Preliminary
Water Quality Management Plan (WQMP)

Project Name:

Paseo De Colinas

CITY OF LAGUNA NIGUEL
GRADING # / PLANNING APPLICATION #
29001 PASEO DE COLINAS
APN 637-181-01, 637-392-02, 637-412-02

Prepared for:

PROJECT DIMENSIONS
4 Park Plaza, Suite 700
Irvine, CA 92614
949.476.2246

Prepared by:

FUSCOE ENGINEERING, INC.

Engineer's Seal

Engineer: Josh Ruiz, PE
Registration No: C90418
16795 Von Karman Suite 100
Irvine, CA 92606
949.474.1960

Prepared on:

May 25, 2021

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)		29001 Paseo De Colinas APN 637-181-01, 637-392-02, 637-412-02	

This Water Quality Management Plan (WQMP) has been prepared for PROJECT DIMENSIONS 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 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, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

OWNER: Project Dimensions		
Title:	Jon Conk	
Company:	Project Dimensions	
Address:	4 Park Plaza, Suite 700	
Email:	jconk@projectdimensions.com	
Telephone #	949.476.2246	
Owner Signature:	**Date:**	

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.**	29001 Paseo De Colinas Laguna Niguel, CA
Additional Information/ Comments	APN 637-181-01, 637-392-02, 637-412-02		
WATER QUALITY CONDITIONS OF APPROVAL OR ISSUANCE			
Water Quality Conditions from prior approvals or applicable watershed-based plans	*PENDING*		

SECTION 2 PROJECT DESCRIPTION

2.1 PROJECT DESCRIPTION

DESCRIPTION OF PROPOSED PROJECT				
Site Location:	*29001 Paseo De Colinas, Laguna Niguel CA 92677* The project is located within "South" Orange County and under the jurisdiction of the San Diego Regional Water Quality Control Board. A vicinity map is included in Attachment C.			
Project Area (ft^2): 107,630 ft^2	**Number of Dwelling Units:** 38		**SIC Code:** N/A	
Narrative Project Description:	The proposed development consists of 38 residential town-home style units. Each proposed unit will be three stories and will be arranged around central courtyard areas. Surface-level parking will be provided throughout the Project Site. On-site activities are anticipated to be passive land uses associated with residential developments. The Project will redevelop an existing lot used for overflow parking for the adjacent middle school. While impervious surfaces are anticipated to decrease, the change in land uses across the site results in the requirement for a Priority WQMP.			
Project Area	**Pervious**		**Impervious**	
	Area (acres or sq ft)	**Percentage**	**Area (acres or sq ft)**	**Percentage**
Pre-Project Conditions	0.346 ac	14%	2.124 ac	86%
Post-Project Conditions	0.716 ac	29%	1.754 ac	71%

2.2 POST-DEVELOPMENT DRAINAGE CHARACTERISTICS

Runoff from the proposed project will follow existing drainage patterns. Low flows will be picked up in the onsite area drain system and conveyed to the BMP system, while high flows will sheet flow offsite to Paseo De Colinas as in the existing condition. Treated water will be pumped up to the surface before exiting the site in the northeast corner via parkway culvert. WQMP Exhibit is included in Attachment C.

2.3 PROPERTY OWNERSHIP/MANAGEMENT

PROPERTY OWNERSHIP/MANAGEMENT	
Private Streets	Project Dimensions
Landscaped Areas	Project Dimensions
Open Space	Capistrano Unified School District
Buildings	Project Dimensions
Storm Drain	Project Dimensions
Structural BMPs	Project Dimensions

All portions of the project disturbed area including BMPs will be the responsibility of the Owner/Developer. The two adjacent portions of the total parcel will be dedicated to the City of Laguna Niguel as parks. This is outlined on the site plan included in Attachment C.

SECTION 3 SITE & WATERSHED CHARACTERIZATION

3.1 SITE CONDITIONS

3.1.1 Existing Site Conditions

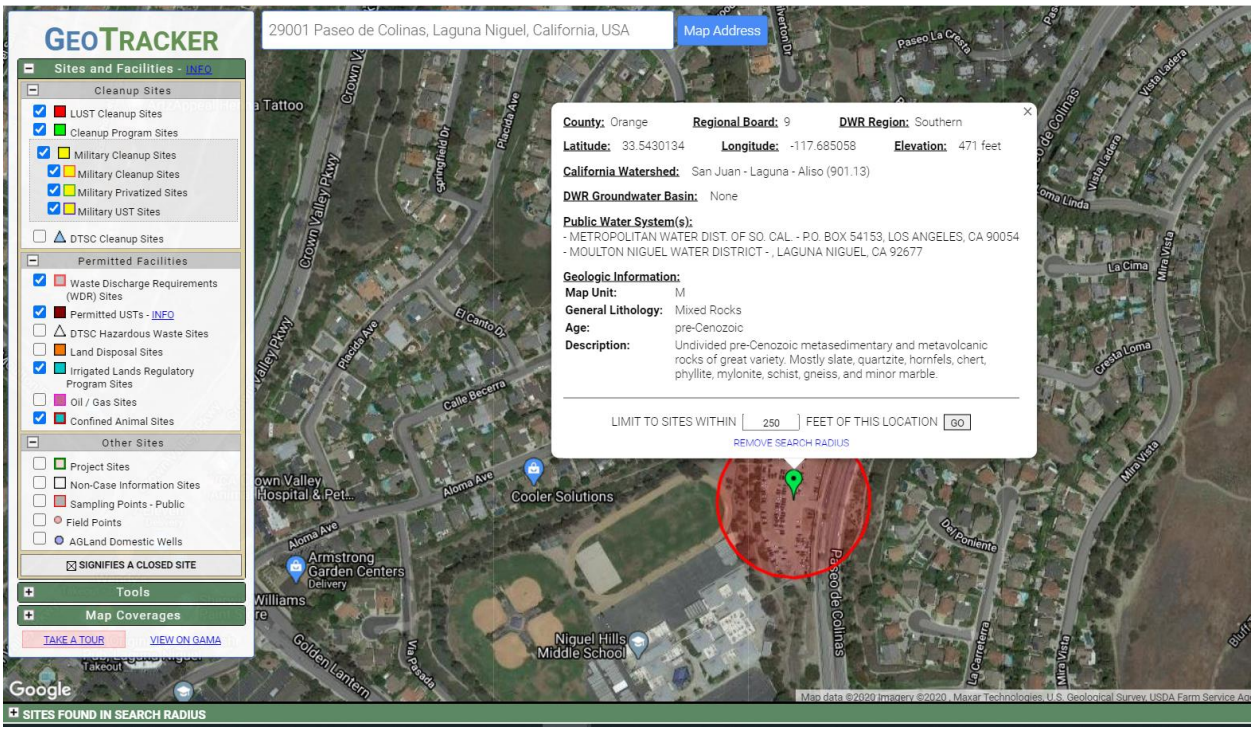
The proposed project site is located in the City of Laguna Niguel, with Paseo De Colinas bordering to the east, residential to the north, and Niguel Hills Middle School along the west/southwest. Currently, the project site is developed as a paved parking lot with minimal landscape and a dirt lot. Site typography is relatively flat with slopes between 1.5 and 3 percent. The site generally drains northerly and leaves the site via surface flow to Paseo De Colinas, or down the 1.5:1 and 2:1 slopes on the northern and western outer edges of the property. The site contains drop inlets and sewer cleanouts that will be removed during construction of new utilities.

EXISTING LAND USES				
Land Use Description	**Total Area (acres)**	**Impervious Area (acres)**	**Pervious Area (acres)**	**Imperviousness (%)**
Parking Lot	2.15	1.85	0.30	86
Dirt Lot	0.32	0.01	0.31	3
Total	2.47	1.75	0.219	71

3.1.2 Infiltration-Related Characteristics

3.1.2.1 Hydrogeologic Conditions

Based on the Geotechnical Feasibility Report by LGC Geotechnical, Inc. dated May 15, 2018, "Groundwater was not encountered to maximum explored depth of approximately 90 feet below ground existing grade. Historic high groundwater is not mapped on the site (CGS, 2001a)." According to the SWRCB Geotracker database, there are no LUST cleanup sites within 250 feet of the project. See screen clip below. County GIS maps also indicated that the site is not within any major Groundwater Management Agency plumes. See supporting maps in Attachment D.



3.1.2.2 Soil and Geologic Infiltration Characteristics

According to Orange County GIS maps, the site is underlain by Type D soils (TGD map in Attachment D). Infiltration testing was not conducted at this preliminary stage of the project.

3.1.2.3 Geotechnical Conditions

Based on the Geotechnical Feasibility Report by LGC Geotechnical, Inc. dated May 15, 2018, "the site is underlain by Capistrano Formation bedrock material. Generally, the Capistrano Formation consists of a weak, clayey siltstone with some interbedded silty sandstone. Bedding within the boring was found to be nearly flat to gently dipping into the slope. Capistrano Formation material and fill derived from it typically has a high potential for expansion and considered to be severely corrosive to concrete."

Slope stability analysis indicated that a 60-foot horizontal setback is required from the top of slope in order to provide the required factor of safety for static loading conditions. This would apply to the northern and southwestern edges of the project site. Geotechnical Feasibility Report is included in Attachment G.

3.1.2.4 Summary of Infiltration Opportunities and Constraints of Existing Site

Due to soil type D and slope stability constraints at the site, infiltration is considered to be infeasible at this time.

3.2 PROPOSED SITE DEVELOPMENT ACTIVITIES

3.2.1 Overview of Site Development Activities

The proposed project will redevelop an existing parking lot into 38 residential townhome style units. Each proposed unit will be three stories and will be arranged around central courtyard areas. Surface-level parking will be provided throughout the site. On-site activities are anticipated to be passive land uses associated with residential developments.

3.2.2. Project Attributes Influencing Stormwater Management

Existing drainage patterns will remain the same in the proposed condition. Low flows will be captured by an onsite area drain system for treatment, while high flows exit the site via surface flow. On-site activities are anticipated to be passive land uses associated with residential developments. The below table shows proposed land use and imperviousness.

PROPOSED LAND USES				
Land Use Description	Total Area (acres)	Impervious Area (acres)	Pervious Area (acres)	Imperviousness (%)
Residential	2.15	1.69	0.46	79
Park	0.32	0.07	0.25	22
Total	**2.47**	**1.75**	**0.72**	**71**

3.2.3 Effects on Infiltration and Harvest and Use Feasibility

Harvest and use (aka. Rainwater Harvesting) BMPs are LID BMPs that capture and store storm water runoff for later use. 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 areas of the project, the Modified Estimated 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 project site was evaluated using planned 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 these areas of the project.

ESTIMATED APPLIED WATER USE (EAWU) FOR COMMON AREA LANDSCAPING

Drainage Area & Landscape Type	Total Area (ac)	% imp.	Impervious Tributary (ac)	Irrigated LS Area (ac)	ETo_{wet} (1) (in/mo)	K_L (2)	Modified EAWU (gpd)	Drawdown of DCV (days)	Is Drawdown of DCV <48 hours?
Project Site Mixed Landscaping	2.47	71%	1.75	0.72	2.75	0.55	786.6	49.5	No

Notes:
1 Per Table F-2 for Irvine Region (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.

As shown above, the project site does not have sufficient water demand during the wet season to support harvest and reuse. There is insufficient irrigation demand to drawdown the DCV in 48 hours.

3.3 RECEIVING WATERBODIES

The project is located within the Aliso Creek watershed. Surface flows enter the City storm drain system that outlets to Aliso Creek, which flows southwesterly to the Pacific Ocean. According to the 2014-2016 303(d) list, Aliso Creek is impaired for benthic community effects, malathion, nitrogen, phosphorus, selenium, toxicity, and indicator bacteria. Aliso Creek has a TMDL for indicator bacteria. The project does not discharge to ESA or ASBS areas.

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	Y	N	N	Other
Nutrients	Y	Y	N	Primary
Heavy Metals	N	Y	N	No
Bacteria/Virus/Pathogens	Y	Y	N	Primary
Pesticides	Y	N	N	Other
Oil and Grease	Y	N	N	Other
Toxic Organic Compounds	N	Y	N	No
Trash and Debris	Y	N	N	Other
Dry Weather Runoff	N	N	Y	Other

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)

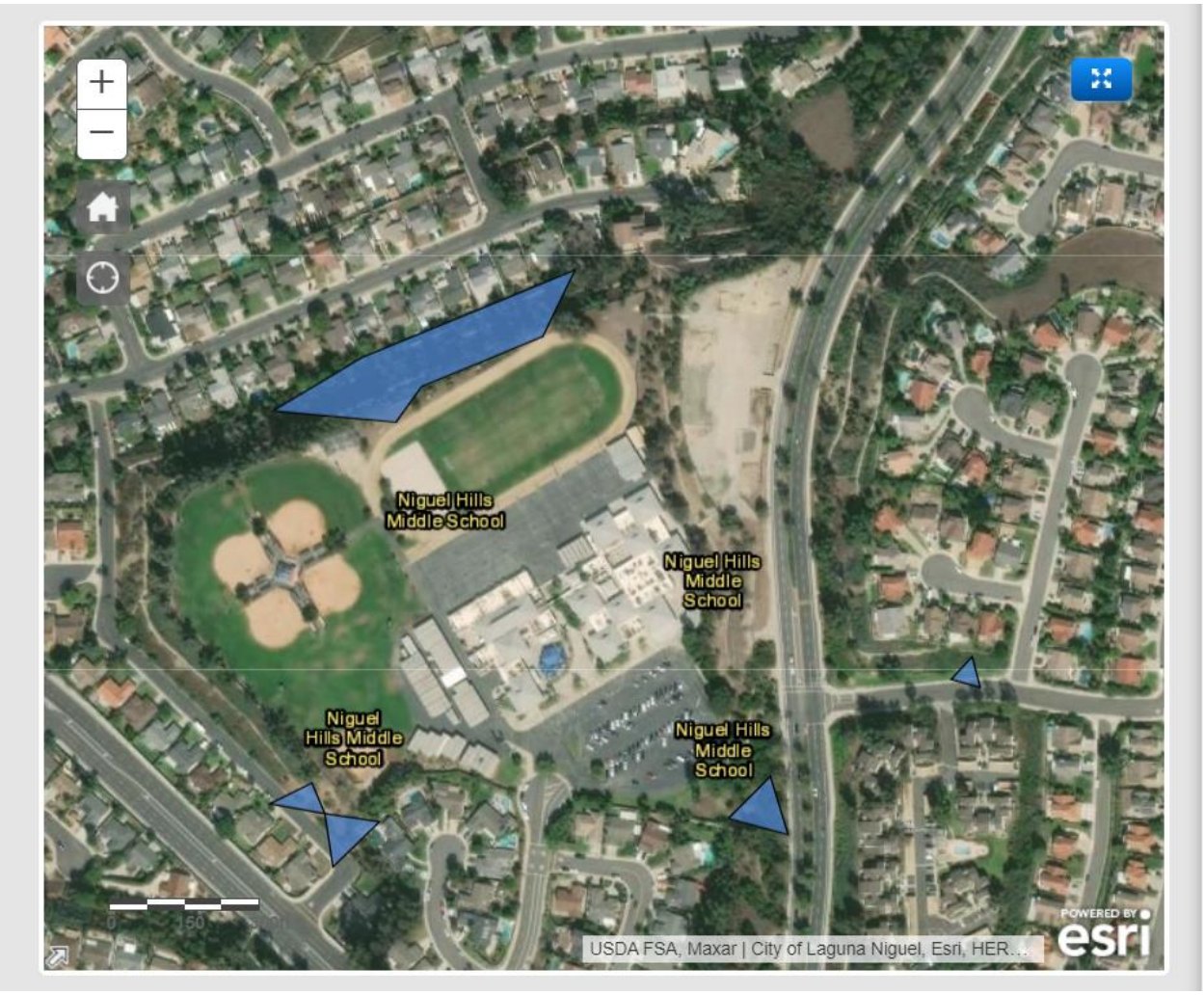
☐ The project discharges to an area identified in the WMAA as exempt from hydromodification concerns

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

Although the project discharges to the storm drain, the storm drain outlets to Aliso Creek. See Attachment E for hydromodification exemption exhibit from the South Orange County TGD.

3.6 CRITICAL COURSE SEDIMENT YIELD AREAS

According to the County GIS database, the project site is not within a potential critical course sediment yield area. See screen clip below. This section is not applicable to the project.



SECTION 4 SITE PLAN AND DRAINAGE PLAN

4.1 DRAINAGE MANAGEMENT AREA DELINEATION

The proposed project site is split into three DMAs. DMAs 1 and 2 that include all of the residential development will be routed to biotreatment BMPs and a detention system to meet hydromodification requirements. DMA 3 consists of a park with very little impervious area which will be considered self treating. WQMP Exhibit is included in Attachment C.

4.2 OVERALL SITE DESIGN BMPS

Minimize Impervious Area

Impervious surfaces have been minimized by incorporating landscaped areas throughout the site.

Maximize Natural Infiltration Capacity

Infiltration is not considered feasible for the project site due to low permeability of soils, and the potential for causing adverse geotechnical conditions. Refer to Section 3.1.2 for details.

Preserve Existing Drainage Patterns and Time of Concentration

Runoff from the site will continue to flow similar to existing conditions. Low flows will be routed to LID and hydromodification BMPs, while high flows will exit the site.

Disconnect Impervious Areas

Landscaping will be provided adjacent to sidewalks and buildings. Low flows will be routed to LID and hydromodification BMPs for treatment before exiting the site.

Protect Existing Vegetation and Sensitive Areas

Not applicable. The existing site contains little to no vegetation.

Revegetate Disturbed Areas

Not applicable. The proposed project will have larger pervious footprint than existing condition.

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.

Firescaping

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

Water Efficient Landscaping

Xeriscape landscaping is not proposed for the project. However, native landscaping with lower water demands will be incorporated into the site design.

Slopes and Channel Buffers

Not applicable. Vegetated slopes are not included in the project footprint.

4.3 DMA CHARACTERISTICS AND SITE DESIGN BMPS

Following is a detailed description of each Drainage Management Area as delineated on the WQMP Exhibit in Attachment C.

4.3.1 DMA 1 & 2

DMAs 1 & 2 include 38 residential townhome units with surrounding landscape and surface level parking. As discussed in Section II and III, infiltration and harvest & reuse were both ruled as infeasible for the project given geotechnical and drawdown constraints. Runoff from DMAs 1 & 2 will be routed to biotreatment units, before entering the hydromodification BMP before exiting the site.

The Project will redevelop an existing lot used for overflow parking for the adjacent middle school. While impervious surfaces are anticipated to decrease, the change in land uses across the site results in the requirement for a Priority WQMP.

4.3.2 DMA 3

DMA 3 is comprised of a park amenity for the residential units and includes grass, turf, benches, hardscape walkways, and cobble walkways. DMA 3 is approximately 22% impervious with walkways draining to adjacent pervious or landscaped areas. Therefore, this area will be considered self treating.

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**
DMA 1	1.73	83	No Infiltration	*Site Design*
DMA 2	0.42	62	No Infiltration	*Site Design*
DMA 3	0.32	22	No Infiltration	*Impervious Area Dispersion*

4.4 SOURCE CONTROL BMPS

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

NON-STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	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)	☐	☒	No hazardous materials storage proposed.
N6	Local Water Quality Permit Compliance	☐	☒	
N7	Spill Contingency Plan	☐	☒	No hazardous materials storage proposed.
N8	Underground Storage Tank Compliance	☐	☒	Not proposed.
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous materials storage proposed.
N10	Uniform Fire Code Implementation	☐	☒	No hazardous materials storage proposed.
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	Not proposed.
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	Not 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/Developer 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/Developer 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/Developer 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/Developer 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/Developer 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/Developer 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/Developer shall be responsible for sweeping all on-site streets, drive aisles, and uncovered parking areas within the project on a weekly 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	☐	☒	None proposed.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☐	☒	None proposed. All units will have separate trash bins.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☐	☒	None proposed.
Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)		☐	☒	None proposed.
S6	Dock areas	☐	☒	None proposed.
S7	Maintenance bays	☐	☒	None proposed.
S8	Vehicle wash areas	☐	☒	None proposed.
S9	Outdoor processing areas	☐	☒	None proposed.
S10	Equipment wash areas	☐	☒	None proposed.
S11	Fueling areas	☐	☒	None proposed.
S12	Hillsidendscaping	☐	☒	None proposed.
S13	Wash water control for food preparation areas	☐	☒	None proposed.
S14	Community car wash racks	☐	☒	None 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.

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.

SECTION 5 LOW IMPACT DEVELOPMENT BMPS

5.1 LID BMPS IN DMA 1

5.1.1 Hydrologic Source Controls for DMA 1 & DMA 2

Impervious area dispersion and reduction will be incorporated into the site design for the project. Worksheet 4 was not used for these DMA's.

5.1.2 Structural LID BMP for DMA 1& DMA 2

STRUCTURAL LID BMP FOR DMA 1 & DMA 2	
Infiltration Feasibility	*Not feasible. See Section 3.1.2*
Harvest and Use Feasibility	*Not feasible. See Section 3.2.3*
Selected BMP	BIO-5: Proprietary Biotreatment (Modular Wetland System) HSC-2: Impervious Area Dispersion
Selected BMP Sizing Method	Worksheet 4: Hydrologic Source Control Calculation Form Worksheet 9: Flow-Based Compact Biofiltration Method
Selected BMP Description	*See Section 4.3.3*

STRUCTURAL LID BMP FOR DMA 1 & DMA 2	
LID Design Flow Rate[1]	DMA 1 $Q_{design} = 1.5 \times Q_{80\%}$ Where: Q_{design} = design flow rate $Q_{80\%} = c \times I_{design} \times A$ c = runoff coefficient = $(0.75 \times imp + 0.15)$ I_{design} = design intensity A = tributary area (acres) Imp = 83% I_{design} = 0.26 in/hr A = 1.73 acres Q_{design} = *1.5 x (0.75 x* 0.83 *+ 0.15) x* 0.26 in/hr *x 1.73 ac* = 0.521 cfs DMA 2 $Q_{design} = 1.5 \times Q_{80\%}$ Where: Q_{design} = design flow rate $Q_{80\%} = c \times I_{design} \times A$ c = runoff coefficient = $(0.75 \times imp + 0.15)$ I_{design} = design intensity A = tributary area (acres) Imp = 62% I_{design} = 0.26 in/hr A = 0.42 acres Q_{design} = *1.5 x (0.75 x* 0.62 *+ 0.15) x* 0.26 in/hr *x 0.42 ac* = 0.101 cfs DMA 3 Simple Method DCV : 311 cf (see Attachment D)
Proprietary BMP[2]	DMA 1: MWS-L-8-20 DMA 2: MWS-L-4-8
Unit Treatment Capacity[1] **(Q_{unit})**	MWS-L-8-20 capacity of 0.577 cfs MWS-L-4-8 capacity of 0.115 cfs
Total Treatment Capacity[1] **(Q_{BMP})**	0.692 cfs

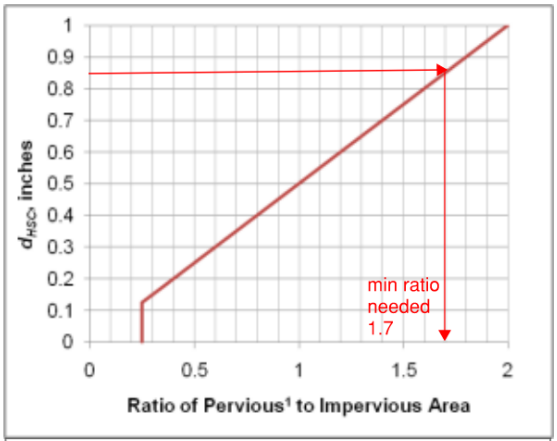
STRUCTURAL LID BMP FOR DMA 1 & DMA 2	
Hydromodification Requirements	Hydromodification requirements were met using an underground storage vault. SOHM routing calculations provided in Attachment E.

Notes:
[1] Refer to Worksheet 9 in Attachment D for further calculation details
[2] Refer to WQMP exhibit and cross sections in Attachment C for BMP details

5.2 SUMMARY OF LID BMPS

FLOW-BASED LID BMP SUMMARY TABLE							
DMA	Selected BMP	BMP Sizing Method	DMA Q_{design} (cfs)	BMP Unit / Model	# of Units	Unit Treatment Capacity (cfs)	Total Treatment Capacity (cfs)
1	BIO-5	Worksheet 9	0.521	MWS-L-8-20	1	0.577	0.577
2	BIO-5	Worksheet 9	0.101	MWS-L-4-8	1	0.115	0.115

HSC BMP SUMMARY TABLE							
DMA	Selected BMP	BMP Sizing Method	Impervious Area (ac)	Pervious Area (ac)	Ratio of Pervious to Impervious	d_{hsc}	Percent Capture Provided by HSCs
3	HSC-2	Worksheet 4	0.07	0.25	3.57	0.85	80%



[1] Pervious area used in calculation should only include the pervious area receiving flow, not pervious area receiving only direct rainfall or upslope pervious drainage.

Chart extends to 0.25, but designs should not go below a minimum value of 0.5 (2 parts impervious to 1 part pervious).

SECTION 6 HYDROMODIFICATION BMPS

6.1 POINTS OF COMPLIANCE

To meet hydromodification requirements, an analysis was prepared using the South Orange County Hydrology Model (SOHM) for the pre- and post-developed conditions at the site in order to determine the detention volume required within the water quality basins to meet the required flow duration requirements.

For both the existing and proposed conditions, there is one (1) main Point of Compliance (POC) based on the existing and proposed drainage patterns. POC "1" drains to Paseo De Colinas. The SOHM analysis compared the existing and proposed flow duration, and an underground tank was sized to appropriately mitigate the hydromodification flow from the project.

6.2 PRE-DEVELOPMENT (NATURAL) CONDITIONS

Surrounding land was used as a reference when identifying the pre-developed land use for the project site, since it is currently a paved parking lot. Slopes, drainage patters, soil types, and critical course sediment yield areas are discussed and identified in Section 3. A brief summary of the existing conditions SOHM modeling results are provided below. Refer to Attachment E for more details.

PRE-DEVELOPMENT FLOW CONDITIONS		
Return Period	**Point of Compliance**	**Pre-Development Flow (cfs)**
2-year	POC "1"	0.77
5-year	POC "1"	0.96
10-year	POC "1"	1.15

6.3 POST-DEVELOPMENT CONDITIONS AND HYDROMODIFICATION BMPS

As described above, first flush runoff from DMA 1 and DMA 2 will be treated by a proprietary biofiltration system (MWS or equivalent) before entering the underground storage tank for hydromodification mitigation. Flows above the first flush will enter the area drain system and bypass the MWS unit and enter the underground tank. Treated flows will exit the tank and be pumped up to grade before exiting the site via parkway culvert to Paseo De Colinas. DMA 3 currently sheet flows to Paseo de Colinas in the existing condition. The proposed condition runoff within the park will mimic existing sheet flow drainage. As the perviousness between the existing and proposed condition is similar, it is anticipated hydromodification controls will not be required for this DMA 3.

A summary of the proposed hydromodification BMPs, details and detention capacity are provided below.

HYDROMODIFICATION BMP's & VOLUME SUMMARY				
Pont of Compliance (POC)	Hydromod Facility	Details	Detention Volume Provided (ft^3)	Detention Volume Provided (ac-ft)
POC "1"	Underground storage system	350' of 5' diameter pipe	6,873	0.158
		Total	6,873	0.158

6.4 MEASURES FOR AVOIDANCE OF CRITICAL COARSE SEDIMENT YIELD AREAS

Not applicable. The project is not within a potential critical coarse sediment yield area.

6.5 HYDROLOGIC MODELING AND HYDROMODIFICATION COMPLIANCE

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 results from the SOHM analysis based on the proposed BMP volume at this preliminary stage of design. Additional detail will be provided during final design. Post-development flows are less than existing conditions and meet the flow duration criteria for POC "1.".

HYDROMODIFICATION CONTROL BMP SUMMARY PER POINT OF COMPLIANCE				
Return Period	Point of Compliance	Pre-Development Flow (cfs)	Post-Development (Mitigated) Flow (cfs)	Reduction, Existing - Mitigated (cfs)_
2-year	POC "1"	0.77	0.65	0.12
5-year	POC "1"	0.95	0.83	0.12
10-year	POC "1"	1.15	1.04	0.11

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

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

Did You Know?

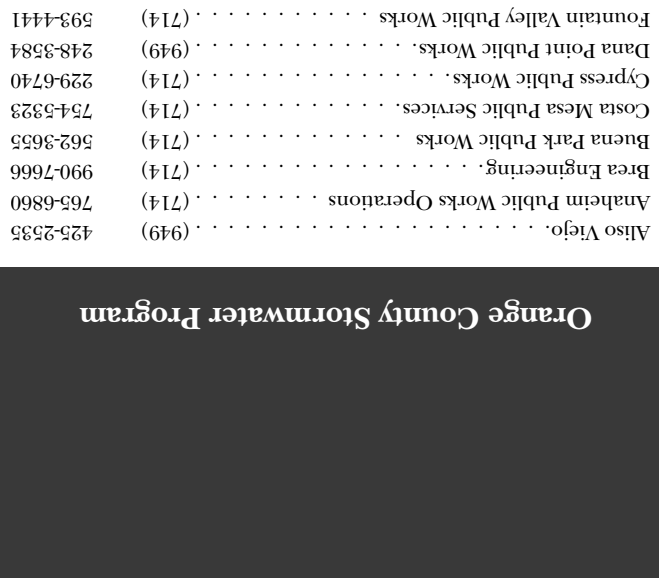
- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution 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?

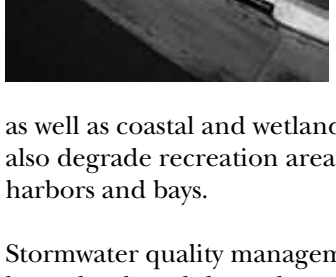
- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer 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.

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

For More Information

Orange County Stormwater Program

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

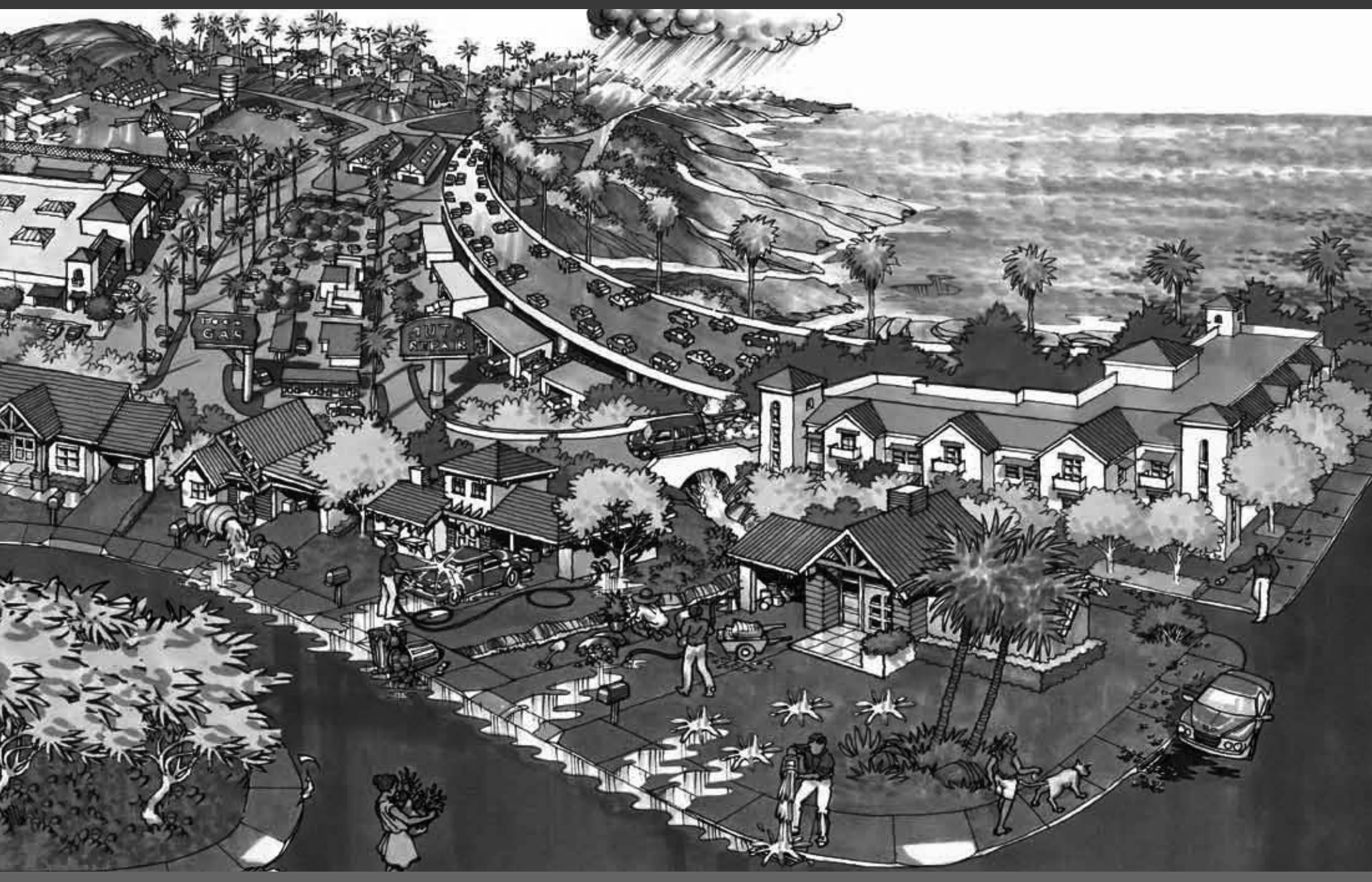
Aliso Viejo	(949)	425-2535
Anaheim Public Works Operations	(714)	765-6860
Brea Engineering	(714)	990-7666
Buena Park Public Works	(714)	562-3655
Costa Mesa Public Services	(714)	754-5323
Cypress Public Works	(714)	229-6740
Dana Point Public Works	(949)	248-3584
Fountain Valley Public Works	(714)	593-4441
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

Printed on Recycled Paper

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

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Home improvement projects and work sites must be maintained to ensure that building materials do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

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

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

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

For emergencies, dial 911.

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

Printed on Recycled Paper

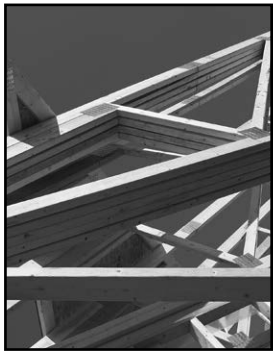
Help Prevent Ocean Pollution:

Tips for Home Improvement Projects

Tips for Home Improvement Projects

Home improvement projects can cause significant damage to the environment. Whether you hire a contractor or work on the house yourself, it is important to follow these simple tips while renovating, remodeling or improving your home:

General Construction



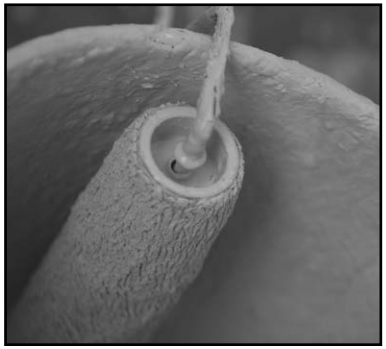
- Schedule projects for dry weather.
- Keep all construction debris away from the street, gutter and storm drain.
- Store materials under cover with temporary roofs or plastic sheets to eliminate or reduce the possibility that rainfall, runoff or wind will carry materials from the project site to the street, storm drain or adjacent properties.

Building Materials

- Never hose materials into a street, gutter or storm drain.
- Exposed piles of construction material should not be stored on the street or sidewalk.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Do not mix more fresh concrete than is needed for each project.
- Wash concrete mixers and equipment in a designated washout area where the water can flow into a containment area or onto dirt.
- Dispose of small amounts of dry excess materials in the trash. Powdery waste, such as dry concrete, must be properly contained within a box or bag prior to disposal. Call your local trash hauler for weight and size limits.

Paint

- Measure the room or object to be painted, then buy only the amount needed.
- Place the lid on firmly and store the paint can upside-down in a dry location away from the elements.
- Tools such as brushes, buckets and rags should never be washed where excess water can drain into the street, gutter or storm drain. All tools should be rinsed in a sink connected to the sanitary sewer.
- When disposing of paint, never put wet paint in the trash.
- Dispose of water-based paint by removing the lid and letting it dry in the can. Large amounts must be taken to a Household Hazardous Waste Collection Center (HHWCC).



- Oil-based paint is a household hazardous waste. All leftover paint should be taken to a HHWCC.
- For HHWCC locations and hours, call **(714) 834-6752** or visit **www.oclandfills.com**.

Erosion Control

- Schedule grading and excavation projects for dry weather.
- When temporarily removing soil, pile it in a contained, covered area where it cannot spill into the street, or obtain the required temporary encroachment or street closure permit and follow the conditions instructed by the permit.
- When permanently removing large quantities of soil, a disposal location must be found prior to excavation. Numerous businesses are available to handle disposal needs. For disposal options, visit **www.ciwmb.ca.gov/SWIS**.
- Prevent erosion by planting fast-growing annual and perennial grasses. They will shield and bind the soil.

Recycle

- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry (bricks, concrete, etc.), carpet, plastic, pipes (plastic, metal and clay), drywall, rocks, dirt and green waste.

- For a listing of construction and demolition recycling locations in your area, visit **www.ciwmb.ca.gov/recycle.**

Spills

- Clean up spills immediately by using an absorbent material such as cat litter, then sweep it up and dispose of it in the trash.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **(714) 567-6363** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

PROJECT Pollution PREVENTION

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)**.**

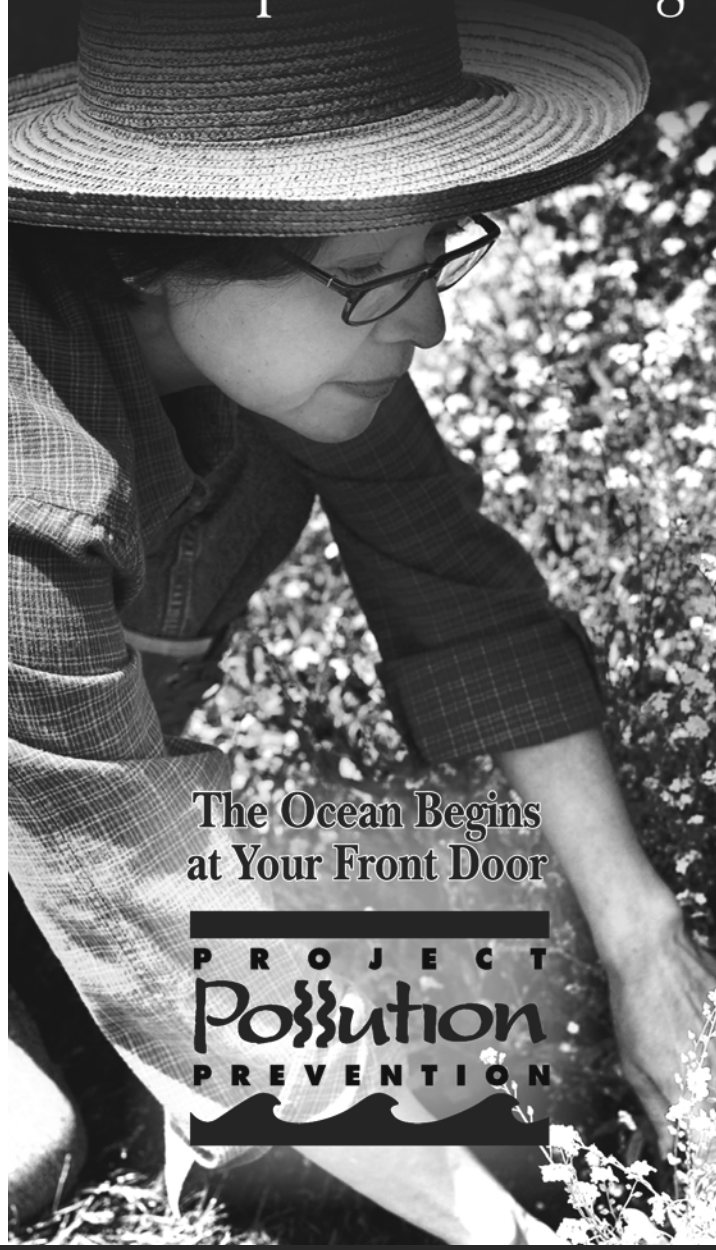
For emergencies, dial 911.

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.

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Tips for Landscape & Gardening



Tips for Landscape & Gardening

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

General Landscaping Tips

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

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

Garden & Lawn Maintenance

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

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

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

Household Hazardous Waste Collection Centers

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

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

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

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

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

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

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

For emergencies, dial 911.

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

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

Printed on Recycled Paper

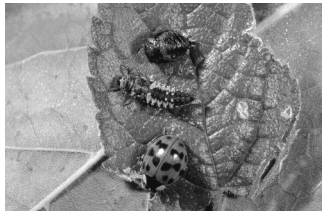
Help Prevent Ocean Pollution:

Responsible Pest Control

Tips for Pest Control

Key Steps to Follow:

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



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

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

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

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

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

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

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

UC CE University of California Cooperative Extension

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Store unused chemicals in a locked cabinet.

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

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

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

PROJECT Pollution PREVENTION

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Pet waste and pet care products can be washed into the storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never put pet waste or pet care products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

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

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

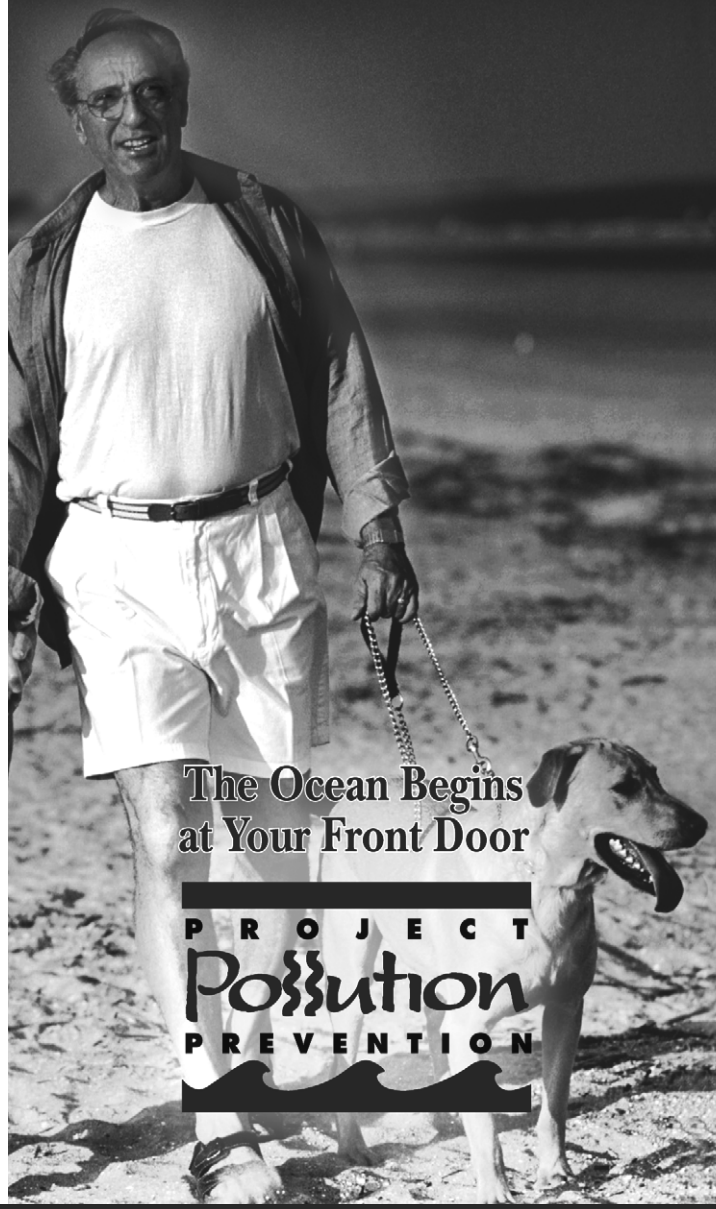
For emergencies, dial 911.

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

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Tips for Pet Care



Tips for Pet Care

Never let any pet care products or washwater run off your yard and into the street, gutter or storm drain.

Washing Your Pets

Even biodegradable soaps and shampoos can be harmful to marine life and the environment.

- If possible, bathe your pets indoors using less-toxic shampoos or have your pet professionally groomed. Follow instructions on the products and clean up spills.

- If you bathe your pet outside, wash it on your lawn or another absorbent/ permeable surface to keep the washwater from running into the street, gutter or storm drain.

Flea Control

- Consider using oral or topical flea control products.

- If you use flea control products such as shampoos, sprays or collars, make sure to dispose of any unused products at a Household Hazardous Waste Collection Center. For location information, call **(714) 834-6752**.

Why You Should Pick Up After Your Pet

It's the law! Every city has an ordinance requiring you to pick up after your pet. Besides being a nuisance, pet waste can lead to water pollution, even if you live inland. During rainfall, pet waste left outdoors can wash into storm drains. This waste flows directly into our waterways and the ocean where it can harm human health, marine life and the environment.

As it decomposes, pet waste demands a high level of oxygen from water. This decomposition can contribute to killing marine life by reducing the amount of dissolved oxygen available to them.

Have fun with your pets, but please be a responsible pet owner by taking care of them and the environment.

- Take a bag with you on walks to pick up after your pet.

- Dispose of the waste in the trash or in a toilet.

PROJECT Pollution PREVENTION

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

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

For emergencies, dial 911.

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

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Tips for Residential Pool, Landscape and Hardscape Drains

The Ocean Begins at Your Front Door

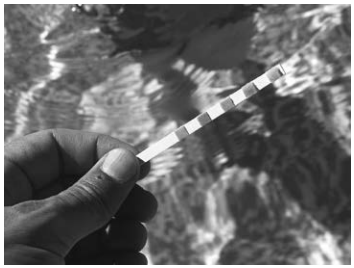
PROJECT Pollution PREVENTION

Tips for Residential Pool, Landscape and Hardscape Drains

Pool Maintenance

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

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



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

Landscape and Hardscape Drains

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

Household Activities

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

Yard Maintenance

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

Vehicle Maintenance

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

The Pollution Solution

Several residential activities can result in water pollution. Among these activities are car washing and hosing off driveways and sidewalks. Both activities can waste water and result in excess runoff. Water conservation methods described in this pamphlet can prevent considerable amounts of runoff and conserve water. By taking your car to a commercial car wash and by sweeping driveways and sidewalks, you can further prevent the transport of pollutants to Orange County waterways. Here are some of the common pollutants for which you can be part of the solution:

1 Pesticides and Fertilizer

- **Pollution:** The same pesticides that are designed to be toxic to pests can have an equally lethal impact on our marine life. The same fertilizer that promotes plant growth in lawns and gardens can also create nuisance algae blooms, which remove oxygen from the water and clog waterways when it decomposes.
- **Solution:** Never use pesticides or fertilizer within 48 hours of an anticipated rainstorm. Use only as much as is directed on the label and keep it off driveways and sidewalks.

2 Dirt and Sediment

- **Pollution:** Dirt or sediment can impede the flow of the stormwater and negatively impact stream habitat as it travels through waterways and deposits downstream. Pollutants can attach to sediment, which can then be transported through our waterways.
- **Solution:** Protect dirt stockpiles by covering them with tarps or secure plastic sheets to prevent wind or rain from allowing dirt or sediment to enter the storm drain system.

3 Metals

- **Pollution:** Metals and other toxins present in car wash water can harm important plankton, which forms the base of the aquatic food chain.
- **Solution:** Take your car to a commercial car wash where the wash water is captured and treated at a local wastewater treatment plant.

DID YOU KNOW?

