR	-	1
30	Washer	EN 1.4301 (AISI 304)	-	1
33	Seeger ring	Carbon steel TC80	UNI 7435	1
34	Impeller nut	A2 - 70 UNI 7323	UNI 5721	1
37	Outer casing	EN 1.4301 (AISI 304)	-	1
44	Strainer	EN 1.4301 (AISI 304)	-	1
45	Upper bearing housing	EN 1706 AC-46000 D	-	1
46	Lower bearing housing	EN 1706 AC-46000 D	-	1
52	Terminal insulating base	PA6	-	1
54	Power cable	-	-	1
55	Switch	-	-	1
57	Spacer	EN 1.4301 (AISI 304)	-	2
58	Power cable connector	PA66-GF30	-	1
59	Switch cable connector	PA66-GF30	-	1
91	Washer	EN 1.4301 (AISI 304)	-	1
92	Lip seal	NBR	-	1
94	Shaft sleeve	EN 1.4305 (AISI 303) ceramic coated	-	1
95	O-ring	NBR	-	1
96	O-ring	NBR	-	1
97	Power cable boot	NBR	-	1
98	Switch cable boot	NBR	-	1
100	O-ring	NBR	-	1
123	Handle	PP	-	1
200	Screw	A2 - 70 UNI 7323	UNI 7687	4
201	Screw	A2 - 70 UNI 7323	UNI 7687	1
204	Screw	A2 - 70 UNI 7323	UNI 7687	1
206	Screw	A2 - 70 UNI 7323	UNI 7687	3
207	Screw	A2 - 70 UNI 7323	UNI 7687	2
208	Screw	A2 - 70 UNI 7323	UNI 7687	3
213	Screw	A2 - 70 UNI 7323	UNI 7687	1
232	Washer	PA6	-	2
235	Washer	Zinked Steel	UNI 8842	1
242	Washer	EN 1.4301 (AISI 304)	-	1
243	Washer	EN 1.4301 (AISI 304)	-	1
246	Ground wire	-	-	1
256	Cable holder	-	-	1
257	Cable holder	-	-	1
260	Oil	Esso Marcol 152	-	40 cc
300	Minimum suction system	Thermoplastic elastomer vulcanizate	-	-

Sectional View – EPD-3AS1, 3SS1

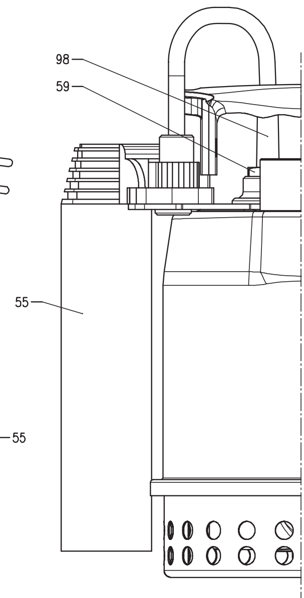




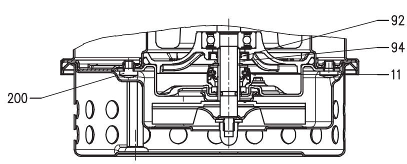
Ground Wire

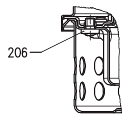


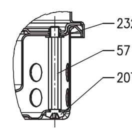
EPD-3AS1



EPD-3SS1







Suction Cover

Strainer

Sectional View – EPD-3AS1, 3SS1, 3MS1

N°	PART NAME	MATERIAL	STANDARD	Qty.
1	Suction cover	EN 1.4301 (AISI 304)	-	1
4	Casing cover	EN 1.4301 (AISI 304)	-	1
6	Shaft with rotor	EN 1.4305 (AISI 303)	-	1
7	Impeller	EN 1.4301 (AISI 304)	-	1
11	Mechanical seal		-	1
12	Motor frame with stator	EN 1.4301 (AISI 304)	-	1
13	Motor cover	EN 1.4301 (AISI 304)	-	1
19	Lower ball bearing	-	-	1
20	Upper ball bearing	-	-	1
21	Adjusting ring	-	-	1
23	Capacitor	-	-	1
26	O-ring	NBR	-	1
27	O-ring	NBR	-	1
28	O-ring	NBR	-	1
29	O-ring	NBR	-	1
30	Washer	EN 1.4301 (AISI 304)	-	1
33	Seeger ring	Carbon steel TC80	UNI 7435	1
34	Impeller nut	A2 - 70 UNI 7323	UNI 5721	1
37	Pump casing	EN 1.4301 (AISI 304)	-	1
44	Strainer	EN 1.4301 (AISI 304)	-	1
45	Upper bearing housing	EN 1706 AC-46000 D	-	1
46	Lower bearing housing	EN 1706 AC-46000 D	-	1
52	Terminal insulating base	PA6	-	1
53	Terminal insulating box	PA6	-	1
54	Power cable	-	-	1
55	Switch	-	-	1
57	Spacer	EN 1.4301 (AISI 304)	-	2
58	Power cable connector	OT 58 UNI 5705-65 Nickel-plated Brass	-	1
59	Switch cable connector	OT 58 UNI 5705-65 Nickel-plated Brass	-	1
91	Washer	EN 1.4301 (AISI 304)	-	1
92	Lip seal	NBR	-	1
94	Shaft sleeve	EN 1.4305 (AISI 303) ceramic coated	-	1
95	O-ring	NBR	-	1
96	O-ring	NBR	-	1
97	Power cable connector	NBR	-	1
98	Switch cable connector	NBR	-	1
100	O-ring	NBR	-	1
123	Handle	PP	-	1
200	Screw	A2 - 70 UNI 7323	UNI 7687	4
201	Screw	A2 - 70 UNI 7323	UNI 7687	1
204	Screw	A2 - 70 UNI 7323	UNI 7687	1
206	Screw	A2 - 70 UNI 7323	UNI 7687	3
207	Screw	A2 - 70 UNI 7323	UNI 7687	2
208	Screw	A2 - 70 UNI 7323	UNI 7687	3
213	Screw	A2 - 70 UNI 7323	UNI 7687	1
232	Washer	PA6	-	1
235	Washer	Zinked Steel	UNI 8842	1
242	Washer	EN 1.4301 (AISI 304)	-	1
243	Washer	EN 1.4301 (AISI 304)	-	1
246	Ground wire	-	-	1
256	Strain relief	-	-	1
257	Strain relief	-	-	1
260	Oil	Esso Marcol 152	-	40 cc
300	Minimum suction system	Thermoplastic elastomer vulcanizate	-	-

Disassembly and Assembly

1. Disassembly

When disassembling pump, have a piece of cardboard or wooden board ready to place the different parts on as you work. Do not pile parts on top of each other. They should be laid out neatly in rows. The O-ring and gasket can not be used again once they are removed. Have replacement parts ready.

Disassemble in the following order, referring to the sectional view.

Be sure to cut off power source before beginning disassembly.

(1) Loosen casing bolts and remove casing.
(2) Loosen bolt at end of pump shaft and lift impeller off shaft.
(3) Remove pump shaft key and mechanical seal. (No shaft key for 1/3 HP pumps.)
(4) Loosen inner casing bolts and remove inner casing.
Note 1: Drain the lubricant oil into a container.
(5) Remove the mechanical seal from the main shaft.
Note 2: Be careful not to cut your fingers on the shaft key groove when pulling out the mechanical seal.
Note 3: Be careful not to scratch or bend the pump shaft during disassembly.

2. Assembly

Re-assemble in reverse order of disassembly.

Be careful of the following points.

(1) During re-assembly, rotate the impeller by hand and check for smooth rotation.
(2) Replace the O-ring.
(3) Replace all parts that are damaged.
(4) Tighten bolts evenly.

Please obtain O-rings, and other parts from pump dealer.

* All specifications subject to change without notice.

In this catalog, the particulars in { } are in accordance with the International System of Units (SI) and given for reference only.

Warranty

EBARA FLUID HANDLING
ROCK HILL, SOUTH CAROLINA
MODEL Optima NO FAULT LIMITED WARRANTY
(MODELS 3MS-1 AND 3AS-1 ONLY)

EBARA FLUID HANDLING, Rock Hill, SC (EFH-RH) warrants to the original purchaser only ("Customer") that the EFH-RH Commercial Pump/Product ("Pump") Model 3MS-1 and/or 3AS-1 ONLY will be free of defects in workmanship and material for a period of twelve (12) months from the date of installation or eighteen (18) months from the date of shipment by EFH-RH, whichever comes first, provided that notification of any such defect is promptly given in writing to EFH-RH. Customer may be required at EFH-RH's request to verify that it is the Customer of the Pump and that the Pump was installed and operated in accordance with EFH-RH's instructions for sump pumps noted in the furnished instruction manual.

EFH-RH's sole obligation under this MODEL Optima NO FAULT LIMITED WARRANTY will be to replace the Pump or at EFH-RH's sole option, to refund the Customer an equitable part or the entire purchase price. In no event shall EFH-RH's cost responsibility exceed the initial purchase price paid by the Customer for the Pump. Freight charges for replacement Pumps under this MODEL Optima NO FAULT LIMITED WARRANTY are the responsibility of the Customer.

To obtain MODEL Optima NO FAULT LIMITED WARRANTY consideration, the original Pump label sticker affixed to the Pump must be removed, submitted and received by EFH-RH before replacement Pump or refund is provided at:

Ebara International Corporation
Attn: Optima Claims Processing
1651 Cedar Line Drive
Rock Hill, SC 29730
803-327-5005 Phone
803-327-5097 Fax

EFH-RH shall be liable only for the cost of the replacement Pump. Customer shall be responsible for labor, cost of removal and installation at Customer's premises, transportation and insurance costs to EFH-RH and any other incidental costs. This warranty is void and does not apply if damage is caused by improper installation, improper maintenance, accident, alteration, abuse, or misuse.

THE FOREGOING WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY ON THIS PUMP, AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE DISCLAIMED AND EXCLUDED FROM THE TERMS OF THIS WARRANTY. EFH-RH'S SOLE OBLIGATION IN CASE OF ANY DEFECT WILL BE TO PROVIDE THE WARRANTY SERVICE SPECIFIED ABOVE. THE FOREGOING IS CUSTOMER'S SOLE AND EXCLUSIVE REMEDY, WHETHER IN CONTRACT, TORT OR OTHERWISE AND EFH-RH SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY KIND WHATSOEVER.

Warranty

COMMERCIAL PUMP/ PRODUCTS LIMITED WARRANTY

EbaraFluid Handling, Rock Hill, SC ("EFH-RH") warrants to the original purchaser only ("Customer") that the EFH-RH Commercial Pump/Product ("Pump") will be free of defects in workmanship and material for a period of twelve (12) months from the date of installation or eighteen (18) months from the date of shipment by EFH-RH, whichever comes first, provided that notification of any such defect is promptly given in writing to EFH-RH. Customer may be required at EFH-RH's request to verify that it is the Customer of the Pump and that the Pump was installed and operated in accordance with EFH-RH's instructions.

EFH-RH's sole obligation under this warranty will be to repair or replace with a new or reconditioned Pump, such Pump as has failed or has been found to be defective during the warranty period, or at EFH-RH's sole option, to refund to the customer an equitable part of the purchase price. In no event shall EFH-RH's cost responsibility exceed the initial purchase price paid by the Customer for the Pump.

EFH-RH shall be liable only for the cost of the Pump, or the cost of repair or replacement of any defective Pump. Customer shall be responsible for labor, cost of removal and installation at Customer's premises, transportation and insurance costs to EFH-RH and any other incidental costs.

This warranty is void and does not apply if damage is caused by improper installation, improper maintenance, accident, alteration, abuse, misuse or if the Pump has been disassembled prior to warranty evaluation without written authorization from EFH-RH.

Warranty service and information for return procedures will be provided by EFH-RH upon receipt of written notice describing the defect or problem to:

Ebara International Corporation
Warranty/Claims
1651 Cedar Line Drive
Rock Hill, SC 29730
803-327-5005 (Phone) • 803-327-5097 (Fax)

THE FOREGOING WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY ON THIS PUMP, AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE DISCLAIMED AND EXCLUDED FROM THE TERMS OF THIS WARRANTY. EFH-RH'S SOLE OBLIGATION IN CASE OF ANY DEFECT WILL BE TO PROVIDE THE WARRANTY SERVICE SPECIFIED ABOVE. THE FOREGOING IS CUSTOMER'S SOLE AND EXCLUSIVE REMEDY, WHETHER IN CONTRACT, TORT OR OTHERWISE AND EFH-RH SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY KIND WHATSOEVER.

Contact your dealer or supplier
for more information about other EBARA products:

EBARA Fluid Handling

1651 Cedar Line Drive • Rock Hill, SC 29730
(t) 803 327 5005 • (f) 803 327 5097
www.pumpsebara.com

EFH EPD1001 0514

Curb Inlet Filter

Bio Clean
A Forterra Company

OPERATION & MAINTENANCE

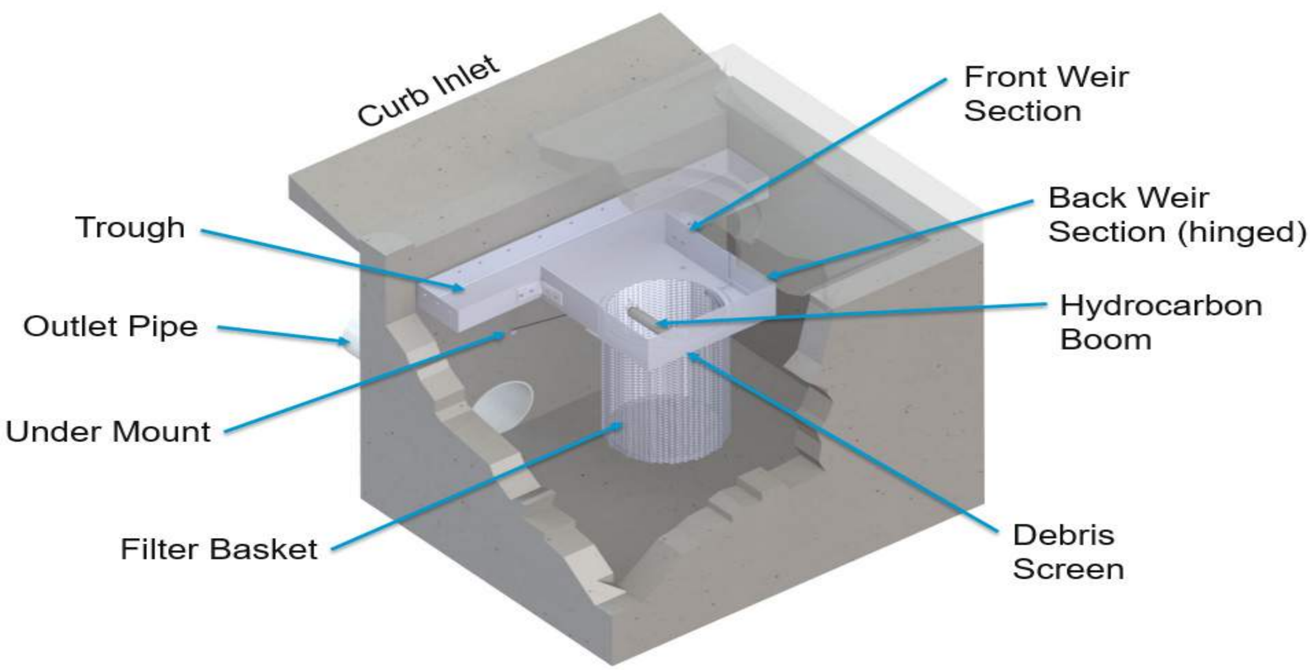
Bio Clean Environmental Services, Inc.
398 Via El Centro
Oceanside, CA 92058

www.BioCleanEnvironmental.com
p: 760.433.7640
f: 760.433.3176

OPERATION & MAINTENANCE

The Bio Clean Curb Inlet Filter is a stormwater device designed to remove high levels of trash, debris, sediments and hydrocarbons. The filter is available in several configurations including trash full capture, multi-level screening, Kraken membrane filter and media filter variations. This manual covers maintenance procedures of the trash full capture and multi-level screening configurations. A supplemental manual is available for the Kraken and media filter variations. The innovative trough & weir system is mounted along the curb face and directs incoming stormwater toward the filter basket which is positioned “directly” under the manhole access opening regardless of its location in the catch basin. This innovative design allows the filter to be cleaned from finish surface without access into the catch basin, therefore drastically reducing maintenance time and eliminating confined space entry. The filter has a lifting handle allowing for the filter to be removed easily through the manhole. The weir also folds up to allow for unimpeded access into the basin for routine maintenance or pipe jetting.

As with all stormwater BMPs, inspection and maintenance on the Curb Inlet Filter is necessary. Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess site-specific loading conditions. This is recommended because pollutant loading can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding of roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years. Without appropriate maintenance a BMP can exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.

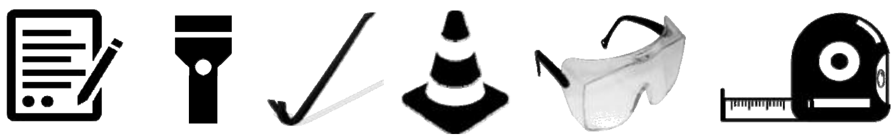


System Diagram:

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the Curb Inlet Filter:

- Bio Clean Environmental Inspection Form (contained within this manual).
- Manhole hook or appropriate tools to remove access hatches and covers.
- Appropriate traffic control signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections or maintenance of the system.



Inspection Steps

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the Curb Inlet Fitler are quick and easy. As mentioned above the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long-term inspection and maintenance interval requirements.

The Curb Inlet Filter can be inspected though visual observation without entry into the catch basin. All necessary pre-inspection steps must be carried out before inspection occurs, such as safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open access hatch or manhole. Once the manhole has been safely opened the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the inside of the catch basin through the manhole. If minimal light is available and vision into the unit is impaired utilize a flashlight to see inside the catch basin.
- Look for any out of the ordinary obstructions in the catch basin, trough, weir, filter basket, basin floor our outlet pipe. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of trash, foliage and sediment accumulated inside the filter basket. Record this information on the inspection form.
- Observe the condition and color of the hydrocarbon boom. Record this information on the inspection form.

- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

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

- Missing or damaged internal components.
- Obstructions in the trough, weir, filter basket or catch basin.
- Excessive accumulation of trash, foliage and sediment in the filter basket and/or trough and weir sections. Maintenance is required when the basket is greater than half-full.
- The following chart shows the 50% and 100% storage capacity of each filter height:

Model	Filter Basket Diameter (in)	Filter Basket Height (in)	50% Storage Capacity (cu ft)	100% Storage Capacity (cu ft)
BC-CURB-30	18	30	2.21	4.42
BC-CURB-24	18	24	1.77	3.53
BC-CURB-18	18	18	1.33	2.65
BC-CURB-12	18	12	0.88	1.77

Maintenance Equipment

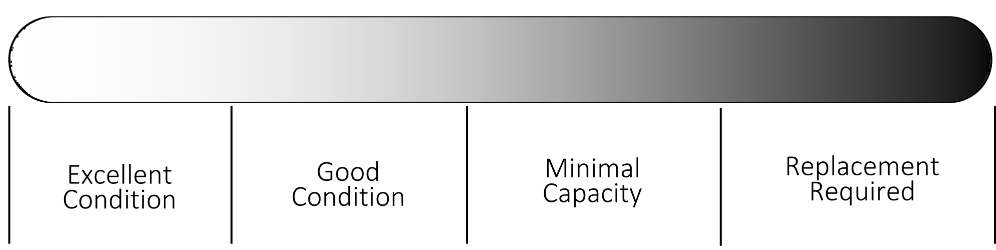
It is recommended that a vacuum truck be utilized to minimize the time required to maintain the Curb Inlet Filter though it can easily cleaned by hand:

- Bio Clean Environmental Maintenance Form (contained in O&M Manual).
- Manhole hook or appropriate tools to access hatches and covers.
- Appropriate safety signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine maintenance of the system. Small or large vacuum truck (with pressure washer attachment preferred).

Maintenance Procedures

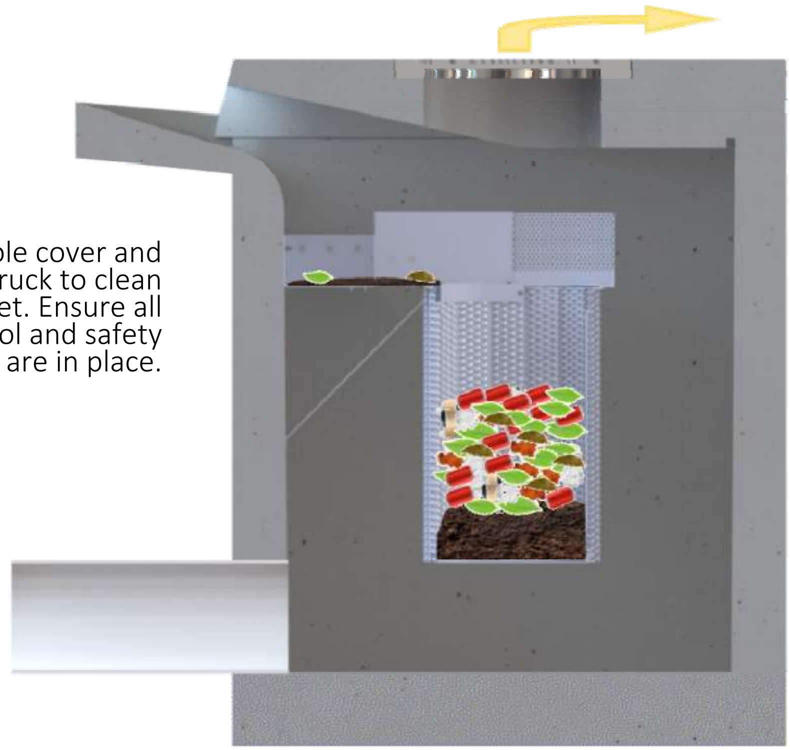
It is recommended that maintenance occurs at least two days after the most recent rain event to allow debris and sediments to dry out. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Cleaning of the Curb Inlet Filter can be performed from finish surface without entry into catch basin utilizing a vacuum truck. Some unique and custom configurations may create conditions which would require entry for some or all of the maintenance procedures. Once all safety measures have been set up cleaning of the Curb Inlet Filter can proceed as followed:

- Remove all manhole cover or access hatches (traffic control and safety measures to be completed prior).
- Using an extension on a vacuum truck position the hose over the opened manhole or hatch opening. Insert the vacuum hose down into the filter basket and suck out trash, foliage and sediment. A pressure wash is recommended and will assist in spraying of any debris stuck on the side or bottom of the filter basket. If the filter basket is full, trash, sediment, and debris will accumulate inside the trough and weir sections of the system. Once the filter basket is clean power wash the weir and trough pushing these debris into the filter basket (leave the hose in the filter basket during this process so entering debris will be sucked out). Power wash off the trough, weir, debris screen, and filter basket sides and bottom.
- Next remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom. Booms can be ordered directly from the manufacturer.
- Follow is a replacement indication color chart for the hydrocarbon booms:

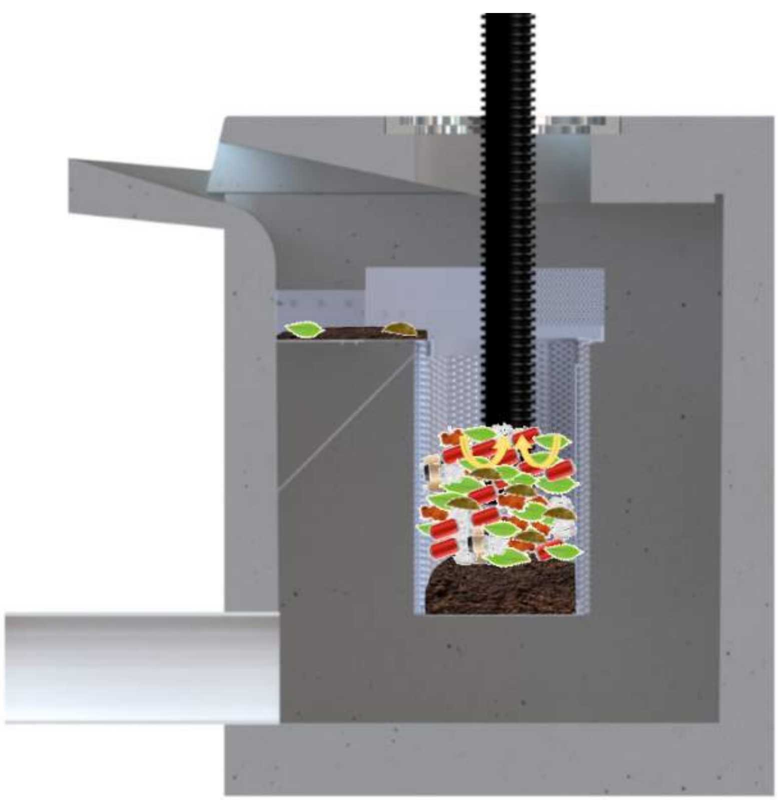


- The last step is to close up and replace the manhole or hatch and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.
- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.
- In the case of damaged components, replacement parts can be ordered from the manufacturer. Hydrocarbon booms can also be ordered directly from the manufacturer as previously noted.

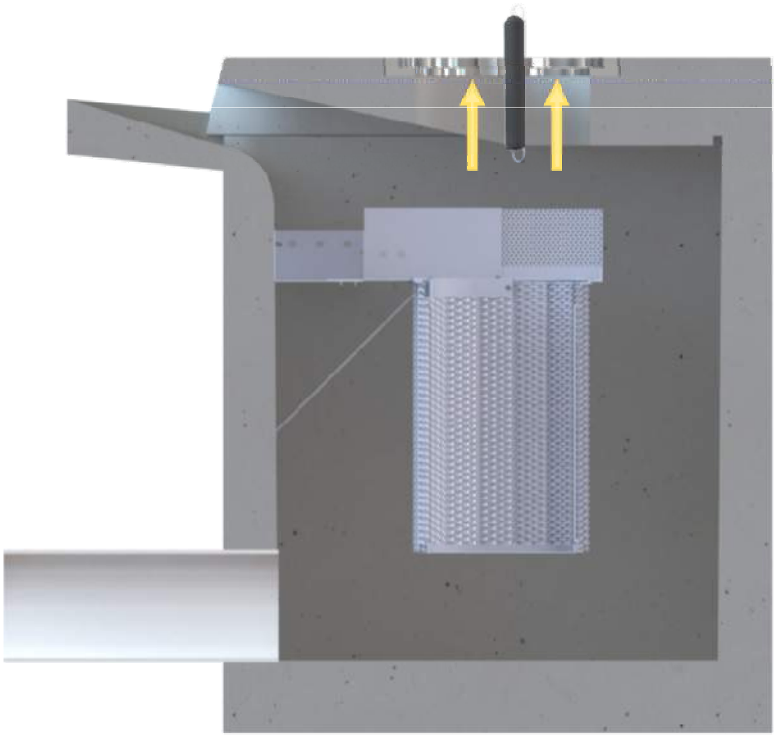
Maintenance Sequence



Remove manhole cover and set up vacuum truck to clean the filter basket. Ensure all traffic control and safety measures are in place.

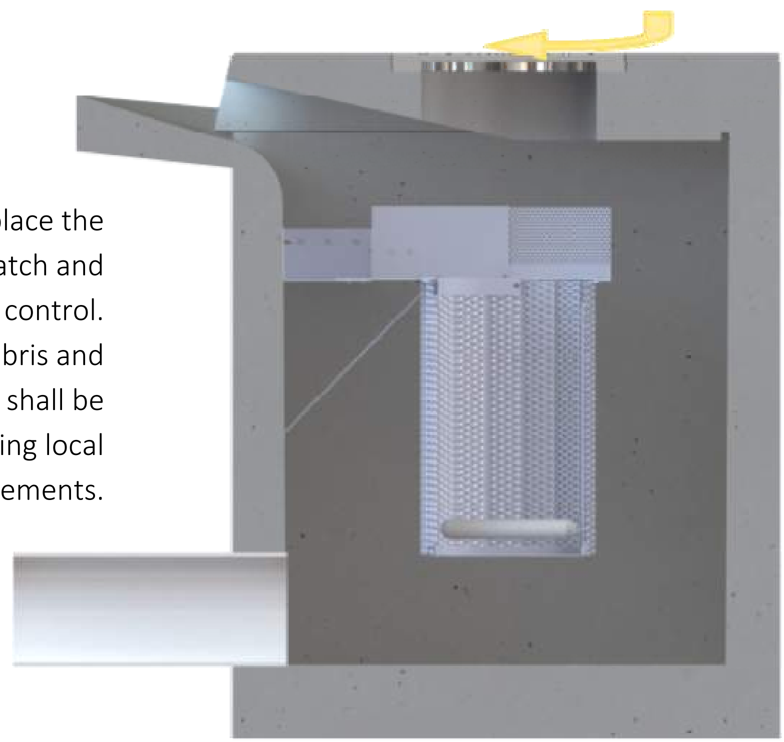


Insert the vacuum hose down into the filter basket and suck out debris. Use a pressure washer to assist in vacuum removal. Pressure wash off the weir and trough and vacuum out any remaining debris.



Remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom.

Close up and replace the manhole or hatch and remove all traffic control. All removed debris and pollutants shall be disposed of following local and state requirements.



For Maintenance Services or Information Please Contact Us At:
760-433-7640
Or Email: info@biocleanenvironmental.com

Bio Clean
A Forterra Company

Inspection and Maintenance Report
Catch Basin Only

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.

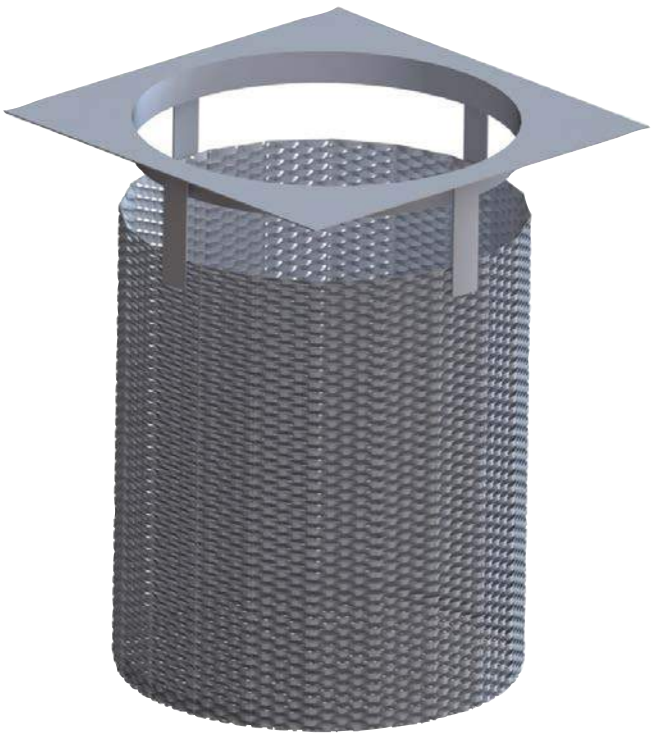
Site Map #	GPS Coordinates of Insert	Catch Basin Size	Evidence of Illicit Discharge?	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Signs of Structural Damage?	Functioning Properly or Maintenance Needed?
1	Lat: Long:							
2	Lat: Long:							
3	Lat: Long:							
4	Lat: Long:							
5	Lat: Long:							
6	Lat: Long:							
7	Lat: Long:							
8	Lat: Long:							
10	Lat: Long:							
11	Lat: Long:							
12	Lat: Long:							

Comments:

Grate Inlet Filter

Bio Clean
A Forterra Company

OPERATION & MAINTENANCE



Bio Clean Environmental Services, Inc.
398 Via El Centro
Oceanside, CA 92058

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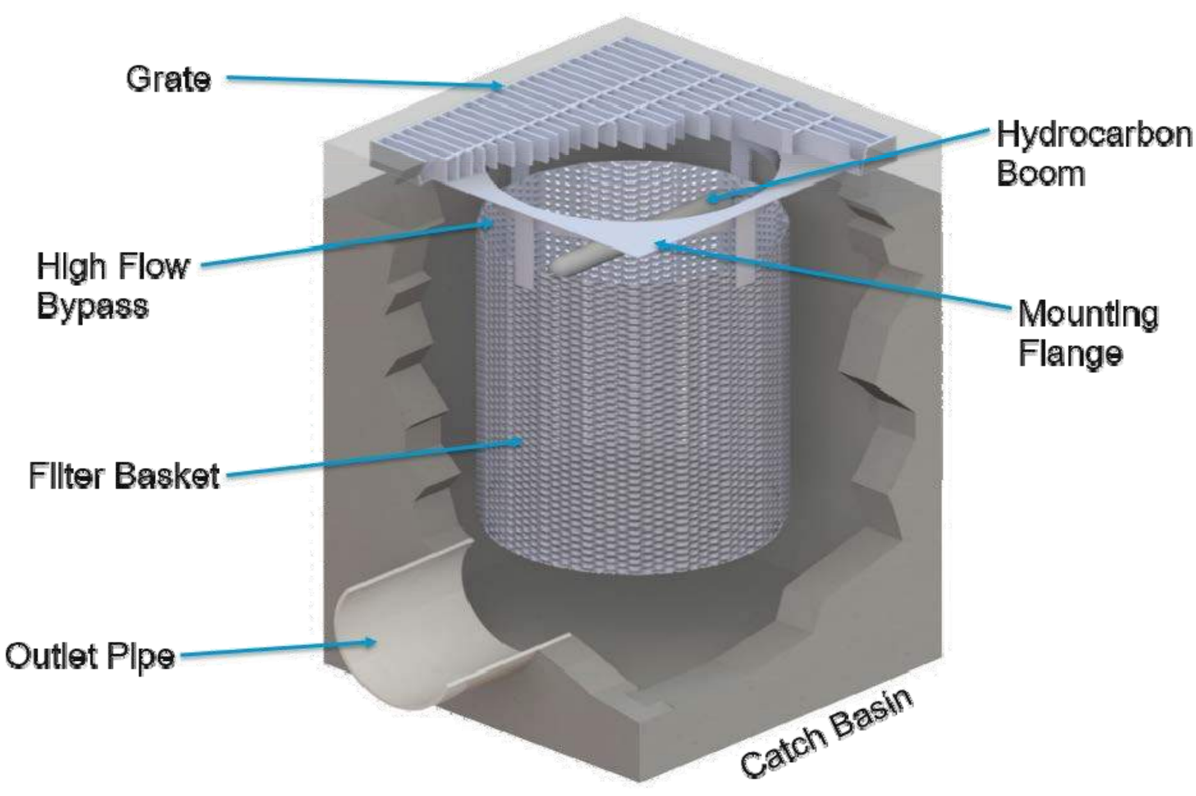
p: 760.433.7640
f: 760.433.3176

OPERATION & MAINTENANCE

The Bio Clean Grate Inlet Filter is a stormwater device designed to remove high levels of trash, debris, sediments and hydrocarbons. The filter is available in several configurations including trash full capture, multi-level screening, Kraken membrane filter and media filter variations. This manual covers maintenance procedures of the trash full capture and multi-level screening configurations. A supplemental manual is available for the Kraken and media filter variations. This filter is made of 100% stainless steel and is available and various sizes and depths allowing it to fit in any grated catch basin inlet. The filters heavy duty construction allows for cleaning with any vacuum truck. The filet can also easily be cleaned by hand.

As with all stormwater BMPs, inspection and maintenance on the Grate Inlet Filter is necessary. Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess site-specific loading conditions. This is recommended because pollutant loading can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding of roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years. Without appropriate maintenance a BMP can exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.

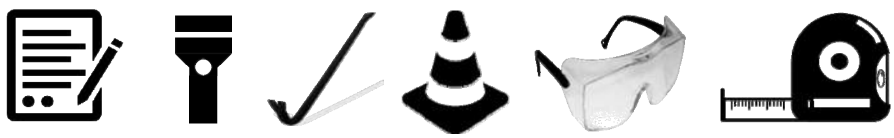


System Diagram:

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the Grate Inlet Filter:

- Bio Clean Environmental Inspection Form (contained within this manual).
- Manhole hook or appropriate tools to remove access hatches and covers.
- Appropriate traffic control signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections or maintenance of the system.



Inspection Steps

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the Grate Inlet Filter are quick and easy. As mentioned above the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long-term inspection and maintenance interval requirements.

The Grate Inlet Filter can be inspected though visual observation. All necessary pre-inspection steps must be carried out before inspection occurs, such as safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open grated inlet. Once the grate has been safely removed the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the filter with the grate removed.
- Look for any out of the ordinary obstructions on the grate or in the filter and its bypass. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of trash, foliage and sediment accumulated inside the filter basket. Record this information on the inspection form.
- Observe the condition and color of the hydrocarbon boom. Record this information on the inspection form.
- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

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

- Missing or damaged internal components.
- Obstructions in the filter basket and its bypass.
- Excessive accumulation of trash, foliage and sediment in the filter basket. Maintenance is required when the basket is greater than half-full.
- The following chart shows the 50% and 100% storage capacity of each filter height:

Model	Filter Basket Diameter (in)	Filter Basket Height (in)	50% Storage Capacity (cu ft)	100% Storage Capacity (cu ft)
BC-GRATE-12-12-12	10.00	12.00	0.27	0.55
BC-GRATE-18-18-18	16.00	18.00	1.05	2.09
BC-GRATE-24-24-24	21.00	24.00	2.41	4.81
BC-GRATE-30-30-24	27.00	24.00	3.98	7.95
BC-GRATE-36-36-24	33.00	24.00	5.94	11.88
BC-GRATE-48-48-18	44.00	18.00	7.92	15.84

Maintenance Equipment

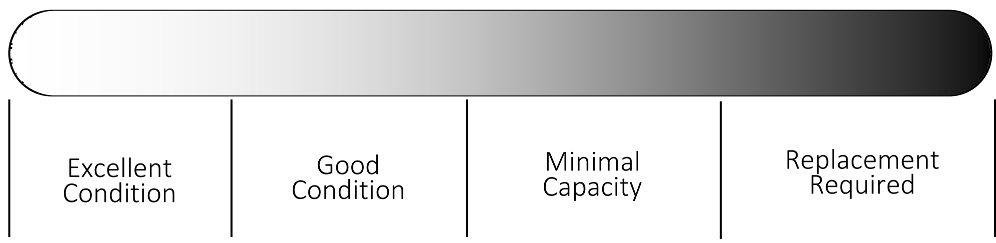
It is recommended that a vacuum truck be utilized to minimize the time required to maintain the Curb Inlet Filter, though it can easily cleaned by hand:

- Bio Clean Environmental Maintenance Form (contained in O&M Manual).
- Manhole hook or appropriate tools to remove the grate.
- Appropriate safety signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine maintenance of the system. Small or large vacuum truck (with pressure washer attachment preferred).

Maintenance Procedures

It is recommended that maintenance occurs at least two days after the most recent rain event to allow debris and sediments to dry out. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Cleaning of the Grate Inlet Filter can be performed utilizing a vacuum truck. Once all safety measures have been set up cleaning of the Grate Inlet Filter can proceed as followed:

- Remove grate (traffic control and safety measures to be completed prior).
- Using an extension on a vacuum truck position the hose over the opened catch basin. Insert the vacuum hose down into the filter basket and suck out trash, foliage and sediment. A pressure wash is recommended and will assist in spraying of any debris stuck on the side or bottom of the filter basket. Power wash off the filter basket sides and bottom.
- Next remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom. Booms can be ordered directly from the manufacturer.
- Follow is a replacement indication color chart for the hydrocarbon booms:



- The last step is to replace the grate and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.
- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.
- In the case of damaged components, replacement parts can be ordered from the manufacturer. Hydrocarbon booms can also be ordered directly from the manufacturer as previously noted.

Maintenance Sequence

Remove grate and set up vacuum truck to clean the filter basket.

Insert the vacuum hose down into the filter basket and suck out debris. Use a pressure washer to assist in vacuum removal. Pressure wash off screens.

Remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom.

Close up and replace the grate and remove all traffic control. All removed debris and pollutants shall be disposed of following local and state requirements.

For Maintenance Services or Information Please Contact Us At:
760-433-7640
Or Email:
info@biocleanenvironmental.com

Bio Clean
A Forterra Company

Inspection and Maintenance Report
Catch Basin Only

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	Catch Basin Size	Evidence of Illicit Discharge?	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Signs of Structural Damage?	Functioning Properly or Maintenance Needed?
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6	Lat: Long:							
7	Lat: Long:							
8	Lat: Long:							
10	Lat: Long:							
11	Lat: Long:							
12	Lat: Long:							

Comments:

Grate Inlet Filter
MLS Type

Bio Clean
A Forterra Company

OPERATION & MAINTENANCE

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Oceanside, CA 92058

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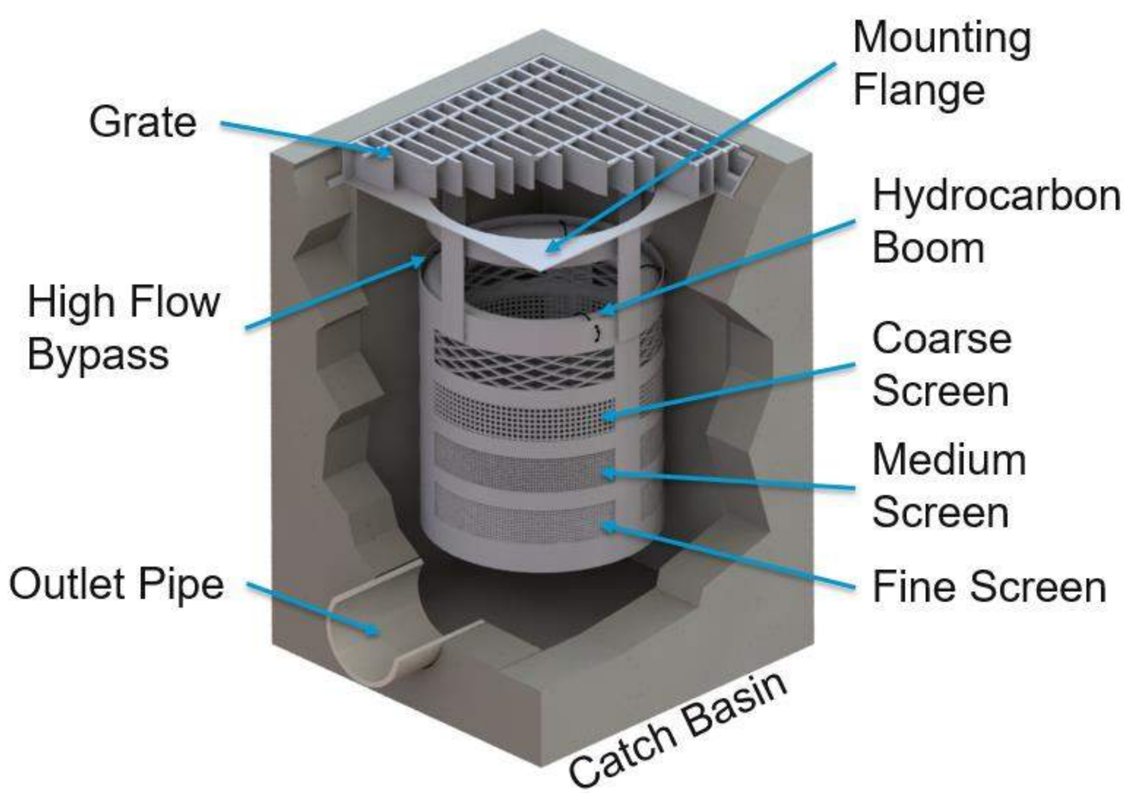
OPERATION & MAINTENANCE

The Bio Clean Grate Inlet Filter is a stormwater device designed to remove high levels of trash, debris, sediments and hydrocarbons. The filter is available in several configurations including trash full capture, multi-level screening, Kraken membrane filter and media filter variations. This manual covers maintenance procedures of the multi-level screening configuration. A supplemental manual is available for the trash full capture configuration, as well as the Kraken and media filter variations. This filter is made of 100% stainless steel and is available in various sizes and depths allowing it to fit in any grated catch basin inlet. The filter's heavy duty construction allows for cleaning with any vacuum truck. The filter can also easily be cleaned by hand.

As with all stormwater BMPs, inspection and maintenance on the Grate Inlet Filter is necessary. Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess site-specific loading conditions. This is recommended because pollutant loading can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding of roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years. Without appropriate maintenance a BMP can exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.

