Appendix I1 Water Quality Management Plan

Appendices

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FUSCOE ENGINEERING

WATER QUALITY MANAGEMENT PLAN (WQMP)

LAGUNA NIGUEL CITY CENTER

PREPARED FOR
LAGUNA NIGUEL TOWN CENTER PARTNERS
18802 Bardeen Ave #1521
Irvine, CA 92612

FUSCOE ENGINEERING, INC.
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PROJECT MANAGER
Mark Nero, PE

DATE PREPARED: October 29, 2019
DATE REVISED: December 20, 2019
2nd REVISION: March 6, 2020
UPDATE: August 18, 2021
February 1, 2022

PROJECT NUMBER: 279.21.01

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Preliminary
Water Quality Management Plan (WQMP)

Project Name:

LAGUNA NIGUEL CITY CENTER

CITY OF LAGUNA NIGUEL
30102 Pacific Island Drive, Laguna Niguel CA 92677
APN 656-242-18

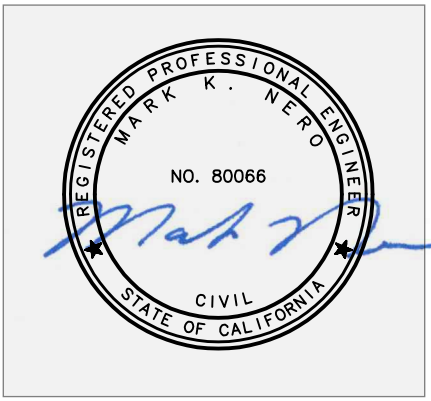
Prepared for:

LAGUNA NIGUEL TOWN CENTER PARTNERS
18802 Bardeen Ave #1521
Irvine, CA 96212
949-756-5959

Prepared by:

FUSCOE ENGINEERING, INC.

Engineer's Seal



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Prepared on: 10/29/2019
Date Revised: 12/20/2019
2nd Revision: 3/06/2020
Update: 8/18/2021
2/1/2022

PROJECT OWNER'S CERTIFICATION			
Permit/Application No.	PENDING	**Grading Permit No.**	PENDING
Tract/Parcel Map No.	N/A	**Building Permit No.**	PENDING
Address of Project Site and/or APN (Specify Lot Numbers if Portions of Tract)		APN 656-242-18	

This Water Quality Management Plan (WQMP) has been prepared for Laguna Niguel Town Center Partners by Fuscoe Engineering, Inc. The WQMP is intended to comply with the requirements of the local NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan once it is approved and developed by LNTCP and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the San Diego Region (South Orange County). Once the undersigned transfers its interest in the property by means of its intended ground lease, its successors-in-interest, LNTCP, shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

OWNER:			
Title:	Chief Real Estate Officer		
Company:	County of Orange		
Address:	333 W Santa Ana Blvd, 3rd FL., Santa Ana, CA 92701		
Email:	thomas.miller@ocgov.com		
Telephone #	(714) 834-6019		
Owner Signature:	Thomas A. Miller	**Date:**	Feb 25, 2022

LESSEE:	Bryon Ward		
Title:	Partner		
Company:	Laguna Niguel Town Center Partners		
Address:	3501 Jamboree Road, Suite 3000, Newport Beach, California 92660		
Email:	bward@burnham-ward.com		
Telephone #	949-760-9150		
Owner Signature:		Date:	2/28/22

CONTENTS

LIST OF ATTACHMENTS

LIST OF EXHIBITS (INCLUDED IN ATTACHMENT C)

- Vicinity Map
- WQMP Exhibit
- Typical Cross Sections

SECTION 1 DISCRETIONARY PERMIT(S) AND WATER QUALITY CONDITIONS

PROJECT INFORMATION			
Permit/Application No.	PENDING	**Site Address Tract/Parcel Map No.**	30102 Pacific Island Drive, Laguna Niguel CA 92677
Additional Information/ Comments			
WATER QUALITY CONDITIONS OF APPROVAL OR ISSUANCE			
Water Quality Conditions from prior approvals or applicable watershed-based plans	Pending issuance. To be provided in Final WQMP.		

SECTION 2 PROJECT DESCRIPTION

2.1 PROJECT DESCRIPTION

DESCRIPTION OF PROPOSED PROJECT				
Site Location:	APN 656-242-18 Includes the following addresses: 30139, 30341, 30143 Crown Valley Parkway, 30141 Alicia Parkway, 23560 and 30102 Pacific Island Drive, Laguna Niguel CA 92677			
Project Area (ft^2): 1,022,805 ft^2	**Number of Dwelling Units:** 275		**SIC Code:**	
Narrative Project Description:	The Laguna Niguel City Center will consist of approximately 206,500 sf of commercial space, 275 residential apartments, and an outdoor plaza. It will be located on about 23.5 acres (23.1 acres disturbed and treated) at the southwest corner of Pacific Island Drive and Alicia Parkway in the City of Laguna Niguel. The commercial portion of the project will include retail, restaurant, office, and library space surrounding multiple outdoor amenity areas and the town center plaza. Parking will be a combination of garage and surface. The residential portion of the new project will be composed of approximately 275 apartment units in two buildings. Pool, gym, clubhouse, leasing office, and other amenities will be included. Parking will be below podium and subterranean. The Site is bordered by Laguna Niguel City Hall to the southeast, Alicia Parkway to the northeast, Pacific Island Drive to the north, and a residential development upslope to the west. Retail/commercial uses are located north of Pacific Island Drive, northeast of Alicia Parkway and south of Crown Valley Parkway. Access is from Pacific Island Drive to the north, Alicia Parkway to the east, and Crown Valley Parkway from the South.			
Project Area	**Pervious**		**Impervious**	
	Area (acres or sq ft)	**Percentage**	**Area (acres or sq ft)**	**Percentage**
Pre-Project Conditions	572,771 sq ft	56%	450,034 sq ft	44%
Post-Project Conditions	153,421 sq ft	15%	869,384 sq ft	85%

2.2 POST-DEVELOPMENT DRAINAGE CHARACTERISTICS

The development will remove the existing 60-inch RCP city storm drain that runs approximately parallel from Highland Drive and connects to Crown Valley Parkway and install a new 60" RCP storm drain realigned to follow the alignment of the proposed roadways. The new alignment will connect to the existing 60-inch storm drain at the intersection of Pacific Island Drive and Highlands Avenue, follow Pacific Island Drive easterly to the west entry of the development off Pacific Island Drive, follow the roadway through the approximate center of the development and cross the parking lot of the retail center on the south side of the project and reconnect to the existing 60-inch storm drain system just north of the north right of way of Crown Valley Parkway. This primary storm drain will convey flows originating from development north of the site (draining down Highlands Ave) through the site to the connection point at Crown Valley. These flows will bypass the development through this pipe and not contribute any tributary flow.

A secondary, private storm drain system will be constructed with the project roadways and convey the project flows through a detention system designed for hydromodification purposes. This detention system is proposed to be located under the parking lot of the retail/market area located on the south side of the project (where the current library is located). The detention basin will be sized and fully calculated in the final hydrology and hydraulics report.

Various area drains and water quality BMP's will be used throughout the central commercial area site to route storm water to the private storm drain system. Alignments and sizes of proposed storm drains will be calculated and described in the Final Hydrology and Hydraulics Report. It is anticipated that these local drainage facilities will be in the 8-inch to 10-inch pipe diameter range. Small landscape drains will connect to the local drain with 4-inch or 6-inch drain pipes throughout the project.

The apartments, located on the east side of the project immediately adjacent to Alicia Blvd, will discharge to the existing landscape area on the eastern side. The volume and flow rate is anticipated to be less than the existing condition due to a much smaller drainage area. The majority of the easterly apartments will convey flow to the private storm drain system in the project roadway.

The townhomes, located in the northwest corner of the site will also convey flows to the private storm drain system.

The retail/market are on the south will drain overland, through water quality BMP's and convey flows via connection pipes to the detention system under the parking lot of that area. The proposed BMP's and detention system will be described in detail in the Final Hydrology and Hydraulics Report and the Final Water Quality Management Plan.

2.3 PROPERTY OWNERSHIP/MANAGEMENT

PROPERTY OWNERSHIP/MANAGEMENT	
Private Streets	Laguna Niguel Town Center Partners
Landscaped Areas	Laguna Niguel Town Center Partners
Library	City of Laguna Niguel
Buildings	Laguna Niguel Town Center Partners

PROPERTY OWNERSHIP/MANAGEMENT	
Storm Drain	Laguna Niguel Town Center Partners
Structural BMPs	Laguna Niguel Town Center Partners

The Owner, Laguna Niguel Town Center Partners, shall assume all BMP maintenance and inspection responsibilities for the proposed project. Inspection and maintenance responsibilities are outlined in Attachment B of this report.

SECTION 3 SITE & WATERSHED CHARACTERIZATION

3.1 SITE CONDITIONS

3.1.1 Existing Site Conditions

Approximately half of the Site is currently undeveloped. The site includes the Orange County Fire Authority Station #5 which will remain. Laguna Niguel Library is also on the site and will be relocated. Several other buildings and parking lots are located on the site and will be demolished. These include the old fire station, a County of Orange Vehicle Maintenance Facility, and the old District Attorney building and Courthouse. Laguna Niguel City Hall is on the corner of Alicia Parkway and Crown Valley Parkway and is not included in this project.

EXISTING LAND USES				
Land Use Description	**Total Area (acres)**	**Impervious Area (acres)**	**Pervious Area (acres)**	**Imperviousness (%)**
Public Library	3.15	2.85	0.3	95
Courthouse	4.25	3.61	0.64	85
Service/Fleet Area	3.0	2.7	0.3	90
Old Fire Station	0.34	0.30	0.04	90
Vacant, Undeveloped	12.76	0.6	12.16	5
Total	**23.50**	**10.06**	**13.44**	**43**

3.1.2 Infiltration-Related Characteristics

Per Figure 7.9a of the South Orange County TGD, the site is located on Type D soils. It is also located in or immediately adjacent to landslide hazard and physiographic feature areas. It is anticipated that infiltration will be infeasible for the project site. Due to the presence of plastic clays and fill soils throughout the project site, current infiltration that occurs on-site is minimal. Development of the project is not anticipated to adversely effect groundwater recharge. On-site infiltration testing will occur as part of the Final WQMP. See Attachment G for a letter from the Geotechnical Engineer stating the infeasibility of infiltration.

3.1.2.1 Hydrogeologic Conditions

A site-specific geotechnical investigation is still pending for the project site, however the project site is not located in an area of known shallow groundwater or adjacent to any groundwater plumes.

3.1.2.2 Soil and Geologic Infiltration Characteristics

Per NRCS Web Soil Survey, the project site is located primarily on Type D soils (marked in red on the figure below). As the area with Type C soils (marked in blue) will be covered by surface and garage parking, the majority of the infiltration opportunities will be within areas with Type D soils. It is not anticipated that infiltration will be feasible for the majority of the project site due to the presence of plastic clays and fill soils throughout the project site, per the preliminary soils report.

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

Tables — Hydrologic Soil Group — Summary By Map Unit

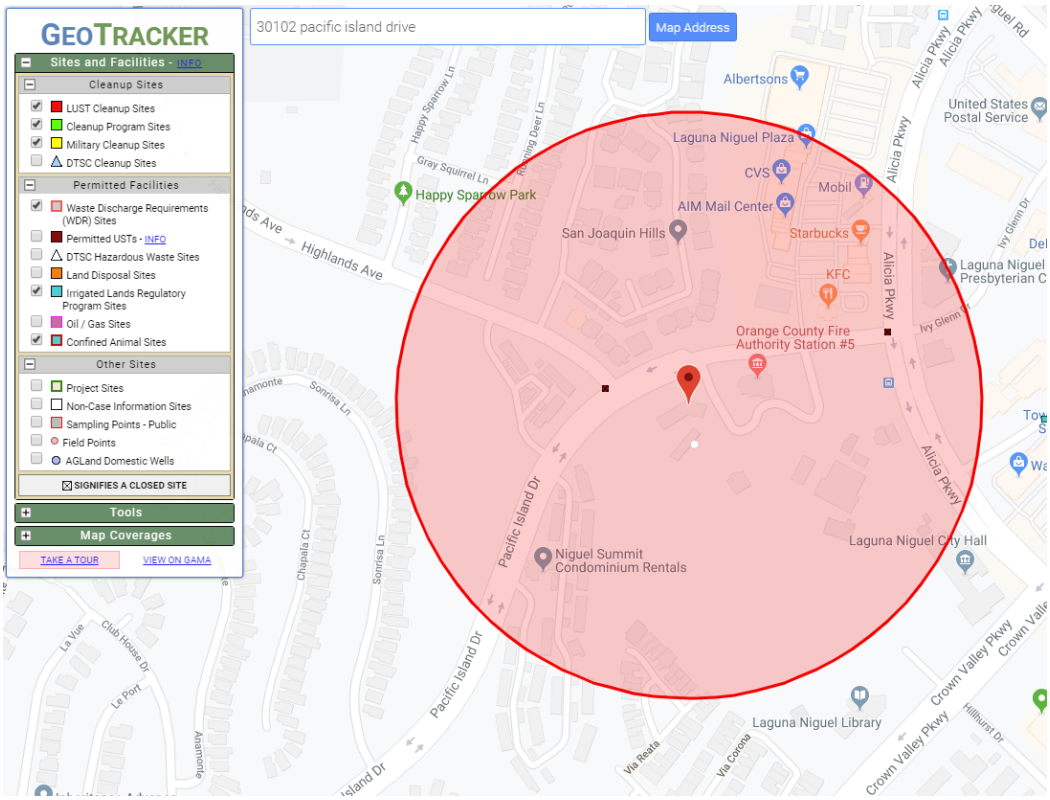
Summary by Map Unit — Orange County and Part of Riverside County, California (CA678)

Summary by Map Unit — Orange County and Part of Riverside County, California (CA678)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
101	Alo clay, 15 to 30 percent slopes, dry	D	18.6	74.8%
127	Bosanko clay, 15 to 30 percent slopes	D	0.2	0.6%
128	Bosanko clay, 30 to 50 percent slopes	D	0.0	0.2%
133	Botella clay loam, 9 to 15 percent slopes	C	5.9	23.7%
134	Calleguas clay loam, 50 to 75 percent slopes, eroded	D	0.2	0.8%
Totals for Area of Interest			**24.9**	**100.0%**

3.1.2.3 Geotechnical Conditions

Overall, it is anticipated that the geotechnical conditions of the project site will not be favorable to infiltration due to presence of fill materials throughout the site, per the preliminary soils report. Per Geotracker, the project site is located at two former Leaking Underground Storage Tank (LUST) Cleanup Sites, currently listed as completed. The Phase I ESA prepared for the project site notes that the former underground storage tanks are considered Historical Recognized Environmental Conditions.



3.1.2.4 Summary of Infiltration Opportunities and Constraints of Existing Site

Based on Figure 7.9 of the South Orange County TGD, the project site is located in an area of multiple overlapping infiltration constraints. Infiltration is not anticipated to be feasible for the project site.

3.2 PROPOSED SITE DEVELOPMENT ACTIVITIES

The Development Area – that is the area to be disturbed within project grading limits – encompasses approximately 23.5 acres that is currently vacant or government and modular buildings. Of these, a total of 23.1 acres will be disturbed and treated via water quality BMPs. The proposed development will consist of 275 proposed residential units and 200,000 square feet of commercial space. A total of approximately 20 acres of the property will be impervious surface, resulting in a proposed imperviousness of 85%, compared to 44% under existing conditions. Refer to Attachment C for the project site plan.

Potential pollutant-generating activities on the site will primarily be from vehicle parking and from passive land-uses by business tenants and residents. All businesses will be retail or commercial with no industrial facilities or heavy commercial facilities anticipated. Wastes generated will be those typically associated with residential sites and retail and food serving establishments.

There is no run-on anticipated for the project site, as potential run-on from the west will be rerouted around the project property. There are no existing environmentally sensitive features to be preserved.

Existing slopes located to the north and west of the project site will be retained and are equipped with drainage systems to capture and divert runoff.

See table below for a breakdown of

PROPOSED LAND USES				
Land Use Description	Total Area (acres)	Impervious Area (acres)	Pervious Area (acres)	Imperviousness (%)
Residential Land Use	4.9	3.92	0.98	80
Commercial Buildings	2.36	2.36	0.0	100
Streets, Drive Aisles	10.1	10.1	0.0	100
Surface Parking Lots	2.07	2.07	0.0	100
Parking Garages	1.51	1.51	0.0	100
Landscaping	2.56	0.0	2.56	0
Total	**23.5**	**19.96**	**3.54**	**84.9**

3.2.1 Overview of Site Development Activities

The proposed development of the project site involves the demolition of the existing buildings on site, outside of the fire station and City Hall buildings, and the construction of buildings throughout that include residential units, commercial facilities, a parking garage, and a new library. The construction of the proposed mixed-use building will result in greater impervious surface than the in the existing condition (85% impervious proposed versus 43% impervious existing). The stormwater runoff from the proposed development will discharge to the same existing storm sewer system on Crown Valley Parkway as the runoff under existing conditions and will continue to enter Sulfur Creek before discharging to Aliso Creek. The City line on Crown Valley Parkway will have adequate capacity for the proposed flows.

3.2.2. Project Attributes Influencing Stormwater Management

No loading docks, outdoor storage areas, vehicle wash areas, or hazardous materials storage are proposed on the project site. Parking will be provided for the proposed mixed-use, residential, and commercial buildings via garage parking on basement and low levels of the podium buildings and through surface lots. Native vegetation will be provided on the project site to minimize the amount of imperviousness proposed and minimize the potable water demands for irrigation.

3.2.3 Effects on Infiltration and Harvest and Use Feasibility

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

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

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

The equation used to calculate the Modified EAWU is:

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

Where:

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

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

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

The overall project site was evaluated using the impervious/pervious land area ratios and planting types to estimate the feasibility for harvest and reuse systems on-site. The following table summarizes the estimated applied water use for the project site.

ESTIMATED APPLIED WATER USE (EAWU) FOR COMMON AREA LANDSCAPING							
Drainage Area & Landscape Type	Total Area (ac)	% Imp	Imp Tributary (ac)	Irrigated LS Area (ac)	ETo_{wet}(1) (in/mo)	K_L(2)	Modified EAWU (gpd)
Blended	23.5	0.85	20.0	3.5	2.75	0.55	3,867
Design Capture Volume (gal)		51,046	Drawdown (days)	98.7	Is Drawdown of DCV <48 hours?		No
Notes: 1 Per Table F-2 for Laguna Beach (similar climate type), South OC Technical Guidance Document, September 28, 2017. 2 Per Table F-4 of the South OC Technical Guidance Document, September 28, 2017							

Based on the proposed drawdown time of 98.7 days, harvest and use will not be feasible for the Project. Treatment requirements will be satisfied through Low Impact Development (LID) BMPs.

3.3 RECEIVING WATERBODIES

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

- Aliso Creek – Benthic Community Effects, Indicator Bacteria, Malathion, Nitrogen, Selenium, Phosphorous, Toxicity

Established TMDLs for the receiving water bodies include:

- Aliso Creek – Indicator Bacteria

3.4 STORMWATER POLLUTANTS OR CONDITIONS OF CONCERN

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

3.5 HYDROLOGIC CONDITIONS OF CONCERN

Does a hydrologic condition of concern exist for this project?

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

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

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

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

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

The project site's runoff discharges to downstream conveyances that are considered hydromodification susceptible, in that they are un-lined, largely earthen channels. Aliso Creek and Sulfur Creek are not concrete-lined. Therefore, under South Orange County hydromodification requirements, post-development runoff flow rates and durations cannot exceed pre-development, naturally occurring, runoff flow rates and durations by more than 10% of the time, from 10% of the 2-year runoff event up to the 10-year runoff event.

Hydromodification requirements will be satisfied through use of a detention system designed to mitigate peak flows to within 10% of existing conditions.

3.6 CRITICAL COARSE SEDIMENT YIELD AREAS

Based on Figure 4 of Appendix N.8 of the South Orange County TGD, there is one small area of critical coarse sediment yield on the project site. However, per the preliminary soils investigation the site is largely overlain will fill soils and site soils are generally high-plastic clay type soils. Therefore, critical coarse sediment yield is not anticipated to be a feature on the project site. Site-specific critical coarse sediment yield data will be included in the Final WQMP.

SECTION 4 SITE PLAN AND DRAINAGE PLAN

4.1 DRAINAGE MANAGEMENT AREA DELINEATION

In accordance with the South Orange County Model WQMP and Technical Guidance Document (TGD), the project site has been divided into Drainage Management Areas (DMAs) to be utilized for defining drainage areas and sizing LID and other treatment control BMPs. The DMAs were delineated based on the project's proposed condition hydrology. As infiltration is considered to be infeasible for the project site, propriety flow-based biofiltration BMPs are proposed throughout the project site. All flows will drain to a large detention system.

4.2 OVERALL SITE DESIGN BMPS

The following site design BMPs were all considered per the South Orange Count Technical Guidance Document, Section 3.

Minimize Impervious Area

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

Maximize Natural Infiltration Capacity

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

Preserve Existing Drainage Patterns and Time of Concentration

Runoff from the site will continue to flow similar to existing conditions. Low-flows and first-flush runoff will drain to landscaping and bioretention BMPs.

Disconnect Impervious Areas

Runoff from the site will drain into self-treating landscaping or proprietary biotreatment BMPs prior to flowing to a detention gallery for storage and controlled release of flows to protect downstream receiving waters. All low flows will also be directed into biotreatment facilities which provide filtration as well as flow attenuation.

Protect Existing Vegetation and Sensitive Areas

Under the existing conditions, there are not sensitive areas to protect. The project design will create new vegetated areas throughout the property.

Revegetate Disturbed Areas

All disturbed areas on the project site will be paved, covered, or revegetated.

Soil Stockpiling and Site Generated Organics

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

Firescaping

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

Water Efficient Landscaping

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

Slopes and Channel Buffers

Adjacent slopes and channels will be protected and reinforced to reduce the risks of scouring.

4.3 DMA CHARACTERISTICS AND SITE DESIGN BMPS

4.3.1 DMAs O1-O5

These DMAs are off-site and are used for hydrology calculations but will not be included as part of the proposed project and associated water quality treatment.

4.3.2 DMA A1-E9

Individual DMA characteristics will be determined as site design is finalized. Individual DMA narrative summaries will be included in the Final WQMP.

4.3.3 DMA Summary

DRAINAGE MANAGEMENT AREAS				
DMA (Number/Description)	Total Area (acres)	Imperviousness (%)	Infiltration Feasibility Category (Full, Partial or No Infiltration)	Hydrologic Source Controls Used
A1	0.70	90%	No Infiltration	N/A
B1	1.10	80%	No Infiltration	N/A
C1	2.80	80%	No Infiltration	N/A
C2	2.20	90%	No Infiltration	N/A
D1	2.50	90%	No Infiltration	N/A

DRAINAGE MANAGEMENT AREAS				
DMA (Number/Description)	Total Area (acres)	Imperviousness (%)	Infiltration Feasibility Category (Full, Partial or No Infiltration)	Hydrologic Source Controls Used
D2	0.80	90%	No Infiltration	N/A
E1	2.70	90%	No Infiltration	N/A
E2	0.50	90%	No Infiltration	N/A
E3	0.30	90%	No Infiltration	N/A
E4	2.50	90%	No Infiltration	N/A
E5	1.40	80%	No Infiltration	N/A
E6	2.20	80%	No Infiltration	N/A
E7	0.3	85%	No Infiltration	N/A
E8	1.90	85%	No Infiltration	N/A
E9	1.20	85%	No Infiltration	N/A

4.4 SOURCE CONTROL BMPS

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

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

N1, Education for Property Owners, Tenants and Occupants

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

N2, Activity Restrictions

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

N3, Common Area Landscape Management

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

N4, BMP Maintenance

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

N11, Common Area Litter Control

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

N12, Employee Training

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

N14, Common Area Catch Basin Inspection

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

N15, Street Sweeping Private Streets and Parking Lots

The Owner shall be responsible for sweeping all on-site streets, drive aisles, and uncovered parking areas within the project on a quarterly basis.

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

STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Check One		Reason Source Control is Not Applicable
		Included	Not Applicable	
S1	Provide storm drain system stenciling and signage	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	No outdoor material storage areas proposed.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☒	☐	
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☒	☐	No slopes on site.
Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)		☒	☐	
S6	Dock areas	☐	☒	No loading docks are proposed.
S7	Maintenance bays	☐	☒	No maintenance bays are proposed.
S8	Vehicle wash areas	☐	☒	No vehicle wash areas are proposed.
S9	Outdoor processing areas	☐	☒	No outdoor material storage areas are proposed.
S10	Equipment wash areas	☐	☒	No equipment wash areas are proposed.
S11	Fueling areas	☐	☒	No fueling areas are proposed.
S12	Hillside landscaping	☒	☐	
S13	Wash water control for food preparation areas	☒	☐	

STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Check One		Reason Source Control is Not Applicable
		Included	Not Applicable	
S6	Dock areas	☐	☒	No loading docks are proposed.

S1, Provide storm drain system stenciling and signage

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

S3, Design and construct trash and waste storage areas to reduce pollution introduction

All trash and waste shall be stored in containers that have lids or tarps to minimize direct precipitation into the containers. Multiple trash enclosures will be located throughout the project site. The trash storage areas will be designed to City standards, and will be walled, roofed, have gates and proper drainage per City standards.

