Appendix L

Low Impact Development Plan

Preliminary Low Impact Development Plan (PLID Plan)

Project Name:

SOUTH EL MONTE ATHLETIC FIELDS AND BUISINESS PARK

825 LEXINGTON-GALLATIN ROAD

SOUTH EL MONTE, CA 91733

Prepared for:

MAGELLAN VALUE PARTNERS, LLC.

10877 WILSHIRE BLVD SUITE 1407

LOS ANGELES, CA 90024

(310) 507-9791 Ext. 105

Prepared by:

KIMLEY-HORN & ASSOCIATES

180 E OCEAN BLVD SUITE 1200

LONG BEACH, CA 90802

(562) 549-2141

WDID#:

June 2025

PROJECT OWNER'S CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my jurisdiction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathered the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Owner's Name:	Rick Martinez		
Owner's Title:	Managing Director		
Company:	Magellan Value Partners, LLC.		
Address:	10877 Wilshire Blvd. Suite 1407 Los Angeles, CA 90024		
Email:	rmartinez@magellanvp.com		
Telephone No:	(310) 507 - 9791 Ext. 105		
Signature:		Date:	

PREPARER (ENGINEER) CERTIFICATION

Engineer's Name:	Hunter Starkey		
Engineer's Title:	P.E.		
Company:	Kimley-Horn & Associates		
Address:	180 E Ocean Blvd Suite 1200 Long Beach, CA 90802		
Email:	Hunter.Starkey@kimley-horn.com		
Telephone No:	(562) 549-2141		
I hereby certify that this Preliminary Low Impact Development Plan is in compliance with, and meets the requirements set forth in Order No. 2021-0105 of the Los Angeles Regional Water Quality Control Board.			
Engineer's Signature		Date	
Place Stamp Here			

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1. PROJECT DESCRIPTION

1.1. PROJECT CATEGORY

Check which box best represents the proposed project category.

REDEVELOPMENT PROJECTS. Complete this section if the project will redevelop an existing development.	
The redevelopment will **create and/or replace 5,000 square feet** or more of impervious surface and will be:	
1. a restaurant (SIC 5812)	Yes ☐
2. a parking lot	Yes ☐
3. an automotive service facility (SIC 5013, 5014, 5511, 5541, 7532-7534 and 7536-7539)	Yes ☐
4. a retail gasoline outlet	Yes ☐
5. on an existing site of 10,000 square feet or more of impervious surface area	Yes ☐
6. within an industrial park of 10,000 square feet or more of surface area	Yes ☐
7. within a commercial mall (including strip malls) of 10,000 square feet or more of surface area	Yes ☐
Or the redevelopment project will:	
8. create and/or replace 2,500 square feet or more of impervious area; discharge stormwater likely to impact sensitive biological species or habitat; and be in, directly adjacent to, or discharge directly to an ASBS[1] or "Sensitive Ecological Area"[2]	Yes ☐

NEW DEVELOPMENT PROJECTS. Complete this section if the existing project site is undeveloped.	
The new development project will:	
9. create 5,000 square feet or more of impervious surface and will be either a restaurant, parking lot, auto service facility (SIC 5013, 5014, 5511, 5541, 7532-7534 and 7536-7539), or retail gasoline outlet	Yes ☐
10. disturb 1 acre or more and add 10,000 square feet or more of impervious surface	Yes ☒
11. be an industrial park of 10,000 square feet or more of surface area	Yes ☒
12. be a commercial mall (including strip malls) of 10,000 square feet of surface area	Yes ☐
13. create 2,500 square feet or more of impervious area; discharge stormwater likely to impact sensitive biological species or habitat; and be in, directly adjacent to, or discharge directly to an ASBS[1] or "Sensitive Ecological Area"[2]	Yes ☐

[1] Areas of Special Biological Significance, as defined in the Water Quality Control Plan for Ocean Waters of California.
[2] As identified by the County of Los Angeles' Significant Ecological Areas Program (http://planning.lacounty.gov/site/sea/home/).

1.2. PROJECT DESCRIPTION

Total Project Area (ft^2): 920,858

Total Project Area (Ac): 21.14

EXISTING CONDITIONS

Condition	Area (ft^2)	Percentage (%)
Pervious Area:	911,650	99
Impervious Area:	9,208	1

PROPOSED CONDITIONS

Condition	Area (ft^2)	Percentage (%)
Pervious Area:	520,193	56
Impervious Area:	400,665	44

SITE CHARACTERISTICS

DRAINAGE PATTERNS/CONNECTIONS Include a detailed description of existing and proposed drainage patterns. Describe the areas and sub-areas (to include square footage), treatment locations, direction of flow through each area, discharge point(s), ultimate termination point, etc.	Existing: The 21.14-acre site is bound by Santa Anita Avenue to the North and West, US Army Corps Property to the East, Lexington-Gallatin Road to the South, and Santa Anita Avenue to the West, forming a rectangularly shaped project site. The existing project site is a vacant undeveloped lot within a US Army Corps flowage easement used for additional storage for the Whitter-Narrows dam. Most of the site is pervious with moderate slopes that generally run from southeast to northwest. During a storm event, water will flow in the northeasterly direction towards Santa Anita Avenue. The stormwater on-site will collect and eventually spill onto Santa Anita Avenue, finding its way into an existing public catch basin near the northeast corner of the site. The water then travels from that public system into the nearby Legg Lake. No stormwater quality improvements currently exist on the Site. LA County Flood Control District requires that the stormwater treatment requirement is the 85th Percentile Storm event.
	Proposed: The proposed site consists of roughly half of the lot (9.88 acres) being developed into an approximately 222,000-square-foot warehouse with a surrounding parking lot and truck court. The remaining area (11.26 acres) will be rough graded for the implementation of a future park as part of a later phase. The future park will largely remain as a grassy area that is

	pervious and self-treating. The future park development would need to determine LID requirements separately. Under the proposed conditions, the drainage pattern for the warehouse site will be modified to convey sheet flow away from the building to various catch basins throughout the business park portion of the site. Although the drainage pattern changes in the proposed condition, project site flow ultimately discharges into the neighboring future park to the North as it did in the existing condition. An underground storm drain system will connect a network of surface inlets for the warehouse drainage. During the peak storm event, onsite flow will be conveyed to a detention system on the North-west side of the business park portion of the site prior to discharging through a headwall that will travel through the future park as it did in the existing condition via a earthen channel. This stormwater will travel through the park to a new headwall near Santa Anita Avenue that will connect to an existing 90-inch pipe maintained by LA County Flood Control District. Project stormwater will be kept separate from the future park's stormwater flow to the maximum extent practicable. Before the stormwater enters the future park, proposed proprietary biotreatment devices, WetlandMODs (or approved equal), will treat the 85th percentile storm event as required by the County. Treatment Volume will then make its way to a site detention system due to flow requirements set by LA County Flood Control district. See separate Hydrology and Hydraulics report for more details. Any runoff greater than the treatment capacity of the WetlandMODs (or approved equal) will bypass the structure and continue straight to the detention system. The high-event storms will discharge into the proposed future park and will flow through a dedicated earthen channel that is isolated from the remaining future park. Eventually the channel will guide stormwater from the proposed industrial warehouse to the proposed 90" RCP-designed headwall and lateral. The underlying soils have poor infiltration rates, and the project site is located within a liquefaction zone, therefore infiltration BMPs are not feasible. Refer to Appendix E for the project's LID Exhibit and Treatment Control BMP Detail Sheets.
NARRATIVE PROJECT DESCRIPTION: Include a detailed description of project areas, type of facilities, activities conducted onsite, materials and products received and stored on site, SIC Code (if applicable), land uses, land cover, design elements, drainage management areas (DMAs), etc.	the project involves the development of a vacant property, with half of the site being devoted to a new warehouse building and surrounding parking lot. The other half will be rough graded for the implementation of a future public park as part of a later phase.

OFFSITE RUNON Describe any offsite runon anticipated and how the runon will be either accounted for in LID BMP sizing or directed around the site.	Flow from adjacent streets is either conveyed to the public storm drain system through gutters that run along to street or sheet flows directly into the Whittier Narrows park located west of the site. This helps to prevent discharge into the project site. Onsite run on is expected to occur from neighboring properties to the southeast and east. These flows will be directed in a swale and rerouted around the future park to the ultimate discharge location of the existing 90-inch pipe.
UTILITY AND INFRASTRUCTURE INFORMATION Include a description of the existing and proposed onsite utility and infrastructure. Evaluate the potential impacts of stormwater infiltration on subsurface utilities, establish necessary setbacks, and if the utilities need to be relocated. Retention-based stormwater quality control measures should not be located near utility lines where an increased volume of water could damage utilities.	Stormwater quality control measures are not anticipated to conflict with proposed and/or existing utilities. There is no existing public storm drain infrastructure on site. Proposed conditions will mimic existing drainage patterns with the site draining to the northwest corner. A new storm drain connection will be added along the existing 90" RCP pipe owned and maintained by LACFCD.
SIGNIFICANT ECOLOGICAL AREAS (SEAS) Identify any known Significant Ecological Area (SEA) which the project is located in or directly adjacent to, or discharging directly to.	N/A

1.3. HYDROMODIFICATION ANALYSIS

Check "Yes" or "No," as applicable.

DOES THE PROPOSED PROJECT FALL INTO ONE OF THE FOLLOWING CATEGORIES?	YES	NO
1. *Project is a redevelopment that decreases the effective impervious area compared to the pre-project conditions.*	☐	☒
Describe: Effective impervious area increases compared to pre-project conditions. Existing condition area is 1% impervious while proposed condition is 18% impervious.		
2. *Project is a redevelopment that increases the infiltration capacity of pervious areas compared to the pre-project conditions.*	☐	☒
Describe: The LID manual outlines Implement LID and maximize in priority order: 1. Infiltrate 2. Capture and Use 3. High efficiency Bio-Filtration/Retention System BMP 4. Combination of above The highest level on the priority list is to use Infiltration unless it is technically infeasible to do so. In this case, infiltration cannot be accomplished due to low infiltration rates obtained from the geotechnical recommendations found in Appendix B. In lieu of infiltration, Biofiltration is proposed to treat the 85th percentile storm event.		
3. *Project discharges directly or via a storm drain to a sump, lake, area under tidal influence, into a waterway that has a 100-year peak flow (Q_{100}) of 25,000 cfs or more.*	☐	☒
Describe:		
4. *Project discharges directly or via a storm drain into concrete or otherwise engineered (not natural) channels (e.g., channelized or armored with rip rap, shotcrete, etc.), which, in turn, discharges into receiving water that is not susceptible to hydromodification impacts.*	☒	☐
Describe: The project discharges directly into a 90" RCP pipe owned and maintained by LACFCD.		

Project is exempt from Hydromodification Control Measures.

1.4. PROPERTY OWNERSHIP/MANAGEMENT

Describe ownership of all portions of project and site. Include information on if any infrastructure transfer to public agencies (City, County, Caltrans, etc.). Describe any property management company/association that will be formed. Include leasee information, as applicable.	No infrastructure is required to be transferred to public agencies currently. There are no street, road, or highway projects that are planned and constructed as part of this WQMP. Property Owner Information Name: Rick Martinez Company: Magellan Value Partners, LLC. Email: rmartinez@magellanvp.com

2. BEST MANAGEMENT PRACTICES (BMPS)

2.1. SITE DESIGN

85TH PERCENTILE, 24-HOUR STORM DEPTH Determined from the Los Angeles County 85th percentile precipitation isohyetal map. If less than 0.75-inch, state as such and use 0.75-inch throughout.	0.95 inch
SITE DESIGN Describe site design and drainage plan including site design practices utilized and how BMPs are incorporated using the appropriate hierarchy.	Careful consideration of site design is a critical first step in stormwater pollution prevention from new developments and redevelopments. The following Low Impact Development site design BMPs were used in this project: - Conserve natural areas by protecting the neighboring park. - Soil compaction will be limited to the project limits. Infiltration has been determined to be infeasible for this project due to a high groundwater level. The project is also located within a liquefaction zone which also deems infiltration infeasible. An underground storm drain system consisting of catch basins and piping will be used to convey water around the site to the west portion of the property. Water will be directed to the concrete lined storm drain system owned by the LACFCD. In the existing condition, no stormwater quality improvements exist on site. LA County Flood Control district requires stormwater treatment for the 85th percentile storm event.

2.2. BMP LIST

Fill out the table below with information on the BMPs proposed in each Drainage Management Area (DMA).

DMA DESIGNATION	DMA SQUARE FOOTAGE (sf)	IMPERVIOUSNESS OF DMA (%)	STORM WATER QUALITY DESIGN VOLUME (SWQDV, cf)	1.5 X SWQDV (cf) [Only applicable for biofiltration]	BMP TYPE [Include make & model if proprietary]	MINIMUM BMP SIZE REQUIRED (sf)	BMP SIZE PROPOSED (sf)	BMP VOLUME CAPACITY (cf)	GPS COORDINATES [At least 6 decimal points]
1A	197,762	91	14,963	22,444	WetlandMOD 11-19-5-V	N/A	209	23,790	34.0363, 118.0524
1B	232.610	96	13,336	20,003	WetlandMOD 11-17-5-V	N/A	187	20,620	34.0386, 118.0519
2	480,486	0	Self-treating	Self-treating	Self-treating	N/A	N/A	N/A	N/A

2.3. BMP SELECTION

2.3.1. INFILTRATION BMPS

NAME	INCLUDED Check all that apply
Bioretention without underdrains	☐
Drywell	☐
Infiltration Basin	☐
Infiltration Trench	☐
Permeable Pavement	☐
Proprietary Subsurface Infiltration Gallery	☐
Other:	☐
Other:	☐

DESCRIPTION Describe Infiltration BMPs. Include descriptions on selection, sizing, and feasibility, as applicable. If infiltration is infeasible, provide brief explanation, including reference to the geotechnical report.	Infiltration has been determined to be infeasible for this project due to a high groundwater level. The project is also located within a liquefaction zone.
CALCULATIONS Show calculations to demonstrate that the Storm Water Quality Design volume can be met with Infiltration BMPs.	N/A

2.3.2. RAINWATER HARVEST AND USE BMPS

NAME	INCLUDED Check all that apply
Above-ground cisterns	☐
Underground detention	☐
Other:	☐
Other:	☐
Other:	☐

DESCRIPTION Describe Rainwater Harvest and Use BMPs. Include descriptions on selection, suitability, sizing, and infeasibility, as applicable.	Rainwater harvesting was deemed infeasible for the business park as there was not sufficient landscaping to clear out the required detention in 48Hrs. The future park's LID requirements were not incorporated as part of these studies. That development will be separate by the City of South El Monte as the Park will be dedicated for the city's use through an easement/agreement with the owner and the city.
CALCULATIONS Show calculations to demonstrate if the Storm Water Quality Design volume can be met with Rainwater Harvest and Use BMPs. If not, document how much can be met with Rainwater Harvest and Use and why it is not feasible to meet the full volume with Rainwater Harvest and Use BMPs.	

2.3.3. ALTERNATIVE COMPLIANCE BMPS

BIOFILTRATION BMPS

(If Infiltration BMPs and Rainwater Harvest and Use BMPs are Infeasible)

NAME	INCLUDED Check all that apply
Bioretention with underdrains	☐
Planter Box with underdrains	☐
Vegetated Swale	☐
Other: WetlandMOD Proprietary Biofiltration BMP	☒
Other:	☐

DESCRIPTION If the full Design Storm Capture Volume cannot be met with Infiltration BMPs, and/or Rainwater Harvest and Use BMPs, describe Biofiltration BMPs. Include descriptions on selection, suitability, sizing, and infeasibility, as applicable.	The WetlandMOD stormwater biofiltration system will provide treatment of stormwater runoff. Additional source control BMPs will further minimize pollutants of concern. The stormwater collection and treatment system consist of 1600 LF of 5' diameter CMP detention tanks (or approved equal), one Bioclean WetlandMOD 11-19-5-V, and one Bioclean WetlandMOD 11-17-5-V. Water enters the detention chamber through the on-site inlets and is routed to the underground detention system. Then the stormwater is pumped into the WetlandMOD system for treatment and then spills to grade where it eventually sheetflows to the west to a concrete lined storm drain system owned by the LACFCD. The WetlandMODs consist of a manufactured planter box with engineering soil, media, planting, and an underdrain. The engineered soil is per the LA County Manual Attachment H specified media. The system has been sized for a 96-hour drawdown time. Since the inlet orifice has been sized to treat the 85th percentile storm, during a larger storm event, stormwater will not be allowed to enter the system and will be routed to a detention CMP tank. Flows will be restricted to meet the LACFCD Qallowable into the 90" RCP pipe located northwest of the site within the proposed future park area.
CALCULATIONS	Calculations were done through Hydrocalc 1.0.3. The stormwater quality design volume (SWQDv) was calculated using the 85th percentile, 24-hour rain event as the design storm. See Attachment A: Calculations.

2.3.4. TREATMENT CONTROL BMPS

Treatment control BMPs can only be used as pre-treatment to LID BMPs.

NAME	INCLUDED Check all that apply
Filter Insert	☒
Hydrodynamic Separator	☐
Media Filter	☐
Other:	☐
Other:	☐

DESCRIPTION Include descriptions on selection, suitability, sizing, and infeasibility, as applicable.	Catch basin insert filters will be installed on all catch basins onsite to pre-treat storm water prior to entering the underground infiltration system.

2.3.5. NON-STRUCTURAL SOURCE CONTROL BMPS

NAME	CHECK ONE	
	Included	**Not Applicable**
Education for Property Owners, Tenants and Occupants	☒	☐
Activity Restrictions	☒	☐
Common Area Landscape Management	☒	☐
Common Area Litter Control	☒	☐
Housekeeping of Loading Docks	☒	☐
Common Area Catch Basin Inspection	☒	☐
Street Sweeping Private Streets and Parking Lots	☒	☐

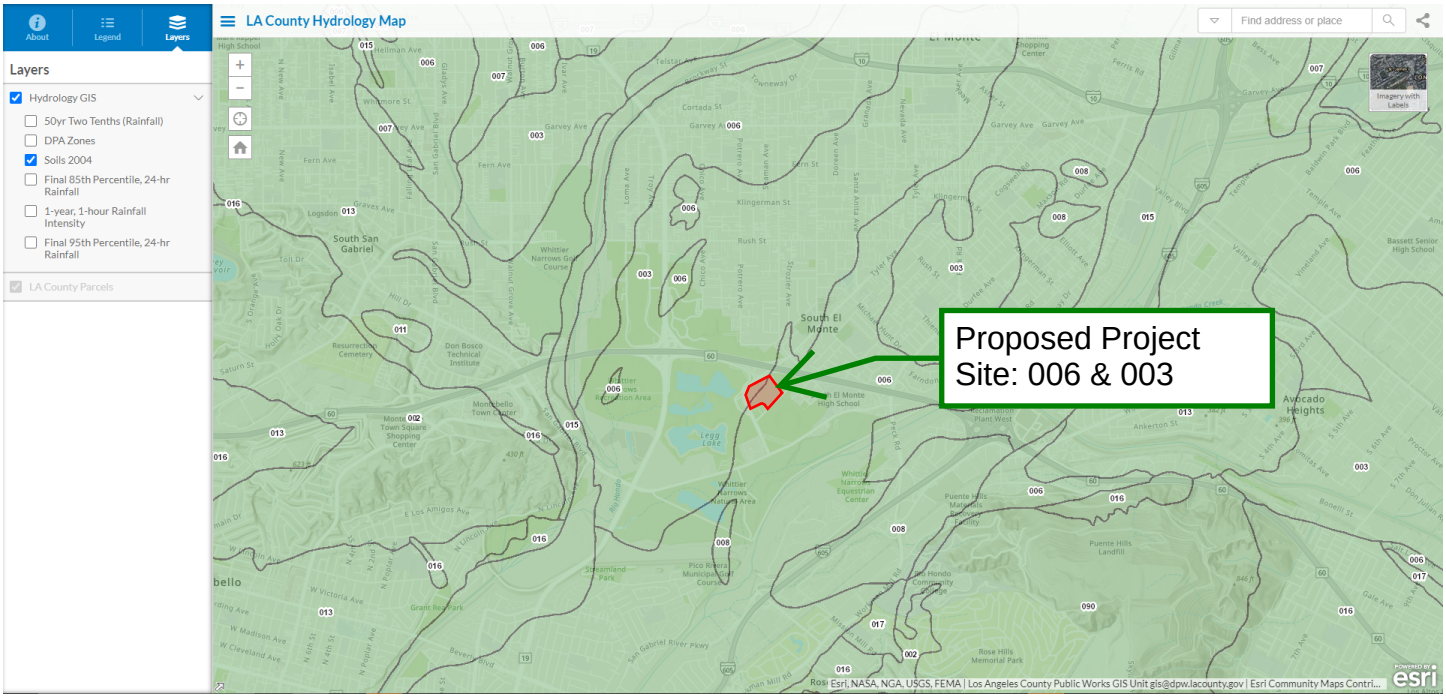
2.3.6. STRUCTURAL SOURCE CONTROL BMPS

NAME	CHECK ONE	
	Included	**Not Applicable**
Provide storm drain system stenciling and signage	☒	☐
Design and construct outdoor material storage areas to reduce pollution introduction	☒	☐
Design and construct trash and waste storage areas to reduce pollution introduction	☒	☐
Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐
Protect slopes and channels and provide energy dissipation	☐	☒
Loading docks	☐	☒
Maintenance bays	☐	☒
Vehicle wash areas	☐	☒
Outdoor processing areas	☐	☒
Equipment wash areas/racks	☐	☒
Fueling areas	☐	☒
Hillside landscaping	☐	☒

ATTACHMENT A: CALCULATIONS

Include calculations for each BMP following an approved published design standard (e.g., City LID Manual or County LID Manual). Calculations must be followed step-by-step with no alterations. Also, include an excerpt from the design standard used.

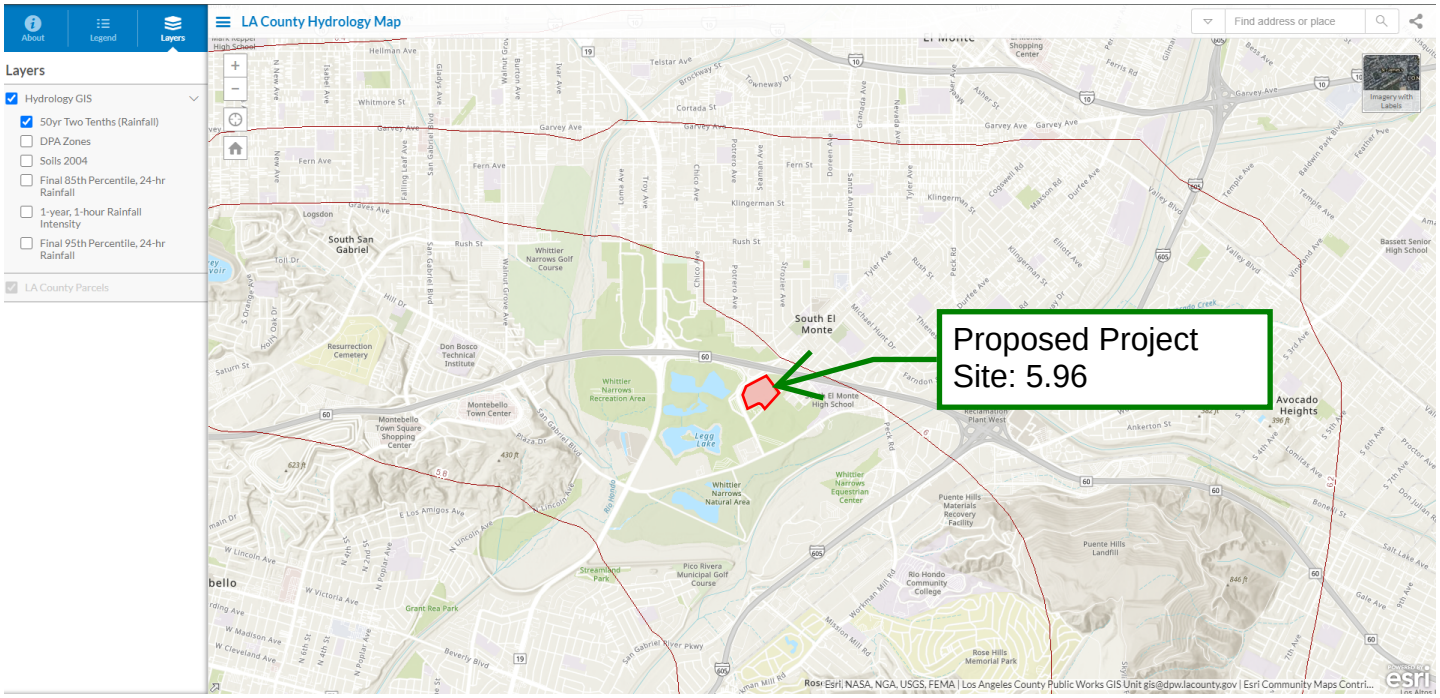
LA County Hydrology GIS Map
Soil Type



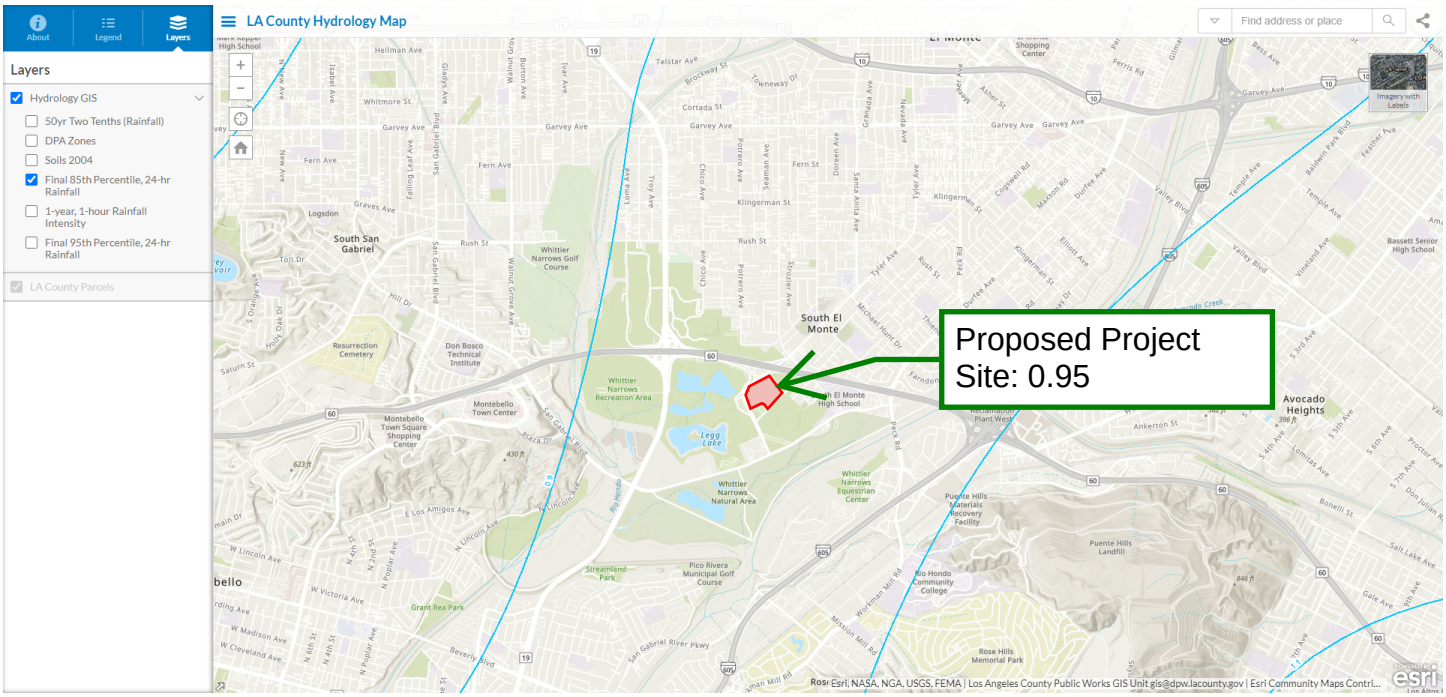
Soil 003 - Chino Silt Loam
(Original Name: CS-1)

Soil 006 - Hanford Fine Sandy Loam
(Original Name: HF-1)

LA County Hydrology GIS Map
50-Year Depths



LA County Hydrology GIS Map
85th Percentile Depths



Peak Flow Hydrologic Analysis

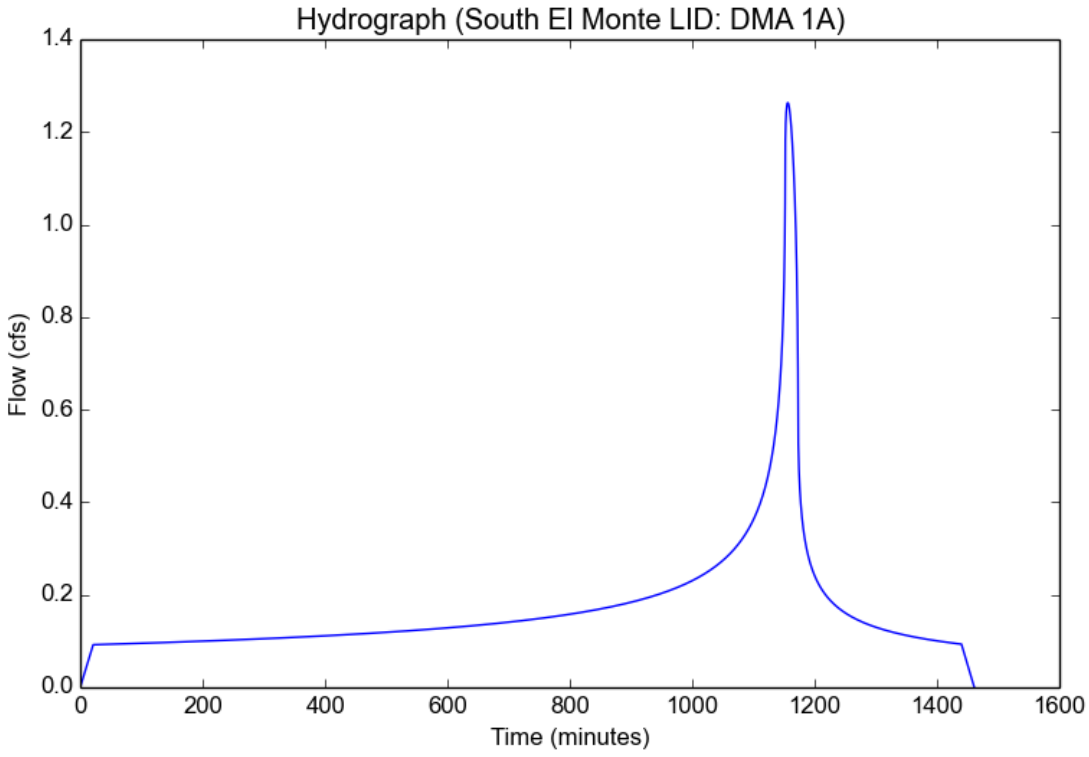
File location: K:/ORA_LDEV/194550001 - Whittier Narrows - South El Monte - Lexington Rd/Reports/LID/Calculations/hydrocalc/South El Monte LID - DM
Version: HydroCalc 1.0.3

Input Parameters

Project Name	South El Monte LID
Subarea ID	DMA 1A
Area (ac)	5.34
Flow Path Length (ft)	375.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	0.94
Percent Impervious	0.91
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.94
Peak Intensity (in/hr)	0.2857
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.828
Time of Concentration (min)	21.0
Clear Peak Flow Rate (cfs)	1.2632
Burned Peak Flow Rate (cfs)	1.2632
24-Hr Clear Runoff Volume (ac-ft)	0.3435
24-Hr Clear Runoff Volume (cu-ft)	14962.5074



Peak Flow Hydrologic Analysis

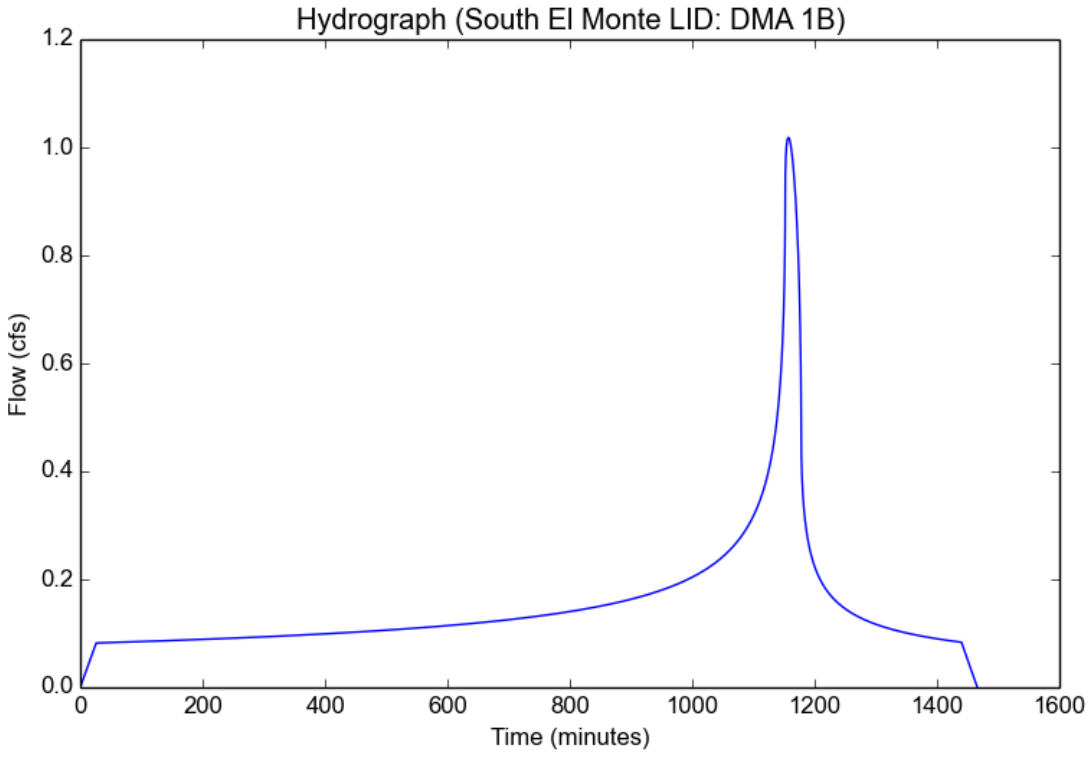
File location: K:/ORA_LDEV/194550001 - Whittier Narrows - South El Monte - Lexington Rd/Reports/LID/Calculations/hydrocalc/South El Monte LID - DM
Version: HydroCalc 1.0.3

Input Parameters

Project Name	South El Monte LID
Subarea ID	DMA 1B
Area (ac)	4.54
Flow Path Length (ft)	442.0
Flow Path Slope (vft/hft)	0.005
85th Percentile Rainfall Depth (in)	0.94
Percent Impervious	0.96
Soil Type	6
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.94
Peak Intensity (in/hr)	0.2584
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.868
Time of Concentration (min)	26.0
Clear Peak Flow Rate (cfs)	1.0183
Burned Peak Flow Rate (cfs)	1.0183
24-Hr Clear Runoff Volume (ac-ft)	0.3061
24-Hr Clear Runoff Volume (cu-ft)	13335.5112



Step 1: Calculate the design volume

Biofiltration areas should be sized to capture and treat 1.5 times the portion of the SWQDv (see Section 6 for SWQDv calculation procedures) that is not reliability retained on the project site, as calculated by the equation below:

$$V_B = 1.5 \times (SWQDv - V_R)$$

Where:

V_B = Biofiltration volume [ft^3];
SWQDv = Stormwater quality design volume [ft^3]; and
V_R = Volume of stormwater runoff reliably retained on-site [ft^3].

Step 2: Calculate the design infiltration rate

Determine the corrected in-situ infiltration rate (f_{design}) of the native soil using the procedures described in the most recent GMED Policy GS 200.1.

Step 3: Calculate the surface area

Select a surface ponding depth (d) that satisfies the geometric criteria and meets the site constraints. Selecting a deeper ponding depth (up to 1.5 ft) generally yields a smaller footprint, however, it will require greater consideration for public safety, energy dissipation, and plant selection.

Calculate the time for the selected ponding depth to filter through the planting media using the following equation:

REMAINDER IS NOT APPLICABLE AS A APPROVED LA COUNTY PROPRIETARY BIOFILTRATION DEVICE IS BEING USED. CALCULATIONS FOR DEVICE TO BE PROVIDED IN PRECISE GRADING PHASE OF PROJECT

Where:

d = P
t_p = R x 96 hr) [hr]; and
f_{design} = Design infiltration rate [in/hr].

If t_p exceeds 96 hours, reduce surface ponding depth (d). In nearly all cases, t_p should not approach 96 hours unless f_{design} is low.

Calculate the required infiltrating surface (filter bottom area) using the following equation:

$$A = \frac{V_B}{d}$$

Where:

Hydro Calc Inputs								Hydro Calc Outputs	Required Treatment Volume	Provided Volume	
DMA	AREA	FLOW PATH	FLOW SLOPE	85TH DEPTH	LS Area	IMPERV.	SOIL	HYDRO CALC 24 SWQDv (CU-FT)	Vb=1.5*SWQDv (CU-FT)	Contech Wetland Mod Size	Wetland Capcity (CU-FT)
1A	5.34	375	0.01	0.94	0.48	0.91	6*	14,963	22,444	WM-11-19	23,790
1B	4.54	442	0.005	0.94	0.20	0.96	6*	13,336	20,003	WM-11-17	20,620

* A soil type 6 was used due to it producing a more conservative value

ATTACHMENT B: GEOTECHNICAL INVESTIGATION

Include all geotechnical documents relevant to infiltration feasibility (i.e., Geotechnical Report, Soils Report, Percolation Report, Soils Letter, etc.). The document(s) must detail the results of the soil investigation, the infiltration rate, groundwater depths, soil characterization, etc. Note that soil borings must be conducted in the area of the proposed BMPs.

GEOTECHNICAL INVESTIGATION
PROPOSED WAREHOUSE

825 Lexington-Gallatin Road
El Monte, California
for
Magellan Value Partners, LLC

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

May 16, 2023

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Magellan Value Partners, LLC
1900 Avenue of the Stars, Suite 2470
Los Angeles, CA 90067

Attention: Mr. Somy Mukherjee
Managing Director

Project No.: **23G130-1**

Subject: **Geotechnical Investigation**
Proposed Warehouse
825 Lexington-Gallatin Road
El Monte, California

Mr. Mukherjee:

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.

Joseph Lozano Leon
Staff Engineer

Daniel W. Nielsen, GE 3166
Senior Engineer

Robert G. Trazo, GE 2655
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER ROBERT TRAZO No. 2655 GEOTECHNICAL STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER DANIEL W. NIELSEN No. 3166 GEOTECHNICAL STATE OF CALIFORNIA

Distribution: (1) Addressee

TABLE OF CONTENTS

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 subject site is located within an area mapped as a liquefaction hazard zone by the state of California.
- Four (4) Cone Penetration Test (CPT) soundings were advanced to depths of 39 to 50± feet at the site as part of our site-specific liquefaction evaluation, supplemented by (2) two 50±-foot-deep borings. Potentially liquefiable soils were encountered at all of the CPT locations.
- The historic high groundwater depth for this site is 2 feet below the ground surface, based on maps published by the state of California. The liquefaction evaluation has identified potentially liquefiable soil layers located at various depths between 2 and 50± feet below the existing site grades.
- The potential liquefaction-induced settlements at the CPT locations range between 3.64 and 5.37± inches. Based on the presence of potentially liquefiable shallow soil layers, some mitigation of the potentially liquefiable soils will be necessary in order to support the proposed structure on conventional shallow foundations. The consequences of liquefaction occurring in shallow soil layers that are influenced by foundations can include excessive settlements and loss of bearing capacity.
- All of the borings encountered artificial fill soils, extending to depths of 2½ to 5½± feet below the finished surface of the existing site grades. The fill soils possess variable strengths and compositions, and are not considered suitable, in their present condition, to support the foundations of the proposed building. The fill soils are underlain by native alluvium consisting of variable strengths silty sands, sandy silts, and sands within the upper 8½ to 22± feet from the ground surface. Two of the borings encountered a stratum consisting of loose sands at depths of 8½ and 9± feet.
- Remedial grading is recommended to remove the undocumented artificial fill soils and a portion of the near-surface alluvial soils from the proposed building pad area. The depth of overexcavation discussed below, should be sufficient to remove any soils disturbed during stripping and demolition and to remove the potentially liquefiable soils from within the foundation influence zones. The overexcavation and recompaction of these soils as structural fill will provide more consistent support characteristics for the proposed structure and help to mitigate against potential surface manifestations due to liquefaction.

Site Preparation

- The proposed development will require demolition of the remnants of previous structures still present within the subject site. Additionally, any existing improvements that will not remain in place for use with the new development should be removed in their entirety.
- Initial site preparation should include stripping of any surficial vegetation. The surficial vegetation, and any organic soils should be properly disposed of off-site.
- Remedial grading is recommended to be performed within the new building pad area to remove the existing fill soils in their entirety and to remove most of the potentially liquefiable soils from with the foundation influence zones of the new foundations. Additionally, the

overexcavation should extend to a depth of 9 feet below existing grade and to a depth of at least 9 feet below proposed pad grade, whichever is greater, and in foundation areas to a depth equal to at least 2 times the footing width below the foundation bearing grades.

- The overexcavation areas should extend at least 5 feet beyond the building and foundation perimeters, and to an extent equal to the depth of fill placed below the foundation bearing grade, whichever is greater.
- 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.
- 3,000 lbs/ft^2 maximum allowable soil bearing pressure.
- Reinforcement consisting of at least six (6) No. 5 rebars (3 top and 3 bottom) in strip footings, due to the presence of potentially 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.
- Minimum slab reinforcement: Reinforcement of the floor slab should consist of No. 3 bars at 18-inches on center in both directions due to the presence of potentially liquefiable soils. The actual floor slab reinforcement should be determined by the structural engineer, based upon the imposed loading.

Pavements

ASPHALT PAVEMENTS (R=30)					
Materials	**Thickness (inches)**				
	Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic			
		TI = 6.0	TI = 7.0	TI = 8.0	TI = 9.0
Asphalt Concrete	3	3½	4	5	5½
Aggregate Base	6	8	10	11	13
Compacted Subgrade	12	12	12	12	12

PORTLAND CEMENT CONCRETE PAVEMENTS (R = 30)				
Materials	**Thickness (inches)**			
	Autos and Light Truck Traffic (TI = 6.0)	Truck Traffic		
		TI = 7.0	TI = 8.0	TI = 9.0
PCC	5	5½	6½	8
Compacted Subgrade (95% minimum compaction)	12	12	12	12

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in accordance with our Proposal No. 23P163 dated February 22, 2023. 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 slab, 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 on the northwest side of Lexington-Gallatin Road, approximately 625 feet northeast of Santa Anita Avenue in El Monte, California. The site is referenced by the street address of 825 Lexington-Gallatin Road. The site is bounded to the north and northwest by Santa Anita Avenue, to the south by a Southern California Municipal Athletic institute, to the east by Lexington-Gallatin Road, and to the northeast by a construction yard. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 in Appendix A of this report.

The site consists of several irregular-shaped parcels, 23± acres in size. The majority of the site is vacant and undeveloped. Remnants of a previously existing structure, such as a 2,300± ft^2 building including a concrete floor slab and surrounding concrete flatwork, are located in the south-central area of the site. The ground surface cover throughout the site consists of native grass and weed growth with areas of exposed soil. Based on our review of readily available historical aerial photographs from https://www.historicaerials.com/viewer#, previous radio towers were located in the central area of the project site. The previous towers were generally demolished between the years of 1972 and 1980. Few remnants of the previous towers, what appear to be column footings or pile caps, are still present in isolated areas of the site.

Detailed topographic information was obtained from the project conceptual grading plan prepared by Kimley-Horn and Associates, Inc. Based on this plan, the site topography generally ranges from 219± feet mean sea level (msl) in the west corner of the site to 226± feet msl in the eastern corner. The site topography slopes downward to the west at a gradient of less than 1 percent.

3.2 Proposed Development

The conceptual grading plan for the proposed development was provided to our office by the client. Based on this plan, the subject site will be developed with a 208,205± ft^2 warehouse, located in the eastern area of the site. Dock-high doors will be constructed along a portion of the southeast building wall. The proposed building is expected to be surrounded by asphaltic concrete (AC) pavements in the parking and drive areas, Portland cement concrete (PCC) pavements pavements in the loading dock area, and concrete flatwork and landscaped planters throughout the site. The proposed development will include a 6-to-12-foot-high retention basin located in the western area of the site. This basin will be surrounded by 2.5h:1v (horizontal to vertical) to 3h:1v earthen slopes. We expect that the proposed retention basin will be used for storage only based on the presence of shallow historic groundwater in this area as discussed in the subsequent section of this report.

Detailed structural information has not been provided. It is assumed that the new building will be a single-story structure of tilt-up concrete construction, typically supported on conventional shallow foundations with a concrete slab-on-grade floor. 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 crawl spaces or new basements, will be included in the proposed development. Based on the conceptual grading plan, fills of 3½ to 8± feet are expected to be necessary to achieve the expected building pad grade of 228± ft msl. Cuts of up to 10± feet will be required to reach the basin bottom of 213± ft msl.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of eight (8) borings (identified as Boring Nos. B-1 through B-8) advanced to depths of 10 to 50± feet below presently existing site grades. All of the borings were logged during drilling by a member of our staff. In addition to the borings, four (4) Cone Penetration Test (CPT) soundings (identified as CPT-1 through CPT-4) were advanced to depths of 39 to 50± feet at the site as part of the liquefaction evaluation. It should be noted that CPT-1, CPT-3 and CPT-4 were terminated at depths shallower than 50 feet due to refusal on very dense soil.

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 soil 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. Standard penetration test (SPT) 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 observation of one our geologist. 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 30-ton CPT rig. The cones used during the program recorded the cone resistance, sleeve friction, and dynamic core pressure at 2.5-centimeter depth intervals. The CPT soundings were expected to advance to depths of 50± feet. As previously indicated, CPT-1, CPT-3 and CPT-4 were terminated at depths shallower than 50 feet due to refusal on very dense soil. A more complete description of the CPT program as well as the results of the data interpretation prepared by KTE are 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 raw data generated by the cone penetrometer equipment has been reduced using CPeT-IT, V.2.3.1.9, 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

Topsoil/Rootmat

All of the borings encountered a surficial layer of topsoil, extending to a depth of 2± inches below the ground surface.

Artificial Fill

Artificial fill soils were encountered at the ground surface at all of the boring locations, extending to depths of 2½ to 5½± feet below the existing site grades. The fill soils generally consist of very loose to loose sandy silts with varying clay content and occasional silty sands. The fill soils possess a mottled and disturbed appearance resulting in their classification as artificial fill.

Alluvium

Native alluvial soils were encountered beneath the fill soils at all of the boring locations. The near-surface alluvial soils within the upper 8½ to 22± feet from the ground surface generally consist of loose to medium dense silty sands, sandy silts, and sands with varying clay, silt and fine gravel content. At greater depths and extending to the maximum depths explored of 50± feet below the existing grades, the alluvium generally consists of medium dense to very dense sandy silts, silty sands and sands with varying fine gravel content. Boring No. B-1 encountered a stratum consisting of very dense gravelly sands at a depth of 48½± feet. Boring Nos. B-3 and B-6 encountered a stratum consisting of loose sands at a depth of 9 and 8½± feet, respectively. Boring No. B-4 encountered a stratum consisting of medium dense silts with little clay and fine sand content at a depth of 33½± feet.

Groundwater

Free water was encountered at Boring Nos. B-1 and B-4 at depths of 33½ and 38½± feet below existing site grades, respectively. Up to 45 minutes after the completion of drilling, the water levels were measured within the inside of the hollow stem augers. Based on the conditions encountered during drilling, the static groundwater is considered to have existed at a depth of 33½ and 38½± feet at the time of the subsurface exploration. In addition, two (2) pore pressure dissipation tests were taken at CPT-1 and CPT-4. Based on the test results, ground water levels of 33½ and 30± feet (below the ground surface) were correlated at CPT-1 and CPT-4, respectively.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. One reference used to determine the historic groundwater depths in this area is the California Geological Survey (CGS) Open File Report 98-15, from the Seismic Hazard Zone Report for the El Monte 7.5-Minute Quadrangle, Los Angeles County, California (SHZR 024), which indicates that the historic high groundwater level for the site is 2± feet below the ground surface.

We also attempted to determine more recent high groundwater levels near the vicinity of the site using readily available well data from the California Department of Water Resources, Water Data Library Station Map, website, https://wdl.water.ca.gov/waterdatalibrary/. One monitoring well on record (identified as Local Well Name: BIG RED) is located as close as 2,350 feet southeast of the site. Water level readings within this monitoring well indicate a high groundwater level of 19± feet below the ground surface in January 2012.

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

Recovered soil samples were classified using the Unified Soil Classification System (USCS), in accordance with ASTM D-2488. 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.

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-3 in Appendix C of this report.

Maximum Dry Density and Optimum Moisture Content

A representative bulk sample has been tested for its maximum dry density and optimum moisture content. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557 and are presented on Plate C-4 in Appendix C of this report. This test is generally used to compare the in-situ densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil types or soil mixes may be necessary at a later date.

Direct Shear

Direct shear tests were performed on representative samples of the near-surface soils to determine its shear strength parameters in accordance with ASTM D-3080. The testing apparatus is designed to accept either natural or remolded samples in a one-inch high ring, approximately 2.416 inches in diameter. For tests on remolded soils, three samples of the same soil are prepared

by remolding them to 90± percent compaction and near optimum moisture. Each of the three samples are then loaded with different normal loads and the resulting shear strength is determined for that particular normal load. The shearing of the samples is performed at a rate slow enough to permit the dissipation of excess pore water pressure. Porous stones are in contact with the top and bottom of the sample to permit the addition or release of pore water. The results of the direct shear test are presented on Plate C-5 in Appendix C of this report.

Expansion Index (EI)

The expansion potential of the on-site soils was determined in general accordance with ASTM D-4829. 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-3 @ 1 to 5 feet	5	Very Low
B-4 @ 1 to 5 feet	1	Very Low

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-2 @ 1 to 5 feet	0.0038	Not Applicable	S0
B-3 @ 1 to 5 feet	0.0021	Not Applicable	S0

Corrosivity Testing

Representative bulk samples of the near-surface soils were submitted to a subcontracted corrosion engineering 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 some of these tests are presented below.

Sample Identification	Saturated Resistivity (ohm-cm)	pH	Chlorides (mg/kg)	Nitrates (mg/kg)	Sulfides (mg/kg)	Redox Potential (mV)
B-2 @ 1 to 5 feet	6,499	7.9	22.9	36.0	0.2	151
B-3 @ 1 to 5 feet	7,370	8.0	10.3	26.9	0.2	161

Grain Size Analysis

Limited grain size analyses have been performed on selected samples, in accordance with ASTM D-1140. These samples were washed over a #200 sieve to evaluate the percentage of fine-grained material in each sample, which is defined as the material which passes the #200 sieve. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these laboratory tests are shown on the attached boring logs.

Atterberg Limits

Atterberg Limits testing (ASTM D-4318) was performed on a selected sample encountered at the site. This test is used to determine the Liquid Limit and Plastic Limit of the soil. The Plasticity Index (PI) is the difference between the two limits. Plasticity Index is a general indicator of the expansive potential of the soil, with higher numbers indicating higher expansive potential. Soils with a PI greater than 25 are considered to have a high plasticity, and a high expansion potential. Soils with a PI greater than 18 are not considered to be susceptible to liquefaction. Soils with a PI between 12 and 18 may possess a moderate susceptibility to liquefaction. The result of the Atterberg Limits testing is presented on the log for Boring No. B-4.

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 structure 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, lateral spreading, tsunamis, inundation, seiches, flooding, and subsidence affecting the site is considered low.

Seismic Design Parameters

The 2022 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 the adoption of the 2022 CBC on January 1, 2023, we expect that the proposed development will be designed in accordance with the 2022 CBC.

The 2022 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 7-16, upon which the 2022 CBC is based. 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 table below was created using data obtained from the application. The output generated from this program is attached to this letter.

The 2022 CBC states that for Site Class D sites with a mapped S1 value greater than 0.2, a site-specific ground motion analysis may be required in accordance with Section 11.4.8 of ASCE 7-16. Supplement 3 to ASCE 7-16, modifies Section 11.4.8 of ASCE 7-16 and states that "a ground motion hazard analysis is not required where the value of the parameter SM1 determined by Eq. (11.4-2) is increased by 50% for all applications of SM1 in this Standard. The resulting value of the parameter SD1 determined by Eq. (11.4-4) shall be used for all applications of SD1 in this Standard."

The seismic design parameters presented in the table below were calculated using the site coefficients (Fa and Fv) from Tables 1613.2.3(1) and 1613.2.3(2) presented in Section 16.4.4 of the 2022 CBC. It should be noted that the site coefficient Fv and the parameters SM1 and SD1 were not included in the SEAOC/OSHPD Seismic Design Maps Tool output for the ASCE 7-16 standard. We calculated these parameters-based on Table 1613.2.3(2) in Section 16.4.4 of the 2022 CBC using the value of S1 obtained from the Seismic Design Maps Tool. The values of SM1 and SD1 tabulated below were determined using equations 11.4-2 and 11.4-4 of ASCE 7-16 (Equations 16-20 and 16-23, respectively, of the 2022 CBC) and **do not include a 50 percent increase.** As discussed above, if a site-specific analysis has not been performed, SM1 and SD1 must be increased by 50 percent for all applications with respect to the ASCE 7-16 standard.

2022 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S_S	1.890
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.677
Site Class	---	D*
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.890
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	1.151
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.260
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.767

*The 2022 CBC requires 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 ASCE 7-16. However, Section 20.3.1 of 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 will possess a fundamental period 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 the structure 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.

Ground Motion Parameters

For the liquefaction evaluation, we utilized a site acceleration consistent with maximum considered earthquake ground motions, as required by the 2022 CBC. The peak ground acceleration (PGA_M) was determined in accordance with Section 11.8.3 of ASCE 7-16. 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 7-16. 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 7-16 as the building code reference document. A portion of the program output is included as Plate E-1 in Appendix E of this report. As indicated on Plate E-1, the PGA_M for this site is 0.896g. An associated earthquake magnitude was obtained from the USGS Unified Hazard Tool, Interactive Deaggregation application available on the USGS website. The deaggregated mean magnitude is 6.89, based on the peak ground acceleration and Soil Classification D for a target return period of about 2,500 years.

Liquefaction

Research of the Earthquake Zones of Required Investigation, El Monte Quadrangle, published by the CGS, indicates that the site is located in a designated liquefaction hazard zone. Therefore, the scope of this investigation included a detailed liquefaction analysis in order to evaluate 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 CPT tip stress, q_{c1N-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.

As part of the liquefaction evaluation, Boring Nos. B-1 and B-4, and one of the four CPT soundings were advanced to depths of 50± feet. As previously indicated, CPT-1, CPT-3 and CPT-4 were terminated at depths shallower than 50 feet due to refusal on very dense soil. The two borings were each drilled in close proximity to two of the CPT locations in order to provide physical samples for laboratory testing and correlation with the CPT data. The liquefaction potential for the on-site soils was evaluated the computer program CLiq V.3.5.2.17, which was developed by Geologismiki, for all four (4) of the CPT locations. The analysis method is based on Boulanger and Idriss, 2014. The liquefaction potential for the on-site soils was evaluated using data obtained at the four CPT locations. The liquefaction potential of the site was analyzed utilizing a PGA_M of 0.90 for a magnitude 6.89 seismic event. A copy of the program output is presented in Appendix G of this report.

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, encountered at various depths throughout the upper 50± feet, 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 (also tabulated in the CLiq program output in Appendix G) are presented below:

- CPT-1: 3.64± inches
- CPT-2: 3.93± inches
- CPT-3: 4.23± inches
- CPT-4: 5.37± inches

Based on these total settlements, differential settlements of up to 3.6± 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 100 feet, indicating a maximum angular distortion of about 0.003 inches per inch.

Shallow Liquefiable Layers

The results of the liquefaction analysis indicate that potentially liquefiable soils are present at all of the CPT locations. Based on current geotechnical standards of practice, and Special Publication 117A, liquefaction potential is analyzed with respect to the historic high groundwater level. Mapping performed by the California Geologic Survey indicates that the historic high ground water

level for this site is located at a depth of approximately 2 feet below the ground surface. Therefore, the results of our analysis indicate that potentially liquefiable soils will be present within the influence zones of new foundations. The zone of significant influence is considered to be to a depth equal to approximately two times the footing width below the foundation bearing grade.

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. Additionally, based on Ishihara's criteria, liquefaction of the near-surface soils could result in surface manifestations, including sand boils.

Based on the potential for liquefaction of the near-surface soils, we do not recommend that the new building be supported on conventional shallow foundations without mitigation of the near-surface liquefaction potential of the soils within the building area. Therefore, this report provides recommendations to perform remedial grading of the soils that will be significantly influenced by the foundations of the proposed structure. The resulting layer of compacted structural fill below the foundations will provide increased strengths and a reduction of the liquefaction potential of the near surface soils, as well as a reduction in the potential for surface manifestations, and other localized reduction of bearing capacity that could occur during a liquefaction-inducing seismic event. Additional details regarding the recommended remedial grading are presented in Section 6.3 of this report. **Following the completion of the recommended remedial grading, potential liquefaction-induced total dynamic settlements are expected to be reduced to:**

- **CPT-1: 1.5± inches**
- **CPT-2: 2.2± inches**
- **CPT-3: 2± inches**
- **CPT-4: 2.7± inches**

Post-remedial grading dynamic settlements are expected to be on the order of 1.8 inches. Assuming that these settlements occur over a distance of 100 feet, an angular distortion of about 0.0015 inches per inch would result.

Other structural options are also available, including the use of a mat foundation or specialized ground improvement techniques. If detailed recommendations regarding these other options are desired, they can be provided at the owner's request.

Lateral Spreading

No significant slopes or free faces are present within several hundred feet from the proposed structure. Therefore, lateral spreading is not considered to be a significant design concern for this project.

6.2 Geotechnical Design Considerations

General

All of the borings encountered artificial fill soils, extending to depths of 2½ to 5½± feet below the existing site grades at the boring locations. These soils possess variable strengths and compositions, as well as a disturbed and mottled appearance. No documentation regarding the placement and compaction of these 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 consisting of variable strengths silty sands, sandy silts, and sands within the upper 8½ to 22± feet from the ground surface. Two of the borings encountered a stratum consisting of loose sands at depths of 8½ and 9± feet. Based on these conditions, the artificial fill materials and some of the near-surface alluvium, in their present condition, are not considered suitable for support of the foundations and floor slab of the new structure. Remedial grading will be necessary within the proposed building area to remove the artificial fill soils in their entirety, as well as a portion of the near-surface alluvium, and to replace these soils as compacted structural fill.