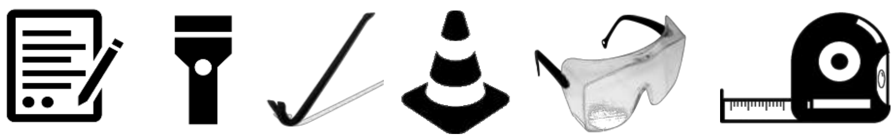


System Diagram:

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the Grate Inlet Filter:

- Bio Clean Environmental Inspection Form (contained within this manual).
- Manhole hook or appropriate tools to remove access hatches and covers.
- Appropriate traffic control signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections or maintenance of the system.



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The Grate Inlet Filter can be inspected though visual observation. All necessary pre-inspection steps must be carried out before inspection occurs, such as safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open grated inlet. Once the grate has been safely removed the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the filter with the grate removed.
- Look for any out of the ordinary obstructions on the grate or in the filter and its bypass. Write down any observations on the inspection form.
- Through observation and/or digital photographs, estimate the amount of trash, foliage and sediment accumulated inside the filter basket. Record this information on the inspection form.
- Observe the condition and color of the hydrocarbon boom. Record this information on the inspection form.
- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

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

- Missing or damaged internal components.
- Obstructions in the filter basket and its bypass.
- Excessive accumulation of trash, foliage and sediment in the filter basket. Maintenance is required when the basket is greater than half-full.
- The following chart shows the 50% and 100% storage capacity of each filter height:

Model	Filter Basket Diameter (in)	Filter Basket Height (in)	50% Storage Capacity (cu ft)	100% Storage Capacity (cu ft)
BC-GRATE-12-12-18	10.00	18.00	0.41	0.82
BC-GRATE-18-18-18	16.00	18.00	1.05	2.09
BC-GRATE-24-24-24	21.00	24.00	2.40	4.81
BC-GRATE-30-30-24	27.00	24.00	3.97	7.95
BC-GRATE-25-38-24	21.00	24.00	4.15	8.31
BC-GRATE-36-36-24	33.00	24.00	5.94	11.87
BC-GRATE-48-48-18	44.00	18.00	7.92	15.83

Maintenance Equipment

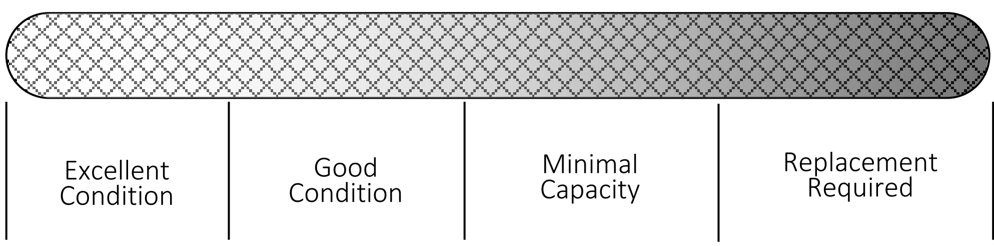
It is recommended that a vacuum truck be utilized to minimize the time required to maintain the Curb Inlet Filter, though it can be easily cleaned by hand:

- Bio Clean Environmental Maintenance Form (contained in O&M Manual).
- Manhole hook or appropriate tools to remove the grate.
- Appropriate safety signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine maintenance of the system. Small or large vacuum truck (with pressure washer attachment preferred).

Maintenance Procedures

It is recommended that maintenance occurs at least two days after the most recent rain event to allow debris and sediments to dry out. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Cleaning of the Grate Inlet Filter can be performed utilizing a vacuum truck. Once all safety measures have been set up, cleaning of the Grate Inlet Filter can proceed as followed:

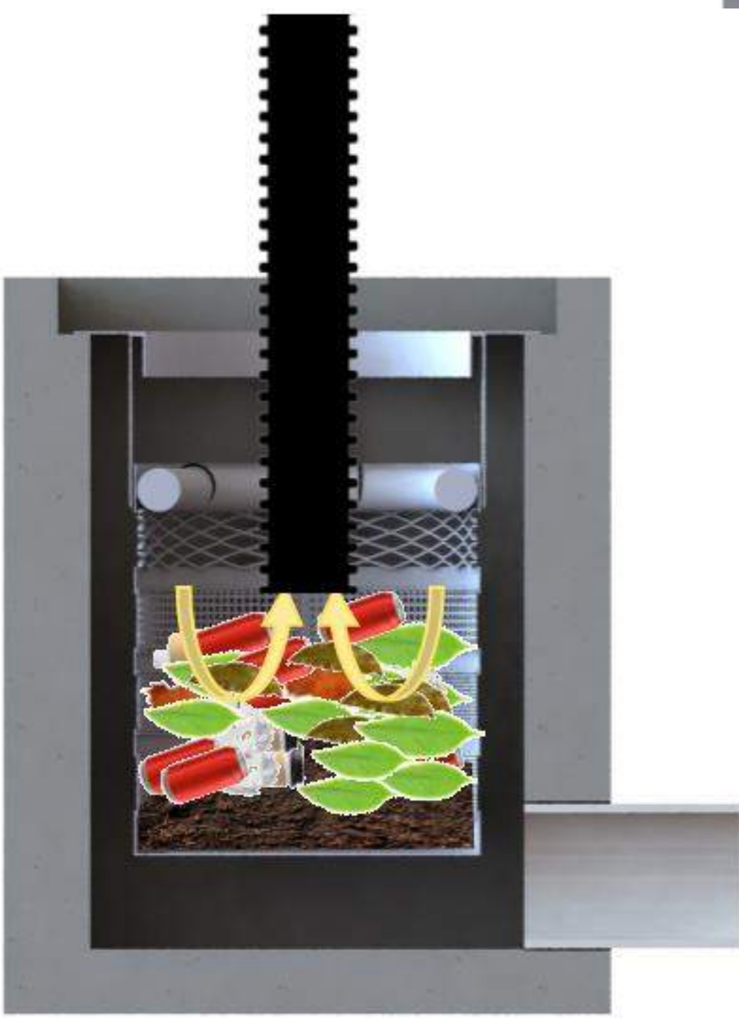
- Remove grate (traffic control and safety measures to be completed prior).
- Using an extension on a vacuum truck, position the hose over the opened catch basin. Insert the vacuum hose down into the filter basket and suck out trash, foliage and sediment. A pressure wash is recommended and will assist in spraying off any debris stuck on the side or bottom of the filter basket. Power wash the sides and bottom of the filter basket off.
- Next, remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is zip tied to the top perimeter of the filter. Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required, install and fasten on a new hydrocarbon boom. Booms can be ordered directly from the manufacturer.
- The following is a replacement indication color chart for the hydrocarbon booms:



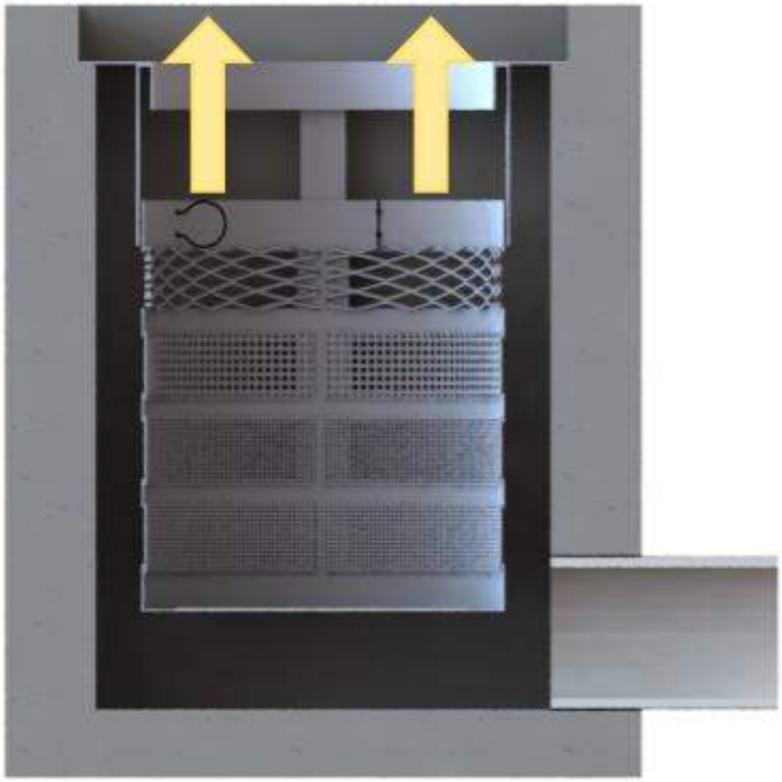
- The last step is to replace the grate and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.
- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.
- In the case of damaged components, replacement parts can be ordered from the manufacturer. Hydrocarbon booms can also be ordered directly from the manufacturer as previously noted. NOTE: outlet to catch basin (if it does not have a sump) should be blocked during power washing to prevent any dirty water from discharging from the catch basin.

Maintenance Sequence

Remove grate and set up vacuum truck to clean the filter basket.



Insert the vacuum hose down into the filter basket and suck out debris. Use a pressure washer to assist in vacuum removal. Pressure wash off screens.



Remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is zip tied to the top perimeter of the filter. Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required, install and fasten on a new hydrocarbon boom.

Close up and replace the grate and remove all traffic control. All removed debris and pollutants shall be disposed of following local and state requirements.

For Maintenance Services or Information Please Contact Us At:
760-433-7640
Or Email:
info@biocleanenvironmental.com

Attachment E

Calculations

Site Characteristics

Worksheets

Table 2.7: Infiltration BMP Feasibility Worksheet

<table>
<tr><th></th><th>Infeasibility Criteria</th><th>Yes</th><th>No</th></tr>
<tr><td>1</td><td>Would Infiltration BMPs pose significant risk for groundwater related concerns? Refer to Appendix VII (Worksheet I) for guidance on groundwater-related infiltration feasibility criteria.</td><td>✓</td><td></td></tr>
<tr><td colspan="4">Provide basis: Infiltration BMPs are not considered feasible for the proposed project site due to high ground water levels. Ground water is reported to be approximately 5-6.5 feet below finished surface therefore concluding infiltration will not be a feasible option for the project site. Refer to the Geotechnical Report for more information.
Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>2</td><td>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.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>3</td><td>Would infiltration of the DCV from drainage area violate downstream water rights?</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

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

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

<table>
<tr><th></th><th>Partial Infeasibility Criteria</th><th>Yes</th><th>No</th></tr>
<tr><td>4</td><td>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?</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>5</td><td>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.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>6</td><td>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?</td><td></td><td></td></tr>
<tr><td colspan="4">Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible:

Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>7</td><td>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?</td><td></td><td></td></tr>
<tr><td colspan="4">Provide citation to applicable study and summarize findings relative to the amount of infiltration that is permissible:

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

Table 2.7: Infiltration BMP Feasibility Worksheet (continued)

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

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=	0.85	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)	$d_{remainder}$=	0.85	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	22.3	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	0.86	
3	Calculate runoff coefficient, $C = (0.75 \times imp) + 0.15$	C=	0.795	
4	Calculate runoff volume, $V_{design} = (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	54,757	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{observed}$ [1] (in/hr) (Appendix VII)	$K_{observed}$=	N/A	In/hr
2	Enter combined safety factor from Worksheet H, S_{total} (unitless)	S_{total}=	N/A	
3	Calculate design infiltration rate, $K_{design} = K_{observed} / S_{total}$	K_{design}=	N/A	In/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	48	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}=	N/A	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	N/A	sq-ft

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

Worksheet J: Summary of Harvested Water Demand and Feasibility

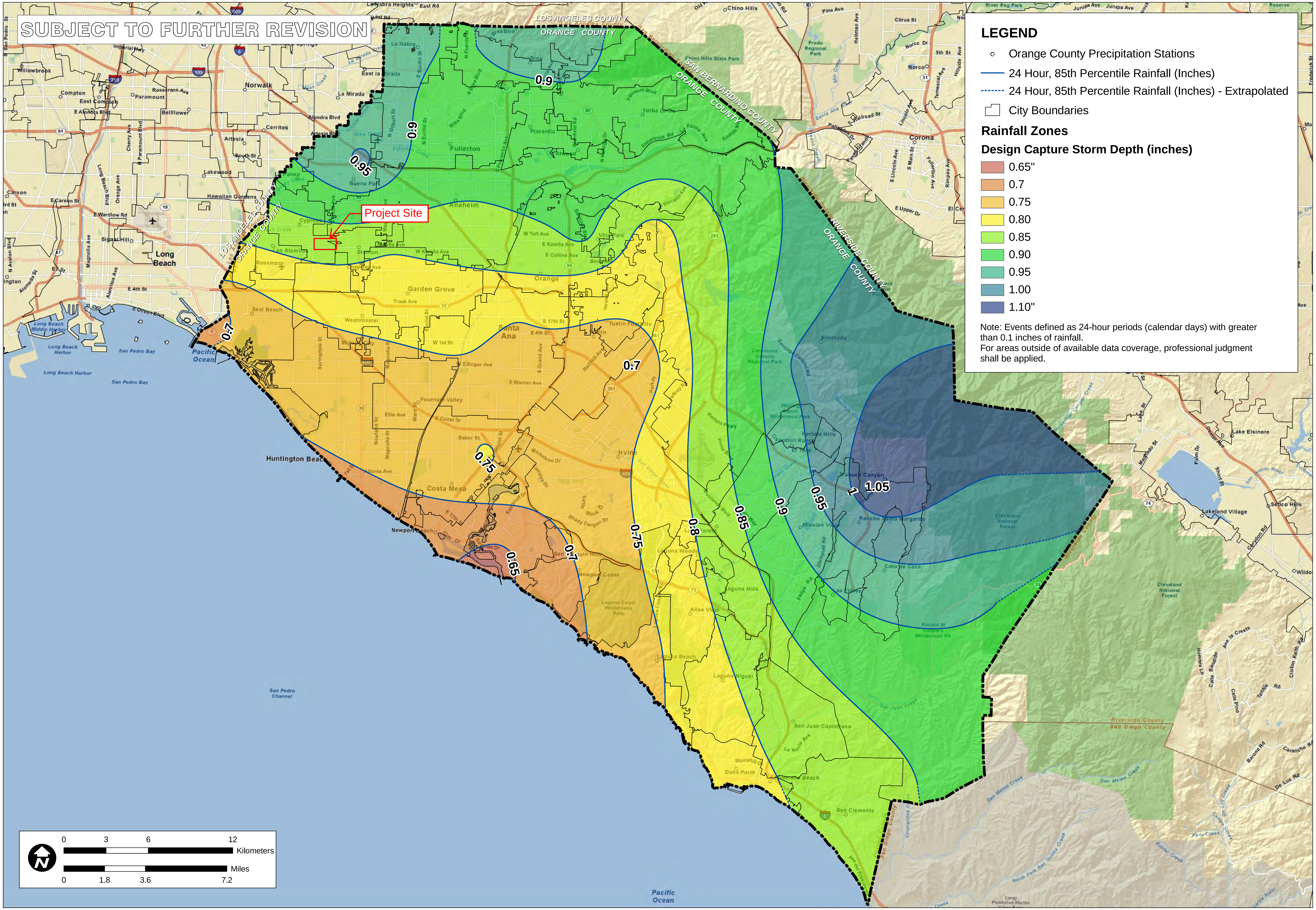
1	What demands for harvested water exist in the tributary area (check all that apply):			
2	Toilet and urinal flushing		☐	
3	Landscape irrigation		✔	
4	Other:____ _		☐	
5	What is the design capture storm depth? (Figure III.1)	d	0.85	inches
6	What is the project size?	A	22.31	ac
7	What is the acreage of impervious area?	IA	19.20	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)		18.24	ac
15	What is the proposed project irrigated area? (multiply conservation landscaping by 1; multiply active turf by 2)		3.11	ac
16	Is partial capture potentially feasible? (Line 15 > Line 14?)		No	

Provide supporting assumptions and citations for controlling demand calculation:

Using Table X.8 in the TGD
Region: Santa Ana
Storm Depth: 0.85 in
Minimum Irrigated Area: 0.95

Site Characteristics

Rainfall Zone



RAINFALL ZONES

TITLE

ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT

ORANGE CO. CA

JOB

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

PACE Advanced Water Engineering

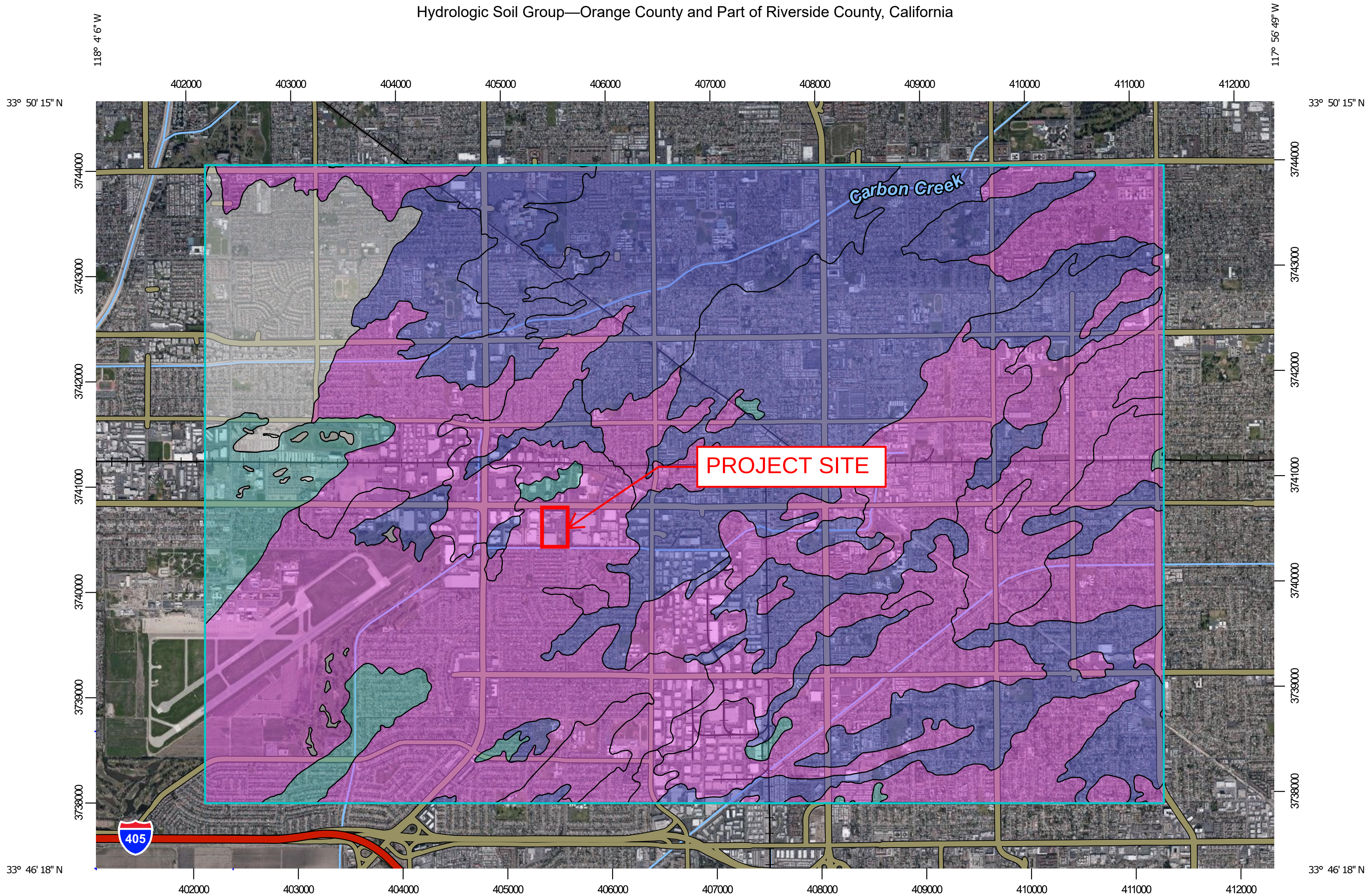
FIGURE

XVI-1

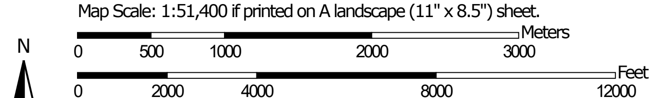
P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-1_RainfallZones_20110215.mxd

Site Characteristics

Hydrologic Soils Group



Map Scale: 1:51,400 if printed on A landscape (11" x 8.5") sheet.



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 Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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.

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 13, Sep 16, 2019

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—Jan 25, 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
122	Bolsa silt loam	C	0.0	0.0%
123	Bolsa silt loam, drained	C	603.6	4.4%
158	Hueneme fine sandy loam, drained	A	4,006.7	29.1%
163	Metz loamy sand	B	3,498.9	25.4%
164	Metz loamy sand, moderately fine substratum	B	1,542.0	11.2%
166	Mocho loam, 0 to 2 percent slopes, warm MAAT, MLRA 19	B	228.6	1.7%
185	Pits		0.1	0.0%
194	San Emigdio fine sandy loam, 0 to 2 percent slopes	A	1,646.3	12.0%
196	San Emigdio fine sandy loam, moderately fine substratum, 0 to 2 percent slopes	A	1,372.3	10.0%
1000LA	Urban land-Metz-Pico complex, 0 to 2 percent slopes		839.8	6.1%
W	Water		24.8	0.2%
Totals for Area of Interest			**13,763.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

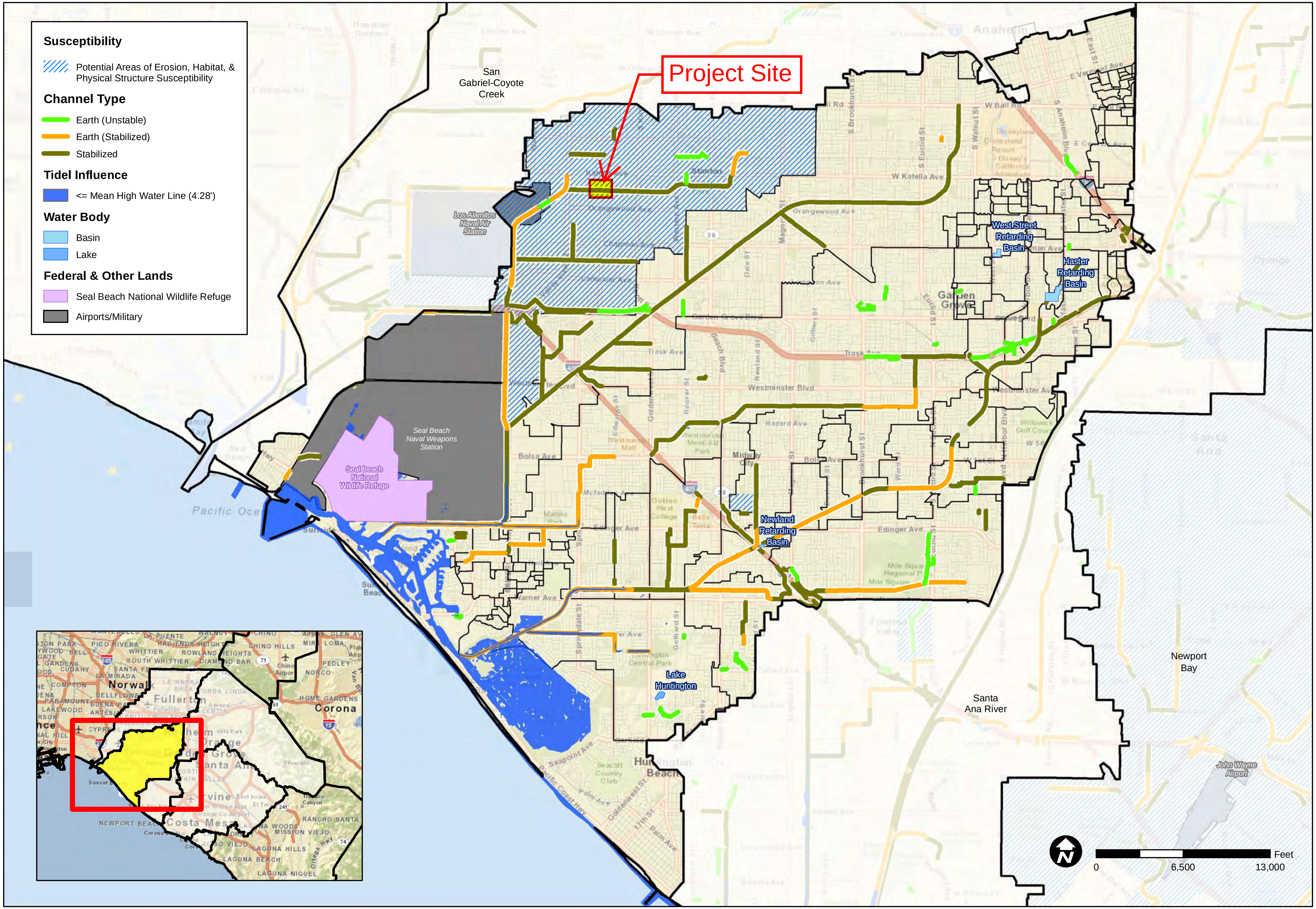
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

HCOC Calculations

Hydromodification Susceptibility Map



P:\9526E\6-GIS\Mxds\Workspace\SusceptibleAnalysis_20100422\9526E_AnaheimBay_20100331.mxd

TITLE
SUSCEPTIBILITY ANALYIS
ANAHEIM BAY-
HUNTINGTON HARBOR

JOB
ORANGE COUNTY
WATERSHED
MASTER PLANNING

ORANGE CO.
CA

SCALE	DESIGNED	DRAWING	CHECKED	DATE	JOB NO.
1" = 6500'	TH	TH	BMP	04/22/10	9526-E

PACE
Advanced Water Engineering

FIGURE
2

HCOC Calculations

Pre-Development Condition:

Drainage Area	Area (ac)	Peak Runoff Q_2 (cfs)	T_c (min.)	2-yr, 24-hr. Runoff Volume (cu-ft)
DA1 DMA1	4.86	9.57	5.14	0
DA2 DMA1	6.95	8.37	11.87	44,775
DA2 DMA2	8.88	11.61	10.34	37,614
DA3 DMA1	1.62	2.73	6.70	2,618
Total				85,007

Post-Development Condition:

Drainage Area	Area (ac)	Peak Runoff Q_2 (cfs)	T_c (min.)	2-yr, 24-hr. Runoff Volume (cu-ft)
A	3.21	5.01	7.66	20,647
B	2.92	4.52	7.75	19,489
C	2.93	5.38	5.79	19,240
D	4.77	8.93	5.61	31,442
E	2.50	5.19	4.69	0
F	2.60	4.92	5.51	16,997
G	3.37	6.29	5.63	21,506
Total:				129,321

HCOC Required Volume

Post-Development Runoff Volume 2-yr, 24-hr (cu-ft)	0.95*Post-Development Runoff Volume 2-yr, 24-hr (cu-ft)	Pre-Development Runoff Volume 2-yr, 24-hr (cu-ft)	HCOC Required Volume V_{HCOC} (cu-ft)
129,321	122,855	85,007	37,848

<u>Note:</u>

1. Volume Reduction needed to meet HCOC Requirement: V_{HCOC} = (Post-Volume)*0.95 – (Pre-Volume)
2. Total Design Capture Volume (Section IV.1) = 57,701 > Total HCOC Required Volume = 37,848 cu-ft
3. In this case, DCV is the controlling stormwater design volume

Pre-Development Calculations

Peak Runoff (2-yr, 24-hr)

```
                   Orange County Rational Hydrology Program

               (Hydrology Manual Date(s) October 1986 & November 1996)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2004 Version 8.0
        Rational Hydrology Study, Date: 03/29/20  File Name: 2019285pre.roc
------------------------------------------------------------------------
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------

Rational hydrology study storm event year is     2.0

Decimal fraction of study above 2000 ft., 600M  =     0.0000
English Units Used for input data


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.100 to Point/Station       1.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.400(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Initial subarea data:
Initial area flow distance =   162.000(Ft.)
Top (of initial area) elevation =    44.400(Ft.)
Bottom (of initial area) elevation =    41.330(Ft.)
Difference in elevation =     3.070(Ft.)
Slope =    0.01895  s(%)=       1.90
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.142 min.
Rainfall intensity =      2.228(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.884
Subarea runoff =      9.568(CFS)
Total initial stream area =       4.860(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.100 to Point/Station       2.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.400(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Initial subarea data:
Initial area flow distance =   399.000(Ft.)
Top (of initial area) elevation =    41.690(Ft.)
```

```
Bottom (of initial area) elevation =    40.990(Ft.)
Difference in elevation =     0.700(Ft.)
Slope =    0.00175  s(%)=       0.18
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.870 min.
NOTE: Distance EXCEEDS recommended maximum value of   328.084(Ft.)
for this Development Type
Rainfall intensity =      1.378(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.874
Subarea runoff =      8.370(CFS)
Total initial stream area =       6.950(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.300 to Point/Station       2.400
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.400(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Initial subarea data:
Initial area flow distance =   483.000(Ft.)
Top (of initial area) elevation =    42.500(Ft.)
Bottom (of initial area) elevation =    40.020(Ft.)
Difference in elevation =     2.480(Ft.)
Slope =    0.00513  s(%)=       0.51
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.336 min.
NOTE: Distance EXCEEDS recommended maximum value of   328.084(Ft.)
for this Development Type
Rainfall intensity =      1.492(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.876
Subarea runoff =     11.605(CFS)
Total initial stream area =       8.880(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       3.100 to Point/Station       3.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.400(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Initial subarea data:
Initial area flow distance =   232.000(Ft.)
Top (of initial area) elevation =    41.700(Ft.)
Bottom (of initial area) elevation =    39.300(Ft.)
Difference in elevation =     2.400(Ft.)
Slope =    0.01034  s(%)=       1.03
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
```

```
Initial area time of concentration =    6.701 min.
Rainfall intensity =      1.914(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.881
Subarea runoff =      2.732(CFS)
Total initial stream area =        1.620(Ac.)
End of computations, total study area =           22.31 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number (AMC 2) =  32.0
```

Pre-Development Conditions

Volume (2-yr, 24-hr)

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 06/23/20   File Name 2019285DA1DMA1.out

++

Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6277

2019-285 6400 Katella Avenue
Pre-Developed Unit Hydrograph
2 Year, 24 Hour Storm
DA1 DMA1

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used
++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	4.9	1.00	A	0.400	0.389	0.156

Area-averaged adjusted loss rate Fm (In/Hr) = 0.156

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
1.89	0.389	32.0	16.6	50.24	0.739
2.97	0.611	98.0	98.0	0.20	0.890

Area-averaged catchment yield fraction, Y = 0.831
Area-averaged low loss fraction, Yb = 0.169
++

```
User entry of time of concentration  =   0.086 (hours)
Watershed area =       4.86(Ac.)
Catchment Lag time =   0.069 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 364.6441
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.156(In/Hr)
Average low loss rate fraction (Yb) = 0.169 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.190(In)
Computed peak 30-minute rainfall =  0.400(In)
Specified peak 1-hour rainfall =  0.530(In)
Computed peak 3-hour rainfall =  0.890(In)
Specified peak 6-hour rainfall =  1.220(In)
Specified peak 24-hour rainfall =  2.050(In)


Rainfall depth area reduction factors:
Using a total area of       4.86(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.190(In)
30-minute factor = 1.000    Adjusted rainfall =  0.400(In)
1-hour factor = 1.000       Adjusted rainfall =  0.530(In)
3-hour factor = 1.000       Adjusted rainfall =  0.890(In)
6-hour factor = 1.000       Adjusted rainfall =  1.220(In)
24-hour factor = 1.000  Adjusted rainfall =  2.050(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph         Unit Hydrograph
Number           Mean values            ((CFS))
---------------------------------------------------------------------
                (K =        19.59 (CFS))

  1              100.000                  0.000
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.2998               0.0465
  2              0.3999               0.0292
  3              0.4715               0.0220
  4              0.5299               0.0184
  5              0.5887               0.0189
  6              0.6416               0.0171
  7              0.6901               0.0157
  8              0.7350               0.0146
  9              0.7770               0.0137
 10              0.8166               0.0130
 11              0.8542               0.0123
```

12	0.8900	0.0118
13	0.9230	0.0108
14	0.9546	0.0104
15	0.9851	0.0100
16	1.0144	0.0097
17	1.0428	0.0094
18	1.0703	0.0091
19	1.0970	0.0088
20	1.1229	0.0086
21	1.1481	0.0083
22	1.1726	0.0081
23	1.1966	0.0079
24	1.2200	0.0077
25	1.2388	0.0062
26	1.2571	0.0061
27	1.2750	0.0059
28	1.2925	0.0058
29	1.3096	0.0057
30	1.3263	0.0055
31	1.3427	0.0054
32	1.3587	0.0053
33	1.3745	0.0052
34	1.3899	0.0051
35	1.4051	0.0050
36	1.4200	0.0049
37	1.4346	0.0049
38	1.4490	0.0048
39	1.4632	0.0047
40	1.4771	0.0046
41	1.4908	0.0045
42	1.5043	0.0045
43	1.5176	0.0044
44	1.5308	0.0044
45	1.5437	0.0043
46	1.5564	0.0042
47	1.5690	0.0042
48	1.5814	0.0041
49	1.5937	0.0041
50	1.6058	0.0040
51	1.6177	0.0040
52	1.6295	0.0039
53	1.6412	0.0039
54	1.6527	0.0038
55	1.6641	0.0038
56	1.6754	0.0037
57	1.6865	0.0037
58	1.6975	0.0037
59	1.7084	0.0036
60	1.7192	0.0036
61	1.7299	0.0035

62	1.7405	0.0035
63	1.7509	0.0035
64	1.7613	0.0034
65	1.7715	0.0034
66	1.7817	0.0034
67	1.7917	0.0033
68	1.8017	0.0033
69	1.8116	0.0033
70	1.8214	0.0033
71	1.8311	0.0032
72	1.8407	0.0032
73	1.8502	0.0032
74	1.8597	0.0031
75	1.8690	0.0031
76	1.8783	0.0031
77	1.8875	0.0031
78	1.8967	0.0030
79	1.9057	0.0030
80	1.9147	0.0030
81	1.9237	0.0030
82	1.9325	0.0029
83	1.9413	0.0029
84	1.9500	0.0029
85	1.9587	0.0029
86	1.9673	0.0029
87	1.9758	0.0028
88	1.9843	0.0028
89	1.9927	0.0028
90	2.0010	0.0028
91	2.0093	0.0028
92	2.0176	0.0027
93	2.0258	0.0027
94	2.0339	0.0027
95	2.0420	0.0027
96	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0080	0.0014	0.0067
2	0.0081	0.0014	0.0067
3	0.0082	0.0014	0.0068
4	0.0083	0.0014	0.0069
5	0.0084	0.0014	0.0069
6	0.0084	0.0014	0.0070
7	0.0085	0.0014	0.0071
8	0.0086	0.0015	0.0072
9	0.0087	0.0015	0.0073
10	0.0088	0.0015	0.0073

11	0.0089	0.0015	0.0074
12	0.0090	0.0015	0.0075
13	0.0091	0.0015	0.0076
14	0.0093	0.0016	0.0077
15	0.0094	0.0016	0.0078
16	0.0095	0.0016	0.0079
17	0.0096	0.0016	0.0080
18	0.0097	0.0016	0.0081
19	0.0099	0.0017	0.0082
20	0.0100	0.0017	0.0083
21	0.0102	0.0017	0.0084
22	0.0103	0.0017	0.0086
23	0.0105	0.0018	0.0087
24	0.0106	0.0018	0.0088
25	0.0108	0.0018	0.0090
26	0.0110	0.0019	0.0091
27	0.0112	0.0019	0.0093
28	0.0113	0.0019	0.0094
29	0.0115	0.0020	0.0096
30	0.0117	0.0020	0.0098
31	0.0120	0.0020	0.0099
32	0.0122	0.0021	0.0101
33	0.0124	0.0021	0.0103
34	0.0127	0.0021	0.0105
35	0.0130	0.0022	0.0108
36	0.0132	0.0022	0.0110
37	0.0135	0.0023	0.0112
38	0.0138	0.0023	0.0115
39	0.0142	0.0024	0.0118
40	0.0145	0.0025	0.0121
41	0.0149	0.0025	0.0124
42	0.0153	0.0026	0.0127
43	0.0158	0.0027	0.0131
44	0.0162	0.0027	0.0135
45	0.0168	0.0028	0.0139
46	0.0173	0.0029	0.0144
47	0.0179	0.0030	0.0149
48	0.0186	0.0031	0.0154
49	0.0235	0.0040	0.0195
50	0.0243	0.0041	0.0202
51	0.0253	0.0043	0.0210
52	0.0263	0.0044	0.0219
53	0.0276	0.0047	0.0229
54	0.0289	0.0049	0.0240
55	0.0306	0.0052	0.0254
56	0.0324	0.0055	0.0269
57	0.0360	0.0061	0.0299
58	0.0387	0.0065	0.0321
59	0.0423	0.0072	0.0352
60	0.0468	0.0079	0.0389

61	0.0536	0.0091	0.0445
62	0.0574	0.0097	0.0477
63	0.0749	0.0127	0.0622
64	0.1427	0.0241	0.1186
65	0.2539	0.0389	0.2150
66	0.0592	0.0100	0.0492
67	0.0462	0.0078	0.0384
68	0.0383	0.0065	0.0318
69	0.0321	0.0054	0.0267
70	0.0287	0.0049	0.0239
71	0.0262	0.0044	0.0217
72	0.0242	0.0041	0.0201
73	0.0185	0.0031	0.0154
74	0.0172	0.0029	0.0143
75	0.0162	0.0027	0.0134
76	0.0153	0.0026	0.0127
77	0.0145	0.0024	0.0120
78	0.0138	0.0023	0.0115
79	0.0132	0.0022	0.0110
80	0.0126	0.0021	0.0105
81	0.0122	0.0021	0.0101
82	0.0117	0.0020	0.0097
83	0.0113	0.0019	0.0094
84	0.0109	0.0018	0.0091
85	0.0106	0.0018	0.0088
86	0.0103	0.0017	0.0085
87	0.0100	0.0017	0.0083
88	0.0097	0.0016	0.0081
89	0.0095	0.0016	0.0079
90	0.0092	0.0016	0.0077
91	0.0090	0.0015	0.0075
92	0.0088	0.0015	0.0073
93	0.0086	0.0015	0.0072
94	0.0084	0.0014	0.0070
95	0.0083	0.0014	0.0069
96	0.0081	0.0014	0.0067

Total soil rain loss = 0.34(In)
Total effective rainfall = 1.71(In)
Peak flow rate in flood hydrograph = 0.00(CFS)

++

24 - H O U R   S T O R M
R u n o f f   H y d r o g r a p h

Hydrograph in 15 Minute intervals ((CFS))

Time(h+m) Volume Ac.Ft   Q(CFS) 0   2.5   5.0   7.5   10.0

```
-----------------------------------------------------------------------
  0+15       0.0000      0.00  Q         |         |         |         |
  0+30       0.0000      0.00  Q         |         |         |         |
  0+45       0.0000      0.00  Q         |         |         |         |
  1+ 0       0.0000      0.00  Q         |         |         |         |
  1+15       0.0000      0.00  Q         |         |         |         |
  1+30       0.0000      0.00  Q         |         |         |         |
  1+45       0.0000      0.00  Q         |         |         |         |
  2+ 0       0.0000      0.00  Q         |         |         |         |
  2+15       0.0000      0.00  Q         |         |         |         |
  2+30       0.0000      0.00  Q         |         |         |         |
  2+45       0.0000      0.00  Q         |         |         |         |
  3+ 0       0.0000      0.00  Q         |         |         |         |
  3+15       0.0000      0.00  Q         |         |         |         |
  3+30       0.0000      0.00  Q         |         |         |         |
  3+45       0.0000      0.00  Q         |         |         |         |
  4+ 0       0.0000      0.00  Q         |         |         |         |
  4+15       0.0000      0.00  Q         |         |         |         |
  4+30       0.0000      0.00  Q         |         |         |         |
  4+45       0.0000      0.00  Q         |         |         |         |
  5+ 0       0.0000      0.00  Q         |         |         |         |
  5+15       0.0000      0.00  Q         |         |         |         |
  5+30       0.0000      0.00  Q         |         |         |         |
  5+45       0.0000      0.00  Q         |         |         |         |
  6+ 0       0.0000      0.00  Q         |         |         |         |
  6+15       0.0000      0.00  Q         |         |         |         |
  6+30       0.0000      0.00  Q         |         |         |         |
  6+45       0.0000      0.00  Q         |         |         |         |
  7+ 0       0.0000      0.00  Q         |         |         |         |
  7+15       0.0000      0.00  Q         |         |         |         |
  7+30       0.0000      0.00  Q         |         |         |         |
  7+45       0.0000      0.00  Q         |         |         |         |
  8+ 0       0.0000      0.00  Q         |         |         |         |
  8+15       0.0000      0.00  Q         |         |         |         |
  8+30       0.0000      0.00  Q         |         |         |         |
  8+45       0.0000      0.00  Q         |         |         |         |
  9+ 0       0.0000      0.00  Q         |         |         |         |
  9+15       0.0000      0.00  Q         |         |         |         |
  9+30       0.0000      0.00  Q         |         |         |         |
  9+45       0.0000      0.00  Q         |         |         |         |
 10+ 0       0.0000      0.00  Q         |         |         |         |
 10+15       0.0000      0.00  Q         |         |         |         |
 10+30       0.0000      0.00  Q         |         |         |         |
 10+45       0.0000      0.00  Q         |         |         |         |
 11+ 0       0.0000      0.00  Q         |         |         |         |
 11+15       0.0000      0.00  Q         |         |         |         |
 11+30       0.0000      0.00  Q         |         |         |         |
 11+45       0.0000      0.00  Q         |         |         |         |
 12+ 0       0.0000      0.00  Q         |         |         |         |
 12+15       0.0000      0.00  Q         |         |         |         |
```

12+30	0.0000	0.00	Q	|	|	|	|
12+45	0.0000	0.00	Q	|	|	|	|
13+ 0	0.0000	0.00	Q	|	|	|	|
13+15	0.0000	0.00	Q	|	|	|	|
13+30	0.0000	0.00	Q	|	|	|	|
13+45	0.0000	0.00	Q	|	|	|	|
14+ 0	0.0000	0.00	Q	|	|	|	|
14+15	0.0000	0.00	Q	|	|	|	|
14+30	0.0000	0.00	Q	|	|	|	|
14+45	0.0000	0.00	Q	|	|	|	|
15+ 0	0.0000	0.00	Q	|	|	|	|
15+15	0.0000	0.00	Q	|	|	|	|
15+30	0.0000	0.00	Q	|	|	|	|
15+45	0.0000	0.00	Q	|	|	|	|
16+ 0	0.0000	0.00	Q	|	|	|	|
16+15	0.0000	0.00	Q	|	|	|	|
16+30	0.0000	0.00	Q	|	|	|	|
16+45	0.0000	0.00	Q	|	|	|	|
17+ 0	0.0000	0.00	Q	|	|	|	|
17+15	0.0000	0.00	Q	|	|	|	|
17+30	0.0000	0.00	Q	|	|	|	|
17+45	0.0000	0.00	Q	|	|	|	|
18+ 0	0.0000	0.00	Q	|	|	|	|
18+15	0.0000	0.00	Q	|	|	|	|
18+30	0.0000	0.00	Q	|	|	|	|
18+45	0.0000	0.00	Q	|	|	|	|
19+ 0	0.0000	0.00	Q	|	|	|	|
19+15	0.0000	0.00	Q	|	|	|	|
19+30	0.0000	0.00	Q	|	|	|	|
19+45	0.0000	0.00	Q	|	|	|	|
20+ 0	0.0000	0.00	Q	|	|	|	|
20+15	0.0000	0.00	Q	|	|	|	|
20+30	0.0000	0.00	Q	|	|	|	|
20+45	0.0000	0.00	Q	|	|	|	|
21+ 0	0.0000	0.00	Q	|	|	|	|
21+15	0.0000	0.00	Q	|	|	|	|
21+30	0.0000	0.00	Q	|	|	|	|
21+45	0.0000	0.00	Q	|	|	|	|
22+ 0	0.0000	0.00	Q	|	|	|	|
22+15	0.0000	0.00	Q	|	|	|	|
22+30	0.0000	0.00	Q	|	|	|	|
22+45	0.0000	0.00	Q	|	|	|	|
23+ 0	0.0000	0.00	Q	|	|	|	|
23+15	0.0000	0.00	Q	|	|	|	|
23+30	0.0000	0.00	Q	|	|	|	|
23+45	0.0000	0.00	Q	|	|	|	|
24+ 0	0.0000	0.00	Q	|	|	|	|