Did you know that most of the pollution found in our waterways is not from a single source, but from a "non-point" source meaning the accumulation of pollution from residents and businesses throughout the community

4 Pet Waste

- **Pollution:** Pet waste carries bacteria through our watersheds and eventually will be washed out to the ocean. This can pose a health risk to swimmers and surfers.
- **Solution:** Pick up after your pets!

5 Trash and Debris

- **Pollution:** Trash and debris can enter waterways by wind, littering and careless maintenance of trash receptacles. Street sweeping collects some of this trash; however, much of what isn't captured ends up in our storm drain system where it flows untreated out to the ocean.
- **Solution:** Don't litter and make sure trash containers are properly covered. It is far more expensive to clean up the litter and trash that ends up in our waterways than it is to prevent it in the first place. Come out to one of Orange County's many locations for Coastal and Inner-Coastal Cleanup Day, which is held in September.

6 Motor Oil / Vehicle Fluids

- **Pollution:** Oil and petroleum products from our vehicles are toxic to people, wildlife and plants.

- **Solution:** Fix any leaks from your vehicle and keep the maintenance up on your car. Use absorbent material such as cat litter on oil spills, then sweep it up and dispose of it in the trash. Recycle used motor oil at a local Household Hazardous Waste Collection Center.

A TEAM EFFORT

The Orange County Stormwater Program has teamed with the Municipal Water District of Orange County (MWDOC) and the University of California Cooperative Extension Program (UCCE) to develop this pamphlet.

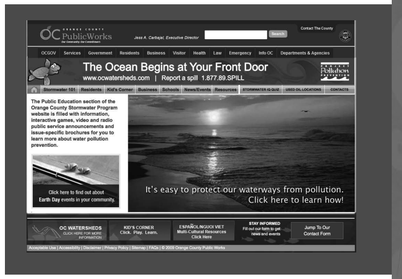
Low Impact Development (LID) and sustainable water use prevents water pollution and conserves water for drinking and reuse. Reducing your water use and the amount of water flowing from your home protects the environment and saves you money.

Thank you for making water protection a priority!

For more information, please visit
www.ocwatersheds.com/publiced/

www.mwdoc.com

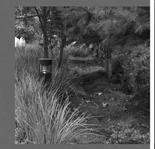
www.uccemg.com



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

Special Thanks to
The City of Los Angeles Stormwater Program for the use of its artwork

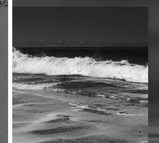
The Metropolitan Water District of Southern California for the use of the California-Friendly Plant and Native Habitat photos



Homeowners Guide for Sustainable Water Use

Low Impact Development, Water Conservation & Pollution Prevention

The Ocean Begins at Your Front Door



RUNOFF, RAINWATER AND REUSE

Where Does Water Runoff Go?

Stormwater, or water from rainfall events, and runoff from outdoor water use such as sprinklers and hoses flows from homes directly into catch basins and the storm drain system. After entering the storm drain, the water flows untreated into streams, rivers, bays and ultimately the Pacific Ocean. Runoff can come from lawns, gardens, driveways, sidewalks and roofs. As it flows over hard, impervious surfaces, it picks up pollutants. Some pollutants carried by the water runoff include trash, pet waste, pesticides, fertilizer, motor oil and more.

Water Conservation

Pollution not only impairs the water quality for habitat and recreation, it can also reduce the water available for reuse. Runoff allowed to soak into the ground is cleaned as it percolates through the soil, replenishing depleted groundwater supplies. Groundwater provides at least 50% of the total water for drinking and other indoor household activities in north and central Orange County. When land is covered with roads, parking lots, homes, etc., there is less land to take in the water and more hard surfaces over which the water can flow.

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

What is Low Impact Development (LID)?

Low Impact Development (LID) is a method of development that seeks to maintain the natural hydrologic character of an area. LID provides a more sustainable and pollution-preventative approach to water management.

New water quality regulations require implementation of LID in larger new developments and encourage implementation of LID and other sustainable practices in existing residential areas. Implementing modifications to your lawn or garden can reduce pollution in our environment, conserve water and reduce your water bill.

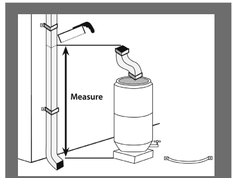
Permeable pavement allows water runoff to infiltrate through the soil and prevents most pollutants from reaching the storm drain system.

OPTIONS FOR RAINWATER HARVESTING AND REUSE

Rainwater harvesting is a great way to save money, prevent pollution and reduce potable water use. To harvest your rainwater, simply redirect the runoff from roofs and downspouts to rain barrels. Rain gardens are another option; these reduce runoff as well as encourage infiltration.

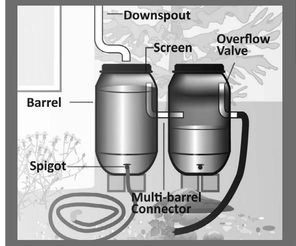
Downspout Disconnection/Redirection

Disconnecting downspouts from pipes running to the gutter prevents runoff from transporting pollutants to the storm drain. Once disconnected, downspouts can be redirected to rain gardens or other vegetated areas, or be connected to a rain barrel.

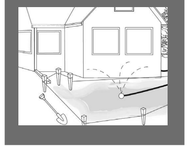


Rain Barrels

Rain barrels capture rainwater flow from roofs for reuse in landscape irrigation. Capacity of rain barrels needed for your home will depend on the amount of roof area and rainfall received. When purchasing your rain barrel, make sure it includes a screen, a spigot to siphon water for use, an overflow tube to allow for excess water to run out and a connector if you wish to connect multiple barrels to add capacity of water storage.



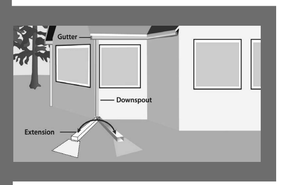
Mosquito growth prevention is very important when installing a rain barrel. The best way to prevent mosquito breeding is to eliminate entry points by ensuring all openings are sealed tightly. If these methods are unsuccessful, products are available to kill mosquito larvae, but that are harmless to animals and humans. Regular application of these products is essential. Please visit the Orange County Vector Control website for more information at www.ocvcd.org/mosquitoes3.php.



Rain Gardens

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

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



For information on how to disconnect a downspout or to install and maintain a rain barrel or rain garden at your home, please see the Los Angeles Rainwater Harvesting Program, A Homeowner's "How-To" Guide, November 2009 at www.larainwaterharvesting.org/

OTHER WATER CONSERVATION AND POLLUTION PREVENTION TECHNIQUES

Native Vegetation and Maintenance

"California Friendly" plants or native vegetation can significantly reduce water use. These plants often require far less fertilizers and pesticides, which are two significant pollutants found in Orange County waterways. Replacing water "thirsty" plants and grass types with water efficient natives is a great way to save water and reduce the need for potentially harmful pesticides and fertilizer.

Please see the California Friendly Garden Guide produced by the Metropolitan Water District of Southern California and associated Southern California Water Agencies for a catalog of California friendly plants and other garden resources at www.bewaterwise.com/Gardensoft.

Weed Free Yards

Weeds are water thieves. They often reproduce quickly and rob your yard of both water and nutrients. Weed your yard by hand if possible. If you use herbicides to control the weeds, use only the amount recommended on the label and never use it if rain is forecast within the next 48 hours.

Soil Amendments

Soil amendments such as green waste (e.g. grass clippings, compost, etc.) can be a significant source of nutrients and can help keep the soil near the roots of plants moist. However, they can cause algal booms if they get into our waterways, which reduces the amount of oxygen in the water and impacts most aquatic organisms. It is important to apply soil amendments more than 48 hours prior to predicted rainfall.

IRRIGATE EFFICIENTLY

Water runoff from sprinklers left on too long will carry pollutants into our waterways.

Smart Irrigation Controllers

Smart Irrigation Controllers have internal clocks as well as sensors that will turn off the sprinklers in response to environmental changes. If it is raining, too windy or too cold, the smart irrigation control sprinklers will automatically shut off.

Check with your local water agency for available rebates on irrigation controllers and smart timers.

- Aim your sprinklers at your lawn, not the sidewalk – By simply adjusting the direction of your sprinklers you can save water, prevent water pollution from runoff, keep your lawn healthy and save money.
- **Set a timer for your sprinklers** – lawns absorb the water they need to stay healthy within a few minutes of turning on the sprinklers. Time your sprinklers; when water begins running off your lawn, you can turn them off. Your timer can be set to water your lawn for this duration every time.
- **Water at Sunrise** – Watering early in the morning will reduce water loss due to evaporation. Additionally, winds tend to die down in the early morning so the water will get to the lawn as intended.
- **Water by hand** – Instead of using sprinklers, consider watering your yard by hand. Hand-watering ensures that all plants get the proper amount of water and you will prevent any water runoff, which wastes water and carries pollutants into our waterways.
- **Fix leaks** - Nationwide, households waste one trillion gallons of water a year to leaks – that is enough water to serve the entire state of Texas for a year. If your garden hose is leaking, replace the nylon or rubber hose washer and ensure a tight connection. Fix broken sprinklers immediately.

ATTACHMENT B

OPERATIONS AND MAINTENANCE (O&M) PLAN

OPERATION & MAINTENANCE (O&M) PLAN FOR WQMP TBD

Project Name:

Paseo De Colinas

Prepared for:

PROJECT DIMENSIONS
4 Park Plaza, Suite 700
Irvine, CA 92614
949.476.1960

Prepared on:

May 25, 2021

CONTENTS

SECTION 1 PROJECT DESCRIPTION AND BMP OVERVIEW

GENERAL PROJECT ATTRIBUTES AND STORMWATER CONTROL MEASURES		
Site Location:	*29001 Paseo De Colinas, Laguna Niguel CA 92677* The project is located within "South" Orange County and under the jurisdiction of the San Diego Regional Water Quality Control Board. A vicinity map is included in Attachment C.	
Project Area: 107,630 ft^2	**Number of Dwelling Units:** 38	**SIC Code:** N/A
Narrative Project Description:	The proposed development consists of 38 residential town-home style units. Each proposed unit will be three stories and will be arranged around central courtyard areas. Surface-level parking will be provided throughout the Project Site. On-site activities are anticipated to be passive land uses associated with residential developments. The Project will redevelop an existing lot used for overflow parking for the adjacent middle school. While impervious surfaces are anticipated to decrease, the change in land uses across the site results in the requirement for a Priority WQMP.	
Project-Specific Source Control BMPs:	(N1) Education for Property Owners, Tenants and 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	
Summary of Drainage Patterns:	The project site drains northerly toward the NE corner of the site, where flows exit the site to Paseo De Colinas.	
Summary of Hydrologic Source Controls:	Minimize Impervious Area - Impervious surfaces have been minimized by incorporating landscaped areas throughout the site. Preserve Existing Drainage Patterns and Time of Concentration - Runoff from the site will continue to flow similar to existing conditions. Low flows will be routed to LID and hydromodification BMPs, while high flows will exit the site. Disconnect Impervious Areas - Landscaping will be provided adjacent to sidewalks and buildings. Low flows will be routed to LID and hydromodification BMPs for treatment before exiting the site.	

GENERAL PROJECT ATTRIBUTES AND STORMWATER CONTROL MEASURES	
	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. Water Efficient Landscaping - Xeriscape landscaping is not proposed for the project. However, native landscaping with lower water demands will be incorporated into the site design.
Structural Treatment and Hydromodification BMPs:	Low flows are picked up in the onsite area drain system and conveyed to the MWS units located on the south side of the northern and middle driveways to Paseo De Colinas. Treated "first flush" and flows up to 10-yr storm will then ender the underground tank located under the surface parking area in the north end of the site for hydromodification mitigation to reduce flows. Runoff leaving the tank is then pumped up to the surface in the northeast corner of the site and exits on the surface through a parkway culvert out to Paseo De Colinas.

Below is a table summary of all BMPs onsite.

BMP ID	BMP Type	Narrative Description	Location	Other Considerations
BMP 1	MWS (Modular Wetland System) Unit	Proprietary 8' x 16' biotreatment device to treat LID ("first flush" flows from DMA 1)	Manholes located in southeastern corner of sidewalk in the middle driveway to/from Paseo De Colinas.	N/A
BMP 2	MWS (Modular Wetland System) Unit	Proprietary 4' x 13' biotreatment device to treat LID ("first flush" flows from DMA 2)	Manholes located in southeastern corner of sidewalk in the northern driveway to/from Paseo De Colinas.	N/A
BMP 3	Underground storage tank	Below ground detention tank 5' diameter x 350' length to reduce flows for hydromodification mitigation	In center of surface parking area in norther portion of the site.	LID flows will be treated first, up to 10-year flows will bypass MWS.

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	Project Dimensions – Jon Conk	949-476-2246	4 Park Plaza, Suite 700, Irvine, CA 92614	jconk@projectdimensions.com
Responsible Party	Project Dimensions – Jon Conk	949-476-2246	4 Park Plaza, Suite 700, Irvine, CA 92614	jconk@projectdimensions.com
Designated Emergency Respondent	Project Dimensions – Jon Conk	949-476-2246	4 Park Plaza, Suite 700, Irvine, CA 92614	jconk@projectdimensions.com

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

At this preliminary stage of design, it is projected that long-term funding for BMP maintenance will be provided by the Owner/Developer. Should the maintenance responsibility be transferred at any time during the operational life of the project, such as when an HOA or POA is formed for a project, a formal notice of transfer shall be submitted to the County of Orange at the time responsibility of the property subject to this WQMP is transferred. The transfer of responsibility shall be incorporated into this WQMP as an amendment.

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

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

2.6 SELF-REPORTING REQUIREMENTS

No additional self-reporting requirements are known at this time.

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 *(ordinance code number unknown at this time)*.

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: *activities to be updated at a later time once CC&R's are finalized.*	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

3.2 INSPECTION AND MAINTENANCE OF HYDROLOGIC SOURCE CONTROLS

No HSCs are proposed for the project to offset LID BMP sizing. This section not applicable.

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 1	*MWS biotreatment Unit (or equivalent)*	*BIO-5 Proprietary Biotreatment (Page 10)*
BMP 2	*MWS biotreatment Unit (or equivalent)*	*BIO-5 Proprietary Biotreatment (Page 10)*
BMP 3	*Underground storage tank*	*Hydromodification Cisterns or Tanks (Page 11)*

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.	

HYDROMODIFICATION CISTERNS OR TANKS	
Activity	**Frequency**
GENERAL INSPECTIONS	
Check for leaks	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.
Inspect for minor sediment in cistern bottom	
Inspect for vector control issues	
Identify any needed corrective maintenance that will require site-specific planning or design	
ROUTINE MAINTENANCE	
Clean out gutters, screening, and/or first-flush diverter	As-needed
Remove sediment, trash, debris, and oil accumulation from cistern	Semi-annually or as needed
Clean inside surfaces of cistern and disinfect	Annually
Maintain treatment systems per manufacturer or designer recommendations	As specified
CORRECTIVE (MAJOR) MAINTENANCE	
Prepare documentation of issues and resolutions for review by appropriate parties; modify WQMP if needed.	Before major maintenance
Document major maintenance activities; record modified WQMP and as-built plan set if needed	After major maintenance

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.

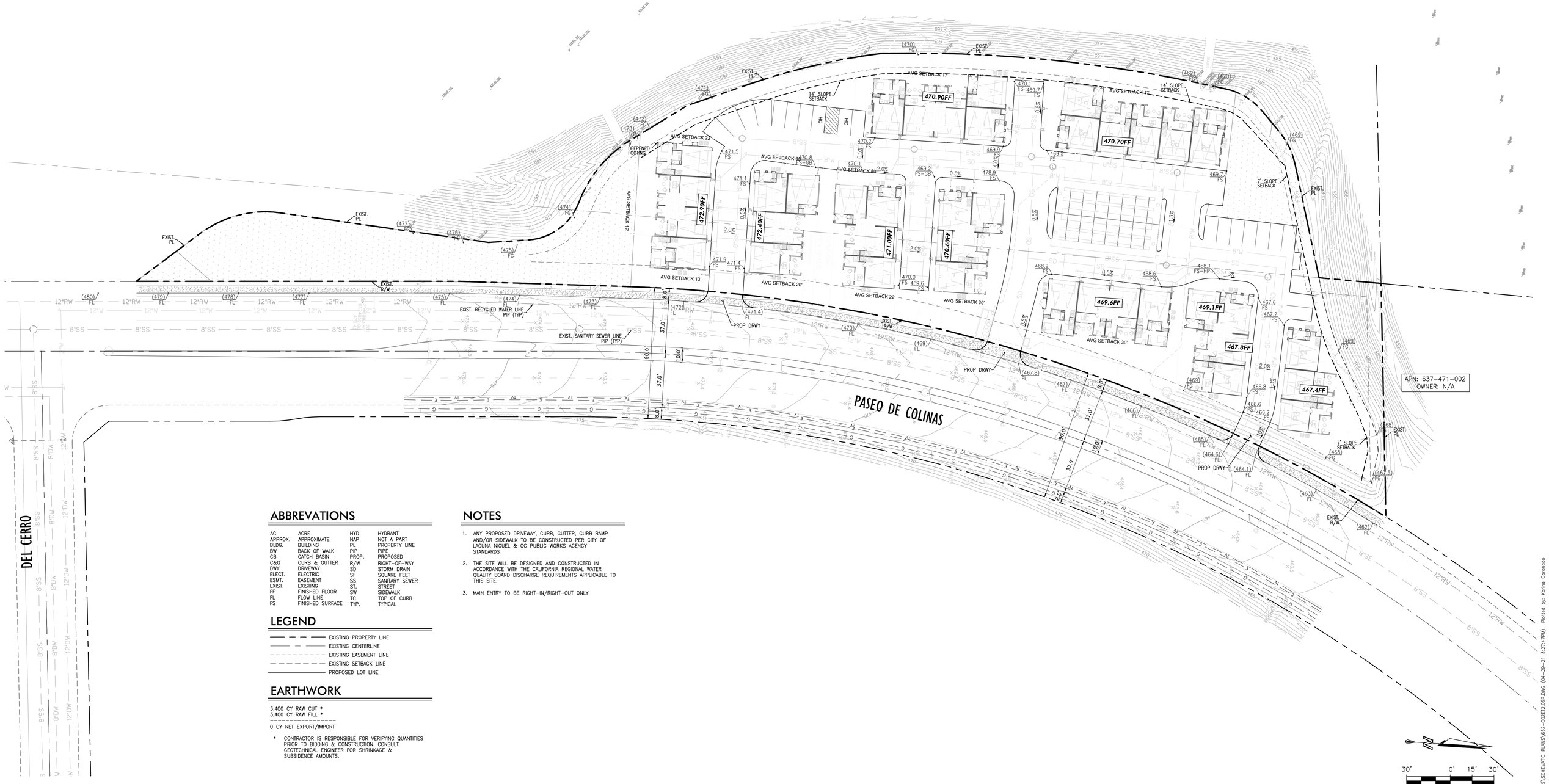
The Orange County Vector Control District may be contacted for more information and support at 714-971-2421 or 949-654-2421 or www.ocvcd.org.

ATTACHMENT 1 PHOTOS AND EXHIBITS

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

NIGUEL HILLS MIDDLE SCHOOL

APN: 637-181-001
OWNER: CAPISTRANO UNIFIED SCHOOL DISTRICT



ABBREVATIONS

AC	ACRE	HYD	HYDRANT
APPROX.	APPROXIMATE	NAP	NOT A PART
BLDG.	BUILDING	PL	PROPERTY LINE
BW	BACK OF WALK	PIP	PIPE
CB	CATCH BASIN	PROP.	PROPOSED
C&G	CURB & GUTTER	R/W	RIGHT-OF-WAY
DWY	DRIVEWAY	SD	STORM DRAIN
ELECT.	ELECTRIC	SF	SQUARE FEET
ESMT.	EASEMENT	SS	SANITARY SEWER
EXIST.	EXISTING	ST.	STREET
FF	FINISHED FLOOR	SW	SIDEWALK
FL	FLOW LINE	TC	TOP OF CURB
FS	FINISHED SURFACE	TYP.	TYPICAL

LEGEND

- EXISTING PROPERTY LINE
- EXISTING CENTERLINE
- EXISTING EASEMENT LINE
- EXISTING SETBACK LINE
- PROPOSED LOT LINE

EARTHWORK

3,400 CY RAW CUT *
3,400 CY RAW FILL *

0 CY NET EXPORT/IMPORT

* CONTRACTOR IS RESPONSIBLE FOR VERIFYING QUANTITIES PRIOR TO BIDDING & CONSTRUCTION. CONSULT GEOTECHNICAL ENGINEER FOR SHRINKAGE & SUBSIDENCE AMOUNTS.

NOTES

1. ANY PROPOSED DRIVEWAY, CURB, GUTTER, CURB RAMP AND/OR SIDEWALK TO BE CONSTRUCTED PER CITY OF LAGUNA NIGUEL & OC PUBLIC WORKS AGENCY STANDARDS
2. THE SITE WILL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE CALIFORNIA REGIONAL WATER QUALITY BOARD DISCHARGE REQUIREMENTS APPLICABLE TO THIS SITE.
3. MAIN ENTRY TO BE RIGHT-IN/RIGHT-OUT ONLY

30' 0' 15' 30'
SCALE: 1" = 30'

PROJECT DIMENSIONS
4 Park Plaza, Suite 700
Irvine, CA 92614

PASEO DE COLINAS
LAGUNA NIGUEL, CA # 2018-1173

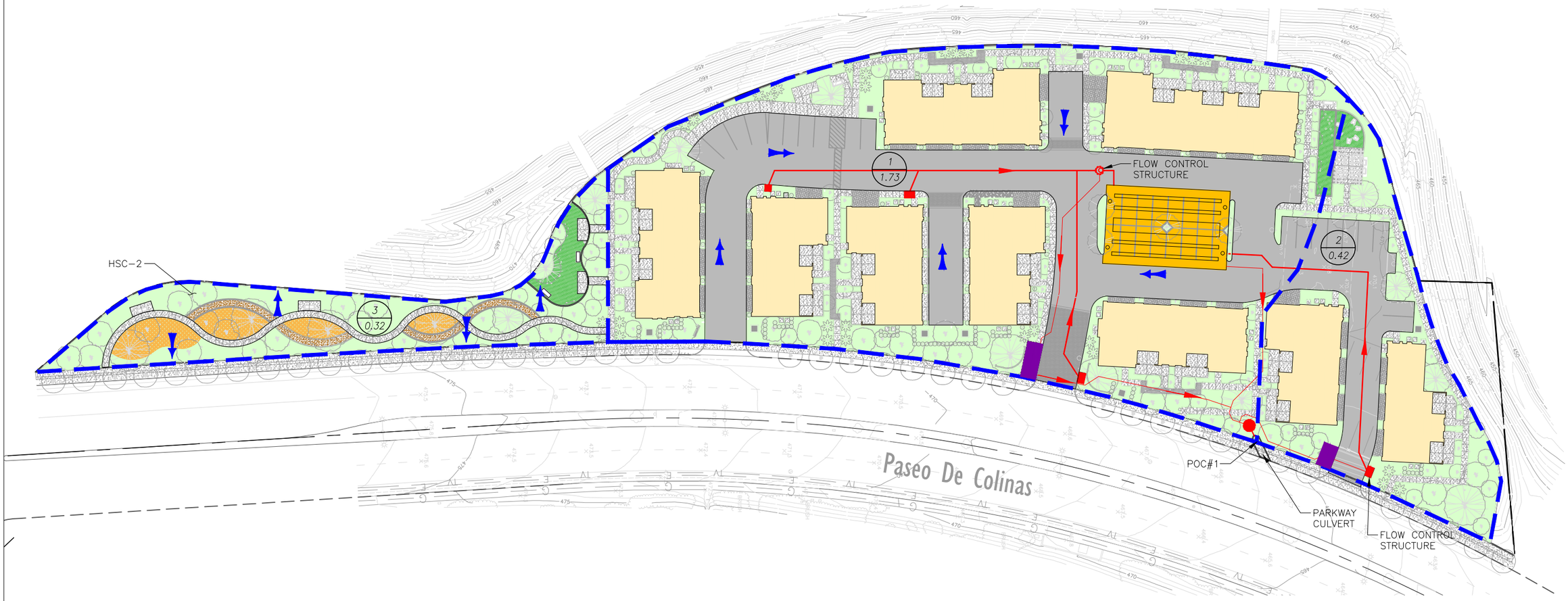
SITE DEVELOPMENT PERMIT APPLICATION
PLOT DATE: 4.29.2021

C-2.0
SITE PLAN - IMPROVEMENTS

FEI # 662-002-01

Civil Engineer
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960
fax 949.474.5315
www.fuscoe.com

FUSCOE ENGINEERING
full circle thinking



LEGEND

- PROPOSED STORM DRAIN - HIGH FLOW
- PROPOSED STORM DRAIN - LOW FLOW
- BMP DRAINAGE AREA BOUNDARY
- STREET SWEEPING PRIVATE STREETS & PARKING LOTS
- CATCH BASIN STENCILING & MAINTENANCE
- PROPOSED HYDROMODIFICATION TANK
- PROPOSED MODULAR WETLAND SYSTEM
- PROPOSED PUMP TO POC#1
- DIRECTION OF SURFACE FLOW
- DIRECTION OF PIPE FLOW
- 00 / #.## — DMA ID / AC
- PROPERTY LINE
- PROPOSED COMMON AREA LANDSCAPING
- PROPOSED SYNTHETIC TURF
- PROPOSED BUILDING
- PROPOSED COBBLE
- PROPOSED DECOMPOSED GRANITE

60’ 0’ 30’ 60’

SCALE: 1” = 60’

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

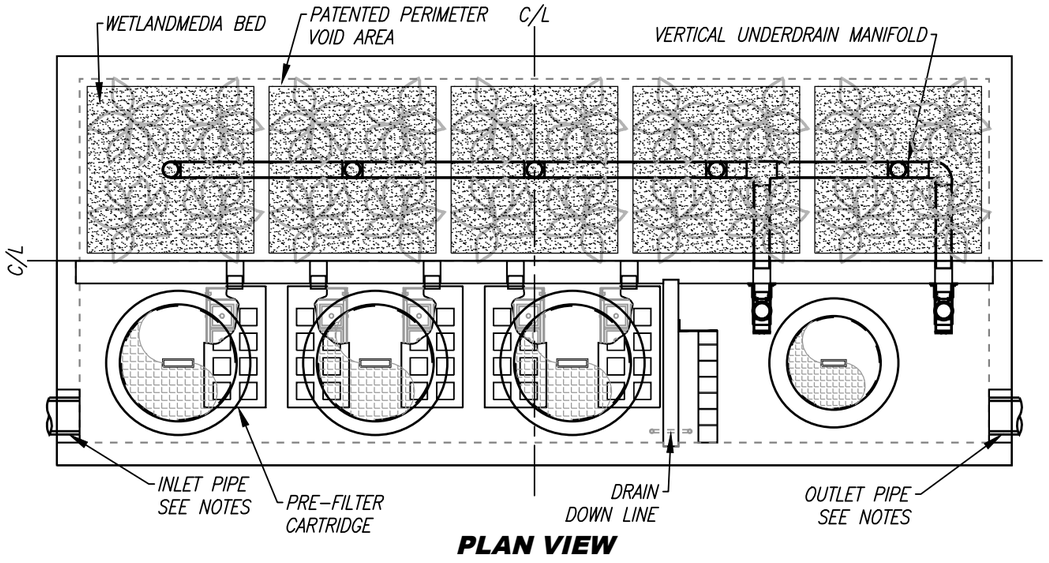
Scale: 1" = 60'

Exhibit Date: 5/25/2021

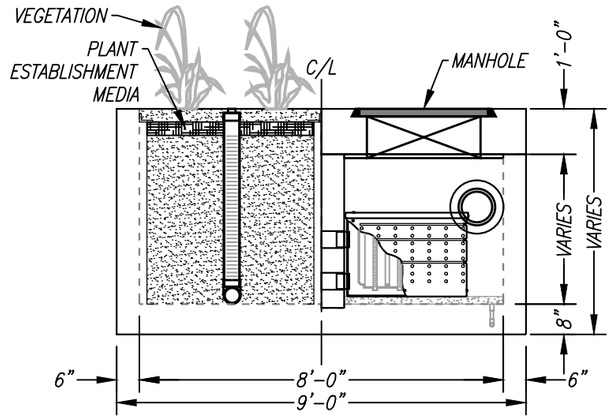
WATER QUALITY MANAGEMENT PLAN
PASEO DE COLINAS
LAGUNA NIGUEL, CA

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.577	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	3EA ø30"	OPEN PLANTER	ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



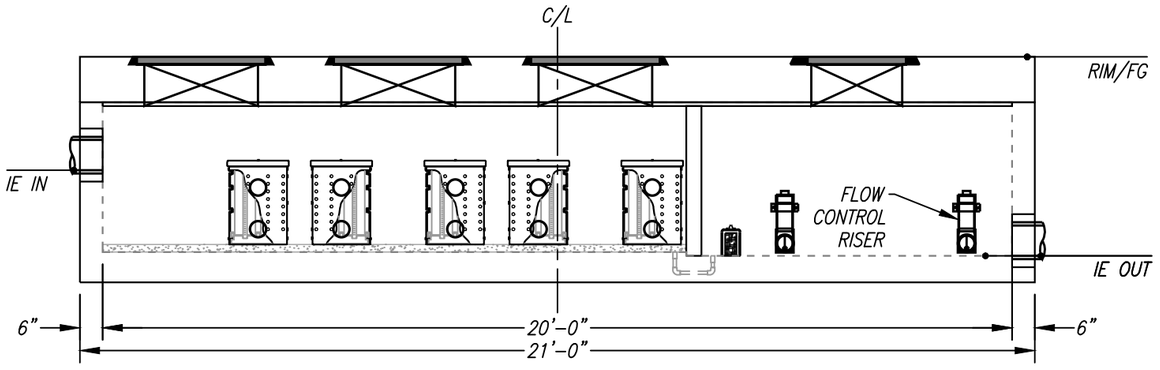
LEFT END VIEW

INSTALLATION NOTES

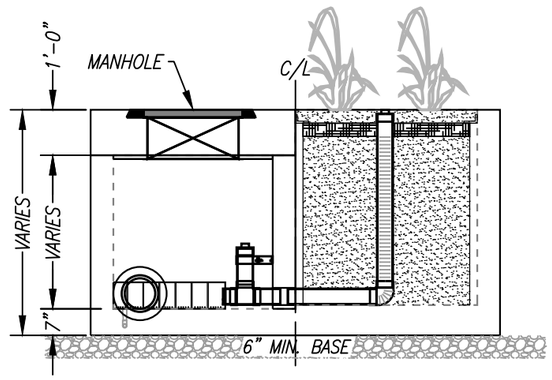
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER 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

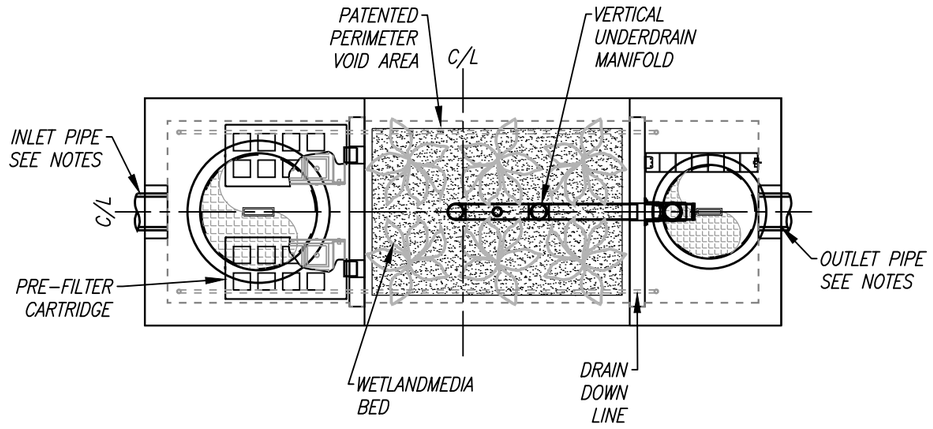
TREATMENT FLOW (CFS)	0.577
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-20-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

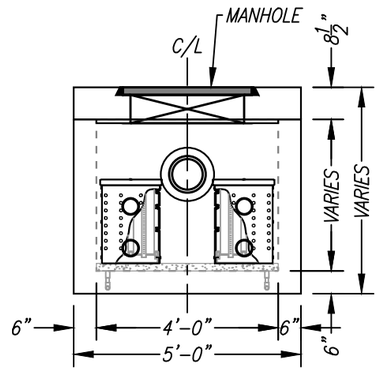
5/23/19 10:LEE

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.144	
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	ø30"	OPEN PLANTER	ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



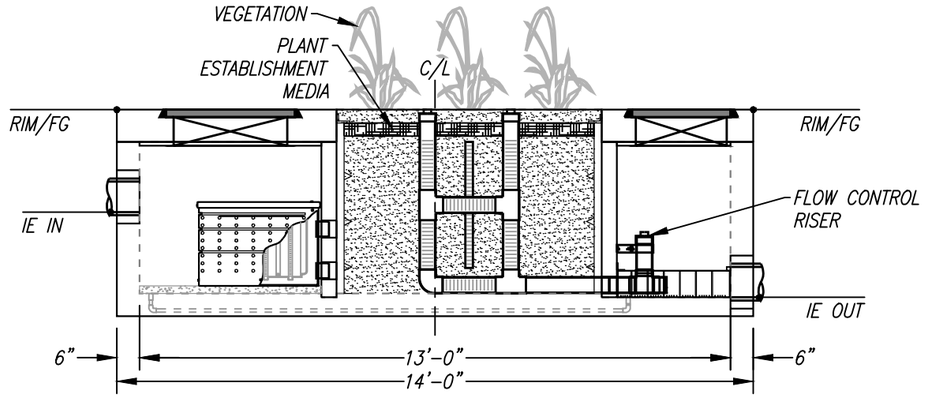
LEFT END VIEW

INSTALLATION NOTES

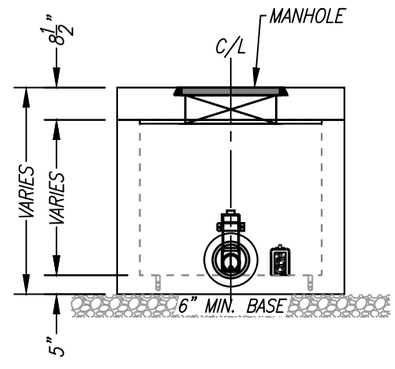
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER 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)	0.144
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	1.3
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

Bio Clean
A Forterra Company

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

5/23/19TOLEE

ATTACHMENT 2 MAINTENANCE AGREEMENT AND FUNDING MECHANISM DOCUMENTATION

NOTICE OF TRANSFER OF RESPONSIBILITY

WATER QUALITY MANAGEMENT PLAN

Paseo De Colinas
29001 Paseo De Colinas, Laguna Niguel, CA 92614

Submission of this Notice Of Transfer of Responsibility constitutes notice to the County of Orange that responsibility for the Water Quality Management Plan ("WQMP") for the subject property identified below, and implementation of that plan, is being transferred from the Previous Owner (and his/her agent) of the site (or a portion thereof) to the New Owner, as further described below.

I. Previous Owner/ Previous Responsible Party Information

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

II. Information about Site Transferred

Name of Project (if applicable):	
Title of WQMP Applicable to site:	
Street Address of Site (if applicable):	
Planning Area (PA) and/ or Tract Number(s) for Site:	Lot Numbers (if Site is a portion of a tract):
Date WQMP Prepared (and revised if applicable):	

III. New Owner/ New Responsible Party Information

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

IV. Ownership Transfer Information

General Description of Site Transferred to New Owner:	General Description of Portion of Project/ Parcel Subject to WQMP Retained by Owner (if any):

Lot/ Tract Numbers of Site Transferred to New Owner:
Remaining Lot/ Tract Numbers Subject to WQMP Still Held by Owner (if any):
Date of Ownership Transfer:

Note: When the Previous Owner is transferring a Site that is a portion of a larger project/ parcel addressed by the WQMP, as opposed to the entire project/parcel addressed by the WQMP, the General Description of the Site transferred and the remainder of the project/ parcel no transferred shall be set forth as maps attached to this notice. These maps shall show those portions of a project/ parcel addressed by the WQMP that are transferred to the New Owner (the Transferred Site), those portions retained by the Previous Owner, and those portions previously transferred by Previous Owner. Those portions retained by Previous Owner shall be labeled as "Previously Transferred".

V. Purpose of Notice of Transfer

The purposes of this Notice of Transfer of Responsibility are: 1) to track transfer of responsibility for implementation and amendment of the WQMP when property to which the WQMP is transferred from the Previous Owner to the New Owner, and 2) to facilitate notification to a transferee of property subject to a WQMP that such New Order is now the Responsible Party of record for the WQMP for those portions of the site that it owns.

VI. Certifications

A. Previous Owner

I certify under penalty of law that I am no longer the owner of the Transferred Site as described in Section II above. I have provided the New Owner with a copy of the WQMP applicable to the Transferred Site that the New Owner is acquiring from the Previous Owner.

Printed Name of Previous Owner Representative:	Title:
Signature of Previous Owner Representative:	Date:

B. New Owner

I certify under penalty of law that I am the owner of the Transferred Site, as described in Section II above, that I have been provided a copy of the WQMP, and that I have informed myself and understand the New Owner's responsibilities related to the WQMP, its implementation, and Best Management Practices associated with it. I understand that by signing this notice, the New Owner is accepting all ongoing responsibilities for implementation and amendment of the WQMP for the Transferred Site, which the New Owner has acquired from the Previous Owner.

Printed Name of New Owner Representative:	Title:
Signature:	Date:

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

For newsletter or mailer educational activities, please include the following information:

- Date of mailing:
- Number distributed:
- Method of distribution:
- Topics addressed:

If a newsletter article was distributed, please include a copy of it.

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

[add additional pages, photographs, drawings, notes as needed]

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)	

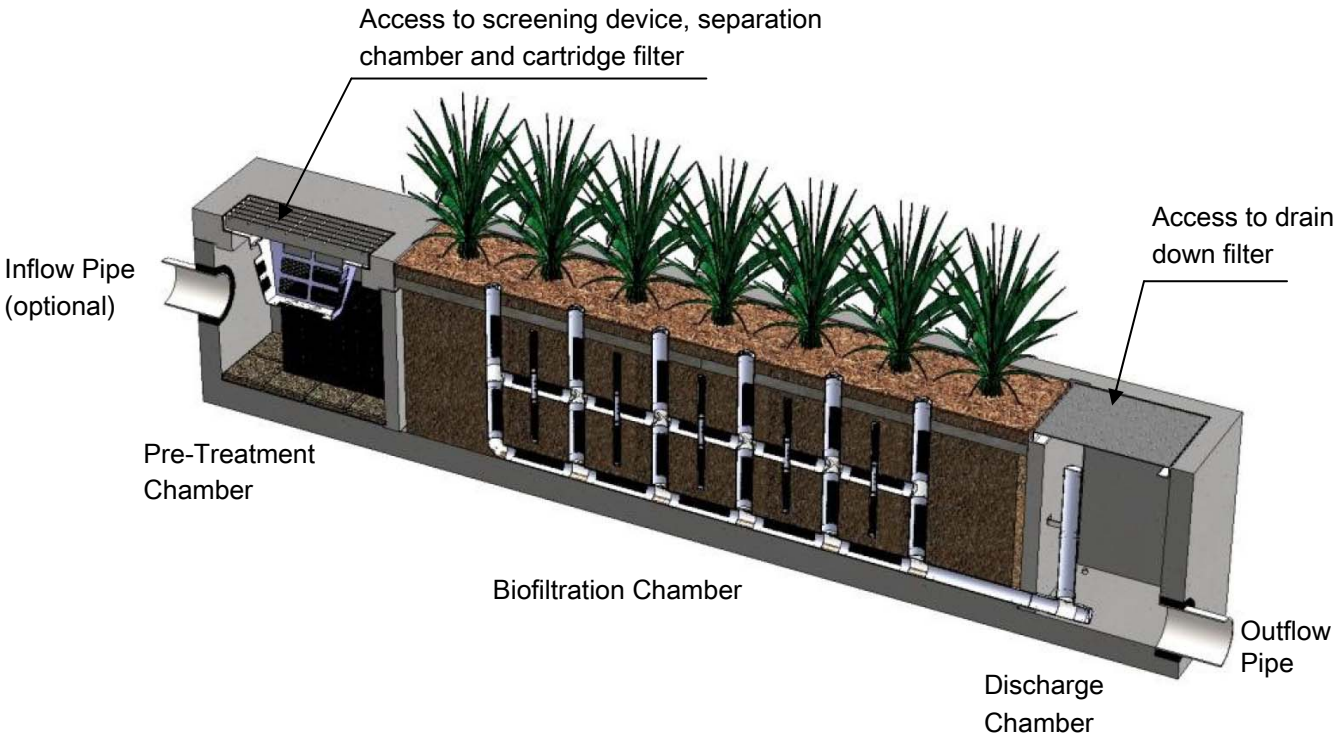
ATTACHMENT 6 VENDOR O&M INFORMATION

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

Screening Device

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

Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.

Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

Trim Vegetation

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

Inspection Form

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

www.modularwetlands.com

Inspection Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

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

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

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

Weather Condition _____ Additional Notes _____

Inspection Checklist

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

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

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

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

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes:

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

Maintenance Report

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

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

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

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

Weather Condition _____ Additional Notes _____

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

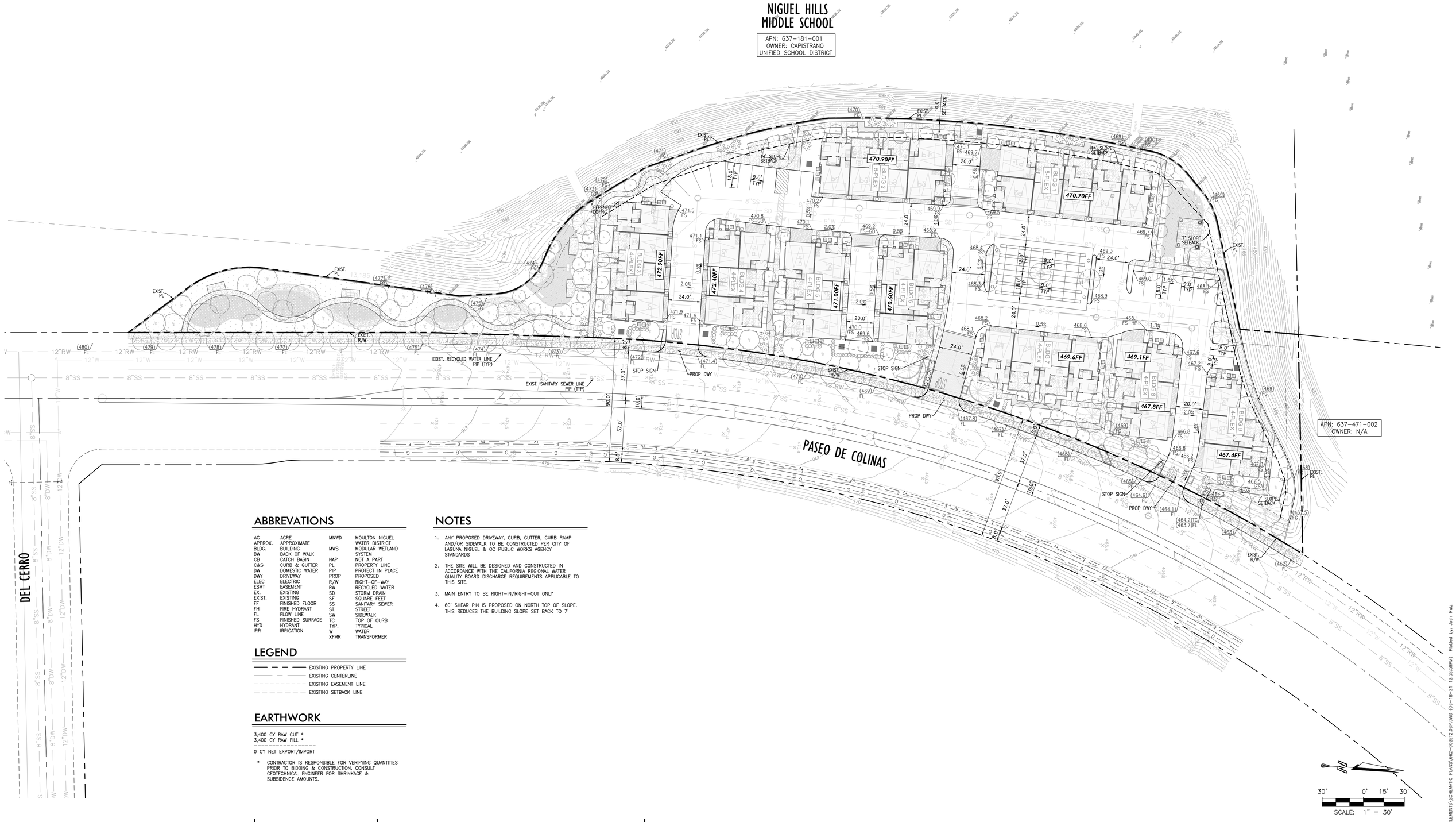
Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins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

Comments:

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

ATTACHMENT C

EXHIBITS



ABBREVATIONS

AC	ACRE	MNWD	MOULTON NIGUEL WATER DISTRICT
APPROX.	APPROXIMATE	MWS	MODULAR WETLAND SYSTEM
BLDG.	BUILDING	NAP	NOT A PART
BW	BACK OF WALK	PL	PROPERTY LINE
CB	CATCH BASIN	PIP	PROTECT IN PLACE
C&G	CURB & GUTTER	PROP	PROPOSED
DW	DOMESTIC WATER	R/W	RIGHT-OF-WAY
DWY	DRIVEWAY	RW	RECYCLED WATER
ELEC	ELECTRIC	SD	STORM DRAIN
ESMT	EASEMENT	SF	SQUARE FEET
EX.	EXISTING	SS	SANITARY SEWER
EXIST.	EXISTING	ST.	STREET
FF	FINISHED FLOOR	SW	SIDEWALK
FH	FIRE HYDRANT	TC	TOP OF CURB
FL	FLOW LINE	TYP.	TYPICAL
FS	FINISHED SURFACE	W	WATER
HYD	HYDRANT	XFMR	TRANSFORMER
IRR	IRRIGATION		

LEGEND

- EXISTING PROPERTY LINE
- EXISTING CENTERLINE
- EXISTING EASEMENT LINE
- EXISTING SETBACK LINE

EARTHWORK

3,400 CY RAW CUT *
3,400 CY RAW FILL *

0 CY NET EXPORT/IMPORT

* CONTRACTOR IS RESPONSIBLE FOR VERIFYING QUANTITIES PRIOR TO BIDDING & CONSTRUCTION. CONSULT GEOTECHNICAL ENGINEER FOR SHRINKAGE & SUBSIDENCE AMOUNTS.