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

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

S5, Protect slopes and channels and provide energy dissipation

The site drainage design shall include appropriate BMPs to decrease the potential for erosion of slopes and/or channels. The design shall be consistent with Federal, State, and local standards (e.g., RWQCB, ACOE, CDFG). Where feasible, the following principles shall be considered: 1) convey runoff safely from the tops of slopes, 2) avoid disturbing steep or unstable slopes, as well as natural channels, 3) implement a permanent stabilization BMP on disturbed slopes and channels as quickly as possible, such as native vegetation, and 4) install energy dissipaters at the outlets of new storm drains, culverts, or channels.

S12, Properly Design: Hillside landscaping

All slopes shall be vegetated and stabilized to prevent erosion, in accordance with "Efficient Irrigation and Landscape Design" source control BMP to prevent erosion.

S13, Properly Design: Wash water control for food preparation areas

All wash water from food prep areas will be controlled and proper staff training conducted by the site operator. Food preparation facilities shall meet all health and safety, building and safety and any other applicable regulations, codes requirements, including installation of a grease interceptor where required. Sinks shall be contained with sanitary sewer connections for disposal of wash waters containing kitchen and food wastes.

SECTION 5 LOW IMPACT DEVELOPMENT BMPS

5.1 LID BMPS IN INDIVIDUAL DMAS

A DMA-specific breakdown of proposed s and LID BMPs will be provided as site design is finalized.

5.1.1 Hydrologic Source Controls for Individual DMAs

Hydrologic Source Controls are not proposed for this project.

5.1.2 Structural LID BMPs for Individual DMAs.

LID treatment throughout the project site will be provided by Modular Wetlands Systems or an equivalent biofiltration BMP.

Modular Wetland System Biotreatment BMP

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

- Modular Wetlands are the only proprietary biotreatment device approved through the Washington State University TAPE (Technology Assessment Protocol – Ecology) program for basic storm water treatment and enhanced treatment including sediment, nutrients and heavy metals (all proposed pollutants of concern for the Upper and Lower Newport Bay watersheds). TAPE approval is based on a series of independent field studies using strict sampling criteria to validate vendor's claims. TAPE approval is considered one of the most stringent and most reliable in the Country.

- Modular Wetlands have a pre-treatment chamber that is specifically designed to capture fine sediments and particulates through a series of BioMediaGREEN sponges which prohibit the fines and particulates from entering the bioretention chamber and accelerating potential clogging of the bioretention soil. The City of Huntington Beach has installed a Modular Wetland for a residential neighborhood and has monitored the maintenance and functionality of the system for several years. Contact: Mark Birchfield, City of Huntington Beach (714-375-5041; MBirchfield@surfcity-hb.org)

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

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

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

These systems were selected based on their ability to treat the project's pollutants of concerns to a medium or high effectiveness, in accordance with the Model WQMP and TGD requirements. The table below summarizes the overall treatment effectiveness for Modular Wetlands, derived from Table 4.2 of the Technical Guidance Document and testing data provided by the manufacturer. Additional details for the Modular Wetland units included in Section VI of this WQMP.

POLLUTANTS OF CONCERN AND PERFORMANCE RATINGS

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

Notes:
1 See Section II.2 for pollutants of concern.
2 Per Table 4.2 of the Model WQMP's companion Technical Guidance Document dated May 19, 2011.
3 Based on third-party independent field tests for a high-flow biotreatment system with raised under drain (Modular Wetland System-Linear).

5.2 SUMMARY OF LID BMPS

BMP DESIGN SUMMARY								
DMA	Total Drainage Area (ac)	% Imp.	80% Capture Q (cfs)	Design Q (cfs)	Structural LID BMP	Capacity (cfs)	Units Proposed	Total Capacity (cfs)
A1	0.70	90%	0.150	0.225	*MWS-L-4-19*	*0.237*	*1*	0.237
B1	1.10	80%	0.215	0.322	*MWS-L-8-12*	*0.346*	*1*	0.346
C1	2.80	80%	0.546	0.819	*MWS-L-8-16*	*0.462*	*2*	0.924
C2	2.20	90%	0.472	0.708	*MWS-L-8-16*	*0.462*	*2*	0.924
D1	2.50	90%	0.536	0.804	*MWS-L-8-16*	*0.462*	*2*	0.924
D2	0.80	90%	0.172	0.257	*MWS-L-4-21*	*0.268*	*1*	0.268
E1	2.70	90%	0.579	0.869	*MWS-L-8-16*	*0.462*	*2*	0.924
E2	0.50	90%	0.107	0.161	*MWS-L-4-21*	*0.268*	*1*	0.268
E3	0.30	90%	0.064	0.097				
E4	2.50	90%	0.536	0.804	*MWS-L-8-16*	*0.462*	*2*	0.924
E5	1.40	80%	0.273	0.410	*MWS-L-8-16*	*0.462*	*1*	0.462
E6	2.20	80%	0.429	0.644	*MWS-L-8-24*	*0.693*	*1*	0.693
E7	0.3	85%	0.451	0.092	*MWS-L-8-24*	*0.693*	*1*	0.693
E8	1.90	85%	0.389	0.584				
E9	1.20	85%	0.246	0.369	*MWS-L-8-16*	*0.462*	*1*	0.462

SECTION 6 HYDROMODIFICATION BMPS

6.1 POINTS OF COMPLIANCE

Hydromodification compliance requires that all discharge points containing impervious areas related to the development project that discharge to natural areas be accounted for. All flows from the impervious areas on the project site are routed into the underground detention gallery and, as such, there is only one Point of Compliance (POC 1) for this project site. Refer to the exhibits in Attachment C for the location of POC 1.

6.2 PRE-DEVELOPMENT (NATURAL) CONDITIONS

All pre-development conditions including exhibits and calculations are provided in Attachment E within this report. A brief summary of the existing conditions SOHM modeling results are provided below. Refer to Attachment E for more details.

PRE-DEVEOPMENT FLOW CONDITIONS	
Return Period	Pre-Development Flow (cfs)
2-year	13.42
5-year	16.74
10-year	21.26

6.3 POST-DEVELOPMENT CONDITIONS AND HYDROMODIFICATION BMPS

To mitigate the increased flows under post-development conditions, an underground detention gallery has been proposed that will decrease post-development peak flows to be less than the pre-development flows for the 2-year up to the 10-year storm frequency events. This gallery will be sized in accordance with the SOC TGD and will meet hydromodification requirements.

One underground detention system will be incorporated in the project site to provide flow duration control. Both treated low flows from the site and high flows below the hydromodification volume will be routed to the detention gallery and slowly released through a small orifice to provide flow duration control for the 2-year through the 10-year events. High flows beyond the hydromodification volume will bypass detention and connect directly to the existing storm drain junction and line on Crown Valley Parkway.

HYDROMODIFICATION BMPs & VOLUME SUMMARY				
Hydromod Facility	Details	Minimum Detention Volume Required (ft^3)	Detention Volume Provided (ft^3)	Detention Volume Provided (ac-ft)
Underground Detention System	Concrete Vault System	73,125	80,000	2.86

A concrete vault structure, sized 7.5' x 95' x 175' is proposed. The system will have an approximate capacity of 80,000 cubic feet of capacity, which is greater than the required detention volume of 73,125 cubic feet per SOHM modeling (See Section 6.5). See table below for mitigated flow conditions.

MITIGATED FLOW CONDITIONS	
Return Period	Pre-Development Flow (cfs)
2-year	10.48
4-year	14.12
10-year	16.87

6.4 MEASURES FOR AVOIDANCE OF CRITICAL COARSE SEDIMENT YIELD AREAS

Per the initial soils investigation, this project is not anticipated to impact critical coarse sediment supply.

6.5 HYDROLOGIC MODELING AND HYDROMODIFICATION COMPLIANCE

Hydromodification calculations for this project were performed using the South Orange County Hydrology Model (SOHM), March 2012 version, developed by Clear Creek Solutions, Inc. The results are summarized in the table below. Additional information on the SOHM methodology regarding this project and a copy of the SOHM Project Report output, which includes calculations for the pre-developed area and proposed (mitigated) storm water flood routing system, is provided in Attachment E.

Based on the results of the proposed hydromodification BMPs, the post-development discharges will be reduced to less than the existing pre-development discharges. The table below provides a summary of the proposed mitigated (post-developed) conditions based on the SOHM modeling results. The post-development peak flows will be diverted to a large underground detention system to reduce the rate of discharge in the post-developed condition to be less than the pre-developed conditions, thereby mitigating hydrologic conditions of concern from the subject property. Additional details on the subsurface detention system BMP design are provided in Attachment E.

Return Period	Pre-Developed Flow (cfs)	Post-Developed (mitigated) Flow (cfs)	Percent Difference
2 year	13.42	10.48	-22%
5 year	16.74	14.12	-16%
10 year	21.26	16.87	-21%
25 year	28.38	22.33	-21%

SECTION 7 EDUCATIONAL MATERIALS INDEX

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

ATTACHMENTS

ATTACHMENT A

EDUCATION MATERIALS

The Ocean Begins at Your Front Door

Orange County Stormwater Program

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

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

Did You Know?

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

Where Does It Go?

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

Sources of Non-Point Source Pollution

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

The Effect on the Ocean

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

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

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

PROJECT POLLUTION PREVENTION

For More Information

California Environmental Protection Agency
www.calepa.ca.gov

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

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

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

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

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

Stormwater Best Management Practice Handbook
Visit www.cabmphandbooks.com

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

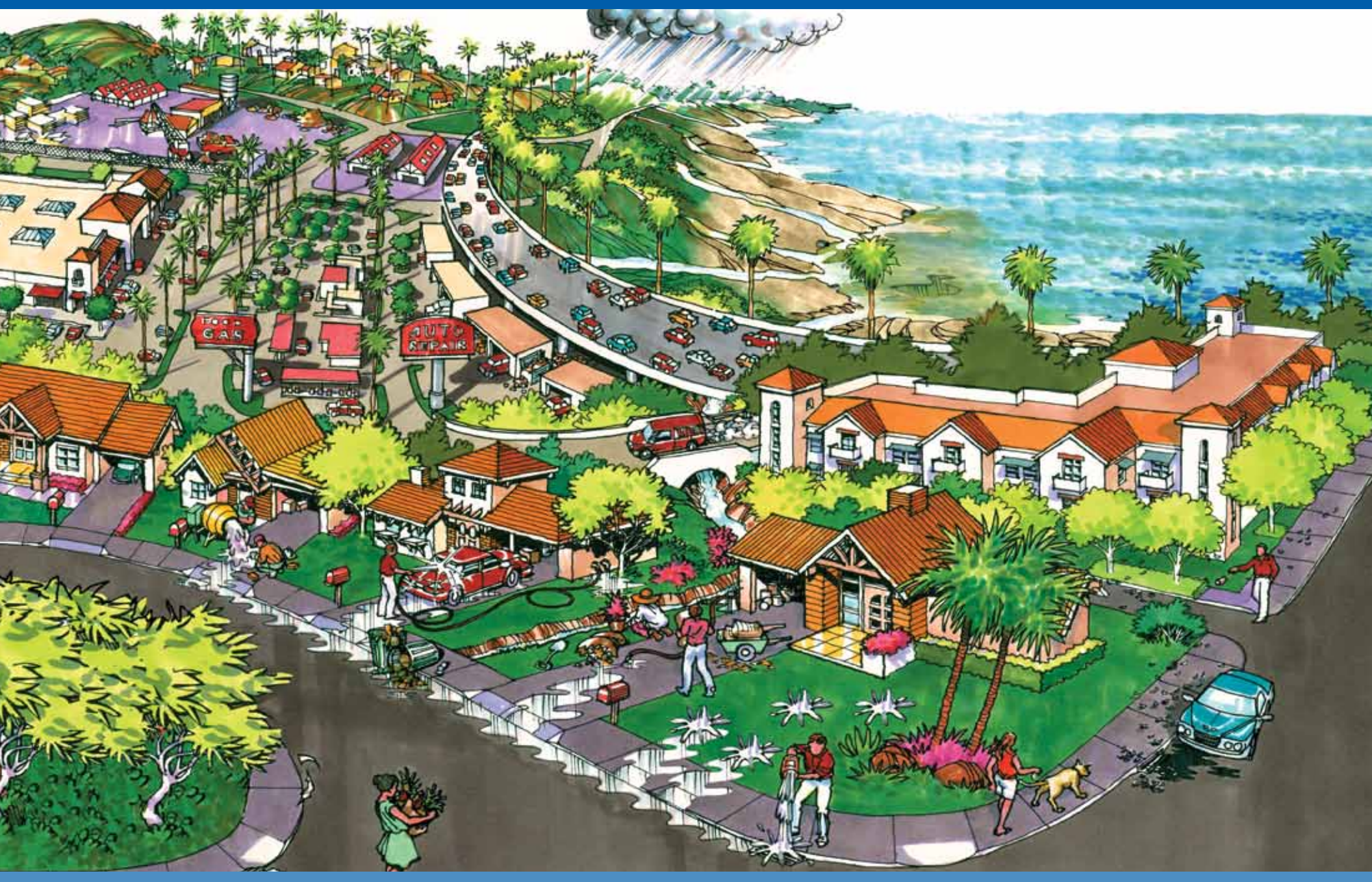
The Orange County Stormwater Program has created and moderates an electronic mailing list to facilitate communications, take questions and exchange ideas among its users about issues and topics related to stormwater and urban runoff and the implementation of program elements. To join the list, please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

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

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

On-line Water Pollution Problem Reporting Form
www.ocwatersheds.com

The Ocean Begins at Your Front Door



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

Follow these simple steps to help reduce water pollution:

Household Activities

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

Automotive

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

Pool Maintenance

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

Landscape and Gardening

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

Trash

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

Pet Care

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

Common Pollutants

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

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

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

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

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

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

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

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

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

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

For emergencies, dial 911.

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

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

RECYCLE USED OIL

Help Prevent Ocean Pollution:

Household Tips

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Pollution Prevention

Household Activities

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

Household Hazardous Wastes include:

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

Gardening Activities

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

Washing and Maintaining Your Car

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

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

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

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

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

UCCE Master Gardener Hotline:
(714) 708-1646

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

For emergencies, dial 911.

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

11-59
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Help Prevent Ocean Pollution:

Tips for Landscape & Gardening

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Landscape & Gardening

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

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.
- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.

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

Garden & Lawn Maintenance

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

- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.

- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit **www.ipm.ucdavis.edu**.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

Household Hazardous Waste Collection Centers

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

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

Preventing water pollution at your commercial/industrial site

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

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

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

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

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

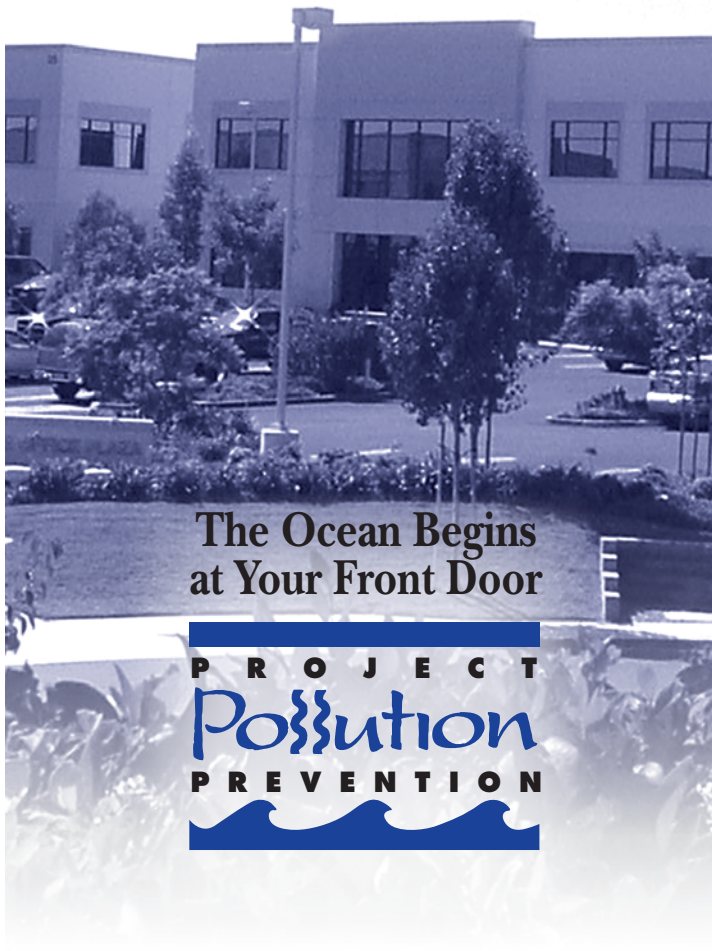
For emergencies, dial 911.

RECYCLE USED OIL

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Proper Maintenance Practices for Your Business



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Proper Maintenance Practices for your Business

Landscape Maintenance

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

Building Maintenance

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

NEVER DISPOSE OF ANYTHING IN THE STORM DRAIN.

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

PROJECT Pollution PREVENTION

ATTACHMENT B

OPERATIONS AND MAINTENANCE (O&M) PLAN

OPERATION & MAINTENANCE (O&M) PLAN FOR WQMP

Project Name:

LAGUNA NIGUEL CITY CENTER

Prepared for:

LAGUNA NIGUEL TOWN CENTER PARTNERS
18802 Bardeen Ave #1521
Irvine, CA 96212
949-756-5959

Prepared on:

8/18/2021

CONTENTS

SECTION 1 PROJECT DESCRIPTION AND BMP OVERVIEW

GENERAL PROJECT ATTRIBUTES AND STORMWATER CONTROL MEASURES		
Site Location:	APN 656-242-218 Includes the following addresses: 30139, 30341, 30143 Crown Valley Parkway, Laguna Niguel CA 92677 30141 Alicia Parkway, Laguna Niguel, CA 92677 23560 and 30102 Pacific Island Drive	
Project Area:	**Number of Dwelling Units:** 275	**SIC Code:**
Narrative Project Description:	The Laguna Niguel City Center will consist of approximately 206,500 sf of commercial space, 275 residential apartments, and an outdoor plaza. It will be located on about 23.5 acres at the southwest corner of Pacific Island Drive and Alicia Parkway in the City of Laguna Niguel. The commercial portion of the project will include retail, restaurant, office, and library space surrounding multiple outdoor amenity areas and the town center plaza. Parking will be a combination of garage and surface. The residential portion of the new project will be composed of approximately 275 apartment units in two buildings. Pool, gym, clubhouse, leasing office, and other amenities will be included. Parking will be below podium and subterranean. The Site is bordered by Laguna Niguel City Hall to the southeast, Alicia Parkway to the northeast, Pacific Island Drive to the north, and a residential development upslope to the west. Retail/commercial uses are located north of Pacific Island Drive, northeast of Alicia Parkway and south of Crown Valley Parkway. Access is from Pacific Island Drive to the north, Alicia Parkway to the east, and Crown Valley Parkway from the South.	
Project-Specific Source Control BMPs:	N1 Education for Property Owners, Tenants & Occupants N2 Activity Restrictions N3 Common Area Landscape Management N4 BMP Maintenance N11 Common Area Litter Control N12 Employee Training N14 Common Area Catch Basin Inspection N15 Street Sweeping Private Streets and Parking Lots S1 Provide storm drain system stenciling and signage S4 Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control. S5 Protect slopes and channels S12 Hillside Landscaping	

GENERAL PROJECT ATTRIBUTES AND STORMWATER CONTROL MEASURES	
	S13 Wash Water for Food Prep Areas
Summary of Drainage Patterns:	The development will remove the existing 60-inch RCP city storm drain that runs approximately parallel from Highland Drive and connects to Crown Valley Parkway and install a new 60" RCP drain realigned to follow the alignment of the proposed roadways. The new alignment will connect to the existing 60-inch storm drain at the intersection of Pacific Island Drive and Highlands Avenue, follow Pacific Island Drive easterly to the west entry of the development off Pacific Island Drive, follow the roadway through the west side of the development and cross the parking lot of the retail/market center on the south side of the project and reconnect to the existing 60-inch storm drain system just north of the north right of way of Crown Valley Parkway. This primary storm drain will convey flows originating from development north of the site (draining down Highlands Ave) through the site to the connection point at Crown Valley. These flows will bypass the development through this pipe and not contribute any tributary flow. A secondary, private storm drain system will be constructed with the project roadways and convey the project flows through a detention system designed for hydromodification purposes. This detention system is proposed to be located under the parking lot of the retail/market area located on the south side of the project (where the current library is located). The detention basin will be sized and fully calculated in the final hydrology and hydraulics report. Various area drains and water quality BMP's will be used throughout the central commercial area site to route storm water to the private storm drain system. The site plan is not developed enough at this conceptual stage to have alignments set or sizes established. It is anticipated that these local drainage facilities will be in the 8-inch to 10-inch pipe diameter range. Small landscape drains will connect to the local drain with 4-inch or 6-inch drain pipes throughout the project.
Summary of Hydrologic Source Controls:	N/A.

GENERAL PROJECT ATTRIBUTES AND STORMWATER CONTROL MEASURES	
Structural Treatment and Hydromodification BMPs:	A detention system is proposed to detain the hydromodification volume.

BMP ID	BMP Type	Narrative Description	Location	Other Considerations
BMP A1	*MWS-L-4-19*	Proprietary Biofiltration Device	Pending	
BMP B2	*MWS-L-8-12*	Proprietary Biofiltration Device	Pending	
BMP C1	*MWS-L-8-16*	Proprietary Biofiltration Device	Pending	
BMP C2	*MWS-L-8-16*	Proprietary Biofiltration Device	Pending	
BMP D1	*MWS-L-8-16*	Proprietary Biofiltration Device	Pending	
BMP D2	*MWS-L-4-21*	Proprietary Biofiltration Device	Pending	
BMP E1	*MWS-L-8-16*	Proprietary Biofiltration Device	Pending	
BMP E2	*MWS-L-4-21*	Proprietary Biofiltration Device	Pending	
BMP E3				
BMP E4	*MWS-L-8-16*	Proprietary Biofiltration Device	Pending	
BMP E5	*MWS-L-8-16*	Proprietary Biofiltration Device	Pending	
BMP E6	*MWS-L-8-24*	Proprietary Biofiltration Device	Pending	
BMP E7	*MWS-L-8-24*	Proprietary Biofiltration Device	Pending	
BMP E8				
BMP E9	*MWS-L-8-16*	Proprietary Biofiltration Device	Pending	

SECTION 2 PERSONNEL, DOCUMENTATION, AND REPORTING

2.1 MAINTENANCE ROLES AND RESPONSIBILITIES

The roles related to O&M of the BMPs are defined as follows:

- *Facility Owner* – The Facility Owner is the party who is ultimately responsible for the functionality of all BMPs. The maintenance agreement (Attachment 2) identifies the facility owner for each BMP, including the timing of any ownership transitions.
- *Responsible Party* – The Responsible Party is the party that shall have direct responsibility for the O&M of the BMPs. This party shall be the designated contact with inspectors and lead maintenance personnel. The Responsible Party shall sign self-inspection reports and any correspondence regarding the verification of inspections and required maintenance. The Responsible Party will establish a system to delegate general inquiries to the appropriate maintenance personnel concerning the operation and maintenance of the BMPs. The Responsible Party reports directly to the Facility Owner and operates and manages the BMPs on the Facility Owner's behalf.
- *Designated Emergency Respondent* – The Designated Emergency Respondent is the party responsible for directing activities and communications during emergencies such as broken irrigation pipes, landslides, hazardous spill responses etc., that would require immediate response should they occur during off-hours. It is the responsibility of the Designated Emergency Respondent to communicate the emergent situation with the Responsible Party as soon as possible.
- *Key Maintenance Personnel* – Key Maintenance Personnel are the designated lead field manager(s) or supervisor(s) who directly oversee and delegate the maintenance activities, maintain the scheduling, and coordinate activities between all personnel. These tend to change more often than other personnel over time, so their names do not necessarily need to be included in the O&M Plan. However, they must be properly trained as recorded in the training logs (Section 2.2).

The table below lists the roles for this project. This table must be updated whenever changes occur.

Role	Name (Title and Affiliation)	Phone Number	Address	Email Address
Facility Owner				
Responsible Party				
Designated Emergency Respondent				

2.2 QUALIFICATION AND TRAINING REQUIREMENTS FOR PERSONNEL

Many of the activities presented in this O&M plan can be completed by personnel with basic landscaping and yard maintenance skills and project-specific orientation. However, there are activities that require a more experienced skillset to identify and remediate potential issues that could compromise the functionality of each BMP. The Responsible Party shall exercise discretion in determining the skillset required to complete each task.

Activities that can typically be completed by maintenance personnel with basic training and/or qualifications include:

- General landscaping activities (pruning, weeding, and raking)
- Routine sediment, trash and debris removal;
- Filling in minor scour or erosion areas, or replacing rip rap that has become displaced; and
- Watering or irrigation, as necessary.

Activities that typically require maintenance personnel with specialized qualifications, training, and/or engineering oversight include:

- Inspection and/or repair of inflow and outflow structures;
- Inspection and/or repair of underground elements;
- Large-volume sediment or media removal requiring specialized equipment;
- Inspection, diagnosis, and remediation of significant erosion issues potentially compromising function and/or structural stability; and
- Spill response and remediation.