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 06/23/20 File Name 2019285DA2DMA1.out

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Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6277

2019-285 6400 Katella Avenue
Pre-Developed Unit Hydrograph
2 Year, 24 Hour Storm
DA2 DMA1

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used

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******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	7.0	1.00	A	0.400	0.194	0.078

Area-averaged adjusted loss rate Fm (In/Hr) = 0.078

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
1.35	0.194	32.0	16.6	50.24	0.739
5.60	0.806	98.0	98.0	0.20	0.890

Area-averaged catchment yield fraction, Y = 0.860
Area-averaged low loss fraction, Yb = 0.140

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```
User entry of time of concentration  =   0.198 (hours)
Watershed area =       6.95(Ac.)
Catchment Lag time =   0.158 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 157.9615
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.078(In/Hr)
Average low loss rate fraction (Yb) = 0.140 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.190(In)
Computed peak 30-minute rainfall =  0.400(In)
Specified peak 1-hour rainfall =  0.530(In)
Computed peak 3-hour rainfall =  0.890(In)
Specified peak 6-hour rainfall =  1.220(In)
Specified peak 24-hour rainfall =  2.050(In)


Rainfall depth area reduction factors:
Using a total area of       6.95(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.190(In)
30-minute factor = 1.000    Adjusted rainfall =  0.400(In)
1-hour factor = 1.000       Adjusted rainfall =  0.530(In)
3-hour factor = 1.000       Adjusted rainfall =  0.890(In)
6-hour factor = 1.000       Adjusted rainfall =  1.220(In)
24-hour factor = 1.000  Adjusted rainfall =  2.050(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph         Unit Hydrograph
Number            Mean values            ((CFS))
---------------------------------------------------------------------
                (K =        28.02 (CFS))

  1              36.908                  10.341
  2              96.197                  16.611
  3             100.000                   1.065
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1             0.2998               0.0465
  2             0.3999               0.0292
  3             0.4714               0.0220
  4             0.5298               0.0184
  5             0.5887               0.0189
  6             0.6416               0.0171
  7             0.6900               0.0157
  8             0.7349               0.0146
  9             0.7769               0.0137
```

10	0.8166	0.0130
11	0.8541	0.0123
12	0.8900	0.0118
13	0.9230	0.0108
14	0.9546	0.0104
15	0.9851	0.0100
16	1.0144	0.0097
17	1.0428	0.0094
18	1.0703	0.0091
19	1.0969	0.0088
20	1.1228	0.0086
21	1.1481	0.0083
22	1.1726	0.0081
23	1.1966	0.0079
24	1.2200	0.0077
25	1.2388	0.0062
26	1.2571	0.0061
27	1.2750	0.0059
28	1.2925	0.0058
29	1.3095	0.0057
30	1.3263	0.0055
31	1.3427	0.0054
32	1.3587	0.0053
33	1.3744	0.0052
34	1.3899	0.0051
35	1.4051	0.0050
36	1.4200	0.0049
37	1.4346	0.0049
38	1.4490	0.0048
39	1.4632	0.0047
40	1.4771	0.0046
41	1.4908	0.0045
42	1.5043	0.0045
43	1.5176	0.0044
44	1.5307	0.0044
45	1.5437	0.0043
46	1.5564	0.0042
47	1.5690	0.0042
48	1.5814	0.0041
49	1.5937	0.0041
50	1.6058	0.0040
51	1.6177	0.0040
52	1.6295	0.0039
53	1.6412	0.0039
54	1.6527	0.0038
55	1.6641	0.0038
56	1.6754	0.0037
57	1.6865	0.0037
58	1.6975	0.0037
59	1.7084	0.0036

60	1.7192	0.0036
61	1.7299	0.0035
62	1.7405	0.0035
63	1.7509	0.0035
64	1.7613	0.0034
65	1.7715	0.0034
66	1.7817	0.0034
67	1.7917	0.0033
68	1.8017	0.0033
69	1.8116	0.0033
70	1.8214	0.0033
71	1.8311	0.0032
72	1.8407	0.0032
73	1.8502	0.0032
74	1.8596	0.0031
75	1.8690	0.0031
76	1.8783	0.0031
77	1.8875	0.0031
78	1.8967	0.0030
79	1.9057	0.0030
80	1.9147	0.0030
81	1.9236	0.0030
82	1.9325	0.0029
83	1.9413	0.0029
84	1.9500	0.0029
85	1.9587	0.0029
86	1.9673	0.0029
87	1.9758	0.0028
88	1.9843	0.0028
89	1.9927	0.0028
90	2.0010	0.0028
91	2.0093	0.0028
92	2.0176	0.0027
93	2.0258	0.0027
94	2.0339	0.0027
95	2.0420	0.0027
96	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0080	0.0011	0.0069
2	0.0081	0.0011	0.0070
3	0.0082	0.0011	0.0070
4	0.0083	0.0012	0.0071
5	0.0084	0.0012	0.0072
6	0.0084	0.0012	0.0073
7	0.0085	0.0012	0.0073
8	0.0086	0.0012	0.0074

9	0.0087	0.0012	0.0075
10	0.0088	0.0012	0.0076
11	0.0089	0.0012	0.0077
12	0.0090	0.0013	0.0078
13	0.0091	0.0013	0.0079
14	0.0093	0.0013	0.0080
15	0.0094	0.0013	0.0081
16	0.0095	0.0013	0.0082
17	0.0096	0.0013	0.0083
18	0.0097	0.0014	0.0084
19	0.0099	0.0014	0.0085
20	0.0100	0.0014	0.0086
21	0.0102	0.0014	0.0087
22	0.0103	0.0014	0.0089
23	0.0105	0.0015	0.0090
24	0.0106	0.0015	0.0091
25	0.0108	0.0015	0.0093
26	0.0110	0.0015	0.0094
27	0.0112	0.0016	0.0096
28	0.0113	0.0016	0.0098
29	0.0115	0.0016	0.0099
30	0.0117	0.0016	0.0101
31	0.0120	0.0017	0.0103
32	0.0122	0.0017	0.0105
33	0.0124	0.0017	0.0107
34	0.0127	0.0018	0.0109
35	0.0130	0.0018	0.0111
36	0.0132	0.0018	0.0114
37	0.0135	0.0019	0.0116
38	0.0138	0.0019	0.0119
39	0.0142	0.0020	0.0122
40	0.0145	0.0020	0.0125
41	0.0149	0.0021	0.0128
42	0.0153	0.0021	0.0132
43	0.0158	0.0022	0.0136
44	0.0162	0.0023	0.0140
45	0.0168	0.0023	0.0144
46	0.0173	0.0024	0.0149
47	0.0179	0.0025	0.0154
48	0.0186	0.0026	0.0160
49	0.0235	0.0033	0.0202
50	0.0243	0.0034	0.0209
51	0.0253	0.0035	0.0218
52	0.0263	0.0037	0.0226
53	0.0276	0.0038	0.0237
54	0.0289	0.0040	0.0249
55	0.0306	0.0043	0.0263
56	0.0324	0.0045	0.0279
57	0.0360	0.0050	0.0310
58	0.0387	0.0054	0.0333

59	0.0423	0.0059	0.0364
60	0.0468	0.0065	0.0403
61	0.0536	0.0075	0.0461
62	0.0574	0.0080	0.0494
63	0.0749	0.0105	0.0644
64	0.1427	0.0194	0.1233
65	0.2538	0.0194	0.2344
66	0.0592	0.0083	0.0510
67	0.0462	0.0064	0.0398
68	0.0383	0.0053	0.0330
69	0.0321	0.0045	0.0277
70	0.0287	0.0040	0.0247
71	0.0262	0.0037	0.0225
72	0.0242	0.0034	0.0208
73	0.0185	0.0026	0.0159
74	0.0172	0.0024	0.0148
75	0.0162	0.0023	0.0139
76	0.0153	0.0021	0.0131
77	0.0145	0.0020	0.0125
78	0.0138	0.0019	0.0119
79	0.0132	0.0018	0.0113
80	0.0126	0.0018	0.0109
81	0.0122	0.0017	0.0105
82	0.0117	0.0016	0.0101
83	0.0113	0.0016	0.0097
84	0.0109	0.0015	0.0094
85	0.0106	0.0015	0.0091
86	0.0103	0.0014	0.0089
87	0.0100	0.0014	0.0086
88	0.0097	0.0014	0.0084
89	0.0095	0.0013	0.0082
90	0.0092	0.0013	0.0080
91	0.0090	0.0013	0.0078
92	0.0088	0.0012	0.0076
93	0.0086	0.0012	0.0074
94	0.0084	0.0012	0.0073
95	0.0083	0.0012	0.0071
96	0.0081	0.0011	0.0070

Total soil rain loss = 0.27(In)
Total effective rainfall = 1.78(In)
Peak flow rate in flood hydrograph = 4.55(CFS)

+++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 15 Minute intervals ((CFS))

```
      --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+15       0.0015      0.07  Q         |         |         |         |
  0+30       0.0053      0.19  Q         |         |         |         |
  0+45       0.0094      0.20  Q         |         |         |         |
  1+ 0       0.0135      0.20  Q         |         |         |         |
  1+15       0.0176      0.20  Q         |         |         |         |
  1+30       0.0218      0.20  Q         |         |         |         |
  1+45       0.0260      0.20  QV        |         |         |         |
  2+ 0       0.0303      0.21  QV        |         |         |         |
  2+15       0.0346      0.21  QV        |         |         |         |
  2+30       0.0390      0.21  QV        |         |         |         |
  2+45       0.0434      0.21  QV        |         |         |         |
  3+ 0       0.0478      0.22  QV        |         |         |         |
  3+15       0.0524      0.22  Q V       |         |         |         |
  3+30       0.0569      0.22  Q V       |         |         |         |
  3+45       0.0616      0.22  Q V       |         |         |         |
  4+ 0       0.0663      0.23  Q V       |         |         |         |
  4+15       0.0710      0.23  Q V       |         |         |         |
  4+30       0.0758      0.23  Q V       |         |         |         |
  4+45       0.0807      0.24  Q  V      |         |         |         |
  5+ 0       0.0856      0.24  Q  V      |         |         |         |
  5+15       0.0907      0.24  Q  V      |         |         |         |
  5+30       0.0957      0.25  Q  V      |         |         |         |
  5+45       0.1009      0.25  Q  V      |         |         |         |
  6+ 0       0.1061      0.25  |Q  V     |         |         |         |
  6+15       0.1115      0.26  |Q  V     |         |         |         |
  6+30       0.1169      0.26  |Q  V     |         |         |         |
  6+45       0.1224      0.27  |Q  V     |         |         |         |
  7+ 0       0.1279      0.27  |Q  V     |         |         |         |
  7+15       0.1336      0.27  |Q   V    |         |         |         |
  7+30       0.1394      0.28  |Q   V    |         |         |         |
  7+45       0.1453      0.28  |Q   V    |         |         |         |
  8+ 0       0.1513      0.29  |Q   V    |         |         |         |
  8+15       0.1574      0.30  |Q    V   |         |         |         |
  8+30       0.1636      0.30  |Q    V   |         |         |         |
  8+45       0.1700      0.31  |Q    V   |         |         |         |
  9+ 0       0.1765      0.31  |Q    V   |         |         |         |
  9+15       0.1831      0.32  |Q     V  |         |         |         |
  9+30       0.1899      0.33  |Q     V  |         |         |         |
  9+45       0.1969      0.34  |Q     V  |         |         |         |
 10+ 0       0.2040      0.34  |Q     V  |         |         |         |
 10+15       0.2113      0.35  |Q      V |         |         |         |
 10+30       0.2188      0.36  |Q      V |         |         |         |
 10+45       0.2265      0.37  |Q      V |         |         |         |
 11+ 0       0.2344      0.38  |Q       V|         |         |         |
 11+15       0.2426      0.40  |Q       V|         |         |         |
 11+30       0.2510      0.41  |Q       V|         |         |         |
 11+45       0.2598      0.42  |Q        V         |         |         |
```

```
12+ 0       0.2688      0.44  |Q        V         |         |         |
12+15       0.2790      0.49  |Q        V         |         |         |
12+30       0.2907      0.57  | Q        V        |         |         |
12+45       0.3030      0.59  | Q       |V        |         |         |
13+ 0       0.3157      0.62  | Q       | V       |         |         |
13+15       0.3290      0.64  | Q       | V       |         |         |
13+30       0.3430      0.68  | Q       |  V      |         |         |
13+45       0.3577      0.71  | Q       |  V      |         |         |
14+ 0       0.3732      0.75  |  Q      |   V     |         |         |
14+15       0.3900      0.81  |  Q      |    V    |         |         |
14+30       0.4083      0.89  |  Q      |    V    |         |         |
14+45       0.4282      0.96  |  Q      |     V   |         |         |
15+ 0       0.4501      1.06  |   Q     |      V  |         |         |
15+15       0.4745      1.18  |   Q     |       V |         |         |
15+30       0.5018      1.32  |    Q    |        V|         |         |
15+45       0.5335      1.54  |     Q   |         V         |         |
16+ 0       0.5831      2.40  |        Q|         | V       |         |
16+15       0.6769      4.54  |         |       Q |     V   |         |
16+30       0.7710      4.55  |         |       Q |        V|         |
16+45       0.8021      1.51  |     Q   |         |          V         |
17+ 0       0.8239      1.06  |   Q     |         |         |V        |
17+15       0.8420      0.88  |  Q      |         |         | V       |
17+30       0.8575      0.75  | Q       |         |         |  V      |
17+45       0.8714      0.67  | Q       |         |         |  V      |
18+ 0       0.8841      0.62  | Q       |         |         |   V     |
18+15       0.8951      0.53  | Q       |         |         |   V     |
18+30       0.9042      0.44  |Q        |         |         |    V    |
18+45       0.9126      0.41  |Q        |         |         |    V    |
19+ 0       0.9205      0.38  |Q        |         |         |    V    |
19+15       0.9280      0.36  |Q        |         |         |     V   |
19+30       0.9351      0.34  |Q        |         |         |     V   |
19+45       0.9419      0.33  |Q        |         |         |     V   |
20+ 0       0.9484      0.31  |Q        |         |         |     V   |
20+15       0.9546      0.30  |Q        |         |         |      V  |
20+30       0.9606      0.29  |Q        |         |         |      V  |
20+45       0.9663      0.28  |Q        |         |         |      V  |
21+ 0       0.9719      0.27  |Q        |         |         |      V  |
21+15       0.9773      0.26  |Q        |         |         |      V  |
21+30       0.9825      0.25  |Q        |         |         |       V |
21+45       0.9876      0.25  Q         |         |         |       V |
22+ 0       0.9925      0.24  Q         |         |         |       V |
22+15       0.9973      0.23  Q         |         |         |       V |
22+30       1.0020      0.23  Q         |         |         |       V |
22+45       1.0066      0.22  Q         |         |         |        V|
23+ 0       1.0110      0.22  Q         |         |         |        V|
23+15       1.0154      0.21  Q         |         |         |        V|
23+30       1.0197      0.21  Q         |         |         |        V|
23+45       1.0238      0.20  Q         |         |         |        V|
24+ 0       1.0279      0.20  Q         |         |         |        V|
24+15       1.0305      0.12  Q         |         |         |        V|
```

```
   24+30        1.0306      0.01  Q         |         |         |         V
-----------------------------------------------------------------------
```

```
        U n i t   H y d r o g r a p h   A n a l y s i s

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        Study date  06/23/20   File Name 2019285DA2DMA2.out


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996


Program License Serial Number 6277

---------------------------------------------------------------------
2019-285 6400 Katella Avenue
Pre-Developed Unit Hydrograph
2 Year, 24 Hour Storm
DA2 DMA2
--------------------------------------------------------------------

        Storm Event Year = 2

        Antecedent Moisture Condition = 1

 English (in-lb) Input Units Used
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  Area       Area       Soil     Fp      Ap      Fm
No.(AMCII) (Ac.)    Fraction     Group  (In/Hr)   (dec.)    (In/Hr)
 32.0       8.9         1.00      A     0.400     0.184    0.074

Area-averaged adjusted loss rate Fm (In/Hr) =  0.074

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC1)           Yield Fr
     1.63   0.184         32.0      16.6      50.24     0.739
     7.25   0.816         98.0      98.0       0.20     0.890

Area-averaged catchment yield fraction, Y =  0.862
Area-averaged low loss fraction, Yb =  0.138
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
User entry of time of concentration  =   0.172 (hours)
Watershed area =       8.88(Ac.)
Catchment Lag time =   0.138 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 181.4044
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.074(In/Hr)
Average low loss rate fraction (Yb) = 0.138 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.190(In)
Computed peak 30-minute rainfall =  0.400(In)
Specified peak 1-hour rainfall =  0.530(In)
Computed peak 3-hour rainfall =  0.890(In)
Specified peak 6-hour rainfall =  1.220(In)
Specified peak 24-hour rainfall =  2.050(In)


Rainfall depth area reduction factors:
Using a total area of       8.88(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.190(In)
30-minute factor = 1.000    Adjusted rainfall =  0.400(In)
1-hour factor = 1.000       Adjusted rainfall =  0.530(In)
3-hour factor = 1.000       Adjusted rainfall =  0.890(In)
6-hour factor = 1.000       Adjusted rainfall =  1.220(In)
24-hour factor = 1.000  Adjusted rainfall =  2.050(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph         Unit Hydrograph
Number            Mean values           ((CFS))
---------------------------------------------------------------------
                (K =        35.80 (CFS))

  1              43.663                 15.630
  2             100.000                  7.815
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                 (In)
  1             0.2998               0.0465
  2             0.3998               0.0292
  3             0.4714               0.0220
  4             0.5298               0.0184
  5             0.5886               0.0189
  6             0.6416               0.0171
  7             0.6900               0.0157
  8             0.7349               0.0146
  9             0.7769               0.0137
 10             0.8165               0.0130
```

11	0.8541	0.0123
12	0.8900	0.0118
13	0.9230	0.0108
14	0.9546	0.0104
15	0.9851	0.0100
16	1.0144	0.0097
17	1.0428	0.0094
18	1.0703	0.0091
19	1.0969	0.0088
20	1.1228	0.0086
21	1.1480	0.0083
22	1.1726	0.0081
23	1.1966	0.0079
24	1.2200	0.0077
25	1.2388	0.0062
26	1.2571	0.0061
27	1.2750	0.0059
28	1.2924	0.0058
29	1.3095	0.0057
30	1.3263	0.0055
31	1.3426	0.0054
32	1.3587	0.0053
33	1.3744	0.0052
34	1.3899	0.0051
35	1.4051	0.0050
36	1.4200	0.0049
37	1.4346	0.0049
38	1.4490	0.0048
39	1.4631	0.0047
40	1.4771	0.0046
41	1.4908	0.0045
42	1.5043	0.0045
43	1.5176	0.0044
44	1.5307	0.0044
45	1.5437	0.0043
46	1.5564	0.0042
47	1.5690	0.0042
48	1.5814	0.0041
49	1.5937	0.0041
50	1.6058	0.0040
51	1.6177	0.0040
52	1.6295	0.0039
53	1.6412	0.0039
54	1.6527	0.0038
55	1.6641	0.0038
56	1.6754	0.0037
57	1.6865	0.0037
58	1.6975	0.0037
59	1.7084	0.0036
60	1.7192	0.0036

61	1.7299	0.0035
62	1.7404	0.0035
63	1.7509	0.0035
64	1.7613	0.0034
65	1.7715	0.0034
66	1.7817	0.0034
67	1.7917	0.0033
68	1.8017	0.0033
69	1.8116	0.0033
70	1.8214	0.0033
71	1.8310	0.0032
72	1.8407	0.0032
73	1.8502	0.0032
74	1.8596	0.0031
75	1.8690	0.0031
76	1.8783	0.0031
77	1.8875	0.0031
78	1.8967	0.0030
79	1.9057	0.0030
80	1.9147	0.0030
81	1.9236	0.0030
82	1.9325	0.0029
83	1.9413	0.0029
84	1.9500	0.0029
85	1.9587	0.0029
86	1.9673	0.0029
87	1.9758	0.0028
88	1.9843	0.0028
89	1.9927	0.0028
90	2.0010	0.0028
91	2.0093	0.0028
92	2.0176	0.0027
93	2.0258	0.0027
94	2.0339	0.0027
95	2.0420	0.0027
96	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0080	0.0011	0.0069
2	0.0081	0.0011	0.0070
3	0.0082	0.0011	0.0071
4	0.0083	0.0011	0.0071
5	0.0084	0.0012	0.0072
6	0.0084	0.0012	0.0073
7	0.0085	0.0012	0.0074
8	0.0086	0.0012	0.0074
9	0.0087	0.0012	0.0075

10	0.0088	0.0012	0.0076
11	0.0089	0.0012	0.0077
12	0.0090	0.0012	0.0078
13	0.0091	0.0013	0.0079
14	0.0093	0.0013	0.0080
15	0.0094	0.0013	0.0081
16	0.0095	0.0013	0.0082
17	0.0096	0.0013	0.0083
18	0.0097	0.0013	0.0084
19	0.0099	0.0014	0.0085
20	0.0100	0.0014	0.0086
21	0.0102	0.0014	0.0088
22	0.0103	0.0014	0.0089
23	0.0105	0.0014	0.0090
24	0.0106	0.0015	0.0092
25	0.0108	0.0015	0.0093
26	0.0110	0.0015	0.0095
27	0.0112	0.0015	0.0096
28	0.0113	0.0016	0.0098
29	0.0115	0.0016	0.0099
30	0.0117	0.0016	0.0101
31	0.0120	0.0017	0.0103
32	0.0122	0.0017	0.0105
33	0.0124	0.0017	0.0107
34	0.0127	0.0018	0.0109
35	0.0130	0.0018	0.0112
36	0.0132	0.0018	0.0114
37	0.0135	0.0019	0.0117
38	0.0138	0.0019	0.0119
39	0.0142	0.0020	0.0122
40	0.0145	0.0020	0.0125
41	0.0149	0.0021	0.0129
42	0.0153	0.0021	0.0132
43	0.0158	0.0022	0.0136
44	0.0162	0.0022	0.0140
45	0.0168	0.0023	0.0145
46	0.0173	0.0024	0.0149
47	0.0179	0.0025	0.0155
48	0.0186	0.0026	0.0160
49	0.0235	0.0032	0.0202
50	0.0243	0.0034	0.0209
51	0.0253	0.0035	0.0218
52	0.0263	0.0036	0.0227
53	0.0276	0.0038	0.0238
54	0.0289	0.0040	0.0249
55	0.0306	0.0042	0.0264
56	0.0324	0.0045	0.0279
57	0.0360	0.0050	0.0310
58	0.0387	0.0053	0.0334
59	0.0423	0.0058	0.0365

60	0.0468	0.0065	0.0403
61	0.0536	0.0074	0.0462
62	0.0574	0.0079	0.0495
63	0.0749	0.0103	0.0646
64	0.1427	0.0184	0.1243
65	0.2538	0.0184	0.2354
66	0.0592	0.0082	0.0510
67	0.0462	0.0064	0.0398
68	0.0383	0.0053	0.0330
69	0.0321	0.0044	0.0277
70	0.0287	0.0040	0.0248
71	0.0262	0.0036	0.0226
72	0.0242	0.0033	0.0208
73	0.0185	0.0026	0.0159
74	0.0172	0.0024	0.0148
75	0.0162	0.0022	0.0139
76	0.0153	0.0021	0.0132
77	0.0145	0.0020	0.0125
78	0.0138	0.0019	0.0119
79	0.0132	0.0018	0.0114
80	0.0126	0.0017	0.0109
81	0.0122	0.0017	0.0105
82	0.0117	0.0016	0.0101
83	0.0113	0.0016	0.0097
84	0.0109	0.0015	0.0094
85	0.0106	0.0015	0.0091
86	0.0103	0.0014	0.0089
87	0.0100	0.0014	0.0086
88	0.0097	0.0013	0.0084
89	0.0095	0.0013	0.0082
90	0.0092	0.0013	0.0080
91	0.0090	0.0012	0.0078
92	0.0088	0.0012	0.0076
93	0.0086	0.0012	0.0074
94	0.0084	0.0012	0.0073
95	0.0083	0.0011	0.0071
96	0.0081	0.0011	0.0070

Total soil rain loss = 0.27(In)
Total effective rainfall = 1.78(In)
Peak flow rate in flood hydrograph = 4.65(CFS)

++

24 - H O U R   S T O R M
R u n o f f   H y d r o g r a p h

Hydrograph in 15 Minute intervals ((CFS))

```
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+15       0.0022      0.11  Q         |         |         |         |
  0+30       0.0056      0.16  Q         |         |         |         |
  0+45       0.0090      0.16  Q         |         |         |         |
  1+ 0       0.0125      0.17  Q         |         |         |         |
  1+15       0.0159      0.17  Q         |         |         |         |
  1+30       0.0194      0.17  Q         |         |         |         |
  1+45       0.0230      0.17  QV        |         |         |         |
  2+ 0       0.0266      0.17  QV        |         |         |         |
  2+15       0.0302      0.18  QV        |         |         |         |
  2+30       0.0339      0.18  QV        |         |         |         |
  2+45       0.0376      0.18  QV        |         |         |         |
  3+ 0       0.0414      0.18  QV        |         |         |         |
  3+15       0.0452      0.18  Q V       |         |         |         |
  3+30       0.0490      0.19  Q V       |         |         |         |
  3+45       0.0529      0.19  Q V       |         |         |         |
  4+ 0       0.0569      0.19  Q V       |         |         |         |
  4+15       0.0609      0.19  Q V       |         |         |         |
  4+30       0.0649      0.20  Q  V      |         |         |         |
  4+45       0.0690      0.20  Q  V      |         |         |         |
  5+ 0       0.0732      0.20  Q  V      |         |         |         |
  5+15       0.0774      0.20  Q  V      |         |         |         |
  5+30       0.0817      0.21  Q  V      |         |         |         |
  5+45       0.0860      0.21  Q  V      |         |         |         |
  6+ 0       0.0905      0.21  Q   V     |         |         |         |
  6+15       0.0949      0.22  Q   V     |         |         |         |
  6+30       0.0995      0.22  Q   V     |         |         |         |
  6+45       0.1041      0.22  Q   V     |         |         |         |
  7+ 0       0.1088      0.23  Q    V    |         |         |         |
  7+15       0.1136      0.23  Q    V    |         |         |         |
  7+30       0.1185      0.24  Q    V    |         |         |         |
  7+45       0.1235      0.24  Q    V    |         |         |         |
  8+ 0       0.1285      0.24  Q    V    |         |         |         |
  8+15       0.1337      0.25  Q     V   |         |         |         |
  8+30       0.1389      0.25  |Q    V   |         |         |         |
  8+45       0.1443      0.26  |Q    V   |         |         |         |
  9+ 0       0.1498      0.27  |Q    V   |         |         |         |
  9+15       0.1554      0.27  |Q     V  |         |         |         |
  9+30       0.1611      0.28  |Q     V  |         |         |         |
  9+45       0.1670      0.28  |Q     V  |         |         |         |
 10+ 0       0.1730      0.29  |Q      V |         |         |         |
 10+15       0.1792      0.30  |Q      V |         |         |         |
 10+30       0.1856      0.31  |Q      V |         |         |         |
 10+45       0.1921      0.32  |Q      V |         |         |         |
 11+ 0       0.1988      0.33  |Q       V|         |         |         |
 11+15       0.2057      0.34  |Q       V|         |         |         |
 11+30       0.2129      0.35  |Q       V|         |         |         |
 11+45       0.2203      0.36  |Q        V         |         |         |
 12+ 0       0.2279      0.37  |Q        V         |         |         |
```

```
   12+15       0.2371      0.44  |Q        V         |         |         |
   12+30       0.2471      0.49  |Q        |V        |         |         |
   12+45       0.2575      0.50  | Q       |V        |         |         |
   13+ 0       0.2683      0.52  | Q       | V       |         |         |
   13+15       0.2797      0.55  | Q       | V       |         |         |
   13+30       0.2916      0.58  | Q       |  V      |         |         |
   13+45       0.3041      0.61  | Q       |   V     |         |         |
   14+ 0       0.3174      0.64  | Q       |   V     |         |         |
   14+15       0.3319      0.70  | Q       |    V    |         |         |
   14+30       0.3477      0.76  |  Q      |     V   |         |         |
   14+45       0.3649      0.83  |  Q      |     V   |         |         |
   15+ 0       0.3838      0.92  |  Q      |      V  |         |         |
   15+15       0.4052      1.04  |   Q     |       V |         |         |
   15+30       0.4286      1.13  |   Q     |        V|         |         |
   15+45       0.4575      1.40  |    Q    |          V        |         |
   16+ 0       0.5080      2.45  |        Q|         |  V      |         |
   16+15       0.6041      4.65  |         |       Q |      V  |         |
   16+30       0.6586      2.64  |         Q         |         V         |
   16+45       0.6797      1.02  |   Q     |         |          V        |
   17+ 0       0.6968      0.83  |  Q      |         |         | V       |
   17+15       0.7111      0.69  | Q       |         |         | V       |
   17+30       0.7236      0.60  | Q       |         |         |  V      |
   17+45       0.7349      0.55  | Q       |         |         |  V      |
   18+ 0       0.7452      0.50  | Q       |         |         |   V     |
   18+15       0.7537      0.41  |Q        |         |         |   V     |
   18+30       0.7611      0.36  |Q        |         |         |    V    |
   18+45       0.7680      0.33  |Q        |         |         |    V    |
   19+ 0       0.7745      0.31  |Q        |         |         |    V    |
   19+15       0.7807      0.30  |Q        |         |         |     V   |
   19+30       0.7865      0.28  |Q        |         |         |     V   |
   19+45       0.7921      0.27  |Q        |         |         |     V   |
   20+ 0       0.7974      0.26  |Q        |         |         |     V   |
   20+15       0.8026      0.25  Q         |         |         |      V  |
   20+30       0.8075      0.24  Q         |         |         |      V  |
   20+45       0.8123      0.23  Q         |         |         |      V  |
   21+ 0       0.8169      0.22  Q         |         |         |      V  |
   21+15       0.8214      0.22  Q         |         |         |       V |
   21+30       0.8257      0.21  Q         |         |         |       V |
   21+45       0.8300      0.20  Q         |         |         |       V |
   22+ 0       0.8341      0.20  Q         |         |         |       V |
   22+15       0.8381      0.19  Q         |         |         |       V |
   22+30       0.8419      0.19  Q         |         |         |       V |
   22+45       0.8457      0.18  Q         |         |         |        V|
   23+ 0       0.8494      0.18  Q         |         |         |        V|
   23+15       0.8531      0.18  Q         |         |         |        V|
   23+30       0.8566      0.17  Q         |         |         |        V|
   23+45       0.8601      0.17  Q         |         |         |        V|
   24+ 0       0.8635      0.16  Q         |         |         |        V|
   24+15       0.8646      0.05  Q         |         |         |        V|
-----------------------------------------------------------------------
```

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 06/23/20   File Name 2019285DA3DMA1.out

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Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6277

2019-285 6400 Katella Avenue
Pre-Developed Unit Hydrograph
2 Year, 24 Hour Storm
DA3 DMA1

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used
++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
67.0	1.6	1.00	A	0.400	0.852	0.341

Area-averaged adjusted loss rate Fm (In/Hr) = 0.341

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
1.38	0.852	67.0	47.4	11.10	0.001
0.24	0.148	98.0	98.0	0.20	0.890

Area-averaged catchment yield fraction, Y = 0.133
Area-averaged low loss fraction, Yb = 0.867
++

```
User entry of time of concentration  =   0.112 (hours)
Watershed area =       1.62(Ac.)
Catchment Lag time =   0.089 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 279.8098
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.341(In/Hr)
Average low loss rate fraction (Yb) = 0.867 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.190(In)
Computed peak 30-minute rainfall =  0.400(In)
Specified peak 1-hour rainfall =  0.530(In)
Computed peak 3-hour rainfall =  0.890(In)
Specified peak 6-hour rainfall =  1.220(In)
Specified peak 24-hour rainfall =  2.050(In)


Rainfall depth area reduction factors:
Using a total area of       1.62(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.190(In)
30-minute factor = 1.000    Adjusted rainfall =  0.400(In)
1-hour factor = 1.000       Adjusted rainfall =  0.530(In)
3-hour factor = 1.000       Adjusted rainfall =  0.890(In)
6-hour factor = 1.000       Adjusted rainfall =  1.220(In)
24-hour factor = 1.000  Adjusted rainfall =  2.050(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values            ((CFS))
---------------------------------------------------------------------
                (K =         6.53 (CFS))

  1               62.344                   4.071
  2              100.000                   2.459
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.2999               0.0465
  2              0.4000               0.0292
  3              0.4715               0.0220
  4              0.5300               0.0184
  5              0.5888               0.0189
  6              0.6417               0.0171
  7              0.6901               0.0157
  8              0.7350               0.0146
  9              0.7770               0.0137
 10              0.8166               0.0130
```

11	0.8542	0.0123
12	0.8900	0.0118
13	0.9230	0.0108
14	0.9547	0.0104
15	0.9851	0.0100
16	1.0145	0.0097
17	1.0428	0.0094
18	1.0703	0.0091
19	1.0970	0.0088
20	1.1229	0.0086
21	1.1481	0.0083
22	1.1726	0.0081
23	1.1966	0.0079
24	1.2200	0.0077
25	1.2388	0.0062
26	1.2571	0.0061
27	1.2750	0.0059
28	1.2925	0.0058
29	1.3096	0.0057
30	1.3263	0.0055
31	1.3427	0.0054
32	1.3587	0.0053
33	1.3745	0.0052
34	1.3899	0.0051
35	1.4051	0.0050
36	1.4200	0.0049
37	1.4346	0.0049
38	1.4490	0.0048
39	1.4632	0.0047
40	1.4771	0.0046
41	1.4908	0.0045
42	1.5043	0.0045
43	1.5176	0.0044
44	1.5308	0.0044
45	1.5437	0.0043
46	1.5565	0.0042
47	1.5690	0.0042
48	1.5814	0.0041
49	1.5937	0.0041
50	1.6058	0.0040
51	1.6178	0.0040
52	1.6296	0.0039
53	1.6412	0.0039
54	1.6527	0.0038
55	1.6641	0.0038
56	1.6754	0.0037
57	1.6865	0.0037
58	1.6976	0.0037
59	1.7085	0.0036
60	1.7192	0.0036

61	1.7299	0.0035
62	1.7405	0.0035
63	1.7509	0.0035
64	1.7613	0.0034
65	1.7715	0.0034
66	1.7817	0.0034
67	1.7917	0.0033
68	1.8017	0.0033
69	1.8116	0.0033
70	1.8214	0.0033
71	1.8311	0.0032
72	1.8407	0.0032
73	1.8502	0.0032
74	1.8597	0.0031
75	1.8690	0.0031
76	1.8783	0.0031
77	1.8875	0.0031
78	1.8967	0.0030
79	1.9057	0.0030
80	1.9147	0.0030
81	1.9237	0.0030
82	1.9325	0.0029
83	1.9413	0.0029
84	1.9500	0.0029
85	1.9587	0.0029
86	1.9673	0.0029
87	1.9758	0.0028
88	1.9843	0.0028
89	1.9927	0.0028
90	2.0011	0.0028
91	2.0094	0.0028
92	2.0176	0.0027
93	2.0258	0.0027
94	2.0339	0.0027
95	2.0420	0.0027
96	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0080	0.0070	0.0011
2	0.0081	0.0070	0.0011
3	0.0082	0.0071	0.0011
4	0.0083	0.0072	0.0011
5	0.0084	0.0072	0.0011
6	0.0084	0.0073	0.0011
7	0.0085	0.0074	0.0011
8	0.0086	0.0075	0.0011
9	0.0087	0.0076	0.0012

10	0.0088	0.0077	0.0012
11	0.0089	0.0077	0.0012
12	0.0090	0.0078	0.0012
13	0.0091	0.0079	0.0012
14	0.0093	0.0080	0.0012
15	0.0094	0.0081	0.0012
16	0.0095	0.0082	0.0013
17	0.0096	0.0083	0.0013
18	0.0097	0.0085	0.0013
19	0.0099	0.0086	0.0013
20	0.0100	0.0087	0.0013
21	0.0102	0.0088	0.0013
22	0.0103	0.0089	0.0014
23	0.0105	0.0091	0.0014
24	0.0106	0.0092	0.0014
25	0.0108	0.0094	0.0014
26	0.0110	0.0095	0.0015
27	0.0112	0.0097	0.0015
28	0.0113	0.0098	0.0015
29	0.0115	0.0100	0.0015
30	0.0117	0.0102	0.0016
31	0.0120	0.0104	0.0016
32	0.0122	0.0106	0.0016
33	0.0124	0.0108	0.0017
34	0.0127	0.0110	0.0017
35	0.0130	0.0112	0.0017
36	0.0132	0.0115	0.0018
37	0.0135	0.0117	0.0018
38	0.0138	0.0120	0.0018
39	0.0142	0.0123	0.0019
40	0.0145	0.0126	0.0019
41	0.0149	0.0129	0.0020
42	0.0153	0.0133	0.0020
43	0.0158	0.0137	0.0021
44	0.0162	0.0141	0.0022
45	0.0168	0.0145	0.0022
46	0.0173	0.0150	0.0023
47	0.0179	0.0156	0.0024
48	0.0186	0.0161	0.0025
49	0.0235	0.0203	0.0031
50	0.0243	0.0211	0.0032
51	0.0253	0.0219	0.0034
52	0.0263	0.0228	0.0035
53	0.0276	0.0239	0.0037
54	0.0289	0.0251	0.0038
55	0.0306	0.0265	0.0041
56	0.0324	0.0281	0.0043
57	0.0360	0.0312	0.0048
58	0.0387	0.0335	0.0051
59	0.0423	0.0367	0.0056

60	0.0468	0.0406	0.0062
61	0.0536	0.0464	0.0071
62	0.0574	0.0498	0.0076
63	0.0749	0.0650	0.0099
64	0.1427	0.0852	0.0575
65	0.2539	0.0852	0.1687
66	0.0592	0.0514	0.0079
67	0.0462	0.0401	0.0061
68	0.0383	0.0332	0.0051
69	0.0321	0.0279	0.0043
70	0.0287	0.0249	0.0038
71	0.0262	0.0227	0.0035
72	0.0242	0.0210	0.0032
73	0.0185	0.0160	0.0025
74	0.0172	0.0149	0.0023
75	0.0162	0.0140	0.0021
76	0.0153	0.0132	0.0020
77	0.0145	0.0126	0.0019
78	0.0138	0.0120	0.0018
79	0.0132	0.0114	0.0018
80	0.0126	0.0110	0.0017
81	0.0122	0.0105	0.0016
82	0.0117	0.0102	0.0016
83	0.0113	0.0098	0.0015
84	0.0109	0.0095	0.0015
85	0.0106	0.0092	0.0014
86	0.0103	0.0089	0.0014
87	0.0100	0.0087	0.0013
88	0.0097	0.0084	0.0013
89	0.0095	0.0082	0.0013
90	0.0092	0.0080	0.0012
91	0.0090	0.0078	0.0012
92	0.0088	0.0076	0.0012
93	0.0086	0.0075	0.0011
94	0.0084	0.0073	0.0011
95	0.0083	0.0072	0.0011
96	0.0081	0.0070	0.0011

Total soil rain loss = 1.60(In)
Total effective rainfall = 0.45(In)
Peak flow rate in flood hydrograph = 0.83(CFS)

+++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 15 Minute intervals ((CFS))

```
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+15       0.0001      0.00  Q         |         |         |         |
  0+30       0.0002      0.01  Q         |         |         |         |
  0+45       0.0004      0.01  Q         |         |         |         |
  1+ 0       0.0005      0.01  Q         |         |         |         |
  1+15       0.0007      0.01  Q         |         |         |         |
  1+30       0.0008      0.01  Q         |         |         |         |
  1+45       0.0010      0.01  Q         |         |         |         |
  2+ 0       0.0011      0.01  Q         |         |         |         |
  2+15       0.0013      0.01  Q         |         |         |         |
  2+30       0.0014      0.01  Q         |         |         |         |
  2+45       0.0016      0.01  QV        |         |         |         |
  3+ 0       0.0018      0.01  QV        |         |         |         |
  3+15       0.0019      0.01  QV        |         |         |         |
  3+30       0.0021      0.01  QV        |         |         |         |
  3+45       0.0023      0.01  QV        |         |         |         |
  4+ 0       0.0024      0.01  QV        |         |         |         |
  4+15       0.0026      0.01  QV        |         |         |         |
  4+30       0.0028      0.01  QV        |         |         |         |
  4+45       0.0030      0.01  QV        |         |         |         |
  5+ 0       0.0031      0.01  Q V       |         |         |         |
  5+15       0.0033      0.01  Q V       |         |         |         |
  5+30       0.0035      0.01  Q V       |         |         |         |
  5+45       0.0037      0.01  Q V       |         |         |         |
  6+ 0       0.0039      0.01  Q V       |         |         |         |
  6+15       0.0041      0.01  Q V       |         |         |         |
  6+30       0.0043      0.01  Q V       |         |         |         |
  6+45       0.0045      0.01  Q V       |         |         |         |
  7+ 0       0.0047      0.01  Q  V      |         |         |         |
  7+15       0.0049      0.01  Q  V      |         |         |         |
  7+30       0.0051      0.01  Q  V      |         |         |         |
  7+45       0.0053      0.01  Q  V      |         |         |         |
  8+ 0       0.0055      0.01  Q  V      |         |         |         |
  8+15       0.0057      0.01  Q  V      |         |         |         |
  8+30       0.0060      0.01  Q  V      |         |         |         |
  8+45       0.0062      0.01  Q   V     |         |         |         |
  9+ 0       0.0064      0.01  Q   V     |         |         |         |
  9+15       0.0067      0.01  Q   V     |         |         |         |
  9+30       0.0069      0.01  Q   V     |         |         |         |
  9+45       0.0072      0.01  Q   V     |         |         |         |
 10+ 0       0.0074      0.01  Q   V     |         |         |         |
 10+15       0.0077      0.01  Q    V    |         |         |         |
 10+30       0.0079      0.01  Q    V    |         |         |         |
 10+45       0.0082      0.01  Q    V    |         |         |         |
 11+ 0       0.0085      0.01  Q    V    |         |         |         |
 11+15       0.0088      0.01  Q    V    |         |         |         |
 11+30       0.0091      0.01  Q     V   |         |         |         |
 11+45       0.0094      0.02  Q     V   |         |         |         |
 12+ 0       0.0098      0.02  Q     V   |         |         |         |
```

```
   12+15       0.0102      0.02  Q     V   |         |         |         |
   12+30       0.0106      0.02  Q      V  |         |         |         |
   12+45       0.0110      0.02  Q      V  |         |         |         |
   13+ 0       0.0115      0.02  Q      V  |         |         |         |
   13+15       0.0120      0.02  Q      V  |         |         |         |
   13+30       0.0125      0.02  Q       V |         |         |         |
   13+45       0.0130      0.03  Q       V |         |         |         |
   14+ 0       0.0136      0.03  Q        V|         |         |         |
   14+15       0.0142      0.03  Q        V|         |         |         |
   14+30       0.0149      0.03  Q        V|         |         |         |
   14+45       0.0156      0.04  Q         V         |         |         |
   15+ 0       0.0164      0.04  Q         V         |         |         |
   15+15       0.0173      0.04  Q         |V        |         |         |
   15+30       0.0183      0.05  Q         | V       |         |         |
   15+45       0.0196      0.06  Q         |  V      |         |         |
   16+ 0       0.0249      0.26  |Q        |     V   |         |         |
   16+15       0.0420      0.83  |  Q      |                V  |         |
   16+30       0.0513      0.45  |Q        |         |         |   V     |
   16+45       0.0522      0.04  Q         |         |         |   V     |
   17+ 0       0.0529      0.04  Q         |         |         |    V    |
   17+15       0.0535      0.03  Q         |         |         |    V    |
   17+30       0.0541      0.03  Q         |         |         |    V    |
   17+45       0.0546      0.02  Q         |         |         |     V   |
   18+ 0       0.0550      0.02  Q         |         |         |     V   |
   18+15       0.0554      0.02  Q         |         |         |     V   |
   18+30       0.0557      0.02  Q         |         |         |      V  |
   18+45       0.0560      0.01  Q         |         |         |      V  |
   19+ 0       0.0563      0.01  Q         |         |         |      V  |
   19+15       0.0565      0.01  Q         |         |         |      V  |
   19+30       0.0568      0.01  Q         |         |         |      V  |
   19+45       0.0570      0.01  Q         |         |         |      V  |
   20+ 0       0.0573      0.01  Q         |         |         |       V |
   20+15       0.0575      0.01  Q         |         |         |       V |
   20+30       0.0577      0.01  Q         |         |         |       V |
   20+45       0.0579      0.01  Q         |         |         |       V |
   21+ 0       0.0581      0.01  Q         |         |         |       V |
   21+15       0.0583      0.01  Q         |         |         |       V |
   21+30       0.0585      0.01  Q         |         |         |       V |
   21+45       0.0586      0.01  Q         |         |         |        V|
   22+ 0       0.0588      0.01  Q         |         |         |        V|
   22+15       0.0590      0.01  Q         |         |         |        V|
   22+30       0.0592      0.01  Q         |         |         |        V|
   22+45       0.0593      0.01  Q         |         |         |        V|
   23+ 0       0.0595      0.01  Q         |         |         |        V|
   23+15       0.0596      0.01  Q         |         |         |        V|
   23+30       0.0598      0.01  Q         |         |         |        V|
   23+45       0.0599      0.01  Q         |         |         |        V|
   24+ 0       0.0601      0.01  Q         |         |         |        V|
   24+15       0.0601      0.00  Q         |         |         |         V
-----------------------------------------------------------------------
```

Post-Development Conditions

Peak Runoff (2-yr, 24-hr)