NOTES

1. ANY PROPOSED DRIVEWAY, CURB, GUTTER, CURB RAMP AND/OR SIDEWALK TO BE CONSTRUCTED PER CITY OF LAGUNA NIGUEL & OC PUBLIC WORKS AGENCY STANDARDS
2. THE SITE WILL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE CALIFORNIA REGIONAL WATER QUALITY BOARD DISCHARGE REQUIREMENTS APPLICABLE TO THIS SITE.
3. MAIN ENTRY TO BE RIGHT-IN/RIGHT-OUT ONLY
4. 60' SHEAR PIN IS PROPOSED ON NORTH TOP OF SLOPE. THIS REDUCES THE BUILDING SLOPE SET BACK TO 7'

30' 0' 15' 30'
SCALE: 1" = 30'

PROJECT DIMENSIONS
4 Park Plaza, Suite 700
Irvine, CA 92614

PASEO DE COLINAS
LAGUNA NIGUEL, CA # 2018-1173

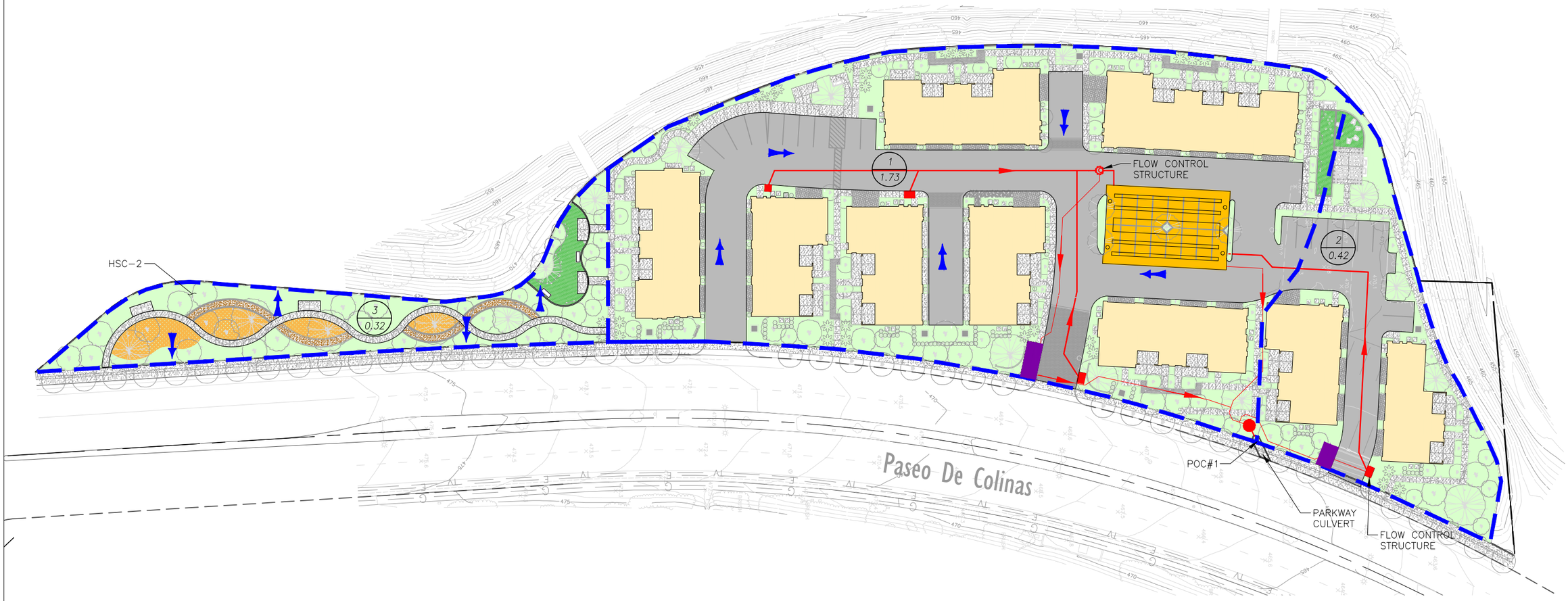
SITE DEVELOPMENT PERMIT APPLICATION
PLOT DATE: 6.14.2021

C-2.0
SITE PLAN - IMPROVEMENTS

FEI # 662-002-01

Civil Engineer
16795 Von Karman, Suite 100
Irvine, California 92606
tel 949.474.1960
fax 949.474.5315
www.fuscoe.com

FUSCOE ENGINEERING
full circle thinking



LEGEND

- PROPOSED STORM DRAIN - HIGH FLOW
- PROPOSED STORM DRAIN - LOW FLOW
- BMP DRAINAGE AREA BOUNDARY
- STREET SWEEPING PRIVATE STREETS & PARKING LOTS
- CATCH BASIN STENCILING & MAINTENANCE
- PROPOSED HYDROMODIFICATION TANK
- PROPOSED MODULAR WETLAND SYSTEM
- PROPOSED PUMP TO POC#1
- DIRECTION OF SURFACE FLOW
- DIRECTION OF PIPE FLOW
- 00 / #.## — DMA ID / AC
- PROPERTY LINE
- PROPOSED COMMON AREA LANDSCAPING
- PROPOSED SYNTHETIC TURF
- PROPOSED BUILDING
- PROPOSED COBBLE
- PROPOSED DECOMPOSED GRANITE

60’ 0’ 30’ 60’

SCALE: 1” = 60’

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

Scale: 1" = 60'

Exhibit Date: 5/25/2021

WATER QUALITY MANAGEMENT PLAN
PASEO DE COLINAS
LAGUNA NIGUEL, CA

ATTACHMENT D

BMP DESIGN CALCULATIONS & DETAILS

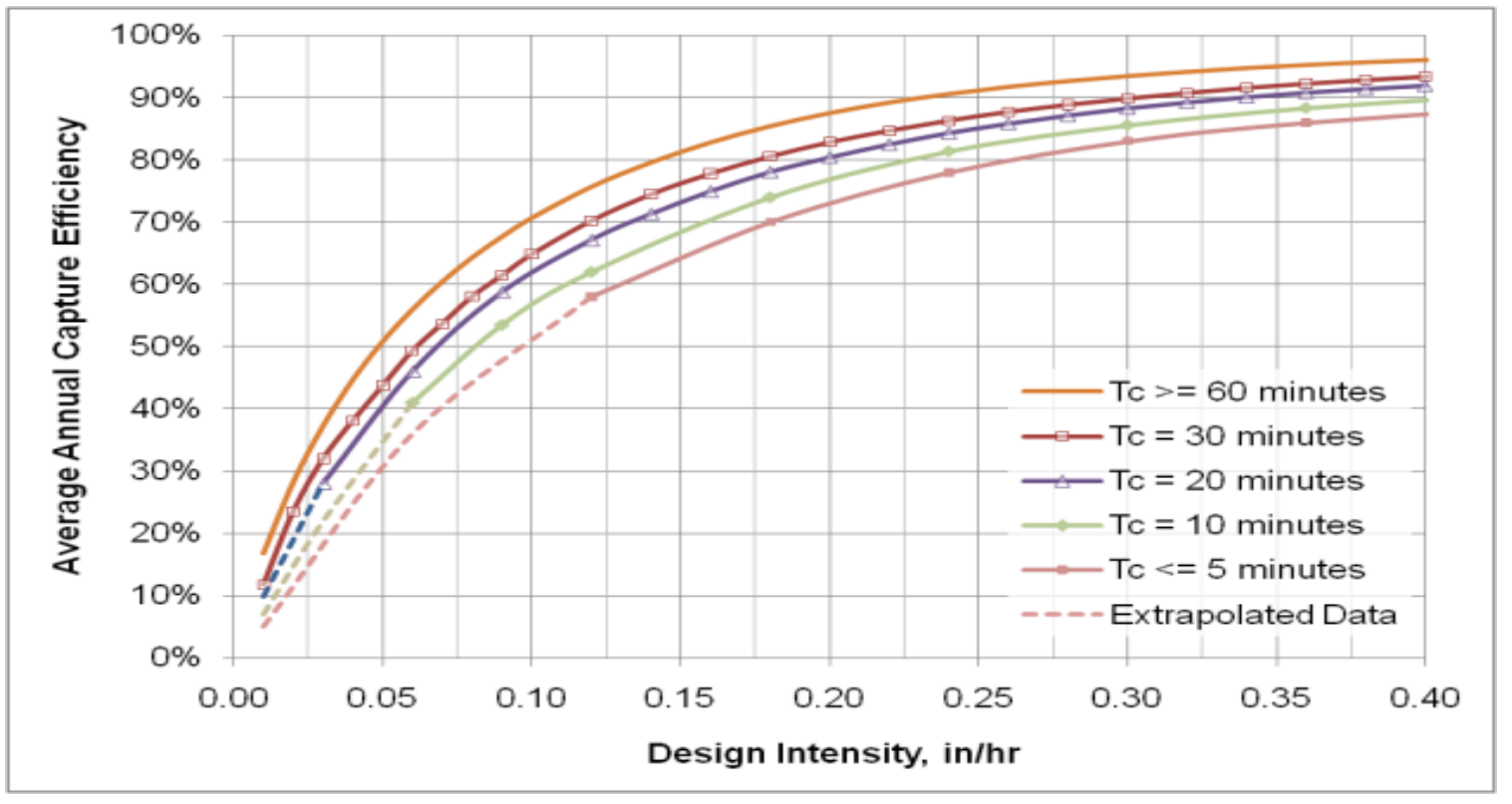
Storm Water Quality Design Calculations

Paseo de Colinas, 5-25-2021

DCV Calculations									
Drainage Area Name / DMA	**Worksheet**	**Total Drainage Area (ft^2)**	**Assumed % impervious**	**Runoff Coefficient**	**Design Storm Depth (in)**	**Average or Estimated Tc (min)**	**Rainfall Intensity (in/hr)**	**Simple Method DCV (ft^3)**	**Q_{Design} (cfs)**
DMA 1	SOC-9	75,359	83%	0.773	0.85	5	0.26	**5,741**	**0.484**
DMA 2	SOC-9	18295.2	62%	0.615	0.85	5	0.26	**3,283**	**0.277**
DMA 3	SOC-4	13,939	22%	0.315	0.85	5	0.26	**311**	**0.026**

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

		DMA =	DMA 1	DMA 2	
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	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	in/hr
3	Enter capture efficiency corresponding to upstream HSCs and/or upstream BMPs, Y_2. Attach associated calculations.	Y_2 =	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	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	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=	1.73	0.42	acres
6b	Enter DMA Imperviousness, imp (unitless)	imp=	83%	62%	
6c	Calculate runoff coefficient, *c= (0.75 x imp) + 0.15*	c=	0.773	0.615	
6d	Calculate flowrate to achieve 80 percent capture, $Q_{80\%} = (c \times I_{design} \times A)$	$Q_{80\%}$=	0.347	0.067	cfs
7	Calculate design flowrate, $Q_{design} = Q_{80\%} \times 150\%$	Q_{design}=	0.521	0.101	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-8-20*	*MWS-L-4-8*	
		Unit Size / Model Treatment Capacity =	*0.577*	*0.115*	cfs
		Number of Units Needed =	*1.000*	*1.000*	
		Total Bio-treatment Provided =	*0.577*	*0.115*	cfs
9	Summarize calculations to demonstrate that volume reduction targets are met, where feasible and applicable.				
Supporting Calculations					
Provide time of concentration assumptions: Minimum Tc assumed for conservative estimation.					
Graphical Operations					



Provide supporting graphical operations in figure above.

Worksheet 4: Hydrologic Source Control Calculation Form

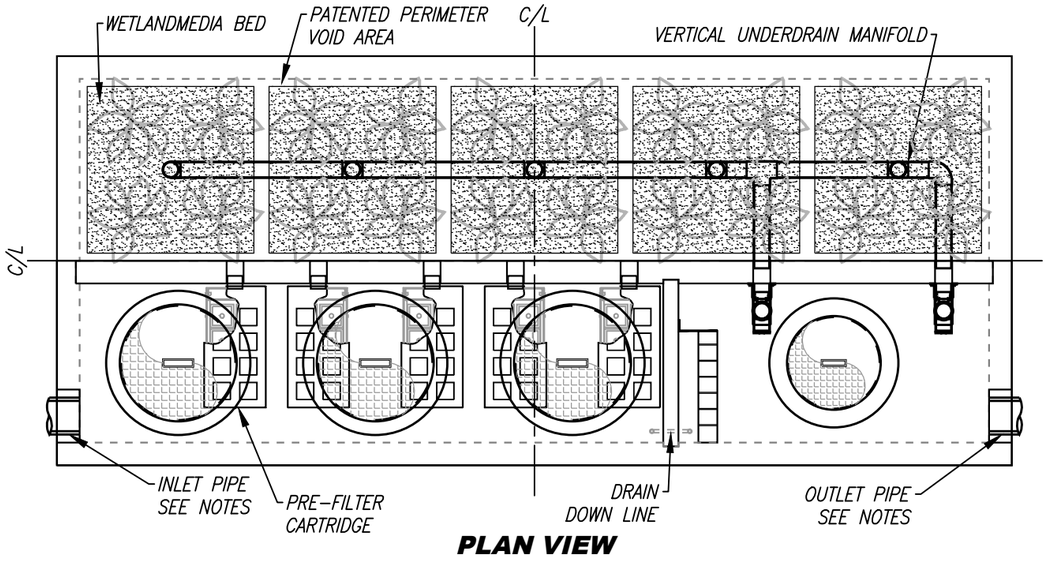
Name Paseo de Colinas, 5-25-2021

		Drainage area ID	**DMA 3**	
		Total drainage area	0.320	acres
		Total drainage area Impervious Area (IA_{total})	0.070	acres
		1. SOC-4 HSC Calcs		
HSC ID	HSC Type/ Description/ Reference BMP Fact Sheet	Effect of individual HSC_i per criteria in **relevant fact sheet (Appendix G.1)** (d_{HSCi})[1]	Impervious Area Tributary to HSC_i (IA_i)	$d_i \times IA_i$
0	HSC-2: Impervious Area Dispersion, Ratio = 3.5	0.85"	0.0704	0.0598
	Box 1:		$\sum d_i \times Iai =$	0.0598
	Box 2:		$IA_{total} =$	0.070
	[Box 1]/[Box 2]:		$d_{HSC\ total} =$	0.850
			Percent Capture Provided by HSCs (Table III.1)	80%

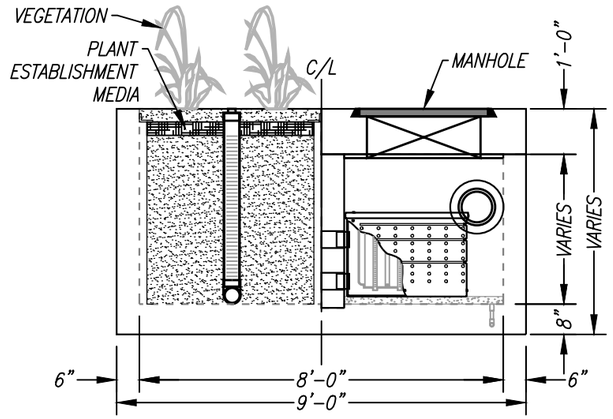
1 - For HSCs meeting criteria to be considered self-retaining, enter the DCV for the project.

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.577	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	3EA ø30"	OPEN PLANTER	ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



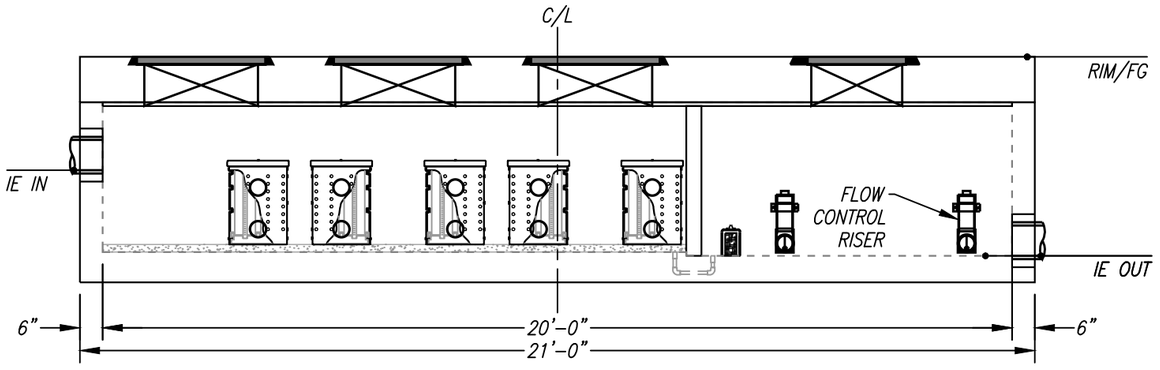
LEFT END VIEW

INSTALLATION NOTES

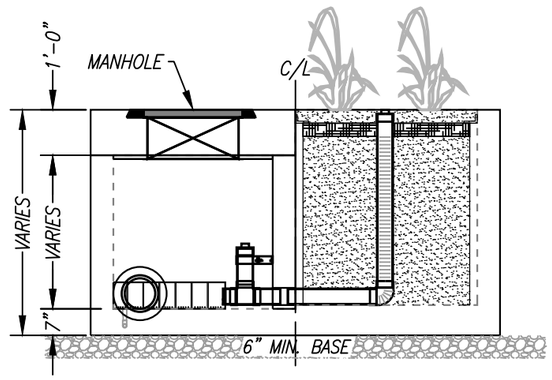
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER 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)	0.577
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

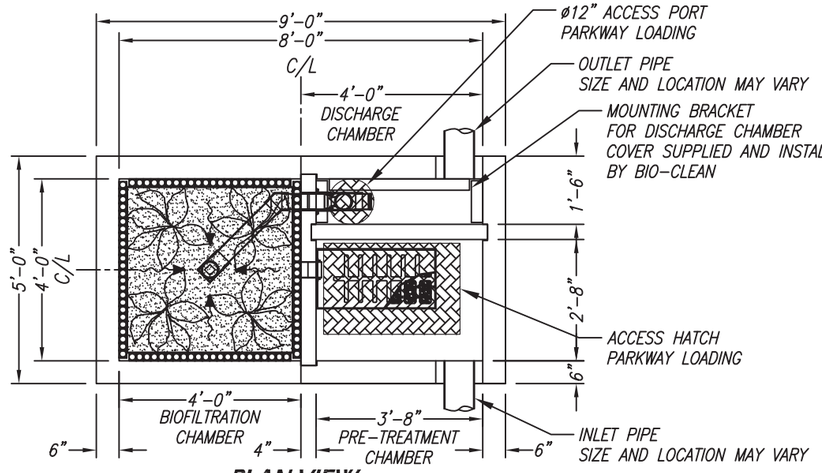
MWS-L-8-20-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

5/23/19 10:LEE

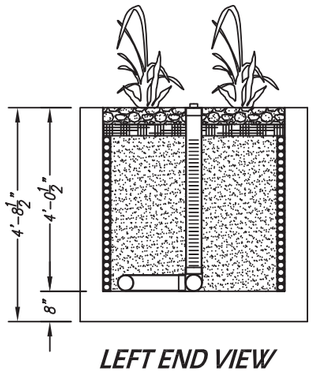
MODULAR WETLAND SYSTEMS - LINEAR 2.0
4-8 VAULT TYPE

FLOW RATES
PEAK TREATMENT FLOW RATE = .116 CFS OR 52.0 GPM
PEAK BYPASS FLOW RATE = OPTIONAL
SPECIFICATIONS
INSTALL AT SURFACE
O.D. DIMENSIONS = 9' X 5' X 4.7'
TOP OF VAULT TO INVERT OUT = 4.13'
SEDIMENT STORAGE CAPACITY = 1000 LBS OR 23.5 CF

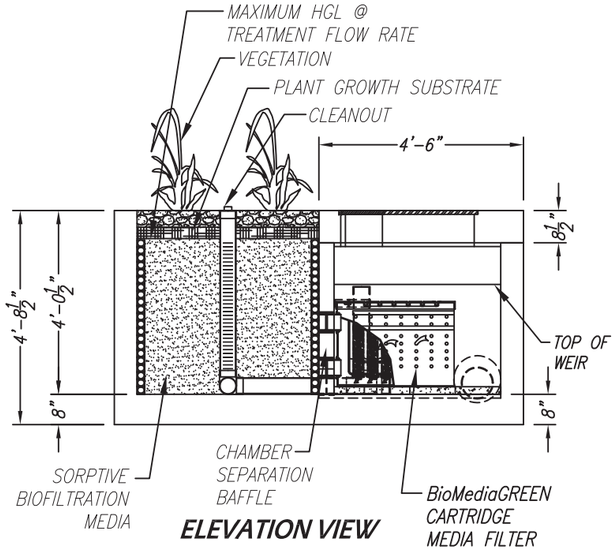
***NOTE:**
MWS UNIT CAN BE CONSTRUCTED WITH INLET ON EITHER SIDE. FOR INLET ON OPPOSITE SIDE ENTIRE UNIT WILL BE MIRRORED.



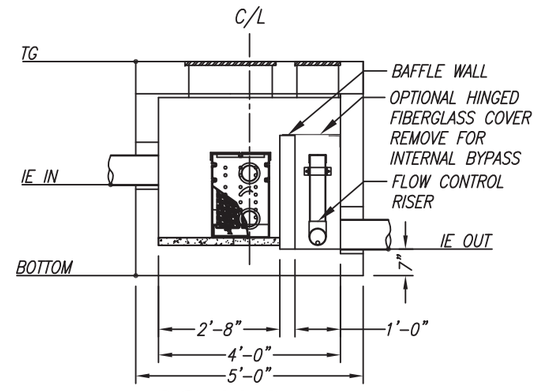
PLAN VIEW



LEFT END VIEW
BIOFILTRATION CHAMBER



ELEVATION VIEW



RIGHT END VIEW
PRETREATMENT/DISCHARGE CHAMBER

BIOFILTRATION CHAMBER SURFACE AREA CALCS
SIDES = 2
3.7' L x 3.4' H = 12.6 SF
SIDE SURFACE AREA = 25.2 SF
ENDS = 2
3.7' L x 3.4' H = 12.6 SF
END SURFACE AREA = 25.2 SF
TOTAL WETLAND MEDIA SURFACE AREA **= 50.4 SF**
WETLAND MEDIA LOADING RATE 52.0 GPM / 50.4 SF **= 1.03 GPM/SF**
PRETREATMENT FILTER SURFACE AREA CALCS
SIDES = 2
0.50' L x 1.67' H = 0.84 SF
SIDE SURFACE AREA = 1.68 SF
ENDS = 2
0.25' L x 1.67' H = 0.42 SF
END SURFACE AREA = 0.84 SF
TOTAL PRETREATMENT SURFACE AREA 2.52 SF x 14 FILTERS **= 35.28 SF**
PRETREATMENT FILTER LOADING RATE 52.0 GPM / 35.28 SF **= 1.47 GPM/SF**

LEGEND

- 2" DRAIN CELL PERIMETER INLET WATER TRANSFER SYSTEM
- WETLAND MEDIA
- PLANT/ROOT MOISTURE RETENTION LAYER
- MANHOLE / ACCESS HATCH

INSTALLATION NOTES:

1. INSTALL UNIT ON LEVEL BED OF GRAVEL OF AT LEAST 6" IN DEPTH.
2. CONCRETE 28 DAY COMPRESSIVE STRENGTH fc=5,000 PSI.
3. REINFORCING: ASTM A-615, GRADE 60.
4. RATED FOR PARKWAY LOADING 300 PSF.
5. JOINT SEALANT: BUTYL RUBBER SS-S-00210
6. PLANTING SUPPLIED AND INSTALLED BY CONTRACTOR PER MANUFACTURES RECOMMENDATIONS UNLESS OTHER WISE STATED ON CONTRACT.

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

	NAME	DATE
DRAWN	jrh	1/9/13
REVIEWED		

COMMENTS:

TITLE: MWS LINEAR 2.0 VAULT TYPE

SIZE	DWG. NO.	REV
	MWS-L-4-8-V	

SCALE 1:40 | UNITS = INCHES | SHEET 1 OF 1

ATTACHMENT E

HYDROMODIFICATION CONTROL CALCULATIONS

SOHM

PROJECT REPORT

General Model Information

Project Name:	CUSD2
Site Name:	CUSD
Site Address:	
City:	Laguna Niguel
Report Date:	5/24/2021
Gage:	Laguna Beach
Data Start:	10/01/1949
Data End:	09/30/2006
Timestep:	Hourly
Precip Scale:	1.000
Version Date:	2021/03/09

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

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
D,Scrub,VSteep(>15%)	1.075
D,Open Brush,VSteep	1.075
Pervious Total	2.15
Impervious Land Use	acre
Impervious Total	0
Basin Total	2.15

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

DMA1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
D,Urban,Flat(0-5%)	0.322
Pervious Total	0.322

Impervious Land Use	acre
Impervious,Flat(0-5)	1.828
Impervious Total	1.828
Basin Total	2.15

Element Flows To:

Surface	Interflow	Groundwater
Tank 1	Tank 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Tank 1

Dimensions
Depth: 5 ft.
Tank Type: Circular
Diameter: 5 ft.
Length: 350 ft.
Discharge Structure
Riser Height: 4 ft.
Riser Diameter: 54 in.
Notch Type: Rectangular
Notch Width: 0.500 ft.
Notch Height: 1.000 ft.
Orifice 1 Diameter: 1.3 in. Elevation:0 ft.
Element Flows To:
Outlet 1 Outlet 2

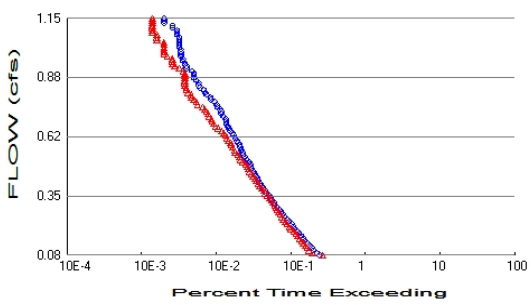
Tank Hydraulic Table

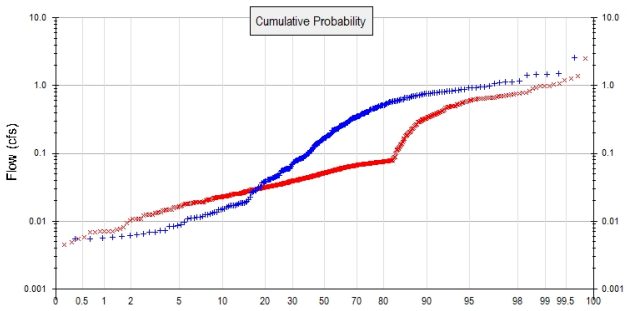
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.000000	0.000000	0.000	0.000
0.0556	0.008422	0.000313	0.010	0.000
0.1111	0.011844	0.000881	0.015	0.000
0.1667	0.014423	0.001614	0.018	0.000
0.2222	0.016558	0.002476	0.021	0.000
0.2778	0.018405	0.003448	0.024	0.000
0.3333	0.020043	0.004517	0.026	0.000
0.3889	0.021519	0.005672	0.028	0.000
0.4444	0.022866	0.006906	0.030	0.000
0.5000	0.024105	0.008211	0.032	0.000
0.5556	0.025251	0.009582	0.034	0.000
0.6111	0.026318	0.011015	0.035	0.000
0.6667	0.027313	0.012505	0.037	0.000
0.7222	0.028246	0.014049	0.039	0.000
0.7778	0.029121	0.015642	0.040	0.000
0.8333	0.029944	0.017283	0.041	0.000
0.8889	0.030719	0.018969	0.043	0.000
0.9444	0.031450	0.020696	0.044	0.000
1.0000	0.032140	0.022462	0.045	0.000
1.0556	0.032790	0.024266	0.047	0.000
1.1111	0.033404	0.026105	0.048	0.000
1.1667	0.033984	0.027977	0.049	0.000
1.2222	0.034531	0.029880	0.050	0.000
1.2778	0.035046	0.031813	0.051	0.000
1.3333	0.035532	0.033774	0.053	0.000
1.3889	0.035989	0.035761	0.054	0.000
1.4444	0.036418	0.037772	0.055	0.000
1.5000	0.036821	0.039807	0.056	0.000
1.5556	0.037197	0.041863	0.057	0.000
1.6111	0.037549	0.043939	0.058	0.000
1.6667	0.037877	0.046034	0.059	0.000
1.7222	0.038181	0.048147	0.060	0.000
1.7778	0.038462	0.050276	0.061	0.000
1.8333	0.038720	0.052420	0.062	0.000
1.8889	0.038956	0.054578	0.063	0.000

1.9444	0.039170	0.056748	0.064	0.000
2.0000	0.039363	0.058930	0.064	0.000
2.0556	0.039535	0.061122	0.065	0.000
2.1111	0.039685	0.063322	0.066	0.000
2.1667	0.039816	0.065531	0.067	0.000
2.2222	0.039926	0.067746	0.068	0.000
2.2778	0.040015	0.069966	0.069	0.000
2.3333	0.040085	0.072192	0.070	0.000
2.3889	0.040135	0.074420	0.070	0.000
2.4444	0.040165	0.076651	0.071	0.000
2.5000	0.040174	0.078882	0.072	0.000
2.5556	0.040165	0.081114	0.073	0.000
2.6111	0.040135	0.083345	0.074	0.000
2.6667	0.040085	0.085573	0.074	0.000
2.7222	0.040015	0.087798	0.075	0.000
2.7778	0.039926	0.090019	0.076	0.000
2.8333	0.039816	0.092234	0.077	0.000
2.8889	0.039685	0.094443	0.077	0.000
2.9444	0.039535	0.096643	0.078	0.000
3.0000	0.039363	0.098835	0.079	0.000
3.0556	0.039170	0.101016	0.102	0.000
3.1111	0.038956	0.103187	0.142	0.000
3.1667	0.038720	0.105344	0.194	0.000
3.2222	0.038462	0.107488	0.256	0.000
3.2778	0.038181	0.109618	0.326	0.000
3.3333	0.037877	0.111730	0.404	0.000
3.3889	0.037549	0.113826	0.488	0.000
3.4444	0.037197	0.115902	0.578	0.000
3.5000	0.036821	0.117958	0.674	0.000
3.5556	0.036418	0.119993	0.775	0.000
3.6111	0.035989	0.122004	0.882	0.000
3.6667	0.035532	0.123991	0.994	0.000
3.7222	0.035046	0.125952	1.110	0.000
3.7778	0.034531	0.127884	1.231	0.000
3.8333	0.033984	0.129788	1.356	0.000
3.8889	0.033404	0.131660	1.485	0.000
3.9444	0.032790	0.133499	1.619	0.000
4.0000	0.032140	0.135302	1.756	0.000
4.0556	0.031450	0.137069	2.382	0.000
4.1111	0.030719	0.138796	3.526	0.000
4.1667	0.029944	0.140481	5.005	0.000
4.2222	0.029121	0.142122	6.755	0.000
4.2778	0.028246	0.143716	8.736	0.000
4.3333	0.027313	0.145260	10.92	0.000
4.3889	0.026318	0.146750	13.29	0.000
4.4444	0.025251	0.148183	15.82	0.000
4.5000	0.024105	0.149554	18.50	0.000
4.5556	0.022866	0.150859	21.32	0.000
4.6111	0.021519	0.152093	24.25	0.000
4.6667	0.020043	0.153248	27.28	0.000
4.7222	0.018405	0.154317	30.39	0.000
4.7778	0.016558	0.155289	33.58	0.000
4.8333	0.014423	0.156151	36.82	0.000
4.8889	0.011844	0.156883	40.09	0.000
4.9444	0.008422	0.157452	43.39	0.000
5.0000	0.000000	0.157765	46.70	0.000
5.0556	0.000000	0.000000	49.99	0.000

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 2.15
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.322
Total Impervious Area: 1.828

Flow Frequency Method: Cunnane

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.774345
5 year	0.957521
10 year	1.154086
25 year	1.480801

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.655779
5 year	0.838205
10 year	1.044747
25 year	1.300589

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0774	1219	1351	110	Pass
0.0883	1113	973	87	Pass
0.0992	1012	883	87	Pass
0.1101	956	826	86	Pass
0.1209	893	785	87	Pass
0.1318	830	737	88	Pass
0.1427	779	694	89	Pass
0.1536	737	652	88	Pass
0.1644	691	616	89	Pass
0.1753	645	588	91	Pass
0.1862	605	548	90	Pass
0.1971	571	506	88	Pass
0.2079	540	475	87	Pass
0.2188	512	444	86	Pass
0.2297	473	424	89	Pass
0.2406	443	398	89	Pass
0.2514	414	382	92	Pass
0.2623	388	363	93	Pass
0.2732	370	340	91	Pass
0.2841	349	327	93	Pass
0.2949	326	315	96	Pass
0.3058	304	305	100	Pass
0.3167	294	289	98	Pass
0.3276	279	274	98	Pass
0.3384	265	259	97	Pass
0.3493	255	244	95	Pass
0.3602	236	229	97	Pass
0.3711	223	221	99	Pass
0.3819	213	203	95	Pass
0.3928	204	190	93	Pass
0.4037	194	184	94	Pass
0.4146	181	173	95	Pass
0.4254	179	165	92	Pass
0.4363	169	156	92	Pass
0.4472	163	150	92	Pass
0.4581	158	141	89	Pass
0.4689	149	135	90	Pass
0.4798	145	131	90	Pass
0.4907	142	124	87	Pass
0.5016	137	114	83	Pass
0.5124	128	107	83	Pass
0.5233	121	102	84	Pass
0.5342	115	97	84	Pass
0.5451	112	90	80	Pass
0.5559	109	88	80	Pass
0.5668	106	83	78	Pass
0.5777	103	79	76	Pass
0.5886	98	78	79	Pass
0.5994	94	72	76	Pass
0.6103	90	70	77	Pass
0.6212	86	67	77	Pass
0.6321	82	63	76	Pass
0.6429	77	59	76	Pass

0.6538	74	53	71	Pass
0.6647	71	49	69	Pass
0.6756	68	46	67	Pass
0.6864	68	44	64	Pass
0.6973	67	43	64	Pass
0.7082	62	40	64	Pass
0.7191	58	39	67	Pass
0.7300	58	37	63	Pass
0.7408	57	35	61	Pass
0.7517	52	33	63	Pass
0.7626	51	28	54	Pass
0.7735	47	27	57	Pass
0.7843	43	25	58	Pass
0.7952	42	23	54	Pass
0.8061	37	23	62	Pass
0.8170	36	21	58	Pass
0.8278	34	20	58	Pass
0.8387	30	20	66	Pass
0.8496	29	19	65	Pass
0.8605	29	19	65	Pass
0.8713	27	19	70	Pass
0.8822	25	19	76	Pass
0.8931	25	19	76	Pass
0.9040	25	19	76	Pass
0.9148	24	18	75	Pass
0.9257	20	16	80	Pass
0.9366	20	14	70	Pass
0.9475	19	13	68	Pass
0.9583	18	13	72	Pass
0.9692	18	13	72	Pass
0.9801	17	11	64	Pass
0.9910	17	10	58	Pass
1.0018	17	10	58	Pass
1.0127	17	10	58	Pass
1.0236	16	10	62	Pass
1.0345	16	10	62	Pass
1.0453	16	10	62	Pass
1.0562	16	8	50	Pass
1.0671	16	8	50	Pass
1.0780	15	8	53	Pass
1.0888	15	7	46	Pass
1.0997	15	7	46	Pass
1.1106	13	7	53	Pass
1.1215	13	7	53	Pass
1.1323	10	7	70	Pass
1.1432	10	7	70	Pass
1.1541	10	7	70	Pass

Water Quality

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

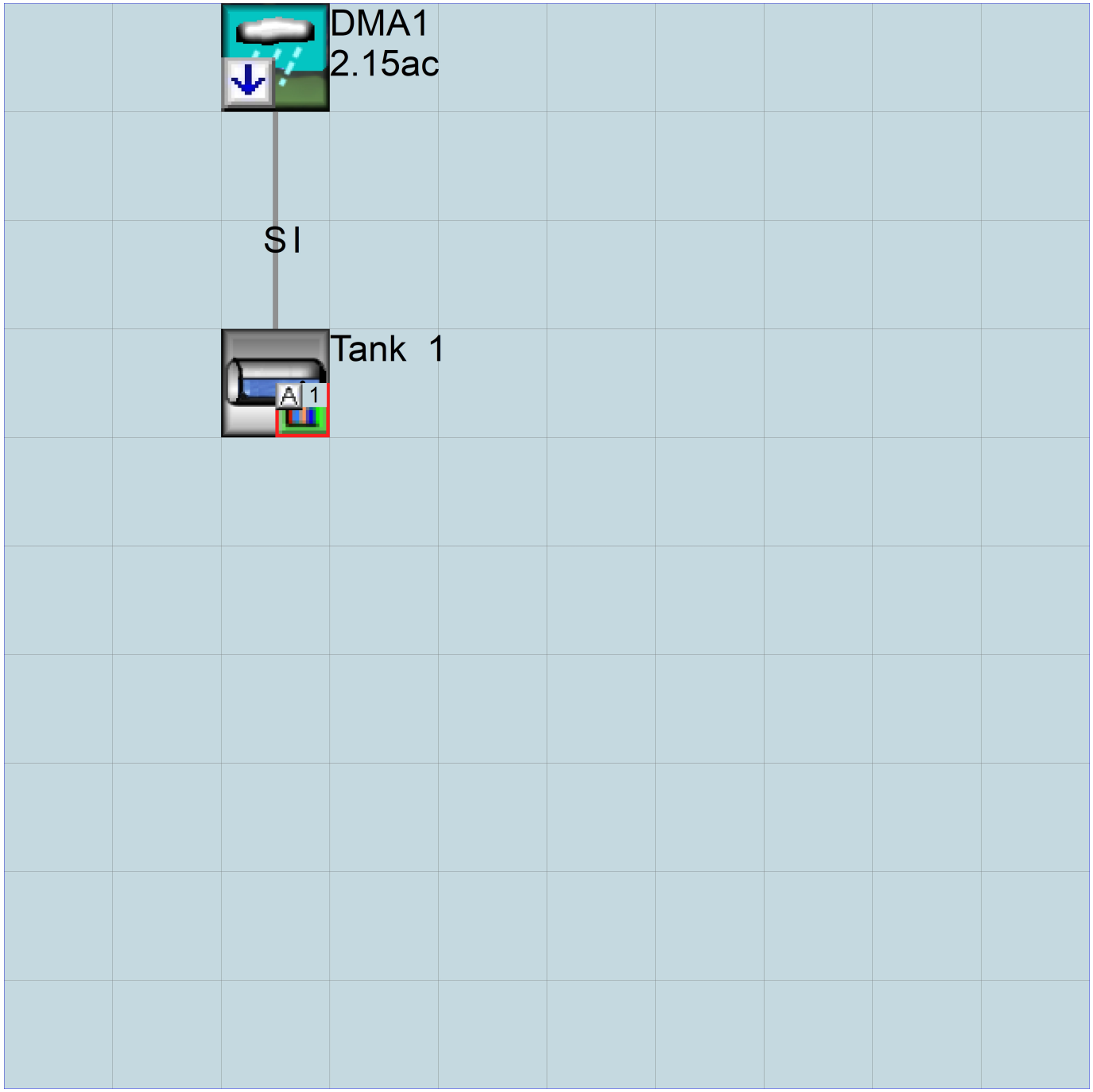
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic

Mitigated Schematic



Predeveloped UCI File

```
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   CUSD2.wdm
MESSU       25   PreCUSD2.MES
            27   PreCUSD2.L61
            28   PreCUSD2.L62
            30   POCCUSD21.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:60
      PERLND      40
      PERLND      44
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         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           ***
   40     D,Scrub,VSteep(>15%)    1    1    1    1   27    0
   44     D,Open Brush,VSteep     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 ***
   40         0    0    1    0    0    0    0    0    0    0    0    0
   44         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  *********
```

```
   40         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   44         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 ***
   40         0    0    0    1    0    0    0    0    1    0    0
   44         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
   40              0       3.7     0.012       250       0.2       0.8     0.955
   44              0       3.7     0.012       250       0.2       0.8     0.955
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   40             40        35         4         2         0      0.03         0
   44             40        35         4         2         0      0.03         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   40              0       0.3       0.3       0.3       0.3         0
   44              0      0.25      0.25       0.3       0.3         0
  END PWAT-PARM4
  MON-LZETPARM
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   40       0.5  0.5  0.5  0.6 0.65 0.65 0.65 0.65 0.65 0.65 0.55  0.5
   44       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
  END MON-LZETPARM
  MON-INTERCEP
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   40      0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13
   44      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
   40              0         0      0.03         0      0.74        0.3      0.01
   44              0         0     0.025         0      0.74        0.3      0.01
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
  END GEN-INFO
  *** Section IWATER***

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

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO
```

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

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

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

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  40                       1.075     COPY   501     12
PERLND  40                       1.075     COPY   501     13
PERLND  44                       1.075     COPY   501     12
PERLND  44                       1.075     COPY   501     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   12.1        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                               ***
  END GEN-INFO
  *** Section RCHRES***

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

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  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
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1
```

```
  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  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
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
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         SUM  PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1         SUM  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

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   501 OUTPUT MEAN   1 1     12.1      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  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


END MASS-LINK

END RUN
```

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   CUSD2.wdm
MESSU       25   MitCUSD2.MES
            27   MitCUSD2.L61
            28   MitCUSD2.L62
            30   POCCUSD21.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:60
      PERLND      61
      IMPLND       1
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Tank  1                     MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         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
  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
  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
  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
  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
  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
  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
  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
  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
  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
  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#   ***
DMA1***
PERLND  61                      0.322     RCHRES   1      2
PERLND  61                      0.322     RCHRES   1      3
IMPLND   1                      1.828     RCHRES   1      5

******Routing******
PERLND  61                      0.322     COPY     1     12
IMPLND   1                      1.828     COPY     1     15
PERLND  61                      0.322     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   12.1        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     Tank  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      0.07       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
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.000000  0.000000  0.000000
  0.055556  0.008422  0.000313  0.010810
  0.111111  0.011844  0.000881  0.015287
  0.166667  0.014423  0.001614  0.018723
  0.222222  0.016558  0.002476  0.021619
  0.277778  0.018405  0.003448  0.024171
  0.333333  0.020043  0.004517  0.026478
  0.388889  0.021519  0.005672  0.028599
  0.444444  0.022866  0.006906  0.030574
  0.500000  0.024105  0.008211  0.032429
  0.555556  0.025251  0.009582  0.034183
  0.611111  0.026318  0.011015  0.035851
  0.666667  0.027313  0.012505  0.037446
  0.722222  0.028246  0.014049  0.038975
  0.777778  0.029121  0.015642  0.040446
  0.833333  0.029944  0.017283  0.041865
  0.888889  0.030719  0.018969  0.043238
  0.944444  0.031450  0.020696  0.044569
  1.000000  0.032140  0.022462  0.045861
  1.055556  0.032790  0.024266  0.047118
  1.111111  0.033404  0.026105  0.048342
  1.166667  0.033984  0.027977  0.049536
  1.222222  0.034531  0.029880  0.050701
  1.277778  0.035046  0.031813  0.051841
  1.333333  0.035532  0.033774  0.052956
  1.388889  0.035989  0.035761  0.054048
  1.444444  0.036418  0.037772  0.055118
  1.500000  0.036821  0.039807  0.056168
  1.555556  0.037197  0.041863  0.057199
  1.611111  0.037549  0.043939  0.058211
  1.666667  0.037877  0.046034  0.059207
  1.722222  0.038181  0.048147  0.060185
  1.777778  0.038462  0.050276  0.061148
  1.833333  0.038720  0.052420  0.062096
  1.888889  0.038956  0.054578  0.063030
  1.944444  0.039170  0.056748  0.063950
  2.000000  0.039363  0.058930  0.064858
  2.055556  0.039535  0.061122  0.065752
  2.111111  0.039685  0.063322  0.066635
  2.166667  0.039816  0.065531  0.067506
  2.222222  0.039926  0.067746  0.068366
  2.277778  0.040015  0.069966  0.069215
```

```
  2.333333  0.040085  0.072192  0.070054
  2.388889  0.040135  0.074420  0.070883
  2.444444  0.040165  0.076651  0.071703
  2.500000  0.040174  0.078882  0.072513
  2.555556  0.040165  0.081114  0.073314
  2.611111  0.040135  0.083345  0.074107
  2.666667  0.040085  0.085573  0.074891
  2.722222  0.040015  0.087798  0.075667
  2.777778  0.039926  0.090019  0.076435
  2.833333  0.039816  0.092234  0.077196
  2.888889  0.039685  0.094443  0.077949
  2.944444  0.039535  0.096643  0.078695
  3.000000  0.039363  0.098835  0.079434
  3.055556  0.039170  0.101016  0.101969
  3.111111  0.038956  0.103187  0.142558
  3.166667  0.038720  0.105344  0.194900
  3.222222  0.038462  0.107488  0.256743
  3.277778  0.038181  0.109618  0.326789
  3.333333  0.037877  0.111730  0.404160
  3.388889  0.037549  0.113826  0.488213
  3.444444  0.037197  0.115902  0.578448
  3.500000  0.036821  0.117958  0.674465
  3.555556  0.036418  0.119993  0.775931
  3.611111  0.035989  0.122004  0.882566
  3.666667  0.035532  0.123991  0.994129
  3.722222  0.035046  0.125952  1.110409
  3.777778  0.034531  0.127884  1.231221
  3.833333  0.033984  0.129788  1.356400
  3.888889  0.033404  0.131660  1.485797
  3.944444  0.032790  0.133499  1.619279
  4.000000  0.032140  0.135302  1.756722
  4.055556  0.031450  0.137069  2.382815
  4.111111  0.030719  0.138796  3.526088
  4.166667  0.029944  0.140481  5.005245
  4.222222  0.029121  0.142122  6.755072
  4.277778  0.028246  0.143716  8.736928
  4.333333  0.027313  0.145260  10.92344
  4.388889  0.026318  0.146750  13.29295
  4.444444  0.025251  0.148183  15.82691
  4.500000  0.024105  0.149554  18.50849
  4.555556  0.022866  0.150859  21.32177
  4.611111  0.021519  0.152093  24.25124
  4.666667  0.020043  0.153248  27.28152
  4.722222  0.018405  0.154317  30.39715
  4.777778  0.016558  0.155289  33.58249
  4.833333  0.014423  0.156151  36.82172
  4.888889  0.011844  0.156883  40.09879
  4.944444  0.008422  0.157452  43.39751
  5.000000  0.001000  0.157765  46.70158
  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         SUM  PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1         SUM  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

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     12.1      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     12.1      WDM    801 FLOW     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
```

Predeveloped HSPF Message File

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
DATE/TIME: 1962/11/30 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-1.718E-02     0.00000  0.0000E+00     0.00000  3.8243E-12

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
DATE/TIME: 1962/12/31 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-4.484E-01     0.00000  0.0000E+00     0.00000  4.5677E-11