Maintenance personnel who have identified a potential major issue with any facility should contact the designated key maintenance personnel for the facility immediately.

Training must be provided for all personnel performing maintenance tasks on or providing maintenance oversight of structural BMPs. The table below provides the personnel and relevant training topics.

Training Logs contained in Attachment 3 should be used to document training of maintenance personnel.

Training Topic	Responsible Party	Designated Emergency Respondent	Key Maintenance Personnel
Proper Maintenance of all BMP components	X		X
Identification and clean-up procedures for spills and overflows	X	X	X
Safety concerns when maintaining devices and responding to emergency situations	X	X	X

2.3 MAINTENANCE AGREEMENTS AND FUNDING MECHANISMS

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

2.4 RECORD KEEPING REQUIREMENTS

Documentation of site conditions, maintenance activities performed, and any other remaining maintenance required is necessary during each inspection/maintenance visit. Inspection and maintenance records shall be retained in an accessible, secure location for the life of the facility, and not less than 5 years.

The following documentation mechanisms and procedures have been established for this O&M Plan:

- Training Logs: Personnel must document training activities as part of implementing this O&M Plan. Attachment 3 contains a sample training log.
- Inspection and Routine Maintenance Logs: Maintenance personnel are required to maintain logs of inspection and maintenance activities. Attachment 4 contain inspection and maintenance logs.
- Rehabilitative and Corrective Maintenance Log and Reporting: Rehabilitation and corrective maintenance activities should be documented at a degree of detail that is commensurate to the complexity/significance of the activity. Any significant changes to the BMP designs that arise from rehabilitation/corrective maintenance will be documented via an update to the Project WQMP and as-built drawings. Corrective maintenance that does not result in design changes will be documented as a special entry in the maintenance logs to provide pertinent details of that rehabilitative or corrective maintenance activity.

2.5 REQUIRED PERMITS ASSOCIATED WITH MAINTENANCE ACTIVITIES

The Project is not subject to any permits.

2.6 SELF-REPORTING REQUIREMENTS

The WQMP Verification Form (Attachment 4) shall be completed accurately and submitted, with associated documentation, to the City of Laguna Niguel by September 30 of each year, or as requested by the City. Failure to complete and submit the verification form will result in a noncompliance and enforcement actions may be taken.

2.7 CITY INSPECTIONS

The City of Laguna Niguel may conduct a site inspection to evaluate compliance with the Project WQMP, at any time, in accordance with Laguna Niguel Municipal Code Section 6-3-406, Storm Water/Surface Runoff Water Quality, Inspections.

2.8 ELECTRONIC DATA SUBMITTAL

This document, along with the attachments, shall be provided to the City or County in PDF format. Autocad files and/or GIS coordinates of BMPs shall also be submitted to the City/County.

SECTION 3 INSPECTION AND MAINTENANCE ACTIVITIES

This section identifies the inspection and O&M activities for each BMP incorporated into the project. Section 3.1 and 3.2 contain common maintenance activities and frequencies associated with Source Control BMPs and HSCs, respectively. Section 3.3 contains individual tables for each structural LID or hydromodification BMP with an explanation of the various types of maintenance activities associated with these BMPs.

3.1 INSPECTION AND MAINTENANCE OF SOURCE CONTROL BMPS

Source Control BMP	Activity	Frequency
Dry Weather Flow Source Control Note: this is a South Orange County High Priority Water Quality Condition for All Projects	Check for dry weather flows such as street washing, irrigation overspray, air conditioner condensate in areas of the project that do not drain to LID BMPs, the sanitary sewer, or landscaped pervious areas. Notify residents of any dry weather flows and follow up to correct.	Twice per year during dry season
	Inspect project outfall or most-downstream project manhole for presence of dry weather flow. If present, conduct reconnaissance to determine source and implement actions to eliminate source.	Twice per year during dry season
N1. Education for Property Owner's Tenants and Occupants	Distribute appropriate materials to owners, tenants, and/or occupants via contract language, mailings, website, or meetings.	Information provided to owners and tenants upon sale or lease. Reminders sent or posted as needed.
	Check www.ocwatersheds.com and/or City website for updated educational materials.	Annually
N2. Activity Restrictions	Within the CC&R's or lease agreement, restrict the following activities: handling and disposal of contaminants, fertilizer and pesticide application restrictions, litter control and pick-up, and vehicle or equipment repair and maintenance in non- designated areas, as well as any other activities that may potentially contribute to water pollution.	Information provided to owners and tenants upon sale or lease. Reminders sent or posted as needed.
N3/S4. Common Area Landscape Management, Efficient Landscape	Check that fertilizer and pesticide usage is in accordance wiN1th the Integrated Pest Management Program. Adjust, if needed.	Annually

Source Control BMP	Activity	Frequency
Design, and Efficient Irrigation	Check the irrigation system water budget to ensure efficiency targets are being met and the system is in good condition. Adjust/repair irrigation system and controllers, if needed.	Annually prior to irrigation system activation
	Check landscaping for presence of invasive species and remove, if needed.	Annually
N11. Common Area Litter Control	Remove trash from around trash enclosure, inspect to ensure lids closed, structurally sound, and not overflowing. Repair or replace, as needed.	Monthly
	Inspect common area for litter and trash disposal violations by homeowners and reporting to the HOA or responsible party for investigation. Remove litter, as needed.	Weekly
N14. Common Area Catch Basin Inspection	Remove trash and debris from catch basins and grates. Check for damage, clogging, and standing water. Repair or mitigate clogging/standing water, as needed.	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events >0.5 inches
N15. Street Sweeping Private Streets and Parking Lots	Sweep curb and gutter areas using a vacuum street sweeper. Report any significant or illicit debris in curb/gutter to HOA or responsible party, as needed.	Weekly
S1. Provide Storm Drain System Stenciling and Signage	Check that all catch basins in paved areas marked or stenciled with "No dumping-Drains to Ocean; No Descargue Basura" language. Replace/repaint markings if faded, damaged, removed, or otherwise illegible.	Annually
S3. Design and Construct Trash and Waste Storage Areas	Check that outdoor waste storage structure is consistently covered, that structural stability is sound, and that no run-on or contact of the trash with runoff is occurring. Repair leaks or damage and mitigate if trash coming into contact with stormwater, as needed.	Twice per year
	Check that trash is removed by local waste management contractor on at least a weekly basis for proper disposal.	Weekly

Source Control BMP	Activity	Frequency
S5. Protect Slopes and Channels and Provide Energy Dissipation	Check slopes, channels, riprap and other conveyance or energy dissipation areas for signs of erosion or scour. Replace material, repair channels, replant vegetation, and/or redesign, as needed for signs of erosion/scour.	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events >0.5 inches
S12. Hillside Landscaping	Check the vegetation on steep hillsides to ensure healthy, and check for signs of erosion. Replace eroded areas with deep-rooted, drought tolerant vegetation and remove invasives, as needed.	Twice per year
S13. Wash Water for Food Preparation Areas	Check that signs are present prohibiting the discharge of wash water from food preparation areas (including outdoor) to areas draining to a storm drain, is prohibited.	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events >0.5 inches
	Check that all wash water, leaks, and spills are prevented from possible contact with rainwater. Check sinks, berms, and other structures for structural soundness and effectiveness. Maintain or replace any failed structural measures, as needed.	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events >0.5 inches
	Remove trash and debris and sweep outdoor food preparation areas	Weekly

3.2 INSPECTION AND MAINTENANCE OF HYDROLOGIC SOURCE CONTROLS

N/A

3.3 INSPECTION AND MAINTENANCE OF STRUCTURAL LID AND HYDROMODIFICATION BMPS

The section is organized by type of structural LID or hydromodification BMP with separate tables for each BMP type included in the project. The section identifies four categories of activities related to O&M of the BMPs:

General Inspections – Evaluations conducted at regularly scheduled intervals to indicate the need for maintenance of structural BMPs.

Routine Maintenance Activities – Activities conducted at regularly scheduled intervals to sustain long-term performance of each BMP, including inspections and normal upkeep.

Corrective (Major) Maintenance Activities – Includes activities conducted to replace or rehabilitate system components at the end of their usable life as well as activities conducted to resolve major issues that are not anticipated.

Emergency Response Activities – Activities related to emergencies, primarily concerning spills, which may require immediate action and notifications (Section 3.4).

BMP ID	BMP Type	Reference Maintenance Table
BMP C1-Q1	*Modular Wetlands System*	*Manufacturer O&M Manual (Attachment 6)*

BIO-5/7 PROPRIETARY BIOTREATMENT	
Activity	**Frequency**
GENERAL INSPECTIONS	
Remove trash and debris	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events ≥ 0.5 inches.
Identify excess erosion or scour	
Identify sediment accumulation that requires maintenance	
Inspect during storm event, when possible, to estimate treatment capacity and determine if premature bypass is occurring	
Evaluate plant health and need for corrective action	
Identify any needed corrective maintenance that will require site-specific planning or design	
OPERATION AND MAINTENANCE	
• O&M of proprietary BMPs must follow established manufacturer guidelines • O&M of accompanying retention BMPs should follow the guidelines established in the associated fact sheet for that BMP.	

3.4 EMERGENCY RESPONSE PLAN

In some cases, adverse conditions may occur which could be an imminent threat to human or environmental health or severe damage to infrastructure or property. For example, a spill of hazardous substances in the contributing area to a BMP could cause harmful substances to enter the BMP and be released downstream, affecting environmental and public health. Other emergencies could arise related to the stormwater features or water quality protection, such as landsliding, major erosion, or burst pipes in the tributary area.

In the event of an actual or suspected hazardous material release, the following plan shall take effect. The primary importance of initial response to an actual or suspected spill will be public safety, control of the source of pollution, and containment of spills that have occurred, as applicable. The table below provides the emergency contact information for hazardous materials spills affecting BMPs.

Name	Phone	When to Report
Local Emergency Response (Fire Department)	911	Immediately
Orange County 24-Hour Water Pollution Problem Reporting Hotline	1-877-897-7455	Immediately
CalOES State Warning Center	1-800-852-7550	Immediately

The first number to call is emergency response (9-1-1), followed by the California Governor's Office of Emergency Services (CalOES), formerly the California Emergency Management Agency (CalEMA). (CalOES) maintains guidance and instructions of what to do in the event of a spill of hazardous substances (http://www.caloes.ca.gov/cal-oes-divisions/fire-rescue/hazardous-materials/spill-release-reporting). This plan is based on the guidance provided by CalOES (CalOES, 2014).

1. If an actual or suspected hazardous material incident exists, maintenance personnel will immediately call 911 and the CalOES State Warning Center (Table 6).
2. The Designated Emergency Respondent and Responsible Party assigned to the facility (from Section 2.1) must also be notified of any actual or potential spill.
3. Remediation of contamination in the water quality facility should be handled as a corrective maintenance issue per Section 3.2 of this O&M plan.

In the event that a potential spill is identified prior to it reaching the BMPs, the Designated Emergency Respondent will implement an isolation protocol to prevent the spill from entering the BMP. An inflatable plug, Hazmat Plug, or equivalent device as approved by the Designated Emergency Respondent will be installed within the storm drains or catch basins to block upstream flow from reaching and contaminating the BMP. The temporary plug will be an interim measure until the spill is properly maintained and remediated and the Designated Emergency Respondent has determined the risk to the BMP of contamination no longer exists.

Similar measures should be taken in the event of a landslide, mudslide, or major erosion within the tributary area of the BMP to prevent sediment from damaging the BMP to the extent possible.

3.5 VECTOR CONTROL

In addition to the inspection and maintenance activities listed in Section 3, all BMPs shall be inspected for standing water on a regular basis. Standing water which exists for longer than 72 hours may contribute to mosquito breeding areas. Standing water may indicate that the BMP is not functioning properly and proper action to remedy the situation shall be taken in a timely manner.

Elimination of standing water and managing garbage, lawn clippings, and pet droppings can help decrease the present of mosquitoes and flies in the area.

The Orange County Vector Control District may be contacted for more information and support at 714-971-2421 or 949-654-2421 or www.ocvcd.org.

ATTACHMENT 1 PHOTOS AND EXHIBITS

- Vicinity Map
- WQMP Exhibit
- BMP Details & Cross Sections

VICINITY MAP
N.T.S.

ATTACHMENT 2 MAINTENANCE AGREEMENT AND FUNDING MECHANISM DOCUMENTATION

ATTACHMENT 3 TRAINING LOG FORM

TRAINING / EDUCATIONAL LOG

Date of Training/Educational Activity: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

Topic of Training/Educational Activity

_____

_____

Name of Participant	Signature of Participant

ATTACHMENT 4 INSPECTION AND MAINTENANCE LOG FORM

TRAINING / EDUCATIONAL LOG

Date of Training/Educational Activity: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

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

ATTACHMENT 5 INSPECTION AND O&M CHECKLIST (OPTIONAL)

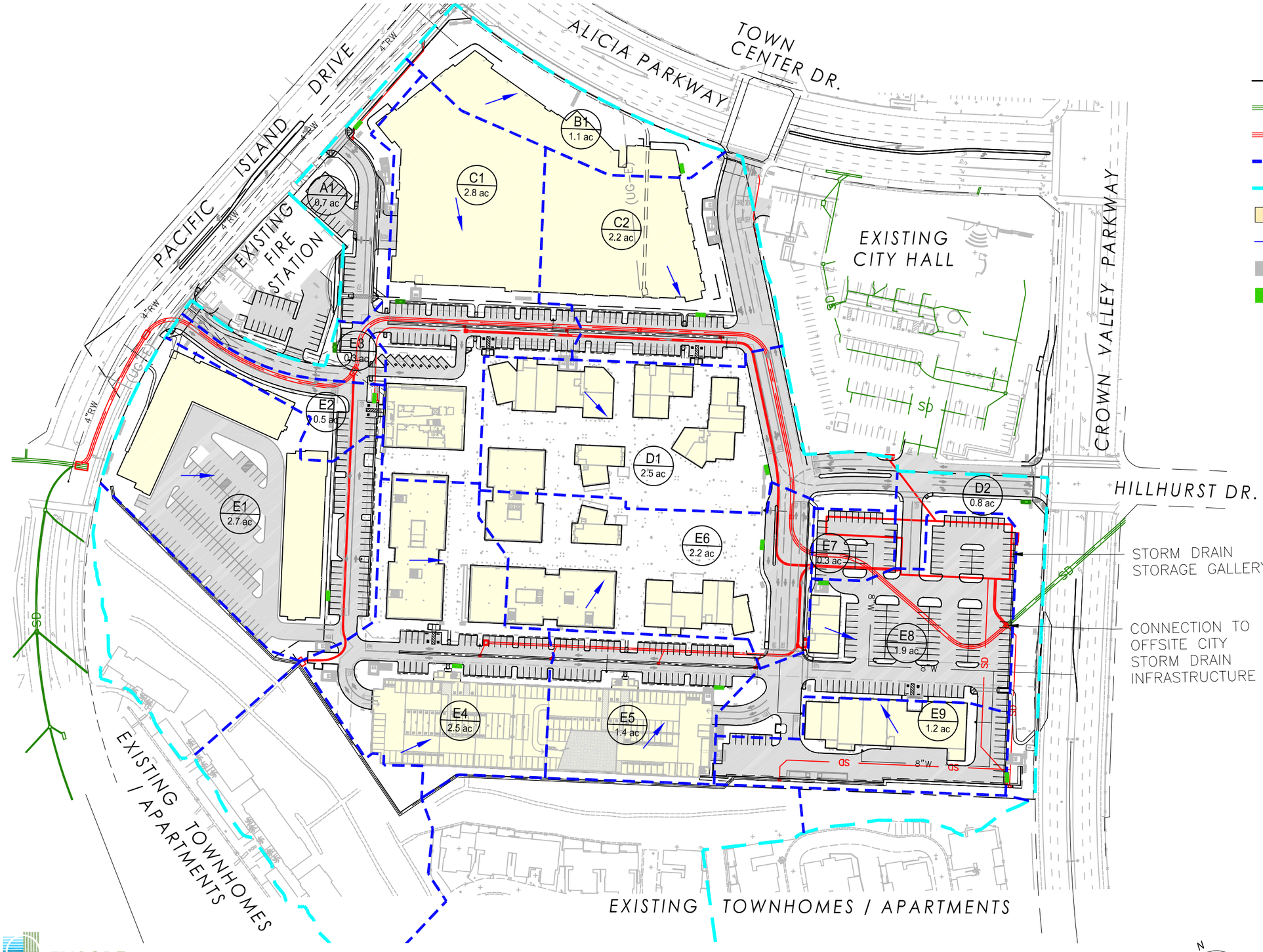
Guidance: Based on the BMPs present at the site, this checklist is intended to summarize the activities necessary at each frequency. Include more details if desired.

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

ATTACHMENT 6 VENDOR O&M INFORMATION

ATTACHMENT C

EXHIBITS



LEGEND

- PROPERTY LINE
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- BMP DRAINAGE AREA BOUNDARY
- SITE HYDROLOGY DRAINAGE BOUNDARY
- PROPOSED BUILDING
- DIRECTION OF FLOW
- PROPOSED AC PAVING
- PROPOSED MODULAR WETLANDS SYSTEM BMP

150' 0' 75' 150'

SCALE: 1" = 150'

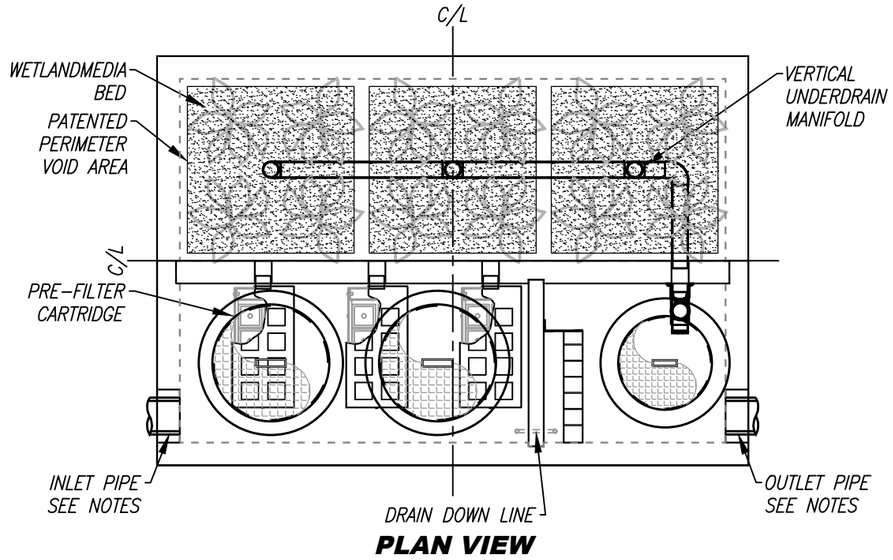
FUSCOE ENGINEERING
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960 • fax 949.474.5315
www.fuscoe.com

Scale: 1" = 150'
Exhibit Date: 08/17/2021

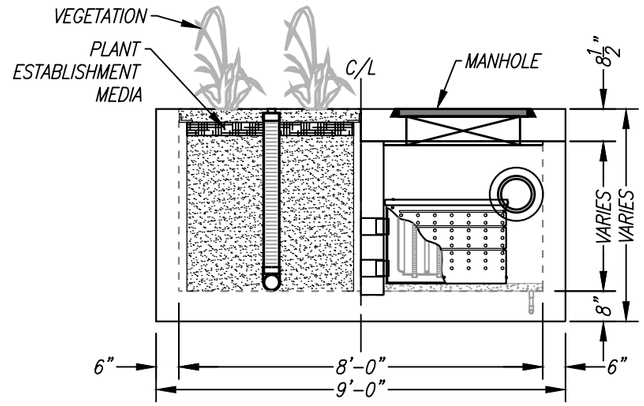
WATER QUALITY MANAGEMENT PLAN
LAGUNA NIGUEL TOWN CENTER
LAGUNA NIGUEL, CA

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

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



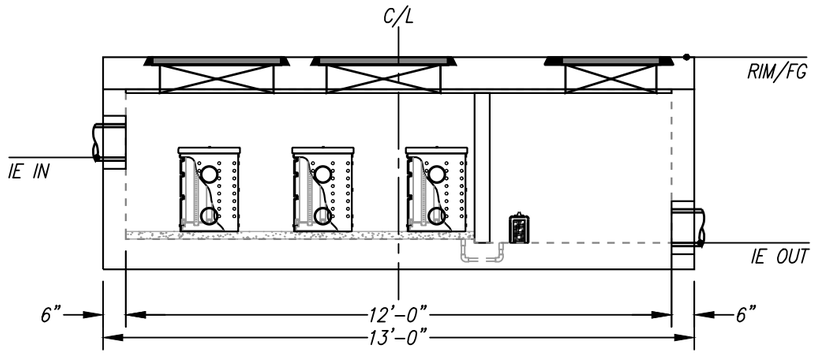
LEFT END VIEW

INSTALLATION NOTES

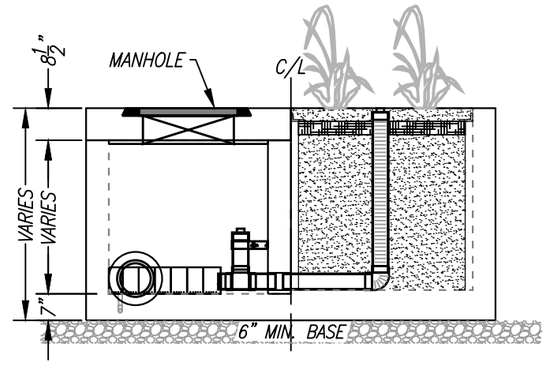
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

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



ELEVATION VIEW



RIGHT END VIEW

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

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

5/23/19 10:EF

ATTACHMENT D

BMP DESIGN CALCULATIONS & DETAILS

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

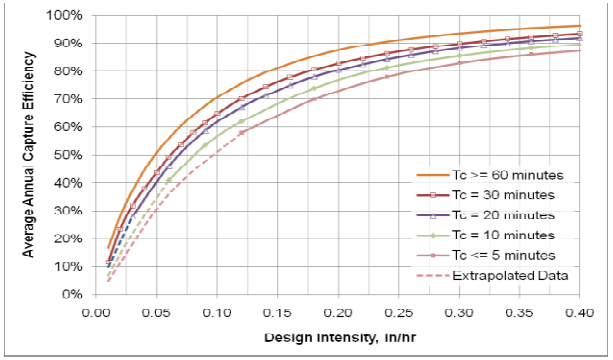
		DMA =	A1	B1	C1	C2	D1	D2	E1	E2	E3	E4	E5	E6	E7	E8	E9	
Part 1: Determine the design storm intensity of the compact biofiltration BMP																		
1	Enter the time of concentration, T_c (min) (See E.2.3) (account for upstream detention by increasing Tc to a maximum 60 minutes per Section E.3.5.2 if detention is provided)	T_c=	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	min
2	Using Figure E-7 or the figure included in the worksheet, determine the design intensity at which the estimated time of concentration (T_c) achieves 80% capture efficiency, I_1	I_1=	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	in/hr
3	Enter capture efficiency corresponding to upstream HSCs and/or upstream BMPs, Y_2. Attach associated calculations.	Y_2 =	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	%
4	Using Figure E-7, determine the design intensity at which the time of concentration (T_c) achieves the upstream capture efficiency(Y_2), I_2	I_2=	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	in/hr
5	Determine the design intensity that must be provided by BMP to achieve 80 percent capture, $I_{design}= I_1-I_2$	$I_{design\_80\%}$=	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	in/hr
Part 2: Calculate the design flowrate of the compact biofiltration BMP (Section E.2.6)																		
6a	Enter DMA area tributary to BMP (s), *A* (acres)	A=	0.7	1.1	2.8	2.2	2.5	0.8	2.7	0.5	0.3	2.5	1.4	2.2	0.3	1.9	1.2	acres
6b	Enter DMA Imperviousness, imp (unitless)	imp=	90%	80%	80%	90%	90%	90%	90%	90%	90%	90%	80%	80%	85%	85%	85%	
6c	Calculate runoff coefficient, *c= (0.75 x imp) + 0.15*	c=	0.825	0.750	0.750	0.825	0.825	0.825	0.825	0.825	0.825	0.825	0.750	0.750	0.788	0.788	0.788	
6d	Calculate flowrate to achieve 80 percent capture, $Q_{80\%}$ = *(c x I_{design} x A)*	$Q_{80\%}$=	0.150	0.215	0.546	0.472	0.536	0.172	0.579	0.107	0.064	0.536	0.273	0.429	0.061	0.389	0.246	cfs
7	Calculate design flowrate, Q_{design} = $Q_{80\%}$ *x 150%*	Q_{design}=	0.225	0.322	0.819	0.708	0.804	0.257	0.869	0.161	0.097	0.804	0.410	0.644	0.092	0.584	0.369	cfs
Part 3: Demonstrate that Supplemental Retention BMPs Conform to Volume Reduction Targets (Only DMAs Categorized as "Biotreatment with Partial Infiltration")																		
8	Describe system, including features to maximize volume reduction (if applicable):																	
	Proprietary BioTreatment (BIO-7):																	
	Unit Size / Model =		*MWS-L-4-19*	*MWS-L-8-12*	*MWS-L-8-16*	*MWS-L-8-16*	*MWS-L-8-16*	*MWS-L-4-21*	*MWS-L-8-16*	*MWS-L-4-21*	*MWS-L-8-16*	*MWS-L-8-16*	*MWS-L-8-24*	*MWS-L-8-24*	*MWS-L-8-16*			
	Unit Size / Model Treatment Capacity =		*0.237*	*0.346*	*0.462*	*0.462*	*0.462*	*0.268*	*0.462*	*0.268*	*0.462*	*0.462*	*0.693*	*0.693*	*0.462*	cfs		
	Number of Units Needed =		*1.000*	*1.000*	*2.000*	*2.000*	*2.000*	*1.000*	*2.000*	*1.000*	*2.000*	*1.000*	*1.000*	*1.000*	*1.000*			
	Total Bio-treatment Provided =		*0.237*	*0.346*	*0.924*	*0.924*	*0.924*	*0.268*	*0.924*	*0.268*	*0.924*	*0.462*	*0.693*	*0.693*	*0.462*	cfs		
9	Summarize calculations to demonstrate that volume reduction targets are met, where feasible and applicable.																	