```
                    Orange County Rational Hydrology Program

                (Hydrology Manual Date(s) October 1986 & November 1996)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2004 Version 8.0
       Rational Hydrology Study, Date: 03/26/20  File Name: 2019285.roc
------------------------------------------------------------------------
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------

Rational hydrology study storm event year is     2.0

Decimal fraction of study above 2000 ft., 600M  =     0.0000
English Units Used for input data


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.100 to Point/Station       1.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.400(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Initial subarea data:
Initial area flow distance =   242.000(Ft.)
Top (of initial area) elevation =    41.320(Ft.)
Bottom (of initial area) elevation =    39.920(Ft.)
Difference in elevation =     1.400(Ft.)
Slope =    0.00579  s(%)=       0.58
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.655 min.
Rainfall intensity =      1.773(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.880
Subarea runoff =      5.006(CFS)
Total initial stream area =       3.210(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.100 to Point/Station       2.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.400(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Initial subarea data:
Initial area flow distance =   249.000(Ft.)
Top (of initial area) elevation =    41.510(Ft.)
```

```
Bottom (of initial area) elevation =    40.080(Ft.)
Difference in elevation =     1.430(Ft.)
Slope =    0.00574  s(%)=       0.57
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.754 min.
Rainfall intensity =      1.760(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.880
Subarea runoff =      4.519(CFS)
Total initial stream area =        2.920(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       3.100 to Point/Station       3.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.400(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Initial subarea data:
Initial area flow distance =   146.000(Ft.)
Top (of initial area) elevation =    41.690(Ft.)
Bottom (of initial area) elevation =    40.450(Ft.)
Difference in elevation =     1.240(Ft.)
Slope =    0.00849  s(%)=       0.85
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.792 min.
Rainfall intensity =      2.081(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.883
Subarea runoff =      5.381(CFS)
Total initial stream area =        2.930(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       4.100 to Point/Station       4.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.400(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Initial subarea data:
Initial area flow distance =   223.000(Ft.)
Top (of initial area) elevation =    41.530(Ft.)
Bottom (of initial area) elevation =    36.330(Ft.)
Difference in elevation =     5.200(Ft.)
Slope =    0.02332  s(%)=       2.33
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.606 min.
Rainfall intensity =      2.120(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.883
Subarea runoff =      8.929(CFS)
```

```
Total initial stream area =        4.770(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       5.100 to Point/Station       5.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.400(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Initial subarea data:
Initial area flow distance =    97.000(Ft.)
Top (of initial area) elevation =    40.490(Ft.)
Bottom (of initial area) elevation =    39.450(Ft.)
Difference in elevation =     1.040(Ft.)
Slope =    0.01072  s(%)=       1.07
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    4.694 min.
Rainfall intensity =      2.347(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.885
Subarea runoff =      5.191(CFS)
Total initial stream area =        2.500(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       6.100 to Point/Station       6.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.400(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Initial subarea data:
Initial area flow distance =   146.000(Ft.)
Top (of initial area) elevation =    40.630(Ft.)
Bottom (of initial area) elevation =    39.040(Ft.)
Difference in elevation =     1.590(Ft.)
Slope =    0.01089  s(%)=       1.09
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.511 min.
Rainfall intensity =      2.141(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.883
Subarea runoff =      4.916(CFS)
Total initial stream area =        2.600(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       7.100 to Point/Station       7.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
SCS curve number for soil(AMC 2)  = 32.00
```

```
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.400(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Initial subarea data:
Initial area flow distance =   170.000(Ft.)
Top (of initial area) elevation =    41.470(Ft.)
Bottom (of initial area) elevation =    39.210(Ft.)
Difference in elevation =     2.260(Ft.)
Slope =    0.01329  s(%)=       1.33
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.628 min.
Rainfall intensity =      2.115(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.883
Subarea runoff =      6.294(CFS)
Total initial stream area =        3.370(Ac.)
End of computations, total study area =           22.30 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number (AMC 2) =  32.0
```

Post Development Conditions

Volume (2-yr, 24-hr)

```
        U n i t   H y d r o g r a p h   A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989-2011, Version 7.1

        Study date  06/23/20   File Name 2019285DMAA.out


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------------------------------------------------------------------------

Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996


Program License Serial Number 6277

---------------------------------------------------------------------
2019-285 6400 Katella Avenue
Post-Developed Unit Hydrograph
2 Year, 24 Hour Storm
DMA A
--------------------------------------------------------------------

        Storm Event Year = 2

        Antecedent Moisture Condition = 1

 English (in-lb) Input Units Used
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  Area       Area       Soil     Fp      Ap      Fm
No.(AMCII) (Ac.)    Fraction     Group  (In/Hr)   (dec.)    (In/Hr)
 32.0       3.2         1.00      A     0.400     0.205    0.082

Area-averaged adjusted loss rate Fm (In/Hr) =  0.082

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC1)           Yield Fr
     0.66   0.205         32.0      16.6      50.24     0.739
     2.55   0.795         98.0      98.0       0.20     0.890

Area-averaged catchment yield fraction, Y =  0.859
Area-averaged low loss fraction, Yb =  0.141
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
User entry of time of concentration  =   0.128 (hours)
Watershed area =       3.21(Ac.)
Catchment Lag time =   0.102 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 244.9386
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.082(In/Hr)
Average low loss rate fraction (Yb) = 0.141 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.190(In)
Computed peak 30-minute rainfall =  0.400(In)
Specified peak 1-hour rainfall =  0.530(In)
Computed peak 3-hour rainfall =  0.890(In)
Specified peak 6-hour rainfall =  1.220(In)
Specified peak 24-hour rainfall =  2.050(In)


Rainfall depth area reduction factors:
Using a total area of       3.21(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.190(In)
30-minute factor = 1.000    Adjusted rainfall =  0.400(In)
1-hour factor = 1.000       Adjusted rainfall =  0.530(In)
3-hour factor = 1.000       Adjusted rainfall =  0.890(In)
6-hour factor = 1.000       Adjusted rainfall =  1.220(In)
24-hour factor = 1.000  Adjusted rainfall =  2.050(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values             ((CFS))
---------------------------------------------------------------------
                (K =        12.94 (CFS))

  1               57.193                  7.401
  2              100.000                  5.539
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.2999               0.0465
  2              0.3999               0.0292
  3              0.4715               0.0220
  4              0.5299               0.0184
  5              0.5888               0.0189
  6              0.6417               0.0171
  7              0.6901               0.0157
  8              0.7350               0.0146
  9              0.7770               0.0137
 10              0.8166               0.0130
```

11	0.8542	0.0123
12	0.8900	0.0118
13	0.9230	0.0108
14	0.9546	0.0104
15	0.9851	0.0100
16	1.0145	0.0097
17	1.0428	0.0094
18	1.0703	0.0091
19	1.0970	0.0088
20	1.1229	0.0086
21	1.1481	0.0083
22	1.1726	0.0081
23	1.1966	0.0079
24	1.2200	0.0077
25	1.2388	0.0062
26	1.2571	0.0061
27	1.2750	0.0059
28	1.2925	0.0058
29	1.3096	0.0057
30	1.3263	0.0055
31	1.3427	0.0054
32	1.3587	0.0053
33	1.3745	0.0052
34	1.3899	0.0051
35	1.4051	0.0050
36	1.4200	0.0049
37	1.4346	0.0049
38	1.4490	0.0048
39	1.4632	0.0047
40	1.4771	0.0046
41	1.4908	0.0045
42	1.5043	0.0045
43	1.5176	0.0044
44	1.5308	0.0044
45	1.5437	0.0043
46	1.5564	0.0042
47	1.5690	0.0042
48	1.5814	0.0041
49	1.5937	0.0041
50	1.6058	0.0040
51	1.6177	0.0040
52	1.6296	0.0039
53	1.6412	0.0039
54	1.6527	0.0038
55	1.6641	0.0038
56	1.6754	0.0037
57	1.6865	0.0037
58	1.6975	0.0037
59	1.7084	0.0036
60	1.7192	0.0036

61	1.7299	0.0035
62	1.7405	0.0035
63	1.7509	0.0035
64	1.7613	0.0034
65	1.7715	0.0034
66	1.7817	0.0034
67	1.7917	0.0033
68	1.8017	0.0033
69	1.8116	0.0033
70	1.8214	0.0033
71	1.8311	0.0032
72	1.8407	0.0032
73	1.8502	0.0032
74	1.8597	0.0031
75	1.8690	0.0031
76	1.8783	0.0031
77	1.8875	0.0031
78	1.8967	0.0030
79	1.9057	0.0030
80	1.9147	0.0030
81	1.9237	0.0030
82	1.9325	0.0029
83	1.9413	0.0029
84	1.9500	0.0029
85	1.9587	0.0029
86	1.9673	0.0029
87	1.9758	0.0028
88	1.9843	0.0028
89	1.9927	0.0028
90	2.0011	0.0028
91	2.0093	0.0028
92	2.0176	0.0027
93	2.0258	0.0027
94	2.0339	0.0027
95	2.0420	0.0027
96	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0080	0.0011	0.0069
2	0.0081	0.0011	0.0070
3	0.0082	0.0012	0.0070
4	0.0083	0.0012	0.0071
5	0.0084	0.0012	0.0072
6	0.0084	0.0012	0.0073
7	0.0085	0.0012	0.0073
8	0.0086	0.0012	0.0074
9	0.0087	0.0012	0.0075

10	0.0088	0.0012	0.0076
11	0.0089	0.0013	0.0077
12	0.0090	0.0013	0.0078
13	0.0091	0.0013	0.0079
14	0.0093	0.0013	0.0079
15	0.0094	0.0013	0.0081
16	0.0095	0.0013	0.0082
17	0.0096	0.0014	0.0083
18	0.0097	0.0014	0.0084
19	0.0099	0.0014	0.0085
20	0.0100	0.0014	0.0086
21	0.0102	0.0014	0.0087
22	0.0103	0.0015	0.0089
23	0.0105	0.0015	0.0090
24	0.0106	0.0015	0.0091
25	0.0108	0.0015	0.0093
26	0.0110	0.0015	0.0094
27	0.0112	0.0016	0.0096
28	0.0113	0.0016	0.0097
29	0.0115	0.0016	0.0099
30	0.0117	0.0017	0.0101
31	0.0120	0.0017	0.0103
32	0.0122	0.0017	0.0105
33	0.0124	0.0018	0.0107
34	0.0127	0.0018	0.0109
35	0.0130	0.0018	0.0111
36	0.0132	0.0019	0.0114
37	0.0135	0.0019	0.0116
38	0.0138	0.0020	0.0119
39	0.0142	0.0020	0.0122
40	0.0145	0.0021	0.0125
41	0.0149	0.0021	0.0128
42	0.0153	0.0022	0.0132
43	0.0158	0.0022	0.0135
44	0.0162	0.0023	0.0139
45	0.0168	0.0024	0.0144
46	0.0173	0.0024	0.0149
47	0.0179	0.0025	0.0154
48	0.0186	0.0026	0.0160
49	0.0235	0.0033	0.0201
50	0.0243	0.0034	0.0209
51	0.0253	0.0036	0.0217
52	0.0263	0.0037	0.0226
53	0.0276	0.0039	0.0237
54	0.0289	0.0041	0.0248
55	0.0306	0.0043	0.0263
56	0.0324	0.0046	0.0278
57	0.0360	0.0051	0.0309
58	0.0387	0.0055	0.0332
59	0.0423	0.0060	0.0364

60	0.0468	0.0066	0.0402
61	0.0536	0.0076	0.0460
62	0.0574	0.0081	0.0493
63	0.0749	0.0106	0.0643
64	0.1427	0.0202	0.1226
65	0.2539	0.0205	0.2334
66	0.0592	0.0084	0.0509
67	0.0462	0.0065	0.0397
68	0.0383	0.0054	0.0329
69	0.0321	0.0045	0.0276
70	0.0287	0.0041	0.0247
71	0.0262	0.0037	0.0225
72	0.0242	0.0034	0.0208
73	0.0185	0.0026	0.0159
74	0.0172	0.0024	0.0148
75	0.0162	0.0023	0.0139
76	0.0153	0.0022	0.0131
77	0.0145	0.0020	0.0124
78	0.0138	0.0019	0.0118
79	0.0132	0.0019	0.0113
80	0.0126	0.0018	0.0109
81	0.0122	0.0017	0.0104
82	0.0117	0.0017	0.0101
83	0.0113	0.0016	0.0097
84	0.0109	0.0015	0.0094
85	0.0106	0.0015	0.0091
86	0.0103	0.0015	0.0088
87	0.0100	0.0014	0.0086
88	0.0097	0.0014	0.0084
89	0.0095	0.0013	0.0081
90	0.0092	0.0013	0.0079
91	0.0090	0.0013	0.0077
92	0.0088	0.0012	0.0076
93	0.0086	0.0012	0.0074
94	0.0084	0.0012	0.0072
95	0.0083	0.0012	0.0071
96	0.0081	0.0011	0.0069

Total soil rain loss = 0.27(In)
Total effective rainfall = 1.78(In)
Peak flow rate in flood hydrograph = 2.41(CFS)

++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 15 Minute intervals ((CFS))

```
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+15       0.0011      0.05  Q         |         |         |         |
  0+30       0.0029      0.09  Q         |         |         |         |
  0+45       0.0048      0.09  Q         |         |         |         |
  1+ 0       0.0067      0.09  Q         |         |         |         |
  1+15       0.0086      0.09  Q         |         |         |         |
  1+30       0.0105      0.09  Q         |         |         |         |
  1+45       0.0125      0.09  QV        |         |         |         |
  2+ 0       0.0144      0.10  QV        |         |         |         |
  2+15       0.0164      0.10  QV        |         |         |         |
  2+30       0.0184      0.10  QV        |         |         |         |
  2+45       0.0205      0.10  QV        |         |         |         |
  3+ 0       0.0226      0.10  QV        |         |         |         |
  3+15       0.0246      0.10  Q V       |         |         |         |
  3+30       0.0268      0.10  Q V       |         |         |         |
  3+45       0.0289      0.10  Q V       |         |         |         |
  4+ 0       0.0311      0.10  Q V       |         |         |         |
  4+15       0.0333      0.11  Q V       |         |         |         |
  4+30       0.0355      0.11  Q V       |         |         |         |
  4+45       0.0377      0.11  Q  V      |         |         |         |
  5+ 0       0.0400      0.11  Q  V      |         |         |         |
  5+15       0.0423      0.11  Q  V      |         |         |         |
  5+30       0.0447      0.11  Q  V      |         |         |         |
  5+45       0.0471      0.12  Q  V      |         |         |         |
  6+ 0       0.0495      0.12  Q   V     |         |         |         |
  6+15       0.0520      0.12  Q   V     |         |         |         |
  6+30       0.0545      0.12  Q   V     |         |         |         |
  6+45       0.0570      0.12  Q   V     |         |         |         |
  7+ 0       0.0596      0.13  Q    V    |         |         |         |
  7+15       0.0622      0.13  Q    V    |         |         |         |
  7+30       0.0649      0.13  Q    V    |         |         |         |
  7+45       0.0676      0.13  Q    V    |         |         |         |
  8+ 0       0.0704      0.13  Q    V    |         |         |         |
  8+15       0.0732      0.14  Q     V   |         |         |         |
  8+30       0.0761      0.14  Q     V   |         |         |         |
  8+45       0.0791      0.14  Q     V   |         |         |         |
  9+ 0       0.0821      0.15  Q     V   |         |         |         |
  9+15       0.0852      0.15  Q      V  |         |         |         |
  9+30       0.0883      0.15  Q      V  |         |         |         |
  9+45       0.0915      0.16  Q      V  |         |         |         |
 10+ 0       0.0948      0.16  Q      V  |         |         |         |
 10+15       0.0982      0.16  Q       V |         |         |         |
 10+30       0.1017      0.17  Q       V |         |         |         |
 10+45       0.1053      0.17  Q       V |         |         |         |
 11+ 0       0.1090      0.18  Q        V|         |         |         |
 11+15       0.1128      0.18  Q        V|         |         |         |
 11+30       0.1167      0.19  Q        V|         |         |         |
 11+45       0.1207      0.20  Q         V         |         |         |
 12+ 0       0.1249      0.20  Q         V         |         |         |
```

```
   12+15       0.1298      0.24  Q         V         |         |         |
   12+30       0.1353      0.27  |Q        |V        |         |         |
   12+45       0.1410      0.28  |Q        |V        |         |         |
   13+ 0       0.1470      0.29  |Q        | V       |         |         |
   13+15       0.1532      0.30  |Q        | V       |         |         |
   13+30       0.1597      0.31  |Q        |  V      |         |         |
   13+45       0.1666      0.33  |Q        |   V     |         |         |
   14+ 0       0.1738      0.35  |Q        |   V     |         |         |
   14+15       0.1817      0.38  |Q        |    V    |         |         |
   14+30       0.1903      0.42  |Q        |     V   |         |         |
   14+45       0.1997      0.45  |Q        |     V   |         |         |
   15+ 0       0.2100      0.50  |Q        |      V  |         |         |
   15+15       0.2216      0.56  | Q       |       V |         |         |
   15+30       0.2344      0.62  | Q       |        V|         |         |
   15+45       0.2499      0.75  | Q       |          V       |         |
   16+ 0       0.2760      1.26  |    Q    |         |  V      |         |
   16+15       0.3257      2.41  |        Q|         |      V  |         |
   16+30       0.3602      1.67  |     Q   |         |         V         |
   16+45       0.3721      0.58  | Q       |         |         |V        |
   17+ 0       0.3817      0.46  |Q        |         |         | V       |
   17+15       0.3897      0.39  |Q        |         |         | V       |
   17+30       0.3966      0.34  |Q        |         |         |  V      |
   17+45       0.4029      0.30  |Q        |         |         |  V      |
   18+ 0       0.4086      0.28  |Q        |         |         |   V     |
   18+15       0.4134      0.23  Q         |         |         |   V     |
   18+30       0.4175      0.20  Q         |         |         |    V    |
   18+45       0.4213      0.18  Q         |         |         |    V    |
   19+ 0       0.4249      0.17  Q         |         |         |    V    |
   19+15       0.4283      0.16  Q         |         |         |     V   |
   19+30       0.4315      0.16  Q         |         |         |     V   |
   19+45       0.4346      0.15  Q         |         |         |     V   |
   20+ 0       0.4376      0.14  Q         |         |         |     V   |
   20+15       0.4404      0.14  Q         |         |         |      V  |
   20+30       0.4431      0.13  Q         |         |         |      V  |
   20+45       0.4458      0.13  Q         |         |         |      V  |
   21+ 0       0.4483      0.12  Q         |         |         |      V  |
   21+15       0.4508      0.12  Q         |         |         |      V  |
   21+30       0.4532      0.12  Q         |         |         |       V |
   21+45       0.4555      0.11  Q         |         |         |       V |
   22+ 0       0.4578      0.11  Q         |         |         |       V |
   22+15       0.4600      0.11  Q         |         |         |       V |
   22+30       0.4621      0.10  Q         |         |         |       V |
   22+45       0.4642      0.10  Q         |         |         |        V|
   23+ 0       0.4662      0.10  Q         |         |         |        V|
   23+15       0.4682      0.10  Q         |         |         |        V|
   23+30       0.4702      0.09  Q         |         |         |        V|
   23+45       0.4721      0.09  Q         |         |         |        V|
   24+ 0       0.4740      0.09  Q         |         |         |        V|
   24+15       0.4748      0.04  Q         |         |         |         V
-----------------------------------------------------------------------
```

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 06/23/20   File Name 2019285DMAB.out

++

Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6277

2019-285 6400 Katella Avenue
Post-Developed Unit Hydrogrpah
2 Year, 24 Hour Storm
DMA B

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	2.9	1.00	A	0.400	0.064	0.026

Area-averaged adjusted loss rate Fm (In/Hr) = 0.026

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
0.19	0.064	32.0	16.6	50.24	0.739
2.73	0.936	98.0	98.0	0.20	0.890

Area-averaged catchment yield fraction, Y = 0.880
Area-averaged low loss fraction, Yb = 0.120

++

```
User entry of time of concentration  =   0.129 (hours)
Watershed area =       2.92(Ac.)
Catchment Lag time =   0.103 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 241.8113
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.026(In/Hr)
Average low loss rate fraction (Yb) = 0.120 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.190(In)
Computed peak 30-minute rainfall =  0.400(In)
Specified peak 1-hour rainfall =  0.530(In)
Computed peak 3-hour rainfall =  0.890(In)
Specified peak 6-hour rainfall =  1.220(In)
Specified peak 24-hour rainfall =  2.050(In)


Rainfall depth area reduction factors:
Using a total area of       2.92(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.190(In)
30-minute factor = 1.000    Adjusted rainfall =  0.400(In)
1-hour factor = 1.000       Adjusted rainfall =  0.530(In)
3-hour factor = 1.000       Adjusted rainfall =  0.890(In)
6-hour factor = 1.000       Adjusted rainfall =  1.220(In)
24-hour factor = 1.000  Adjusted rainfall =  2.050(In)
---------------------------------------------------------------------

                        U n i t   H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values            ((CFS))
---------------------------------------------------------------------
                (K =        11.77 (CFS))

  1               56.663                   6.670
  2              100.000                   5.101
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.2999               0.0465
  2              0.3999               0.0292
  3              0.4715               0.0220
  4              0.5299               0.0184
  5              0.5888               0.0189
  6              0.6417               0.0171
  7              0.6901               0.0157
  8              0.7350               0.0146
  9              0.7770               0.0137
 10              0.8166               0.0130
```

11	0.8542	0.0123
12	0.8900	0.0118
13	0.9230	0.0108
14	0.9547	0.0104
15	0.9851	0.0100
16	1.0145	0.0097
17	1.0428	0.0094
18	1.0703	0.0091
19	1.0970	0.0088
20	1.1229	0.0086
21	1.1481	0.0083
22	1.1726	0.0081
23	1.1966	0.0079
24	1.2200	0.0077
25	1.2388	0.0062
26	1.2571	0.0061
27	1.2750	0.0059
28	1.2925	0.0058
29	1.3096	0.0057
30	1.3263	0.0055
31	1.3427	0.0054
32	1.3587	0.0053
33	1.3745	0.0052
34	1.3899	0.0051
35	1.4051	0.0050
36	1.4200	0.0049
37	1.4346	0.0049
38	1.4490	0.0048
39	1.4632	0.0047
40	1.4771	0.0046
41	1.4908	0.0045
42	1.5043	0.0045
43	1.5176	0.0044
44	1.5308	0.0044
45	1.5437	0.0043
46	1.5564	0.0042
47	1.5690	0.0042
48	1.5814	0.0041
49	1.5937	0.0041
50	1.6058	0.0040
51	1.6177	0.0040
52	1.6296	0.0039
53	1.6412	0.0039
54	1.6527	0.0038
55	1.6641	0.0038
56	1.6754	0.0037
57	1.6865	0.0037
58	1.6976	0.0037
59	1.7084	0.0036
60	1.7192	0.0036

61	1.7299	0.0035
62	1.7405	0.0035
63	1.7509	0.0035
64	1.7613	0.0034
65	1.7715	0.0034
66	1.7817	0.0034
67	1.7917	0.0033
68	1.8017	0.0033
69	1.8116	0.0033
70	1.8214	0.0033
71	1.8311	0.0032
72	1.8407	0.0032
73	1.8502	0.0032
74	1.8597	0.0031
75	1.8690	0.0031
76	1.8783	0.0031
77	1.8875	0.0031
78	1.8967	0.0030
79	1.9057	0.0030
80	1.9147	0.0030
81	1.9237	0.0030
82	1.9325	0.0029
83	1.9413	0.0029
84	1.9500	0.0029
85	1.9587	0.0029
86	1.9673	0.0029
87	1.9758	0.0028
88	1.9843	0.0028
89	1.9927	0.0028
90	2.0011	0.0028
91	2.0094	0.0028
92	2.0176	0.0027
93	2.0258	0.0027
94	2.0339	0.0027
95	2.0420	0.0027
96	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0080	0.0010	0.0071
2	0.0081	0.0010	0.0071
3	0.0082	0.0010	0.0072
4	0.0083	0.0010	0.0073
5	0.0084	0.0010	0.0074
6	0.0084	0.0010	0.0074
7	0.0085	0.0010	0.0075
8	0.0086	0.0010	0.0076
9	0.0087	0.0010	0.0077

10	0.0088	0.0011	0.0078
11	0.0089	0.0011	0.0079
12	0.0090	0.0011	0.0080
13	0.0091	0.0011	0.0081
14	0.0093	0.0011	0.0081
15	0.0094	0.0011	0.0083
16	0.0095	0.0011	0.0084
17	0.0096	0.0012	0.0085
18	0.0097	0.0012	0.0086
19	0.0099	0.0012	0.0087
20	0.0100	0.0012	0.0088
21	0.0102	0.0012	0.0089
22	0.0103	0.0012	0.0091
23	0.0105	0.0013	0.0092
24	0.0106	0.0013	0.0093
25	0.0108	0.0013	0.0095
26	0.0110	0.0013	0.0096
27	0.0112	0.0013	0.0098
28	0.0113	0.0014	0.0100
29	0.0115	0.0014	0.0102
30	0.0117	0.0014	0.0103
31	0.0120	0.0014	0.0105
32	0.0122	0.0015	0.0107
33	0.0124	0.0015	0.0109
34	0.0127	0.0015	0.0112
35	0.0130	0.0016	0.0114
36	0.0132	0.0016	0.0116
37	0.0135	0.0016	0.0119
38	0.0138	0.0017	0.0122
39	0.0142	0.0017	0.0125
40	0.0145	0.0017	0.0128
41	0.0149	0.0018	0.0131
42	0.0153	0.0018	0.0135
43	0.0158	0.0019	0.0139
44	0.0162	0.0019	0.0143
45	0.0168	0.0020	0.0148
46	0.0173	0.0021	0.0152
47	0.0179	0.0022	0.0158
48	0.0186	0.0022	0.0164
49	0.0235	0.0028	0.0206
50	0.0243	0.0029	0.0214
51	0.0253	0.0030	0.0223
52	0.0263	0.0032	0.0232
53	0.0276	0.0033	0.0243
54	0.0289	0.0035	0.0254
55	0.0306	0.0037	0.0269
56	0.0324	0.0039	0.0285
57	0.0360	0.0043	0.0317
58	0.0387	0.0046	0.0340
59	0.0423	0.0051	0.0373

60	0.0468	0.0056	0.0412
61	0.0536	0.0064	0.0472
62	0.0574	0.0064	0.0510
63	0.0749	0.0064	0.0685
64	0.1427	0.0064	0.1363
65	0.2539	0.0064	0.2475
66	0.0592	0.0064	0.0528
67	0.0462	0.0055	0.0407
68	0.0383	0.0046	0.0337
69	0.0321	0.0039	0.0283
70	0.0287	0.0034	0.0253
71	0.0262	0.0031	0.0230
72	0.0242	0.0029	0.0213
73	0.0185	0.0022	0.0163
74	0.0172	0.0021	0.0152
75	0.0162	0.0019	0.0142
76	0.0153	0.0018	0.0134
77	0.0145	0.0017	0.0127
78	0.0138	0.0017	0.0121
79	0.0132	0.0016	0.0116
80	0.0126	0.0015	0.0111
81	0.0122	0.0015	0.0107
82	0.0117	0.0014	0.0103
83	0.0113	0.0014	0.0100
84	0.0109	0.0013	0.0096
85	0.0106	0.0013	0.0093
86	0.0103	0.0012	0.0091
87	0.0100	0.0012	0.0088
88	0.0097	0.0012	0.0086
89	0.0095	0.0011	0.0083
90	0.0092	0.0011	0.0081
91	0.0090	0.0011	0.0079
92	0.0088	0.0011	0.0078
93	0.0086	0.0010	0.0076
94	0.0084	0.0010	0.0074
95	0.0083	0.0010	0.0073
96	0.0081	0.0010	0.0071

```
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      0.21(In)
Total effective rainfall =      1.84(In)
Peak flow rate in flood hydrograph =      2.35(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in  15   Minute intervals ((CFS))

--------------------------------------------------------------------
```

```
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+15       0.0010      0.05  Q         |         |         |         |
  0+30       0.0027      0.08  Q         |         |         |         |
  0+45       0.0044      0.08  Q         |         |         |         |
  1+ 0       0.0062      0.09  Q         |         |         |         |
  1+15       0.0080      0.09  Q         |         |         |         |
  1+30       0.0098      0.09  Q         |         |         |         |
  1+45       0.0116      0.09  QV        |         |         |         |
  2+ 0       0.0134      0.09  QV        |         |         |         |
  2+15       0.0153      0.09  QV        |         |         |         |
  2+30       0.0172      0.09  QV        |         |         |         |
  2+45       0.0191      0.09  QV        |         |         |         |
  3+ 0       0.0210      0.09  QV        |         |         |         |
  3+15       0.0230      0.09  Q V       |         |         |         |
  3+30       0.0249      0.10  Q V       |         |         |         |
  3+45       0.0269      0.10  Q V       |         |         |         |
  4+ 0       0.0289      0.10  Q V       |         |         |         |
  4+15       0.0310      0.10  Q V       |         |         |         |
  4+30       0.0331      0.10  Q V       |         |         |         |
  4+45       0.0352      0.10  Q  V      |         |         |         |
  5+ 0       0.0373      0.10  Q  V      |         |         |         |
  5+15       0.0395      0.10  Q  V      |         |         |         |
  5+30       0.0417      0.11  Q  V      |         |         |         |
  5+45       0.0439      0.11  Q  V      |         |         |         |
  6+ 0       0.0461      0.11  Q   V     |         |         |         |
  6+15       0.0484      0.11  Q   V     |         |         |         |
  6+30       0.0508      0.11  Q   V     |         |         |         |
  6+45       0.0531      0.11  Q   V     |         |         |         |
  7+ 0       0.0556      0.12  Q   V     |         |         |         |
  7+15       0.0580      0.12  Q    V    |         |         |         |
  7+30       0.0605      0.12  Q    V    |         |         |         |
  7+45       0.0630      0.12  Q    V    |         |         |         |
  8+ 0       0.0656      0.13  Q    V    |         |         |         |
  8+15       0.0683      0.13  Q     V   |         |         |         |
  8+30       0.0710      0.13  Q     V   |         |         |         |
  8+45       0.0737      0.13  Q     V   |         |         |         |
  9+ 0       0.0765      0.14  Q     V   |         |         |         |
  9+15       0.0794      0.14  Q      V  |         |         |         |
  9+30       0.0823      0.14  Q      V  |         |         |         |
  9+45       0.0853      0.15  Q      V  |         |         |         |
 10+ 0       0.0884      0.15  Q      V  |         |         |         |
 10+15       0.0915      0.15  Q       V |         |         |         |
 10+30       0.0948      0.16  Q       V |         |         |         |
 10+45       0.0981      0.16  Q       V |         |         |         |
 11+ 0       0.1016      0.17  Q        V|         |         |         |
 11+15       0.1051      0.17  Q        V|         |         |         |
 11+30       0.1087      0.18  Q        V|         |         |         |
 11+45       0.1125      0.18  Q         V         |         |         |
 12+ 0       0.1164      0.19  Q         V         |         |         |
```

```
12+15       0.1210      0.22  Q         V         |         |         |
12+30       0.1261      0.25  Q          V        |         |         |
12+45       0.1315      0.26  |Q        |V        |         |         |
13+ 0       0.1370      0.27  |Q        | V       |         |         |
13+15       0.1428      0.28  |Q        | V       |         |         |
13+30       0.1488      0.29  |Q        |  V      |         |         |
13+45       0.1552      0.31  |Q        |  V      |         |         |
14+ 0       0.1620      0.33  |Q        |   V     |         |         |
14+15       0.1694      0.36  |Q        |    V    |         |         |
14+30       0.1774      0.39  |Q        |    V    |         |         |
14+45       0.1861      0.42  |Q        |     V   |         |         |
15+ 0       0.1957      0.46  |Q        |      V  |         |         |
15+15       0.2066      0.52  | Q       |       V |         |         |
15+30       0.2186      0.58  | Q       |        V|         |         |
15+45       0.2334      0.72  | Q       |         V         |         |
16+ 0       0.2594      1.26  |    Q    |         |  V      |         |
16+15       0.3079      2.35  |        Q|         |      V  |         |
16+30       0.3412      1.61  |     Q   |         |         V         |
16+45       0.3524      0.54  | Q       |         |          V        |
17+ 0       0.3613      0.43  |Q        |         |         | V       |
17+15       0.3688      0.36  |Q        |         |         | V       |
17+30       0.3752      0.31  |Q        |         |         |  V      |
17+45       0.3811      0.28  |Q        |         |         |   V     |
18+ 0       0.3864      0.26  |Q        |         |         |   V     |
18+15       0.3909      0.22  Q         |         |         |   V     |
18+30       0.3947      0.18  Q         |         |         |    V    |
18+45       0.3983      0.17  Q         |         |         |    V    |
19+ 0       0.4016      0.16  Q         |         |         |    V    |
19+15       0.4048      0.15  Q         |         |         |     V   |
19+30       0.4078      0.15  Q         |         |         |     V   |
19+45       0.4107      0.14  Q         |         |         |     V   |
20+ 0       0.4134      0.13  Q         |         |         |     V   |
20+15       0.4161      0.13  Q         |         |         |      V  |
20+30       0.4186      0.12  Q         |         |         |      V  |
20+45       0.4211      0.12  Q         |         |         |      V  |
21+ 0       0.4235      0.11  Q         |         |         |      V  |
21+15       0.4258      0.11  Q         |         |         |       V |
21+30       0.4280      0.11  Q         |         |         |       V |
21+45       0.4302      0.10  Q         |         |         |       V |
22+ 0       0.4323      0.10  Q         |         |         |       V |
22+15       0.4343      0.10  Q         |         |         |       V |
22+30       0.4363      0.10  Q         |         |         |       V |
22+45       0.4383      0.09  Q         |         |         |        V|
23+ 0       0.4402      0.09  Q         |         |         |        V|
23+15       0.4420      0.09  Q         |         |         |        V|
23+30       0.4439      0.09  Q         |         |         |        V|
23+45       0.4457      0.09  Q         |         |         |        V|
24+ 0       0.4474      0.08  Q         |         |         |        V|
24+15       0.4482      0.04  Q         |         |         |         V
-----------------------------------------------------------------------
```

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 06/23/20   File Name 2019285DMAC.out

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Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6277

2019-285 6400 Katella Avenue
Post-Developed Unit Hydrogrpah
2 Year, 24 Hour Storm
DMA C

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used
++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	2.9	1.00	A	0.400	0.123	0.049

Area-averaged adjusted loss rate Fm (In/Hr) = 0.049

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
0.36	0.123	32.0	16.6	50.24	0.739
2.57	0.877	98.0	98.0	0.20	0.890

Area-averaged catchment yield fraction, Y = 0.871
Area-averaged low loss fraction, Yb = 0.129
++

```
User entry of time of concentration  =   0.097 (hours)
Watershed area =       2.93(Ac.)
Catchment Lag time =   0.077 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 323.7235
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.049(In/Hr)
Average low loss rate fraction (Yb) = 0.129 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.190(In)
Computed peak 30-minute rainfall =  0.400(In)
Specified peak 1-hour rainfall =  0.530(In)
Computed peak 3-hour rainfall =  0.890(In)
Specified peak 6-hour rainfall =  1.220(In)
Specified peak 24-hour rainfall =  2.050(In)


Rainfall depth area reduction factors:
Using a total area of       2.93(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.190(In)
30-minute factor = 1.000    Adjusted rainfall =  0.400(In)
1-hour factor = 1.000       Adjusted rainfall =  0.530(In)
3-hour factor = 1.000       Adjusted rainfall =  0.890(In)
6-hour factor = 1.000       Adjusted rainfall =  1.220(In)
24-hour factor = 1.000  Adjusted rainfall =  2.050(In)
---------------------------------------------------------------------

                        U n i t   H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph         Unit Hydrograph
Number            Mean values           ((CFS))
---------------------------------------------------------------------
                (K =        11.81 (CFS))

  1              67.348                  7.955
  2             100.000                  3.857
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1             0.2999              0.0465
  2             0.3999              0.0292
  3             0.4715              0.0220
  4             0.5299              0.0184
  5             0.5888              0.0189
  6             0.6417              0.0171
  7             0.6901              0.0157
  8             0.7350              0.0146
  9             0.7770              0.0137
 10             0.8166              0.0130
```

11	0.8542	0.0123
12	0.8900	0.0118
13	0.9230	0.0108
14	0.9547	0.0104
15	0.9851	0.0100
16	1.0145	0.0097
17	1.0428	0.0094
18	1.0703	0.0091
19	1.0970	0.0088
20	1.1229	0.0086
21	1.1481	0.0083
22	1.1726	0.0081
23	1.1966	0.0079
24	1.2200	0.0077
25	1.2388	0.0062
26	1.2571	0.0061
27	1.2750	0.0059
28	1.2925	0.0058
29	1.3096	0.0057
30	1.3263	0.0055
31	1.3427	0.0054
32	1.3587	0.0053
33	1.3745	0.0052
34	1.3899	0.0051
35	1.4051	0.0050
36	1.4200	0.0049
37	1.4346	0.0049
38	1.4490	0.0048
39	1.4632	0.0047
40	1.4771	0.0046
41	1.4908	0.0045
42	1.5043	0.0045
43	1.5176	0.0044
44	1.5308	0.0044
45	1.5437	0.0043
46	1.5564	0.0042
47	1.5690	0.0042
48	1.5814	0.0041
49	1.5937	0.0041
50	1.6058	0.0040
51	1.6177	0.0040
52	1.6296	0.0039
53	1.6412	0.0039
54	1.6527	0.0038
55	1.6641	0.0038
56	1.6754	0.0037
57	1.6865	0.0037
58	1.6976	0.0037
59	1.7084	0.0036
60	1.7192	0.0036

61	1.7299	0.0035
62	1.7405	0.0035
63	1.7509	0.0035
64	1.7613	0.0034
65	1.7715	0.0034
66	1.7817	0.0034
67	1.7917	0.0033
68	1.8017	0.0033
69	1.8116	0.0033
70	1.8214	0.0033
71	1.8311	0.0032
72	1.8407	0.0032
73	1.8502	0.0032
74	1.8597	0.0031
75	1.8690	0.0031
76	1.8783	0.0031
77	1.8875	0.0031
78	1.8967	0.0030
79	1.9057	0.0030
80	1.9147	0.0030
81	1.9237	0.0030
82	1.9325	0.0029
83	1.9413	0.0029
84	1.9500	0.0029
85	1.9587	0.0029
86	1.9673	0.0029
87	1.9758	0.0028
88	1.9843	0.0028
89	1.9927	0.0028
90	2.0011	0.0028
91	2.0093	0.0028
92	2.0176	0.0027
93	2.0258	0.0027
94	2.0339	0.0027
95	2.0420	0.0027
96	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0080	0.0010	0.0070
2	0.0081	0.0010	0.0071
3	0.0082	0.0011	0.0071
4	0.0083	0.0011	0.0072
5	0.0084	0.0011	0.0073
6	0.0084	0.0011	0.0074
7	0.0085	0.0011	0.0074
8	0.0086	0.0011	0.0075
9	0.0087	0.0011	0.0076

10	0.0088	0.0011	0.0077
11	0.0089	0.0012	0.0078
12	0.0090	0.0012	0.0079
13	0.0091	0.0012	0.0080
14	0.0093	0.0012	0.0081
15	0.0094	0.0012	0.0082
16	0.0095	0.0012	0.0083
17	0.0096	0.0012	0.0084
18	0.0097	0.0013	0.0085
19	0.0099	0.0013	0.0086
20	0.0100	0.0013	0.0087
21	0.0102	0.0013	0.0089
22	0.0103	0.0013	0.0090
23	0.0105	0.0013	0.0091
24	0.0106	0.0014	0.0093
25	0.0108	0.0014	0.0094
26	0.0110	0.0014	0.0096
27	0.0112	0.0014	0.0097
28	0.0113	0.0015	0.0099
29	0.0115	0.0015	0.0101
30	0.0117	0.0015	0.0102
31	0.0120	0.0015	0.0104
32	0.0122	0.0016	0.0106
33	0.0124	0.0016	0.0108
34	0.0127	0.0016	0.0110
35	0.0130	0.0017	0.0113
36	0.0132	0.0017	0.0115
37	0.0135	0.0017	0.0118
38	0.0138	0.0018	0.0121
39	0.0142	0.0018	0.0124
40	0.0145	0.0019	0.0127
41	0.0149	0.0019	0.0130
42	0.0153	0.0020	0.0133
43	0.0158	0.0020	0.0137
44	0.0162	0.0021	0.0141
45	0.0168	0.0022	0.0146
46	0.0173	0.0022	0.0151
47	0.0179	0.0023	0.0156
48	0.0186	0.0024	0.0162
49	0.0235	0.0030	0.0204
50	0.0243	0.0031	0.0212
51	0.0253	0.0033	0.0220
52	0.0263	0.0034	0.0229
53	0.0276	0.0036	0.0240
54	0.0289	0.0037	0.0252
55	0.0306	0.0039	0.0266
56	0.0324	0.0042	0.0282
57	0.0360	0.0046	0.0314
58	0.0387	0.0050	0.0337
59	0.0423	0.0055	0.0369

60	0.0468	0.0060	0.0408
61	0.0536	0.0069	0.0467
62	0.0574	0.0074	0.0500
63	0.0749	0.0097	0.0653
64	0.1427	0.0123	0.1304
65	0.2539	0.0123	0.2416
66	0.0592	0.0076	0.0516
67	0.0462	0.0060	0.0402
68	0.0383	0.0049	0.0334
69	0.0321	0.0041	0.0280
70	0.0287	0.0037	0.0250
71	0.0262	0.0034	0.0228
72	0.0242	0.0031	0.0211
73	0.0185	0.0024	0.0161
74	0.0172	0.0022	0.0150
75	0.0162	0.0021	0.0141
76	0.0153	0.0020	0.0133
77	0.0145	0.0019	0.0126
78	0.0138	0.0018	0.0120
79	0.0132	0.0017	0.0115
80	0.0126	0.0016	0.0110
81	0.0122	0.0016	0.0106
82	0.0117	0.0015	0.0102
83	0.0113	0.0015	0.0099
84	0.0109	0.0014	0.0095
85	0.0106	0.0014	0.0092
86	0.0103	0.0013	0.0090
87	0.0100	0.0013	0.0087
88	0.0097	0.0013	0.0085
89	0.0095	0.0012	0.0083
90	0.0092	0.0012	0.0080
91	0.0090	0.0012	0.0079
92	0.0088	0.0011	0.0077
93	0.0086	0.0011	0.0075
94	0.0084	0.0011	0.0073
95	0.0083	0.0011	0.0072
96	0.0081	0.0010	0.0070

Total soil rain loss = 0.24(In)
Total effective rainfall = 1.81(In)
Peak flow rate in flood hydrograph = 2.42(CFS)

24 - H O U R   S T O R M
R u n o f f   H y d r o g r a p h

Hydrograph in 15 Minute intervals ((CFS))