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
```

DATE/TIME: 1980/11/30 24: 0

RCHRES :   1

RELERR	STORS	STOR	MATIN	MATDIF
-2.872E-02	0.00000	0.0000E+00	0.00000	7.2466E-12

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238   1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1999/12/31 24: 0

RCHRES :   1

RELERR	STORS	STOR	MATIN	MATDIF
-1.827E-02	0.00000	0.0000E+00	0.00000	3.4807E-12

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

Disclaimer

Legal Notice

This program and accompanying documentation are provided 'as-is' without warranty of any kind. The entire risk regarding the performance and results of this program is assumed by End User. Clear Creek Solutions Inc. and the governmental licensee or sublicensees disclaim all warranties, either expressed or implied, including but not limited to implied warranties of program and accompanying documentation. In no event shall Clear Creek Solutions Inc. be liable for any damages whatsoever (including without limitation to damages for loss of business profits, loss of business information, business interruption, and the like) arising out of the use of, or inability to use this program even if Clear Creek Solutions Inc. or their authorized representatives have been advised of the possibility of such damages.

Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

ATTACHMENT F

CONDITIONS OF APPROVAL

ATTACHMENT G

GEOTECHNICAL FEASIBILITY REPORT

May 15, 2018 Project No. 18045-01

Mr. Jon Conk
Project Dimensions, Inc.
4 Park Plaza, Suite 700
Irvine, California 92614

Subject: ***Summary of Geotechnical Evaluation and Feasibility Study, Residential Development, Paseo De La Colinas, Laguna Niguel, California***

Introduction

In accordance with your request and authorization, LGC Geotechnical, Inc. has performed a preliminary geotechnical evaluation and feasibility study for the proposed residential development to be located at a property located between Niguel Hills Middle School and Paseo De La Colinas in the City of Laguna Niguel, California. We have prepared this report to present the findings of our study and our conclusions with regard to feasibility of site development from a geotechnical standpoint.

Site Description

The subject site is a 2.5-acre property located between Niguel Hills Middle School and Paseo De La Colinas in the City of Laguna Niguel, California (Figure 1). The site is a roughly rectangular-shaped, flat site, with slopes descending from the north and west sides. The flat portion of the site is at an elevation of approximately 470 feet above mean sea-level (msl). The west-facing slope is approximately 40 feet tall, at an inclination of approximately 2:1 (horizontal to vertical). The north-facing slope is approximately 80 feet tall, at an inclination of approximately 1.5:1 (horizontal to vertical). Vegetation on the slopes is generally comprised of low brush, and weeds. Some bare dirt areas are also present. The flat portion of the site is covered in areas by asphalt concrete, gravel and bare dirt and is currently being utilized for auto parking.

We understand that potential development of the site may include grading for and construction of 30 at-grade multi-family residential units, associated interior drives and parking.

Geotechnical Evaluation

The field portion of our evaluation included geologic mapping of the site and excavation of two large-diameter borings (BA-1 & BA-2) in the top of slope area in the northern and western portions of the site, respectively (see Geologic Map, Sheet 1). Borings BA-1 and BA-2 were drilled and sampled to depth of 90 feet and 55 feet below existing grade, respectively. The borings were then entered and down-hole logged by a geologist from our firm. The boring logs are included with this report.

Based on the findings of our study, a geologic model of the site geologic conditions was prepared. The geologic model is presented on Cross-Sections A-A', B-B' & C-C' (Figures 2, 3 & 4, respectively).

Laboratory Testing

Representative driven and bulk samples were retained for laboratory testing during our field evaluation. Laboratory testing included in-situ dry density and moisture content, Atterberg Limits and direct shear. A summary of the laboratory test results is provided in Appendix C.

- Dry density values ranged from approximately 88 pounds per cubic foot (pcf) to 104 pcf with an average of 98 pcf. Field moisture contents ranged from approximately 22 percent to 32 percent with an average of 25 percent.
- Two Atterberg Limits tests were performed. Results indicated Plasticity Index values of 27 and 42.
- Direct shear tests were performed on select obtained driven soil samples. The shear plots are provided in Appendix C.

A summary of the laboratory test results is presented in Appendix C. The moisture and dry unit weight results are presented on the boring logs in Appendix B.

Geotechnical Conditions

Based on our evaluation, the site is underlain by Capistrano Formation bedrock material. Generally, the Capistrano Formation consists of a weak, clayey siltstone with some interbedded silty sandstone. Bedding within the boring was found to be nearly flat to gently dipping into the slope. Capistrano Formation material and fill derived from it typically has a high potential for expansion and are considered to be "severely" corrosive to concrete.

No active or inactive faults are mapped in the vicinity of the site (CGS, 1974). No landslides were observed or have been mapped in the vicinity of the site (CGS, 1974). The slopes descending from the site are located in a zone of potential seismically-induced landsliding (CGS, 2001b). The site is not located in a zone of potential seismically-induced liquefaction (CGS, 2001b).

Minor groundwater seepage was observed along sandy beds and along some joints. Historic high groundwater is not mapped on the site (CGS, 2001a).

Soil Shear Strength Parameters

The soil shear strength parameters utilized in our slope stability analysis are based on laboratory testing, published shear strength data (CDMG, 2001a) and engineering judgment. The along bedding clay shear strength is based on published shear strength correlations (Liquid Limit) for drained fully-softened friction angle (Stark and Hussain, 2013). Soil shear strength parameters for seismic loading conditions were increased (below composite peak strength) for Capistrano Formation bedrock. Table 1 summarizes the static shear strength parameters utilized in our analysis.

TABLE 1

Static Soil Shear Strength Parameters for Slope Stability Analysis

Soil Type	ϕ (Degrees)	Cohesion (psf)
Capistrano Formation (Tc)	26	300
Along Clay Bed	18	0

Slope Stability Analysis

Slope stability analysis was performed on a two-dimensional cross-sectional model (Cross-Sections A-A' through C-C', Figures 2 through 4) positioned through the northern and western site slopes. The cross-sections were drawn approximately perpendicular to the face of the slope at each location.

Slope stability analysis was performed using the computer program GSTABL7 with STEDwin version 2.005.3 (Gregory Geotechnical Software, 2013). Potential rotational and block surfaces were analyzed using Bishop's Modified Method and Janbu's Simplified Method, respectively. Slope stability analysis was performed for static and seismic loading conditions. A minimum factor of safety of 1.5 is typically required for static loading conditions. Seismic slope stability analysis was performed in accordance with the County of Orange Grading Manual (1993). Where applicable, the County of Orange Grading Manual requires a horizontal seismic coefficient (Kh) of 0.15 with a minimum resulting factor of safety of 1.1. Since the clay bed is less than 12 degrees from the horizontal, pseudostatic (seismic) slope stability was not performed for block surfaces in accordance with County of Orange Grading Manual.

The results of our analyses indicate that the existing northern portion of the site has a static factor of safety less than 1.5 and requires a structural set-back zone of 60 horizontal feet from the top-of-slope in order to provide the required static factor of safety of 1.5 (refer to the Geologic Map and Cross Section A-A' Refer to the Slope stability analysis provided in Appendix D.

Conclusions and Recommendations

Based on the results of our preliminary geotechnical evaluation, it is our professional opinion that proposed development of the site is feasible from a geotechnical standpoint. However, significant slope stability issues will need to be considered. This and the other geotechnical constraints and advantages of the site are discussed in the follow subsections.

Please note that the subject evaluation was focused on the geotechnical stability of the site and feasibility of site development in consideration of the geologic constraints encountered. The intent of this study was to provide sufficient data to allow prospective developers to understand the site geologic conditions and how they will impact the proposed site development. Once development plans have been prepared, additional geotechnical analyses and laboratory testing must be performed in order to provide design-level geotechnical recommendations. A full geotechnical evaluation report can be prepared at that time, including project specific conclusions, recommendations and parameters for site design, grading and construction. It is anticipated that the scope of services described herein will contribute data to that study.

1) *Slope Stability*

Based on the findings of our study, slope stability indicates that the top of slope area in the northern portion of the site has a static factor of safety less than 1.5 for the current site conditions. Accordingly, structural improvements must be set back at least 60 horizontal feet from the top of slope in the northern portion of the site (see Geologic Map). We recommend that no structures designed for human occupancy be constructed in this area. However, this does not preclude the construction of patio slabs, small retaining walls, drainage swales, landscape related features, and the like with the understanding that these improvements will be founded in an area that may undergo tilting/deflection and cracking and could potentially be rendered unusable. Elsewhere on the site, slope stability analysis generally indicates adequate static and seismic slope stability factor of safety.

The site is not located within a State of California Seismic Hazard Zone for earthquake-induced landslides (CGS, 2001b). No landslides were observed during our site visit or are mapped in the vicinity of the site (CGS, 1974).

2) *Seismicity*

The subject site is not located within a Fault Rupture Hazard Zone and there are no active or potentially active faults mapped on or in close vicinity of the site (CGS, 1974).

The main seismic hazard that may affect the site is from ground shaking from one of the active regional faults. The subject site will likely experience strong seismic ground shaking during its design life. Parameters for seismic design in accordance with the current California Building Code should be provided in future geotechnical reports for the project.

3) *Liquefaction*

The site is not located in a zone of potential seismically-induced liquefaction (CGS, 2001b).

4) *Expansive Soils*

The majority of the onsite soils are expected to have a High to Very High expansion potential. Mitigation measures are recommended for foundations and site improvements like concrete flatwork to minimize the impacts of expansive site soils. Pre-soaking of the subgrade for building slabs and flatwork is recommended due to site expansive soils.

5) *Corrosive Soils*

Based on experience in the area, site soils are considered to be “severely” corrosive to concrete.

6) *Groundwater*

Groundwater was not encountered to maximum explored depth of approximately 90 feet below existing grade. Historic high groundwater is not mapped on the site (CGS, 2001a).

7) *Remedial Grading*

The depth of potentially compressible materials recommended for removal during site remedial grading are estimated to extend from approximately 3 to 5 feet below existing grades. This should be further evaluated based on the proposed grading plan and structural loads of the proposed building structures.

8) *Rippability and Oversized Material*

In general, rippability is not anticipated to be an issue during the majority of site grading. It is anticipated that the onsite materials, within the limits of proposed grading, may be excavated with conventional construction equipment.

Generation of some oversized material (material larger than 8 inches in maximum dimension) during site grading should be anticipated. Recommendations for appropriate handling of oversized materials should be provided in future geotechnical reports for the project.

9) *Temporary Excavations*

Excavations should be made in accordance with Cal/OSHA, as a general guideline. Excavation safety is the sole responsibility of the contractor.

10) *Fill Placement*

In general, it appears that the onsite soils should be considered geotechnically suitable for use as compacted fill provided the soils are free of organics, oversized rock and other deleterious material. Oversized rock may be placed in nonstructural areas or in structural fills if placed in accordance with the recommendations of the geotechnical consultant and local grading codes.

The site contains soils that are not suitable for retaining wall backfill due to their fines content and expansion potential, therefore import of sandy soils will be required by the contractor for obtaining suitable backfill soil for planned site retaining walls.

Limitations

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

Our services were provided in order to form an opinion concerning the suitability of the proposed development relative to the geotechnical aspects of the site. The data and information provided in this report are based on observations made by representatives of our firm during a brief site visit. This report is not a warranty of the work performed by others.

In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and modification, and should not be relied upon after a period of 3 years.

Should you have any questions regarding this report, please do not hesitate to contact our office. We appreciate this opportunity to be of service.

Respectfully,

LGC Geotechnical, Inc.

Brad Zellmer, GE 2618
Project Engineer

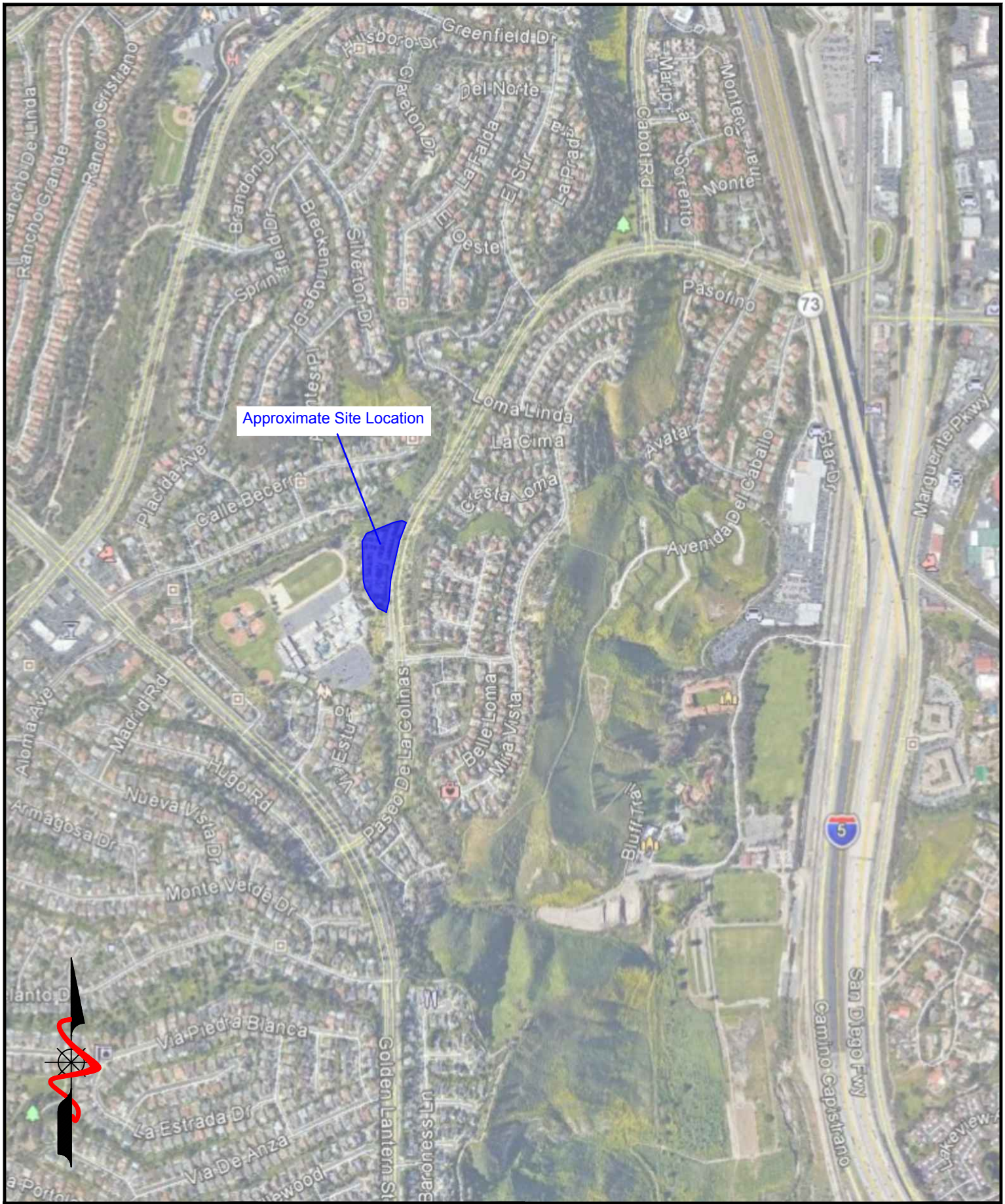
Kevin B. Colson, CEG 2210
Vice President

KBC/BTZ/aca

Attachments: Figure 1 – Site Location Map
Figure 2 – Cross-Section A-A'
Figure 3 – Cross-Section B-B'
Figure 4 – Cross-Section C-C'

Sheet 1 – Geologic Map
Appendix A - References
Appendix B - Boring Logs
Appendix C - Laboratory Test Results
Appendix D – Slope Stability Analysis

Distribution: (4) Addressee (1 electronic copy & 3 wet-signed copies)



PROJECT NAME	Laguna Niguel - Paseo de la Colinas
PROJECT NO.	18045-01
ENG. / GEOL.	BTZ/KBC
SCALE	Not to Scale
DATE	May 2018

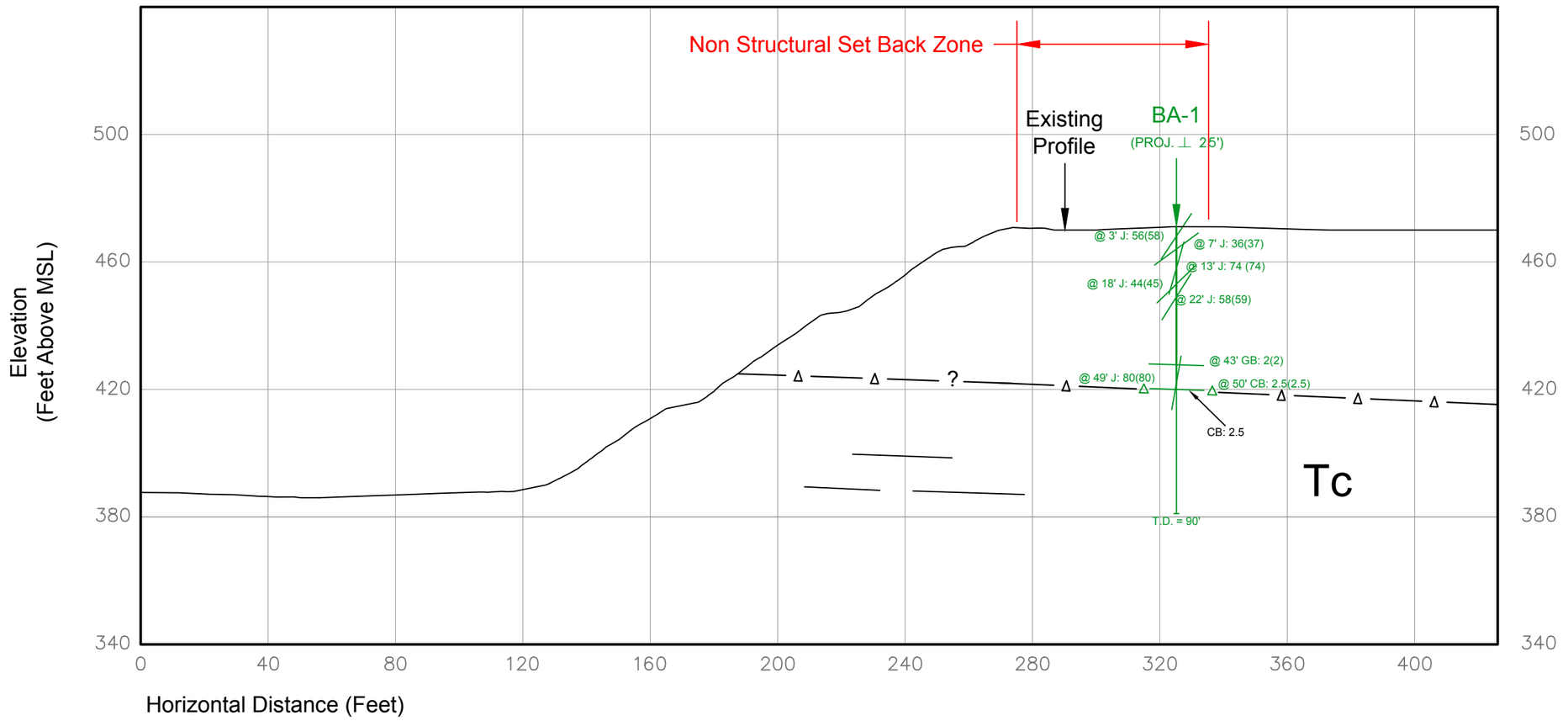
LGC Geotechnical, Inc.

FIGURE 1
Site Location Map

A

N11W
Section Orientation

A'



SCALE: 1"=40'

40' 0 40' 80'

LGC Geotechnical, Inc.

LGC Geotechnical, Inc.
131 Calle Iglesia, Ste. 200
San Clemente, CA 92672
TEL (949) 369-6141 FAX (949) 369-6142

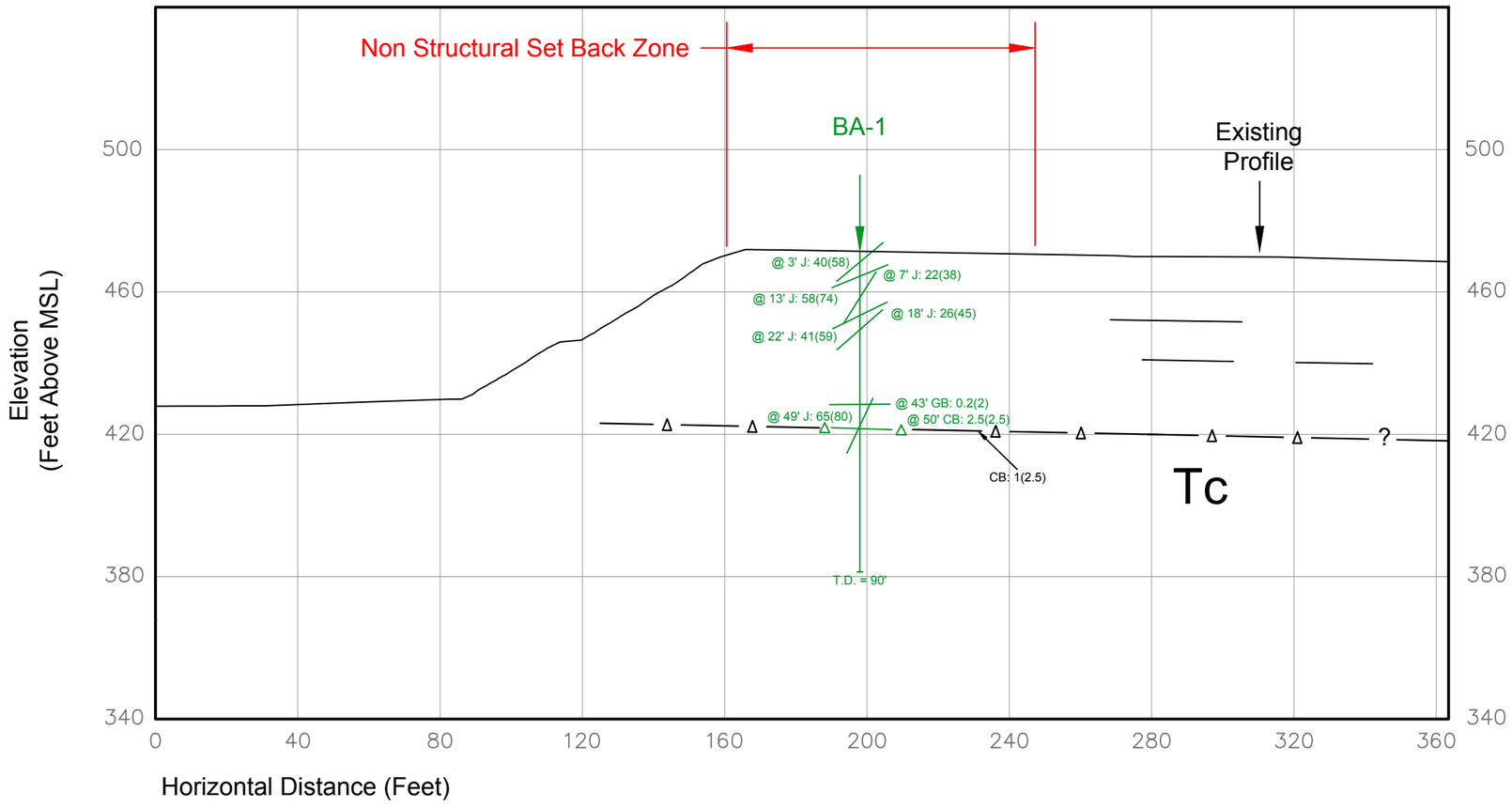
Figure 2
Cross Section A-A'

PROJECT NAME	Paseo De La Colinas
PROJECT NO.	18045-01
ENG. / GEOL.	BTZ/KBC
SCALE	1" = 40'
DATE	May 2018

B

B'

E-W
Section Orientation



SCALE: 1"=40'

40' 0 40' 80'

LGC Geotechnical, Inc.

LGC Geotechnical, Inc.
131 Calle Iglesia, Ste. 200
San Clemente, CA 92672
TEL (949) 369-6141 FAX (949) 369-6142

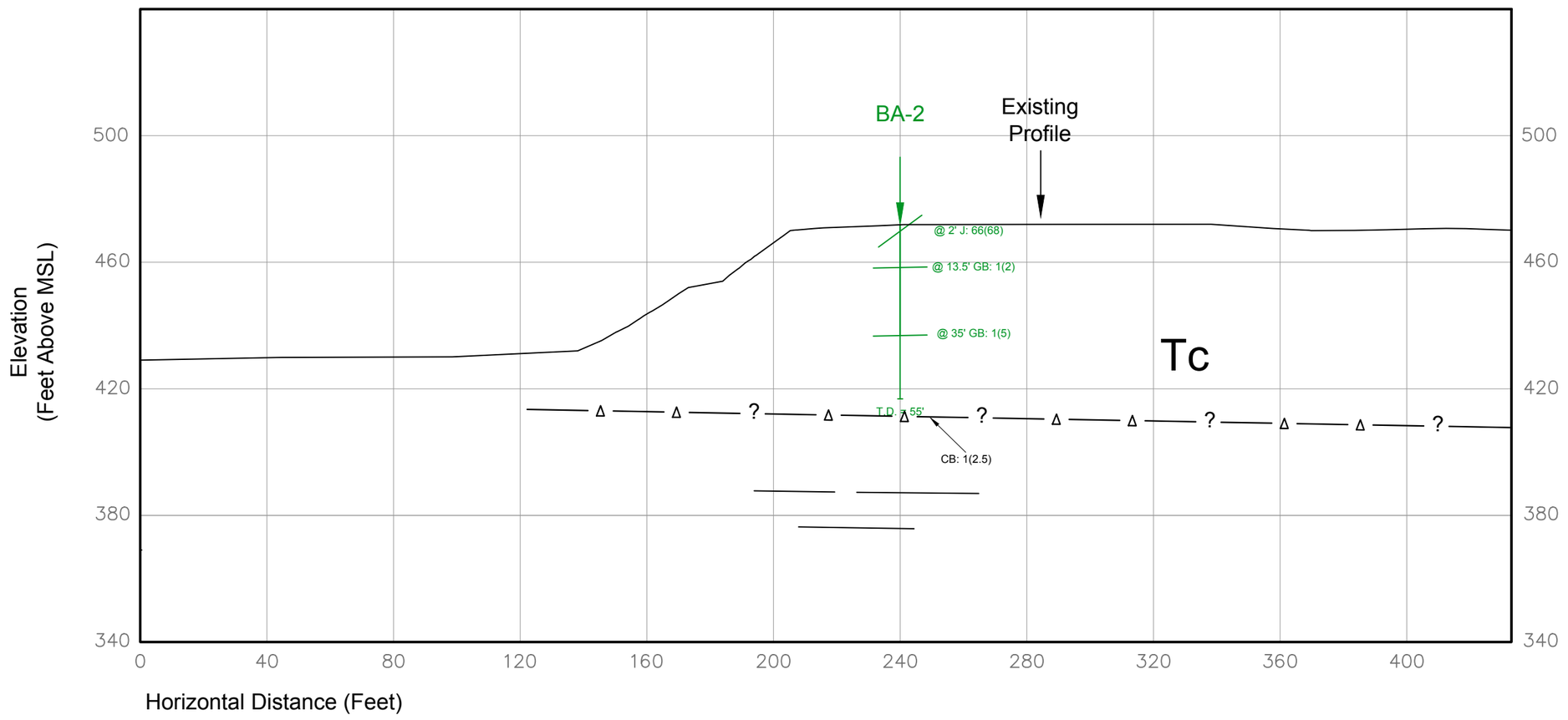
Figure 3
Cross Section B-B'

PROJECT NAME	Paseo De La Colinas
PROJECT NO.	18045-01
ENG. / GEOL.	BTZ/KBC
SCALE	1" = 40'
DATE	May 2018

C

C'

N75E
Section Orientation



SCALE: 1"=40'

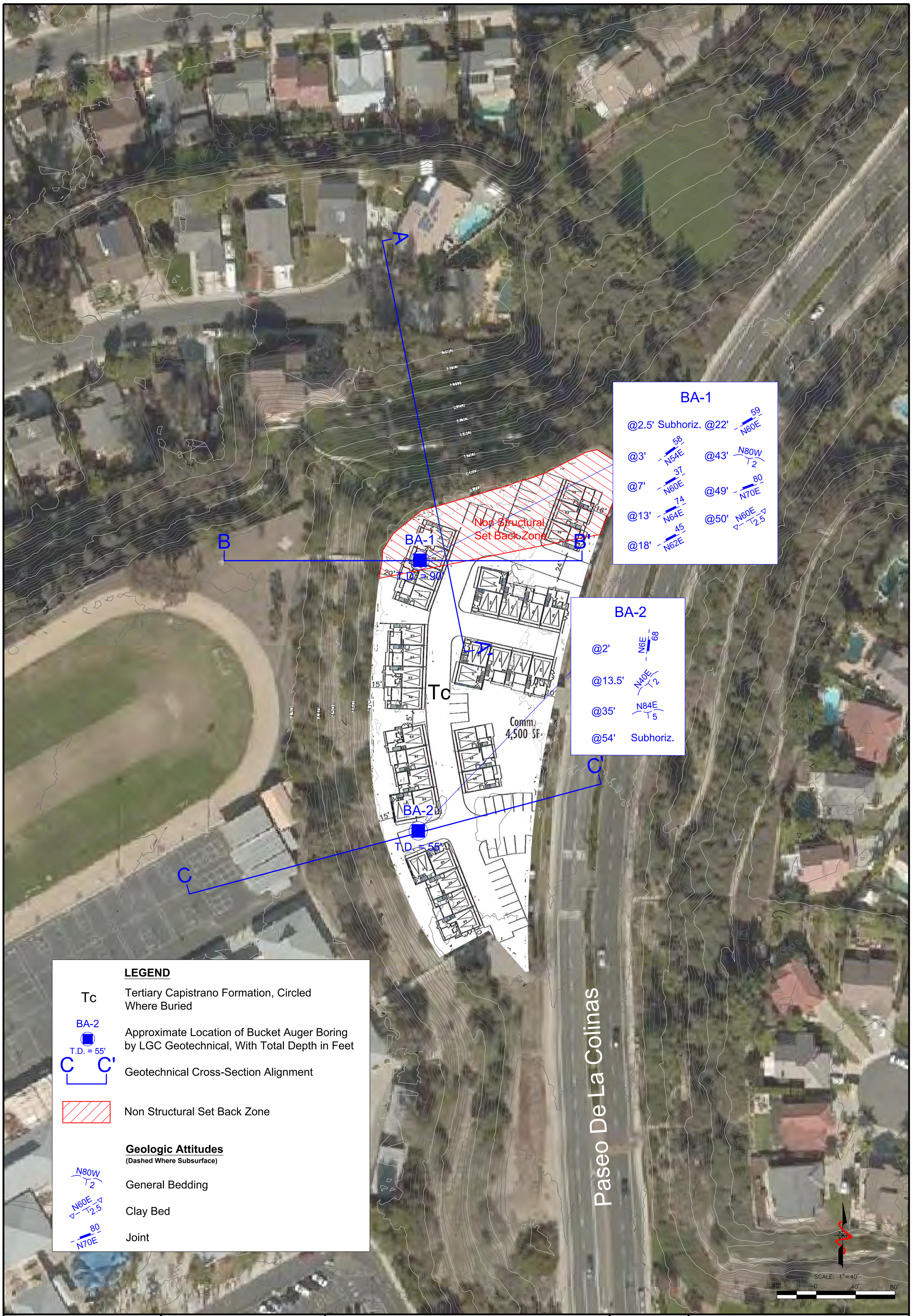
40' 0 40' 80'

LGC Geotechnical, Inc.

LGC Geotechnical, Inc.
131 Calle Iglesia, Ste. 200
San Clemente, CA 92672
TEL (949) 369-6141 FAX (949) 369-6142

Figure 4
Cross Section C-C'

PROJECT NAME	Paseo De La Colinas
PROJECT NO.	18045-01
ENG. / GEOL.	BTZ/KBC
SCALE	1" = 40'
DATE	May 2018



LGC Geotechnical, Inc.
LGC Geotechnical, Inc.
131 Calle Iglesia, Ste. 200
San Clemente, CA 92672
TEL (949) 369-6141 FAX (949) 369-6142

Geologic Map

PROJECT NAME	Paseo De La Colinas
PROJECT NO.	18045-01
ENG. / GEOL.	BTZ/KBC
SCALE	1'=40"
DATE	May 2018

SHEET 1 of 1

Appendix A
References

References

California Geological Survey (CGS), (Previously California Division of Mines and Geology), 1974, Geologic Map of the San Juan Capistrano Quadrangle, Orange County, California, Paul K. Morton, William J. Edgington and Donald L. Fife, Scale: 1:12,000.

_____, 2000, Digital Images of Official Maps of Alquist-Priolo Earthquake Fault Zones of California, Southern Region, CDMG CD 2000-03.

_____, 2001a, Seismic Hazard Evaluation of the San Juan Capistrano 7.5-Minute Quadrangle, Orange County, California, Open File Report 053.

_____, 2001b, State of California Seismic Hazard Zones, San Juan Capistrano Quadrangle, Official Map, Released December 21, 2001.

_____, 2007, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps, Special Publication 42, Interim Revision 2007.

County of Orange Grading Manual, 1993, Appendix F, Minimum Standards for Slope Stability Analysis.

Gregory Geotechnical Software, 2013, GSTABL7, Version 2.005.3, March.

Stark T.D., Choi, H., and McCone, S., 2005, Drained shear strength parameters for analysis of landslides, *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, pp. 575-588, dated May 2005.

Stark, T.D., Hussain, M., 2013, Empirical Correlations: Drained shear strength for slope stability analysis, *Journal of Geotechnical and Geoenvironmental Engineering,* ASCE, pp. 853-862, dated June 2013.

Appendix B
Boring Logs

Geotechnical Boring Log BA-1

Date :	4/19/2018 Page 1 of 4	**Drilling Company :**	Big Johnny's Drilling
Project Name :	Paseo De La Colinas	**Type of Rig :**	Calweld
Project Number :	18045-01	**Drop :** 18"	**Hole Diameter :** 24"
Elevation of Top of Hole :	~ 470 ' MSL	**Drive Weight :**	0'-25' = 3300 lbs; 25'-50' = 2200 lbs; 50 -75' = 1100 lbs; 75'-95' = 2100 lbs
Hole Location :	See Geotechnical Map		

Logged by ARN

Sampled by ARN

Elevation (ft)	Depth (ft)	Graphic Log	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0								**@0' to 90' Tertiary Capistrano Formation (Tc):** @0' - Crushed aggregate base; pavement section @1' - SILTSTONE with SAND lenses and CLAY: light gray brown with orange, moist, stiff; moderately weathered bedrock	
			J: N54E, 58N						@2' - Silty SAND: orange; subhorizontal bedding, 4" thick, poorly defined	
465	5								@3' - Joint attitude on gypsum filled joint; overall moderately weathered bedrock with iron oxide and evenly spaced jointing; moisture increasing with depth, moist to very moist in general	
			J: N60E, 37N						@7' - Joint attitude on crystalline gypsum filled joint; similar to above; approximately 1/2" wide	
460	10			R-1	1 for 12"	89.8	31.9	CL	@10' - SILTSTONE to SILTSTONE with SAND: light gray brown, very moist, stiff to very stiff; scattered oxidation staining; transitions from moderately weathered to slightly weathered	
			J: N64E, 74N						@11' - Trace fossils; manganese oxide on joint surfaces @13' - Joint attitude on gypsum filled joint; planar joint with iron oxide staining, part of the way around the boring; moisture has decreased; stiffness has increased @14' - Subhorizontal Sand stringers	
455	15								@16' - Scattered jarosite; soft sediment deformation observed in faintly stained sand lenses	
			J: N62E, 45N						@ 17' to 22' - Joint attitude. Manganese and iron oxide stained gypsum filled joint; ~ 1/8" thick; less weathered material below and joint all around boring, entering at ~17' and exiting ~22'. Increased stiffness, scattered joints. below 22'; averaged attitude at 22'; variable oxidation	AL MD DS
450	20			R-2	1 1	97.1	26.1	CH		
			J: N60E, 59N							
445	25								@ 27' - Joint attitude, iron oxide	
			J: N64E, Vertical							

LGC Geotechnical, Inc.

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 THE ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE
G	GRAB SAMPLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE

Last Edited: 5/2/2018

Geotechnical Boring Log BA-1

Date :	4/19/2018 Page 2 of 4	**Drilling Company :**	Big Johnny's Drilling
Project Name :	Paseo De La Colinas	**Type of Rig :**	Calweld
Project Number :	18045-01	**Drop :** 18"	**Hole Diameter :** 24"
Elevation of Top of Hole :	~ 470 ' MSL	**Drive Weight :**	0'-25' = 3300 lbs; 25'-50' = 2200 lbs; 50 -75' = 1100 lbs; 75'-95' = 2100 lbs
Hole Location :	See Geotechnical Map		

Logged by ARN

Sampled by ARN

Elevation (ft)	Depth (ft)	Graphic Log	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	30			R-3	1 1	93.8	29.2	CL	@30' - Vertical joint, followed since 27', tight, has gypsum, iron oxide, and manganese oxide. Material is dark gray, SILTSTONE w/ SAND, sl. moist, v. stiff.	
									@33' - SILTSTONE with SAND; Increase in fine SAND, and oxidized zone with circular laminations.	
440	35								@36' - SILTSTONE with some SAND: dark gray, moist, very stiff; fresh bedrock; unoxidized	
									@37.5 - Lense of orange SILT; subhorizontal; discontinuous; two large oxidized circles	
435	40			R-4	2 4	98.2	26.9	ML	@40 - Same as above @36'	
			GB: N80W, 2S						@43' - General bedding attitude on SANDSTONE interbed: orange, wet; 1" thick; minor seepage from sandbed, gypsum	
430	45								@45.5' - Active seep; coming out of sandbed; varies in thickness from 1" to 3"; ~1" zone of Sandy SILT around the sand bed; bioturbation on sand lense; subhorizontal; at 46' returns to the same material as above	
									@46' - SILTSTONE; dark gray, moist, stiff; iron oxide and manganese oxide staining	
			J: N70E, 80N						@49' - Attitude on joint; iron oxide joint with few gypsum crystals. ends on claybed @50'	
425	50		CB: Sub-horizontal	R-5 GB-1	3 10	88.3	24.7	ML	@50' - Two or three very thin CLAY beds in a ~1" thick zone; subhorizontal; an iron oxide joint ends at the claybed; clay beds are poorly defined, subplanar	
420	55									

LGC Geotechnical, Inc.

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 THE ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE
G	GRAB SAMPLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE

Geotechnical Boring Log BA-1

Date :	4/19/2018 Page 3 of 4	**Drilling Company :**	Big Johnny's Drilling
Project Name :	Paseo De La Colinas	**Type of Rig :**	Calweld
Project Number :	18045-01	**Drop :** 18"	**Hole Diameter :** 24"
Elevation of Top of Hole :	~ 470 ' MSL	**Drive Weight :**	0'-25' = 3300 lbs; 25'-50' = 2200 lbs; 50 -75' = 1100 lbs; 75'-95' = 2100 lbs
Hole Location :	See Geotechnical Map		

Logged by ARN

Sampled by ARN

Elevation (ft)	Depth (ft)	Graphic Log	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	60			R-6	4 9	101.5	22.6	CL-ML	@60' - Dark gray SILTSTONE w/ variable SAND, moist to wet, v. stiff to sl. hard.	MD DS
415	65									
410	70			R-7	7 16	103.2	24.1	ML	@70' - as above at 60', moist	
									@73' - SAND content increased; becomes Sandy SILTSTONE, color slightly browning gray	
405	75								@76' - Small concretion; ~2" diameter, irregular shape	
400	80			R-8	4 12	103.6	23.0	ML	@79' - Decreased SAND; back to SILTSTONE with some SAND, moist, sl. hard, micaceous	
395	85								@87' - End visual log	

LGC Geotechnical, Inc.

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 THE ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE
G	GRAB SAMPLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE

Geotechnical Boring Log BA-1

Date :	4/19/2018 Page 4 of 4	**Drilling Company :**	Big Johnny's Drilling
Project Name :	Paseo De La Colinas	**Type of Rig :**	Calweld
Project Number :	18045-01	**Drop :** 18"	**Hole Diameter :** 24"
Elevation of Top of Hole :	~ 470 ' MSL	**Drive Weight :**	0'-25' = 3300 lbs; 25'-50' = 2200 lbs; 50 -75' = 1100 lbs; 75'-95' = 2100 lbs
Hole Location :	See Geotechnical Map		

Logged by ARN

Sampled by ARN

Elevation (ft)	Depth (ft)	Graphic Log	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	90			R-9	3 10	101.7	23.2	ML	**Total Depth = 90'** **Groundwater Seepage Encountered** **Backfilled with Cuttings on 4/19/2018**	
390	95									
385	100									
380	105									
375	110									
370	115									

LGC Geotechnical, Inc.

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 THE ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE
G	GRAB SAMPLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE

Geotechnical Boring Log BA-2

Date :	4/20/2018 Page 1 of 2	**Drilling Company :**	Big Johnny's Drilling
Project Name :	Paseo De La Colinas	**Type of Rig :**	Calweld
Project Number :	18045-01	**Drop :** 18"	**Hole Diameter :** 24"
Elevation of Top of Hole :	~ 470 ' MSL	**Drive Weight :**	0'-25' = 3300 lbs; 25'-50' = 2200 lbs; 50 -75' = 1100 lbs; 75'-95' = 2100 lbs
Hole Location :	See Geotechnical Map		

Logged by KTM/ARN

Sampled by ARN

Elevation (ft)	Depth (ft)	Graphic Log	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0								**@0' to 55' <u>Tertiary Capistrano Formation (Tc)</u>:** @0' - SILTSTONE with SAND lenses: medium gray, moist, stiff; abundant jarosite and iron oxide lined SAND stringers along subhorizontal bedding; moderately to slightly weathered	
			J: N6E, 68S						@2.5' - Attitude on gypsum filled joint; ~1/8" wide by 7" long; steeply dipping; rough but planar surface	
465	5								@3' - Massive SILTSTONE; SAND decrease	
				B-1					@ 8.8' - Slightly stiffer material; tighter; a couple small trace fossils and/or burrows; light brown SAND filling burrows	
460	10			R-1	2 2	103.0	22.4	ML	@10' - SILTSTONE: medium gray, moist, stiff	
									@10.5' - Concretion; gray; ~3" diameter	
			GB: N40E, 2S						@13.5' - General bedding attitude. Sandy SILTSTONE interbed; subhorizontal bedding; correlates to the bed from BA-1 at 2' depth; ~4" thick ; bioturbated; poorly defined boundaries	
455	15								@17' - Small concretion	
450	20			R-2	2 4	98.5	25.2	ML	@20' -Gradual increase in SAND content; Sample is similar to 10' above	
445	25								@25.5' - Fine SAND filled trace fossil; tan colored SAND	
									@ 27' - Increase in trace fossil abundance	

LGC Geotechnical, Inc.

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 THE ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE
G	GRAB SAMPLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE

Last Edited: 5/2/2018

Geotechnical Boring Log BA-2

Date :	4/20/2018 Page 2 of 2	**Drilling Company :**	Big Johnny's Drilling
Project Name :	Paseo De La Colinas	**Type of Rig :**	Calweld
Project Number :	18045-01	**Drop :** 18"	**Hole Diameter :** 24"
Elevation of Top of Hole :	~ 470 ' MSL	**Drive Weight :**	0'-25' = 3300 lbs; 25'-50' = 2200 lbs; 50 -75' = 1100 lbs; 75'-95' = 2100 lbs
Hole Location :	See Geotechnical Map		

Logged by KTM/ARN

Sampled by ARN

Elevation (ft)	Depth (ft)	Graphic Log	Attitudes	Sample Number	Blow Count	Dry Density(pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	30			R-3	2 4	101.1	24.0	ML	@30' - SILTSTONE: medium to dark gray, moist, stiff; has some white specs; slightly micaceous, few forams	
440	35		GB: N84E, 5S						@35' - General bedding attitude taken on cemented Sandy SILT concretion; poorly defined edges; disc shaped and several feet long; occupied ~1/2 of the boring; discontinuous; vague	
435	40			R-4	3 7	100.2	24.4	ML	@40' - as above at 30', some SAND @43.7' - Very thin SAND stringer; brownish gray; subhorizontal	
430	45								@44' - Zone of Sandy SILTSTONE with abundant trace burrows ; few concretions; SILTSTONE to Sandy SILTSTONE below	
425	50			R-5	3 8	95.8	24.7	ML	@50' - as above at 30', variable SAND	
420	55								@54' - Gray SAND bed; coorelates to BA-1 at 43' depth; ~1" thick, active seepage, continuous around boring	
									Total Depth = 55' **No Ground Water Encountered** **Backfilled with Cuttings on 4/20/2018**	

LGC Geotechnical, Inc.

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 THE ACTUAL CONDITIONS ENCOUNTERED.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE
G	GRAB SAMPLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE

Appendix C
Laboratory Test Results

APPENDIX C

Laboratory Test Results

The laboratory testing program was directed towards providing quantitative data relating to the relevant engineering properties of the soils. Samples considered representative of site conditions were tested in general accordance with American Society for Testing and Materials (ASTM) procedure and/or California Test Methods (CTM), where applicable. The following summary is a brief outline of the test type and a table summarizing the test results.

Moisture and Density Determination Tests: Moisture content (ASTM D2216) and dry density determinations (ASTM D2937) were performed on driven samples obtained from the test borings. The results of these tests are presented in the boring logs. Where applicable, only moisture content was determined from undisturbed or disturbed samples.

Atterberg Limits: The liquid and plastic limits ("Atterberg Limits") were determined per ASTM D4318 for engineering classification of fine-grained material and presented in the table below. The USCS soil classification indicated in the table below is based on the portion of sample passing the No. 40 sieve and may not necessarily be representative of the entire sample. The plots are provided in this Appendix.

Sample Location	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Soil Classification
BA-1 @ 20 ft	54	27	27	CH
BA-1 @ 50 ft	65	23	42	CH

Direct Shear: Direct shear tests were performed on selected driven samples, which were soaked for a minimum of 24 hours prior to testing. The samples were tested under various normal loads using a motor-driven, strain-controlled, direct-shear testing apparatus (ASTM D3080). The plot is provided in this Appendix.

ATTERBERG LIMITS

ASTM D 4318

Project Name:	Laguna Niguel	Tested By:	R. Manning	Date:	05/03/18
Project No. :	18045-01	Input By:	J. Ward	Date:	05/04/18
Boring No.:	BA-1	Checked By:	J. Ward		
Sample No.:	2	Depth (ft.)	20.0		
Soil Identification:	Light olive brown fat clay (CH)				

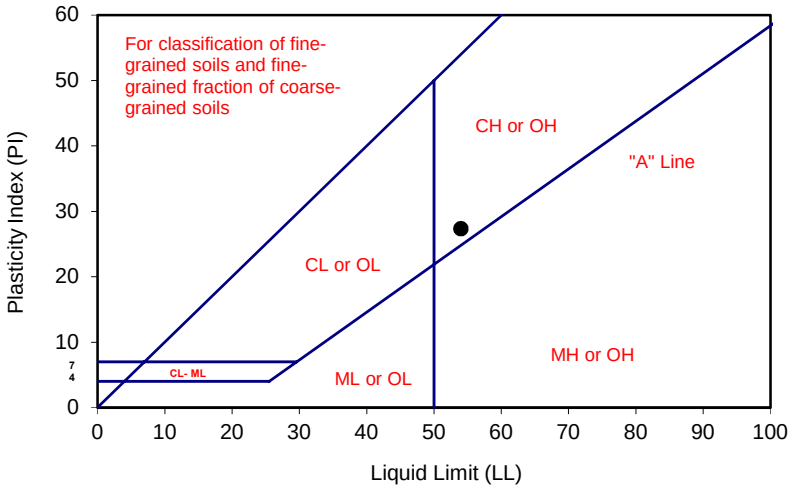
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	26	19	
Wet Wt. of Soil + Cont. (g)	18.61	18.15	24.34	25.12	25.52	
Dry Wt. of Soil + Cont. (g)	17.17	16.70	20.67	21.05	21.28	
Wt. of Container (g)	11.75	11.27	13.58	13.51	13.70	
Moisture Content (%) [Wn]	26.57	26.70	51.76	53.98	55.94	

Liquid Limit	**54**
Plastic Limit	**27**
Plasticity Index	**27**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 24.82

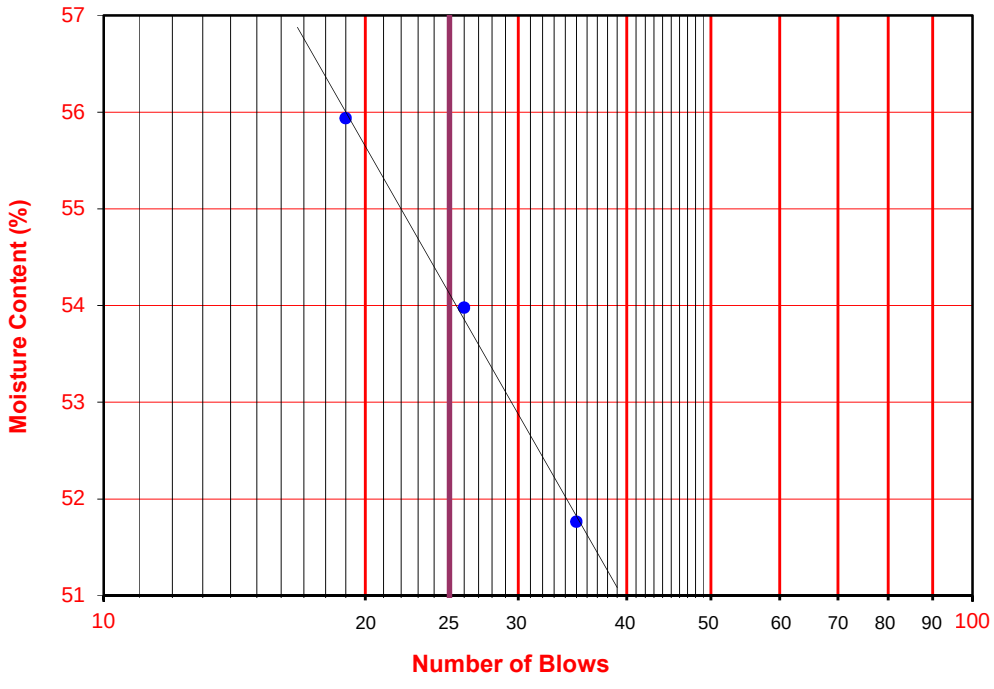
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$

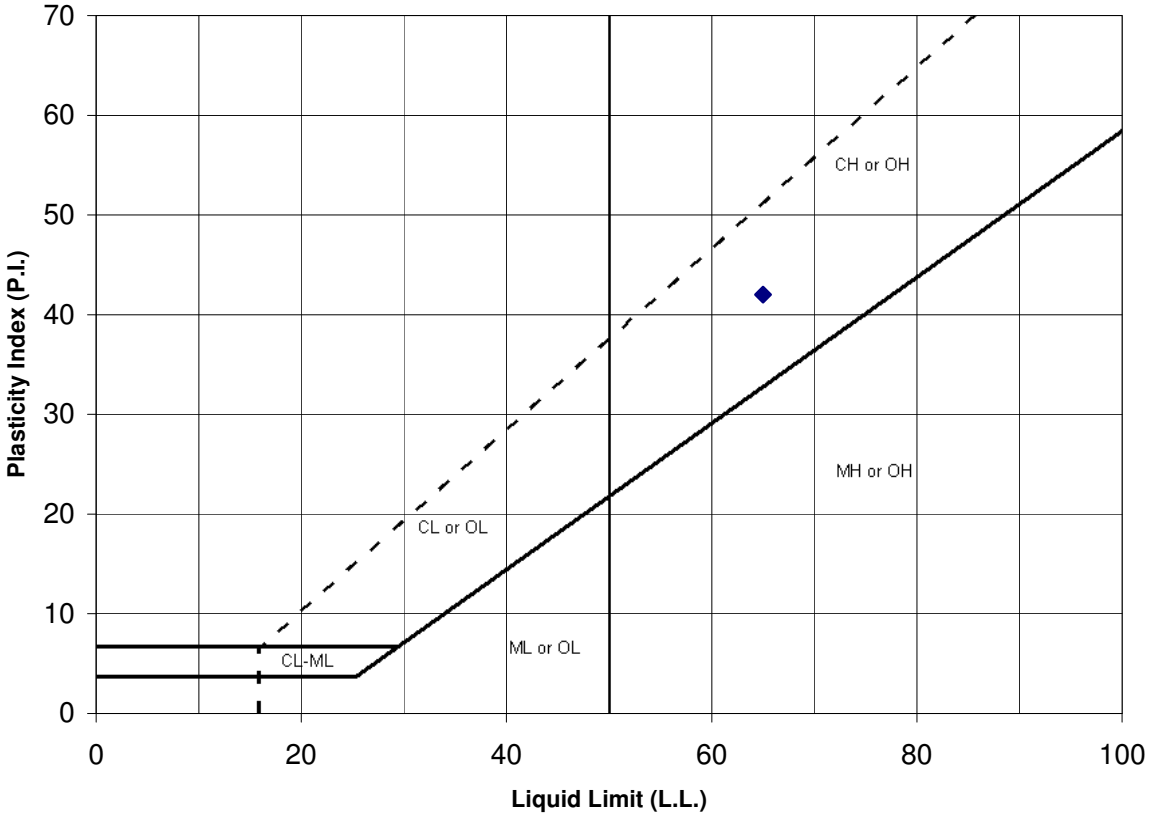


PROCEDURES USED

	Wet Preparation
	Multipoint - Wet
X	Dry Preparation
	Multipoint - Dry
X	Procedure A
	Multipoint Test
	Procedure B
	One-point Test



PLASTICITY CHART - CLASSIFICATION OF FINE-GRAINED SOILS

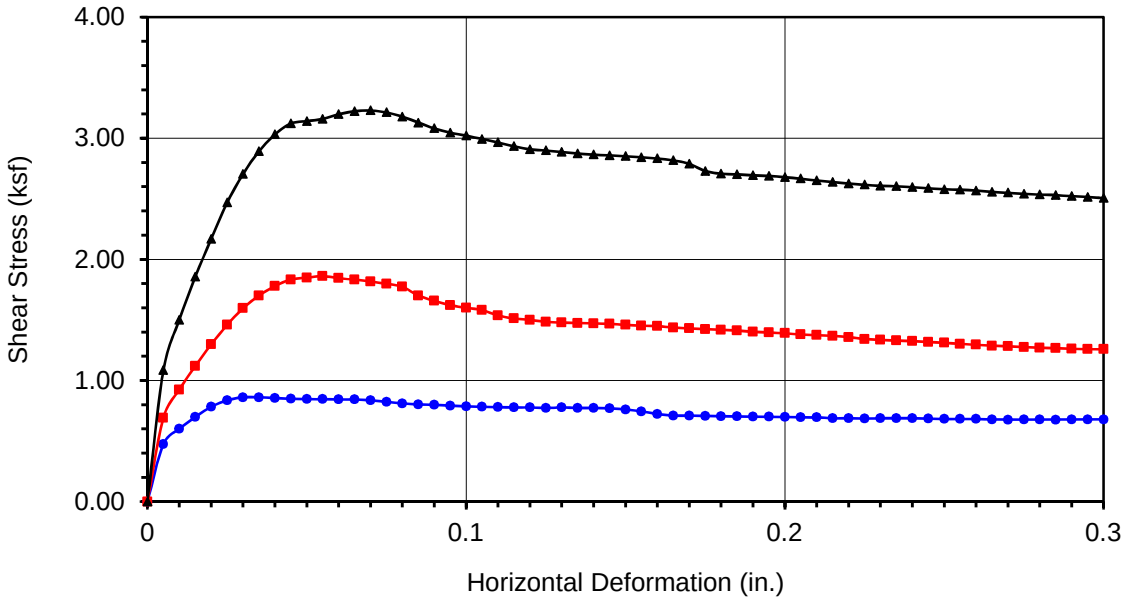


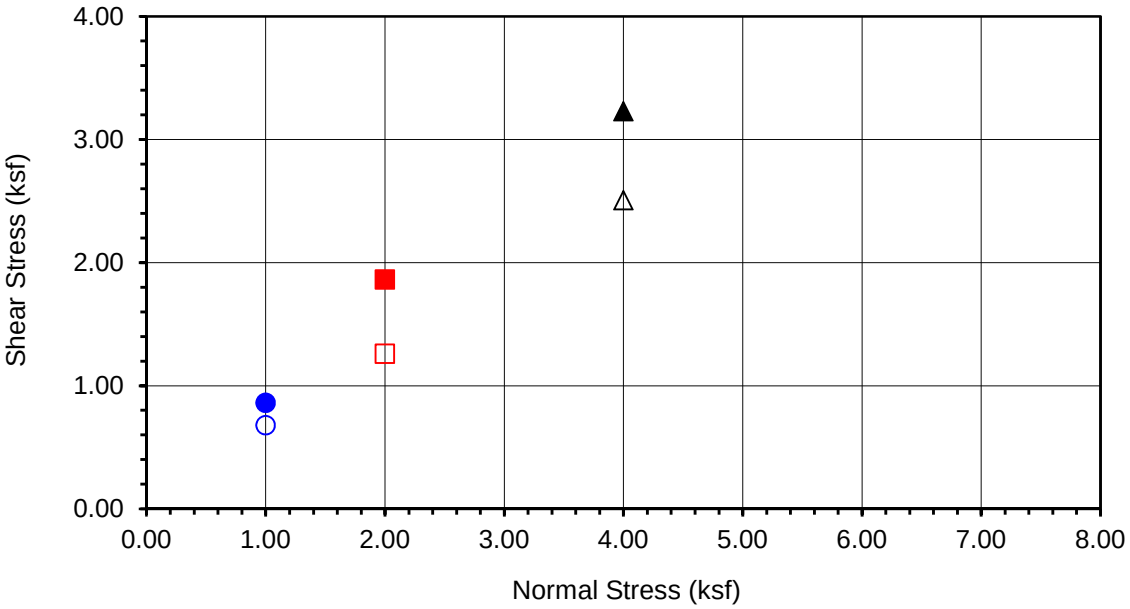
Symbol	Location.:	Sample No.:	Depth (ft)	Passing No. 200 Sieve (%)	Liquid Limit (%) LL	Plastic Limit (%) PL	Plasticity Index (%) PI	USCS
◆	BA-1	G-1	50'	-	65	23	42	CH

ATTERBERG LIMITS
(ASTM D 4318)

Project Number: 18045-01
Date: Apr-18

Laguna Niguel - Paseo de la Colinas





Boring No.	**BA-1**
Sample No.	**2**
Depth (ft)	**20**
Sample Type: Ring	
Soil Identification: Light olive brown fat clay (CH)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.861	■ 1.861	▲ 3.229
Shear Stress @ End of Test (ksf)	○ 0.679	□ 1.258	△ 2.506
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	26.08	26.08	26.08
Dry Density (pcf)	94.1	97.1	97.3
Saturation (%)	88.9	95.8	96.2
Soil Height Before Shearing (in.)	0.9931	0.9906	0.9818
Final Moisture Content (%)	29.2	30.4	28.4

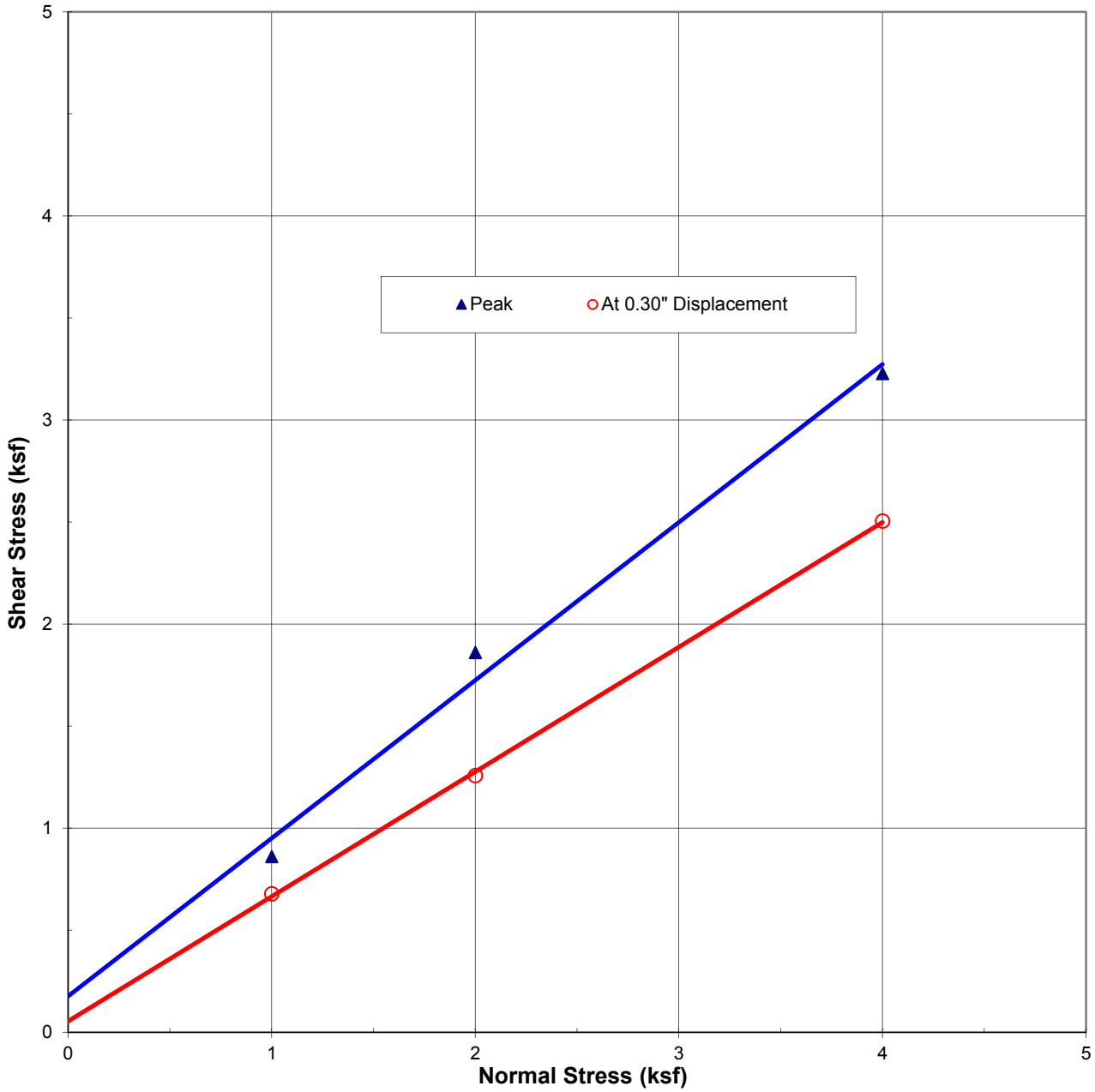
DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 18045-01

Laguna Niguel

04-18



Tested Sample:
BA-1 at 20 ft

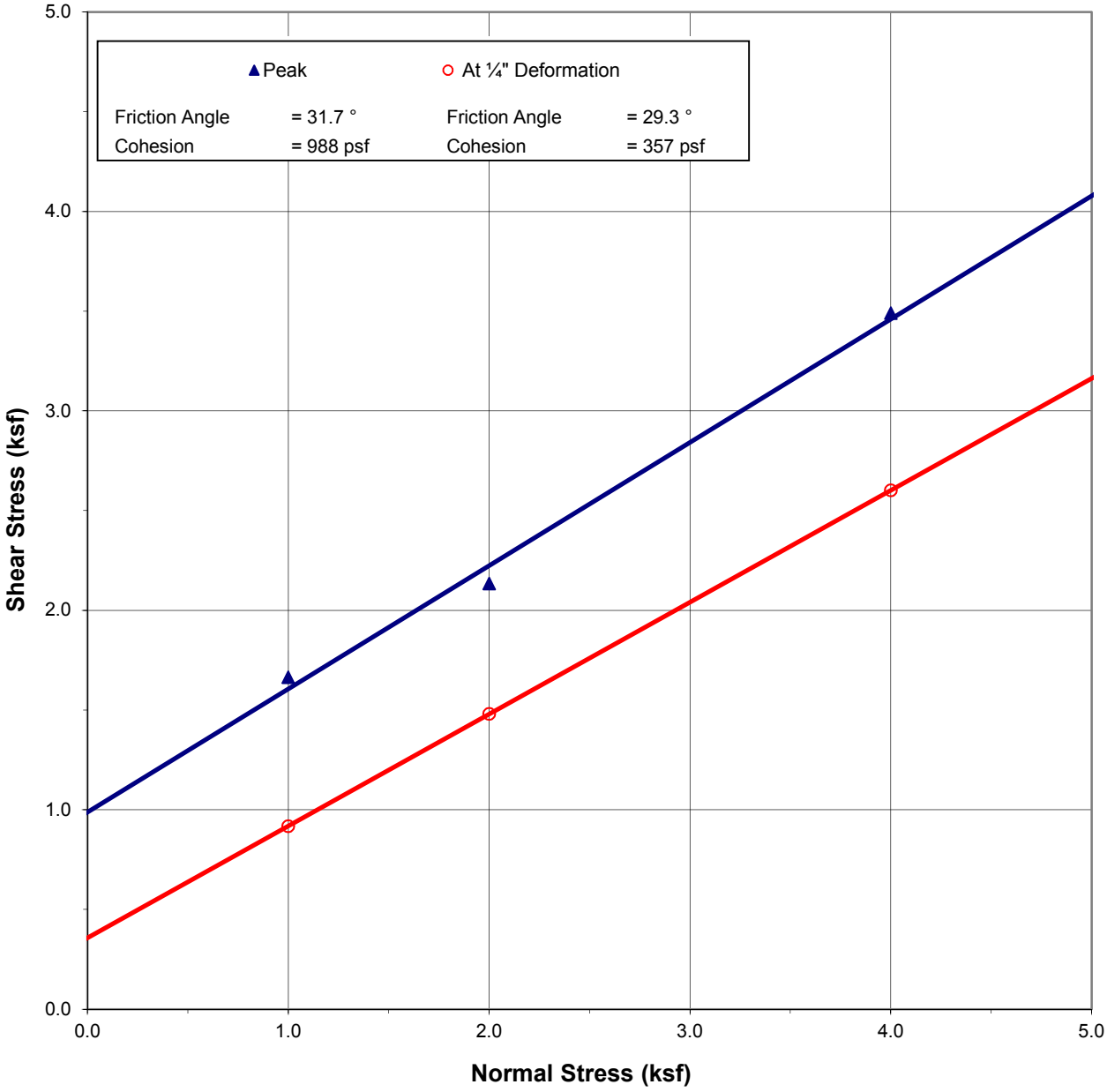
	Peak:	At 0.30" Displacement:
	37.8 Degrees	31.4 Degrees
	0.18 ksf	0.05 ksf

LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 18045-01
Date: May-18

Paseo de la Colinas, Laguna Niguel



Location:	Sample No.:	Depth (ft)	Sample Type	Shear Rate (inch/min)	Dry Density (pcf)	Initial Moisture Content (%)	Final Moisture Content (%)
BA-2	**R-3**	**30**	**Ring**	**0.0005**	**101.1**	**24.0**	**30.0**

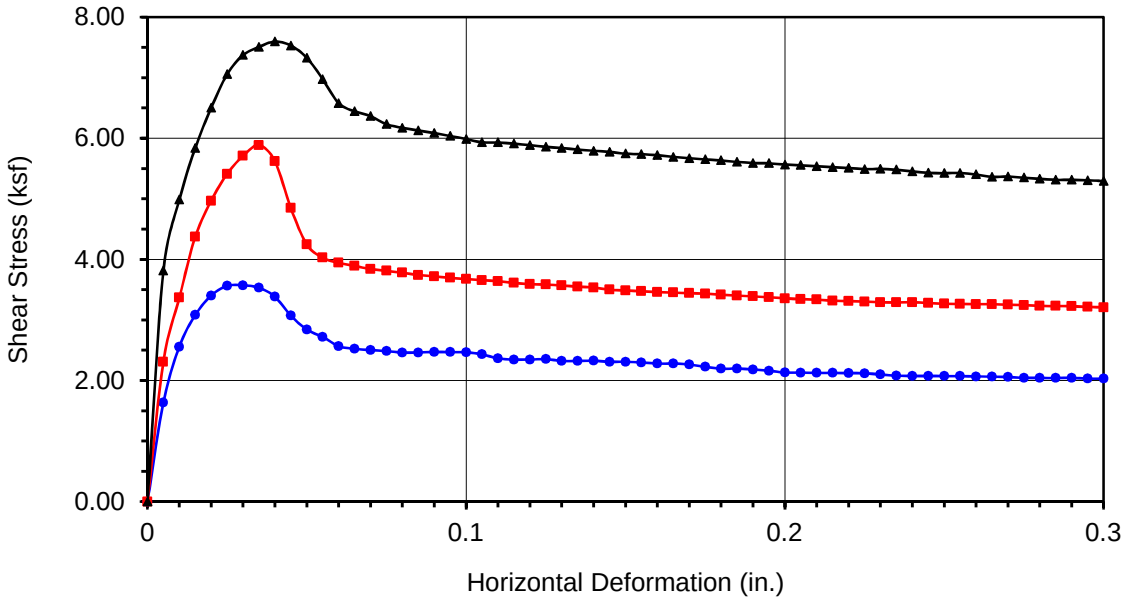
Sample Description: Dark Gray Clay (CH)

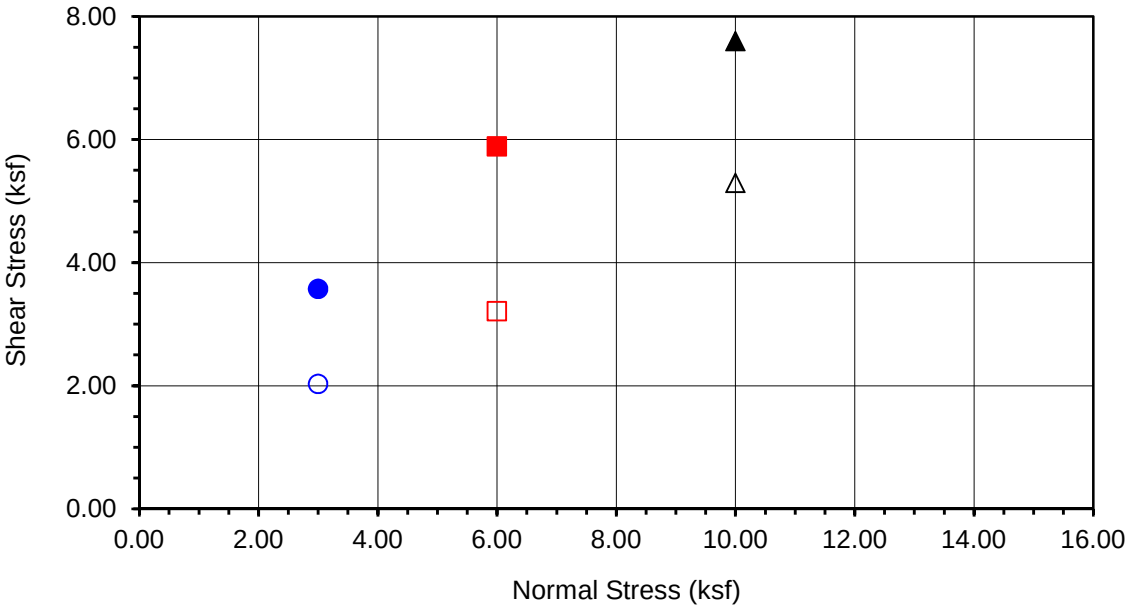
LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 18045-01
Date: May-11

Laguna Niguel - Paseo de la Colinas





Boring No.	**BA-1**
Sample No.	**6**
Depth (ft)	**60**
Sample Type: Ring	
Soil Identification: Dark olive gray silty clay'stone' (CL-ML)	

Normal Stress (kip/ft²)	3.000	6.000	10.000
Peak Shear Stress (kip/ft²)	● 3.571	■ 5.885	▲ 7.595
Shear Stress @ End of Test (ksf)	○ 2.031	□ 3.207	△ 5.294
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	22.62	22.62	22.62
Dry Density (pcf)	99.3	100.6	101.8
Saturation (%)	87.6	90.3	93.1
Soil Height Before Shearing (in.)	0.9978	0.9909	0.9842
Final Moisture Content (%)	26.2	25.5	24.7

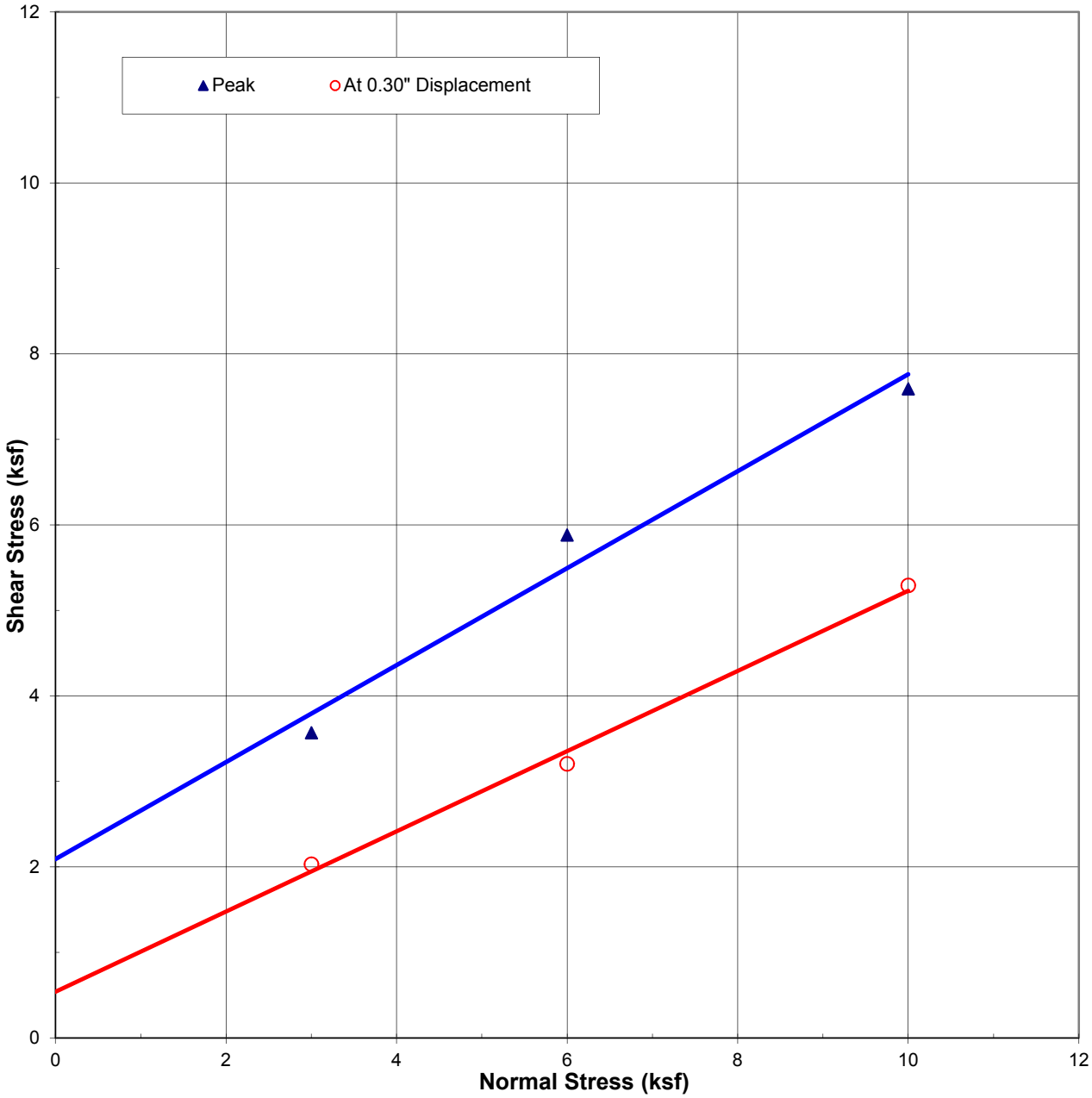
DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 18045-01

Laguna Niguel

04-18



Tested Sample:
BA-1 at 60 ft

Peak:	At 0.30" Displacement:
29.5 Degrees	25.1 Degrees
2.09 ksf	0.54 ksf

LGC Geotechnical, Inc.

DIRECT SHEAR PLOT

Project Number: 18045-01
Date: May-18

Paseo de la Colinas, Laguna Niguel

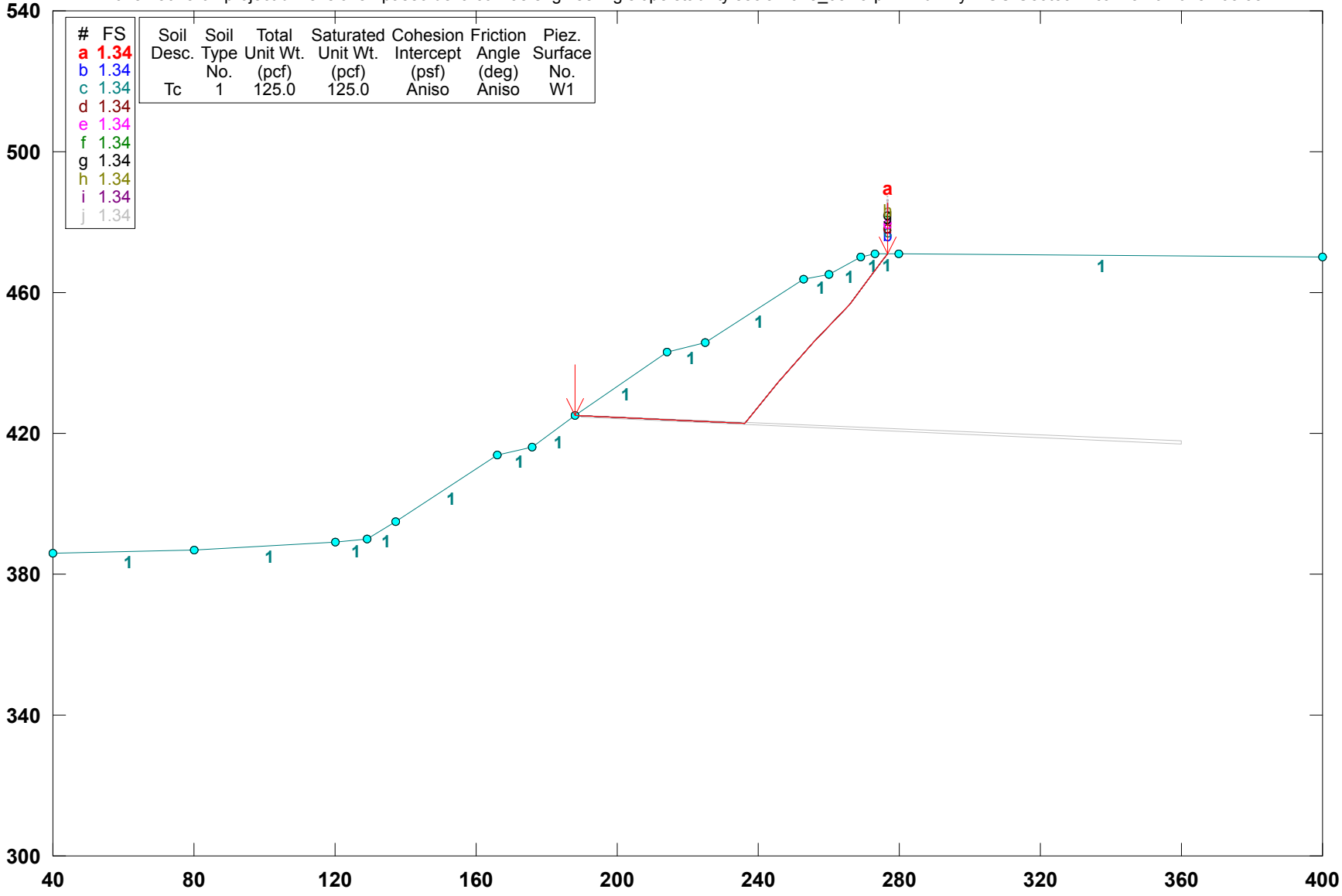
Appendix D
Slope Stability Analysis

Summary of Slope Stability Analysis

Cross-Section	File Name	Factor of Safety	Description
A-A’	xa	1.34	Along Clay Bed - Static
	xa15	1.53	Along Clay Bed – 30 ft Set-Back
	xar	1.32	Rotational – Static
	xarx15	1.51	Rotational – 60 ft Set-Back - Static
	xarx15e	1.28	Rotational - 60 ft Set-Back - Seismic
B-B’	sec b	1.47	Along Clay Bed - Static
	sec br	1.68	Rotational – Static
	sec bre	1.49	Rotational - Seismic
C-C’	sec c	1.83	Along Clay Bed - Static
	sec cr	1.72	Rotational – Static
	sec cre	1.53	Rotational - Seismic

Paseo de la Colinas 18045-01/ Sec A-A' / Along Clay Bed / Static

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec a\2018_05\xa.pl2 Run By: LGC Geotechnical 5/10/2018 03:38PM

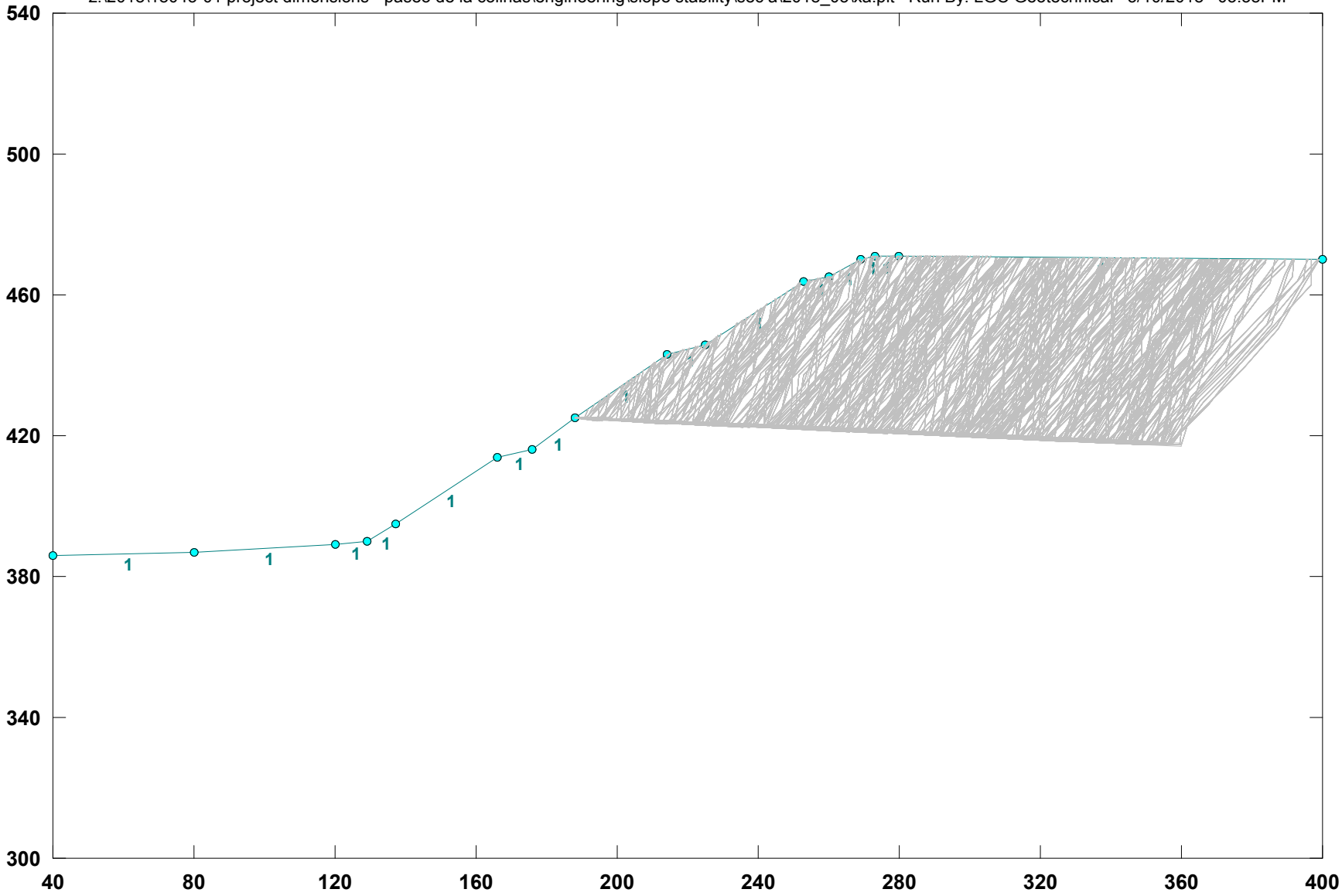


GSTABL7 v.2 FSmin=1.34

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Paseo de la Colinas 18045-01/ Sec A-A' / Along Clay Bed / Static

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec a\2018_05\xa.plt Run By: LGC Geotechnical 5/10/2018 03:38PM



***** GSTABL7 *****

** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
(All Rights Reserved-Unauthorized Use Prohibited)

****

SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/10/2018
Time of Run: 03:38PM
Run By: LGC Geotechnical
Input Data Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec A\2018_05\xa.in
Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec A\2018_05\xa.OUT
Unit System: English
Plotted Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec A\2018_05\xa.PLT
PROBLEM DESCRIPTION: Paseo de la Colinas 18045-01/ Sec A-A'
/ Along Clay Bed / Static

BOUNDARY COORDINATES
15 Top Boundaries
15 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	386.00	80.00	387.00	1
2	80.00	387.00	120.00	389.00	1
3	120.00	389.00	129.00	390.00	1
4	129.00	390.00	137.00	395.00	1
5	137.00	395.00	166.00	414.00	1
6	166.00	414.00	176.00	416.00	1
7	176.00	416.00	188.00	425.00	1
8	188.00	425.00	214.00	443.00	1
9	214.00	443.00	225.00	446.00	1
10	225.00	446.00	253.00	464.00	1
11	253.00	464.00	260.00	465.00	1
12	260.00	465.00	269.00	470.00	1
13	269.00	470.00	273.00	471.00	1
14	273.00	471.00	280.00	471.00	1
15	280.00	471.00	400.00	470.00	1

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	26.0	0.00	0.0	1

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 1 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	-4.0	300.00	26.00
2	-1.0	0.00	18.00
3	90.0	300.00	26.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and

C equal to zero, with water weight in the tension crack.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 15.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	188.10	425.00	188.10	425.00	0.00
2	190.00	424.90	360.00	417.50	0.80

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 49.611 FS Min = 1.337 FS Ave = 2.849
Standard Deviation = 2.721 Coefficient of Variation = 95.51 %
Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.051	425.036
2	188.100	425.000
3	236.391	422.792
4	245.666	434.581
5	255.522	445.888
6	265.939	456.681
7	274.934	468.685
8	276.748	471.000

Factor of Safety
*** 1.337 ***
Individual data on the 13 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.0	0.2	0.0	0.0	0.	0.	0.0	0.0	0.0
2	25.9	31166.5	0.0	0.0	0.	0.	0.0	0.0	0.0
3	11.0	28786.5	0.0	0.0	0.	0.	0.0	0.0	0.0
4	11.4	37887.7	0.0	0.0	0.	0.	0.0	0.0	0.0
5	9.3	32020.1	0.0	0.0	0.	0.	0.0	0.0	0.0
6	7.3	20951.6	0.0	0.0	0.	0.	0.0	0.0	0.0
7	2.5	6222.1	0.0	0.0	0.	0.	0.0	0.0	0.0
8	4.5	9220.5	0.0	0.0	0.	0.	0.0	0.0	0.0
9	5.9	9684.7	0.0	0.0	0.	0.	0.0	0.0	0.0
10	3.1	3989.1	0.0	0.0	0.	0.	0.0	0.0	0.0
11	4.0	3532.4	0.0	0.0	0.	0.	0.0	0.0	0.0
12	1.9	871.5	0.0	0.0	0.	0.	0.0	0.0	0.0
13	1.8	262.5	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.051	425.036
2	188.100	425.000
3	236.391	422.792
4	245.666	434.581
5	255.522	445.888
6	265.939	456.681
7	274.934	468.685
8	276.748	471.000

Factor of Safety
*** 1.337 ***
Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.051	425.036

2	188.100	425.000
3	236.391	422.792
4	245.666	434.581
5	255.522	445.888
6	265.939	456.681
7	274.934	468.685
8	276.748	471.000

Factor of Safety
*** 1.337 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.051	425.036
2	188.100	425.000
3	236.391	422.792
4	245.666	434.581
5	255.522	445.888
6	265.939	456.681
7	274.934	468.685
8	276.748	471.000

Factor of Safety
*** 1.337 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.051	425.036
2	188.100	425.000
3	236.391	422.792
4	245.666	434.581
5	255.522	445.888
6	265.939	456.681
7	274.934	468.685
8	276.748	471.000

Factor of Safety
*** 1.337 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.051	425.036
2	188.100	425.000
3	236.391	422.792
4	245.666	434.581
5	255.522	445.888
6	265.939	456.681
7	274.934	468.685
8	276.748	471.000

Factor of Safety
*** 1.337 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.051	425.036
2	188.100	425.000
3	236.391	422.792
4	245.666	434.581
5	255.522	445.888
6	265.939	456.681
7	274.934	468.685
8	276.748	471.000

Factor of Safety
*** 1.337 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.051	425.036
2	188.100	425.000
3	236.391	422.792
4	245.666	434.581
5	255.522	445.888
6	265.939	456.681

7	274.934	468.685
8	276.748	471.000

Factor of Safety
*** 1.337 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.051	425.036
2	188.100	425.000
3	236.391	422.792
4	245.666	434.581
5	255.522	445.888
6	265.939	456.681
7	274.934	468.685
8	276.748	471.000

Factor of Safety
*** 1.337 ***

Failure Surface Specified By 8 Coordinate Points

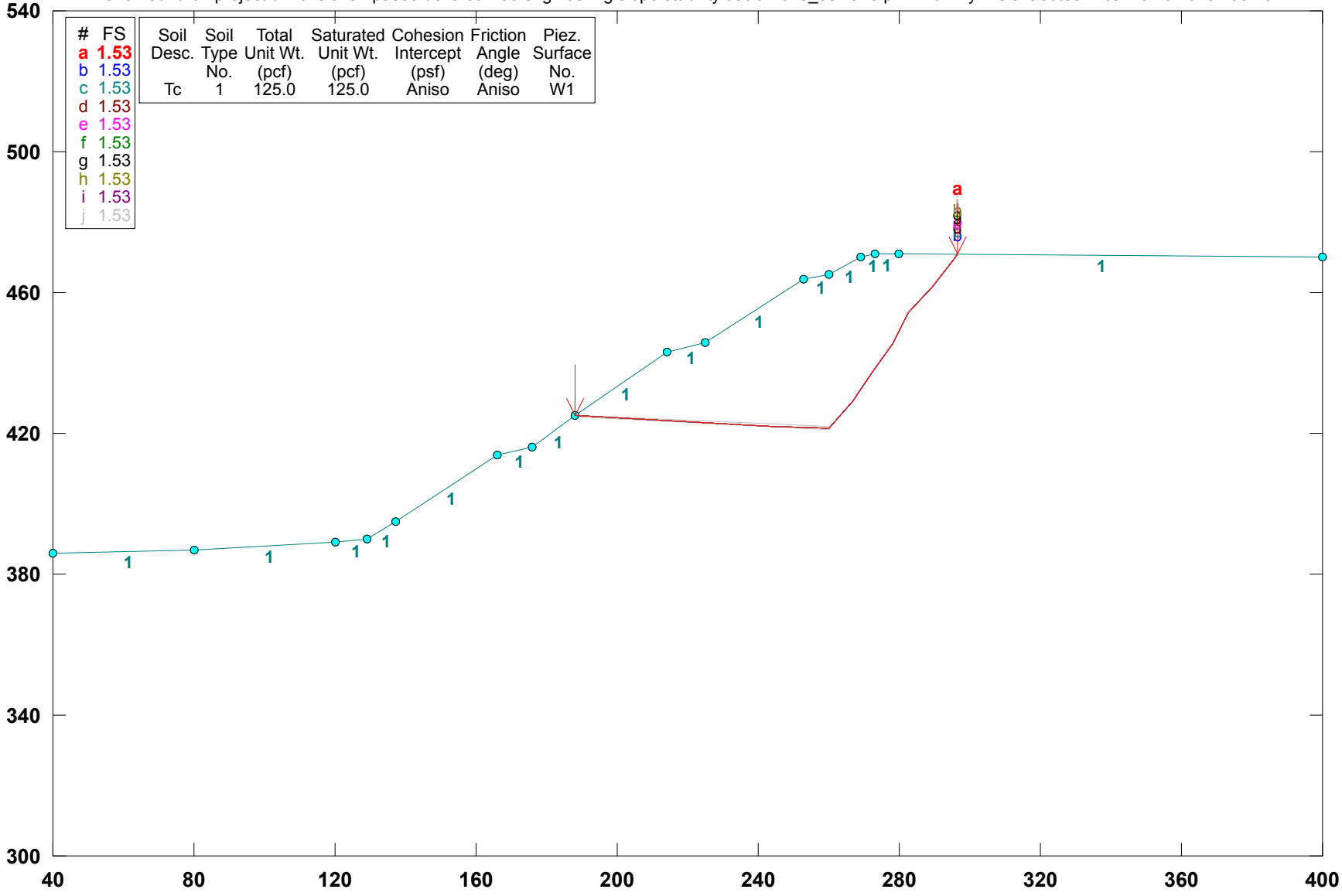
Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.051	425.036
2	188.100	425.000
3	236.391	422.792
4	245.666	434.581
5	255.522	445.888
6	265.939	456.681
7	274.934	468.685
8	276.748	471.000

Factor of Safety
*** 1.337 ***

**** END OF GSTABL7 OUTPUT ****

Paseo de la Colinas 18045-01/ Sec A-A' / Along Clay - 30 ft Setback / Static

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec a\2018_05\xa15.pl2 Run By: LGC Geotechnical 5/10/2018 03:45PM

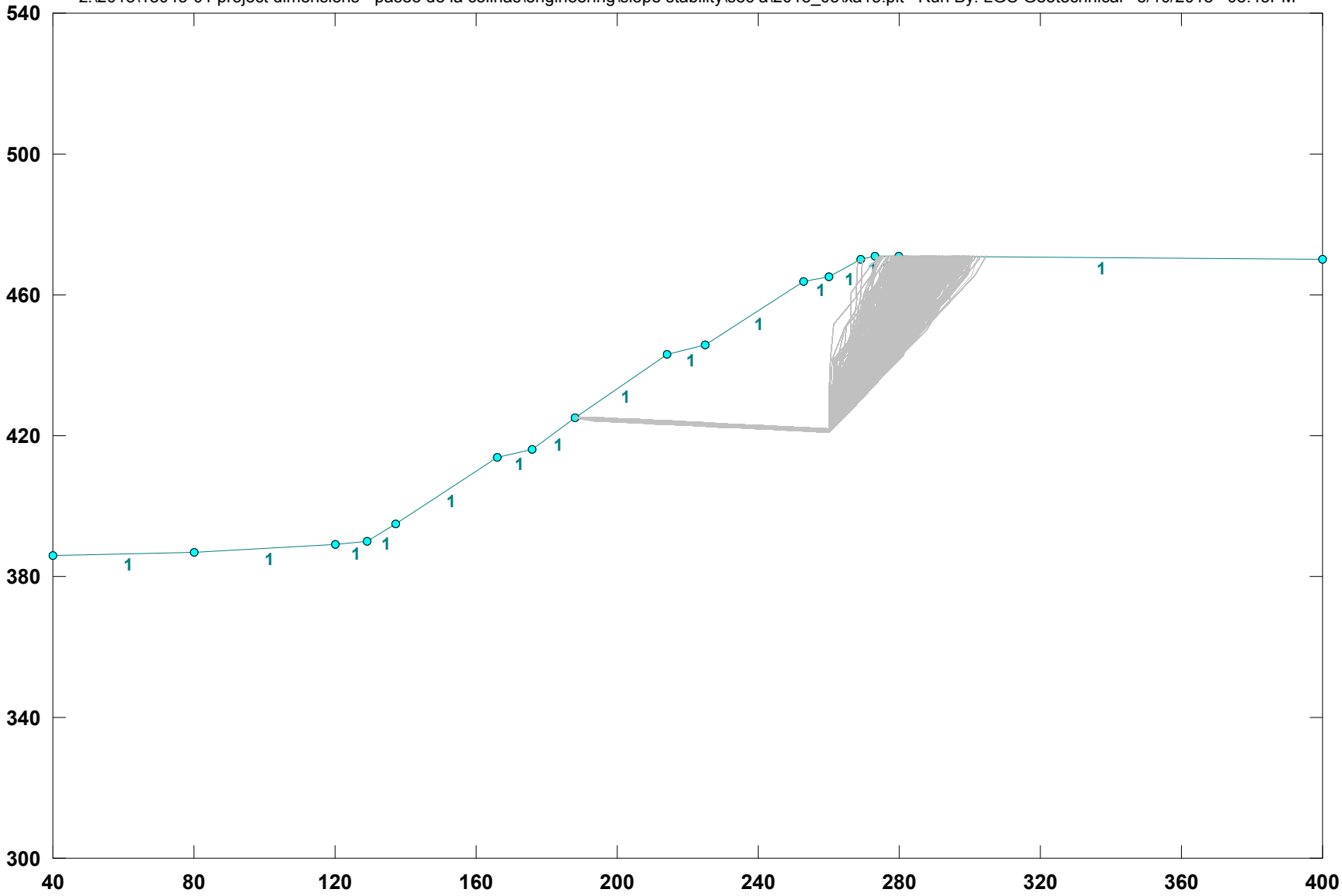


GSTABL7 v.2 FSmin=1.53

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Paseo de la Colinas 18045-01/ Sec A-A' / Along Clay - 30 ft Setback / Static

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec a\2018_05\xa15.plt Run By: LGC Geotechnical 5/10/2018 03:45PM



***** GSTABL7 *****

** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
(All Rights Reserved-Unauthorized Use Prohibited)

****

SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/10/2018
Time of Run: 03:45PM
Run By: LGC Geotechnical
Input Data Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec A\2018_05\xa15.in
Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec A\2018_05\xa15.OUT
Unit System: English
Plotted Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec A\2018_05\xa15.PLT
PROBLEM DESCRIPTION: Paseo de la Colinas 18045-01/ Sec A-A'
/ Along Clay - 30 ft Setback / Static

BOUNDARY COORDINATES
15 Top Boundaries
15 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	386.00	80.00	387.00	1
2	80.00	387.00	120.00	389.00	1
3	120.00	389.00	129.00	390.00	1
4	129.00	390.00	137.00	395.00	1
5	137.00	395.00	166.00	414.00	1
6	166.00	414.00	176.00	416.00	1
7	176.00	416.00	188.00	425.00	1
8	188.00	425.00	214.00	443.00	1
9	214.00	443.00	225.00	446.00	1
10	225.00	446.00	253.00	464.00	1
11	253.00	464.00	260.00	465.00	1
12	260.00	465.00	269.00	470.00	1
13	269.00	470.00	273.00	471.00	1
14	273.00	471.00	280.00	471.00	1
15	280.00	471.00	400.00	470.00	1

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	26.0	0.00	0.0	1

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 1 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	-4.0	300.00	26.00
2	-1.0	0.00	18.00
3	90.0	300.00	26.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and

C equal to zero, with water weight in the tension crack.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
3 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 10.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	188.10	425.00	188.10	425.00	0.00
2	190.00	424.90	260.00	421.50	0.80
3	260.10	421.50	260.10	421.50	0.80

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 6.617 FS Min = 1.529 FS Ave = 1.831
Standard Deviation = 0.395 Coefficient of Variation = 21.60 %
Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.043	425.030
2	188.100	425.000
3	243.914	421.946
4	260.100	421.585
5	266.712	429.087
6	272.421	437.297
7	278.246	445.425
8	282.618	454.419
9	289.416	461.753
10	295.690	469.540
11	296.693	470.861

Factor of Safety
*** 1.529 ***
Individual data on the 17 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.1	0.2	0.0	0.0	0.	0.	0.0	0.0	0.0
2	25.9	31543.5	0.0	0.0	0.	0.	0.0	0.0	0.0
3	11.0	29174.8	0.0	0.0	0.	0.	0.0	0.0	0.0
4	18.9	70020.3	0.0	0.0	0.	0.	0.0	0.0	0.0
5	9.1	44560.1	0.0	0.0	0.	0.	0.0	0.0	0.0
6	7.0	37480.5	0.0	0.0	0.	0.	0.0	0.0	0.0
7	0.1	543.1	0.0	0.0	0.	0.	0.0	0.0	0.0
8	6.6	34347.1	0.0	0.0	0.	0.	0.0	0.0	0.0
9	2.3	11048.3	0.0	0.0	0.	0.	0.0	0.0	0.0
10	3.4	15220.7	0.0	0.0	0.	0.	0.0	0.0	0.0
11	0.6	2403.7	0.0	0.0	0.	0.	0.0	0.0	0.0
12	5.2	19170.0	0.0	0.0	0.	0.	0.0	0.0	0.0
13	1.8	5212.3	0.0	0.0	0.	0.	0.0	0.0	0.0
14	2.6	6303.0	0.0	0.0	0.	0.	0.0	0.0	0.0
15	6.8	10931.1	0.0	0.0	0.	0.	0.0	0.0	0.0
16	6.3	4116.9	0.0	0.0	0.	0.	0.0	0.0	0.0
17	1.0	83.3	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.043	425.030
2	188.100	425.000
3	243.914	421.946
4	260.100	421.585
5	266.712	429.087
6	272.421	437.297

7	278.246	445.425
8	282.618	454.419
9	289.416	461.753
10	295.690	469.540
11	296.693	470.861

Factor of Safety
*** 1.529 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.043	425.030
2	188.100	425.000
3	243.914	421.946
4	260.100	421.585
5	266.712	429.087
6	272.421	437.297
7	278.246	445.425
8	282.618	454.419
9	289.416	461.753
10	295.690	469.540
11	296.693	470.861

Factor of Safety
*** 1.529 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.043	425.030
2	188.100	425.000
3	243.914	421.946
4	260.100	421.585
5	266.712	429.087
6	272.421	437.297
7	278.246	445.425
8	282.618	454.419
9	289.416	461.753
10	295.690	469.540
11	296.693	470.861

Factor of Safety
*** 1.529 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.043	425.030
2	188.100	425.000
3	243.914	421.946
4	260.100	421.585
5	266.712	429.087
6	272.421	437.297
7	278.246	445.425
8	282.618	454.419
9	289.416	461.753
10	295.690	469.540
11	296.693	470.861

Factor of Safety
*** 1.529 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.043	425.030
2	188.100	425.000
3	243.914	421.946
4	260.100	421.585
5	266.712	429.087
6	272.421	437.297
7	278.246	445.425
8	282.618	454.419
9	289.416	461.753
10	295.690	469.540
11	296.693	470.861

Factor of Safety

*** 1.529 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.043	425.030
2	188.100	425.000
3	243.914	421.946
4	260.100	421.585
5	266.712	429.087
6	272.421	437.297
7	278.246	445.425
8	282.618	454.419
9	289.416	461.753
10	295.690	469.540
11	296.693	470.861

Factor of Safety
*** 1.529 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.043	425.030
2	188.100	425.000
3	243.914	421.946
4	260.100	421.585
5	266.712	429.087
6	272.421	437.297
7	278.246	445.425
8	282.618	454.419
9	289.416	461.753
10	295.690	469.540
11	296.693	470.861

Factor of Safety
*** 1.529 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.043	425.030
2	188.100	425.000
3	243.914	421.946
4	260.100	421.585
5	266.712	429.087
6	272.421	437.297
7	278.246	445.425
8	282.618	454.419
9	289.416	461.753
10	295.690	469.540
11	296.693	470.861

Factor of Safety
*** 1.529 ***

Failure Surface Specified By 11 Coordinate Points

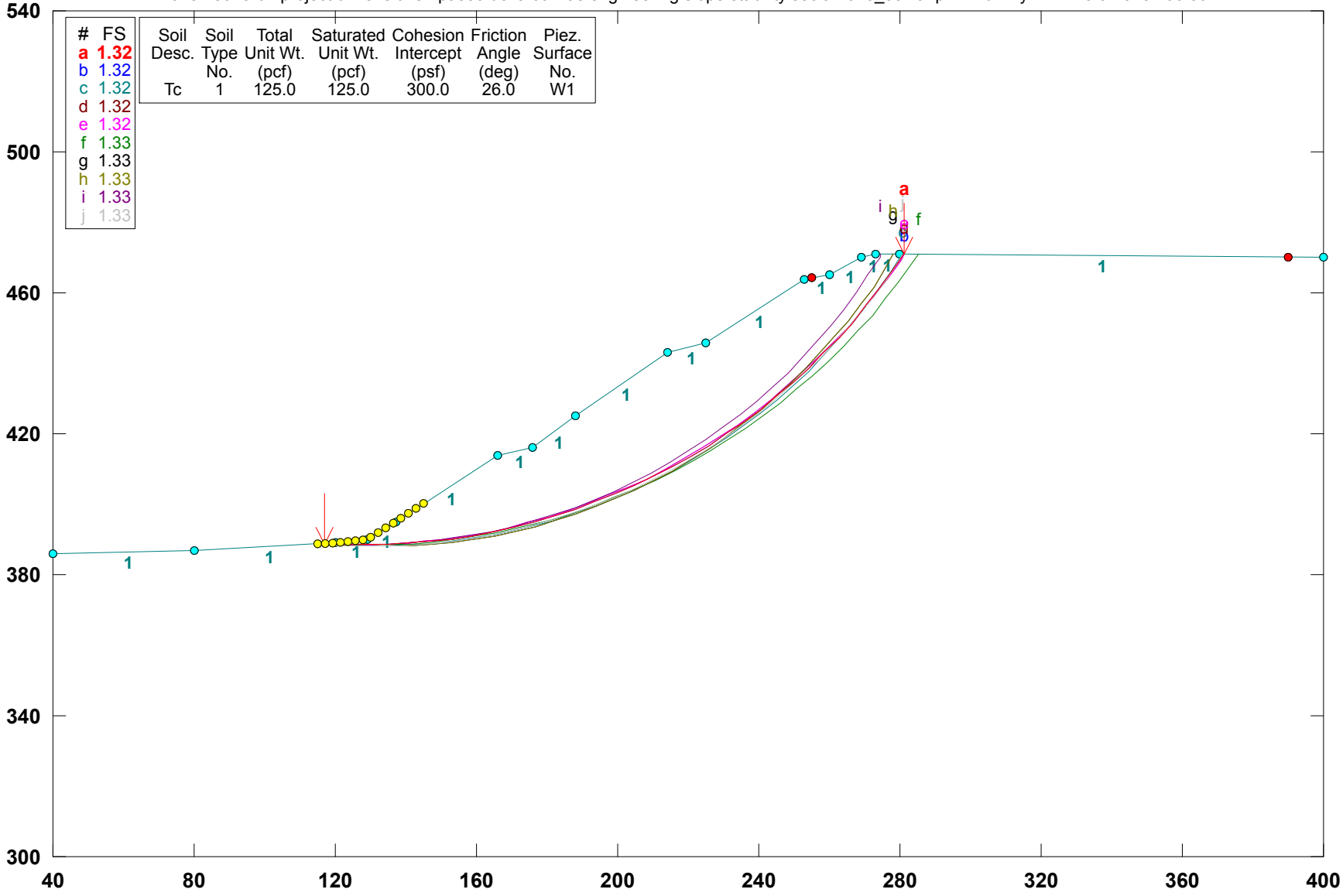
Point No.	X-Surf (ft)	Y-Surf (ft)
1	188.043	425.030
2	188.100	425.000
3	243.914	421.946
4	260.100	421.585
5	266.712	429.087
6	272.421	437.297
7	278.246	445.425
8	282.618	454.419
9	289.416	461.753
10	295.690	469.540
11	296.693	470.861

Factor of Safety
*** 1.529 ***

**** END OF GSTABL7 OUTPUT ****

Paseo de la Colinas 18045-01/ Sec A-A' / Rotational / Static

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec a\2018_05\xar.pl2 Run By: BTZ 5/9/2018 06:30PM



GSTABL7 v.2 FSmin=1.32

Safety Factors Are Calculated By The Modified Bishop Method

***** GSTABL7 *****

** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **

****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/9/2018
Time of Run: 06:30PM
Run By: BTZ
Input Data Filename: C:\Users\Bradley\Documents\Engineering\Slope Stability\Paseo de la Colinas\Sec A\xar.in
Output Filename: C:\Users\Bradley\Documents\Engineering\Slope Stability\Paseo de la Colinas\Sec A\xar.OUT
Unit System: English
Plotted Output Filename: C:\Users\Bradley\Documents\Engineering\Slope Stability\Paseo de la Colinas\Sec A\xar.PLT
PROBLEM DESCRIPTION: Paseo de la Colinas 18045-01/ Sec A-A'
/ Rotational / Static

BOUNDARY COORDINATES
15 Top Boundaries
15 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	386.00	80.00	387.00	1
2	80.00	387.00	120.00	389.00	1
3	120.00	389.00	129.00	390.00	1
4	129.00	390.00	137.00	395.00	1
5	137.00	395.00	166.00	414.00	1
6	166.00	414.00	176.00	416.00	1
7	176.00	416.00	188.00	425.00	1
8	188.00	425.00	214.00	443.00	1
9	214.00	443.00	225.00	446.00	1
10	225.00	446.00	253.00	464.00	1
11	253.00	464.00	260.00	465.00	1
12	260.00	465.00	269.00	470.00	1
13	269.00	470.00	273.00	471.00	1
14	273.00	471.00	280.00	471.00	1
15	280.00	471.00	400.00	470.00	1

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	26.0	0.00	0.0	1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
45000 Trial Surfaces Have Been Generated.
3000 Surface(s) Initiate(s) From Each Of 15 Points Equally Spaced
Along The Ground Surface Between X = 115.00(ft)
and X = 145.00(ft)
Each Surface Terminates Between X = 255.00(ft)
and X = 390.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)
6.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 0

Number of Trial Surfaces With Valid FS = 0
Statistical Data On All Valid FS Values:
FS Max = 0.000 FS Min = 500.000 FS Ave = NaN
Standard Deviation = 0.000 Coefficient of Variation = NaN %
Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.143	388.857
2	123.137	388.591
3	129.137	388.522
4	135.135	388.650
5	141.126	388.975
6	147.104	389.495
7	153.061	390.212
8	158.991	391.124
9	164.888	392.229
10	170.746	393.528
11	176.558	395.018
12	182.318	396.698
13	188.020	398.566
14	193.658	400.620
15	199.225	402.858
16	204.715	405.277
17	210.124	407.875
18	215.444	410.649
19	220.670	413.596
20	225.797	416.713
21	230.819	419.997
22	235.730	423.443
23	240.526	427.049
24	245.201	430.810
25	249.750	434.722
26	254.168	438.782
27	258.450	442.984
28	262.593	447.325
29	266.591	451.799
30	270.440	456.402
31	274.135	461.128
32	277.674	465.974
33	281.052	470.932
34	281.089	470.991

Circle Center At X = 128.243 ; Y = 571.393 ; and Radius = 182.874
Factor of Safety
*** 1.321 ***
Individual data on the 46 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	2.9	48.1	0.0	0.0	0.	0.	0.0	0.0	0.0
2	3.1	201.3	0.0	0.0	0.	0.	0.0	0.0	0.0
3	5.9	818.4	0.0	0.0	0.	0.	0.0	0.0	0.0
4	0.1	25.9	0.0	0.0	0.	0.	0.0	0.0	0.0
5	6.0	2529.8	0.0	0.0	0.	0.	0.0	0.0	0.0
6	1.9	1332.6	0.0	0.0	0.	0.	0.0	0.0	0.0
7	4.1	3862.9	0.0	0.0	0.	0.	0.0	0.0	0.0
8	6.0	7790.5	0.0	0.0	0.	0.	0.0	0.0	0.0
9	6.0	10214.5	0.0	0.0	0.	0.	0.0	0.0	0.0
10	5.9	12451.8	0.0	0.0	0.	0.	0.0	0.0	0.0
11	5.9	14494.9	0.0	0.0	0.	0.	0.0	0.0	0.0
12	1.1	2957.3	0.0	0.0	0.	0.	0.0	0.0	0.0
13	4.7	12739.2	0.0	0.0	0.	0.	0.0	0.0	0.0
14	5.3	13970.6	0.0	0.0	0.	0.	0.0	0.0	0.0
15	0.6	1483.6	0.0	0.0	0.	0.	0.0	0.0	0.0
16	5.8	16358.9	0.0	0.0	0.	0.	0.0	0.0	0.0
17	5.7	17926.4	0.0	0.0	0.	0.	0.0	0.0	0.0
18	0.0	66.3	0.0	0.0	0.	0.	0.0	0.0	0.0
19	5.6	19288.8	0.0	0.0	0.	0.	0.0	0.0	0.0
20	5.6	20253.6	0.0	0.0	0.	0.	0.0	0.0	0.0
21	5.5	21004.5	0.0	0.0	0.	0.	0.0	0.0	0.0

22	5.4	21544.2	0.0	0.0	0.	0.	0.0	0.0	0.0
23	3.9	15880.1	0.0	0.0	0.	0.	0.0	0.0	0.0
24	1.4	5941.7	0.0	0.0	0.	0.	0.0	0.0	0.0
25	5.2	20894.7	0.0	0.0	0.	0.	0.0	0.0	0.0
26	4.3	16506.2	0.0	0.0	0.	0.	0.0	0.0	0.0
27	0.8	2967.0	0.0	0.0	0.	0.	0.0	0.0	0.0
28	5.0	18688.4	0.0	0.0	0.	0.	0.0	0.0	0.0
29	4.9	18171.8	0.0	0.0	0.	0.	0.0	0.0	0.0
30	4.8	17500.3	0.0	0.0	0.	0.	0.0	0.0	0.0
31	4.7	16685.8	0.0	0.0	0.	0.	0.0	0.0	0.0
32	4.5	15740.6	0.0	0.0	0.	0.	0.0	0.0	0.0
33	3.3	10864.2	0.0	0.0	0.	0.	0.0	0.0	0.0
34	1.2	3771.6	0.0	0.0	0.	0.	0.0	0.0	0.0
35	4.3	12628.1	0.0	0.0	0.	0.	0.0	0.0	0.0
36	1.5	4085.8	0.0	0.0	0.	0.	0.0	0.0	0.0
37	2.6	6402.3	0.0	0.0	0.	0.	0.0	0.0	0.0
38	4.0	8989.7	0.0	0.0	0.	0.	0.0	0.0	0.0
39	2.4	4846.1	0.0	0.0	0.	0.	0.0	0.0	0.0
40	1.4	2634.2	0.0	0.0	0.	0.	0.0	0.0	0.0
41	2.6	4045.8	0.0	0.0	0.	0.	0.0	0.0	0.0
42	1.1	1504.1	0.0	0.0	0.	0.	0.0	0.0	0.0
43	3.5	3295.1	0.0	0.0	0.	0.	0.0	0.0	0.0
44	2.3	965.0	0.0	0.0	0.	0.	0.0	0.0	0.0
45	1.1	109.9	0.0	0.0	0.	0.	0.0	0.0	0.0
46	0.0	0.1	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.143	388.857
2	123.137	388.591
3	129.137	388.522
4	135.135	388.650
5	141.126	388.975
6	147.104	389.495
7	153.061	390.212
8	158.991	391.124
9	164.888	392.229
10	170.746	393.528
11	176.558	395.018
12	182.318	396.698
13	188.020	398.566
14	193.658	400.620
15	199.225	402.858
16	204.715	405.277
17	210.124	407.875
18	215.444	410.649
19	220.670	413.596
20	225.797	416.713
21	230.819	419.997
22	235.730	423.443
23	240.526	427.049
24	245.201	430.810
25	249.750	434.722
26	254.168	438.782
27	258.450	442.984
28	262.593	447.325
29	266.591	451.799
30	270.440	456.402
31	274.135	461.128
32	277.674	465.974
33	281.052	470.932
34	281.089	470.991

Circle Center At X = 128.243 ; Y = 571.393 ; and Radius = 182.874

Factor of Safety

*** 1.321 ***

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.143	388.857
2	123.129	388.444

3	129.125	388.238
4	135.125	388.237
5	141.122	388.443
6	147.107	388.854
7	153.076	389.471
8	159.019	390.293
9	164.931	391.319
10	170.804	392.547
11	176.631	393.976
12	182.406	395.605
13	188.121	397.431
14	193.770	399.453
15	199.347	401.668
16	204.844	404.072
17	210.255	406.665
18	215.573	409.442
19	220.794	412.400
20	225.909	415.535
21	230.914	418.845
22	235.802	422.324
23	240.567	425.970
24	245.205	429.777
25	249.708	433.741
26	254.073	437.858
27	258.294	442.122
28	262.366	446.529
29	266.284	451.073
30	270.043	455.750
31	273.640	460.552
32	277.069	465.476
33	280.327	470.514
34	280.616	470.995

Circle Center At X = 132.147 ; Y = 562.739 ; and Radius = 174.528

Factor of Safety

*** 1.324 ***

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	115.000	388.750
2	120.994	388.484
3	126.994	388.411
4	132.992	388.531
5	138.984	388.843
6	144.963	389.347
7	150.923	390.044
8	156.857	390.931
9	162.759	392.009
10	168.624	393.275
11	174.445	394.730
12	180.216	396.370
13	185.932	398.195
14	191.586	400.203
15	197.173	402.392
16	202.686	404.758
17	208.121	407.301
18	213.471	410.017
19	218.731	412.903
20	223.896	415.957
21	228.960	419.175
22	233.918	422.554
23	238.765	426.091
24	243.495	429.781
25	248.105	433.622
26	252.589	437.608
27	256.943	441.737
28	261.162	446.003
29	265.241	450.403
30	269.177	454.932
31	272.966	459.584
32	276.603	464.356

33	280.085	469.242
34	281.248	470.990

Circle Center At X = 126.288 ; Y = 575.087 ; and Radius = 186.679

Factor of Safety

*** 1.324 ***

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	115.000	388.750
2	120.994	388.484
3	126.994	388.411
4	132.992	388.531
5	138.984	388.843
6	144.963	389.347
7	150.923	390.044
8	156.857	390.931
9	162.759	392.009
10	168.624	393.275
11	174.445	394.730
12	180.216	396.370
13	185.932	398.195
14	191.586	400.203
15	197.173	402.392
16	202.686	404.758
17	208.121	407.301
18	213.471	410.017
19	218.731	412.903
20	223.896	415.957
21	228.960	419.175
22	233.918	422.554
23	238.765	426.091
24	243.495	429.781
25	248.105	433.622
26	252.589	437.608
27	256.943	441.737
28	261.162	446.003
29	265.241	450.403
30	269.177	454.932
31	272.966	459.584
32	276.603	464.356
33	280.085	469.242
34	281.248	470.990

Circle Center At X = 126.288 ; Y = 575.087 ; and Radius = 186.679

Factor of Safety

*** 1.324 ***

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.143	388.857
2	123.136	388.561
3	129.135	388.455
4	135.134	388.541
5	141.128	388.817
6	147.109	389.285
7	153.073	389.942
8	159.013	390.788
9	164.923	391.824
10	170.797	393.047
11	176.629	394.456
12	182.414	396.050
13	188.145	397.828
14	193.816	399.787
15	199.422	401.925
16	204.957	404.241
17	210.415	406.732
18	215.792	409.395
19	221.081	412.228
20	226.277	415.228
21	231.375	418.392
22	236.370	421.716

23	241.256	425.198
24	246.030	428.833
25	250.685	432.619
26	255.217	436.551
27	259.622	440.625
28	263.894	444.837
29	268.031	449.183
30	272.027	453.659
31	275.879	458.259
32	279.582	462.980
33	283.134	467.816
34	285.289	470.956

Circle Center At X = 129.463 ; Y = 576.864 ; and Radius = 188.410

Factor of Safety

*** 1.325 ***

Failure Surface Specified By 33 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.143	388.857
2	123.124	388.387
3	129.119	388.130
4	135.119	388.088
5	141.116	388.259
6	147.104	388.644
7	153.074	389.243
8	159.019	390.054
9	164.931	391.076
10	170.803	392.309
11	176.627	393.750
12	182.397	395.399
13	188.103	397.252
14	193.740	399.307
15	199.300	401.562
16	204.777	404.014
17	210.162	406.660
18	215.449	409.496
19	220.632	412.519
20	225.704	415.724
21	230.658	419.109
22	235.488	422.668
23	240.189	426.398
24	244.753	430.292
25	249.175	434.347
26	253.450	438.557
27	257.573	442.917
28	261.537	447.421
29	265.338	452.063
30	268.970	456.838
31	272.431	461.740
32	275.714	466.762
33	278.274	471.000

Circle Center At X = 133.315 ; Y = 556.274 ; and Radius = 168.196

Factor of Safety

*** 1.326 ***

Failure Surface Specified By 33 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.143	388.857
2	123.124	388.387
3	129.119	388.130
4	135.119	388.088
5	141.116	388.259
6	147.104	388.644
7	153.074	389.243
8	159.019	390.054
9	164.931	391.076
10	170.803	392.309
11	176.627	393.750
12	182.397	395.399
13	188.103	397.252

14	193.740	399.307
15	199.300	401.562
16	204.777	404.014
17	210.162	406.660
18	215.449	409.496
19	220.632	412.519
20	225.704	415.724
21	230.658	419.109
22	235.488	422.668
23	240.189	426.398
24	244.753	430.292
25	249.175	434.347
26	253.450	438.557
27	257.573	442.917
28	261.537	447.421
29	265.338	452.063
30	268.970	456.838
31	272.431	461.740
32	275.714	466.762
33	278.274	471.000

Circle Center At X = 133.315 ; Y = 556.274 ; and Radius = 168.196

Factor of Safety

*** 1.326 ***

Failure Surface Specified By 33 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	117.143	388.857
2	123.136	388.563
3	129.135	388.480
4	135.134	388.607
5	141.124	388.946
6	147.099	389.494
7	153.051	390.253
8	158.972	391.220
9	164.856	392.394
10	170.695	393.775
11	176.482	395.360
12	182.210	397.147
13	187.871	399.135
14	193.459	401.320
15	198.967	403.700
16	204.387	406.273
17	209.714	409.034
18	214.940	411.981
19	220.060	415.110
20	225.067	418.416
21	229.954	421.897
22	234.716	425.547
23	239.346	429.363
24	243.840	433.339
25	248.191	437.470
26	252.394	441.751
27	256.445	446.178
28	260.337	450.744
29	264.066	455.445
30	267.628	460.273
31	271.018	465.224
32	274.231	470.291
33	274.647	471.000

Circle Center At X = 128.506 ; Y = 559.169 ; and Radius = 170.691

Factor of Safety

*** 1.326 ***

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	115.000	388.750
2	120.986	388.337
3	126.982	388.126
4	132.982	388.117
5	138.979	388.311

6	144.966	388.705
7	150.936	389.302
8	156.883	390.099
9	162.800	391.095
10	168.679	392.291
11	174.516	393.684
12	180.301	395.272
13	186.031	397.054
14	191.697	399.029
15	197.293	401.193
16	202.813	403.544
17	208.251	406.079
18	213.600	408.797
19	218.855	411.692
20	224.009	414.764
21	229.058	418.007
22	233.994	421.418
23	238.812	424.993
24	243.507	428.729
25	248.074	432.620
26	252.507	436.663
27	256.802	440.853
28	260.953	445.186
29	264.956	449.655
30	268.806	454.257
31	272.499	458.986
32	276.030	463.837
33	279.396	468.803
34	280.775	470.994

Circle Center At X = 130.263 ; Y = 566.181 ; and Radius = 178.087

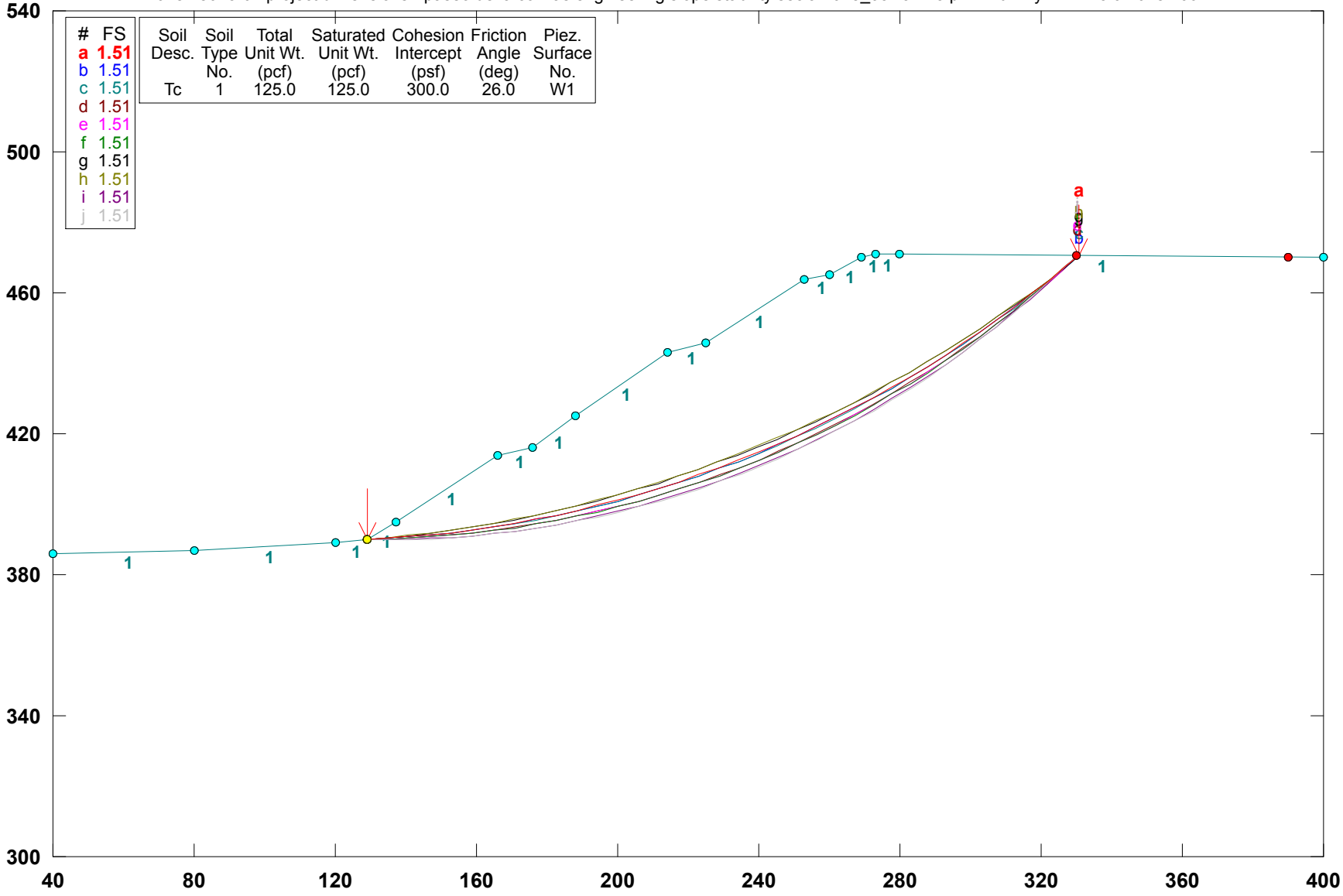
Factor of Safety

*** 1.326 ***

**** END OF GSTABL7 OUTPUT ****

Paseo de la Colinas 18045-01/ Sec A-A' / Rotational / 60 ft Setback / Static

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec a\2018_05\xarx15.pl2 Run By: BTZ 5/9/2018 06:44PM



GSTABL7 v.2 FSmin=1.51

Safety Factors Are Calculated By The Modified Bishop Method

***** GSTABL7 *****

** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **

****

SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/9/2018
Time of Run: 06:44PM
Run By: BTZ
Input Data Filename: C:\Users\Bradley\Documents\Engineering\Slope Stability\Paseo de la Colinas\Sec A\xarx15.in
Output Filename: C:\Users\Bradley\Documents\Engineering\Slope Stability\Paseo de la Colinas\Sec A\xarx15.OUT
Unit System: English
Plotted Output Filename: C:\Users\Bradley\Documents\Engineering\Slope Stability\Paseo de la Colinas\Sec A\xarx15.PLT
PROBLEM DESCRIPTION: Paseo de la Colinas 18045-01/ Sec A-A'
/ Rotational / 60 ft Setback / Static

BOUNDARY COORDINATES
15 Top Boundaries
15 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	386.00	80.00	387.00	1
2	80.00	387.00	120.00	389.00	1
3	120.00	389.00	129.00	390.00	1
4	129.00	390.00	137.00	395.00	1
5	137.00	395.00	166.00	414.00	1
6	166.00	414.00	176.00	416.00	1
7	176.00	416.00	188.00	425.00	1
8	188.00	425.00	214.00	443.00	1
9	214.00	443.00	225.00	446.00	1
10	225.00	446.00	253.00	464.00	1
11	253.00	464.00	260.00	465.00	1
12	260.00	465.00	269.00	470.00	1
13	269.00	470.00	273.00	471.00	1
14	273.00	471.00	280.00	471.00	1
15	280.00	471.00	400.00	470.00	1

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	26.0	0.00	0.0	1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
45000 Trial Surfaces Have Been Generated.
3000 Surface(s) Initiate(s) From Each Of 15 Points Equally Spaced Along The Ground Surface Between X = 129.00(ft)
and X = 129.00(ft)
Each Surface Terminates Between X = 330.00(ft)
and X = 390.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00(ft)
6.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 0

Number of Trial Surfaces With Valid FS = 0
Statistical Data On All Valid FS Values:
FS Max = 0.000 FS Min = 500.000 FS Ave = NaN
Standard Deviation = 0.000 Coefficient of Variation = NaN %

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.990	390.345
3	140.973	390.797
4	146.947	391.357
5	152.910	392.025
6	158.859	392.800
7	164.794	393.681
8	170.712	394.670
9	176.611	395.765
10	182.490	396.966
11	188.346	398.272
12	194.178	399.684
13	199.983	401.200
14	205.760	402.821
15	211.507	404.545
16	217.222	406.372
17	222.903	408.302
18	228.548	410.334
19	234.156	412.468
20	239.725	414.702
21	245.252	417.035
22	250.737	419.468
23	256.177	422.000
24	261.570	424.628
25	266.916	427.354
26	272.211	430.175
27	277.455	433.091
28	282.645	436.101
29	287.781	439.204
30	292.859	442.398
31	297.880	445.684
32	302.840	449.060
33	307.739	452.524
34	312.575	456.076
35	317.346	459.714
36	322.050	463.438
37	326.687	467.246
38	330.600	470.578

Circle Center At X = 112.857 ; Y = 722.871 ; and Radius = 333.262
Factor of Safety
*** 1.506 ***
Individual data on the 0 slices

Slice No.	Width (ft)	Weight (lbs)	Water Top Force (lbs)	Water Bot Force (lbs)	Tie Norm Force (lbs)	Tie Tan Force (lbs)	Earthquake Hor Force (lbs)	Earthquake Ver Force (lbs)	Surcharge Load (lbs)

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.991	390.323
3	140.976	390.755
4	146.951	391.296
5	152.916	391.946
6	158.868	392.704
7	164.805	393.570
8	170.726	394.544
9	176.627	395.626
10	182.508	396.814
11	188.367	398.110
12	194.201	399.512
13	200.008	401.019
14	205.787	402.633

15	211.536	404.351
16	217.253	406.173
17	222.935	408.099
18	228.581	410.128
19	234.190	412.260
20	239.759	414.493
21	245.286	416.827
22	250.770	419.261
23	256.209	421.795
24	261.601	424.427
25	266.944	427.157
26	272.236	429.984
27	277.477	432.906
28	282.663	435.923
29	287.793	439.035
30	292.866	442.239
31	297.880	445.534
32	302.833	448.921
33	307.724	452.397
34	312.550	455.961
35	317.311	459.612
36	322.005	463.350
37	326.630	467.172
38	330.601	470.578

Circle Center At X = 114.243 ; Y = 719.407 ; and Radius = 329.737

Factor of Safety

*** 1.506 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.992	390.315
3	140.977	390.739
4	146.953	391.273
5	152.918	391.915
6	158.871	392.667
7	164.809	393.527
8	170.731	394.495
9	176.633	395.572
10	182.515	396.756
11	188.375	398.047
12	194.209	399.445
13	200.018	400.949
14	205.798	402.560
15	211.547	404.275
16	217.264	406.096
17	222.947	408.020
18	228.594	410.048
19	234.203	412.179
20	239.772	414.412
21	245.299	416.746
22	250.783	419.181
23	256.222	421.716
24	261.613	424.349
25	266.955	427.081
26	272.246	429.910
27	277.485	432.835
28	282.669	435.855
29	287.798	438.969
30	292.869	442.176
31	297.880	445.476
32	302.830	448.867
33	307.717	452.347
34	312.540	455.916
35	317.297	459.573
36	321.987	463.316
37	326.607	467.144
38	330.602	470.578

Circle Center At X = 114.772 ; Y = 718.084 ; and Radius = 328.393

Factor of Safety

*** 1.506 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.999	390.129
3	140.993	390.378
4	146.982	390.747
5	152.962	391.235
6	158.931	391.842
7	164.887	392.568
8	170.827	393.413
9	176.750	394.377
10	182.651	395.458
11	188.530	396.657
12	194.384	397.973
13	200.211	399.406
14	206.007	400.955
15	211.772	402.619
16	217.502	404.398
17	223.196	406.291
18	228.850	408.297
19	234.464	410.415
20	240.034	412.646
21	245.559	414.987
22	251.035	417.437
23	256.462	419.997
24	261.836	422.664
25	267.156	425.439
26	272.420	428.318
27	277.625	431.303
28	282.770	434.390
29	287.852	437.580
30	292.869	440.870
31	297.820	444.260
32	302.702	447.748
33	307.513	451.333
34	312.252	455.013
35	316.916	458.787
36	321.504	462.654
37	326.015	466.611
38	330.361	470.580

Circle Center At X = 125.527 ; Y = 690.558 ; and Radius = 300.578

Factor of Safety

*** 1.507 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.999	390.121
3	140.994	390.363
4	146.983	390.724
5	152.964	391.205
6	158.934	391.806
7	164.890	392.527
8	170.831	393.366
9	176.754	394.325
10	182.657	395.401
11	188.536	396.596
12	194.391	397.909
13	200.218	399.338
14	206.016	400.884
15	211.781	402.546
16	217.512	404.323
17	223.206	406.214
18	228.861	408.219
19	234.475	410.337
20	240.045	412.567
21	245.570	414.908
22	251.046	417.359

23	256.472	419.919
24	261.846	422.588
25	267.166	425.364
26	272.428	428.245
27	277.632	431.232
28	282.775	434.322
29	287.855	437.515
30	292.871	440.808
31	297.819	444.202
32	302.698	447.694
33	307.506	451.283
34	312.242	454.967
35	316.902	458.746
36	321.486	462.617
37	325.992	466.579
38	330.362	470.580

Circle Center At X = 125.951 ; Y = 689.499 ; and Radius = 299.515

Factor of Safety

*** 1.507 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.999	390.115
3	140.994	390.351
4	146.984	390.707
5	152.965	391.183
6	158.935	391.780
7	164.892	392.496
8	170.834	393.332
9	176.757	394.286
10	182.660	395.360
11	188.541	396.552
12	194.396	397.861
13	200.224	399.289
14	206.022	400.832
15	211.788	402.492
16	217.519	404.268
17	223.214	406.158
18	228.869	408.162
19	234.483	410.279
20	240.053	412.509
21	245.578	414.850
22	251.054	417.301
23	256.480	419.862
24	261.853	422.532
25	267.172	425.309
26	272.434	428.192
27	277.637	431.180
28	282.779	434.272
29	287.858	437.467
30	292.871	440.763
31	297.818	444.159
32	302.695	447.654
33	307.501	451.246
34	312.234	454.933
35	316.892	458.715
36	321.473	462.590
37	325.975	466.556
38	330.362	470.580

Circle Center At X = 126.260 ; Y = 688.729 ; and Radius = 298.742

Factor of Safety

*** 1.508 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.979	390.506
3	140.948	391.110
4	146.907	391.813

5	152.853	392.614
6	158.785	393.513
7	164.702	394.510
8	170.601	395.604
9	176.482	396.796
10	182.342	398.084
11	188.180	399.470
12	193.994	400.951
13	199.783	402.528
14	205.545	404.201
15	211.279	405.968
16	216.983	407.830
17	222.655	409.786
18	228.294	411.835
19	233.899	413.977
20	239.467	416.211
21	244.998	418.537
22	250.490	420.954
23	255.941	423.461
24	261.350	426.058
25	266.715	428.744
26	272.035	431.518
27	277.309	434.379
28	282.535	437.327
29	287.711	440.361
30	292.837	443.480
31	297.910	446.684
32	302.930	449.970
33	307.895	453.339
34	312.803	456.790
35	317.654	460.321
36	322.446	463.932
37	327.178	467.621
38	330.842	470.576

Circle Center At X = 101.387 ; Y = 752.264 ; and Radius = 363.315

Factor of Safety

*** 1.508 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.977	390.521
3	140.945	391.139
4	146.903	391.855
5	152.847	392.669
6	158.778	393.579
7	164.692	394.587
8	170.590	395.692
9	176.468	396.893
10	182.327	398.189
11	188.163	399.582
12	193.975	401.070
13	199.763	402.653
14	205.523	404.331
15	211.256	406.103
16	216.959	407.968
17	222.630	409.926
18	228.268	411.978
19	233.873	414.121
20	239.441	416.355
21	244.972	418.681
22	250.464	421.096
23	255.916	423.602
24	261.326	426.196
25	266.693	428.879
26	272.016	431.649
27	277.292	434.505
28	282.521	437.448
29	287.700	440.476
30	292.830	443.589

31	297.908	446.785
32	302.933	450.063
33	307.903	453.424
34	312.818	456.865
35	317.676	460.387
36	322.476	463.987
37	327.216	467.666
38	330.841	470.576

Circle Center At X = 100.215 ; Y = 755.196 ; and Radius = 366.329

Factor of Safety

*** 1.508 ***

Failure Surface Specified By 39 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	135.000	389.959
3	140.999	390.047
4	146.995	390.264
5	152.985	390.609
6	158.967	391.084
7	164.936	391.687
8	170.891	392.418
9	176.830	393.277
10	182.748	394.263
11	188.644	395.377
12	194.514	396.617
13	200.357	397.983
14	206.168	399.474
15	211.947	401.090
16	217.689	402.830
17	223.392	404.693
18	229.054	406.678
19	234.673	408.784
20	240.244	411.011
21	245.766	413.357
22	251.237	415.821
23	256.654	418.402
24	262.013	421.099
25	267.314	423.911
26	272.552	426.836
27	277.727	429.873
28	282.835	433.021
29	287.874	436.277
30	292.842	439.641
31	297.737	443.112
32	302.556	446.686
33	307.297	450.364
34	311.957	454.143
35	316.536	458.020
36	321.030	461.996
37	325.437	466.067
38	329.756	470.232
39	330.104	470.582

Circle Center At X = 133.913 ; Y = 668.989 ; and Radius = 279.032

Factor of Safety

*** 1.510 ***

Failure Surface Specified By 39 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	135.000	389.939
3	140.999	390.008
4	146.996	390.207
5	152.987	390.536
6	158.969	390.995
7	164.941	391.583
8	170.897	392.301
9	176.837	393.147
10	182.758	394.122
11	188.655	395.225

12	194.528	396.456
13	200.372	397.814
14	206.186	399.298
15	211.966	400.908
16	217.709	402.643
17	223.414	404.501
18	229.077	406.483
19	234.696	408.588
20	240.268	410.813
21	245.791	413.159
22	251.261	415.624
23	256.677	418.207
24	262.035	420.907
25	267.333	423.722
26	272.570	426.652
27	277.741	429.694
28	282.845	432.848
29	287.880	436.111
30	292.843	439.483
31	297.732	442.962
32	302.544	446.546
33	307.277	450.233
34	311.929	454.022
35	316.498	457.911
36	320.982	461.898
37	325.378	465.981
38	329.685	470.159
39	330.103	470.582

Circle Center At X = 134.816 ; Y = 666.733 ; and Radius = 276.795

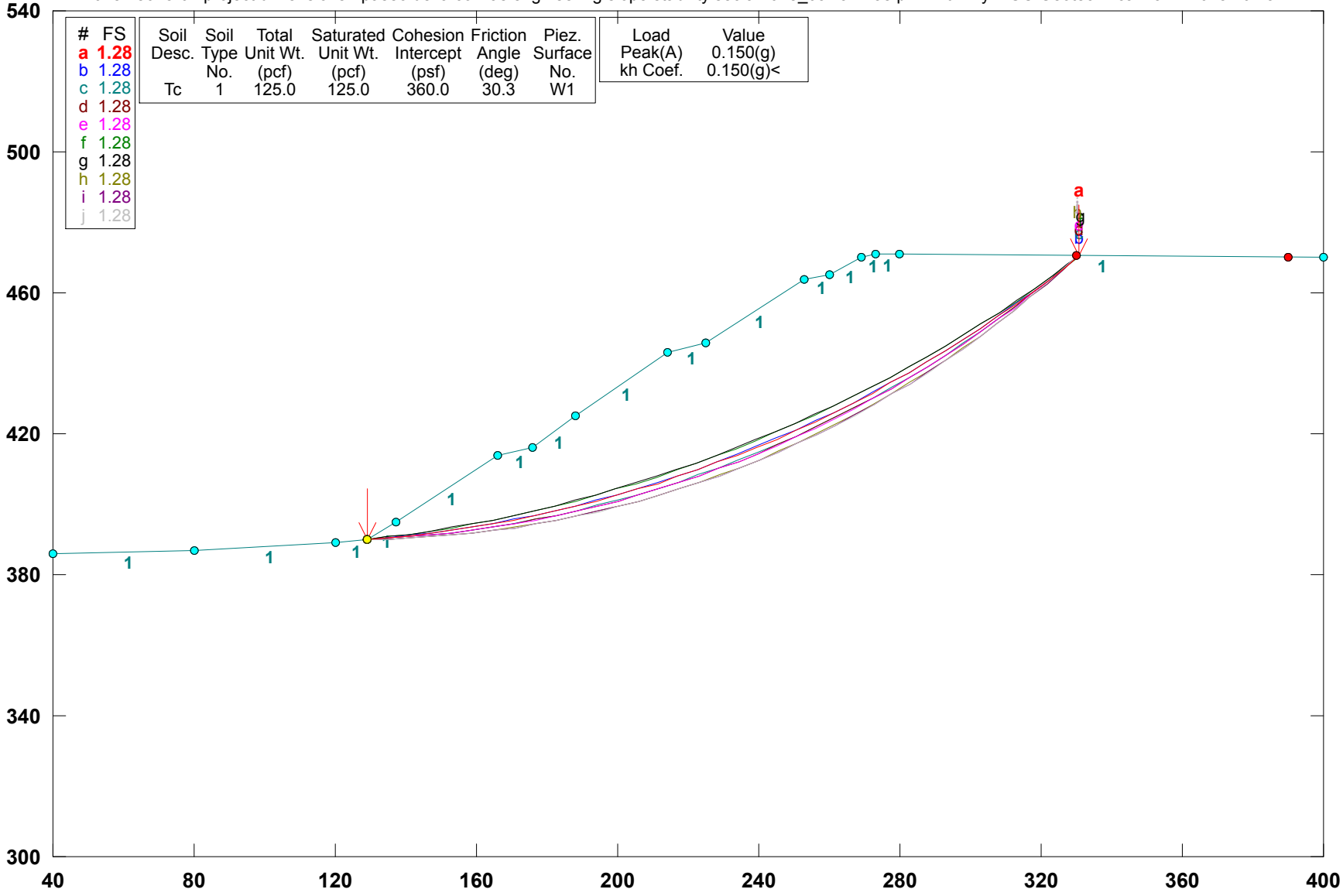
Factor of Safety

*** 1.511 ***

**** END OF GSTABL7 OUTPUT ****

Paseo de la Colinas 18045-01/ Sec A-A' / Rotational / 60 ft Setback / Seismic

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec a\2018_05\xarx15e.pl2 Run By: LGC Geotechnical 5/11/2018 02:54PM



GSTABL7 v.2 FSmin=1.28

Safety Factors Are Calculated By The Modified Bishop Method

***** GSTABL7 *****

** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **

****

SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/11/2018
Time of Run: 02:54PM
Run By: LGC Geotechnical
Input Data Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec A\2018_05\xarx15e.in
Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec A\2018_05\xarx15e.OUT
Unit System: English
Plotted Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec A\2018_05\xarx15e.PLT
PROBLEM DESCRIPTION: Paseo de la Colinas 18045-01/ Sec A-A'
/ Rotational / 60 ft Setback / Seismic
BOUNDARY COORDINATES
15 Top Boundaries
15 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	386.00	80.00	387.00	1
2	80.00	387.00	120.00	389.00	1
3	120.00	389.00	129.00	390.00	1
4	129.00	390.00	137.00	395.00	1
5	137.00	395.00	166.00	414.00	1
6	166.00	414.00	176.00	416.00	1
7	176.00	416.00	188.00	425.00	1
8	188.00	425.00	214.00	443.00	1
9	214.00	443.00	225.00	446.00	1
10	225.00	446.00	253.00	464.00	1
11	253.00	464.00	260.00	465.00	1
12	260.00	465.00	269.00	470.00	1
13	269.00	470.00	273.00	471.00	1
14	273.00	471.00	280.00	471.00	1
15	280.00	471.00	400.00	470.00	1

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	360.0	30.3	0.00	0.0	1

Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
45000 Trial Surfaces Have Been Generated.
3000 Surface(s) Initiate(s) From Each Of 15 Points Equally Spaced
Along The Ground Surface Between X = 129.00(ft)
and X = 129.00(ft)
Each Surface Terminates Between X = 330.00(ft)
and X = 390.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)
6.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial

Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 0
Number of Trial Surfaces With Valid FS = 0
Statistical Data On All Valid FS Values:
FS Max = 0.000 FS Min = 500.000 FS Ave = NaN
Standard Deviation = 0.000 Coefficient of Variation = NaN %
Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.979	390.506
3	140.948	391.110
4	146.907	391.813
5	152.853	392.614
6	158.785	393.513
7	164.702	394.510
8	170.601	395.604
9	176.482	396.796
10	182.342	398.084
11	188.180	399.470
12	193.994	400.951
13	199.783	402.528
14	205.545	404.201
15	211.279	405.968
16	216.983	407.830
17	222.655	409.786
18	228.294	411.835
19	233.899	413.977
20	239.467	416.211
21	244.998	418.537
22	250.490	420.954
23	255.941	423.461
24	261.350	426.058
25	266.715	428.744
26	272.035	431.518
27	277.309	434.379
28	282.535	437.327
29	287.711	440.361
30	292.837	443.480
31	297.910	446.684
32	302.930	449.970
33	307.895	453.339
34	312.803	456.790
35	317.654	460.321
36	322.446	463.932
37	327.178	467.621
38	330.842	470.576

Circle Center At X = 101.387 ; Y = 752.264 ; and Radius = 363.315
Factor of Safety
*** 1.275 ***
Individual data on the 0 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.977	390.521
3	140.945	391.139
4	146.903	391.855
5	152.847	392.669
6	158.778	393.579
7	164.692	394.587
8	170.590	395.692
9	176.468	396.893
10	182.327	398.189

11	188.163	399.582
12	193.975	401.070
13	199.763	402.653
14	205.523	404.331
15	211.256	406.103
16	216.959	407.968
17	222.630	409.926
18	228.268	411.978
19	233.873	414.121
20	239.441	416.355
21	244.972	418.681
22	250.464	421.096
23	255.916	423.602
24	261.326	426.196
25	266.693	428.879
26	272.016	431.649
27	277.292	434.505
28	282.521	437.448
29	287.700	440.476
30	292.830	443.589
31	297.908	446.785
32	302.933	450.063
33	307.903	453.424
34	312.818	456.865
35	317.676	460.387
36	322.476	463.987
37	327.216	467.666
38	330.841	470.576

Circle Center At X = 100.215 ; Y = 755.196 ; and Radius = 366.329

Factor of Safety

*** 1.275 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.990	390.345
3	140.973	390.797
4	146.947	391.357
5	152.910	392.025
6	158.859	392.800
7	164.794	393.681
8	170.712	394.670
9	176.611	395.765
10	182.490	396.966
11	188.346	398.272
12	194.178	399.684
13	199.983	401.200
14	205.760	402.821
15	211.507	404.545
16	217.222	406.372
17	222.903	408.302
18	228.548	410.334
19	234.156	412.468
20	239.725	414.702
21	245.252	417.035
22	250.737	419.468
23	256.177	422.000
24	261.570	424.628
25	266.916	427.354
26	272.211	430.175
27	277.455	433.091
28	282.645	436.101
29	287.781	439.204
30	292.859	442.398
31	297.880	445.684
32	302.840	449.060
33	307.739	452.524
34	312.575	456.076
35	317.346	459.714
36	322.050	463.438

37	326.687	467.246
38	330.600	470.578

Circle Center At X = 112.857 ; Y = 722.871 ; and Radius = 333.262

Factor of Safety

*** 1.275 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.991	390.323
3	140.976	390.755
4	146.951	391.296
5	152.916	391.946
6	158.868	392.704
7	164.805	393.570
8	170.726	394.544
9	176.627	395.626
10	182.508	396.814
11	188.367	398.110
12	194.201	399.512
13	200.008	401.019
14	205.787	402.633
15	211.536	404.351
16	217.253	406.173
17	222.935	408.099
18	228.581	410.128
19	234.190	412.260
20	239.759	414.493
21	245.286	416.827
22	250.770	419.261
23	256.209	421.795
24	261.601	424.427
25	266.944	427.157
26	272.236	429.984
27	277.477	432.906
28	282.663	435.923
29	287.793	439.035
30	292.866	442.239
31	297.880	445.534
32	302.833	448.921
33	307.724	452.397
34	312.550	455.961
35	317.311	459.612
36	322.005	463.350
37	326.630	467.172
38	330.601	470.578

Circle Center At X = 114.243 ; Y = 719.407 ; and Radius = 329.737

Factor of Safety

*** 1.275 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.992	390.315
3	140.977	390.739
4	146.953	391.273
5	152.918	391.915
6	158.871	392.667
7	164.809	393.527
8	170.731	394.495
9	176.633	395.572
10	182.515	396.756
11	188.375	398.047
12	194.209	399.445
13	200.018	400.949
14	205.798	402.560
15	211.547	404.275
16	217.264	406.096
17	222.947	408.020
18	228.594	410.048

19	234.203	412.179
20	239.772	414.412
21	245.299	416.746
22	250.783	419.181
23	256.222	421.716
24	261.613	424.349
25	266.955	427.081
26	272.246	429.910
27	277.485	432.835
28	282.669	435.855
29	287.798	438.969
30	292.869	442.176
31	297.880	445.476
32	302.830	448.867
33	307.717	452.347
34	312.540	455.916
35	317.297	459.573
36	321.987	463.316
37	326.607	467.144
38	330.602	470.578

Circle Center At X = 114.772 ; Y = 718.084 ; and Radius = 328.393

Factor of Safety

*** 1.276 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.958	390.706
3	140.906	391.499
4	146.841	392.379
5	152.762	393.345
6	158.669	394.399
7	164.560	395.539
8	170.433	396.765
9	176.288	398.077
10	182.123	399.474
11	187.937	400.957
12	193.729	402.525
13	199.496	404.178
14	205.240	405.915
15	210.957	407.735
16	216.646	409.640
17	222.308	411.627
18	227.939	413.697
19	233.540	415.850
20	239.108	418.084
21	244.643	420.400
22	250.144	422.796
23	255.609	425.273
24	261.037	427.829
25	266.427	430.465
26	271.778	433.180
27	277.089	435.972
28	282.358	438.842
29	287.584	441.789
30	292.767	444.812
31	297.905	447.911
32	302.997	451.085
33	308.042	454.332
34	313.038	457.654
35	317.986	461.048
36	322.883	464.515
37	327.729	468.052
38	331.080	470.574

Circle Center At X = 83.832 ; Y = 796.976 ; and Radius = 409.475

Factor of Safety

*** 1.278 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	129.000	390.000
2	134.956	390.721
3	140.902	391.529
4	146.835	392.423
5	152.754	393.402
6	158.659	394.468
7	164.548	395.619
8	170.419	396.855
9	176.272	398.177
10	182.104	399.583
11	187.916	401.073
12	193.706	402.648
13	199.472	404.307
14	205.214	406.049
15	210.929	407.874
16	216.618	409.782
17	222.278	411.772
18	227.909	413.844
19	233.509	415.997
20	239.078	418.232
21	244.613	420.547
22	250.114	422.942
23	255.580	425.417
24	261.010	427.970
25	266.402	430.603
26	271.755	433.313
27	277.068	436.100
28	282.340	438.964
29	287.570	441.905
30	292.757	444.921
31	297.900	448.012
32	302.997	451.177
33	308.048	454.416
34	313.051	457.727
35	318.006	461.111
36	322.911	464.567
37	327.765	468.093
38	331.079	470.574

Circle Center At X = 82.287 ; Y = 800.848 ; and Radius = 413.495

Factor of Safety

*** 1.278 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.999	390.129
3	140.993	390.378
4	146.982	390.747
5	152.962	391.235
6	158.931	391.842
7	164.887	392.568
8	170.827	393.413
9	176.750	394.377
10	182.651	395.458
11	188.530	396.657
12	194.384	397.973
13	200.211	399.406
14	206.007	400.955
15	211.772	402.619
16	217.502	404.398
17	223.196	406.291
18	228.850	408.297
19	234.464	410.415
20	240.034	412.646
21	245.559	414.987
22	251.035	417.437
23	256.462	419.997
24	261.836	422.664
25	267.156	425.439
26	272.420	428.318

27	277.625	431.303
28	282.770	434.390
29	287.852	437.580
30	292.869	440.870
31	297.820	444.260
32	302.702	447.748
33	307.513	451.333
34	312.252	455.013
35	316.916	458.787
36	321.504	462.654
37	326.015	466.611
38	330.361	470.580

Circle Center At X = 125.527 ; Y = 690.558 ; and Radius = 300.578

Factor of Safety

*** 1.278 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.999	390.121
3	140.994	390.363
4	146.983	390.724
5	152.964	391.205
6	158.934	391.806
7	164.890	392.527
8	170.831	393.366
9	176.754	394.325
10	182.657	395.401
11	188.536	396.596
12	194.391	397.909
13	200.218	399.338
14	206.016	400.884
15	211.781	402.546
16	217.512	404.323
17	223.206	406.214
18	228.861	408.219
19	234.475	410.337
20	240.045	412.567
21	245.570	414.908
22	251.046	417.359
23	256.472	419.919
24	261.846	422.588
25	267.166	425.364
26	272.428	428.245
27	277.632	431.232
28	282.775	434.322
29	287.855	437.515
30	292.871	440.808
31	297.819	444.202
32	302.698	447.694
33	307.506	451.283
34	312.242	454.967
35	316.902	458.746
36	321.486	462.617
37	325.992	466.579
38	330.362	470.580

Circle Center At X = 125.951 ; Y = 689.499 ; and Radius = 299.515

Factor of Safety

*** 1.279 ***

Failure Surface Specified By 38 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.000	390.000
2	134.999	390.115
3	140.994	390.351
4	146.984	390.707
5	152.965	391.183
6	158.935	391.780
7	164.892	392.496
8	170.834	393.332

9	176.757	394.286
10	182.660	395.360
11	188.541	396.552
12	194.396	397.861
13	200.224	399.289
14	206.022	400.832
15	211.788	402.492
16	217.519	404.268
17	223.214	406.158
18	228.869	408.162
19	234.483	410.279
20	240.053	412.509
21	245.578	414.850
22	251.054	417.301
23	256.480	419.862
24	261.853	422.532
25	267.172	425.309
26	272.434	428.192
27	277.637	431.180
28	282.779	434.272
29	287.858	437.467
30	292.871	440.763
31	297.818	444.159
32	302.695	447.654
33	307.501	451.246
34	312.234	454.933
35	316.892	458.715
36	321.473	462.590
37	325.975	466.556
38	330.362	470.580

Circle Center At X = 126.260 ; Y = 688.729 ; and Radius = 298.742

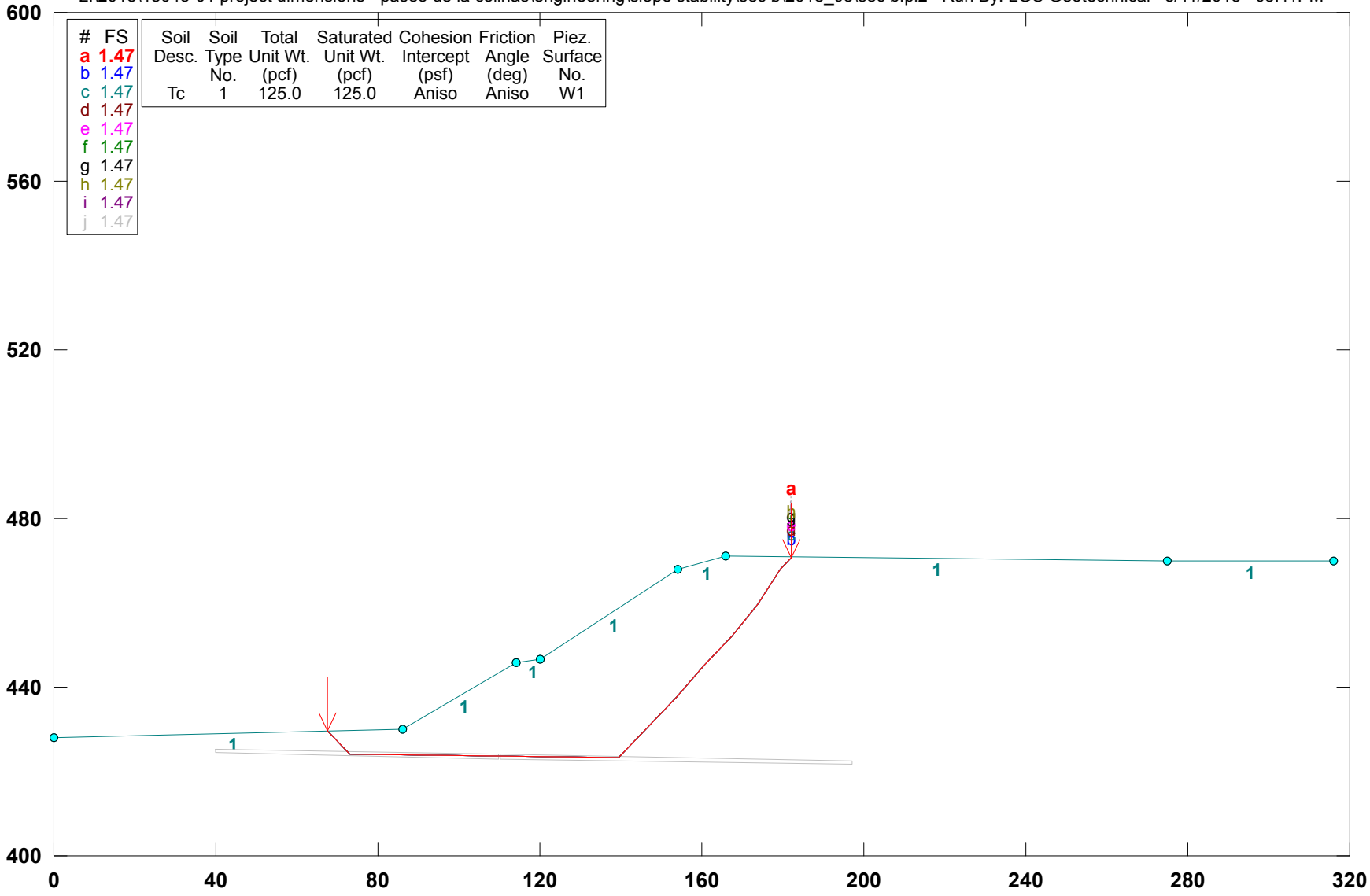
Factor of Safety

*** 1.279 ***

**** END OF GSTABL7 OUTPUT ****

Paseo de la Colinas 18045-01/ Sec B-B' / Along Clay Bed / Static

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec b\2018_05\sec b.pl2 Run By: LGC Geotechnical 5/11/2018 03:11PM

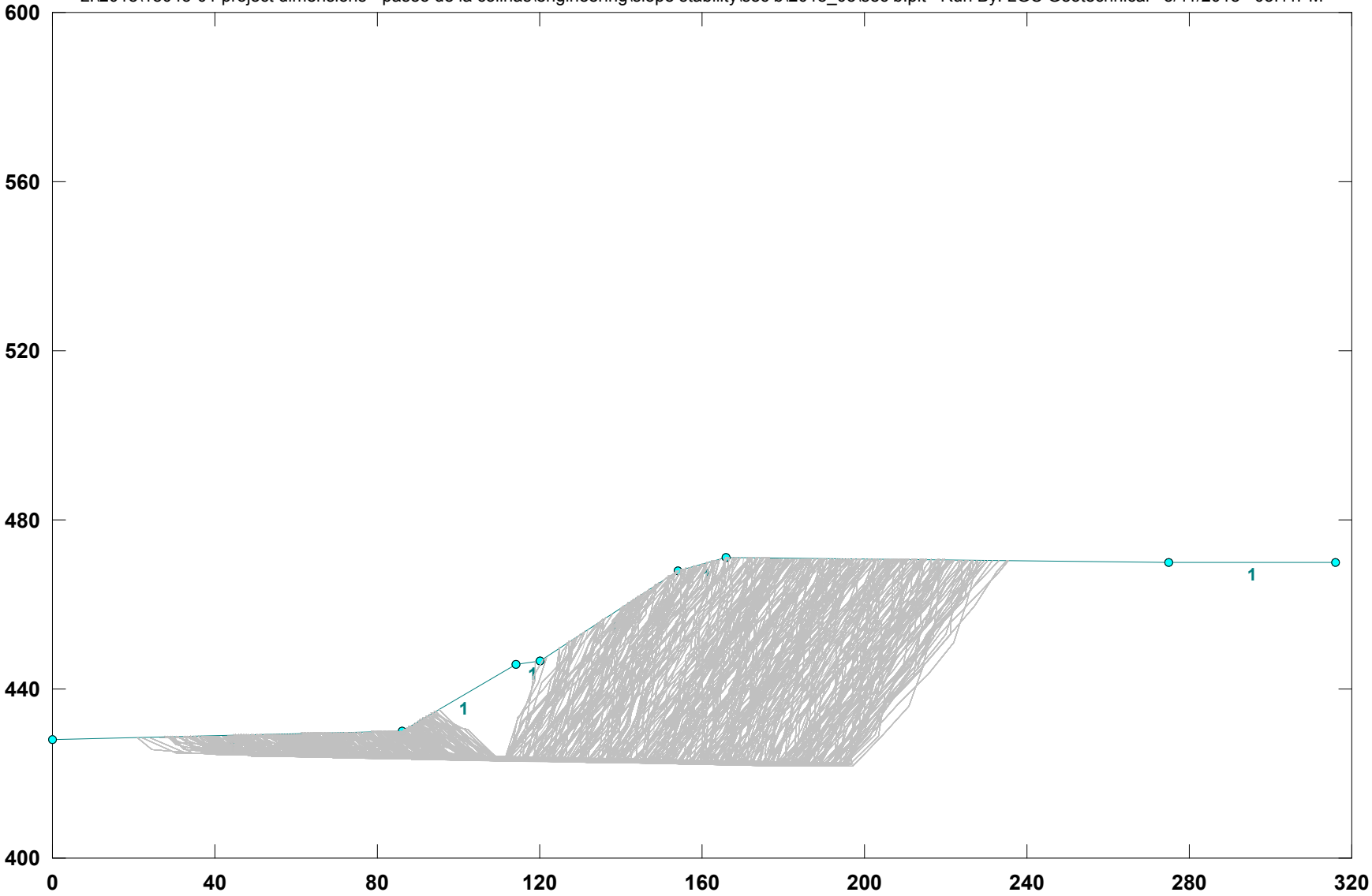


GSTABL7 v.2 FSmin=1.47

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Paseo de la Colinas 18045-01/ Sec B-B' / Along Clay Bed / Static

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec b\2018_05\sec b.plt Run By: LGC Geotechnical 5/11/2018 03:11PM



***** GSTABL7 *****

** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **

****

SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/11/2018
Time of Run: 03:11PM
Run By: LGC Geotechnical
Input Data Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec B\2018_05\sec b.in
Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec B\2018_05\sec b.OUT
Unit System: English
Plotted Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec B\2018_05\sec b.PLT
PROBLEM DESCRIPTION: Paseo de la Colinas 18045-01/ Sec B-B'
/ Along Clay Bed / Static

BOUNDARY COORDINATES
7 Top Boundaries
7 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	428.00	86.00	430.00	1
2	86.00	430.00	114.00	446.00	1
3	114.00	446.00	120.00	446.50	1
4	120.00	446.50	154.00	468.00	1
5	154.00	468.00	166.00	471.00	1
6	166.00	471.00	275.00	470.00	1
7	275.00	470.00	316.00	470.00	1

User Specified Y-Origin = 400.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	26.0	0.00	0.0	1

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 1 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	-2.0	300.00	26.00
2	0.0	0.00	18.00
3	90.0	300.00	26.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of

Sliding Block Is 10.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	40.00	424.70	110.00	423.50	0.80
2	110.10	423.50	197.00	422.00	0.80

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 4.424 FS Min = 1.465 FS Ave = 2.230
Standard Deviation = 0.493 Coefficient of Variation = 22.13 %
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.458	429.569
2	73.116	424.251
3	139.457	423.343
4	146.515	430.427
5	153.461	437.621
6	160.294	444.922
7	167.359	452.000
8	173.618	459.799
9	179.507	467.881
10	182.154	470.852

Factor of Safety
*** 1.465 ***

Individual data on the 14 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	5.7	1927.2	0.0	0.0	0.	0.	0.0	0.0	0.0
2	12.9	9159.9	0.0	0.0	0.	0.	0.0	0.0	0.0
3	28.0	49410.3	0.0	0.0	0.	0.	0.0	0.0	0.0
4	6.0	16950.0	0.0	0.0	0.	0.	0.0	0.0	0.0
5	19.5	70961.6	0.0	0.0	0.	0.	0.0	0.0	0.0
6	7.1	30126.8	0.0	0.0	0.	0.	0.0	0.0	0.0
7	6.9	27297.1	0.0	0.0	0.	0.	0.0	0.0	0.0
8	0.5	2016.1	0.0	0.0	0.	0.	0.0	0.0	0.0
9	6.3	21421.6	0.0	0.0	0.	0.	0.0	0.0	0.0
10	5.7	16052.2	0.0	0.0	0.	0.	0.0	0.0	0.0
11	1.4	3342.3	0.0	0.0	0.	0.	0.0	0.0	0.0
12	6.3	11782.2	0.0	0.0	0.	0.	0.0	0.0	0.0
13	5.9	5199.5	0.0	0.0	0.	0.	0.0	0.0	0.0
14	2.6	495.6	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.458	429.569
2	73.116	424.251
3	139.457	423.343
4	146.515	430.427
5	153.461	437.621
6	160.294	444.922
7	167.359	452.000
8	173.618	459.799
9	179.507	467.881
10	182.154	470.852

Factor of Safety
*** 1.465 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.458	429.569
2	73.116	424.251
3	139.457	423.343
4	146.515	430.427

5	153.461	437.621
6	160.294	444.922
7	167.359	452.000
8	173.618	459.799
9	179.507	467.881
10	182.154	470.852

Factor of Safety
*** 1.465 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.458	429.569
2	73.116	424.251
3	139.457	423.343
4	146.515	430.427
5	153.461	437.621
6	160.294	444.922
7	167.359	452.000
8	173.618	459.799
9	179.507	467.881
10	182.154	470.852

Factor of Safety
*** 1.465 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.458	429.569
2	73.116	424.251
3	139.457	423.343
4	146.515	430.427
5	153.461	437.621
6	160.294	444.922
7	167.359	452.000
8	173.618	459.799
9	179.507	467.881
10	182.154	470.852

Factor of Safety
*** 1.465 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.458	429.569
2	73.116	424.251
3	139.457	423.343
4	146.515	430.427
5	153.461	437.621
6	160.294	444.922
7	167.359	452.000
8	173.618	459.799
9	179.507	467.881
10	182.154	470.852

Factor of Safety
*** 1.465 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.458	429.569
2	73.116	424.251
3	139.457	423.343
4	146.515	430.427
5	153.461	437.621
6	160.294	444.922
7	167.359	452.000
8	173.618	459.799
9	179.507	467.881
10	182.154	470.852

Factor of Safety
*** 1.465 ***

Failure Surface Specified By 10 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	67.458	429.569
2	73.116	424.251
3	139.457	423.343
4	146.515	430.427
5	153.461	437.621
6	160.294	444.922
7	167.359	452.000
8	173.618	459.799
9	179.507	467.881
10	182.154	470.852

Factor of Safety
*** 1.465 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.458	429.569
2	73.116	424.251
3	139.457	423.343
4	146.515	430.427
5	153.461	437.621
6	160.294	444.922
7	167.359	452.000
8	173.618	459.799
9	179.507	467.881
10	182.154	470.852

Factor of Safety
*** 1.465 ***

Failure Surface Specified By 10 Coordinate Points

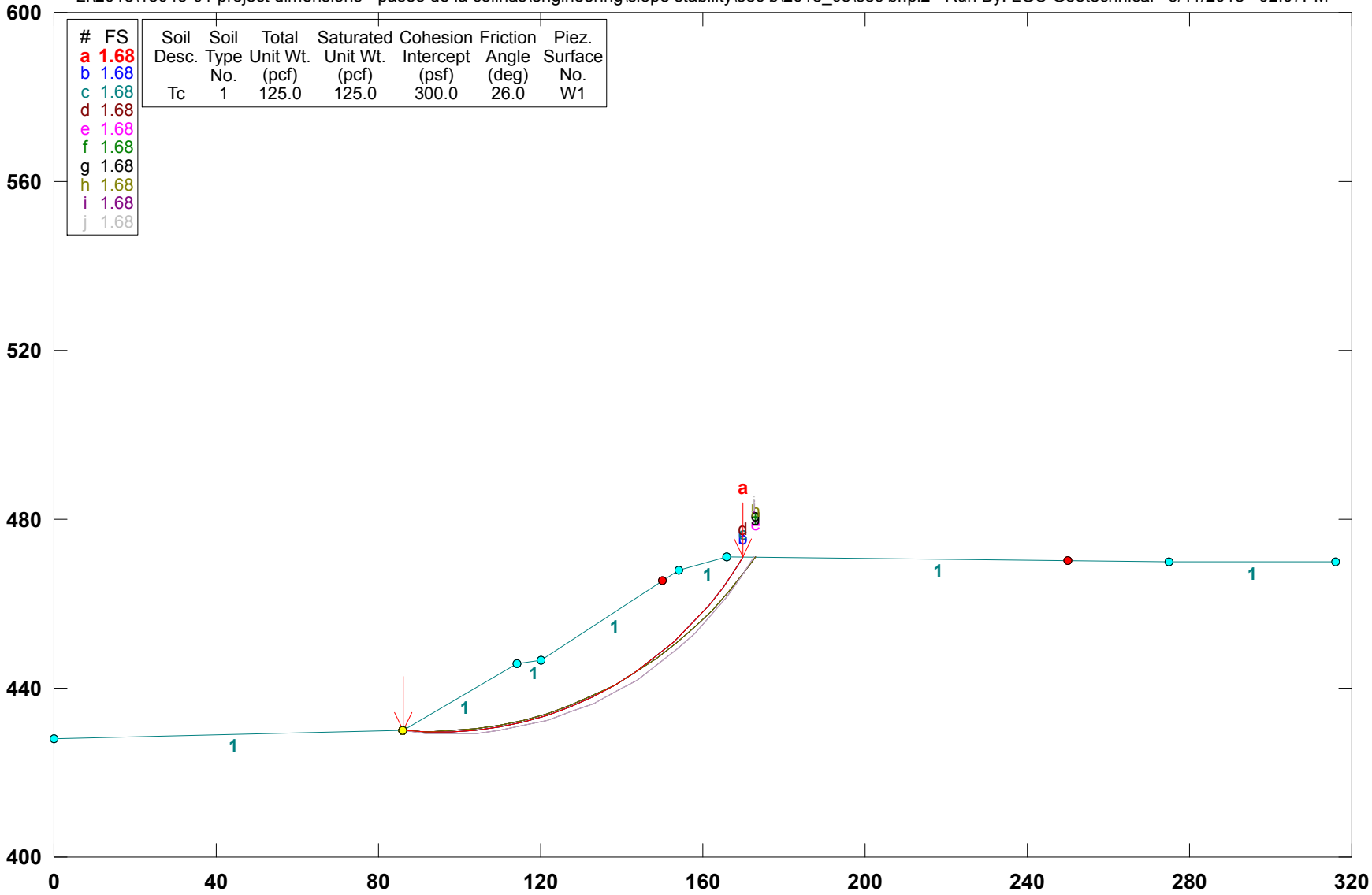
Point No.	X-Surf (ft)	Y-Surf (ft)
1	67.458	429.569
2	73.116	424.251
3	139.457	423.343
4	146.515	430.427
5	153.461	437.621
6	160.294	444.922
7	167.359	452.000
8	173.618	459.799
9	179.507	467.881
10	182.154	470.852

Factor of Safety
*** 1.465 ***

**** END OF GSTABL7 OUTPUT ****

Paseo de la Colinas 18045-01/ Sec B-B' / Rotational / Static

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec b\2018_05\sec br.pl2 Run By: LGC Geotechnical 5/11/2018 02:07PM



GSTABL7 v.2 FSmin=1.68

Safety Factors Are Calculated By The Modified Bishop Method

***** GSTABL7 *****

** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
(All Rights Reserved-Unauthorized Use Prohibited)

****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/11/2018
Time of Run: 02:07PM
Run By: LGC Geotechnical
Input Data Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec B\2018_05\sec br.in
Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec B\2018_05\sec br.OUT
Unit System: English
Plotted Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec B\2018_05\sec br.PLT
PROBLEM DESCRIPTION: Paseo de la Colinas 18045-01/ Sec B-B'
/ Rotational / Static

BOUNDARY COORDINATES
7 Top Boundaries
7 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	428.00	86.00	430.00	1
2	86.00	430.00	114.00	446.00	1
3	114.00	446.00	120.00	446.50	1
4	120.00	446.50	154.00	468.00	1
5	154.00	468.00	166.00	471.00	1
6	166.00	471.00	275.00	470.00	1
7	275.00	470.00	316.00	470.00	1

User Specified Y-Origin = 400.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	26.0	0.00	0.0	1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
20000 Trial Surfaces Have Been Generated.
1000 Surface(s) Initiate(s) From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 86.00(ft)
and X = 86.00(ft)
Each Surface Terminates Between X = 150.00(ft)
and X = 250.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)
6.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 0
Number of Trial Surfaces With Valid FS = 0
Statistical Data On All Valid FS Values:
FS Max = 0.000 FS Min = 500.000 FS Ave = NaN
Standard Deviation = 0.000 Coefficient of Variation = NaN %
Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000

2	91.987	429.610
3	97.987	429.623
4	103.973	430.040
5	109.917	430.860
6	115.792	432.077
7	121.572	433.688
8	127.230	435.684
9	132.741	438.056
10	138.080	440.794
11	143.222	443.885
12	148.145	447.315
13	152.826	451.069
14	157.243	455.129
15	161.377	459.478
16	165.209	464.095
17	168.721	468.960
18	169.972	470.964

Circle Center At X = 94.815 ; Y = 518.479 ; and Radius = 88.917
Factor of Safety
*** 1.677 ***

Individual data on the 21 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	6.0	1426.4	0.0	0.0	0.	0.	0.0	0.0	0.0
2	6.0	4139.5	0.0	0.0	0.	0.	0.0	0.0	0.0
3	6.0	6530.4	0.0	0.0	0.	0.	0.0	0.0	0.0
4	5.9	8557.8	0.0	0.0	0.	0.	0.0	0.0	0.0
5	4.1	6916.6	0.0	0.0	0.	0.	0.0	0.0	0.0
6	1.8	3176.4	0.0	0.0	0.	0.	0.0	0.0	0.0
7	4.2	7186.2	0.0	0.0	0.	0.	0.0	0.0	0.0
8	1.6	2657.4	0.0	0.0	0.	0.	0.0	0.0	0.0
9	5.7	10324.3	0.0	0.0	0.	0.	0.0	0.0	0.0
10	5.5	10984.0	0.0	0.0	0.	0.	0.0	0.0	0.0
11	5.3	11225.0	0.0	0.0	0.	0.	0.0	0.0	0.0
12	5.1	11068.9	0.0	0.0	0.	0.	0.0	0.0	0.0
13	4.9	10547.7	0.0	0.0	0.	0.	0.0	0.0	0.0
14	4.7	9703.9	0.0	0.0	0.	0.	0.0	0.0	0.0
15	1.2	2351.5	0.0	0.0	0.	0.	0.0	0.0	0.0
16	3.2	5986.1	0.0	0.0	0.	0.	0.0	0.0	0.0
17	4.1	6213.2	0.0	0.0	0.	0.	0.0	0.0	0.0
18	3.8	4088.9	0.0	0.0	0.	0.	0.0	0.0	0.0
19	0.8	618.9	0.0	0.0	0.	0.	0.0	0.0	0.0
20	2.7	1330.7	0.0	0.0	0.	0.	0.0	0.0	0.0
21	1.3	157.5	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000
2	91.987	429.610
3	97.987	429.623
4	103.973	430.040
5	109.917	430.860
6	115.792	432.077
7	121.572	433.688
8	127.230	435.684
9	132.741	438.056
10	138.080	440.794
11	143.222	443.885
12	148.145	447.315
13	152.826	451.069
14	157.243	455.129
15	161.377	459.478
16	165.209	464.095
17	168.721	468.960
18	169.972	470.964

Circle Center At X = 94.815 ; Y = 518.479 ; and Radius = 88.917
Factor of Safety
*** 1.677 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000
2	91.987	429.610
3	97.987	429.623
4	103.973	430.040
5	109.917	430.860
6	115.792	432.077
7	121.572	433.688
8	127.230	435.684
9	132.741	438.056
10	138.080	440.794
11	143.222	443.885
12	148.145	447.315
13	152.826	451.069
14	157.243	455.129
15	161.377	459.478
16	165.209	464.095
17	168.721	468.960
18	169.972	470.964

Circle Center At X = 94.815 ; Y = 518.479 ; and Radius = 88.917

Factor of Safety

*** 1.677 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000
2	91.987	429.610
3	97.987	429.623
4	103.973	430.040
5	109.917	430.860
6	115.792	432.077
7	121.572	433.688
8	127.230	435.684
9	132.741	438.056
10	138.080	440.794
11	143.222	443.885
12	148.145	447.315
13	152.826	451.069
14	157.243	455.129
15	161.377	459.478
16	165.209	464.095
17	168.721	468.960
18	169.972	470.964

Circle Center At X = 94.815 ; Y = 518.479 ; and Radius = 88.917

Factor of Safety

*** 1.677 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000
2	91.995	429.759
3	97.994	429.883
4	103.974	430.373
5	109.913	431.227
6	115.789	432.441
7	121.580	434.011
8	127.264	435.931
9	132.821	438.193
10	138.230	440.791
11	143.470	443.713
12	148.523	446.949
13	153.368	450.487
14	157.990	454.314
15	162.369	458.415
16	166.490	462.776
17	170.338	467.380
18	172.959	470.936

Circle Center At X = 92.976 ; Y = 528.011 ; and Radius = 98.259

Factor of Safety

*** 1.677 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000
2	91.995	429.759
3	97.994	429.883
4	103.974	430.373
5	109.913	431.227
6	115.789	432.441
7	121.580	434.011
8	127.264	435.931
9	132.821	438.193
10	138.230	440.791
11	143.470	443.713
12	148.523	446.949
13	153.368	450.487
14	157.990	454.314
15	162.369	458.415
16	166.490	462.776
17	170.338	467.380
18	172.959	470.936

Circle Center At X = 92.976 ; Y = 528.011 ; and Radius = 98.259

Factor of Safety

*** 1.677 ***

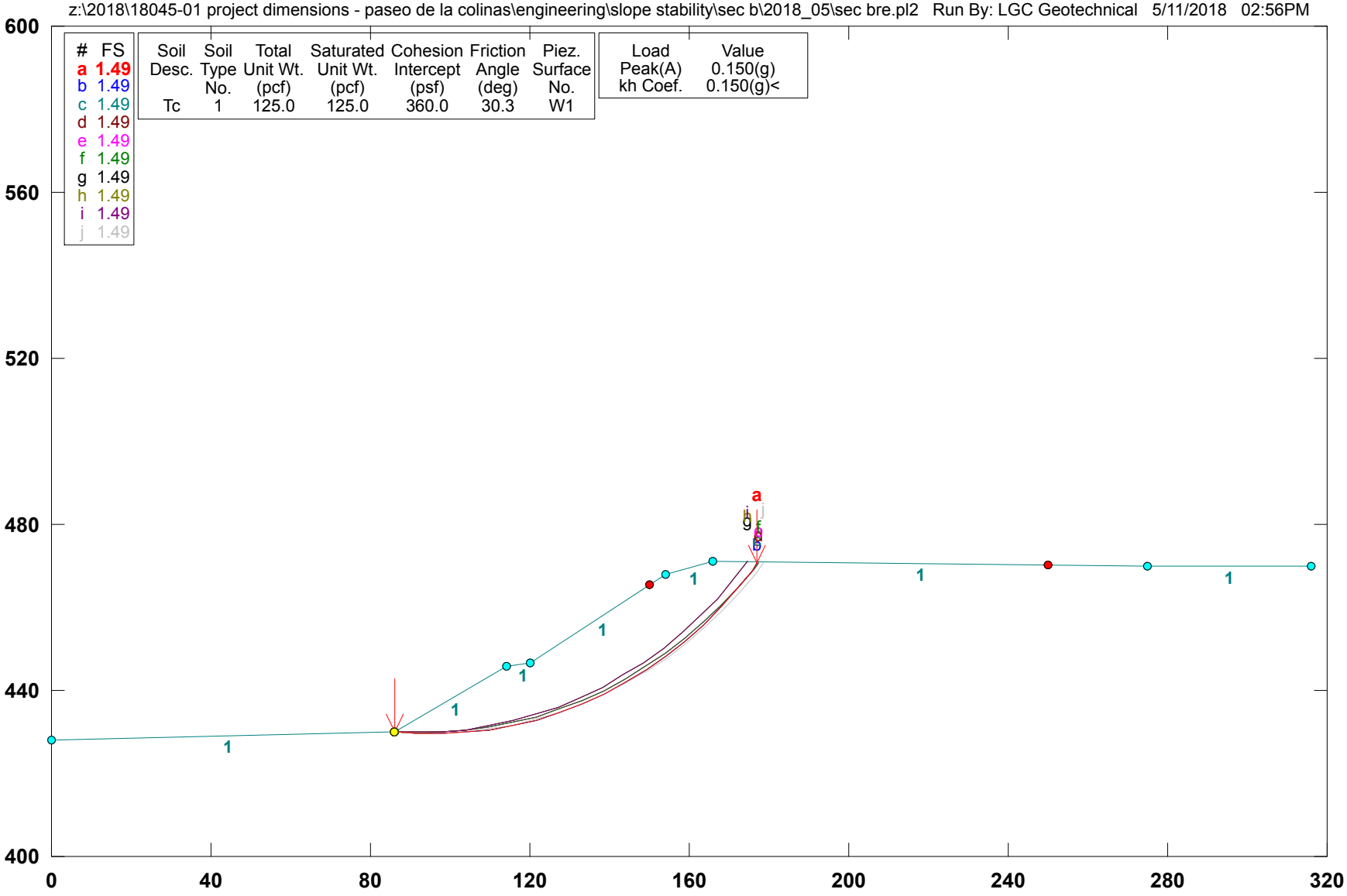
Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000
2	91.995	429.759
3	97.994	429.883
4	103.974	430.373
5	109.913	431.227
6	115.789	432.441
7	121.580	434.011
8	127.264	435.931
9	132.821	438.193
10	138.230	440.791
11	143.470	443.713
12	148.523	446.949
13	153.368	450.487
14	157.990	454.314
15	162.369	458.415
16	166.490	462.776
17	170.338	467.380