Supporting Calculations

Provide time of concentration assumptions:

A time of concentration of 5 minutes was assumed for all DMAs in order to ensure that MWS units were sized conservatively

Graphical Operations



Provide supporting graphical operations in figure above.

ATTACHMENT E

HYDROMODIFICATION CONTROL CALCULATIONS

SOHM

PROJECT REPORT

General Model Information

Project Name:	LNTC7
Site Name:	Laguna Niguel Town Center
Site Address:	Crown Valley Parkway at Alicia Parkway
City:	Laguna Niguel
Report Date:	12/19/2019
Gage:	Laguna Beach
Data Start:	10/01/1949
Data End:	09/30/2006
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/04/19

POC Thresholds

Low Flow Threshold for POC1:	10 Percent of the 2 Year
High Flow Threshold for POC1:	10 Year

Landuse Basin Data
Predeveloped Land Use

Predeveloped

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C,Open Brush,VSteep	5.2
D,Open Brush,VSteep	17.9
Pervious Total	23.1

Impervious Land Use	acre
Impervious Total	0
Basin Total	23.1

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	Yes
GroundWater:	No

Pervious Land Use	acre
D,Urban,Flat(0-5%)	0.48
Pervious Total	0.48

Impervious Land Use	acre
Impervious,Flat(0-5)	4.32
Impervious Total	4.32
Basin Total	4.8

Element Flows To:

Surface	Interflow	Groundwater

Basin 2-to Vault 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
D,Urban,Flat(0-5%)	1.31
C,Urban,Flat(0-5%)	0.52
Pervious Total	1.83

Impervious Land Use	acre
Impervious,Flat(0-5)	16.47
Impervious Total	16.47
Basin Total	18.3

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Mitigated Routing

Vault 1

Width: 75 ft.
Length: 130 ft.
Depth: 7.5 ft.
Discharge Structure
Riser Height: 6.5 ft.
Riser Diameter: 54 in.
Notch Type: Rectangular
Notch Width: 1.000 ft.
Notch Height: 0.250 ft.
Orifice 1 Diameter: 2 in. Elevation:0 ft.
Orifice 2 Diameter: 2 in. Elevation:0.5 ft.
Orifice 3 Diameter: 2 in. Elevation:1 ft.
Element Flows To:
Outlet 1 Outlet 2

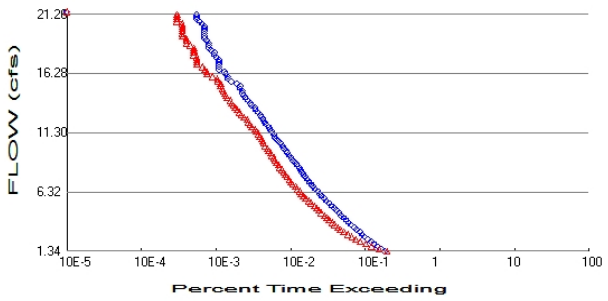
Vault Hydraulic Table

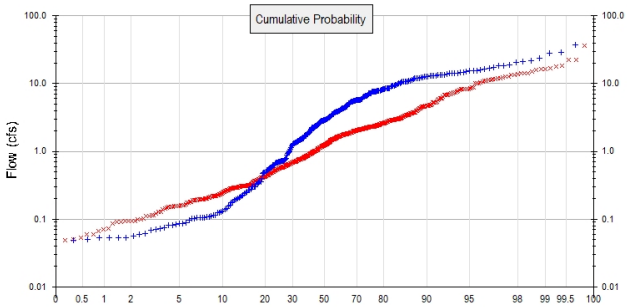
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.223	0.000	0.000	0.000
0.0833	0.223	0.018	0.031	0.000
0.1667	0.223	0.037	0.044	0.000
0.2500	0.223	0.056	0.054	0.000
0.3333	0.223	0.074	0.062	0.000
0.4167	0.223	0.093	0.070	0.000
0.5000	0.223	0.111	0.076	0.000
0.5833	0.223	0.130	0.114	0.000
0.6667	0.223	0.149	0.132	0.000
0.7500	0.223	0.167	0.148	0.000
0.8333	0.223	0.186	0.161	0.000
0.9167	0.223	0.205	0.174	0.000
1.0000	0.223	0.223	0.185	0.000
1.0833	0.223	0.242	0.227	0.000
1.1667	0.223	0.261	0.250	0.000
1.2500	0.223	0.279	0.269	0.000
1.3333	0.223	0.298	0.287	0.000
1.4167	0.223	0.317	0.303	0.000
1.5000	0.223	0.335	0.318	0.000
1.5833	0.223	0.354	0.332	0.000
1.6667	0.223	0.373	0.346	0.000
1.7500	0.223	0.391	0.359	0.000
1.8333	0.223	0.410	0.371	0.000
1.9167	0.223	0.429	0.383	0.000
2.0000	0.223	0.447	0.395	0.000
2.0833	0.223	0.466	0.406	0.000
2.1667	0.223	0.485	0.417	0.000
2.2500	0.223	0.503	0.427	0.000
2.3333	0.223	0.522	0.438	0.000
2.4167	0.223	0.540	0.448	0.000
2.5000	0.223	0.559	0.458	0.000
2.5833	0.223	0.578	0.467	0.000
2.6667	0.223	0.596	0.477	0.000
2.7500	0.223	0.615	0.486	0.000
2.8333	0.223	0.634	0.495	0.000

2.9167	0.223	0.652	0.504	0.000
3.0000	0.223	0.671	0.513	0.000
3.0833	0.223	0.690	0.521	0.000
3.1667	0.223	0.708	0.530	0.000
3.2500	0.223	0.727	0.538	0.000
3.3333	0.223	0.746	0.546	0.000
3.4167	0.223	0.764	0.554	0.000
3.5000	0.223	0.783	0.562	0.000
3.5833	0.223	0.802	0.570	0.000
3.6667	0.223	0.820	0.578	0.000
3.7500	0.223	0.839	0.585	0.000
3.8333	0.223	0.858	0.593	0.000
3.9167	0.223	0.876	0.600	0.000
4.0000	0.223	0.895	0.608	0.000
4.0833	0.223	0.914	0.615	0.000
4.1667	0.223	0.932	0.622	0.000
4.2500	0.223	0.951	0.629	0.000
4.3333	0.223	0.969	0.636	0.000
4.4167	0.223	0.988	0.643	0.000
4.5000	0.223	1.007	0.650	0.000
4.5833	0.223	1.025	0.657	0.000
4.6667	0.223	1.044	0.663	0.000
4.7500	0.223	1.063	0.670	0.000
4.8333	0.223	1.081	0.677	0.000
4.9167	0.223	1.100	0.683	0.000
5.0000	0.223	1.119	0.690	0.000
5.0833	0.223	1.137	0.696	0.000
5.1667	0.223	1.156	0.702	0.000
5.2500	0.223	1.175	0.709	0.000
5.3333	0.223	1.193	0.715	0.000
5.4167	0.223	1.212	0.721	0.000
5.5000	0.223	1.231	0.727	0.000
5.5833	0.223	1.249	0.733	0.000
5.6667	0.223	1.268	0.739	0.000
5.7500	0.223	1.287	0.745	0.000
5.8333	0.223	1.305	0.751	0.000
5.9167	0.223	1.324	0.757	0.000
6.0000	0.223	1.343	0.763	0.000
6.0833	0.223	1.361	0.768	0.000
6.1667	0.223	1.380	0.774	0.000
6.2500	0.223	1.398	0.780	0.000
6.3333	0.223	1.417	0.866	0.000
6.4167	0.223	1.436	1.018	0.000
6.5000	0.223	1.454	1.213	0.000
6.5833	0.223	1.473	2.367	0.000
6.6667	0.223	1.492	4.471	0.000
6.7500	0.223	1.510	7.189	0.000
6.8333	0.223	1.529	10.39	0.000
6.9167	0.223	1.548	14.02	0.000
7.0000	0.223	1.566	17.99	0.000
7.0833	0.223	1.585	22.26	0.000
7.1667	0.223	1.604	26.77	0.000
7.2500	0.223	1.622	31.47	0.000
7.3333	0.223	1.641	36.32	0.000
7.4167	0.223	1.660	41.25	0.000
7.5000	0.223	1.678	46.21	0.000
7.5833	0.223	1.697	51.14	0.000
7.6667	0.000	0.000	56.00	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 23.1
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 2.31
Total Impervious Area: 20.79

Flow Frequency Method: Cunnane

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	13.402162
5 year	16.749951
10 year	21.260684
25 year	28.377538

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	10.478248
5 year	14.122332
10 year	16.874254
25 year	22.331048

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
1.3402	3592	3917	109	Pass
1.5414	3230	3052	94	Pass
1.7426	2916	2436	83	Pass
1.9439	2610	2031	77	Pass
2.1451	2368	1704	71	Pass
2.3463	2155	1474	68	Pass
2.5475	1957	1314	67	Pass
2.7487	1810	1160	64	Pass
2.9500	1678	1030	61	Pass
3.1512	1536	927	60	Pass
3.3524	1411	852	60	Pass
3.5536	1294	778	60	Pass
3.7548	1190	715	60	Pass
3.9560	1097	651	59	Pass
4.1573	1021	612	59	Pass
4.3585	949	563	59	Pass
4.5597	888	514	57	Pass
4.7609	820	473	57	Pass
4.9621	757	443	58	Pass
5.1633	700	413	58	Pass
5.3646	654	371	56	Pass
5.5658	600	348	58	Pass
5.7670	557	316	56	Pass
5.9682	515	296	57	Pass
6.1694	490	277	56	Pass
6.3706	464	262	56	Pass
6.5719	427	243	56	Pass
6.7731	396	231	58	Pass
6.9743	375	212	56	Pass
7.1755	352	200	56	Pass
7.3767	336	190	56	Pass
7.5779	311	179	57	Pass
7.7792	297	169	56	Pass
7.9804	279	161	57	Pass
8.1816	271	152	56	Pass
8.3828	259	140	54	Pass
8.5840	240	136	56	Pass
8.7852	227	128	56	Pass
8.9865	215	122	56	Pass
9.1877	202	119	58	Pass
9.3889	192	112	58	Pass
9.5901	181	107	59	Pass
9.7913	172	101	58	Pass
9.9925	163	97	59	Pass
10.1938	156	89	57	Pass
10.3950	147	86	58	Pass
10.5962	137	84	61	Pass
10.7974	128	81	63	Pass
10.9986	121	77	63	Pass
11.1998	118	73	61	Pass
11.4011	111	69	62	Pass
11.6023	105	66	62	Pass
11.8035	101	60	59	Pass

12.0047	94	57	60	Pass
12.2059	89	54	60	Pass
12.4071	85	52	61	Pass
12.6084	81	47	58	Pass
12.8096	79	43	54	Pass
13.0108	73	41	56	Pass
13.2120	67	38	56	Pass
13.4132	66	36	54	Pass
13.6144	60	34	56	Pass
13.8157	57	32	56	Pass
14.0169	53	31	58	Pass
14.2181	49	28	57	Pass
14.4193	47	27	57	Pass
14.6205	45	26	57	Pass
14.8217	45	25	55	Pass
15.0230	42	24	57	Pass
15.2242	42	23	54	Pass
15.4254	38	23	60	Pass
15.6266	32	21	65	Pass
15.8278	29	21	72	Pass
16.0290	29	18	62	Pass
16.2303	27	15	55	Pass
16.4315	26	15	57	Pass
16.6327	22	14	63	Pass
16.8339	22	13	59	Pass
17.0351	22	11	50	Pass
17.2363	22	11	50	Pass
17.4376	22	11	50	Pass
17.6388	20	11	55	Pass
17.8400	19	10	52	Pass
18.0412	19	10	52	Pass
18.2424	17	10	58	Pass
18.4436	16	10	62	Pass
18.6449	16	9	56	Pass
18.8461	16	8	50	Pass
19.0473	15	8	53	Pass
19.2485	14	8	57	Pass
19.4497	14	7	50	Pass
19.6509	14	7	50	Pass
19.8522	14	7	50	Pass
20.0534	14	7	50	Pass
20.2546	14	7	50	Pass
20.4558	13	7	53	Pass
20.6570	12	6	50	Pass
20.8583	11	6	54	Pass
21.0595	11	6	54	Pass
21.2607	11	6	54	Pass

Water Quality

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

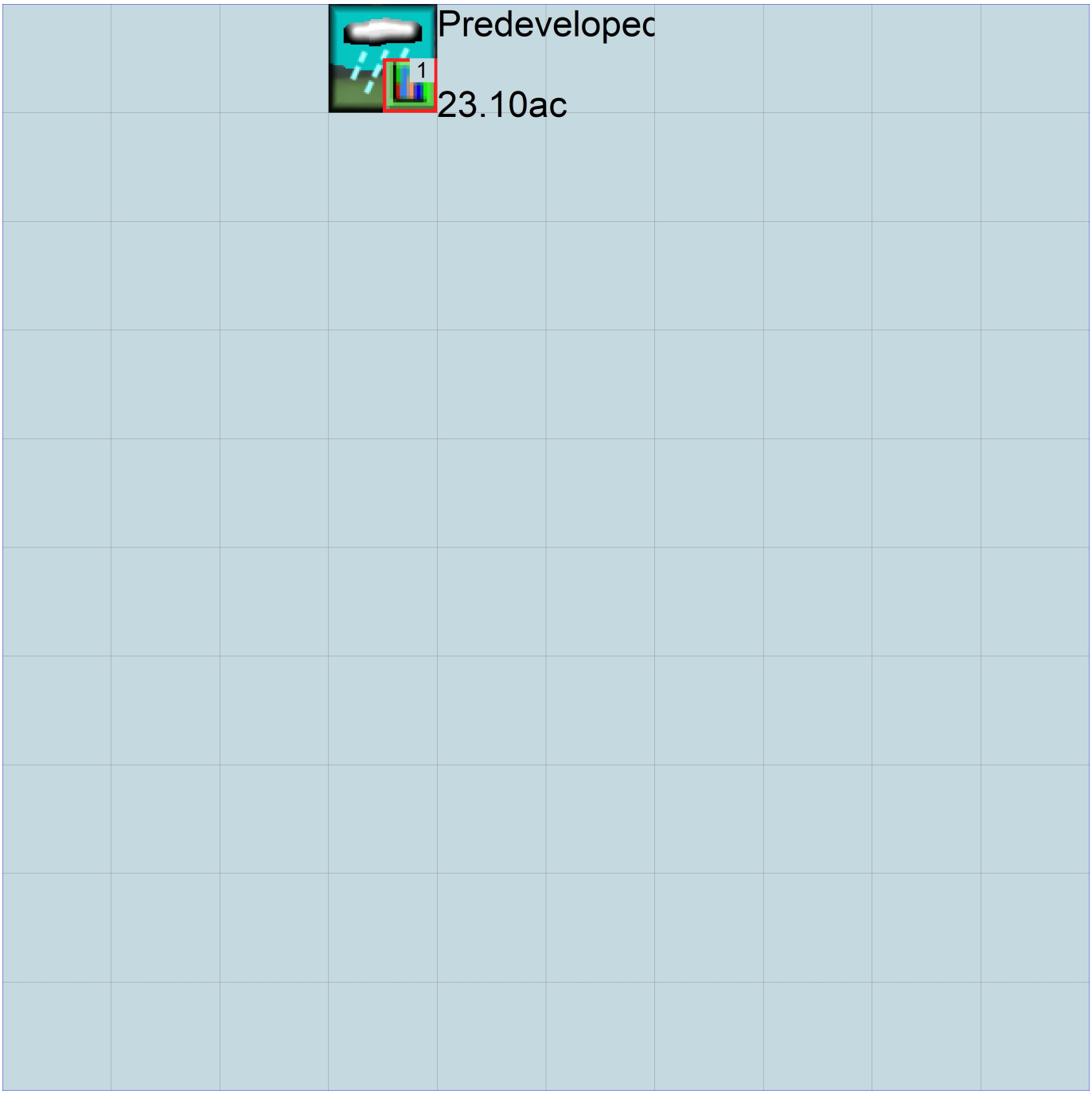
No PERLND changes have been made.

IMPLND Changes

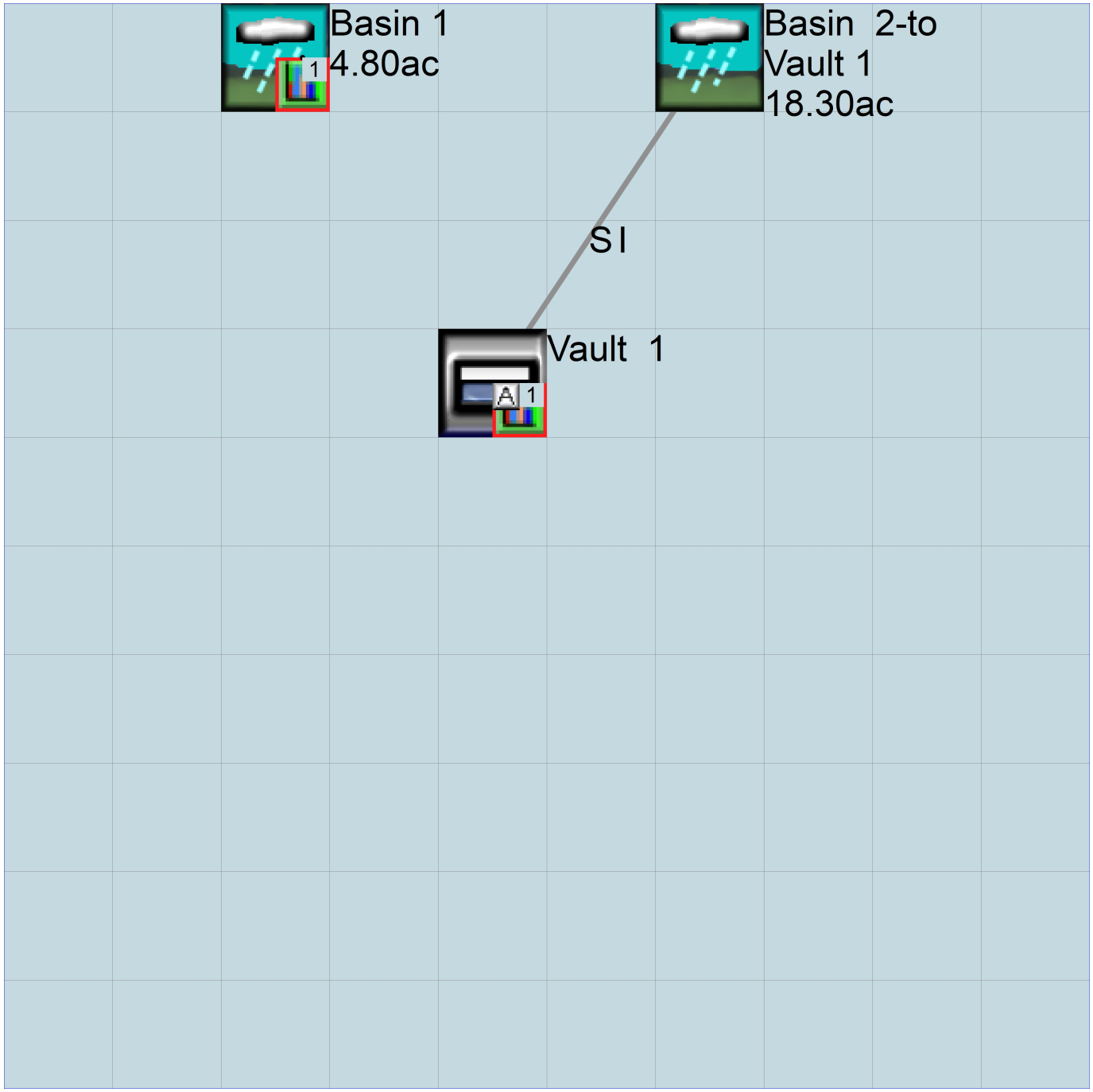
No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1949 10 01        END    2006 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   LNTC7.wdm
MESSU       25   MitLNTC7.MES
            27   MitLNTC7.L61
            28   MitLNTC7.L62
            30   POCLNTC71.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      61
      IMPLND       1
      PERLND      57
      RCHRES       1
      COPY         1
      COPY       501
      COPY       601
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Vault  1                   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  601         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   61     D,Urban,Flat(0-5%)      1    1    1    1   27    0
   57     C,Urban,Flat(0-5%)      1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   61         0    0    1    0    0    0    0    0    0    0    0    0
   57         0    0    1    0    0    0    0    0    0    0    0    0
```

```
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   61         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   57         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   61         0    0    0    1    0    0    0    0    1    0    0
   57         0    0    0    1    0    0    0    0    1    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   61              0       4.4      0.04       400      0.05       0.8     0.955
   57              0       4.6     0.045       400      0.05       0.8     0.955
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   61             40        35         4         2         0      0.03         0
   57             40        35         3         2         0      0.03         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   61              0       0.7      0.25         3       0.7         0
   57              0       0.7      0.25         3       0.7         0
  END PWAT-PARM4
  MON-LZETPARM
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   61       0.5  0.5  0.5  0.6 0.65 0.65 0.65 0.65 0.65 0.65 0.55  0.5
   57       0.5  0.5  0.5  0.6 0.65 0.65 0.65 0.65 0.65 0.65 0.55  0.5
  END MON-LZETPARM
  MON-INTERCEP
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   61      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
   57      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
  END MON-INTERCEP

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   61              0         0      0.07         0      0.88       0.3      0.01
   57              0         0      0.07         0      0.92       0.3      0.01
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    1     Impervious,Flat(0-5)    1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
```

```
    1         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            100      0.05       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  2-to Vault 1***
PERLND  61                       1.31     RCHRES   1      2
PERLND  61                       1.31     RCHRES   1      3
PERLND  57                       0.52     RCHRES   1      2
PERLND  57                       0.52     RCHRES   1      3
IMPLND   1                      16.47     RCHRES   1      5
Basin 1***
PERLND  61                       0.48     COPY   501     12
PERLND  61                       0.48     COPY   601     12
PERLND  61                       0.48     COPY   501     13
PERLND  61                       0.48     COPY   601     13
IMPLND   1                       4.32     COPY   501     15
IMPLND   1                       4.32     COPY   601     15

******Routing******
PERLND  61                       1.31     COPY     1     12
PERLND  57                       0.52     COPY     1     12
IMPLND   1                      16.47     COPY     1     15
PERLND  61                       1.31     COPY     1     13
PERLND  57                       0.52     COPY     1     13
RCHRES   1                          1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
```