In order to support the building on conventional shallow foundations, it is recommended that the soils present throughout most of the foundation influence zones of the structure be overexcavated and recompacted as structural fill. The consequences of excessive liquefaction occurring in the foundation influence zone of the footings could result in localized loss of bearing capacity and greater settlements than those projected during the liquefaction evaluation for "free field" conditions. Recompacting most of the soils in the foundation influence zones will significantly reduce the potential for liquefaction-induced settlements, as well as reduce the potential for localized ground failures due to surface manifestations or loss of bearing capacity.

Static Settlement

The recommended remedial grading will remove the existing fill soils as well as a portion of the variable strength alluvium from the new building area, and replace these materials as compacted structural fill. The native soils that will remain in place below the recommended depth of overexcavation will not be subject to significant load increases from the foundations of the new structure. Provided that the recommended remedial grading is completed, the post-construction settlements are expected to be within tolerable limits.

Soluble Sulfates

The results of the soluble sulfate testing, discussed in Section 5.0 of this report, indicate soluble sulfate concentrations of up to 0.0038 percent. These concentrations are considered to be negligible or "not applicable" with respect to the American Concrete Institute (ACI) Publication 318-05 Building Code Requirements for Structural Concrete and Commentary, 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 grade.

Corrosion Potential

The results of laboratory testing indicate that the on-site soils possess saturated resistivities of 6,499 and 7,370 ohm-cm, and pH values of 7.9 and 8.0. The soils possess redox potentials of 151 and 161 mV and sulfide concentrations of 0.2 mg/kg. 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, pH, sulfide concentration, redox potential, and moisture content are the five factors that enter into the evaluation procedure. Based on these factors, the on-site soils are considered to be mildly corrosive to ferrous pipes. Therefore, corrosion protection is expected to be required for cast iron or ductile iron pipes.

Based on American Concrete Institute (ACI) Publication 318 Building Code Requirements for Structural Concrete and Commentary, reinforced concrete that is exposed to external sources of chlorides requires corrosion protection for the steel reinforcement contained within the concrete. ACI 318 defines concrete exposed to moisture and an external source of chlorides as "severe" or exposure category C2. ACI 318 does not clearly define a specific chloride concentration at which contact with the adjacent soil will constitute a "C2" or severe exposure. However, the Caltrans Memo to Designers 10-5, Protection of Reinforcement Against Corrosion Due to Chlorides, Acids and Sulfates, dated June 2010, indicates that soils possessing chloride concentrations greater than 500 mg/kg are considered to be corrosive to reinforced concrete. The results of the laboratory testing indicate chloride concentrations of 10.3 and 22.9 mg/kg. Although the soils contain some chlorides, we do not expect that the chloride concentrations of the tested soils are high enough to constitute a "severe" or C2 chloride exposure. Therefore, a chloride exposure category of C1 is considered appropriate for this site.

Nitrates present in soil can be corrosive to copper tubing at concentrations greater than 50 mg/kg. The tested samples possess nitrate concentrations of 26.9 and 36.0 mg/kg. Based on the test results, the on-site soils are not considered to be corrosive to copper pipe.

It should be noted that SCG does not practice in the field of corrosion engineering. Therefore, the client may wish to contact a corrosion engineer to provide a more thorough evaluation.

Expansion

The near-surface soils consist of sandy silts and silty sands with occasional clay content. Laboratory testing performed on representative samples of the near-surface soils indicates that the test samples possess very low expansion potentials (EI = 1, and 5). Therefore, no design considerations related to expansive soils are considered warranted for this.

Shrinkage/Subsidence

Removal and recompaction of the near-surface native fill soils is estimated to result in an average shrinkage of 12 to 19 percent. However, the estimated shrinkage of the individual soil layers at the site is highly variable, locally ranging from 8 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 0.15± 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

Detailed grading and foundation plans were unavailable at the time of this report. It is therefore recommended that we be provided with copies of the preliminary grading and foundation 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 remnants of previous structures still present within the subject site. Additionally, any existing improvements that will not remain in place for use with the new development should be removed in their entirety. Debris resultant from demolition should be disposed of off-site. All applicable federal, state and local specifications and regulations should be followed in demolition, abandonment, and disposal of the resulting debris.

As previously indicated, few remnants of the previous radio towers, what appear to be column footings or pile caps, are still present in isolated areas of the site. Detailed structural information regarding the previous structures has not been provided to our office. Therefore, the foundation systems supporting the existing structures are generally unknown by SCG. We expect that the previous radio towers could have been supported on deep foundations. Therefore, existing piles or drilled piers located within the proposed building area should be cut off at a depth of at least 2 feet below the bottom of the planned overexcavation. Where drilled pier or pile 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.

Initial site stripping should include removal of any surficial vegetation, as well as any underlying topsoil or other organic materials. This should include any weeds, grasses, shrubs, and trees. Root systems associated with the trees should be removed in their entirety, and the resultant excavations should be backfilled with compacted structural fill soils. 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. These materials should be disposed of off-site.

Treatment of Existing Soils: Building Pad

Remedial grading should be performed within the new building pad area to remove all of the undocumented fill soils and a portion of the near-surface native alluvium. Based on the presence of shallow potentially liquefiable soils, we recommend that most of the existing soils that will be significantly influenced by the proposed building foundations be removed and recompacted as structural fill. At a minimum, we recommend that the near-surface soils within the upper 9 feet below the existing site grades and 9 feet below the proposed building pad grade be overexcavated, whichever is greater. Additionally, the overexcavation should also extend to a depth equal to at least 2 times the foundation width below the proposed foundation bearing grades.

The overexcavation areas should extend at least 5 feet beyond the building and foundation perimeters, and to an extent equal to the depth of fill placed below the foundation bearing grade, whichever is greater. 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 building area 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, or low density native soils are encountered at the base of the overexcavation.

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 raise the moisture content of the underlying soils to at least 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 building pad areas may then be raised to grade with previously excavated soils or imported structural fill.

Treatment of Existing Soils: Cut and Fill Slopes

Based on the conceptual grading plan, new cut slopes, and possibly fill slopes, will likely be constructed around the perimeter of the project retention basin. All slopes should be at an inclination of 2h:1v or flatter. A keyway should be excavated at the toe of new fill slopes which are not located in fill areas. The keyway should be at least 15 feet wide and 3 feet deep. The recommended width of the keyway is based on 1.5 times the width of typical grading equipment. If smaller equipment is utilized, a smaller keyway may be suitable, at the discretion of the geotechnical engineer. The base of the keyway should slope at least 1 foot downward into the

slope. Following completion of the keyway cut, the subgrade soils should be evaluated by the geotechnical engineer to verify that the keyway is founded into competent materials. The resulting subgrade soils should then be scarified to a depth of 10 to 12 inches, moisture conditioned to 0 to 4 percent above optimum moisture content and recompacted. During construction of the new fill slope, the existing slope should be benched in accordance with the detail presented on Plate D-4. Benches less than 4 feet in height may be used at the discretion of the geotechnical engineer.

Cut slopes may be undercut and replaced as stability fills. Stability fills for cut slopes will provide a more uniform appearance and allow landscaping on the slope. Should a stability fill for cut slope be necessary, the recommendations for the stability fill will be the same as the recommendations for the fill slopes, mentioned above.

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 area. 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. The geotechnical engineer of record should be contacted for recommendations pertaining to this type of condition.

Treatment of Existing Soils: Flatwork, Parking and Drive Areas

Based on economic considerations, overexcavation of the existing near-surface existing soils in the new flatwork, 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 flatwork, 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 0 to 4 percent above the optimum moisture content, 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 flatwork, parking and drive areas assume that the owner and/or developer can tolerate minor amounts of settlement within these areas. The grading recommendations presented above do not mitigate the extent of undocumented fill or lower strength native alluvium in the flatwork, parking and drive areas. As such, some 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 flatwork, parking and drive areas should be overexcavated to a depth of 2 feet below proposed pavement subgrade elevation, with the resulting soils replaced as compacted structural fill.

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.
- 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 2022 CBC and the grading code of the city of El Monte.
- 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 El Monte. 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.

Any soils used to backfill voids around subsurface utility structures, such as manholes or vaults, should be placed as compacted structural fill. If it is not practical to place compacted fill in these areas, then such void spaces may be backfilled with lean concrete slurry. Uncompacted pea gravel

or sand is not recommended for backfilling these voids since these materials have a potential to settle and thereby cause distress of pavements placed around these subterranean structures.

6.4 Construction Considerations

Excavation Considerations

The near-surface soils generally consist of sands, sandy silts and silty sands. Some of these materials will be subject to moderate caving within shallow excavations. Where caving does occur, flattened excavation slopes may be sufficient to provide excavation stability. On a preliminary basis, the inclination of temporary slopes should not exceed 2h:1v. 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

Some of the near-surface soils possess appreciable silt content and may become unstable if exposed to significant moisture infiltration or disturbance by construction traffic. In addition, based on their granular content, some of the on-site soils will also be susceptible to erosion. The site should, therefore, be graded to prevent ponding of surface water and to prevent water from running into excavations.

Groundwater

Based on the conditions encountered in the borings and the pore pressure dissipation tests taken at CPT-1 and CPT-4, the groundwater table is considered to have been present at a depth of 30 to 38½± feet at the time of subsurface exploration. Therefore, based on the current groundwater depth, we do not expect that groundwater will affect excavations for the new foundations or utilities. However, it should be noted that the mapped historic high groundwater level for this site is 2± 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 structural fill soils extending to a depth of at least 9 feet and to a depth equal to at least 2 times the foundation width below foundation bearing grade, underlain by 1± foot of additional soil that has been densified and moisture conditioned in place. Based on this subsurface profile, and based on the design considerations presented in Section 6.1 of this report, the proposed structure may be supported on conventional shallow foundations.

Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 3,000 lbs/ft^2.

- Reduced net allowable soil bearing pressure: 1,000 to 2,000 lbs/ft^2 if the full recommended extent of remedial grading cannot be achieved, typically for new footings along the property lines.

- 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 potential for liquefaction-induced settlement.

- 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 one-third when considering short duration wind loads. However, based on the presence of potentially liquefiable soil layers that will remain at elevations located below the proposed overexcavation depth, we do not recommend that the bearing pressure be increased with respect to seismic loads. The minimum steel reinforcement recommended above is based on standard geotechnical practice. Additional rigidity may be necessary for structural considerations, or to resist the effects of the liquefaction-induced differential settlements, as discussed in Section 6.1. 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 to 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 overexcavation.

The foundation subgrade soils should also be properly moisture conditioned to 0 to 4 percent above the Modified Proctor (ASTM D-1557) 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 50-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.** 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 slab 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: 275 lbs/ft^3
- Friction Coefficient: 0.28

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 the new floor slab 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 9 feet below finished pad grade. Based on geotechnical considerations, the floor slab may be designed as follows:

- Minimum slab thickness: 6 inches.

- Modulus of Subgrade Reaction: 100 psi/in.

- Minimum slab reinforcement: No. 3 bars at 18-inches on-center, in both directions, due to presence of potentially liquefiable soils. The actual floor slab reinforcement should be determined by the structural engineer, based upon the imposed loading, and the potential 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 a 15 mil. 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 0 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 slab should be completed by the structural engineer to verify adequate thickness and reinforcement.

6.7 Exterior Flatwork Design and Construction

Subgrades which will support new exterior slabs-on-grade for sidewalks, patios, and other concrete flatwork, should be prepared in accordance with the recommendations contained in the ***Grading Recommendations*** section of this report. Based on geotechnical considerations, exterior slabs on grade may be designed as follows:

- Minimum slab thickness: 4½ inches.

- Minimum slab reinforcement: No. 3 bars at 24 inches on center, in both directions.

- The flatwork at building entry areas should be structurally connected to the perimeter foundation that is recommended to span across the door opening. This recommendation is designed to reduce the potential for differential movement at this joint.

- Moisture condition the flatwork subgrade soils to 0 to 4 percent of optimum moisture content, to a depth of at least 12 inches. Adequate moisture conditioning should be verified by the geotechnical engineer 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.

- Control joints should be provided at a maximum spacing of 8 feet on center in two directions for slabs and at 6 feet on center for sidewalks. Control joints are intended to direct cracking. Minor cracking of exterior concrete slabs on grade should be expected.

- Where flatwork is immediately adjacent to landscape planters, a thickened edge should be utilized. This edge should extend to a depth of at least 12 inches and incorporate longitudinal reinforcement consisting of at least two No. 4 bars.

- Expansion or felt joints should be used at the interface of exterior slabs on grade and any fixed structures to permit relative movement.

6.8 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 the dock-high areas of the building. 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. The following parameters assume that only the on-site soils will be utilized for retaining wall backfill. The near-surface soils generally consist of sands, silty sands and sandy silts. Based on the results of laboratory testing, the native on-site soils possess a friction angle of at least 30 degrees.

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 Sandy Silts
Internal Friction Angle (ϕ)		30°
Unit Weight		128 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	43 lbs/ft^3
	Active Condition (2h:1v backfill)	69 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 0.28 and an equivalent passive pressure of 275 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 accordance with the 2022 CBC, any retaining walls more than 6 feet in height must be designed for seismic lateral earth pressures. If walls 6 feet or more are required for this site, the geotechnical engineer should be contacted for supplementary seismic lateral earth pressure 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 2 feet below proposed foundation 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

On-site soils may be used to backfill the retaining walls. However, 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 D1557-91). 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 2-inch diameter holes in the wall situated slightly above the ground surface elevation on the exposed side of the wall and at an approximate 10-foot on-center spacing. Alternatively, 4-inch diameter holes at an approximate 20-foot on-center spacing can be used for this type of drainage system. In addition, 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. The actual design of this type of system should be determined by the civil engineer to verify that the drainage system possesses the adequate capacity and slope for its intended use.

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

6.9 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 sandy silts with varying clay content and silty sands. These soils are generally considered to possess fair to good pavement support characteristics with estimated R-values of 25 to 45. R-value testing was outside the scope of services. The subsequent pavement design is therefore based upon an assumed R-value of 30. It is recommended that R-value testing be performed after completion of rough grading to verify that the pavement design recommendations presented herein are valid.

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
9.0	93

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)				
	Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic			
		TI = 6.0	TI = 7.0	TI = 8.0	TI = 9.0
Asphalt Concrete	3	3½	4	5	5½
Aggregate Base	6	8	10	11	13
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 batch plant-reported maximum density. 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 (R = 30)				
Materials	**Thickness (inches)**			
	Autos and Light Truck Traffic (TI = 6.0)	Truck Traffic		
		TI = 7.0	TI = 8.0	TI = 9.0
PCC	5	5½	6½	8
Compacted Subgrade (95% minimum compaction)	12	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. Any reinforcement within the PCC pavements should be determined by the project structural engineer.

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 and CPT 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.

Boulanger, R.W., Idriss, I. M., "CPT and SPT Based Liquefaction Triggering Procedures", Report No. UCD/CGM-14/01, Center of Geotechnical Modeling, University of California, Davis, California, 2014.

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.

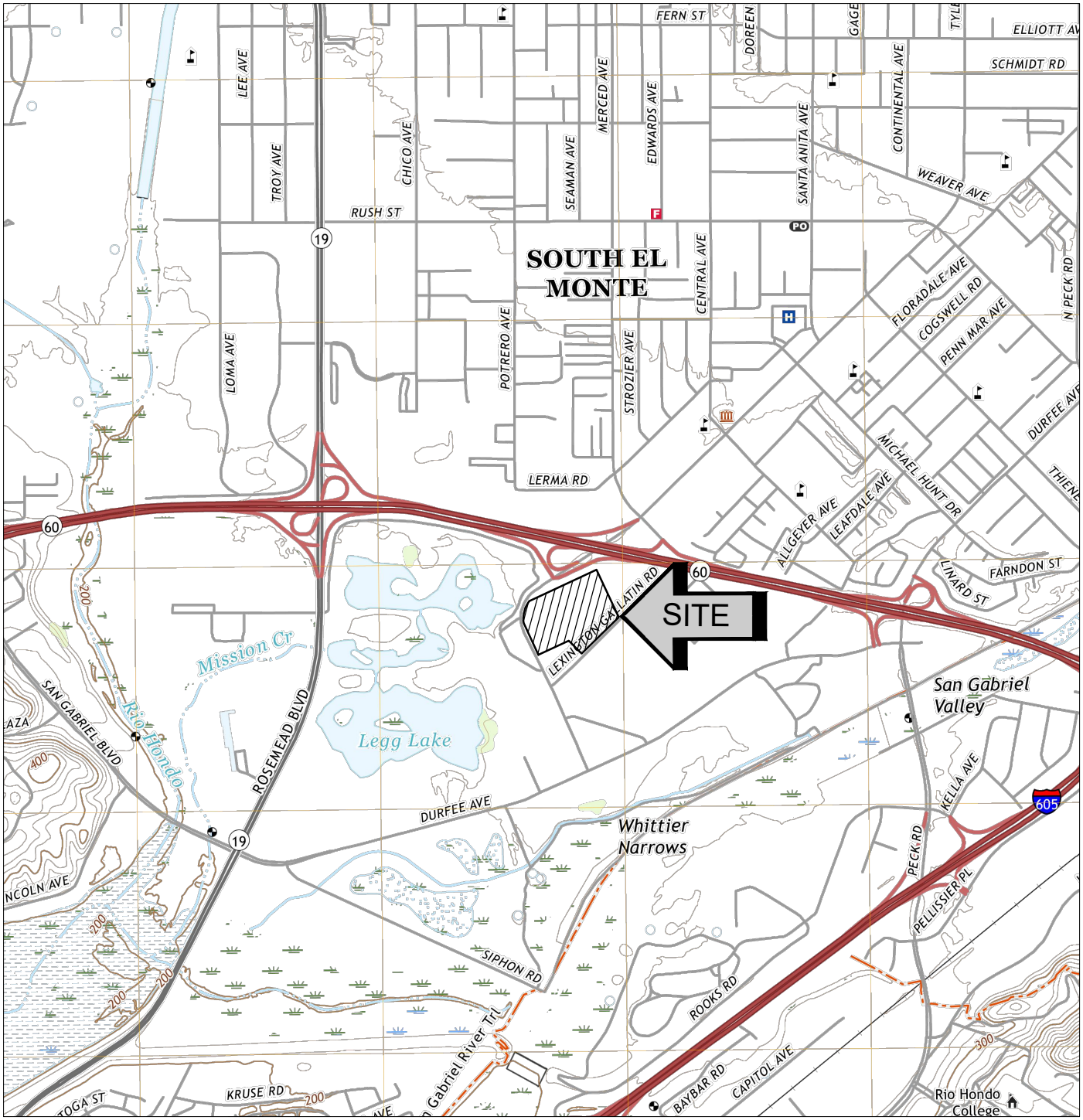
Southern California Earthquake Center (SCEC), University of Southern California, "Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California," Committee formed 1997.

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: USGS TOPOGRAPHIC MAPS OF THE EL MONTE QUADRANGLE, LOS ANGELES COUNTY, CALIFORNIA, 2022.

SITE LOCATION MAP

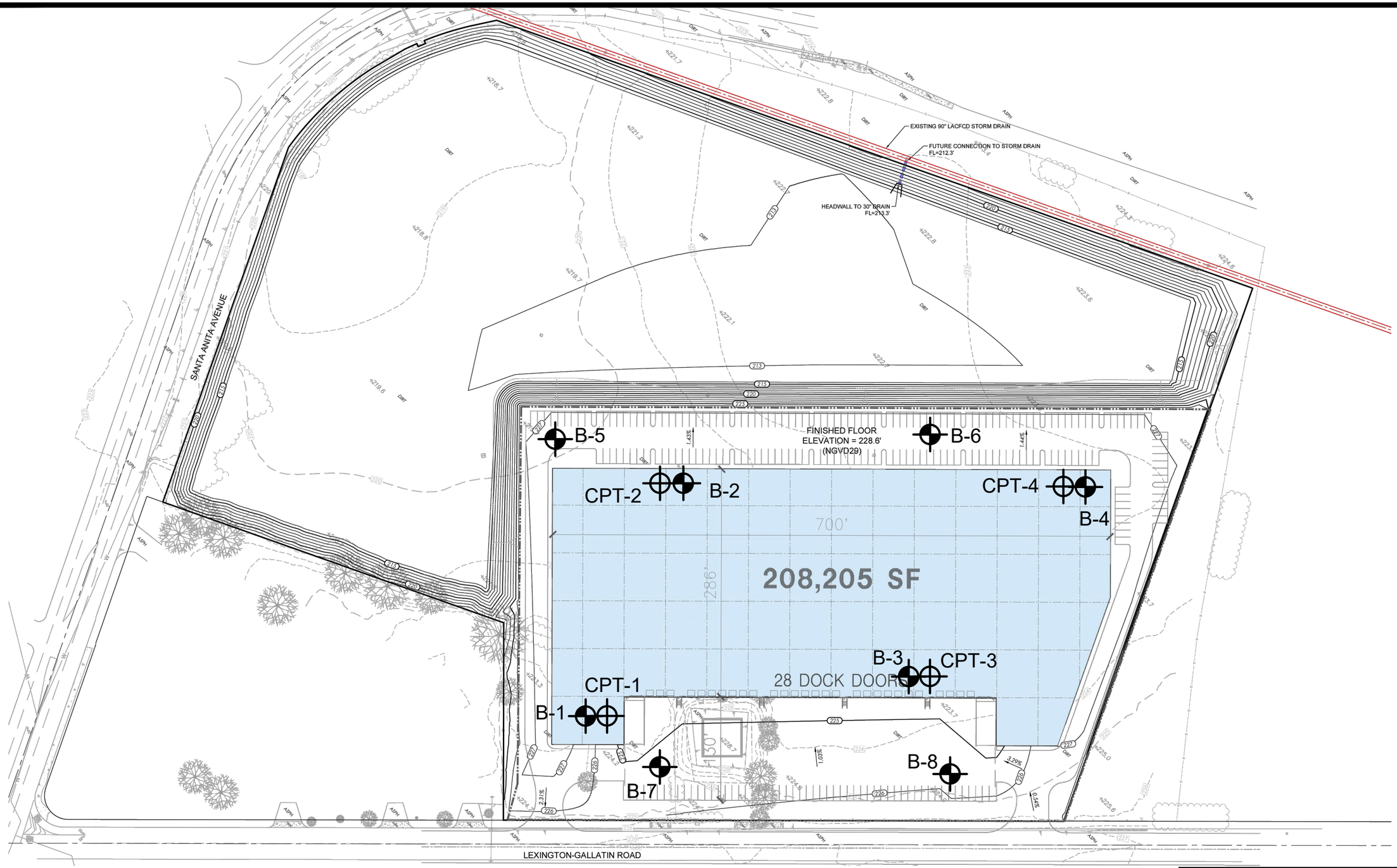
PROPOSED WAREHOUSE

EL MONTE, CALIFORNIA

SCALE: 1" = 2000'	
DRAWN: JLL CHKD: RGT	
SCG PROJECT 23G130-1	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND

- APPROXIMATE BORING LOCATION
- APPROXIMATE CPT BORING LOCATION

NOTE: CONCEPTUAL GRADING PLAN PROVIDED BY KIMLEY-HORN AND ASSOCIATES, INC.

BORING AND CPT LOCATION PLAN

PROPOSED WAREHOUSE

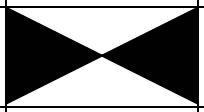
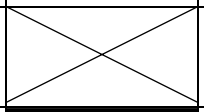
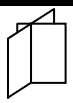
EL MONTE, CALIFORNIA

SCALE: 1" = 120'	
DRAWN: JLL CHKD: RGT	
SCG PROJECT 23G130-1	
PLATE 2	

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.

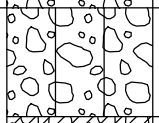
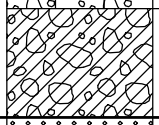
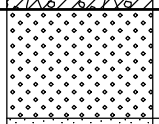
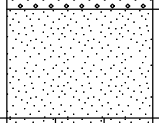
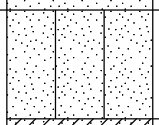
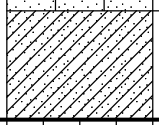
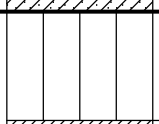
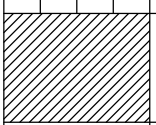
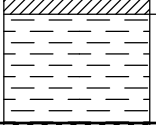
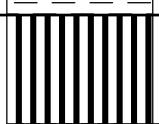
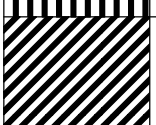
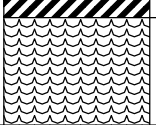
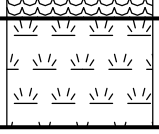
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

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 MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	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
	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

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-1

JOB NO.: 23G130-1
PROJECT: Proposed Warehouse
LOCATION: El Monte, California

DRILLING DATE: 4/11/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: 33.5 feet
CAVE DEPTH: 31 feet
READING TAKEN: 45 Min After 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
					2± inches of Rootmat							
		6			FILL: Gray fine Sandy Silt, trace Silt, loose-very moist		33					
					FILL: Gray Brown fine Sand, little medium Sand, little Silt, loose-damp		5					
		12			ALLUVIUM: Gray Brown fine to medium Sand, trace coarse Sand, trace fine Gravel, trace Silt, little Iron Oxide staining, medium dense-dry to damp		3					
5		17			@ 6 feet, little coarse Sand, trace to little fine Gravel		3			2		
		22					3					
10												
		29					3					
15												
		34			@ 18½ feet, dense		3					
20												
					Light Gray Brown fine Sand, dense-dry to damp							
		44					3					
25												
					Dark Gray Silty fine Sand to fine Sandy Silt, trace Clay, medium dense-very moist							
		24					20			44		
30												
					Gray Brown fine to medium Sand, trace coarse Sand, little fine Gravel, little Silt, trace Iron Oxide staining, very dense-wet							
		60					13					

TBL 23G130-1.GPJ SOCALGEO.GDT 5/12/23

TEST BORING LOG

PLATE B-1a

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-1

JOB NO.: 23G130-1
PROJECT: Proposed Warehouse
LOCATION: El Monte, California

DRILLING DATE: 4/11/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: 33.5 feet
CAVE DEPTH: 31 feet
READING TAKEN: 45 Min After Completion

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
					Gray Brown fine to medium Sand, trace coarse Sand, little fine Gravel, little Silt, trace Iron Oxide staining, very dense-wet							
					Gray Brown fine to coarse Sand, little fine Gravel, little Silt, trace Iron Oxide staining, very dense-wet							
		89/11"					12					
40												
					Gray Brown Silty fine to coarse Sand, trace fine Gravel, very dense-wet							
		50/5"					19					
45												
					Gray Brown Gravelly fine to coarse Sand, trace to little Silt, very dense-wet							
		66					10					
50												
					Boring Terminated at 50 feet							

TBL 23G130-1.GPJ SOCALGEO.GDT 5/12/23

TEST BORING LOG

PLATE B-1b

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-2

JOB NO.: 23G130-1
PROJECT: Proposed Warehouse
LOCATION: El Monte, California

DRILLING DATE: 4/11/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: 20 feet
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
					2± inches of Rootmat							
		20			FILL: Dark Gray Brown fine Sandy Silt, trace Clay, trace coarse Sand, trace fine root fibers, medium dense-moist to very moist	93	16					
		14			ALLUVIUM: Gray Brown Silty fine Sand and fine Sandy Silt, thinly interbedded, little Iron Oxide staining loose-moist to very moist	94	13					
5		13				93	18					
		18			Gray fine Sand, little medium Sand, trace coarse Sand, trace fine Gravel, medium dense-dry to damp	99	3					
		47			Light Gray fine to medium Sand, trace to little Silt, trace fine Gravel, dense-dry	103	1					
10												
					Dark Gray Brown fine Sandy Silt with 2-inch Silty fine Sand lenses, trace Clay, medium dense-very moist								
		31				102	20					
15												
					Gray Silty fine Sand, little Clay, trace Iron Oxide staining, medium dense-very moist							
		23				96	17					
20												
					Light Gray Brown fine Sand, trace to little medium to coarse Sand, trace fine Gravel, trace Iron Oxide staining, dense-dry								
		50				100	1					
25												
					Boring Terminated at 25 feet							

TBL 23G130-1.GPJ SOCALGEO.GDT 5/12/23

TEST BORING LOG

PLATE B-2

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-3

JOB NO.: 23G130-1
PROJECT: Proposed Warehouse
LOCATION: El Monte, California

DRILLING DATE: 4/11/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: 19 feet
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
					2± inches of Rootmat							
		10			FILL: Dark Gray Brown fine Sandy Silt, little Clay, trace medium to coarse Sand, loose-moist to very moist	95	18					EI = 5 @ 1 to 5 feet
					FILL: Gray Brown Silty fine Sand, little Iron Oxide staining, loose-very moist							
		15			ALLUVIUM: Gray Brown Silty fine Sand, abundant Iron Oxide staining, loose to medium dense-damp	92	5					
5		14				96	9					
		18			Gray Brown fine Sand, trace to little medium Sand, little Silt, little Iron Oxide staining, loose to medium dense-damp	96	6					
10		10					4					@ 9 feet, Disturbed Sample
		21			@ 14 feet, dry	101	2					
15					Gray Brown fine Sandy Silt, trace Clay, trace to little Iron Oxide staining, medium dense-dry to very moist							
20		22				106	21					
					Light Gray Brown fine Sand, trace medium Sand, dense-dry							
		54				110	2					
25					Boring Terminated at 25 feet							

TBL 23G130-1.GPJ SOCALGEO.GDT 5/12/23

TEST BORING LOG

PLATE B-3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 23G130-1
PROJECT: Proposed Warehouse
LOCATION: El Monte, California

DRILLING DATE: 4/11/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: 38.5 feet
CAVE DEPTH: 26 feet
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
					2± inches of Rootmat							
		5			FILL: Brown fine Sandy Silt, trace Clay, little Iron Oxide staining, trace fine root fibers, loose-very moist		25					EI = 1 @ 1 to 5 feet
		8			ALLUVIUM: Gray Brown Silty fine Sand, trace Iron Oxide staining, loose-very moist		15			24		
5		15			Gray Silty fine to medium Sand, trace to little coarse Sand, trace to little fine Gravel, medium dense-damp		4					
		22					2					
10												
		24					5			25		
15												
		32			Gray fine to coarse Sand, little Silt, little fine Gravel, dense-dry		2					
20												
		43			Light Brown fine Sand, trace medium Sand, trace Silt, dense-damp		3					
25												
		56			Light Gray Brown fine to coarse Sand, little fine Gravel, trace coarse Gravel, trace Silt, very dense-damp		3					
30												
		16			Dark Gray Brown Silt, little fine Sand, little Clay, trace Iron Oxide staining, medium dense-very moist		31	34	23	88		

TBL 23G130-1.GPJ SOCALGEO.GDT 5/12/23

TEST BORING LOG

PLATE B-4a

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 23G130-1
PROJECT: Proposed Warehouse
LOCATION: El Monte, California

DRILLING DATE: 4/11/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: 38.5 feet
CAVE DEPTH: 26 feet
READING TAKEN: At Completion

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
					Dark Gray Brown Silt, little fine Sand, little Clay, trace Iron Oxide staining, medium dense-very moist							
					Gray Brown fine to coarse Sand, little fine Gravel, trace coarse Gravel, trace to little Silt, trace Iron Oxide staining, very dense-wet							
40		71					15					
45		58					12					
50		68/10"					17					
					Boring Terminated at 50 feet							

TBL 23G130-1.GPJ SOCALGEO.GDT 5/12/23

TEST BORING LOG **PLATE B-4b**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-5

JOB NO.: 23G130-1
PROJECT: Proposed Warehouse
LOCATION: El Monte, California

DRILLING DATE: 4/11/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: 7 feet
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
					2± inches of Rootmat							
		2			FILL: Dark Gray Brown fine Sandy Silt, trace fine root fibers, very loose-very moist		31					
		11			ALLUVIUM: Gray Brown fine Sand, little Silt, little Iron Oxide staining, loose to medium dense-damp to very moist		7					
5		6					16					
		16					12					
10					Boring Terminated at 10 feet							

TBL 23G130-1.GPJ SOCALGEO.GDT 5/12/23

TEST BORING LOG

PLATE B-5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-6

JOB NO.: 23G130-1
PROJECT: Proposed Warehouse
LOCATION: El Monte, California

DRILLING DATE: 4/11/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: 5.5 feet
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
					2± inches of Rootmat							
		4			FILL: Dark Gray Brown fine Sandy Silt, little Iron Oxide staining, trace fine root fibers, loose-very moist		34					
		3			FILL: Gray Brown Silty fine Sand, little Iron Oxide staining, very loose-moist		10					
5												
		10			ALLUVIUM: Gray Brown fine Sand, trace to little medium to coarse Sand, little Silt, loose to medium dense-damp		3					
		7					4					
10					Boring Terminated at 10 feet							

TBL 23G130-1.GPJ SOCALGEO.GDT 5/12/23

TEST BORING LOG

PLATE B-6

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-7

JOB NO.: 23G130-1
PROJECT: Proposed Warehouse
LOCATION: El Monte, California

DRILLING DATE: 4/11/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: 7.5 feet
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
					2± inches of Rootmat							
		3			FILL: Gray Brown Silty fine Sand, trace coarse Sand, trace fine root fibers, very loose-moist to very moist		13					
		8			ALLUVIUM: Gray Brown fine Sand, trace to little medium to coarse Sand, little Silt, trace Iron Oxide staining, loose to medium dense-damp to moist		11					
5		14					5					
		27					5					
10					Boring Terminated at 10 feet							

TBL 23G130-1.GPJ SOCALGEO.GDT 5/12/23

TEST BORING LOG **PLATE B-7**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-8

JOB NO.: 23G130-1
PROJECT: Proposed Warehouse
LOCATION: El Monte, California

DRILLING DATE: 4/11/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

WATER DEPTH: Dry
CAVE DEPTH: 8 feet
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
					2± inches of Rootmat							
		2			FILL: Dark Gray Brown fine Sandy Silt, trace Clay, very loose-very moist		30					
		7			ALLUVIUM: Gray Brown fine Sand, trace medium Sand, little Silt, trace to little Iron Oxide staining, loose to medium dense-damp to moist		8					
5												
		8			@ 6 feet, trace coarse Sand, trace fine Gravel		6					
		15					7					
10					Boring Terminated at 10 feet							

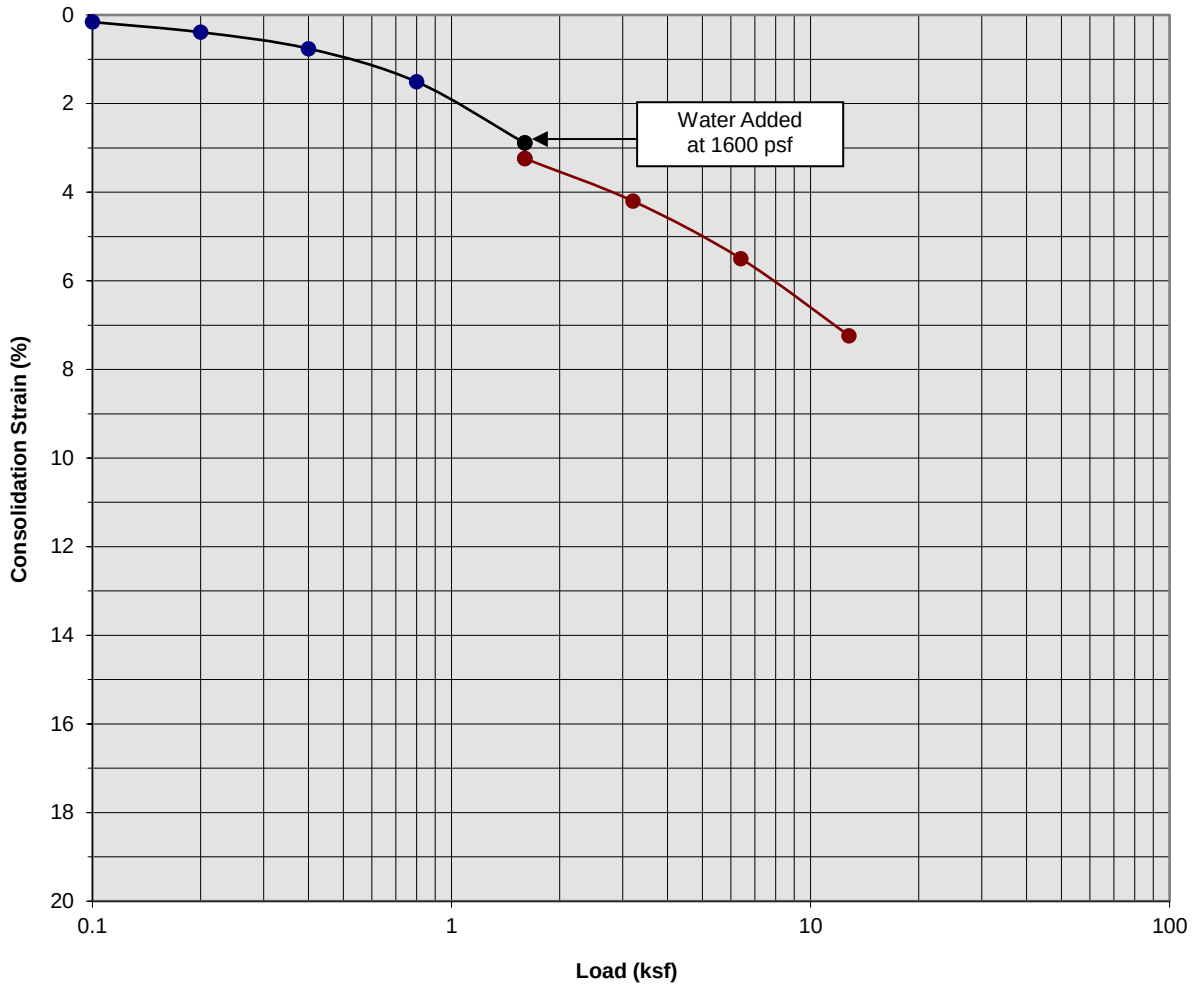
TBL 23G130-1.GPJ SOCALGEO.GDT 5/12/23

TEST BORING LOG

PLATE B-8

APPENDIX C

Consolidation/Collapse Test Results



Classification: Gray Brown Silty fine Sand

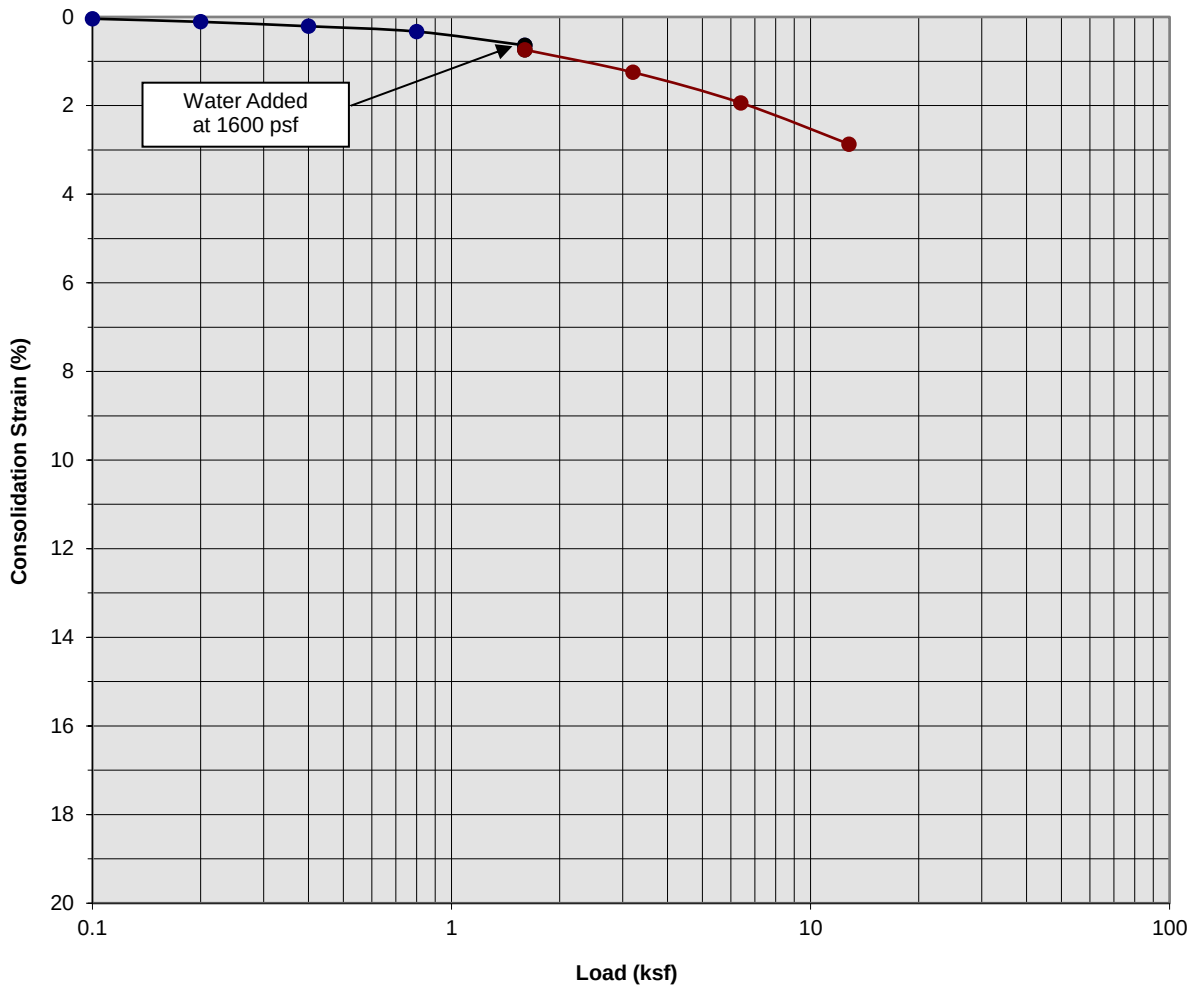
Boring Number:	B-3	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	25
Depth (ft)	3 to 4	Initial Dry Density (pcf)	92.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	98.4
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.35

Proposed Warehouse
El Monte, California
Project No. 23G130-1

PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



Classification: Gray Brown Silty fine Sand

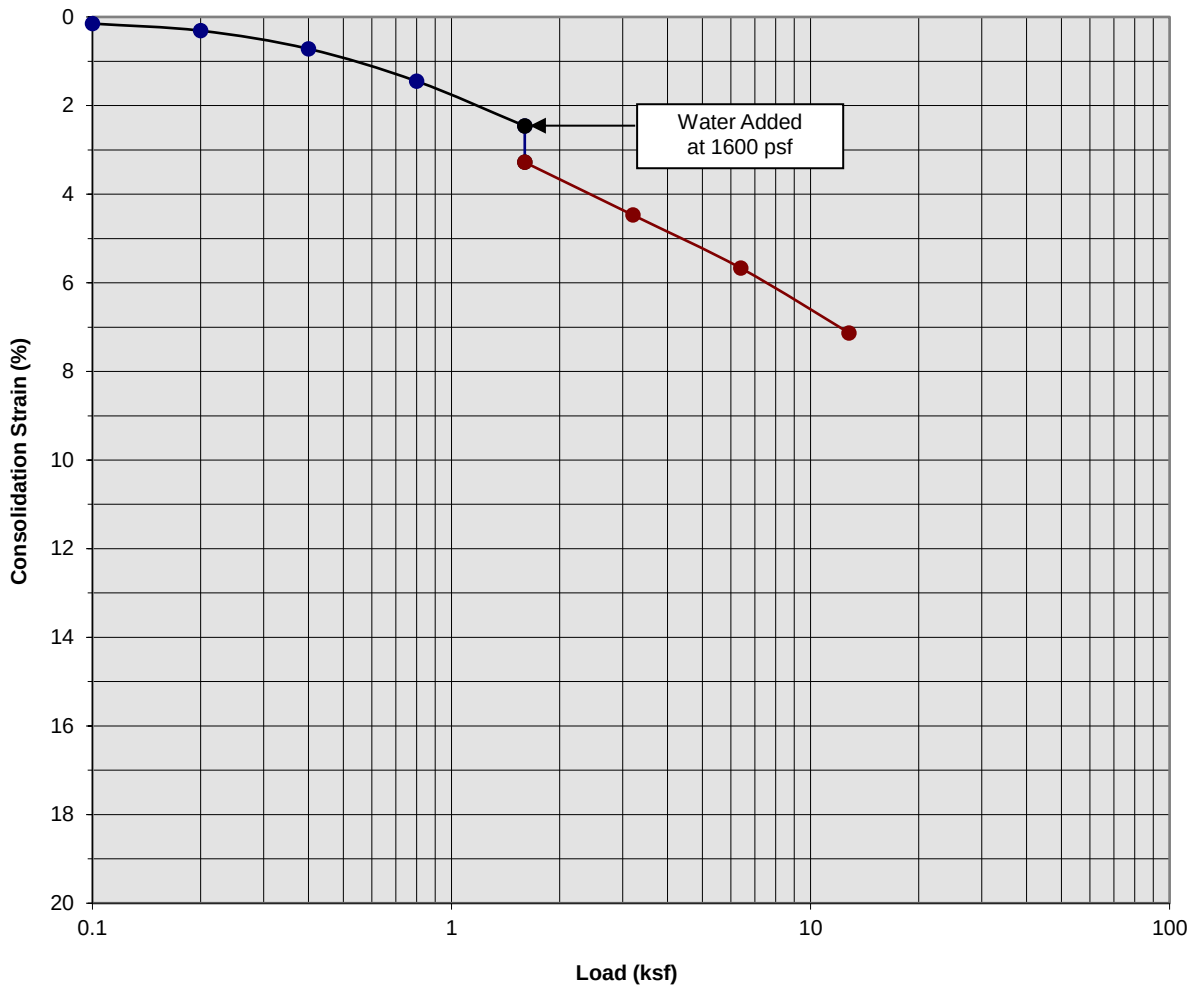
Boring Number:	B-3	Initial Moisture Content (%)	9
Sample Number:	---	Final Moisture Content (%)	23
Depth (ft)	5 to 6	Initial Dry Density (pcf)	96.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	99.2
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.10

Proposed Warehouse
El Monte, California
Project No. 23G130-1

PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



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

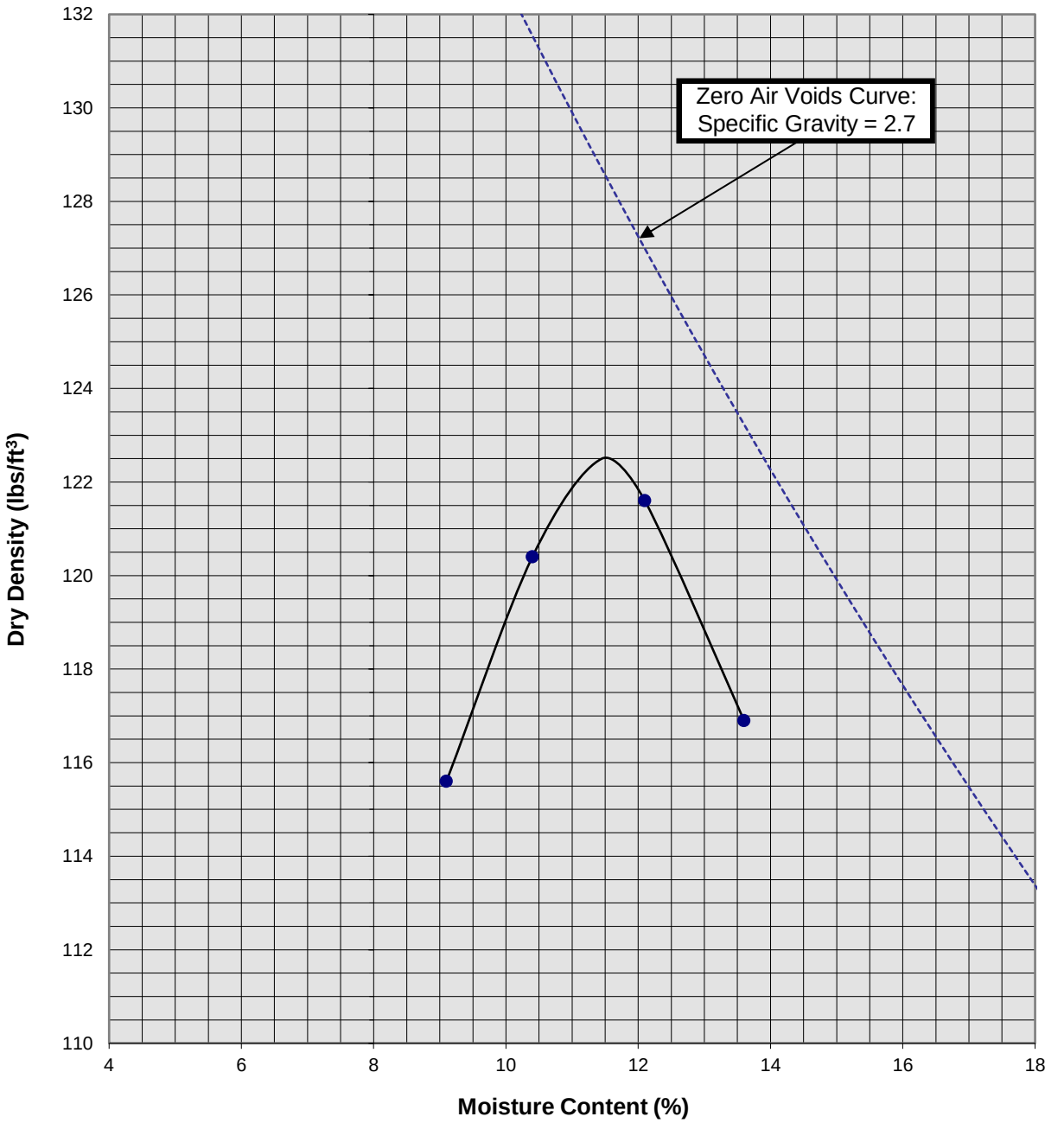
Boring Number:	B-3	Initial Moisture Content (%)	2
Sample Number:	---	Final Moisture Content (%)	20
Depth (ft)	14 to 14½	Initial Dry Density (pcf)	100.6
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	107.5
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.82

Proposed Warehouse
El Monte, California
Project No. 23G130-1

PLATE C- 3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Moisture/Density Relationship
ASTM D-1557



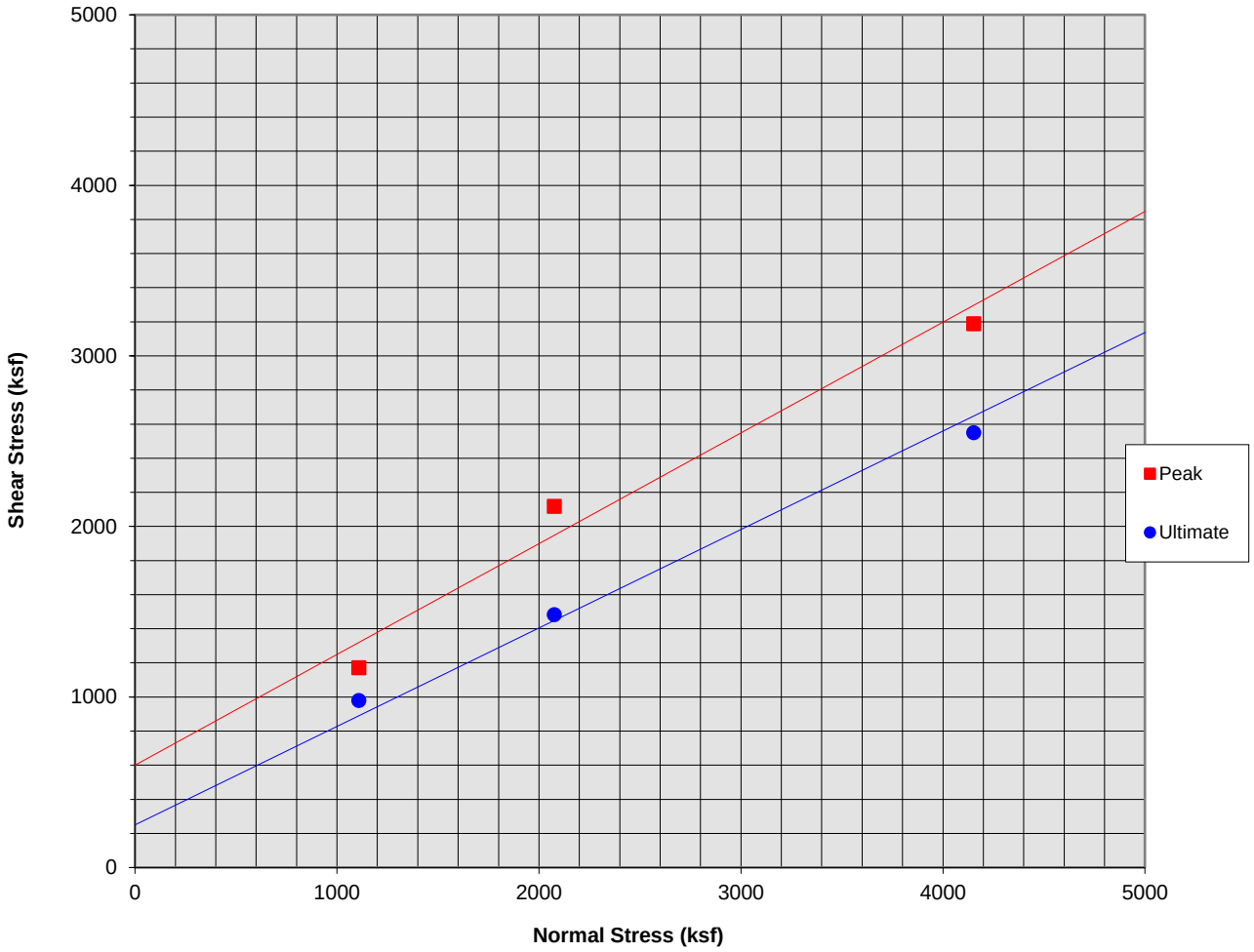
Soil ID Number	B-2 @ 1-5'
Optimum Moisture (%)	11.5
Maximum Dry Density (pcf)	122.5
Soil Classification	Gray Brown fine Sandy Silt, trace coarse Sand

Proposed Warehouse
El Monte, California
Project No. 23G130-1

PLATE C- 4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Direct Shear Test Results
(Undisturbed)



Sample Description: B-2 @ 5 to 6 feet

Classification: Gray Brown Silty fine Sand and fine Sandy Silt, thinly interbedded

Sample Data	
Initial Moisture Content	18.0
Final Moisture Content	27.0
Initial Dry Density	93.0
Final Dry Density	--
Specimen Diameter (in)	2.4
Specimen Thickness (in)	1.0

Test Results		
	Peak	Ultimate
ϕ (°)	33.0	30.0
C (psf)	600	250

Proposed Warehouse
El Monte, California
Project No. 23G130-1

PLATE C- 5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

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.

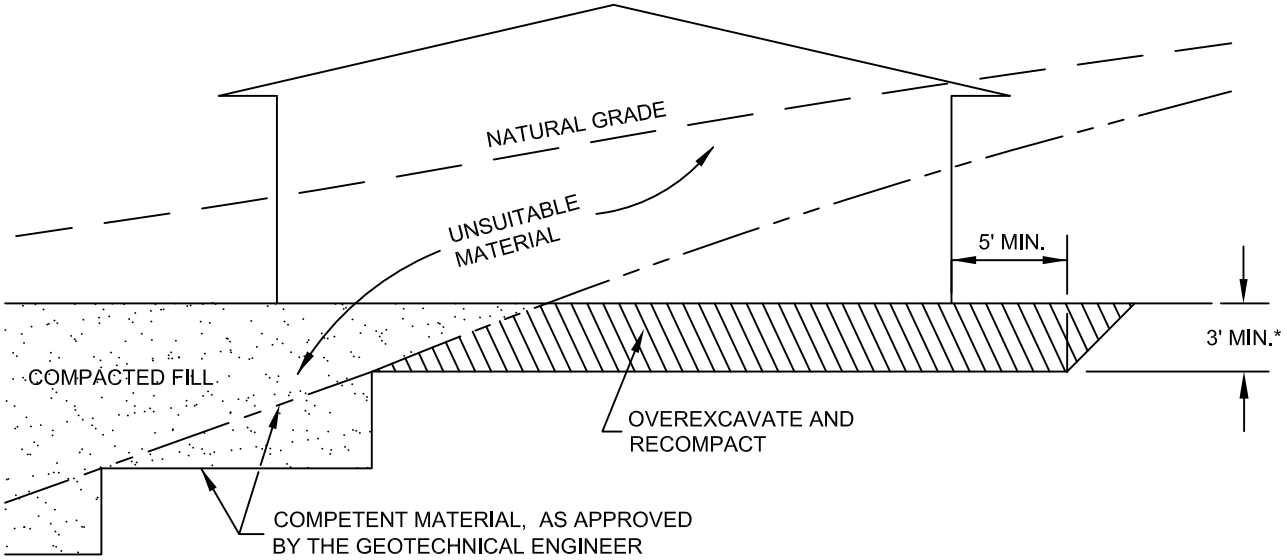
Subdrains

- 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.