```
   18        172.959      470.936
Circle Center At X =    92.976 ; Y =   528.011 ; and Radius =    98.259
      Factor of Safety
      ***    1.677   ***
Failure Surface Specified By 18 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         86.000      430.000
    2         91.969      429.388
    3         97.965      429.187
    4        103.962      429.397
    5        109.930      430.017
    6        115.841      431.044
    7        121.668      432.474
    8        127.384      434.300
    9        132.961      436.513
   10        138.373      439.102
   11        143.595      442.057
   12        148.603      445.362
   13        153.372      449.002
   14        157.881      452.961
   15        162.108      457.219
   16        166.034      461.756
   17        169.639      466.552
   18        172.490      470.940
Circle Center At X =    97.914 ; Y =   516.660 ; and Radius =    87.475
      Factor of Safety
      ***    1.678   ***
Failure Surface Specified By 18 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         86.000      430.000
    2         91.969      429.388
    3         97.965      429.187
    4        103.962      429.397
    5        109.930      430.017
    6        115.841      431.044
    7        121.668      432.474
    8        127.384      434.300
    9        132.961      436.513
   10        138.373      439.102
   11        143.595      442.057
   12        148.603      445.362
   13        153.372      449.002
   14        157.881      452.961
   15        162.108      457.219
   16        166.034      461.756
   17        169.639      466.552
   18        172.490      470.940
Circle Center At X =    97.914 ; Y =   516.660 ; and Radius =    87.475
      Factor of Safety
      ***    1.678   ***
          **** END OF GSTABL7 OUTPUT ****
```

Paseo de la Colinas 18045-01/ Sec B-B' / Rotational / Seismic

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec b\2018_05\sec bre.pl2 Run By: LGC Geotechnical 5/11/2018 02:56PM



GSTABL7 v.2 FSmin=1.49

Safety Factors Are Calculated By The Modified Bishop Method