```
Time(h+m) Volume Ac.Ft   Q(CFS)  0         2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+15       0.0011      0.06  Q         |         |         |         |
  0+30       0.0029      0.08  Q         |         |         |         |
  0+45       0.0046      0.08  Q         |         |         |         |
  1+ 0       0.0064      0.08  Q         |         |         |         |
  1+15       0.0081      0.09  Q         |         |         |         |
  1+30       0.0099      0.09  Q         |         |         |         |
  1+45       0.0117      0.09  QV        |         |         |         |
  2+ 0       0.0136      0.09  QV        |         |         |         |
  2+15       0.0154      0.09  QV        |         |         |         |
  2+30       0.0173      0.09  QV        |         |         |         |
  2+45       0.0192      0.09  QV        |         |         |         |
  3+ 0       0.0211      0.09  QV        |         |         |         |
  3+15       0.0230      0.09  Q V       |         |         |         |
  3+30       0.0250      0.09  Q V       |         |         |         |
  3+45       0.0270      0.10  Q V       |         |         |         |
  4+ 0       0.0290      0.10  Q V       |         |         |         |
  4+15       0.0310      0.10  Q V       |         |         |         |
  4+30       0.0331      0.10  Q V       |         |         |         |
  4+45       0.0352      0.10  Q  V      |         |         |         |
  5+ 0       0.0373      0.10  Q  V      |         |         |         |
  5+15       0.0394      0.10  Q  V      |         |         |         |
  5+30       0.0416      0.11  Q  V      |         |         |         |
  5+45       0.0438      0.11  Q  V      |         |         |         |
  6+ 0       0.0461      0.11  Q   V     |         |         |         |
  6+15       0.0484      0.11  Q   V     |         |         |         |
  6+30       0.0507      0.11  Q   V     |         |         |         |
  6+45       0.0530      0.11  Q   V     |         |         |         |
  7+ 0       0.0554      0.12  Q    V    |         |         |         |
  7+15       0.0579      0.12  Q    V    |         |         |         |
  7+30       0.0604      0.12  Q    V    |         |         |         |
  7+45       0.0629      0.12  Q    V    |         |         |         |
  8+ 0       0.0655      0.12  Q    V    |         |         |         |
  8+15       0.0681      0.13  Q     V   |         |         |         |
  8+30       0.0708      0.13  Q     V   |         |         |         |
  8+45       0.0735      0.13  Q     V   |         |         |         |
  9+ 0       0.0763      0.14  Q     V   |         |         |         |
  9+15       0.0791      0.14  Q      V  |         |         |         |
  9+30       0.0821      0.14  Q      V  |         |         |         |
  9+45       0.0851      0.14  Q      V  |         |         |         |
 10+ 0       0.0881      0.15  Q      V  |         |         |         |
 10+15       0.0913      0.15  Q       V |         |         |         |
 10+30       0.0945      0.16  Q       V |         |         |         |
 10+45       0.0978      0.16  Q       V |         |         |         |
 11+ 0       0.1012      0.17  Q        V|         |         |         |
 11+15       0.1048      0.17  Q        V|         |         |         |
 11+30       0.1084      0.18  Q        V|         |         |         |
 11+45       0.1122      0.18  Q         V         |         |         |
 12+ 0       0.1161      0.19  Q         V         |         |         |
```

```
   12+15       0.1207      0.22  Q         V         |         |         |
   12+30       0.1258      0.25  Q         |V        |         |         |
   12+45       0.1311      0.26  |Q        |V        |         |         |
   13+ 0       0.1367      0.27  |Q        | V       |         |         |
   13+15       0.1424      0.28  |Q        | V       |         |         |
   13+30       0.1485      0.29  |Q        |  V      |         |         |
   13+45       0.1549      0.31  |Q        |   V     |         |         |
   14+ 0       0.1616      0.33  |Q        |   V     |         |         |
   14+15       0.1690      0.36  |Q        |    V    |         |         |
   14+30       0.1771      0.39  |Q        |     V   |         |         |
   14+45       0.1858      0.42  |Q        |     V   |         |         |
   15+ 0       0.1955      0.47  |Q        |      V  |         |         |
   15+15       0.2064      0.53  | Q       |       V |         |         |
   15+30       0.2183      0.58  | Q       |        V|         |         |
   15+45       0.2330      0.71  | Q       |          V        |         |
   16+ 0       0.2597      1.29  |    Q    |         |  V      |         |
   16+15       0.3098      2.42  |        Q|         |       V |         |
   16+30       0.3375      1.34  |    Q    |         |         V         |
   16+45       0.3482      0.52  | Q       |         |          V        |
   17+ 0       0.3569      0.42  |Q        |         |         | V       |
   17+15       0.3642      0.35  |Q        |         |         | V       |
   17+30       0.3705      0.31  |Q        |         |         |  V      |
   17+45       0.3763      0.28  |Q        |         |         |   V     |
   18+ 0       0.3815      0.26  |Q        |         |         |   V     |
   18+15       0.3859      0.21  Q         |         |         |   V     |
   18+30       0.3896      0.18  Q         |         |         |    V    |
   18+45       0.3931      0.17  Q         |         |         |    V    |
   19+ 0       0.3964      0.16  Q         |         |         |    V    |
   19+15       0.3996      0.15  Q         |         |         |     V   |
   19+30       0.4025      0.14  Q         |         |         |     V   |
   19+45       0.4054      0.14  Q         |         |         |     V   |
   20+ 0       0.4081      0.13  Q         |         |         |     V   |
   20+15       0.4107      0.13  Q         |         |         |      V  |
   20+30       0.4132      0.12  Q         |         |         |      V  |
   20+45       0.4157      0.12  Q         |         |         |      V  |
   21+ 0       0.4180      0.11  Q         |         |         |      V  |
   21+15       0.4203      0.11  Q         |         |         |       V |
   21+30       0.4225      0.11  Q         |         |         |       V |
   21+45       0.4247      0.10  Q         |         |         |       V |
   22+ 0       0.4267      0.10  Q         |         |         |       V |
   22+15       0.4288      0.10  Q         |         |         |       V |
   22+30       0.4308      0.10  Q         |         |         |       V |
   22+45       0.4327      0.09  Q         |         |         |        V|
   23+ 0       0.4346      0.09  Q         |         |         |        V|
   23+15       0.4364      0.09  Q         |         |         |        V|
   23+30       0.4382      0.09  Q         |         |         |        V|
   23+45       0.4400      0.09  Q         |         |         |        V|
   24+ 0       0.4417      0.08  Q         |         |         |        V|
   24+15       0.4423      0.03  Q         |         |         |         V
-----------------------------------------------------------------------
```

U n i t   H y d r o g r a p h   A n a l y s i s

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Study date 06/23/20 File Name 2019285DMAD.out

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Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6277

2019-285 6400 Katella Avenue
Post-Developed Unit Hydrogrpah
2 Year, 24 Hour Storm
DMA D

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used
++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	4.8	1.00	A	0.400	0.108	0.043

Area-averaged adjusted loss rate Fm (In/Hr) = 0.043

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
0.52	0.108	32.0	16.6	50.24	0.739
4.25	0.892	98.0	98.0	0.20	0.890

Area-averaged catchment yield fraction, Y = 0.873
Area-averaged low loss fraction, Yb = 0.127
++

```
User entry of time of concentration  =   0.093 (hours)
Watershed area =       4.77(Ac.)
Catchment Lag time =   0.075 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 334.4643
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.043(In/Hr)
Average low loss rate fraction (Yb) = 0.127 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.190(In)
Computed peak 30-minute rainfall =  0.400(In)
Specified peak 1-hour rainfall =  0.530(In)
Computed peak 3-hour rainfall =  0.890(In)
Specified peak 6-hour rainfall =  1.220(In)
Specified peak 24-hour rainfall =  2.050(In)


Rainfall depth area reduction factors:
Using a total area of       4.77(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.190(In)
30-minute factor = 1.000    Adjusted rainfall =  0.400(In)
1-hour factor = 1.000       Adjusted rainfall =  0.530(In)
3-hour factor = 1.000       Adjusted rainfall =  0.890(In)
6-hour factor = 1.000       Adjusted rainfall =  1.220(In)
24-hour factor = 1.000  Adjusted rainfall =  2.050(In)
---------------------------------------------------------------------

                        U n i t   H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values             ((CFS))
---------------------------------------------------------------------
                (K =        19.23 (CFS))

  1              68.387                 13.150
  2             100.000                  6.079
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number             (In)                 (In)
  1             0.2998                0.0465
  2             0.3999                0.0292
  3             0.4715                0.0220
  4             0.5299                0.0184
  5             0.5887                0.0189
  6             0.6416                0.0171
  7             0.6901                0.0157
  8             0.7350                0.0146
  9             0.7770                0.0137
 10             0.8166                0.0130
```

11	0.8542	0.0123
12	0.8900	0.0118
13	0.9230	0.0108
14	0.9546	0.0104
15	0.9851	0.0100
16	1.0144	0.0097
17	1.0428	0.0094
18	1.0703	0.0091
19	1.0970	0.0088
20	1.1229	0.0086
21	1.1481	0.0083
22	1.1726	0.0081
23	1.1966	0.0079
24	1.2200	0.0077
25	1.2388	0.0062
26	1.2571	0.0061
27	1.2750	0.0059
28	1.2925	0.0058
29	1.3096	0.0057
30	1.3263	0.0055
31	1.3427	0.0054
32	1.3587	0.0053
33	1.3745	0.0052
34	1.3899	0.0051
35	1.4051	0.0050
36	1.4200	0.0049
37	1.4346	0.0049
38	1.4490	0.0048
39	1.4632	0.0047
40	1.4771	0.0046
41	1.4908	0.0045
42	1.5043	0.0045
43	1.5176	0.0044
44	1.5308	0.0044
45	1.5437	0.0043
46	1.5564	0.0042
47	1.5690	0.0042
48	1.5814	0.0041
49	1.5937	0.0041
50	1.6058	0.0040
51	1.6177	0.0040
52	1.6295	0.0039
53	1.6412	0.0039
54	1.6527	0.0038
55	1.6641	0.0038
56	1.6754	0.0037
57	1.6865	0.0037
58	1.6975	0.0037
59	1.7084	0.0036
60	1.7192	0.0036

61	1.7299	0.0035
62	1.7405	0.0035
63	1.7509	0.0035
64	1.7613	0.0034
65	1.7715	0.0034
66	1.7817	0.0034
67	1.7917	0.0033
68	1.8017	0.0033
69	1.8116	0.0033
70	1.8214	0.0033
71	1.8311	0.0032
72	1.8407	0.0032
73	1.8502	0.0032
74	1.8597	0.0031
75	1.8690	0.0031
76	1.8783	0.0031
77	1.8875	0.0031
78	1.8967	0.0030
79	1.9057	0.0030
80	1.9147	0.0030
81	1.9237	0.0030
82	1.9325	0.0029
83	1.9413	0.0029
84	1.9500	0.0029
85	1.9587	0.0029
86	1.9673	0.0029
87	1.9758	0.0028
88	1.9843	0.0028
89	1.9927	0.0028
90	2.0010	0.0028
91	2.0093	0.0028
92	2.0176	0.0027
93	2.0258	0.0027
94	2.0339	0.0027
95	2.0420	0.0027
96	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0080	0.0010	0.0070
2	0.0081	0.0010	0.0071
3	0.0082	0.0010	0.0072
4	0.0083	0.0010	0.0072
5	0.0084	0.0011	0.0073
6	0.0084	0.0011	0.0074
7	0.0085	0.0011	0.0075
8	0.0086	0.0011	0.0075
9	0.0087	0.0011	0.0076

10	0.0088	0.0011	0.0077
11	0.0089	0.0011	0.0078
12	0.0090	0.0011	0.0079
13	0.0091	0.0012	0.0080
14	0.0093	0.0012	0.0081
15	0.0094	0.0012	0.0082
16	0.0095	0.0012	0.0083
17	0.0096	0.0012	0.0084
18	0.0097	0.0012	0.0085
19	0.0099	0.0013	0.0086
20	0.0100	0.0013	0.0087
21	0.0102	0.0013	0.0089
22	0.0103	0.0013	0.0090
23	0.0105	0.0013	0.0091
24	0.0106	0.0013	0.0093
25	0.0108	0.0014	0.0094
26	0.0110	0.0014	0.0096
27	0.0112	0.0014	0.0097
28	0.0113	0.0014	0.0099
29	0.0115	0.0015	0.0101
30	0.0117	0.0015	0.0103
31	0.0120	0.0015	0.0105
32	0.0122	0.0015	0.0106
33	0.0124	0.0016	0.0109
34	0.0127	0.0016	0.0111
35	0.0130	0.0016	0.0113
36	0.0132	0.0017	0.0116
37	0.0135	0.0017	0.0118
38	0.0138	0.0018	0.0121
39	0.0142	0.0018	0.0124
40	0.0145	0.0018	0.0127
41	0.0149	0.0019	0.0130
42	0.0153	0.0019	0.0134
43	0.0158	0.0020	0.0138
44	0.0162	0.0021	0.0142
45	0.0168	0.0021	0.0146
46	0.0173	0.0022	0.0151
47	0.0179	0.0023	0.0157
48	0.0186	0.0024	0.0162
49	0.0235	0.0030	0.0205
50	0.0243	0.0031	0.0212
51	0.0253	0.0032	0.0221
52	0.0263	0.0033	0.0230
53	0.0276	0.0035	0.0241
54	0.0289	0.0037	0.0253
55	0.0306	0.0039	0.0267
56	0.0324	0.0041	0.0283
57	0.0360	0.0046	0.0314
58	0.0387	0.0049	0.0338
59	0.0423	0.0054	0.0370

60	0.0468	0.0059	0.0409
61	0.0536	0.0068	0.0468
62	0.0574	0.0073	0.0501
63	0.0749	0.0095	0.0654
64	0.1427	0.0108	0.1319
65	0.2539	0.0108	0.2431
66	0.0592	0.0075	0.0517
67	0.0462	0.0058	0.0404
68	0.0383	0.0048	0.0335
69	0.0321	0.0041	0.0281
70	0.0287	0.0036	0.0251
71	0.0262	0.0033	0.0229
72	0.0242	0.0031	0.0211
73	0.0185	0.0023	0.0161
74	0.0172	0.0022	0.0150
75	0.0162	0.0020	0.0141
76	0.0153	0.0019	0.0133
77	0.0145	0.0018	0.0126
78	0.0138	0.0017	0.0120
79	0.0132	0.0017	0.0115
80	0.0126	0.0016	0.0110
81	0.0122	0.0015	0.0106
82	0.0117	0.0015	0.0102
83	0.0113	0.0014	0.0099
84	0.0109	0.0014	0.0096
85	0.0106	0.0013	0.0093
86	0.0103	0.0013	0.0090
87	0.0100	0.0013	0.0087
88	0.0097	0.0012	0.0085
89	0.0095	0.0012	0.0083
90	0.0092	0.0012	0.0081
91	0.0090	0.0011	0.0079
92	0.0088	0.0011	0.0077
93	0.0086	0.0011	0.0075
94	0.0084	0.0011	0.0074
95	0.0083	0.0010	0.0072
96	0.0081	0.0010	0.0071

Total soil rain loss = 0.23(In)
Total effective rainfall = 1.82(In)
Peak flow rate in flood hydrograph = 4.00(CFS)

++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 15 Minute intervals ((CFS))

```
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+15      0.0019     0.09  Q         |         |         |         |
  0+30      0.0047     0.14  Q         |         |         |         |
  0+45      0.0075     0.14  Q         |         |         |         |
  1+ 0      0.0104     0.14  Q         |         |         |         |
  1+15      0.0133     0.14  Q         |         |         |         |
  1+30      0.0162     0.14  Q         |         |         |         |
  1+45      0.0192     0.14  QV        |         |         |         |
  2+ 0      0.0222     0.14  QV        |         |         |         |
  2+15      0.0252     0.15  QV        |         |         |         |
  2+30      0.0282     0.15  QV        |         |         |         |
  2+45      0.0313     0.15  QV        |         |         |         |
  3+ 0      0.0344     0.15  QV        |         |         |         |
  3+15      0.0376     0.15  Q V       |         |         |         |
  3+30      0.0408     0.15  Q V       |         |         |         |
  3+45      0.0440     0.16  Q V       |         |         |         |
  4+ 0      0.0473     0.16  Q V       |         |         |         |
  4+15      0.0506     0.16  Q V       |         |         |         |
  4+30      0.0540     0.16  Q V       |         |         |         |
  4+45      0.0574     0.17  Q  V      |         |         |         |
  5+ 0      0.0609     0.17  Q  V      |         |         |         |
  5+15      0.0644     0.17  Q  V      |         |         |         |
  5+30      0.0680     0.17  Q  V      |         |         |         |
  5+45      0.0716     0.17  Q  V      |         |         |         |
  6+ 0      0.0752     0.18  Q   V     |         |         |         |
  6+15      0.0790     0.18  Q   V     |         |         |         |
  6+30      0.0828     0.18  Q   V     |         |         |         |
  6+45      0.0866     0.19  Q   V     |         |         |         |
  7+ 0      0.0905     0.19  Q    V    |         |         |         |
  7+15      0.0945     0.19  Q    V    |         |         |         |
  7+30      0.0986     0.20  Q    V    |         |         |         |
  7+45      0.1027     0.20  Q    V    |         |         |         |
  8+ 0      0.1069     0.20  Q    V    |         |         |         |
  8+15      0.1112     0.21  Q     V   |         |         |         |
  8+30      0.1155     0.21  Q     V   |         |         |         |
  8+45      0.1200     0.22  Q     V   |         |         |         |
  9+ 0      0.1246     0.22  Q     V   |         |         |         |
  9+15      0.1292     0.23  Q      V  |         |         |         |
  9+30      0.1340     0.23  Q      V  |         |         |         |
  9+45      0.1389     0.24  Q      V  |         |         |         |
 10+ 0      0.1439     0.24  Q      V  |         |         |         |
 10+15      0.1490     0.25  Q       V |         |         |         |
 10+30      0.1543     0.26  |Q      V |         |         |         |
 10+45      0.1597     0.26  |Q      V |         |         |         |
 11+ 0      0.1653     0.27  |Q       V|         |         |         |
 11+15      0.1711     0.28  |Q       V|         |         |         |
 11+30      0.1770     0.29  |Q       V|         |         |         |
 11+45      0.1832     0.30  |Q        V         |         |         |
 12+ 0      0.1895     0.31  |Q        V         |         |         |
```

```
   12+15       0.1971      0.37  |Q        V         |         |         |
   12+30       0.2055      0.40  |Q        |V        |         |         |
   12+45       0.2142      0.42  |Q        |V        |         |         |
   13+ 0       0.2232      0.44  |Q        | V       |         |         |
   13+15       0.2326      0.46  |Q        | V       |         |         |
   13+30       0.2425      0.48  |Q        |  V      |         |         |
   13+45       0.2529      0.50  | Q       |  V      |         |         |
   14+ 0       0.2640      0.53  | Q       |   V     |         |         |
   14+15       0.2761      0.59  | Q       |    V    |         |         |
   14+30       0.2892      0.64  | Q       |     V   |         |         |
   14+45       0.3035      0.69  | Q       |     V   |         |         |
   15+ 0       0.3192      0.76  |  Q      |      V  |         |         |
   15+15       0.3371      0.86  |  Q      |       V |         |         |
   15+30       0.3566      0.94  |  Q      |        V|         |         |
   15+45       0.3806      1.17  |   Q     |          V        |         |
   16+ 0       0.4247      2.13  |       Q |         |  V      |         |
   16+15       0.5073      4.00  |         |    Q    |       V |         |
   16+30       0.5519      2.16  |       Q |         |         V         |
   16+45       0.5693      0.85  |  Q      |         |          V        |
   17+ 0       0.5835      0.69  | Q       |         |         | V       |
   17+15       0.5953      0.57  | Q       |         |         | V       |
   17+30       0.6057      0.50  | Q       |         |         |  V      |
   17+45       0.6150      0.45  |Q        |         |         |   V     |
   18+ 0       0.6236      0.42  |Q        |         |         |   V     |
   18+15       0.6307      0.34  |Q        |         |         |   V     |
   18+30       0.6368      0.30  |Q        |         |         |    V    |
   18+45       0.6425      0.28  |Q        |         |         |    V    |
   19+ 0       0.6479      0.26  |Q        |         |         |    V    |
   19+15       0.6530      0.25  Q         |         |         |     V   |
   19+30       0.6579      0.24  Q         |         |         |     V   |
   19+45       0.6625      0.22  Q         |         |         |     V   |
   20+ 0       0.6670      0.22  Q         |         |         |     V   |
   20+15       0.6712      0.21  Q         |         |         |      V  |
   20+30       0.6753      0.20  Q         |         |         |      V  |
   20+45       0.6793      0.19  Q         |         |         |      V  |
   21+ 0       0.6831      0.19  Q         |         |         |      V  |
   21+15       0.6869      0.18  Q         |         |         |       V |
   21+30       0.6905      0.17  Q         |         |         |       V |
   21+45       0.6940      0.17  Q         |         |         |       V |
   22+ 0       0.6974      0.16  Q         |         |         |       V |
   22+15       0.7007      0.16  Q         |         |         |       V |
   22+30       0.7039      0.16  Q         |         |         |       V |
   22+45       0.7071      0.15  Q         |         |         |        V|
   23+ 0       0.7102      0.15  Q         |         |         |        V|
   23+15       0.7132      0.15  Q         |         |         |        V|
   23+30       0.7161      0.14  Q         |         |         |        V|
   23+45       0.7190      0.14  Q         |         |         |        V|
   24+ 0       0.7218      0.14  Q         |         |         |        V|
   24+15       0.7227      0.04  Q         |         |         |        V|
-----------------------------------------------------------------------
```

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 06/23/20   File Name 2019285DMAE.out

++

Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6277

2019-285 6400 Katella Avenue
Post-Developed Unit Hydrogrpah
2 Year, 24 Hour Storm
DMA E

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used
++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	2.5	1.00	A	0.400	0.077	0.031

Area-averaged adjusted loss rate Fm (In/Hr) = 0.031

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
0.19	0.077	32.0	16.6	50.24	0.739
2.31	0.923	98.0	98.0	0.20	0.890

Area-averaged catchment yield fraction, Y = 0.878
Area-averaged low loss fraction, Yb = 0.122
++

```
User entry of time of concentration  =   0.078 (hours)
Watershed area =       2.50(Ac.)
Catchment Lag time =   0.063 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 399.4478
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.031(In/Hr)
Average low loss rate fraction (Yb) = 0.122 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.190(In)
Computed peak 30-minute rainfall =  0.400(In)
Specified peak 1-hour rainfall =  0.530(In)
Computed peak 3-hour rainfall =  0.890(In)
Specified peak 6-hour rainfall =  1.220(In)
Specified peak 24-hour rainfall =  2.050(In)


Rainfall depth area reduction factors:
Using a total area of       2.50(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.190(In)
30-minute factor = 1.000    Adjusted rainfall =  0.400(In)
1-hour factor = 1.000       Adjusted rainfall =  0.530(In)
3-hour factor = 1.000       Adjusted rainfall =  0.890(In)
6-hour factor = 1.000       Adjusted rainfall =  1.220(In)
24-hour factor = 1.000  Adjusted rainfall =  2.050(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values            ((CFS))
---------------------------------------------------------------------
                (K =        10.08 (CFS))

  1              100.000                  0.000
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.2999               0.0465
  2              0.4000               0.0292
  3              0.4715               0.0220
  4              0.5299               0.0184
  5              0.5888               0.0189
  6              0.6417               0.0171
  7              0.6901               0.0157
  8              0.7350               0.0146
  9              0.7770               0.0137
 10              0.8166               0.0130
 11              0.8542               0.0123
```

12	0.8900	0.0118
13	0.9230	0.0108
14	0.9547	0.0104
15	0.9851	0.0100
16	1.0145	0.0097
17	1.0428	0.0094
18	1.0703	0.0091
19	1.0970	0.0088
20	1.1229	0.0086
21	1.1481	0.0083
22	1.1726	0.0081
23	1.1966	0.0079
24	1.2200	0.0077
25	1.2388	0.0062
26	1.2571	0.0061
27	1.2750	0.0059
28	1.2925	0.0058
29	1.3096	0.0057
30	1.3263	0.0055
31	1.3427	0.0054
32	1.3587	0.0053
33	1.3745	0.0052
34	1.3899	0.0051
35	1.4051	0.0050
36	1.4200	0.0049
37	1.4346	0.0049
38	1.4490	0.0048
39	1.4632	0.0047
40	1.4771	0.0046
41	1.4908	0.0045
42	1.5043	0.0045
43	1.5176	0.0044
44	1.5308	0.0044
45	1.5437	0.0043
46	1.5564	0.0042
47	1.5690	0.0042
48	1.5814	0.0041
49	1.5937	0.0041
50	1.6058	0.0040
51	1.6177	0.0040
52	1.6296	0.0039
53	1.6412	0.0039
54	1.6527	0.0038
55	1.6641	0.0038
56	1.6754	0.0037
57	1.6865	0.0037
58	1.6976	0.0037
59	1.7085	0.0036
60	1.7192	0.0036
61	1.7299	0.0035

62	1.7405	0.0035
63	1.7509	0.0035
64	1.7613	0.0034
65	1.7715	0.0034
66	1.7817	0.0034
67	1.7917	0.0033
68	1.8017	0.0033
69	1.8116	0.0033
70	1.8214	0.0033
71	1.8311	0.0032
72	1.8407	0.0032
73	1.8502	0.0032
74	1.8597	0.0031
75	1.8690	0.0031
76	1.8783	0.0031
77	1.8875	0.0031
78	1.8967	0.0030
79	1.9057	0.0030
80	1.9147	0.0030
81	1.9237	0.0030
82	1.9325	0.0029
83	1.9413	0.0029
84	1.9500	0.0029
85	1.9587	0.0029
86	1.9673	0.0029
87	1.9758	0.0028
88	1.9843	0.0028
89	1.9927	0.0028
90	2.0011	0.0028
91	2.0094	0.0028
92	2.0176	0.0027
93	2.0258	0.0027
94	2.0339	0.0027
95	2.0420	0.0027
96	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0080	0.0010	0.0070
2	0.0081	0.0010	0.0071
3	0.0082	0.0010	0.0072
4	0.0083	0.0010	0.0073
5	0.0084	0.0010	0.0073
6	0.0084	0.0010	0.0074
7	0.0085	0.0010	0.0075
8	0.0086	0.0011	0.0076
9	0.0087	0.0011	0.0077
10	0.0088	0.0011	0.0078

11	0.0089	0.0011	0.0078
12	0.0090	0.0011	0.0079
13	0.0091	0.0011	0.0080
14	0.0093	0.0011	0.0081
15	0.0094	0.0011	0.0082
16	0.0095	0.0012	0.0083
17	0.0096	0.0012	0.0084
18	0.0097	0.0012	0.0086
19	0.0099	0.0012	0.0087
20	0.0100	0.0012	0.0088
21	0.0102	0.0012	0.0089
22	0.0103	0.0013	0.0091
23	0.0105	0.0013	0.0092
24	0.0106	0.0013	0.0093
25	0.0108	0.0013	0.0095
26	0.0110	0.0013	0.0096
27	0.0112	0.0014	0.0098
28	0.0113	0.0014	0.0100
29	0.0115	0.0014	0.0101
30	0.0117	0.0014	0.0103
31	0.0120	0.0015	0.0105
32	0.0122	0.0015	0.0107
33	0.0124	0.0015	0.0109
34	0.0127	0.0015	0.0111
35	0.0130	0.0016	0.0114
36	0.0132	0.0016	0.0116
37	0.0135	0.0016	0.0119
38	0.0138	0.0017	0.0122
39	0.0142	0.0017	0.0125
40	0.0145	0.0018	0.0128
41	0.0149	0.0018	0.0131
42	0.0153	0.0019	0.0135
43	0.0158	0.0019	0.0139
44	0.0162	0.0020	0.0143
45	0.0168	0.0020	0.0147
46	0.0173	0.0021	0.0152
47	0.0179	0.0022	0.0157
48	0.0186	0.0023	0.0163
49	0.0235	0.0029	0.0206
50	0.0243	0.0030	0.0213
51	0.0253	0.0031	0.0222
52	0.0263	0.0032	0.0231
53	0.0276	0.0034	0.0242
54	0.0289	0.0035	0.0254
55	0.0306	0.0037	0.0269
56	0.0324	0.0039	0.0284
57	0.0360	0.0044	0.0316
58	0.0387	0.0047	0.0340
59	0.0423	0.0052	0.0372
60	0.0468	0.0057	0.0411

61	0.0536	0.0065	0.0470
62	0.0574	0.0070	0.0504
63	0.0749	0.0077	0.0672
64	0.1427	0.0077	0.1350
65	0.2539	0.0077	0.2462
66	0.0592	0.0072	0.0520
67	0.0462	0.0056	0.0406
68	0.0383	0.0047	0.0336
69	0.0321	0.0039	0.0282
70	0.0287	0.0035	0.0252
71	0.0262	0.0032	0.0230
72	0.0242	0.0029	0.0212
73	0.0185	0.0023	0.0162
74	0.0172	0.0021	0.0151
75	0.0162	0.0020	0.0142
76	0.0153	0.0019	0.0134
77	0.0145	0.0018	0.0127
78	0.0138	0.0017	0.0121
79	0.0132	0.0016	0.0116
80	0.0126	0.0015	0.0111
81	0.0122	0.0015	0.0107
82	0.0117	0.0014	0.0103
83	0.0113	0.0014	0.0099
84	0.0109	0.0013	0.0096
85	0.0106	0.0013	0.0093
86	0.0103	0.0013	0.0090
87	0.0100	0.0012	0.0088
88	0.0097	0.0012	0.0085
89	0.0095	0.0012	0.0083
90	0.0092	0.0011	0.0081
91	0.0090	0.0011	0.0079
92	0.0088	0.0011	0.0077
93	0.0086	0.0011	0.0076
94	0.0084	0.0010	0.0074
95	0.0083	0.0010	0.0073
96	0.0081	0.0010	0.0071

```
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      0.22(In)
Total effective rainfall =      1.83(In)
Peak flow rate in flood hydrograph =      0.00(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in  15   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
```

```
-----------------------------------------------------------------------
  0+15        0.0000       0.00  Q          |         |         |         |
  0+30        0.0000       0.00  Q          |         |         |         |
  0+45        0.0000       0.00  Q          |         |         |         |
  1+ 0        0.0000       0.00  Q          |         |         |         |
  1+15        0.0000       0.00  Q          |         |         |         |
  1+30        0.0000       0.00  Q          |         |         |         |
  1+45        0.0000       0.00  Q          |         |         |         |
  2+ 0        0.0000       0.00  Q          |         |         |         |
  2+15        0.0000       0.00  Q          |         |         |         |
  2+30        0.0000       0.00  Q          |         |         |         |
  2+45        0.0000       0.00  Q          |         |         |         |
  3+ 0        0.0000       0.00  Q          |         |         |         |
  3+15        0.0000       0.00  Q          |         |         |         |
  3+30        0.0000       0.00  Q          |         |         |         |
  3+45        0.0000       0.00  Q          |         |         |         |
  4+ 0        0.0000       0.00  Q          |         |         |         |
  4+15        0.0000       0.00  Q          |         |         |         |
  4+30        0.0000       0.00  Q          |         |         |         |
  4+45        0.0000       0.00  Q          |         |         |         |
  5+ 0        0.0000       0.00  Q          |         |         |         |
  5+15        0.0000       0.00  Q          |         |         |         |
  5+30        0.0000       0.00  Q          |         |         |         |
  5+45        0.0000       0.00  Q          |         |         |         |
  6+ 0        0.0000       0.00  Q          |         |         |         |
  6+15        0.0000       0.00  Q          |         |         |         |
  6+30        0.0000       0.00  Q          |         |         |         |
  6+45        0.0000       0.00  Q          |         |         |         |
  7+ 0        0.0000       0.00  Q          |         |         |         |
  7+15        0.0000       0.00  Q          |         |         |         |
  7+30        0.0000       0.00  Q          |         |         |         |
  7+45        0.0000       0.00  Q          |         |         |         |
  8+ 0        0.0000       0.00  Q          |         |         |         |
  8+15        0.0000       0.00  Q          |         |         |         |
  8+30        0.0000       0.00  Q          |         |         |         |
  8+45        0.0000       0.00  Q          |         |         |         |
  9+ 0        0.0000       0.00  Q          |         |         |         |
  9+15        0.0000       0.00  Q          |         |         |         |
  9+30        0.0000       0.00  Q          |         |         |         |
  9+45        0.0000       0.00  Q          |         |         |         |
 10+ 0        0.0000       0.00  Q          |         |         |         |
 10+15        0.0000       0.00  Q          |         |         |         |
 10+30        0.0000       0.00  Q          |         |         |         |
 10+45        0.0000       0.00  Q          |         |         |         |
 11+ 0        0.0000       0.00  Q          |         |         |         |
 11+15        0.0000       0.00  Q          |         |         |         |
 11+30        0.0000       0.00  Q          |         |         |         |
 11+45        0.0000       0.00  Q          |         |         |         |
 12+ 0        0.0000       0.00  Q          |         |         |         |
 12+15        0.0000       0.00  Q          |         |         |         |
```

12+30	0.0000	0.00	Q					
12+45	0.0000	0.00	Q					
13+ 0	0.0000	0.00	Q					
13+15	0.0000	0.00	Q					
13+30	0.0000	0.00	Q					
13+45	0.0000	0.00	Q					
14+ 0	0.0000	0.00	Q					
14+15	0.0000	0.00	Q					
14+30	0.0000	0.00	Q					
14+45	0.0000	0.00	Q					
15+ 0	0.0000	0.00	Q					
15+15	0.0000	0.00	Q					
15+30	0.0000	0.00	Q					
15+45	0.0000	0.00	Q					
16+ 0	0.0000	0.00	Q					
16+15	0.0000	0.00	Q					
16+30	0.0000	0.00	Q					
16+45	0.0000	0.00	Q					
17+ 0	0.0000	0.00	Q					
17+15	0.0000	0.00	Q					
17+30	0.0000	0.00	Q					
17+45	0.0000	0.00	Q					
18+ 0	0.0000	0.00	Q					
18+15	0.0000	0.00	Q					
18+30	0.0000	0.00	Q					
18+45	0.0000	0.00	Q					
19+ 0	0.0000	0.00	Q					
19+15	0.0000	0.00	Q					
19+30	0.0000	0.00	Q					
19+45	0.0000	0.00	Q					
20+ 0	0.0000	0.00	Q					
20+15	0.0000	0.00	Q					
20+30	0.0000	0.00	Q					
20+45	0.0000	0.00	Q					
21+ 0	0.0000	0.00	Q					
21+15	0.0000	0.00	Q					
21+30	0.0000	0.00	Q					
21+45	0.0000	0.00	Q					
22+ 0	0.0000	0.00	Q					
22+15	0.0000	0.00	Q					
22+30	0.0000	0.00	Q					
22+45	0.0000	0.00	Q					
23+ 0	0.0000	0.00	Q					
23+15	0.0000	0.00	Q					
23+30	0.0000	0.00	Q					
23+45	0.0000	0.00	Q					
24+ 0	0.0000	0.00	Q					

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 06/23/20   File Name 2019285DMAF.out

++

Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6277

2019-285 6400 Katella Avenue
Post-Developed Unit Hydrogrpah
2 Year, 24 Hour Storm
DMA F

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	2.6	1.00	A	0.400	0.141	0.056

Area-averaged adjusted loss rate Fm (In/Hr) = 0.056

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
0.37	0.141	32.0	16.6	50.24	0.739
2.23	0.859	98.0	98.0	0.20	0.890

Area-averaged catchment yield fraction, Y = 0.868
Area-averaged low loss fraction, Yb = 0.132

++

```
User entry of time of concentration  =   0.092 (hours)
Watershed area =       2.60(Ac.)
Catchment Lag time =   0.073 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 340.2286
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.056(In/Hr)
Average low loss rate fraction (Yb) = 0.132 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.190(In)
Computed peak 30-minute rainfall =  0.400(In)
Specified peak 1-hour rainfall =  0.530(In)
Computed peak 3-hour rainfall =  0.890(In)
Specified peak 6-hour rainfall =  1.220(In)
Specified peak 24-hour rainfall =  2.050(In)


Rainfall depth area reduction factors:
Using a total area of       2.60(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.190(In)
30-minute factor = 1.000    Adjusted rainfall =  0.400(In)
1-hour factor = 1.000       Adjusted rainfall =  0.530(In)
3-hour factor = 1.000       Adjusted rainfall =  0.890(In)
6-hour factor = 1.000       Adjusted rainfall =  1.220(In)
24-hour factor = 1.000  Adjusted rainfall =  2.050(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph         Unit Hydrograph
Number            Mean values            ((CFS))
---------------------------------------------------------------------
                (K =        10.48 (CFS))

  1               68.921                   7.224
  2              100.000                   3.257
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                 (In)
  1              0.2999               0.0465
  2              0.4000               0.0292
  3              0.4715               0.0220
  4              0.5299               0.0184
  5              0.5888               0.0189
  6              0.6417               0.0171
  7              0.6901               0.0157
  8              0.7350               0.0146
  9              0.7770               0.0137
 10              0.8166               0.0130
```

11	0.8542	0.0123
12	0.8900	0.0118
13	0.9230	0.0108
14	0.9547	0.0104
15	0.9851	0.0100
16	1.0145	0.0097
17	1.0428	0.0094
18	1.0703	0.0091
19	1.0970	0.0088
20	1.1229	0.0086
21	1.1481	0.0083
22	1.1726	0.0081
23	1.1966	0.0079
24	1.2200	0.0077
25	1.2388	0.0062
26	1.2571	0.0061
27	1.2750	0.0059
28	1.2925	0.0058
29	1.3096	0.0057
30	1.3263	0.0055
31	1.3427	0.0054
32	1.3587	0.0053
33	1.3745	0.0052
34	1.3899	0.0051
35	1.4051	0.0050
36	1.4200	0.0049
37	1.4346	0.0049
38	1.4490	0.0048
39	1.4632	0.0047
40	1.4771	0.0046
41	1.4908	0.0045
42	1.5043	0.0045
43	1.5176	0.0044
44	1.5308	0.0044
45	1.5437	0.0043
46	1.5564	0.0042
47	1.5690	0.0042
48	1.5814	0.0041
49	1.5937	0.0041
50	1.6058	0.0040
51	1.6177	0.0040
52	1.6296	0.0039
53	1.6412	0.0039
54	1.6527	0.0038
55	1.6641	0.0038
56	1.6754	0.0037
57	1.6865	0.0037
58	1.6976	0.0037
59	1.7085	0.0036
60	1.7192	0.0036

61	1.7299	0.0035
62	1.7405	0.0035
63	1.7509	0.0035
64	1.7613	0.0034
65	1.7715	0.0034
66	1.7817	0.0034
67	1.7917	0.0033
68	1.8017	0.0033
69	1.8116	0.0033
70	1.8214	0.0033
71	1.8311	0.0032
72	1.8407	0.0032
73	1.8502	0.0032
74	1.8597	0.0031
75	1.8690	0.0031
76	1.8783	0.0031
77	1.8875	0.0031
78	1.8967	0.0030
79	1.9057	0.0030
80	1.9147	0.0030
81	1.9237	0.0030
82	1.9325	0.0029
83	1.9413	0.0029
84	1.9500	0.0029
85	1.9587	0.0029
86	1.9673	0.0029
87	1.9758	0.0028
88	1.9843	0.0028
89	1.9927	0.0028
90	2.0011	0.0028
91	2.0094	0.0028
92	2.0176	0.0027
93	2.0258	0.0027
94	2.0339	0.0027
95	2.0420	0.0027
96	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0080	0.0011	0.0070
2	0.0081	0.0011	0.0070
3	0.0082	0.0011	0.0071
4	0.0083	0.0011	0.0072
5	0.0084	0.0011	0.0073
6	0.0084	0.0011	0.0073
7	0.0085	0.0011	0.0074
8	0.0086	0.0011	0.0075
9	0.0087	0.0011	0.0076

10	0.0088	0.0012	0.0077
11	0.0089	0.0012	0.0078
12	0.0090	0.0012	0.0078
13	0.0091	0.0012	0.0079
14	0.0093	0.0012	0.0080
15	0.0094	0.0012	0.0081
16	0.0095	0.0012	0.0082
17	0.0096	0.0013	0.0084
18	0.0097	0.0013	0.0085
19	0.0099	0.0013	0.0086
20	0.0100	0.0013	0.0087
21	0.0102	0.0013	0.0088
22	0.0103	0.0014	0.0090
23	0.0105	0.0014	0.0091
24	0.0106	0.0014	0.0092
25	0.0108	0.0014	0.0094
26	0.0110	0.0014	0.0095
27	0.0112	0.0015	0.0097
28	0.0113	0.0015	0.0098
29	0.0115	0.0015	0.0100
30	0.0117	0.0015	0.0102
31	0.0120	0.0016	0.0104
32	0.0122	0.0016	0.0106
33	0.0124	0.0016	0.0108
34	0.0127	0.0017	0.0110
35	0.0130	0.0017	0.0112
36	0.0132	0.0017	0.0115
37	0.0135	0.0018	0.0118
38	0.0138	0.0018	0.0120
39	0.0142	0.0019	0.0123
40	0.0145	0.0019	0.0126
41	0.0149	0.0020	0.0130
42	0.0153	0.0020	0.0133
43	0.0158	0.0021	0.0137
44	0.0162	0.0021	0.0141
45	0.0168	0.0022	0.0146
46	0.0173	0.0023	0.0150
47	0.0179	0.0024	0.0156
48	0.0186	0.0024	0.0161
49	0.0235	0.0031	0.0204
50	0.0243	0.0032	0.0211
51	0.0253	0.0033	0.0220
52	0.0263	0.0035	0.0229
53	0.0276	0.0036	0.0239
54	0.0289	0.0038	0.0251
55	0.0306	0.0040	0.0266
56	0.0324	0.0043	0.0281
57	0.0360	0.0047	0.0313
58	0.0387	0.0051	0.0336
59	0.0423	0.0056	0.0368

60	0.0468	0.0062	0.0406
61	0.0536	0.0070	0.0465
62	0.0574	0.0076	0.0498
63	0.0749	0.0099	0.0651
64	0.1427	0.0141	0.1286
65	0.2539	0.0141	0.2398
66	0.0592	0.0078	0.0514
67	0.0462	0.0061	0.0401
68	0.0383	0.0050	0.0333
69	0.0321	0.0042	0.0279
70	0.0287	0.0038	0.0249
71	0.0262	0.0034	0.0227
72	0.0242	0.0032	0.0210
73	0.0185	0.0024	0.0161
74	0.0172	0.0023	0.0150
75	0.0162	0.0021	0.0140
76	0.0153	0.0020	0.0133
77	0.0145	0.0019	0.0126
78	0.0138	0.0018	0.0120
79	0.0132	0.0017	0.0114
80	0.0126	0.0017	0.0110
81	0.0122	0.0016	0.0106
82	0.0117	0.0015	0.0102
83	0.0113	0.0015	0.0098
84	0.0109	0.0014	0.0095
85	0.0106	0.0014	0.0092
86	0.0103	0.0014	0.0089
87	0.0100	0.0013	0.0087
88	0.0097	0.0013	0.0084
89	0.0095	0.0012	0.0082
90	0.0092	0.0012	0.0080
91	0.0090	0.0012	0.0078
92	0.0088	0.0012	0.0077
93	0.0086	0.0011	0.0075
94	0.0084	0.0011	0.0073
95	0.0083	0.0011	0.0072
96	0.0081	0.0011	0.0070

Total soil rain loss = 0.25(In)
Total effective rainfall = 1.80(In)
Peak flow rate in flood hydrograph = 2.15(CFS)

+++

24 - H O U R   S T O R M

R u n o f f   H y d r o g r a p h

Hydrograph in 15 Minute intervals ((CFS))

```
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+15       0.0010      0.05  Q         |         |         |         |
  0+30       0.0026      0.07  Q         |         |         |         |
  0+45       0.0041      0.07  Q         |         |         |         |
  1+ 0       0.0056      0.08  Q         |         |         |         |
  1+15       0.0072      0.08  Q         |         |         |         |
  1+30       0.0088      0.08  Q         |         |         |         |
  1+45       0.0104      0.08  QV        |         |         |         |
  2+ 0       0.0120      0.08  QV        |         |         |         |
  2+15       0.0136      0.08  QV        |         |         |         |
  2+30       0.0153      0.08  QV        |         |         |         |
  2+45       0.0170      0.08  QV        |         |         |         |
  3+ 0       0.0187      0.08  QV        |         |         |         |
  3+15       0.0204      0.08  Q V       |         |         |         |
  3+30       0.0221      0.08  Q V       |         |         |         |
  3+45       0.0239      0.09  Q V       |         |         |         |
  4+ 0       0.0257      0.09  Q V       |         |         |         |
  4+15       0.0275      0.09  Q V       |         |         |         |
  4+30       0.0293      0.09  Q V       |         |         |         |
  4+45       0.0311      0.09  Q  V      |         |         |         |
  5+ 0       0.0330      0.09  Q  V      |         |         |         |
  5+15       0.0349      0.09  Q  V      |         |         |         |
  5+30       0.0368      0.09  Q  V      |         |         |         |
  5+45       0.0388      0.09  Q  V      |         |         |         |
  6+ 0       0.0408      0.10  Q   V     |         |         |         |
  6+15       0.0428      0.10  Q   V     |         |         |         |
  6+30       0.0449      0.10  Q   V     |         |         |         |
  6+45       0.0469      0.10  Q   V     |         |         |         |
  7+ 0       0.0491      0.10  Q    V    |         |         |         |
  7+15       0.0512      0.10  Q    V    |         |         |         |
  7+30       0.0534      0.11  Q    V    |         |         |         |
  7+45       0.0557      0.11  Q    V    |         |         |         |
  8+ 0       0.0579      0.11  Q    V    |         |         |         |
  8+15       0.0603      0.11  Q     V   |         |         |         |
  8+30       0.0626      0.11  Q     V   |         |         |         |
  8+45       0.0651      0.12  Q     V   |         |         |         |
  9+ 0       0.0675      0.12  Q     V   |         |         |         |
  9+15       0.0701      0.12  Q      V  |         |         |         |
  9+30       0.0726      0.13  Q      V  |         |         |         |
  9+45       0.0753      0.13  Q      V  |         |         |         |
 10+ 0       0.0780      0.13  Q      V  |         |         |         |
 10+15       0.0808      0.13  Q       V |         |         |         |
 10+30       0.0836      0.14  Q       V |         |         |         |
 10+45       0.0866      0.14  Q       V |         |         |         |
 11+ 0       0.0896      0.15  Q        V|         |         |         |
 11+15       0.0927      0.15  Q        V|         |         |         |
 11+30       0.0960      0.16  Q        V|         |         |         |
 11+45       0.0993      0.16  Q         V         |         |         |
 12+ 0       0.1027      0.17  Q         V         |         |         |
```

```
   12+15       0.1069      0.20  Q         V         |         |         |
   12+30       0.1114      0.22  Q         |V        |         |         |
   12+45       0.1161      0.23  Q         |V        |         |         |
   13+ 0       0.1210      0.24  Q         | V       |         |         |
   13+15       0.1261      0.25  Q         | V       |         |         |
   13+30       0.1314      0.26  |Q        |  V      |         |         |
   13+45       0.1371      0.27  |Q        |   V     |         |         |
   14+ 0       0.1431      0.29  |Q        |   V     |         |         |
   14+15       0.1496      0.32  |Q        |    V    |         |         |
   14+30       0.1568      0.34  |Q        |     V   |         |         |
   14+45       0.1645      0.37  |Q        |     V   |         |         |
   15+ 0       0.1731      0.41  |Q        |      V  |         |         |
   15+15       0.1827      0.47  |Q        |       V |         |         |
   15+30       0.1933      0.51  | Q       |        V|         |         |
   15+45       0.2064      0.63  | Q       |          V        |         |
   16+ 0       0.2299      1.14  |   Q     |         |  V      |         |
   16+15       0.2744      2.15  |       Q |         |       V |         |
   16+30       0.2982      1.15  |   Q     |         |         V         |
   16+45       0.3076      0.46  |Q        |         |          V        |
   17+ 0       0.3153      0.37  |Q        |         |         | V       |
   17+15       0.3217      0.31  |Q        |         |         | V       |
   17+30       0.3273      0.27  |Q        |         |         |  V      |
   17+45       0.3324      0.25  Q         |         |         |   V     |
   18+ 0       0.3370      0.23  Q         |         |         |   V     |
   18+15       0.3409      0.18  Q         |         |         |   V     |
   18+30       0.3442      0.16  Q         |         |         |    V    |
   18+45       0.3473      0.15  Q         |         |         |    V    |
   19+ 0       0.3502      0.14  Q         |         |         |    V    |
   19+15       0.3530      0.13  Q         |         |         |     V   |
   19+30       0.3556      0.13  Q         |         |         |     V   |
   19+45       0.3581      0.12  Q         |         |         |     V   |
   20+ 0       0.3605      0.12  Q         |         |         |     V   |
   20+15       0.3628      0.11  Q         |         |         |      V  |
   20+30       0.3651      0.11  Q         |         |         |      V  |
   20+45       0.3672      0.10  Q         |         |         |      V  |
   21+ 0       0.3693      0.10  Q         |         |         |      V  |
   21+15       0.3713      0.10  Q         |         |         |       V |
   21+30       0.3733      0.09  Q         |         |         |       V |
   21+45       0.3752      0.09  Q         |         |         |       V |
   22+ 0       0.3770      0.09  Q         |         |         |       V |
   22+15       0.3788      0.09  Q         |         |         |       V |
   22+30       0.3805      0.08  Q         |         |         |       V |
   22+45       0.3823      0.08  Q         |         |         |        V|
   23+ 0       0.3839      0.08  Q         |         |         |        V|
   23+15       0.3856      0.08  Q         |         |         |        V|
   23+30       0.3872      0.08  Q         |         |         |        V|
   23+45       0.3887      0.08  Q         |         |         |        V|
   24+ 0       0.3902      0.07  Q         |         |         |        V|
   24+15       0.3907      0.02  Q         |         |         |         V
-----------------------------------------------------------------------
```

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 06/23/20   File Name 2019285DMAG.out

++

Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6277

2019-285 6400 Katella Avenue
Post-Developed Unit Hydrogrpah
2 Year, 24 Hour Storm
DMA G

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used
++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	3.4	1.00	A	0.400	0.245	0.098

Area-averaged adjusted loss rate Fm (In/Hr) = 0.098

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
0.83	0.245	32.0	16.6	50.24	0.739
2.54	0.755	98.0	98.0	0.20	0.890

Area-averaged catchment yield fraction, Y = 0.853
Area-averaged low loss fraction, Yb = 0.147
++

```
User entry of time of concentration  =   0.094 (hours)
Watershed area =       3.37(Ac.)
Catchment Lag time =   0.075 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 333.1557
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.098(In/Hr)
Average low loss rate fraction (Yb) = 0.147 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.190(In)
Computed peak 30-minute rainfall =  0.400(In)
Specified peak 1-hour rainfall =  0.530(In)
Computed peak 3-hour rainfall =  0.890(In)
Specified peak 6-hour rainfall =  1.220(In)
Specified peak 24-hour rainfall =  2.050(In)


Rainfall depth area reduction factors:
Using a total area of       3.37(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.190(In)
30-minute factor = 1.000    Adjusted rainfall =  0.400(In)
1-hour factor = 1.000       Adjusted rainfall =  0.530(In)
3-hour factor = 1.000       Adjusted rainfall =  0.890(In)
6-hour factor = 1.000       Adjusted rainfall =  1.220(In)
24-hour factor = 1.000  Adjusted rainfall =  2.050(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number           Mean values            ((CFS))
---------------------------------------------------------------------
                (K =        13.59 (CFS))

  1              68.264                  9.274
  2             100.000                  4.311
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1             0.2999              0.0465
  2             0.3999              0.0292
  3             0.4715              0.0220
  4             0.5299              0.0184
  5             0.5888              0.0189
  6             0.6417              0.0171
  7             0.6901              0.0157
  8             0.7350              0.0146
  9             0.7770              0.0137
 10             0.8166              0.0130
```

11	0.8542	0.0123
12	0.8900	0.0118
13	0.9230	0.0108
14	0.9546	0.0104
15	0.9851	0.0100
16	1.0144	0.0097
17	1.0428	0.0094
18	1.0703	0.0091
19	1.0970	0.0088
20	1.1229	0.0086
21	1.1481	0.0083
22	1.1726	0.0081
23	1.1966	0.0079
24	1.2200	0.0077
25	1.2388	0.0062
26	1.2571	0.0061
27	1.2750	0.0059
28	1.2925	0.0058
29	1.3096	0.0057
30	1.3263	0.0055
31	1.3427	0.0054
32	1.3587	0.0053
33	1.3745	0.0052
34	1.3899	0.0051
35	1.4051	0.0050
36	1.4200	0.0049
37	1.4346	0.0049
38	1.4490	0.0048
39	1.4632	0.0047
40	1.4771	0.0046
41	1.4908	0.0045
42	1.5043	0.0045
43	1.5176	0.0044
44	1.5308	0.0044
45	1.5437	0.0043
46	1.5564	0.0042
47	1.5690	0.0042
48	1.5814	0.0041
49	1.5937	0.0041
50	1.6058	0.0040
51	1.6177	0.0040
52	1.6296	0.0039
53	1.6412	0.0039
54	1.6527	0.0038
55	1.6641	0.0038
56	1.6754	0.0037
57	1.6865	0.0037
58	1.6975	0.0037
59	1.7084	0.0036
60	1.7192	0.0036

61	1.7299	0.0035
62	1.7405	0.0035
63	1.7509	0.0035
64	1.7613	0.0034
65	1.7715	0.0034
66	1.7817	0.0034
67	1.7917	0.0033
68	1.8017	0.0033
69	1.8116	0.0033
70	1.8214	0.0033
71	1.8311	0.0032
72	1.8407	0.0032
73	1.8502	0.0032
74	1.8597	0.0031
75	1.8690	0.0031
76	1.8783	0.0031
77	1.8875	0.0031
78	1.8967	0.0030
79	1.9057	0.0030
80	1.9147	0.0030
81	1.9237	0.0030
82	1.9325	0.0029
83	1.9413	0.0029
84	1.9500	0.0029
85	1.9587	0.0029
86	1.9673	0.0029
87	1.9758	0.0028
88	1.9843	0.0028
89	1.9927	0.0028
90	2.0011	0.0028
91	2.0093	0.0028
92	2.0176	0.0027
93	2.0258	0.0027
94	2.0339	0.0027
95	2.0420	0.0027
96	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0080	0.0012	0.0068
2	0.0081	0.0012	0.0069
3	0.0082	0.0012	0.0070
4	0.0083	0.0012	0.0071
5	0.0084	0.0012	0.0071
6	0.0084	0.0012	0.0072
7	0.0085	0.0013	0.0073
8	0.0086	0.0013	0.0074
9	0.0087	0.0013	0.0074

10	0.0088	0.0013	0.0075
11	0.0089	0.0013	0.0076
12	0.0090	0.0013	0.0077
13	0.0091	0.0013	0.0078
14	0.0093	0.0014	0.0079
15	0.0094	0.0014	0.0080
16	0.0095	0.0014	0.0081
17	0.0096	0.0014	0.0082
18	0.0097	0.0014	0.0083
19	0.0099	0.0015	0.0084
20	0.0100	0.0015	0.0085
21	0.0102	0.0015	0.0087
22	0.0103	0.0015	0.0088
23	0.0105	0.0015	0.0089
24	0.0106	0.0016	0.0091
25	0.0108	0.0016	0.0092
26	0.0110	0.0016	0.0093
27	0.0112	0.0016	0.0095
28	0.0113	0.0017	0.0097
29	0.0115	0.0017	0.0098
30	0.0117	0.0017	0.0100
31	0.0120	0.0018	0.0102
32	0.0122	0.0018	0.0104
33	0.0124	0.0018	0.0106
34	0.0127	0.0019	0.0108
35	0.0130	0.0019	0.0110
36	0.0132	0.0019	0.0113
37	0.0135	0.0020	0.0115
38	0.0138	0.0020	0.0118
39	0.0142	0.0021	0.0121
40	0.0145	0.0021	0.0124
41	0.0149	0.0022	0.0127
42	0.0153	0.0023	0.0131
43	0.0158	0.0023	0.0135
44	0.0162	0.0024	0.0138
45	0.0168	0.0025	0.0143
46	0.0173	0.0025	0.0148
47	0.0179	0.0026	0.0153
48	0.0186	0.0027	0.0158
49	0.0235	0.0035	0.0200
50	0.0243	0.0036	0.0207
51	0.0253	0.0037	0.0216
52	0.0263	0.0039	0.0224
53	0.0276	0.0041	0.0235
54	0.0289	0.0043	0.0247
55	0.0306	0.0045	0.0261
56	0.0324	0.0048	0.0276
57	0.0360	0.0053	0.0307
58	0.0387	0.0057	0.0330
59	0.0423	0.0062	0.0361

60	0.0468	0.0069	0.0399
61	0.0536	0.0079	0.0457
62	0.0574	0.0085	0.0489
63	0.0749	0.0110	0.0639
64	0.1427	0.0210	0.1217
65	0.2539	0.0245	0.2294
66	0.0592	0.0087	0.0505
67	0.0462	0.0068	0.0394
68	0.0383	0.0056	0.0327
69	0.0321	0.0047	0.0274
70	0.0287	0.0042	0.0245
71	0.0262	0.0039	0.0223
72	0.0242	0.0036	0.0206
73	0.0185	0.0027	0.0158
74	0.0172	0.0025	0.0147
75	0.0162	0.0024	0.0138
76	0.0153	0.0022	0.0130
77	0.0145	0.0021	0.0123
78	0.0138	0.0020	0.0118
79	0.0132	0.0019	0.0112
80	0.0126	0.0019	0.0108
81	0.0122	0.0018	0.0104
82	0.0117	0.0017	0.0100
83	0.0113	0.0017	0.0096
84	0.0109	0.0016	0.0093
85	0.0106	0.0016	0.0090
86	0.0103	0.0015	0.0088
87	0.0100	0.0015	0.0085
88	0.0097	0.0014	0.0083
89	0.0095	0.0014	0.0081
90	0.0092	0.0014	0.0079
91	0.0090	0.0013	0.0077
92	0.0088	0.0013	0.0075
93	0.0086	0.0013	0.0073
94	0.0084	0.0012	0.0072
95	0.0083	0.0012	0.0070
96	0.0081	0.0012	0.0069

Total soil rain loss = 0.29(In)
Total effective rainfall = 1.76(In)
Peak flow rate in flood hydrograph = 2.65(CFS)

+++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 15 Minute intervals ((CFS))

```
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+15      0.0013      0.06  Q         |         |         |         |
  0+30      0.0032      0.09  Q         |         |         |         |
  0+45      0.0052      0.09  Q         |         |         |         |
  1+ 0      0.0072      0.10  Q         |         |         |         |
  1+15      0.0092      0.10  Q         |         |         |         |
  1+30      0.0112      0.10  Q         |         |         |         |
  1+45      0.0132      0.10  QV        |         |         |         |
  2+ 0      0.0153      0.10  QV        |         |         |         |
  2+15      0.0174      0.10  QV        |         |         |         |
  2+30      0.0195      0.10  QV        |         |         |         |
  2+45      0.0216      0.10  QV        |         |         |         |
  3+ 0      0.0237      0.10  QV        |         |         |         |
  3+15      0.0259      0.11  Q V       |         |         |         |
  3+30      0.0281      0.11  Q V       |         |         |         |
  3+45      0.0304      0.11  Q V       |         |         |         |
  4+ 0      0.0326      0.11  Q V       |         |         |         |
  4+15      0.0349      0.11  Q V       |         |         |         |
  4+30      0.0373      0.11  Q  V      |         |         |         |
  4+45      0.0396      0.11  Q  V      |         |         |         |
  5+ 0      0.0420      0.12  Q  V      |         |         |         |
  5+15      0.0444      0.12  Q  V      |         |         |         |
  5+30      0.0469      0.12  Q  V      |         |         |         |
  5+45      0.0494      0.12  Q  V      |         |         |         |
  6+ 0      0.0519      0.12  Q   V     |         |         |         |
  6+15      0.0545      0.12  Q   V     |         |         |         |
  6+30      0.0571      0.13  Q   V     |         |         |         |
  6+45      0.0597      0.13  Q   V     |         |         |         |
  7+ 0      0.0624      0.13  Q    V    |         |         |         |
  7+15      0.0652      0.13  Q    V    |         |         |         |
  7+30      0.0680      0.14  Q    V    |         |         |         |
  7+45      0.0708      0.14  Q    V    |         |         |         |
  8+ 0      0.0737      0.14  Q    V    |         |         |         |
  8+15      0.0767      0.14  Q     V   |         |         |         |
  8+30      0.0797      0.15  Q     V   |         |         |         |
  8+45      0.0828      0.15  Q     V   |         |         |         |
  9+ 0      0.0859      0.15  Q     V   |         |         |         |
  9+15      0.0891      0.16  Q      V  |         |         |         |
  9+30      0.0924      0.16  Q      V  |         |         |         |
  9+45      0.0958      0.16  Q      V  |         |         |         |
 10+ 0      0.0992      0.17  Q       V |         |         |         |
 10+15      0.1028      0.17  Q       V |         |         |         |
 10+30      0.1064      0.18  Q       V |         |         |         |
 10+45      0.1102      0.18  Q       V |         |         |         |
 11+ 0      0.1140      0.19  Q        V|         |         |         |
 11+15      0.1180      0.19  Q        V|         |         |         |
 11+30      0.1221      0.20  Q        V|         |         |         |
 11+45      0.1263      0.21  Q         V         |         |         |
 12+ 0      0.1307      0.21  Q         V         |         |         |
```

```
   12+15       0.1360      0.25  |Q         V        |         |         |
   12+30       0.1417      0.28  |Q        |V        |         |         |
   12+45       0.1477      0.29  |Q        |V        |         |         |
   13+ 0       0.1539      0.30  |Q        | V       |         |         |
   13+15       0.1604      0.31  |Q        | V       |         |         |
   13+30       0.1673      0.33  |Q        |  V      |         |         |
   13+45       0.1744      0.35  |Q        |   V     |         |         |
   14+ 0       0.1821      0.37  |Q        |   V     |         |         |
   14+15       0.1904      0.40  |Q        |    V    |         |         |
   14+30       0.1995      0.44  |Q        |     V   |         |         |
   14+45       0.2093      0.48  |Q        |     V   |         |         |
   15+ 0       0.2202      0.53  | Q       |      V  |         |         |
   15+15       0.2325      0.60  | Q       |       V |         |         |
   15+30       0.2459      0.65  | Q       |        V|         |         |
   15+45       0.2625      0.80  |  Q      |          V        |         |
   16+ 0       0.2915      1.40  |    Q    |         |  V      |         |
   16+15       0.3463      2.65  |         Q         |       V |         |
   16+30       0.3764      1.46  |    Q    |         |         V         |
   16+45       0.3885      0.58  | Q       |         |          V        |
   17+ 0       0.3982      0.47  |Q        |         |         | V       |
   17+15       0.4064      0.39  |Q        |         |         | V       |
   17+30       0.4135      0.35  |Q        |         |         |  V      |
   17+45       0.4200      0.31  |Q        |         |         |  V      |
   18+ 0       0.4259      0.29  |Q        |         |         |   V     |
   18+15       0.4308      0.24  Q         |         |         |   V     |
   18+30       0.4350      0.20  Q         |         |         |    V    |
   18+45       0.4390      0.19  Q         |         |         |    V    |
   19+ 0       0.4427      0.18  Q         |         |         |    V    |
   19+15       0.4462      0.17  Q         |         |         |     V   |
   19+30       0.4496      0.16  Q         |         |         |     V   |
   19+45       0.4528      0.15  Q         |         |         |     V   |
   20+ 0       0.4558      0.15  Q         |         |         |     V   |
   20+15       0.4588      0.14  Q         |         |         |      V  |
   20+30       0.4616      0.14  Q         |         |         |      V  |
   20+45       0.4643      0.13  Q         |         |         |      V  |
   21+ 0       0.4670      0.13  Q         |         |         |      V  |
   21+15       0.4696      0.12  Q         |         |         |      V  |
   21+30       0.4720      0.12  Q         |         |         |       V |
   21+45       0.4745      0.12  Q         |         |         |       V |
   22+ 0       0.4768      0.11  Q         |         |         |       V |
   22+15       0.4791      0.11  Q         |         |         |       V |
   22+30       0.4813      0.11  Q         |         |         |       V |
   22+45       0.4835      0.11  Q         |         |         |        V|
   23+ 0       0.4856      0.10  Q         |         |         |        V|
   23+15       0.4877      0.10  Q         |         |         |        V|
   23+30       0.4897      0.10  Q         |         |         |        V|
   23+45       0.4917      0.10  Q         |         |         |        V|
   24+ 0       0.4937      0.09  Q         |         |         |        V|
   24+15       0.4943      0.03  Q         |         |         |        V|
-----------------------------------------------------------------------
```

Biotreatment Calculations

Modular Wetland System Sizing

Date: 30 June, 2020

Subject: Bio Clean Environmental Modular Wetland System Sizing for Katella Avenue Industrial Project, City of Cypress, CA

To Whom It May Concern,

The Modular Wetland System Linear (MWS) has Washington State Department of Ecology (DOE) General Use Level Designation (GULD) at a loading rate of 1 gpm/sq ft. for TSS (Basic), phosphorous and dissolved metals (Enhanced) for water quality design flows based on applicable hydrology data.

This project, being a volume based design, is treating a fairly large volume of water over a 48 hour period which results in a larger contributing drainage management area (DMA) than would be typically treated by the MWS for a flow based design.

Due to this large volume we are reducing our media loading rate to 0.26 gpm/sf, a 74% reduction. This will increase the size of the MWS which will provide the necessary volume of pretreatment media and WetlandMedia, which will provide the needed additional capture, storage, and biological digestion of the higher pollutant loading coming from the larger DMA.

If you have any questions please feel free to contact us at your convenience.

Sincerely,

Hal Schillinger

Hal Schillinger
Regional Manager
Bio Clean
A Forterra Company

Modular Wetland System Sizing Calculations

Background Information

- The Wetlandmedia Surface Area is equal to the Wetlandmedia Perimeter x the Treatment HGL Height
- The Wetlandmedia Surface Area of 302 sf corresponds to the Surface Area calculated using Bioclean's standard operating head (3.4 ft)
- The MWS Brochure lists a treatment flow rate of 0.693 cfs for an MWS-L-8-24 Model, but this corresponds to a flow based unit which has a loading rate of 1 gpm/sf
- For this project, a volume based MWS is proposed which has a loading rate of 0.26 gpm/sf
- The loading rate for a volume based MWS is lower than for a flow based unit in order to treat a larger drainage management area

Given

Model	MWS-L-8-24
Wetlandmedia Surface Area w/ 3.4 ft HGL (sf)	302
Volume Based MWS Loading Rate (gpm/sf)	0.26
MWS Standard Operating Head (ft)	3.4
Drawdown Time (hr)	48
Treatment HGL Height (ft)	6.25
DCV (cf)	54,757

Calculations

Wetland Media Perimeter (ft) = 302 sf/3.4 ft	88.82
Wetland Media Surface Area w/ 6.25 HGL (sf) = 88.82 ft x 6.25 ft	555.15
Treatment Flow Rate (gpm) = 555.15 sf x 0.26 gpm/sf	144.34
Treatment Flow Rate (cfs)	0.32
Volume Treated in 48 Hours (cf) = 0.32 cfs x 48hr x 3600 sec/hr	55,570

Conclusion

- The volume that is able to be treated over 48 hours from an MWS-L-8-24 is 55,570 cf
- This meets the DCV of 54,757 required by the project

SPECIFICATIONS

FLOW-BASED DESIGNS

The Modular Wetlands® System Linear can be used in stand-alone applications to meet treatment flow requirements. Since the Modular Wetlands® 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.

MODEL #	DIMENSIONS	WETLANDMEDIA SURFACE AREA (sq. ft.)	TREATMENT FLOW RATE (cfs)
MWS-L-4-4	4' x 4'	23	0.052
MWS-L-4-6	4' x 6'	32	0.073
MWS-L-4-8	4' x 8'	50	0.115
MWS-L-4-13	4' x 13'	63	0.144
MWS-L-4-15	4' x 15'	76	0.175
MWS-L-4-17	4' x 17'	90	0.206
MWS-L-4-19	4' x 19'	103	0.237
MWS-L-4-21	4' x 21'	117	0.268
MWS-L-6-8	7' x 9'	64	0.147
MWS-L-8-8	8' x 8'	100	0.230
MWS-L-8-12	8' x 12'	151	0.346
MWS-L-8-16	8' x 16'	201	0.462
MWS-L-8-20	9' x 21'	252	0.577
MWS-L-8-24	9' x 25'	302	0.693
MWS-L-10-20	10' x 20'	302	0.693

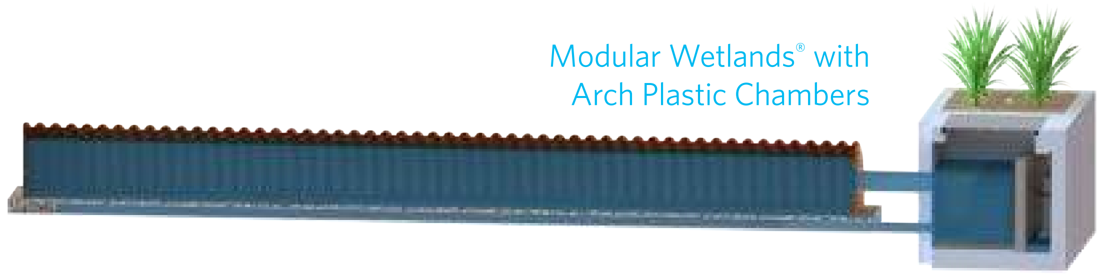
VOLUME-BASED DESIGNS

HORIZONTAL FLOW BIOFILTRATION ADVANTAGE

Modular Wetlands® with Box Culvert Prestorage

The Modular Wetlands® System Linear offers a unique advantage in the world of biofiltration due to its exclusive horizontal flow design: Volume-Based Design. No other biofilter has the ability to be placed downstream of detention ponds, extended dry detention basins, underground storage systems and permeable paver reservoirs. The systems horizontal flow configuration and built-in orifice control allows it to be installed with just 6" of fall between inlet and outlet pipe for a simple connection to projects with shallow downstream tie-in points. In the example above, the Modular Wetlands® is installed downstream of underground box culvert storage. Designed for the water quality volume, the Modular Wetlands® will treat and discharge the required volume within local draindown time requirements.

Modular Wetlands® with Arch Plastic Chambers



DESIGN SUPPORT

Bio Clean engineers are trained to provide you with superior support for all volume sizing configurations throughout the country. Our vast knowledge of state and local regulations allow us to quickly and efficiently size a system to maximize feasibility. Volume control and hydromodification regulations are expanding the need to decrease the cost and size of your biofiltration system. Bio Clean will help you realize these cost savings with the Modular Wetlands®, the only biofilter than can be used downstream of storage BMPs.

ADVANTAGES

- LOWER COST THAN FLOW-BASED DESIGN
- MEETS LID REQUIREMENTS
- BUILT-IN ORIFICE CONTROL STRUCTURE
- WORKS WITH DEEP INSTALLATIONS

Bio Clean
A Forterra Company

MWS Linear 2.0 HGL Volume Sizing Matrix - 48 Hour Draindown

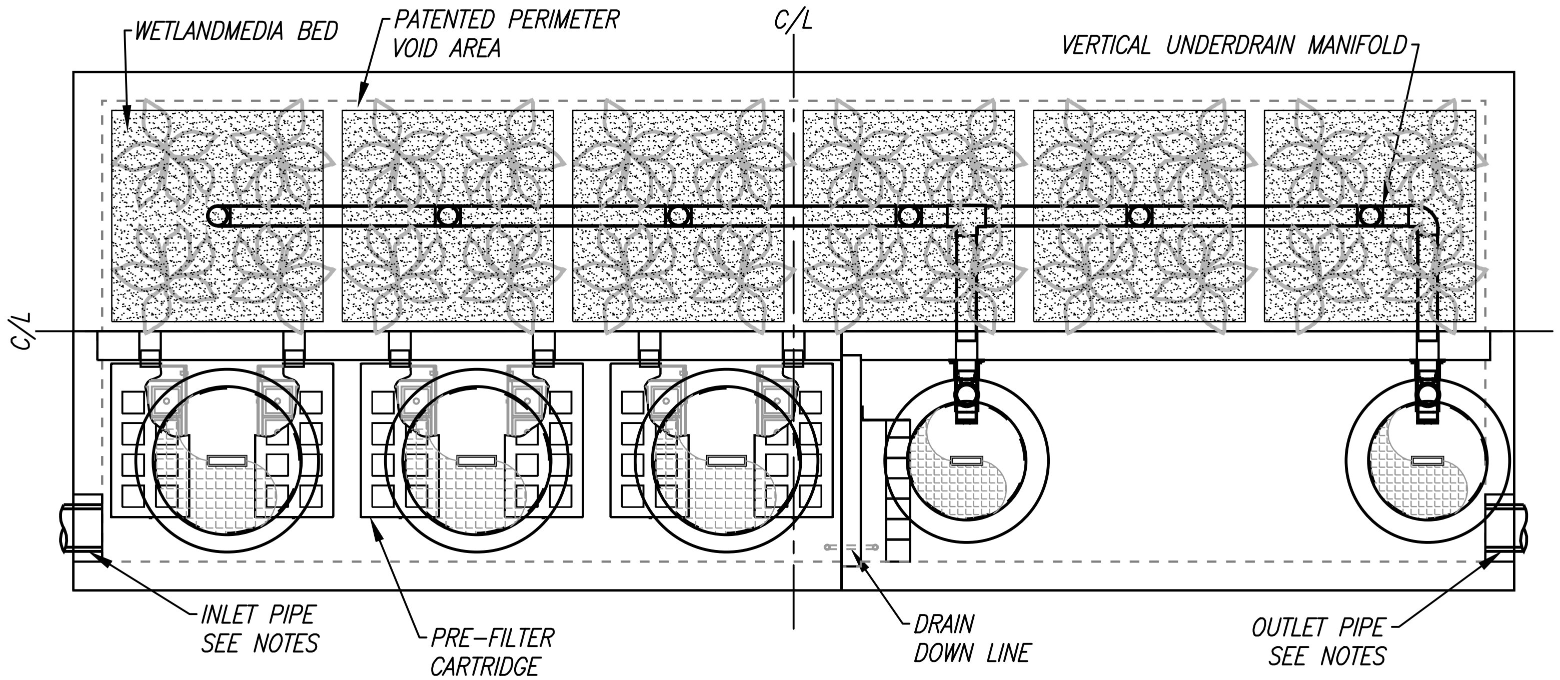
MWS MODEL SIZE	WETLAND PERMITER LENGTH (FEET)	LOADING RATE		DRAIN DOWN (HOURS)		AVALIABLE TREATMENT HGL HEIGHT (FEET)																													
						SHALLOW MODELS																				STANDARD HEIGHT MODEL	HIGH CAPACITY MODELS								
		INCH/HR	GPM/SF			1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	**3.4**	3.5	3.6	4.00	4.50	5.00	5.50	6.00	6.50	7.00
MWS-L-4-4	6.70	26	0.26	48	CF	939	1006	1073	1140	1207	1274	1342	1409	1476	1543	1610	1677	1744	1811	1878	1945	2012	2079	2146	2214	**2281**	2348	2415	2683	3018	3354	3689	4025	4360	4695
					DISCHARGE RATE GPM	2.439	2.613	2.787	2.961	3.136	3.310	3.484	3.658	3.832	4.007	4.181	4.355	4.529	4.703	4.878	5.052	5.226	5.400	5.574	5.749	5.923	6.097	6.271	6.968	7.839	8.710	9.581	10.452	11.323	12.194
MWS-L-4-6	9.30	26	0.26	48	CF	1303	1397	1490	1583	1676	1769	1862	1955	2048	2141	2235	2328	2421	2514	2607	2700	2793	2886	2979	3073	**3166**	3259	3352	3724	4190	4655	5121	5586	6052	6517
					DISCHARGE RATE GPM	3.385	3.627	3.869	4.111	4.352	4.594	4.836	5.078	5.320	5.561	5.803	6.045	6.287	6.529	6.770	7.012	7.254	7.496	7.738	7.979	8.221	8.463	8.705	9.672	10.881	12.090	13.299	14.508	15.717	16.926
MWS-L-4-8	14.80	26	0.26	48	CF	2074	2223	2371	2519	2667	2815	2963	3112	3260	3408	3556	3704	3852	4001	4149	4297	4445	4593	4741	4890	**5038**	5186	5334	5927	6668	7408	8149	8890	9631	10372
					DISCHARGE RATE GPM	5.387	5.772	6.157	6.542	6.926	7.311	7.696	8.081	8.466	8.850	9.235	9.620	10.005	10.390	10.774	11.159	11.544	11.929	12.314	12.698	13.083	13.468	13.853	15.392	17.316	19.240	21.164	23.088	25.012	26.936
MWS-L-4-13	18.40	26	0.26	48	CF	2579	2763	2947	3132	3316	3500	3684	3868	4053	4237	4421	4605	4789	4974	5158	5342	5526	5711	5895	6079	**6263**	6447	6632	7368	8289	9211	10132	11053	11974	12895
					DISCHARGE RATE GPM	6.698	7.176	7.654	8.133	8.611	9.090	9.568	10.046	10.525	11.003	11.482	11.960	12.438	12.917	13.395	13.874	14.352	14.830	15.309	15.787	16.266	16.744	17.222	19.136	21.528	23.920	26.312	28.704	31.096	33.488
MWS-L-4-15	22.40	26	0.26	48	CF	3140	3364	3588	3812	4037	4261	4485	4709	4934	5158	5382	5606	5831	6055	6279	6503	6728	6952	7176	7400	**7625**	7849	8073	8970	10092	11213	12334	13455	14577	15698
					DISCHARGE RATE GPM	8.154	8.736	9.318	9.901	10.483	11.066	11.648	12.230	12.813	13.395	13.978	14.560	15.142	15.725	16.307	16.890	17.472	18.054	18.637	19.219	19.802	20.384	20.966	23.296	26.208	29.120	32.032	34.944	37.856	40.768
MWS-L-4-17	26.40	26	0.26	48	CF	3700	3965	4229	4493	4757	5022	5286	5550	5815	6079	6343	6608	6872	7136	7400	7665	7929	8193	8458	8722	**8986**	9251	9515	10572	11894	13215	14537	15858	17180	18501
					DISCHARGE RATE GPM	9.610	10.296	10.982	11.669	12.355	13.042	13.728	14.414	15.101	15.787	16.474	17.160	17.846	18.533	19.219	19.906	20.592	21.278	21.965	22.651	23.338	24.024	24.710	27.456	30.888	34.320	37.752	41.184	44.616	48.048
MWS-L-4-19	30.40	26	0.26	48	CF	4261	4565	4870	5174	5478	5783	6087	6391	6696	7000	7304	7609	7913	8217	8522	8826	9130	9435	9739	10043	**10348**	10652	10957	12174	13696	15217	16739	18261	19783	21304
					DISCHARGE RATE GPM	11.066	11.856	12.646	13.437	14.227	15.018	15.808	16.598	17.389	18.179	18.970	19.760	20.550	21.341	22.131	22.922	23.712	24.502	25.293	26.083	26.874	27.664	28.454	31.616	35.568	39.520	43.472	47.424	51.376	55.328
MWS-L-4-21	34.40	26	0.26	48	CF	4822	5166	5510	5855	6199	6543	6888	7232	7577	7921	8265	8610	8954	9299	9643	9987	10332	10676	11021	11365	**11709**	12054	12398	13776	15498	17220	18942	20664	22386	24108
					DISCHARGE RATE GPM	12.522	13.416	14.310	15.205	16.099	16.994	17.888	18.782	19.677	20.571	21.466	22.360	23.254	24.149	25.043	25.938	26.832	27.726	28.621	29.515	30.410	31.304	32.198	35.776	40.248	44.720	49.192	53.664	58.136	62.608
MWS-L-6-8	18.80	26	0.26	48	CF	2635	2823	3011	3200	3388	3576	3764	3953	4141	4329	4517	4705	4894	5082	5270	5458	5646	5835	6023	6211	**6399**	6588	6776	7529	8470	9411	10352	11293	12234	13175
					DISCHARGE RATE GPM	6.843	7.332	7.821	8.310	8.798	9.287	9.776	10.265	10.754	11.242	11.731	12.220	12.709	13.198	13.686	14.175	14.664	15.153	15.642	16.130	16.619	17.108	17.597	19.552	21.996	24.440	26.884	29.328	31.772	34.216
MWS-L-8-8	29.60	26	0.26	48	CF	4149	4445	4741	5038	5334	5630	5927	6223	6519	6816	7112	7408	7705	8001	8297	8594	8890	9187	9483	9779	**10076**	10372	10668	11854	13335	14817	16299	17780	19262	20744
					DISCHARGE RATE GPM	10.774	11.544	12.314	13.083	13.853	14.622	15.392	16.162	16.931	17.701	18.470	19.240	20.010	20.779	21.549	22.318	23.088	23.858	24.627	25.397	26.166	26.936	27.706	30.784	34.632	38.480	42.328	46.176	50.024	53.872
MWS-L-8-12	44.40	26	0.26	48	CF	6223	6668	7112	7557	8001	8446	8890	9335	9779	10224	10668	11113	11557	12002	12446	12891	13335	13780	14224	14669	**15113**	15558	16002	17780	20003	22225	24448	26671	28893	31116
					DISCHARGE RATE GPM	16.162	17.316	18.470	19.625	20.779	21.934	23.088	24.242	25.397	26.551	27.706	28.860	30.014	31.169	32.323	33.478	34.632	35.786	36.941	38.095	39.250	40.404	41.558	46.176	51.948	57.720	63.492	69.264	75.036	80.808
MWS-L-8-16	59.20	26	0.26	48	CF	8297	8890	9483	10076	10668	11261	11854	12446	13039	13632	14224	14817	15410	16002	16595	17188	17780	18373	18966	19558	**20151**	20744	21336	23707	26671	29634	32597	35561	38524	41487
					DISCHARGE RATE GPM	21.549	23.088	24.627	26.166	27.706	29.245	30.784	32.323	33.862	35.402	36.941	38.480	40.019	41.558	43.098	44.637	46.176	47.715	49.254	50.794	52.333	53.872	55.411	61.568	69.264	76.960	84.656	92.352	100.048	107.744
MWS-L-8-20	74.00	26	0.26	48	CF	10372	11113	11854	12594	13335	14076	14817	15558	16299	17039	17780	18521	19262	20003	20744	21485	22225	22966	23707	24448	**25189**	25930	26671	29634	33338	37042	40747	44451	48155	51859
					DISCHARGE RATE GPM	26.936	28.860	30.784	32.708	34.632	36.556	38.480	40.404	42.328	44.252	46.176	48.100	50.024	51.948	53.872	55.796	57.720	59.644	61.568	63.492	65.416	67.340	69.264	76.960	86.580	96.200	105.820	115.440	125.060	134.680
MWS-L-8-24 OR MWS-L-10-20	88.80	26	0.26	48	CF	12446	13335	14224	15113	16002	16891	17780	18669	19558	20447	21336	22225	23114	24003	24892	25782	26671	27560	28449	29338	**30227**	31116	32005	35561	40006	44451	48896	53341	57786	62231
					DISCHARGE RATE GPM	32.323	34.632	36.941	39.250	41.558	43.867	46.176	48.485	50.794	53.102	55.411	57.720	60.029	62.338	64.646	66.955	69.264	71.573	73.882	76.190	78.499	80.808	83.117	92.352	103.896	115.440	126.984	138.528	150.072	161.616

HGL Height of 6.25' is needed to treat a DCV of 54,757

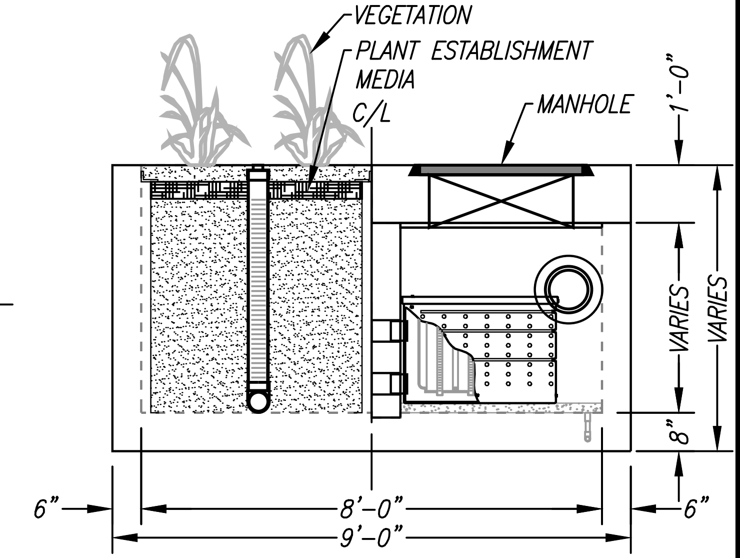
SITE SPECIFIC DATA

PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
	VOLUME BASED (CF)		FLOW BASED (CFS)
	30227		N/A
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	3EA ø30"	OPEN PLANTER	2EA ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



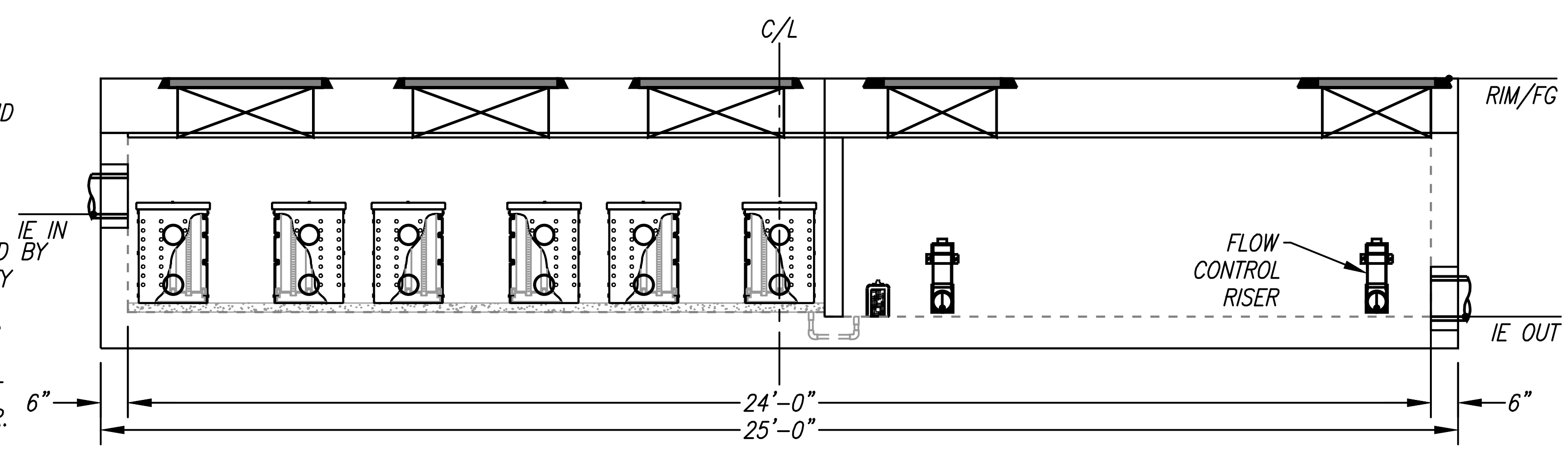
PLAN VIEW



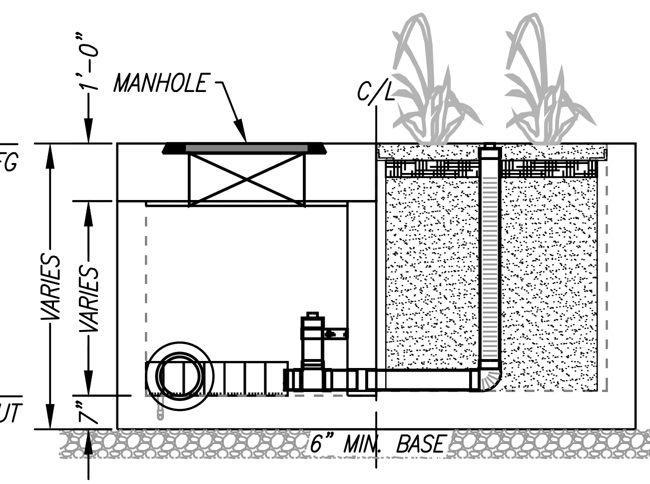
LEFT END VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. 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 PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.



ELEVATION VIEW



RIGHT END VIEW

REQUIRED TREATMENT VOLUME (CF)	30227
DRAINDOWN DURATION (HOURS)	48
AVERAGE DISCHARGE RATE PER MWS UNIT(GPM)	26.17
OPERATING HEAD (FT)	3.4
WETLANDMEDIA INFILTRATION RATE (IN/HR)	26
WETLANDMEDIA LOADING RATE (GPM/SF)	0.26

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 BIO CLEAN.

MODULAR WETLANDS

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

Bio Clean
A Forterra Company

MWS-L-8-24-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

5/24/19TOLFE

Biotreatment Calculations

Underground CMP System Sizing

CONTECH ENGINEERED SOLUTIONS

Date: 7/1/2020
Project Name: 6400 Katella Ave - Underground CMP System

City / County:
State:

Designed By:
Company:
Telephone:

CMP: Underground Detention System
Storage Volume Estimation

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. **This tool is only applicable for rectangular shaped systems.**

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	544.0	Backfill Porosity (%):	0%	System Diameter (in):	96
Out-to-out width (ft):	19.0	Depth Above Pipe (in):	0.0	Pipe Spacing (in):	36
Number of Manifolds (ea):	1.0	Depth Below Pipe (in):	0.0	Incremental Analysis (in):	2
Number of Barrels (ea):	2.0	Width At Ends (ft):	1.0	System Invert (Elevation):	0
		Width At Sides (ft):	1.0		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Percent Open Storage (%)	Ave. Surface Area (sf)
0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	0.0
0.17	0.16	278.2	278.2	0.0	0.0	278.2	278.2	100.0%	2,493.2
0.33	0.33	503.7	781.8	0.0	0.0	503.7	781.8	100.0%	3,488.2
0.50	0.50	645.2	1,427.1	0.0	0.0	645.2	1,427.1	100.0%	4,225.4
0.67	0.66	755.7	2,182.8	0.0	0.0	755.7	2,182.8	100.0%	4,824.6
0.83	0.83	847.5	3,030.2	0.0	0.0	847.5	3,030.2	100.0%	5,332.4
1.00	1.00	926.3	3,956.5	0.0	0.0	926.3	3,956.5	100.0%	5,773.0
1.17	1.16	995.2	4,951.7	0.0	0.0	995.2	4,951.7	100.0%	6,160.9
1.33	1.33	1,056.1	6,007.7	0.0	0.0	1,056.1	6,007.7	100.0%	6,505.5
1.50	1.50	1,110.4	7,118.1	0.0	0.0	1,110.4	7,118.1	100.0%	6,813.3
1.67	1.66	1,159.0	8,277.1	0.0	0.0	1,159.0	8,277.1	100.0%	7,089.2
1.83	1.83	1,202.5	9,479.6	0.0	0.0	1,202.5	9,479.6	100.0%	7,336.7
2.00	2.00	1,241.6	10,721.2	0.0	0.0	1,241.6	10,721.2	100.0%	7,558.7
2.17	2.16	1,276.6	11,997.9	0.0	0.0	1,276.6	11,997.9	100.0%	7,757.3
2.33	2.33	1,307.9	13,305.8	0.0	0.0	1,307.9	13,305.8	100.0%	7,934.3
2.50	2.50	1,335.7	14,641.5	0.0	0.0	1,335.7	14,641.5	100.0%	8,091.1
2.67	2.66	1,360.2	16,001.7	0.0	0.0	1,360.2	16,001.7	100.0%	8,228.8
2.83	2.83	1,381.7	17,383.4	0.0	0.0	1,381.7	17,383.4	100.0%	8,348.5
3.00	3.00	1,400.2	18,783.6	0.0	0.0	1,400.2	18,783.6	100.0%	8,450.8
3.17	3.16	1,415.8	20,199.4	0.0	0.0	1,415.8	20,199.4	100.0%	8,536.5
3.33	3.33	1,428.8	21,628.2	0.0	0.0	1,428.8	21,628.2	100.0%	8,605.9
3.50	3.50	1,439.0	23,067.2	0.0	0.0	1,439.0	23,067.2	100.0%	8,659.5
3.67	3.66	1,446.6	24,513.9	0.0	0.0	1,446.6	24,513.9	100.0%	8,697.6
3.83	3.83	1,451.7	25,965.6	0.0	0.0	1,451.7	25,965.6	100.0%	8,720.4
4.00	4.00	1,454.2	27,419.8	0.0	0.0	1,454.2	27,419.8	100.0%	8,728.0
4.17	4.16	1,454.2	28,874.1	0.0	0.0	1,454.2	28,874.1	100.0%	8,720.4
4.33	4.33	1,451.7	30,325.8	0.0	0.0	1,451.7	30,325.8	100.0%	8,697.6
4.50	4.50	1,446.6	31,772.4	0.0	0.0	1,446.6	31,772.4	100.0%	8,659.5
4.67	4.66	1,439.0	33,211.4	0.0	0.0	1,439.0	33,211.4	100.0%	8,605.9
4.83	4.83	1,428.8	34,640.2	0.0	0.0	1,428.8	34,640.2	100.0%	8,536.5
5.00	5.00	1,415.8	36,056.0	0.0	0.0	1,415.8	36,056.0	100.0%	8,450.8
5.17	5.16	1,400.2	37,456.2	0.0	0.0	1,400.2	37,456.2	100.0%	8,348.5

These results are submitted to you as a guideline only, without liability on the part of CONTECH Engineered Solutions, LLC for accuracy or suitability to any particular application, and are subject to your verification.

5.33	5.33	1,381.7	38,837.9	0.0	0.0	1,381.7	38,837.9	100.0%	8,228.8
5.50	5.50	1,360.2	40,198.2	0.0	0.0	1,360.2	40,198.2	100.0%	8,091.1
5.67	5.66	1,335.7	41,533.9	0.0	0.0	1,335.7	41,533.9	100.0%	7,934.3
5.83	5.83	1,307.9	42,841.8	0.0	0.0	1,307.9	42,841.8	100.0%	7,757.3
6.00	6.00	1,276.6	44,118.4	0.0	0.0	1,276.6	44,118.4	100.0%	7,558.7
6.17	6.16	1,241.6	45,360.0	0.0	0.0	1,241.6	45,360.0	100.0%	7,336.7
6.33	6.33	1,202.5	46,562.6	0.0	0.0	1,202.5	46,562.6	100.0%	7,089.2
6.50	6.50	1,159.0	47,721.5	0.0	0.0	1,159.0	47,721.5	100.0%	6,813.3
6.67	6.66	1,110.4	48,831.9	0.0	0.0	1,110.4	48,831.9	100.0%	6,505.5
6.83	6.83	1,056.1	49,888.0	0.0	0.0	1,056.1	49,888.0	100.0%	6,160.9
7.00	7.00	995.2	50,883.1	0.0	0.0	995.2	50,883.1	100.0%	5,773.0
7.17	7.16	926.3	51,809.4	0.0	0.0	926.3	51,809.4	100.0%	5,332.4
7.33	7.33	847.5	52,656.9	0.0	0.0	847.5	52,656.9	100.0%	4,824.6
7.50	7.50	755.7	53,412.6	0.0	0.0	755.7	53,412.6	100.0%	4,225.4
7.67	7.66	645.2	54,057.8	0.0	0.0	645.2	54,057.8	100.0%	3,488.2
7.83	7.83	503.7	54,561.4	0.0	0.0	503.7	54,561.4	100.0%	2,493.2
8.00	8.00	278.2	54,839.6	0.0	0.0	278.2	54,839.6	100.0%	0.0

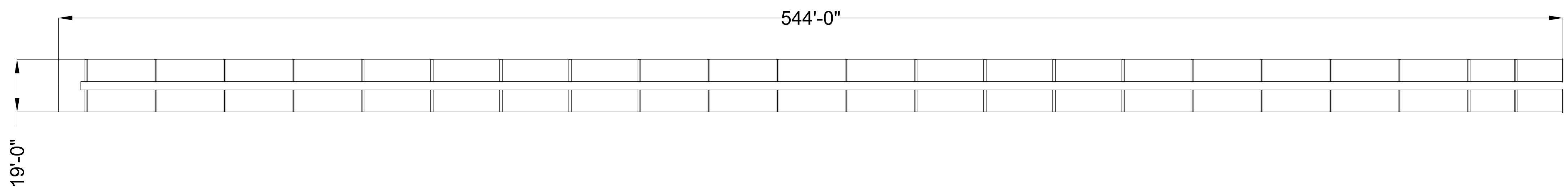
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20 & HS25
- APPROX. LINEAR FOOTAGE = 1,091 lf.

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = 54,757 cf.
- PIPE STORAGE VOLUME = 54,840 cf.
- BACKFILL STORAGE VOLUME = 0 cf.
- TOTAL STORAGE PROVIDED = 54,840 cf.

PIPE DETAILS
- DIAMETER = 96 IN.
- CORRUGATION = 5x1
- GAGE = 16
- COATING = ALT2
- WALL TYPE = Solid
- BARRELL SPACING = 36 IN.

BACKFILL DETAILS
- WIDTH AT ENDS = 12 IN.
- ABOVE PIPE = 0 IN.
- WIDTH AT SIDES = 12 IN.
- BELOW PIPE = 0 IN.



ASSEMBLY
SCALE: 1" = 50'

NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE 2⅔" x ½" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.

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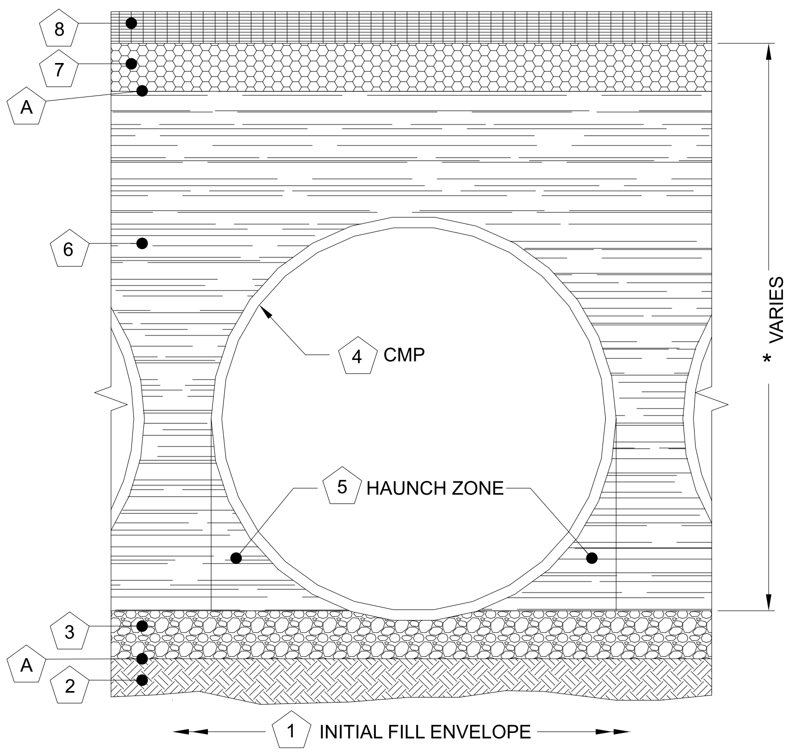
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS

CONTECH **DYODS** DRAWING

DYO668 6400 Katella Ave
6400 Katella Ave - Underground CMP System
Cypress, California
DETENTION SYSTEM

PROJECT No.: 481	SEQ. No.: 668	DATE: 7/1/2020
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D1		



DETENTION SYSTEMS - CMP DETENTION / CMP DRAINAGE				
	Material Location	Description	Material Designation	Designation
8	Rigid or Flexible Pavement (if applicable)			
7	Road Base (if applicable)			
A	Geotextile Layer	Non-Woven Geotextile	CONTECH C-40 or C-45	Engineer Decision for consideration to prevent soil migration into varying soil types
6	Backfill	Well graded granular material which may contain small amounts of silt or clay.	AASHTO M 145- A-1, A-2, A-3	Placed in 8" +/- loose lifts and compacted to 90% Standard Proctor Per AASHTO T 99
3	Bedding Stone	Well graded granular bedding material w/maximum particle size of 3"	AASHTO M43 - 3,357,4,467, 5, 56, 57	Engineer to determine if bedding is required. Pipe may be placed on the trench bottom of a relatively loose, native suitable well graded & granular material. For Arch pipes it is recommended to be shaped to a relatively flat bottom or fine-grade the foundation to a slight v-shape. Unsuitable material should be over-excavated and re-placed with a 4"-6" layer of well graded & granular stone per the material designation. See AASHTO 26.3.8.1 / 26.5.3 Bedding info.
A	Geotextile Layer	Non-Woven Geotextile	CONTECH C-40 or C-45	Engineer Decision for consideration to prevent soil migration into varying soil types
*	*Note: Backfill using controlled low-strength material (CLSM, "flash fill" or "flowable fill") when the spacing between the pipes will not allow for placement and adequate compaction of the backfill.*			

1 MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT

FOUNDATION/BEDDING PREPARATION

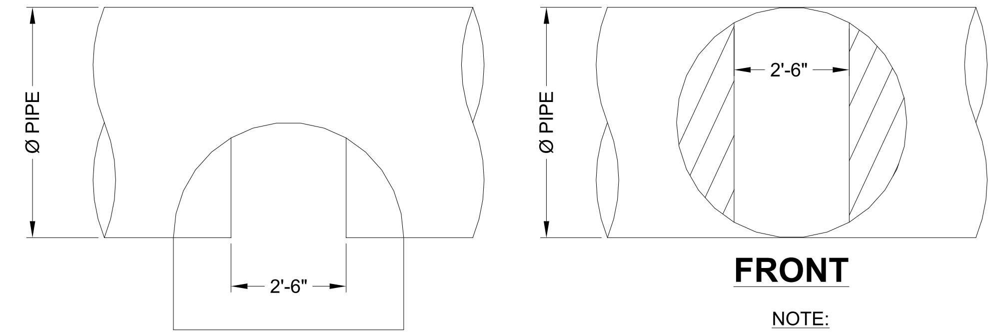
2 PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER.

5 HAUNCH ZONE MATERIAL SHALL BE PLACED AND UNIFORMALLY COMPACTED WITHOUT SOFT SPOTS.

BACKFILL

WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE DETENTION SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON THE PIPE.

OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.



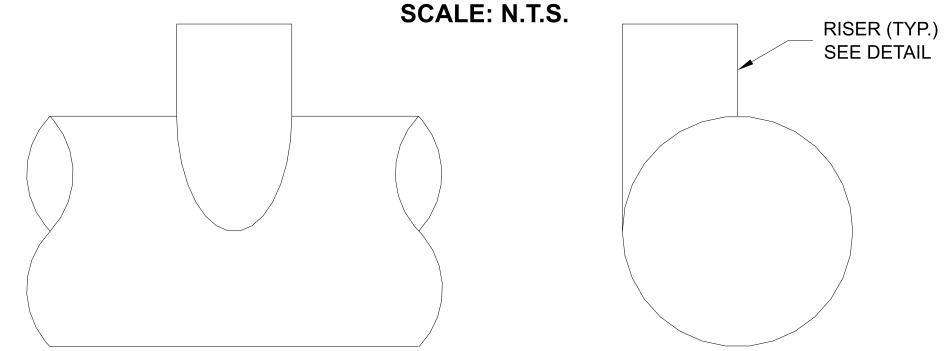
PLAN

FRONT

NOTE:
MANWAY DETAIL APPLICABLE FOR CMP SYSTEMS WITH DIAMETERS 48" AND LARGER. MANWAYS MAY BE REQUIRED ON SMALLER SYSTEMS DEPENDING ON ACTUAL SITE SPECIFIC CONDITIONS.

TYPICAL MANWAY DETAIL

SCALE: N.T.S.



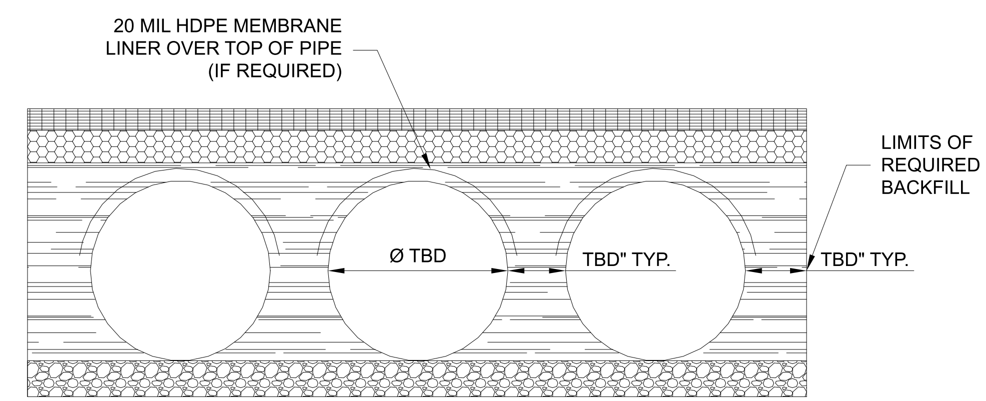
ELEVATION

END

NOTE:
LADDERS ARE OPTIONAL AND ARE NOT REQUIRED FOR ALL SYSTEMS.

TYPICAL RISER DETAIL

SCALE: N.T.S.



TYPICAL SECTION VIEW

LINER OVER ROWS

SCALE: N.T.S.

NOTE: IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, AN HDPE MEMBRANE LINER IS RECOMMENDED WITH THE SYSTEM. THE IMPERMEABLE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

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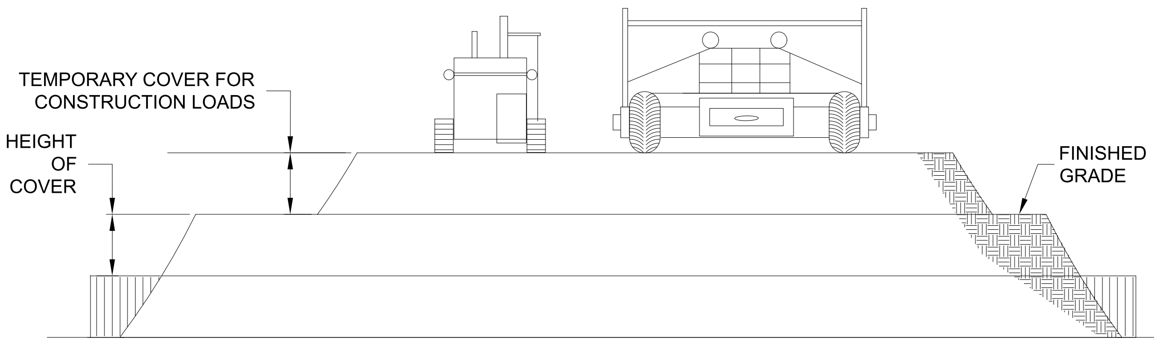
CONTECH CMP DETENTION SYSTEMS

CONTECH DYODS DRAWING

DYO668 6400 Katella Ave
6400 Katella Ave - Underground CMP System
Cypress, California
DETENTION SYSTEM

PROJECT No.: 481	SEQ. No.: 668	DATE: 7/1/2020
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: D2		



CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

POLYMER COATED: AASHTO M-245 OR ASTM A-762

ALUMINUM: AASHTO M-196 OR ASTM B-745

HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.

INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

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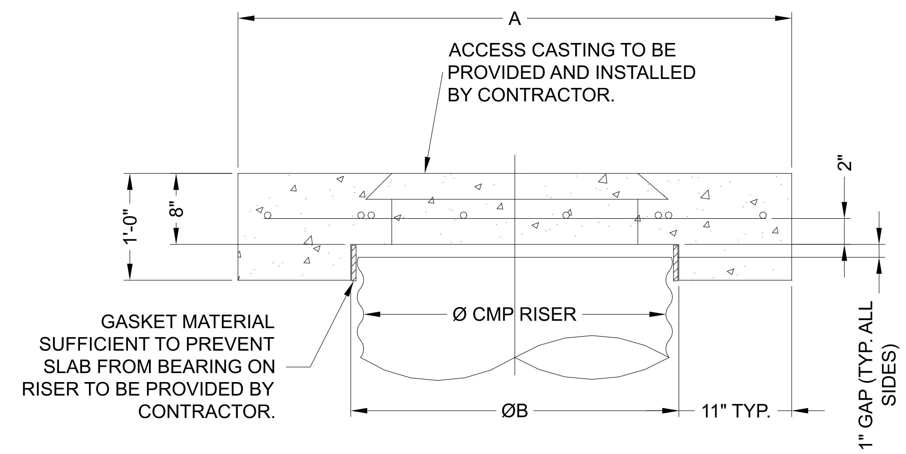
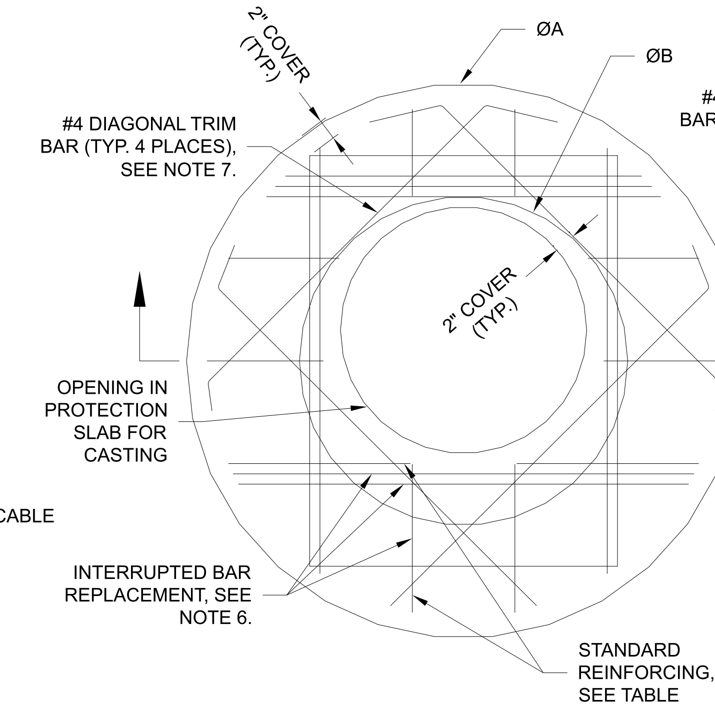


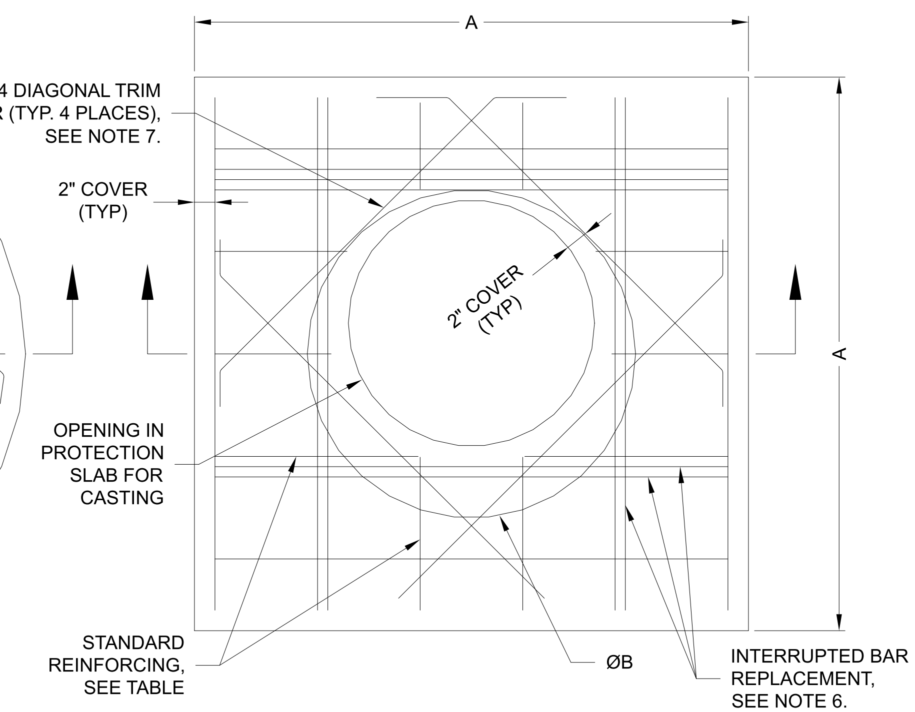
SECTION VIEW

Ø CMP RISER	A	Ø B	REINFORCING	**BEARING PRESSURE (PSF)
REINFORCING TABLE				
24"	Ø 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	Ø 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	Ø 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	Ø 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	Ø 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

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CONTECH CMP DETENTION SYSTEMS

CONTECH **DYODS** DRAWING

DYO668 6400 Katella Ave
6400 Katella Ave - Underground CMP System
Cypress, California
DETENTION SYSTEM

PROJECT No.: 481	SEQ. No.: 668	DATE: 7/1/2020
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: D3		

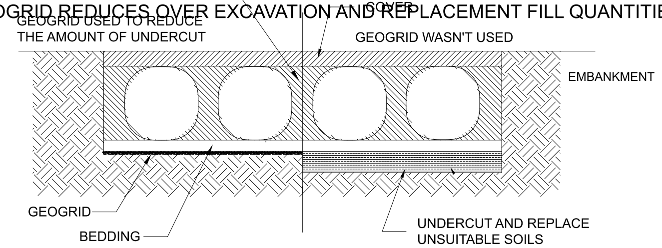
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.

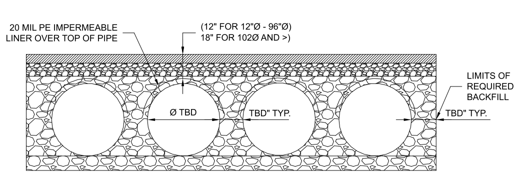


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

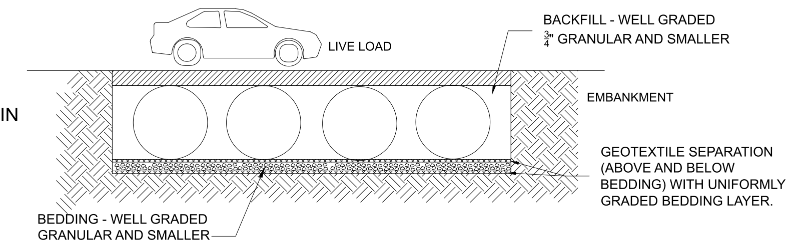
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

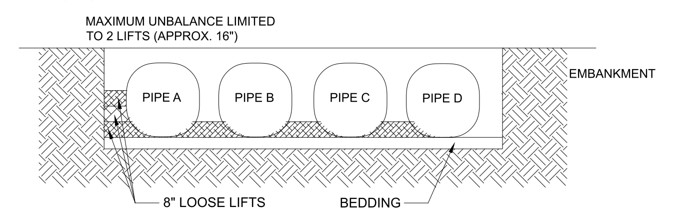
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



BACKFILL PLACEMENT

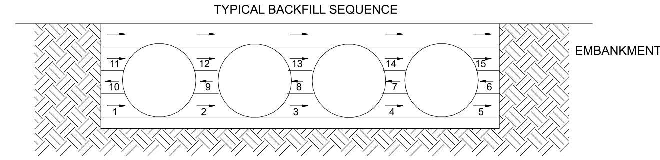
MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.



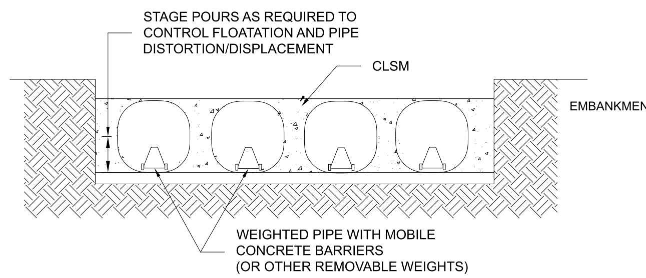
IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.

TYPICAL BACKFILL SEQUENCE



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

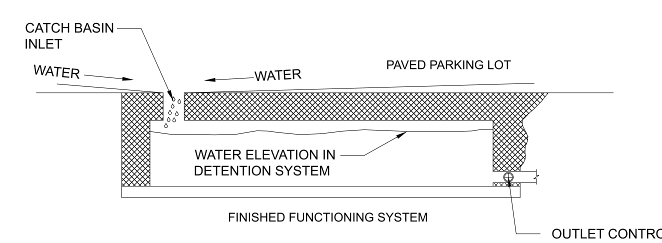


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, QUARTERLY INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

C:\EXPORTS\TEMPLATES\CMP.DWG 10/18/2019 10:02 AM

MARK	DATE	REVISION DESCRIPTION	BY

CONTECH® ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH® CMP DETENTION SYSTEMS

CONTECH **DYODS** DRAWING

DYO668 6400 Katella Ave
6400 Katella Ave - Underground CMP System
Cypress, California
DETENTION SYSTEM

PROJECT No.: 481	SEQ. No.: 668	DATE: 7/1/2020
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: D4		

Biotreatment Calculations

Filter Inserts Reference

Bio Clean
A Forterra Company

Grate Inlet Filter

A Stormwater Trash Capture Solution

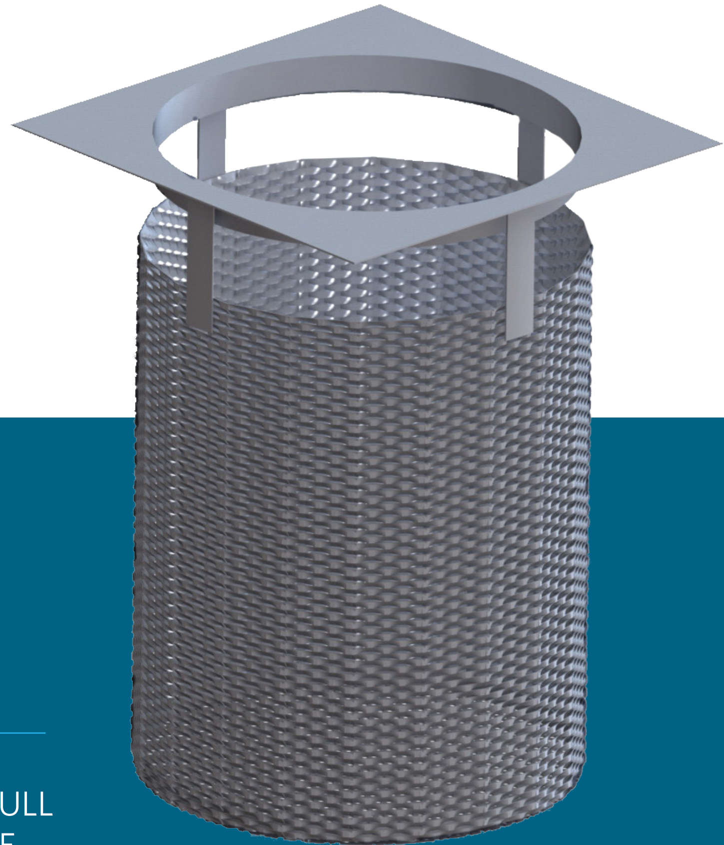
OVERVIEW

The Bio Clean Grate Inlet Filter for catch basins is a filter system that is designed to capture fine to coarse sediments, floatable trash, debris, and hydrocarbons conveyed in stormwater runoff.

The filter system is available in three different model types: Full Capture, Multi-Level Screening (MLS), and the revolutionary Kraken Type media filter model.

Constructed of 100% high-grade stainless steel, it is built to last longer than any other filter brand. The non-clogging screens provide higher levels of filtration and water flow. The filter is equipped with unimpeded high flow bypass to prevent backflow during the largest storm events. The filter is also equipped with a floating hydrocarbon boom mounted to rails allowing it to flow up and down with the water level to provide constant oil and grease removal.

The filter is designed for grated inlets of any size and depth. Each filter can be custom built to meet specific project needs. Screen size and media type can be modified to remove specific pollutants.



FULL TRASH CAPTURE TYPE

PERFORMANCE

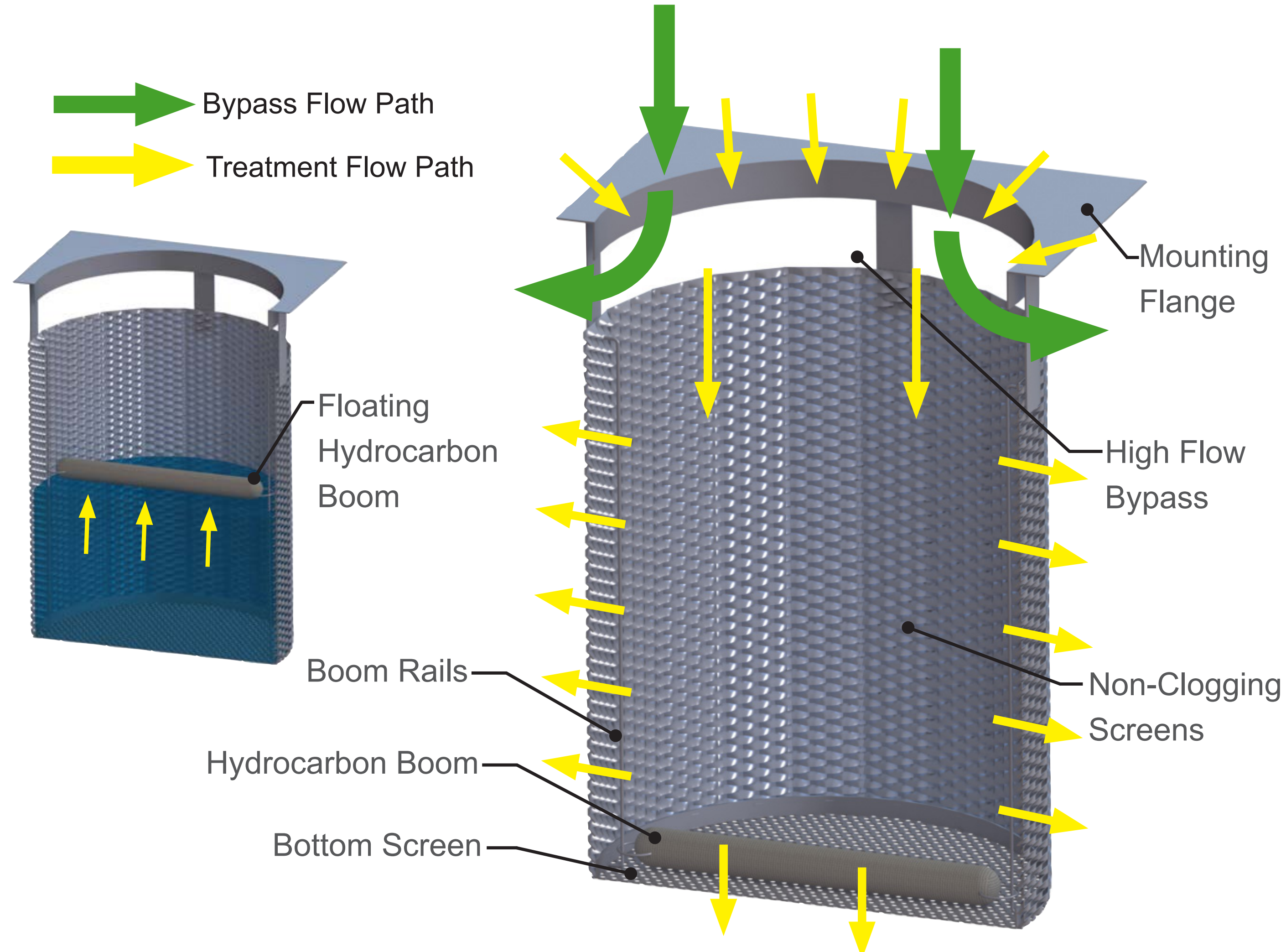
100% REMOVAL OF TRASH AND DEBRIS

- MEETS FULL CAPTURE REQUIREMENTS

ADVANTAGES

- 8-YEAR WARRANTY
- CUSTOM SIZES AVAILABLE
- NO NETS OR GEOFABRICS
- 15+ YEARS USER LIFE
- NO REPLACEMENT COSTS AS FOUND WITH FABRIC FILTERS
- MEETS LEED REQUIREMENTS
- FITS IN SHALLOW CATCH BASINS

OPERATION



SPECIFICATIONS

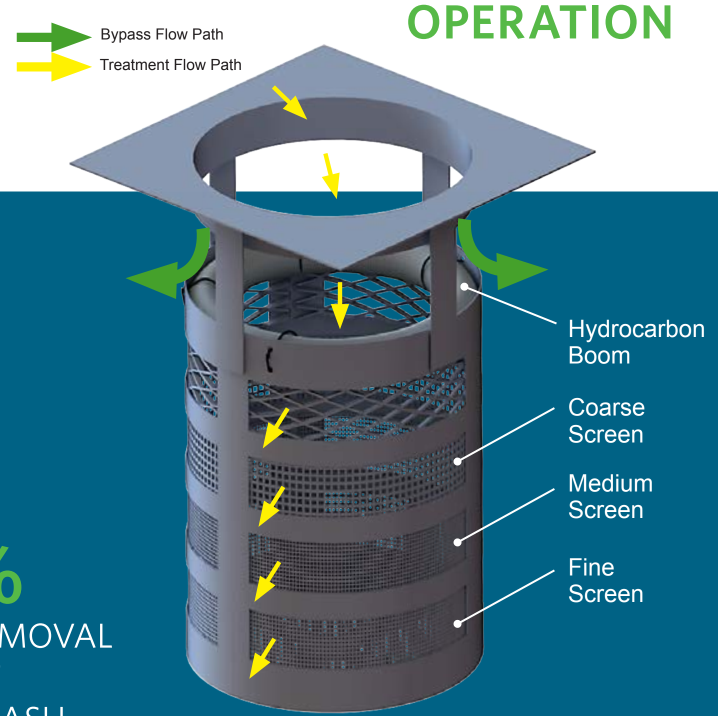
MODEL #	TREATMENT FLOW (cfs)	BYPASS FLOW (cfs)
BIO-GRATE-FULL-12-12-12	1.55	1.55
BIO-GRATE-FULL-18-18-18	4.32	3.68
BIO-GRATE-FULL-24-24-24	7.67	4.83
BIO-GRATE-FULL-30-30-24	12.97	6.21
BIO-GRATE-FULL-25-38-24	13.53	6.59
BIO-GRATE-FULL-36-36-24	19.64	7.60
BIO-GRATE-FULL-48-48-18	25.59	10.13

NOTE: Treatment and bypass flow rates include a safety factor of 2.

GRATE INLET MLS

The Bio Clean Multi-Level Screening Grate Inlet Filter is the standard configuration used for more than a decade and provides the best overall performance for all pollutants of concern.

OPERATION



MULTI-LEVEL SCREENING

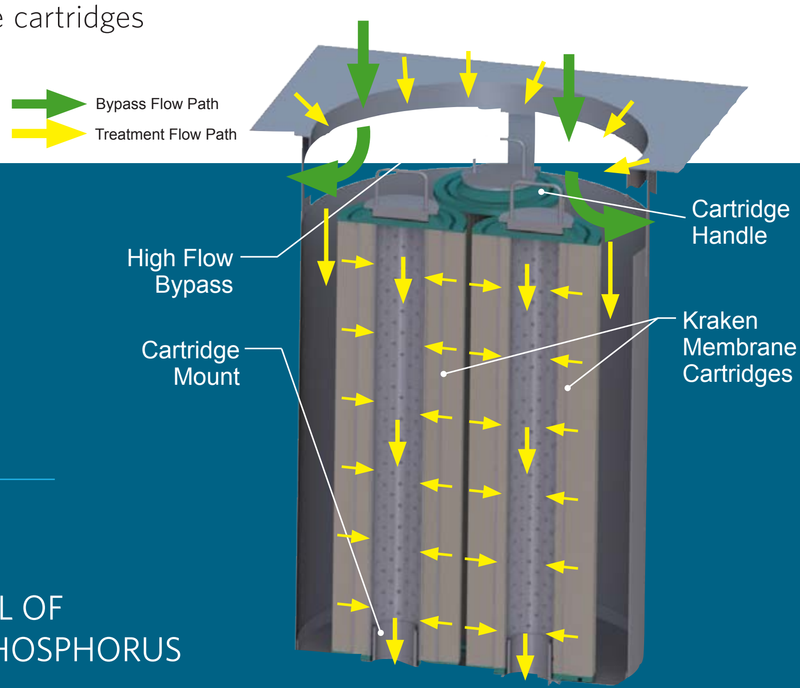
PERFORMANCE

80% REMOVAL OF SEDIMENTS	100% REMOVAL OF TRASH
100% REMOVAL OF FOLIAGE	• MEDIUM LEVEL REMOVAL FOR PARTICULATE METALS AND NUTRIENTS • INCLUDES HYDROCARBON BOOM FOR REMOVAL OF OILS AND GREASE

GRATE INLET MEDIA FILTER

The Bio Clean Grate Inlet Media Filter is an advanced-level filtration device designed with Kraken membrane cartridges for increased removal efficiencies.

OPERATION



KRAKEN TYPE

PERFORMANCE

85% REMOVAL OF FINE TSS	72% REMOVAL OF TOTAL PHOSPHORUS		
52% REMOVAL OF COPPER	58% REMOVAL OF ZINC	81% REMOVAL OF OILS & GREASE	60% REMOVAL OF FECAL COLIFORM

SPECIFICATIONS

MODEL #	SCREEN TREATMENT FLOW (cfs)	BYPASS FLOW (cfs)
BIO-GRATE-MLS-12-12-12	1.19	1.55
BIO-GRATE-MLS-18-18-18	4.32	3.68
BIO-GRATE-MLS-24-24-24	7.67	4.83
BIO-GRATE-MLS-30-30-24	12.97	6.21
BIO-GRATE-MLS-25-38-24	13.53	6.59
BIO-GRATE-MLS-36-36-24	19.64	7.60
BIO-GRATE-MLS-48-48-18	24.84	10.13

SPECIFICATIONS

MODEL #	MEDIA TREATMENT FLOW (cfs)	BYPASS FLOW (cfs)
BIO-GRATE-KMF-12-12-30	.04	1.55
BIO-GRATE-KMF-18-18-30	.04	3.68
BIO-GRATE-KMF-24-24-30	.11	4.83
BIO-GRATE-KMF-36-36-30	.27	6.21
BIO-GRATE-KMF-48-48-30	.49	7.60

INSTALLATION

Bio Clean's Grate Inlet Filters are easily installed directly under grated inlets with no special equipment.

Highly effective trash capture.

MAINTENANCE

Perfect for retrofit applications like parking lots, roadways, and bioswale bypass structures.

Filters can be lifted out by hand for routine maintenance and inspections.

Bio Clean
A Forterra Company

5796 Armada Drive Suite 250
Carlsbad, CA 92008
855.566.3938
stormwater@forterrabp.com
biocleanenvironmental.com

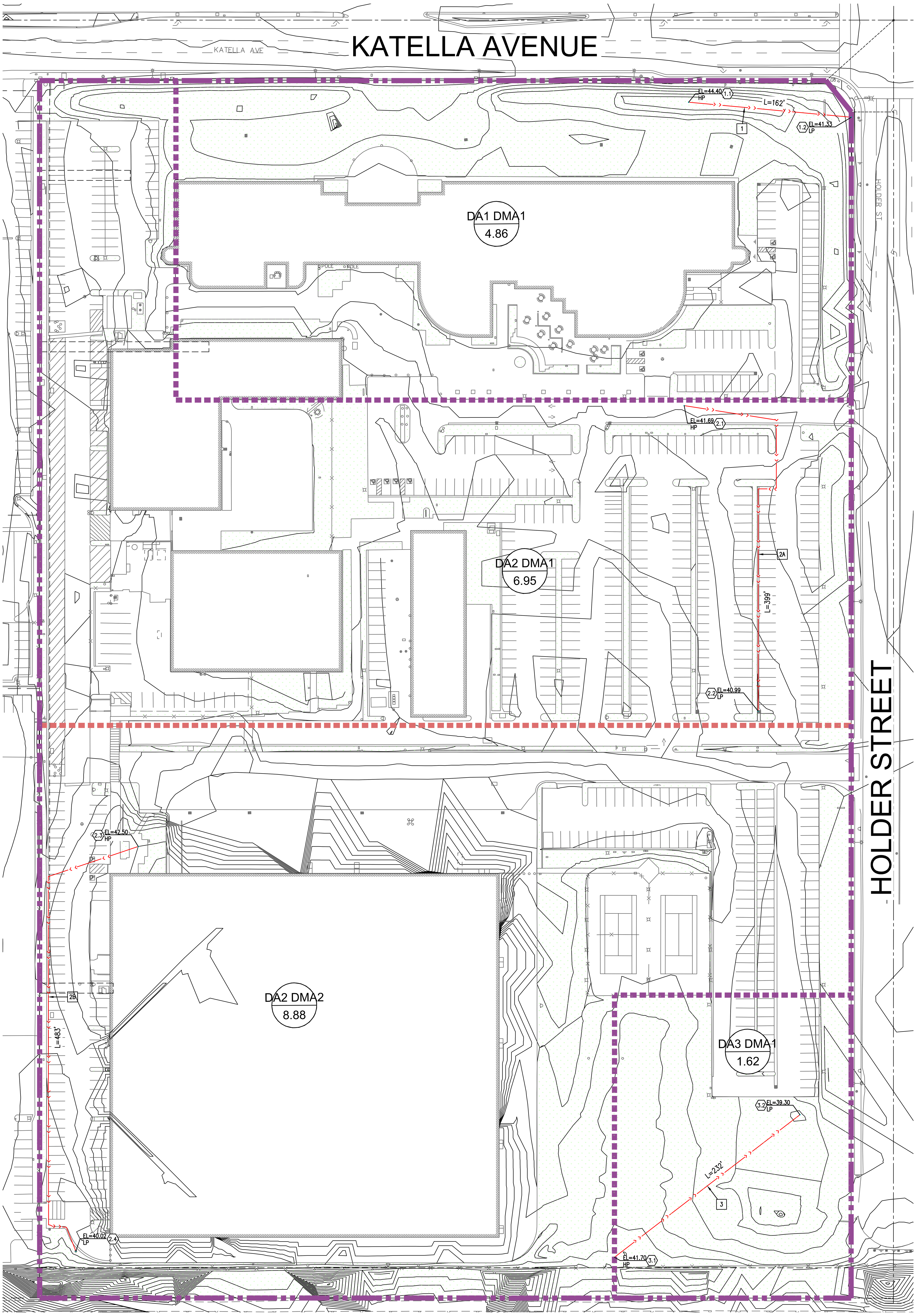
122018R1A

Attachment F

Exhibits

WQMP Exhibit

Existing Conditions



LEGEND:

- DRAINAGE AREA BOUNDARY
- SUB-DRAINAGE AREA BOUNDARY
- LONGEST FLOW PATH
- LANDSCAPE AREA
- A / X-XX — DRAINAGE SUB AREA DESIGNATION / AREA (AC)
- 3.10 — NODE (US/DS)
- 3 — STREAM #
- HP, LP — HIGH POINT, LOW POINT

HYDROLOGY INFORMATION

SITE AREA:	23.3 ACRE
SOIL TYPE:	B
IMPERVIOUS:	72% (PER CALCULATIONS)
ISOHYETALS	0.85" (85TH PERCENTILE)
	2.05" (2 YEAR)
FREQUENCY:	100 YEAR
	85TH PERCENTILE
METHOD:	ORANGE COUNTY HYDROLOGY MANUAL

WQMP SUMMARY

DRAINAGE AREA NO.	DRAINAGE SUB-AREA	TRIBUTARY AREA (SF)	TRIBUTARY AREA (AC)	IMPERVIOUS RATIO
DA1	DA1 DMA1	211,826	4.86	0.61
DA2	DA2 DMA1	302,640	6.95	0.81
	DA2 DMA2	386,644	8.88	0.82
DA3	DA3 DMA1	70,521	1.62	0.15

N

50 0 50 100
scale 1"= 50' feet

PREPARED BY:

WestLAND Group, Inc. Land Surveyors • Civil Engineers • GIS
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
JOB NO: 2018-131

KATELLA AVE INDUSTRIAL EXISTING WQMP EXHIBIT

CITY OF CYPRESS

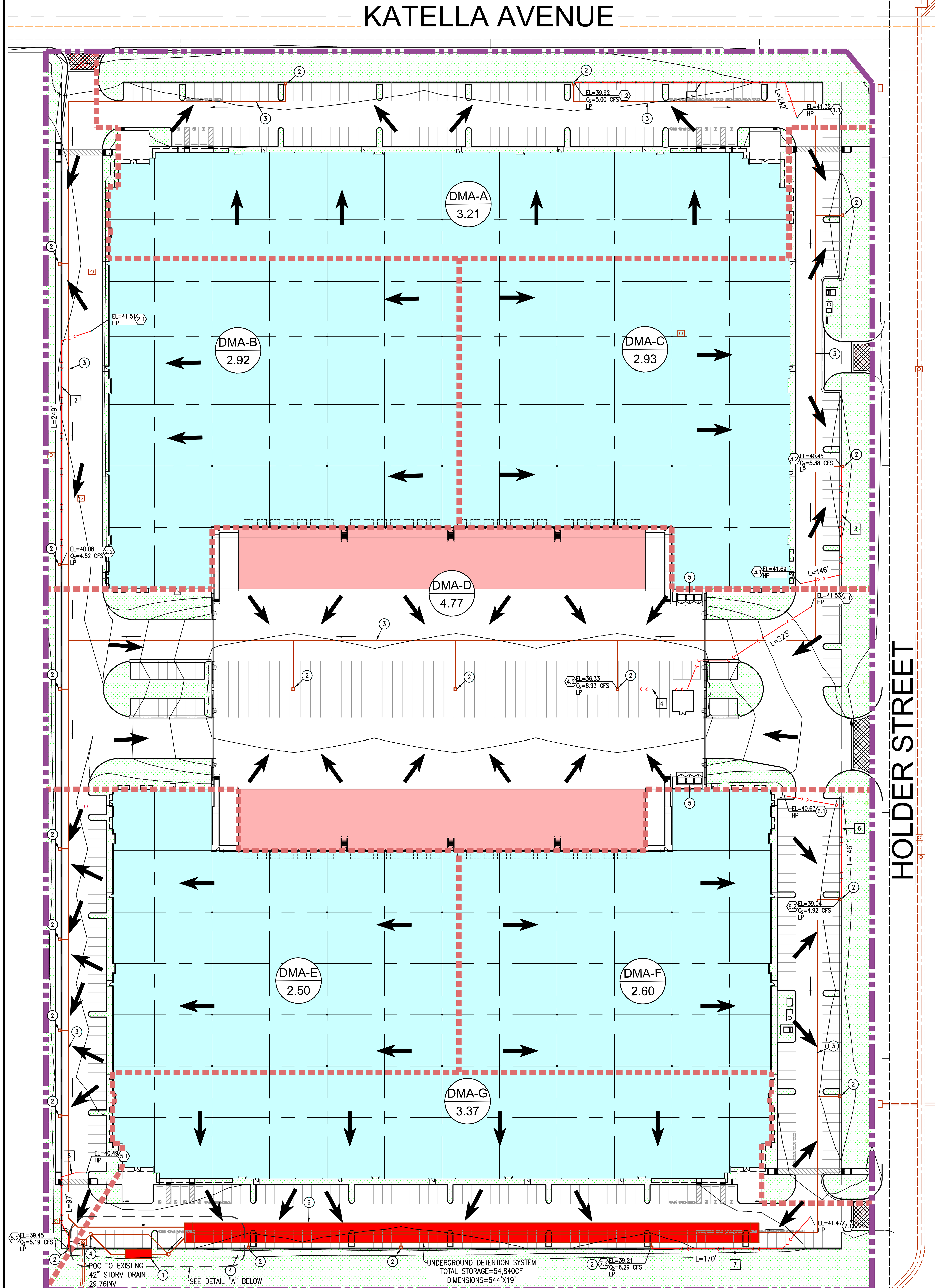
DATE: MAR 2020
SHEET 1 OF 1

Drawing Name: P:\Year_2019\2019-285 Industrial Project 6400 Katella, Cypress -Duke Realty\05 Engineering\Reports\WQMP\3_Exhibits\2019-285_PRE_WQMP.dwg
Last Opened: Apr 21, 2020 - 7:13pm by: ivan.thieu

WQMP Exhibit

Proposed Conditions

CITY OF CYPRESS
WQMP EXHIBIT

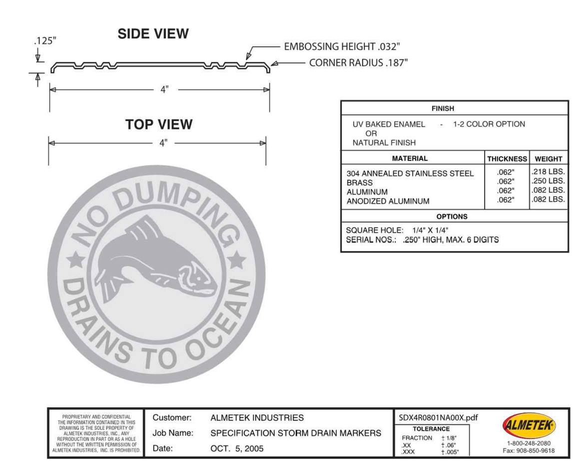


LEGEND:

- DRAINAGE AREA BOUNDARY
- SUB-DRAINAGE AREA BOUNDARY
- STORM DRAIN
- LONGEST FLOW PATH
- LANDSCAPE AREA
- PROP. LID DEVICE
- A / X-XX — DRAINAGE SUB AREA DESIGNATION, AREA (AC)
- 1.0 — NODE (US/DS)
- 3 — STREAM #
- HP, LP — HIGH POINT, LOW POINT
- SURFACE FLOW DIRECTION
- STORM DRAIN FLOW DIRECTION

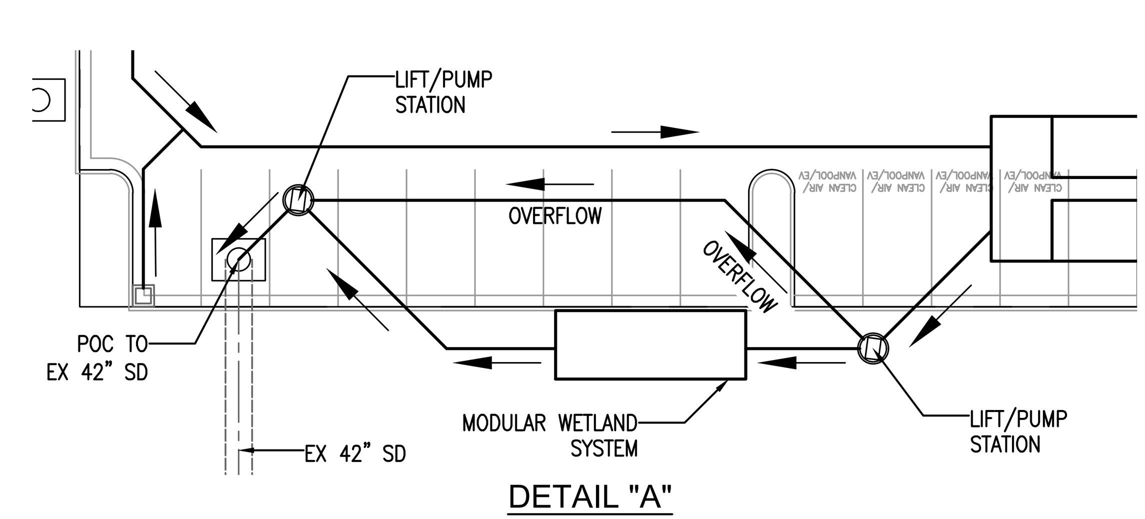
HYDROLOGY INFORMATION

SITE AREA:	23.3 ACRE	
SOIL TYPE:	B	
IMPERVIOUS:	86% (PER CALCULATIONS)	
ISOHYETALS	0.85"	(85TH PERCENTILE)
	2.05"	(2 YEAR)
FREQUENCY:	25 YEAR	
	85TH PERCENTILE	
METHOD:	ORANGE COUNTY HYDROLOGY MANUAL	



STORM DRAIN MARKER

50 0 50 100 scale 1"= 50' feet



DETAIL "A"
SCALE: 1"=10'

WQMP SUMMARY

DRAINAGE AREA No.	DRAINAGE SUB-AREA	BMP TYPE	TRIBUTARY AREA (SF)	TRIBUTARY AREA (AC)	IMPERVIOUS RATIO	REQUIRED DESIGN CAPTURE VOLUME (CF)	PROVIDED VOLUME (CF)
DA1	DMA–A	MODULAR WETLAND SYSTEM UNDERGROUND DETENTION SYSTEM CATCH BASIN FILTER INSERTS	139,838	3.21	0.80	54,757	54,840 (UNDERGROUND DETENTION SYSTEM)
	DMA–B		127,357	2.92	0.94		
	DMA–C		127,691	2.93	0.88		
	DMA–D		207,784	4.77	0.89		
	DMA–E		108,881	2.50	0.92		
	DMA–F		113,140	2.60	0.86		
	DMA–G		146,939	3.37	0.76		

DRAINAGE NOTES:

1. PROP. LID DEVICE– MODULAR WETLAND SYSTEM
2. PROPOSED CATCH BASIN WITH FILTER INSERT
3. PROPOSED STORM DRAIN PIPE PRIVATE MAINTAINED
4. PROPOSED LIFT/PUMP STATION
5. TRASH ENCLOSURE AREA. SEE FOLLOWING SHEET FOR DETAIL.

NOTE:
1. ALL ON-SITE STORM DRAINS ARE PRIVATE STORM DRAIN SYSTEMS, NOT TO BE MAINTAINED BY THE CITY OF CYPRESS.
2. ALL ON-SITE BMP'S & UNDERGROUND DETENTION SYSTEM TO BE MAINTAINED BY OWNER

PREPARED BY:
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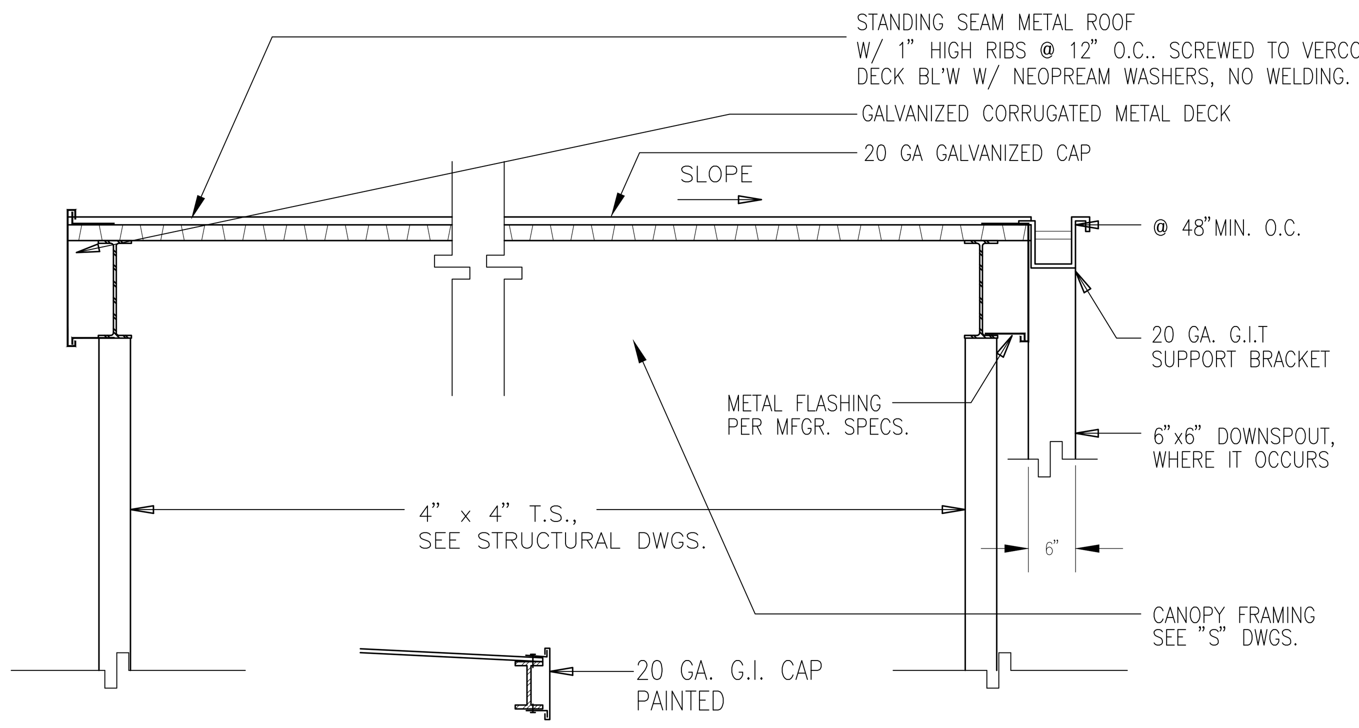
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
JOB NO: 2018-131

KATELLA AVE INDUSTRIAL
PROPOSED WQMP EXHIBIT

CITY OF CYPRESS

DATE: MAR 2020
SHEET 1 OF 1

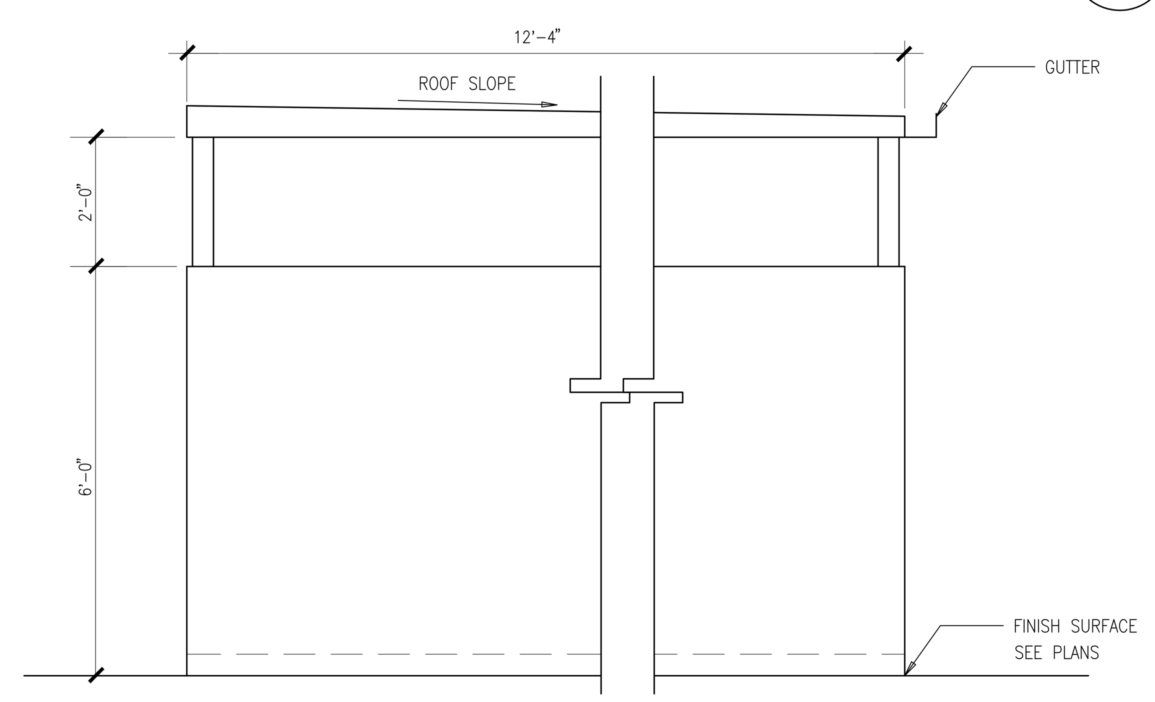


TYPICAL END CONDITION

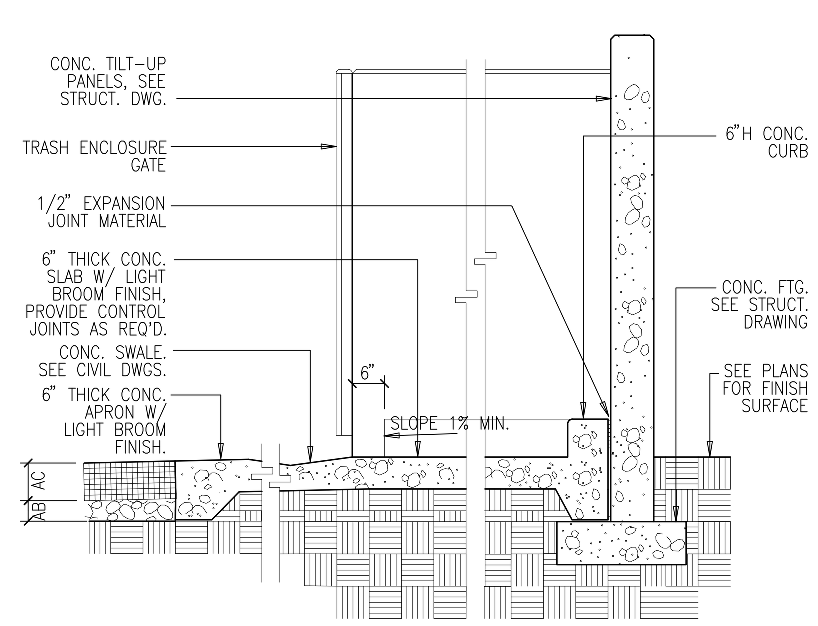
NOTES:
1. ENCLOSURE ROOF SHALL SLOPE TOWARD A LANDSCAPE WHERE POSSIBLE
2. ENCLOSURE ROOF SHALL SLOPE AT 1% MINIMUM

ALL EXPOSED STELL TO BE GALVANIZED, PRIMED AND PAINTED TO MATCH BUILDING WALL COLOR

TRASH ENCLOSURE/OUTDOOR STORAGE CANOPY DETAIL 9
SCALE: 1/2" = 1'-0"

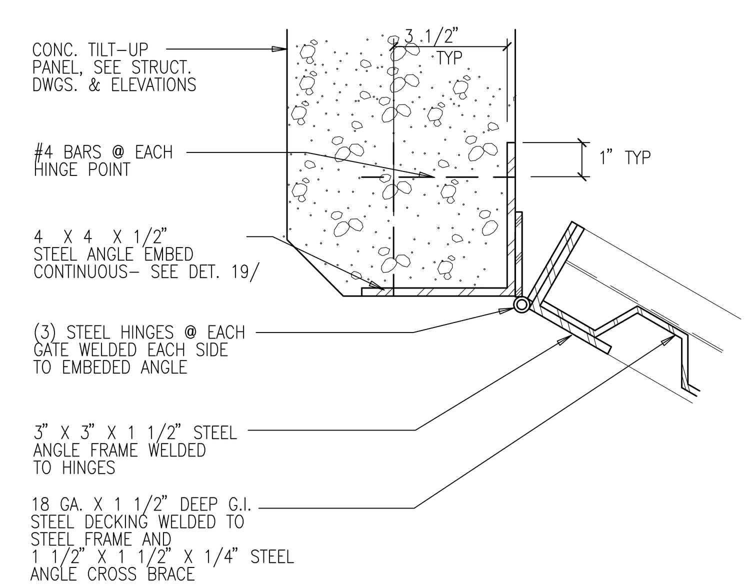


TRASH ENCLOSURE GATE ELEVATION 10
SCALE: 1/2" = 1'-0" SCALE: 3"=1'-0" A10502B



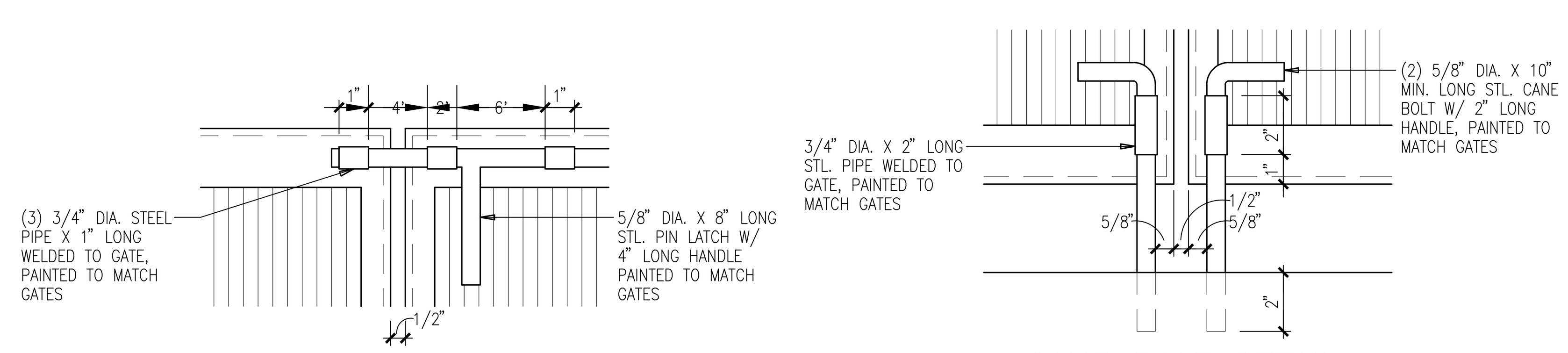
NOTES:
1. SEE SOILS REPORT FOR BELOW SLAB PREPARATIONS AND STEEL REINFORCEMENT RECOMMENDATIONS.

TRASH ENCLOSURE SECTION 15
SCALE: 1/2" = 1'-0"

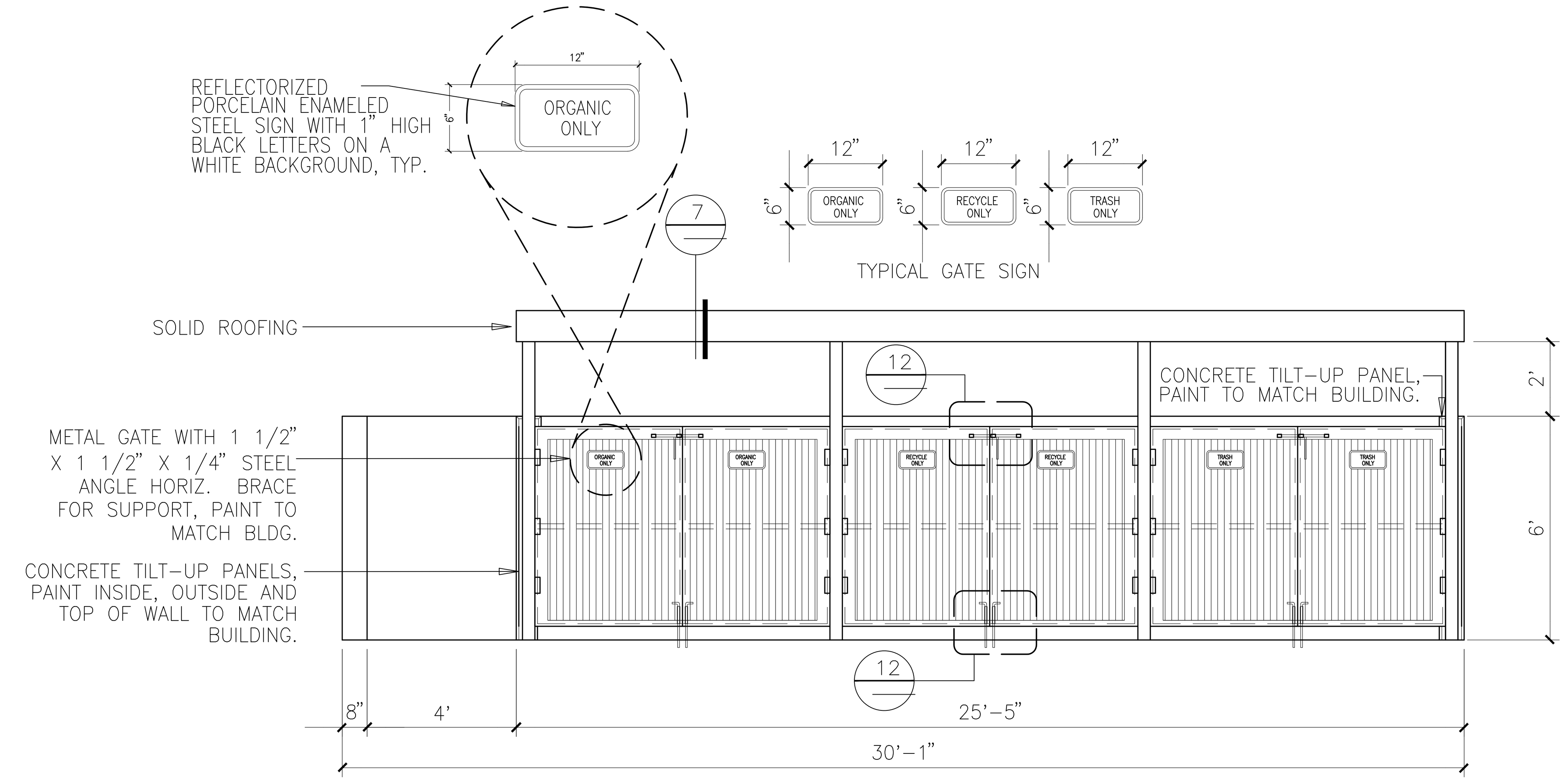


NOTES:
1. PAINT ALL METAL TO MATCH ENCLOSURE PER SPECIFICATIONS. UNLESS OTHERWISE NOTED ON ELEVATIONS

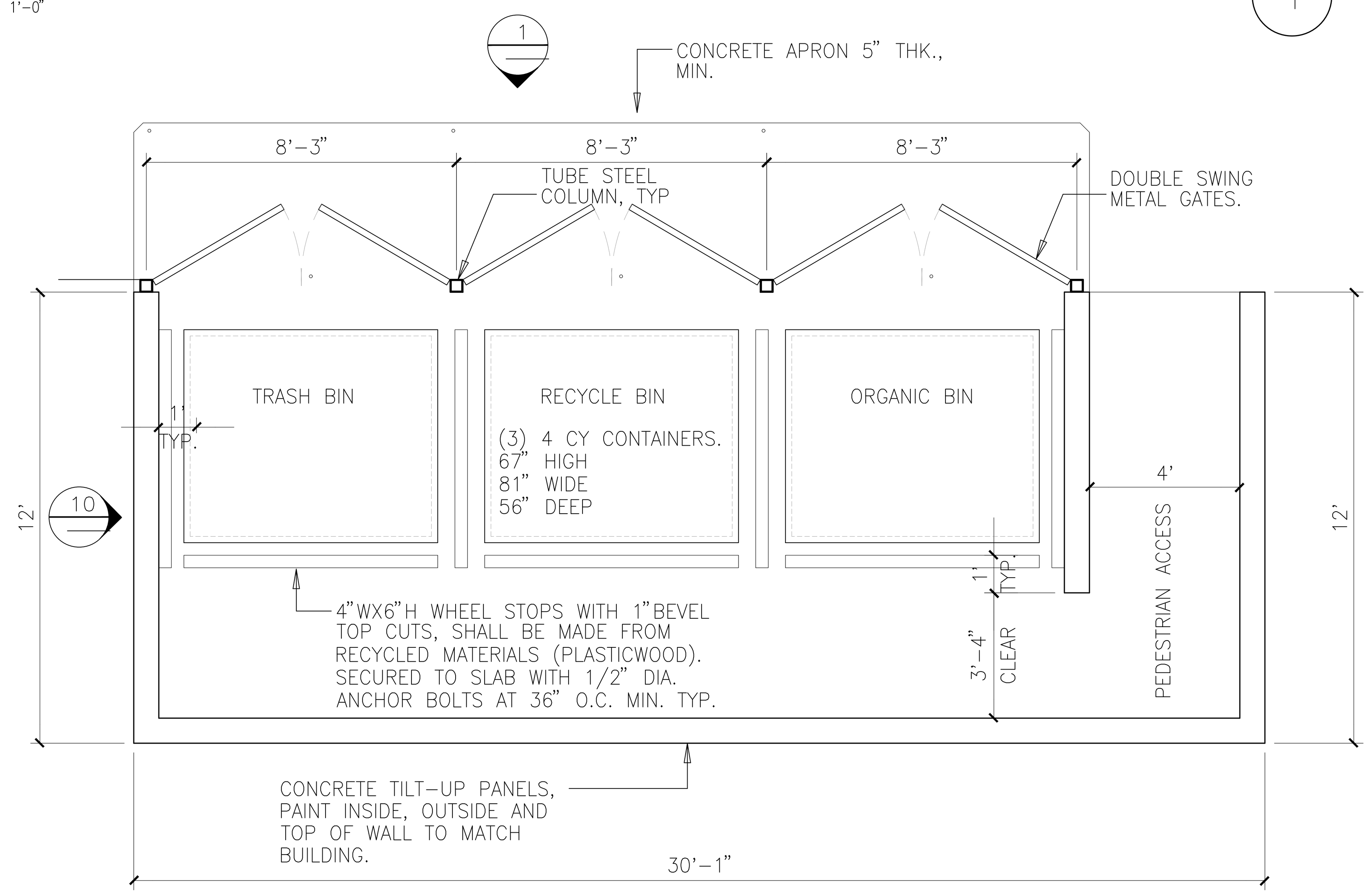
TRASH ENCLOSURE GATE & HINGE 11
SCALE: 3"=1'-0" 10506C



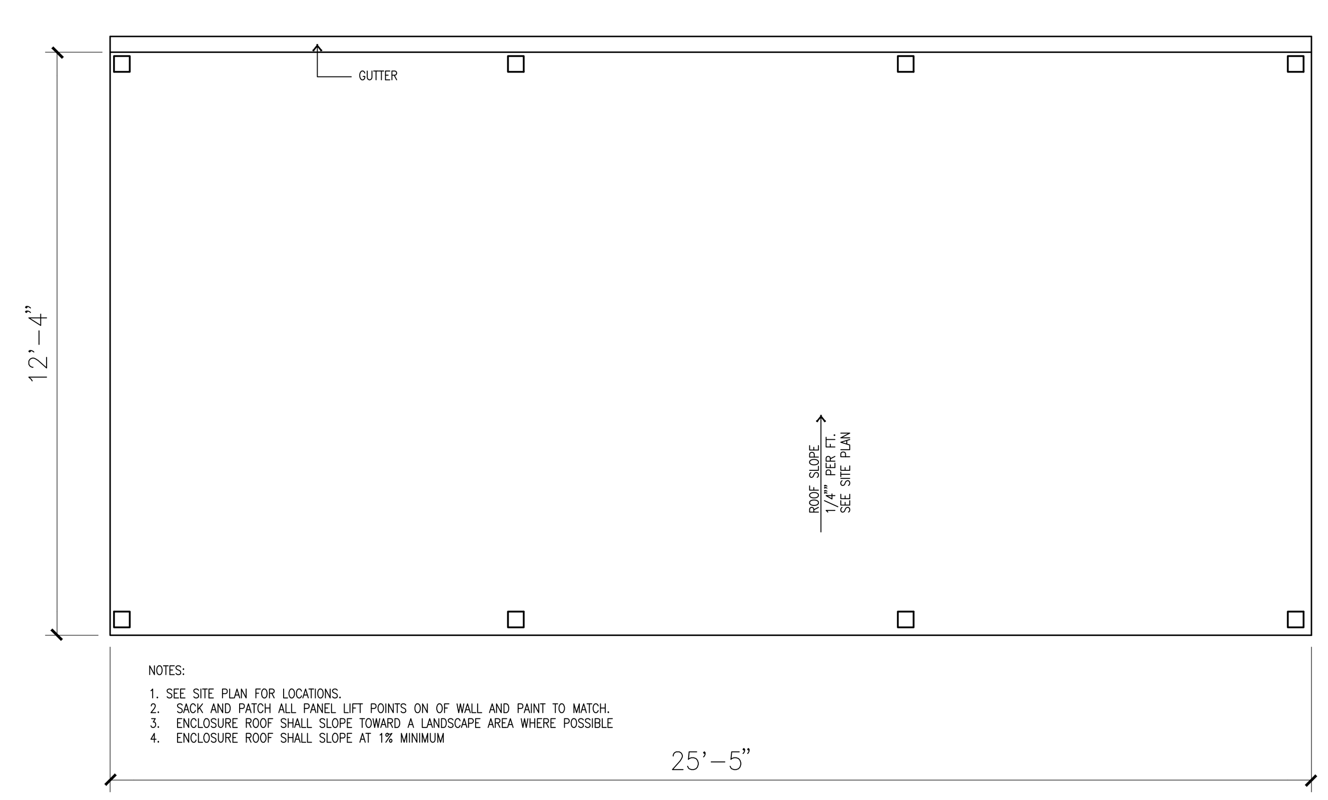
TRASH ENCLOSURE GATE LATCHES 12
SCALE: 3" = 1'-0" DEX-0003



TRASH ENCLOSURE ELEVATION 1
SCALE: 3/8" = 1'-0"



TRASH ENCLOSURE PLAN VIEW 2
SCALE: 3/8" = 1'-0"



NOTES:
1. SEE SITE PLAN FOR LOCATIONS.
2. SACK AND PATCH ALL PANEL LIFT POINTS ON OF WALL AND PAINT TO MATCH.
3. ENCLOSURE ROOF SHALL SLOPE TOWARD A LANDSCAPE AREA WHERE POSSIBLE
4. ENCLOSURE ROOF SHALL SLOPE AT 1% MINIMUM

TRASH ENCLOSURE ROOF VIEW 3
SCALE: 3/8" = 1'-0"

Duke REALTY
Duke Realty
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Irvine, CA 92618

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18831 bardeen avenue - ste. #100
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Consultants
Civil: WESTLAND GROUP
Structural:
Mechanical:
Plumbing:
Electrical:
Landscape: HUNTER
Fire Protection:
Soils Engineer:

Revisions:

Duke Job Number:
Date: 04/15/2020
Drawn By: CR
Checked By: SH

6400 KATELLA AVE.
CYPRESS, CA 90630

LICENSED ARCHITECT
YONG NAM
C-29451
3-31-21
RENEWAL DATE
STATE OF CALIFORNIA

Drawing Title:
TRASH ENCLOSURE

Drawing Number:
DAB-A4.2
Of Sheets

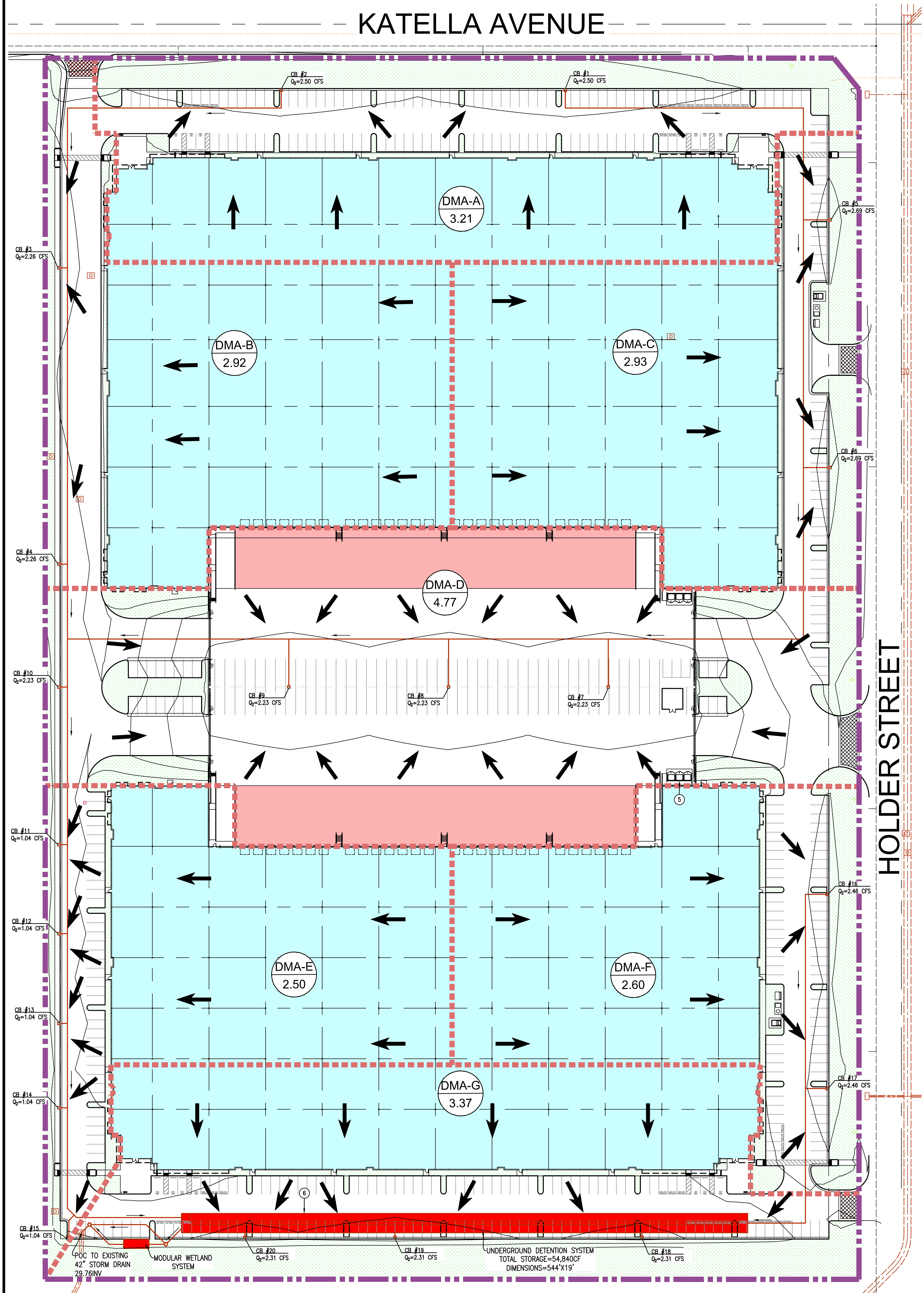
Duke-Weeks Job Number:

HPA Job Number:
19530

WQMP Exhibit

Map of Catch Basins with Filter Inserts

CITY OF CYPRESS
CATCH BASINS MAP



LEGEND:

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- STORM DRAIN
- LONGEST FLOW PATH
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- PROP. LID DEVICE
- A / X-XX — DRAINAGE SUB AREA DESIGNATION / AREA (AC)
- SURFACE FLOW DIRECTION
- STORM DRAIN FLOW DIRECTION

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	2.05" (2 YEAR)
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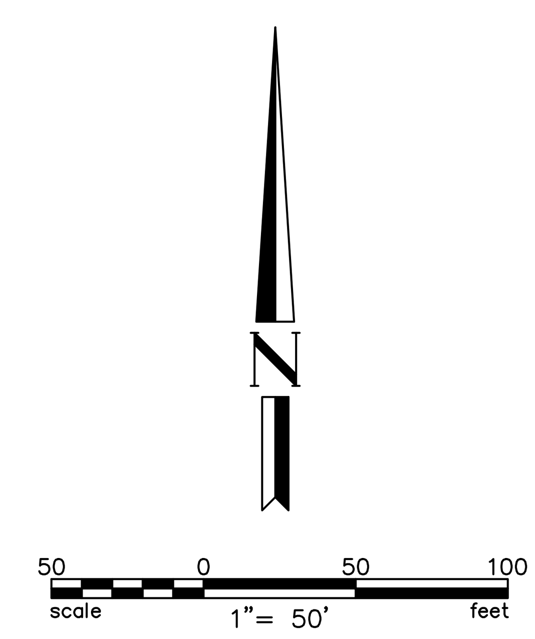
	85TH PERCENTILE
METHOD:	ORANGE COUNTY HYDROLOGY MANUAL



WQMP SUMMARY

DRAINAGE AREA No.	DRAINAGE SUB-AREA	BMP TYPE	TRIBUTARY AREA (SF)	TRIBUTARY AREA (AC)	IMPERVIOUS RATIO	REQUIRED DESIGN CAPTURE VOLUME (CF)	PROVIDED VOLUME (CF)
DA1	DMA-A	MODULAR WETLAND SYSTEM UNDERGROUND DETENTION SYSTEM	139,838	3.21	0.80	54,757	54,840 (UNDERGROUND DETENTION SYSTEM)
	DMA-B		127,357	2.92	0.94		
	DMA-C		127,691	2.93	0.88		
	DMA-D		207,784	4.77	0.89		
	DMA-E		108,881	2.50	0.92		
	DMA-F		113,140	2.60	0.86		
	DMA-G		146,939	3.37	0.76		

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JOB NO: 2018-131

KATELLA AVE INDUSTRIAL
CATCH BASINS MAP

CITY OF CYPRESS

DATE: MAR 2020