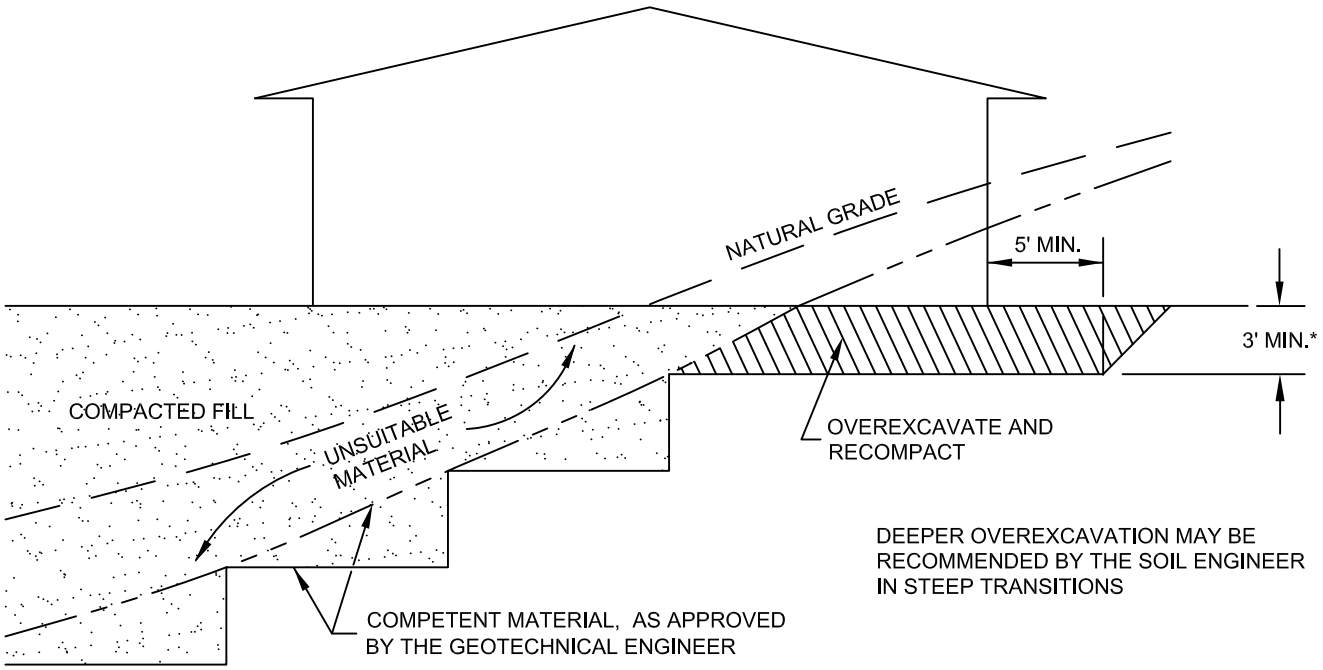
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

- 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)



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

TRANSITION LOT DETAIL

GRADING GUIDE SPECIFICATIONS

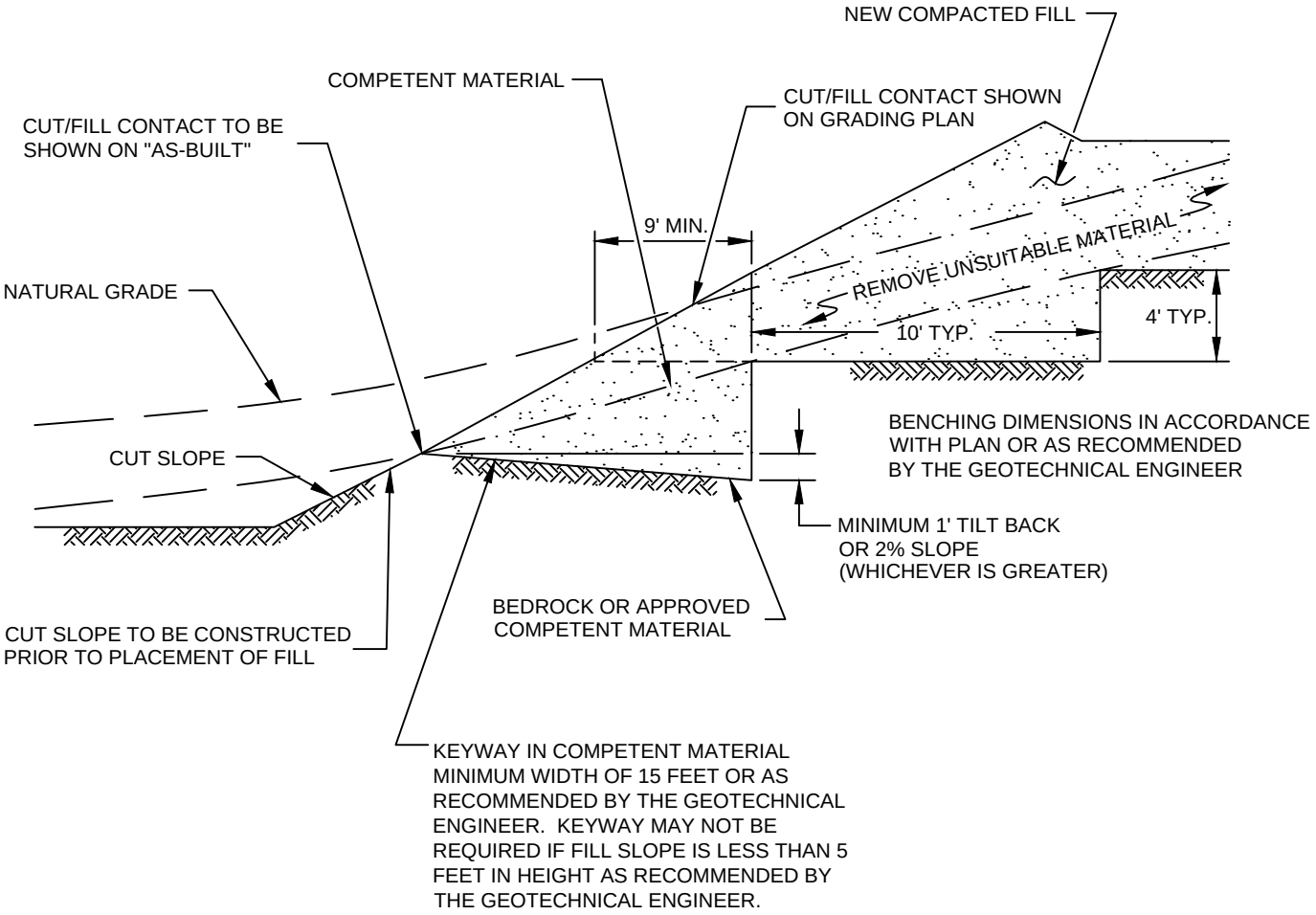
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



FILL ABOVE CUT SLOPE DETAIL

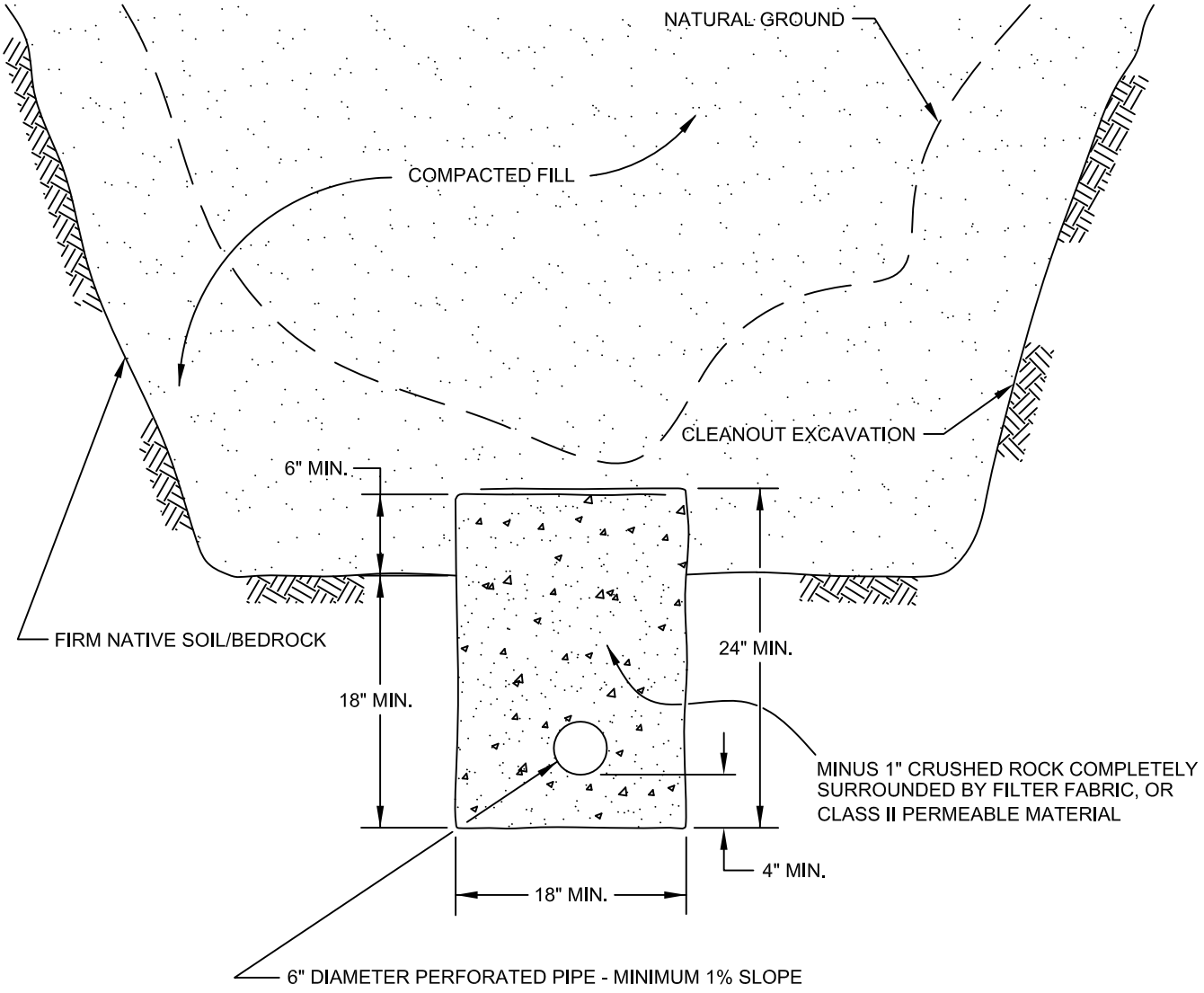
GRADING GUIDE SPECIFICATIONS

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

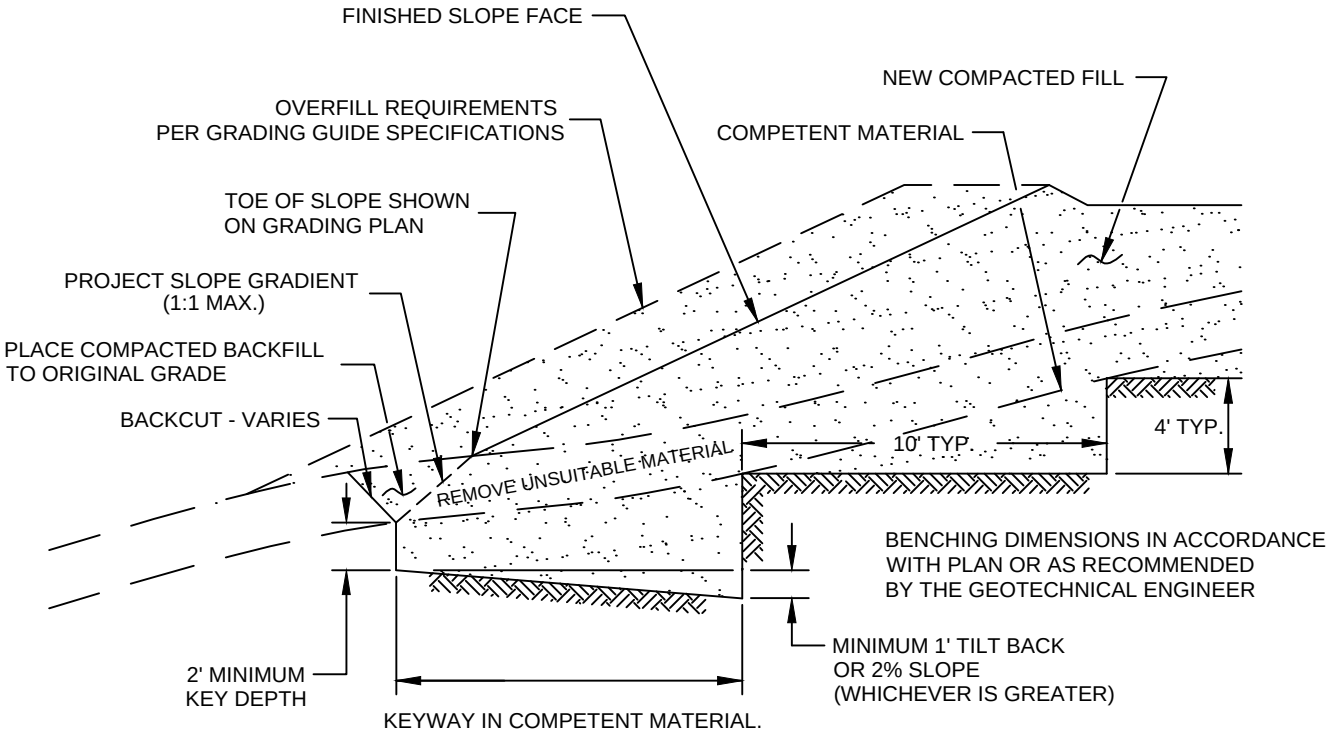
SCHEMATIC ONLY
NOT TO SCALE

CANYON SUBDRAIN DETAIL
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE
DRAWN: JAS
CHKD: GKM

PLATE D-3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



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

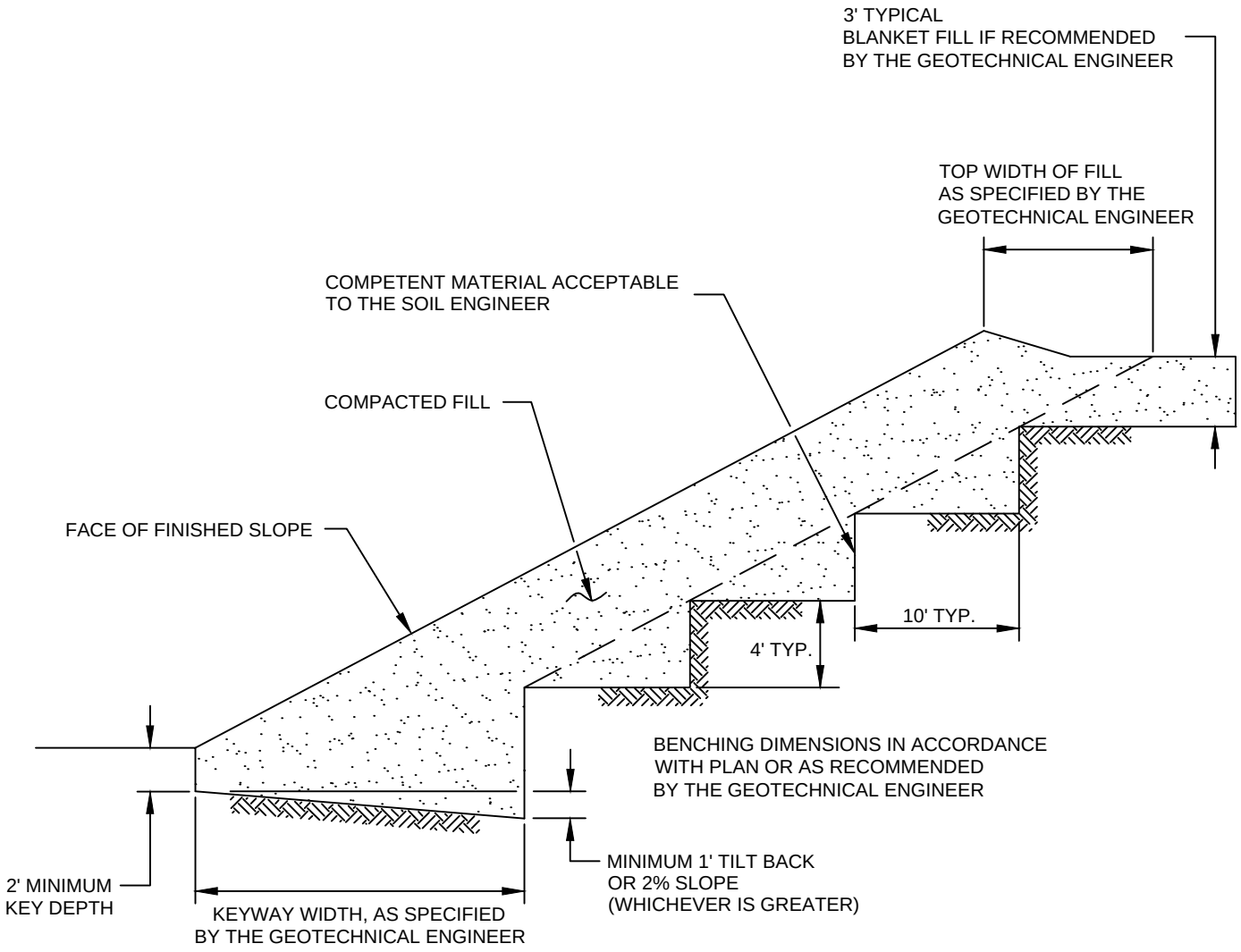
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



STABILIZATION FILL DETAIL

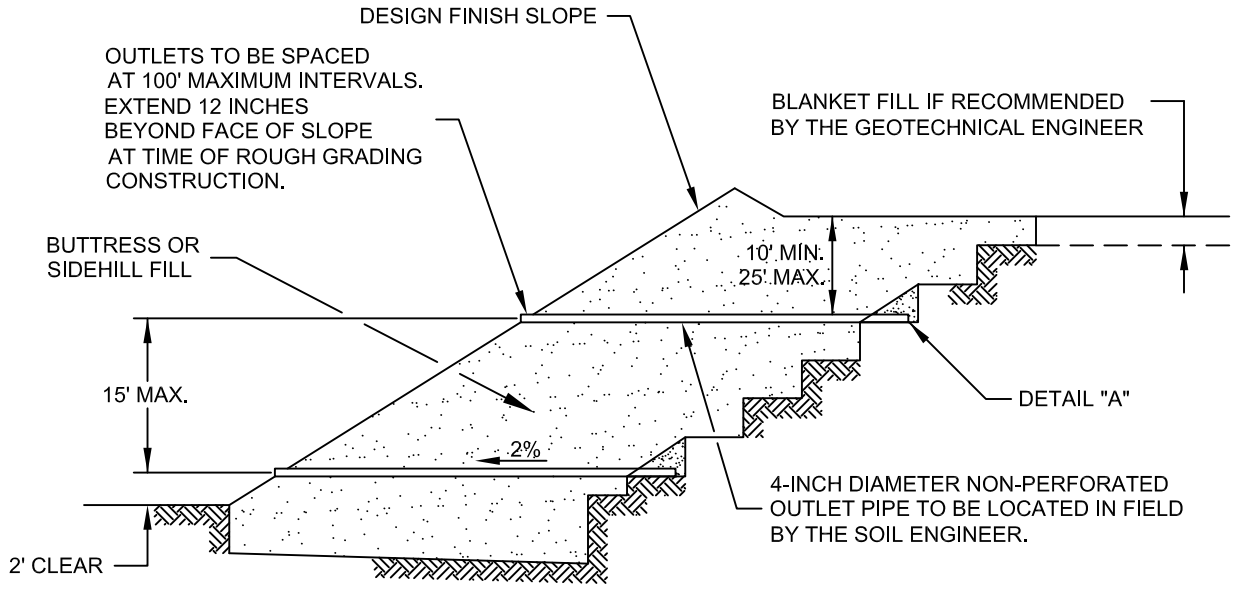
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



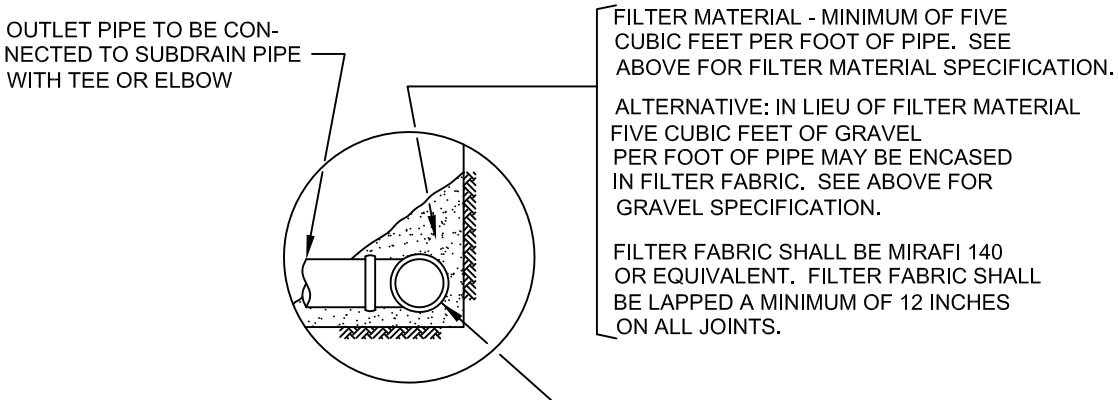
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

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

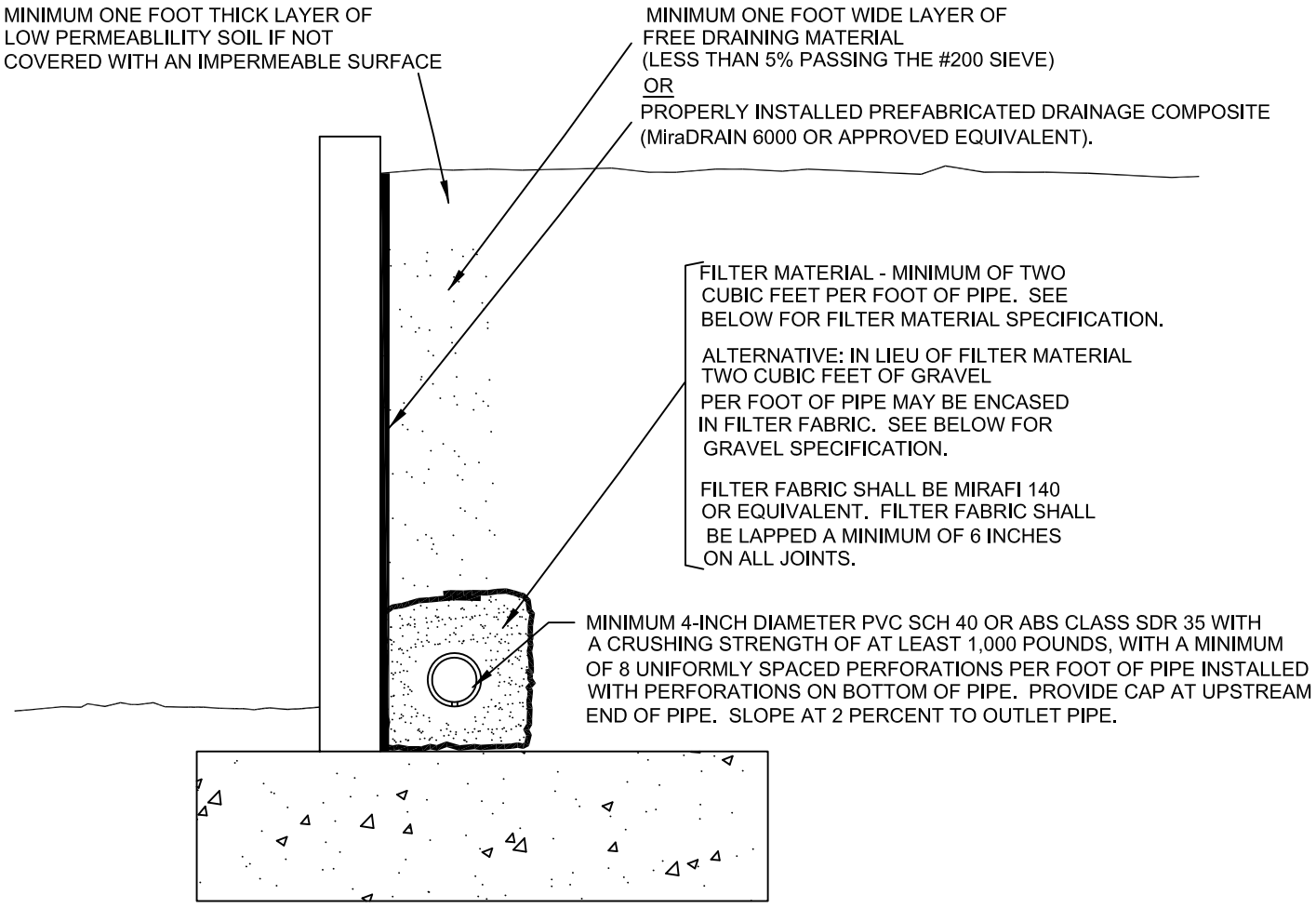
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-6

SoCalGeo
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

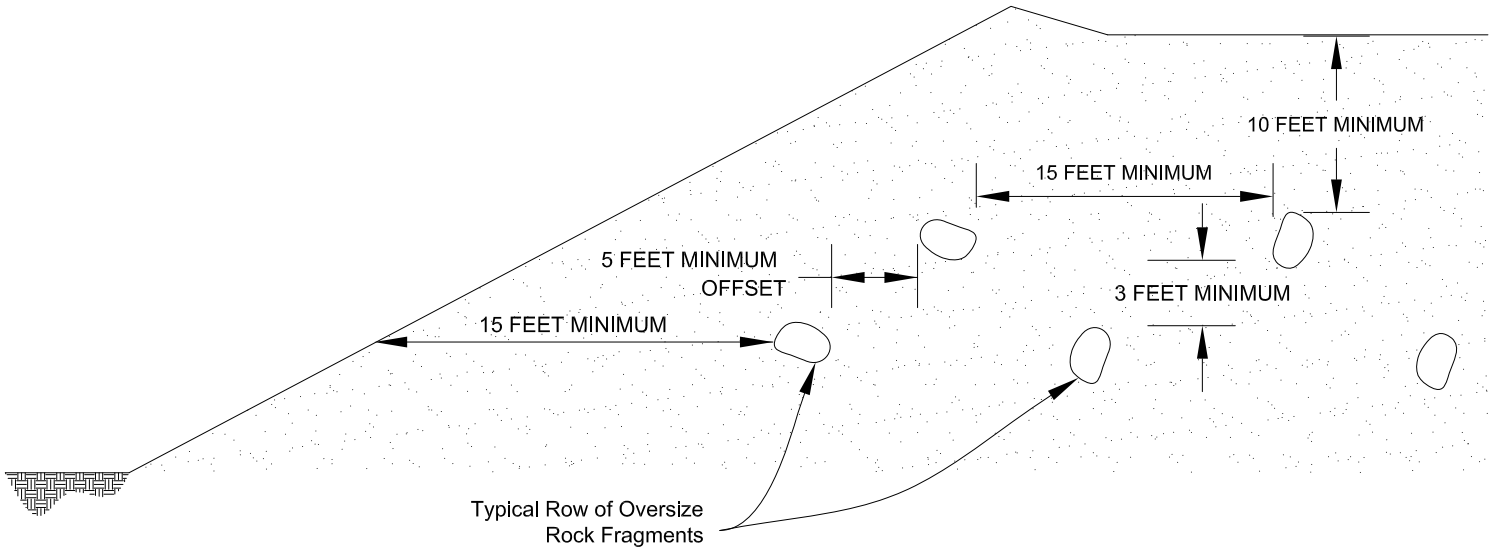
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

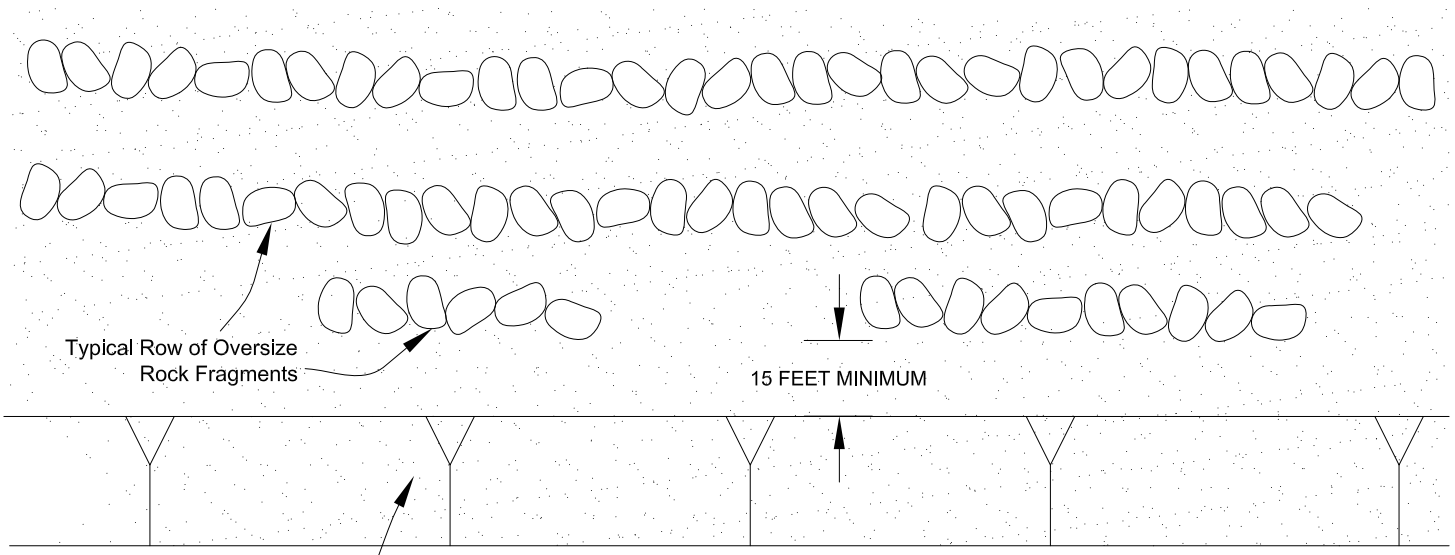
PLATE D-7

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



Section View



Plan View

PLACEMENT OF OVERSIZED MATERIAL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: PM
CHKD: GKM

PLATE D-8

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX E

Latitude, Longitude: 34.03724217, -118.05156087

Date	4/12/2023, 3:33:00 PM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.89	MCE_R ground motion. (for 0.2 second period)
S_1	0.677	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.89	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.26	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	0.815	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.896	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.89	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	2.108	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.32	Factored deterministic acceleration value. (0.2 second)
S1RT	0.677	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.756	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.832	Factored deterministic acceleration value. (1.0 second)
PGAd	0.93	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.815	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.896	Mapped value of the risk coefficient at short periods
C_{R1}	0.896	Mapped value of the risk coefficient at a period of 1 s
C_V	1.478	Vertical coefficient

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

SEISMIC DESIGN PARAMETERS - 2022 CBC

PROPOSED WAREHOUSE

EL MONTE, CALIFORNIA

DRAWN: MK
CHKD: RGT

SCG PROJECT
23G130-1

PLATE E-1

SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX F

SUMMARY

OF

CONE PENETRATION TEST DATA

Project:

825 Lexington-Gallatin Road
El Monte, CA
April 17, 2023

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:

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 825 Lexington-Gallatin Road in El Monte, California. The work was performed by Kehoe Testing & Engineering (KTE) on April 17, 2023. 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	46	Refusal
CPT-2	50	
CPT-3	39	Refusal
CPT-4	45	Refusal

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 with a cone net area ratio of 0.83. The following parameters were recorded 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 behavior type on the CPT plots is derived from the attached CPT SBT plot (Robertson, "Interpretation of Cone Penetration Test…", 2009) 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

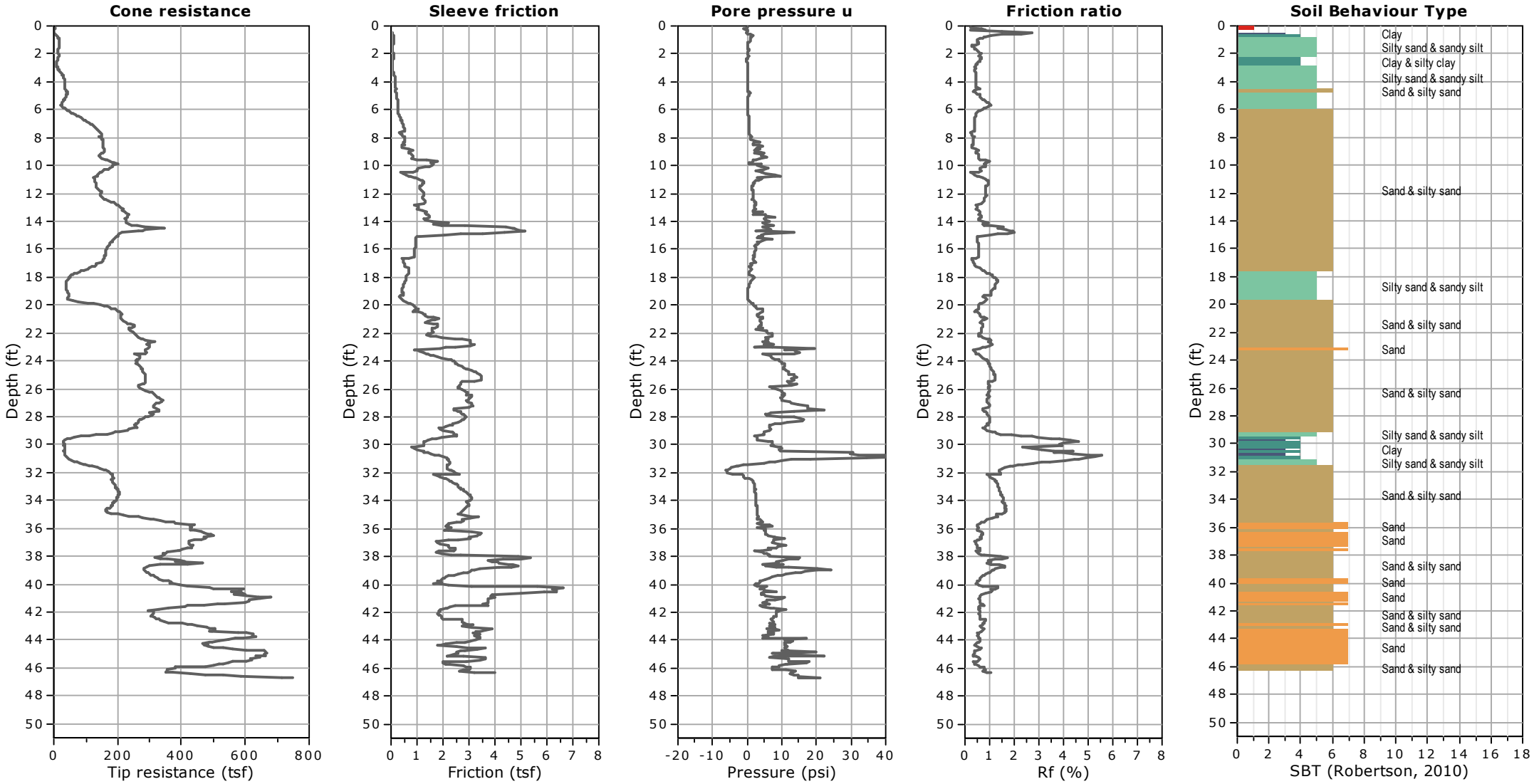
04/20/23-aa-5308

APPENDIX

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

Project: **Southern California Geotechnical**
Location: **825 Leixington-Galletin Rd, El Monte, CA**

CPT-1
Total depth: 46.72 ft, Date: 4/17/2023



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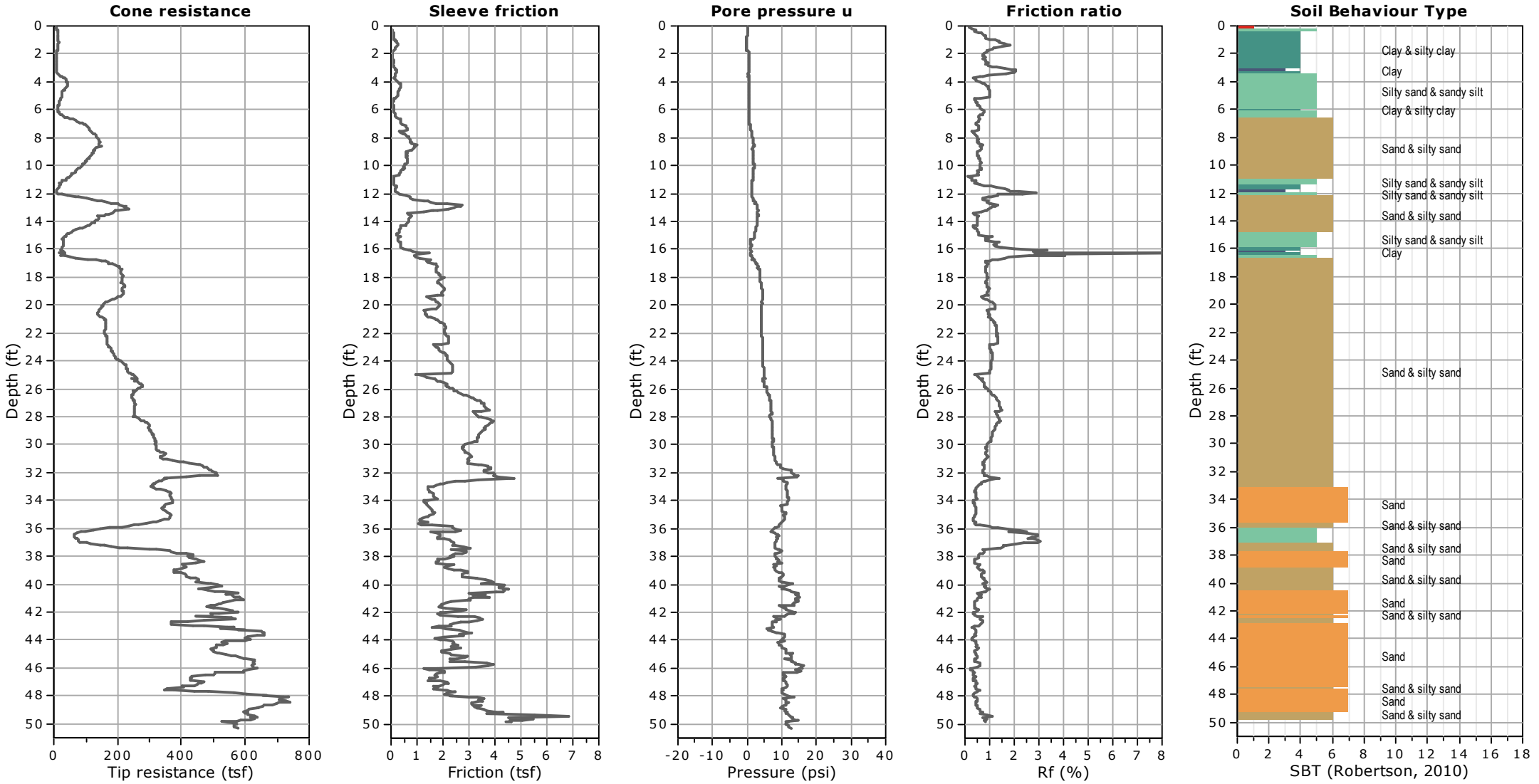
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: **Southern California Geotechnical**
Location: **825 Leixington-Galletin Rd, El Monte, CA**

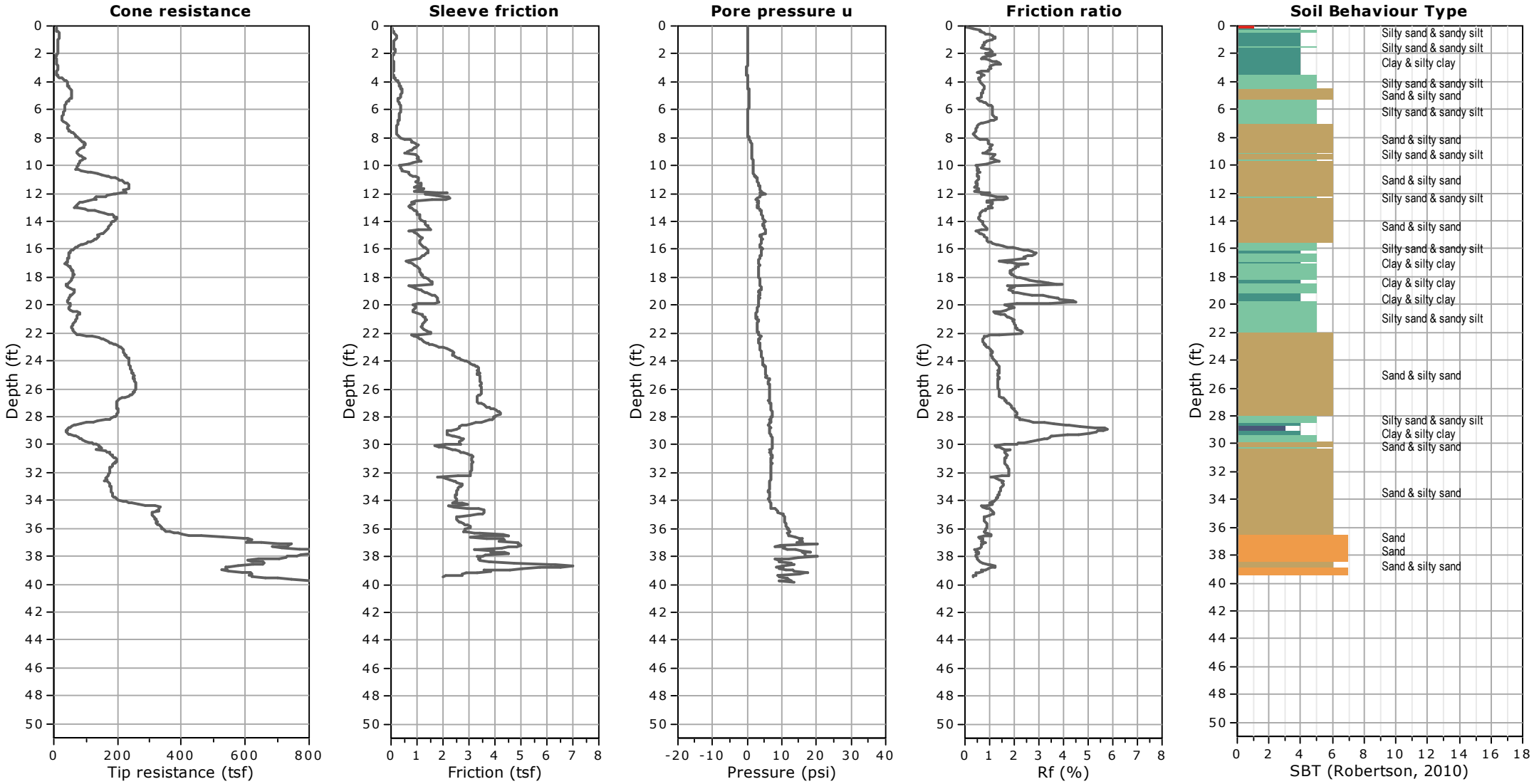
CPT-2
Total depth: 50.27 ft, Date: 4/17/2023



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

Project: **Southern California Geotechnical**
Location: **825 Leixington-Galletin Rd, El Monte, CA**

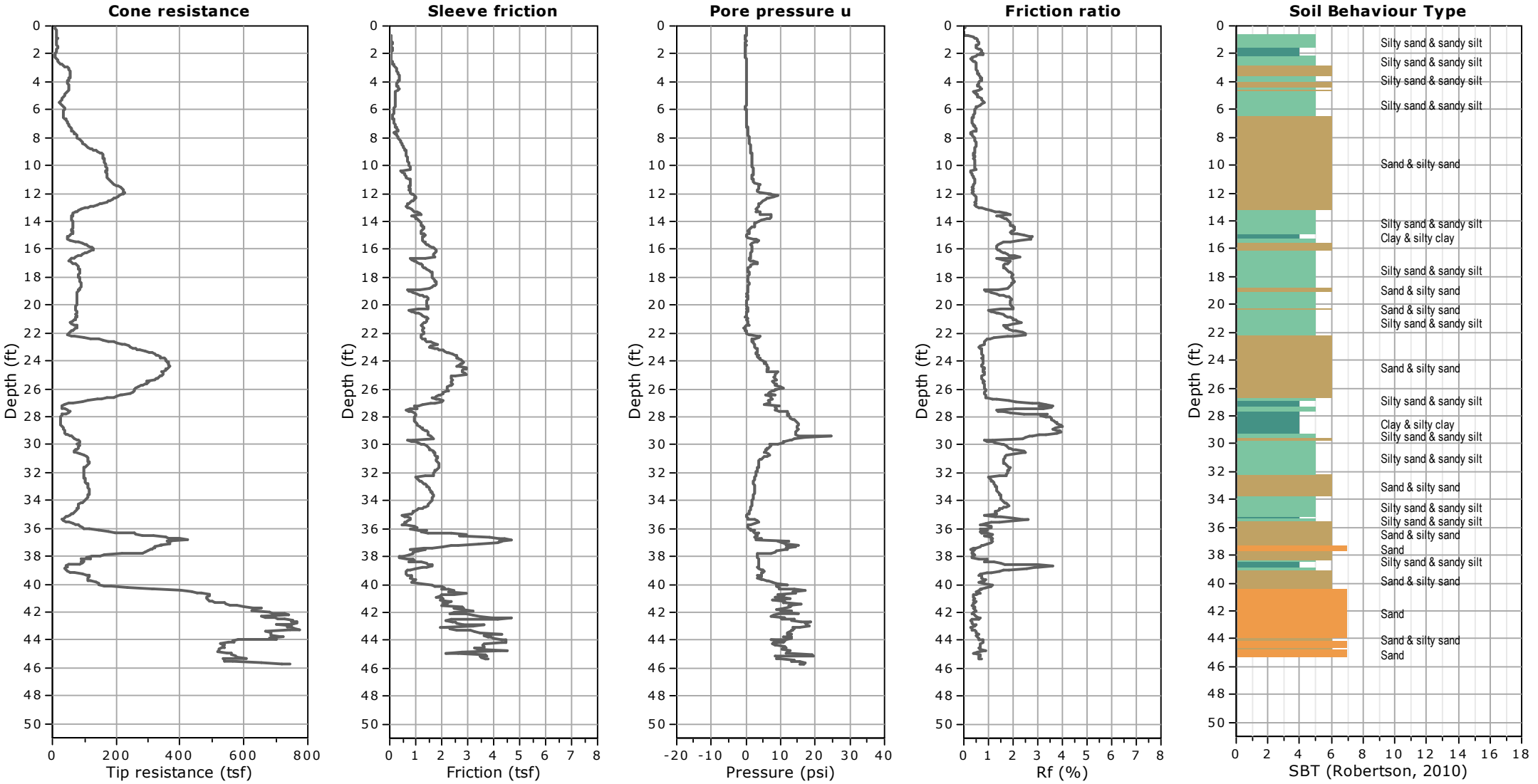
CPT-3
Total depth: 39.84 ft, Date: 4/17/2023



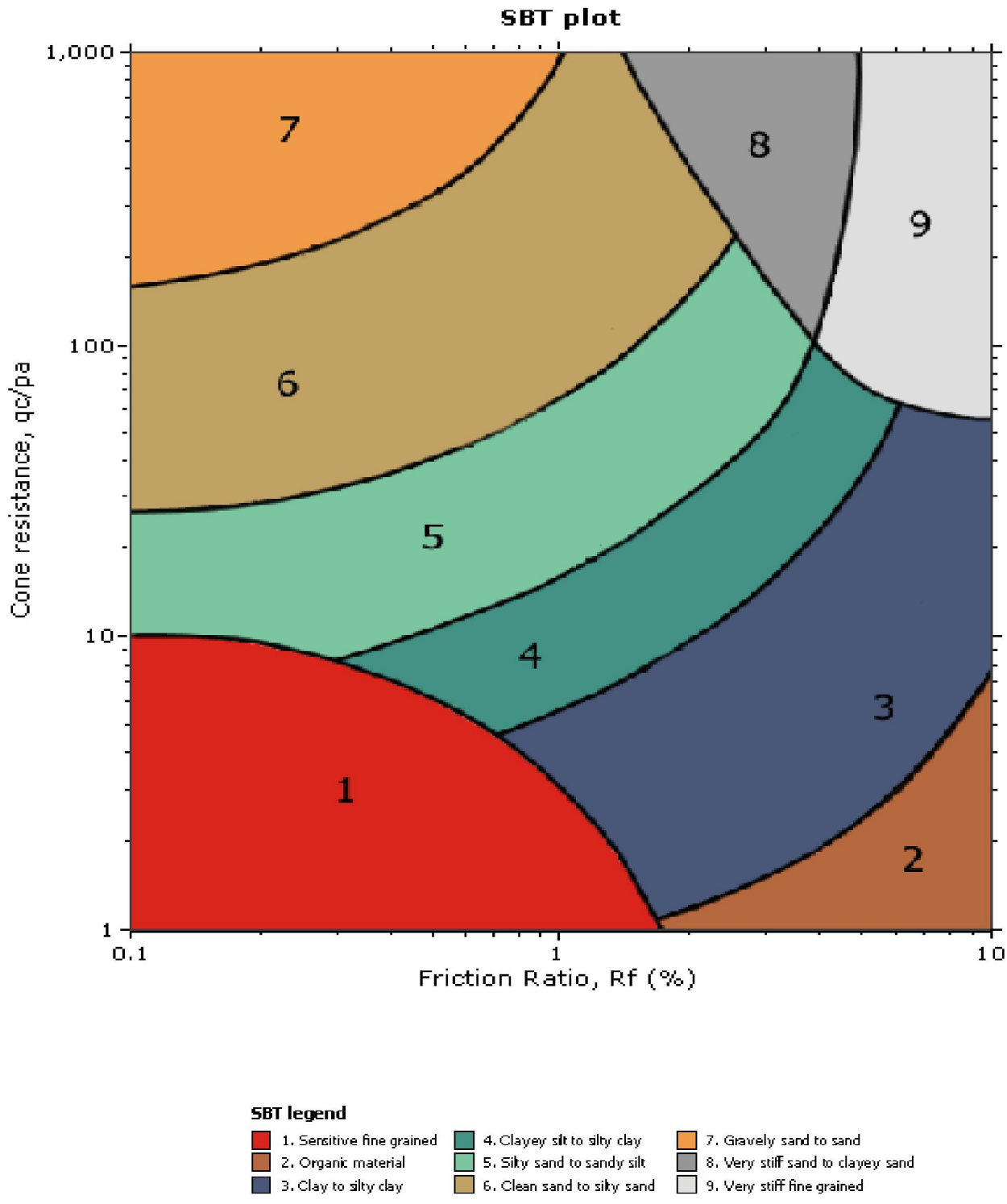
Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: **Southern California Geotechnical**
Location: **825 Leixington-Galletin Rd, El Monte, CA**

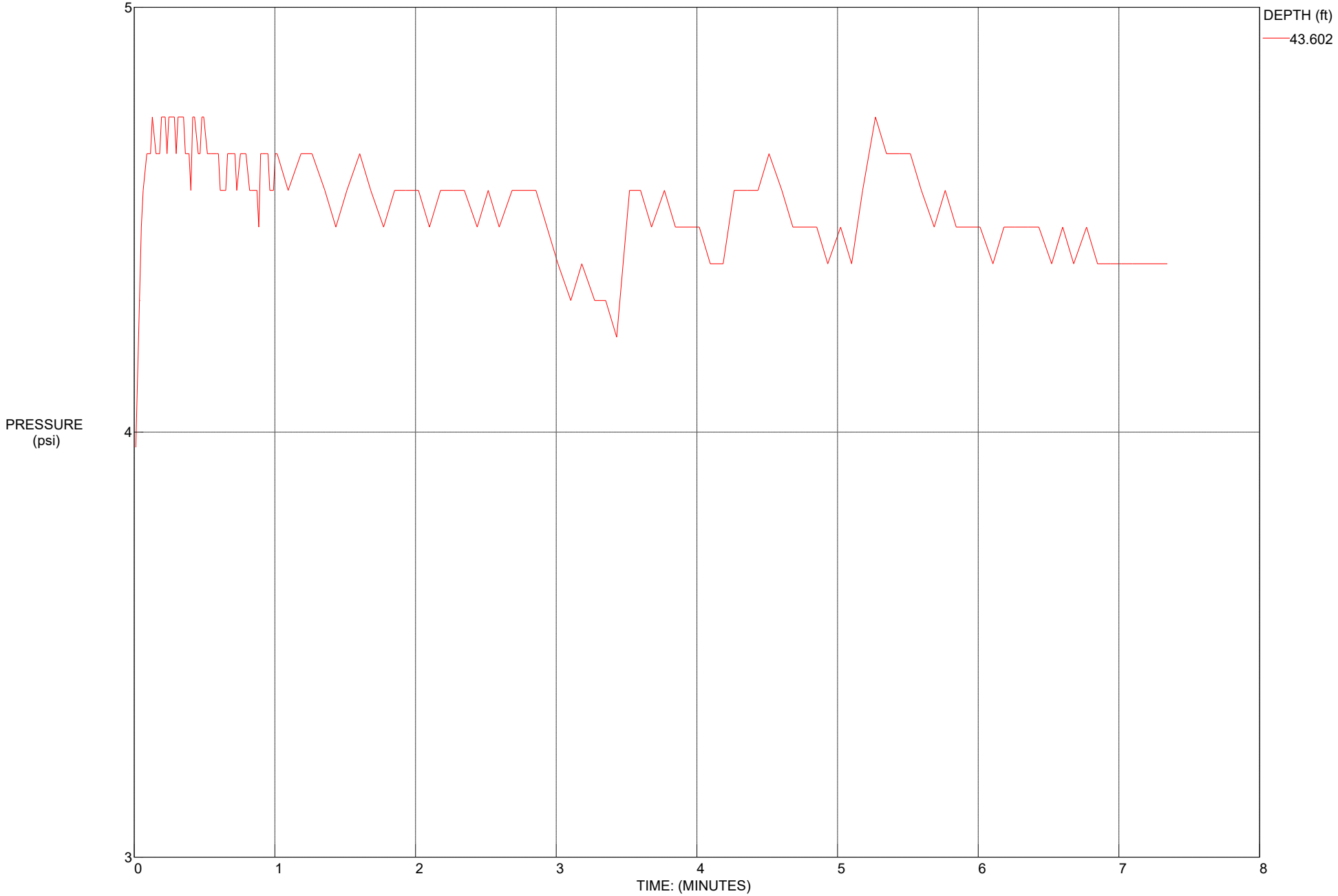
CPT-4
Total depth: 45.75 ft, Date: 4/17/2023



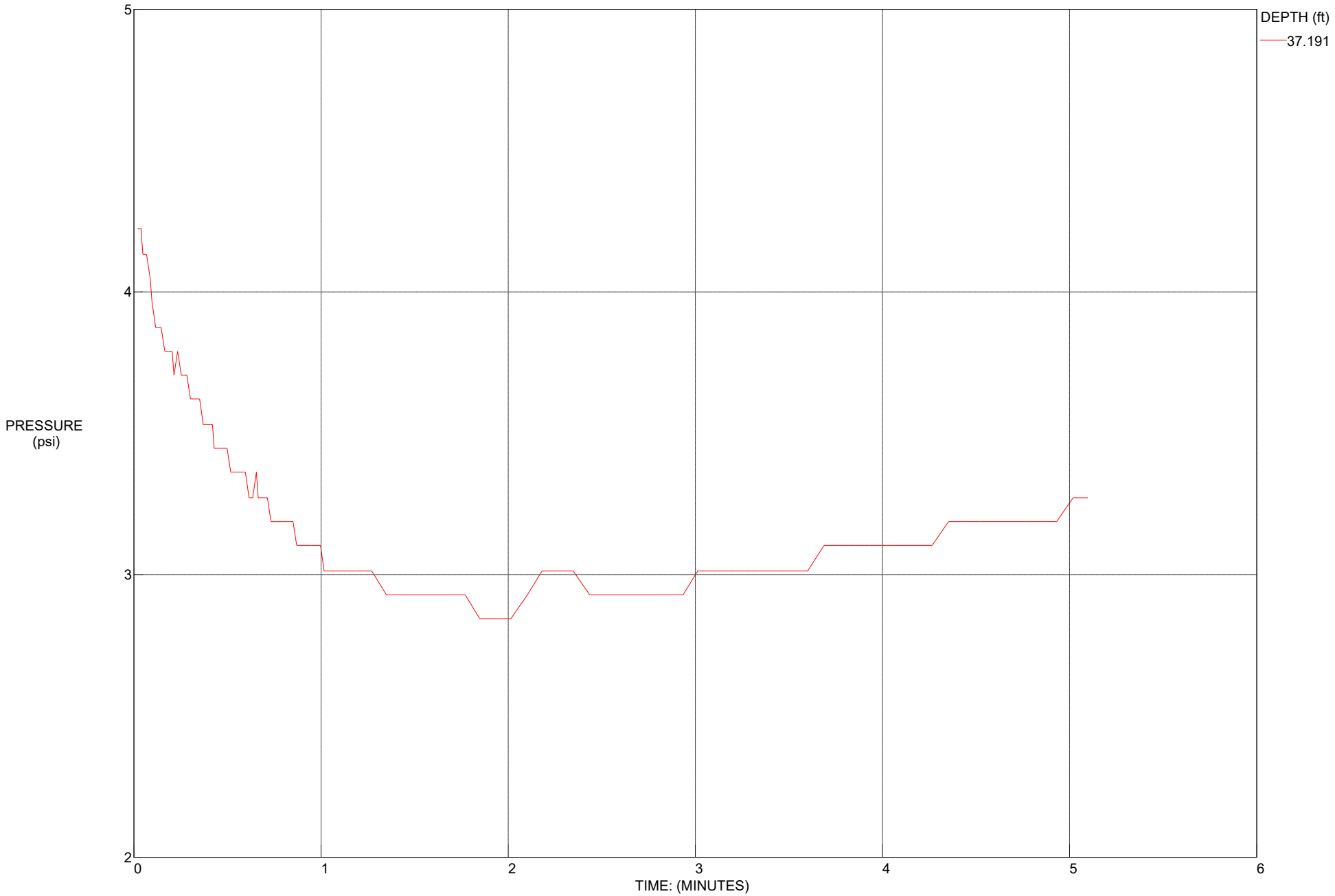
Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com