```
                              ***  GSTABL7  ***
                ** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
       ** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
                   (All Rights Reserved-Unauthorized Use Prohibited)
    ********************************************************************************
                         SLOPE STABILITY ANALYSIS SYSTEM
           Modified Bishop, Simplified Janbu, or GLE Method of Slices.
           (Includes Spencer & Morgenstern-Price Type Analysis)
           Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
           Nonlinear Undrained Shear Strength, Curved Phi Envelope,
           Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
           Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
    ********************************************************************************
    Analysis Run Date:        5/11/2018
    Time of Run:              02:56PM
    Run By:                   LGC Geotechnical
    Input Data Filename:      Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\En
gineering\Slope Stability\Sec B\2018_05\sec bre.in
    Output Filename:          Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\En
gineering\Slope Stability\Sec B\2018_05\sec bre.OUT
    Unit System:              English
    Plotted Output Filename:  Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\En
gineering\Slope Stability\Sec B\2018_05\sec bre.PLT
    PROBLEM DESCRIPTION:  Paseo de la Colinas 18045-01/ Sec B-B'
                          / Rotational / Seismic
    BOUNDARY COORDINATES
        7 Top   Boundaries
        7 Total Boundaries
    Boundary     X-Left     Y-Left    X-Right    Y-Right    Soil Type
       No.        (ft)       (ft)       (ft)       (ft)     Below Bnd
        1          0.00     428.00      86.00     430.00        1
        2         86.00     430.00     114.00     446.00        1
        3        114.00     446.00     120.00     446.50        1
        4        120.00     446.50     154.00     468.00        1
        5        154.00     468.00     166.00     471.00        1
        6        166.00     471.00     275.00     470.00        1
        7        275.00     470.00     316.00     470.00        1
    User Specified Y-Origin =       400.00(ft)
    Default X-Plus Value = 0.00(ft)
    Default Y-Plus Value = 0.00(ft)
   ISOTROPIC SOIL PARAMETERS
    1 Type(s) of Soil
    Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
    Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
     No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
      1   125.0    125.0     360.0     30.3    0.00       0.0      1
    Specified Peak Ground Acceleration Coefficient (A) =   0.150(g)
    Specified Horizontal Earthquake Coefficient (kh) =   0.150(g)
    Specified Vertical Earthquake Coefficient (kv) =   0.000(g)
    Specified Seismic Pore-Pressure Factor =   0.000
    A Critical Failure Surface Searching Method, Using A Random
    Technique For Generating Circular Surfaces, Has Been Specified.
   20000 Trial Surfaces Have Been Generated.
    1000 Surface(s) Initiate(s) From Each Of    20 Points Equally Spaced
    Along The Ground Surface Between  X =  86.00(ft)
                                 and  X =  86.00(ft)
    Each Surface Terminates Between   X = 150.00(ft)
                                 and   X = 250.00(ft)
    Unless Further Limitations Were Imposed, The Minimum Elevation
    At Which A Surface Extends Is  Y =      0.00(ft)
     6.00(ft) Line Segments Define Each Trial Failure Surface.
    Following Are Displayed The Ten Most Critical Of The Trial
          Failure Surfaces Evaluated. They Are
          Ordered - Most Critical First.
          * * Safety Factors Are Calculated By The Modified Bishop Method * *
          Total Number of Trial Surfaces Attempted =     0
          Number of Trial Surfaces With Valid FS =    0
          Statistical Data On All Valid FS Values:
             FS Max =   0.000   FS Min = 500.000   FS Ave =  NaN
             Standard Deviation =    0.000   Coefficient of Variation =  NaN    %
```