```
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<-----------------><---> User T-series  Engl Metr LKFG            ***
                                      in  out                               ***
    1     Vault  1               1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                   ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
           FG FG FG FG  possible  exit  *** possible  exit      possible  exit
            *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
    1       0  1  0  0    4  0  0  0  0       0  0  0  0  0        2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1              1      0.02       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                      ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1             0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   92    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.223829  0.000000  0.000000
  0.083333  0.223829  0.018652  0.031335
  0.166667  0.223829  0.037305  0.044314
  0.250000  0.223829  0.055957  0.054274
  0.333333  0.223829  0.074610  0.062670
  0.416667  0.223829  0.093262  0.070067
  0.500000  0.223829  0.111915  0.076754
  0.583333  0.223829  0.130567  0.114239
  0.666667  0.223829  0.149219  0.132943
  0.750000  0.223829  0.167872  0.148278
  0.833333  0.223829  0.186524  0.161759
  0.916667  0.223829  0.205177  0.173993
  1.000000  0.223829  0.223829  0.185302
  1.083333  0.223829  0.242482  0.227219
  1.166667  0.223829  0.261134  0.250187
  1.250000  0.223829  0.279787  0.269638
  1.333333  0.223829  0.298439  0.287099
  1.416667  0.223829  0.317091  0.303190
```

1.500000	0.223829	0.335744	0.318244
1.583333	0.223829	0.354396	0.332469
1.666667	0.223829	0.373049	0.346007
1.750000	0.223829	0.391701	0.358959
1.833333	0.223829	0.410354	0.371403
1.916667	0.223829	0.429006	0.383400
2.000000	0.223829	0.447658	0.394999
2.083333	0.223829	0.466311	0.406240
2.166667	0.223829	0.484963	0.417155
2.250000	0.223829	0.503616	0.427775
2.333333	0.223829	0.522268	0.438122
2.416667	0.223829	0.540921	0.448217
2.500000	0.223829	0.559573	0.458080
2.583333	0.223829	0.578225	0.467725
2.666667	0.223829	0.596878	0.477168
2.750000	0.223829	0.615530	0.486421
2.833333	0.223829	0.634183	0.495494
2.916667	0.223829	0.652835	0.504400
3.000000	0.223829	0.671488	0.513146
3.083333	0.223829	0.690140	0.521742
3.166667	0.223829	0.708792	0.530195
3.250000	0.223829	0.727445	0.538512
3.333333	0.223829	0.746097	0.546700
3.416667	0.223829	0.764750	0.554764
3.500000	0.223829	0.783402	0.562711
3.583333	0.223829	0.802055	0.570544
3.666667	0.223829	0.820707	0.578270
3.750000	0.223829	0.839360	0.585892
3.833333	0.223829	0.858012	0.593415
3.916667	0.223829	0.876664	0.600842
4.000000	0.223829	0.895317	0.608177
4.083333	0.223829	0.913969	0.615423
4.166667	0.223829	0.932622	0.622584
4.250000	0.223829	0.951274	0.629663
4.333333	0.223829	0.969927	0.636662
4.416667	0.223829	0.988579	0.643584
4.500000	0.223829	1.007231	0.650431
4.583333	0.223829	1.025884	0.657206
4.666667	0.223829	1.044536	0.663912
4.750000	0.223829	1.063189	0.670550
4.833333	0.223829	1.081841	0.677122
4.916667	0.223829	1.100494	0.683630
5.000000	0.223829	1.119146	0.690077
5.083333	0.223829	1.137798	0.696463
5.166667	0.223829	1.156451	0.702791
5.250000	0.223829	1.175103	0.709062
5.333333	0.223829	1.193756	0.715278
5.416667	0.223829	1.212408	0.721439
5.500000	0.223829	1.231061	0.727548
5.583333	0.223829	1.249713	0.733606
5.666667	0.223829	1.268365	0.739614
5.750000	0.223829	1.287018	0.745573
5.833333	0.223829	1.305670	0.751485
5.916667	0.223829	1.324323	0.757350
6.000000	0.223829	1.342975	0.763170
6.083333	0.223829	1.361628	0.768946
6.166667	0.223829	1.380280	0.774678
6.250000	0.223829	1.398933	0.780368
6.333333	0.223829	1.417585	0.866124
6.416667	0.223829	1.436237	1.018203
6.500000	0.223829	1.454890	1.213443
6.583333	0.223829	1.473542	2.367684
6.666667	0.223829	1.492195	4.471096
6.750000	0.223829	1.510847	7.189258
6.833333	0.223829	1.529500	10.39831
6.916667	0.223829	1.548152	14.01980
7.000000	0.223829	1.566804	17.99227
7.083333	0.223829	1.585457	22.26114
7.166667	0.223829	1.604109	26.77411
7.250000	0.223829	1.622762	31.47904

```
  7.333333  0.223829  1.641414  36.32301
  7.416667  0.223829  1.660067  41.25207
  7.500000  0.223829  1.678719  46.21148
  7.583333  0.223829  1.697371  51.14624
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP
WDM     22 IRRG     ENGL    0.7       SAME PERLND  61     EXTNL  SURLI
WDM     22 IRRG     ENGL    0.7       SAME PERLND  57     EXTNL  SURLI

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
COPY   601 OUTPUT MEAN   1 1     48.4      WDM    901 FLOW     ENGL      REPL
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15

  MASS-LINK       16
RCHRES     ROFLOW                          COPY           INPUT  MEAN
  END MASS-LINK   16


END MASS-LINK

END RUN
```

Disclaimer

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ATTACHMENT F

CONDITIONS OF APPROVAL

ATTACHMENT G

SOILS REPORTING

GEOTECHNICAL PROFESSIONALS INC.

December 19, 2019

Laguna Niguel Town Center Partners
1100 Newport Center Drive
Newport Beach, CA 92660

Attention: Mr. Christian Santos, Development Director

Subject: Supplemental Geotechnical Recommendations – Storm Water Infiltration
Proposed Laguna Niguel City Center
30102 Pacific Island Drive (Crown Valley Parkway at Alicia Parkway)
Laguna Niguel, California
GPI Project No. 2952.I/City of Laguna Niguel Reference No. SP19-13

Dear Christian:

As requested by Mark Nero, P.E. at Fuscoe Engineering, Inc., this letter presents our geotechnical opinion regarding the storm water infiltration conditions at the subject site. We performed a preliminary geotechnical investigation for the subject project for CEQA and presented our findings and recommendations in a report dated October 11, 2019.

We performed four exploratory borings and five cone penetration tests (CPT's) across the site, and we have reviewed logs from numerous prior site explorations by others. The site is generally underlain by shallow fill soils comprised predominantly of expansive clay soils, with the exception of the western portion of the site where we encountered deeper fill soils within a former tributary canyon. The natural materials underlying the fills throughout the site consist predominantly of Capistrano Formation siltstone and claystone bedrock. As with the fill soils derived from the bedrock, the upper natural bedrock materials are anticipated to have a high to very high potential for expansion.

Given the subsurface conditions, it is our geotechnical opinion that infiltration of storm water at the site is not feasible because of the very low anticipated infiltration rates. In addition, because of the expansion potential of the on-site soils and presence of deep fill soils along the western side of the site, infiltration of storm water is not recommended from a geotechnical standpoint.

Please contact us if you have questions on the above findings or need additional information.

Very truly yours,
Geotechnical Professionals Inc.

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Project Engineer

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cc: Mark Nero, P.E. and Alex Bennett, Fuscoe Engineering, Inc.
Byron C. Ward, Burnham Ward Properties
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August 19, 2019

Sares Regis Group
3501 Jamboree Road, Suite 300
Newport Beach, California 92660

Attention: Mr. Christian Santos
Development Director

Subject: Planning-Level Preliminary Geotechnical Investigation
Proposed Laguna Niguel Town Center
30102 Pacific Island Drive (Crown Valley Parkway and Alicia Parkway)
Laguna Niguel, California
GPI Project No. 2952.I

Dear Mr. Santos:

In accordance with your request, this letter report presents the results of our planning-level preliminary geotechnical investigation for the proposed Laguna Niguel Town Center development at the subject site. The purpose of our investigation is to support due diligence efforts by providing preliminary geotechnical input for the conceptual design of the project.

Our preliminary geotechnical investigation consisted of a review of recent limited subsurface explorations, available subsurface and geologic information, and limited engineering analyses. The results of our limited field exploration program and preliminary engineering analyses are presented in this letter report. The findings of our geologic study as it relates to the State of California Environmental Quality Act (CEQA) Guidelines are presented in a separate Geotechnical Evaluation Report.

A comprehensive geotechnical investigation to support detailed design and construction should be conducted for final design.

INTRODUCTION

The proposed development is approximately 23.5 acres in size and will consist of about 200,000 square feet of commercial space (retail, office, library), 275 apartment units, a parking structure, and an outdoor plaza. The proposed structures will be limited to 3 stories, and below grade construction is not planned, with the exception for partial subterranean levels where the finished grade is sloping along Alicia Parkway. The apartments (currently planned for the northern portion of the subject site) will be supported in a podium style with 1 to 2 levels of concrete parking. Structural loads are not yet available but are anticipated to be up to 600 kips for the parking structure, up to 400 kips for the apartment buildings, and up to 300 kips for the office/retail/library buildings. In general, the proposed site grades are anticipated to be within a few feet of the existing site grades, with some local deeper areas of cut and fill to achieve the finished grades.

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The site location is shown on the Site Location Map, Figure 1. The layout of the site with existing and proposed conditions is shown on Figures 2 and 3, the Existing Site Plan and Proposed Site Plan, respectively. A Site Geologic Map is presented on Figure 4. A Subsurface Cross Section is presented on Figure 5.

PRIOR SITE WORK

GPI was provided with a prior geotechnical report by others for a proposed south court facility as an addition to the existing court house property within the limits of the subject site (Group Delta, 2005). The prior investigation included seven Cone Penetration Tests (CPT's), 13 exploratory borings, and laboratory testing consisting of fines content analyses, Atterberg limits, consolidation, shear strength analyses, maximum dry density and optimum moisture content, expansion index, corrosivity, and R-value tests. The proposed project investigated in this report was not developed.

We have reviewed a prior geotechnical evaluation report by others for the slope that ascends along the western and southwestern property lines, with apartments and homes in-place at the top of the slope (DHLA, 2009). The prior report presented an evaluation of the on-going lateral deflection and creep of the subject slope. The evaluation included 16 exploratory borings, two test pits, and laboratory testing including fines content, Atterberg limits, consolidation, shear strength analyses, maximum dry density and optimum moisture content, expansion index, and corrosivity testing. Following the evaluation, it was recommended to stabilize the subject slope using a tie-back system. Long-term repair measures recommended for the slope (tie-back stabilization program) do not appear to have been implemented. We understand that on-going lateral slope movement and localized surficial failures have continued in more recent years.

We have also reviewed prior reports by others related to the investigation phase and construction phase for the City Hall property southeast of the subject site. These reports included a preliminary geotechnical investigation and conceptual grading plan review report (GMU, 2007), a supplemental letter (GMU, January 2010), report of geotechnical observation and testing during rough grading (GMU, June 2010), and report of geotechnical observation and testing during precise grading and on-site improvements (GMU, 2011). The investigation reports included two exploratory borings, four test pits, and laboratory testing consisting of grain size analyses, shear strength, consolidation, and R-value.

The above prior reports were referenced when planning our preliminary investigation, performing our geotechnical and geologic evaluation, and preparing this letter report.

Based on our review of the Group Delta (2005) report referenced above, we are also aware of prior geotechnical reports related to the rough grading and fine grading of the site in 1981 and 1982, respectively (Westland, 1981; 1982), but we have not reviewed those reports as of yet. It is our understanding that the rough and fine grading reports address the grading associated with the filling of the tributary canyon that previously existed on the west side of the subject site. Westland also provided geotechnical services during the development of portions of the residential developments to the west of the site and the ascending slope up to those developments.

SCOPE OF WORK

Our overall scope of work included review of readily available subsurface and geologic data from previous geotechnical reports by others, a limited subsurface exploration, limited laboratory testing, a geologic and seismic hazard evaluation, preliminary foundation analyses, and preparation of the following reports:

- A Geotechnical Evaluation Report for CEQA for the overall development to address geotechnical and geologic/seismic hazards outlined in Appendix G of the State CEQA Guidelines and their potential to impact site development

- A Preliminary Geotechnical Investigation Report for the project to provide preliminary geotechnical recommendations for conceptual design.

This letter report presents our preliminary geotechnical findings and recommendations for conceptual design. Our evaluation of the potential geologic and seismic hazards for the development as outlined in Appendix G of the CEQA guidelines are presented in a separate report.

Our preliminary field exploration program for the overall site consisted of five Cone Penetration Tests (CPTs) and four exploratory borings. The CPTs were advanced to depths of 30 to 50 feet below existing grades. The borings were drilled to depths of approximately 30 to 50 feet below the existing grades. Descriptions of field procedures and logs of the CPTs and borings are presented in Appendices A and B, respectively. The approximate locations of the subsurface explorations are shown on the Existing and Proposed Site Plans, Figures 2 and 3, respectively.

Limited laboratory soil tests were performed on selected representative samples as an aid in soil classification, supplementing prior testing by others, and to evaluate the engineering properties of the soils. The preliminary geotechnical laboratory testing program included determination of moisture content and dry density, fines content, Atterberg limits, direct shear, consolidation, maximum dry density and optimum moisture content, and expansion index. Laboratory testing procedures and results are summarized in Appendix C.

Engineering evaluations were performed to provide planning-level recommendations and an assessment of seismic hazards. The results of our evaluations are presented in the remainder of this letter report.

SITE HISTORY

Our understanding of the development history of the site is based on information provided by our client, a review of historical aerial photographs (Historical Aerials and Google Earth), vintage stereoscopic air photographs, and additional online sources. Our understanding of the site history is presented in our geotechnical evaluation report for CEQA, with a brief summary of this history presented below. In general, the site has been in its approximate current configuration since 1994.

In 1938, the site was undeveloped and included a tributary canyon on the west side of the property that drained into Sulphur Creek from the northwest. Sulphur Creek was the primary canyon to the south-southeast of the site near the current alignment of Crown Valley Parkway.

Between 1938 and 1963, the site appears to be relatively unchanged with some minor unpaved roads being developed. In 1967, a paved roadway along the approximate alignment of Crown Valley Parkway along the southern property limit appears.

By 1970, Crown Valley Parkway and Alicia Parkway were constructed and the east portion of the site was graded for construction of the courthouse and adjacent district attorney building, with a surface parking lot in-place near the corner of Crown Valley Parkway and Alicia Parkway (newly constructed) where the current City Hall development is located. By 1978, the west side of the site was not graded, including the tributary canyon from the northwest, which remained as a natural canyon area.

By 1980, the tributary canyon had been filled in, the remainder of the site outside of the development shown in the 1970 aerial had been cleared, and the housing development to the southwest was in place. In 1981, one of the buildings currently occupied by the County fleet vehicle service facility had been constructed, the ascending slope to the west was constructed, and Pacific Island Drive was in-place. By 1994, the library, fire station, and apartments to the west were built and the parking around the courthouse building had been extended to the north.

EXISTING SURFACE CONDITIONS

The subject site is approximately 23.5 acres in size and bounded by Crown Valley Parkway to the southeast, Alicia Parkway to the northeast, Pacific Island Drive to the northwest, and residential developments to the southwest. Currently, about half the site is undeveloped, with the remaining portions containing buildings that will be demolished or relocated. These buildings include a former fire station and a former County courthouse (east end of site along Alicia Parkway) and a County vehicle maintenance facility (north end of site along Pacific Island Drive). A City Library along Crown Valley Parkway (south end of site) will be demolished and rebuilt as part of the proposed development. An existing fire station (north end of site along Pacific Island Drive) and Laguna Niguel City Hall (at intersection of Alicia Parkway and Crown Valley Parkway) are adjacent to the project site and will remain.

The ground surface elevation across the site varies from about Elevation +305 in the south to +370 feet in the north. An approximately 18-foot high, 3:2 (horizontal:vertical) ascending slope extends along the northwestern property line, with Pacific Island Drive at the top of the slope. At the northeast portion of the site, a 15- to 20-foot high descending slope extends down to Alicia Parkway. A 40- to 50-foot high, 2:1 (horizontal:vertical) ascending slope extends along the western and southwestern property lines, with apartments and homes in-place at the top of the slope. As discussed previously, the 40- to 50-foot slope below the homes (southern portion of the west property limits) was evaluated in 2009 for on-going lateral deflection and creep (DHLA, 2009). Long-term repair measures for the slope instability do not appear to have been implemented since that evaluation.

In our borings located in pavement areas (B-2 and B-4), the existing asphalt concrete pavement sections consisted of 2 to 4 inches of asphalt concrete overlying 3 to 9½ inches of aggregate base. Prior borings by others noted 2 to 4 inches of asphalt concrete and 3 to 12 inches of underlying aggregate base (Group Delta, 2005). The remaining explorations were performed in undeveloped areas.

SUBSURFACE CONDITIONS

Our preliminary field investigation disclosed a subsurface profile consisting of shallow to relatively deep fill soils overlying natural materials. Detailed descriptions of the conditions encountered are shown on the Logs of CPTs and Borings in Appendices A and B, respectively. Approximate boundaries between the shallow and deep fills are shown on the Geologic Map, Figure 4. In addition, the subsurface conditions along the western portions of the property (former tributary canyon) are shown on the subsurface cross section in Figure 5.

Based on our review of the data from previous geotechnical investigations, as well as our limited subsurface investigation, the subsurface geotechnical conditions at the site can be generally characterized as follows:

- The eastern portion of the site is generally a cut into bedrock of the Capistrano Formation (Tc), with relatively shallow clayey fills overlying the bedrock.

- The western portion of the site comprises the area where a tributary canyon, approximately 30 to 40 feet deep, was filled to current site grades with clayey fill soils generated from on-site cuts in the Capistrano Formation and possibly other sources.

Based on our review of a report by others (Group Delta, 2005), the rough grading and fine grading of the site in 1981 and 1982 were documented in reports by Westland (Westland, 1981; 1982). These reports supposedly documented the deep fills within the former tributary canyon area on the west portion of the site. We have not yet obtained or reviewed those reports.

Within the eastern portions of the site, we encountered shallow fill soils up to depths of about 2 feet below existing grades. Prior borings by others (Group Delta, 2005) also performed in the eastern portions of the site encountered fill soils between depths of about 0 to 5 feet below grades. The fill soils consisted of very moist to wet, highly plastic fat clays. Expansion testing of the fills within the eastern portions of the site, performed by others, indicate that they are highly expansive (EI of 115 to 126). Documentation regarding the placement of the fills soils was not available at the time this report was prepared. Deeper fills associated with the currently existing structures may be encountered during demolition and site grading.

Within the western portions of the site along the former tributary canyon area, we encountered fill soils to depths of 20 to 29 feet below the existing grades. Although not encountered in our limited explorations in this area, we anticipate deeper fills may exist along the former tributary canyon. A prior boring by others encountered the fill soils to a depth of 34 feet in this area (Group Delta, 2005). The fills consist predominantly of firm to very stiff Capistrano Formation (Tc) derived fat clays, sandy clays, and silty clays. These clayey fills are predominantly moist to wet, with moisture contents ranging between 14 and 32 percent. In our boring B-4, located at the south end of the site, we also encountered moist clayey sand with gravel fills between depths of 10 and 20 feet. Expansion index testing of the clay soils in this area indicated that they are highly expansive (EI of 121 in our recent testing and 115 to 168 previously by others).

The natural materials underlying the fills throughout the site consist predominantly of Capistrano Formation (Tc) siltstone and claystone. Within the former tributary canyon, it appears that a thin layer of colluvial or alluvial soils are in-place between the fill and underlying bedrock. The bedrock encountered in our limited subsurface explorations is predominantly very

stiff to hard (using soil consistency terminology rather than rock) and very moist to wet. The natural bedrock materials exhibited moderate to high strength and low to moderate compressibility characteristics. Although not tested, the upper natural bedrock materials are anticipated to have a high to very high potential for expansion (the fill soils that were tested and found to have a high to very high expansion potential appear to be derived from the on-site bedrock).

Prior test by others (Crandall, 1988 and Group Delta, 2005) indicate that the soils are severely corrosive to concrete and steel. Sulfate contents were somewhat variable (115 to 10,600 ppm), soil pH was acidic to neutral (3 to 7.2), resistivity values are consistently less than 1,000 ohm-cm, and chlorides were generally high with respect to corrosion of reinforcing steel (708 to 1,487 ppm).

GROUNDWATER AND CAVING

Data published by the State of California indicates a shallowest depth to groundwater of 5 to 20 feet at the subject site (CGS, 2001). The available data is isolated to former drainages (20 feet in the western and southwestern portions of the site; 5 feet along the southeastern portions of the site) while data doesn't appear to be available outside of these drainages.

Groundwater was encountered at depths of approximately 14 feet to 24.5 feet below existing site grades in three of our borings, corresponding to approximate elevations of +331.5 to +339.5 feet. Groundwater was not encountered in our southernmost boring (B-4) within the 30-foot depth explored (tip elevation of +310 feet). Prior explorations by others encountered groundwater throughout the site at depths ranging between 16.5 to 47 feet, corresponding to elevations of +286 to +346 feet (Group Delta, 2005).

Caving was not encountered in our 8-inch diameter hollow-stem borings. Based on the fines and moisture contents of the soils encountered, the caving potential of the fill soils or the natural bedrock is considered to be low.

FINDINGS AND RECOMMENDATIONS

Based on the results of our investigation and experience with similar projects, it is our opinion that from a geotechnical engineering viewpoint it is feasible to develop the site as proposed. The most significant geotechnical issues to consider for the design and construction of the proposed structures are as follows:

- There are no known faults crossing or projecting through the site. The site is not located in a Special Studies Fault Zone. Therefore, ground rupture due to faulting is considered unlikely at this site. The closest fault to the site is the Newport-Inglewood fault, which is about 2.7 miles to the southwest.

- Typical of Southern California, there is a potential that the site development will be subjected to strong ground motion during its life. Based on published information and using the methods outlined in the 2016 California Building Code (CBC), we computed that the site could be subjected to a peak ground acceleration (PGA_M) of 0.59g for an approximate Magnitude 6.6 earthquake. This acceleration has been computed using the mapped Maximum Considered Geometric Mean peak ground acceleration from

ASCE 7-10 (ASCE, 2010) and a site coefficient (F_{PGA}) based on Site Class.

- The site is not located in a seismic hazards zone for liquefaction potential. The site was likely excluded from a liquefaction hazard zone because of the presence of high plasticity, cohesive fill soils and shallow bedrock materials.

- We assume that seismic design of the proposed development will be in accordance with the 2019 California Building Code (CBC) criteria. For the 2019 CBC, Site Class D may be used. The Project Structural Engineer can determine the remaining seismic code values by using the value above and the pertinent websites and tables from the building code.

- Based on our limited subsurface investigation and our review of prior investigations by others, existing undocumented fills were encountered to depths of 0 to 5 feet below existing grades in the eastern portions of the site and to approximate depths of 20 to 34 feet below existing grades in the western portions of the site (former tributary canyon area). Localized deeper fills associated with prior structures may be encountered in the eastern half of the site. We also anticipate deeper fills may be present within the former tributary canyon area. The fills are not considered suitable for direct support of foundations or floor slabs.

- The on-site soils and bedrock are generally corrosive to severely corrosive to common construction materials. CBC corrosion protection requirements are outlined in ACI 318, Section 4.3. Laboratory testing by others indicates that the soluble sulfate content is variable but locally at levels corresponding to Category S2 in ACI 318. Chloride concentrations are more consistently high, corresponding to Category C2 in ACI 318. Prior pH test results indicate that the soils are acidic to neutral. Finally, resistivity testing indicated that the on-site materials are severely corrosive to buried metals, requiring consideration of non-metallic materials, cathodic protection, or coatings for buried metals. Foundation concrete will need to include minimum compressive strengths, maximum water cement ratios, specific cement types, and additional cover around reinforcing steel. We recommend that a Corrosion Engineer be retained for the design, and additional corrosion testing be included in the comprehensive geotechnical investigation for the project.

- Grading for the proposed development will likely remove the undocumented fills and portions of the upper bedrock materials within the eastern portions of the site. Due to the depth of undocumented fills in the western portions of the site (up to 34 feet below existing grades), a conventional overexcavation and recompaction grading program is likely not feasible for structures within the proximity of the former tributary canyon area. As such, we anticipate the proposed parking structure, select apartment buildings, and select retail buildings will need to be supported on deep foundations extending through the fill soils placed within the former tributary canyon.

- For preliminary planning purposes, we anticipate removals for the support of planned structures located entirely within the eastern half of the site (no portion of the structure's footprint extending into the former tributary canyon area) should extend to depths of 4 feet below existing grades or 2 feet below the base of shallow foundations, whichever is deeper.

- For minor structures throughout the subject site, such as site walls, removals should extend at least 3 feet below the existing grade or 1 foot below the base of foundations, whichever is deeper. In proposed pavement and hardscape areas, removals should extend to depths of 2 feet below existing or finished grades, whichever is deeper. Deeper localized removals will be required in the former building footprints (courthouse, library, fleet services) where deeper soils are disturbed by demolition.

- For structures at least partially located within the western portions of the site (former tributary canyon area), remedial grading is not considered feasible due to the excessive depth of the former tributary canyon fills. As such, we anticipate these structures will be supported on deep foundations (i.e. concrete piles) or shallow foundations supported on rammed aggregate piers (RAP) or deep soil-mixing (DSM). For structures supported on pile foundations, RAP, or DSM, additional removals below the base of shallow footing bottoms may be omitted. However, regardless of the foundation system, for planning purposes we recommend that soils within 2 feet of the finished grade for floor slabs be removed and replaced with select, non-expansive soils or chemically treated (i.e. cement or lime) to limit the potential for expansion when undergoing changes in moisture content.

- The near-surface soils encountered in our limited explorations were very moist to wet, with moisture contents generally 5 to 10 percent above optimum. Fine-grained, above optimum soils have the tendency to yield or “pump” under conventional rubber-tired equipment. Where wet soils are exposed, the contractor may need to utilize track-mounted equipment to avoid disturbance and yielding of the over-optimum soils. Additionally, subgrade stabilization may be required to support compaction equipment and to achieve a firm and unyielding bottom to support the placement of fill. Stabilization may consist of crushed base materials and geogrid or chemical treatment (i.e. cement or lime). Further testing and evaluation of the soil sulfate content will be required prior to determining the feasibility of chemical treatment and development of treatment recommendations. Based on the available information, chemical treatment is feasible but will require special measures, such as a mellowing period between mixing.

- The upper clayey soils exhibit a high to very high potential for expansion and are expected to shrink or swell with changes in moisture content. As such, these materials are not considered suitable for placement as retaining wall backfill or directly beneath conventional building floor slabs or hardscape. We recommend the on-site clayey soils should not be placed within 2 feet of the finished subgrade in conventional floor slab or hardscape areas. Post-tension slabs should be considered for buildings. Reinforcing is recommended for conventional slabs and hardscape, and consideration will need to be given for sufficient cover around the reinforcing. Soils placed as subgrade support for conventional slabs, hardscape, and retaining wall backfill should be granular and relatively non-expansive. Such soils are not anticipated to be available on-site. As such, we anticipate the need to import select fill. If the site will balance or require a net export of soil, it may be more economical to chemically treat the upper 2 feet of the building pads and hardscape areas. As previously noted, additional corrosivity testing and special provisions will be required for chemical treatment of the soils because of the locally very severe sulfate content.

- Based on our findings, it appears that the proposed buildings outside of the former tributary canyon area can be supported on spread footings on the undisturbed natural bedrock materials or properly compacted fill. Allowable net bearing capacities for conventional spread footings on the order of 3 kips per square foot (ksf) for properly compacted fill and 4 ksf for the undisturbed bedrock are anticipated. Total static settlement (column loads of up to 400 kips) is anticipated to be up to 1-inch.

- As stated previously, pile foundations or shallow foundations supported on rammed aggregate piers (RAPs) or deep soil-mixing (DSM) are anticipated for the structures located at least partially within the former tributary canyon area (west portion of site). The pile foundations, RAPs, or DSM columns will need to extend to depths in excess of 34 feet below the existing grades in order to extend through the former tributary canyon fill. Coordination of the below-grade work and the existing storm drain extending along the former tributary canyon will need to be performed when planning the work in the western portion of the site.

- Rammed aggregate piers (RAPs) consist of drilled holes that are filled with aggregate base or gravel that is mechanically compacted as it is placed. The methods for installing the RAPs will need to consider the need to penetrate below the groundwater. DSM consists of mixing cement with the in-place soils in columns extending down to a dense bearing layer. The resulting soil-cement stabilized soils have significantly higher strength and lower compressibility than the original in-place soils. DSM also results in little to no soil cuttings that require handling or export. The RAPs and DSM columns are constructed on a design-build basis, and GPI should be provided with details of the design for review prior to installation.

- Subsequent to the installation of RAPs or DSM, the structures may be supported on conventional isolated and/or continuous shallow spread footings. The benefits of such a system include significantly reducing the extent of remedial grading, increased allowable foundation bearing pressures and coefficient of friction when compared with values allowed for conventional compacted fill, and reduced anticipated settlements. Because such systems are proprietary, the work is performed on a design-build basis by the specialty contractor. Our design review is typically limited to confirming that the soil parameters used are consistent with the data provided in this report. The design and construction of the RAPs or the DSM columns are the responsibility of the designer. The design will need to include support for foundations and conventional floor slabs, if planned, and extend through the deep fill soils and into the underlying bedrock. In addition, the designer should provide a design report with estimated vertical and lateral capacity of footings bearing on RAPs or DSM columns, the embedment required, static and seismic settlements, and QA/QC and load testing requirements.

- To extend the building foundations through the undocumented fills encountered between depths of 20 to 34 feet below the existing grade and limit potential foundation settlements, deep pile foundations are also a feasible option for the structures in the former tributary canyon area. Pile foundations may consist of cast-in-drilled-hole (CIDH) concrete piles or auger pressure grouted (APG) piles. Based on our experience, pile foundations may not be as economic when compared to alternatives such as RAPs or DSM columns, but provide relatively high axial capacities and a more reliable structural solution for settlement sensitive structures located over the deep fill soils.

- As previously noted, conventional floor slabs should not be supported directly on the on-site highly expansive soils. Unless the on-site soils are replaced with select, non-expansive soils or chemically treated, we recommend using post-tensioned floor slabs for the planned buildings.

- Partial basement walls, cantilever retaining walls, and temporary shoring may be planned as part of the proposed development. The on-site clays are not suitable for wall backfill. We recommend that conventionally backfilled walls be backfilled with granular, relatively non-expansive soils. As stated previously, such soils are not anticipated to be available on-site and will need to be imported. For cantilevered retaining walls less than 15 feet in height with level, drained backfill comprised of granular soils, the magnitude of active pressures is equivalent to the pressures imposed by a fluid weighing 35 pounds per cubic foot (pcf).

- At-rest lateral earth pressures should be used for restrained walls that remain rigid enough to be essentially non-yielding, such as basement walls. At-rest pressures imposed by a fluid weighing 58 pounds pcf should be used for drained, granular backfill.

- Retaining walls supporting more than 6 feet of backfill must account for seismic lateral earth pressures in their design. To account for seismic loads, an additional lateral earth pressure equal to 20 pounds pcf (equivalent fluid pressure distribution) should be added to the above active pressure. If the wall is design using the above at-rest pressure, the added seismic load can be omitted.

- In the vicinity of the project site, the bedding within the Capistrano formation generally dips downward towards the east. If the bedding is determined to be dipping out of slope within basement wall excavations and other temporary cuts, design lateral earth pressures and allowable slope inclinations may be impacted. We did not evaluate the bedding within the bedrock during this preliminary study, but the comprehensive investigation should include this evaluation and determine the impacts of potential adverse bedding on lateral wall pressures and allowable inclinations for temporary slopes.

- Based on limited available documentation and a listing of references, the ascending slopes to the west and southwest of the site have experienced instability and lateral movement since shortly after construction. Although the slopes do not appear to extend onto the subject property, building code requirements for structural setbacks from the toe of the slope should be incorporated into the project layout. Current requirements require a lateral offset between the toe of slope and building face of the smaller of 15 feet or one-half the height of the slope. Without confirmation that the slope stability issues have been resolved, consideration should be given to increasing the lateral offset where feasible.

- Groundwater will need to be accounted for in the installation of deep foundations or ground improvement methods. We encountered perched groundwater seepage within the Capistrano formation bedrock as shallow as 14 feet below the ground surface at the northeast portion of the site. Further explorations will be required, but if subterranean construction is planned in that area (the 200-Apartment portion of the development),

design measures may be required for the below-grade level (waterproof and design to resist hydrostatic pressure or install a permanent subdrain). In the remainder of the site, groundwater was encountered as shallow as 23 feet below the ground surface and it is not anticipated to impact the design or long-term maintenance of the development unless two subterranean levels are planned.

- Based on R-value testing by others (Group Delta, 2005), the upper clayey soils are expected to have relatively poor pavement support characteristics (R-values of 5 to 8). Using Caltrans design methods and the available subgrade information, we anticipate the following asphalt concrete pavement sections for planning purposes:
    - Parking Areas – Traffic Index of 4: 3 inches AC over 7 inches AB
    - Automobile Drives – Traffic Index of 5.5: 3 inches AC over 12 inches AB
    - Truck Drives – Traffic Index of 7: 4 inches AC over 16 inches AB

  We anticipate 8 inches of portland cement concrete pavement over 4 inches of aggregate base in truck drives and high traffic areas such as loading dock and trash enclosure aprons, and drive approaches. If concrete pavers are planned, we recommend that they be underlain by concrete pavement or a thickened aggregate base section placed over a suitable geogrid reinforcement, such as Tensar BX1100 or equivalent.

In general, development of the subject site as planned is feasible from a geotechnical standpoint but includes some geotechnical challenges that will impact the design and construction. These challenges include, but are not limited to, deep fill in the former tributary canyon, highly expansive and corrosive soils, and high moisture contents in the upper soils. Additional explorations and testing, as well as structural loads and details, will be required for the design-level geotechnical study to provide detailed recommendations for earthwork and design of foundations, floor slabs, retaining walls, and pavements.

LIMITATIONS

The geotechnical investigation reported herein was performed for the exclusive use by Sares Regis Group and their consultants in evaluating the feasibility of constructing the proposed development. This report should not be used for evaluating the feasibility of developing the site for other uses or for the detailed design of the proposed project, because this report does not contain sufficient or appropriate information for such use.

Soil deposits may vary in type, strength, and many other important properties between points of exploration due to non-uniformity of the geologic formations or to man-made cut and fill operations. While we cannot evaluate the consistency of the properties of materials in areas not explored, the conclusions drawn in this report are based on the assumption that the data obtained in the field and laboratory are reasonably representative of field conditions and are conducive to interpolation and extrapolation.

As noted previously, additional geotechnical investigations will be needed for design and construction. Furthermore, our recommendations were developed with the assumption that a proper level of field observation and construction review will be provided by a qualified geotechnical consulting firm during grading, excavation, and foundation construction. If design- and construction-phase geotechnical services are performed by others they must accept full responsibility for all geotechnical aspects of the project.

Our investigation and evaluations were performed using generally accepted engineering approaches and principles available at this time and the degree of care and skill ordinarily exercised under similar circumstances by reputable Geotechnical Engineers practicing in this area. No other representation, either expressed or implied, is included or intended in our report.

Respectfully submitted,
Geotechnical Professionals Inc.

Dylan J. Boyle, P.E.
Project Engineer

Paul R. Schade, G.E.
Principal

Enclosures: References

Figure 1	- Site Location Map
Figure 2	- Existing Site Plan
Figure 3	- Proposed Site Plan
Figure 4	- Geologic Map
Figure 5	- Subsurface Cross Section
Appendix A	- Cone Penetration Tests
Appendix B	- Exploratory Borings
Appendix C	- Laboratory Testing

Distribution: (1) Addressee

REFERENCES

American Society of Civil Engineers (2010), "Minimum Design Loads for Buildings and Other Structures," ASCE/SEI 7-10.

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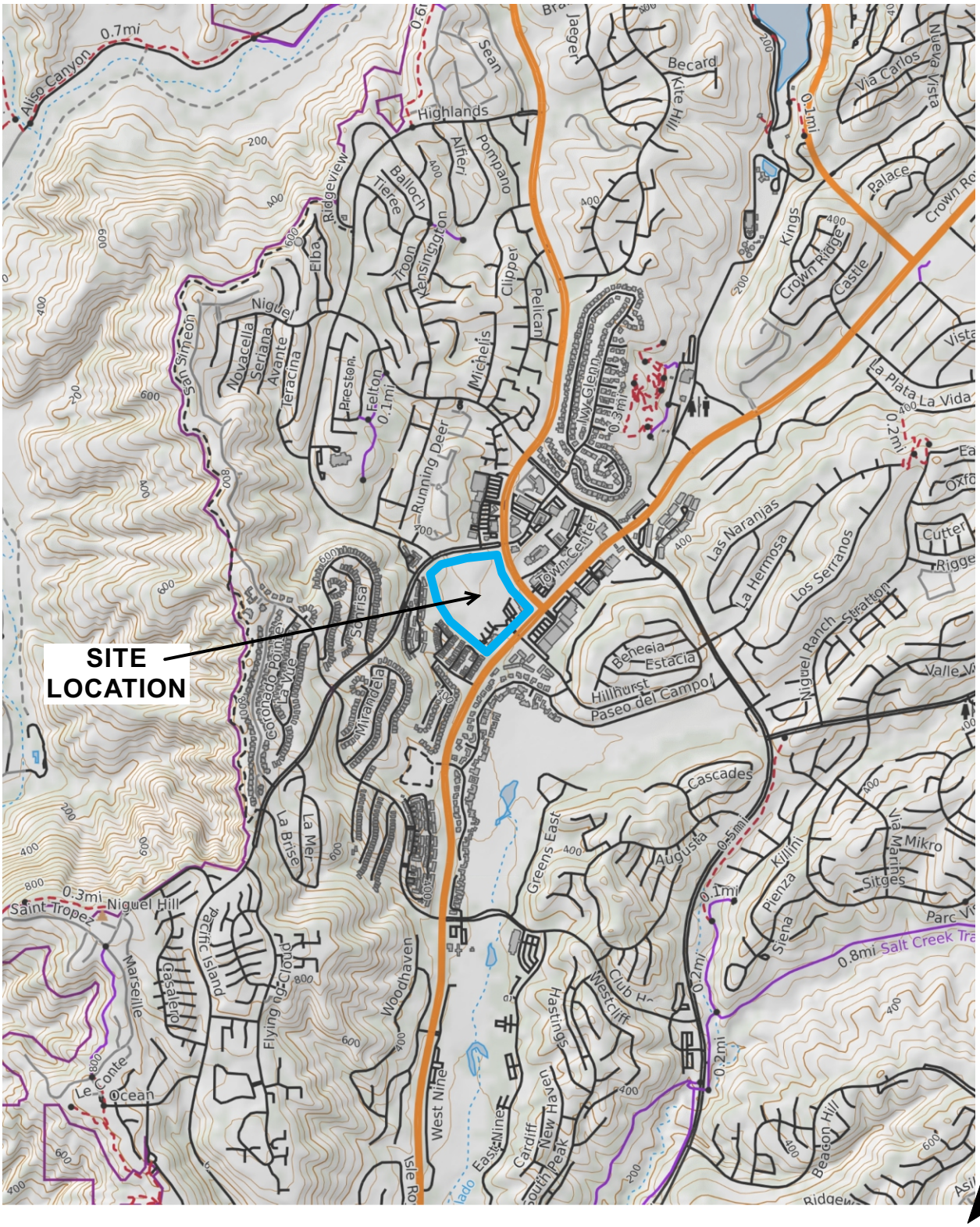

BASE MAP REPRODUCED FROM USGS 7.5' TOPO MAPS (WGS84 USNG ZONE 11SMT) © CALTOPO

GEOTECHNICAL PROFESSIONALS, INC.

SITE LOCATION MAP

SRG LAGUNA NIGUEL TOWN CENTER

GPI PROJECT NO.: 2952.I

SCALE: 1" = 2000'

FIGURE 1

EXPLANATION

- B-5 — APPROXIMATE LOCATION AND NUMBER OF EXPLORATORY BORING
- C-5 — APPROXIMATE LOCATION AND NUMBER OF CONE PENETRATION TEST
- B-13 — APPROXIMATE LOCATION AND NUMBER OF PRIOR EXPLORATION BY OTHERS (2005)
- (5') — APPROXIMATE DEPTH OF FILL (FEET)
- SUBSURFACE CROSS SECTION

N

0 150 300 FEET

GPI GEOTECHNICAL PROFESSIONALS, INC.

SRG LAGUNA NIGUEL TOWN CENTER

GPI PROJECT NO.: 2952.I | SCALE: 1" = 150'

EXISTING SITE PLAN

FIGURE 2

EXPLANATION

- B-5 — APPROXIMATE LOCATION AND NUMBER OF EXPLORATORY BORING
- C-5 — APPROXIMATE LOCATION AND NUMBER OF CONE PENETRATION TEST
- B-13 — APPROXIMATE LOCATION AND NUMBER OF PRIOR EXPLORATION BY OTHERS (2005)
- (5') — APPROXIMATE DEPTH OF FILL (FEET)
- SUBSURFACE CROSS SECTION

N

0 150 300 FEET

BASE MAP REPRODUCED FROM DESIGN CONCEPT PREPARED BY BURNHAM WARD PROPERTIES: DATED 04/09/2019

GPI GEOTECHNICAL PROFESSIONALS, INC.

SRG LAGUNA NIGUEL TOWN CENTER

GPI PROJECT NO.: 2952.I | SCALE: 1" = 150'

PROPOSED SITE PLAN

FIGURE 3

EXPLANATION

- Af_1 — APPROXIMATE LIMITS OF FILL PLACED DURING PREVIOUS GRADING (CIRCA 1980-1981)
- Af_2 — APPROXIMATE LIMITS OF FILL PLACED DURING PREVIOUS GRADING OF EXISTING STRUCTURES AND PARKING AREAS
- Tc — CAPISTRANO FORMATION
- B-5 — APPROXIMATE LOCATION AND NUMBER OF EXPLORATORY BORING
- C-5 — APPROXIMATE LOCATION AND NUMBER OF CONE PENETRATION TEST
- B-13 — APPROXIMATE LOCATION AND NUMBER OF PRIOR EXPLORATION BY OTHERS (2005)
- (5') — APPROXIMATE DEPTH OF FILL (FEET)
- APPROXIMATE BOTTOM OF FILLED CANYON AND POSSIBLY OF CANYON SUBDRAINS
- GEOLOGIC CONTACT
- SUBSURFACE CROSS SECTION

N

0 150 300 FEET

BASE MAP REPRODUCED FROM TOPOGRAPHIC PLAN PROVIDED BY OWEN GROUP (UNDATED)

I1-122

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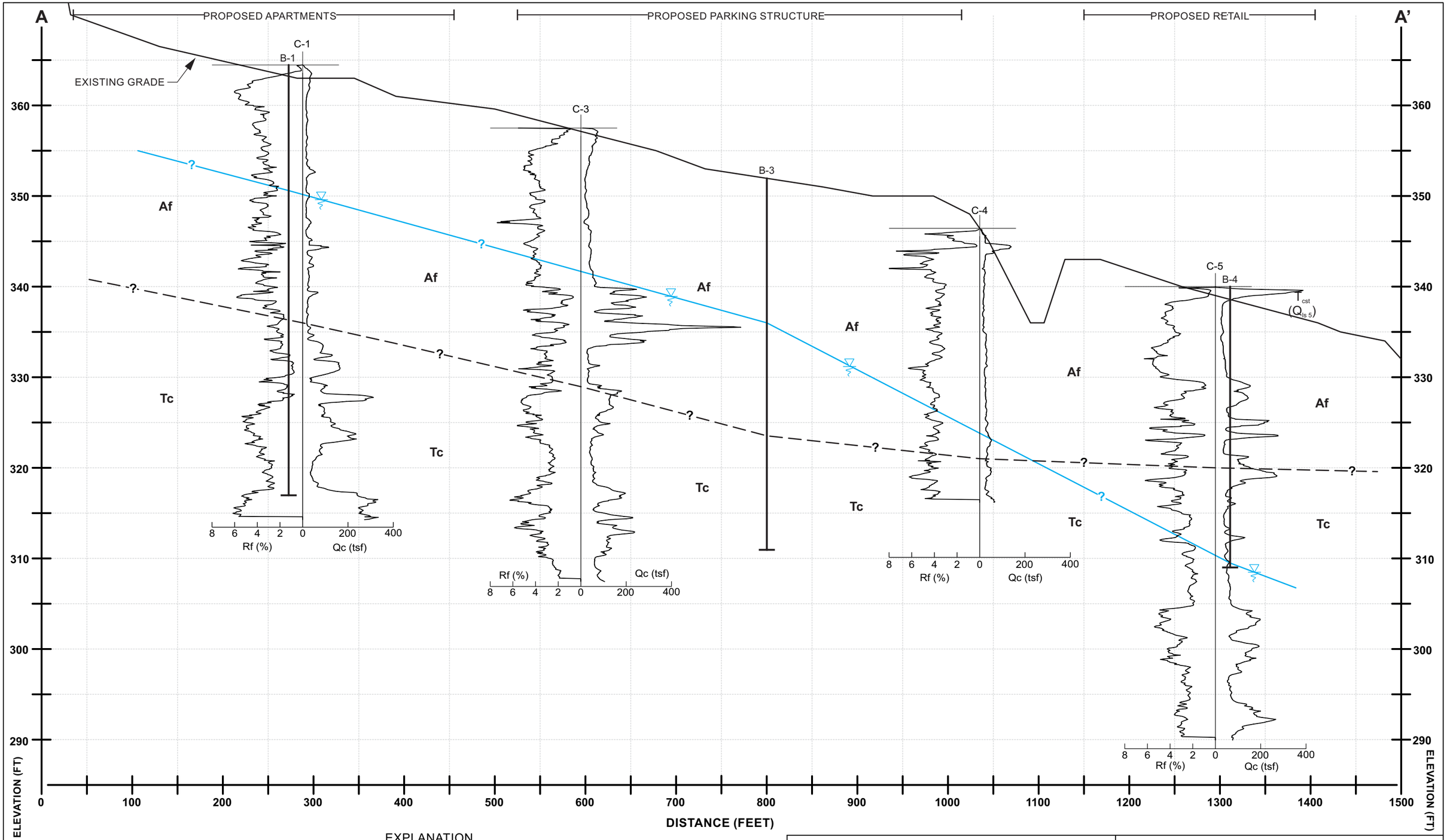
SRG LAGUNA NIGUEL TOWN CENTER

GPI PROJECT NO.: 2952.I | SCALE: 1" = 150'

SITE GEOLOGIC MAP

FIGURE 4



EXPLANATION

Af APPROXIMATE LIMITS OF FILL PLACED DURING PREVIOUS GRADING (CIRCA 1980-1981)

Tc CAPISTRANO FORMATION

Note: This section is based upon information obtained at borings and CPTs obtained during geotechnical investigation. The section is based upon limited geotechnical data and localized variations should be anticipated. This section is intended for descriptive purposes only.

HORIZONTAL: 1" = 100'
VERTICAL: 1" = 10'
11-123

GPI GEOTECHNICAL PROFESSIONALS, INC.

SRG LAGUNA NIGUEL TOWN CENTER

GPI PROJECT NO.: 2952.I | SCALE AS SHOWN

SUBSURFACE CROSS SECTION

FIGURE 5

APPENDIX A

APPENDIX A

CONE PENETRATION TESTS

The subsurface conditions were investigated by performing five Cone Penetration Tests (CPT's) at the site. The soundings were advanced to depths ranging from 30 to 50 feet below existing grades. The locations of the CPT's are shown on the Existing and Proposed Site Plans, Figures 2 and 3, respectively.

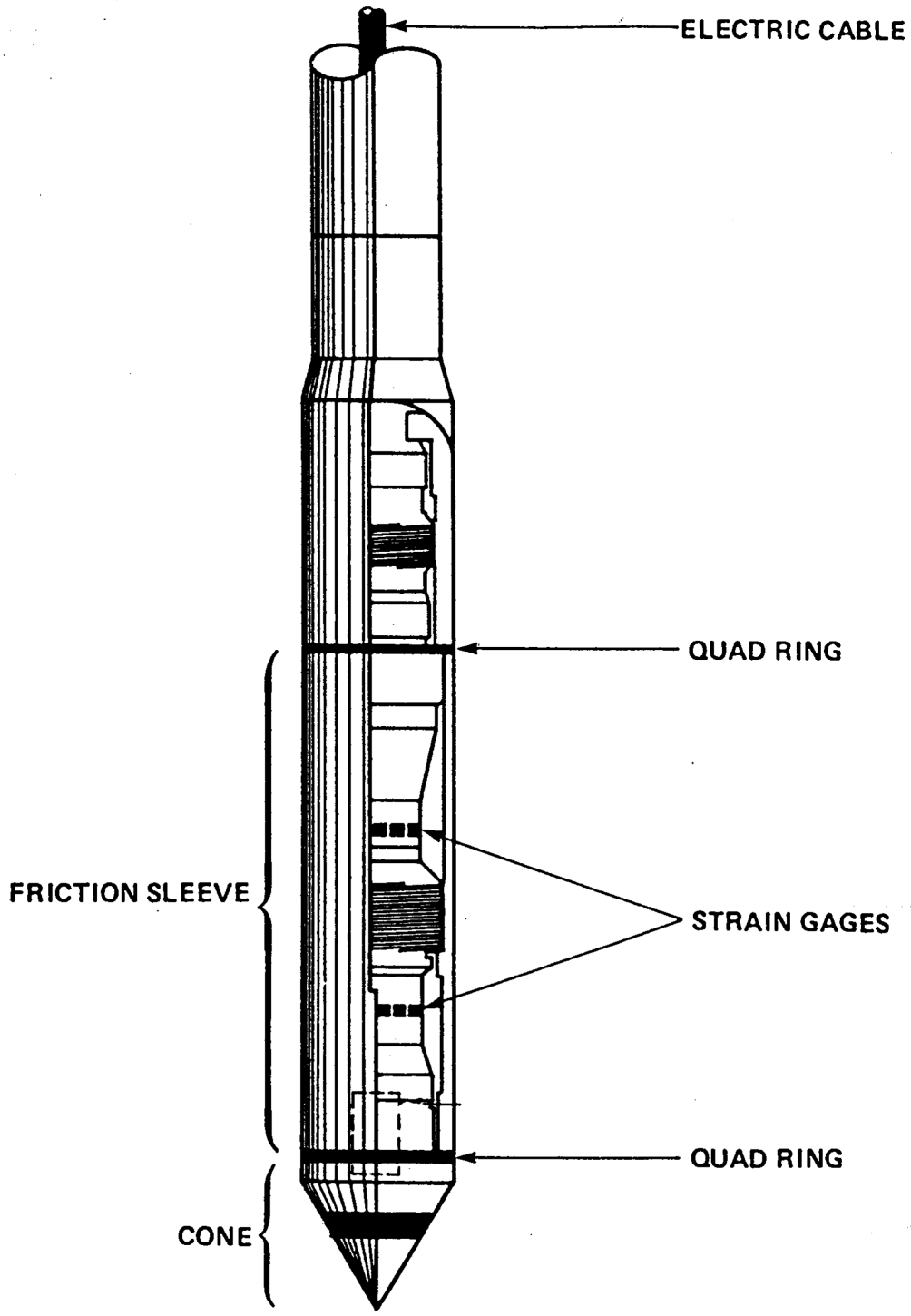
The Cone Penetration Test consists of pushing a cone-tipped probe into the soil deposit while simultaneously recording the cone tip resistance and side friction resistance of the soil to penetration (refer to Figure A-1). The CPT described in this report was conducted in general accordance with ASTM specifications (ASTM D 5778) using an electric cone penetrometer.

The CPT equipment consists of a cone assembly mounted at the end of a series of hollow sounding rods. A set of hydraulic rams is used to push the cone and rods into the soil while a continuous record of cone and friction resistance versus depth is obtained in both analog and digital form at the ground surface. A specially designed truck is used to transport and house the test equipment and to provide a 30-ton reaction to the thrust of the hydraulic rams.

Standard data obtained during a CPT consists of continuous stratigraphic information with close vertical resolution. Stratigraphic interpretation is based on relationships between cone tip resistance and friction resistance. The calculated friction ratio (CPT friction sleeve resistance divided by cone tip resistance) is used as an indicator of soil type. Granular soils typically have low friction ratios and high cone resistance, while cohesive or organic soils have high friction ratios and low cone resistance. These stratigraphic material categories form the basis for all subsequent calculations which utilize the CPT data.

Computer plots of the reduced CPT data acquired for this investigation are presented in Figures A-2 to A-6 of this appendix. The field testing and computer processing was performed by Kehoe Testing and Engineering under subcontract to Geotechnical Professionals Inc. (GPI). The interpreted soil descriptions were prepared by GPI.

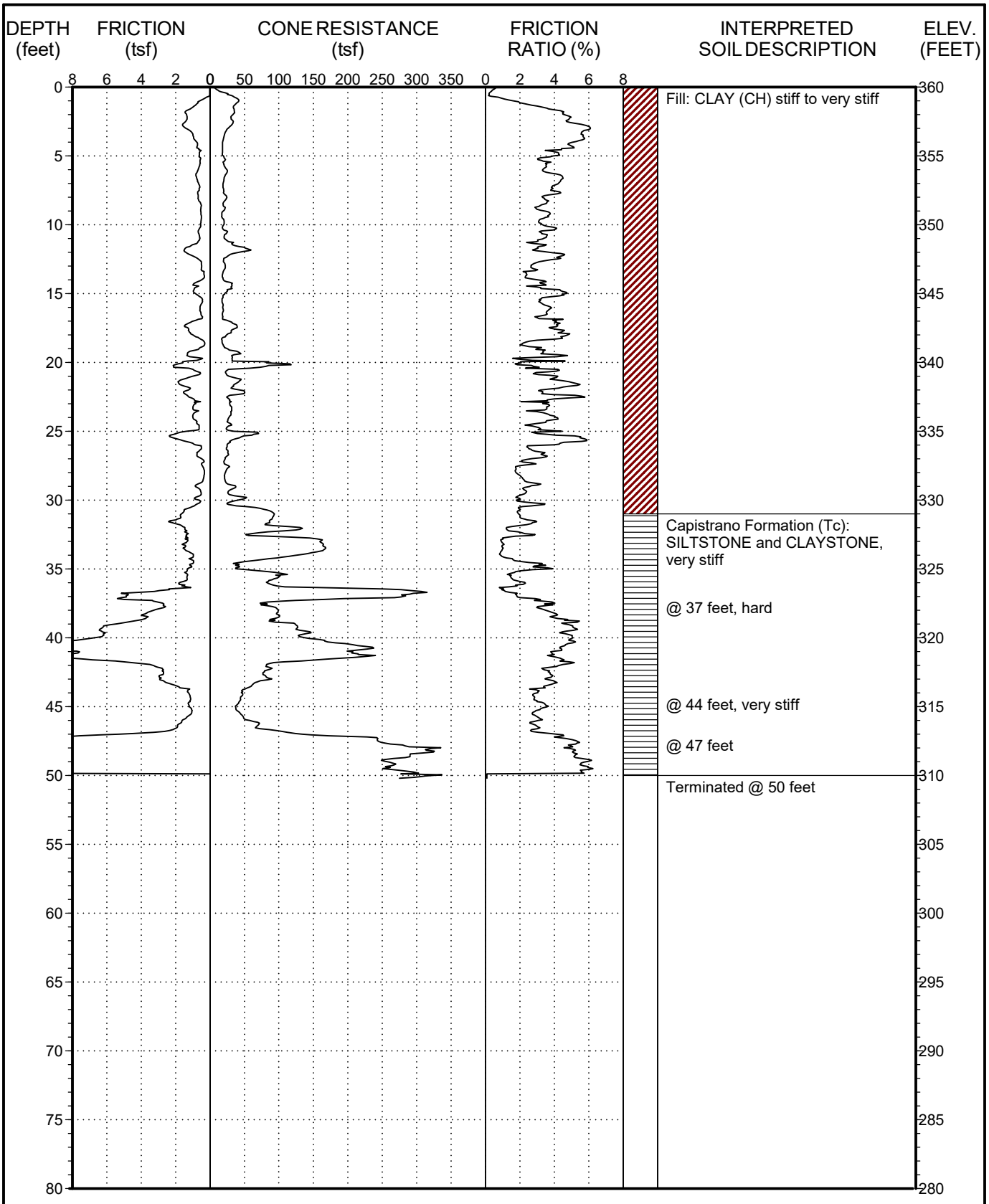
The CPT locations were laid out in the field by measuring from existing site features. Upon completion the uncaved portions of the CPT holes were backfilled with bentonite chips. Ground surface elevations at the CPT locations were estimated from internet sources and should be considered approximate.



GEOTECHNICAL PROFESSIONALS, INC.

CONE PENETROMETER

FIGURE A-1



Date performed:7-3-19

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

GPI

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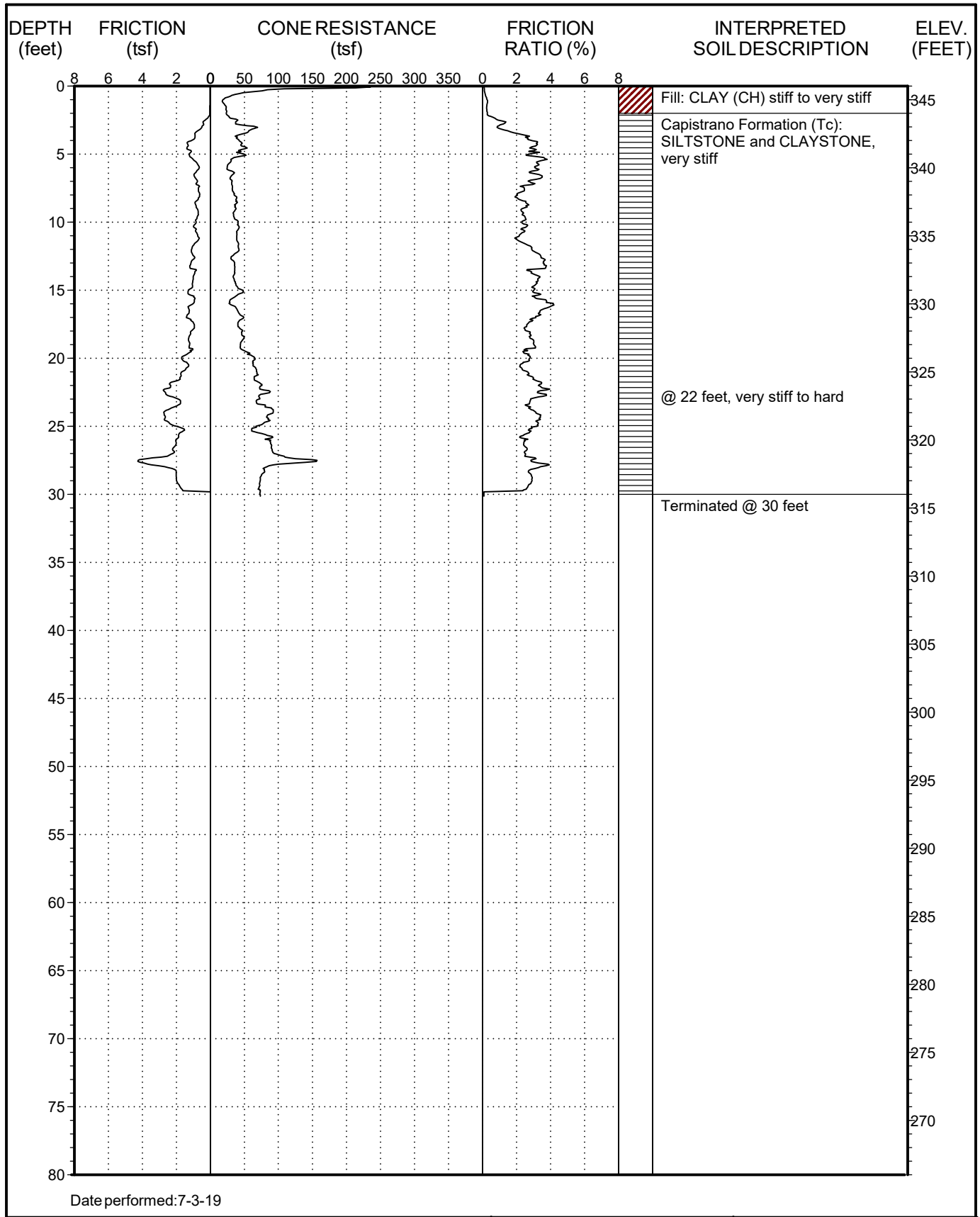
SRG LAGUNA NIGUEL TOWN CENTER

LOG OF CPT NO. C-1

FIGURE A-2



Date performed:7-3-19

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

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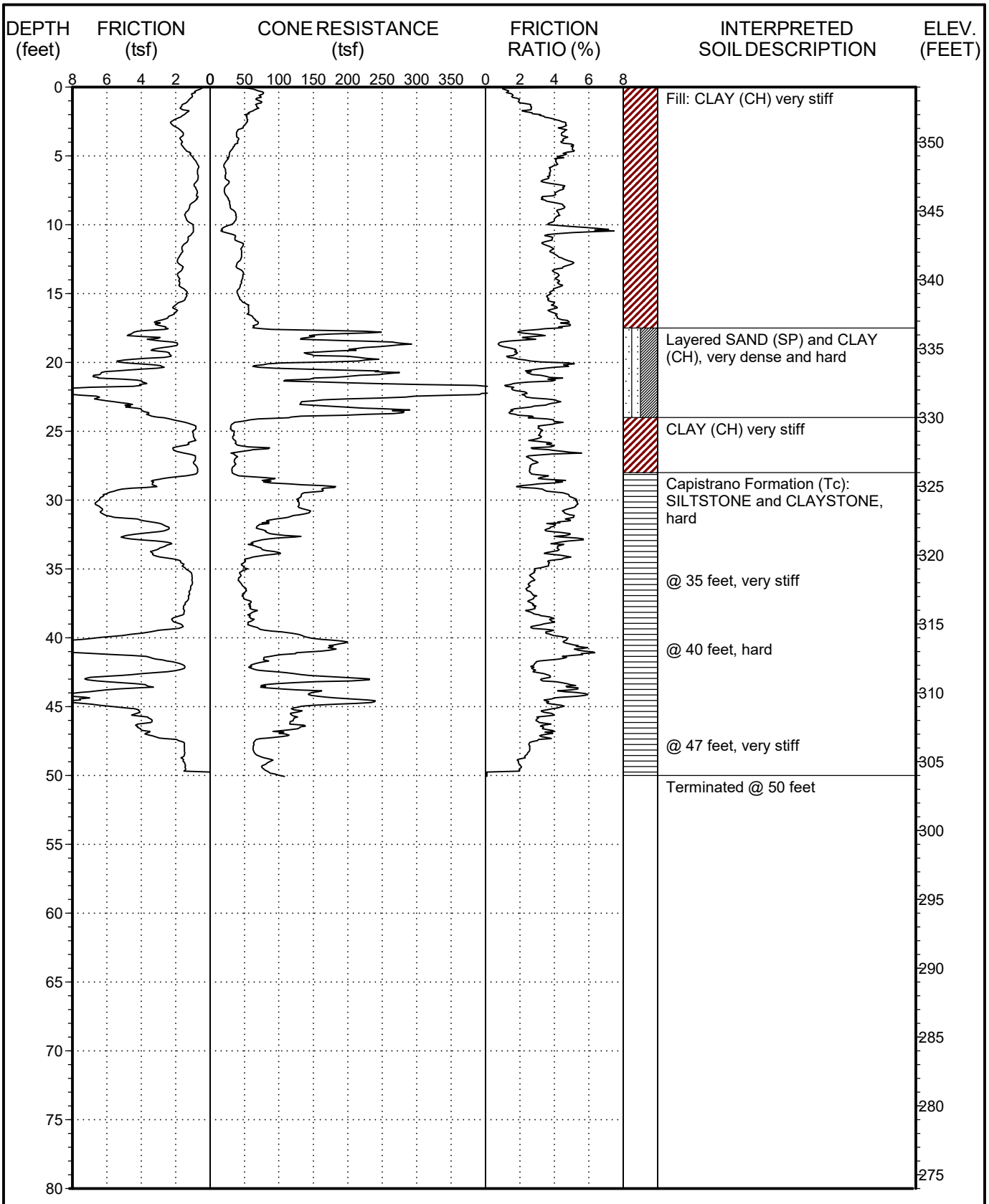
PROJECT NO.: 2952.I

SRG LAGUNA NIGUEL TOWN CENTER

LOG OF CPT NO. C-2

FIGURE A-3



Date performed:7-3-19

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

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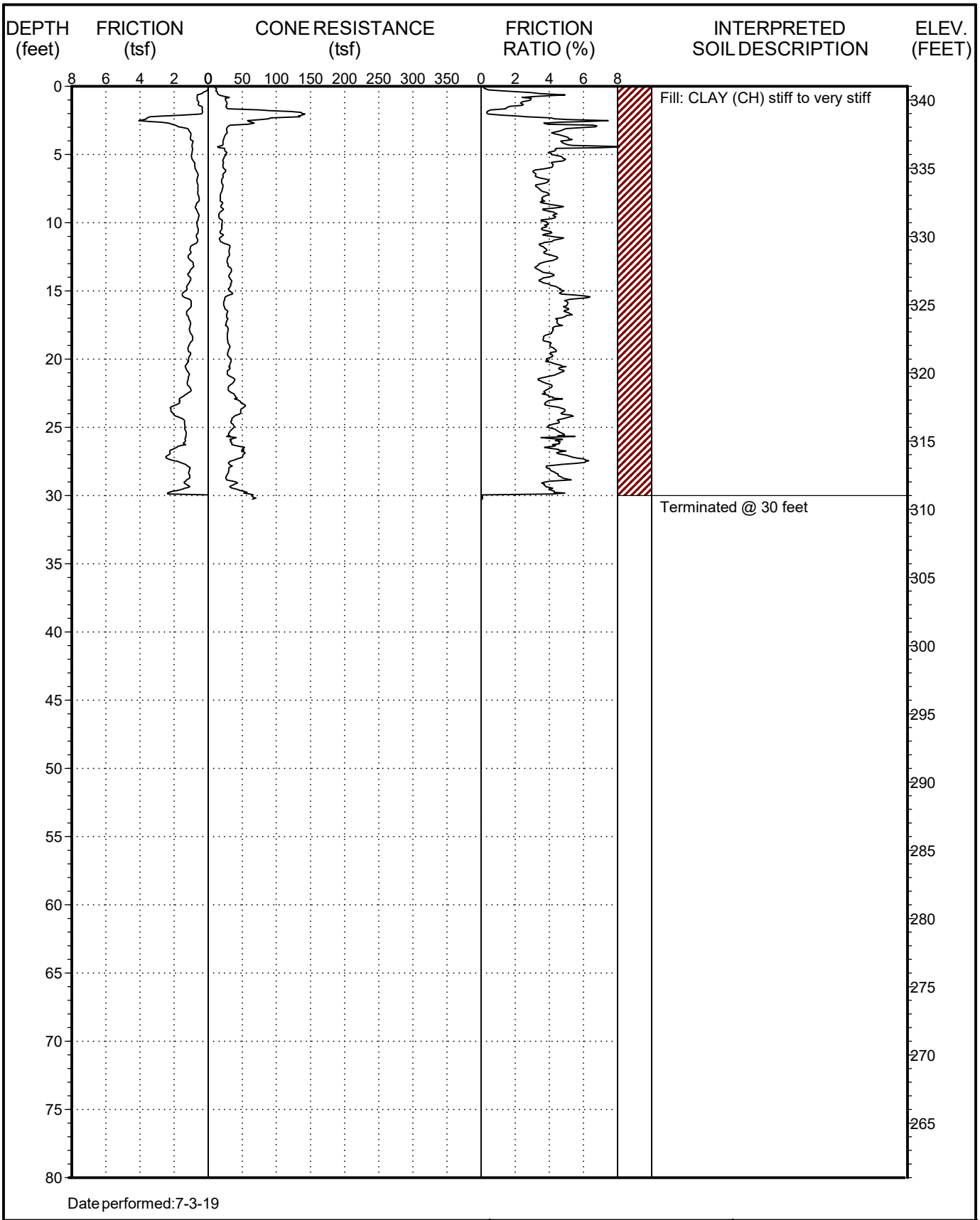
PROJECT NO.: 2952.I

SRG LAGUNA NIGUEL TOWN CENTER

LOG OF CPT NO. C-3

FIGURE A-4



Date performed:7-3-19

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

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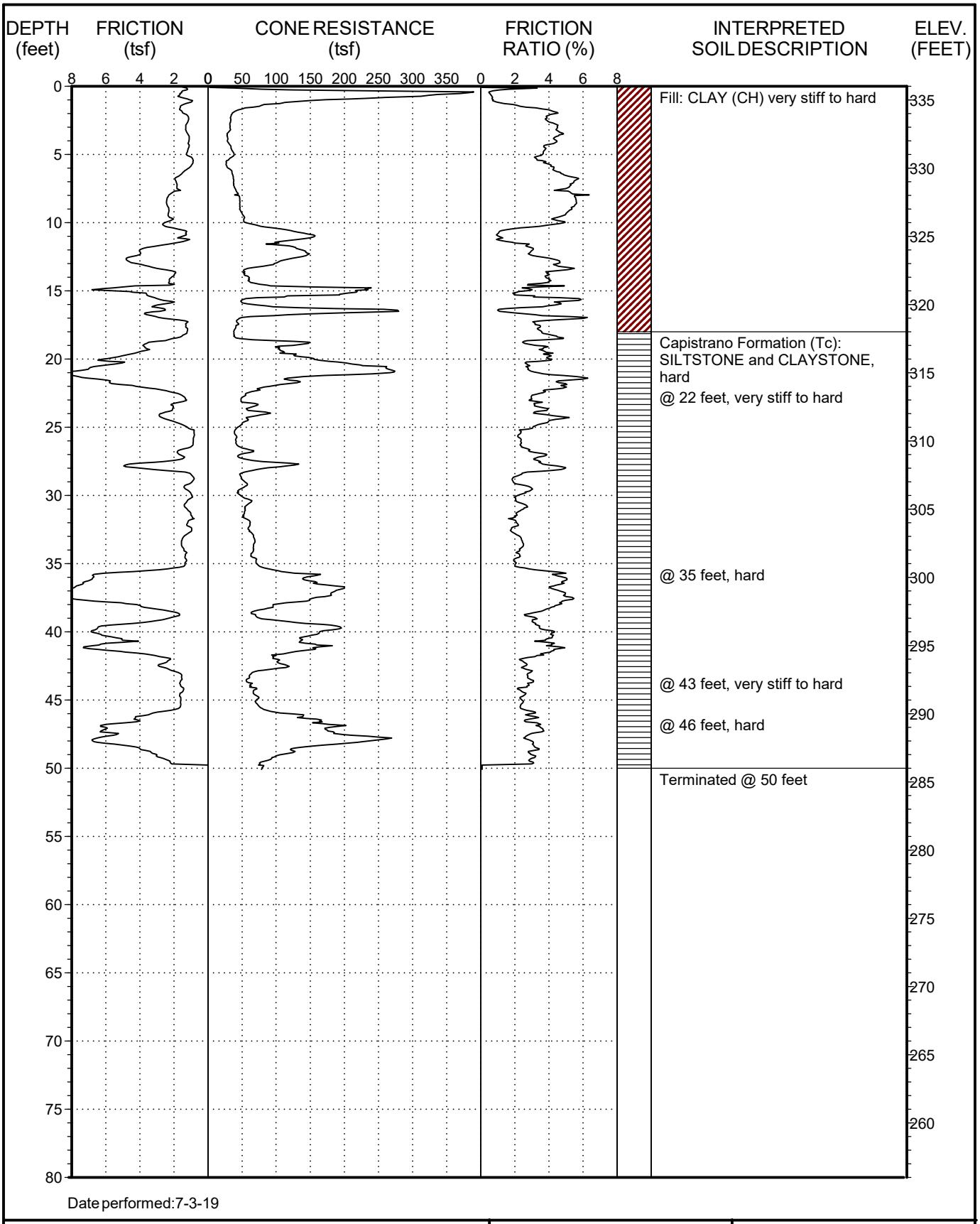
PROJECT NO.: 2952.I

SRG LAGUNA NIGUEL TOWN CENTER

LOG OF CPT NO. C-4

FIGURE A-5



Date performed:7-3-19

This summary applies only at the location of this cone penetration test and at the time of the exploration. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The interpreted soil description is derived from the friction ratio and cone resistance and is a simplification of actual conditions encountered.

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PROJECT NO.: 2952.I

SRG LAGUNA NIGUEL TOWN CENTER

LOG OF CPT NO. C-5

FIGURE A-6

APPENDIX B

APPENDIX B

EXPLORATORY BORINGS

The subsurface conditions at the site were investigated by drilling and sampling four exploratory borings. The borings were advanced to depths ranging from 31 to 48 feet below the existing ground surface. The locations of the explorations are shown on the Existing and Proposed Site Plans, Figures 2 and 3, respectively.

The exploratory borings were drilled using truck-mounted hollow-stem auger drill equipment. Relatively undisturbed samples were obtained using a brass-ring lined sampler (ASTM D 3550). The brass-rings have an inside diameter of 2.42 inches. The ring samples were driven into the soil by a 140-pound hammer dropping 30 inches. The number of blows needed to drive the sampler into the soil was recorded as the penetration resistance.

At selected locations, disturbed samples were obtained using a split-spoon sampler by means of the Standard Penetration Test (SPT, ASTM D 6066). The spoon sampler was driven into the soil by a 140-pound hammer dropping 30 inches, employing the “free-fall” hammer described above. After an initial seating drive of 6 inches, the number of blows needed to drive the sampler into the soil a depth of 12 inches was recorded as the penetration resistance. These values are the raw uncorrected blowcounts.

The field explorations for the investigation were performed under the continuous technical supervision of GPI's representative, who visually inspected the site, maintained detailed logs of the borings, classified the soils encountered, and obtained relatively undisturbed samples for examination and laboratory testing. The soils encountered in the borings were classified in the field and through further examination in the laboratory in accordance with the Unified Soils Classification System. Detailed logs of the borings are presented in Figures B-1 to B-4 in this appendix.

The boring locations were laid out in the field by measuring from existing site features. Ground surface elevations at the boring locations were estimated from internet sources and should be considered approximate.

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	ELEVATION (FEET)
			B	0	Fill: **CLAY (CH)** mottled brown and grey, very moist, stiff, trace sand and silt	360
21.9	97	17	D			
26.3	93	17	D	5	@ 4 feet, very moist to wet	355
29.6	90	15	D		@ 7 feet, wet	
30.8	90	24	D	10	@ 10 feet, stiff to very stiff, trace gravel	350
31.4	94	17	D	15		345
28.1	101	21	D	20	@ 20 feet, dark grey to black, some sand	340
14.4	122	19	D	25	@ 25 feet, moist	335
13.3	123	26	D	30	Alluvium: **CLAYEY SAND (SC)** dark grey, very moist to wet, medium dense	330
13.0					Capistrano Formation (Tc): **SILTSTONE and CLAYSTONE** light brown and grey, very moist to wet, stiff to very stiff	
32.4	88	20	D	35		325

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-10-19

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): 25

GPI

PROJECT NO.: 2952.I

SRG LAGUNA NIGUEL TOWN CENTER

LOG OF BORING NO. B-1

FIGURE B-1

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
34.5		16	S	40		320
16.6	114	94/9"	D	45	@ 45 feet, moist, hard	315
19.9		50/2"	S		@ 47 feet, very moist	
					Refusal at 47.7 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-10-19

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): 25

GPI

PROJECT NO.: 2952.I

SRG LAGUNA NIGUEL TOWN CENTER

LOG OF BORING NO. B-1

FIGURE B-1

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
			B	0	2" AC, 3" Base	345
					Fill: **CLAY (CH)** brown and orange, very moist, very stiff	
19.7	102	25	D		Capistrano Formation (Tc): **SILTSTONE and CLAYSTONE** brown and grey, very moist to wet, very stiff, trace sand and gypsum	
25.1	101	28	D	5		
31.1	92	29	D		@ 6 feet, wet	340
30.7	90	28	D			
31.8	89	38	D	10	@ 10 feet, with oxidized streaks	335
37.7	83	38	D	15		330
31.5	90	45	D	20	@ 20 feet, moist, very stiff to hard	325
26.1	97	53	D	25		320
31.9	90	38	D	30	@ 30 feet, very stiff	315
					Total Depth 31 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-10-19

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): 14

GPI

PROJECT NO.: 2952.I

SRG LAGUNA NIGUEL TOWN CENTER

LOG OF BORING NO. B-2

FIGURE B-2

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	
			B	0	Fill: **CLAY (CH)** brown, very moist, very stiff, trace sand	
18.3	101	28	D			
20.1	66	24	D			345
21.4	98	18	D	5	@ 5 feet, mottled dark brown	
30.4	88	12	D		@ 8 feet, grey with oxidized streaks, wet, firm	340
10.4	113	42	D	10	@ 10 feet, very stiff, trace gravel	
						335
31.5	82	13	D	15	@ 15 feet, stiff	
						330
16.2	115	22	D	20	@ 20 feet, dark grey to black, very moist, stiff to very stiff	
						325
19.1	112	33	D	25	@ 25 feet, moist to very moist	
						320
13.0	118	75/10"	D	30	Alluvium: **CLAYEY SAND (SC)** brown, very moist, dense to very dense	
					Capistrano Formation (Tc) **SILTSTONE and CLAYSTONE** brown and grey, very moist to wet, hard, trace gravel	
						315
25.5		47	S	35		
						310
19.1	106	82/11"	D		Total Depth 40 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-10-19

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): 21

GPI

PROJECT NO.: 2952.I

SRG LAGUNA NIGUEL TOWN CENTER

LOG OF BORING NO. B-3

FIGURE B-3

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	ELEVATION (FEET)
			B	0	4" AC, 9.5" Base	335
21.9	98	20	D		Fill: **CLAY (CH)** mottled brown, very moist, stiff	
19.7	99	29	D	5	@ 4 feet, brown, very stiff, trace sand	
15.0	112	40	D		@ 6 feet, dark brown to black, moist, trace gypsum	330
15.9	113	54	D		**SANDY CLAY (CL)** brown with gypsum, slightly moist, hard	
8.0	93	84	D	10	Fill? **CLAYEY SAND (SC)** brown, moist, very dense, trace gravel	325
9.2	138	50/4"	D	15	@ 15 feet, orange and brown, with gravel fragments	320
17.5	106	78	D	20	Capistrano Formation (Tc): **SILTSTONE and CLAYSTONE** grey with oxidized streaks, moist, hard	315
30.2	90	28	D	25	@ 25 feet, wet, very stiff	310
31.5	86	50	D	30	@ 30 feet, dark grey to black (unoxidized)	305
					Total Depth 31 feet	

SAMPLE TYPES
- C Rock Core
- S Standard Split Spoon
- D Drive Sample
- B Bulk Sample
- T Tube Sample

DATE DRILLED: 7-10-19

EQUIPMENT USED: 8 " Hollow Stem Auger

GROUNDWATER LEVEL (ft): Not Encountered

GPI

PROJECT NO.: 2952.I

SRG LAGUNA NIGUEL TOWN CENTER

LOG OF BORING NO. B-4

FIGURE B-4

APPENDIX C

APPENDIX C

LABORATORY TESTS

INTRODUCTION

Representative undisturbed soil samples and bulk samples were carefully packaged in the field and sealed to prevent moisture loss. The samples were then transported to our Cypress office for examination and testing assignments. Laboratory tests were performed on selected representative samples as an aid in classifying the soils and to evaluate the physical properties of the soils affecting foundation design and construction procedures. Detailed descriptions of the laboratory tests are presented below under the appropriate test headings. Test results are presented in the figures that follow.

MOISTURE CONTENT AND DRY DENSITY

Moisture content and dry density were determined from a number of the ring samples. The samples were first trimmed to obtain volume and wet weight and then were dried in accordance with ASTM D 2216. After drying, the weight of each sample was measured, and moisture content and dry density were calculated. Moisture content and dry density values are presented on the boring logs in Appendix B.

ATTERBERG LIMITS

Liquid and plastic limits were determined for selected samples in accordance with ASTM D 4318. The results of the Atterberg Limits tests are presented in Figure C-1.

GRAIN SIZE DISTRIBUTION

Selected soil samples were dried, weighed, soaked in water until individual soil particles were separated, and then washed on the No. 200 sieve. That portion of the material retained on the No. 200 sieve was oven-dried and weighed to determine the percentage of the material passing the No. 200 sieve. A summary of the percentages passing the No. 200 sieve is presented below.

BORING NO.	DEPTH (ft)	SOIL DESCRIPTION	PERCENT PASSING No. 200 SIEVE
B-4	10	Clayey Sand (SC)	38

DIRECT SHEAR

Direct shear tests were performed on undisturbed and remolded bulk samples in accordance with ASTM D 3080. The bulk samples were remolded to approximately 90 percent of maximum density (ASTM D 1557). The samples were placed in the shear machine, and a normal load comparable to the in-situ overburden stress was applied. The samples were inundated, allowed to consolidate, and then were sheared to failure. The tests were repeated on additional test specimens under increased normal loads. Shear

stress and sample deformation were monitored throughout the test. The results of the direct shear tests are presented in Figures C-2 and C-3.

CONSOLIDATION

One-dimensional consolidation testing was performed on selected undisturbed samples in accordance with ASTM D 2435. After trimming the ends, the samples were placed in the consolidometer and loaded to 0.27 ksf. Thereafter, the samples were incrementally loaded to a maximum load of 34.1 ksf. The samples were inundated at 2.1 ksf. Sample deformation was measured to 0.0001 inch. Rebound behavior was investigated by unloading the samples back to 0.53 ksf. Results of the consolidation tests, in the form of percent consolidation versus log pressure, are presented in Figures C-4 and C-5.

COMPACTION TEST

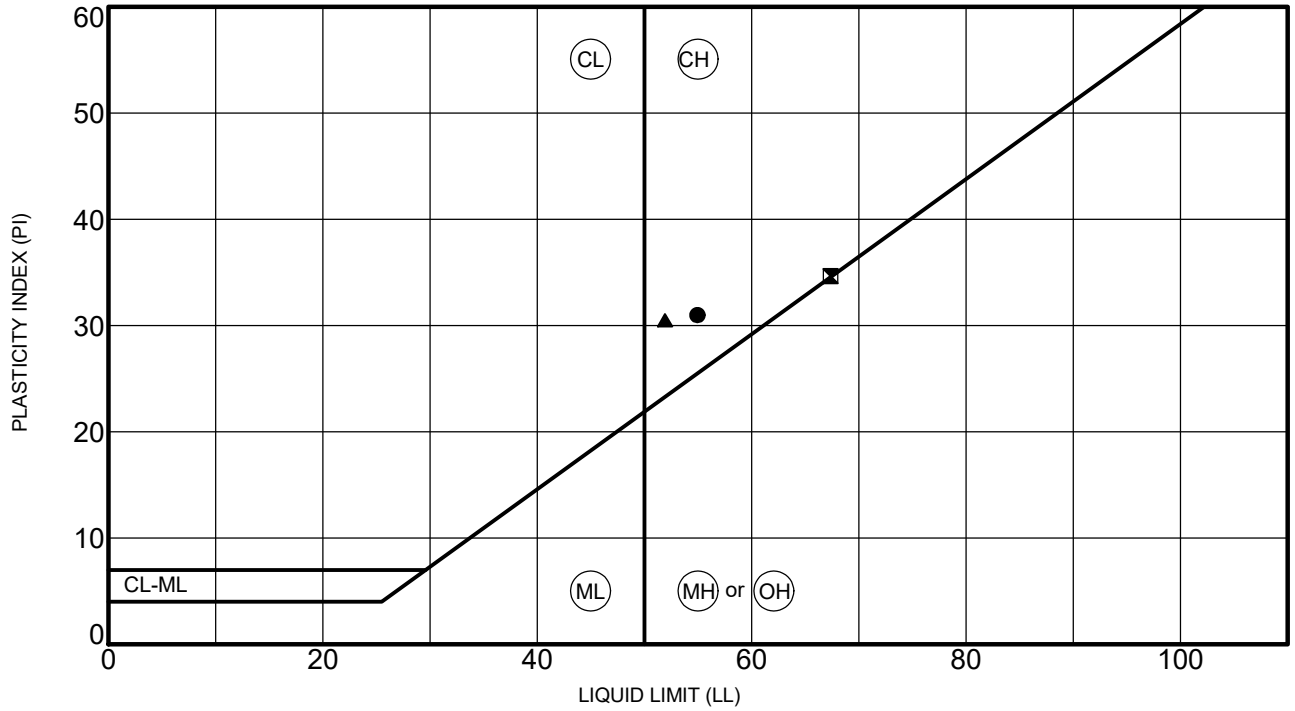
Maximum dry density/optimum moisture tests were performed on selected samples in accordance with ASTM D 1557 on representative bulk samples of the site soils. The test results are as follows:

BORING NO.	DEPTH (ft)	SOIL DESCRIPTION	OPIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)
B-1	0-5	Clay (CH)	14.0	116
B-4	0-5	Clay (CH)	13.0	119

EXPANSION INDEX

An expansion tests was performed in accordance with ASTM D 4829 on a bulk sample to assess the expansion potential of the on-site fill soils. The results of the test are summarized below.

BORING NO.	DEPTH (ft)	SOIL DESCRIPTION	EXPANSION INDEX
B-1	0-5	Clay (CH)	121



	SAMPLE LOCATION		LL	PL	PI	Fines, %	Classification
●	B-1	7.0	55	24	31		FAT CLAY (CH)
⊠	B-2	20.0	67	33	35		CLAYSTONE (Tc)
▲	B-4	4.0	52	21	31		FAT CLAY (CH)

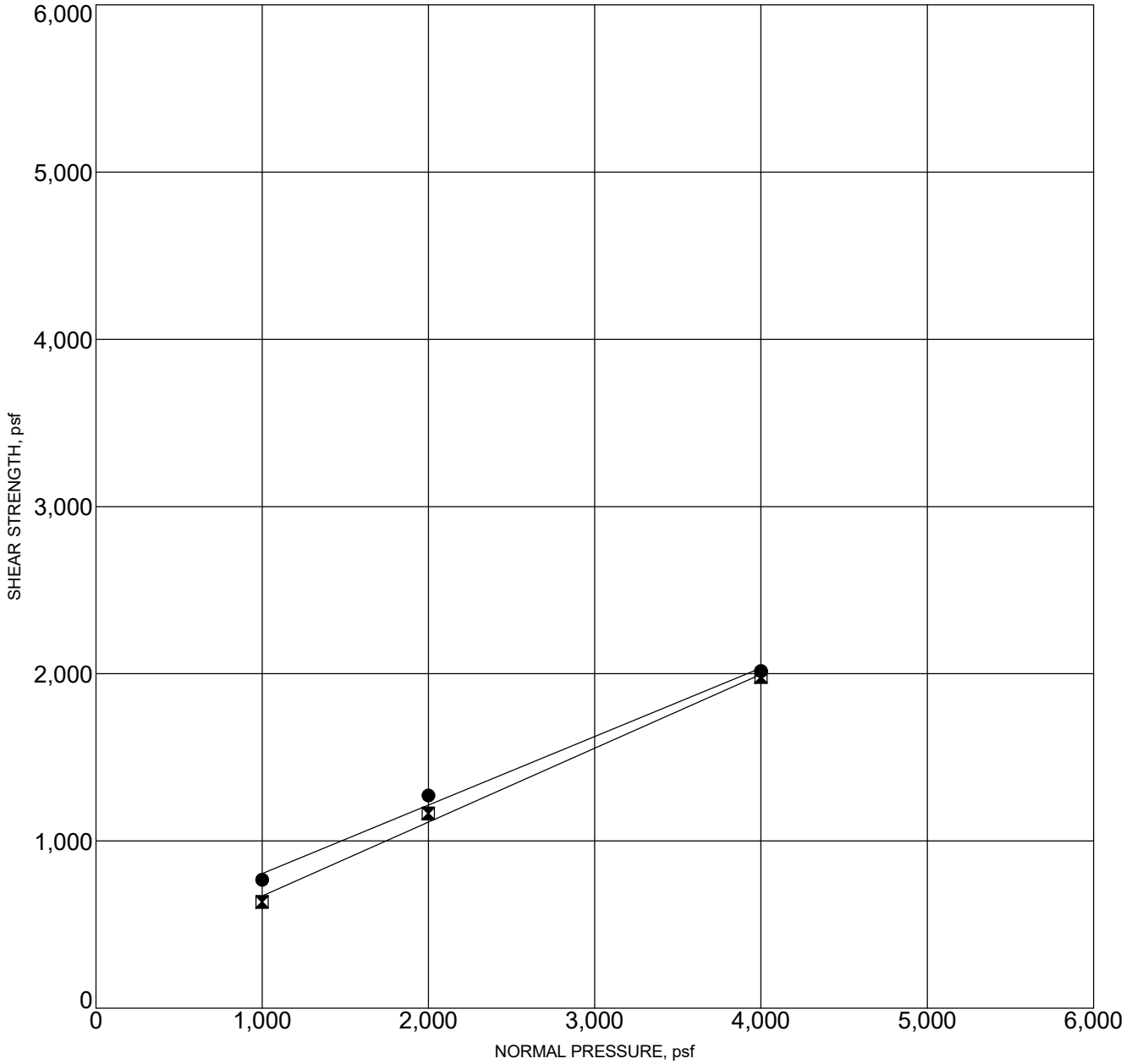
PROJECT: SRG LAGUNA NIGUEL TOWN CENTER PROJECT NO. 2952.I

GPI

ATTERBERG LIMITS TEST RESULTS

I1-142

FIGURE C-1



● **PEAK STRENGTH**
Friction Angle= 22 degrees
Cohesion= 396 psf

⧓ **ULTIMATE STRENGTH**
Friction Angle= 24 degrees
Cohesion= 228 psf

Note: Samples remolded to 90% of maximum dry density

Sample Location		Classification	DD,pcf	MC,%
B-1	0-5	FAT CLAY (CH)	104	14.0

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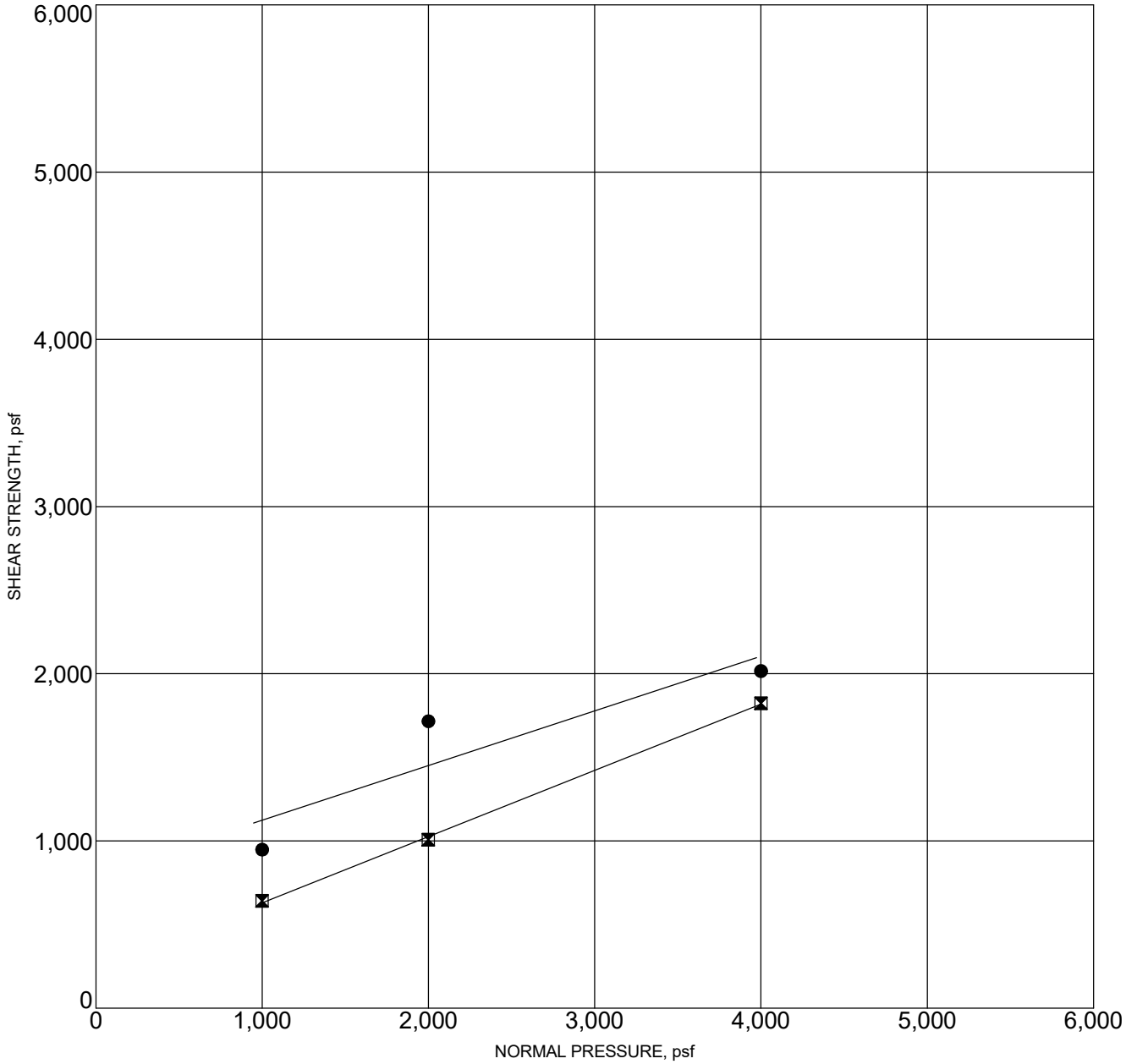
DIRECT SHEAR TEST RESULTS

I1-143

FIGURE C-2



● **PEAK STRENGTH**
Friction Angle= 18 degrees
Cohesion= 798 psf

⧓ **ULTIMATE STRENGTH**
Friction Angle= 22 degrees
Cohesion= 234 psf

Sample Location		Classification	DD,pcf	MC,%
B-3	8.0	FAT CLAY (CH)	88	30.4

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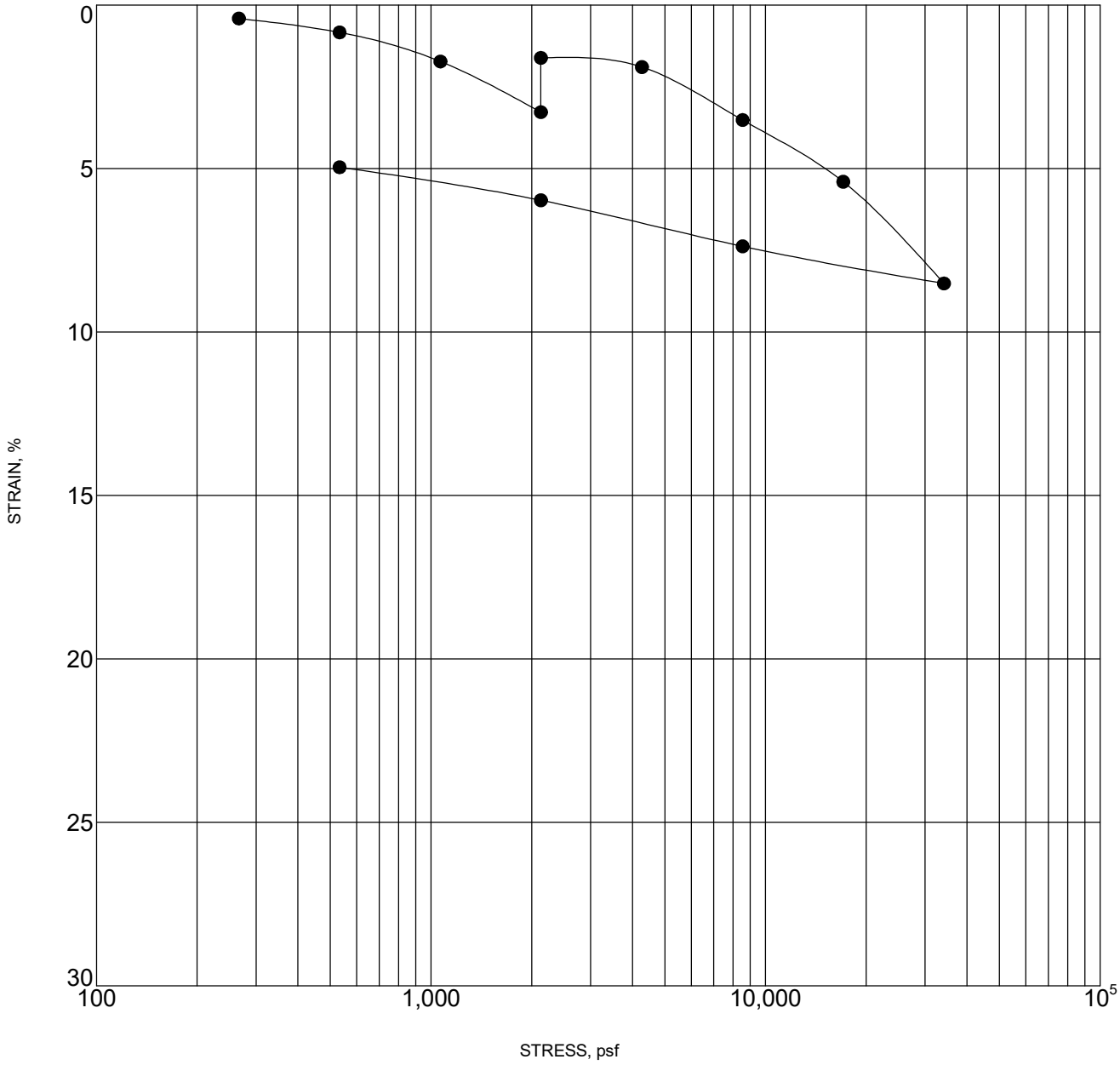
DIRECT SHEAR TEST RESULTS

I1-144

FIGURE C-3



Sample inundated at 2130 psf

	Sample Location		Classification	DD,pcf	MC,%
●	B-2	15.0	CLAYSTONE (Tc)	83	37.7

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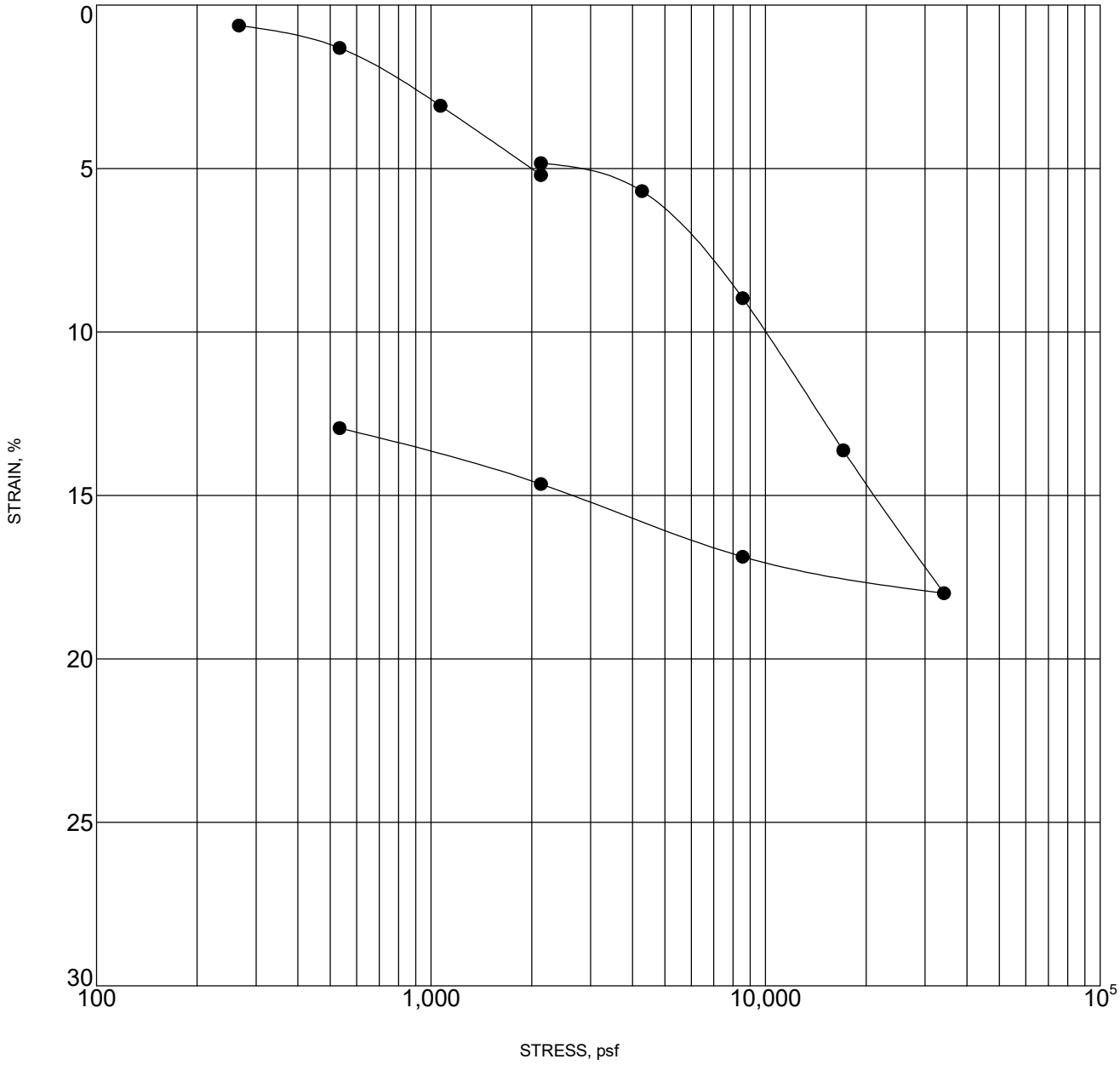
CONSOLIDATION TEST RESULTS

I1-145

FIGURE C-4



Sample inundated at 2130 psf

	Sample Location		Classification	DD,pcf	MC,%
●	B-3	15.0	Fill: FAT CLAY (CH)	82	31.5

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CONSOLIDATION TEST RESULTS

I1-146

FIGURE C-5