TEST ID: CPT-1



TEST ID: CPT-4



APPENDIX G

TABLE OF CONTENTS

Southern California Geotechnical, Inc.
714-685-1115

www.socalgeo.com

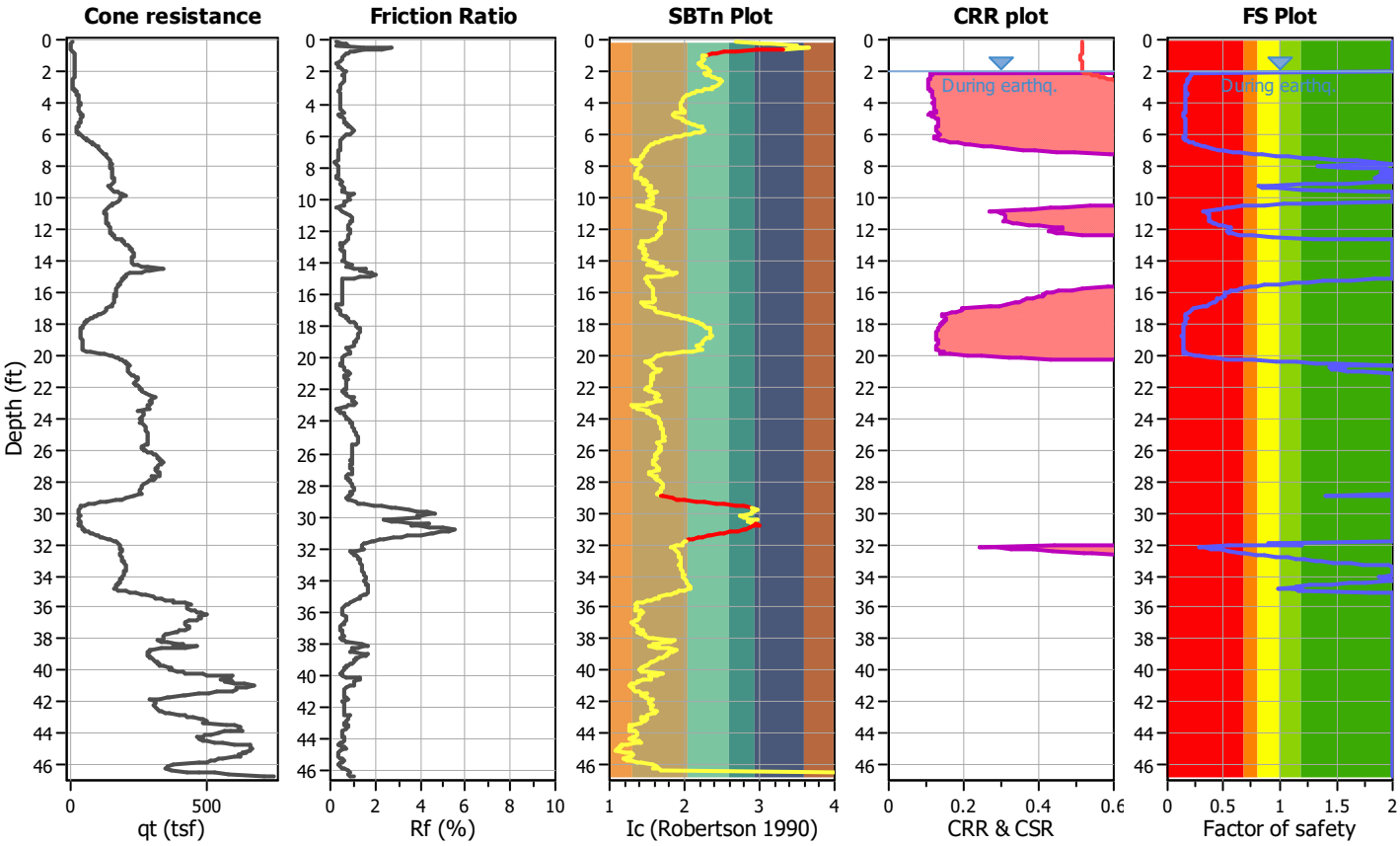
LIQUEFACTION ANALYSIS REPORT

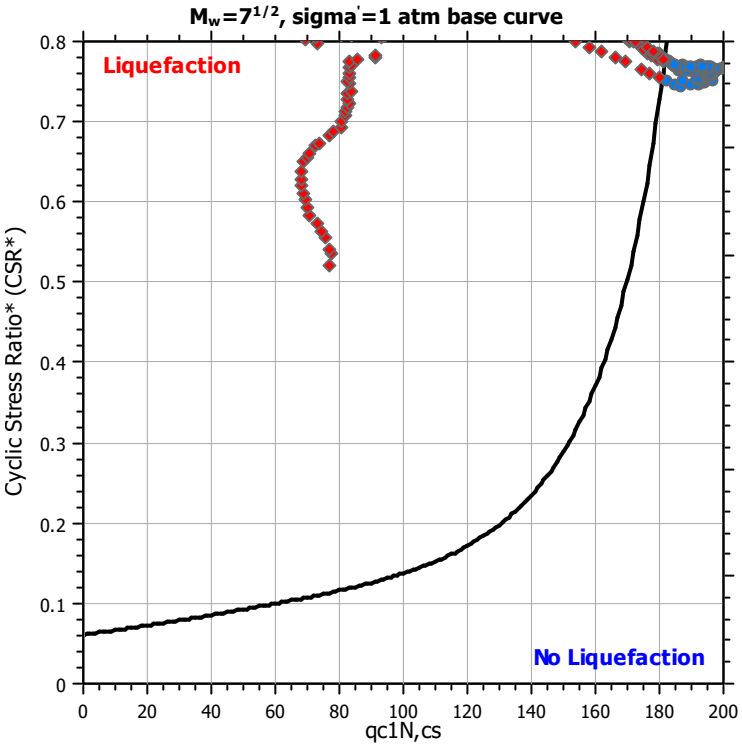
Project title : Proposed Warehouse **Location : El Monte, CA**

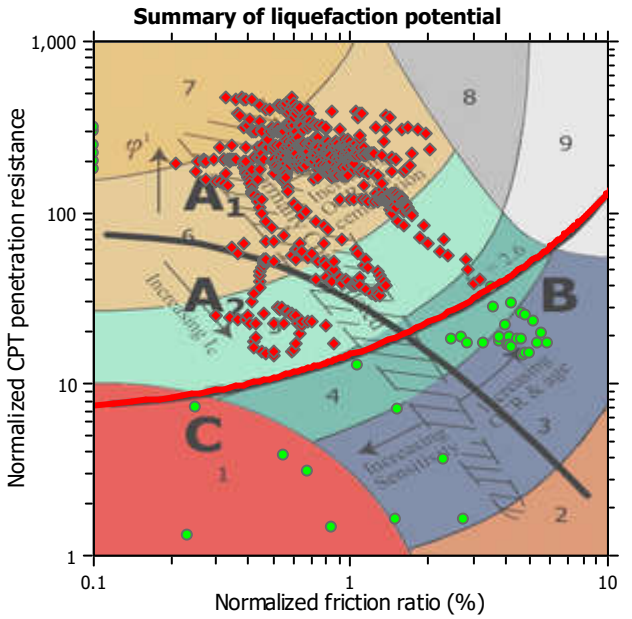
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	30.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.89	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method
Peak ground acceleration:	0.90	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

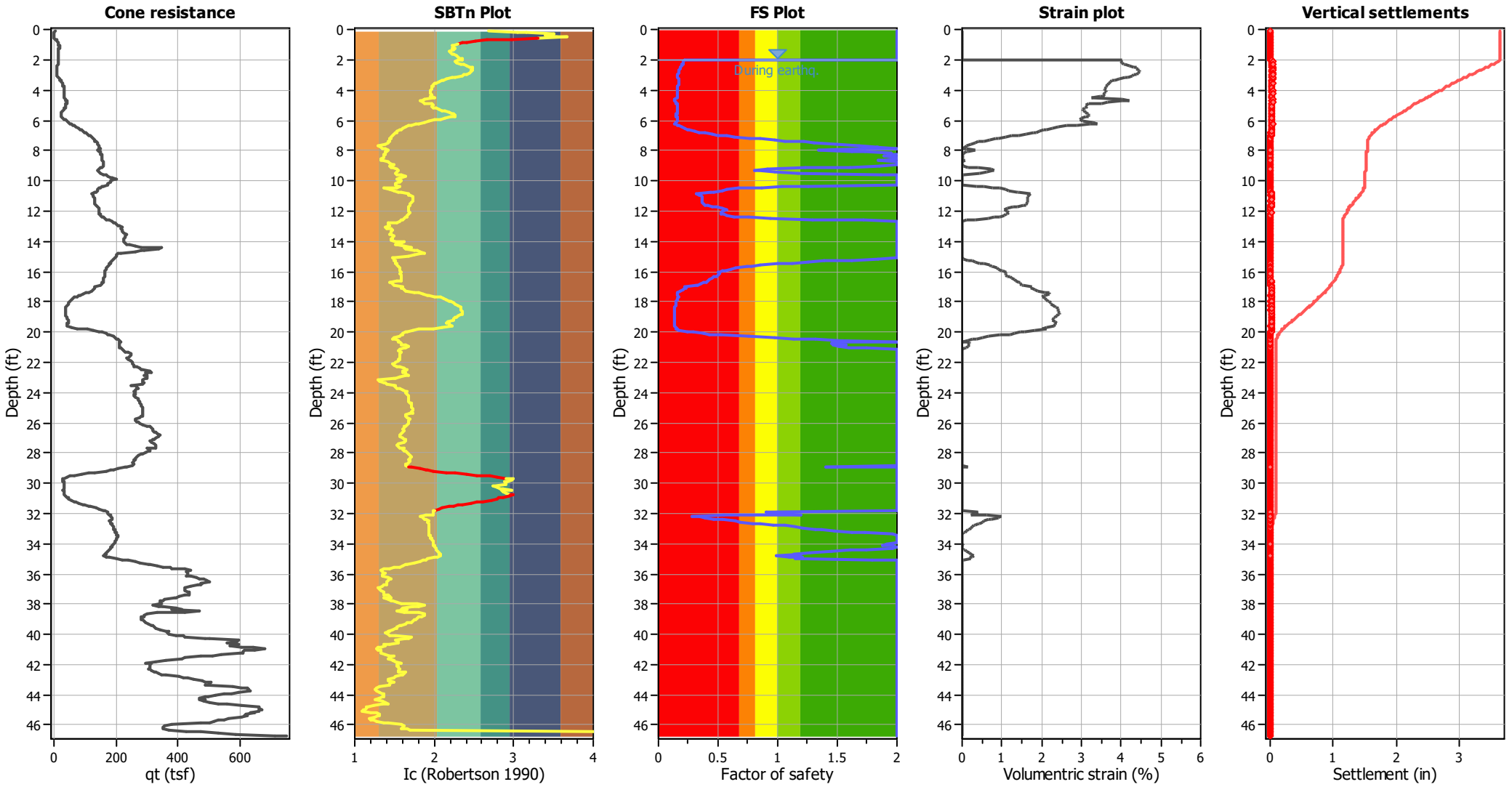






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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)
2.04	76.73	0.22	4.03	0.97	0.03	2.13	77.22	0.21	4.00	0.96	0.04
2.17	76.99	0.21	4.01	0.96	0.02	2.26	75.83	0.20	4.06	0.96	0.05
2.31	74.65	0.20	4.11	0.96	0.03	2.37	72.90	0.19	4.20	0.96	0.03
2.45	70.88	0.19	4.31	0.96	0.04	2.50	69.71	0.18	4.37	0.96	0.03
2.58	69.16	0.18	4.40	0.96	0.04	2.63	68.69	0.17	4.42	0.96	0.03
2.71	68.07	0.17	4.45	0.95	0.04	2.76	68.09	0.17	4.45	0.95	0.03
2.85	68.41	0.17	4.42	0.95	0.05	2.93	68.94	0.16	4.38	0.95	0.05
2.98	69.84	0.16	4.33	0.95	0.02	3.03	70.38	0.16	4.29	0.95	0.03
3.11	72.71	0.16	4.16	0.95	0.04	3.15	74.04	0.16	4.09	0.95	0.02
3.25	76.89	0.17	3.93	0.94	0.04	3.30	78.43	0.17	3.86	0.94	0.02
3.35	80.33	0.17	3.77	0.94	0.03	3.43	80.86	0.17	3.74	0.94	0.03
3.52	81.67	0.17	3.70	0.94	0.04	3.56	81.97	0.17	3.68	0.94	0.02
3.63	82.56	0.16	3.65	0.94	0.03	3.70	82.97	0.16	3.63	0.94	0.03
3.75	82.75	0.16	3.63	0.94	0.02	3.83	82.79	0.16	3.63	0.94	0.03
3.88	83.57	0.16	3.59	0.93	0.02	3.97	83.20	0.16	3.60	0.93	0.04
4.01	82.58	0.16	3.62	0.93	0.02	4.09	82.91	0.16	3.60	0.93	0.03
4.13	83.35	0.16	3.58	0.93	0.02	4.23	83.25	0.16	3.58	0.93	0.04
4.28	83.71	0.16	3.56	0.93	0.02	4.36	83.18	0.15	3.58	0.93	0.03
4.41	85.82	0.16	3.46	0.93	0.02	4.50	91.48	0.16	3.25	0.92	0.03
4.54	90.99	0.16	3.26	0.92	0.02	4.62	72.99	0.14	4.03	0.92	0.04
4.67	69.60	0.13	4.21	0.92	0.03	4.72	72.70	0.14	4.04	0.92	0.02
4.81	80.46	0.14	3.66	0.92	0.04	4.86	83.61	0.15	3.52	0.92	0.02
4.93	92.91	0.16	3.17	0.92	0.03	4.99	94.52	0.16	3.11	0.92	0.02
5.08	93.64	0.16	3.14	0.91	0.03	5.12	94.63	0.16	3.10	0.91	0.02
5.21	95.44	0.16	3.07	0.91	0.03	5.26	96.16	0.16	3.05	0.91	0.02
5.32	96.24	0.16	3.04	0.91	0.02	5.38	95.09	0.16	3.07	0.91	0.02
5.47	93.39	0.16	3.12	0.91	0.03	5.53	92.58	0.15	3.15	0.91	0.02
5.59	91.43	0.15	3.18	0.91	0.02	5.66	91.20	0.15	3.19	0.90	0.03
5.71	91.47	0.15	3.18	0.90	0.02	5.79	93.21	0.15	3.11	0.90	0.03
5.88	96.09	0.16	3.01	0.90	0.03	5.91	97.40	0.16	2.97	0.90	0.01
5.97	97.70	0.16	2.96	0.90	0.02	6.06	94.72	0.15	3.05	0.90	0.03
6.11	88.00	0.14	3.27	0.90	0.02	6.20	84.61	0.14	3.40	0.89	0.04
6.24	89.75	0.14	3.20	0.89	0.02	6.30	98.79	0.16	2.91	0.89	0.02
6.37	107.85	0.17	2.65	0.89	0.02	6.45	116.93	0.19	2.43	0.89	0.02
6.51	125.11	0.22	2.26	0.89	0.02	6.58	131.74	0.24	2.13	0.89	0.02
6.63	135.49	0.26	2.06	0.89	0.01	6.73	143.68	0.31	1.93	0.89	0.02
6.77	147.75	0.34	1.87	0.89	0.01	6.84	153.62	0.39	1.79	0.88	0.01
6.91	158.36	0.45	1.61	0.88	0.01	6.96	161.64	0.49	1.44	0.88	0.01
7.04	166.28	0.57	1.23	0.88	0.01	7.09	169.37	0.64	1.10	0.88	0.01
7.18	174.55	0.77	0.92	0.88	0.01	7.23	177.01	0.85	0.84	0.88	0.00
7.30	180.21	0.97	0.68	0.88	0.01	7.36	182.28	1.06	0.56	0.88	0.00
7.42	185.26	1.22	0.41	0.87	0.00	7.49	186.84	1.31	0.34	0.87	0.00
7.55	189.90	1.50	0.21	0.87	0.00	7.62	192.26	1.68	0.12	0.87	0.00
7.72	194.06	1.84	0.06	0.87	0.00	7.75	193.98	1.83	0.06	0.87	0.00
7.83	196.99	2.00	0.00	0.87	0.00	7.89	192.97	1.74	0.10	0.87	0.00
7.95	187.56	1.34	0.32	0.87	0.00	8.05	191.73	1.63	0.15	0.86	0.00
8.10	192.99	1.73	0.10	0.86	0.00	8.14	195.28	1.95	0.02	0.86	0.00
8.21	195.17	1.93	0.02	0.86	0.00	8.28	196.39	2.00	0.00	0.86	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)
8.36	194.76	1.89	0.04	0.86	0.00	8.40	195.88	2.00	0.00	0.86	0.00
8.48	196.96	2.00	0.00	0.86	0.00	8.53	196.27	2.00	0.00	0.86	0.00
8.62	194.80	1.88	0.04	0.85	0.00	8.67	194.40	1.84	0.06	0.85	0.00
8.76	197.41	2.00	0.00	0.85	0.00	8.80	196.86	2.00	0.00	0.85	0.00
8.89	196.23	2.00	0.00	0.85	0.00	8.93	195.97	2.00	0.00	0.85	0.00
9.00	194.63	1.86	0.05	0.85	0.00	9.07	191.71	1.60	0.16	0.85	0.00
9.12	186.13	1.23	0.38	0.85	0.00	9.20	179.60	0.92	0.72	0.84	0.01
9.27	176.40	0.80	0.82	0.84	0.01	9.34	177.69	0.85	0.78	0.84	0.01
9.40	181.14	0.98	0.64	0.84	0.00	9.47	185.05	1.17	0.44	0.84	0.00
9.56	194.77	1.86	0.05	0.84	0.00	9.60	201.03	2.00	0.00	0.84	0.00
9.66	207.93	2.00	0.00	0.84	0.00	9.74	214.59	2.00	0.00	0.83	0.00
9.78	219.03	2.00	0.00	0.83	0.00	9.85	232.90	2.00	0.00	0.83	0.00
9.92	229.39	2.00	0.00	0.83	0.00	9.99	213.11	2.00	0.00	0.83	0.00
10.05	215.04	2.00	0.00	0.83	0.00	10.11	211.89	2.00	0.00	0.83	0.00
10.19	204.58	2.00	0.00	0.83	0.00	10.27	200.55	2.00	0.00	0.83	0.00
10.32	186.55	1.25	0.36	0.83	0.00	10.37	182.42	1.03	0.56	0.82	0.00
10.44	178.17	0.86	0.75	0.82	0.01	10.50	171.85	0.67	0.94	0.82	0.01
10.56	167.23	0.57	1.11	0.82	0.01	10.63	165.32	0.53	1.18	0.82	0.01
10.72	160.74	0.46	1.38	0.82	0.01	10.77	159.34	0.44	1.44	0.82	0.01
10.85	147.02	0.32	1.73	0.82	0.02	10.90	150.33	0.34	1.69	0.82	0.01
10.97	151.68	0.36	1.67	0.81	0.01	11.04	152.55	0.36	1.65	0.81	0.01
11.10	152.99	0.37	1.65	0.81	0.01	11.17	153.20	0.37	1.64	0.81	0.01
11.26	153.25	0.37	1.64	0.81	0.02	11.30	153.05	0.37	1.64	0.81	0.01
11.35	152.77	0.37	1.64	0.81	0.01	11.43	152.66	0.36	1.64	0.81	0.01
11.49	154.05	0.38	1.62	0.81	0.01	11.57	155.69	0.40	1.60	0.80	0.02
11.62	157.16	0.41	1.53	0.80	0.01	11.71	160.09	0.45	1.38	0.80	0.01
11.75	162.40	0.48	1.27	0.80	0.01	11.82	165.67	0.54	1.14	0.80	0.01
11.89	167.38	0.57	1.07	0.80	0.01	11.95	167.36	0.57	1.07	0.80	0.01
12.02	165.78	0.54	1.13	0.80	0.01	12.10	164.76	0.52	1.17	0.79	0.01
12.16	165.32	0.53	1.14	0.79	0.01	12.21	166.32	0.55	1.10	0.79	0.01
12.28	167.65	0.57	1.05	0.79	0.01	12.34	170.61	0.64	0.95	0.79	0.01
12.42	175.24	0.76	0.80	0.79	0.01	12.47	180.30	0.94	0.65	0.79	0.00
12.56	187.44	1.30	0.31	0.79	0.00	12.60	193.30	1.72	0.10	0.79	0.00
12.67	201.81	2.00	0.00	0.79	0.00	12.74	207.45	2.00	0.00	0.78	0.00
12.80	211.54	2.00	0.00	0.78	0.00	12.87	214.22	2.00	0.00	0.78	0.00
12.94	219.00	2.00	0.00	0.78	0.00	13.00	223.57	2.00	0.00	0.78	0.00
13.08	232.00	2.00	0.00	0.78	0.00	13.13	229.71	2.00	0.00	0.78	0.00
13.19	227.35	2.00	0.00	0.78	0.00	13.26	233.52	2.00	0.00	0.78	0.00
13.33	232.75	2.00	0.00	0.77	0.00	13.40	237.30	2.00	0.00	0.77	0.00
13.49	244.03	2.00	0.00	0.77	0.00	13.53	244.31	2.00	0.00	0.77	0.00
13.61	239.25	2.00	0.00	0.77	0.00	13.67	238.30	2.00	0.00	0.77	0.00
13.73	237.99	2.00	0.00	0.77	0.00	13.79	231.00	2.00	0.00	0.77	0.00
13.85	234.77	2.00	0.00	0.77	0.00	13.93	232.52	2.00	0.00	0.76	0.00
13.99	232.32	2.00	0.00	0.76	0.00	14.06	232.03	2.00	0.00	0.76	0.00
14.12	234.99	2.00	0.00	0.76	0.00	14.19	240.36	2.00	0.00	0.76	0.00
14.25	250.12	2.00	0.00	0.76	0.00	14.31	266.11	2.00	0.00	0.76	0.00
14.37	287.79	2.00	0.00	0.76	0.00	14.44	349.01	2.00	0.00	0.76	0.00
14.52	339.84	2.00	0.00	0.75	0.00	14.59	291.32	2.00	0.00	0.75	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)
14.64	283.02	2.00	0.00	0.75	0.00	14.70	273.33	2.00	0.00	0.75	0.00
14.78	243.88	2.00	0.00	0.75	0.00	14.83	219.48	2.00	0.00	0.75	0.00
14.90	207.03	2.00	0.00	0.75	0.00	14.96	205.66	2.00	0.00	0.75	0.00
15.03	202.15	2.00	0.00	0.75	0.00	15.09	199.66	2.00	0.00	0.74	0.00
15.17	194.61	1.85	0.05	0.74	0.00	15.23	192.06	1.62	0.13	0.74	0.00
15.31	188.87	1.39	0.24	0.74	0.00	15.37	186.55	1.25	0.32	0.74	0.00
15.43	184.15	1.12	0.42	0.74	0.00	15.50	181.53	1.00	0.54	0.74	0.00
15.56	177.98	0.86	0.68	0.74	0.00	15.64	175.88	0.79	0.73	0.73	0.01
15.68	174.34	0.74	0.77	0.73	0.00	15.76	170.80	0.65	0.87	0.73	0.01
15.82	169.23	0.61	0.92	0.73	0.01	15.90	166.77	0.56	1.00	0.73	0.01
15.95	165.58	0.54	1.04	0.73	0.01	16.02	164.21	0.52	1.09	0.73	0.01
16.09	163.51	0.50	1.11	0.73	0.01	16.17	163.79	0.51	1.10	0.73	0.01
16.21	163.54	0.50	1.11	0.73	0.00	16.29	162.78	0.49	1.14	0.72	0.01
16.36	161.10	0.47	1.20	0.72	0.01	16.41	159.66	0.45	1.26	0.72	0.01
16.48	158.40	0.43	1.31	0.72	0.01	16.58	157.31	0.42	1.36	0.72	0.02
16.61	157.18	0.42	1.36	0.72	0.01	16.67	156.08	0.40	1.41	0.72	0.01
16.75	153.55	0.38	1.45	0.72	0.01	16.82	151.19	0.35	1.47	0.71	0.01
16.89	148.01	0.33	1.50	0.71	0.01	16.93	146.25	0.31	1.52	0.71	0.01
17.01	128.94	0.22	1.75	0.71	0.02	17.06	130.71	0.23	1.72	0.71	0.01
17.13	128.27	0.22	1.75	0.71	0.01	17.20	123.49	0.20	1.82	0.71	0.02
17.26	118.76	0.19	1.90	0.71	0.01	17.35	108.90	0.16	2.08	0.71	0.02
17.40	103.51	0.15	2.19	0.71	0.01	17.48	103.58	0.15	2.18	0.70	0.02
17.54	107.38	0.16	2.10	0.70	0.01	17.59	108.89	0.16	2.07	0.70	0.01
17.67	111.32	0.17	2.01	0.70	0.02	17.72	109.96	0.17	2.04	0.70	0.01
17.79	108.01	0.16	2.07	0.70	0.02	17.86	105.73	0.16	2.12	0.70	0.02
17.94	102.69	0.15	2.18	0.70	0.02	17.98	102.07	0.15	2.19	0.70	0.01
18.06	100.64	0.15	2.22	0.69	0.02	18.12	99.15	0.15	2.25	0.69	0.02
18.21	96.92	0.14	2.29	0.69	0.02	18.24	95.98	0.14	2.31	0.69	0.01
18.31	94.28	0.14	2.35	0.69	0.02	18.39	93.09	0.14	2.38	0.69	0.02
18.48	92.13	0.13	2.40	0.69	0.03	18.51	91.92	0.13	2.40	0.69	0.01
18.57	91.31	0.13	2.41	0.69	0.02	18.66	90.41	0.13	2.43	0.68	0.03
18.70	89.98	0.13	2.44	0.68	0.01	18.78	89.85	0.13	2.44	0.68	0.02
18.84	90.36	0.13	2.42	0.68	0.01	18.92	91.72	0.13	2.38	0.68	0.02
18.98	92.71	0.14	2.35	0.68	0.02	19.05	93.81	0.14	2.32	0.68	0.02
19.10	94.69	0.14	2.30	0.68	0.02	19.17	95.64	0.14	2.27	0.68	0.02
19.24	96.24	0.14	2.25	0.67	0.02	19.33	92.54	0.13	2.34	0.67	0.03
19.37	91.01	0.13	2.37	0.67	0.01	19.44	91.93	0.13	2.35	0.67	0.02
19.51	92.16	0.13	2.34	0.67	0.02	19.59	92.48	0.13	2.32	0.67	0.02
19.62	93.20	0.14	2.30	0.67	0.01	19.71	100.67	0.15	2.13	0.67	0.02
19.76	105.49	0.15	2.02	0.67	0.01	19.83	100.31	0.15	2.13	0.66	0.02
19.88	114.74	0.17	1.85	0.66	0.01	19.96	134.22	0.24	1.56	0.66	0.01
20.02	142.89	0.29	1.45	0.66	0.01	20.09	154.24	0.38	1.33	0.66	0.01
20.15	158.34	0.43	1.20	0.66	0.01	20.22	165.10	0.53	0.95	0.66	0.01
20.31	175.10	0.76	0.67	0.66	0.01	20.36	180.98	0.97	0.50	0.65	0.00
20.43	184.36	1.13	0.36	0.65	0.00	20.49	187.70	1.32	0.25	0.65	0.00
20.55	190.37	1.50	0.16	0.65	0.00	20.65	196.17	2.00	0.00	0.65	0.00
20.67	189.88	1.47	0.18	0.65	0.00	20.74	189.59	1.45	0.18	0.65	0.00
20.81	191.41	1.58	0.13	0.65	0.00	20.88	189.78	1.46	0.18	0.65	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)
20.94	190.52	1.51	0.15	0.65	0.00	21.03	191.67	1.60	0.12	0.64	0.00
21.07	193.34	1.74	0.07	0.64	0.00	21.14	197.96	2.00	0.00	0.64	0.00
21.21	202.91	2.00	0.00	0.64	0.00	21.30	207.37	2.00	0.00	0.64	0.00
21.33	214.72	2.00	0.00	0.64	0.00	21.39	226.25	2.00	0.00	0.64	0.00
21.47	222.72	2.00	0.00	0.64	0.00	21.54	226.16	2.00	0.00	0.63	0.00
21.61	218.14	2.00	0.00	0.63	0.00	21.67	212.80	2.00	0.00	0.63	0.00
21.75	211.75	2.00	0.00	0.63	0.00	21.83	213.53	2.00	0.00	0.63	0.00
21.85	213.64	2.00	0.00	0.63	0.00	21.92	220.77	2.00	0.00	0.63	0.00
22.02	225.31	2.00	0.00	0.63	0.00	22.06	226.29	2.00	0.00	0.63	0.00
22.11	227.96	2.00	0.00	0.63	0.00	22.19	231.98	2.00	0.00	0.62	0.00
22.26	231.55	2.00	0.00	0.62	0.00	22.33	236.89	2.00	0.00	0.62	0.00
22.42	245.59	2.00	0.00	0.62	0.00	22.44	250.15	2.00	0.00	0.62	0.00
22.51	257.33	2.00	0.00	0.62	0.00	22.60	277.20	2.00	0.00	0.62	0.00
22.65	281.05	2.00	0.00	0.62	0.00	22.72	263.88	2.00	0.00	0.61	0.00
22.77	267.74	2.00	0.00	0.61	0.00	22.84	257.29	2.00	0.00	0.61	0.00
22.91	266.21	2.00	0.00	0.61	0.00	22.99	264.93	2.00	0.00	0.61	0.00
23.04	266.71	2.00	0.00	0.61	0.00	23.10	260.43	2.00	0.00	0.61	0.00
23.18	253.17	2.00	0.00	0.61	0.00	23.23	254.70	2.00	0.00	0.61	0.00
23.32	254.11	2.00	0.00	0.60	0.00	23.38	255.53	2.00	0.00	0.60	0.00
23.44	253.87	2.00	0.00	0.60	0.00	23.51	219.10	2.00	0.00	0.60	0.00
23.57	232.04	2.00	0.00	0.60	0.00	23.63	235.00	2.00	0.00	0.60	0.00
23.70	236.41	2.00	0.00	0.60	0.00	23.77	234.68	2.00	0.00	0.60	0.00
23.84	231.31	2.00	0.00	0.60	0.00	23.89	227.49	2.00	0.00	0.60	0.00
23.97	223.11	2.00	0.00	0.59	0.00	24.02	227.26	2.00	0.00	0.59	0.00
24.11	225.76	2.00	0.00	0.59	0.00	24.15	227.02	2.00	0.00	0.59	0.00
24.22	222.46	2.00	0.00	0.59	0.00	24.28	229.30	2.00	0.00	0.59	0.00
24.38	234.31	2.00	0.00	0.59	0.00	24.42	235.22	2.00	0.00	0.59	0.00
24.48	237.02	2.00	0.00	0.59	0.00	24.56	239.29	2.00	0.00	0.58	0.00
24.61	239.83	2.00	0.00	0.58	0.00	24.69	240.51	2.00	0.00	0.58	0.00
24.74	240.62	2.00	0.00	0.58	0.00	24.80	242.59	2.00	0.00	0.58	0.00
24.87	244.56	2.00	0.00	0.58	0.00	24.96	247.26	2.00	0.00	0.58	0.00
25.01	247.71	2.00	0.00	0.58	0.00	25.10	247.50	2.00	0.00	0.57	0.00
25.14	247.61	2.00	0.00	0.57	0.00	25.23	247.23	2.00	0.00	0.57	0.00
25.27	247.26	2.00	0.00	0.57	0.00	25.34	246.06	2.00	0.00	0.57	0.00
25.41	245.29	2.00	0.00	0.57	0.00	25.47	245.00	2.00	0.00	0.57	0.00
25.54	244.70	2.00	0.00	0.57	0.00	25.61	241.66	2.00	0.00	0.57	0.00
25.68	238.29	2.00	0.00	0.56	0.00	25.74	224.70	2.00	0.00	0.56	0.00
25.81	224.22	2.00	0.00	0.56	0.00	25.86	223.80	2.00	0.00	0.56	0.00
25.94	227.62	2.00	0.00	0.56	0.00	25.99	229.06	2.00	0.00	0.56	0.00
26.07	236.83	2.00	0.00	0.56	0.00	26.12	244.94	2.00	0.00	0.56	0.00
26.20	255.71	2.00	0.00	0.56	0.00	26.26	263.60	2.00	0.00	0.55	0.00
26.32	267.78	2.00	0.00	0.55	0.00	26.39	270.72	2.00	0.00	0.55	0.00
26.48	271.55	2.00	0.00	0.55	0.00	26.53	272.74	2.00	0.00	0.55	0.00
26.59	276.56	2.00	0.00	0.55	0.00	26.65	278.75	2.00	0.00	0.55	0.00
26.72	284.51	2.00	0.00	0.55	0.00	26.79	290.33	2.00	0.00	0.55	0.00
26.84	285.55	2.00	0.00	0.55	0.00	26.91	286.74	2.00	0.00	0.54	0.00
26.97	279.65	2.00	0.00	0.54	0.00	27.06	273.56	2.00	0.00	0.54	0.00
27.11	268.96	2.00	0.00	0.54	0.00	27.19	263.80	2.00	0.00	0.54	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)
27.24	263.10	2.00	0.00	0.54	0.00	27.30	264.89	2.00	0.00	0.54	0.00
27.36	272.28	2.00	0.00	0.54	0.00	27.46	277.93	2.00	0.00	0.53	0.00
27.51	277.40	2.00	0.00	0.53	0.00	27.57	277.53	2.00	0.00	0.53	0.00
27.65	274.27	2.00	0.00	0.53	0.00	27.69	251.38	2.00	0.00	0.53	0.00
27.76	259.56	2.00	0.00	0.53	0.00	27.82	261.09	2.00	0.00	0.53	0.00
27.91	256.82	2.00	0.00	0.53	0.00	27.96	245.52	2.00	0.00	0.53	0.00
28.04	238.36	2.00	0.00	0.52	0.00	28.09	234.81	2.00	0.00	0.52	0.00
28.18	224.83	2.00	0.00	0.52	0.00	28.22	220.68	2.00	0.00	0.52	0.00
28.30	217.33	2.00	0.00	0.52	0.00	28.36	215.24	2.00	0.00	0.52	0.00
28.44	212.75	2.00	0.00	0.52	0.00	28.49	210.19	2.00	0.00	0.52	0.00
28.58	208.74	2.00	0.00	0.52	0.00	28.62	206.28	2.00	0.00	0.51	0.00
28.69	207.54	2.00	0.00	0.51	0.00	28.76	210.45	2.00	0.00	0.51	0.00
28.82	203.39	2.00	0.00	0.51	0.00	28.89	188.96	1.41	0.16	0.51	0.00
28.94	184.10	2.00	0.00	0.51	0.00	29.04	170.50	2.00	0.00	0.51	0.00
29.12	175.41	2.00	0.00	0.51	0.00	29.16	178.39	2.00	0.00	0.51	0.00
29.22	179.02	2.00	0.00	0.50	0.00	29.30	165.97	2.00	0.00	0.50	0.00
29.34	152.35	2.00	0.00	0.50	0.00	29.41	132.60	2.00	0.00	0.50	0.00
29.47	113.44	2.00	0.00	0.50	0.00	29.53	36.57	2.00	0.00	0.50	0.00
29.60	29.49	2.00	0.00	0.50	0.00	29.66	24.25	2.00	0.00	0.50	0.00
29.74	20.31	2.00	0.00	0.50	0.00	29.79	20.08	2.00	0.00	0.50	0.00
29.87	22.10	2.00	0.00	0.49	0.00	29.92	23.03	2.00	0.00	0.49	0.00
30.01	22.65	2.00	0.00	0.49	0.00	30.05	22.92	2.00	0.00	0.49	0.00
30.15	24.92	2.00	0.00	0.49	0.00	30.19	24.28	2.00	0.00	0.49	0.00
30.26	23.19	2.00	0.00	0.49	0.00	30.32	23.26	2.00	0.00	0.49	0.00
30.41	23.73	2.00	0.00	0.48	0.00	30.46	20.13	2.00	0.00	0.48	0.00
30.51	24.94	2.00	0.00	0.48	0.00	30.59	25.13	2.00	0.00	0.48	0.00
30.64	24.72	2.00	0.00	0.48	0.00	30.72	23.34	2.00	0.00	0.48	0.00
30.78	22.85	2.00	0.00	0.48	0.00	30.85	26.26	2.00	0.00	0.48	0.00
30.94	30.86	2.00	0.00	0.48	0.00	30.99	33.77	2.00	0.00	0.47	0.00
31.04	35.29	2.00	0.00	0.47	0.00	31.11	39.47	2.00	0.00	0.47	0.00
31.21	47.99	2.00	0.00	0.47	0.00	31.26	118.68	2.00	0.00	0.47	0.00
31.30	125.46	2.00	0.00	0.47	0.00	31.39	136.29	2.00	0.00	0.47	0.00
31.44	140.18	2.00	0.00	0.47	0.00	31.50	147.16	2.00	0.00	0.47	0.00
31.57	152.32	2.00	0.00	0.46	0.00	31.66	161.53	2.00	0.00	0.46	0.00
31.70	165.02	2.00	0.00	0.46	0.00	31.79	171.42	2.00	0.00	0.46	0.00
31.84	174.39	2.00	0.00	0.46	0.00	31.93	179.25	0.90	0.40	0.46	0.00
31.97	181.78	1.00	0.33	0.46	0.00	32.06	185.56	1.20	0.22	0.46	0.00
32.11	166.07	0.55	0.64	0.46	0.00	32.15	141.98	0.28	1.00	0.46	0.01
32.24	149.71	0.34	0.94	0.45	0.01	32.29	154.84	0.39	0.91	0.45	0.01
32.36	161.27	0.47	0.75	0.45	0.01	32.42	165.65	0.54	0.64	0.45	0.00
32.51	170.89	0.65	0.53	0.45	0.01	32.55	172.28	0.68	0.51	0.45	0.00
32.64	176.07	0.79	0.44	0.45	0.00	32.68	178.01	0.85	0.41	0.45	0.00
32.75	180.90	0.97	0.35	0.44	0.00	32.82	183.03	1.06	0.28	0.44	0.00
32.88	184.73	1.15	0.24	0.44	0.00	32.96	185.89	1.21	0.21	0.44	0.00
33.04	187.75	1.32	0.17	0.44	0.00	33.08	188.48	1.37	0.15	0.44	0.00
33.16	190.05	1.47	0.12	0.44	0.00	33.23	192.07	1.62	0.08	0.44	0.00
33.27	193.34	1.73	0.05	0.44	0.00	33.35	195.84	1.97	0.01	0.43	0.00
33.40	197.30	2.00	0.00	0.43	0.00	33.47	199.37	2.00	0.00	0.43	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)
33.54	200.54	2.00	0.00	0.43	0.00	33.62	201.41	2.00	0.00	0.43	0.00
33.67	202.03	2.00	0.00	0.43	0.00	33.73	202.48	2.00	0.00	0.43	0.00
33.80	202.66	2.00	0.00	0.43	0.00	33.89	201.88	2.00	0.00	0.43	0.00
33.94	201.03	2.00	0.00	0.42	0.00	34.03	195.31	1.91	0.01	0.42	0.00
34.08	194.98	1.88	0.02	0.42	0.00	34.17	195.82	1.97	0.01	0.42	0.00
34.21	196.03	1.99	0.00	0.42	0.00	34.26	196.30	2.00	0.00	0.42	0.00
34.32	195.81	1.96	0.01	0.42	0.00	34.40	193.56	1.75	0.05	0.42	0.00
34.46	191.90	1.61	0.08	0.42	0.00	34.53	189.80	1.45	0.12	0.41	0.00
34.60	186.90	1.27	0.17	0.41	0.00	34.66	184.56	1.14	0.23	0.41	0.00
34.72	185.50	1.19	0.20	0.41	0.00	34.78	181.43	0.99	0.30	0.41	0.00
34.84	183.79	1.10	0.24	0.41	0.00	34.91	185.86	1.21	0.19	0.41	0.00
34.98	184.76	1.15	0.22	0.41	0.00	35.05	194.00	1.79	0.04	0.41	0.00
35.11	202.11	2.00	0.00	0.40	0.00	35.18	211.18	2.00	0.00	0.40	0.00
35.25	217.96	2.00	0.00	0.40	0.00	35.34	241.90	2.00	0.00	0.40	0.00
35.38	248.88	2.00	0.00	0.40	0.00	35.47	268.26	2.00	0.00	0.40	0.00
35.52	280.95	2.00	0.00	0.40	0.00	35.57	300.90	2.00	0.00	0.40	0.00
35.63	304.52	2.00	0.00	0.40	0.00	35.70	338.94	2.00	0.00	0.39	0.00
35.78	354.09	2.00	0.00	0.39	0.00	35.83	342.08	2.00	0.00	0.39	0.00
35.90	343.30	2.00	0.00	0.39	0.00	35.96	344.69	2.00	0.00	0.39	0.00
36.05	342.92	2.00	0.00	0.39	0.00	36.10	342.70	2.00	0.00	0.39	0.00
36.16	352.66	2.00	0.00	0.39	0.00	36.22	368.07	2.00	0.00	0.39	0.00
36.29	374.53	2.00	0.00	0.38	0.00	36.37	385.10	2.00	0.00	0.38	0.00
36.43	392.16	2.00	0.00	0.38	0.00	36.50	398.89	2.00	0.00	0.38	0.00
36.59	376.44	2.00	0.00	0.38	0.00	36.63	381.75	2.00	0.00	0.38	0.00
36.70	377.87	2.00	0.00	0.38	0.00	36.77	368.68	2.00	0.00	0.38	0.00
36.81	350.03	2.00	0.00	0.38	0.00	36.90	336.27	2.00	0.00	0.37	0.00
36.94	336.39	2.00	0.00	0.37	0.00	37.03	336.26	2.00	0.00	0.37	0.00
37.07	336.38	2.00	0.00	0.37	0.00	37.17	341.32	2.00	0.00	0.37	0.00
37.21	346.33	2.00	0.00	0.37	0.00	37.28	345.12	2.00	0.00	0.37	0.00
37.35	344.86	2.00	0.00	0.37	0.00	37.44	333.86	2.00	0.00	0.37	0.00
37.47	319.91	2.00	0.00	0.36	0.00	37.54	311.58	2.00	0.00	0.36	0.00
37.62	308.25	2.00	0.00	0.36	0.00	37.69	281.28	2.00	0.00	0.36	0.00
37.74	278.72	2.00	0.00	0.36	0.00	37.80	270.58	2.00	0.00	0.36	0.00
37.88	270.77	2.00	0.00	0.36	0.00	37.93	273.44	2.00	0.00	0.36	0.00
38.02	271.48	2.00	0.00	0.36	0.00	38.07	277.71	2.00	0.00	0.35	0.00
38.14	270.82	2.00	0.00	0.35	0.00	38.20	279.61	2.00	0.00	0.35	0.00
38.29	312.72	2.00	0.00	0.35	0.00	38.33	326.35	2.00	0.00	0.35	0.00
38.39	302.04	2.00	0.00	0.35	0.00	38.45	368.76	2.00	0.00	0.35	0.00
38.54	332.49	2.00	0.00	0.35	0.00	38.59	265.99	2.00	0.00	0.35	0.00
38.66	264.65	2.00	0.00	0.34	0.00	38.72	256.97	2.00	0.00	0.34	0.00
38.79	240.23	2.00	0.00	0.34	0.00	38.86	218.11	2.00	0.00	0.34	0.00
38.93	215.15	2.00	0.00	0.34	0.00	38.98	215.08	2.00	0.00	0.34	0.00
39.05	219.19	2.00	0.00	0.34	0.00	39.13	222.05	2.00	0.00	0.34	0.00
39.20	226.06	2.00	0.00	0.34	0.00	39.26	229.84	2.00	0.00	0.33	0.00
39.31	234.63	2.00	0.00	0.33	0.00	39.40	244.65	2.00	0.00	0.33	0.00
39.44	249.34	2.00	0.00	0.33	0.00	39.53	254.89	2.00	0.00	0.33	0.00
39.57	257.30	2.00	0.00	0.33	0.00	39.65	259.62	2.00	0.00	0.33	0.00
39.70	269.45	2.00	0.00	0.33	0.00	39.79	283.54	2.00	0.00	0.33	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)
39.83	289.38	2.00	0.00	0.32	0.00	39.90	286.82	2.00	0.00	0.32	0.00
39.97	292.20	2.00	0.00	0.32	0.00	40.04	310.42	2.00	0.00	0.32	0.00
40.10	327.85	2.00	0.00	0.32	0.00	40.17	332.60	2.00	0.00	0.32	0.00
40.24	383.67	2.00	0.00	0.32	0.00	40.29	394.26	2.00	0.00	0.32	0.00
40.36	468.15	2.00	0.00	0.32	0.00	40.42	457.55	2.00	0.00	0.31	0.00
40.50	460.68	2.00	0.00	0.31	0.00	40.56	435.67	2.00	0.00	0.31	0.00
40.62	463.74	2.00	0.00	0.31	0.00	40.69	467.65	2.00	0.00	0.31	0.00
40.76	443.46	2.00	0.00	0.31	0.00	40.82	471.44	2.00	0.00	0.31	0.00
40.88	501.92	2.00	0.00	0.31	0.00	40.95	530.99	2.00	0.00	0.31	0.00
41.02	503.99	2.00	0.00	0.30	0.00	41.08	478.11	2.00	0.00	0.30	0.00
41.14	477.03	2.00	0.00	0.30	0.00	41.21	477.48	2.00	0.00	0.30	0.00
41.28	468.15	2.00	0.00	0.30	0.00	41.36	418.94	2.00	0.00	0.30	0.00
41.41	399.78	2.00	0.00	0.30	0.00	41.47	368.85	2.00	0.00	0.30	0.00
41.54	327.60	2.00	0.00	0.30	0.00	41.60	321.38	2.00	0.00	0.29	0.00
41.69	281.95	2.00	0.00	0.29	0.00	41.74	279.96	2.00	0.00	0.29	0.00
41.81	255.28	2.00	0.00	0.29	0.00	41.87	222.79	2.00	0.00	0.29	0.00
41.94	240.10	2.00	0.00	0.29	0.00	42.00	239.58	2.00	0.00	0.29	0.00
42.06	239.14	2.00	0.00	0.29	0.00	42.15	235.38	2.00	0.00	0.29	0.00
42.19	235.68	2.00	0.00	0.28	0.00	42.26	232.41	2.00	0.00	0.28	0.00
42.33	237.37	2.00	0.00	0.28	0.00	42.39	242.37	2.00	0.00	0.28	0.00
42.46	248.75	2.00	0.00	0.28	0.00	42.52	256.07	2.00	0.00	0.28	0.00
42.59	260.59	2.00	0.00	0.28	0.00	42.66	270.00	2.00	0.00	0.28	0.00
42.73	280.56	2.00	0.00	0.28	0.00	42.82	311.91	2.00	0.00	0.27	0.00
42.87	325.13	2.00	0.00	0.27	0.00	42.91	335.90	2.00	0.00	0.27	0.00
43.00	349.77	2.00	0.00	0.27	0.00	43.05	371.78	2.00	0.00	0.27	0.00
43.14	379.18	2.00	0.00	0.27	0.00	43.18	391.01	2.00	0.00	0.27	0.00
43.26	390.09	2.00	0.00	0.27	0.00	43.33	384.07	2.00	0.00	0.27	0.00
43.38	378.08	2.00	0.00	0.26	0.00	43.44	447.37	2.00	0.00	0.26	0.00
43.50	468.15	2.00	0.00	0.26	0.00	43.57	483.55	2.00	0.00	0.26	0.00
43.64	484.63	2.00	0.00	0.26	0.00	43.71	480.47	2.00	0.00	0.26	0.00
43.78	489.21	2.00	0.00	0.26	0.00	43.86	458.09	2.00	0.00	0.26	0.00
43.90	440.57	2.00	0.00	0.26	0.00	43.97	421.71	2.00	0.00	0.25	0.00
44.05	400.79	2.00	0.00	0.25	0.00	44.12	383.04	2.00	0.00	0.25	0.00
44.17	375.25	2.00	0.00	0.25	0.00	44.23	360.53	2.00	0.00	0.25	0.00
44.29	374.21	2.00	0.00	0.25	0.00	44.36	362.91	2.00	0.00	0.25	0.00
44.46	373.11	2.00	0.00	0.25	0.00	44.50	384.53	2.00	0.00	0.25	0.00
44.57	408.29	2.00	0.00	0.24	0.00	44.63	430.49	2.00	0.00	0.24	0.00
44.69	464.52	2.00	0.00	0.24	0.00	44.76	508.97	2.00	0.00	0.24	0.00
44.83	509.48	2.00	0.00	0.24	0.00	44.89	509.06	2.00	0.00	0.24	0.00
44.95	515.28	2.00	0.00	0.24	0.00	45.03	507.64	2.00	0.00	0.24	0.00
45.08	509.24	2.00	0.00	0.24	0.00	45.16	485.26	2.00	0.00	0.23	0.00
45.21	497.87	2.00	0.00	0.23	0.00	45.29	476.03	2.00	0.00	0.23	0.00
45.35	472.58	2.00	0.00	0.23	0.00	45.42	478.05	2.00	0.00	0.23	0.00
45.49	464.22	2.00	0.00	0.23	0.00	45.56	431.21	2.00	0.00	0.23	0.00
45.62	420.90	2.00	0.00	0.23	0.00	45.70	407.21	2.00	0.00	0.23	0.00
45.74	396.08	2.00	0.00	0.22	0.00	45.81	383.55	2.00	0.00	0.22	0.00
45.87	364.18	2.00	0.00	0.22	0.00	45.93	291.14	2.00	0.00	0.22	0.00
46.00	292.27	2.00	0.00	0.22	0.00	46.07	272.49	2.00	0.00	0.22	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)
46.14	270.65	2.00	0.00	0.22	0.00	46.19	270.59	2.00	0.00	0.22	0.00
46.28	268.72	2.00	0.00	0.22	0.00	46.33	284.88	2.00	0.00	0.21	0.00
46.42	325.97	2.00	0.00	0.21	0.00	46.46	362.18	2.00	0.00	0.21	0.00
46.53	404.74	2.00	0.00	0.21	0.00	46.60	447.23	2.00	0.00	0.21	0.00
46.68	545.37	2.00	0.00	0.21	0.00	46.72	572.78	2.00	0.00	0.21	0.00

Total estimated settlement: 3.64

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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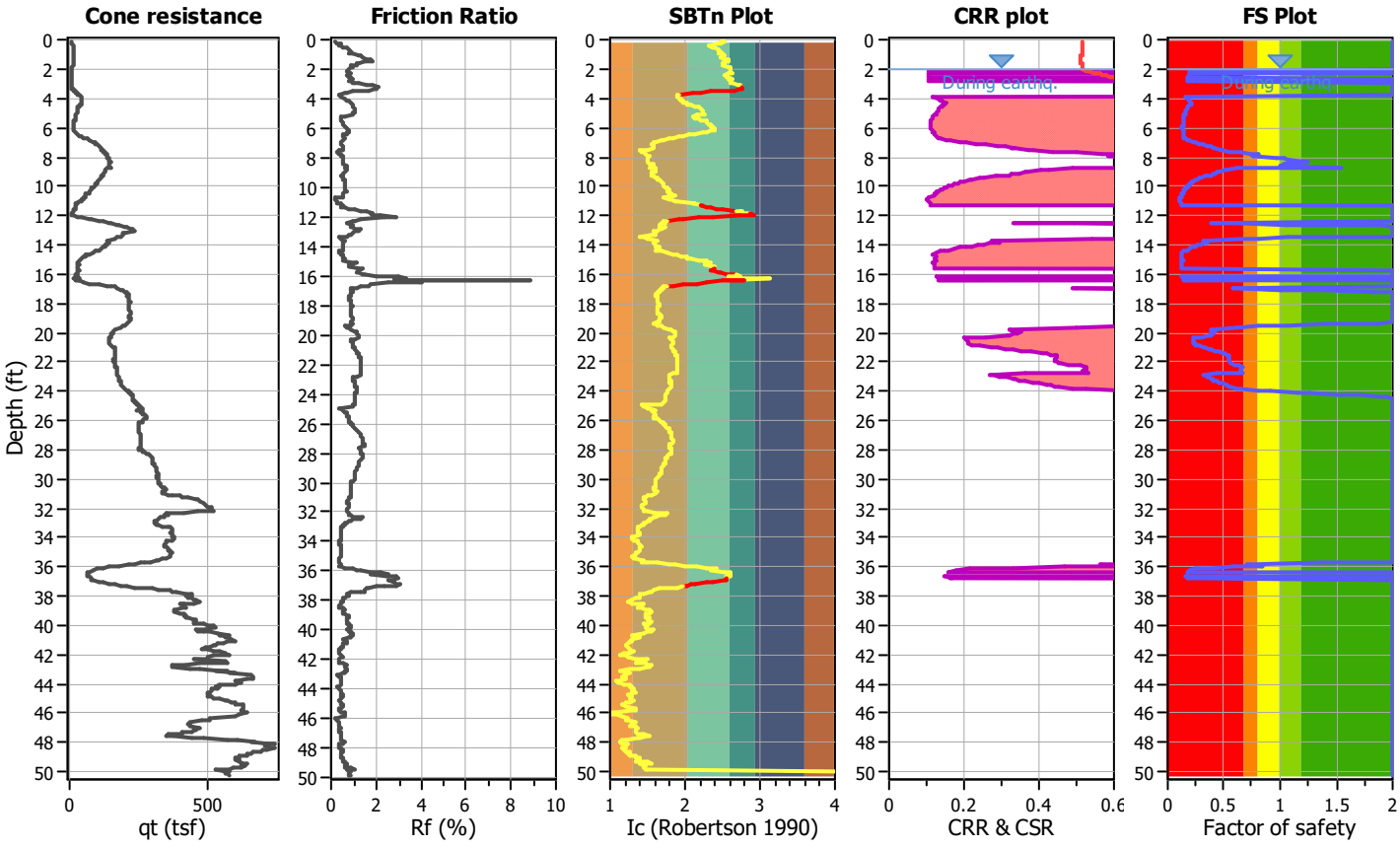
LIQUEFACTION ANALYSIS REPORT

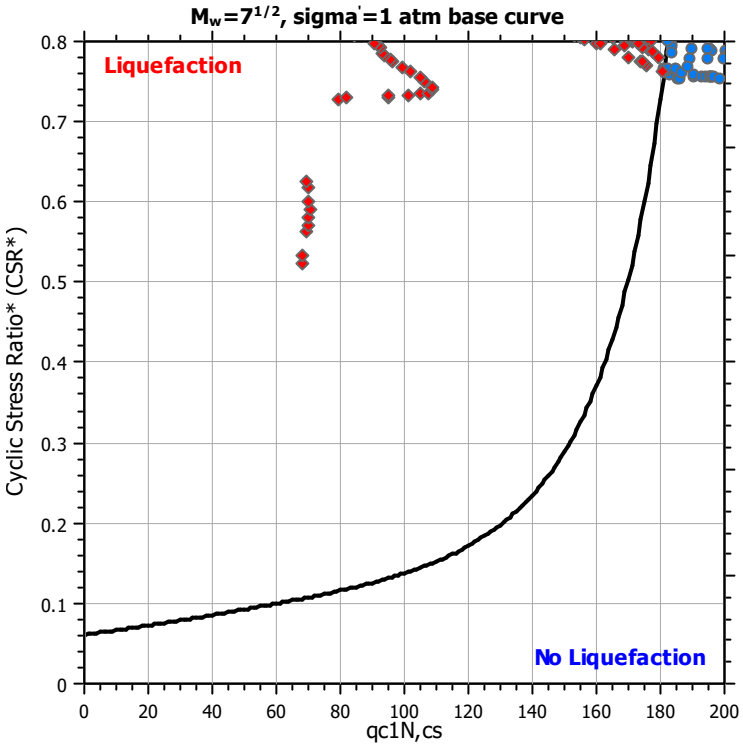
Project title : Proposed Warehouse **Location : El Monte, CA**

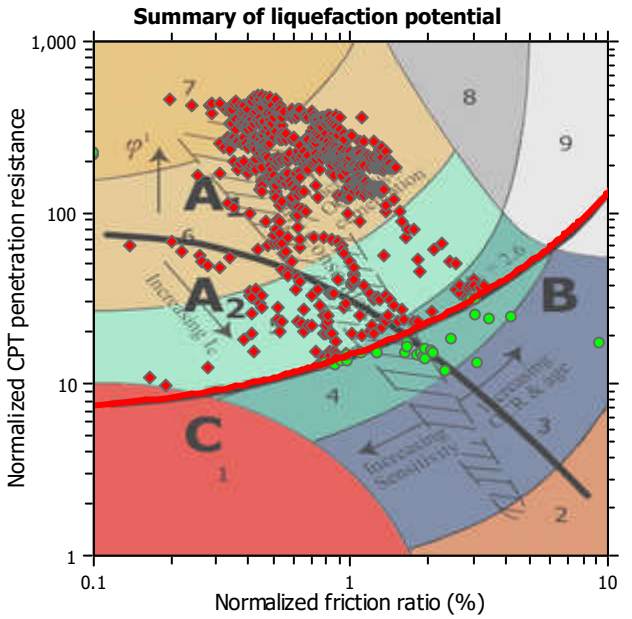
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	33.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.89	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method
Peak ground acceleration:	0.90	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

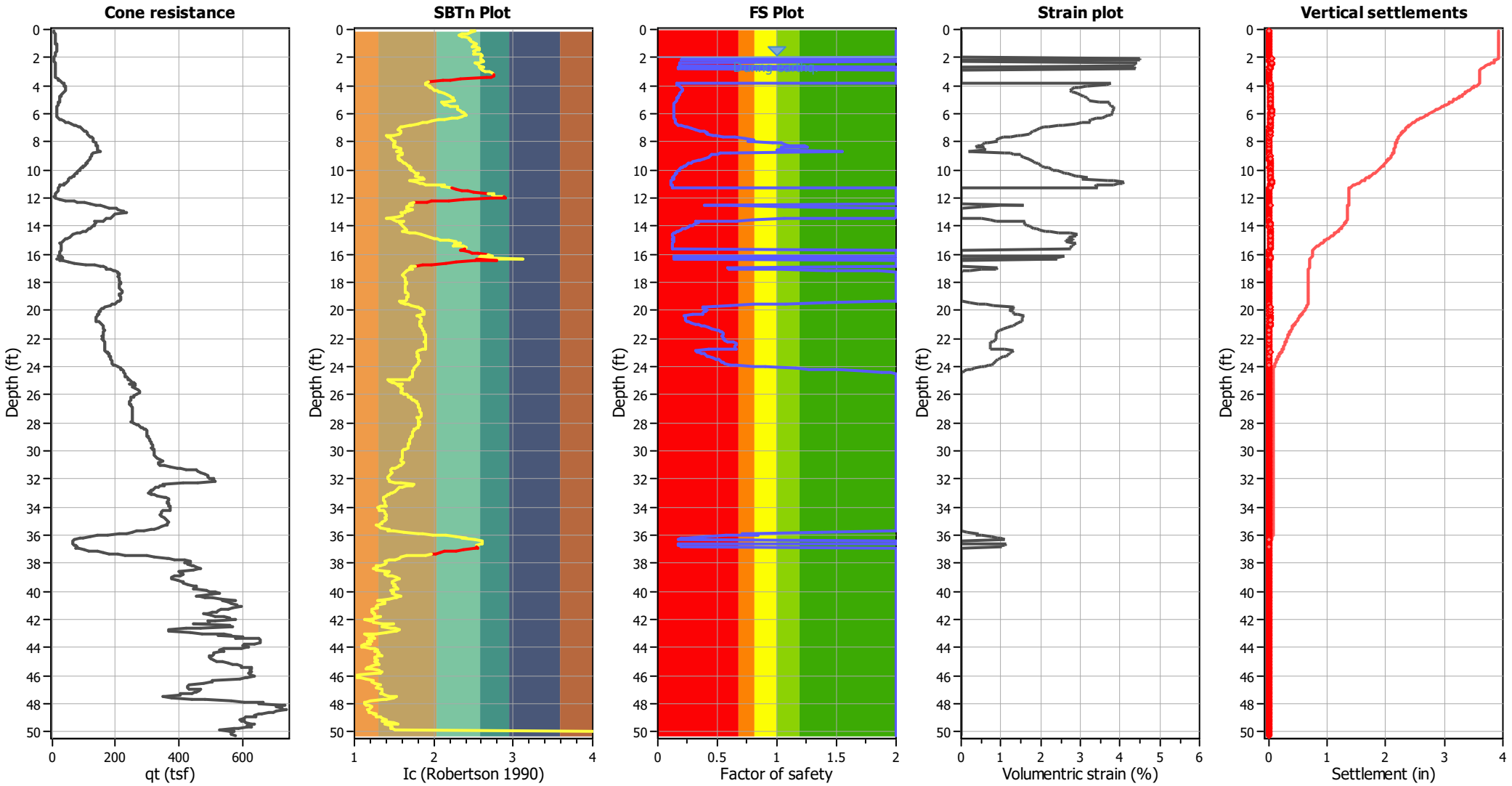






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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)
2.05	67.94	0.20	4.51	0.97	0.05	2.11	67.95	0.20	4.51	0.96	0.03
2.19	13.37	2.00	0.00	0.96	0.00	2.23	13.08	2.00	0.00	0.96	0.00
2.31	69.13	0.19	4.42	0.96	0.04	2.36	69.83	0.19	4.38	0.96	0.03
2.43	70.20	0.19	4.35	0.96	0.04	2.50	70.32	0.18	4.34	0.96	0.04
2.57	69.95	0.18	4.35	0.96	0.04	2.64	13.67	2.00	0.00	0.96	0.00
2.71	69.69	0.17	4.36	0.95	0.04	2.78	69.32	0.17	4.37	0.95	0.03
2.86	14.85	2.00	0.00	0.95	0.00	2.91	15.30	2.00	0.00	0.95	0.00
2.95	15.44	2.00	0.00	0.95	0.00	3.02	15.44	2.00	0.00	0.95	0.00
3.09	15.44	2.00	0.00	0.95	0.00	3.17	15.52	2.00	0.00	0.95	0.00
3.22	15.60	2.00	0.00	0.95	0.00	3.31	15.60	2.00	0.00	0.94	0.00
3.35	16.19	2.00	0.00	0.94	0.00	3.42	17.53	2.00	0.00	0.94	0.00
3.49	82.47	2.00	0.00	0.94	0.00	3.58	85.94	2.00	0.00	0.94	0.00
3.62	87.32	2.00	0.00	0.94	0.00	3.70	72.27	2.00	0.00	0.94	0.00
3.76	71.52	2.00	0.00	0.94	0.00	3.84	79.40	0.16	3.77	0.93	0.04
3.88	82.04	0.16	3.66	0.93	0.02	3.98	94.74	0.18	3.17	0.93	0.04
4.02	95.29	0.18	3.14	0.93	0.02	4.10	101.22	0.19	2.95	0.93	0.03
4.16	104.94	0.20	2.84	0.93	0.02	4.21	107.67	0.20	2.77	0.93	0.02
4.29	108.85	0.20	2.73	0.93	0.03	4.34	108.64	0.20	2.73	0.93	0.02
4.43	106.15	0.19	2.79	0.92	0.03	4.47	104.75	0.19	2.83	0.92	0.01
4.55	101.85	0.18	2.91	0.92	0.03	4.60	99.35	0.18	2.98	0.92	0.02
4.70	96.30	0.17	3.07	0.92	0.04	4.74	95.38	0.17	3.10	0.92	0.01
4.81	93.92	0.17	3.14	0.92	0.03	4.86	93.23	0.16	3.16	0.92	0.02
4.96	92.30	0.16	3.19	0.92	0.04	4.99	91.77	0.16	3.21	0.92	0.01
5.06	90.93	0.16	3.23	0.91	0.03	5.14	84.36	0.15	3.48	0.91	0.03
5.19	78.57	0.14	3.72	0.91	0.02	5.27	77.99	0.14	3.74	0.91	0.04
5.32	77.85	0.14	3.74	0.91	0.02	5.39	77.42	0.14	3.76	0.91	0.03
5.45	76.75	0.14	3.79	0.91	0.03	5.52	75.23	0.13	3.85	0.91	0.03
5.59	75.29	0.13	3.85	0.91	0.03	5.67	75.18	0.13	3.85	0.90	0.04
5.72	75.28	0.13	3.84	0.90	0.02	5.80	75.78	0.13	3.81	0.90	0.04
5.85	75.85	0.13	3.80	0.90	0.02	5.93	75.44	0.13	3.81	0.90	0.04
5.97	75.58	0.13	3.80	0.90	0.02	6.06	76.20	0.13	3.77	0.90	0.04
6.12	77.41	0.13	3.71	0.90	0.03	6.19	79.35	0.13	3.62	0.90	0.03
6.25	81.23	0.14	3.53	0.89	0.03	6.32	83.97	0.14	3.42	0.89	0.03
6.39	86.99	0.14	3.29	0.89	0.03	6.44	87.58	0.14	3.27	0.89	0.02
6.52	88.86	0.14	3.22	0.89	0.03	6.56	88.23	0.14	3.24	0.89	0.02
6.65	93.76	0.15	3.04	0.89	0.03	6.70	98.48	0.16	2.89	0.89	0.02
6.78	109.91	0.18	2.58	0.89	0.03	6.83	115.50	0.19	2.45	0.88	0.01
6.92	127.49	0.23	2.20	0.88	0.02	6.96	132.97	0.25	2.09	0.88	0.01
7.05	139.20	0.28	1.99	0.88	0.02	7.09	144.57	0.31	1.90	0.88	0.01
7.18	150.03	0.36	1.82	0.88	0.02	7.23	153.06	0.38	1.78	0.88	0.01
7.32	155.46	0.41	1.75	0.88	0.02	7.36	155.26	0.41	1.75	0.88	0.01
7.41	156.33	0.42	1.71	0.87	0.01	7.51	159.98	0.47	1.51	0.87	0.02
7.55	161.32	0.48	1.44	0.87	0.01	7.62	165.40	0.55	1.25	0.87	0.01
7.69	169.91	0.64	1.07	0.87	0.01	7.77	173.49	0.73	0.94	0.87	0.01
7.82	175.76	0.80	0.87	0.87	0.00	7.90	175.00	0.78	0.89	0.87	0.01
7.95	174.18	0.75	0.91	0.87	0.00	8.01	180.34	0.97	0.67	0.86	0.00
8.08	182.04	1.04	0.58	0.86	0.01	8.17	182.54	1.06	0.56	0.86	0.01
8.21	183.22	1.09	0.52	0.86	0.00	8.30	185.86	1.24	0.39	0.86	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)
8.35	186.19	1.25	0.38	0.86	0.00	8.40	182.07	1.04	0.58	0.86	0.00
8.49	182.45	1.05	0.56	0.86	0.01	8.53	181.36	1.00	0.62	0.86	0.00
8.61	182.34	1.05	0.57	0.85	0.01	8.66	190.77	1.55	0.19	0.85	0.00
8.73	168.99	0.61	1.08	0.85	0.01	8.80	164.74	0.53	1.25	0.85	0.01
8.86	163.12	0.50	1.32	0.85	0.01	8.93	159.51	0.45	1.49	0.85	0.01
9.01	158.91	0.44	1.52	0.85	0.01	9.06	157.62	0.42	1.58	0.85	0.01
9.15	155.07	0.39	1.69	0.84	0.02	9.20	154.39	0.39	1.70	0.84	0.01
9.28	150.29	0.35	1.74	0.84	0.02	9.32	149.06	0.34	1.76	0.84	0.01
9.39	143.37	0.29	1.84	0.84	0.01	9.45	141.17	0.28	1.87	0.84	0.02
9.52	136.94	0.26	1.93	0.84	0.02	9.59	134.82	0.25	1.96	0.84	0.02
9.67	130.64	0.23	2.02	0.84	0.02	9.73	128.13	0.22	2.07	0.84	0.02
9.78	126.24	0.21	2.10	0.83	0.01	9.86	120.88	0.20	2.19	0.83	0.02
9.92	117.48	0.19	2.26	0.83	0.02	9.98	114.35	0.18	2.32	0.83	0.02
10.06	109.35	0.17	2.43	0.83	0.02	10.13	105.30	0.16	2.52	0.83	0.02
10.18	102.61	0.15	2.59	0.83	0.01	10.27	99.04	0.15	2.68	0.83	0.03
10.31	94.96	0.14	2.79	0.83	0.01	10.39	91.24	0.14	2.90	0.82	0.03
10.44	88.81	0.13	2.98	0.82	0.02	10.54	83.18	0.13	3.17	0.82	0.04
10.58	83.99	0.13	3.14	0.82	0.02	10.63	86.64	0.13	3.04	0.82	0.02
10.72	70.51	0.11	3.70	0.82	0.04	10.76	67.34	0.11	3.85	0.82	0.02
10.85	62.55	0.11	4.12	0.82	0.04	10.90	63.13	0.11	4.08	0.82	0.03
10.99	64.90	0.11	3.97	0.81	0.04	11.02	67.49	0.11	3.83	0.81	0.02
11.09	76.31	0.12	3.41	0.81	0.03	11.16	76.80	0.12	3.38	0.81	0.03
11.24	75.32	0.12	3.44	0.81	0.03	11.29	72.74	2.00	0.00	0.81	0.00
11.36	76.32	2.00	0.00	0.81	0.00	11.43	75.72	2.00	0.00	0.81	0.00
11.50	76.76	2.00	0.00	0.81	0.00	11.56	76.50	2.00	0.00	0.80	0.00
11.65	14.52	2.00	0.00	0.80	0.00	11.70	12.52	2.00	0.00	0.80	0.00
11.75	13.18	2.00	0.00	0.80	0.00	11.83	12.33	2.00	0.00	0.80	0.00
11.88	10.45	2.00	0.00	0.80	0.00	11.96	11.44	2.00	0.00	0.80	0.00
12.01	16.08	2.00	0.00	0.80	0.00	12.07	84.75	2.00	0.00	0.80	0.00
12.14	104.15	2.00	0.00	0.79	0.00	12.24	118.35	2.00	0.00	0.79	0.00
12.28	116.89	2.00	0.00	0.79	0.00	12.35	119.59	2.00	0.00	0.79	0.00
12.42	137.34	2.00	0.00	0.79	0.00	12.50	155.73	0.39	1.57	0.79	0.02
12.55	169.45	0.60	0.98	0.79	0.01	12.60	183.62	1.06	0.50	0.79	0.00
12.68	195.68	1.90	0.03	0.79	0.00	12.76	217.26	2.00	0.00	0.78	0.00
12.82	220.50	2.00	0.00	0.78	0.00	12.87	233.84	2.00	0.00	0.78	0.00
12.95	240.21	2.00	0.00	0.78	0.00	13.00	237.03	2.00	0.00	0.78	0.00
13.07	246.05	2.00	0.00	0.78	0.00	13.17	213.73	2.00	0.00	0.78	0.00
13.22	207.23	2.00	0.00	0.78	0.00	13.26	207.37	2.00	0.00	0.78	0.00
13.32	200.69	2.00	0.00	0.77	0.00	13.40	196.55	1.99	0.00	0.77	0.00
13.48	183.58	1.06	0.49	0.77	0.00	13.53	176.97	0.80	0.74	0.77	0.00
13.60	172.07	0.66	0.88	0.77	0.01	13.65	147.68	0.31	1.62	0.77	0.01
13.72	151.07	0.34	1.58	0.77	0.01	13.79	151.05	0.34	1.58	0.77	0.01
13.88	146.97	0.31	1.62	0.76	0.02	13.92	144.07	0.29	1.66	0.76	0.01
13.99	140.62	0.27	1.70	0.76	0.01	14.05	137.21	0.25	1.75	0.76	0.01
14.11	132.03	0.23	1.82	0.76	0.01	14.18	127.45	0.21	1.89	0.76	0.02
14.24	121.21	0.19	1.99	0.76	0.01	14.32	114.27	0.17	2.12	0.76	0.02
14.39	108.00	0.16	2.24	0.76	0.02	14.45	98.59	0.14	2.46	0.76	0.02
14.52	88.76	0.13	2.73	0.75	0.02	14.59	82.50	0.12	2.93	0.75	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)
14.64	85.28	0.13	2.83	0.75	0.02	14.72	83.25	0.12	2.90	0.75	0.03
14.77	88.45	0.13	2.72	0.75	0.02	14.84	89.03	0.13	2.70	0.75	0.02
14.90	85.74	0.13	2.80	0.75	0.02	14.99	85.38	0.13	2.81	0.75	0.03
15.04	90.56	0.13	2.65	0.75	0.02	15.11	90.41	0.13	2.65	0.74	0.02
15.16	84.27	0.12	2.83	0.74	0.02	15.23	82.15	0.12	2.90	0.74	0.03
15.31	84.81	0.12	2.81	0.74	0.02	15.36	84.90	0.12	2.80	0.74	0.02
15.44	85.26	0.12	2.78	0.74	0.03	15.51	86.09	0.13	2.75	0.74	0.02
15.56	86.10	0.13	2.75	0.74	0.02	15.62	85.61	0.12	2.76	0.74	0.02
15.71	87.50	2.00	0.00	0.73	0.00	15.75	86.46	2.00	0.00	0.73	0.00
15.83	84.23	2.00	0.00	0.73	0.00	15.89	83.46	2.00	0.00	0.73	0.00
15.95	83.40	2.00	0.00	0.73	0.00	16.01	24.52	2.00	0.00	0.73	0.00
16.10	22.92	2.00	0.00	0.73	0.00	16.15	90.07	0.13	2.59	0.73	0.02
16.22	96.93	0.14	2.40	0.73	0.02	16.28	16.97	2.00	0.00	0.72	0.00
16.35	96.38	0.14	2.41	0.72	0.02	16.42	23.60	2.00	0.00	0.72	0.00
16.47	96.08	2.00	0.00	0.72	0.00	16.55	110.37	2.00	0.00	0.72	0.00
16.62	125.58	2.00	0.00	0.72	0.00	16.71	146.86	2.00	0.00	0.72	0.00
16.75	144.67	2.00	0.00	0.72	0.00	16.81	150.76	2.00	0.00	0.72	0.00
16.87	160.77	2.00	0.00	0.71	0.00	16.93	169.06	0.59	0.90	0.71	0.01
17.01	169.72	0.60	0.88	0.71	0.01	17.06	182.50	1.01	0.51	0.71	0.00
17.13	189.79	1.41	0.22	0.71	0.00	17.20	195.23	1.85	0.04	0.71	0.00
17.26	202.47	2.00	0.00	0.71	0.00	17.34	202.22	2.00	0.00	0.71	0.00
17.39	205.59	2.00	0.00	0.71	0.00	17.47	207.28	2.00	0.00	0.70	0.00
17.55	202.29	2.00	0.00	0.70	0.00	17.59	202.99	2.00	0.00	0.70	0.00
17.68	203.59	2.00	0.00	0.70	0.00	17.72	203.58	2.00	0.00	0.70	0.00
17.79	205.29	2.00	0.00	0.70	0.00	17.86	206.61	2.00	0.00	0.70	0.00
17.94	209.16	2.00	0.00	0.70	0.00	17.99	206.91	2.00	0.00	0.70	0.00
18.04	206.77	2.00	0.00	0.69	0.00	18.13	203.70	2.00	0.00	0.69	0.00
18.18	203.44	2.00	0.00	0.69	0.00	18.27	203.04	2.00	0.00	0.69	0.00
18.32	202.84	2.00	0.00	0.69	0.00	18.40	201.39	2.00	0.00	0.69	0.00
18.45	203.10	2.00	0.00	0.69	0.00	18.51	207.22	2.00	0.00	0.69	0.00
18.58	210.42	2.00	0.00	0.69	0.00	18.66	210.28	2.00	0.00	0.68	0.00
18.71	208.31	2.00	0.00	0.68	0.00	18.78	204.12	2.00	0.00	0.68	0.00
18.84	201.76	2.00	0.00	0.68	0.00	18.93	201.49	2.00	0.00	0.68	0.00
18.99	202.85	2.00	0.00	0.68	0.00	19.03	204.16	2.00	0.00	0.68	0.00
19.12	204.93	2.00	0.00	0.68	0.00	19.17	204.40	2.00	0.00	0.68	0.00
19.25	202.41	2.00	0.00	0.67	0.00	19.30	199.85	2.00	0.00	0.67	0.00
19.36	195.19	1.87	0.03	0.67	0.00	19.43	189.43	1.41	0.21	0.67	0.00
19.49	183.45	1.07	0.42	0.67	0.00	19.57	176.99	0.81	0.64	0.67	0.01
19.63	169.82	0.61	0.82	0.67	0.01	19.73	155.03	0.39	1.33	0.67	0.02
19.76	154.83	0.38	1.33	0.67	0.01	19.82	154.53	0.38	1.33	0.66	0.01
19.89	155.65	0.39	1.32	0.66	0.01	19.98	157.92	0.42	1.22	0.66	0.01
20.04	156.77	0.41	1.27	0.66	0.01	20.08	155.95	0.40	1.31	0.66	0.01
20.17	154.59	0.38	1.32	0.66	0.01	20.22	154.02	0.38	1.32	0.66	0.01
20.29	144.56	0.30	1.42	0.66	0.01	20.35	131.49	0.23	1.57	0.66	0.01
20.41	131.62	0.23	1.57	0.65	0.01	20.49	132.87	0.23	1.55	0.65	0.01
20.56	133.54	0.23	1.54	0.65	0.01	20.61	133.65	0.23	1.54	0.65	0.01
20.69	134.18	0.24	1.53	0.65	0.02	20.74	134.56	0.24	1.52	0.65	0.01
20.80	137.02	0.25	1.49	0.65	0.01	20.88	142.11	0.28	1.43	0.65	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)
20.96	147.68	0.32	1.36	0.64	0.01	21.00	149.93	0.34	1.34	0.64	0.01
21.09	153.04	0.37	1.30	0.64	0.01	21.14	155.49	0.39	1.28	0.64	0.01
21.20	158.17	0.42	1.18	0.64	0.01	21.27	160.67	0.46	1.08	0.64	0.01
21.37	163.34	0.50	0.98	0.64	0.01	21.41	164.19	0.51	0.95	0.64	0.00
21.48	165.12	0.53	0.92	0.64	0.01	21.54	165.83	0.54	0.90	0.63	0.01
21.59	166.29	0.55	0.88	0.63	0.00	21.67	166.31	0.55	0.88	0.63	0.01
21.72	166.28	0.55	0.88	0.63	0.00	21.79	165.88	0.54	0.89	0.63	0.01
21.86	165.78	0.54	0.89	0.63	0.01	21.93	166.04	0.54	0.88	0.63	0.01
21.99	166.30	0.55	0.87	0.63	0.01	22.05	166.67	0.56	0.86	0.63	0.01
22.12	167.01	0.56	0.85	0.63	0.01	22.19	168.29	0.59	0.81	0.62	0.01
22.26	170.49	0.64	0.75	0.62	0.01	22.34	171.33	0.66	0.73	0.62	0.01
22.39	171.36	0.66	0.72	0.62	0.00	22.46	171.26	0.66	0.72	0.62	0.01
22.53	171.01	0.65	0.73	0.62	0.01	22.57	170.73	0.64	0.74	0.62	0.00
22.64	170.87	0.65	0.73	0.62	0.01	22.71	171.44	0.66	0.72	0.62	0.01
22.79	158.98	0.43	1.10	0.61	0.01	22.84	147.03	0.31	1.30	0.61	0.01
22.93	148.85	0.33	1.28	0.61	0.01	22.98	151.16	0.35	1.26	0.61	0.01
23.05	153.65	0.37	1.23	0.61	0.01	23.11	155.63	0.39	1.21	0.61	0.01
23.17	156.53	0.40	1.18	0.61	0.01	23.26	157.26	0.41	1.15	0.61	0.01
23.31	159.03	0.43	1.08	0.60	0.01	23.39	161.27	0.46	1.00	0.60	0.01
23.44	162.72	0.49	0.95	0.60	0.01	23.50	164.26	0.51	0.90	0.60	0.01
23.57	165.16	0.53	0.87	0.60	0.01	23.63	166.04	0.54	0.84	0.60	0.01
23.70	166.54	0.55	0.83	0.60	0.01	23.75	166.78	0.56	0.82	0.60	0.01
23.84	169.18	0.61	0.75	0.60	0.01	23.89	171.26	0.65	0.70	0.60	0.00
23.98	176.46	0.80	0.58	0.59	0.01	24.03	179.26	0.90	0.52	0.59	0.00
24.11	184.73	1.16	0.31	0.59	0.00	24.16	186.68	1.27	0.25	0.59	0.00
24.23	190.37	1.51	0.14	0.59	0.00	24.30	192.90	1.72	0.07	0.59	0.00
24.38	194.61	1.87	0.03	0.59	0.00	24.42	195.41	1.95	0.01	0.59	0.00
24.50	196.00	2.00	0.00	0.58	0.00	24.55	195.83	2.00	0.00	0.58	0.00
24.62	196.40	2.00	0.00	0.58	0.00	24.68	196.89	2.00	0.00	0.58	0.00
24.75	198.91	2.00	0.00	0.58	0.00	24.83	202.86	2.00	0.00	0.58	0.00
24.87	205.64	2.00	0.00	0.58	0.00	24.95	210.57	2.00	0.00	0.58	0.00
25.01	213.69	2.00	0.00	0.58	0.00	25.09	217.14	2.00	0.00	0.57	0.00
25.14	221.09	2.00	0.00	0.57	0.00	25.23	223.67	2.00	0.00	0.57	0.00
25.27	206.13	2.00	0.00	0.57	0.00	25.35	223.02	2.00	0.00	0.57	0.00
25.41	217.10	2.00	0.00	0.57	0.00	25.49	222.29	2.00	0.00	0.57	0.00
25.54	224.84	2.00	0.00	0.57	0.00	25.62	231.21	2.00	0.00	0.57	0.00
25.67	233.48	2.00	0.00	0.56	0.00	25.75	236.38	2.00	0.00	0.56	0.00
25.81	238.40	2.00	0.00	0.56	0.00	25.86	234.63	2.00	0.00	0.56	0.00
25.92	229.02	2.00	0.00	0.56	0.00	25.99	225.67	2.00	0.00	0.56	0.00
26.06	219.61	2.00	0.00	0.56	0.00	26.12	215.96	2.00	0.00	0.56	0.00
26.18	210.47	2.00	0.00	0.56	0.00	26.25	210.69	2.00	0.00	0.56	0.00
26.32	208.48	2.00	0.00	0.55	0.00	26.39	207.93	2.00	0.00	0.55	0.00
26.46	205.70	2.00	0.00	0.55	0.00	26.52	204.77	2.00	0.00	0.55	0.00
26.60	205.93	2.00	0.00	0.55	0.00	26.66	207.04	2.00	0.00	0.55	0.00
26.73	209.86	2.00	0.00	0.55	0.00	26.79	211.79	2.00	0.00	0.55	0.00
26.87	214.36	2.00	0.00	0.54	0.00	26.93	215.67	2.00	0.00	0.54	0.00
26.97	217.03	2.00	0.00	0.54	0.00	27.06	218.39	2.00	0.00	0.54	0.00
27.10	218.70	2.00	0.00	0.54	0.00	27.19	218.06	2.00	0.00	0.54	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)
27.24	218.13	2.00	0.00	0.54	0.00	27.32	219.70	2.00	0.00	0.54	0.00
27.37	221.00	2.00	0.00	0.54	0.00	27.43	221.83	2.00	0.00	0.54	0.00
27.50	224.43	2.00	0.00	0.53	0.00	27.57	215.08	2.00	0.00	0.53	0.00
27.64	209.47	2.00	0.00	0.53	0.00	27.73	210.41	2.00	0.00	0.53	0.00
27.76	210.39	2.00	0.00	0.53	0.00	27.83	211.30	2.00	0.00	0.53	0.00
27.90	210.83	2.00	0.00	0.53	0.00	27.95	211.38	2.00	0.00	0.53	0.00
28.04	217.34	2.00	0.00	0.52	0.00	28.11	223.97	2.00	0.00	0.52	0.00
28.17	228.51	2.00	0.00	0.52	0.00	28.24	232.16	2.00	0.00	0.52	0.00
28.31	235.58	2.00	0.00	0.52	0.00	28.35	238.07	2.00	0.00	0.52	0.00
28.42	242.80	2.00	0.00	0.52	0.00	28.49	246.83	2.00	0.00	0.52	0.00
28.55	248.31	2.00	0.00	0.52	0.00	28.65	247.74	2.00	0.00	0.51	0.00
28.68	247.83	2.00	0.00	0.51	0.00	28.75	246.97	2.00	0.00	0.51	0.00
28.81	246.64	2.00	0.00	0.51	0.00	28.88	247.47	2.00	0.00	0.51	0.00
28.97	248.87	2.00	0.00	0.51	0.00	29.01	250.99	2.00	0.00	0.51	0.00
29.10	254.25	2.00	0.00	0.51	0.00	29.15	254.92	2.00	0.00	0.51	0.00
29.24	257.27	2.00	0.00	0.50	0.00	29.28	257.56	2.00	0.00	0.50	0.00
29.33	257.73	2.00	0.00	0.50	0.00	29.42	258.03	2.00	0.00	0.50	0.00
29.47	259.82	2.00	0.00	0.50	0.00	29.55	260.91	2.00	0.00	0.50	0.00
29.61	261.77	2.00	0.00	0.50	0.00	29.67	262.60	2.00	0.00	0.50	0.00
29.74	263.56	2.00	0.00	0.50	0.00	29.80	259.84	2.00	0.00	0.49	0.00
29.87	263.72	2.00	0.00	0.49	0.00	29.94	259.92	2.00	0.00	0.49	0.00
30.01	263.85	2.00	0.00	0.49	0.00	30.05	264.18	2.00	0.00	0.49	0.00
30.14	263.51	2.00	0.00	0.49	0.00	30.19	264.52	2.00	0.00	0.49	0.00
30.27	264.23	2.00	0.00	0.49	0.00	30.32	264.88	2.00	0.00	0.49	0.00
30.40	266.79	2.00	0.00	0.48	0.00	30.45	269.23	2.00	0.00	0.48	0.00
30.52	273.08	2.00	0.00	0.48	0.00	30.59	279.72	2.00	0.00	0.48	0.00
30.68	285.83	2.00	0.00	0.48	0.00	30.72	284.97	2.00	0.00	0.48	0.00
30.81	277.08	2.00	0.00	0.48	0.00	30.84	274.43	2.00	0.00	0.48	0.00
30.95	274.07	2.00	0.00	0.48	0.00	30.99	278.34	2.00	0.00	0.47	0.00
31.06	290.44	2.00	0.00	0.47	0.00	31.11	302.06	2.00	0.00	0.47	0.00
31.18	320.99	2.00	0.00	0.47	0.00	31.26	330.55	2.00	0.00	0.47	0.00
31.30	343.72	2.00	0.00	0.47	0.00	31.38	369.17	2.00	0.00	0.47	0.00
31.44	373.57	2.00	0.00	0.47	0.00	31.53	378.87	2.00	0.00	0.47	0.00
31.58	380.46	2.00	0.00	0.46	0.00	31.66	390.23	2.00	0.00	0.46	0.00
31.70	392.51	2.00	0.00	0.46	0.00	31.79	396.56	2.00	0.00	0.46	0.00
31.83	397.69	2.00	0.00	0.46	0.00	31.93	401.60	2.00	0.00	0.46	0.00
31.98	411.81	2.00	0.00	0.46	0.00	32.04	406.57	2.00	0.00	0.46	0.00
32.10	410.15	2.00	0.00	0.46	0.00	32.17	415.38	2.00	0.00	0.45	0.00
32.24	370.61	2.00	0.00	0.45	0.00	32.29	334.00	2.00	0.00	0.45	0.00
32.36	279.86	2.00	0.00	0.45	0.00	32.43	286.52	2.00	0.00	0.45	0.00
32.50	274.96	2.00	0.00	0.45	0.00	32.55	270.88	2.00	0.00	0.45	0.00
32.62	263.96	2.00	0.00	0.45	0.00	32.71	258.03	2.00	0.00	0.45	0.00
32.76	253.55	2.00	0.00	0.44	0.00	32.81	248.84	2.00	0.00	0.44	0.00
32.88	244.29	2.00	0.00	0.44	0.00	32.94	248.14	2.00	0.00	0.44	0.00
33.03	241.97	2.00	0.00	0.44	0.00	33.07	247.52	2.00	0.00	0.44	0.00
33.14	257.22	2.00	0.00	0.44	0.00	33.21	265.74	2.00	0.00	0.44	0.00
33.30	281.98	2.00	0.00	0.44	0.00	33.34	286.60	2.00	0.00	0.43	0.00
33.40	292.21	2.00	0.00	0.43	0.00	33.48	292.71	2.00	0.00	0.43	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)
33.56	291.78	2.00	0.00	0.43	0.00	33.61	291.05	2.00	0.00	0.43	0.00
33.69	291.70	2.00	0.00	0.43	0.00	33.74	293.11	2.00	0.00	0.43	0.00
33.82	294.19	2.00	0.00	0.43	0.00	33.88	295.08	2.00	0.00	0.43	0.00
33.97	296.14	2.00	0.00	0.42	0.00	34.00	297.06	2.00	0.00	0.42	0.00
34.06	297.29	2.00	0.00	0.42	0.00	34.12	296.83	2.00	0.00	0.42	0.00
34.19	296.01	2.00	0.00	0.42	0.00	34.27	278.02	2.00	0.00	0.42	0.00
34.34	274.98	2.00	0.00	0.42	0.00	34.41	276.08	2.00	0.00	0.42	0.00
34.45	273.02	2.00	0.00	0.42	0.00	34.54	269.68	2.00	0.00	0.41	0.00
34.59	269.91	2.00	0.00	0.41	0.00	34.65	273.67	2.00	0.00	0.41	0.00
34.72	280.34	2.00	0.00	0.41	0.00	34.81	283.25	2.00	0.00	0.41	0.00
34.85	283.13	2.00	0.00	0.41	0.00	34.94	288.02	2.00	0.00	0.41	0.00
34.99	289.06	2.00	0.00	0.41	0.00	35.06	290.80	2.00	0.00	0.41	0.00
35.12	288.02	2.00	0.00	0.40	0.00	35.18	287.88	2.00	0.00	0.40	0.00
35.26	287.49	2.00	0.00	0.40	0.00	35.30	284.43	2.00	0.00	0.40	0.00
35.37	274.89	2.00	0.00	0.40	0.00	35.44	265.00	2.00	0.00	0.40	0.00
35.53	254.92	2.00	0.00	0.40	0.00	35.57	245.09	2.00	0.00	0.40	0.00
35.66	223.85	2.00	0.00	0.40	0.00	35.71	202.88	2.00	0.00	0.39	0.00
35.76	188.59	1.37	0.13	0.39	0.00	35.84	174.59	0.75	0.41	0.39	0.00
35.89	173.12	0.70	0.43	0.39	0.00	35.97	177.59	0.84	0.36	0.39	0.00
36.04	167.67	0.58	0.52	0.39	0.00	36.10	155.99	0.40	0.77	0.39	0.01
36.17	135.10	0.25	0.90	0.39	0.01	36.24	122.28	0.20	1.00	0.39	0.01
36.31	113.17	0.18	1.09	0.38	0.01	36.37	44.23	2.00	0.00	0.38	0.00
36.44	43.88	2.00	0.00	0.38	0.00	36.49	43.86	2.00	0.00	0.38	0.00
36.59	43.47	2.00	0.00	0.38	0.00	36.62	108.14	0.17	1.12	0.38	0.00
36.68	110.64	0.17	1.09	0.38	0.01	36.75	115.54	0.18	1.04	0.38	0.01
36.82	118.62	0.19	1.01	0.38	0.01	36.90	117.92	2.00	0.00	0.37	0.00
36.96	122.87	2.00	0.00	0.37	0.00	37.04	138.49	2.00	0.00	0.37	0.00
37.08	148.74	2.00	0.00	0.37	0.00	37.15	165.93	2.00	0.00	0.37	0.00
37.22	175.32	2.00	0.00	0.37	0.00	37.29	189.66	2.00	0.00	0.37	0.00
37.36	201.72	2.00	0.00	0.37	0.00	37.40	201.77	2.00	0.00	0.37	0.00
37.49	231.83	2.00	0.00	0.36	0.00	37.54	252.46	2.00	0.00	0.36	0.00
37.62	286.16	2.00	0.00	0.36	0.00	37.67	290.02	2.00	0.00	0.36	0.00
37.74	301.48	2.00	0.00	0.36	0.00	37.80	326.37	2.00	0.00	0.36	0.00
37.88	342.73	2.00	0.00	0.36	0.00	37.94	329.16	2.00	0.00	0.36	0.00
38.01	343.42	2.00	0.00	0.36	0.00	38.07	333.83	2.00	0.00	0.35	0.00
38.16	344.08	2.00	0.00	0.35	0.00	38.20	348.95	2.00	0.00	0.35	0.00
38.27	355.94	2.00	0.00	0.35	0.00	38.34	367.79	2.00	0.00	0.35	0.00
38.41	364.43	2.00	0.00	0.35	0.00	38.47	348.63	2.00	0.00	0.35	0.00
38.53	313.15	2.00	0.00	0.35	0.00	38.59	321.96	2.00	0.00	0.35	0.00
38.68	316.72	2.00	0.00	0.34	0.00	38.73	320.70	2.00	0.00	0.34	0.00
38.80	324.66	2.00	0.00	0.34	0.00	38.85	314.53	2.00	0.00	0.34	0.00
38.92	300.93	2.00	0.00	0.34	0.00	38.99	293.05	2.00	0.00	0.34	0.00
39.08	292.65	2.00	0.00	0.34	0.00	39.11	295.35	2.00	0.00	0.34	0.00
39.18	309.34	2.00	0.00	0.34	0.00	39.26	320.20	2.00	0.00	0.33	0.00
39.31	323.96	2.00	0.00	0.33	0.00	39.40	322.68	2.00	0.00	0.33	0.00
39.44	323.64	2.00	0.00	0.33	0.00	39.51	332.18	2.00	0.00	0.33	0.00
39.57	346.36	2.00	0.00	0.33	0.00	39.65	353.10	2.00	0.00	0.33	0.00
39.71	352.35	2.00	0.00	0.33	0.00	39.80	346.60	2.00	0.00	0.33	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)
39.85	349.55	2.00	0.00	0.32	0.00	39.93	377.33	2.00	0.00	0.32	0.00
39.98	384.02	2.00	0.00	0.32	0.00	40.06	400.63	2.00	0.00	0.32	0.00
40.11	409.03	2.00	0.00	0.32	0.00	40.16	405.20	2.00	0.00	0.32	0.00
40.23	381.33	2.00	0.00	0.32	0.00	40.29	353.76	2.00	0.00	0.32	0.00
40.38	358.94	2.00	0.00	0.32	0.00	40.42	374.80	2.00	0.00	0.31	0.00
40.49	390.91	2.00	0.00	0.31	0.00	40.56	411.88	2.00	0.00	0.31	0.00
40.64	446.75	2.00	0.00	0.31	0.00	40.69	417.68	2.00	0.00	0.31	0.00
40.75	429.61	2.00	0.00	0.31	0.00	40.82	435.79	2.00	0.00	0.31	0.00
40.88	437.41	2.00	0.00	0.31	0.00	40.95	452.10	2.00	0.00	0.31	0.00
41.01	452.48	2.00	0.00	0.30	0.00	41.09	461.92	2.00	0.00	0.30	0.00
41.15	441.49	2.00	0.00	0.30	0.00	41.22	427.91	2.00	0.00	0.30	0.00
41.28	411.07	2.00	0.00	0.30	0.00	41.36	404.72	2.00	0.00	0.30	0.00
41.43	401.60	2.00	0.00	0.30	0.00	41.49	390.65	2.00	0.00	0.30	0.00
41.54	380.28	2.00	0.00	0.30	0.00	41.61	369.89	2.00	0.00	0.29	0.00
41.69	385.70	2.00	0.00	0.29	0.00	41.74	398.05	2.00	0.00	0.29	0.00
41.81	416.49	2.00	0.00	0.29	0.00	41.87	431.73	2.00	0.00	0.29	0.00
41.95	426.59	2.00	0.00	0.29	0.00	42.00	446.05	2.00	0.00	0.29	0.00
42.08	397.92	2.00	0.00	0.29	0.00	42.13	380.31	2.00	0.00	0.29	0.00
42.20	383.13	2.00	0.00	0.28	0.00	42.27	379.96	2.00	0.00	0.28	0.00
42.33	342.47	2.00	0.00	0.28	0.00	42.40	429.54	2.00	0.00	0.28	0.00
42.47	433.33	2.00	0.00	0.28	0.00	42.53	438.40	2.00	0.00	0.28	0.00
42.60	361.01	2.00	0.00	0.28	0.00	42.66	323.94	2.00	0.00	0.28	0.00
42.73	282.39	2.00	0.00	0.28	0.00	42.80	282.99	2.00	0.00	0.27	0.00
42.86	283.60	2.00	0.00	0.27	0.00	42.92	334.90	2.00	0.00	0.27	0.00
42.98	362.03	2.00	0.00	0.27	0.00	43.06	415.83	2.00	0.00	0.27	0.00
43.11	433.64	2.00	0.00	0.27	0.00	43.18	401.23	2.00	0.00	0.27	0.00
43.26	460.15	2.00	0.00	0.27	0.00	43.31	442.03	2.00	0.00	0.27	0.00
43.38	499.36	2.00	0.00	0.26	0.00	43.45	502.21	2.00	0.00	0.26	0.00
43.51	503.64	2.00	0.00	0.26	0.00	43.59	503.48	2.00	0.00	0.26	0.00
43.66	503.33	2.00	0.00	0.26	0.00	43.70	486.80	2.00	0.00	0.26	0.00
43.79	464.13	2.00	0.00	0.26	0.00	43.84	459.16	2.00	0.00	0.26	0.00
43.91	473.04	2.00	0.00	0.26	0.00	43.96	468.77	2.00	0.00	0.25	0.00
44.05	456.86	2.00	0.00	0.25	0.00	44.09	412.80	2.00	0.00	0.25	0.00
44.17	402.00	2.00	0.00	0.25	0.00	44.23	414.84	2.00	0.00	0.25	0.00
44.30	407.03	2.00	0.00	0.25	0.00	44.36	388.98	2.00	0.00	0.25	0.00
44.43	387.67	2.00	0.00	0.25	0.00	44.49	387.58	2.00	0.00	0.25	0.00
44.56	386.28	2.00	0.00	0.24	0.00	44.63	377.00	2.00	0.00	0.24	0.00
44.70	378.79	2.00	0.00	0.24	0.00	44.76	382.32	2.00	0.00	0.24	0.00
44.82	380.53	2.00	0.00	0.24	0.00	44.90	390.15	2.00	0.00	0.24	0.00
44.96	394.22	2.00	0.00	0.24	0.00	45.03	409.75	2.00	0.00	0.24	0.00
45.09	424.66	2.00	0.00	0.24	0.00	45.15	433.37	2.00	0.00	0.23	0.00
45.22	444.11	2.00	0.00	0.23	0.00	45.28	454.01	2.00	0.00	0.23	0.00
45.36	455.48	2.00	0.00	0.23	0.00	45.41	477.83	2.00	0.00	0.23	0.00
45.48	474.98	2.00	0.00	0.23	0.00	45.54	477.53	2.00	0.00	0.23	0.00
45.62	475.47	2.00	0.00	0.23	0.00	45.69	477.18	2.00	0.00	0.23	0.00
45.74	475.59	2.00	0.00	0.22	0.00	45.81	470.98	2.00	0.00	0.22	0.00
45.87	473.17	2.00	0.00	0.22	0.00	45.96	473.79	2.00	0.00	0.22	0.00
46.00	483.90	2.00	0.00	0.22	0.00	46.09	465.28	2.00	0.00	0.22	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)
46.14	463.73	2.00	0.00	0.22	0.00	46.21	449.99	2.00	0.00	0.22	0.00
46.27	450.04	2.00	0.00	0.22	0.00	46.34	382.61	2.00	0.00	0.21	0.00
46.41	383.77	2.00	0.00	0.21	0.00	46.46	380.55	2.00	0.00	0.21	0.00
46.54	360.67	2.00	0.00	0.21	0.00	46.61	327.86	2.00	0.00	0.21	0.00
46.66	328.29	2.00	0.00	0.21	0.00	46.72	324.23	2.00	0.00	0.21	0.00
46.81	324.90	2.00	0.00	0.21	0.00	46.86	324.84	2.00	0.00	0.21	0.00
46.92	325.54	2.00	0.00	0.20	0.00	46.98	354.57	2.00	0.00	0.20	0.00
47.05	349.79	2.00	0.00	0.20	0.00	47.12	343.13	2.00	0.00	0.20	0.00
47.19	339.83	2.00	0.00	0.20	0.00	47.26	332.19	2.00	0.00	0.20	0.00
47.31	304.74	2.00	0.00	0.20	0.00	47.39	305.92	2.00	0.00	0.20	0.00
47.45	267.58	2.00	0.00	0.20	0.00	47.53	262.33	2.00	0.00	0.19	0.00
47.58	283.23	2.00	0.00	0.19	0.00	47.65	332.00	2.00	0.00	0.19	0.00
47.71	365.01	2.00	0.00	0.19	0.00	47.78	427.08	2.00	0.00	0.19	0.00
47.85	455.28	2.00	0.00	0.19	0.00	47.94	501.78	2.00	0.00	0.19	0.00
47.97	492.38	2.00	0.00	0.19	0.00	48.06	541.75	2.00	0.00	0.19	0.00
48.10	553.86	2.00	0.00	0.18	0.00	48.17	536.35	2.00	0.00	0.18	0.00
48.25	530.99	2.00	0.00	0.18	0.00	48.32	546.36	2.00	0.00	0.18	0.00
48.37	547.17	2.00	0.00	0.18	0.00	48.43	555.67	2.00	0.00	0.18	0.00
48.50	531.53	2.00	0.00	0.18	0.00	48.57	524.57	2.00	0.00	0.18	0.00
48.62	515.27	2.00	0.00	0.18	0.00	48.69	496.17	2.00	0.00	0.17	0.00
48.76	491.31	2.00	0.00	0.17	0.00	48.83	480.35	2.00	0.00	0.17	0.00
48.89	482.38	2.00	0.00	0.17	0.00	48.96	458.35	2.00	0.00	0.17	0.00
49.02	456.45	2.00	0.00	0.17	0.00	49.09	445.92	2.00	0.00	0.17	0.00
49.15	455.88	2.00	0.00	0.17	0.00	49.23	448.93	2.00	0.00	0.17	0.00
49.28	455.30	2.00	0.00	0.16	0.00	49.37	456.67	2.00	0.00	0.16	0.00
49.41	470.33	2.00	0.00	0.16	0.00	49.49	477.32	2.00	0.00	0.16	0.00
49.54	462.32	2.00	0.00	0.16	0.00	49.64	472.41	2.00	0.00	0.16	0.00
49.68	461.94	2.00	0.00	0.16	0.00	49.76	440.19	2.00	0.00	0.16	0.00
49.80	429.32	2.00	0.00	0.16	0.00	49.87	394.47	2.00	0.00	0.15	0.00
49.95	418.38	2.00	0.00	0.15	0.00	50.00	430.39	2.00	0.00	0.15	0.00
50.07	423.50	2.00	0.00	0.15	0.00	50.14	421.18	2.00	0.00	0.15	0.00
50.20	422.39	2.00	0.00	0.15	0.00	50.27	430.86	2.00	0.00	0.15	0.00

Total estimated settlement: 3.93

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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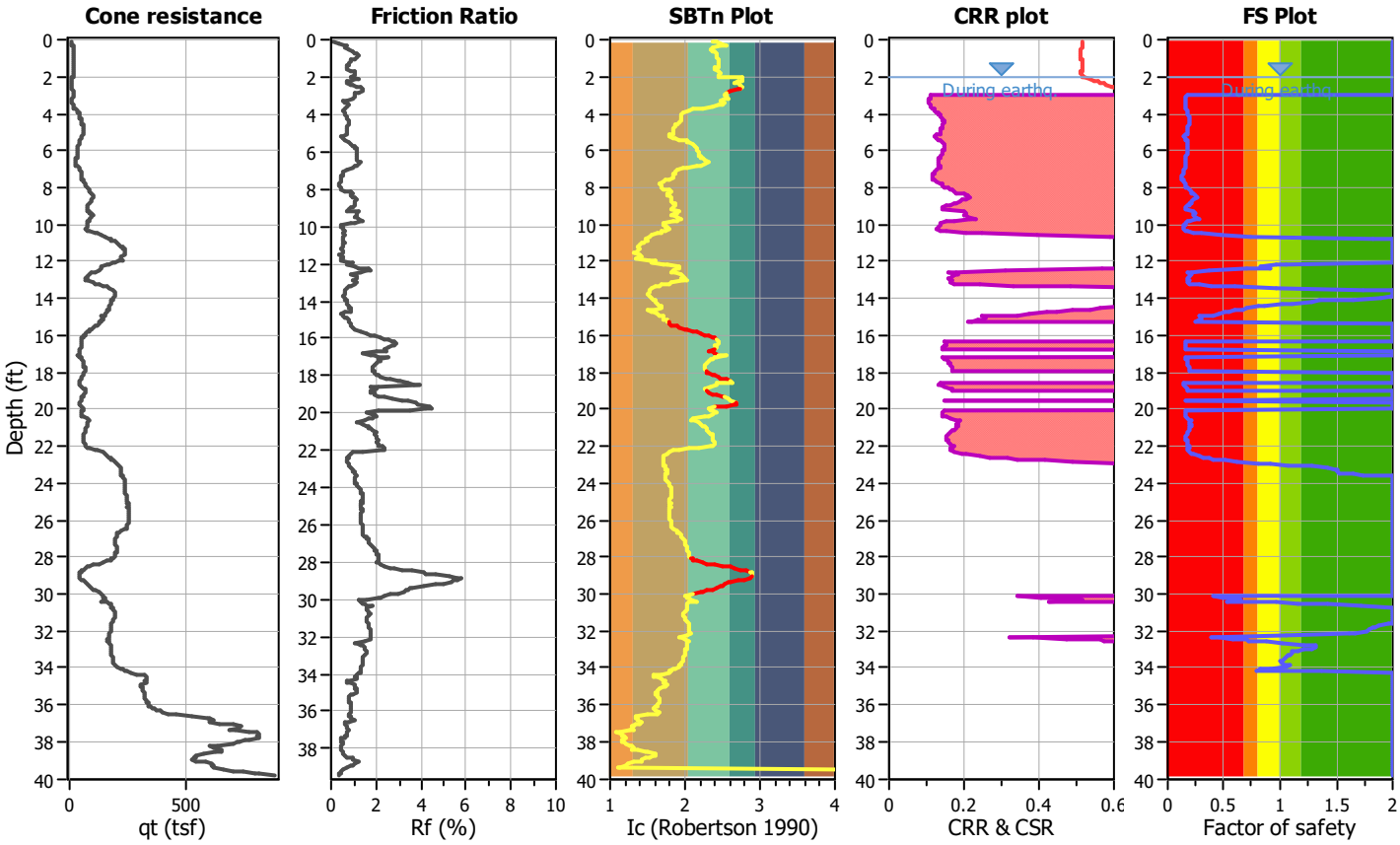
LIQUEFACTION ANALYSIS REPORT

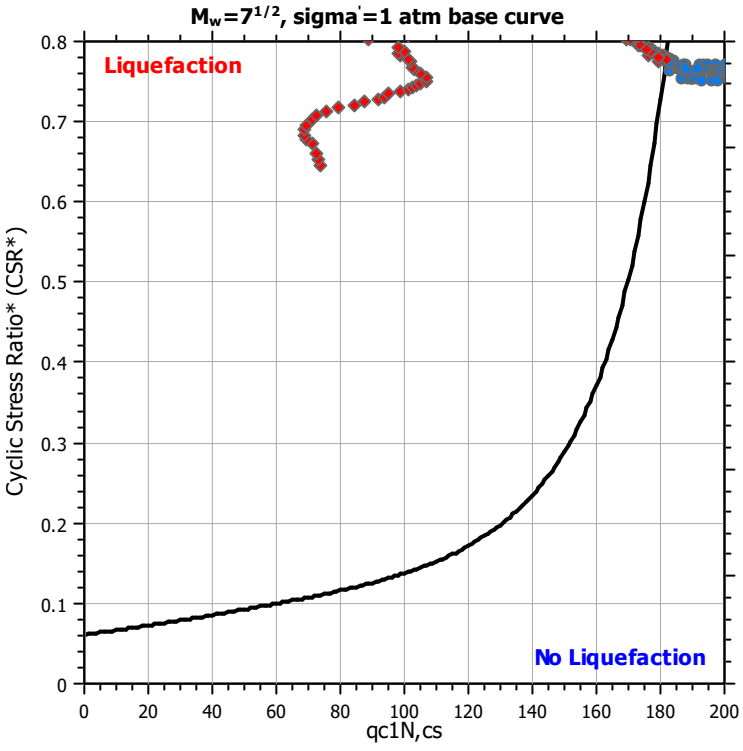
Project title : Proposed Warehouse **Location : El Monte, CA**

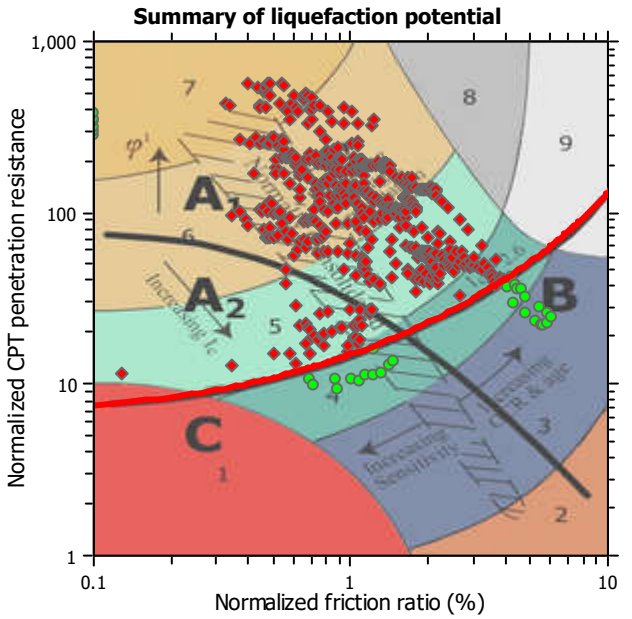
CPT file : CPT-3

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	37.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.89	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method
Peak ground acceleration:	0.90	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

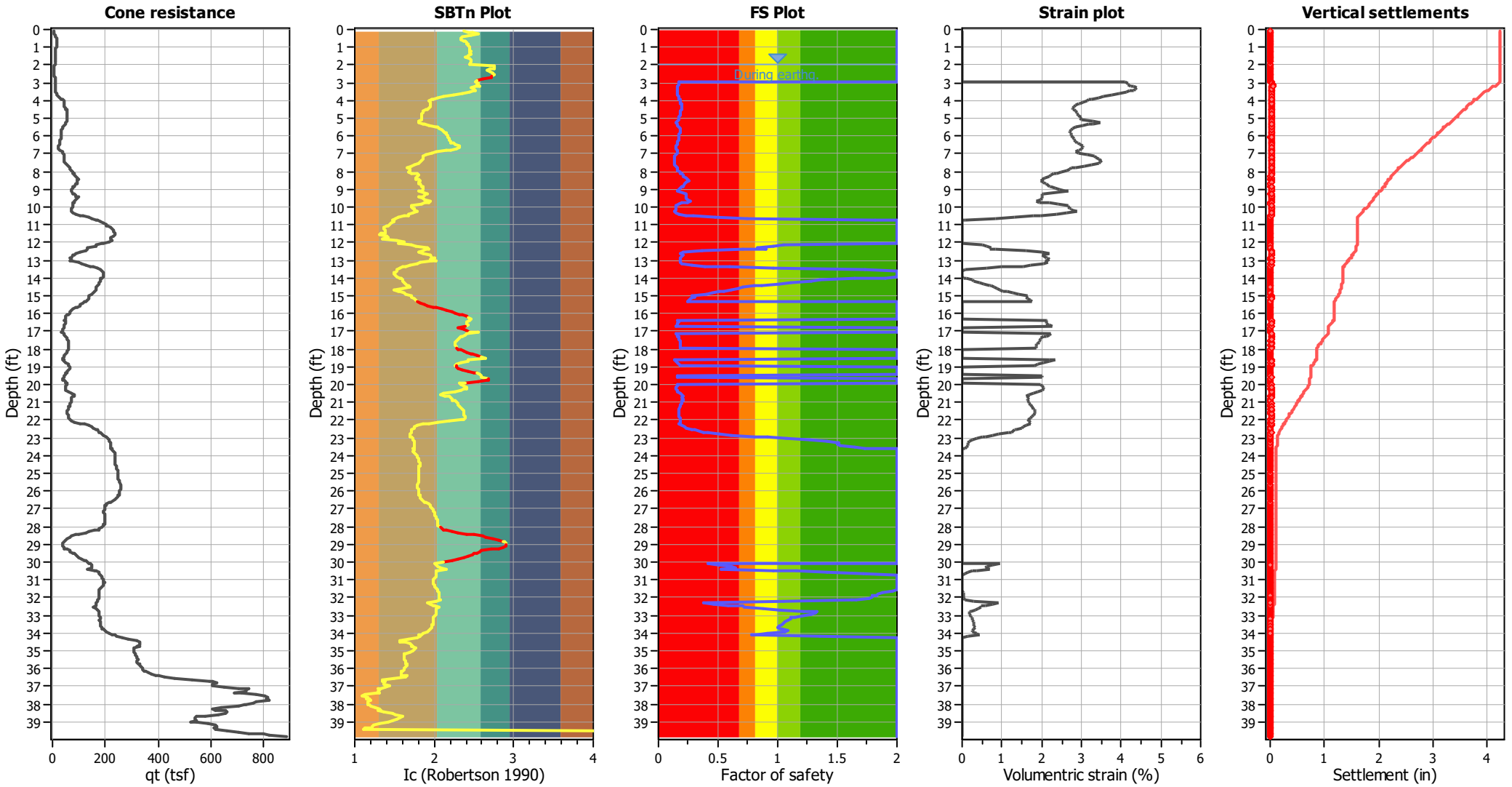






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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)
2.05	11.29	2.00	0.00	0.97	0.00	2.11	10.56	2.00	0.00	0.96	0.00
2.19	9.37	2.00	0.00	0.96	0.00	2.25	10.11	2.00	0.00	0.96	0.00
2.30	10.84	2.00	0.00	0.96	0.00	2.38	10.84	2.00	0.00	0.96	0.00
2.43	10.84	2.00	0.00	0.96	0.00	2.52	11.58	2.00	0.00	0.96	0.00
2.56	11.74	2.00	0.00	0.96	0.00	2.63	13.22	2.00	0.00	0.96	0.00
2.70	13.82	2.00	0.00	0.95	0.00	2.79	16.34	2.00	0.00	0.95	0.00
2.85	73.57	2.00	0.00	0.95	0.00	2.92	74.26	2.00	0.00	0.95	0.00
2.97	73.98	0.17	4.10	0.95	0.02	3.02	72.94	0.17	4.15	0.95	0.02
3.10	72.24	0.17	4.18	0.95	0.04	3.19	70.96	0.16	4.25	0.95	0.05
3.23	69.55	0.16	4.33	0.95	0.02	3.29	68.58	0.16	4.38	0.94	0.03
3.36	69.05	0.15	4.34	0.94	0.04	3.42	69.58	0.15	4.31	0.94	0.03
3.48	71.25	0.15	4.21	0.94	0.03	3.55	72.78	0.15	4.12	0.94	0.03
3.62	75.87	0.16	3.96	0.94	0.03	3.68	79.61	0.16	3.78	0.94	0.03
3.75	84.44	0.17	3.56	0.94	0.03	3.82	87.53	0.17	3.43	0.94	0.03
3.91	91.78	0.18	3.27	0.93	0.03	3.95	93.84	0.18	3.20	0.93	0.02
4.02	95.21	0.18	3.15	0.93	0.02	4.08	98.46	0.18	3.04	0.93	0.02
4.17	101.18	0.19	2.95	0.93	0.03	4.22	102.24	0.19	2.92	0.93	0.02
4.29	103.84	0.19	2.87	0.93	0.03	4.34	105.25	0.19	2.82	0.93	0.02
4.40	106.97	0.20	2.77	0.93	0.02	4.49	106.71	0.19	2.78	0.92	0.03
4.53	105.19	0.19	2.82	0.92	0.01	4.63	103.19	0.19	2.87	0.92	0.03
4.67	102.81	0.18	2.88	0.92	0.01	4.76	101.76	0.18	2.90	0.92	0.03
4.81	101.03	0.18	2.92	0.92	0.02	4.88	98.99	0.17	2.98	0.92	0.03
4.93	98.42	0.17	2.99	0.92	0.02	4.99	99.85	0.17	2.95	0.92	0.02
5.07	98.10	0.17	3.00	0.91	0.03	5.14	88.89	0.16	3.30	0.91	0.03
5.21	84.30	0.15	3.47	0.91	0.03	5.30	88.44	0.15	3.31	0.91	0.03
5.34	91.61	0.16	3.19	0.91	0.02	5.40	96.61	0.16	3.02	0.91	0.02
5.47	101.49	0.17	2.87	0.91	0.02	5.51	102.62	0.17	2.84	0.91	0.02
5.58	104.41	0.18	2.78	0.91	0.02	5.65	105.46	0.18	2.75	0.90	0.02
5.71	106.41	0.18	2.72	0.90	0.02	5.78	106.39	0.18	2.72	0.90	0.02
5.85	105.92	0.18	2.73	0.90	0.02	5.91	105.52	0.18	2.74	0.90	0.02
5.98	104.91	0.17	2.75	0.90	0.02	6.07	104.03	0.17	2.77	0.90	0.03
6.11	103.68	0.17	2.78	0.90	0.01	6.19	102.47	0.17	2.80	0.90	0.03
6.25	101.50	0.17	2.83	0.89	0.02	6.30	100.28	0.16	2.86	0.89	0.02
6.37	99.00	0.16	2.90	0.89	0.02	6.43	97.31	0.16	2.94	0.89	0.02
6.51	96.04	0.16	2.98	0.89	0.03	6.57	94.24	0.15	3.03	0.89	0.02
6.65	93.69	0.15	3.05	0.89	0.03	6.72	94.56	0.15	3.01	0.89	0.02
6.78	96.25	0.15	2.96	0.89	0.02	6.83	97.68	0.16	2.91	0.88	0.02
6.92	99.13	0.16	2.86	0.88	0.03	6.96	97.22	0.15	2.92	0.88	0.01
7.03	89.90	0.14	3.15	0.88	0.03	7.10	84.96	0.14	3.33	0.88	0.03
7.18	83.84	0.14	3.37	0.88	0.03	7.23	83.31	0.13	3.38	0.88	0.02
7.29	82.21	0.13	3.42	0.88	0.02	7.36	81.09	0.13	3.46	0.88	0.03
7.42	80.02	0.13	3.50	0.87	0.02	7.50	80.99	0.13	3.46	0.87	0.04
7.56	81.54	0.13	3.43	0.87	0.02	7.62	85.74	0.14	3.26	0.87	0.02
7.68	90.75	0.14	3.08	0.87	0.02	7.77	98.30	0.15	2.84	0.87	0.03
7.81	102.04	0.16	2.73	0.87	0.02	7.90	102.65	0.16	2.71	0.87	0.03
7.95	105.60	0.16	2.63	0.87	0.01	8.02	111.89	0.18	2.47	0.86	0.02
8.08	115.65	0.19	2.38	0.86	0.02	8.15	118.54	0.19	2.32	0.86	0.02
8.23	121.98	0.20	2.24	0.86	0.02	8.28	124.22	0.21	2.20	0.86	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)
8.35	130.44	0.23	2.08	0.86	0.02	8.42	134.33	0.25	2.01	0.86	0.02
8.47	133.04	0.24	2.03	0.86	0.01	8.55	135.71	0.26	1.99	0.86	0.02
8.63	131.68	0.24	2.05	0.85	0.02	8.68	128.73	0.22	2.10	0.85	0.01
8.73	126.48	0.22	2.14	0.85	0.01	8.82	123.21	0.21	2.19	0.85	0.02
8.87	121.60	0.20	2.22	0.85	0.01	8.93	116.23	0.19	2.33	0.85	0.02
9.00	110.61	0.17	2.45	0.85	0.02	9.07	104.81	0.16	2.59	0.85	0.02
9.13	102.11	0.16	2.66	0.85	0.02	9.23	131.18	0.23	2.03	0.84	0.02
9.27	131.36	0.23	2.03	0.84	0.01	9.34	132.45	0.24	2.01	0.84	0.02
9.41	131.95	0.24	2.01	0.84	0.02	9.47	131.17	0.23	2.02	0.84	0.02
9.52	131.93	0.24	2.01	0.84	0.01	9.58	134.41	0.25	1.97	0.84	0.01
9.67	139.58	0.27	1.88	0.84	0.02	9.72	134.97	0.25	1.95	0.84	0.01
9.80	121.89	0.20	2.18	0.83	0.02	9.84	111.23	0.17	2.40	0.83	0.01
9.94	99.83	0.15	2.68	0.83	0.03	9.98	99.63	0.15	2.68	0.83	0.01
10.05	98.41	0.15	2.71	0.83	0.02	10.11	96.87	0.15	2.75	0.83	0.02
10.18	97.11	0.15	2.74	0.83	0.02	10.24	92.33	0.14	2.88	0.83	0.02
10.32	100.75	0.15	2.63	0.83	0.02	10.38	111.06	0.17	2.38	0.82	0.02
10.47	131.65	0.23	1.98	0.82	0.02	10.50	143.04	0.29	1.80	0.82	0.01
10.58	161.97	0.48	1.32	0.82	0.01	10.64	174.49	0.74	0.86	0.82	0.01
10.73	194.36	1.82	0.06	0.82	0.00	10.76	199.13	2.00	0.00	0.82	0.00
10.83	206.24	2.00	0.00	0.82	0.00	10.91	216.88	2.00	0.00	0.82	0.00
11.00	225.34	2.00	0.00	0.81	0.00	11.03	229.53	2.00	0.00	0.81	0.00
11.10	234.85	2.00	0.00	0.81	0.00	11.18	240.23	2.00	0.00	0.81	0.00
11.23	245.79	2.00	0.00	0.81	0.00	11.29	253.24	2.00	0.00	0.81	0.00
11.36	254.51	2.00	0.00	0.81	0.00	11.44	256.67	2.00	0.00	0.81	0.00
11.50	255.18	2.00	0.00	0.81	0.00	11.55	254.23	2.00	0.00	0.80	0.00
11.63	252.18	2.00	0.00	0.80	0.00	11.71	241.59	2.00	0.00	0.80	0.00
11.77	239.05	2.00	0.00	0.80	0.00	11.81	240.29	2.00	0.00	0.80	0.00
11.90	245.34	2.00	0.00	0.80	0.00	11.95	233.12	2.00	0.00	0.80	0.00
12.02	209.89	2.00	0.00	0.80	0.00	12.08	206.03	2.00	0.00	0.80	0.00
12.17	182.83	1.05	0.52	0.79	0.01	12.21	181.01	0.97	0.61	0.79	0.00
12.28	177.28	0.83	0.75	0.79	0.01	12.34	179.46	0.91	0.69	0.79	0.01
12.40	173.36	0.71	0.86	0.79	0.01	12.48	152.84	0.37	1.60	0.79	0.01
12.56	124.02	0.20	2.02	0.79	0.02	12.61	114.48	0.18	2.19	0.79	0.01
12.67	124.65	0.21	2.00	0.79	0.01	12.75	124.17	0.20	2.01	0.78	0.02
12.84	117.77	0.19	2.12	0.78	0.02	12.88	116.05	0.18	2.15	0.78	0.01
12.93	114.59	0.18	2.18	0.78	0.01	13.00	116.65	0.18	2.13	0.78	0.02
13.06	118.86	0.19	2.09	0.78	0.02	13.15	115.73	0.18	2.14	0.78	0.02
13.20	121.66	0.20	2.03	0.78	0.01	13.26	141.69	0.28	1.72	0.78	0.01
13.33	155.54	0.39	1.54	0.77	0.01	13.39	168.79	0.60	0.99	0.77	0.01
13.47	180.80	0.96	0.61	0.77	0.01	13.55	193.49	1.73	0.09	0.77	0.00
13.60	197.55	2.00	0.00	0.77	0.00	13.66	200.32	2.00	0.00	0.77	0.00
13.73	204.59	2.00	0.00	0.77	0.00	13.78	204.26	2.00	0.00	0.77	0.00
13.87	201.41	2.00	0.00	0.76	0.00	13.91	200.67	2.00	0.00	0.76	0.00
14.00	195.25	1.90	0.03	0.76	0.00	14.04	192.43	1.65	0.12	0.76	0.00
14.11	188.42	1.36	0.27	0.76	0.00	14.18	187.21	1.28	0.31	0.76	0.00
14.26	184.14	1.11	0.44	0.76	0.00	14.32	182.04	1.01	0.54	0.76	0.00
14.40	178.35	0.86	0.69	0.76	0.01	14.44	176.44	0.80	0.74	0.76	0.00
14.54	173.24	0.70	0.82	0.75	0.01	14.58	171.77	0.67	0.87	0.75	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)
14.65	169.06	0.60	0.95	0.75	0.01	14.72	166.40	0.55	1.04	0.75	0.01
14.76	164.12	0.51	1.12	0.75	0.01	14.84	160.06	0.45	1.29	0.75	0.01
14.90	156.67	0.41	1.44	0.75	0.01	14.97	142.56	0.29	1.64	0.75	0.01
15.06	145.04	0.30	1.61	0.74	0.02	15.11	144.28	0.30	1.61	0.74	0.01
15.19	140.13	0.27	1.66	0.74	0.02	15.24	136.65	0.25	1.71	0.74	0.01
15.30	133.35	0.24	1.75	0.74	0.01	15.36	128.94	2.00	0.00	0.74	0.00
15.42	126.48	2.00	0.00	0.74	0.00	15.51	130.66	2.00	0.00	0.74	0.00
15.55	131.45	2.00	0.00	0.74	0.00	15.64	135.13	2.00	0.00	0.73	0.00
15.69	134.85	2.00	0.00	0.73	0.00	15.75	132.51	2.00	0.00	0.73	0.00
15.82	130.69	2.00	0.00	0.73	0.00	15.89	127.82	2.00	0.00	0.73	0.00
15.96	124.97	2.00	0.00	0.73	0.00	16.03	120.81	2.00	0.00	0.73	0.00
16.09	118.49	2.00	0.00	0.73	0.00	16.15	114.85	2.00	0.00	0.73	0.00
16.22	112.12	2.00	0.00	0.73	0.00	16.29	109.37	2.00	0.00	0.72	0.00
16.36	108.66	0.16	2.13	0.72	0.02	16.43	109.06	0.16	2.12	0.72	0.02
16.49	109.22	0.16	2.11	0.72	0.02	16.58	107.91	0.16	2.14	0.72	0.02
16.63	106.42	0.16	2.16	0.72	0.01	16.67	104.80	0.16	2.20	0.72	0.01
16.74	101.80	0.15	2.26	0.72	0.02	16.81	97.87	2.00	0.00	0.72	0.00
16.89	98.20	2.00	0.00	0.71	0.00	16.94	97.84	2.00	0.00	0.71	0.00
17.03	97.99	2.00	0.00	0.71	0.00	17.06	92.79	2.00	0.00	0.71	0.00
17.13	101.71	0.15	2.24	0.71	0.02	17.20	104.20	0.15	2.18	0.71	0.02
17.26	107.74	0.16	2.10	0.71	0.01	17.33	110.78	0.17	2.04	0.71	0.02
17.39	113.19	0.17	1.99	0.71	0.01	17.47	114.02	0.17	1.97	0.70	0.02
17.52	115.24	0.18	1.95	0.70	0.01	17.59	116.48	0.18	1.92	0.70	0.02
17.68	117.92	0.18	1.89	0.70	0.02	17.74	118.61	0.19	1.88	0.70	0.01
17.79	118.77	0.19	1.87	0.70	0.01	17.85	118.74	0.19	1.87	0.70	0.01
17.92	119.03	0.19	1.86	0.70	0.01	18.00	118.86	2.00	0.00	0.69	0.00
18.05	118.00	2.00	0.00	0.69	0.00	18.13	116.63	2.00	0.00	0.69	0.00
18.19	115.33	2.00	0.00	0.69	0.00	18.27	112.46	2.00	0.00	0.69	0.00
18.31	110.79	2.00	0.00	0.69	0.00	18.40	106.76	2.00	0.00	0.69	0.00
18.46	102.89	2.00	0.00	0.69	0.00	18.54	37.36	2.00	0.00	0.69	0.00
18.59	99.58	0.15	2.21	0.68	0.02	18.64	94.08	0.14	2.34	0.68	0.01
18.72	99.22	0.15	2.21	0.68	0.02	18.77	106.88	0.16	2.05	0.68	0.01
18.86	115.19	0.18	1.89	0.68	0.02	18.90	117.94	0.18	1.84	0.68	0.01
18.97	117.64	0.18	1.84	0.68	0.01	19.05	120.95	2.00	0.00	0.68	0.00
19.10	120.52	2.00	0.00	0.68	0.00	19.18	118.69	2.00	0.00	0.67	0.00
19.24	115.41	2.00	0.00	0.67	0.00	19.32	112.18	2.00	0.00	0.67	0.00
19.36	109.87	2.00	0.00	0.67	0.00	19.45	106.94	2.00	0.00	0.67	0.00
19.50	106.18	0.16	2.02	0.67	0.01	19.56	106.07	0.16	2.02	0.67	0.01
19.64	38.02	2.00	0.00	0.67	0.00	19.73	37.58	2.00	0.00	0.67	0.00
19.77	39.40	2.00	0.00	0.66	0.00	19.86	106.65	2.00	0.00	0.66	0.00
19.91	106.35	2.00	0.00	0.66	0.00	19.95	106.04	2.00	0.00	0.66	0.00
20.04	106.90	0.16	1.98	0.66	0.02	20.08	105.42	0.16	2.01	0.66	0.01
20.17	102.50	0.15	2.06	0.66	0.02	20.21	102.64	0.15	2.06	0.66	0.01
20.28	102.15	0.15	2.06	0.66	0.02	20.34	104.68	0.15	2.01	0.66	0.02
20.42	109.56	0.16	1.91	0.65	0.02	20.48	116.36	0.18	1.79	0.65	0.01
20.55	123.27	0.20	1.68	0.65	0.01	20.62	126.78	0.21	1.63	0.65	0.01
20.68	124.39	0.20	1.66	0.65	0.01	20.77	123.53	0.20	1.67	0.65	0.02
20.82	124.61	0.20	1.65	0.65	0.01	20.87	125.05	0.20	1.64	0.65	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)
20.94	123.58	0.20	1.66	0.65	0.01	21.00	122.17	0.19	1.68	0.64	0.01
21.09	120.46	0.19	1.70	0.64	0.02	21.14	119.26	0.19	1.72	0.64	0.01
21.22	116.79	0.18	1.75	0.64	0.02	21.26	116.15	0.18	1.76	0.64	0.01
21.36	113.64	0.17	1.80	0.64	0.02	21.40	112.55	0.17	1.81	0.64	0.01
21.48	111.22	0.17	1.83	0.64	0.02	21.54	110.61	0.16	1.84	0.63	0.01
21.63	110.56	0.16	1.83	0.63	0.02	21.66	110.72	0.17	1.83	0.63	0.01
21.72	112.16	0.17	1.80	0.63	0.01	21.81	114.29	0.17	1.76	0.63	0.02
21.89	116.75	0.18	1.72	0.63	0.02	21.94	118.24	0.18	1.69	0.63	0.01
21.98	120.26	0.19	1.66	0.63	0.01	22.07	119.37	0.19	1.67	0.63	0.02
22.11	115.98	0.18	1.72	0.63	0.01	22.20	118.52	0.18	1.68	0.62	0.02
22.25	115.51	0.18	1.72	0.62	0.01	22.33	121.86	0.19	1.62	0.62	0.01
22.39	129.25	0.22	1.52	0.62	0.01	22.45	132.00	0.23	1.48	0.62	0.01
22.52	142.07	0.28	1.36	0.62	0.01	22.58	146.53	0.31	1.32	0.62	0.01
22.67	153.87	0.38	1.24	0.62	0.01	22.71	157.14	0.41	1.17	0.62	0.01
22.78	163.81	0.51	0.93	0.61	0.01	22.84	169.24	0.61	0.77	0.61	0.01
22.92	176.48	0.81	0.60	0.61	0.01	22.97	179.49	0.92	0.52	0.61	0.00
23.04	183.02	1.08	0.38	0.61	0.00	23.11	186.57	1.27	0.25	0.61	0.00
23.17	188.83	1.41	0.19	0.61	0.00	23.25	190.01	1.50	0.15	0.61	0.00
23.30	190.29	1.52	0.14	0.61	0.00	23.36	190.10	1.50	0.15	0.60	0.00
23.44	190.43	1.53	0.14	0.60	0.00	23.50	191.95	1.65	0.10	0.60	0.00
23.57	193.02	1.74	0.07	0.60	0.00	23.63	196.08	2.00	0.00	0.60	0.00
23.70	197.85	2.00	0.00	0.60	0.00	23.76	201.86	2.00	0.00	0.60	0.00
23.83	203.19	2.00	0.00	0.60	0.00	23.89	203.43	2.00	0.00	0.60	0.00
23.96	203.40	2.00	0.00	0.59	0.00	24.02	203.23	2.00	0.00	0.59	0.00
24.11	204.36	2.00	0.00	0.59	0.00	24.16	204.49	2.00	0.00	0.59	0.00
24.24	205.77	2.00	0.00	0.59	0.00	24.29	207.29	2.00	0.00	0.59	0.00
24.36	209.13	2.00	0.00	0.59	0.00	24.42	210.84	2.00	0.00	0.59	0.00
24.48	212.05	2.00	0.00	0.59	0.00	24.55	212.27	2.00	0.00	0.58	0.00
24.63	211.94	2.00	0.00	0.58	0.00	24.69	211.98	2.00	0.00	0.58	0.00
24.76	213.29	2.00	0.00	0.58	0.00	24.82	214.62	2.00	0.00	0.58	0.00
24.87	213.03	2.00	0.00	0.58	0.00	24.96	214.30	2.00	0.00	0.58	0.00
25.00	214.30	2.00	0.00	0.58	0.00	25.09	215.88	2.00	0.00	0.57	0.00
25.14	215.21	2.00	0.00	0.57	0.00	25.21	215.85	2.00	0.00	0.57	0.00
25.28	214.37	2.00	0.00	0.57	0.00	25.34	215.72	2.00	0.00	0.57	0.00
25.41	217.14	2.00	0.00	0.57	0.00	25.46	217.97	2.00	0.00	0.57	0.00
25.53	218.80	2.00	0.00	0.57	0.00	25.62	219.25	2.00	0.00	0.57	0.00
25.66	219.24	2.00	0.00	0.57	0.00	25.72	219.00	2.00	0.00	0.56	0.00
25.80	219.35	2.00	0.00	0.56	0.00	25.88	219.55	2.00	0.00	0.56	0.00
25.93	218.96	2.00	0.00	0.56	0.00	26.00	218.38	2.00	0.00	0.56	0.00
26.07	218.08	2.00	0.00	0.56	0.00	26.12	217.37	2.00	0.00	0.56	0.00
26.19	216.30	2.00	0.00	0.56	0.00	26.25	215.07	2.00	0.00	0.56	0.00
26.32	214.32	2.00	0.00	0.55	0.00	26.43	211.95	2.00	0.00	0.55	0.00
26.46	210.10	2.00	0.00	0.55	0.00	26.51	208.82	2.00	0.00	0.55	0.00
26.61	209.76	2.00	0.00	0.55	0.00	26.65	210.22	2.00	0.00	0.55	0.00
26.73	210.19	2.00	0.00	0.55	0.00	26.78	210.10	2.00	0.00	0.55	0.00
26.84	209.81	2.00	0.00	0.55	0.00	26.92	209.61	2.00	0.00	0.54	0.00
26.97	210.72	2.00	0.00	0.54	0.00	27.05	213.32	2.00	0.00	0.54	0.00
27.13	215.00	2.00	0.00	0.54	0.00	27.18	215.89	2.00	0.00	0.54	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)
27.27	217.84	2.00	0.00	0.54	0.00	27.32	219.28	2.00	0.00	0.54	0.00
27.37	220.85	2.00	0.00	0.54	0.00	27.43	223.25	2.00	0.00	0.54	0.00
27.50	225.58	2.00	0.00	0.53	0.00	27.56	226.94	2.00	0.00	0.53	0.00
27.63	227.71	2.00	0.00	0.53	0.00	27.72	227.67	2.00	0.00	0.53	0.00
27.77	226.93	2.00	0.00	0.53	0.00	27.85	225.97	2.00	0.00	0.53	0.00
27.90	223.02	2.00	0.00	0.53	0.00	27.97	220.31	2.00	0.00	0.53	0.00
28.03	217.27	2.00	0.00	0.52	0.00	28.12	212.30	2.00	0.00	0.52	0.00
28.16	208.44	2.00	0.00	0.52	0.00	28.22	198.76	2.00	0.00	0.52	0.00
28.29	181.28	2.00	0.00	0.52	0.00	28.35	168.93	2.00	0.00	0.52	0.00
28.42	149.07	2.00	0.00	0.52	0.00	28.48	134.87	2.00	0.00	0.52	0.00
28.55	53.63	2.00	0.00	0.52	0.00	28.61	48.83	2.00	0.00	0.52	0.00
28.69	41.86	2.00	0.00	0.51	0.00	28.74	36.75	2.00	0.00	0.51	0.00
28.82	34.19	2.00	0.00	0.51	0.00	28.87	32.59	2.00	0.00	0.51	0.00
28.96	30.18	2.00	0.00	0.51	0.00	29.01	29.36	2.00	0.00	0.51	0.00
29.08	29.32	2.00	0.00	0.51	0.00	29.16	31.11	2.00	0.00	0.51	0.00
29.22	34.27	2.00	0.00	0.50	0.00	29.27	39.15	2.00	0.00	0.50	0.00
29.36	114.10	2.00	0.00	0.50	0.00	29.40	117.02	2.00	0.00	0.50	0.00
29.49	123.94	2.00	0.00	0.50	0.00	29.54	128.36	2.00	0.00	0.50	0.00
29.59	132.53	2.00	0.00	0.50	0.00	29.67	136.82	2.00	0.00	0.50	0.00
29.75	143.07	2.00	0.00	0.50	0.00	29.82	151.63	2.00	0.00	0.49	0.00
29.90	159.51	2.00	0.00	0.49	0.00	29.94	162.71	2.00	0.00	0.49	0.00
30.00	159.87	2.00	0.00	0.49	0.00	30.07	151.46	2.00	0.00	0.49	0.00
30.12	156.97	0.41	0.94	0.49	0.01	30.19	163.13	0.50	0.76	0.49	0.01
30.26	169.10	0.61	0.61	0.49	0.01	30.33	170.70	0.64	0.58	0.49	0.00
30.38	164.80	0.52	0.71	0.49	0.00	30.46	180.80	0.96	0.38	0.48	0.00
30.52	184.87	1.16	0.26	0.48	0.00	30.58	189.17	1.42	0.15	0.48	0.00
30.65	193.15	1.72	0.06	0.48	0.00	30.73	197.27	2.00	0.00	0.48	0.00
30.78	198.95	2.00	0.00	0.48	0.00	30.84	200.50	2.00	0.00	0.48	0.00
30.92	201.17	2.00	0.00	0.48	0.00	30.98	201.90	2.00	0.00	0.47	0.00
31.06	202.71	2.00	0.00	0.47	0.00	31.11	202.54	2.00	0.00	0.47	0.00
31.18	203.10	2.00	0.00	0.47	0.00	31.24	202.80	2.00	0.00	0.47	0.00
31.31	201.54	2.00	0.00	0.47	0.00	31.37	200.39	2.00	0.00	0.47	0.00
31.46	198.29	2.00	0.00	0.47	0.00	31.50	197.69	2.00	0.00	0.47	0.00
31.58	196.53	2.00	0.00	0.46	0.00	31.64	195.77	1.97	0.01	0.46	0.00
31.69	194.82	1.87	0.02	0.46	0.00	31.77	194.51	1.84	0.03	0.46	0.00
31.86	194.35	1.83	0.03	0.46	0.00	31.91	194.01	1.80	0.04	0.46	0.00
31.98	194.02	1.80	0.04	0.46	0.00	32.03	193.72	1.77	0.05	0.46	0.00
32.12	192.43	1.66	0.07	0.46	0.00	32.17	191.96	1.62	0.08	0.45	0.00
32.22	182.64	1.05	0.30	0.45	0.00	32.31	154.20	0.38	0.91	0.45	0.01
32.35	161.03	0.46	0.75	0.45	0.00	32.42	168.01	0.58	0.59	0.45	0.00
32.49	173.28	0.71	0.49	0.45	0.00	32.55	173.67	0.72	0.48	0.45	0.00
32.62	178.77	0.88	0.40	0.45	0.00	32.68	181.89	1.01	0.32	0.45	0.00
32.76	185.90	1.22	0.21	0.44	0.00	32.81	187.74	1.32	0.17	0.44	0.00
32.90	187.69	1.32	0.17	0.44	0.00	32.95	187.04	1.28	0.18	0.44	0.00
33.02	185.81	1.21	0.21	0.44	0.00	33.08	184.70	1.15	0.24	0.44	0.00
33.14	183.95	1.11	0.26	0.44	0.00	33.21	183.83	1.10	0.26	0.44	0.00
33.27	183.39	1.08	0.27	0.44	0.00	33.34	183.08	1.07	0.28	0.43	0.00
33.42	182.67	1.05	0.29	0.43	0.00	33.49	182.54	1.04	0.29	0.43	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)
33.54	182.54	1.04	0.29	0.43	0.00	33.61	182.01	1.02	0.30	0.43	0.00
33.66	181.57	1.00	0.31	0.43	0.00	33.75	182.06	1.02	0.30	0.43	0.00
33.80	182.53	1.04	0.29	0.43	0.00	33.89	183.37	1.08	0.26	0.43	0.00
33.93	182.92	1.06	0.27	0.42	0.00	34.02	179.53	0.91	0.37	0.42	0.00
34.07	176.96	0.82	0.40	0.42	0.00	34.13	175.74	0.78	0.42	0.42	0.00
34.19	188.33	1.36	0.15	0.42	0.00	34.26	202.94	2.00	0.00	0.42	0.00
34.33	219.44	2.00	0.00	0.42	0.00	34.40	251.02	2.00	0.00	0.42	0.00
34.47	262.31	2.00	0.00	0.42	0.00	34.52	261.65	2.00	0.00	0.41	0.00
34.58	261.51	2.00	0.00	0.41	0.00	34.66	260.80	2.00	0.00	0.41	0.00
34.74	253.64	2.00	0.00	0.41	0.00	34.79	259.70	2.00	0.00	0.41	0.00
34.87	238.18	2.00	0.00	0.41	0.00	34.92	237.88	2.00	0.00	0.41	0.00
34.98	237.59	2.00	0.00	0.41	0.00	35.06	240.59	2.00	0.00	0.41	0.00
35.14	242.43	2.00	0.00	0.40	0.00	35.19	243.54	2.00	0.00	0.40	0.00
35.24	246.27	2.00	0.00	0.40	0.00	35.31	248.52	2.00	0.00	0.40	0.00
35.37	250.25	2.00	0.00	0.40	0.00	35.46	252.36	2.00	0.00	0.40	0.00
35.51	252.60	2.00	0.00	0.40	0.00	35.57	250.54	2.00	0.00	0.40	0.00
35.64	250.89	2.00	0.00	0.40	0.00	35.70	254.09	2.00	0.00	0.39	0.00
35.77	256.69	2.00	0.00	0.39	0.00	35.84	260.24	2.00	0.00	0.39	0.00
35.91	263.35	2.00	0.00	0.39	0.00	36.00	264.75	2.00	0.00	0.39	0.00
36.05	265.72	2.00	0.00	0.39	0.00	36.11	269.05	2.00	0.00	0.39	0.00
36.17	274.91	2.00	0.00	0.39	0.00	36.24	283.04	2.00	0.00	0.39	0.00
36.31	293.03	2.00	0.00	0.38	0.00	36.35	302.50	2.00	0.00	0.38	0.00
36.43	312.59	2.00	0.00	0.38	0.00	36.49	328.27	2.00	0.00	0.38	0.00
36.55	359.22	2.00	0.00	0.38	0.00	36.63	410.64	2.00	0.00	0.38	0.00
36.72	460.64	2.00	0.00	0.38	0.00	36.76	471.55	2.00	0.00	0.38	0.00
36.83	481.23	2.00	0.00	0.38	0.00	36.88	470.12	2.00	0.00	0.37	0.00
36.96	468.84	2.00	0.00	0.37	0.00	37.01	503.46	2.00	0.00	0.37	0.00
37.09	544.93	2.00	0.00	0.37	0.00	37.14	576.01	2.00	0.00	0.37	0.00
37.21	567.61	2.00	0.00	0.37	0.00	37.27	566.61	2.00	0.00	0.37	0.00
37.34	530.56	2.00	0.00	0.37	0.00	37.41	551.70	2.00	0.00	0.37	0.00
37.48	595.90	2.00	0.00	0.36	0.00	37.53	622.98	2.00	0.00	0.36	0.00
37.60	629.08	2.00	0.00	0.36	0.00	37.67	626.96	2.00	0.00	0.36	0.00
37.73	630.80	2.00	0.00	0.36	0.00	37.80	631.83	2.00	0.00	0.36	0.00
37.86	595.99	2.00	0.00	0.36	0.00	37.94	587.67	2.00	0.00	0.36	0.00
38.00	564.99	2.00	0.00	0.36	0.00	38.06	561.29	2.00	0.00	0.35	0.00
38.13	545.08	2.00	0.00	0.35	0.00	38.20	494.00	2.00	0.00	0.35	0.00
38.26	466.24	2.00	0.00	0.35	0.00	38.33	476.78	2.00	0.00	0.35	0.00
38.40	503.70	2.00	0.00	0.35	0.00	38.45	506.99	2.00	0.00	0.35	0.00
38.52	504.21	2.00	0.00	0.35	0.00	38.60	481.72	2.00	0.00	0.35	0.00
38.66	443.92	2.00	0.00	0.34	0.00	38.73	419.26	2.00	0.00	0.34	0.00
38.78	415.25	2.00	0.00	0.34	0.00	38.86	414.18	2.00	0.00	0.34	0.00
38.91	417.47	2.00	0.00	0.34	0.00	38.98	403.76	2.00	0.00	0.34	0.00
39.04	419.70	2.00	0.00	0.34	0.00	39.13	453.31	2.00	0.00	0.34	0.00
39.18	473.30	2.00	0.00	0.34	0.00	39.27	475.96	2.00	0.00	0.33	0.00
39.32	468.01	2.00	0.00	0.33	0.00	39.38	475.23	2.00	0.00	0.33	0.00
39.44	474.60	2.00	0.00	0.33	0.00	39.52	507.21	2.00	0.00	0.33	0.00
39.57	538.84	2.00	0.00	0.33	0.00	39.64	571.30	2.00	0.00	0.33	0.00
39.70	612.91	2.00	0.00	0.33	0.00	39.76	627.38	2.00	0.00	0.33	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)
39.83	679.09	2.00	0.00	0.32	0.00						

Total estimated settlement: 4.23

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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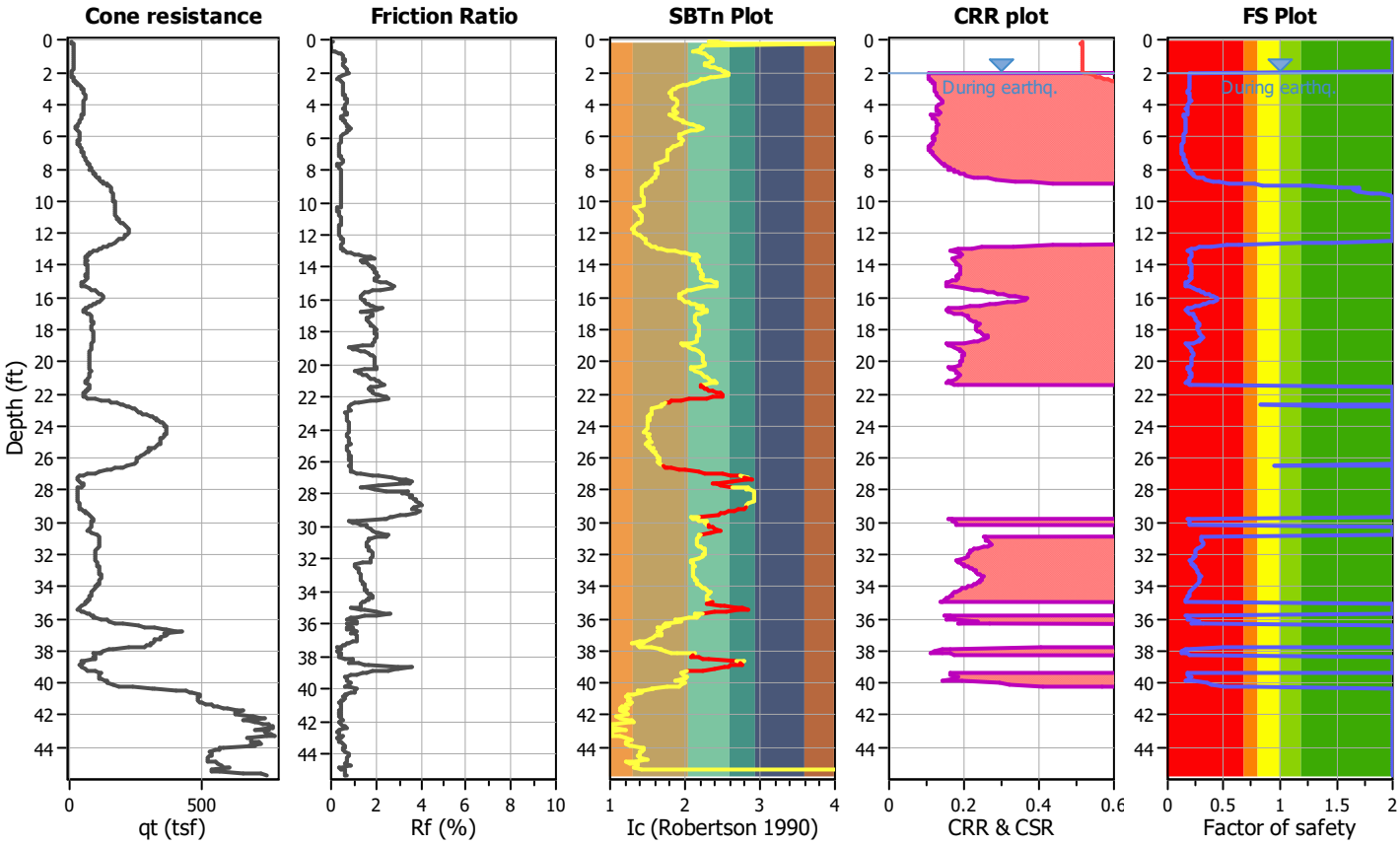
LIQUEFACTION ANALYSIS REPORT

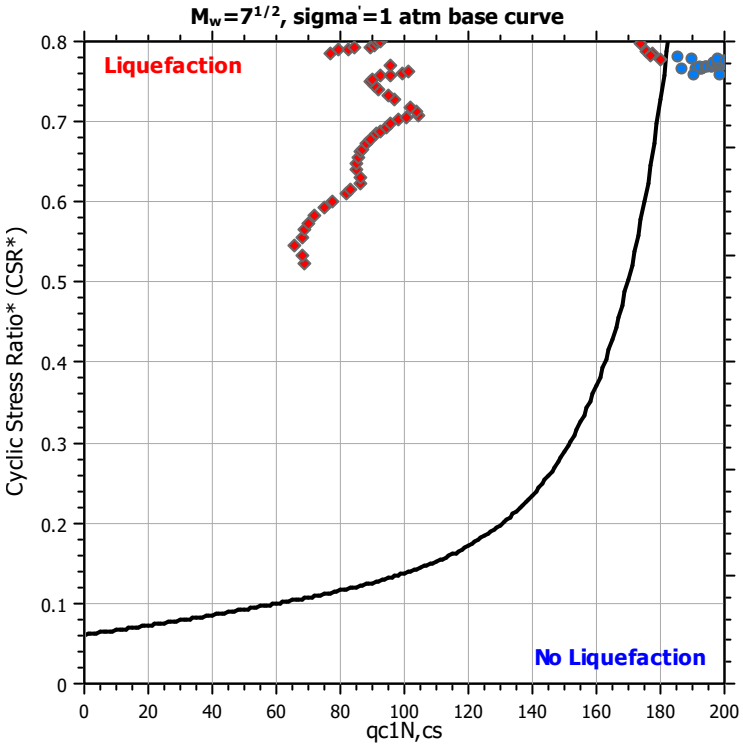
Project title : Proposed Warehouse **Location : El Monte, CA**

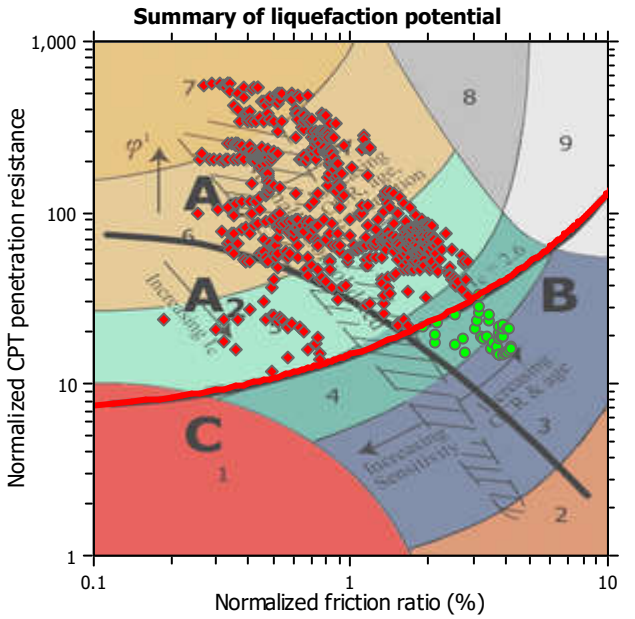
CPT file : CPT-4

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	29.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.89	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method
Peak ground acceleration:	0.90	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

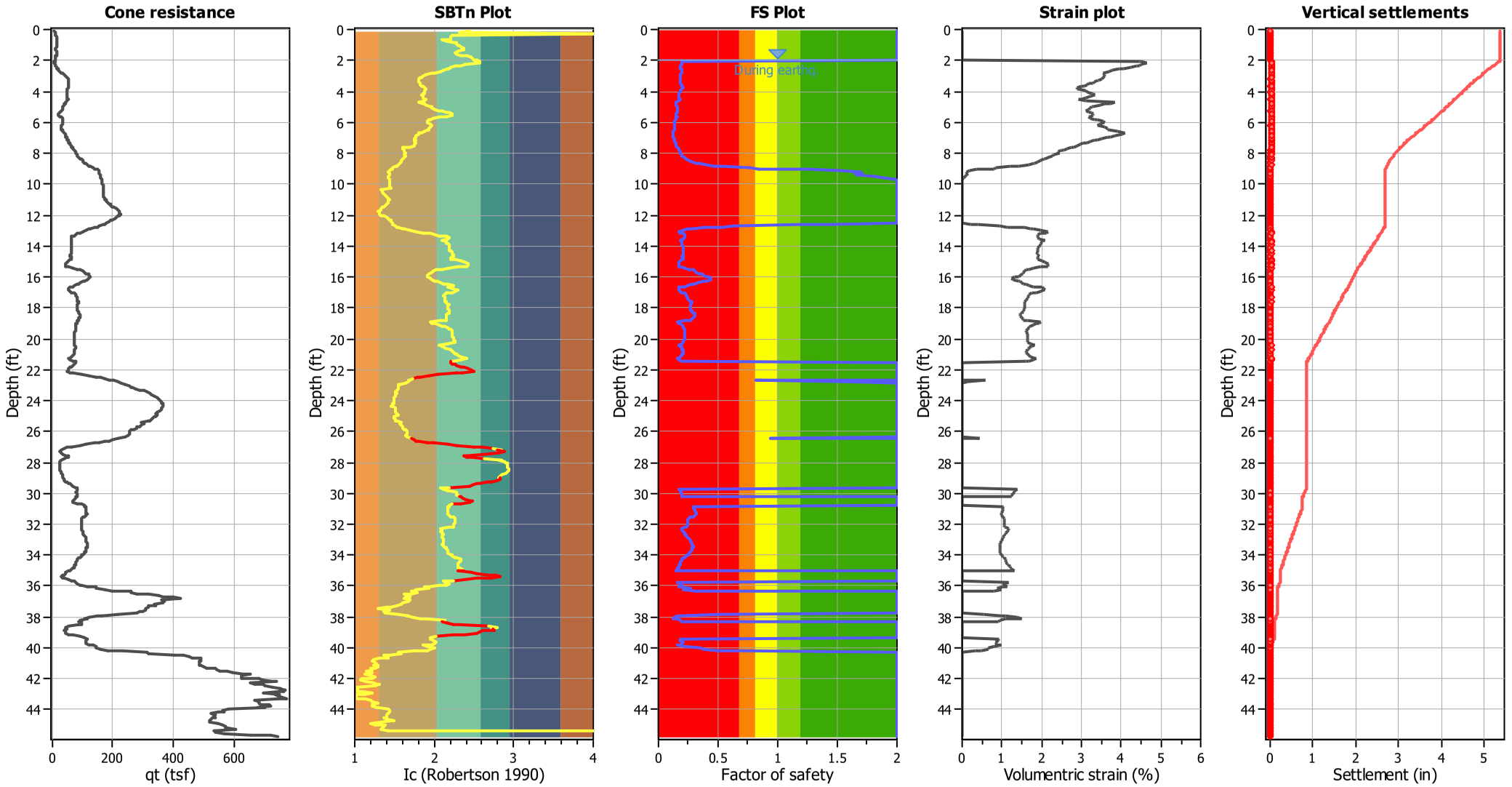






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and 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)
2.04	68.62	0.20	4.47	0.97	0.03	2.10	68.09	0.20	4.50	0.96	0.03
2.18	65.68	0.19	4.65	0.96	0.04	2.24	67.95	0.19	4.50	0.96	0.03
2.30	68.69	0.19	4.45	0.96	0.04	2.36	69.90	0.19	4.37	0.96	0.03
2.43	71.92	0.19	4.25	0.96	0.04	2.51	75.15	0.19	4.07	0.96	0.04
2.57	77.74	0.19	3.94	0.96	0.03	2.66	81.69	0.19	3.75	0.95	0.04
2.69	83.32	0.19	3.68	0.95	0.02	2.78	86.05	0.20	3.56	0.95	0.03
2.83	86.52	0.19	3.54	0.95	0.02	2.91	84.97	0.19	3.60	0.95	0.03
2.97	84.74	0.19	3.60	0.95	0.03	3.06	85.45	0.18	3.57	0.95	0.04
3.12	86.02	0.18	3.54	0.95	0.02	3.15	86.73	0.18	3.51	0.95	0.02
3.24	88.35	0.18	3.44	0.95	0.03	3.29	89.37	0.18	3.40	0.94	0.02
3.38	91.52	0.19	3.31	0.94	0.03	3.42	92.47	0.19	3.28	0.94	0.02
3.51	94.59	0.19	3.20	0.94	0.03	3.55	95.50	0.19	3.16	0.94	0.02
3.65	98.40	0.19	3.06	0.94	0.03	3.69	100.37	0.20	3.00	0.94	0.02
3.76	104.17	0.20	2.88	0.94	0.02	3.81	103.64	0.20	2.90	0.94	0.02
3.88	101.95	0.20	2.94	0.93	0.02	3.96	96.90	0.18	3.09	0.93	0.03
4.01	94.98	0.18	3.16	0.93	0.02	4.10	92.01	0.17	3.25	0.93	0.04
4.14	90.75	0.17	3.29	0.93	0.02	4.20	89.30	0.17	3.34	0.93	0.02
4.27	89.85	0.17	3.32	0.93	0.03	4.34	92.64	0.17	3.22	0.93	0.03
4.41	95.82	0.17	3.10	0.93	0.02	4.50	99.40	0.18	2.99	0.92	0.03
4.54	101.07	0.18	2.93	0.92	0.02	4.60	95.45	0.17	3.11	0.92	0.02
4.67	76.66	0.14	3.85	0.92	0.03	4.76	79.26	0.15	3.72	0.92	0.04
4.81	82.38	0.15	3.58	0.92	0.02	4.87	84.49	0.15	3.49	0.92	0.03
4.94	89.38	0.16	3.30	0.92	0.03	4.99	90.71	0.16	3.24	0.92	0.02
5.06	90.98	0.16	3.23	0.91	0.03	5.12	92.62	0.16	3.17	0.91	0.02
5.21	93.93	0.16	3.12	0.91	0.03	5.26	93.48	0.16	3.13	0.91	0.02
5.34	91.39	0.16	3.20	0.91	0.03	5.39	89.85	0.15	3.25	0.91	0.02
5.48	88.24	0.15	3.31	0.91	0.03	5.52	88.41	0.15	3.30	0.91	0.02
5.60	90.13	0.15	3.23	0.91	0.03	5.66	91.29	0.15	3.18	0.90	0.02
5.75	89.83	0.15	3.23	0.90	0.03	5.80	86.97	0.15	3.33	0.90	0.02
5.84	85.47	0.14	3.39	0.90	0.02	5.93	81.74	0.14	3.53	0.90	0.04
5.97	80.72	0.14	3.57	0.90	0.02	6.05	81.51	0.14	3.53	0.90	0.03
6.11	83.23	0.14	3.46	0.90	0.02	6.19	84.15	0.14	3.42	0.90	0.04
6.23	83.54	0.14	3.44	0.89	0.02	6.32	79.51	0.13	3.60	0.89	0.04
6.37	78.19	0.13	3.66	0.89	0.02	6.44	78.27	0.13	3.65	0.89	0.03
6.51	76.72	0.13	3.71	0.89	0.03	6.59	72.12	0.12	3.93	0.89	0.04
6.65	69.51	0.12	4.06	0.89	0.03	6.70	68.77	0.12	4.10	0.89	0.03
6.78	70.38	0.12	4.01	0.89	0.04	6.86	73.77	0.12	3.83	0.88	0.04
6.91	76.04	0.13	3.72	0.88	0.02	6.96	77.23	0.13	3.66	0.88	0.02
7.05	80.34	0.13	3.52	0.88	0.04	7.10	82.57	0.13	3.42	0.88	0.02
7.17	84.37	0.13	3.34	0.88	0.03	7.22	87.47	0.14	3.23	0.88	0.02
7.29	89.41	0.14	3.15	0.88	0.02	7.36	92.52	0.14	3.04	0.88	0.03
7.42	94.91	0.15	2.96	0.87	0.02	7.49	97.40	0.15	2.88	0.87	0.02
7.57	99.53	0.15	2.81	0.87	0.03	7.63	102.44	0.16	2.73	0.87	0.02
7.71	106.28	0.17	2.62	0.87	0.02	7.76	108.07	0.17	2.58	0.87	0.01
7.83	111.65	0.18	2.49	0.87	0.02	7.90	115.13	0.18	2.40	0.87	0.02
7.97	114.20	0.18	2.42	0.86	0.02	8.01	113.44	0.18	2.44	0.86	0.01
8.10	120.19	0.20	2.29	0.86	0.03	8.15	121.55	0.20	2.26	0.86	0.01
8.24	126.08	0.21	2.17	0.86	0.02	8.27	126.83	0.22	2.15	0.86	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)
8.35	130.20	0.23	2.09	0.86	0.02	8.40	132.16	0.24	2.05	0.86	0.01
8.50	137.55	0.26	1.96	0.86	0.02	8.55	140.57	0.28	1.91	0.86	0.01
8.61	145.82	0.31	1.83	0.85	0.01	8.66	148.94	0.34	1.78	0.85	0.01
8.77	156.23	0.41	1.67	0.85	0.02	8.81	160.72	0.46	1.43	0.85	0.01
8.86	165.54	0.54	1.21	0.85	0.01	8.95	175.39	0.77	0.86	0.85	0.01
8.99	177.54	0.84	0.79	0.85	0.00	9.07	186.59	1.26	0.37	0.85	0.00
9.12	190.96	1.54	0.19	0.85	0.00	9.19	192.89	1.69	0.11	0.84	0.00
9.26	192.99	1.70	0.11	0.84	0.00	9.34	192.27	1.64	0.14	0.84	0.00
9.39	192.71	1.68	0.12	0.84	0.00	9.48	194.26	1.81	0.07	0.84	0.00
9.53	194.36	1.82	0.06	0.84	0.00	9.59	195.08	1.89	0.04	0.84	0.00
9.66	196.04	1.98	0.01	0.84	0.00	9.74	196.45	2.00	0.00	0.83	0.00
9.80	196.83	2.00	0.00	0.83	0.00	9.84	196.93	2.00	0.00	0.83	0.00
9.92	196.93	2.00	0.00	0.83	0.00	9.98	197.49	2.00	0.00	0.83	0.00
10.07	198.41	2.00	0.00	0.83	0.00	10.15	199.41	2.00	0.00	0.83	0.00
10.18	199.78	2.00	0.00	0.83	0.00	10.25	199.35	2.00	0.00	0.83	0.00
10.35	198.28	2.00	0.00	0.82	0.00	10.38	197.65	2.00	0.00	0.82	0.00
10.47	197.13	2.00	0.00	0.82	0.00	10.50	196.95	2.00	0.00	0.82	0.00
10.60	198.20	2.00	0.00	0.82	0.00	10.64	198.69	2.00	0.00	0.82	0.00
10.72	198.54	2.00	0.00	0.82	0.00	10.78	198.17	2.00	0.00	0.82	0.00
10.84	198.09	2.00	0.00	0.82	0.00	10.92	199.77	2.00	0.00	0.81	0.00
10.96	201.43	2.00	0.00	0.81	0.00	11.03	202.96	2.00	0.00	0.81	0.00
11.09	205.50	2.00	0.00	0.81	0.00	11.18	208.36	2.00	0.00	0.81	0.00
11.24	210.56	2.00	0.00	0.81	0.00	11.32	214.89	2.00	0.00	0.81	0.00
11.36	217.16	2.00	0.00	0.81	0.00	11.43	221.50	2.00	0.00	0.81	0.00
11.49	226.51	2.00	0.00	0.81	0.00	11.58	233.95	2.00	0.00	0.80	0.00
11.62	237.56	2.00	0.00	0.80	0.00	11.72	242.10	2.00	0.00	0.80	0.00
11.76	242.85	2.00	0.00	0.80	0.00	11.83	242.32	2.00	0.00	0.80	0.00
11.90	242.85	2.00	0.00	0.80	0.00	11.94	243.33	2.00	0.00	0.80	0.00
12.01	238.38	2.00	0.00	0.80	0.00	12.08	235.70	2.00	0.00	0.80	0.00
12.16	228.23	2.00	0.00	0.79	0.00	12.21	224.17	2.00	0.00	0.79	0.00
12.30	214.22	2.00	0.00	0.79	0.00	12.34	211.01	2.00	0.00	0.79	0.00
12.41	204.35	2.00	0.00	0.79	0.00	12.48	198.11	2.00	0.00	0.79	0.00
12.57	190.04	1.45	0.22	0.79	0.00	12.61	185.54	1.18	0.40	0.79	0.00
12.71	170.51	0.63	0.94	0.78	0.01	12.75	165.42	0.53	1.12	0.78	0.01
12.83	155.64	0.39	1.56	0.78	0.02	12.89	142.35	0.28	1.72	0.78	0.01
12.93	136.41	0.25	1.80	0.78	0.01	13.00	125.94	0.21	1.97	0.78	0.02
13.06	114.85	0.18	2.17	0.78	0.02	13.15	116.19	0.18	2.14	0.78	0.02
13.21	124.96	0.20	1.97	0.78	0.01	13.27	128.12	0.21	1.92	0.78	0.01
13.33	129.13	0.22	1.90	0.77	0.01	13.40	127.88	0.21	1.92	0.77	0.02
13.46	127.84	0.21	1.91	0.77	0.01	13.52	125.21	0.20	1.96	0.77	0.01
13.59	118.61	0.19	2.07	0.77	0.02	13.65	121.06	0.19	2.02	0.77	0.01
13.73	121.98	0.19	2.00	0.77	0.02	13.78	122.64	0.20	1.99	0.77	0.01
13.85	123.10	0.20	1.98	0.77	0.02	13.93	123.62	0.20	1.96	0.76	0.02
13.99	125.56	0.21	1.93	0.76	0.02	14.06	126.52	0.21	1.91	0.76	0.02
14.12	127.65	0.21	1.89	0.76	0.01	14.18	127.32	0.21	1.89	0.76	0.01
14.26	126.96	0.21	1.89	0.76	0.02	14.32	126.40	0.21	1.90	0.76	0.01
14.37	126.88	0.21	1.89	0.76	0.01	14.44	127.30	0.21	1.88	0.76	0.01
14.51	126.67	0.21	1.89	0.75	0.02	14.57	124.62	0.20	1.92	0.75	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)
14.64	123.44	0.20	1.94	0.75	0.02	14.71	124.67	0.20	1.91	0.75	0.02
14.77	125.81	0.21	1.89	0.75	0.01	14.83	125.41	0.21	1.90	0.75	0.01
14.91	124.03	0.20	1.91	0.75	0.02	14.98	119.27	0.19	1.99	0.75	0.02
15.04	113.87	0.17	2.09	0.75	0.02	15.11	110.05	0.17	2.16	0.74	0.02
15.18	109.98	0.17	2.16	0.74	0.02	15.27	109.80	0.17	2.16	0.74	0.02
15.31	109.90	0.17	2.16	0.74	0.01	15.36	119.10	0.19	1.98	0.74	0.01
15.44	130.71	0.22	1.79	0.74	0.02	15.49	138.54	0.26	1.67	0.74	0.01
15.57	143.20	0.29	1.61	0.74	0.01	15.62	145.52	0.30	1.58	0.74	0.01
15.70	148.05	0.32	1.55	0.73	0.01	15.76	149.88	0.34	1.52	0.73	0.01
15.84	152.67	0.36	1.49	0.73	0.01	15.89	154.70	0.38	1.46	0.73	0.01
15.95	156.52	0.40	1.42	0.73	0.01	16.02	158.92	0.43	1.30	0.73	0.01
16.08	159.88	0.44	1.26	0.73	0.01	16.16	159.40	0.44	1.28	0.73	0.01
16.25	156.41	0.40	1.41	0.72	0.01	16.29	153.99	0.38	1.46	0.72	0.01
16.36	149.37	0.33	1.51	0.72	0.01	16.42	146.25	0.31	1.54	0.72	0.01
16.48	141.33	0.28	1.60	0.72	0.01	16.56	135.73	0.25	1.67	0.72	0.02
16.61	128.15	0.22	1.78	0.72	0.01	16.69	113.53	0.17	2.02	0.72	0.02
16.74	111.45	0.17	2.06	0.72	0.01	16.80	110.53	0.17	2.07	0.72	0.02
16.87	111.91	0.17	2.04	0.71	0.02	16.94	115.95	0.18	1.96	0.71	0.02
17.00	121.62	0.19	1.86	0.71	0.01	17.07	129.22	0.22	1.74	0.71	0.01
17.14	132.38	0.23	1.69	0.71	0.01	17.20	133.33	0.24	1.68	0.71	0.01
17.30	134.54	0.24	1.66	0.71	0.02	17.34	135.24	0.25	1.65	0.71	0.01
17.39	136.04	0.25	1.63	0.71	0.01	17.45	137.58	0.26	1.61	0.70	0.01
17.56	139.81	0.27	1.58	0.70	0.02	17.61	140.76	0.27	1.56	0.70	0.01
17.66	141.09	0.28	1.56	0.70	0.01	17.74	140.34	0.27	1.56	0.70	0.02
17.79	139.68	0.27	1.57	0.70	0.01	17.88	139.21	0.27	1.57	0.70	0.02
17.92	139.02	0.26	1.57	0.70	0.01	18.01	138.84	0.26	1.57	0.69	0.02
18.05	139.11	0.27	1.57	0.69	0.01	18.13	140.64	0.27	1.55	0.69	0.02
18.18	141.56	0.28	1.53	0.69	0.01	18.27	142.46	0.29	1.52	0.69	0.02
18.32	143.47	0.29	1.50	0.69	0.01	18.38	145.31	0.30	1.48	0.69	0.01
18.44	145.85	0.31	1.47	0.69	0.01	18.51	145.61	0.31	1.47	0.69	0.01
18.59	144.22	0.30	1.49	0.68	0.02	18.64	142.96	0.29	1.50	0.68	0.01
18.70	140.79	0.28	1.52	0.68	0.01	18.77	138.59	0.26	1.55	0.68	0.01
18.85	129.98	0.22	1.66	0.68	0.01	18.90	109.83	0.16	1.98	0.68	0.01
18.97	112.77	0.17	1.92	0.68	0.02	19.03	116.84	0.18	1.85	0.68	0.01
19.10	120.85	0.19	1.78	0.68	0.01	19.17	124.86	0.20	1.72	0.68	0.02
19.24	126.88	0.21	1.68	0.67	0.01	19.31	127.59	0.21	1.67	0.67	0.01
19.37	129.16	0.22	1.65	0.67	0.01	19.43	130.27	0.22	1.63	0.67	0.01
19.50	130.56	0.22	1.62	0.67	0.01	19.58	129.99	0.22	1.63	0.67	0.02
19.62	129.50	0.22	1.63	0.67	0.01	19.69	129.16	0.22	1.63	0.67	0.01
19.76	128.93	0.22	1.63	0.67	0.01	19.82	128.52	0.22	1.64	0.66	0.01
19.89	128.30	0.21	1.64	0.66	0.01	19.96	128.26	0.21	1.63	0.66	0.01
20.02	127.99	0.21	1.64	0.66	0.01	20.11	127.30	0.21	1.64	0.66	0.02
20.16	126.66	0.21	1.65	0.66	0.01	20.24	126.31	0.21	1.65	0.66	0.02
20.29	121.70	0.19	1.72	0.66	0.01	20.38	113.75	0.17	1.84	0.65	0.02
20.42	116.59	0.18	1.79	0.65	0.01	20.47	119.49	0.19	1.74	0.65	0.01
20.55	122.70	0.20	1.69	0.65	0.02	20.60	124.13	0.20	1.67	0.65	0.01
20.69	123.59	0.20	1.67	0.65	0.02	20.74	124.97	0.20	1.65	0.65	0.01
20.82	126.68	0.21	1.62	0.65	0.02	20.87	126.88	0.21	1.62	0.65	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)
20.95	125.67	0.20	1.63	0.64	0.02	21.00	124.56	0.20	1.64	0.64	0.01
21.06	122.29	0.19	1.67	0.64	0.01	21.13	119.06	0.18	1.72	0.64	0.01
21.22	112.56	0.17	1.82	0.64	0.02	21.28	110.68	0.16	1.85	0.64	0.01
21.36	114.74	0.17	1.78	0.64	0.02	21.41	121.17	0.19	1.67	0.64	0.01
21.46	124.81	0.20	1.62	0.64	0.01	21.54	125.89	2.00	0.00	0.63	0.00
21.60	124.94	2.00	0.00	0.63	0.00	21.67	122.27	2.00	0.00	0.63	0.00
21.72	119.79	2.00	0.00	0.63	0.00	21.81	115.97	2.00	0.00	0.63	0.00
21.85	113.32	2.00	0.00	0.63	0.00	21.94	109.35	2.00	0.00	0.63	0.00
21.98	106.72	2.00	0.00	0.63	0.00	22.08	102.79	2.00	0.00	0.63	0.00
22.12	102.40	2.00	0.00	0.63	0.00	22.22	112.53	2.00	0.00	0.62	0.00
22.25	118.43	2.00	0.00	0.62	0.00	22.32	133.93	2.00	0.00	0.62	0.00
22.38	136.06	2.00	0.00	0.62	0.00	22.45	132.48	2.00	0.00	0.62	0.00
22.51	138.54	2.00	0.00	0.62	0.00	22.57	152.62	2.00	0.00	0.62	0.00
22.66	166.81	2.00	0.00	0.62	0.00	22.70	176.73	0.82	0.59	0.62	0.00
22.79	190.85	1.55	0.13	0.61	0.00	22.84	198.86	2.00	0.00	0.61	0.00
22.93	210.78	2.00	0.00	0.61	0.00	22.97	213.76	2.00	0.00	0.61	0.00
23.06	224.49	2.00	0.00	0.61	0.00	23.11	231.44	2.00	0.00	0.61	0.00
23.17	235.02	2.00	0.00	0.61	0.00	23.25	243.14	2.00	0.00	0.61	0.00
23.30	258.27	2.00	0.00	0.61	0.00	23.38	268.47	2.00	0.00	0.60	0.00
23.43	276.56	2.00	0.00	0.60	0.00	23.51	284.37	2.00	0.00	0.60	0.00
23.56	286.32	2.00	0.00	0.60	0.00	23.63	291.62	2.00	0.00	0.60	0.00
23.69	297.18	2.00	0.00	0.60	0.00	23.75	299.32	2.00	0.00	0.60	0.00
23.83	307.10	2.00	0.00	0.60	0.00	23.92	311.22	2.00	0.00	0.59	0.00
23.96	313.97	2.00	0.00	0.59	0.00	24.05	317.53	2.00	0.00	0.59	0.00
24.10	316.68	2.00	0.00	0.59	0.00	24.16	318.93	2.00	0.00	0.59	0.00
24.22	319.36	2.00	0.00	0.59	0.00	24.28	319.85	2.00	0.00	0.59	0.00
24.36	321.95	2.00	0.00	0.59	0.00	24.41	321.52	2.00	0.00	0.59	0.00
24.50	317.47	2.00	0.00	0.58	0.00	24.55	313.81	2.00	0.00	0.58	0.00
24.62	309.75	2.00	0.00	0.58	0.00	24.67	309.13	2.00	0.00	0.58	0.00
24.74	301.55	2.00	0.00	0.58	0.00	24.81	298.09	2.00	0.00	0.58	0.00
24.88	300.34	2.00	0.00	0.58	0.00	24.94	299.79	2.00	0.00	0.58	0.00
25.03	297.93	2.00	0.00	0.58	0.00	25.08	294.26	2.00	0.00	0.57	0.00
25.13	289.41	2.00	0.00	0.57	0.00	25.22	284.09	2.00	0.00	0.57	0.00
25.27	280.14	2.00	0.00	0.57	0.00	25.35	275.90	2.00	0.00	0.57	0.00
25.41	255.51	2.00	0.00	0.57	0.00	25.47	260.83	2.00	0.00	0.57	0.00
25.52	259.40	2.00	0.00	0.57	0.00	25.61	254.76	2.00	0.00	0.57	0.00
25.66	248.42	2.00	0.00	0.57	0.00	25.73	241.68	2.00	0.00	0.56	0.00
25.79	238.75	2.00	0.00	0.56	0.00	25.88	227.88	2.00	0.00	0.56	0.00
25.93	220.86	2.00	0.00	0.56	0.00	26.00	215.69	2.00	0.00	0.56	0.00
26.06	215.50	2.00	0.00	0.56	0.00	26.15	215.20	2.00	0.00	0.56	0.00
26.18	215.10	2.00	0.00	0.56	0.00	26.25	211.54	2.00	0.00	0.56	0.00
26.32	202.51	2.00	0.00	0.55	0.00	26.42	180.25	0.94	0.45	0.55	0.00
26.45	177.46	2.00	0.00	0.55	0.00	26.55	162.72	2.00	0.00	0.55	0.00
26.59	154.49	2.00	0.00	0.55	0.00	26.64	142.43	2.00	0.00	0.55	0.00
26.72	154.28	2.00	0.00	0.55	0.00	26.77	159.03	2.00	0.00	0.55	0.00
26.86	150.68	2.00	0.00	0.54	0.00	26.90	138.49	2.00	0.00	0.54	0.00
27.00	112.60	2.00	0.00	0.54	0.00	27.04	40.22	2.00	0.00	0.54	0.00
27.13	29.33	2.00	0.00	0.54	0.00	27.18	23.23	2.00	0.00	0.54	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)
27.23	23.55	2.00	0.00	0.54	0.00	27.31	21.01	2.00	0.00	0.54	0.00
27.37	23.84	2.00	0.00	0.54	0.00	27.45	27.65	2.00	0.00	0.53	0.00
27.53	92.88	2.00	0.00	0.53	0.00	27.58	98.30	2.00	0.00	0.53	0.00
27.63	99.92	2.00	0.00	0.53	0.00	27.70	98.56	2.00	0.00	0.53	0.00
27.77	31.60	2.00	0.00	0.53	0.00	27.83	22.49	2.00	0.00	0.53	0.00
27.89	23.38	2.00	0.00	0.53	0.00	27.98	20.52	2.00	0.00	0.53	0.00
28.02	19.51	2.00	0.00	0.53	0.00	28.08	19.21	2.00	0.00	0.52	0.00
28.16	19.24	2.00	0.00	0.52	0.00	28.24	19.36	2.00	0.00	0.52	0.00
28.29	19.34	2.00	0.00	0.52	0.00	28.35	19.45	2.00	0.00	0.52	0.00
28.42	19.57	2.00	0.00	0.52	0.00	28.48	19.68	2.00	0.00	0.52	0.00
28.56	20.01	2.00	0.00	0.52	0.00	28.64	20.67	2.00	0.00	0.51	0.00
28.69	21.63	2.00	0.00	0.51	0.00	28.79	24.17	2.00	0.00	0.51	0.00
28.82	24.72	2.00	0.00	0.51	0.00	28.87	25.75	2.00	0.00	0.51	0.00
28.96	26.97	2.00	0.00	0.51	0.00	29.01	27.24	2.00	0.00	0.51	0.00
29.10	27.65	2.00	0.00	0.51	0.00	29.14	28.62	2.00	0.00	0.51	0.00
29.22	32.21	2.00	0.00	0.50	0.00	29.28	35.89	2.00	0.00	0.50	0.00
29.35	104.58	2.00	0.00	0.50	0.00	29.40	107.57	2.00	0.00	0.50	0.00
29.47	112.02	2.00	0.00	0.50	0.00	29.54	116.01	2.00	0.00	0.50	0.00
29.62	113.50	2.00	0.00	0.50	0.00	29.67	108.28	2.00	0.00	0.50	0.00
29.73	114.22	0.17	1.39	0.50	0.01	29.80	118.70	0.18	1.33	0.49	0.01
29.86	120.95	0.19	1.30	0.49	0.01	29.92	118.88	0.19	1.32	0.49	0.01
29.99	122.31	0.20	1.28	0.49	0.01	30.08	123.96	0.20	1.26	0.49	0.01
30.12	124.04	0.20	1.25	0.49	0.01	30.20	123.59	0.20	1.26	0.49	0.01
30.26	122.56	2.00	0.00	0.49	0.00	30.34	120.43	2.00	0.00	0.49	0.00
30.39	118.56	2.00	0.00	0.48	0.00	30.48	114.45	2.00	0.00	0.48	0.00
30.52	113.64	2.00	0.00	0.48	0.00	30.58	116.42	2.00	0.00	0.48	0.00
30.66	126.50	2.00	0.00	0.48	0.00	30.71	137.01	2.00	0.00	0.48	0.00
30.79	141.58	2.00	0.00	0.48	0.00	30.88	143.74	0.29	1.04	0.48	0.01
30.91	144.50	0.30	1.03	0.48	0.00	30.98	144.82	0.30	1.03	0.47	0.01
31.06	145.04	0.30	1.02	0.47	0.01	31.10	145.02	0.30	1.02	0.47	0.01
31.18	145.75	0.30	1.01	0.47	0.01	31.24	146.79	0.31	1.00	0.47	0.01
31.32	147.27	0.32	0.99	0.47	0.01	31.37	147.26	0.32	0.99	0.47	0.01
31.45	145.72	0.30	1.00	0.47	0.01	31.51	143.78	0.29	1.01	0.47	0.01
31.57	140.06	0.27	1.04	0.46	0.01	31.64	137.97	0.26	1.06	0.46	0.01
31.72	136.12	0.25	1.07	0.46	0.01	31.78	135.49	0.25	1.07	0.46	0.01
31.86	135.14	0.24	1.07	0.46	0.01	31.91	134.68	0.24	1.08	0.46	0.01
31.96	134.42	0.24	1.08	0.46	0.01	32.04	134.36	0.24	1.07	0.46	0.01
32.11	134.02	0.24	1.07	0.46	0.01	32.17	133.56	0.24	1.07	0.45	0.01
32.22	130.28	0.22	1.10	0.45	0.01	32.31	123.07	0.20	1.17	0.45	0.01
32.35	123.78	0.20	1.16	0.45	0.01	32.44	125.85	0.21	1.14	0.45	0.01
32.49	126.86	0.21	1.12	0.45	0.01	32.55	128.73	0.22	1.10	0.45	0.01
32.62	130.32	0.22	1.09	0.45	0.01	32.68	131.16	0.23	1.08	0.45	0.01
32.75	133.72	0.24	1.05	0.44	0.01	32.82	135.78	0.25	1.03	0.44	0.01
32.91	137.15	0.25	1.01	0.44	0.01	32.95	137.71	0.26	1.01	0.44	0.01
33.03	139.01	0.26	1.00	0.44	0.01	33.09	139.67	0.27	0.99	0.44	0.01
33.17	140.60	0.27	0.98	0.44	0.01	33.22	141.56	0.28	0.97	0.44	0.01
33.30	142.55	0.28	0.96	0.44	0.01	33.37	143.20	0.29	0.95	0.43	0.01
33.40	143.40	0.29	0.95	0.43	0.00	33.49	143.08	0.29	0.95	0.43	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)
33.53	142.69	0.29	0.95	0.43	0.01	33.62	141.77	0.28	0.95	0.43	0.01
33.67	141.28	0.28	0.95	0.43	0.01	33.74	140.44	0.27	0.96	0.43	0.01
33.83	139.35	0.27	0.96	0.43	0.01	33.87	138.66	0.26	0.97	0.43	0.00
33.93	136.98	0.25	0.98	0.42	0.01	34.02	133.91	0.24	1.00	0.42	0.01
34.07	132.29	0.23	1.01	0.42	0.01	34.13	129.49	0.22	1.03	0.42	0.01
34.20	126.33	0.21	1.06	0.42	0.01	34.29	122.18	0.20	1.09	0.42	0.01
34.33	120.72	0.19	1.10	0.42	0.01	34.42	119.46	0.19	1.11	0.42	0.01
34.47	118.93	0.19	1.11	0.42	0.01	34.51	118.00	0.19	1.12	0.42	0.01
34.60	115.09	0.18	1.15	0.41	0.01	34.65	112.83	0.17	1.17	0.41	0.01
34.73	110.35	0.17	1.19	0.41	0.01	34.78	109.18	0.17	1.20	0.41	0.01
34.87	106.86	0.16	1.23	0.41	0.01	34.92	104.18	0.16	1.26	0.41	0.01
34.98	100.26	0.15	1.30	0.41	0.01	35.05	93.48	2.00	0.00	0.41	0.00
35.14	91.02	2.00	0.00	0.40	0.00	35.18	90.06	2.00	0.00	0.40	0.00
35.27	26.43	2.00	0.00	0.40	0.00	35.32	23.38	2.00	0.00	0.40	0.00
35.38	21.26	2.00	0.00	0.40	0.00	35.45	23.74	2.00	0.00	0.40	0.00
35.50	87.75	2.00	0.00	0.40	0.00	35.58	93.60	2.00	0.00	0.40	0.00
35.63	99.79	2.00	0.00	0.40	0.00	35.71	99.10	2.00	0.00	0.39	0.00
35.77	106.71	0.16	1.18	0.39	0.01	35.84	116.39	0.18	1.08	0.39	0.01
35.93	121.02	0.19	1.03	0.39	0.01	35.98	118.12	0.19	1.05	0.39	0.01
36.02	110.94	0.17	1.12	0.39	0.01	36.09	122.06	0.20	1.01	0.39	0.01
36.16	140.49	0.27	0.86	0.39	0.01	36.25	125.42	0.21	0.98	0.39	0.01
36.29	146.53	0.31	0.82	0.38	0.00	36.36	200.35	2.00	0.00	0.38	0.00
36.42	201.88	2.00	0.00	0.38	0.00	36.50	222.40	2.00	0.00	0.38	0.00
36.56	255.51	2.00	0.00	0.38	0.00	36.62	284.53	2.00	0.00	0.38	0.00
36.69	293.42	2.00	0.00	0.38	0.00	36.75	320.57	2.00	0.00	0.38	0.00
36.83	340.06	2.00	0.00	0.38	0.00	36.88	289.29	2.00	0.00	0.37	0.00
36.95	297.73	2.00	0.00	0.37	0.00	37.03	293.83	2.00	0.00	0.37	0.00
37.09	294.49	2.00	0.00	0.37	0.00	37.17	271.66	2.00	0.00	0.37	0.00
37.23	274.04	2.00	0.00	0.37	0.00	37.28	256.84	2.00	0.00	0.37	0.00
37.36	257.27	2.00	0.00	0.37	0.00	37.41	254.67	2.00	0.00	0.37	0.00
37.47	247.53	2.00	0.00	0.36	0.00	37.54	245.38	2.00	0.00	0.36	0.00
37.60	238.99	2.00	0.00	0.36	0.00	37.68	226.99	2.00	0.00	0.36	0.00
37.74	219.94	2.00	0.00	0.36	0.00	37.81	163.21	0.50	0.56	0.36	0.00
37.89	115.79	0.18	0.99	0.36	0.01	37.94	105.05	0.16	1.09	0.36	0.01
38.01	83.19	0.13	1.37	0.36	0.01	38.08	76.10	0.12	1.49	0.35	0.01
38.15	102.56	0.15	1.11	0.35	0.01	38.20	116.56	0.18	0.97	0.35	0.01
38.28	120.26	0.19	0.93	0.35	0.01	38.35	111.55	2.00	0.00	0.35	0.00
38.42	125.44	2.00	0.00	0.35	0.00	38.48	128.27	2.00	0.00	0.35	0.00
38.52	122.93	2.00	0.00	0.35	0.00	38.61	36.62	2.00	0.00	0.35	0.00
38.66	30.48	2.00	0.00	0.34	0.00	38.74	32.64	2.00	0.00	0.34	0.00
38.79	29.98	2.00	0.00	0.34	0.00	38.85	26.37	2.00	0.00	0.34	0.00
38.91	29.45	2.00	0.00	0.34	0.00	39.01	88.98	2.00	0.00	0.34	0.00
39.05	89.35	2.00	0.00	0.34	0.00	39.14	95.67	2.00	0.00	0.34	0.00
39.19	101.99	2.00	0.00	0.34	0.00	39.26	107.31	2.00	0.00	0.33	0.00
39.31	105.52	2.00	0.00	0.33	0.00	39.39	114.89	0.18	0.92	0.33	0.01
39.45	115.53	0.18	0.92	0.33	0.01	39.51	115.43	0.18	0.91	0.33	0.01
39.60	122.21	0.20	0.86	0.33	0.01	39.65	124.41	0.21	0.84	0.33	0.01
39.72	120.88	0.20	0.86	0.33	0.01	39.77	121.36	0.20	0.85	0.33	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)
39.83	105.19	0.16	0.99	0.32	0.01	39.90	129.14	0.22	0.79	0.32	0.01
39.99	150.76	0.35	0.66	0.32	0.01	40.04	150.68	0.35	0.66	0.32	0.00
40.10	154.20	0.38	0.64	0.32	0.00	40.17	163.51	0.50	0.49	0.32	0.00
40.23	173.59	0.72	0.34	0.32	0.00	40.31	247.62	2.00	0.00	0.32	0.00
40.36	250.61	2.00	0.00	0.32	0.00	40.44	320.14	2.00	0.00	0.31	0.00
40.49	345.04	2.00	0.00	0.31	0.00	40.58	359.99	2.00	0.00	0.31	0.00
40.62	368.05	2.00	0.00	0.31	0.00	40.68	389.31	2.00	0.00	0.31	0.00
40.76	388.10	2.00	0.00	0.31	0.00	40.84	388.10	2.00	0.00	0.31	0.00
40.89	383.19	2.00	0.00	0.31	0.00	40.95	383.05	2.00	0.00	0.31	0.00
41.01	382.91	2.00	0.00	0.30	0.00	41.09	385.20	2.00	0.00	0.30	0.00
41.16	387.56	2.00	0.00	0.30	0.00	41.24	395.02	2.00	0.00	0.30	0.00
41.28	403.34	2.00	0.00	0.30	0.00	41.34	424.04	2.00	0.00	0.30	0.00
41.41	427.71	2.00	0.00	0.30	0.00	41.49	437.71	2.00	0.00	0.30	0.00
41.54	456.41	2.00	0.00	0.30	0.00	41.61	470.71	2.00	0.00	0.29	0.00
41.68	497.08	2.00	0.00	0.29	0.00	41.74	514.66	2.00	0.00	0.29	0.00
41.80	494.05	2.00	0.00	0.29	0.00	41.89	491.08	2.00	0.00	0.29	0.00
41.94	492.59	2.00	0.00	0.29	0.00	42.02	536.58	2.00	0.00	0.29	0.00
42.07	543.52	2.00	0.00	0.29	0.00	42.14	570.84	2.00	0.00	0.29	0.00
42.20	582.54	2.00	0.00	0.28	0.00	42.27	516.29	2.00	0.00	0.28	0.00
42.34	523.89	2.00	0.00	0.28	0.00	42.40	549.02	2.00	0.00	0.28	0.00
42.46	553.58	2.00	0.00	0.28	0.00	42.52	572.10	2.00	0.00	0.28	0.00
42.61	592.21	2.00	0.00	0.28	0.00	42.65	587.52	2.00	0.00	0.28	0.00
42.72	602.37	2.00	0.00	0.28	0.00	42.79	599.86	2.00	0.00	0.27	0.00
42.85	587.80	2.00	0.00	0.27	0.00	42.92	548.49	2.00	0.00	0.27	0.00
42.98	586.56	2.00	0.00	0.27	0.00	43.05	575.34	2.00	0.00	0.27	0.00
43.11	585.33	2.00	0.00	0.27	0.00	43.19	593.46	2.00	0.00	0.27	0.00
43.25	606.32	2.00	0.00	0.27	0.00	43.31	583.45	2.00	0.00	0.27	0.00
43.37	522.52	2.00	0.00	0.26	0.00	43.45	535.52	2.00	0.00	0.26	0.00
43.53	536.09	2.00	0.00	0.26	0.00	43.59	535.95	2.00	0.00	0.26	0.00
43.66	536.59	2.00	0.00	0.26	0.00	43.71	558.56	2.00	0.00	0.26	0.00
43.77	564.63	2.00	0.00	0.26	0.00	43.84	530.44	2.00	0.00	0.26	0.00
43.90	547.77	2.00	0.00	0.26	0.00	43.97	454.55	2.00	0.00	0.25	0.00
44.03	439.70	2.00	0.00	0.25	0.00	44.10	442.16	2.00	0.00	0.25	0.00
44.16	429.14	2.00	0.00	0.25	0.00	44.24	409.11	2.00	0.00	0.25	0.00
44.32	416.47	2.00	0.00	0.25	0.00	44.37	418.39	2.00	0.00	0.25	0.00
44.43	417.85	2.00	0.00	0.25	0.00	44.50	418.51	2.00	0.00	0.25	0.00
44.56	412.64	2.00	0.00	0.24	0.00	44.63	406.62	2.00	0.00	0.24	0.00
44.72	404.54	2.00	0.00	0.24	0.00	44.75	404.49	2.00	0.00	0.24	0.00
44.84	402.43	2.00	0.00	0.24	0.00	44.90	426.48	2.00	0.00	0.24	0.00
44.95	435.94	2.00	0.00	0.24	0.00	45.02	436.38	2.00	0.00	0.24	0.00
45.08	444.67	2.00	0.00	0.24	0.00	45.15	446.52	2.00	0.00	0.23	0.00
45.23	448.34	2.00	0.00	0.23	0.00	45.28	470.25	2.00	0.00	0.23	0.00
45.34	415.56	2.00	0.00	0.23	0.00	45.41	417.60	2.00	0.00	0.23	0.00
45.49	417.19	2.00	0.00	0.23	0.00	45.54	438.95	2.00	0.00	0.23	0.00
45.62	508.44	2.00	0.00	0.23	0.00	45.67	558.07	2.00	0.00	0.23	0.00
45.75	577.43	2.00	0.00	0.22	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)

Total estimated settlement: 5.37

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: MASTER COVENANT AGREEMENT (MCA)

Include the Master Covenant Agreement (MCA) form. The MCA must list the type, dimensions, and model number (if applicable) of each BMP. It will eventually need to have the following attached: Operations and Maintenance (O&M) Plan, Site Plan, and Owner's Certification. Once complete, the MCA will need to be notarized and recorded (along with attachments) with the County Recorder's Office.

Recording requested by and mail to:

Name: City of Norwalk
Department of Public Works
ATTN: Director of Public Works

Address: 12700 Norwalk Boulevard
Norwalk, CA 90651-1030

Space Above This Line For Recorder's Use

MASTER COVENANT AND AGREEMENT

REGARDING ON-SITE BMP MAINTENANCE

The undersigned hereby certifies I am (we are) the owner(s) of the hereinafter legally described real property located in the City of Norwalk, County of Los Angeles, State of California (please give legal description: assessor's ID, tract no., lot no., etc.):

_____

Site Address _____

Owner(s) do hereby covenant and agree to and with the City of Norwalk to maintain all on-site structural Best Management Practices (BMPs) in accordance with the Site Map and the Operations & Maintenance (O&M) Plan set forth in Attachment 1 hereto and incorporated herein by this reference. The specific structural BMPs are listed as follows:

_____

_____

Owner(s) shall maintain the listed drainage devices above on the property indicated and as shown on plans permitted by the City of Norwalk in a good and functional condition to safeguard the property owners and adjoining properties from damage and pollution.

Owner(s) hereby consent to inspection of the Property by an inspector authorized by the City Manager, or his or her designee, for the purpose for verifying compliance with the provisions of this Agreement.

Owner(s) shall provide printed educational materials with any sale of the property which provide information on what stormwater management facilities are present, the type(s) and location(s) of maintenance signs that are required, and how the necessary maintenance can be performed.

Owner(s) shall provide actual notice of this Agreement and its terms to any respective successor(s) in interest to the Property prior to transfer of said interest to such successor(s) in interest. This covenant and agreement shall run with the land and shall be binding upon any future owners, encumbrances, their successors, heirs or assigns and shall continue in effect until the City of Norwalk approves its termination.

_____ _____

(Print Name of Property Owner and Company) (Print Name of Property Owner and Company)

_____ _____

(Signature of Property Owner) (Signature of Property Owner)

Dated this _____ day of _____ 20 _____

CALIFORNIA ALL-PURPOSE ACKNOWLEDGEMENT

********** Space Below This Line For Notary's Use **********

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of _____ }
}
County of _____ }

On _____ before me, _____
(Insert Name of Notary Public and Title)

personally appeared _____, who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf on which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature _____ (Seal)

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

Description of attached document

Title or type of document: _____

_____

_____

Document Date: _____ Number of Pages:_____

Signer(s) Other than Named Above: _____

ATTACHMENT D: OPERATIONS AND MAINTENANCE (O&M) PLAN

Provide an Operations and Maintenance (O&M) Plan. This should include the components of the BMPs, description of maintenance requirements, frequency of inspections and maintenance, and the responsible entity. Manufacturer maintenance guidelines for proprietary BMPs and sump pumps should be referenced and included, along with an 8.5”x11” site map that calls out the BMPs.

Operations and Maintenance (O&M) Plan

For

825 Lexington-Gallatin Road

South El Monte, CA

8119-005-32

RECORDKEEPING

All records must be made available for review upon request.

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:	Rick Martinez
Company:	Magellan Value Partners, LLC.
Title:	Managing Director
Address 1:	10877 Wilshire Blvd. Suite 1407
Address 2:	
Phone Number:	(310) 507 – 9791 Ext. 105
Email:	rmartinez@magellanvp.com

BMP Applicable? Yes/No	BMP Name	BMP Implementation, Maintenance, and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Non-Structural Source Control BMPs				
Yes	**Education for Property Owners, Tenants and Occupants**	Educational material shall be provided to all employees and tenants.	Within 30 days of tenant occupancy and annually thereafter.	Owner
Yes	**Activity Restriction**	The owner shall develop activity restrictions to minimize the threat of hazardous waste or contamination into the storm drainage system. Car washing is not allowed on-site at any time.	Ongoing; Yearly for all employees and within 30 days of hire date for new employees.	Owner
Yes	**Common Area Landscape Management**	Training on landscape management consistent with County Water Conservation Resolution or City equivalent, plus Management Guidelines for Fertilizers (DAMP Section 5.5) shall be conducted for all new field landscape maintenance personnel.	Twice Monthly or according to an established maintenance schedule.	Owner
Yes	**Common Area Litter Control**	Litter patrol, violations investigation, reporting and other litter control activities shall be performed in conjunction with maintenance activities.	Weekly	Owner

BMP Applicable? Yes/No	BMP Name	BMP Implementation, Maintenance, and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Yes	**Housekeeping of Loading Docks**	Litter patrol, violation investigation, reporting and other litter control activities shall be performed in conjunction with maintenance activities.	Weekly	Owner
Yes	**Common Area Catch Basin Inspection**	Litter and debris removal, illicit discharge violations investigation and reporting shall be performed in conjunction with maintenance activities.	Twice a month to remove debris and after every major storm event	Owner
Yes	**Street Sweeping Private Streets and Parking Lots**	Private streets and parking area within the project shall be swept at a minimum frequency of once a month.	Monthly	Owner
Structural Source Control BMPs				
Yes	**Provide Storm Drain System Stenciling and Signage**	All proposed inlets shall be marked with the appropriate "No Dumping. Drains to Ocean." Stencil. The stencils must be repainted when they become illegible, but at a minimum once every five years. Inspect stenciling for legibility no later than the beginning of the rainy season on October 1st each year. Stenciling must be re-stenciled to maintain legibility as necessary and when deemed necessary by the local inspecting agency	Yearly	Owner

BMP Applicable? Yes/No	BMP Name	BMP Implementation, Maintenance, and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Yes	**Design and Construct Outdoor Material Storage Areas to Reduce Pollutant Introduction**	Proper design of outdoor storage areas for materials reduces opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the stormwater conveyance system. Materials may be in the form of raw products, by-products, finished products, and waste products. The type of pollutants associated with the materials will vary depending on the type of commercial or industrial activity.	Initial Design	Owner
Yes	**Design and Construct Trash and Waste Storage Areas to Reduce Pollutant Introduction**	The trash and waste storage areas will be inspected in conjunction with Litter Control on a weekly basis. The area will be inspected for loose debris and dumpster capacity. If dumpsters are overflowing more frequent pick-ups shall be arranged.	Initial Design, Weekly Inspections	Owner
Yes	**Use Efficient Irrigation Systems & Landscape Design**	Verify that landscape design continues to function properly by correctly adjusting to eliminate overspray to hardscape areas, and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, and day or night time temperatures.	Twice Monthly or according to an established maintenance schedule.	Owner

BMP Applicable? Yes/No	BMP Name	BMP Implementation, Maintenance, and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
No	**Protect Slopes and Channels and Provide Energy Dissipation**	N/A	N/A	N/A
No	**Loading Docks**	N/A	N/A	N/A
No	**Maintenance Bays**	N/A	N/A	N/A
No	**Vehicle Wash Areas/Racks**	N/A	N/A	N/A
No	**Outdoor Processing Areas**	N/A	N/A	N/A
No	**Equipment Wash Areas**	N/A	N/A	N/A
No	**Fueling Areas**	N/A	N/A	N/A
No	**Hillside Landscaping**	N/A	N/A	N/A
Treatment Control BMPs				
Yes	**Catch Basin Inlet Filters**	See O&M Manual attached below for implementations, Maintenance, and Inspection procedures.	Quarterly, two days after the storm event for the first year and adjust frequency based of first year data.	Owner
LID BMPs				

BMP Applicable? Yes/No	BMP Name	BMP Implementation, Maintenance, and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Yes	**WetlandMOD**	The WetlandMOD pre-filter, separation chamber, and Biofiltration media are all designed to allow for the use of vacuum removal of captured pollutants and spent filter media by centrifugal compressor vacuum units without causing damage to the filter, or during normal cleaning and maintenance. Filters and chambers can be cleaned from the finished surface through a standard manhole, hatch, or grade access. Refer to the following BioClean WetlandMOD O&M plan.	Twice monthly or according to an established maintenance schedule.	Owner
Yes	**Contech Underground Detention System CMP**	The underground detention system can be inspected through visual observation without entry into the system. All necessary pre-inspection steps must be carried out before inspection occurs, especially traffic control and other safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open access hatch or manhole. Refer to the following Contech Underground Detention System O&M plan.	Yearly and after each rain event or according to an established maintenance schedule	Owner

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

BioClean
WetlandMOD
O&M

Bio Clean
A Forterra Company

Maintenance Overview –

A. Every installed WetlandMOD unit is to be maintained by the Supplier, or a Supplier approved contractor. The cost of this service varies among providers.

B. The WetlandMOD is a multi-stage self-contained treatment train for stormwater treatment. Each stage protects subsequent stages from clogging. Stages include: screening, separation, and Biofiltration. The biofiltration stage contains various types of vegetation which will require annual evaluation and trimming.

1. Clean Bio Clean® Pre-Filter Screen – Screening is provided by well proven continuous modular screen filter. The filter removes gross solids, including litter, and sediments greater than 5 mm. This procedure is easily done by hand or with a small industrial vacuum device.

2. Clean Separation (sediment) Chamber – separation occurs in the pre-treatment chamber. This chamber targets TSS, and particulate metals and nutrients. This procedure can be performed with a standard vacuum truck. This chamber is located directly under the manhole, hatch, or grate access cover.

3. Trim Vegetation – The system utilizes multiple plants in the biofiltration chamber to provide enhanced treatment. The vegetation will need to be maintained (trimmed) as needed. This can be done as part of the project normal landscape maintenance. NO FERTILIZER SHALL BE USED IN THIS CHAMBER.

4. Evaluate Biofiltration Media Flow Hydraulic Conductivity – The system's flow can be assessed from the discharge. This should be done during a rain event. By viewing into the discharge pipe, the flow out of the system can be observed. If little to no flow is observed, this is a sign of potential Biofiltration media maintenance needs.

5. Biofiltration Media Replacement –This filter contains a mix that supports abundant plant life. Replacement of the media is simple. Removal of spent media can be done with a shovel and a vacuum truck.

C. The WetlandMOD pre-filter, separation chamber, and Biofiltration media are all designed to allow for the use of vacuum removal of captured pollutants and spent filter media by centrifugal compressor vacuum units without causing damage to the filter, or during normal cleaning and maintenance. Filters and chambers can be cleaned from the finished surface through a standard manhole, hatch, or grate access.

Maintenance Procedures –

1. Clean Bio Clean® Pre-Filter – Bio Clean recommends the **pre-filter** be inspected and cleaned a minimum of once every six months. The procedure is easily done with the use of any standard vacuum truck. *This procedure takes approximately 15 minutes.*

1. Remove grate, manhole, or hatch to gain access to the pre-filter insert. Where possible, the maintenance should be performed from the ground surface. Note: entry into an underground stormwater vault such as an inlet vault may require certification in confined space training.
2. Remove all trash, debris, organics, and sediments collected by the pre-filter. Removal of the trash and debris can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screen of the pre-filter.
3. Transport all debris, trash, organics and sediments to an approved facility for disposal in accordance with local and state requirements. Hazardous material can only be handled by a certified hazardous waste trained person (minimum of OSHA 24-hour hazardous waste worker (hazwoper) training).

2. Clean Separation (sediment) Chamber – Bio Clean recommends the **separation chamber** be inspected and cleaned a minimum of once a year. The procedure is easily done with the use of any standard vacuum truck. *This procedure takes approximately 30 minutes.*

1. Remove grate, manhole, or hatch to gain access to the separation chamber.
2. Where possible, the maintenance should be performed from the ground surface. Note: entry into an underground stormwater vault such as an inlet vault may require certification in confined space training.
3. With a pressure washer, spray down pollutants accumulated on walls and pre-filters.
4. Vacuum out separation chamber and remove all accumulated debris and sediments.
5. Replace grate, manhole, or hatch cover.
6. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

3. Trim Vegetation – Bio Clean recommends the plants/vegetation be inspected and maintained a minimum of once a year. It is also recommended that the plants receive the same care as other landscaped areas. Note: No fertilizer is to be used on this area. *Trimming of vegetation takes approximately 15 minutes.*

4. Evaluate Biofiltration Media Flow Hydraulic Conductivity – Bio Clean recommends system flow be inspected and observed a minimum of once a year. This needs to be done during a rain event. *Inspection and Observation takes approximately 5 minutes.*

1. Observe discharge out of system.
2. Observe the level of flow from the bottom of the pipe.
3. If flow is steady and high, the system is operating normally.
4. If little or no flow is observed exiting the discharge pipe, possible maintenance to the Biofiltration media may be needed. Contact Bio Clean for further assistance.

5. **Biofiltration Media Replacement** – Bio Clean recommends the Biofiltration media be replaced a minimum of once every 20 years. *Inspection takes approximately 15 minutes. Replacement of rock media takes approximately 6 hours and requires a vacuum truck.*

1. Remove plants from the Biofiltration chamber.
2. Use a vacuum truck or shovel to remove all wetland media.
3. Spray down the walls and floor of the chamber and vacuum out any accumulated pollutants.
4. Spray down perforated piping and netting of flow matrix and the inflow and outflow end to remove any accumulated pollutants.
5. Vacuum out any standing water from the media removal and ensure the chamber is clean.
6. Use a small backhoe to fill chamber with new media. Call Bio Clean for media delivery information.
7. Plant new vegetation in the same configuration and quantity as old vegetation.
8. Spray down the plants and media with water to saturate.
9. Continue supplemental irrigation (spray or drip) for at least 90 days.

6. **Other Maintenance Notes –**

1. Following maintenance and/or inspection, the maintenance operator shall prepare a maintenance/inspection record. The record shall include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanism.
2. The owner shall retain the maintenance/inspection record for a minimum of five years from the date of maintenance. These records shall be made available to the governing municipality for inspection upon request at any time.
3. Any person performing maintenance activities must have completed a minimum of OSHA 24-hour hazardous waste worker (hazwoper) training.
4. Remove access manhole lid or grate to gain access to filter screens and sediment chambers. Where possible, the maintenance should be performed

from the ground surface. Note: entry into an underground stormwater vault such as an inlet vault requires certification in confined space training.

5. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.
6. The hydrocarbon boom is classified as hazardous material and will have to be picked up and disposed of as hazardous waste. Hazardous material can only be handled by a certified hazardous waste trained person (minimum 24-hour hazwoper).

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

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

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

Weather Condition _____ Additional Notes _____

Inspection Checklist

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

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

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

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

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes:

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

Maintenance Report

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

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

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

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

Weather Condition _____ Additional Notes _____

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

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

Comments:

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

BioClean Full
Capture Grate Inlet
Filter O&M

CONTECH®
ENGINEERED SOLUTIONS

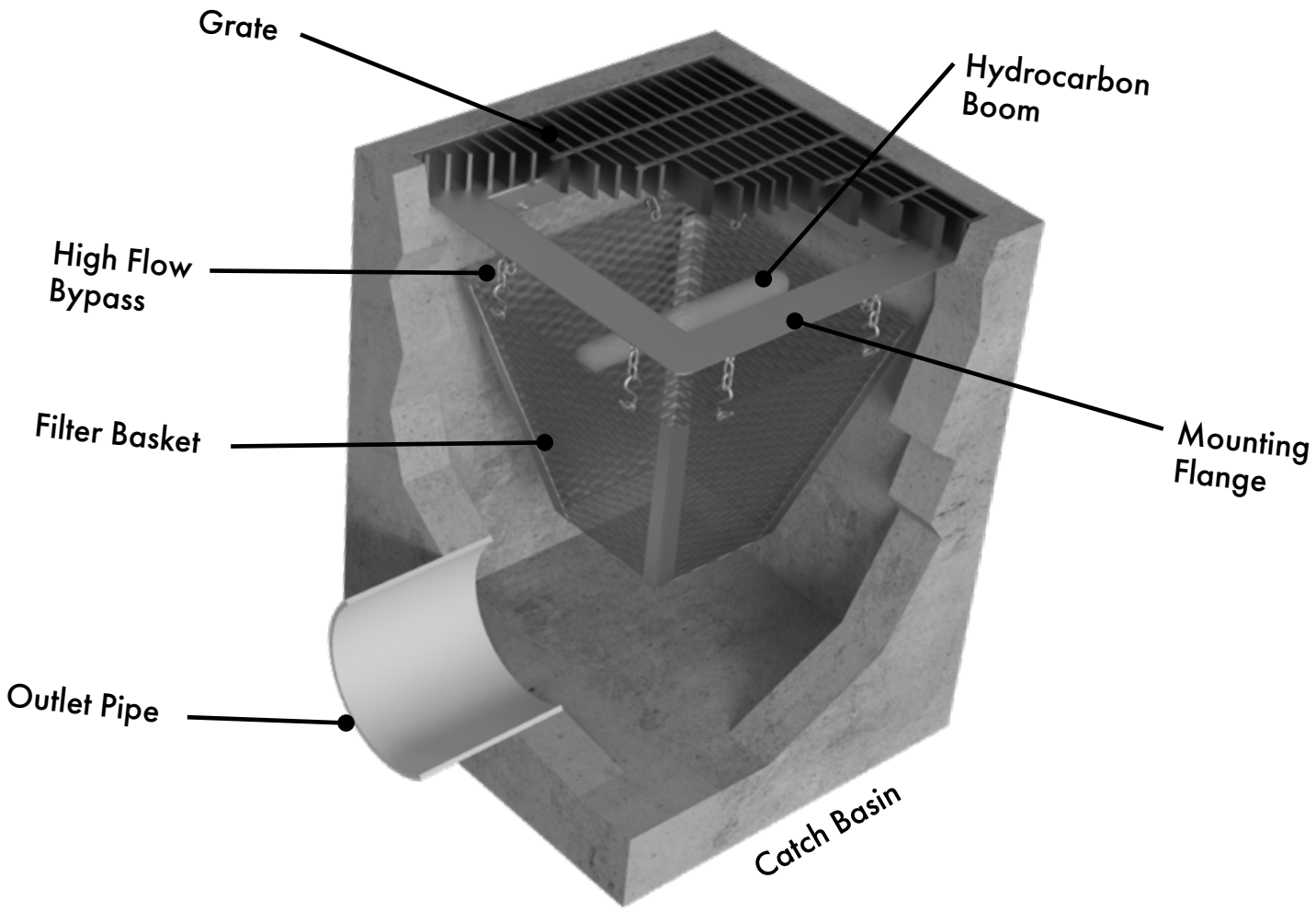
Bio Clean® Grate Inlet Filter
Operation & Maintenance Manual

Bio Clean®

Operation & Maintenance

Contech's 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, Kraken® membrane filter, and fabric filter variations. This manual covers maintenance procedures of the trash full capture and fabric filter configurations. A supplemental manual is available for the Kraken variation. The trash full capture filter is made of 100% stainless steel, while the fabric filter is made of a woven monofilament geotextile fabric. Both filters are available at various sizes and depths allowing them to fit in any grated catch basin inlet. The filters 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:

- Contech 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:

Basket Model	Height[1] (inches)	Top Width (inches)	Top Length (inches)	Bottom Width (inches)	Bottom Length (inches)	50% Storage Capacity (CF)	100% Storage Capacity (CF)
BIO-GRATE-FULL/ FABRIC-12-12-12	6.00	10.00	10.00	8.31	8.31	0.15	0.30
BIO-GRATE-FULL/ FABRIC-18-18-12	6.00	15.00	15.00	12.50	12.50	0.33	0.66
BIO-GRATE-FULL/ FABRIC-24-24-12	6.00	20.00	20.00	16.69	16.69	0.59	1.18
BIO-GRATE-FULL/ FABRIC-24-24-24	18.00	20.00	20.00	10.00	10.00	1.22	2.44
BIO-GRATE-FULL/ FABRIC-24-40-12	6.00	20.00	30.00	16.69	25.00	0.88	1.76
BIO-GRATE-FULL/ FABRIC-24-40-24	18.00	20.00	30.00	10.00	15.00	1.82	3.64
BIO-GRATE-FULL/ FABRIC-36-36-24	18.00	30.00	30.00	15.00	15.00	2.73	5.46
BIO-GRATE-FULL/ FABRIC-24-40-24	18.00	20.00	30.00	10.00	15.00	1.82	3.64
BIO-GRATE-FULL/ FABRIC-36-36-24	18.00	30.00	30.00	15.00	15.00	2.73	5.46

[1] Refers to basket height, total system height is equal to basket height plus 6 inches for bypass.

Maintenance Equipment

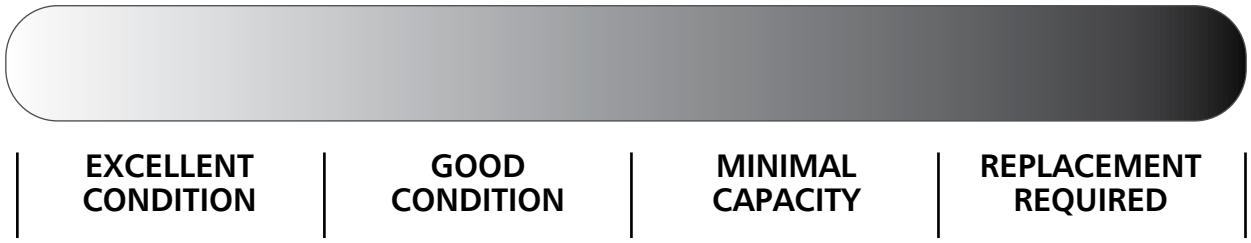
It is recommended that a vacuum truck be utilized to minimize the time required to maintain the Curb Inlet Filter, though it can easily be cleaned by hand:

- Contech 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:

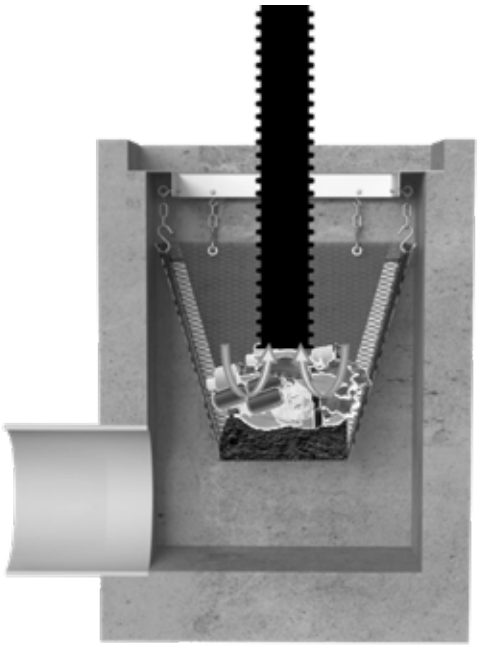
- Remove grate (traffic control and safety measures to be completed prior)
- Using an extension on a vacuum truck, position the hose over the opened catch basin. Insert the vacuum hose down into the filter basket and suck out trash, foliage and sediment. A pressure wash is recommended and will assist in spraying off any debris stuck on the side or bottom of the filter basket. Power wash 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.
- The following is a replacement indication color chart for the hydrocarbon booms:



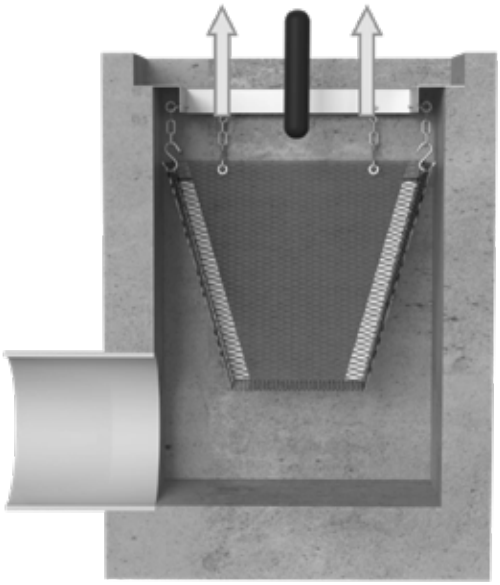
- The last step is to replace the grate and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.
- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, 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.

Maintenance Sequence

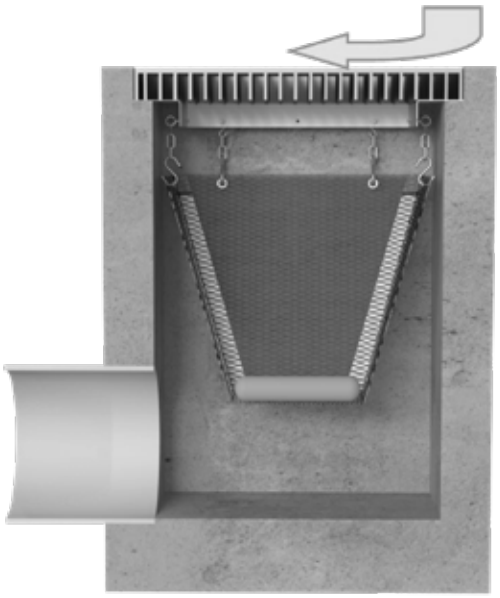
1. Remove grate and set up vacuum truck to clean the filter basket.



2. 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.



3. 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 information in the chart above. If replacement is required, install and fasten on a new hydrocarbon boom.



4. 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.

CONTECH®
ENGINEERED SOLUTIONS

Inspection and Maintenance Report
Catch Basin Only

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

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

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

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

Weather Condition _____ Additional Notes _____

Site Map #	GPS Coordinates of Insert	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:								

CONTECH®
ENGINEERED SOLUTIONS

800-338-1122

WWW.CONTECHES.COM

CONTECH ENGINEERED SOLUTIONS LLC PROVIDES SITE SOLUTIONS FOR THE CIVIL ENGINEERING INDUSTRY. CONTECH'S PORTFOLIO INCLUDES BRIDGES, DRAINAGE, SANITARY SEWER, STORMWATER AND EARTH STABILIZATION PRODUCTS. FOR INFORMATION ON OTHER CONTECH DIVISION OFFERINGS, VISIT CONTECHES.COM OR CALL 800-338-1122.

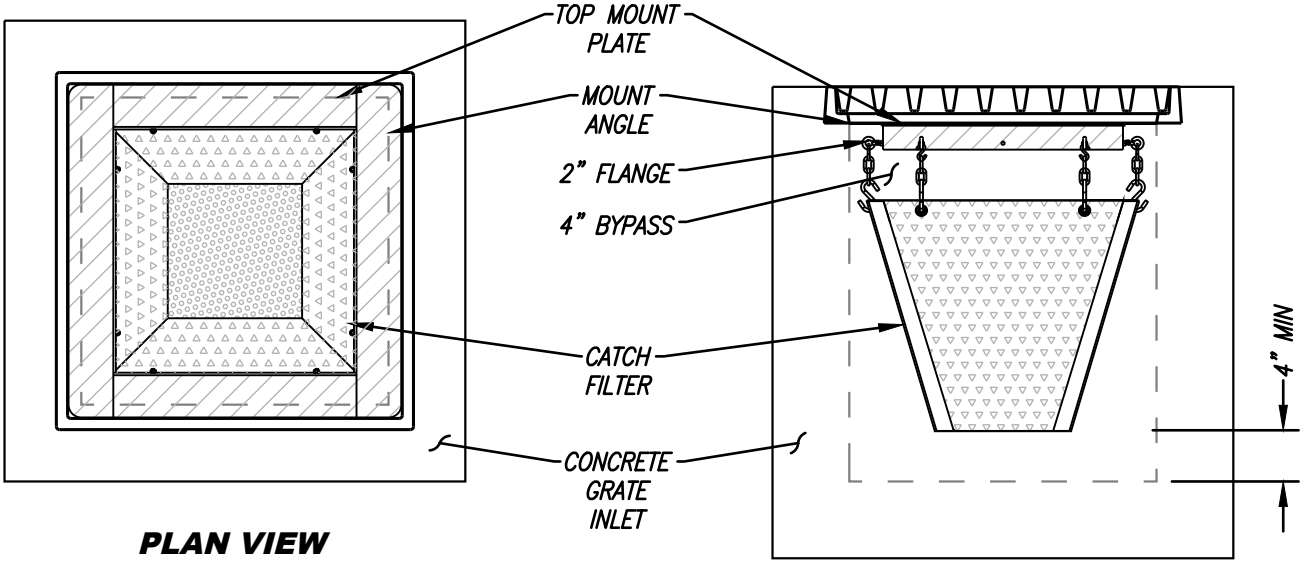
SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

BioClean Full
Capture Grate Inlet
Filter Spec

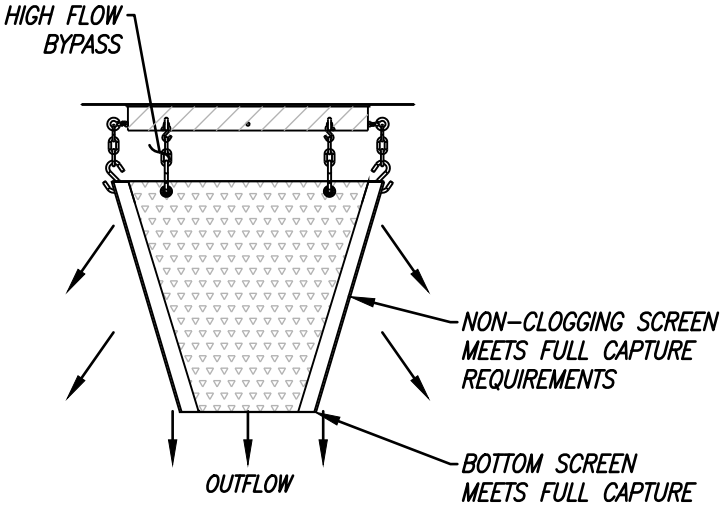
BIO CLEAN FULL CAPTURE FILTER

FOR USE IN GRATE INLETS



PLAN VIEW
(GRATE NOT SHOWN)

ELEVATION VIEW



FLOW DIAGRAM

MODEL #	TREATMENT FLOW RATE (CFS)	BYPASS FLOW (CFS)	SOLIDS STORAGE CAPACITY (CF)
BIO-GRATE-FULL 12-12-12	1.04	1.24	0.15
BIO-GRATE-FULL 18-18-12	1.78	2.79	0.33
BIO-GRATE-FULL 24-24-12	2.70	4.96	0.59
BIO-GRATE-FULL 24-40-12	3.70	6.35	0.88
BIO-GRATE-FULL 24-24-24	7.31	4.96	1.22
BIO-GRATE-FULL 24-40-24	9.53	6.35	1.82
BIO-GRATE-FULL 36-36-24	11.93	7.74	2.73

INSTALLATION NOTES:

1. ALL HARDWARE, FLANGE, FRAME, SCREENS SHALL BE STAINLESS STEEL.
2. OPTIONAL HYDROCARBON BOOM SHALL BE 2" DIAMETER.
3. SEE PERFORMANCE REPORTS IN MANUFACTURES SPECIFICATIONS.
4. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE – CONTACT BIO CLEAN FOR MORE INFORMATION.
5. BASED ON 37% OPEN AREA.
6. CONSIDERS A SAFETY FACTOR OF 2.0.
7. CONSIDERS A LOCAL DEPRESSION PONDING DEPTH OF 6 INCHES.
8. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
9. CONCRETE STRUCTURES SOLD SEPARATELY.

NOT TO SCALE

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com

GRATE INLET FILTER
FULL CAPTURE
STANDARD DETAIL

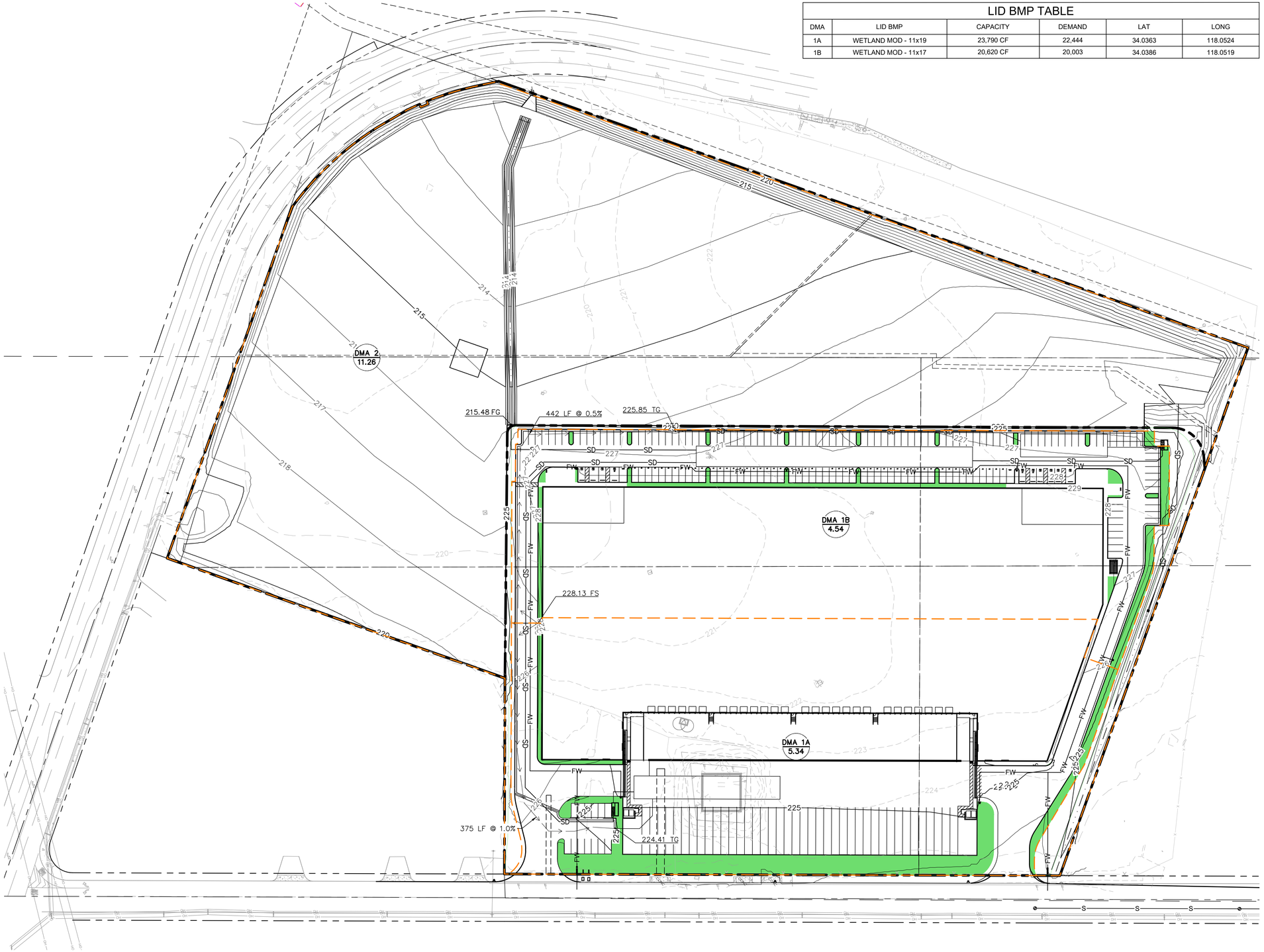
9/23/22CSCHIPPER

ATTACHMENT E: PLANS

Include full sized copies (24" x 36" or larger) of all relevant plans (i.e., grading plans, plumbing plans, drainage plans, etc.) and stamped by a California licensed civil engineer with all water quality notes and details. The plans should indicate the locations of all BMPs, cross-sectional details of all BMPs, conveyance systems, drainage connections, overflow processes, elevations, inverts, etc. All conveyance systems (i.e. ribbon gutters, area drains, storm drains, swales, etc.) must be indicated with inverts and elevations. The cross-sectional details of the BMPs must show the type and depth of all layers (i.e., amended soil layer, gravel layer, etc.) and must follow the criteria from the design standard used.

LID BMP TABLE

DMA	LID BMP	CAPACITY	DEMAND	LAT	LONG
1A	WETLAND MOD - 11x19	23,790 CF	22,444	34.0363	118.0524
1B	WETLAND MOD - 11x17	20,620 CF	20,003	34.0386	118.0519



LEGEND

- PROPERTY LINE
- STREET CENETERLINE
- DIRECTION OF WATER FLOW
- SD — PROPOSED STORM DRAIN LINE
- FLOW PATH
- DRAINAGE SUBAREA BOUNDARY
- DMA X / XX — DRAINAGE MANAGEMENT AREA ID / DRAINAGE MANAGEMENT AREA ACREAGE
- PROPOSED LANDSCAPE AREA

FLOOD ZONE

FLOOD ZONE X : AREA OF MINIMAL FLOOD HAZARD (06037C0816G)

THE EXISTING UTILITIES SHOWN ON THE PLAN ARE BASED ON AVAILABLE RECORDS. THE CONTRACTOR MUST FIELD DETERMINE THE LOCATION AND DEPTH OF ALL UTILITIES PRIOR TO ANY CONSTRUCTION. REPORT DISCREPANCIES AND POTENTIAL CONFLICTS WITH PROPOSED UTILITIES TO ENGINEER PRIOR TO INSTALLATION OF ANY PIPING.

EXISTING UTILITY NOTE

No.	REVISIONS	DATE	BY

Kimley»Horn
© 2025 KIMLEY-HORN AND ASSOCIATES, INC.
180 EAST OCEAN BLVD.SUITE 1200
LONG BEACH, CA 90802
(562) 549 -2200
WWW.KIMLEY-HORN.COM

KHA PROJECT	194550001
DATE	6/18/2025
SCALE	AS SHOWN
DESIGNED BY	KG
DRAWN BY	KG/JM
CHECKED BY	HS

SOUTH EL MONTE ATHLETIC FIELDS AND BUSINESS PARK

PREPARED FOR
MVP SOUTH EL MONTE I, LLC

CITY OF SOUTH EL MONTE

REGISTERED PROFESSIONAL ENGINEER HUNTER "" NOT FOR CONSTRUCTION CIVIL STATE OF CALIFORNIA

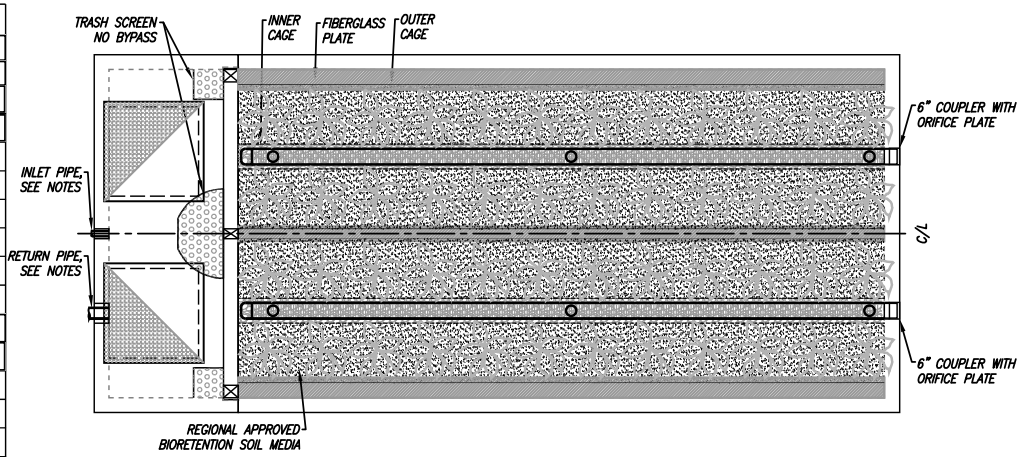
PROPOSED LID EXHIBIT

SHEET NUMBER
1
OF
1

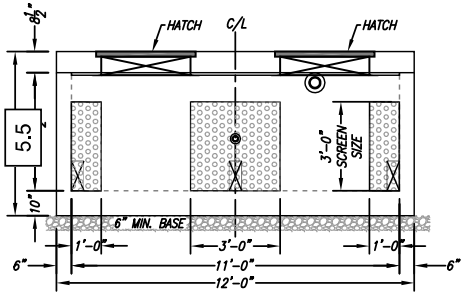
SITE SPECIFIC DATA

PROJECT ID			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
22,768.00		---	
TREATMENT HGL AVAILABLE (FT)			---
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE			
RETURN PIPE			
OUTLET PIPE	-5.00	PVC–SDR35	6"
	PRETREATMENT	BIOFILTRATION	N/A
RIM ELEVATION	0.00	0.00	N/A
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	N/A
FRAME & COVER	(2) 36"X36"	N/A	N/A
LA COUNTY MEDIA MIX VOLUME (CY)			---
GRAVEL LAYER WITHIN MEDIA CHAMBER (CY)			---
ORIFICE DIAMETER (IN)			---

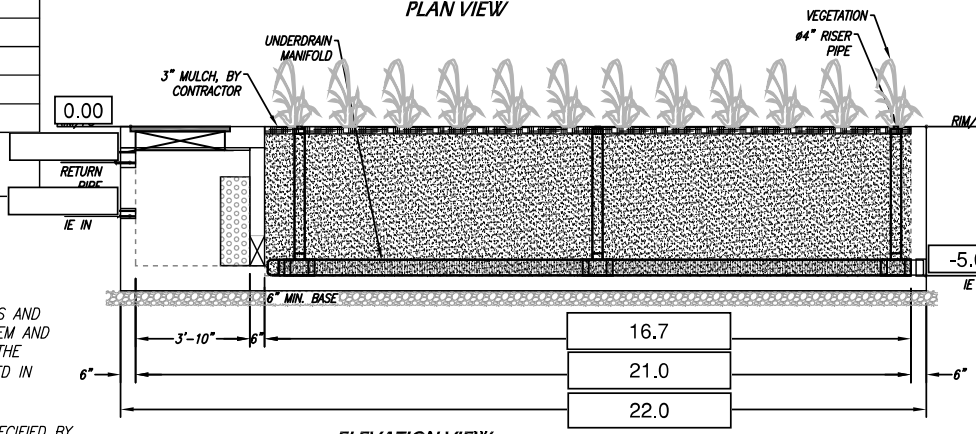
NOTES: PRELIMINARY, NOT FOR CONSTRUCTION.

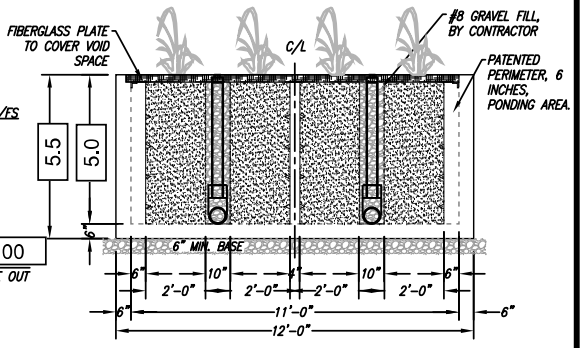


PLAN VIEW



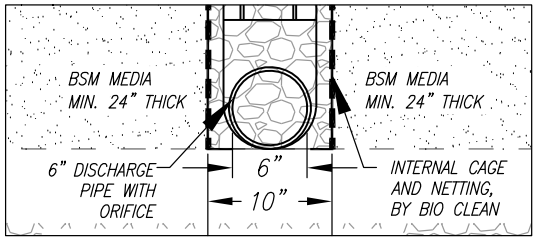
INLET VIEW





OUTLET VIEW

ELEVATION VIEW



INTERNAL CAGE DETAILS

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

GENERAL NOTES

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

REQUIRED HORIZ. MEDIA THICKNESS (INCHES)	24
TREATMENT VOLUME (CF)	22,768.00
TARGETED DRAINDOWN DURATION (HR)	96.0
WETLANDMEDIA INFILTRATION RATE (IN/HR)	12.0
WETLANDMEDIA LOADING RATE (GPM/SF)	0.12
DISCHARGE RATE (CFS)	0.07
REQUIRED TOTAL MEDIA SURFACE AREA (SF)	246.39
PROVIDED TOTAL MEDIA SURFACE AREA (SF)	TBD
NUMBER OF ROW(S)	1

Bio Clean
A Forterra Company

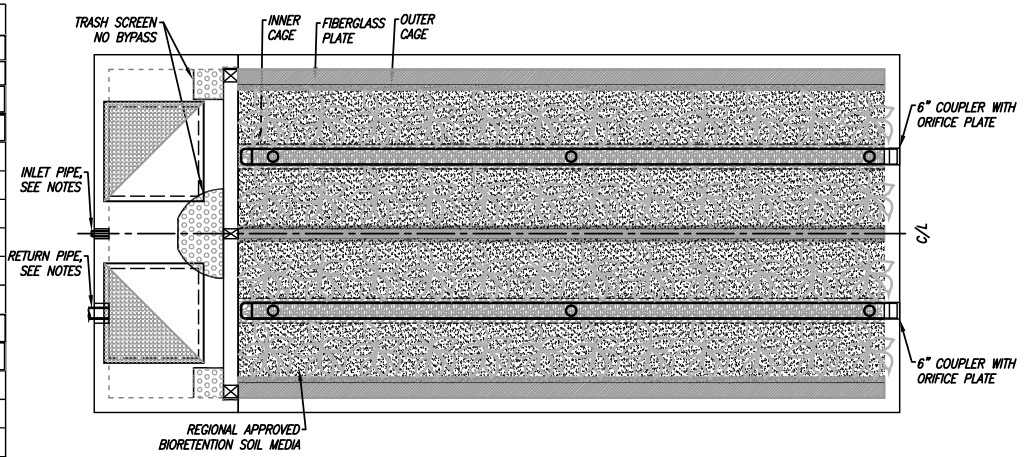
WetlandMOD- 11 21.0 5.0 -V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

6/8/21CSNGH

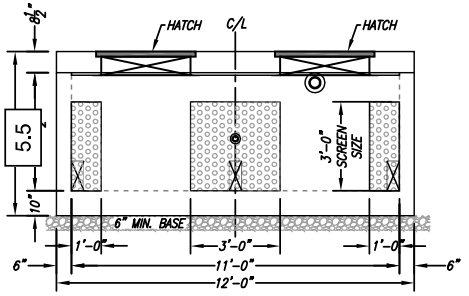
SITE SPECIFIC DATA

PROJECT ID			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
19,771.00		---	
TREATMENT HGL AVAILABLE (FT)			---
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE			
RETURN PIPE			
OUTLET PIPE	-5.00	PVC–SDR35	6"
	PRETREATMENT	BIOFILTRATION	N/A
RIM ELEVATION	0.00	0.00	N/A
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	N/A
FRAME & COVER	(2) 36"X36"	N/A	N/A
LA COUNTY MEDIA MIX VOLUME (CY)			---
GRAVEL LAYER WITHIN MEDIA CHAMBER (CY)			---
ORIFICE DIAMETER (IN)			---

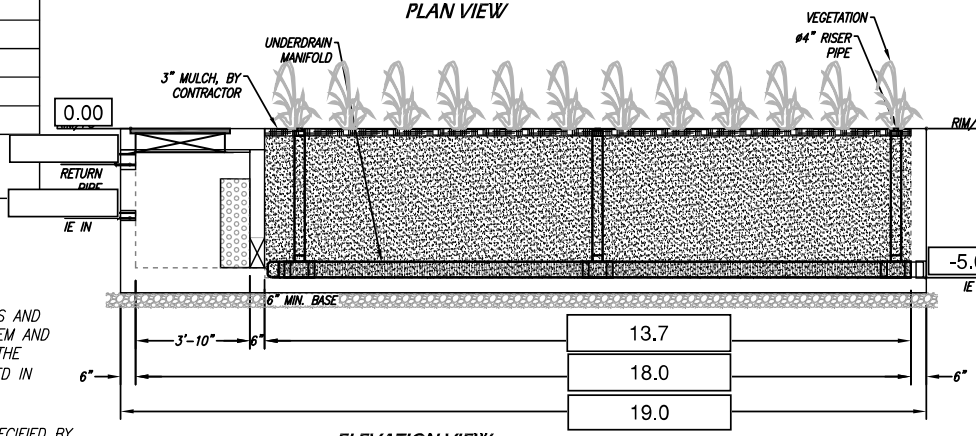
NOTES: PRELIMINARY, NOT FOR CONSTRUCTION.

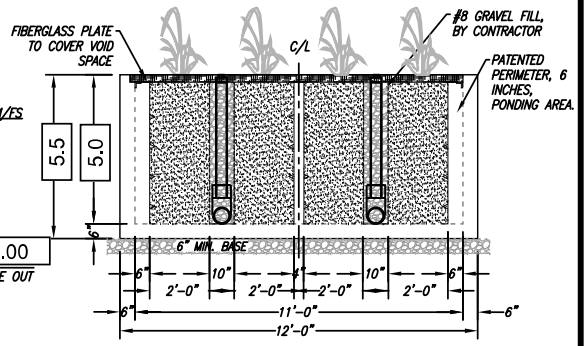


PLAN VIEW



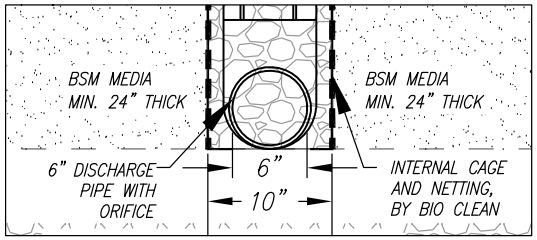
INLET VIEW





OUTLET VIEW

ELEVATION VIEW



INTERNAL CAGE DETAILS

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 MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
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GENERAL NOTES

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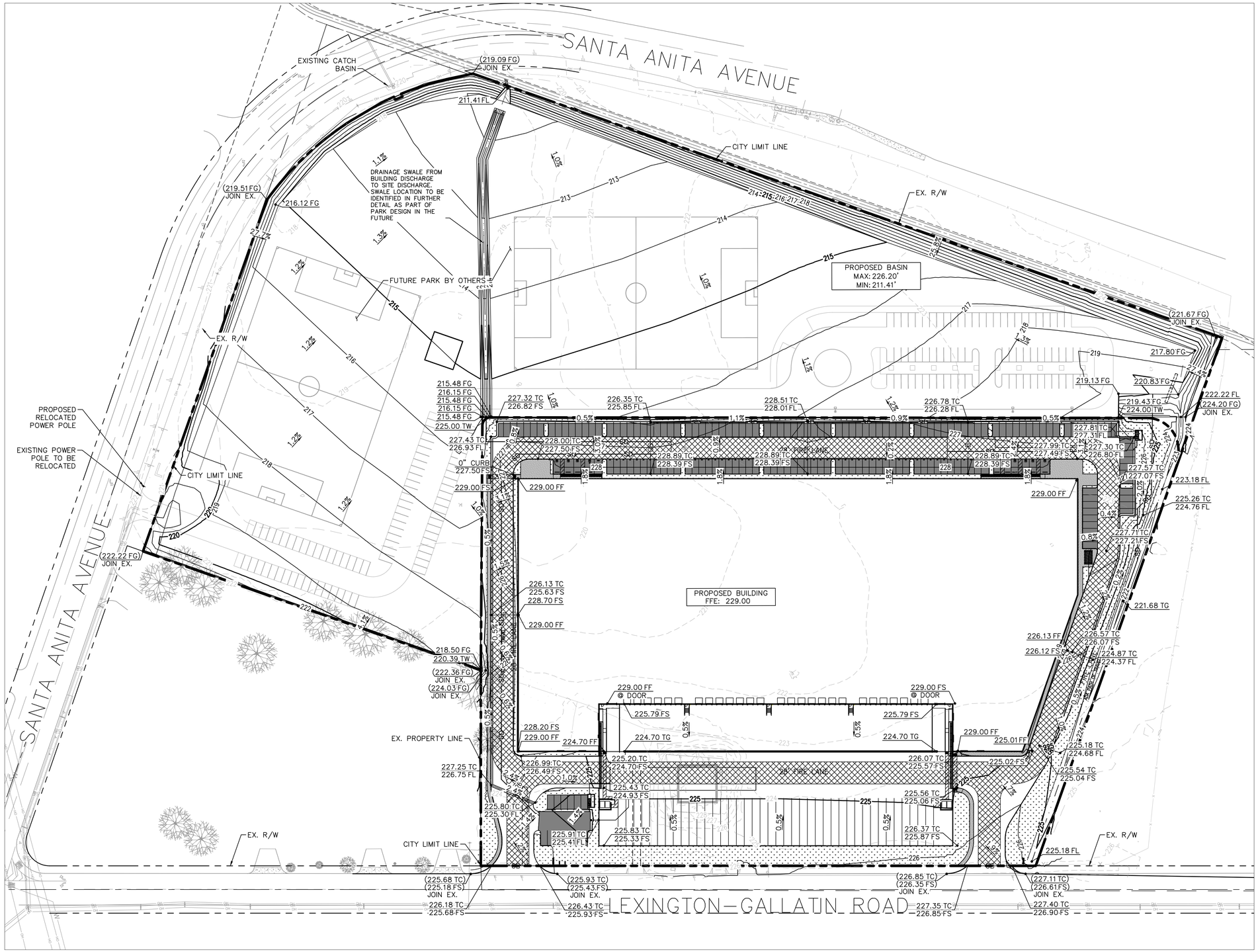
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

REQUIRED HORIZ. MEDIA THICKNESS (INCHES)	24
TREATMENT VOLUME (CF)	19,771.00
TARGETED DRAINDOWN DURATION (HR)	96.0
WETLANDMEDIA INFILTRATION RATE (IN/HR)	12.0
WETLANDMEDIA LOADING RATE (GPM/SF)	0.12
DISCHARGE RATE (CFS)	0.06
REQUIRED TOTAL MEDIA SURFACE AREA (SF)	213.96
PROVIDED TOTAL MEDIA SURFACE AREA (SF)	TBD
NUMBER OF ROW(S)	1

Bio Clean
A Forterra Company

WetlandMOD- 11 18.0 5.0 -V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

6/8/21CSNICH



LEGEND

- CENTER LINE
- PROPERTY LINE
- EASEMENT LINE
- APPROXIMATE LIMITS OF PAD PREP LINE
- GB — GRADE BREAK LINE
- R — RIDGE LINE
- FLOW LINE
- SD — PROPOSED STORM DRAIN LINE
- TOP / TOE — 2:1 SLOPE (MAX)
- 49.50 TC / 49.00 FS — PROPOSED SPOT GRADE
- (49.50 TC) / (49.00 FS) — EXISTING SPOT GRADE
- 2.2% — PROPOSED FLOW (DIRECTION AND SLOPE)
- LANDSCAPE / PLANTER AREA
- X–X — SECTION
- ACCESSIBLE PATH OF TRAVEL
- DAYLIGHT LINE
- FIRELANE

GRAPHIC SCALE IN FEET
0 30 60 120
HORIZONTAL
1" = 60'

NORTH

No.	REVISIONS	DATE	BY

Kimley»Horn
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180 EAST OCEAN BLVD.SUITE 1200
LONG BEACH, CA 90802
(562) 549 -2200
WWW.KIMLEY-HORN.COM

KHA PROJECT	194550001
DATE	1/15/2025
SCALE	AS SHOWN
DESIGNED BY	KG
DRAWN BY	KG/JM
CHECKED BY	HS

SOUTH EL MONTE ATHLETIC FIELDS AND BUSINESS PARK
PREPARED FOR
MVP SOUTH EL MONTE I, LLC
CITY OF SOUTH EL MONTE

REGISTERED PROFESSIONAL ENGINEER HUNTER ** NOT FOR CONSTRUCTION CIVIL STATE OF CALIFORNIA

PRELIMINARY GRADING PLAN

SHEET NUMBER 1 OF 1

ATTACHMENT F: EDUCATIONAL MATERIALS

After the Storm

For more information contact:

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

EPA United States Environmental Protection Agency

EPA 833-B-03-002

January 2003

Internet Address (URL) • HTTP://www.epa.gov
Recycled/Recyclable • Printed With Vegetable Oil Based Inks on 100% Postconsumer, Process Chlorine Free Recycled Paper

THE YEAR OF CLEAN WATER
"Celebration & Recommitment"

A Citizen's Guide to Understanding Stormwater

What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Why is stormwater runoff a problem?

Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.

- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.
- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.
- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

Stormwater Pollution Solutions

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential

Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

Pet waste

Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.

Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Commercial

Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

Construction

Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

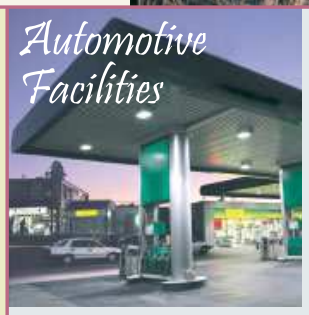
- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.

Agriculture

Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.

- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.

Automotive Facilities



Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

Forestry

Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.

Stormwater Pollution

What you should know for...

Industrial & Commercial Facilities

Best Management Practices (BMPS) for:

- Industrial Facilities
- Commercial Facilities

Riverside County Stormwater Program Members

City of Banning
(951) 922-3105

City of Beaumont
(951) 769-8520

City of Calimesa
(909) 795-9801

City of Canyon Lake
(951) 244-2955

City of Cathedral City
(760) 770-0340

City of Coachella
(760) 398-3502

City of Corona
(951) 736-2447

City of Desert Hot Springs
(760) 329-6411

City of Eastvale
(951) 361-0900

City of Hemet
(951) 765-2300

City of Indian Wells
(760) 346-2489

City of Indio
(760) 391-4000

City of Jurupa Valley
(951) 332-6464

City of Lake Elsinore
(951) 674-3124

City of La Quinta
(760) 777-7000

City of Menifee
(951) 672-6777

City of Moreno Valley
(951) 413-3000

City of Murrieta
(951) 304-2489

City of Norco
(951) 270-5607

City of Palm Desert
(760) 346-0611

City of Palm Springs
(760) 323-8299

City of Perris
(951) 943-6100

City of Rancho Mirage
(760) 324-4511

City of Riverside
(951) 826-5311

City of San Jacinto
(951) 487-7330

City of Temecula
(951) 694-6444

City of Wildomar
(951) 677-7751

Coachella Valley Water District
(760) 398-2651

County of Riverside
(951) 955-1000

Riverside County Flood Control District
(951) 955-1200

YOU can prevent Stormwater Pollution following these practices...

Industrial and Commercial Facilities

The Riverside County Stormwater Program has identified a number of Best Management Practices (BMPs) for Industrial and Commercial Facilities. These BMPs control and reduce stormwater pollutants from reaching our storm drain system and ultimately our local water bodies. City and County ordinances require businesses to use these BMPs to protect our water quality. Local cities and the County are required to verify implementation of these BMPs by performing regular facility inspections.

Prohibited Discharges

Discontinue all non-stormwater discharges to the storm drain system. It is *prohibited* to discharge any chemicals, paints, debris, wastes or wastewater into the gutter, street or storm drain.

Outdoor Storage BMPs

- Install covers and secondary containment areas for all hazardous materials and wastes stored outdoors in accordance with County and/or City standards.
- Keep all temporary waste containers covered, at all times when not in use.
- Sweep outdoor areas instead of using a hose or pressure washer.
- Move all process operations including vehicle/equipment maintenance inside of the building or under a covered and contained area.
- Wash equipment and vehicles in a contained and covered wash bay which is closed-loop or connected to a clarifier sized to local standards and discharged to a sanitary sewer or take them to a commercial car wash.

Spills and Clean Up BMPs

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep up the area.
- Clean up spills immediately when they occur, using dry clean up methods such as absorbent materials or sweep followed by proper disposal of materials.
- Always have a spill kit available near chemical loading dock doors and vehicle maintenance and fueling areas.
- Follow your Business Emergency Plan, as filed with the local Fire Department.
- Report all prohibited discharges and non-implementation of BMPs to your local Stormwater Coordinator as listed on the back of this pamphlet.

- Report hazardous materials spills to 951-358-5055 or call after hours to 951-782-2973 or, if an emergency, call the Fire Department's Haz Mat Team at 911.

Plastic Manufacturing Facilities BMPs

AB 258 requires plastic product manufacturers to use BMPs, such as safe storage and clean-up procedures to prevent plastic pellets (nurdles) from entering the waterway. The plastic pellets are released into the environment during transporting, packaging and processing and migrate to waterways through the storm drain system. AB 258 will help protect fish and wildlife from the hazards of plastic pollution.

Training BMPs

As prescribed by your City and County Stormwater Ordinance(s), train employees in spill procedures and prohibit non-stormwater discharges to the storm drain system. Applicable BMP examples can be found at www.cabmphandbooks.com.

Permitting

Stormwater discharges associated with specific categories for industrial facilities are regulated by the State Water Resources Control Board through an Industrial Stormwater General Permit. A copy of this General Permit and application forms are available at: www.waterboards.ca.gov, select stormwater then the industrial quick link.

To report illegal dumping or for more information on stormwater pollution prevention call: 1-800-506-2555 or e-mail us at: fcnpdes@rcflood.org.

Landscaping and garden maintenance activities can be major contributors to water pollution. Soils, yard wastes, over-watering and garden chemicals become part of the urban runoff mix that winds its way through streets, gutters and storm drains before entering lakes, rivers, streams, etc. Urban runoff pollution contaminates water and harms aquatic life!

In Riverside County, report illegal discharges into the storm drain, call
1-800-506-2555
"Only Rain Down the Storm Drain"

Important Links:

Riverside County Household Hazardous Waste Collection Information
1-800-304-2226 or www.rivcowm.org

Riverside County Backyard Composting Program
1-800-366-SAVE

Integrated Pest Management (IPM) Solutions
www.ipm.ucdavis.edu

California Master Gardener Programs
www.mastergardeners.org
www.camastergardeners.ucdavis.edu

California Native Plant Society
www.cnps.org

The Riverside County "Only Rain Down the Storm Drain" Pollution Prevention Program gratefully acknowledges Orange County's Storm Water Program for their contribution to this brochure.

...Only Rain Down ...the Storm Drain

What you should know for... Landscape and Gardening

Best Management tips for:

- Professionals
- Novices
- Landscapers
- Gardeners
- Cultivators

Tips for Landscape & Gardening

This brochure will help you to get the most of your lawn and gardening efforts and keep our waterways clean. Clean waterways provide recreation, establish thriving fish habitats, secure safe sanctuaries for wildlife, and add beauty to our communities. NEVER allow gardening products or waste water to enter the street, gutter or storm drain.

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.

- Plant native vegetation to reduce the amount of water, fertilizers and pesticides applied to the landscape.
- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro-spray systems. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.

- Consider recycling your green waste and adding "nature's own fertilizer" to your lawn or garden.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.
- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains or sewers. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting.
- Try natural long-term common sense solutions first. Integrated Pest Management (IPM) can provide landscaping guidance and solutions, such as:
  - **Physical Controls** - Try hand picking, barriers, traps or caulking holes to control weeds and pests.
  - **Biological Controls** - Use predatory insects to control harmful pests.
  - **Chemical Controls** - Check out www.ipm.ucdavis.edu before using chemicals. Remember, all chemicals should be used cautiously and in moderation.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Waste Collection Center to be recycled.
- *Dumping toxics into the street, gutter or storm drain is illegal!*

www.bewaterwise.com Great water conservation tips and drought tolerant garden designs.

www.ourwaterourworld.com Learn how to safely manage home and garden pests.

Additional information can also be found on the back of this brochure.

Helpful telephone numbers and links:

Riverside County Stormwater Protection Partners

Flood Control District	(951) 955-1200
County of Riverside	(951) 955-1000
City of Banning	(951) 922-3105
City of Beaumont	(951) 769-8520
City of Calimesa	(909) 795-9801
City of Canyon Lake	(951) 244-2955
Cathedral City	(760) 770-0327
City of Coachella	(760) 398-4978
City of Corona	(951) 736-2447
City of Desert Hot Springs	(760) 329-6411
City of Eastvale	(951) 361-0900
City of Hemet	(951) 765-2300
City of Indian Wells	(760) 346-2489
City of Indio	(760) 391-4000
City of Lake Elsinore	(951) 674-3124
City of La Quinta	(760) 777-7000
City of Menifee	(951) 672-6777
City of Moreno Valley	(951) 413-3000
City of Murrieta	(951) 304-2489
City of Norco	(951) 270-5607
City of Palm Desert	(760) 346-0611
City of Palm Springs	(760) 323-8299
City of Perris	(951) 943-6100
City of Rancho Mirage	(760) 324-4511
City of Riverside	(951) 361-0900
City of San Jacinto	(951) 654-7337
City of Temecula	(951) 694-6444
City of Wildomar	(951) 677-7751

REPORT ILLEGAL STORM DRAIN DISPOSAL
1-800-506-2555 or e-mail us at
fcnpdes@rcflood.org

- Riverside County Flood Control and Water Conservation District
  www.rcflood.org

Online resources include:

- California Storm Water Quality Association
  www.casqa.org
- State Water Resources Control Board
  www.waterboards.ca.gov
- Power Washers of North America
  www.thepwna.org

Stormwater Pollution

What you should know for...

Outdoor Cleaning Activities and Professional Mobile Service Providers

Storm drain pollution prevention information for:

- Car Washing / Mobile Detailers
- Window and Carpet Cleaners
- Power Washers
- Waterproofers / Street Sweepers
- Equipment cleaners or degreasers and all mobile service providers

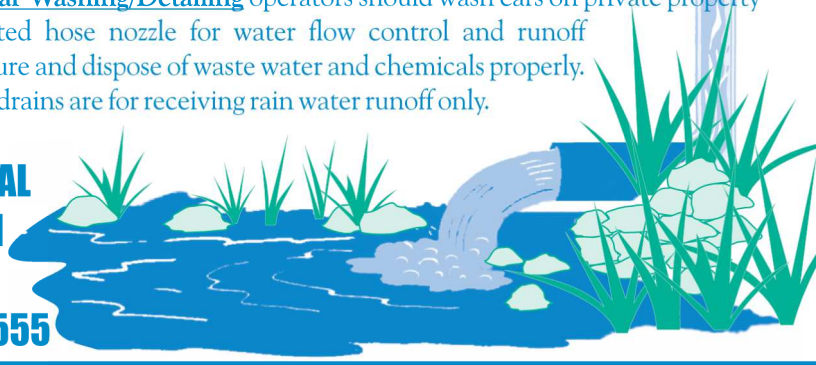
Do you know where street flows actually go?

Storm drains are NOT connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry *rain* water away from developed areas to prevent flooding. Pollutants discharged to storm drains are transported directly into rivers, lakes and streams. Soaps, degreasers, automotive fluids, litter and a host of materials are washed off buildings, sidewalks, plazas and parking areas. Vehicles and equipment must be properly managed to prevent the pollution of local waterways.

Unintentional spills by mobile service operators can flow into storm drains and pollute our waterways. **Avoid mishaps.** *Always* have a **Spill Response Kit** on hand to clean up unintentional spills. Only emergency **Mechanical** repairs should be done in City streets, using drip pans for spills. **Plumbing** should be done on private property. Always store chemicals in a leak-proof container and keep covered when not in use. **Window/Power Washing** waste water shouldn't be released into the streets, but should be disposed of in a sanitary sewer, landscaped area or in the soil. Soiled **Carpet Cleaning** wash water should be filtered before being discharged into the sanitary sewer. Dispose of all filter debris properly. **Car Washing/Detailing** operators should wash cars on private property and use a regulated hose nozzle for water flow control and runoff prevention. Capture and dispose of waste water and chemicals properly. Remember, storm drains are for receiving rain water runoff only.

REPORT ILLEGAL STORM DRAIN DISPOSAL 1-800-506-2555



Help Protect Our Waterways!

Use these guidelines for Outdoor Cleaning Activities and Wash Water Disposal

Did you know that disposing of pollutants into the street, gutter, storm drain or body of water is *PROHIBITED* by law and can result in stiff penalties?

Best Management Practices

Waste wash water from Mechanics, Plumbers, Window/Power Washers, Carpet Cleaners, Car Washing and Mobile Detailing activities may contain significant quantities of motor oil, grease, chemicals, dirt, detergents, brake pad dust, litter and other materials.

Best Management Practices, or BMPs as they are known, are guides to prevent pollutants from entering the storm drains. ***Each of us*** can do our part to keep stormwater clean by using the suggested BMPs below:

Simple solutions for both light and heavy duty jobs:

Do...consider dry cleaning methods first such as a mop, broom, rag or wire brush. Always keep a spill response kit on site.

Do...prepare the work area before power cleaning by using sand bags, rubber mats, vacuum booms, containment pads or temporary berms to keep wash water away from the gutters and storm drains.

Do...use vacuums or other machines to remove and collect loose debris or litter before applying water.

Do...obtain the property owner's permission to dispose of ***small amounts*** of power washing waste water on to landscaped, gravel or unpaved surfaces.

Do...check your local sanitary sewer agency's policies on wash water disposal regulations before disposing of wash water into the sewer. (See list on reverse side)

Do...be aware that if discharging to landscape areas, soapy wash water may damage landscaping. Residual wash water may remain on paved surfaces to evaporate. Sweep up solid residuals and dispose of properly. Vacuum booms are another option for capturing and collecting wash water.

Do...check to see if local ordinances prevent certain activities.

Do not let...wash or waste water from sidewalk, plaza or building cleaning go into a street or storm drain.

Report illegal storm drain disposal
Call Toll Free
1-800-506-2555

Using Cleaning Agents

Try using biodegradable/phosphate-free products. They are easier on the environment, but don't confuse them with being toxic free. Soapy water entering the storm drain system can impact the delicate aquatic environment.

When cleaning surfaces with a ***high-pressure washer*** or ***steam cleaner***, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning can loosen additional material that can contaminate local waterways.

Think Water Conservation

Minimize water use by using high pressure, low volume nozzles. Be sure to check all hoses for leaks. Water is a precious resource, don't let it flow freely and be sure to shut it off in between uses.

Screening Wash Water

Conduct thorough dry cleanup before washing exterior surfaces, such as buildings and decks ***with loose paint***, sidewalks or plaza areas. Keep debris from entering the storm drain after cleaning by first passing the wash water through a "20 mesh" or finer screen to catch the solid materials, then dispose of the mesh in a refuse container. Do not let the remaining wash water enter a street, gutter or storm drain.

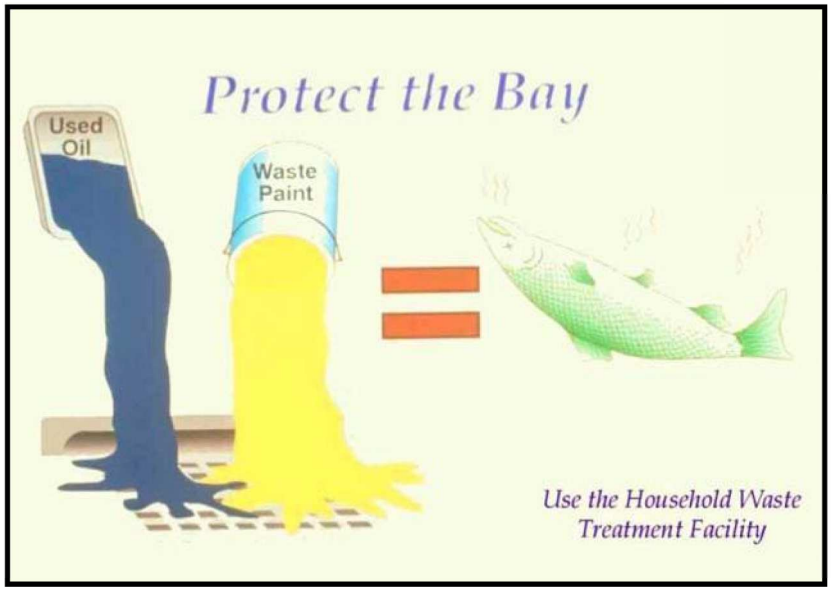
Drain Inlet Protection & Collection of Wash Water

- Prior to any washing, block all storm drains with an impervious barrier such as sandbags or berms, or seal the storm drain with plugs or other appropriate materials.
- Create a containment area with berms and traps or take advantage of a low spot to keep wash water contained.
- Wash vehicles and equipment on grassy or gravel areas so that the wash water can seep into the ground.
- Pump or vacuum up all wash water in the contained area.

Concrete/Coring/Saw Cutting and Drilling Projects

Protect any down-gradient inlets by using dry activity techniques whenever possible. If water is used, minimize the amount of water used during the coring/drilling or saw cutting process. Place a barrier of sandbags and/or absorbent berms to protect the storm drain inlet or watercourse. Use a shovel or wet vacuum to remove the residue from the pavement. Do not wash residue or particulate matter into a storm drain inlet or watercourse.

Non-Stormwater Discharges SC-10



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, air conditioner condensate, etc. However there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains. They can generally be detected through a combination of detection and elimination. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of pollutants on streets and into the storm drain system and creeks.

Targeted Constituents

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

Approach

Initially the industry must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is in the elimination of non-stormwater discharges.

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Pollution Prevention

- Ensure that used oil, used antifreeze, and hazardous chemical recycling programs are being implemented. Encourage litter control.

Suggested Protocols

Recommended Complaint Investigation Equipment

- Field Screening Analysis
  - pH paper or meter
  - Commercial stormwater pollutant screening kit that can detect for reactive phosphorus, nitrate nitrogen, ammonium nitrogen, specific conductance, and turbidity
  - Sample jars
  - Sample collection pole
  - A tool to remove access hole covers
- Laboratory Analysis
  - Sample cooler
  - Ice
  - Sample jars and labels
  - Chain of custody forms
- Documentation
  - Camera
  - Notebook
  - Pens
  - Notice of Violation forms
  - Educational materials

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.
- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled or demarcated next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

- See SC44 Stormwater Drainage System Maintenance for additional information.

Illicit Connections

- Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- Isolate problem areas and plug illicit discharge points.
- Locate and evaluate all discharges to the industrial storm drain system.

Visual Inspection and Inventory

- Inventory and inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system.
- Inspect the path of floor drains in older buildings.

Smoke Testing

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.
- During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

Dye Testing

- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

TV Inspection of Drainage System

- TV Cameras can be employed to visually identify illicit connections to the industrial storm drainage system.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Once a site has been cleaned:

- Post "No Dumping" signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC11 Spill Prevention, Control, and Cleanup.

Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.
- Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.

Reporting

- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.
- Document and report annually the results of the program.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

Training

- Training of technical staff in identifying and documenting illegal dumping incidents is required.
- Consider posting the quick reference table near storm drains to reinforce training.
- Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.
- Conduct spill response drills annually (if no events occurred to evaluate your plan) in cooperation with other industries.
- When a responsible party is identified, educate the party on the impacts of his or her actions.

Spill Response and Prevention

- See SC11 Spill Prevention Control and Cleanup.

Other Considerations

- Many facilities do not have accurate, up-to-date schematic drawings.

Requirements

Costs (including capital and operation & maintenance)

- The primary cost is for staff time and depends on how aggressively a program is implemented.
- Cost for containment and disposal is borne by the discharger.
- Illicit connections can be difficult to locate especially if there is groundwater infiltration.
- Indoor floor drains may require re-plumbing if cross-connections to storm drains are detected.

Maintenance (including administrative and staffing)

- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Further Detail of the BMP

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. All of these wastes cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots

- Types and quantities (in some cases) of wastes
- Patterns in time of occurrence (time of day/night, month, or year)
- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
- Responsible parties

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

What constitutes a "non-stormwater" discharge?

- Non-stormwater discharges to the stormwater collection system may include any water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

- Facilities subject to stormwater permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The State's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Performance Evaluation

- Review annually internal investigation results; assess whether goals were met and what changes or improvements are necessary.
- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Building & Grounds Maintenance SC-41

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

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

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

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- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Training

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- Clean up spills immediately.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.
- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Parking/Storage Area Maintenance SC-43

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

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

Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

CASQA California Stormwater Quality Association

SC-43 Parking/Storage Area Maintenance

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Drainage System Maintenance SC-44

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Targeted Constituents

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

Approach

Pollution Prevention

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Suggested Protocols

Catch Basins/Inlet Structures

- Staff should regularly inspect facilities to ensure compliance with the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

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- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- Conduct routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS.

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
  - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?
- Record locations of apparent illegal discharges/illicit connections?
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Eliminate the discharge once the origin of flow is established.

- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- Have staff involved in detection and removal of illicit connections trained in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).

- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:

  - Purchase and installation of signs.

  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.

  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.

  - Purchase of landfill space to dispose of illegally-dumped items and material.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm

Landscape Maintenance SC-73

Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

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

Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Approach

Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

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- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

Suggested Protocols

Mowing, Trimming, and Weeding

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.
- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.
- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.
- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.
- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).
- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.
- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.
- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

Irrigation

- Where practical, use automatic timers to minimize runoff.
- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.
- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.
- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:
  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.
  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.
  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.
  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.
  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.
- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.
- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a know in location
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in "agricultural use" areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.
- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.
- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Waste Management

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

Contractors and Other Pesticide Users

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: http://www.epa.gov/npdes/menuofbmps/poll_8.htm

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect

    Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Description

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

Approach

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

Design Objectives

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

Maintenance Bays & Docks SD-31

Design Objectives

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

Description

Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach

In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications

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

Design Considerations

Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

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- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.

- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.

- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.

- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.

- Other features may be comparable and equally effective.

Redeveloping Existing Installations

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

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

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

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

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

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

Section 5
Monitoring, Reporting, and Program Evaluation

Conducting a monitoring program, reviewing the monitoring information, evaluating BMPs, and record keeping and reporting are all important elements of the implementation phase of the SWPPP. The success of the SWPPP depends upon the thorough implementation of the monitoring plan and evaluation of the effectiveness of the plan elements once they have been implemented.

Monitoring, Reporting, and Evaluation Elements

- Conduct monitoring program
- Conduct record keeping and reporting
- Conduct annual site evaluation
  - Review monitoring information
  - Evaluate BMPs
  - Review and revise the SWPPP as necessary

5.1 Conduct Monitoring Program

The General Permit requires that a monitoring program be a component of the SWPPP. The program has the following objectives:

- To monitor the quality of the stormwater discharge
- To aid in SWPPP implementation
- To measure the BMP effectiveness

To meet these objectives the monitoring effort has these elements:

- Training
- Visual observations
- Stormwater monitoring
- Authorized non-stormwater discharges

5.1.1 Training

Familiarity with the requirements of the stormwater monitoring plan and competence in the techniques and protocols specified in the plan are essential to ensure that stormwater samples are collected in a manner that meets the goals of the plan, while protecting the health and safety of the monitoring team members. It is recommended that all stormwater monitoring personnel receive training prior to conducting any stormwater monitoring activities. Stormwater monitoring training should include the following basic elements:

- Review of the Monitoring Plan and Health and Safety Plan

- Classroom training session
- Field training and sampling simulation (dry run)
- Annual refresher training

5.1.2 Visual Observations

Visual observations of both stormwater and non-stormwater discharges should be made at all facilities to document the presence of any discolorations, odors, floating and suspended material, oil and grease, etc., and to identify the source of any pollutants and non-stormwater flows. Visual observations should be made under the leadership of the SWPPP Leader, with appropriate members of the Pollution Prevention Team, according to the following schedule:

- All drainage areas within the facility should be checked for the presence of unauthorized non-stormwater discharges on a quarterly basis, during daylight hours, on days with no stormwater discharges.
- All authorized non-stormwater discharges and their sources should be observed quarterly during daylight hours, on days with no stormwater discharges.
- One storm event per month during the wet season (October 1-May 30) should be visually observed during the first hour of discharge at all discharge locations. These observations are only required of stormwater discharges that occur during daylight hours that are preceded by at least three working days without stormwater discharges and that occur during scheduled facility operating hours.

The results of the visual observations should be recorded and include: the date of the observation, locations observed, observations, response taken to eliminate unauthorized non-stormwater discharges, and actions taken to reduce or prevent pollutants from contacting non-stormwater or stormwater discharges. Results are included in the Annual Report.

5.1.3 Stormwater Monitoring

Each facility should either conduct an individual monitoring plan or participate in a group-sampling program. A group-monitoring program may be developed either by an entity representing a group of similar facilities or by a local stormwater agency that holds its own NPDES permit. According to the General Permit, the monitoring plan is to contain the rationale and description of the visual observation methods, location, and frequency; and the analytical methods and corresponding method detection limits used to detect constituents.

Selection of sites for industrial stormwater monitoring will depend on many factors including the following:

Representativeness

It is important to select sites that are representative of typical site operations.

- Runoff from the facility should combine to form a definable runoff stream.

- The runoff stream should represent the full range of activities at the facility.
- Runoff from the facility should not combine with runoff from other sources.
- Adequate flow volume must be available for sample collection.

Personal Safety

Development of a health and safety plan is recommended. Site selection should insure monitoring personnel from the following potential hazards:

- Traffic
- Uneven or slippery footing surface
- Poor night visibility (lighting)

Site Access

Ease of monitoring site access for monitoring personnel and vehicles parking is essential. Also, for sites that require installation of sample collection or flow metering equipment, adequate equipment access for maintenance and monitoring activities must be available.

Equipment Security

Permanently installed monitoring equipment must be located at a site that will minimize potential vandalism and other possible damage.

Adequate Flow Volume

Monitoring sites should be configured such that adequate flow volume is present for sample collection. Hydraulic conditions should be well mixed and free flowing.

Utility Access

If automated monitoring equipment is required, electrical power should be readily available at selected monitoring sites. Additionally, telephone service may be required for off-site station controlling and data transfer.

Stormwater samples should be collected during the first hour of discharge from (1) the first storm event of the wet season, and (2) at least one other storm event in the wet season. If the first event is missed, sampling of two events during the wet season is still required. Furthermore, a justification for failing to sample the first event should be provided in the Annual Report. Sample collection is only required of stormwater discharges that occur during scheduled facility operating hours and that are preceded by at least three working days without stormwater discharge. Sample collection is not required if dangerous weather conditions are present (e.g., flooding, electrical storm, etc.), when stormwater discharges begin after scheduled facility operating hours or when stormwater discharges are not preceded by three working days without discharge. When the required samples are not collected due to these exceptions, an explanation must be provided in the Annual Report. Visual observations and sample collection may be conducted more than one hour after discharge begins if it is determined that the

monitoring objectives will be better satisfied. If this occurs, an explanation should be provided in the Annual Report.

Specific sampling and analysis requirements include the following:

- All sampling and sample preservation should be in accordance with the current edition of "Standard Methods for the Examination of Water and Wastewater".
- All monitoring instruments and equipment should be calibrated and maintained in accordance with manufacturers' specifications to ensure accurate measurements.
- All laboratory analyses should be conducted according to test procedures under 40 CFR Part 136, unless other test procedures have been specified by the RWQCB.
- Analyze samples for total suspended solids (TSS), pH, specific conductance, and total organic carbon (TOC). Oil and grease (O&G) may be substituted for TOC.
- Analyze toxic chemicals and other pollutants that are likely to be present in stormwater discharges. Any of these pollutants that are not detected in significant quantities after two consecutive sampling events may be eliminated from future sampling analysis until the pollutant is likely to be present again. (According to the definitions section of the General Permit, "significant quantities" is defined as the volume, concentration, or mass of a pollutant that can cause or threaten to cause pollution, contamination, or nuisance; adversely impact human health or the environment; and/or cause or contribute to a violation of any applicable water quality standards for the receiving water.)
- Other analytical parameters should be included based on the facility's standard industrial classification (see Table D of the General Permit).

Rules to Follow to Reduce Potential Sample Contamination

1. No smoking.
2. Never sample near a running vehicle. Do not park vehicles in immediate sample collection area (even non-running vehicles)
3. Always wear clean, powder-free nitrile gloves when handling composite bottles, lids, sterile grab sample bottles, tubing, or strainers.
4. Never touch the inside surface of a sample bottle or lid, even with gloved hands.
5. Never touch the exposed end of a sampling tube.
6. Never allow the inner surface of a sample bottle, lid, or sampling tube to be contacted by any material other than the sample water.
7. Never allow any object or material to fall into or contact the collected sample water.
8. Avoid allowing rain water to drip from rain gear or other surfaces into sample bottles.
9. Do not eat or drink during sample collection.
10. Do not breathe, sneeze or cough in the direction of an open sample bottle.

In addition to the requirements above, which are outlined in the General Permit, the following procedures are recommended to maximize the ability of sampling personnel to collect samples reliably and with minimal sample contamination.

- Before stormwater samples are collected, personnel must ensure the safety of such activities at each sampling location.
- Select the appropriate sample bottles and equipment for each parameter to be measured. As general guidelines, all sampling equipment and sample bottles used for trace metals determination should be nonmetallic and free from any material that may contain metals. Only high-density plastic or Teflon containers should be used for metals analytical sample storage bottles. All sampling equipment and sample bottles used for trace organics determination should be glass or Teflon. Nutrients and most "conventional" parameters may be sampled using plastic or glass bottles.
- Employ "clean" sampling techniques to minimize potential sources of sample contamination, particularly from trace pollutants. Experience has shown that when clean sampling techniques are used, detected concentrations of constituents tend to be lower.

5.2 Conduct Record Keeping and Reporting

Records of all stormwater monitoring information, inspections and visual observations, certifications, corrective actions and follow-up activities, and copies of all reports should be retained for a period of at least five years. These records should include:

- The date, place, and time of site inspections, sampling, visual observations, and measurements
- The individual(s) who performed the site inspections, sampling, visual observations, and measurements
- Flow measurements or estimates (as required by Section B.6 of the General Permit)
- The date and approximate time of analyses
- The individual who performed the analyses
- Analytical results, method detection limits, and the analytical techniques or methods used
- Quality assurance and quality control records and results
- Non-stormwater discharge inspections and visual observations and stormwater discharge visual observation records
- Visual observations and sample collection exception records
- All calibration and maintenance records of onsite instruments used

- All sampling and analysis exemption and reduction certifications and supporting documentation

- The records of any corrective actions and follow-up activities that resulted from the visual observations

It is also recommended that information regarding the rain event be collected. A nearby recording gage should be identified and used to document the start and stop times and date of precipitation event. Some industries may want to consider installing a recording gage at the monitoring site.

Photographs can be useful. Also keep a record of maintenance activities or any other BMPs that are of an "action" nature. It is easy to demonstrate that a BMP that involves a physical change, such as berming or covering, has been accomplished. But actions that relate to good housekeeping can only be demonstrated by record keeping. Keeping a record of catch basin cleaning, for example, also provides insight into how soon it takes for the catch basin sump to refill.

An Annual Report including the items listed below should be submitted by July 1 of each year to the Executive Officer of the appropriate RWQCB.

- Summary of visual observations and sampling results

- Evaluation of the visual observations and sampling and analysis results

- Documentation that the BMPs in the SWPPP are being implemented and properly maintained as necessary

- Laboratory reports (including detection limits for each analytical parameter)

- The Annual Comprehensive Site Compliance Evaluation Report (as described below)

- Documentation, including the justification, of any deviations from the General Permit requirements (if not already included in the Evaluation Report)

- Records

- Detection limits for each analytical parameter

5.3 Conduct Annual Site Evaluation

All facilities should conduct an annual comprehensive site compliance evaluation. It may be helpful to involve the Pollution Prevention Team (PPT) in this effort (see Section 2). The SWPPP should be revised within 90 days of the evaluation based on the evaluation and the revisions implemented. Evaluations should include the following:

- A review of the results of visual inspections of potential pollutant sources for evidence of, or the potential for, pollutants entering the drainage system

- A review of visual observation records, inspection records, and sampling and analysis results
- A review and evaluation of each BMP to determine whether it is adequate, properly implemented, and maintained
- A review of site activities to ascertain if change has occurred, and if so, whether new or modified BMPs are needed
- A review of the list of significant materials to ascertain if the list has changed, and if so, whether new or modified BMPs are needed
- A review of spills that have occurred over the past 12 months, with a determination of cause(s) and possible solutions, including modified or new BMPs
- A determination of whether each BMP must be modified, replaced, and whether additional BMPs are needed
- An evaluation report

ATTACHMENT G: PHASE I AND II ESA

PARTNER
Engineering and Science, Inc.®

PHASE I ENVIRONMENTAL SITE ASSESSMENT REPORT

825 Lexington-Gallatin

825 Lexington-Gallatin Road
South El Monte, California 91733

Report Date: January 6, 2022
Partner Project No. 21-331089.1

Prepared for:

Magellan Value Partners
1900 Avenue of the Stars, Suite 2470
Los Angeles, California 90067

PARTNER
Engineering and Science, Inc.

January 6, 2022

Mr. Somy Mukherjee
Magellan Value Partners
1900 Avenue of the Stars, Suite 2470
Los Angeles, California 90067

Subject: Phase I Environmental Site Assessment
825 Lexington-Gallatin
825 Lexington-Gallatin Road
South El Monte, California 91733
Partner Project No. 21-331089.1

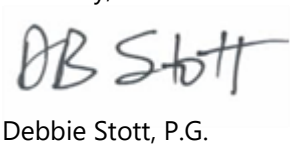
Dear Mr. Mukherjee:

Partner Engineering and Science, Inc. (Partner) is pleased to provide the results of the *Phase I Environmental Site Assessment* (Phase I ESA) report of the abovementioned address (the "subject property"). This assessment was performed in conformance with the scope and limitations as detailed in the ASTM Practice E1527-13 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process.

This assessment included a site reconnaissance as well as research and interviews with representatives of the public, property ownership, site manager, and regulatory agencies. An assessment was made, conclusions stated, and recommendations outlined.

We appreciate the opportunity to provide environmental services to you. If you have any questions concerning this report, or if we can assist you in any other matter, please contact me at (310) 622-8855.

Sincerely,



Debbie Stott, P.G.
Principal

EXECUTIVE SUMMARY

Partner Engineering and Science, Inc. (Partner) has performed a Phase I Environmental Site Assessment (ESA) in accordance with the scope of work and limitations of ASTM Standard Practice E1527-13, the Environmental Protection Agency Standards and Practices for All Appropriate Inquiries (AAI) (40 CFR Part 312) and set forth by Magellan Value Partners for the property located at 825 Lexington-Gallatin Road in South El Monte, Los Angeles County, California (the "subject property"). The Phase I Environmental Site Assessment is designed to provide Magellan Value Partners with an assessment concerning environmental conditions (limited to those issues identified in the report) as they exist at the subject property.

Property Description

The subject property is located on the northwest side of Lexington-Gallatin Road, east-southeast of Santa Anita Avenue, within a mixed commercial, residential, and recreation area of Los Angeles County. Please refer to the table below for further description of the subject property:

Subject Property Data	
Address:	825 Lexington-Gallatin Road, South El Monte, California
Property Use:	Commercial – currently vacant land with dilapidated building
Land Acreage (Ac):	21.18 Ac
Number of Buildings:	1
Number of Floors:	1
Date of Construction:	By 1948
Assessor's Parcel Number (APN):	8119-005-032
Current Tenants:	Vacant
Site Assessment Performed By:	Janet Tentler of Partner*
Site Assessment Conducted On:	August 11, 2021

The subject property consists of vacant land with the remnants of one abandoned structure on the south side of the site. The building consist of a shell with no roof. Trees were observed growing in the building interior. The remainder of the property consists of an unpaved lot surrounded by a fence.

No hazardous substances or petroleum products were observed on the subject property during the site reconnaissance. No evidence of current or former aboveground storage tanks (ASTs) or underground storage tanks (USTs) was observed during the site reconnaissance.

According to review of available historical data, it appears that the subject property was agriculturally developed land from 1928 to at least 1938. Between 1948 to at least 1994, the subject property was developed with a radio station and between 3 to 6 radio towers. The radio station was occupied by KXLA (1953) and KRLA (1953-1994). By 2002, the radio towers appeared to have been removed, leaving the building on the southern portion of the property and vacant land.

The agency database report obtained from Environmental Data Resources, Inc. (EDR) identified the subject property as:

- AT&T Mobility- LAC033-01 South El Monte (USID1208)(EDR Map ID: A1-A4), is listed at 825 Lexington-Gallatin Road, is identified in the RCRA NonGen, CERS, CERS Haz Waste, FINDs, and

ECHO databases. No RCRA violations were listed. The facility was last inspected on June 19, 2019 by the Los Angeles County Fire Department. No violations were listed.

- New Cingular Wireless (EDR Map ID: A5), is listed at 825 Lexington-Gallatin Road, is identified in the HWTS database. The facility is identified as a Satellite Telecommunications facility.

Based on the regulatory status and lack of listings in other databases indicating violations and/or a release, these listings are not considered to have created an environmental concern to the subject property.

During the vicinity reconnaissance, During the vicinity reconnaissance, Partner observed the following land use on properties in the immediate vicinity of the subject property:

Immediately Surrounding Properties

Northeast: Construction yard (995 Lexington-Gallatin Road)

Northwest: Santa Anita Avenue, followed by Whittier Narrows Recreation Area (parking lot and Legg Lakes) and 60 Freeway.

South: Los Angeles County Parks and Recreation Maximo Training Center (823 Lexington-Gallatin Road), Lexington-Gallatin Road and Santa Anita Avenue.

Southeast: Lexington-Gallatin Road, followed by Whittier Narrows Recreation Area, Group Picnic Area and residential properties,

Southwest: Santa Anita Avenue, followed by Whittier Narrows Recreation Area (parking lot and Legg Lakes).

No environmental concerns associated with adjacent properties were identified based on visual observation from publicly accessible rights-of-way.

The subject property is located within the boundaries of the San Gabriel Valley (Area 1) National Priority List (NPL) site, an 11-square-mile area of contaminated groundwater in Los Angeles County, California. It is one of four Superfund sites in the 170-square-mile San Gabriel Valley. Multiple potentially responsible parties (PRPs) contaminated over 30 square miles of groundwater under the Valley with volatile organic compounds (VOCs) and industrial solvents. About 400 facilities in the region have soil contamination. Cleanup, operation and maintenance activities, and monitoring are ongoing.

The subject property is located within the Whittier Narrows Operable Unit (OU) and adjacent to the South El Monte OU. The primary contaminant in Whittier Narrows is tetrachloroethylene (PCE). Analytical data results from shallow zone sampling conducted in January/February, 2011 indicate that PCE concentrations are below the drinking water maximum contaminant level (MCL) throughout the Whittier Narrows OU and are typically non-detect or less than 0.5 micrograms per liter (µg/L). PCE concentrations have generally been declining in the intermediate zone in the upgradient portions of the Whittier Narrows OU.

In the shallow zone, the extent of contamination has shrunk dramatically since remedy construction was completed in 2002 and PCE concentrations have continued to decline consistently over the last five years (2006 to 2010). There are currently no shallow zone MCL exceedances in the Whittier Narrows OU, indicating that continued extraction is not needed to meet the goals of this hydraulic containment remedy.

Based on the contaminant isoconcentration maps created in 2017 (EPA 2017 Annual Performance Review), the subject property is located outside the shallow zone PCE contamination zone (nearest monitoring well EPAMW4-13; depth to water 27-29 feet below ground surface (bgs)). The subject property is located within the groundwater plume with PCE contamination ranging from 0.5 to 5 µg/L in the Intermediate zone es (between 150-300 and 450-600 feet bgs). Based on the confirmed groundwater contamination in deeper groundwater zones in the vicinity of the subject property, this listing is considered to represent a recognized environmental condition (REC).

No potential vapor intrusion concerns were identified onsite nor from offsite facilities.

According to information obtained from the California State Water Resources Board online database, GeoTracker, for a nearby release (Case Number T0603770196 – 1100 Santa Anita Avenue) and topographic map interpretation, groundwater in the vicinity of the subject property is present at 27 feet bgs and flows toward the southwest.

Findings

A *recognized environmental condition (REC)* refers to the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property: due to release to the environment; under conditions indicative of a release to the environment; or under conditions that pose a material threat of a future release to the environment. The following was identified during the course of this assessment:

- The subject property is located within the boundaries of the San Gabriel Valley (Area 1) National Priority List (NPL) site, an 11-square-mile area of contaminated groundwater in Los Angeles, California. Groundwater is contaminated with trichloroethylene (TCE) and PCE according to analyses by State agencies and local water companies. EPA conducted two five-year reviews of the Whittier Narrows and South El Monte OU's interim remedies. The subject property is located within the Whittier Narrows OU and adjacent to the South El Monte OU. The primary contaminant in Whittier Narrows is PCE. Based on the contaminant isoconcentration maps created in 2017 (EPA 2017 Annual Performance Review), the subject property is located outside the shallow zone PCE contamination zone (nearest monitoring well EPAMW4-13; depth to groundwater 27-29 feet bgs). The subject property is located within the groundwater plume with PCE contamination ranging from 0.5 to 5 µg/L in the Intermediate zone (between 150-300 and 450-600 feet bgs). Based on the confirmed groundwater contamination in the vicinity of the subject property, this listing is considered to represent a REC.

  The subject property is not considered a source nor is it within a source area. Based on the current data indicating that VOCs in shallow groundwater are not above drinking water standards, availability of public water supply, remedial actions, identification of responsible parties, and regulatory oversight by USEPA, no further action related to current and future commercial use of the subject property appears to be required at this time.

A *controlled recognized environmental condition (CREC)* refers to a REC resulting from a past release of hazardous substances or petroleum products that has been addressed to the satisfaction of the applicable regulatory authority, with hazardous substances or petroleum products allowed to remain in place subject

to the implementation of required controls. The following was identified during the course of this assessment:

- Partner did not identify any controlled recognized environmental conditions during the course of this assessment.

A *historical recognized environmental condition (HREC)* refers to a past release of any hazardous substances or petroleum products that has occurred in connection with the property and has been addressed to the satisfaction of the applicable regulatory authority or meeting unrestricted use criteria established by a regulatory authority, without subjecting the property to any required controls. The following was identified during the course of this assessment:

- Partner did not identify any historical recognized environmental conditions during the course of this assessment.

An *environmental issue* refers to environmental concerns identified by Partner, which do not qualify as RECs; however, warrant further discussion. The following was identified during the course of this assessment:

- Due to the age of the subject property building, there is a potential that asbestos-containing material (ACM) and/or lead-based paint (LBP) are present. Should these materials be replaced, the identified suspect ACMs would need to be sampled to confirm the presence or absence of asbestos prior to any renovation or demolition activities to prevent potential exposure to workers and/or building occupants.

Conclusions, Opinions and Recommendations

Partner has performed a Phase I Environmental Site Assessment in conformance with the scope and limitations of ASTM Practice E1527-13 of 825 Lexington-Gallatin Road in South El Monte, Los Angeles County, California (the "subject property"). Any exceptions to, or deletions from, this practice are described in Section 1.5 of this report.

This assessment has revealed evidence of recognized environmental conditions and environmental issues in connection with the subject property; however, based on the conclusions of this assessment described above, Partner recommends no further investigation of the subject property at this time.

Portion of
Environmental Phase 1
& 2 Report provided
For Reference Only,
The remainder can be
provided upon request.