```
          Failure Surface Specified By 19 Coordinate Points
            Point      X-Surf      Y-Surf
             No.        (ft)        (ft)
              1         86.000      430.000
              2         91.987      429.607
              3         97.987      429.569
              4        103.979      429.888
              5        109.941      430.562
              6        115.852      431.588
              7        121.692      432.963
              8        127.441      434.683
              9        133.077      436.740
             10        138.581      439.128
             11        143.934      441.839
             12        149.117      444.862
             13        154.111      448.187
             14        158.899      451.803
             15        163.464      455.697
             16        167.790      459.855
             17        171.862      464.262
             18        175.665      468.902
             19        177.111      470.898
          Circle Center At X =    95.615 ; Y =   530.622 ; and Radius =   101.080
                Factor of Safety
               ***    1.488   ***
              Individual data on the     0  slices
                         Water  Water     Tie     Tie     Earthquake
                         Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
          Failure Surface Specified By 19 Coordinate Points
            Point      X-Surf      Y-Surf
             No.        (ft)        (ft)
              1         86.000      430.000
              2         91.987      429.607
              3         97.987      429.569
              4        103.979      429.888
              5        109.941      430.562
              6        115.852      431.588
              7        121.692      432.963
              8        127.441      434.683
              9        133.077      436.740
             10        138.581      439.128
             11        143.934      441.839
             12        149.117      444.862
             13        154.111      448.187
             14        158.899      451.803
             15        163.464      455.697
             16        167.790      459.855
             17        171.862      464.262
             18        175.665      468.902
             19        177.111      470.898
          Circle Center At X =    95.615 ; Y =   530.622 ; and Radius =   101.080
                Factor of Safety
               ***    1.488   ***
          Failure Surface Specified By 19 Coordinate Points
            Point      X-Surf      Y-Surf
             No.        (ft)        (ft)
              1         86.000      430.000
              2         91.987      429.607
              3         97.987      429.569
              4        103.979      429.888
              5        109.941      430.562
              6        115.852      431.588
              7        121.692      432.963
              8        127.441      434.683
              9        133.077      436.740
             10        138.581      439.128
             11        143.934      441.839
             12        149.117      444.862
```

13	154.111	448.187
14	158.899	451.803
15	163.464	455.697
16	167.790	459.855
17	171.862	464.262
18	175.665	468.902
19	177.111	470.898

Circle Center At X = 95.615 ; Y = 530.622 ; and Radius = 101.080

Factor of Safety

*** 1.488 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000
2	91.996	429.795
3	97.995	429.924
4	103.977	430.387
5	109.924	431.181
6	115.818	432.306
7	121.640	433.756
8	127.372	435.528
9	132.997	437.617
10	138.497	440.015
11	143.855	442.715
12	149.054	445.710
13	154.079	448.989
14	158.914	452.542
15	163.543	456.359
16	167.953	460.428
17	172.129	464.736
18	176.060	469.269
19	177.319	470.896

Circle Center At X = 92.679 ; Y = 537.588 ; and Radius = 107.795

Factor of Safety

*** 1.488 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000
2	91.996	429.795
3	97.995	429.924
4	103.977	430.387
5	109.924	431.181
6	115.818	432.306
7	121.640	433.756
8	127.372	435.528
9	132.997	437.617
10	138.497	440.015
11	143.855	442.715
12	149.054	445.710
13	154.079	448.989
14	158.914	452.542
15	163.543	456.359
16	167.953	460.428
17	172.129	464.736
18	176.060	469.269
19	177.319	470.896

Circle Center At X = 92.679 ; Y = 537.588 ; and Radius = 107.795

Factor of Safety

*** 1.488 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000
2	91.996	429.795
3	97.995	429.924
4	103.977	430.387
5	109.924	431.181
6	115.818	432.306
7	121.640	433.756

8	127.372	435.528
9	132.997	437.617
10	138.497	440.015
11	143.855	442.715
12	149.054	445.710
13	154.079	448.989
14	158.914	452.542
15	163.543	456.359
16	167.953	460.428
17	172.129	464.736
18	176.060	469.269
19	177.319	470.896

Circle Center At X = 92.679 ; Y = 537.588 ; and Radius = 107.795

Factor of Safety

*** 1.488 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000
2	91.998	429.834
3	97.995	430.016
4	103.972	430.544
5	109.908	431.417
6	115.783	432.632
7	121.579	434.185
8	127.275	436.071
9	132.852	438.283
10	138.292	440.814
11	143.577	443.656
12	148.688	446.798
13	153.609	450.231
14	158.323	453.943
15	162.815	457.921
16	167.068	462.152
17	171.070	466.623
18	174.492	470.922

Circle Center At X = 91.870 ; Y = 533.448 ; and Radius = 103.614

Factor of Safety

*** 1.489 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000
2	91.998	429.834
3	97.995	430.016
4	103.972	430.544
5	109.908	431.417
6	115.783	432.632
7	121.579	434.185
8	127.275	436.071
9	132.852	438.283
10	138.292	440.814
11	143.577	443.656
12	148.688	446.798
13	153.609	450.231
14	158.323	453.943
15	162.815	457.921
16	167.068	462.152
17	171.070	466.623
18	174.492	470.922

Circle Center At X = 91.870 ; Y = 533.448 ; and Radius = 103.614

Factor of Safety

*** 1.489 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000
2	91.998	429.834
3	97.995	430.016
4	103.972	430.544

5	109.908	431.417
6	115.783	432.632
7	121.579	434.185
8	127.275	436.071
9	132.852	438.283
10	138.292	440.814
11	143.577	443.656
12	148.688	446.798
13	153.609	450.231
14	158.323	453.943
15	162.815	457.921
16	167.068	462.152
17	171.070	466.623
18	174.492	470.922

Circle Center At X = 91.870 ; Y = 533.448 ; and Radius = 103.614

Factor of Safety

*** 1.489 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	430.000
2	91.992	429.681
3	97.991	429.700
4	103.981	430.058
5	109.940	430.753
6	115.851	431.783
7	121.695	433.144
8	127.452	434.833
9	133.105	436.844
10	138.636	439.170
11	144.027	441.804
12	149.260	444.738
13	154.320	447.963
14	159.190	451.468
15	163.855	455.242
16	168.299	459.273
17	172.509	463.548
18	176.471	468.053
19	178.690	470.884

Circle Center At X = 94.648 ; Y = 536.013 ; and Radius = 106.365

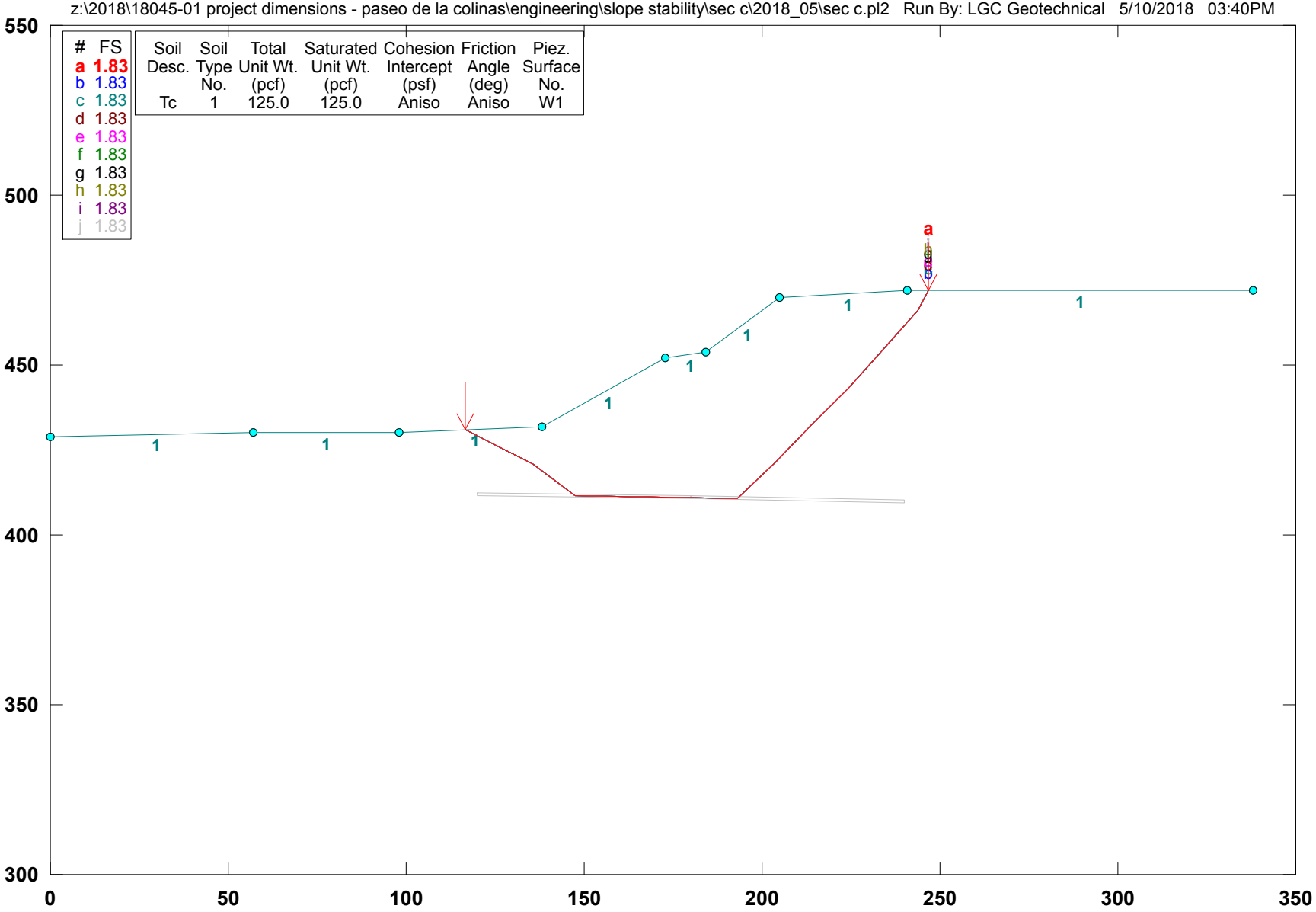
Factor of Safety

*** 1.489 ***

**** END OF GSTABL7 OUTPUT ****

Paseo de la Colinas 18045-01/ Sec C-C' / Along Clay Bed / Static

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec c\2018_05\sec c.pl2 Run By: LGC Geotechnical 5/10/2018 03:40PM

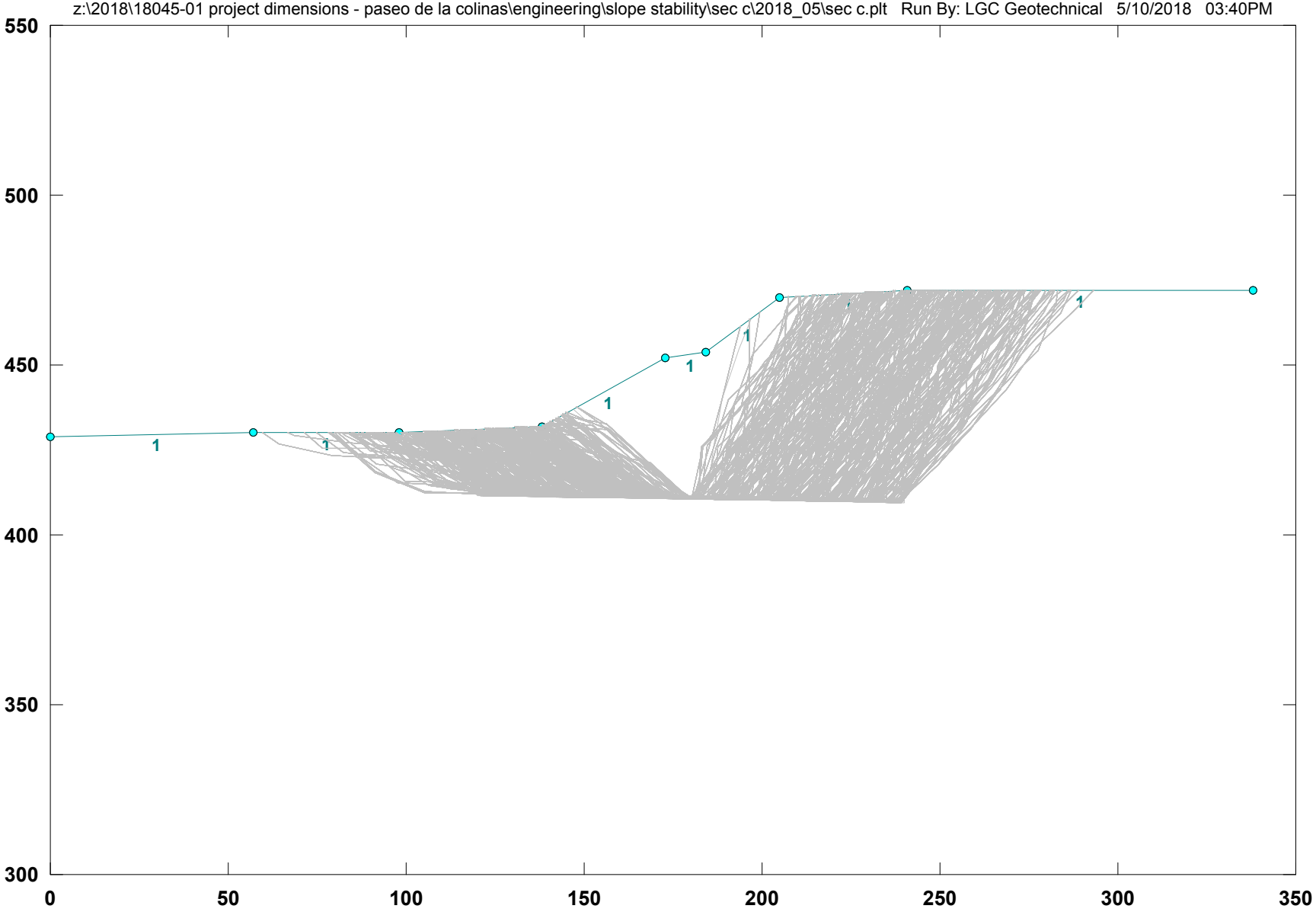


GSTABL7 v.2 FSmin=1.83

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Paseo de la Colinas 18045-01/ Sec C-C' / Along Clay Bed / Static

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec c\2018_05\sec c.plt Run By: LGC Geotechnical 5/10/2018 03:40PM



***** GSTABL7 *****

** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **

****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/10/2018
Time of Run: 03:40PM
Run By: LGC Geotechnical
Input Data Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec C\2018_05\sec c.in
Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec C\2018_05\sec c.OUT
Unit System: English
Plotted Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec C\2018_05\sec c.PLT
PROBLEM DESCRIPTION: Paseo de la Colinas 18045-01/ Sec C-C'
/ Along Clay Bed / Static

BOUNDARY COORDINATES
8 Top Boundaries
8 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	429.00	57.00	430.00	1
2	57.00	430.00	98.00	430.00	1
3	98.00	430.00	138.00	432.00	1
4	138.00	432.00	173.00	452.00	1
5	173.00	452.00	184.00	454.00	1
6	184.00	454.00	205.00	470.00	1
7	205.00	470.00	241.00	472.00	1
8	241.00	472.00	338.00	472.00	1

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	26.0	0.00	0.0	1

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 1 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	-2.0	300.00	26.00
2	0.0	0.00	18.00
3	90.0	300.00	26.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 15.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	120.00	412.10	180.00	411.00	0.80
2	180.10	411.00	240.00	410.00	0.80

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 6.664 FS Min = 1.825 FS Ave = 2.601
Standard Deviation = 0.612 Coefficient of Variation = 23.53 %
Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	116.488	430.924
2	122.300	428.022
3	135.440	420.787
4	147.389	411.719
5	193.258	410.676
6	203.835	421.312
7	213.968	432.372
8	224.166	443.372
9	234.019	454.682
10	243.866	465.997
11	246.682	472.000

Factor of Safety
*** 1.825 ***
Individual data on the 15 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	5.8	1160.1	0.0	0.0	0.	0.	0.0	0.0	0.0
2	13.1	11726.0	0.0	0.0	0.	0.	0.0	0.0	0.0
3	2.6	3878.1	0.0	0.0	0.	0.	0.0	0.0	0.0
4	9.4	22769.4	0.0	0.0	0.	0.	0.0	0.0	0.0
5	25.6	106462.1	0.0	0.0	0.	0.	0.0	0.0	0.0
6	11.0	57734.4	0.0	0.0	0.	0.	0.0	0.0	0.0
7	9.3	54096.4	0.0	0.0	0.	0.	0.0	0.0	0.0
8	10.6	64900.7	0.0	0.0	0.	0.	0.0	0.0	0.0
9	1.2	6934.3	0.0	0.0	0.	0.	0.0	0.0	0.0
10	9.0	47948.6	0.0	0.0	0.	0.	0.0	0.0	0.0
11	10.2	41952.2	0.0	0.0	0.	0.	0.0	0.0	0.0
12	9.9	27480.1	0.0	0.0	0.	0.	0.0	0.0	0.0
13	7.0	11442.5	0.0	0.0	0.	0.	0.0	0.0	0.0
14	2.9	2740.5	0.0	0.0	0.	0.	0.0	0.0	0.0
15	2.8	1056.4	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	116.488	430.924
2	122.300	428.022
3	135.440	420.787
4	147.389	411.719
5	193.258	410.676
6	203.835	421.312
7	213.968	432.372
8	224.166	443.372
9	234.019	454.682
10	243.866	465.997
11	246.682	472.000

Factor of Safety
*** 1.825 ***
Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	116.488	430.924
2	122.300	428.022
3	135.440	420.787
4	147.389	411.719
5	193.258	410.676
6	203.835	421.312
7	213.968	432.372
8	224.166	443.372
9	234.019	454.682
10	243.866	465.997
11	246.682	472.000

Factor of Safety
*** 1.825 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	116.488	430.924
2	122.300	428.022
3	135.440	420.787
4	147.389	411.719
5	193.258	410.676
6	203.835	421.312
7	213.968	432.372
8	224.166	443.372
9	234.019	454.682
10	243.866	465.997
11	246.682	472.000

Factor of Safety
*** 1.825 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	116.488	430.924
2	122.300	428.022
3	135.440	420.787
4	147.389	411.719
5	193.258	410.676
6	203.835	421.312
7	213.968	432.372
8	224.166	443.372
9	234.019	454.682
10	243.866	465.997
11	246.682	472.000

Factor of Safety
*** 1.825 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	116.488	430.924
2	122.300	428.022
3	135.440	420.787
4	147.389	411.719
5	193.258	410.676
6	203.835	421.312
7	213.968	432.372
8	224.166	443.372
9	234.019	454.682
10	243.866	465.997
11	246.682	472.000

Factor of Safety
*** 1.825 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	116.488	430.924
2	122.300	428.022
3	135.440	420.787
4	147.389	411.719
5	193.258	410.676
6	203.835	421.312

7	213.968	432.372
8	224.166	443.372
9	234.019	454.682
10	243.866	465.997
11	246.682	472.000

Factor of Safety
*** 1.825 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	116.488	430.924
2	122.300	428.022
3	135.440	420.787
4	147.389	411.719
5	193.258	410.676
6	203.835	421.312
7	213.968	432.372
8	224.166	443.372
9	234.019	454.682
10	243.866	465.997
11	246.682	472.000

Factor of Safety
*** 1.825 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	116.488	430.924
2	122.300	428.022
3	135.440	420.787
4	147.389	411.719
5	193.258	410.676
6	203.835	421.312
7	213.968	432.372
8	224.166	443.372
9	234.019	454.682
10	243.866	465.997
11	246.682	472.000

Factor of Safety
*** 1.825 ***

Failure Surface Specified By 11 Coordinate Points

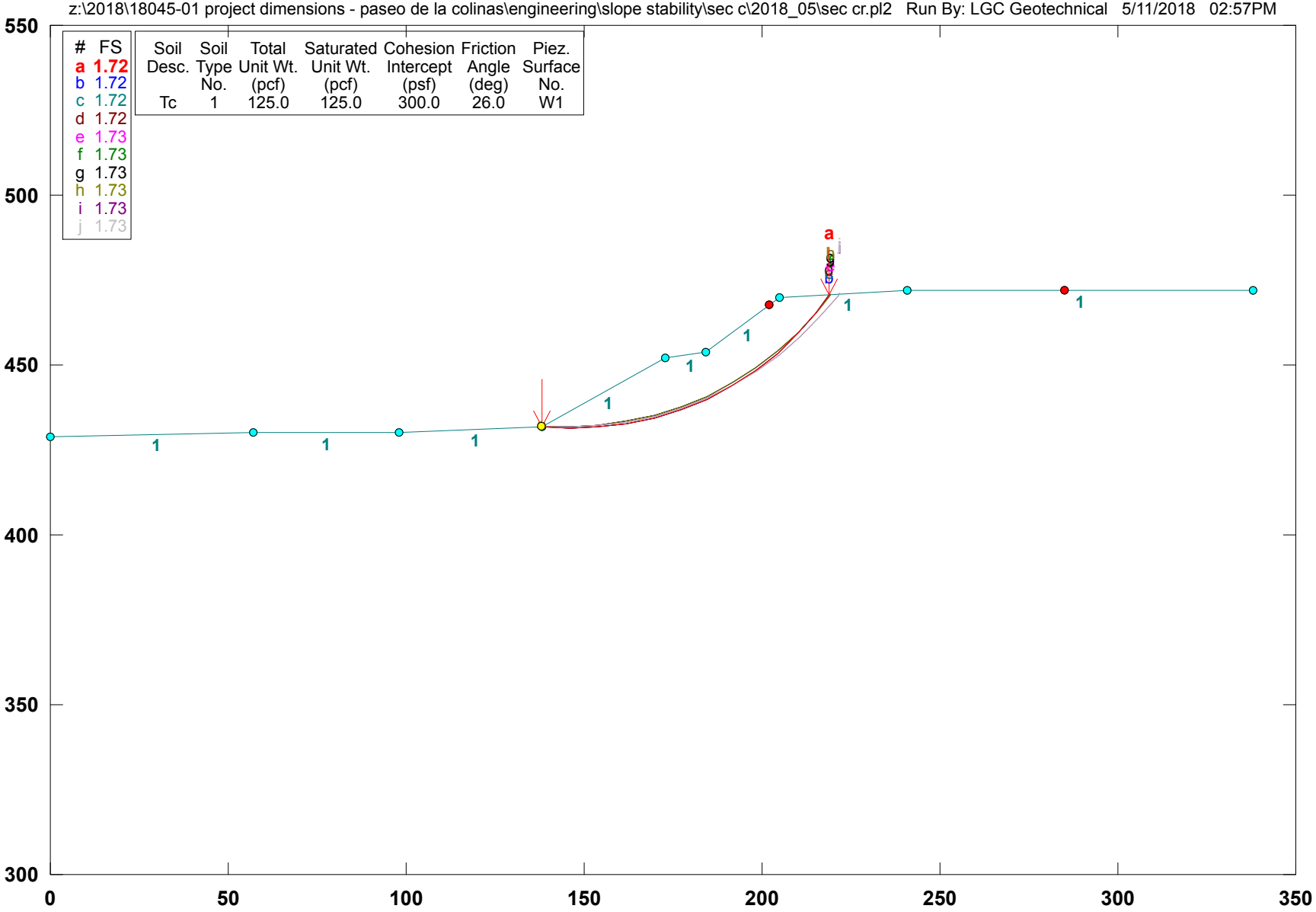
Point No.	X-Surf (ft)	Y-Surf (ft)
1	116.488	430.924
2	122.300	428.022
3	135.440	420.787
4	147.389	411.719
5	193.258	410.676
6	203.835	421.312
7	213.968	432.372
8	224.166	443.372
9	234.019	454.682
10	243.866	465.997
11	246.682	472.000

Factor of Safety
*** 1.825 ***

**** END OF GSTABL7 OUTPUT ****

Paseo de la Colinas 18045-01/ Sec C-C' / Rotational / Static

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec c\2018_05\sec cr.pl2 Run By: LGC Geotechnical 5/11/2018 02:57PM



GSTABL7 v.2 FSmin=1.72

Safety Factors Are Calculated By The Modified Bishop Method

***** GSTABL7 *****

** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
(All Rights Reserved-Unauthorized Use Prohibited)

****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/11/2018
Time of Run: 02:57PM
Run By: LGC Geotechnical
Input Data Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec C\2018_05\sec cr.in
Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec C\2018_05\sec cr.OUT
Unit System: English
Plotted Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\Engineering\Slope Stability\Sec C\2018_05\sec cr.PLT
PROBLEM DESCRIPTION: Paseo de la Colinas 18045-01/ Sec C-C'
/ Rotational / Static

BOUNDARY COORDINATES
8 Top Boundaries
8 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	429.00	57.00	430.00	1
2	57.00	430.00	98.00	430.00	1
3	98.00	430.00	138.00	432.00	1
4	138.00	432.00	173.00	452.00	1
5	173.00	452.00	184.00	454.00	1
6	184.00	454.00	205.00	470.00	1
7	205.00	470.00	241.00	472.00	1
8	241.00	472.00	338.00	472.00	1

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	26.0	0.00	0.0	1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
30000 Trial Surfaces Have Been Generated.
1000 Surface(s) Initiate(s) From Each Of 30 Points Equally Spaced
Along The Ground Surface Between X = 138.00(ft)
and X = 138.00(ft)
Each Surface Terminates Between X = 202.00(ft)
and X = 285.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)
8.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 0
Number of Trial Surfaces With Valid FS = 0
Statistical Data On All Valid FS Values:
FS Max = 0.000 FS Min = 500.000 FS Ave = NaN
Standard Deviation = 0.000 Coefficient of Variation = NaN %
Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.983	431.479
3	153.980	431.714
4	161.919	432.700
5	169.729	434.431
6	177.342	436.890
7	184.689	440.056
8	191.704	443.900
9	198.327	448.389
10	204.496	453.481
11	210.159	459.133
12	215.263	465.293
13	218.995	470.778

Circle Center At X = 147.503 ; Y = 516.246 ; and Radius = 84.780
Factor of Safety
*** 1.724 ***
Individual data on the 15 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	8.0	2535.8	0.0	0.0	0.	0.	0.0	0.0	0.0
2	8.0	7246.9	0.0	0.0	0.	0.	0.0	0.0	0.0
3	7.9	11107.0	0.0	0.0	0.	0.	0.0	0.0	0.0
4	7.8	13994.1	0.0	0.0	0.	0.	0.0	0.0	0.0
5	3.3	6585.2	0.0	0.0	0.	0.	0.0	0.0	0.0
6	4.3	8794.9	0.0	0.0	0.	0.	0.0	0.0	0.0
7	6.7	12542.4	0.0	0.0	0.	0.	0.0	0.0	0.0
8	0.7	1235.6	0.0	0.0	0.	0.	0.0	0.0	0.0
9	7.0	13346.8	0.0	0.0	0.	0.	0.0	0.0	0.0
10	6.6	13449.9	0.0	0.0	0.	0.	0.0	0.0	0.0
11	6.2	12594.5	0.0	0.0	0.	0.	0.0	0.0	0.0
12	0.5	1012.0	0.0	0.0	0.	0.	0.0	0.0	0.0
13	5.2	8759.8	0.0	0.0	0.	0.	0.0	0.0	0.0
14	5.1	5241.8	0.0	0.0	0.	0.	0.0	0.0	0.0
15	3.7	1231.1	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.983	431.479
3	153.980	431.714
4	161.919	432.700
5	169.729	434.431
6	177.342	436.890
7	184.689	440.056
8	191.704	443.900
9	198.327	448.389
10	204.496	453.481
11	210.159	459.133
12	215.263	465.293
13	218.995	470.778

Circle Center At X = 147.503 ; Y = 516.246 ; and Radius = 84.780
Factor of Safety
*** 1.724 ***
Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.983	431.479
3	153.980	431.714
4	161.919	432.700
5	169.729	434.431
6	177.342	436.890
7	184.689	440.056
8	191.704	443.900
9	198.327	448.389
10	204.496	453.481
11	210.159	459.133
12	215.263	465.293

13	218.995	470.778

Circle Center At X = 147.503 ; Y = 516.246 ; and Radius = 84.780

Factor of Safety

*** 1.724 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.983	431.479
3	153.980	431.714
4	161.919	432.700
5	169.729	434.431
6	177.342	436.890
7	184.689	440.056
8	191.704	443.900
9	198.327	448.389
10	204.496	453.481
11	210.159	459.133
12	215.263	465.293
13	218.995	470.778

Circle Center At X = 147.503 ; Y = 516.246 ; and Radius = 84.780

Factor of Safety

*** 1.724 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.995	431.730
3	153.983	432.172
4	161.900	433.321
5	169.684	435.169
6	177.273	437.701
7	184.607	440.897
8	191.628	444.731
9	198.281	449.174
10	204.513	454.190
11	210.275	459.740
12	215.521	465.780
13	219.142	470.786

Circle Center At X = 145.027 ; Y = 521.716 ; and Radius = 89.990

Factor of Safety

*** 1.726 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.995	431.730
3	153.983	432.172
4	161.900	433.321
5	169.684	435.169
6	177.273	437.701
7	184.607	440.897
8	191.628	444.731
9	198.281	449.174
10	204.513	454.190
11	210.275	459.740
12	215.521	465.780
13	219.142	470.786

Circle Center At X = 145.027 ; Y = 521.716 ; and Radius = 89.990

Factor of Safety

*** 1.726 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.995	431.730
3	153.983	432.172
4	161.900	433.321
5	169.684	435.169
6	177.273	437.701

7	184.607	440.897
8	191.628	444.731
9	198.281	449.174
10	204.513	454.190
11	210.275	459.740
12	215.521	465.780
13	219.142	470.786

Circle Center At X = 145.027 ; Y = 521.716 ; and Radius = 89.990

Factor of Safety

*** 1.726 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.995	431.730
3	153.983	432.172
4	161.900	433.321
5	169.684	435.169
6	177.273	437.701
7	184.607	440.897
8	191.628	444.731
9	198.281	449.174
10	204.513	454.190
11	210.275	459.740
12	215.521	465.780
13	219.142	470.786

Circle Center At X = 145.027 ; Y = 521.716 ; and Radius = 89.990

Factor of Safety

*** 1.726 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.994	431.678
3	153.985	432.044
4	161.916	433.093
5	169.728	434.819
6	177.362	437.209
7	184.764	440.245
8	191.878	443.904
9	198.651	448.161
10	205.035	452.983
11	210.981	458.335
12	216.447	464.177
13	221.391	470.466
14	221.693	470.927

Circle Center At X = 145.755 ; Y = 524.760 ; and Radius = 93.084

Factor of Safety

*** 1.726 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.994	431.678
3	153.985	432.044
4	161.916	433.093
5	169.728	434.819
6	177.362	437.209
7	184.764	440.245
8	191.878	443.904
9	198.651	448.161
10	205.035	452.983
11	210.981	458.335
12	216.447	464.177
13	221.391	470.466
14	221.693	470.927

Circle Center At X = 145.755 ; Y = 524.760 ; and Radius = 93.084

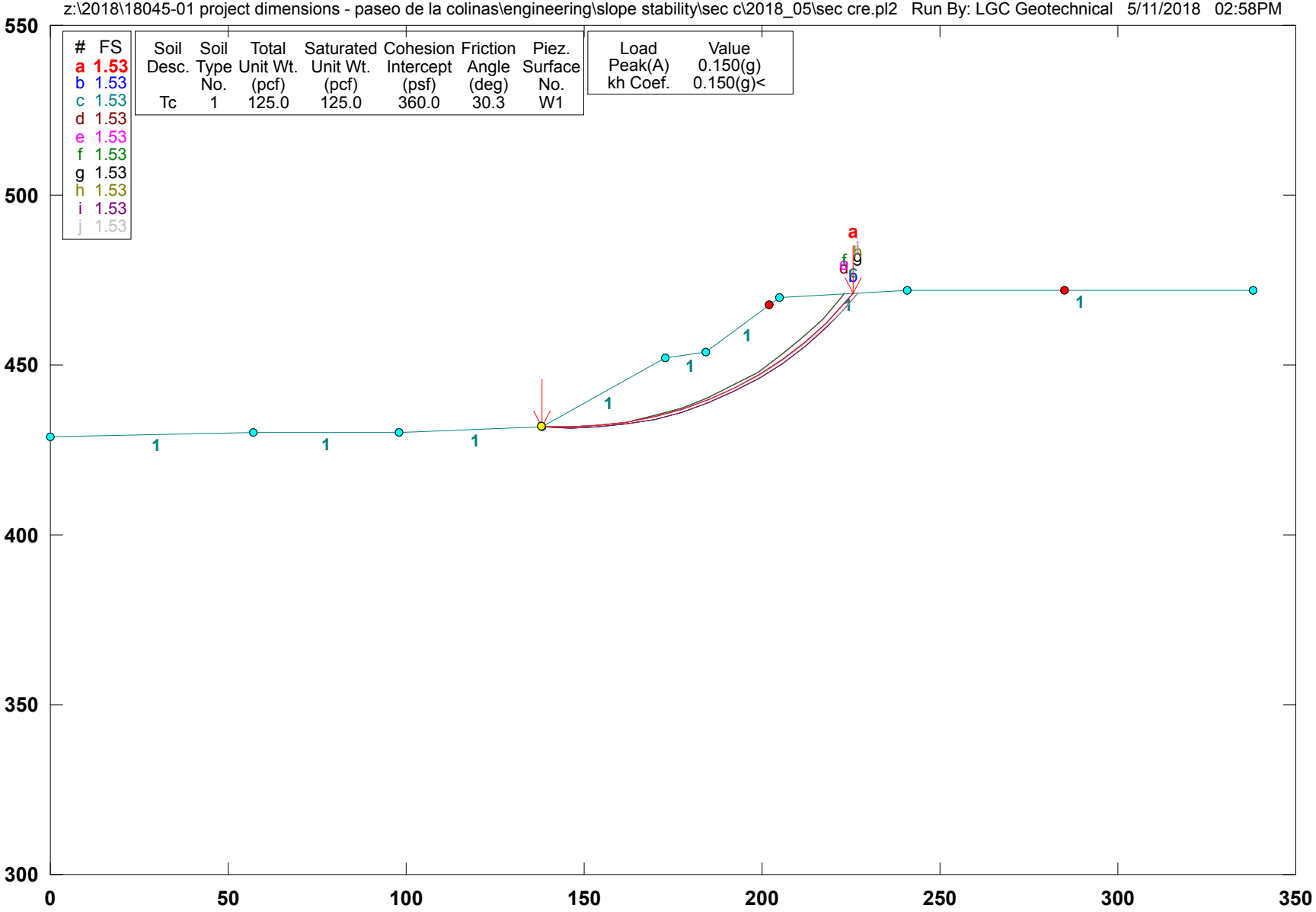
Factor of Safety

*** 1.726 ***

**** END OF GSTABL7 OUTPUT ****

Paseo de la Colinas 18045-01/ Sec C-C' / Rotational / Seismic

z:\2018\18045-01 project dimensions - paseo de la colinas\engineering\slope stability\sec c\2018_05\sec cre.pl2 Run By: LGC Geotechnical 5/11/2018 02:58PM



GSTABL7 v.2 FSmin=1.53

Safety Factors Are Calculated By The Modified Bishop Method

```
                       ***  GSTABL7  ***
         ** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
  ** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
            (All Rights Reserved-Unauthorized Use Prohibited)
 *********************************************************************************
                     SLOPE STABILITY ANALYSIS SYSTEM
        Modified Bishop, Simplified Janbu, or GLE Method of Slices.
        (Includes Spencer & Morgenstern-Price Type Analysis)
        Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
        Nonlinear Undrained Shear Strength, Curved Phi Envelope,
        Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
        Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
 *********************************************************************************
 Analysis Run Date:       5/11/2018
 Time of Run:             02:58PM
 Run By:                  LGC Geotechnical
 Input Data Filename:     Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\En
gineering\Slope Stability\Sec C\2018_05\sec cre.in
 Output Filename:         Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\En
gineering\Slope Stability\Sec C\2018_05\sec cre.OUT
 Unit System:             English
 Plotted Output Filename: Z:\2018\18045-01 Project Dimensions - Paseo de la Colinas\En
gineering\Slope Stability\Sec C\2018_05\sec cre.PLT
 PROBLEM DESCRIPTION:  Paseo de la Colinas 18045-01/ Sec C-C'
                      / Rotational / Seismic
 BOUNDARY COORDINATES
     8 Top   Boundaries
     8 Total Boundaries
 Boundary     X-Left     Y-Left     X-Right    Y-Right    Soil Type
    No.        (ft)       (ft)        (ft)       (ft)     Below Bnd
     1          0.00     429.00      57.00     430.00        1
     2         57.00     430.00      98.00     430.00        1
     3         98.00     430.00     138.00     432.00        1
     4        138.00     432.00     173.00     452.00        1
     5        173.00     452.00     184.00     454.00        1
     6        184.00     454.00     205.00     470.00        1
     7        205.00     470.00     241.00     472.00        1
     8        241.00     472.00     338.00     472.00        1
 User Specified Y-Origin =       300.00(ft)
 Default X-Plus Value = 0.00(ft)
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  1 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
   1   125.0    125.0     360.0     30.3    0.00       0.0      1
 Specified Peak Ground Acceleration Coefficient (A) =   0.150(g)
 Specified Horizontal Earthquake Coefficient (kh) =   0.150(g)
 Specified Vertical Earthquake Coefficient (kv) =   0.000(g)
 Specified Seismic Pore-Pressure Factor =   0.000
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
30000 Trial Surfaces Have Been Generated.
 1000 Surface(s) Initiate(s) From Each Of    30 Points Equally Spaced
 Along The Ground Surface Between  X = 138.00(ft)
                             and  X = 138.00(ft)
 Each Surface Terminates Between   X = 202.00(ft)
                            and   X = 285.00(ft)
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is  Y =      0.00(ft)
  8.00(ft) Line Segments Define Each Trial Failure Surface.
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Modified Bishop Method * *
       Total Number of Trial Surfaces Attempted =     0
       Number of Trial Surfaces With Valid FS =    0
       Statistical Data On All Valid FS Values:
          FS Max =   0.000   FS Min = 500.000   FS Ave =  NaN
```



```
   Standard Deviation =    0.000   Coefficient of Variation =  NaN    %
Failure Surface Specified By 14 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1       138.000      432.000
    2       145.995      431.727
    3       153.987      432.085
    4       161.926      433.072
    5       169.762      434.682
    6       177.447      436.905
    7       184.933      439.727
    8       192.173      443.131
    9       199.122      447.095
   10       205.737      451.594
   11       211.976      456.601
   12       217.801      462.085
   13       223.176      468.010
   14       225.596      471.144
Circle Center At X =   145.511 ; Y =   532.775 ; and Radius =   101.054
       Factor of Safety
      ***    1.525   ***
      Individual data on the     0  slices
                Water  Water     Tie     Tie     Earthquake
                Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight   Top    Bot      Norm    Tan     Hor     Ver    Load
 No.   (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
Failure Surface Specified By 14 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1       138.000      432.000
    2       145.995      431.727
    3       153.987      432.085
    4       161.926      433.072
    5       169.762      434.682
    6       177.447      436.905
    7       184.933      439.727
    8       192.173      443.131
    9       199.122      447.095
   10       205.737      451.594
   11       211.976      456.601
   12       217.801      462.085
   13       223.176      468.010
   14       225.596      471.144
Circle Center At X =   145.511 ; Y =   532.775 ; and Radius =   101.054
       Factor of Safety
      ***    1.525   ***
Failure Surface Specified By 14 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1       138.000      432.000
    2       145.995      431.727
    3       153.987      432.085
    4       161.926      433.072
    5       169.762      434.682
    6       177.447      436.905
    7       184.933      439.727
    8       192.173      443.131
    9       199.122      447.095
   10       205.737      451.594
   11       211.976      456.601
   12       217.801      462.085
   13       223.176      468.010
   14       225.596      471.144
Circle Center At X =   145.511 ; Y =   532.775 ; and Radius =   101.054
       Factor of Safety
      ***    1.525   ***
Failure Surface Specified By 14 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1       138.000      432.000
```

2	145.997	431.779
3	153.985	432.212
4	161.911	433.296
5	169.723	435.023
6	177.367	437.382
7	184.793	440.358
8	191.951	443.930
9	198.794	448.074
10	205.276	452.764
11	211.352	457.966
12	216.984	463.648
13	222.133	469.771
14	223.006	471.000

Circle Center At X =   144.736 ; Y =   529.460 ; and Radius =   97.692

Factor of Safety

***   1.526   ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.997	431.779
3	153.985	432.212
4	161.911	433.296
5	169.723	435.023
6	177.367	437.382
7	184.793	440.358
8	191.951	443.930
9	198.794	448.074
10	205.276	452.764
11	211.352	457.966
12	216.984	463.648
13	222.133	469.771
14	223.006	471.000

Circle Center At X =   144.736 ; Y =   529.460 ; and Radius =   97.692

Factor of Safety

***   1.526   ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.997	431.779
3	153.985	432.212
4	161.911	433.296
5	169.723	435.023
6	177.367	437.382
7	184.793	440.358
8	191.951	443.930
9	198.794	448.074
10	205.276	452.764
11	211.352	457.966
12	216.984	463.648
13	222.133	469.771
14	223.006	471.000

Circle Center At X =   144.736 ; Y =   529.460 ; and Radius =   97.692

Factor of Safety

***   1.526   ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.989	431.575
3	153.986	431.790
4	161.940	432.645
5	169.800	434.133
6	177.516	436.245
7	185.039	438.968
8	192.319	442.285
9	199.310	446.173
10	205.968	450.608
11	212.250	455.562

12	218.115	461.003
13	223.526	466.895
14	226.899	471.217

Circle Center At X =   147.340 ; Y =   531.197 ; and Radius =   99.636

Factor of Safety

***   1.526   ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.989	431.575
3	153.986	431.790
4	161.940	432.645
5	169.800	434.133
6	177.516	436.245
7	185.039	438.968
8	192.319	442.285
9	199.310	446.173
10	205.968	450.608
11	212.250	455.562
12	218.115	461.003
13	223.526	466.895
14	226.899	471.217

Circle Center At X =   147.340 ; Y =   531.197 ; and Radius =   99.636

Factor of Safety

***   1.526   ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.989	431.575
3	153.986	431.790
4	161.940	432.645
5	169.800	434.133
6	177.516	436.245
7	185.039	438.968
8	192.319	442.285
9	199.310	446.173
10	205.968	450.608
11	212.250	455.562
12	218.115	461.003
13	223.526	466.895
14	226.899	471.217

Circle Center At X =   147.340 ; Y =   531.197 ; and Radius =   99.636

Factor of Safety

***   1.526   ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	432.000
2	145.998	431.828
3	153.987	432.256
4	161.921	433.281
5	169.756	434.897
6	177.448	437.096
7	184.953	439.865
8	192.230	443.189
9	199.238	447.048
10	205.936	451.422
11	212.288	456.285
12	218.258	461.610
13	223.813	467.368
14	227.010	471.223

Circle Center At X =   144.344 ; Y =   538.213 ; and Radius =   106.402

Factor of Safety

***   1.526   ***

**** END OF GSTABL7 OUTPUT ****

United States Department of Agriculture

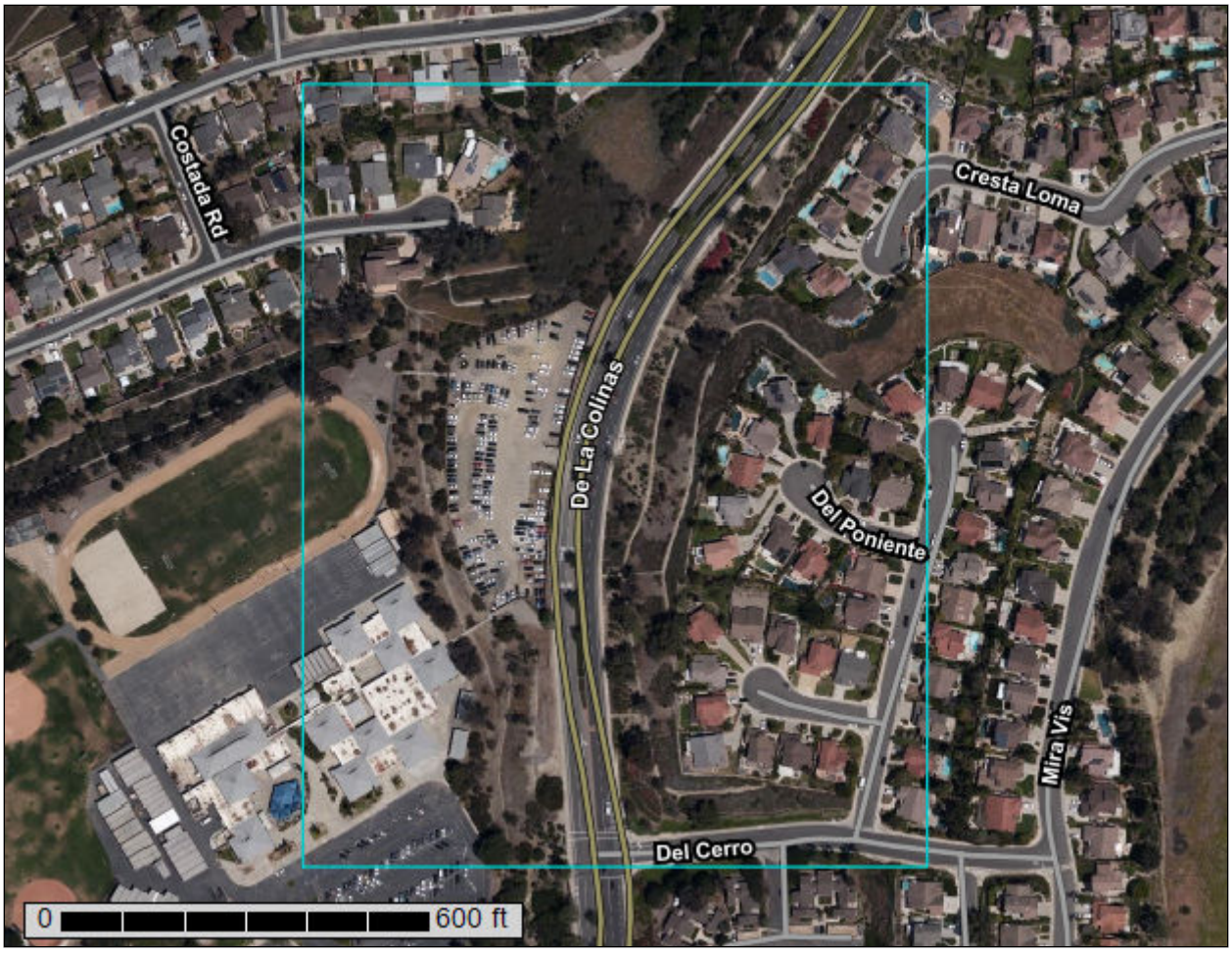
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Orange County and Part of Riverside County, California

CUSD Laguna Niguel



April 9, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,400 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 13, Sep 16, 2019

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

Date(s) aerial images were photographed: Apr 11, 2018—May 5, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
101	Alo clay, 15 to 30 percent slopes, dry	3.8	12.7%
102	Alo clay, 30 to 50 percent slopes, warm MAAT, MLRA 20	23.6	79.4%
133	Botella clay loam, 9 to 15 percent slopes	1.7	5.8%
209	Sorrento clay loam, 2 to 9 percent slopes, warm MAAT, MLRA 19	0.6	2.1%
Totals for Area of Interest		**29.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Orange County and Part of Riverside County, California

101—Alo clay, 15 to 30 percent slopes, dry

Map Unit Setting

National map unit symbol: 2y8sm
Elevation: 20 to 1,720 feet
Mean annual precipitation: 13 to 16 inches
Mean annual air temperature: 64 to 65 degrees F
Frost-free period: 360 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Alo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alo

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from calcareous sandstone or shale

Typical profile

A - 0 to 15 inches: clay
Bkss - 15 to 22 inches: clay
Cr - 22 to 59 inches: bedrock

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 22 to 26 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Balcom, clay loam
Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Anaheim, clay loam
Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Bonsall, clay
Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

102—Alo clay, 30 to 50 percent slopes, warm MAAT, MLRA 20

Map Unit Setting
National map unit symbol: 2tyzn
Elevation: 10 to 1,890 feet
Mean annual precipitation: 12 to 21 inches
Mean annual air temperature: 63 to 65 degrees F
Frost-free period: 300 to 360 days
Farmland classification: Not prime farmland

Map Unit Composition
Alo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alo

Setting
Landform: Hills

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and shale

Typical profile

A - 0 to 15 inches: clay
Bkss - 15 to 22 inches: clay
Cr - 22 to 79 inches: bedrock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 20 to 30 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Anaheim

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Balcom

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Calleguas

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Bosanko

Percent of map unit: 2 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

133—Botella clay loam, 9 to 15 percent slopes

Map Unit Setting

National map unit symbol: hcm9
Elevation: 50 to 800 feet
Mean annual precipitation: 12 to 25 inches
Mean annual air temperature: 57 to 59 degrees F
Frost-free period: 260 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition

Botella and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Botella

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Riser, flat
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 8 inches: clay loam
H2 - 8 to 35 inches: silty clay loam
H3 - 35 to 66 inches: sandy clay loam

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Botella, loam

Percent of map unit: 4 percent
Hydric soil rating: No

Mocho, loam

Percent of map unit: 4 percent
Hydric soil rating: No

Sorrento, clay loam

Percent of map unit: 4 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 3 percent
Hydric soil rating: No

209—Sorrento clay loam, 2 to 9 percent slopes, warm MAAT, MLRA 19

Map Unit Setting

National map unit symbol: 2tz07
Elevation: 20 to 2,040 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 62 to 66 degrees F
Frost-free period: 320 to 365 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Sorrento and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sorrento

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Alluvium derived from sedimentary rock

Typical profile

Ap1 - 0 to 6 inches: clay loam
Ap2 - 6 to 12 inches: clay loam
AB1 - 12 to 21 inches: silty clay loam
AB2 - 21 to 27 inches: silty clay loam
AB3 - 27 to 37 inches: silty clay loam
Bk1 - 37 to 49 inches: silty clay loam
Bk2 - 49 to 62 inches: silty clay loam
2C - 62 to 72 inches: stratified loamy fine sand to silt loam

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Mocho

Percent of map unit: 10 percent
Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: LOAMY (1975) (R019XD029CA)
Hydric soil rating: No

Sorrento, loam

Percent of map unit: 10 percent
Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: LOAMY (1975) (R019XD029CA)
Hydric soil rating: No

Botella

Percent of map unit: 5 percent
Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf