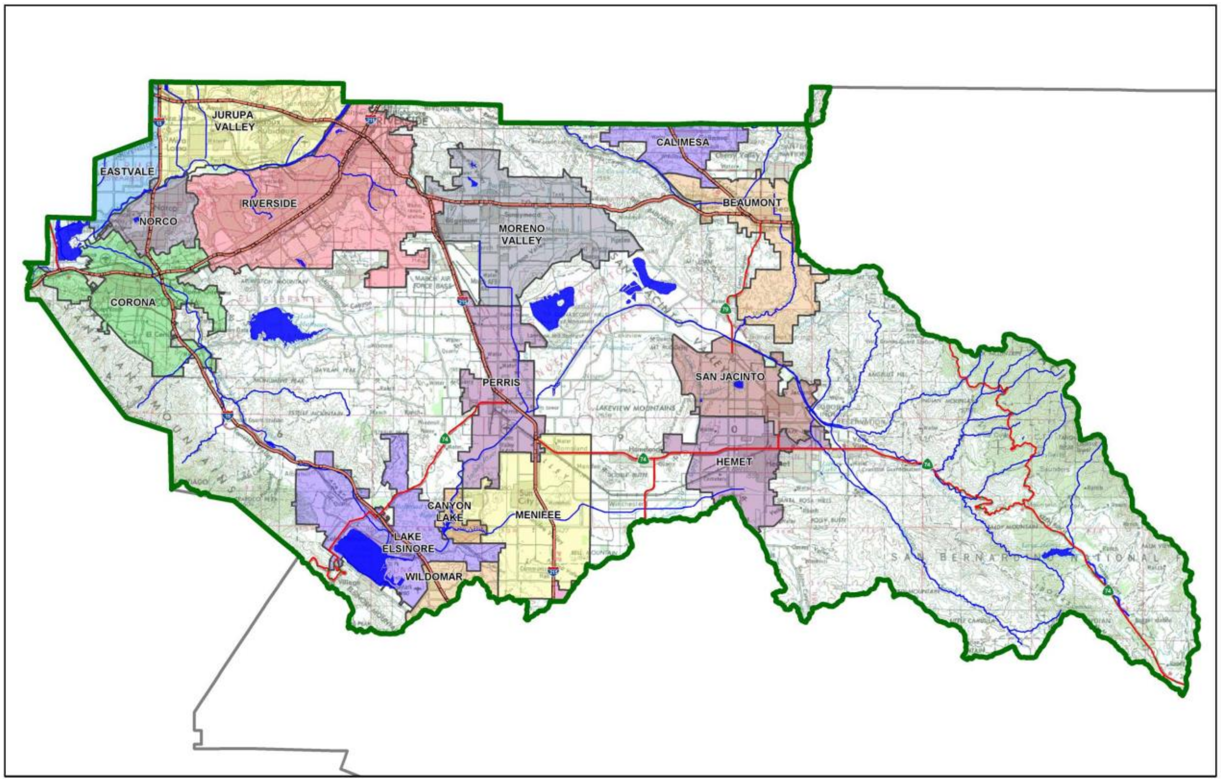
Project Specific Water Quality Management Plan

*A Template for Projects located within the **Santa Ana Watershed** Region of Riverside County*

Project Title: Beaumont Pointe

Development No: TBD

Design Review/Case No: PW2021-0824



☒ **Preliminary**
☐ **Final**

Original Date Prepared: 4/11/2022

Revision Date(s):

Prepared for Compliance with
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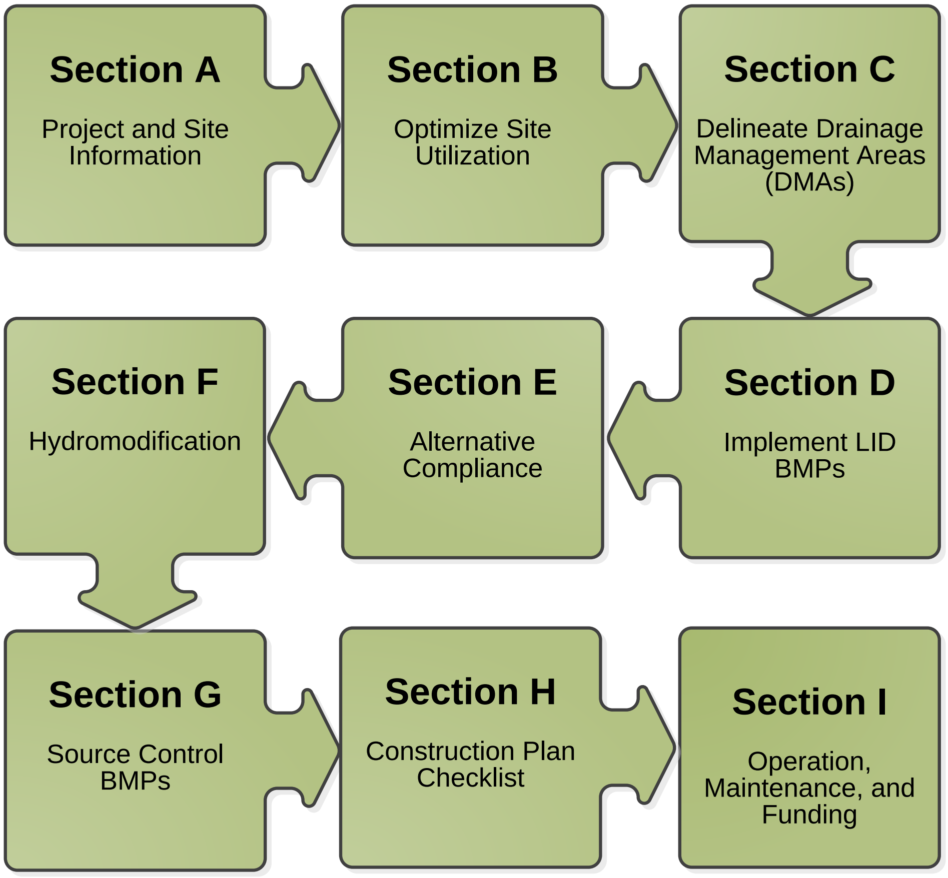
A Brief Introduction

This Project-Specific WQMP Template for the **Santa Ana Region** has been prepared to help guide you in documenting compliance for your project. Because this document has been designed to specifically document compliance, you will need to utilize the WQMP Guidance Document as your "how-to" manual to help guide you through this process. Both the Template and Guidance Document go hand-in-hand, and will help facilitate a well-prepared Project-Specific WQMP. Below is a flowchart for the layout of this Template that will provide the steps required to document compliance.



OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for **JRT BP 1 LLC** by **George Lenfestey** for the **Beaumont Pointe** project.

This WQMP is intended to comply with the requirements of **County of Riverside** which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under **County of Riverside** Water Quality Ordinance.

"I, the undersigned, certify under penalty of law that the provisions of this WQMP have been reviewed and accepted and that the WQMP will be transferred to future successors in interest."

Owner's Signature	Date
Owner's Printed Name	Owner's Title/Position

PREPARER'S CERTIFICATION

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan meet the requirements of Regional Water Quality Control Board Order No. **R8-2010-0033** and any subsequent amendments thereto."

Preparer's Signature	Date
George Lenfestey, P.E. Preparer's Printed Name	Principal Preparer's Title/Position

Preparer's Licensure:

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Commercial Retail
Planning Area:	N/A
Community Name:	N/A
Development Name:	Beaumont Pointe
PROJECT LOCATION	
Latitude & Longitude (DMS): Lat: 33°56’20”N, Long: 117°02’56”W	
Project Watershed and Sub-Watershed: Santa Ana River; via San Timoteo Canyon-San Timoteo Wash	
Gross Acres: 539.9 Acres	
APN(s): 422-060-002, 422-060-005, 422-060-009, 422-060-010, 422-060-016, 422-060-017, A Portion of 422-060-18, 422-060-021, 422-060-022, 422-170-005, 422-170-008, 422-170-009, 422-170-010, 422-170-010, 422-170-007, 422-170-011,	
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PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s):	CR-Commercial Retail
Proposed or Potential SIC Code(s):	1541 – General Contractors-Industrial Buildings and Warehouses
Area of Impervious Project Footprint (SF)	9,848,388 s.f.
Total Area of proposed Impervious Surfaces within the Project Footprint (SF)/or Replacement	9,848,388 s.f.
Does the project consist of offsite road improvements?	☒ Y ☐ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the Project limits Footprint (SF)	77,180 s.f.
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	Not in a cell
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☐ Y ☒ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	A, B, C, & D
What is the Water Quality Design Storm Depth for the project?	0.75 in

A.1 Maps and Site Plans

When completing your Project-Specific WQMP, include a map of the local vicinity and existing site. In addition, include all grading, drainage, landscape/plant palette and other pertinent construction plans in Appendix 2. At a **minimum**, your WQMP Site Plan should include the following:

The Beaumont Pointe project proposes the development of a portion of the 539.9-acre vacant property into five warehouse buildings with parking and driveways, two commercial/retail parcels, and the roadway improvements. The project is situated in-between the Freeway 60 and the hillsides to the south within the County of Riverside, southwest of the city limits of the City of Beaumont. At present, the property contains a few residential structures, stables, and paved roadways. The stormwater generally flows from southern hillside towards Freeway 60 into 16 culverts where the runoff confluences with the San Timoteo Creek.

The project's improvements include drainage inlets and conveyance system, and stormwater treatment BMP basins which collects onsite runoff and directs it to the treatment detention facilities. Once the runoff is treated, the flow will be conveyed towards their respective culverts. The project proposes four BMP extended detention basins throughout the project as infiltration basins would not be feasible due to the extensive cut and fill operations recommended by the geotechnical engineer. Bioretention basins would not be feasible because the tributary areas for the proposed basins exceed the recommended 10-acre maximum. These extended detention BMP basins are sized to provide the required treatment capacity and peak runoff mitigation.

The proposed development will be completed in three phases with the first phase beginning from the east which includes BMP basins 1 and 2, and future commercial/retail Planning Areas 1 and 2. Phases comprises BMP basin 3 and the final phase includes BMP basin 4. Planning Areas 1 and 2 will be mass graded as part of the of this project but will need to prepare their own final WQMPs for when they begin the final development of their respective parcels. In the interim, these areas will implement temporary bioretention basins as these planning areas are expected to be developed last for this project.

- Drainage Management Areas
- Proposed Structural BMPs
- Drainage Path
- Drainage Infrastructure, Inlets, Overflows
- Source Control BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces
- Standard Labeling
- BMP Locations (Lat/Long)

Use your discretion on whether or not you may need to create multiple sheets or can appropriately accommodate these features on one or two sheets. Keep in mind that the Co-Permittee plan reviewer must be able to easily analyze your project utilizing this template and its associated site plans and maps.

A.2 Identify Receiving Waters

Using Table A.1 below, list in order of upstream to downstream, the receiving waters that the project site is tributary to. Continue to fill each row with the Receiving Water's 303(d) listed impairments (if any), designated beneficial uses, and proximity, if any, to a RARE beneficial use. Include a map of the receiving waters in Appendix 1.

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
On-site Storm Drain System	N/A	N/A	9 Miles
San Timoteo Creek – Reach 3	None	N/A	9 Miles
San Timoteo Creek – Reach 2	None	AGR, GWR, WARM, WILD, MUN, RARE, REC1, REC2	2 Miles
San Timoteo Creek – Reach 1	None	N/A	2 Miles
Santa Ana River – Reach 5	None	SPWN, AGR	6 Miles
Santa Ana River – Reach 4	Pathogens	N/A	1 Mile
Santa Ana River – Reach 3	Copper, Lead, Pathogens, Nitrates	WILD, WARM, REC2, REC1, MUN, GWR	1 Mile
Prado Basin	Yes – Nutrients	AGR, GWR, REC1, REC2, WARM, WILD, RARE, SPWN	1 Mile
Santa Ana River – Reach 2	Metals, Indicator Bacteria	AGR, GWR, WARM, WILD, MUN, RARE, REC1, REC2	1 Mile
Santa Ana River – Reach 1	None	WARM, WILD, MUN, RARE, REC1, REC2	1 mile

AGR = Agricultural Supply; GWR = Groundwater Recharge; REC1 = Primary Contact Recreation; REC2 = Secondary Contact Recreation; WARM = Warm Freshwater Habitat; WILD = Wildlife Habitat; MUN = Municipal and Domestic Supply; RARE = Rare, Threatened, or Endangered Species; SPWN = Spawning, Reproduction and Development.

A.3 Additional Permits/Approvals required for the Project:

Table A.2 Other Applicable Permits

Agency	Permit Required	
State Department of Fish and Game, 1602 Streambed Alteration Agreement	☐ Y	☒ N
State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Cert.	☐ Y	☒ N
US Army Corps of Engineers, CWA Section 404 Permit	☐ Y	☒ N
US Fish and Wildlife, Endangered Species Act Section 7 Biological Opinion	☐ Y	☒ N
Statewide Construction General Permit Coverage	☒ Y	☐ N
Statewide Industrial General Permit Coverage	☐ Y	☒ N
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	☐ Y	☒ N
Other *(please list in the space below as required)* **N/A**	☐ Y	☒ N

If yes is answered to any of the questions above, the Co-Permittee may require proof of approval/coverage from those agencies as applicable including documentation of any associated requirements that may affect this Project-Specific WQMP.

Section B: Optimize Site Utilization (LID Principles)

Review of the information collected in Section 'A' will aid in identifying the principal constraints on site design and selection of LID BMPs as well as opportunities to reduce imperviousness and incorporate LID Principles into the site and landscape design. For example, **constraints** might include impermeable soils, high groundwater, groundwater pollution or contaminated soils, steep slopes, geotechnical instability, high-intensity land use, heavy pedestrian or vehicular traffic, utility locations or safety concerns. **Opportunities** might include existing natural areas, low areas, oddly configured or otherwise unbuildable parcels, easements and landscape amenities including open space and buffers (which can double as locations for bioretention BMPs), and differences in elevation (which can provide hydraulic head). Prepare a brief narrative for each of the site optimization strategies described below. This narrative will help you as you proceed with your LID design and explain your design decisions to others.

The 2010 Santa Ana MS4 Permit further requires that LID Retention BMPs (Infiltration Only or Harvest and Use) be used unless it can be shown that those BMPs are infeasible. Therefore, it is important that your narrative identify and justify if there are any constraints that would prevent the use of those categories of LID BMPs. Similarly, you should also note opportunities that exist which will be utilized during project design. Upon completion of identifying Constraints and Opportunities, include these on your WQMP Site plan in Appendix 1.

Consideration of "highest and best use" of the discharge should also be considered. For example, Lake Elsinore is evaporating faster than runoff from natural precipitation can recharge it. Requiring infiltration of 85% of runoff events for projects tributary to Lake Elsinore would only exacerbate current water quality problems associated with Pollutant concentration due to lake water evaporation. In cases where rainfall events have low potential to recharge Lake Elsinore (i.e. no hydraulic connection between groundwater to Lake Elsinore, or other factors), requiring infiltration of Urban Runoff from projects is counterproductive to the overall watershed goals. Project proponents, in these cases, would be allowed to discharge Urban Runoff, provided they used equally effective filtration based BMPs.

Site Optimization

The following questions are based upon Section 3.2 of the WQMP Guidance Document. Review of the WQMP Guidance Document will help you determine how best to optimize your site and subsequently identify opportunities and/or constraints, and document compliance.

Did you identify and preserve existing drainage patterns? If so, how? If not, why?

> ***Yes**, the undeveloped property drains to the northeast towards 16 existing Caltrans culverts under the 60 Freeway. The developed conditions capture and discharge runoff to 4 on-site BMP basins for treatment before discharging into their respective culverts.*

Did you identify and protect existing vegetation? If so, how? If not, why?

> ***Yes**, the project will develop 276.4 acres of the total 539.9 acres of which the remaining area shall be reserved for open space. However, the proposed site will be planted with landscaping approved by the City of Beaumont.*

Did you identify and preserve natural infiltration capacity? If so, how? If not, why?

> ***No,*** *the geotechnical report has indicated that large cut and fill operations will be required for the recommended removals for this project which will adversely affect the natural infiltration capacity, however natural infiltration will be implemented within landscaped areas and undisturbed open areas.*

Did you identify and minimize impervious area? If so, how? If not, why?

> ***Yes****, within the development envelope, street and sidewalk widths were minimized to the acceptable City standard. Parking lots were designed to meet the minimum required stall count for each parcel to minimize the overall parking lot size.*

Did you identify and disperse runoff to adjacent pervious areas? If so, how? If not, why?

> ***Yes****, where possible, runoff from impervious areas drain towards landscaped areas and bioretention basins through curb cutouts. All runoff from the commercial parcels will enter the basins (Basins 1,2, 3 & 4) for treatment and mitigation before discharging into their respective culverts. Each culvert has a natural depress areas upstream which also acts as a natural detention area.*

Section C: Delineate Drainage Management Areas (DMAs)

Utilizing the procedure in Section 3.3 of the WQMP Guidance Document which discusses the methods of delineating and mapping your project site into individual DMAs, complete Table C.1 below to appropriately categorize the types of classification (e.g., Type A, Type B, etc.) per DMA for your project site. Upon completion of this table, this information will then be used to populate and tabulate the corresponding tables for their respective DMA classifications.

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1][2]	Area (Sq. Ft.)	DMA Type
DMA 1	Impervious: Rooftop, Driveway, Sidewalk, & Asphalt Street Pervious: Ornamental Landscaping (Bioretention Basin)	3,083,283	Type D
DMA 6	Impervious: Rooftop, Driveway, Sidewalk, & Asphalt Street Pervious: Ornamental Landscaping (Bioretention Basin)	1,470,461	Type D
DMA 13	Impervious: Rooftop, Driveway, Sidewalk, & Asphalt Street Pervious: Ornamental Landscaping (Bioretention Basin)	3,864,845	Type D
DMA 16	Impervious: Rooftop, Driveway, Sidewalk, & Asphalt Street Pervious: Ornamental Landscaping	3,728,951	Type D
DMA 17	Impervious: Streets & Sidewalks Pervious: Ornamental Landscaping	238,170	Type D
DMA PA-1	Pervious: Undeveloped Graded Land	915,140	Type A
DMA PA-2	Pervious: Undeveloped Graded Land	114,304	Type A
Remaining Open Space	Pervious: Natural Open Space	11,132,334	Type A

[1] *Reference Table 2-1 in the WQMP Guidance Document to populate this column*
[2] *If multi-surface provide back-up*

Table C.2 Type ‘A’, Self-Treating Areas **– NOT APPLICABLE**

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)
DMA PA-1	915,140	Hydroseed	None
DMA PA-1	114,304	Hydroseed	None
Remaining Open Space	10,978,427	Hydroseed	None

Table C.3 Type ‘B’, Self-Retaining Areas

Self-Retaining Area				**Type ‘C’ DMAs that are draining to the Self-Retaining Area**		
DMA Name/ ID	Post-project surface type	Area (square feet)	Storm Depth (inches)	DMA Name / ID	[C] from Table C.4 =	Required Retention Depth (inches)
		[A]	[B]		[C]	[D]

$$[D] = [B] + \frac{[B] \cdot [C]}{[A]}$$

Table C.4 Type ‘C’, Areas that Drain to Self-Retaining Areas **– NOT APPLICABLE**

DMA					**Receiving Self-Retaining DMA**		
DMA Name/ ID	Area (square feet)	Post-project surface type	Impervious fraction	Product	DMA name /ID	Area (square feet)	Ratio
	[A]		[B]	[C] = [A] x [B]		[D]	[C]/[D]

Table C.5 Type ‘D’, Areas Draining to BMPs

DMA Name or ID	BMP Name or ID
DMA 1	Extended Detention Basin 4
DMA 6	Extended Detention Basin 3
DMA 13	Extended Detention Basin 2
DMA 16	Extended Detention Basin 1
DMA 17	Bioretention Basin 5

Note: More than one drainage management area can drain to a single LID BMP, however, one drainage management area may not drain to more than one BMP.

Section D: Implement LID BMPs

D.1 Infiltration Applicability

Is there an approved downstream 'Highest and Best Use' for stormwater runoff (see discussion in Chapter 2.4.4 of the WQMP Guidance Document for further details)? ☐ Y ☒ N

If yes has been checked, Infiltration BMPs shall not be used for the site; proceed to section D.3

If no, continue working through this section to implement your LID BMPs. It is recommended that you contact your Co-Permittee to verify whether or not your project discharges to an approved downstream 'Highest and Best Use' feature.

Geotechnical Report

A Geotechnical Report or Phase I Environmental Site Assessment may be required by the Copermittee to confirm present and past site characteristics that may affect the use of Infiltration BMPs. In addition, the Co-Permittee, at their discretion, may not require a geotechnical report for small projects as described in Chapter 2 of the WQMP Guidance Document. If a geotechnical report has been prepared, include it in Appendix 3. In addition, if a Phase I Environmental Site Assessment has been prepared, include it in Appendix 4.

Is this project classified as a small project consistent with the requirements of Chapter 2 of the WQMP Guidance Document? ☐ Y ☒ N

Infiltration Feasibility

Table D.1 below is meant to provide a simple means of assessing which DMAs on your site support Infiltration BMPs and is discussed in the WQMP Guidance Document in Chapter 2.4.5. Check the appropriate box for each question and then list affected DMAs as applicable. If additional space is needed, add a row below the corresponding answer.

Table D.1 Infiltration Feasibility

Does the project site…	YES	NO
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?		X
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		X
If Yes, list affected DMAs:		
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?		X
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?		X
If Yes, list affected DMAs: ***ALL,***		
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?	X	
If Yes, list affected DMAs: ***ALL***		
…geotechnical report identify other site-specific factors that would preclude effective and safe infiltration?		X
Describe here:		

If you answered "Yes" to any of the questions above for any DMA, Infiltration BMPs should not be used for those DMAs and you should proceed to the assessment for Harvest and Use below.

D.2 Harvest and Use Assessment

Please check what applies*:*

☐ Reclaimed water will be used for the non-potable water demands for the project.

☐Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Copermittee).

☐The Design Capture Volume will be addressed using Infiltration Only BMPs. In such a case, Harvest and Use BMPs are still encouraged, but it would not be required if the Design Capture Volume will be infiltrated or evapotranspired.

If any of the above boxes have been checked, Harvest and Use BMPs need not be assessed for the site. If none of the above criteria applies, follow the steps below to assess the feasibility of irrigation use, toilet use and other non-potable uses (e.g., industrial use).

Irrigation Use Feasibility – NOT APPLICABLE

Complete the following steps to determine the feasibility of harvesting stormwater runoff for Irrigation Use BMPs on your site:

Step 1: Identify the total area of irrigated landscape on the site, and the type of landscaping used.

Total Area of Irrigated Landscape: 2,166,009 s.f.

Type of Landscaping (Conservation Design or Active Turf): Conservation Design

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for irrigation use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: 9,648,444 s.f.

Step 3: Cross reference the Design Storm depth for the project site (see Exhibit A of the WQMP Guidance Document) with the left column of Table 2-3 in Chapter 2 to determine the minimum area of Effective Irrigated Area per Tributary Impervious Area (EIATIA).

Enter your EIATIA factor: 1.59

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum irrigated area that would be required.

Minimum required irrigated area: 15,341,026 s.f.

Step 5: Determine if harvesting stormwater runoff for irrigation use is feasible for the project by comparing the total area of irrigated landscape (Step 1) to the minimum required irrigated area (Step 4).

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)
15,341,026 s.f.	2,166,009 s.f.

Toilet Use Feasibility – NOT APPLICABLE

Complete the following steps to determine the feasibility of harvesting stormwater runoff for toilet flushing uses on your site:

Step 1: Identify the projected total number of daily toilet users during the wet season, and account for any periodic shutdowns or other lapses in occupancy:

Projected Number of Daily Toilet Users: 250

Project Type: Industrial

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for toilet use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: 9,648,444 s.f.

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-2 in Chapter 2 to determine the minimum number or toilet users per tributary impervious acre (TUTIA).

Enter your TUTIA factor: 208

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of toilet users that would be required.

Minimum number of toilet users: 2,006,876,352

Step 5: Determine if harvesting stormwater runoff for toilet flushing use is feasible for the project by comparing the Number of Daily Toilet Users (Step 1) to the minimum required number of toilet users (Step 4).

Minimum required Toilet Users (Step 4)	Projected number of toilet users (Step 1)
2,006,876,352	*250*

Other Non-Potable Use Feasibility – NOT APPLICABLE

Are there other non-potable uses for stormwater runoff on the site (e.g. industrial use)? See Chapter 2 of the Guidance for further information. If yes, describe below. If no, write N/A.

N/A

Step 1: Identify the projected average daily non-potable demand, in gallons per day, during the wet season and accounting for any periodic shutdowns or other lapses in occupancy or operation.

Average Daily Demand: Projected Average Daily Use (gpd)

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for the identified non-potable use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: Insert Area (Acres)

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-4 in Chapter 2 to determine the minimum demand for non-potable uses per tributary impervious acre.

Enter the factor from Table 2-4: Enter Value

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of gallons per day of non-potable use that would be required.

Minimum required use: Minimum use required (gpd)

Step 5: Determine if harvesting stormwater runoff for other non-potable use is feasible for the project by comparing the projected average daily use (Step 1) to the minimum required non-potable use (Step 4).

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
Minimum use required (gpd)	Projected Average Daily Use (gpd)

If Irrigation, Toilet and Other Use feasibility anticipated demands are less than the applicable minimum values, Harvest and Use BMPs are not required, and you should proceed to utilize LID Bioretention and Biotreatment per Section 3.4.2 of the WQMP Guidance Document.

D.3 Bioretention and Biotreatment Assessment

Other LID Bioretention and Biotreatment BMPs as described in Chapter 2.4.7 of the WQMP Guidance Document are feasible on nearly all development sites with sufficient advance planning.

Select one of the following:

☒ LID Bioretention/Biotreatment BMPs will be used for some, or all DMAs of the project as noted below in Section D.4 (note the requirements of Section 3.4.2 in the WQMP Guidance Document).

☐ A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5. If you plan to submit an analysis demonstrating the technical infeasibility of LID BMPs, request a pre-submittal meeting with the Copermittee to discuss this option. Proceed to Section E to document your alternative compliance measures.

D.4 Feasibility Assessment Summaries

From the Infiltration, Harvest and Use, Bioretention and Biotreatment Sections above, complete Table D.2 below to summarize which LID BMPs are technically feasible, and which are not, based upon the established hierarchy.

Table D.2 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
DMA 1	☐	☐	☐	☒	☐
DMA 6	☐	☐	☐	☒	☐
DMA 13	☐	☐	☐	☒	☐
DMA 16	☐	☐	☐	☒	☐
DMA 17	☐	☐	☒	☐	☐
PA-1	☐	☐	☒	☐	☐
PA-2	☐	☐	☒	☐	☐

For those DMAs where LID BMPs are not feasible, provide a brief narrative below summarizing why they are not feasible, include your technical infeasibility criteria in Appendix 5, and proceed to Section E below to document Alternative Compliance measures for those DMAs. Recall that each proposed DMA must pass through the LID BMP hierarchy before alternative compliance measures may be considered.

D.5 LID BMP Sizing

Each LID BMP must be designed to ensure that the Design Capture Volume will be addressed by the selected BMPs. First, calculate the Design Capture Volume for each LID BMP using the V_{BMP} worksheet in Appendix F of the LID BMP Design Handbook. Second, design the LID BMP to meet the required V_{BMP} using a method approved by the Copermittee. Utilize the worksheets found in the LID BMP Design Handbook or consult with your Copermittee to assist you in correctly sizing your LID BMPs. Complete Table D.3 below to document the Design Capture Volume and the Proposed Volume for each LID BMP. Provide the completed design procedure sheets for each LID BMP in Appendix 6. You may add additional rows to the table below as needed.

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Extended Detention Basin 4*		
DMA 1	[A]		[B]	[C]	[A] x [C]			
Impervious Areas	*2,722,393*	*Concrete, & Asphalt*	*1.0*	*0.89*	*2,428,374.6*	*Design Storm Depth (in)*	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Pervious Areas	*259,555*	*Ornamental Landscaping*	*0.1*	*0.11*	*28,669.9*			
BMP Basin	*101,335*	*Ornamental Landscaping*	*0.1*	*0.11*	*11,193.3*			
	$A_T = \Sigma[A]$ **3,083,283**				$\Sigma = [D]$ **2,468,237.8**	[E] **0.75**	$[F] = \frac{[D]x[E]}{12}$ **154,264.9**	[G] **416,869**

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Table D.4 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Extended Detention Basin 3*		
DMA 6	[A]		[B]	[C]	[A] x [C]			
Impervious Areas	*2,722,393*	*Concrete & Asphalt*	*1.0*	*0.89*	*2,428,374.6*	*Design Storm Depth (in)*	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Pervious Areas	*259,555*	*Ornamental Landscaping*	*0.1*	*0.11*	*28,669.9*			
BMP Basin	*101,335*	*Ornamental Landscaping*	*0.1*	*0.11*	*1,193.3*			
	$A_T = \Sigma[A]$ **3,083,283**				$\Sigma = [D]$ **2,468,237.8**	[E] **0.75**	$[F] = \frac{[D]x[E]}{12}$ **154,264.9**	[G] **412,284**

Table D.5 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Extended Detention Basin 2*		
DMA 13	[A]		[B]	[C]	[A] x [C]			
Impervious Areas	*3,075,717*	*Concrete & Asphalt*	*1.0*	*0.89*	*2,743,539.6*	*Design Storm Depth (in)*	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Pervious Areas	*674,044*	*Ornamental Landscaping*	*0.1*	*0.11*	*74,453.6*			
BMP Basin	*115,084*	*Ornamental Landscaping*	*0.1*	*0.11*	*12,711.9*			
	$A_T = \Sigma[A]$ **3,864,845**				$\Sigma = [D]$ **2,830,705.1**	[E] **0.75**	$[F] = \frac{[D]x[E]}{12}$ **176,919.1**	[G] **484,817**

Table D.6 DCV Calculations for LID BMPs

DMA Type/ID	**DMA Area (square feet)**	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f**	**DMA Runoff Factor**	**DMA Areas x Runoff Factor**	***Extended Detention Basin 4***		
DMA 16	[A]		[B]	[C]	[A] x [C]	*Design Storm Depth (in)*	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Impervious Areas	*2,816,060*	*Concrete & Asphalt*	*1.0*	*0.89*	*2,511,925.5*			
Pervious Areas	*801,273*	*Ornamental Landscaping*	*0.1*	*0.11*	*88,507*			
BMP Basin	*111,618*	*Ornamental Landscaping*	*0.1*	*0.11*	*12,329.1*			
	$A_T = \Sigma[A]$ **3,728,951**				$\Sigma = [D]$ **2,612,761.6**	[E] **0.75**	$[F] = \frac{[D]x[E]}{12}$ **163,297.6**	[G] **447,431**

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Table D.7 DCV Calculations for LID BMPs

DMA Type/ID	**DMA Area (square feet)**	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f**	**DMA Runoff Factor**	**DMA Areas x Runoff Factor**	***Bioretention Basin 5***		
DMA 17	[A]		[B]	[C]	[A] x [C]	*Design Storm Depth (in)*	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Impervious: Streets & Sidewalks	*144,682*	*Concrete & Asphalt*	*1.0*	*0.89*	*129,056.3*			
Pervious: Ornamental Landscape	*61,102*	*Ornamental Landscaping*	*0.1*	*0.11*	*6,749.2*			
BMP Basin	*32,386*	*Ornamental Landscaping*	*0.1*	*0.11*	*3,577.3*			
	$A_T = \Sigma[A]$ **238,170**				$\Sigma = [D]$ **139,382.8**	[E] **0.75**	$[F] = \frac{[D]x[E]}{12}$ **8,711.4**	[G] ***36,191***

Section E: Alternative Compliance (LID Waiver Program)

LID BMPs are expected to be feasible on virtually all projects. Where LID BMPs have been demonstrated to be infeasible as documented in Section D, other Treatment Control BMPs must be used (subject to LID waiver approval by the Copermittee). Check one of the following Boxes:

☒ LID Principles and LID BMPs have been incorporated into the site design to fully address all Drainage Management Areas. No alternative compliance measures are required for this project and thus this Section is not required to be completed.

- *Or* -

☐ The following Drainage Management Areas are unable to be addressed using LID BMPs. A site-specific analysis demonstrating technical infeasibility of LID BMPs has been approved by the Co-Permittee and included in Appendix 5. Additionally, no downstream regional and/or sub-regional LID BMPs exist or are available for use by the project. The following alternative compliance measures on the following pages are being implemented to ensure that any pollutant loads expected to be discharged by not incorporating LID BMPs, are fully mitigated.

List DMAs here.

E.1 Identify Pollutants of Concern

Utilizing Table A.1 from Section A above which noted your project's receiving waters and their associated EPA approved 303(d) listed impairments, cross reference this information with that of your selected Priority Development Project Category in Table E.1 below. If the identified General Pollutant Categories are the same as those listed for your receiving waters, then these will be your Pollutants of Concern and the appropriate box or boxes will be checked on the last row. The purpose of this is to document compliance and to help you appropriately plan for mitigating your Pollutants of Concern in lieu of implementing LID BMPs.

Table E.1 Potential Pollutants by Land Use Type

Priority Development Project Categories and/or Project Features (check those that apply)		**General Pollutant Categories**							
		Bacterial Indicators	**Metals**	**Nutrients**	**Pesticides**	**Toxic Organic Compounds**	**Sediments**	**Trash & Debris**	**Oil & Grease**
☐	Detached Residential Development	P	N	P	P	N	P	P	P
☐	Attached Residential Development	P	N	P	P	N	P	P	P[2]
☒	Commercial/Industrial Development	P[3]	P	P[1]	P[1]	P[5]	P[1]	P	P
☐	Automotive Repair Shops	N	P	N	N	P[4, 5]	N	P	P
☐	Restaurants (>5,000 ft^2)	P	N	N	N	N	N	P	P
☒	Hillside Development (>5,000 ft2)	P	N	P	P	N	P	P	P
☒	Parking Lots (>5,000 ft^2)	P[6]	P	P[1]	P[1]	P[4]	P[1]	P	P
☐	Retail Gasoline Outlets	N	P	N	N	P	N	P	P
Project Priority Pollutant(s) of Concern		☒	☒	☒	☐	☐	☐	☐	☐

P = Potential

N = Not Potential

(1) A potential Pollutant if non-native landscaping exists or is proposed onsite; otherwise not expected

(2) A potential Pollutant if the project includes uncovered parking areas; otherwise not expected

(3) A potential Pollutant is land use involving animal waste

(4) Specifically petroleum hydrocarbons

(5) Specifically solvents

(6) Bacterial indicators are routinely detected in pavement runoff

E.2 Stormwater Credits – NOT APPLICABLE

Projects that cannot implement LID BMPs but nevertheless implement smart growth principles are potentially eligible for Stormwater Credits. Utilize Table 3-8 within the WQMP Guidance Document to identify your Project Category and its associated Water Quality Credit. If not applicable, write N/A.

Table E.2 Water Quality Credits

Qualifying Project Categories	Credit Percentage[2]
Total Credit Percentage[1]	

[1]Cannot Exceed 50%

[2]Obtain corresponding data from Table 3-8 in the WQMP Guidance Document

E.3 Sizing Criteria – NOT APPLICABLE

After you appropriately considered Stormwater Credits for your project, utilize Table E.3 below to appropriately size them to the DCV, or Design Flow Rate, as applicable. Please reference Chapter 3.5.2 of the WQMP Guidance Document for further information.

Table E.3 Treatment Control BMP Sizing

DMA Type/ID	**DMA Area (square feet)**	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f**	**DMA Runoff Factor**	**DMA Area x Runoff Factor**	*Design Storm Depth (in)*	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
DMA 1	[A]		[B]	[C]	[A] x [C]				
	A_T= Σ[A]				Σ= [D]	[E]	[F] = $\frac{[D]x[E]}{[G]}$	[F] X (1-[H])	[I]

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document

[E] is for Flow-Based Treatment Control BMPs [E] = .2, for Volume-Based Control Treatment BMPs, [E] obtained from Exhibit A in the WQMP Guidance Document

[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12

[H] is from the Total Credit Percentage as Calculated from Table E.2 above

[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

E.4 Treatment Control BMP Selection

Treatment Control BMPs typically provide proprietary treatment mechanisms to treat potential pollutants in runoff, but do not sustain significant biological processes. Treatment Control BMPs must have a removal efficiency of a medium or high effectiveness as quantified below:

- **High**: equal to or greater than 80% removal efficiency
- **Medium**: between 40% and 80% removal efficiency

Such removal efficiency documentation (e.g., studies, reports, etc.) as further discussed in Chapter 3.5.2 of the WQMP Guidance Document, must be included in Appendix 6. In addition, ensure that proposed Treatment Control BMPs are properly identified on the WQMP Site Plan in Appendix 1.

Table E.4 Treatment Control BMP Selection

Selected Treatment Control BMP Name or ID[1]	Priority Pollutant(s) of Concern to Mitigate[2]	Removal Efficiency Percentage[3]
Extended Detention Basins (5)	Nutrients	Medium
Bioretention Basin (1)	Nutrients	High

[1] Treatment Control BMPs must not be constructed within Receiving Waters. In addition, a proposed Treatment Control BMP may be listed more than once if they possess more than one qualifying pollutant removal efficiency.

[2] Cross Reference Table E.1 above to populate this column.

[3] As documented in a Co-Permittee Approved Study and provided in Appendix 6.

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

Once you have determined that the LID design is adequate to address water quality requirements, you will need to assess if the proposed LID Design may still create a HCOC. Review Chapters 2 and 3 (including Figure 3-7) of the WQMP Guidance Document to determine if your project must mitigate for Hydromodification impacts. If your project meets one of the following criteria which will be indicated by the check boxes below, you do not need to address Hydromodification at this time. However, if the project does not qualify for Exemptions 1, 2 or 3, then additional measures must be added to the design to comply with HCOC criteria. This is discussed in further detail below in Section F.2.

HCOC EXEMPTION 1: The Priority Development Project disturbs less than one acre. The Copermittee has the discretion to require a Project-Specific WQMP to address HCOCs on projects less than one acre on a case by case basis. The disturbed area calculation should include all disturbances associated with larger common plans of development.

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, HCOC criteria do not apply.

HCOC EXEMPTION 2: The volume and time of concentration[1] of storm water runoff for the post-development condition is not significantly different from the pre-development condition for a 2-year return frequency storm (a difference of 5% or less is considered insignificant) using one of the following methods to calculate:

- Riverside County Hydrology Manual
- Technical Release 55 (TR-55): Urban Hydrology for Small Watersheds (NRCS 1986), or derivatives thereof, such as the Santa Barbara Urban Hydrograph Method
- Other methods acceptable to the Co-Permittee

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, report results in Table F.1 below and provide your substantiated hydrologic analysis in Appendix 7.

Table F.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	Post-condition	% Difference
Time of Concentration			
Volume (Cubic Feet)	1,666,094	2,877,832	53.3%

[1] Time of concentration is defined as the time after the beginning of the rainfall when all portions of the drainage basin are contributing to flow at the outlet.

HCOC EXEMPTION 3: All downstream conveyance channels to an adequate sump (for example, Prado Dam, Lake Elsinore, Canyon Lake, Santa Ana River, or other lake, reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Susceptibility Maps.

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, HCOC criteria do not apply and note below which adequate sump applies to this HCOC qualifier:

F.2 HCOC Mitigation

If none of the above HCOC Exemption Criteria are applicable, HCOC criteria is considered mitigated if they meet one of the following conditions:

a. Additional LID BMPS are implemented onsite or offsite to mitigate potential erosion or habitat impacts as a result of HCOCs. This can be conducted by an evaluation of site-specific conditions utilizing accepted professional methodologies published by entities such as the California Stormwater Quality Association (CASQA), the Southern California Coastal Water Research Project (SCCRWP), or other Co-Permittee approved methodologies for site-specific HCOC analysis.

b. The project is developed consistent with an approved Watershed Action Plan that addresses HCOC in Receiving Waters.

c. Mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

Be sure to include all pertinent documentation used in your analysis of the items a, b or c in Appendix 7.

C. TR55 Method has been used to determine the HCOC Volume required. This volume was compared with the total Water Quality Vbmp and the larger of the two volumes was used to size the BMPs. In this case, it was determined that the hydromodification volume governed the sizing of the BMPs where the combined Vbmp is 555,154 c.f. and a 1,045,129 c.f. Documentation of the analysis can be found in Appendix 7.

Section G: Source Control BMPs

Source control BMPs include permanent, structural features that may be required in your project plans — such as roofs over and berms around trash and recycling areas — and Operational BMPs, such as regular sweeping and "housekeeping", that must be implemented by the site's occupant or user. The MEP standard typically requires both types of BMPs. In general, Operational BMPs cannot be substituted for a feasible and effective permanent BMP. Using the Pollutant Sources/Source Control Checklist in Appendix 8, review the following procedure to specify Source Control BMPs for your site:

1. ***Identify Pollutant Sources*****:** Review Column 1 in the Pollutant Sources/Source Control Checklist. Check off the potential sources of Pollutants that apply to your site.

2. ***Note Locations on Project-Specific WQMP Exhibit*****:** Note the corresponding requirements listed in Column 2 of the Pollutant Sources/Source Control Checklist. Show the location of each Pollutant source and each permanent Source Control BMP in your Project-Specific WQMP Exhibit located in Appendix 1.

3. ***Prepare a Table and Narrative*****:** Check off the corresponding requirements listed in Column 3 in the Pollutant Sources/Source Control Checklist. In the left column of Table G.1 below, list each potential source of runoff Pollutants on your site (from those that you checked in the Pollutant Sources/Source Control Checklist). In the middle column, list the corresponding permanent, Structural Source Control BMPs (from Columns 2 and 3 of the Pollutant Sources/Source Control Checklist) used to prevent Pollutants from entering runoff. **Add additional narrative** in this column that explains any special features, materials or methods of construction that will be used to implement these permanent, Structural Source Control BMPs.

4. ***Identify Operational Source Control BMPs:*** To complete your table, refer once again to the Pollutant Sources/Source Control Checklist. List in the right column of your table the Operational BMPs that should be implemented as long as the anticipated activities continue at the site. Copermittee stormwater ordinances require that applicable Source Control BMPs be implemented; the same BMPs may also be required as a condition of a use permit or other revocable Discretionary Approval for use of the site.

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
A. On-site storm drain inlets	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.	• Maintain and periodically repaint or replace inlet markings. • Provide stormwater pollution prevention information to new site owners, lessees, or operators. • See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
B. Interior floor drains and elevator shaft sump pumps	State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	Inspect and maintain drains to prevent blockages and overflow.
D2. Landscape/ Outdoor Pesticide Use	• Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. • Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater by following manufacturers guidelines. • Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. • Consider using pest-resistant plants, especially adjacent to hardscape. • To ensure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	• Maintain landscaping using minimum or no pesticides. • See applicable operational BMPs in "What you should know for…..Landscape and Gardening" athttp://rcflood.org/stormwater
G. Refuse areas	• State how site refuse will be handled and provide supporting detail to what is shown on plans. • State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	State how the following will be implemented: Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs.

		Inspect and pick up litter daily and clean up spills immediately. See Fact Sheet WM-4 “Spill Prevention and Control” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com Keep spill control materials available on-site. See Fact Sheet SC-34, “Waste Handling and Disposal” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
M. Loading Docks		• Move loaded and unloaded items indoors as soon as possible. • See Fact Sheet SC-30, “Outdoor Loading and Unloading,” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
N. Fire Sprinkler Test Water	Provide a means to drain fire sprinkler test water to the sanitary sewer.	• See the note in Fact Sheet SC-41, “Building and Grounds Maintenance,” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
O. Miscellaneous Drain or Wash Water or Other Sources • Rooftop equipment • Roofing, gutters, and trim.		• Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment. • Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.
P. Plazas, sidewalks, and parking lots.		• Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Use absorbent to collect fluids, oil and greases and dispose of properly to prevent entry into the storm drain system. In the event wastewater is required, it is to be contained and collected without entering the storm drain system.

Section H: Construction Plan Checklist

Populate Table H.1 below to assist the plan checker in an expeditious review of your project. The first two columns will contain information that was prepared in previous steps, while the last column will be populated with the corresponding plan sheets. This table is to be completed with the submittal of your final Project-Specific WQMP.

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)	BMP Location (Lat/Long)
Basin 1	Extended Detention Basin sized to capture the adequate DCV	Sheet 3 Preliminary WQMP Site Plan	Lat: 33°56’32”N Long: 117°03’27”W
Basin 2	Extended Detention Basin sized to capture the adequate DCV	Sheet 2 Preliminary WQMP Site Plan	Lat: 33°56’26”N Long: 117°03’15”W
Basin 3	Extended Detention Basin sized to capture the adequate DCV	Sheet 2 Preliminary WQMP Site Plan	Lat: 33°56’15”N Long: 117°02’56”W
Basin 4	Extended Detention Basin sized to capture the adequate DCV	Sheet 1 Preliminary WQMP Site Plan	Lat: 33°56’04”N Long: 117°02’32”W
Basin 5	Bioretention Basin sized to capture the adequate DCV	Sheet 3 Preliminary WQMP Site Plan	Lat: 33°55'59"N Long: 117° 02'04"W

Note that the updated table — or Construction Plan WQMP Checklist — is **only a reference tool** to facilitate an easy comparison of the construction plans to your Project-Specific WQMP. Co-Permittee staff can advise you regarding the process required to propose changes to the approved Project-Specific WQMP.

Section I: Operation, Maintenance and Funding

The Copermittee will periodically verify that Stormwater BMPs on your site are maintained and continue to operate as designed. To make this possible, your Copermittee will require that you include in Appendix 9 of this Project-Specific WQMP:

1. A means to finance and implement facility maintenance in perpetuity, including replacement cost.
2. Acceptance of responsibility for maintenance from the time the BMPs are constructed until responsibility for operation and maintenance is legally transferred. A warranty covering a period following construction may also be required.
3. An outline of general maintenance requirements for the Stormwater BMPs you have selected.
4. Figures delineating and designating pervious and impervious areas, location, and type of Stormwater BMP, and tables of pervious and impervious areas served by each facility. Geo-locating the BMPs using a coordinate system of latitude and longitude is recommended to help facilitate a future statewide database system.
5. A separate list and location of self-retaining areas or areas addressed by LID Principles that do not require specialized O&M or inspections but will require typical landscape maintenance as noted in Chapter 5, pages 85-86, in the WQMP Guidance. Include a brief description of typical landscape maintenance for these areas.

Your local Co-Permittee will also require that you prepare and submit a detailed Stormwater BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the Stormwater BMPs built on your site. An agreement assigning responsibility for maintenance and providing for inspections and certification may also be required.

Details of these requirements and instructions for preparing a Stormwater BMP Operation and Maintenance Plan are in Chapter 5 of the WQMP Guidance Document.

Maintenance Mechanism: *Private facilities, including the storm drain conveyance system, extended detention basins, bioretention basin, and all other structural BMPs, will be maintained by the Property Owner's Association, funded by a POA fee assessment, as required by the maintenance stipulations in the recorded C, C & R's for this project.*

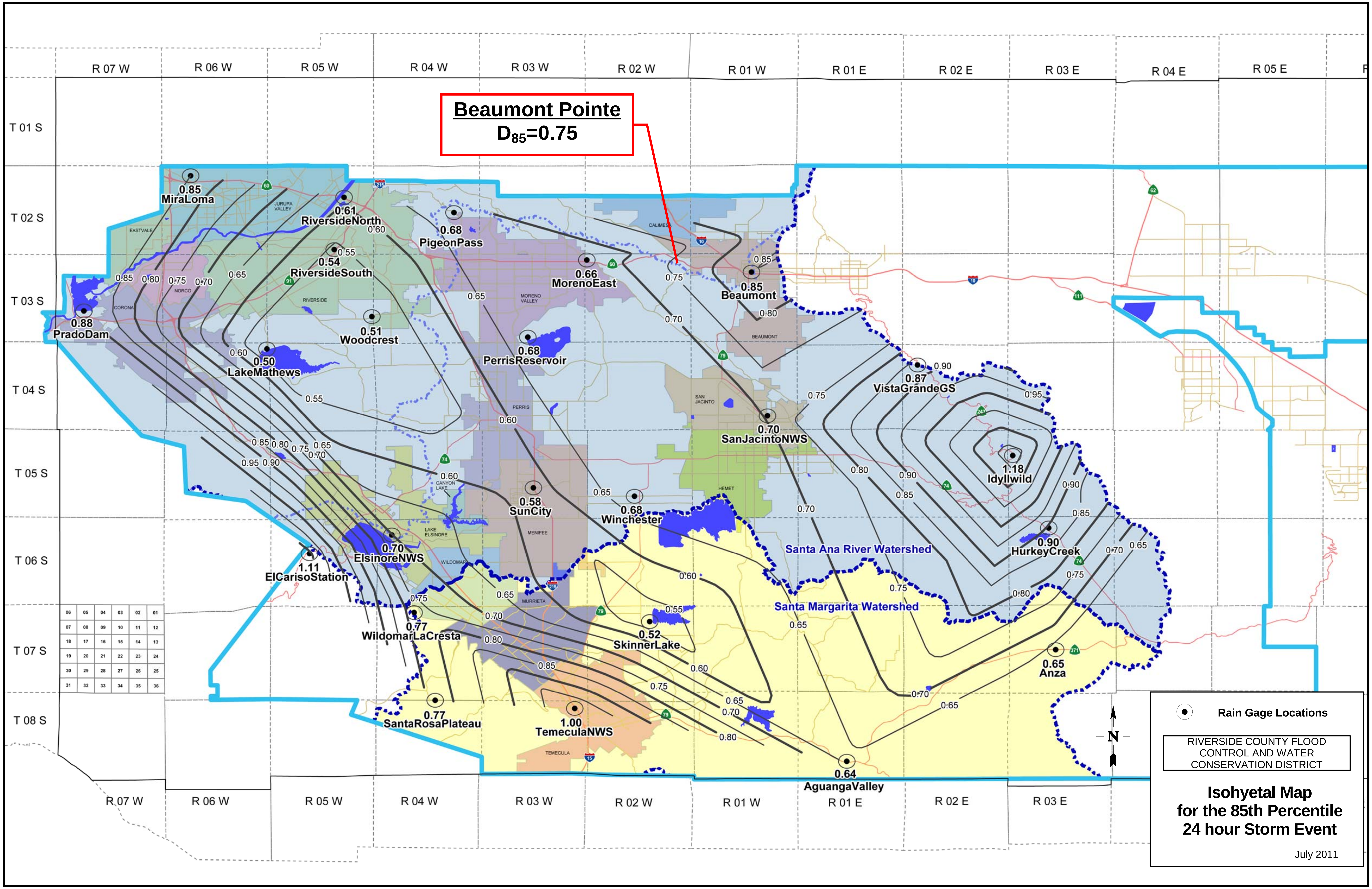
Will the proposed BMPs be maintained by a Homeowners' Association (HOA) or Property Owners Association (POA)?

☒ Y ☐ N

Include your Operation and Maintenance Plan and Maintenance Mechanism in Appendix 9. Additionally, include all pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP in Appendix 10.

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map



Beaumont Pointe
$D_{85}=0.75$

Rain Gage Locations

RIVERSIDE COUNTY FLOOD
CONTROL AND WATER
CONSERVATION DISTRICT

Isohyetal Map
for the 85th Percentile
24 hour Storm Event

July 2011

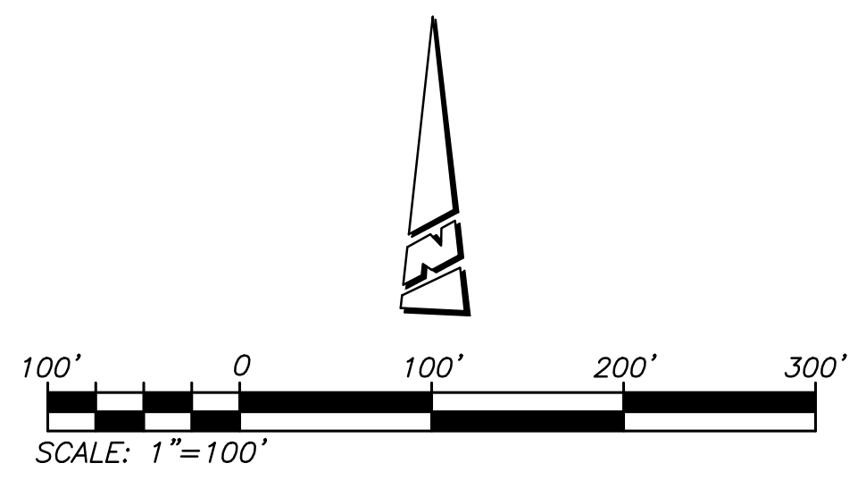
LEGEND:

— - — -	PROPERTY BOUNDARY
🟥	MAJOR DRAINAGE BOUNDARY
☐	IMPERVIOUS AREAS
🟩	PERVIOUS/LANDSCAPING AREAS
▨	PROPOSED BMP BASIN
🟦	FUTURE COMMERCIAL / SELF-TREATING AREA
🟫	REMAINDER PARCEL/NATURAL SELF-TREATING AREAS
—SD→	PROPOSED STORM DRAIN WITH FLOW DIRECTION
←	PROPOSED FLOW DIRECTION
—▭—	PROPOSED CATCH BASIN WITH "ONLY RAIN IN THE DRAIN" STENCIL
TE	PROPOSED TRASH ENCLOSURES

BEAUMONT POINTE
PRELIMINARY WATER QUALITY MANAGEMENT SITE PLAN
INDEX MAP

PROACTIVE ENGINEERING
CONSULTANTS WEST, INC.
25109 JEFFERSON AVE. SUITE 200
MURRIETA, CA 92562
951-200-6840

SHEET:
1 OF 4



PRELIMINARY WQMP SUMMARY		
	DMA 1	DMA 6
TOTAL IMPERVIOUS AREA (SF)	2,722,393	1,089,540
TOTAL PERVIOUS AREA (SF)	360,890	380,926
TOTAL AREA (AC)	70.78	33.76
BASIN ID	BMP BASIN 4	BMP BASIN 3
BMP BASIN TYPE	EXTENDED DETENTION BASIN	EXTENDED DETENTION BASIN
REQUIRED VBMP (CF)	154,265	63,372
TOTAL BASIN CAPACITY (CF)	416,869	412,078

LEGEND:

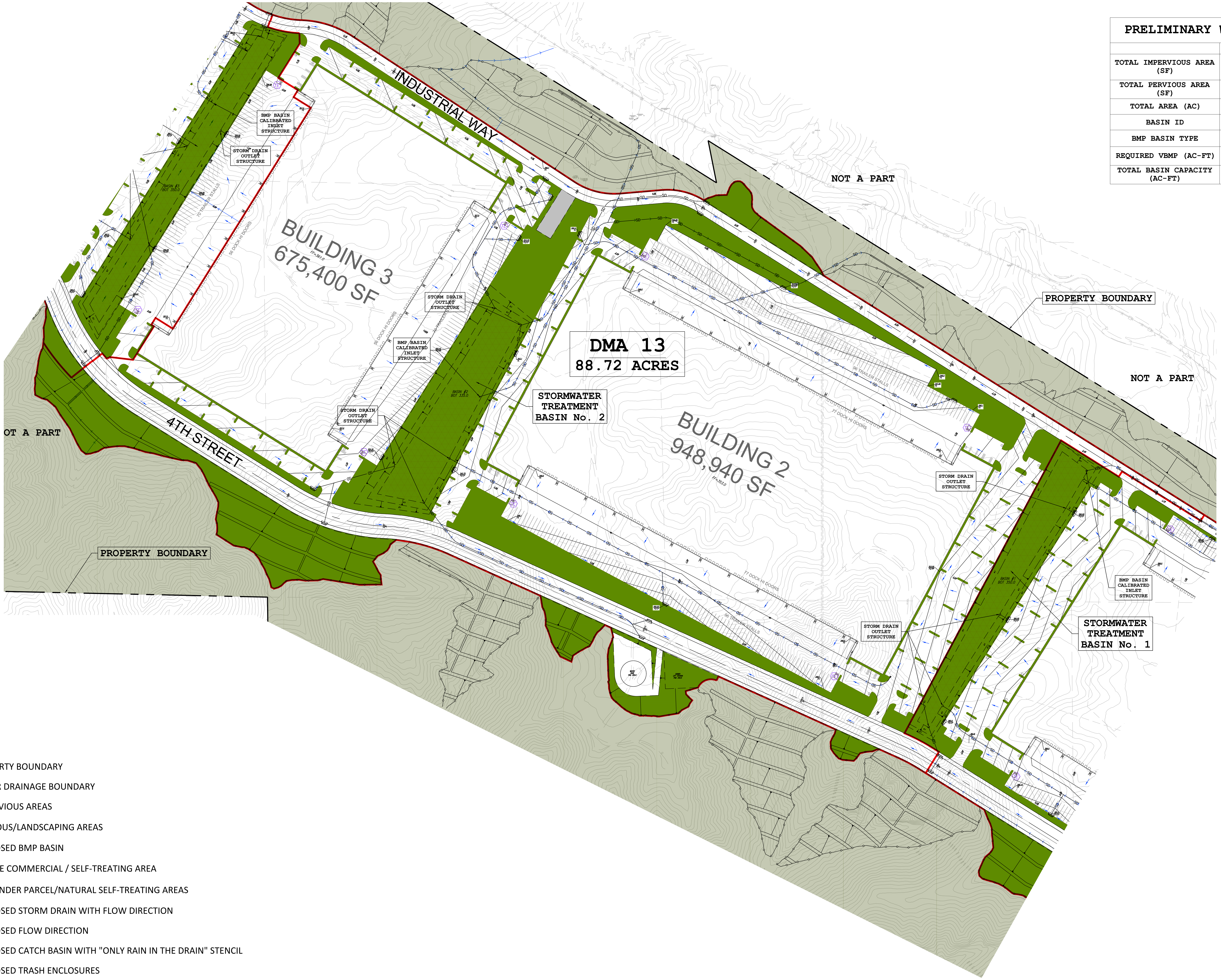
— - —	PROPERTY BOUNDARY
—	MAJOR DRAINAGE BOUNDARY
☐	IMPERVIOUS AREAS
🟩	PERVIOUS/LANDSCAPING AREAS
▨	PROPOSED BMP BASIN
🟦	FUTURE COMMERCIAL / SELF-TREATING AREA
🟫	REMAINDER PARCEL/NATURAL SELF-TREATING AREAS
—SD—	PROPOSED STORM DRAIN WITH FLOW DIRECTION
→	PROPOSED FLOW DIRECTION
—▭—	PROPOSED CATCH BASIN WITH "ONLY RAIN IN THE DRAIN" STENCIL
TE	PROPOSED TRASH ENCLOSURES

BEAUMONT POINTE
PRELIMINARY WATER QUALITY MANAGEMENT SITE PLAN
DMAS 1 & 6

PROACTIVE ENGINEERING CONSULTANTS WEST, INC.
25109 JEFFERSON AVE. SUITE 200
MURRIETA, CA 92562
951-200-6840

SHEET:
2 OF 4

PRELIMINARY WQMP SUMMARY	
	DMA 13
TOTAL IMPERVIOUS AREA (SF)	3,020,455
TOTAL PERVIOUS AREA (SF)	844,390
TOTAL AREA (AC)	88.72
BASIN ID	BMP BASIN 2
BMP BASIN TYPE	EXTENDED DETENTION BASIN
REQUIRED VBMP (AC-FT)	176,919
TOTAL BASIN CAPACITY (AC-FT)	484,817



LEGEND:

- ‒ ‒ ‒ PROPERTY BOUNDARY
- ━ MAJOR DRAINAGE BOUNDARY
- ☐ IMPERVIOUS AREAS
- 🟩 PERVIOUS/LANDSCAPING AREAS
- ▨ PROPOSED BMP BASIN
- 🟦 FUTURE COMMERCIAL / SELF-TREATING AREA
- ▩ REMAINDER PARCEL/NATURAL SELF-TREATING AREAS
- ─SD─ PROPOSED STORM DRAIN WITH FLOW DIRECTION
- ← PROPOSED FLOW DIRECTION
- ─▭─ PROPOSED CATCH BASIN WITH "ONLY RAIN IN THE DRAIN" STENCIL
- ⬡TE PROPOSED TRASH ENCLOSURES

BEAUMONT POINTE
PRELIMINARY WATER QUALITY MANAGEMENT SITE PLAN
DMAS 13

PROACTIVE ENGINEERING
CONSULTANTS WEST, INC.
25109 JEFFERSON AVE. SUITE 200
MURRIETA, CA 92562
951-200-6840

SHEET:
3 OF 4

PRELIMINARY WQMP SUMMARY

	DMA 16	DMA 17	FUTURE COMMERCIAL PA-1	FUTURE COMMERCIAL PA-2
TOTAL IMPERVIOUS AREA (SF)	2,816,060	144,682	0	0
TOTAL PERVIOUS AREA (SF)	912,891	61,102	915,140	92,898
TOTAL AREA (AC)	85.60	5.47	21.01	2.13
BASIN ID	BMP BASIN 1	BMP BASIN 6	TEMP. BMP BASIN A1	TEMP. BMP BASIN A2
BMP BASIN TYPE	EXTENDED DETENTION BASIN	BIORETENETION BASIN	SELF-TREATING AREA	SELF TREATING AREA
REQUIRED VBMP (CF)	163,298	8,711	15,999	1,624
TOTAL BASIN CAPACITY (CF)	447,431	36,191	16,035	1,629

LEGEND:

- — — PROPERTY BOUNDARY
- — MAJOR DRAINAGE BOUNDARY
- ☐ IMPERVIOUS AREA
- 🟩 PERVIOUS AREA
- ▨ PROPOSED BMP BASIN
- 🟦 FUTURE COMMERCIAL / SELF-TREATING AREA
- ■ REMAINDER PARCEL/NATURAL SELF-TREATING AREAS
- —SD— PROPOSED STORM DRAIN WITH FLOW DIRECTION
- ← PROPOSED FLOW DIRECTION
- PROPOSED CATCH BASIN WITH "ONLY RAIN IN THE DRAIN" STENCIL
- TE PROPOSED TRASH ENCLOSURES

100' 0 100' 200' 300'
SCALE: 1"=100'

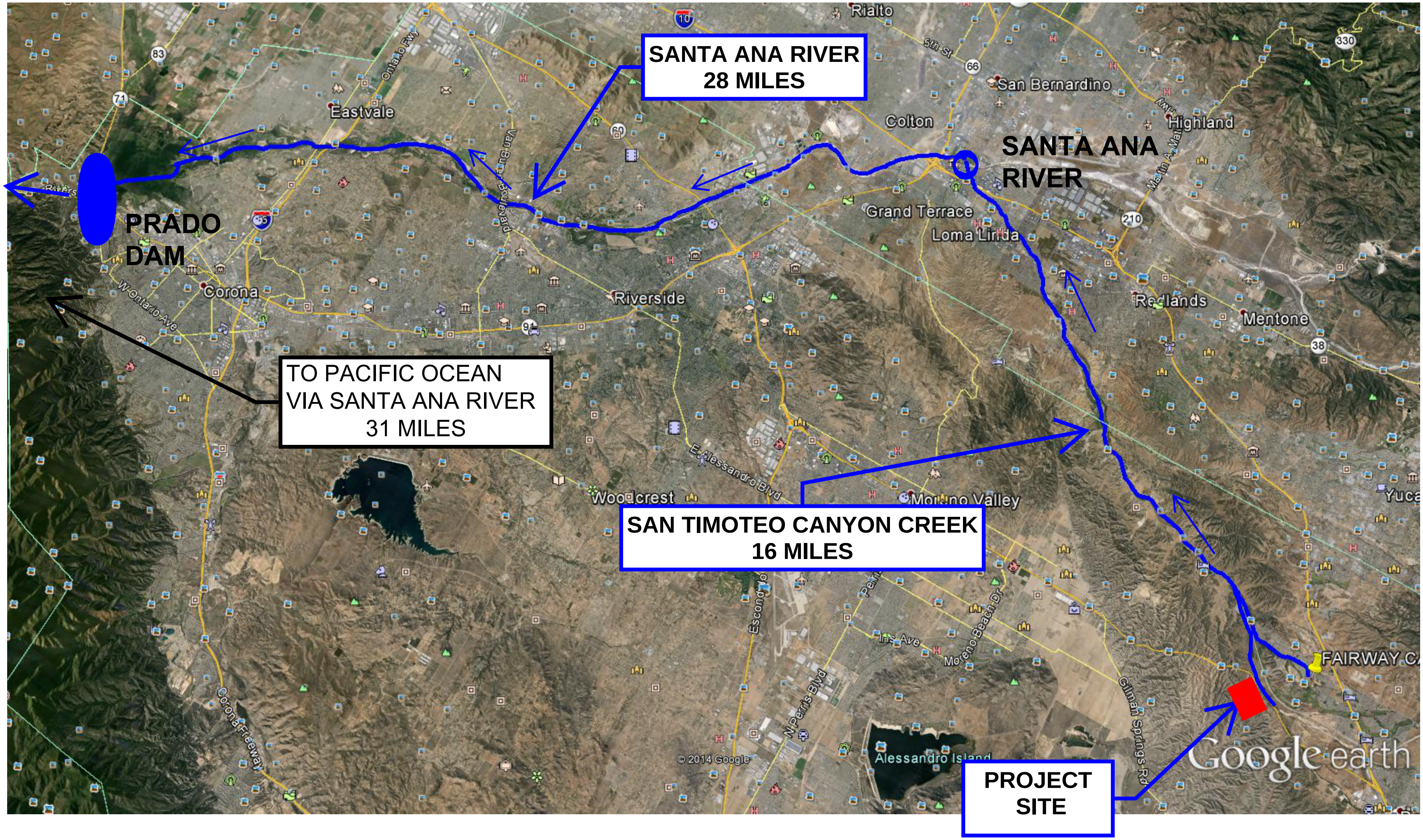
BEAUMONT POINTE
PRELIMINARY WATER QUALITY MANAGEMENT SITE PLAN
DMAS 16, 17, PA-1, & PA-2

PROACTIVE ENGINEERING
CONSULTANTS WEST, INC.
25109 JEFFERSON AVE. SUITE 200
MURRIETA, CA 92562
951-200-6840

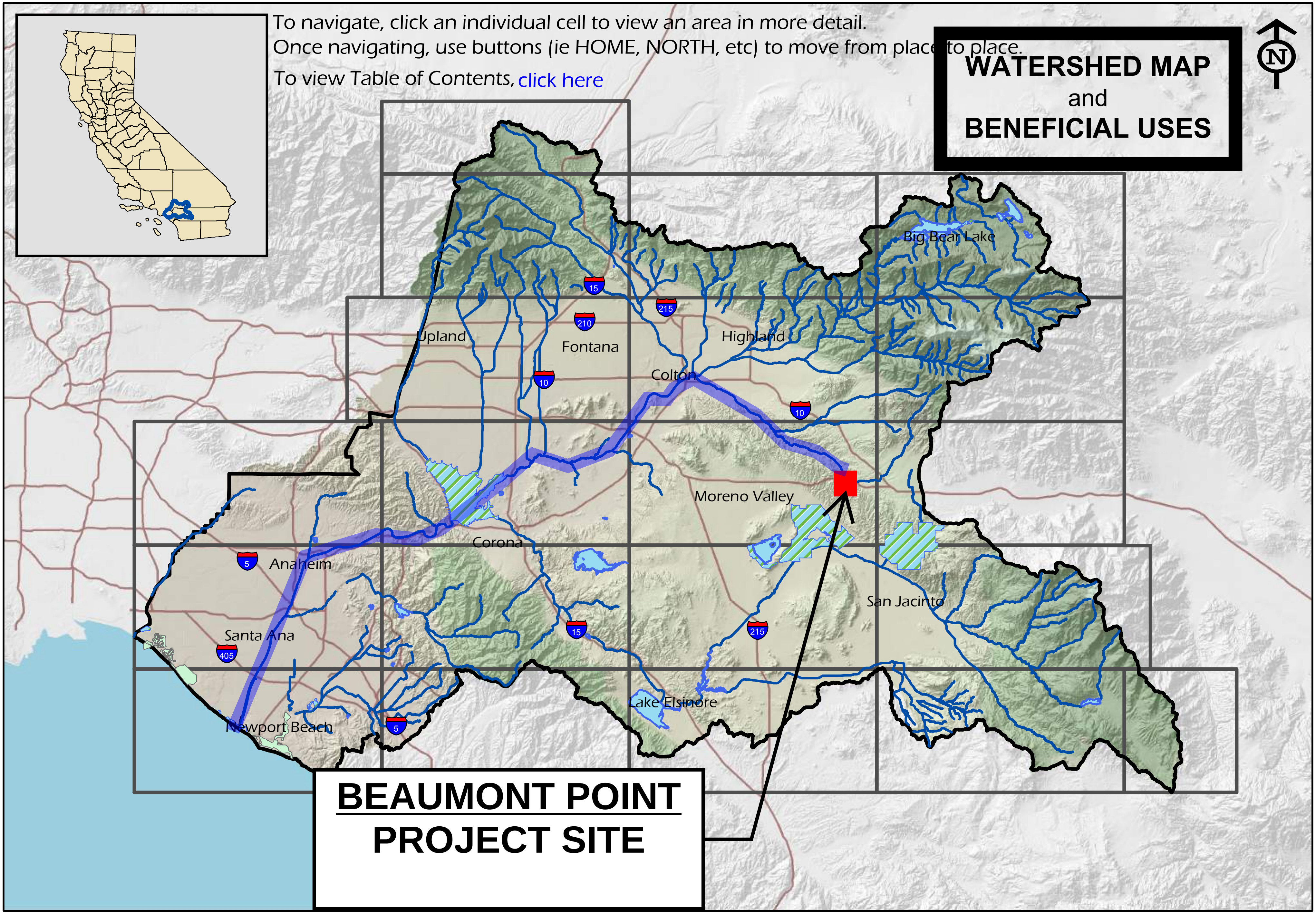
SHEET:
4 OF 4

BEAUMONT POINTE

DRAINAGE PATH EXHIBIT



Regional Water Quality Control Board
Region 8 Basin Plan map - Beneficial Uses

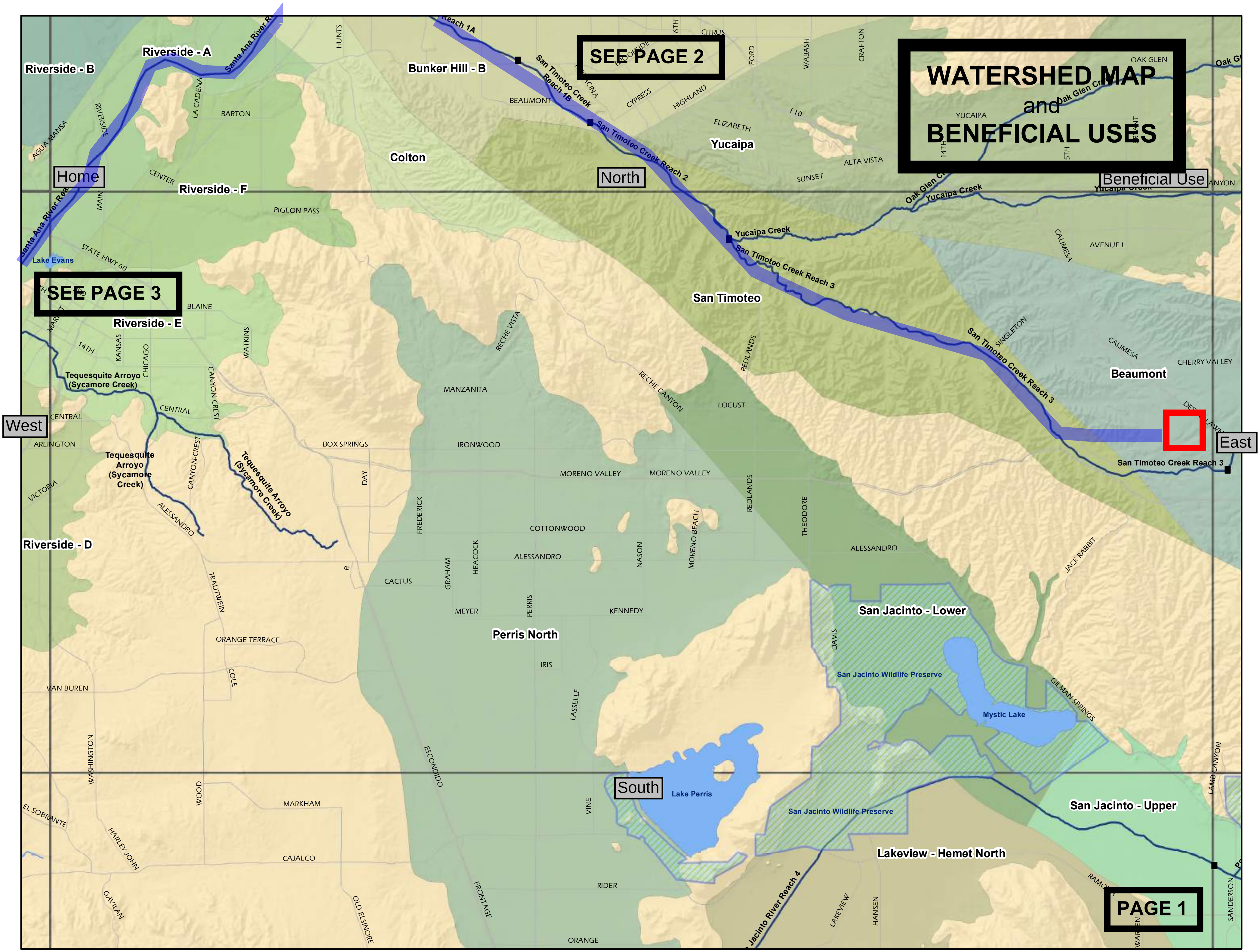


To navigate, click an individual cell to view an area in more detail.
Once navigating, use buttons (ie HOME, NORTH, etc) to move from place to place.

To view Table of Contents, click here

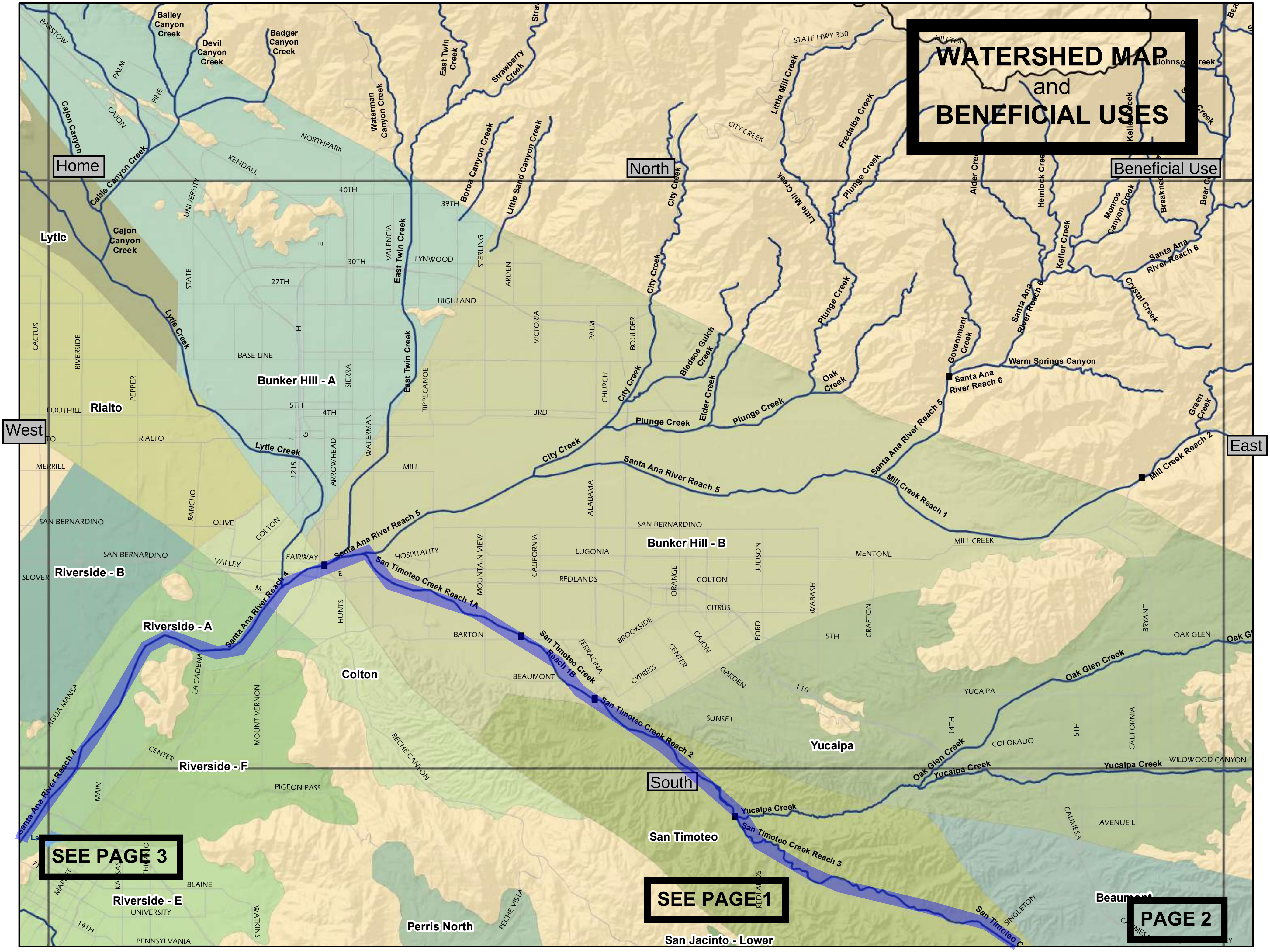
WATERSHED MAP
and
BENEFICIAL USES

BEAUMONT POINT
PROJECT SITE



WATERSHED MAP and BENEFICIAL USES

WATERSHED MAP and BENEFICIAL USES



WATERSHED MAP
and
BENEFICIAL USES

Home
North
West
East
South
Beneficial Use
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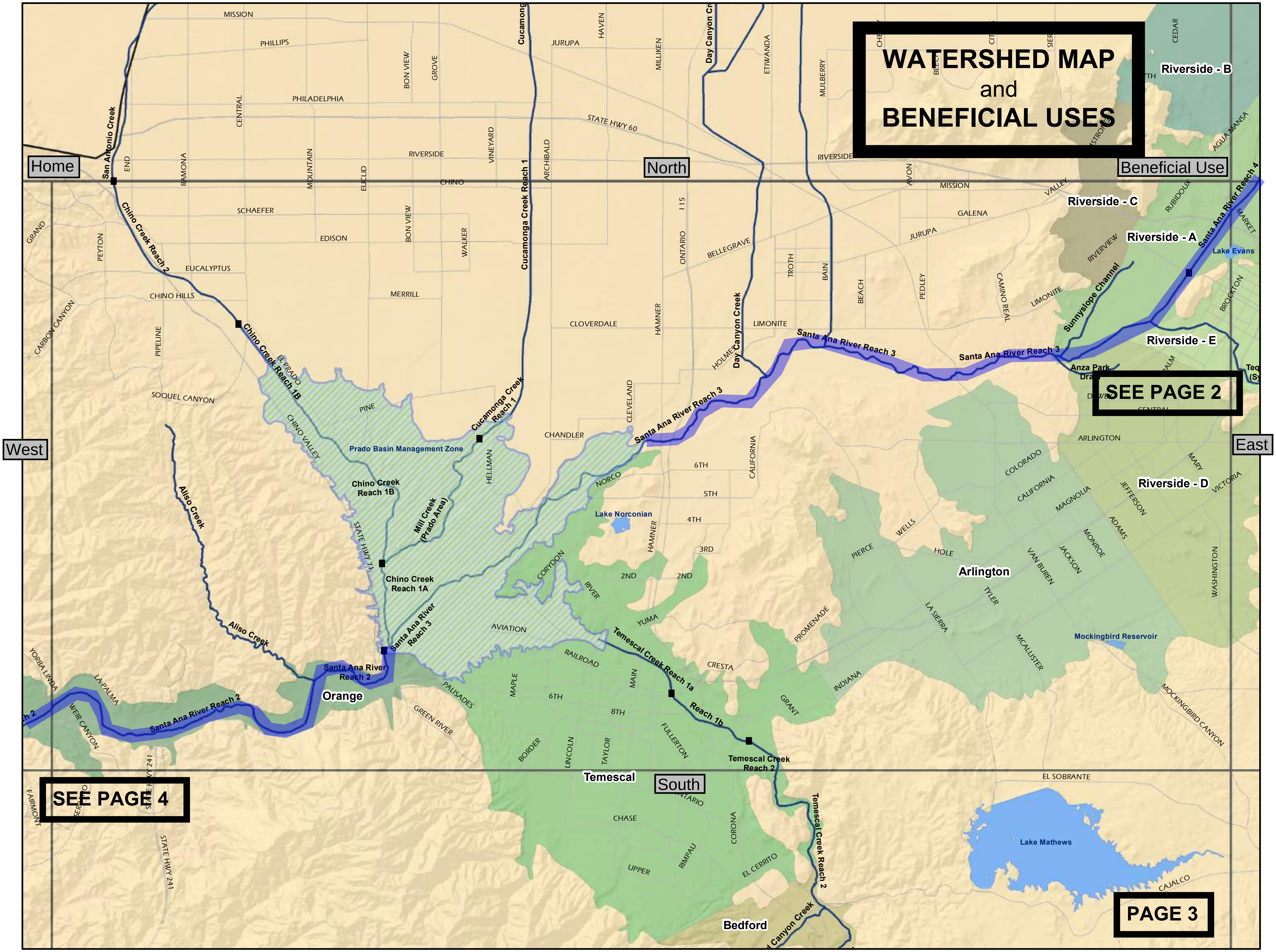
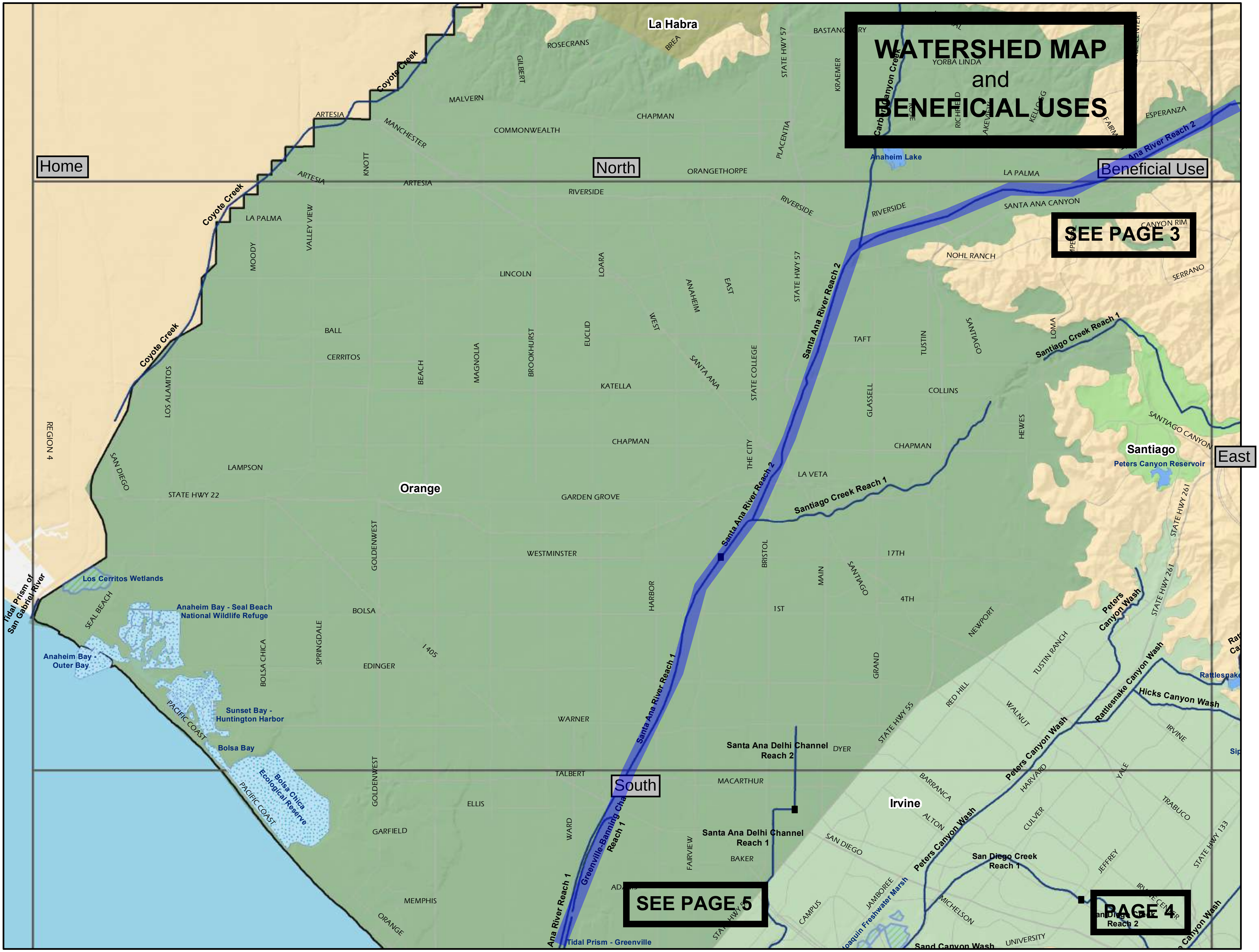
PAGE 3




WATERSHED MAP
and
BENEFICIAL USES
Home
North
Beneficial Use
East
South
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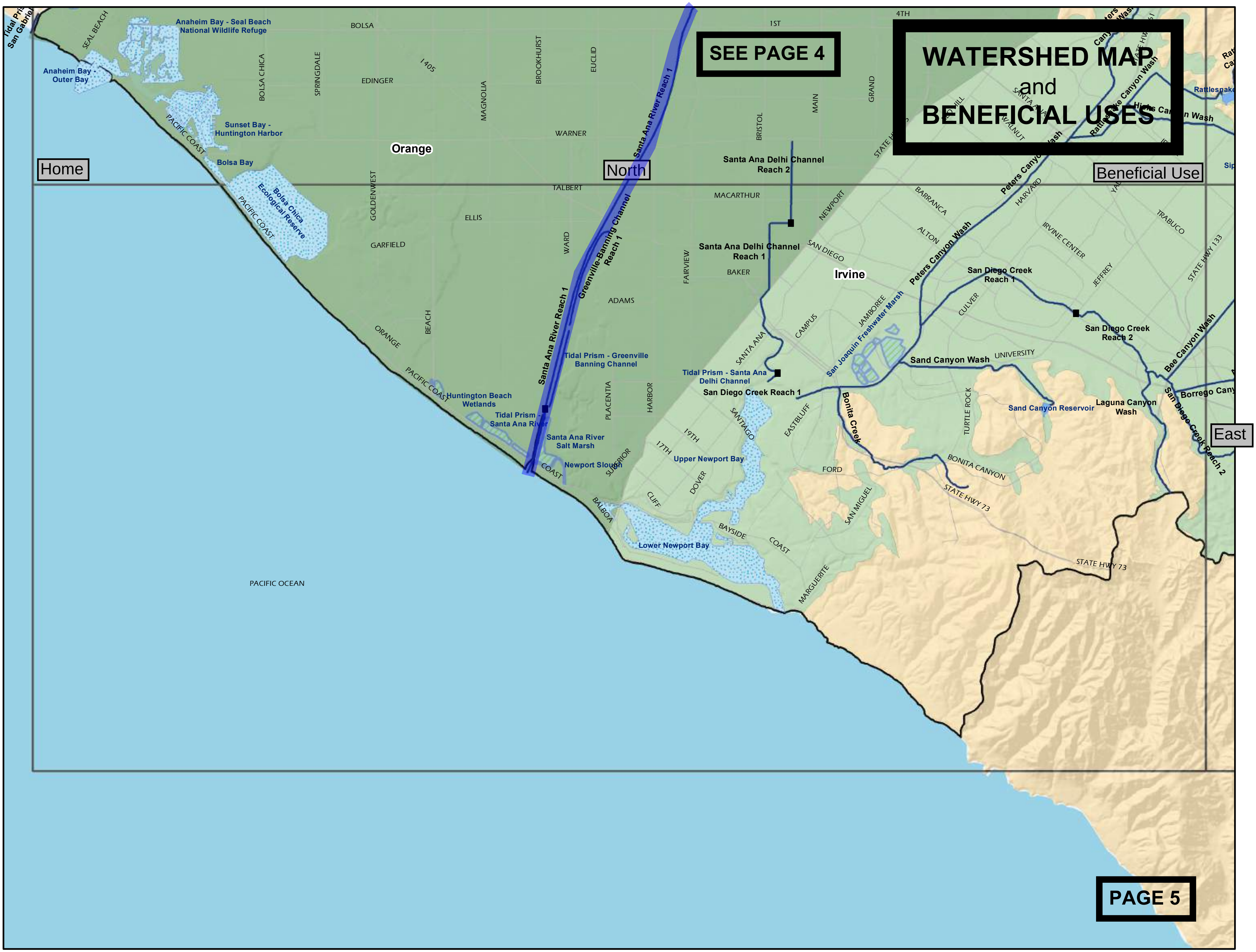
PAGE 4
La Habra
Orange
Santiago
Irvine
REGION 4
Coyote Creek
Coyote Creek
Coyote Creek
Santa Ana River Reach 2
Santa Ana River Reach 2
Ana River Reach 2
Santa Ana River Reach 1
Ana River Reach 1
Santiago Creek Reach 1
Santiago Creek Reach 1
Greenville-Banning Channel Reach 1
Santa Ana Delhi Channel Reach 2
Santa Ana Delhi Channel Reach 1
Peters Canyon Wash
Peters Canyon Wash
Peters Canyon Wash
Rattlesnake Canyon Wash
Hicks Canyon Wash
San Diego Creek Reach 1
San Diego Creek Reach 2
Sand Canyon Wash
Carbon Canyon Creek
Anaheim Lake
Peters Canyon Reservoir
Rattlesnake
Tidal Prism of San Gabriel River
Tidal Prism - Greenville
Los Cerritos Wetlands
Anaheim Bay - Seal Beach National Wildlife Refuge
Anaheim Bay - Outer Bay
Sunset Bay - Huntington Harbor
Bolsa Bay
Bolsa Chica Ecological Reserve
San Joaquin Freshwater Marsh
ROSECRANS
BREA
STATE HWY 57
BASTANCHURY
KRAMER
YORBA LINDA
GILBERT
MALVERN
CHAPMAN
COMMONWEALTH
ARTESIA
MANCHESTER
PLACENTIA
RICHFIELD
LAKEVIEW
KELLOGG
FAIRMONT
ESPERANZA
ORANGETHORPE
KNOTT
LA PALMA
RIVERSIDE
SANTA ANA CANYON
CANYON RIM
NOHL RANCH
SERRANO
MOODY
VALLEY VIEW
LINCOLN
LOARA
ANAHEIM
EAST
WEST
BALL
CERRITOS
BEACH
MAGNOLIA
BROOKHURST
EUCLID
SANTA ANA
STATE COLLEGE
TAFT
TUSTIN
SANTIAGO
LOMA
KATELLA
COLLINS
GLASSELL
LOS ALAMITOS
SAN DIEGO
LAMPSON
CHAPMAN
THE CITY
LA VETA
HEWES
SANTIAGO CANYON
STATE HWY 22
GARDEN GROVE
STATE HWY 261
WESTMINSTER
GOLDENWEST
BRISTOL
MAIN
SANTIAGO
17TH
4TH
1ST
HARBOR
NEWPORT
SEAL BEACH
BOLSA
BOLSA CHICA
SPRINGDALE
I 405
EDINGER
GRAND
TUSTIN RANCH
RED HILL
WALNUT
IRVINE
STATE HWY 55
PACIFIC COAST
WARNER
DYER
TALBERT
MACARTHUR
BARRANCA
HARVARD
YALE
TRABUCO
ELLIS
ALTON
CULVER
GARFIELD
WARD
FAIRVIEW
BAKER
SAN DIEGO
STATE HWY 133
JEFFREY
IRVINE CENTER
MEMPHIS
ADAMS
CAMPUS
JAMBOREE
MICHELSON
UNIVERSITY
ORANGE

WATERSHED MAP and BENEFICIAL USES

SEE PAGE 4

Home
North
Beneficial Use
East



		PROC	X
6	Riverside - B (GW Mgmt Zone)	MUN	X
		AGR	X
		IND	X
		PROC	X
6	Riverside - F (GW Mgmt Zone)	MUN	X
		AGR	X
		IND	X
		PROC	X
6	San Timoteo (GW Mgmt Zone)	MUN	X
		AGR	X
		IND	X
		PROC	X
6	San Timoteo Creek Reach 1A	AGR	I
		MUN	+
		REC1	I
		REC2	I
		WARM	I
		WILD	I
6	San Timoteo Creek Reach 1B	MUN	+
		AGR	I
		GWR	I
		REC1	I
		REC2	I
		WARM	I
		WILD	I
6	San Timoteo Creek Reach 2	GWR	X
		MUN	+
		REC1	X
		REC2	X
		WARM	X
		WILD	X
6	Santa Ana River Reach 4	WARM	X
		WILD	X
		GWR	X
		MUN	+
		RARE	X
		REC1	X
		REC2	X
		SPWN	X
6	Santa Ana River Reach 5	AGR	X

7	Yucaipa (GW Mgmt Zone)	MUN	X
		AGR	X
		IND	X
		PROC	X

Cell	Waterbody or GW Mgmt Zone Name	Beneficial Use	Beneficial Use Value
8	Anaheim Lake	GWR	X
		MUN	+
		REC1	X
		REC2	X
		WARM	X
		WILD	X
8	Carbon Canyon Creek	GWR	X
		MUN	X
		RARE	X
		REC1	X
		REC2	X
		WARM	X
		WILD	X
8	Coyote Creek	MUN	X
		WARM	X
		WILD	X
		REC1	X
		REC2	X
8	La Habra (GW Mgmt Zone)	MUN	X
		AGR	X
8	Orange (GW Mgmt Zone)	MUN	X
		AGR	X
		IND	X
		PROC	X
8	Santa Ana River Reach 2	WARM	X
		WILD	X
		MUN	+
		RARE	X
		REC1	X
		REC2	X
		AGR	X
		GWR	X

Return to map cell 8

Beneficial Use definitions
can be found in the Basin Plan.

Beneficial Use Values key:

X = Existing Beneficial Use

I = Intermittent Beneficial Use

U = Rec1/REC2 not attainable
uses as determined by UAA

+ = Excepted from MUN

9	Riverside - A (GW Mgmt Zone)	MUN	X
		AGR	X
		IND	X
		PROC	X
9	Riverside - C (GW Mgmt Zone)	MUN	X
		AGR	X
		IND	X
		PROC	X
9	Riverside - D (GW Mgmt Zone)	MUN	X
		AGR	X
		IND	X
		PROC	X
9	Riverside - E (GW Mgmt Zone)	MUN	X
		AGR	X
		IND	X
		PROC	X
9	San Sevaine Creek	MUN	I
		REC1	I
		REC2	I
		WILD	I
		COLD	I
		GWR	I
9	Santa Ana River Reach 2	GWR	X
		AGR	X
		REC2	X
		REC1	X
		RARE	X
		MUN	+
		WILD	X
		WARM	X
9	Santa Ana River Reach 3	AGR	X
		GWR	X
		MUN	+
		RARE	X
		REC1	X
		REC2	X
		SPWN	X
		WARM	X
		WILD	X
9	Santa Ana River Reach 4	MUN	+
		GWR	X

		SPWN	X
		REC2	X
		REC1	X
		RARE	X
		WILD	X
		WARM	X
9	Sunnyslope Channel	MUN	X
		RARE	X
		REC1	X
		REC2	X
		SPWN	X
		WARM	X
		WILD	X
9	Temescal	MUN	X
		AGR	X
		IND	X
		PROC	X
9	Temescal Creek Reach 1A	MUN	+
		REC1	U
		REC2	X
		WARM	X
		WILD	X
9	Temescal Creek Reach 1B	MUN	+
		REC1	U
		REC2	U
		WARM	X
		WILD	X
9	Temescal Creek Reach 2	AGR	X
		GWR	X
		IND	X
		WILD	X
		MUN	+
		REC1	X
		REC2	X
		WARM	X
9	Tequesquite Arroyo (Sycamore Creek)	GWR	X
		MUN	+
		WILD	X
		REC1	X
		REC2	X
		SPWN	X

		PROC	X
10	San Timoteo Creek Reach 2	GWR	X
		WILD	X
		WARM	X
		REC2	X
		REC1	X
		MUN	+
10	San Timoteo Creek Reach 3	GWR	X
		MUN	+
		REC1	X
		REC2	X
		WARM	X
		WILD	X
10	Santa Ana River Reach 4	WARM	X
		WILD	X
		RARE	X
		REC1	X
		REC2	X
		SPWN	X
		GWR	X
		MUN	+
10	Tequesquite Arroyo (Sycamore Creek)	WARM	X
		WARM	X
		SPWN	X
		SPWN	X
		REC2	X
		REC2	X
		REC1	X
		REC1	X
		WILD	X
		WILD	X
		MUN	+
		MUN	+
		GWR	X
		GWR	X
10	Yucaipa (GW Mgmt Zone)	MUN	X
		AGR	X
		IND	X
		PROC	X
10	Yucaipa Creek	GWR	I
		MUN	I

		REC1	I
		REC2	I
		WARM	I
		WILD	I

Cell	Waterbody or GW Mgmt Zone Name	Beneficial Use	Beneficial Use Value
11	Beaumont (GW Mgmt Zone)	MUN	X
		AGR	X
		IND	X
		PROC	X
11	Little San Gorgonio Creek	REC1	X
		MUN	X
		GWR	X
		WILD	X
		REC2	X
		COLD	X
11	Potrero Creek	MUN	I
		AGR	I
		GWR	I
		REC1	I
		REC2	I
		WARM	I
		WILD	I
11	San Jacinto Wildlife Preserve	BIOL	X
		WARM	X
		REC2	X
		REC1	X
		RARE	X
		WILD	X
		MUN	+
11	San Timoteo Creek Reach 3	WILD	X
		WARM	X
		REC2	X
		REC1	X
		MUN	+
		GWR	X
11	Yucaipa (GW Mgmt Zone)	MUN	X
		AGR	X
		IND	X
		PROC	X

Return to map cell 11

Beneficial Use definitions
can be found in the Basin Plan.

Beneficial Use Values key:

X = Existing Beneficial Use

I = Intermittent Beneficial Use

U = Rec1/REC2 not attainable
uses as determined by UAA

+ = Excepted from MUN

		REC2	X
		WARM	X
		WILD	X
12	Peters Canyon Wash	REC2	I
		WARM	I
		WILD	I
		GWR	I
		MUN	+
		REC1	I
12	Rattlesnake Canyon Wash	WILD	I
		GWR	I
		MUN	+
		REC1	I
		REC2	I
		WARM	I
12	Santa Ana River Reach 1	REC1	X
		REC2	X
		WARM	I
		WILD	I
		MUN	+
12	Santa Ana River Reach 2	AGR	X
		GWR	X
		WARM	X
		WILD	X
		MUN	+
		RARE	X
		REC1	X
		REC2	X
12	Santa Ana Delhi Channel Reach 2	MUN	+
		REC1	U
		REC2	X
		WARM	X
		WILD	X
12	Santiago (GW Mgmt Zone)	MUN	X
		AGR	X
		IND	X
12	Santiago Creek Reach 1	GWR	X
		WILD	X
		MUN	X
		REC1	X
		REC2	X

		WILD	X
16	San Diego Creek Reach 2	GWR	I
		MUN	+
		REC1	I
		REC2	I
		WARM	I
		WILD	I
16	San Joaquin Freshwater Marsh	MUN	+
		REC1	X
		REC2	X
		WARM	X
		BIOL	X
		WILD	X
		RARE	X
16	Sand Canyon Reservoir	MUN	+
		AGR	X
		REC1	X
		REC2	X
		WARM	X
		WILD	X
16	Sand Canyon Wash	GWR	I
		MUN	+
		RARE	I
		REC1	I
		REC2	I
		WARM	I
		WILD	I
16	Santa Ana River Reach 1	MUN	+
		WILD	I
		WARM	I
		REC2	X
		REC1	X
16	Santa Ana River Salt Marsh	MUN	+
		REC1	X
		REC2	X
		BIOL	X
		WILD	X
		RARE	X
		MAR	X
		EST	X
16	Santa Ana-Delhi Channel Reach 1	MUN	+

Appendix 2: Construction Plans

Grading and Drainage Plans

REVISIONS		
NO.	BY	DESCRIPTION

"FOR FINANCE AND CONVEYANCE PURPOSES"

TENTATIVE PARCEL MAP NO. 38161

IN THE CITY OF BEAUMONT, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

BEING A SUBDIVISION OF A PORTION SECTIONS 1, 2 AND 12, T.3 S., R.2 W., S.B.M.

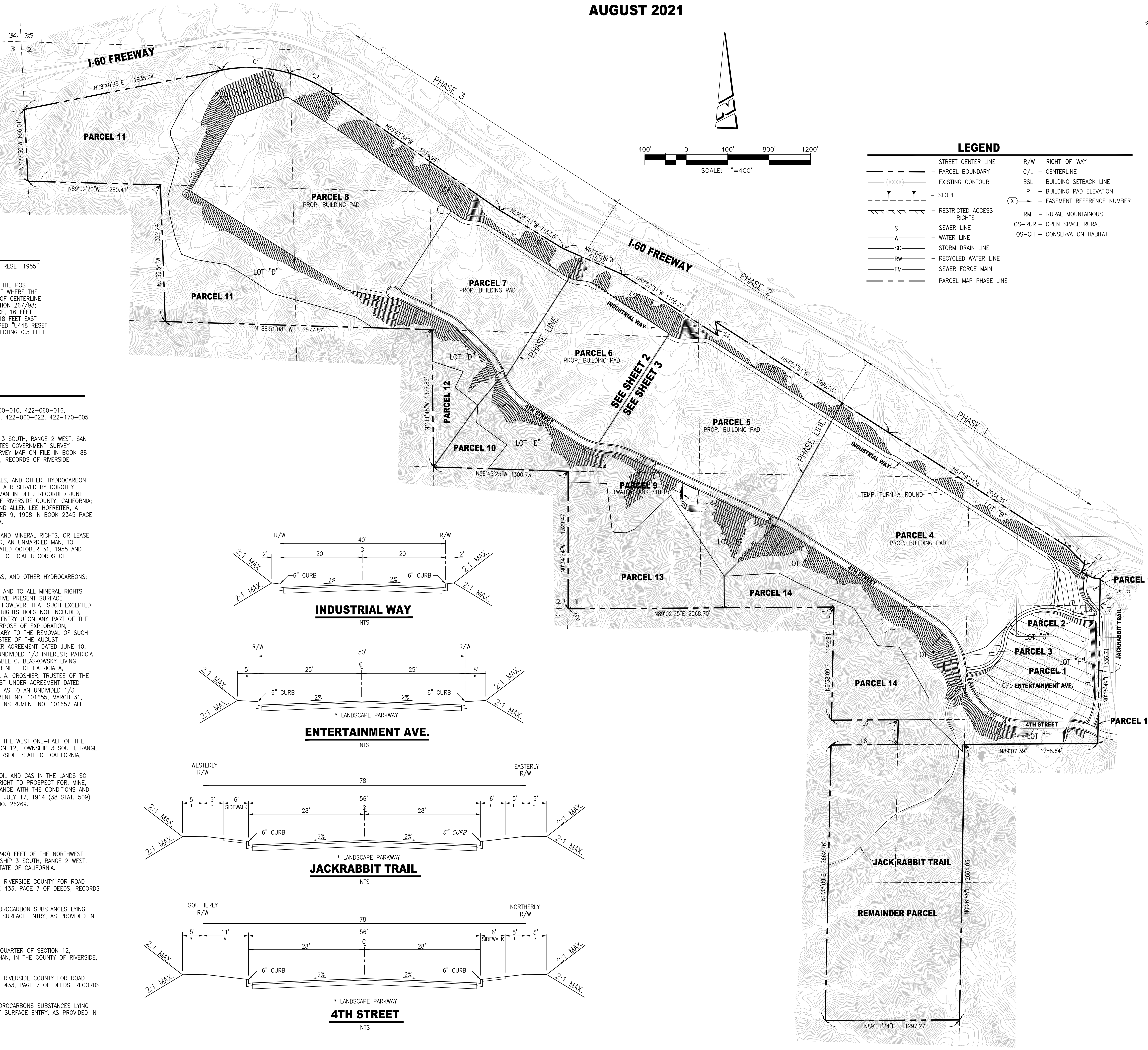
AUGUST 2021

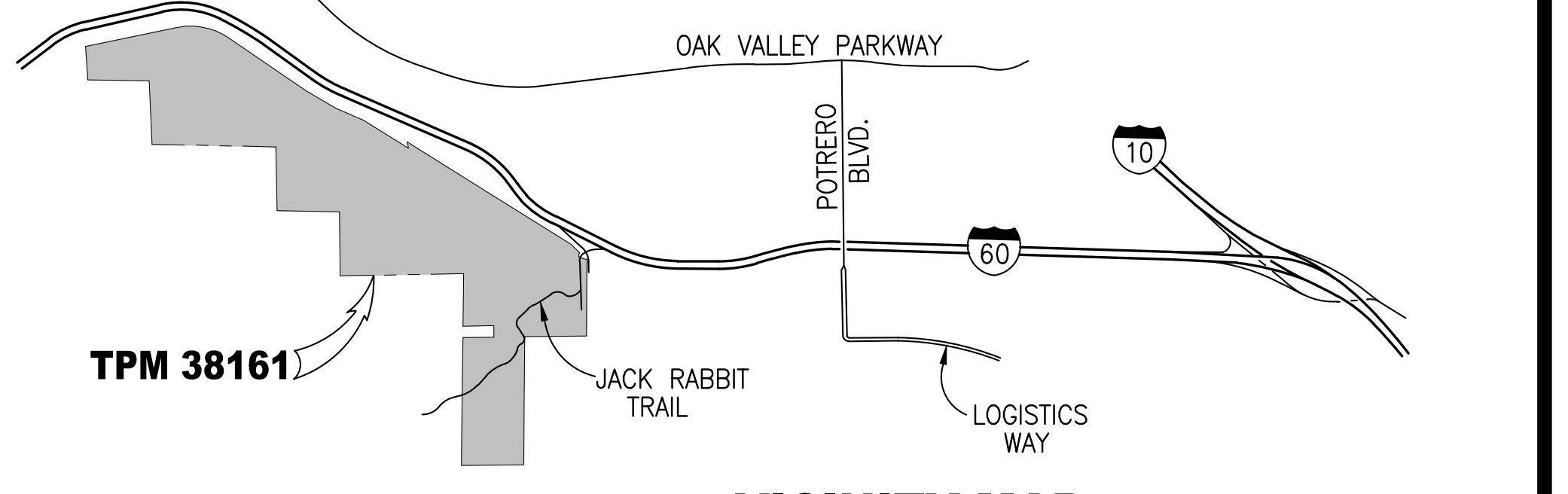
CURVE DATA

C1	Δ= 27°23'02"	R=1400.52'	L=669.36'
C2	Δ= 18°46'42"	R=1398.19'	L=458.25'

LINE DATA

L1	N45°31'23"W	249.8'
L2	N21°27'50"E	80.31'
L3	N63°29'39"W	119.14'
L4	N80°54'14"W	76.1'
L5	N0°16'14"E	253.63'
L6	N11°14'01"W	137.38'
L7	N89°07'39"E	643.93'
L8	N89°07'39"E	644.32'





VICINITY MAP

N.T.S.

LEGEND

— —	STREET CENTER LINE
▬ ▬	PARCEL BOUNDARY
(XXXX)	EXISTING CONTOUR
▼	SLOPE
⌿⌿⌿	RESTRICTED ACCESS RIGHTS
—S—	SEWER LINE
—W—	WATER LINE
—SD—	STORM DRAIN LINE
—RW—	RECYCLED WATER LINE
—FM—	SEWER FORCE MAIN
▬ ▬	PARCEL MAP PHASE LINE

R/W – RIGHT-OF-WAY
C/L – CENTERLINE
BSL – BUILDING SETBACK LINE
P – BUILDING PAD ELEVATION
⟨X⟩→ – EASEMENT REFERENCE NUMBER
RM – RURAL MOUNTAINOUS
OS-RUR – OPEN SPACE RURAL
OS-CH – CONSERVATION HABITAT

TOPOGRAPHY SOURCE

THIENES ENGINEERING
14349 FIRESTONE BLVD.
LA MIRADA, CA 90638
PH. (714) 521-4811

SURVEY NOTES:

BOUNDARY DATA SHOWN HEREIN, IS PER ALTA SURVEY PREPARED BY THIENES ENGINEERING DATED 4/15/2019 (J.N. 3752)

BENCHMARK:

NATIONAL GEODETIC SURVEY BENCHMARK NO. "U 448 RESET 1955"
ELEV. 2448.129' (NGVD '29) DATE: 1955

2.4 MILES WESTERLY ALONG U.S. HIGHWAY 60 FROM THE POST OFFICE AT BEAUMONT, RIVERSIDE COUNTY, AT A POINT WHERE THE HIGHWAY PASSES THROUGH A CUT, 97 FEET NORTH OF CENTERLINE OF THE HIGHWAY OPPOSITE HIGHWAY ENGINEERS STATION 267/98; 16 FEET SOUTH OF THE NORTH RIGHT-OFOWAY FENCE, 16 FEET WEST OF THE RIGHT-OF-WAY FENCE CORNER, AND 18 FEET EAST OF POWER POLE #82663E, A STANDARD DISK, STAMPED "U448 RESET 1955" AND SET IN TOP OF A CONCRETE POST PROJECTING 0.5 FEET ABOVE GROUND.

LEGAL DESCRIPTION:

PARCEL 1:
(APN: 422-060-002, 422-060-005, 422-060-009, 422-060-010, 422-060-016, 422-060-017, A PORTION OF 422-060-018, 422-060-021, 422-060-022, 422-170-005 AND 422-170-008)

ALL THOSE PORTIONS OF SECTIONS 1, 2 AND 12, TOWNSHIP 3 SOUTH, RANGE 2 WEST, SAN BERNARDINO BASE AND MERIDIAN, ACCORDING TO UNITED STATES GOVERNMENT SURVEY THEREOF, LYING WITHIN THE BOUNDARIES OF RECORD OF SURVEY MAP ON FILE IN BOOK 88 PAGES 87 THROUGH 90 INCLUSIVE OF RECORDS OF SURVEYS, RECORDS OF RIVERSIDE COUNTY, CALIFORNIA;

EXCEPT VARIOUS INTERESTS IN AND TO ALL OIL, GAS, MINERALS, AND OTHER. HYDROCARBON SUBSTANCES, TOGETHER WITH APPURTENANT RIGHTS THERETO, A RESERVED BY DOROTHY HOFREITER, A WIDOW, AND ALLEN LEE HOFREITER, A SINGLE MAN IN DEED RECORDED JUNE 12, 1956 IN BOOK 1926 PAGE 194 OF OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA; AND AS RESERVED BY DOROTHY LEE HOFREITER, A WIDOW, AND ALLEN LEE HOFREITER, A MARRIED MAN, MOTHER AND SON, IN DEED RECORDED OCTOBER 9, 1958 IN BOOK 2345 PAGE 170 OF OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA;

ALSO EXCEPTING THEREFROM 55 PERCENT OF ALL OIL, GAS, AND MINERAL RIGHTS, OR LEASE OF SAME, AS RESERVED IN DEED FROM ALLEN LEE HOFREITER, AN UNMARRIED MAN, TO THADDEUS KALETA AND MARY KALETA, HUSBAND AND WIFE, DATED OCTOBER 31, 1955 AND RECORDED DECEMBER 14, 1955 IN BOOK 1833 PAGE 468 OF OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA;

ALSO EXCEPTING THEREFROM ALL OIL, MINERALS, NATURAL GAS, AND OTHER HYDROCARBONS;

ALSO EXCEPTING THEREFROM AN UNDIVIDED 1/2 INTEREST IN AND TO ALL MINERAL RIGHTS LYING AND BEING MORE THAN 500 FEET BELOW THE RESPECTIVE PRESENT SURFACE ELEVATIONS OF THE ABOVE DESCRIBED PROPERTY, PROVIDED, HOWEVER, THAT SUCH EXCEPTED OWNERSHIP OF SUCH « INTEREST IN AND TO SUCH MINERAL RIGHTS DOES NOT INCLUDED, AND SHALL NOT BE CONSTRUED TO INCLUDE, ANY RIGHT OF ENTRY UPON ANY PART OF THE SURFACE OF THE HEREIN DESCRIBED PROPERTY FOR THE PURPOSE OF EXPLORATION, DEVELOPMENT, DRILLING, STORAGE, OR OTHER ACTIVITY ANCILLARY TO THE REMOVAL OF SUCH MINERAL RIGHT, AS RESERVED BY PATRICIA A CROSHIER, TRUSTEE OF THE AUGUST BLASKOWSKY AND MABEL C. BLASKOWSKY LIVING TRUST UNDER AGREEMENT DATED JUNE 10, 1980, FOR THE BENEFIT OF DOLORES J. WELCH, AS TO AN UNDIVIDED 1/3 INTEREST; PATRICIA A. CROSHIER, TRUSTEE OF THE AUGUST BLASKOWSKY AND MABEL C. BLASKOWSKY LIVING TRUST UNDER AGREEMENT DATED JUNE 10, 1980, FOR THE BENEFIT OF PATRICIA A, CROSHIER, AS TO AN UNDIVIDED 1/3 INTEREST; AND PATRICIA A. CROSHIER, TRUSTEE OF THE AUGUST BLASKOWSKY AND MABEL C BLASKOWSKY LIVING TRUST UNDER AGREEMENT DATED JUNE 10, 1980, FOR THE BENEFIT OF EILEEN R. OVERNOLTE, AS TO AN UNDIVIDED 1/3 INTEREST BY DEEDS RECORDED MARCH 31, 1989 AS INSTRUMENT NO, 101655, MARCH 31, 1989 AS INSTRUMENT NO. 101656 AND MARCH 31, 1989 AS INSTRUMENT NO. 101657 ALL OF OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

PARCEL 2:
(APN 422-170-009 AND 422-170-010)

THE NORTHWEST QUARTER OF THE SOUTHEAST QUARTER, AND THE WEST ONE-HALF OF THE SOUTHWEST QUARTER OF THE NORTHEAST QUARTER OF SECTION 12, TOWNSHIP 3 SOUTH, RANGE 2 WEST, SAN BERNARDINO MERIDIAN, IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, ACCORDING TO THE OFFICIAL PLAT THEREOF.

EXCEPTING AND RESERVING TO THE UNITED STATES ALL THE OIL AND GAS IN THE LANDS SO PATENTED AND TO IT, OR PERSONS AUTHORIZED BY IT, THE RIGHT TO PROSPECT FOR, MINE, AND REMOVE SUCH DEPOSITS FROM THE SAME UPON COMPLIANCE WITH THE CONDITIONS AND SUBJECT TO THE PROVISIONS AND LIMITATION OF THE ACT OF JULY 17, 1914 (38 STAT. 509) AS RESERVED RECORDED MARCH 15, 1963 AS INSTRUMENT NO. 26269.

PARCEL 3:
(APN 422-170-007 AND 422-170-011)

PARCEL 3A:

THE EAST ONE HALF OF THE SOUTH TWO HUNDRED FORTY (240) FEET OF THE NORTHWEST QUARTER OF THE NORTHEAST QUARTER IN SECTION 12, TOWNSHIP 3 SOUTH, RANGE 2 WEST, SAN BERNARDINO MERIDIAN, IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA.

EXCEPTING THEREFROM THAT PORTION THEREOF CONVEYED TO RIVERSIDE COUNTY FOR ROAD PURPOSES, BY DEED RECORDED OCTOBER 29, 1915 IN BOOK 433, PAGE 7 OF DEEDS, RECORDS OF SAID COUNTY.

EXCEPT THEREFROM ALL OIL, GAS, MINERALS, AND OTHER HYDROCARBON SUBSTANCES LYING BELOW THE SURFACE OF SAID LAND, BUT WITH NO RIGHT OF SURFACE ENTRY, AS PROVIDED IN PATENT.

PARCEL 3B:

THE EAST OF THE SOUTHWEST QUARTER OF THE NORTHEAST QUARTER OF SECTION 12, TOWNSHIP 3 SOUTH, RANGE 2 WEST, SAN BERNARDINO MERIDIAN, IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA.

EXCEPTING THEREFROM THAT PORTION THEREOF CONVEYED TO RIVERSIDE COUNTY FOR ROAD PURPOSES, BY DEED RECORDED OCTOBER 29, 1915 IN BOOK 433, PAGE 7 OF DEEDS, RECORDS OF SAID COUNTY.

EXCEPT THEREFROM ALL OIL, GAS, MINERALS, AND OTHER HYDROCARBONS SUBSTANCES LYING BELOW THE SURFACE OF SAID LAND, BUT WITH THE RIGHT OF SURFACE ENTRY, AS PROVIDED IN PATENT.

GENERAL INFORMATION

1. DATE OF MAP PREPARATION: AUGUST 2021
2. GROSS AREA: 622.5 ACRES
3. EXISTING LAND USE: VACANT
4. PROPOSED LAND USE: GENERAL COMMERCIAL/INDUSTRIAL/CONSERVATION/RECREATION
5. PROPOSED ZONING: BEAUMONT PONTE SPECIFIC PLAN (SP)
6. ADJACENT LAND USES:
   - WEST: OS-CH, OS-RUR
   - SOUTH: OS-RUR, OS
   - NORTH: RM
   - EAST: RM, OS
7. SCHOOL: BEAUMONT & SAN JACINTO UNIFIED SCHOOL DISTRICT
8. PROPOSED WATER SERVICE WILL BE PROVIDED BY BEAUMONT CHERRY VALLEY WATER DIST.
9. POLICE AND FIRE SERVICES WILL BE PROVIDED BY THE CITY OF BEAUMONT
10. PROPOSED SEWER SERVICE W ILL BE PROVIDED BY THE CITY OF BEAUMONT
11. ALL UTILITIES SHALL BE UNDERGROUND:
    - GAS ....SOUTHERN CALIFORNIA GAS COMPANY
    - ELECTRIC .... SOUTHERN CALIFORNIA EDISON COMPANY
    - TELEPHONE .... FRONTIER
    - CABLE TV ....SPECTRUM
    - SEWER .... CITY OF BEAUMONT
    - WATER .... BEAUMONT CHERRY VALLEY WATER DISTRICT
    - STORM DRAIN .... RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT, CITY OF BEAUMONT
12. THOMAS GUIDE: MAP PAGE 719, GRID H2, AND PAGE 720, GRID B2
13. FINAL PARCEL MAP TO BE RECORDED IN THREE PHASES AS FOLLOWS:
    - PHASE 1: PARCEL MAP: PARCELS 1-4, 14, 15, 16 REMAINDER PARCEL, LOTS "B", "F", "G", AND PORTION OF "LOT A"
    - PHASE 2: PARCEL MAP: PARCELS 5, 6, 9, 13, AND LOTS "C", "E", AND PORTION OF "LOT A"
    - PHASE 3: PARCEL MAP: PARCELS 7, 8, 11, 12, AND LOT "D", "E", LOT "D" AND PORTION OF "LOT A"

* NOTE: TEMPORARY TURN-A-ROUNDS WILL BE DEDICATED AND CONSTRUCTED AS NEEDED TO ADDRESS PARCEL MAP PHASING. PUBLIC ROAD UTILITY EASEMENT WILL ALSO BE DEDICATED ON FINAL PARCEL MAPS TO AS REQUIRED.

14. CONTOUR INTERVAL: 10'
15. STREETS WILL BE CONSTRUCTED PER CITY OF BEAUMONT STANDARDS.
16. ALL DIMENSIONS SHOWN HEREIN ARE APPROXIMATE.
17. PARCEL MAP WILL BE RECORDED IN THREE (3) PHASES

PARCEL SUMMARY TABLE

PARCEL/LOT	AREA	PROP. LAND USE
1	23.50 AC. GR.	GENERAL COMMERCIAL
2	3.15 AC. GR.	GENERAL COMMERCIAL
3	1.66 AC. GR.	INDUSTRIAL
4	65.24 AC. GR.	INDUSTRIAL
5	50.49 AC. NET *	INDUSTRIAL
6	32.55 AC. NET *	INDUSTRIAL
7	28.96 AC. NET *	INDUSTRIAL
8	60.97 AC. NET	INDUSTRIAL
9	0.60 AC. NET	WATER TANK SITE
10	4.64 AC. NET	CONSERVATION
11	48.31 AC. NET	CONSERVATION
12	5.50 AC. NET	CONSERVATION
13	30.97 AC. NET	CONSERVATION
14	22.64 AC. NET	CONSERVATION
15	0.03 AC. NET	GENERAL COMMERCIAL
16	0.74 AC. NET	GENERAL COMMERCIAL
REMAINDER PARCEL	81.30 AC. GR.	CONSERVATION AREA
LOT "A"	15.25 AC.	4TH ST. R/W DEDICATION
LOT "B"	10.39 AC.	RECREATION/CONSERVATION
LOT "C"	12.81 AC.	RECREATION/CONSERVATION
LOT "D"	61.84 AC.	RECREATION/CONSERVATION
LOT "E"	29.44 AC.	RECREATION/CONSERVATION
LOT "F"	30.17 AC.	RECREATION/CONSERVATION
LOT "G"	–	ENTERTAINMENT WAY EASEMENT
LOT "H"	1.22 AC.	R/W DEDICATION

TOTAL MAP ACREAGE: 622.5 GROSS ACRES

* INCLUDES INDUSTRIAL WAY R/W

OWNER/DEVELOPER

JRT BP 1, LLC
18032 LEMON DRIVE-SUITE 367
YORBA LINDA, CA 92886
CONTACT: MICHAEL MASTERSON
PH: 714-299-8549

ENGINEER / REPRESENTATIVE

PROACTIVE ENGINEERING CONSULTANTS WEST,INC.
25109 JEFFERSON AVE.SUITE 200
MURRIETA, CA 92562
951-200-6840

"FOR FINANCE AND CONVEYANCE PURPOSES"

TENTATIVE PARCEL MAP NO. 38161

IN THE CITY OF BEAUMONT, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

BEING A SUBDIVISION OF A PORTION SECTIONS 1, 2 AND 12, T.3 S., R.2 W., S.B.M.

AUGUST 2021

EXISTING EASEMENT NOTES

1. WATER RIGHTS, CLAIMS OR TITLE TO WATER, WHETHER OR NOT DISCLOSED BY THE PUBLIC RECORDS.

2. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:

GRANTED TO: PACIFIC TELEPHONE AND TELEGRAPH COMPANY, ITS SUCCESSORS AND/OR ASSIGNS
PURPOSE: POLE LINES
RECORDING DATE: DECEMBER 30, 1910
RECORDING NO: IN BOOK 326, PAGE 4, DEEDS
AFFECTS: SAID LAND

THE EXACT LOCATION AND EXTENT OF SAID EASEMENT IS NOT DISCLOSED OF RECORD.

3. RESERVATIONS CONTAINED IN THE PATENT

FROM: THE UNITED STATES OF AMERICA
TO: CHARLES E. BROCKMAN
RECORDING DATE: FEBRUARY 24, 1920
RECORDING NO: IN BOOK 8, PAGE 69, PATENTS

WHICH AMONG OTHER THINGS RECITES AS FOLLOWS:

SUBJECT TO ANY VESTED AND ACCRUED WATER RIGHTS FOR MINING, AGRICULTURAL, MANUFACTURING, OR OTHER PURPOSES AND RIGHTS TO DITCHES AND RESERVOIRS USED IN CONNECTION WITH SUCH WATER RIGHTS, AS MAY BE RECOGNIZED AND ACKNOWLEDGED BY THE LOCAL CUSTOMS, LAWS AND DECISIONS OF THE COURTS, AND THE RESERVATION FROM THE LANDS HEREBY GRANTED, A RIGHT OF WAY THEREON FOR DITCHES OR CANALS CONSTRUCTED BY THE AUTHORITY OF THE UNITED STATES.

4. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO AS RESERVED IN A DOCUMENT;

RESERVED BY: GERTRUDE I. SINGLETON, A WIDOW, JAMES S. HASKELL, ALSO KNOWN AS J.S. HASKELL AND ANNA E. HASKELL, HIS WIFE, LEWIS W. HASKELL AND MARIE L. HASKELL, HIS WIFE AND HAYDEN KELSEY HASKELL AND DOROTHY HASKELL
PURPOSE: INGRESS AND EGRESS SAN TIMOTEO WASH
RECORDING DATE: JUNE 16, 1937
RECORDING NO: BOOK 325, PAGE 452 OF OFFICIAL RECORDS
AFFECTS: LOTS 1 AND 2 OF SECTION 2

5. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:

GRANTED TO: SOUTHERN CALIFORNIA EDISON COMPANY, LTD., A CORPORATION, ITS SUCCESSORS AND/OR ASSIGNS
PURPOSE: POLE LINES
RECORDING DATE: MAY 28, 1949
RECORDING NO: IN BOOK 1080, PAGE 231, OFFICIAL RECORDS
AFFECTS: AS DESCRIBED THEREIN

6. THE OWNERSHIP OF SAID LAND DOES NOT INCLUDE RIGHTS OF ACCESS TO OR FROM THE STREET, HIGHWAY, OR FREEWAY ABUTTING SAID LAND, SUCH RIGHTS HAVING BEEN RELINQUISHED BY THE DOCUMENT,

RECORDING DATE: DECEMBER 24, 1957
RECORDING NO: IN BOOK 2197, PAGE 227, OFFICIAL RECORDS
AFFECTS: SAID LAND ABUTTING STATE HIGHWAY

7. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:

GRANTED TO: CALIFORNIA WATER AND TELEPHONE COMPANY, A CORPORATION, ITS SUCCESSORS AND/OR ASSIGNS
PURPOSE: PUBLIC UTILITIES
RECORDING DATE: MAY 18, 1959
RECORDING NO: 42712, OFFICIAL RECORDS
AFFECTS: AS DESCRIBED THEREIN

8. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:

GRANTED TO: CALIFORNIA ELECTRIC POWER COMPANY, ITS SUCCESSORS AND/OR ASSIGNS
PURPOSE: INGRESS AND PUBLIC UTILITIES
RECORDING DATE: JULY 29, 1960
RECORDING NO: 67256, OFFICIAL RECORDS
AFFECTS: AS DESCRIBED THEREIN

9. RESERVATIONS CONTAINED IN THE PATENT

FROM: THE UNITED STATES OF AMERICA
RECORDING DATE: MARCH 15, 1963
RECORDING NO: 26269 OF OFFICIAL RECORDS

WHICH AMONG OTHER THINGS RECITES AS FOLLOWS:

SUBJECT TO ANY VESTED AND ACCRUED WATER RIGHTS FOR MINING, AGRICULTURAL, MANUFACTURING, OR OTHER PURPOSES AND RIGHTS TO DITCHES AND RESERVOIRS USED IN CONNECTION WITH SUCH WATER RIGHTS, AS MAY BE RECOGNIZED AND ACKNOWLEDGED BY THE LOCAL CUSTOMS, LAWS AND DECISIONS OF THE COURTS, AND THE RESERVATION FROM THE LANDS HEREBY GRANTED, A RIGHT OF WAY THEREON FOR DITCHES OR CANALS CONSTRUCTED BY THE AUTHORITY OF THE UNITED STATES.

10. INTENTIONALLY DELETED

11. THE OWNERSHIP OF SAID LAND DOES NOT INCLUDE RIGHTS OF ACCESS TO OR FROM THE STREET, HIGHWAY, OR FREEWAY ABUTTING SAID LAND, SUCH RIGHTS HAVING BEEN RELINQUISHED BY THE DOCUMENT,

RECORDING DATE: JULY 26, 1974
RECORDING NO: 94466 OF OFFICIAL RECORDS
AFFECTS: SAID LAND

12. THE OWNERSHIP OF SAID LAND DOES NOT INCLUDE RIGHTS OF ACCESS TO OR FROM THE STREET, HIGHWAY, OR FREEWAY ABUTTING SAID LAND, SUCH RIGHTS HAVING BEEN RELINQUISHED BY THE DOCUMENT,

RECORDING DATE: AUGUST 5, 1974
RECORDING NO: 99049, OFFICIAL RECORDS
AFFECTS: THE NORTHERLY LINE OF SAID LAND ABUTTING STATE FREEWAY

13. THE OWNERSHIP OF SAID LAND DOES NOT INCLUDE RIGHTS OF ACCESS TO OR FROM THE STREET, HIGHWAY, OR FREEWAY ABUTTING SAID LAND, SUCH RIGHTS HAVING BEEN RELINQUISHED BY THE DOCUMENT,

RECORDING DATE: NOVEMBER 15, 1974
RECORDING NO: 147477, OFFICIAL RECORDS
AFFECTS: THE NORTHERLY LINE OF SAID LAND ABUTTING STATE FREEWAY

14. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:

GRANTED TO: SOUTHERN CALIFORNIA EDISON COMPANY, A CORPORATION, ITS SUCCESSORS AND/OR ASSIGNS
PURPOSE: PUBLIC UTILITIES
RECORDING DATE: FEBRUARY 20, 1979
RECORDING NO: 34426 OF OFFICIAL RECORDS
AFFECTS: AS DESCRIBED THEREIN

15. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:

GRANTED TO: SOUTHERN CALIFORNIA EDISON COMPANY, A CORPORATION, ITS SUCCESSORS AND/OR ASSIGNS
PURPOSE: PUBLIC UTILITIES
RECORDING DATE: FEBRUARY 28, 1979
RECORDING NO: 40584 OF OFFICIAL RECORDS
AFFECTS: AS DESCRIBED THEREIN

16. INTENTIONALLY DELETED

17. THE EFFECT OF A DOCUMENT ENTITLED "RESOLUTION NO. 92–235 TERMINATION OF MAINTENANCE OF JACK RABBIT TRAIL, "RECORDED AUGUST 3, 1992 AS INSTRUMENT NO. 286237 OF OFFICIAL RECORDS.

18. INTENTIONALLY DELETED

19. MATTERS CONTAINED IN THAT CERTAIN DOCUMENT

ENTITLED: INGRESS AND EGRESS EASEMENT AND AGREEMENT
RECORDING DATE: APRIL 20, 2016
RECORDING NO: 2016–0156702, OFFICIAL RECORDS
REFERENCE IS HEREBY MADE TO SAID DOCUMENT FOR FULL PARTICULARS.
AMONG OTHER THINGS, SAID AGREEMENT PROVIDES FOR:
AN EASEMENT FOR PEDESTRIAN AND VEHICULAR INGRESS AND EGRESS OVER A PORTION OF SAID LAND.

20. MATTERS CONTAINED IN THAT CERTAIN DOCUMENT

ENTITLED: ACCESS EASEMENT AGREEMENT
RECORDING DATE: APRIL 21, 2017
RECORDING NO: 2017–0160522, OFFICIAL RECORDS
REFERENCE IS HEREBY MADE TO SAID DOCUMENT FOR FULL PARTICULARS.
AMONG OTHER THINGS, SAID AGREEMENT PROVIDES FOR:
EASEMENTS FOR VEHICULAR ACCESS, TELECOMMUNICATION FACILITIES AND A LOCKED GATE.

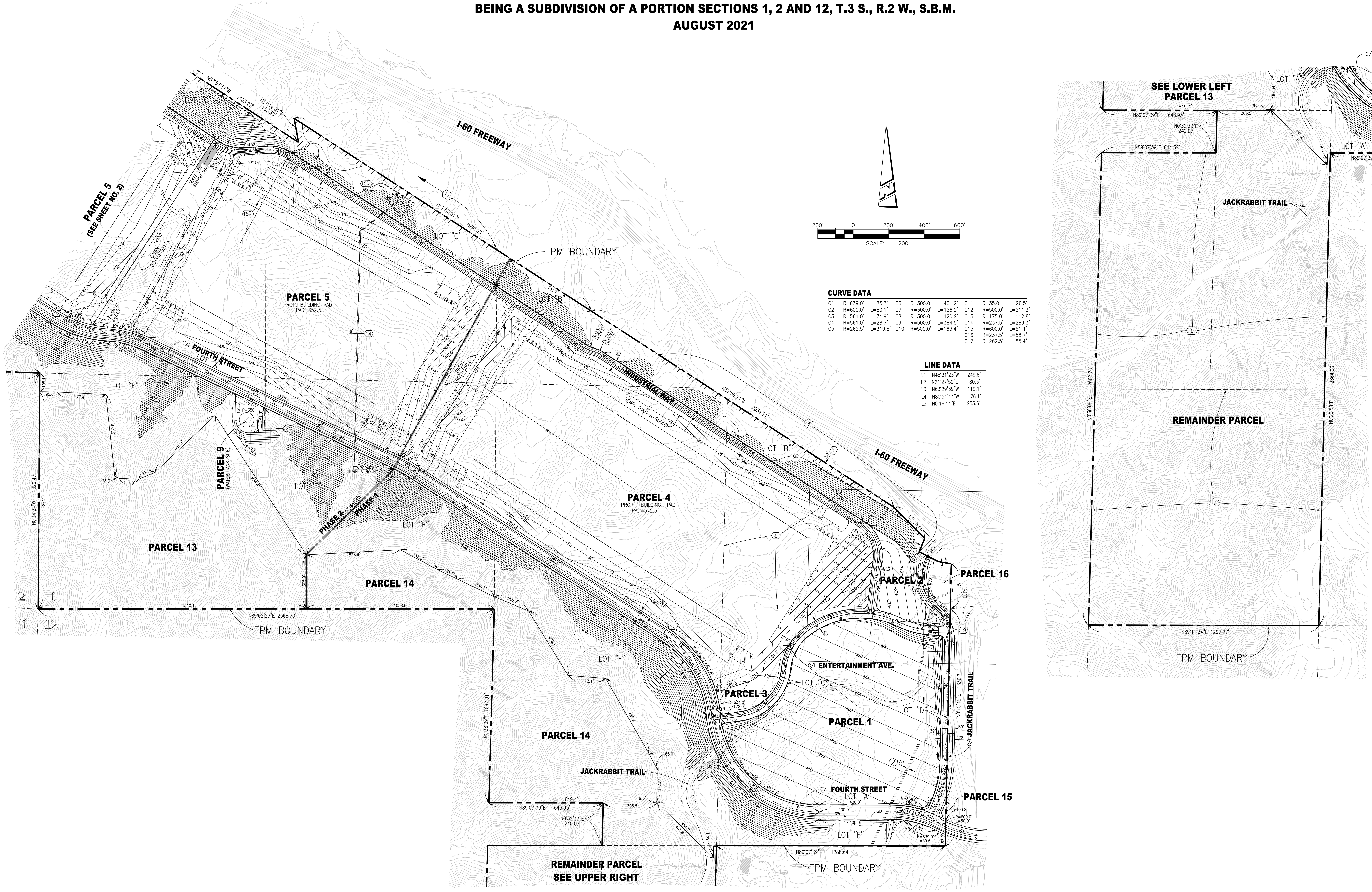
"FOR FINANCE AND CONVEYANCE PURPOSES"

TENTATIVE PARCEL MAP NO. 38161

IN THE CITY OF BEAUMONT, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

BEING A SUBDIVISION OF A PORTION SECTIONS 1, 2 AND 12, T.3 S., R.2 W., S.B.M.

AUGUST 2021



CURVE DATA

C1	R=639.0'	L=85.3'	C6	R=300.0'	L=401.2'	C11	R=35.0'	L=26.5'
C2	R=600.0'	L=80.1'	C7	R=300.0'	L=126.2'	C12	R=500.0'	L=211.3'
C3	R=561.0'	L=74.9'	C8	R=300.0'	L=120.2'	C13	R=175.0'	L=112.8'
C4	R=561.0'	L=28.7'	C9	R=500.0'	L=384.5'	C14	R=237.5'	L=289.3'
C5	R=262.5'	L=319.8'	C10	R=500.0'	L=163.4'	C15	R=600.0'	L=51.1'
						C16	R=237.5'	L=58.7'
						C17	R=262.5'	L=85.4'

LINE DATA

L1	N45°31'23"W	249.8'
L2	N21°27'50"E	80.3'
L3	N63°29'39"W	119.1'
L4	N80°54'14"W	76.1'
L5	N0°16'14"E	253.6'

PROJECT INFORMATION - SCHEME 10					08.24.2020
GROSS SITE AREA		**27,114,668**	**SF**	**622.47**	**AC**
PAD AREA (SELLABLE AREA) - EXCLUDING RETAIL		10,346,886	SF	237.532	AC
4TH STREET		524,551	SF	12.04	AC
TOTAL BUILDING AREA		4,888,260	SF		
NET FAR				**47.24%**	
MAX FAR				NONE	
ZONE				(M)-MANUFACTURING	
STREET FRONT BLDG. SETBACK				25	FT
STREET SIDE BLDG. SETBACK				NONE	
STREET FRONT PARKING SETBACK				50	FT
STREET FRONT LANDSCAPE SETBACK				NONE	
INT/REAR BLDG SETBACK				NONE	
PARKING REQUIRED	(9X19)			5,014	
SUGGESTED: PARKING REQUIRED				2,419	
PARKING PROVIDED				3,370	
LANDSCAPE REQUIRED			15%	1,552,033	SF
LANDSCAPE PROVIDED			14.6%	1,509,869	SF
TRAILERS REQUIRED	(12X50)			806	
TRAILERS PROVIDED				984	

BUILDING 5				
NET AREA			2,608,798	SF
FAR			49.6%	
BUILDING 1 AREA			**1,294,800**	**SF**
FOOTPRINT			1,289,800	SF
	WAREHOUSE		1,284,800	SF
	OFFICE		5,000	SF
MEZZANINE			5,000	SF
	OFFICE		5,000	SF
PARKING REQUIRED PER ZONING	(9X19)		1,325	
	WAREHOUSE @ 1/1000		1,285	
	OFFICE @ 1/250		40	
	COMPACT: MAX 10% WHERE 20+ SPACES PROVIDED		0	
	SUGGESTED: PARKING REQUIRED		*682*	
	WAREHOUSE @ 1/2000		*642*	
	OFFICE @ 1/250		*40*	
PARKING PROVIDED			1,123	
TRAILER REQUIRED	(12X50)		196	
	1/VEHICLE OPERATED FROM SITE			
TRAILER PROVIDED			229	
LANDSCAPE PROVIDED		9.5%	247,001	SF

BUILDING 4				
NET AREA			1,352,148	SF
FAR			43.6%	
BUILDING 2 AREA			**589,240**	**SF**
FOOTPRINT			586,240	SF
	WAREHOUSE		583,240	SF
	OFFICE		3,000	SF
MEZZANINE			3,000	SF
	OFFICE		3,000	SF
PARKING REQUIRED PER ZONING	(9X19)		607	
	WAREHOUSE @ 1/1000		583	
	OFFICE @ 1/,250		24	
	COMPACT: MAX 10% WHERE 20+ SPACES PROVIDED		0	
	SUGGESTED: PARKING REQUIRED		*316*	
	WAREHOUSE @ 1/2000		*292*	
	OFFICE @ 1/250		*24*	
PARKING PROVIDED			464	
TRAILER REQUIRED	(12X50)		106	
	1/VEHICLE OPERATED FROM SITE			
TRAILER PROVIDED			125	
LANDSCAPE PROVIDED		14.9%	200,951	SF

BUILDING 3				
NET AREA			1,462,528	SF
FAR			46.2%	
BUILDING 3 AREA			**675,400**	**SF**
FOOTPRINT			672,400	SF
	WAREHOUSE		669,400	SF
	OFFICE		3,000	SF
MEZZANINE			3,000	SF
	OFFICE		3,000	SF
PARKING REQUIRED PER ZONING	(9X19)		693	
	WAREHOUSE @ 1/1000		669	
	OFFICE @ 1/,250		24	
	COMPACT: MAX 10% WHERE 20+ SPACES PROVIDED		0	
	SUGGESTED: PARKING REQUIRED		*359*	
	WAREHOUSE @ 1/2000		*335*	
	OFFICE @ 1/250		*24*	
PARKING PROVIDED			394	
TRAILER REQUIRED	(12X50)		112	
	1/VEHICLE OPERATED FROM SITE			
TRAILER PROVIDED			140	
LANDSCAPE PROVIDED		18.5%	270,320	SF

BUILDING 2				
NET AREA			2,190,695	SF
FAR			43.3%	
BUILDING 4 AREA			**948,940**	**SF**
FOOTPRINT			943,940	SF
	WAREHOUSE		938,940	SF
	OFFICE		5,000	SF
MEZZANINE			5,000	SF
	OFFICE		5,000	SF
PARKING REQUIRED PER ZONING	(9X19)		979	
	WAREHOUSE @ 1/1000		939	
	OFFICE @ 1/,250		40	
	COMPACT: MAX 10% WHERE 20+ SPACES PROVIDED		0	
	SUGGESTED: PARKING REQUIRED		*509*	
	WAREHOUSE @ 1/2000		*469*	
	OFFICE @ 1/250		*40*	
PARKING PROVIDED			637	
TRAILER REQUIRED	(12X50)		154	
	1/VEHICLE OPERATED FROM SITE			
TRAILER PROVIDED			192	
LANDSCAPE PROVIDED		21.8%	477,179	SF

BUILDING 1				
NET AREA			2,732,725	SF
FAR			50.5%	
BUILDING 5 AREA			**1,379,880**	**SF**
FOOTPRINT			1,374,880	SF
	WAREHOUSE		1,369,880	SF
	OFFICE		5,000	SF
MEZZANINE			5,000	SF
	OFFICE		5,000	SF
PARKING REQUIRED PER ZONING	(9X19)		1,410	
	WAREHOUSE @ 1/1000		1,370	
	OFFICE @ 1/,250		40	
	COMPACT: MAX 10% WHERE 20+ SPACES PROVIDED		0	
	SUGGESTED: PARKING REQUIRED		*553*	
	WAREHOUSE @ 1/2000		*685*	
	OFFICE @ 1/250		*40*	
PARKING PROVIDED			752	
TRAILER REQUIRED	(12X50)		238	
	1/VEHICLE OPERATED FROM SITE			
TRAILER PROVIDED			298	
LANDSCAPE PROVIDED		9.2%	251,471	SF

A CONCEPTUAL SITE PLAN
SCALE: 1" = 300'

PROJECT

CYBURT HOLDINGS SITE

BEAUMONT, CA

SCHEME 10
SITE PLAN

HERDMAN
ARCHITECTURE + DESIGN

16201 Scientific Way
Irvine, CA 92618
www.Herdman-AD.com
714.389.2800
info@Herdman-AD.com

A19-2104
08.24.2020

NORTH

CONCEPTUAL SITE PLAN

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

Revised Preliminary Geotechnical Feasibility Investigation, Beaumont Pointe Specific Plan, 539.9 Acre Industrial/Commercial Development, Jackrabbit Trail, Beaumont Area, Riverside County, California.

PN: 18060-01
July 23, 2021

KCG KLING Consulting Group, Inc.

KCG KLING Consulting Group, Inc.

July 23, 2021 PN 18060-01

Mr. Michael Masterson
JRT BP 1 LLC
18032 Lemon Drive, Suite 367
Yorba Linda, Ca. 92866

Subject: **Revised** Preliminary Geotechnical Feasibility Investigation, **Beaumont Pointe Specific Plan**, 539.9 Acre Industrial/Commercial Development, Jackrabbit Trail, Beaumont Area, Riverside County, California.

Dear Mr. Masterson:

In accordance with your request and authorization, Kling Consultant Group, Inc. has conducted a Preliminary Geotechnical Feasibility Investigation for the proposed subject development as presented on the 150-scale "Conceptual Grading Plans", prepared by Thienes Engineering, dated June 4, 2019. This plan was used as our base map during our limited geotechnical feasibility evaluation and constitutes our Geotechnical Map (Plate 1 and Plate 2). This report presents our findings from subsurface exploration, laboratory testing of selected soil samples, geotechnical analyses, and review of previous relevant reports, along with our conclusions and preliminary recommendations.

Kling Consulting Group, Inc. appreciates this opportunity to be of service to you on this project. Should you have any questions regarding the content of this report, please do not hesitate to contact our office at your earliest convenience.

Sincerely,

KLING CONSULTING GROUP, INC.

REGISTERED PROFESSIONAL ENGINEER
HENRY F. KLING
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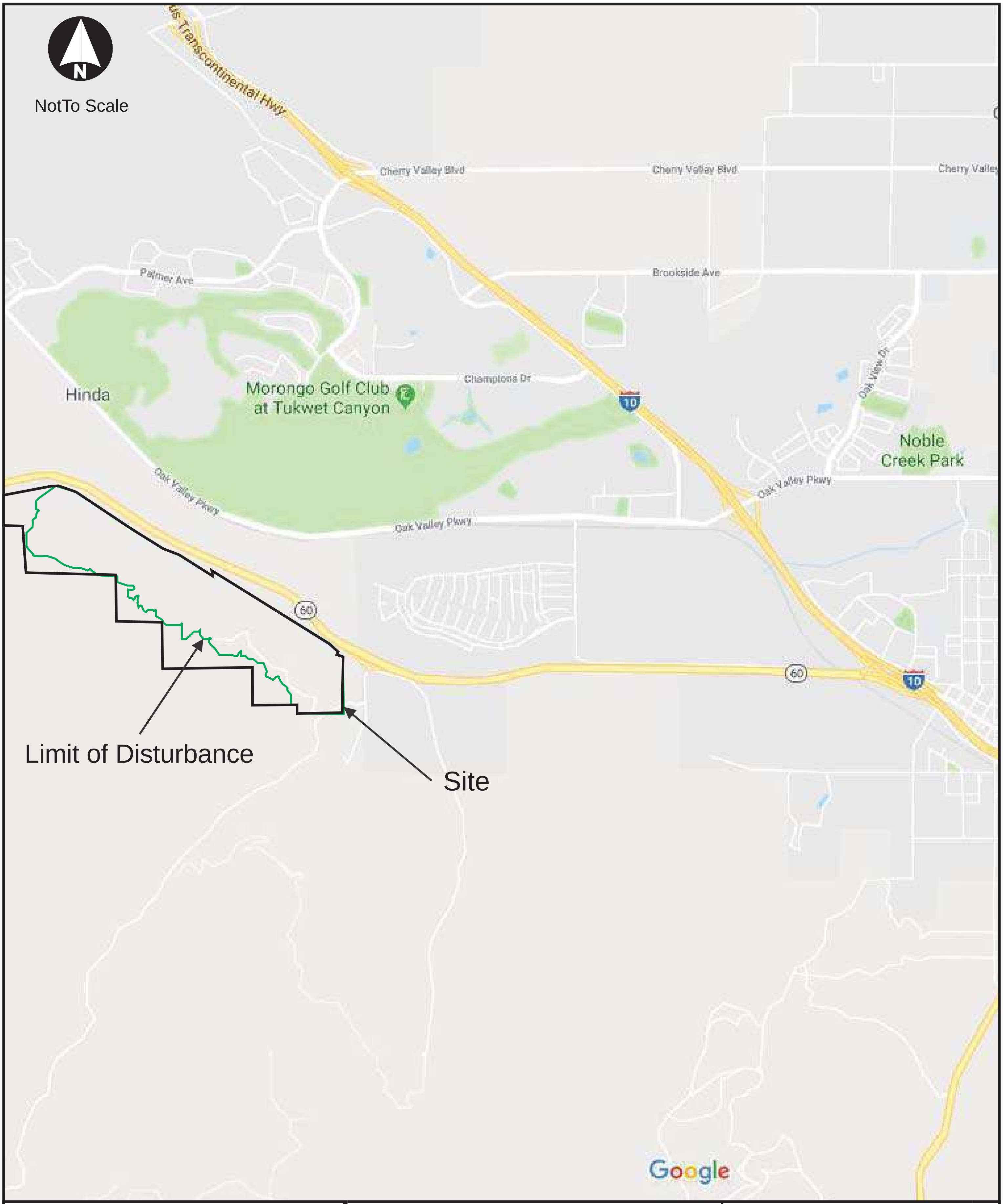
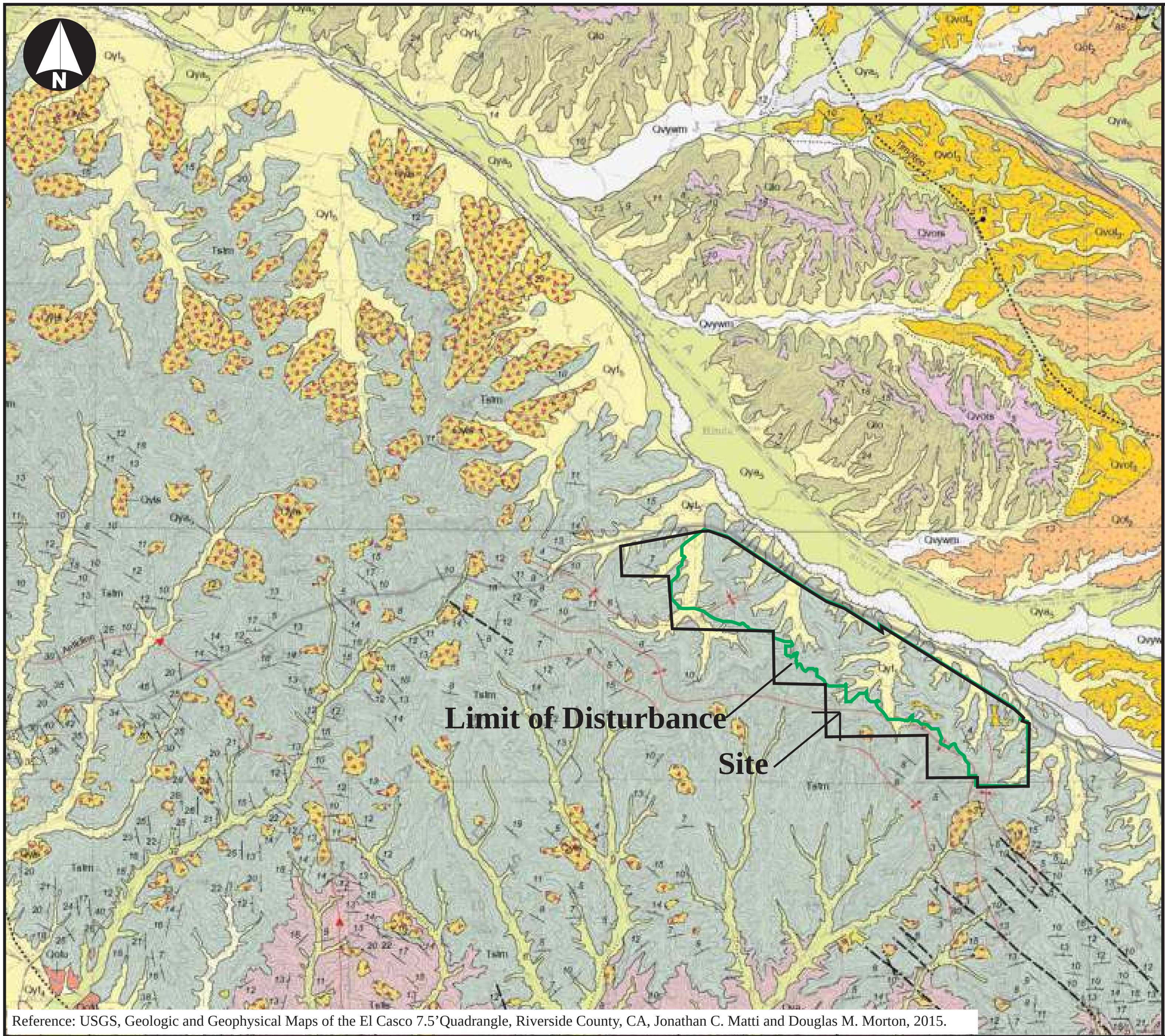


KCG KLING Consulting Group, Inc.

Site Location Map
Beaumont Pointe Specific Plan
Beaumont, CA

Figure:	**1**
PN:	**18060-01**
Date:	**July 23, 2021**



Reference: USGS, Geologic and Geophysical Maps of the El Casco 7.5'Quadrangle, Riverside County, CA, Jonathan C. Matti and Douglas M. Morton, 2015.

Legend:

VeryYoung Surficial Materials:

Qvywm	Very young wash deposits, modern

Young Surficial Materials:

Qya5	Young axial-valley deposits, unit 5 (uppermost Holocene)
Qyf5	Young alluvial fan deposits, unit 5 (uppermost Holocene)
Qyf4	Young alluvial fan deposits, unit 4 (upper Holocene)
Qyf3	Young alluvial fan deposits, unit 3 (middle Holocene)
Qyls	Young landslide deposits (Holocene and uppermost Pleistocene)

Old Surficial Deposits:

Qof2	Old alluvial fan deposits, unit 2 (upper to middle Pleistocene)
Qof1	Old alluvial fan deposits, unit 1 (upper to middle Pleistocene)
Qofu	Old alluvial fan deposits, undifferentiated (upper to middle Pleistocene)

Very Old Surficial Deposits:

Qvors	Very old residuum and (or) pedogenic soil (middle to lower Pleistocene)
Qvof3	Very old alluvial fan deposits, unit 3 (middle Pleistocene)

Cenozoic Sedimentary Materials:

Qlo	Sedimentary deposits of Live Oak Canyon (Pleistocene)
Tstm	SanTimoteo formation, middle member (upper and middle Pliocene)
Tstfs	SanTimoteo formation, sandstone unit (lower Pliocene)

Explanation of Map Symbols:

Contact: separates geologic map units; solid where accurate, dashed where inaccurate, dotted where concealed.

Contact: separates terraced alluvial units where younger unit is incised into older unit.

Fault: Solid where accurate, dashed where inaccurate, dotted where concealed by mapped unit, queried where existence uncertain. Hachures indicate scarp with hachures on down-dropped block. Paired arrows show relative movement. Single arrow indicates direction and amount of fault-plane dip. Bar and ball on down-thrown block.

Fault: interpreted from seismic imaging; no locational accuracy implied.

Anticline, showing plunge direction

Syncline, showing plunge direction

50 Strike and dip of sedimentary layering, inclined

0 2000 4000

Scale: 1"= 2000'

KCG KLING Consulting Group, Inc.

Regional Geology Map:

Beaumont Pointe Specific Plan
Beaumont, CA

Figure:	**2**
PN:	**18060-01**
Date:	**July 23, 2021**

References: https://maps.conservation.ca.gov/cgs/fam/app/, http://scedc.caltech.edu/significant/index.html

Legend:

★ Site Location

Earthquake Epicenters:

🔵	M 5.0 to 5.9
🟡	M 6.0 to 6.9
🟠	M 7.0 to 7.9

Historic Earthquake Events:

Event	Magnitude
1) North San Jacinto, 1923	M 6.3
2) San Jacinto, 1918	M 6.8
3) North Palm Springs, 1986	M 5.6
4) Greater LosAngelesArea, 1858	M 6.0
5) Elsinore, 1910	M 6.0
6) Lytle Creek, 1970	M 5.2
7)WhiteWash, 1980	M 5.5
8) JoshuaTree, 1992	M 6.1
9) Landers, 1992	M 7.3
10) Upland Earthquake, 1990	M 5.4
11) Chino Hills, 2008	M 5.4
12) Southern CaliforniaArea, 1812	M 6.9
13) Long Beach, 1933	M 6.4
14) Big Bear, 1992	M 6.4
15) Southern CaliforniaArea, 1890	M 6.8
16)Whittier Narrows, 1987	M 5.9
17) Hector Mine, 1999	M 7.1
18) Greater LosAngelesArea, 1855	M 6.0

Fault Activity levels:
Red: Latest Quaternary ~200 years
Orange: Holocene ~11,700 years
Green: Middle to Late Quaternary < 700,000 Years
Purple: Undifferentiated Quaternary 1.6 million years.

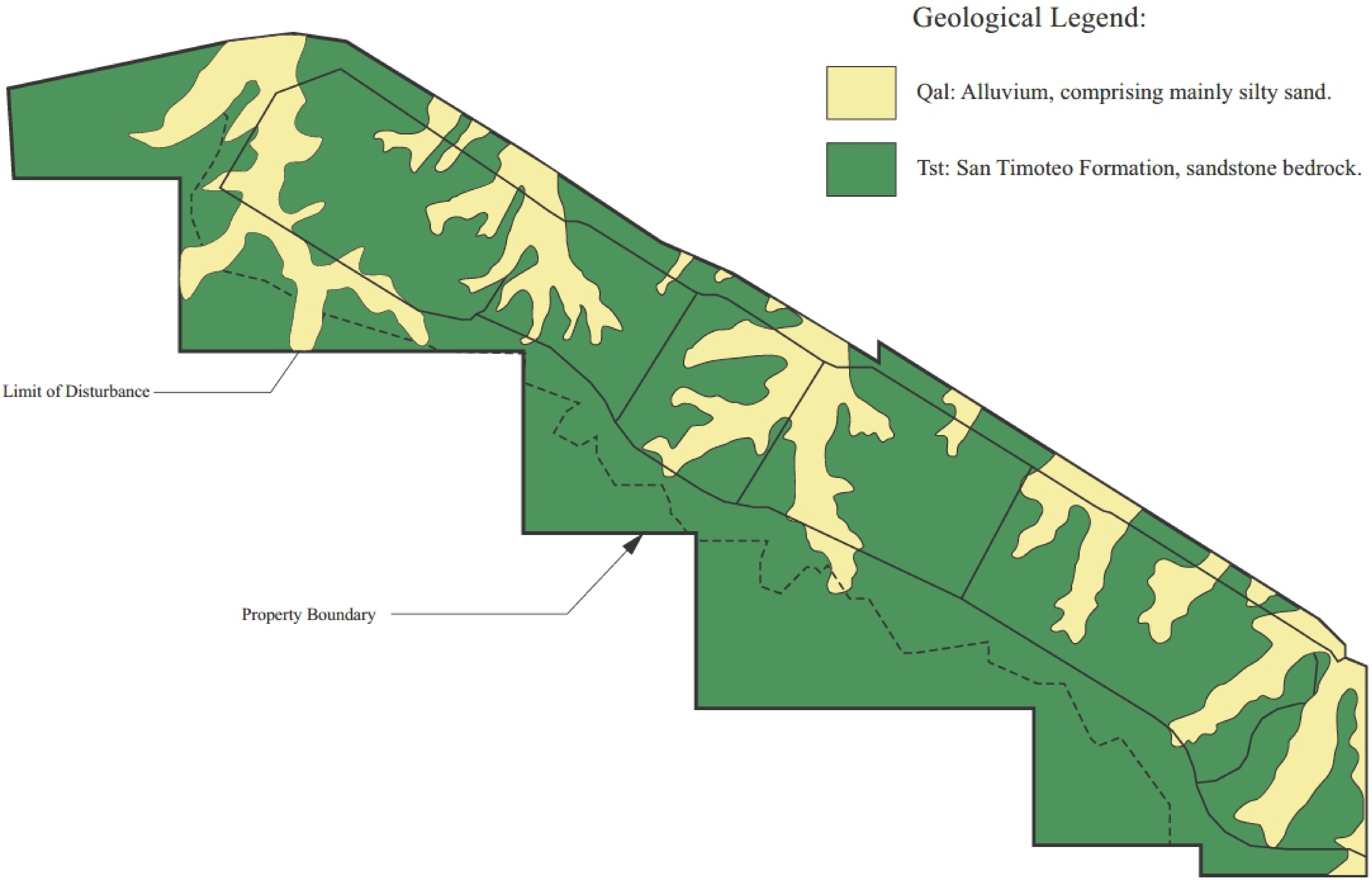
Scale:

0 20 40 miles

KCG KLING Consulting Group, Inc.

Regional Fault and Seismicity Map
Beaumont Pointe Specific Plan
Beaumont, CA

Figure:	3
PN	18060-01
Date:	July 23, 2021



Notes:

Scale: 1”:1200’

KCG KLING Consulting Group, Inc.

Client:
Beaumont Pointe Specific Plan

Address:
Jackrabbit Trail,
Beaumont, California

Geology Map

Drawn: S.W	**Date:** July 23, 2021
P/N: 18060-01	**Figure:** 4

1. INTRODUCTION

In accordance with your request and authorization, Kling Consulting Group, Inc. (KCG) has conducted a Feasibility Level Geotechnical Investigation for the proposed approximately 539.9 acre commercial/industrial park development in Beaumont, California. It is our understanding that the current development concept generally includes the proposed grading of five large super pads for five large warehouse type buildings and a commercial area, along with associated access roads, perimeter slopes, and related improvements, including a sewer lift station, and stormwater/water quality detention basin areas. The purpose of this geotechnical feasibility evaluation was to perform limited subsurface exploration along with laboratory testing to evaluate the overall geotechnical site conditions to support the proposed project conceptual design (Reference 18), as well as a review of a previous geotechnical evaluation previously performed at the site in 1989 by Leighton (Reference 14), and to prepare this Preliminary Geotechnical Feasibility Evaluation.

The 150-scale conceptual grading plans prepared by Thienes Engineering dated June 4, 2019 (Reference 18) were utilized as a base map for our Geotechnical Map (**Plate 1 and 2**).

1.1 Site Description and History

The proposed industrial/commercial development is an approximately 539.9-acre site located in the western portion of the City of Beaumont in Riverside County (**Figure 1**) and includes multiple contiguous parcels. The irregular shaped property is generally bounded to the south and west, by open land, along with existing industrial development immediately to the east, and to the north by Highway 60. Access to the site is via a frontage road west of the Highway 60 and Jack Rabbit Trail road intersection.

The site is situated along the northeasterly edge of an accumulation of sedimentary deposits that form an extensive hillside area known as 'The Badlands". The subject site is characterized by rugged steep ridges and hillsides with narrow canyons that are generally situated on the southwest portion of the site and relatively gentle ridges and broad canyons/valleys on the northwest portion of the site. A roughly northwest trending drainage divide directs drainage to the north into San Timoteo Canyon and south through the badlands into San Jacinto Valley. Elevations range from approximately 2,230 feet mean sea level (msl) in the northwest portion of the site to approximately 2,510 feet (msl) in the southeast. Bedrock exposures at the surface are relatively limited with most exposures visible along existing dirt road cuts.

The site is generally undisturbed and includes a network of dirt roads and trails. The paved Jack Rabbit Trail road crosses the southeastern portion of the property. A residential property is located partially on the southeastern portion of the overall property to the south and east of Jack Rabbit Trail Road. The residential property is occupied by a main residence, multiple ancillary structures and related improvements. No subsurface exploration was performed in this area of the overall property. An above ground electric power pole transmission line easement parallels the northern property boundary. Reportedly 2 to 3 water wells are located on the site and we observed one well in the northern portion of the site. Reportedly, a gas pipeline alignment traverses the site in the extreme northwest corner of the site. Vegetation across the site is generally sparse to locally very dense, with a variety of grasses, brush and scattered trees.

Low-lying relatively flat portions of this parcel are understood to have been used for grazing and agricultural purposes in the past, various barbed wire fences generally separate this parcel from neighboring parcels.

1.2 Previous Geotechnical Evaluation/Investigations

A geotechnical evaluation and subsequent addendum report was performed by Leighton and Associates, Inc. for the subject site in 1989 (Leighton, 1989, reference 14).The evaluation was reviewed as part of our scope of work and is summarized below:

The report dated April 28, 1989, and subsequent addendum dated May 8, 1989 was prepared to assess geotechnical conditions as related to future development. No subsurface exploration or laboratory testing was performed as part of the geotechnical evaluation. The report summarized overall geotechnical conditions based on review of aerial photographs, review and research of geology, and surface geologic reconnaissance mapping. The report listed principle geotechnical constraints that could affect development along with possible mitigation measures which may be utilized. Leighton's report did not appear to list any geotechnical constraints that would preclude future development. Leighton recommended a comprehensive geotechnical investigation be performed to properly assess geotechnical site conditions, including seismic ground shaking and secondary phenomena, presence of onsite faulting, slope stability, and expansive soil potential to provide appropriate recommendations/corrective measures as necessary.

1.3 Proposed Development

The current approximate 150-scale Conceptual Grading Plan (Reference 18), prepared by Thienes Engineering, dated June 4, 2019, indicates the property is comprised of multiple parcels to be developed for commercial/industrial purposes. Based on a Land Use Plan- Beaumont Pointe Specific Plan, dated February 17, 2021, and a conceptual site plan dated October 6, 2019, by Herdman Architecture and Design, it is our understanding that five warehouse buildings ranging from approximately 612,120 square feet to 1,425,559 square feet are planned. A commercial pad area is also planned. Graded pads will be created to accommodate the future large warehouse structures. Three Phases of construction are being considered with one to two buildings per Phase. A primary access road is proposed which will be extended from 4th Street to the east.

No grading plans are available. No estimates of cut and fill earthwork quantities are indicated on the conceptual grading plan provided. However, it is our understanding that based on preliminary earthwork volume analysis the project is estimated at approximately 12 million cubic yards of cut and fill earthwork in three phases. It is currently unknown how much import/export is required for each phase of grading.

Relatively deep cuts and fills are anticipated in some areas of the site in order to achieve grades for the proposed pads and primary access road alignment. Perimeter slopes are planned of variable height. We understand that cut slopes may be up to approximately 125 feet in height, and fill slopes up to approximately 150 feet. Cut slopes up to approximately 125 feet in height are proposed along the southern edges of the project and fill slopes up to approximately 150 feet or in height are proposed along the northern and southern edges of the project. Cuts up to approximately 125 feet and fills up to approximately 145 feet are anticipated to accommodate the proposed grading. The proposed grading will likely also result in cut/fill transitions within the building pad areas, with some areas transitioning abruptly from cut to deep fills where ridges and canyon drainages exist.

A primary paved access road is planned for the site and appears the access road will connect to the western extension of 4th Street, immediately east of the subject project. A secondary/emergency access drive is planned off of Jackrabbit Trail. Access to the proposed subject site is from Jack Rabbit Trail near the northeast corner of the site.

1.4 Purpose and Scope of Work

Our scope of services has been performed in general accordance with our Work Authorization and Agreement dated February 6, 2019 and authorized May 16, 2019. The purpose of our geotechnical investigation was to assess the geologic and engineering characteristics of the alluvial soils and bedrock materials as well as general geotechnical conditions of the site relative to the proposed site development and future site improvements for feasibility purposes. Our subsurface field exploration was performed on June 24, 2019 and June 26, 2019 and July 8, 2019 and July 9, 2019.

The scope of the work undertaken for this investigation included the following tasks:

- Notification and coordination with Underground Service Alert (USA) to mark and identify buried utilities;
- Communication with the design team members, as necessary, to facilitate the development concept;
- Coordination with a grading contractor for pioneering of access roads to help facilitate drill rig access;
- A review of available pertinent geotechnical literature and publications (Appendix A) with respect to soils, geology, local and regional seismicity, faulting, groundwater, and liquefaction potential.
- Limited site geologic mapping and reconnaissance to map the areal distribution of earth units and significance of surficial features, as compiled from available documentation, literature, aerial photographs and reviewed reports.
- Drilling and logging of ten (10) hollow-stem auger borings to depths of approximately 51.5 feet below the existing ground surface. Bulk and drive samples were obtained from the borings and delivered to our laboratory for testing and evaluation;
- Excavation and logging of eight (8) backhoe test-pits to depths ranging from 6 to 16 feet. Bulk and drive samples were obtained for testing in our laboratory;
- Laboratory testing on select soil samples including moisture/density determinations, Maximum density, sieve analysis, direct shear, consolidation, hydro-collapse potential;
- Preparation of geotechnical cross-sections;
- Preparation of a site Geotechnical Map (150-scale) illustrating the locations of subsurface investigation, site geology, and cross-section locations;
- Preliminary geotechnical analysis and evaluation of the compiled field and laboratory test data and information with respect to the current proposed Site Plan Concept;

§ Preparation of this Preliminary Geotechnical Feasibility report. The accompanying report incorporates data from our limited geotechnical evaluation and presents a description of our preliminary findings, conclusions and recommendations relative to the current site development concept.

2. GEOLOGIC FINDINGS

2.1 Regional Geology

The subject site is located within the Peninsular Ranges geomorphic province of southern California. This area lies along the southern boundary of the San Timoteo River Valley and is located within the western San Jacinto Mountains. This area is commonly known as the San Timoteo Badlands.

The site lies within the San Jacinto Fault block, which is comprised of weathered and eroded pre-Cenozoic metamorphic and granitic basement rocks, as well as Plio-Pleistocene aged sedimentary bedrock of the San Timoteo Formation. The San Jacinto Block is bordered by the Banning Fault on the north, and by the San Jacinto Fault on the south. Both the San Jacinto Fault and the Banning Fault are considered to belong to the seismically active San Andreas Fault System. The site is comprised primarily of relatively soft to locally hard San Timoteo Formation bedrock, as well as younger alluvium and older alluvium. The sediments composing the San Timoteo Formation were derived from eroded pre-Cenozoic units. The younger alluvium and older alluvium were derived from the pre-Cenozoic basement rocks as well as the San Timoteo Formation. Regional Geology of the site vicinity is presented on **Figure 2.**

2.2 Site Geology

Geologic units encountered during our subsurface investigation of the subject site included surficial soils and bedrock. The surficial soils include undocumented man-made fills, topsoil/slopewash/colluvium, and alluvium (Qal). The bedrock unit consists of the San Timoteo Formation (Tst). These materials are described in more detail below. Subsurface exploration boring logs and trench logs are presented in **Appendix B**, while results of laboratory testing on soil and bedrock samples obtained from the current investigation are presented in **Appendix C.** The distribution of geologic units and investigation activities are illustrated on the 150-scale **Geotechnical Map, Plates 1 and 2**.

2.2.1 Surficial Soils

2.2.1.1. Undocumented Artificial Fill

Undocumented artificial fill is locally present at the subject site and is typically associated with past site improvements such as development of the Jackrabbit Road through the drainage area near the southeastern portion of the site and a what appears to be a former borrow area along the east side of a ridge in the southeast portion of the site. Artificial fill materials would also be anticipated to be present in any of the existing utility easements on the subject site. These fill materials appear to be typically derived from onsite soils and are estimated to be between one and ten feet thick. In general, these fills are not considered suitable for support of additional fill placement or structures. However, the proposed grading for the site is anticipated to remove the majority of undocumented fill associated with the improvements and remedial removals will remove and reprocess undocumented fill materials in the lower portions of the site. Undocumented fill materials are not illustrated on any of the Geotechnical Maps.

2.2.1.2. Topsoil/Slopewash/Colluvium

Colluvium, topsoil, and slopewash materials are considered interchangeable designations for the purposes of this report and are typically referred to herein as "colluvium." These materials were observed locally mantling natural slopes untouched by prior mining or grading activities as well as (rarely) observed beneath undocumented fill materials. Topsoil and colluvial materials are a result of weathering processes of the underlying bedrock materials. These materials were typically observed to be less than approximately 3 feet thick but do vary in thickness locally up to approximately 8 feet as observed in KTP-3, and were not considered a mapable unit on the attached Geotechnical Maps. These materials were generally observed to consist of sandy clay and silty sand and were damp to moist. These materials also ranged from very loose to loose and soft to stiff and contained plant roots, root hairs, and were porous.

2.2.1.3. Alluvium (Qal)

Holocene alluvial fan deposits (Qal/Qyf$_5$) were observed during our exploratory drilling in the canyon and drainage areas. Holocene aged Younger alluvium was encountered overlying Pleistocene aged older alluvium (alluvial fan) deposits in eight of our exploratory borings. As encountered in our exploratory borings alluvium generally consisted of silty sand with minor interbeds of sandy silt, clayey sand or sandy clay and traces of fine to coarse gravel. The younger alluvial deposits are locally porous, generally dry to moist, and loose to medium dense in the upper 7.5 feet to 30 feet and slightly porous; dry to wet, and medium dense to dense below. Older alluvium was encountered underlying the Younger alluvium at depths of approximately 15 to 50 feet in Borings KB-1 through KB-4, and KB-6 through KB-8 and generally consisted of dense to very dense silty sand, silty sands with gravel, very stiff to hard sandy and clayey silt and sandy clays which were damp to moist. Younger alluvium appears to be 50 feet thick to greater than 51.5 feet thick in the north-central and northwest drainage/canyon area of the site, as observed in borings KB-5, KB-9 and KB-10 (Appendix B). The results of the laboratory analyses for dry density and moisture contents of the alluvium encountered on site are found on the boring logs (Appendix B). Laboratory testing indicates that the younger alluvium on-site exhibits a collapse potential of essentially zero to as much as 4-1/2 percent (Appendix C), which is respectively considered slight to moderate.

2.2.2 Bedrock Unit

2.2.2.1. San Timoteo Formation (Tst)

Pliocene aged San Timoteo Formation (Tst) bedrock was observed during our investigation predominantly in the hillside areas and presumed to underlie the alluvial deposits at depth. The San Timoteo Formation has previously been mapped within the region by Dibblee (Reference 8) and Matti, et al (Reference 15), and at the site vicinity by Kling Consulting Group (References 12 and 13). Within the site, the San Timoteo Formation is composed of laminated and cross-bedded, to massively bedded arkosic and lithic sandstones, as well as some conglomerates, claystones and siltstones. The San Timoteo Formation is typically dry to damp. The San Timoteo Formation ranged from dense to very dense and stiff to hard where encountered during this study. The upper, approximately 5 feet of the San Timoteo Formation bedrock was moderately to heavily weathered where encountered in the recent site investigation.

2.3 Geologic Structure

Based on our experience within the site, site vicinity, geologic mapping and review of geologic and geotechnical literature for the region, the geologic structure reflects folded and warped bedding as exhibited by generally northwest trending anticlines and synclines mapped across the site and site vicinity. Typically, bedding within the San Timoteo Formation (Tst) bedrock is northerly dipping with some southerly dips. Bedding was measured during our field reconnaissance mapping and subsurface exploration dipping approximately 3 degrees to 19 degrees to the southwest and southeast. Locally bedding was also measured dipping approximately 20 degrees to the northeast.

Jointing within the San Timoteo Formation bedrock where observed was generally steeply inclined and generally trending northerly to northwesterly with steep dips to the west-southwest and east-northeast. Clay layers and seams are locally present within the San Timoteo Formation and were observed in several of the exploratory trenches/test pits.

Several northwest striking inactive faults have been mapped in the vicinity of the site and observed on the adjacent Hidden Canyon project to the east. No faulting was evident during our field mapping and exploration.

No evidence of recent active faulting was observed at the site during the course of this investigation and is not documented in our review of the available geologic and geotechnical literature of the site.

2.4 Groundwater

Groundwater was encountered during field subsurface exploration in two of our borings within the low-lying drainage areas in the northern-northwest portion of the site. Groundwater was encountered at approximately 40 feet below the ground surface (bgs) in Boring KB-5 and 48 feet below the ground surface (bgs) in Boring KB-7. It should be noted that variations in groundwater may result from fluctuations in the ground surface topography, subsurface stratification, rainfall, irrigation, and other factors that may not be evident at the time of our subsurface exploration.

2.5 Seismic Design Code Provisions

Presented below are the site seismic parameters utilizing geologic, seismic and geotechnical data gathered for the site. All structures should be designed for earthquake induced strong ground motions in accordance with the 2016 CBC procedures utilizing the following parameters:

Site Class (Soil Profile)	D
Latitude, Longitude	33.9390°, -117.0481°
Short Period Spectral Acceleration, Ss:	1.804
1-Second Period Spectral Acceleration, S1:	0.794
Site Coefficient, Fa:	1.0
Site Coefficient, Fv:	1.5
Maximum Considered Earthquake Spectral Response Acceleration, S_{MS}:	1.804
Maximum Considered Earthquake Spectral Response Acceleration, S_{M1}:	1.191
Design Spectral Response Acceleration, SDS:	1.203
Design Spectral Response Acceleration, SD1:	0.794
Site Modified Peak Ground Acceleration, PGA_m	0.705
Seismic Design Category	E

2.6 Faulting and Seismicity

2.6.1 Faulting

No evidence of active faulting was observed on-site during our site exploration. Maps reviewed during our investigation did not indicate the presence of active faulting at the site and no County Fault Hazard Zones are located within the subject site or adjacent properties per the Riverside County TLMA GIS website as indicated in Appendix A. Additionally, the site is not located within an Alquist-Priolo Earthquake Fault Hazard Zone (References 4 and 10). However, the Southern California region is seismically active with faults capable of producing seismic shaking at the site.

The Regional Fault and Seismicity Map (**Figure 3**) illustrates the spatial relationship between the subject property and the geographic locations of known historical earthquakes and active faults in the Southern California region.

It is anticipated that the site will periodically experience ground acceleration as a result of exposure to moderate to large magnitude earthquakes occurring on nearby and distant faults. Additionally, active "blind thrust faults" (faults which lack surface expression, commonly associated with fold belts and compressional deformation) or other potentially active sources (currently not zoned) may be capable of generating earthquakes. Blind thrust faults were responsible for both the 1987 Whittier Narrows (M5.9) and the 1994 Northridge (M6.7) earthquakes.

We have performed a computer aided search of known active and potentially active faults within a 50-mile (80-km) radius of the site and have researched the available geologic literature to determine the maximum magnitude earthquakes that may be expected to be generated on each fault. The site is located on the USGS El Casco, California 7.5 minute Quadrangle map, with the approximate center of the site being at latitude 33.9390°N and longitude 117.0481°W. Table 1 below, summarizes 12 of the known active and potentially active faults, which, in our opinion, may have the greatest impact on the site. Selection of these faults was based on the proximity of the fault to the site, and the potential of the fault to generate moderate to large ground motion at the site.

Table 1 was generated from information provided on the USGS online resource (USGS, 2008, National Seismic Hazards Maps, Source Parameters, Reference 19), with the approximate center of the site being at latitude 33.9390°N and longitude 117.0481°W. It is our opinion that the most significant faults that may affect the site are the San Jacinto and the San Andreas Fault systems during an earthquake event along those faults.

Table 1
Major Significant Faults in the Project Site Vicinity

Fault Name	Approximate Distance from Site [Miles (km)]	Maximum Event (Moment Magnitude), Mw
San Jacinto- San Jacinto Valley	3.4(5.4)	7.9
S. San Andreas – San Bernardino	9.3 (15.0)	8.1
Pinto Mountain	20.3 (32.7)	7.3
Elsinore-Glenn Ivy	25.1 (40.4)	6.9
Elsinore- W+ Glenn Ivy	25.1 (38.7)	7.3
Cleghorn	25.4 (40.9)	6.8
Elsinore – Glenn Ivy+Temecula+J+CM	25.6 (41.2)	7.4
Elsinore – Temecula+Julian	26.2 (42.2)	7.5
Cucamonga	28.1 (45.2)	6.7
North Frontal (West)	29.0 (46.7)	7.2
Helendale – S. Lockhardt	29.7 (47.8)	7.4
Chino-Alt 2	30.8 (49.6)	6.8

2.6.2 Historical Earthquakes

A computer search of major historical significant earthquakes that have occurred within a 62-mile (100 km) radius of the site from 1800 through 2019 has been performed. Our search was limited to those earthquakes with magnitudes greater than M5. Table 2 below was generated using information provided by the USGS, and the Southern California Earthquake Data center.
(http://scedc.caltech.edu/significant/chronindex.html,
https://earthquake.usgs.gov/earthquakes/map/).

The Regional Fault and Seismicity Map, **Figure 3**, presents the location of major faults and historical earthquake events relative to the subject site. The major historical earthquakes determined by those resources are tabulated below on Table 2:

Table 2
Historical Earthquakes

Earthquake Name/Location	**Date**	**Magnitude (Mw)**	**Approximate Distance (miles)**
North San Jacinto	7/22/1923	6.3	12
San Jacinto	4/21/1918	6.8	16
North Palm Springs	7/8/1986	5.6	25
Greater Los Angeles Area	12/16/1858	6.0	26
Elsinore	5/15/1910	6.0	26.5
Lytle Creek	9/12/1970	5.2	37
White Wash	2/25/1980	5.5	38
Joshua Tree	4/22/1992	6.1	39
Landers	6/28/1992	7.3	40
1990 Upland Earthquake	2/28/1990	5.4	40
Chino Hills	7/29/2008	5.4	41
Southern California Area	12/8/1812	6.9	46
Long Beach	3/10/1933	6.4	54
Big Bear	6/28/1992	6.4	57
Southern California Area	2/9/1890	6.8	57
Whittier Narrows	10/1/1987	5.9	59
Hector Mine	12/16/1999	7.1	60.5
Greater Los Angeles Area	7/11/1855	6.0	62

The historical earthquake that likely had the most significant impact on the project site occurred in 1923, approximately 12 miles northwest of the site, located on a fault known as the San Jacinto Fault and the San Jacinto earthquake. This earthquake had an estimated magnitude of 6.8 (USGS/SCEDC).

The closest fault to the subject site is the San Jacinto Fault located approximately three miles from the site. The estimated site modified peak ground acceleration (PGA_M) is 0.705g as generated from information provided on the USGS online resource (USGS, 2008, National Seismic Hazards Maps, Source Parameters, Reference 15).

2.7 Other Geologic Hazards

2.7.1 Liquefaction

The site is not located within a State of California Seismic Hazard Zone (California Geologic Survey (CGS)/California Department of Conservation) indicating a susceptibility for liquefaction potential. Information available in the County of Riverside Safety Element December, 2015, (Reference 7) indicates that portions of the site may have "very low" to "low" potential for liquefaction and information available on the Riverside County Mapping and Spatial Data Portal, GIS data, March 15, 2018 (Reference 16) indicates that portions of the site are in "Zone 109" and may have a "moderate" susceptibility to liquefaction.

Portions of the site appear to be susceptible to relatively minor amounts of liquefaction settlement. The magnitudes of seismic–induced liquefaction settlement appear to be relatively minor and somewhat localized, occurring generally below depths of 40 feet where groundwater was encountered in two (2) of our borings.

The total earthquake-induced liquefaction settlement potential was calculated using the LiquefyPro software. Our evaluation was based on the site class and adjusted peak ground acceleration of 0.705g, as presented in the **Seismic Design Parameters Table** above, and a probabilistic 2,475 year modal magnitude of 8.1. Our analysis indicates the estimated settlement due to earthquake-induced liquefaction settlement is approximately 0.00 inches to approximately 1 inch. Differential settlements are estimated to be negligible to approximately a little over 0.5 inches over a distance of 50 feet. Due to the lack of a shallow static groundwater level and the materials encountered underlying the site overall relatively dense and stiff nature, the materials are not considered to be susceptible to significant amounts of liquefaction induced seismic settlement. With the proposed fill depths and loads imposed from the fill, liquefaction is considered to be negligible.

The potential for lateral spreading is low based on our analysis and information which indicates that the site is not considered susceptible to significant amounts of liquefaction induced settlement as discussed above. Additionally, there are no free slopes adjacent to the project. The results of our analysis are included herein in **Appendix D–Seismic Settlement Analysis.**

2.7.2 Seismically Induced Dry Settlement

The total earthquake-induced dry sand settlement potential was calculated using the LiquefyPro software. Our evaluation was based on the site class and adjusted peak ground acceleration of 0.705g, as presented in the Seismic Design Parameters Table above, and a probabilistic 2,475 year modal magnitude of 8.1. Total earthquake-induced dry sand settlement was calculated using Boulanger and Idriss (2014) analysis method and theSPTblowcounts from our borings. Our analysis indicates the estimated settlement due to earthquake-induced dry settlement ranges from approximately 0.6 inches to 4.6 inches. Differential settlements are estimated to range from approximately a little over 0.25-inches to 3.0 inches over a distance of 50 feet. The majority of the seismic induced dry settlement occurs in the upper 10 to 30 feet within the younger alluvial materials. The majority of the alluvium that is potentially susceptible to seismic induced dry settlement would be removed during remedial earthwork and in our opinion would also be subject to additional settlement during construction due to fill loads, which would reduce the settlement significantly. The older alluvial materials underlying the younger alluvium at the site are overall relatively dense and the dry settlement potential is considered relatively minor to negligible within the Older Alluvial materials. Results of our analysis are included herein (**Appendix D**).

2.7.3 Seismically Induced Slope Instability/Landslides

The site is not mapped within a State of California designated Hazard Zone for Slope Instability. Information available in the County of Riverside Safety Element, December, 2015, (Reference 7) indicates that portions of the site may have "low" to "moderate" susceptibility for seismic induced slope instability. The potential for seismic induced slope instability is considered in section 3.2 of this report.

2.7.4 Tsunamis and Seiches

The site is not located near any ocean or landlocked bodies of water; therefore we do not consider Tsunamis or sieches to be a potential hazard to the project.

2.8 Flooding

According to the Federal Emergency Management Agency (FEMA), the subject site is located within an area of minimal flood Hazard- Zone X (Reference 9). It is our understanding the overall subject site will be elevated by proposed design grading to be situated well above local drainage courses. As such, the risk for flooding of the site is considered relatively low.

3. GEOTECHNICAL ENGINEERING ANALYSIS

The results of our geotechnical engineering analysis performed during our investigation are discussed and presented below.

3.1 Laboratory Testing

In order to perform the geotechnical analysis considered necessary for this project, soil mechanics laboratory testing was performed on selected soil samples obtained from the exploratory borings. The laboratory tests performed included moisture/density determinations, maximum density, sieve analysis, direct shear, consolidation, collapse potential and classification tests. Consolidation-related (dry) and hydro-collapse potential (wet) was evaluated along with the time-rate of settlement. Direct shear tests were performed on both relatively undisturbed ring samples as well as samples remolded to 90 percent relative compaction to represent both in-situ and fill conditions. The consolidation and hydro-collapse testing was performed on relatively undisturbed in-situ soil samples (natural soil deposits) in order to determine the long-term settlement deformation in response to the proposed fill loading. The exploratory boring and test pit logs for exploration conducted during this investigation is presented within Appendix B. test-pit logs. Laboratory test results are presented in Appendix C.

3.2 Slope Stability

3.2.1 Deep Seated Slope Stability

Approximate 2:1 (horizontal to vertical) cut and fill slopes of variable height are proposed throughout the site. Deep seated slope stability analysis was performed on selected geologic cross-sections considered representative of the various proposed conceptual slope configurations. The computer program Slide version 8.0 by Roc Science was employed for slope stability calculations. The sections assigned for stability analysis included both proposed fill and cut slopes. Stability analyses were conducted utilizing conventional limit equilibrium methodologies for both force and moment equilibrium. The results of our analysis are presented below and summarized in **Appendix E**. The locations of the cross sections are presented on **Plates 1 and 2** and the cross sections presented on **Plate 3**.

Samples collected on-site were tested and the soil strength parameters utilized for analysis are presented in the table below. Direct shear strength parameters utilized were based on laboratory testing and our past and recent experience with similar materials on projects in the site vicinity.

Soil Strength Parameters

Material Type	**Unit Weight, γ [pcf]**	**Cohesion, c [psf]**	**Friction Angle, φ [degrees]**
Artificial Fill (Af)	125	150	31
Alluvium (Qal)	120	100	29
San Timoteo Formation (Tst-Bedrock)	130	550	33

Stability analyses were conducted on the geologic cross sections indicated in the table below. Each cross section was analyzed for both static and pseudostatic conditions with a horizontal acceleration coefficient "K" of 0.15. Results of the analysis are presented below. Minimum factors of safety of 1.5 and 1.1 are considered acceptable for static and pseudostatic conditions respectively. Proposed 2:1 fill slopes and 2:1 cut slopes are considered grossly stable in the absence of adverse geologic conditions.

Slope Stability Analysis

Cross Section	Factor of Safety	
	Static	Pseudostatic (Seismic)
A - A'	2.18	1.53
B- B'	2.36	1.67
C - C'	2.26	1.59
D - D'	1.63	1.13

The results of detailed stability analyses summarized above are presented in **Appendix E**.

3.2.2 Surficial Slope Stability

Proposed 2:1 fill and cut slopes analyzed resulted in a factor of safety against surficial failure greater than 1.5 and are therefore considered surficially stable. Our analysis is summarized in **Appendix E**.

3.3 Erosion Potential

Fill slopes constructed with granular materials derived from on-site sandstone bedrock may be susceptible to erosion.

Bedrock units include the San Timoteo Formation (Tst) and the surficial units include undocumented artificial fill, colluvium (Qcol), and alluvium (Qal) Bedrock encountered during this investigation was moderately hard to hard and is considered to be slightly to moderately erodible. In general, surficial soils encountered are typically granular and appear to be readily erodible as evidenced by their soft to loose state and localized erosion gullies.

The erosion potential of cut slopes exposing on-site bedrock materials may range from low to medium depending on the bedrock materials exposed on the cut slope, as well as the orientation of bedding and joint planes within the slope. In general, cut slopes exposing well-indurated and/or cemented sandstones should have a low to moderate susceptibly to erosion. Friable, poorly cemented, sandstones should have a moderate to high erosion susceptibility.

3.4 Surface Drainage

Surficial drainage of the proposed development could significantly affect strength and compression characteristics of the proposed engineered fills, as well as the on-site bedrock materials. Maintenance of positive drainage from proposed roadways, building pad areas and slopes is paramount to the long-term performance of the site improvements, especially erosion on slopes. Recommendations for surface drainage are included in Section 5.6 below.

3.5 Rippability

The degree of rippability of bedrock material is, in general, dependent upon several factors which include the lithology of the bedrock, the geologic structure, the degree of weathering, as well as the type of earth moving equipment employed.

Difficult excavation could be encountered locally within the San Timoteo Formation (Tst). In general, the upper 15 to 30 feet of bedrock in natural areas has been affected by long-term weathering processes and should exhibit easier excavation characteristics above those depths. Local indurated or very hard zones could exist, which would make excavation difficult by conventional means, which may require special techniques including the use of single shank rippers, rock breakers mounted to excavators, etc.

Although not anticipated, in the event that non-rippable materials are encountered and blasting is required, a qualified, experienced licensed blasting contractor should perform the blasting using current and professionally accepted methods, products, and procedures to maximize safety during blasting operations in accordance with applicable laws and ordinances. The contractor would be responsible for all required permits, blasting procedures, safety, methodology, pre-blast monitoring, monitoring during blasting and post-blast monitoring, including appropriate pre-blast, blast and post-blast warning signals.

The blasting contractor should incorporate procedures that protect personal safety, property, and produce blast rock of appropriate sizes, make sure the blast will prevent/minimize production of flyrock and air blast hazards, minimize peak particle velocities, and minimize overblasting. Oversize materials generated from excavations and/or blasting can be used as fill (Section 5.3) and placed in accordance with oversize material placement (Section 5.8) as recommended in General Earthwork and Grading Specifications presented in Appendix F.

3.6 Fill Suitability

Materials generated from the excavation of undocumented fill, alluvium (Qal) and bedrock units San Timoteo Formation (Tst) are considered suitable for use as engineered fill, provided they are free of deleterious materials such as trash or organics.

3.7 Settlement Potential

The existing alluvium materials (Qal) have been evaluated on a preliminary basis for settlement. Loose younger alluvium should be removed as recommended in Section 5.3. Relatively competent alluvium can be left in place within the canyons beneath the proposed building pads and beneath proposed design fills of the site beneath proposed fill slopes of variable heights and configurations.

Based on our preliminary analyses, the amount of settlement varies from slight to severe. It should be understood that the amount of estimated consolidation-related and hydro-collapse settlement are generally independent of one another and therefore should be combined when evaluating the total amount of settlement. On the other hand, much of the normal consolidation-related settlement should occur as the new engineered fill is placed. This settlement should occur immediately upon fill placement and continue until grading is complete. We expect the majority of the predicted settlement to have occurred by the end of grading. However, in order to monitor the settlement, we recommend that settlement monuments be established in strategic locations along the northerly fill slopes. These monuments should be read periodically and the results evaluated by the geotechnical consultant prior to site improvements constructed within those areas.

3.8 Expansion Potential

The onsite geologic formations are comprised of mostly sandstone, which generates soils that are generally sandy and therefore low in expansion potential; however, siltstone/clay layers subject to excavation would produce clayey soils, which would be expansive. Minor amounts of siltstone exists onsite that if placed at pad grade would produce moderately expansive soils. Expansion potential of the soils exposed at finished grade should be evaluated at the completion of grading.

3.9 Preliminary Earthwork Shrinkage and Bulking

The volume change of excavated on-site materials upon excavation and placement as engineered fill will vary with bedrock/soil type, location and compactive effort. However, the overall earthwork shrinkage/bulking and subsidence of the onsite soils may be approximated by the following parameters:

§	San Timoteo (Tst)	5% bulking
§	Alluvium (Qal)	15% shrinkage
§	Alluvium (Qal)	1.0 feet subsidence (average)

4. CONCLUSIONS

The following preliminary conclusions are based on our review of the available geotechnical data as well as the results of our field investigation, laboratory testing and engineering analysis. It is our opinion that the subject property investigated herein is considered geotechnically suitable and feasible for the development of proposed improvements discussed above, provided that the recommendations presented herein are implemented during further design, grading, and construction. If the recommendations in this report are incorporated into design and construction of the project, the proposed grading should not adversely affect adjoining sites.

- Generally, undocumented fill, topsoil/colluvium and younger alluvium on site are considered potentially compressible and prone to settlement and portions of the younger alluvium prone to hydrocollapse. Alluvium left in place may support proposed fills provided the recommendations discussed in Section 5 are incorporated into grading operations and site development/design;

- Alluvial soils are subject to settlement upon loading by proposed fill soils and the majority of the settlement is expected to occur during grading and within a few months thereafter. However, as a precaution, we are recommending that surface monuments be installed at strategic locations along the top of slopes and pad areas of the project;

- Stability analyses indicate that the design cut and fill slopes are grossly stable under static and pseudostatic conditions, and generally should not be subject to earthquake induced failures or excessive deformation under seismic conditions in the absence of adverse geologic conditions and provided the recommendations in this report are implemented. Stability calculations are included in Appendix E. Supplemental subsurface exploration is recommended, see Section 5.1;

- Site soils subject to earthwork operations are generally sandstone and sandy alluvium. Fill materials derived from these types of materials will typically exhibit a very low to low expansion potential. However, a limited amount of siltstone and clay onsite could generate moderately expansive soil at finished surface and should be evaluated at the completion of grading;

- Fill soils derived from sandstone should be rippable and generally suitable for use as fill materials, provided they are free of vegetation, debris and over-sized cobbles and/or boulders. Deeper cuts of bedrock materials may locally be difficult to excavate by conventional methods and may generate oversize rocks. Local indurated or very hard zones could exist, which would make excavation difficult by conventional means, which may require special techniques including the use of single shank rippers, rock breakers mounted to excavators, etc. Blasting is not anticipated, however, oversize materials generated from excavations and/or blasting can be used as fill (Section 5.3 and 5.8) and placed in accordance with oversize material placement as recommended in General Earthwork and Grading Specifications presented in Appendix F.

- No active faulting is known to exist at the site and the risk of surface fault rupture is considered to be very low. However, the project site lies within a region of historical seismicity and will likely be subject to seismic shaking in the future;

- Groundwater was encountered at depth during the subsurface investigation in two (2) of our borings, KB-5 and KB-7, at depths of approximately 40 and 48 feet below the ground surface, within the low-lying canyon drainage areas located along the northerly edge of the site. Groundwater levels are not expected to have an impact on the project;

- The younger alluvium is also subject to minor amounts of liquefaction settlement of less than 1-inch at depths of 40 feet, which is not considered as significant. With the proposed fill depths and loads imposed from the fill, the materials would be subject to additional settlement during construction, and in our opinion, reduce the seismic induced settlement potential for liquefaction. Therefore, liquefaction is considered to be negligible. The upper portion of the younger alluvium is subject to seismic-induced dry settlement, which would occur primarily in the upper 10 to 30 feet. The maximum seismic induced settlement that could occur would be on the order of approximately 0.6-inches to 4.6 inches. The majority of the alluvium that is potentially susceptible to seismic induced dry settlement would be removed during remedial earthwork and in our opinion would also be subject to additional settlement during construction due to fill loads, which would reduce the settlement significantly;

- Preliminary remedial grading recommendations include leaving alluvium in place within the canyons. It is considered prudent to place survey settlement monuments at selected locations where alluvium has been left in place, deep fill areas and over cut/ fill transition areas.

5. RECOMMENDATIONS

Geotechnical recommendations presented below are based on our understanding of the intended site use and the preliminary geotechnical information gathered and analyzed to date for feasibility purposes. Recommendations contained herein are preliminary in that they would be subject to modifications based on additional subsurface exploration to further characterize the site conditions and refine the recommendations, specifically, the alluvial removal and over-excavation requirements intended to reduce the differential settlement that could be experienced at finished pad grades, based on development of detailed rough grading plans.

5.1 Supplemental Subsurface Exploration

Our preliminary geotechnical investigation is a feasibility level study, we recommend that a supplemental geotechnical investigation be performed that includes additional large and small diameter borings to further characterize site conditions when detailed grading plans are available and prior to final design and construction to supplement and check that the subsurface conditions are consistent with our findings, conclusions and our preliminary recommendations. Recommendations would be updated as warranted.

5.2 General Earthwork and Grading

Grading should be performed in accordance with the General Earthwork and Grading Specifications presented in Appendix F, unless specifically amended below, and should also conform to applicable governing agency requirements. Prior to commencement of grading operations, all vegetation, organic topsoil, and man-made structures (i.e., tanks, pipes, fences, etc.) should be cleared and disposed of off-site. Areas receiving fill should be scarified about 6 to 12 inches deep and/or over-excavated, moisture-conditioned to at least two percent above optimum moisture content, and compacted to a minimum of 90 percent relative compaction for areas to receive new fills up to 50 vertical feet and 95 percent for areas to receive greater than 50 feet of fill. All earthwork and grading operations should be performed under the observation and testing of the geotechnical consultant.

5.3 Fill Placement and Compaction

5.3.1 Fill Lifts

Fill material shall be placed in near-horizontal layers not exceeding 8 inches in loose thickness. Should abundant cobbles or rocks up to 12-inches in diameter be exposed, fill lift thicknesses could be increased to this dimension. Rocks greater than 12 inches should be collected and placed as over-sized material. Each fill layer should be spread evenly and should be thoroughly mixed during spreading to attain uniformity of material and moisture in each layer.

5.3.2 Fill Moisture

Fill layers at moisture contents less than optimum shall be watered and mixed; and fill layers shall be aerated by scarification or shall be blended with drier material. Moisture-conditioning and mixing of fill layers shall continue until the fill material is uniformly processed at a minimum of two percent above optimum moisture content.

5.3.3 Fill Compaction

After each layer has been evenly spread, moisture-conditioned, to a minimum of two percentage points above optimum moisture content and mixed, it shall be uniformly compacted to not less than 90 percent for fills up to 50 feet in depth, and 95 percent for fills greater than 50 feet in depth, of the maximum dry density. Compaction equipment shall be adequately sized and shall be either specifically designed for soil compaction or of proven reliability, to efficiently achieve the specified degree of compaction.

5.4 Remedial Grading

Preliminary remedial grading recommended for this project is based on the findings and conclusions generated during this limited feasibility level geotechnical investigation of the site, and with the expectations and specifications of the client based on the ultimate site development. As such, the remedial grading recommendations presented herein are based on preliminary site-specific project development and site conditions. Undocumented fill and surficial topsoil and colluvium should be completely removed and recompacted during remedial earthwork. Remedial removals of the alluvium could range from approximately 7.5 feet to 30 feet below existing grades or greater and 3 to 5 feet for the San Timoteo Formation bedrock.

5.4.1 Over-excavation Along Cut/Fill Transitions

In order to minimize the potential for differential settlement, proposed cut-fill transition lots should be overexcavated a minimum of three feet below design finish pad grades. In general, and on a preliminary basis, lots with steep fill transitions should be overexcavated 1/3 of the maximum depth of fill in the shallower fill portions of the pad (Appendix F-GD3).

5.4.2 Over-excavation of Cut Areas

In order to limit the fill differential between cut and fill, and to provide a more uniform foundation pad for the proposed improvements, proposed cut areas are recommended to be over-excavated prior to placing fill. In general, the over-excavation of the cut area should be at least 3 feet below design finish pad grades.

5.5 Manufactured Slopes

All design slopes should be constructed in accordance with City of Beaumont, County of Riverside requirements along with recommendations contained herein. Keyway backcuts, if any, greater than 5 feet in height should not be made steeper than a 2:1 slope gradient unless approved by the geotechnical consultant. Vertical benches with a minimum height of 4 feet should be established for all fills placed on ground sloping steeper than 5:1 (horizontal:vertical). Keyways should be constructed as depicted in the Grading Details (Appendix F) or as determined by the geotechnical field representative during grading. Slope maintenance guidelines are provided in Appendix M.

5.5.1 Slope Stabilization and Buttresses

Each fill slope stabilization, if any, should be provided with a subdrainage system as outlined in Appendix L. Keyways should be a minimum of 3 feet deep and a minimum of 15 feet wide, or half the slope height (whichever is greater). The locations of slope stabilization and buttress keyway dimensions should be evaluated and confirmed during grading.

All keyways and backcuts for proposed slope stabilization, if any, should be observed by the geotechnical consultant during grading. Keyway dimensions may be modified based on the actual geotechnical conditions encountered during grading. Stabilization and buttress fills should be provided with backdrains constructed in accordance with the specifications contained in Appendix G and applicable City of Beaumont or County of Riverside grading ordinances.

5.5.2 Fill Slopes

All fill slopes should be provided with a fill key excavated to a minimum depth of 3 feet into bedrock, or into alluvial materials after removals have been conducted, as determined by the geotechnical consultant during grading. Slopes higher than 30 feet should be provided with a keyway that has a minimum width of one-half the slope height and a depth of at least 3 feet into bedrock, or competent materials as determined by the geotechnical consultant during grading. Larger keyways may be required depending on slope height and soil conditions encountered beneath the proposed fill slopes. Vertical benches with a minimum height of 4 feet should be established for all fills placed on ground sloping steeper than 5:1. Oversize or cohesionless sandy material should not be utilized near the slope face. Fill slopes should be constructed of well-blended mixtures of sands, silts and clays where possible. Where considered necessary, fill slopes should be provided with backdrains constructed in accordance with the specifications contained in Appendix F and applicable City of Beaumont or County of Riverside grading ordinances.

5.5.3 Cut Slopes

In general, cut slopes proposed in the Timoteo Formation are considered stable when cut to design gradients of 2:1 horizontal to vertical, in the absence of adverse geologic conditions.

All cut slopes should be geologically mapped during grading. Cut slopes found during grading to expose adverse geologic structure should be provided with replacement stability fills constructed in accordance with the specifications presented herein and in Appendix F. Furthermore, cut slopes exposing earth materials that are susceptible to erosion should be constructed as replacement fill slopes. Keyway backcuts greater than 5 feet in height should not be made steeper than a 2:1 slope gradient. Stabilization fills should be provided with backdrains constructed in accordance with the specifications contained in Appendix F and applicable City of Beaumont and County of Riverside grading ordinances.

5.5.4 Cut/Fill Transition Slopes

In general, slopes that will have a cut/fill transition and bedrock/alluvium transitions can be cut to grade. However, where the resulting fill would be too thin, we would recommend replacement. Where bedrock/alluvium transitions occur, they should be evaluated in the field for suitability, and be treated with a replacement slope with keyways and drains as determined by the geotechnical consultant.

5.6 Surface Drainage

Appropriate surface drainage measures should be provided by the civil engineer, including terrace drains, surface gradients, and suitable non-erosive collection devices in accordance with the 2016 California Building Code and City of Beaumont regulations. Surface drainage should never be allowed to flow toward or over the top of slopes.

Consideration for the eventual settlement of the canyon areas should also be taken into account while designing local drainage. Currently, the site plan sheet flows across the entire site. However, it may be necessary to consider designing local low spots with area drains over the main canyon.

5.7 Subdrainage

Canyon fills and stabilization fills will require appropriate subdrain installation in accordance with the recommendations described in Appendix F, or as modified by the geotechnical consultant during grading. Subdrains should be installed in canyon bottoms with tributary drainages installed after the overexcavation of unsuitable soil materials, prior to the placement of compacted fills. Subdrainage should also be provided for any significant seepage encountered during grading. The necessity and locations of subdrains should be evaluated upon review of more detailed grading plans.

5.8 Oversized Rock Materials

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fills, unless the location, materials, and disposal methods are specifically recommended by the geotechnical consultant.

Any oversized materials, with a maximum dimension of 36-inches, generated during excavation that cannot be broken down to less than 12 inches nominal size should be disposed off-site or placed within a rock windrow as illustrated on Detail GD-5 in Appendix F. Oversize material shall not be placed within 10 feet vertically or within 20 feet horizontally of any finished surface, unless specifically recommended by the geotechnical consultant during grading. Oversized disposal operations shall be such that nesting of oversize material does not occur, and such that the oversize material is completely surrounded by compacted or densified fill.

Individual rocks with a maximum dimension of 36-inches to 72-inches may be disposed of within fill areas under the direction of the geotechnical consultant on a case by case basis. Individual oversized rock disposal operations shall be such that the oversize material is completely surrounded by compacted or densified fill. Individual oversize material shall not be placed within 20 feet vertically or within 20 feet horizontally of any finished surface, unless specifically recommended by the geotechnical consultant during grading.

5.9 Deep Fill Areas/Settlement Monitoring

Based upon our understanding of proposed concept grading, fills on the order of 145 feet deep (design grading) are planned. Engineered fills deeper than 50 feet should incorporate a minimum relative compaction of 95 percent, and a moisture content of at least two percentage points above optimum moisture content. Compaction requirements may be revised based on hydrocollapse testing conducted while fill is being placed. A settlement monitoring program should be implemented consisting of the surveying of surface monuments to monitor settlement of alluvial soils left in-place and/or proposed fills deeper than 50 feet.

Survey monument readings for both deep fill areas and for fill over natural ground (Qal) should be conducted following the completion of fill placement. These areas would preliminarily include the fill slopes along the north edge of the site and over the main north-south trending canyons/drainages under the proposed building pads. Survey monument locations should be selected by the geotechnical consultant. Construction of the monuments may be completed by the contractor or the geotechnical consultant in accordance with our grading details SM-2 and SM-3 (Appendix F). Survey readings should be taken weekly for the first month and on a monthly basis thereafter until vertical movement of the fill mass achieve 90 percent of primary compression, begin secondary compression or the estimated remaining settlement is less than one inch. Construction of proposed structures should not commence until approved by the geotechnical consultant based on the results of the settlement monitoring.

The survey bench marks used for the monitoring should be confirmed with the geotechnical consultant prior to initial readings being performed. Based on our analyses, it is estimated that primary consolidation settlement would require from a few months to a year following the completion of fill placement provided all recommendations presented herein have been implemented. It should also be remembered that the site improvements will need to be designed for a maximum tolerance deflection ratio (for differential settlement) with an estimated total settlement that is expected to occur in the deep canyons and fill areas. A portion of this settlement is also expected to occur during grading.

5.10 Preliminary Foundation Recommendations

All foundation criteria are considered minimum requirements that may be superseded by more stringent requirements from the architect, structural engineer, or governing agencies.

The following preliminary geotechnical design parameters are provided for the design of proposed foundations for the proposed buildings. The proposed buildings may be supported by continuous and square pad footings utilizing an allowable bearing pressure of 2000 pounds per square foot. The width of the continuous footings should be a minimum of 15 inches and embedded to a minimum depth of 18 inches below the lowest adjacent grade. For square pad footings, it is recommended that the width be at least 24 inches embedded a minimum of 18 inches below the lowest adjacent grade. Bearing pressures may be increased by 250 pounds per square foot per additional foot of width or depth to a maximum allowable bearing pressure of 2,500 pounds per square foot. A coefficient of friction of 0.40 may be used, along with a passive lateral resistance of 250 pounds per square foot per foot of embedment. Footings should bear on at least two feet of compacted fill.

If normal code requirements are used for seismic design, the allowable bearing value and coefficient of friction may be increased by 1/3 for short duration loads, such as the effect of wind or seismic forces.

If any utility lines are within a 1:1 (horizontal: vertical) projection from the bottom of a footing, they may be within the influence zone of the proposed footing load. If this condition exists, the proposed footing should be deepened so that the utility is outside the zone of influence; the utility line could also be relocated or encased with concrete slurry. These conditions should be evaluated on a case by case basis.

5.11 Retaining Walls

General guidelines are provided below for low retaining walls up to ten feet in retained height.

For preliminary purposes, retaining walls should be designed to resist an equivalent fluid pressure of 40 pounds per cubic foot for level backfill and 55 pounds per cubic foot for 2:1 sloping backfill. Backfill materials should consist of granular material (S.E. $\geq$ 30) and drainage systems should be installed as shown on retaining wall details in Appendix F. Please note that drainage recommendations are provided only as a means to create a drained condition behind proposed retaining walls. Surface drains should not be connected to retaining wall sub-drainage. These drains are not intended as a means of waterproofing. If moisture or salt deposition is not desired, or if stone facing, stucco, or paint is to be applied to the wall outer surface, the wall should be provided with suitable waterproofing. The waterproofing system for the wall should be designed by a qualified waterproofing consultant. Any waterproofing or drainage system damaged by soil placement and compaction efforts should be repaired prior to completion of backfilling.

Foundations for proposed retaining and perimeter (non-retaining) walls which are to be founded into compacted fill materials may be designed utilizing an allowable bearing pressure as presented above for conventional foundations.

5.12 Sulfate Potential

Based on the soluble sulfate test results at this time, the on-site soils possess a sulfate exposure that is considered “Class S0”. For preliminary purposes, concrete should be designed in accordance with ACI 318, Section 19 Table 3.1.1, utilizing “Class S0” sulfate exposure.

5.13 Corrosion Potential

Laboratory testing on surficial deposits within the subject site has preliminarily indicated the soil is “highly-corrosive” to ferrous metals when the soil is saturated, as per Caltrans guidelines.

5.14 Preliminary Pavement Design

For “preliminary” design, parameters are provided below. Laboratory R-Value test results indicated R-Values ranging from 13 to 41 on surficial soils tested. We have assumed an R-Value of 25 for preliminary design purposes and to account for soil variability. Additional R-Value testing should be performed on subgrade soils at the completion of rough grading to confirm final structural pavement sections. The selection of actual traffic index should be the purview of the project civil or traffic engineer.

Preliminary Pavement Section Design

R-Value	Traffic Index	Multiple Layered	
		Asphalt Concrete (inches)	Aggregate Base* (inches)
25	4.0	3.0	5.0
25	5.0	3.0	6.0
25	6.0	3.0	9.0
25	7.0	4.0	11.0

*Aggregate base material should consist of Class 2 aggregate base materials or Crushed Miscellaneous Base (CMB).

5.15 Temporary Excavations

Temporary excavations and trench walls to a depth of four feet may be made vertically without shoring, subject to verification of safety by the contractor. Deeper excavations should be no steeper than 1.5:1 (horizontal to vertical) or braced or shored in accordance with CAL OSHA standards and guidelines. The contractor is assumed responsible for maintaining safety at the jobsite. All excavation work should be in compliance with current CAL OSHA standards. Under no circumstances should excavations be made deeper than four feet or below groundwater without shoring, bracing or laying-back, in accordance with CAL OSHA standards and guidelines. No surcharge loads should be allowed within five feet from the top of the cuts.

Existing utility lines, roadways and other easements/right-of-ways may be impacted by the temporary excavations may require shoring to obtain the full depth of the excavation.

5.16 Grading Plan Review

Our office should review the 40-scale grading plans, produced in the future. Grading plan review will be necessary to verify that our recommendations in this report remain relevant and to provide updated geotechnical recommendations specific to the plans as necessary.

5.17 Geotechnical Testing and Observation

Geotechnical observation and testing should be conducted during the following stages of grading:

- Upon the completion of clearing and grubbing;
- During all phases of grading, including benching, backcut and key excavation, cut slope excavation, remedial removals of surficial soils, backdrain/subdrain/filter material installation and engineered fill placement;
- During Settlement Monument placement;
- During roadway subgrade preparation and compaction of roadway aggregate base;
- When any unusual conditions are encountered during grading.

6. PROFESSIONAL LIMITATIONS

Geotechnical services are provided by KCG in accordance with generally accepted professional engineering and geologic practice in the area where these services are to be rendered. Client acknowledges that the present standard in the engineering and geologic and environmental profession does not include a guarantee of perfection and, except as expressly set forth in the conditions above, no warranty, expressed or implied, is extended by KCG.

All excavations used for subsurface exploration were backfilled prior to leaving the site. As with any backfill, consolidation and subsidence may result in depression of the excavation area and a potentially hazardous condition. The client and/or owner of the property are hereby advised to periodically examine the excavation areas, and if necessary backfill any resulting depressions. KCG shall not be responsible for injury or damage resulting from subsidence of backfill.

Geotechnical reports are based on the project description and proposed scope of work as described in the proposal. Our conclusions and recommendations are based on the results of the field, laboratory, and office studies, combined with an interpolation and extrapolation of soil conditions as described in the report. The results reflect our geotechnical interpretation of the limited direct evidence obtained. Our conclusions and recommendations are made contingent upon the opportunity for KCG to continue to provide geotechnical services beyond the scope in the proposal to include all geotechnical services. If parties other than KCG are engaged to provide such services, they must be notified that they will be required to assume complete responsibility for the geotechnical work of the project by concurring with the recommendations in our report or providing alternate recommendations.

All locations of borings, limits of fill, contacts, elevations, etc., are represented herein to the best of our abilities. The approximate locations depicted on all plates and figures are based upon available control as provided in the field by others. Where no information was provided by others, locations were approximated using limited measuring methods and crude instrumentation. We do not verify the locations or elevations reported herein as accurate in survey or void of error. KCG assumes no responsibility for any future costs associated with errors in the area of survey.

It is the reader's responsibility to verify the correct interpretation and intention of the recommendations presented herein. KCG assumes no responsibility for misunderstandings or improper interpretations that result in unsatisfactory or unsafe work products. It is the reader's further responsibility to acquire copies of any supplemental reports, addenda or responses to public agency reviews that may supersede recommendations in this report.

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

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APPENDIX A

REFERENCES
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APPENDIX B

EXPLORATORY LOGS

LOG OF EXPLORATORY BORING

Sheet **1** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-1**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/25/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2348.0**

◩ Standard Split Spoon	■ Shelby Tube	▽ Water Level ATD
⧓ California	☒ Bulk Sample	▼ Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
							@ Surface - TOPSOIL			
			☒				**Younger Alluvium (Qa):** **@ 0.5 feet - Sandy SILT (ML)** olive-brown, some mica grains, damp.			
2345			⧓	3 3 5	9	105	**@ 2.5 feet - SAME:** medium stiff.		DS	
	5		⧓	2 2 3	10	102	**@ 5.0 feet - SAME:** some calcium carbonate.			
2340			⧓	3 4 5	12	111	**@ 7.5 feet - SAME:** trace clay.			
	10		⧓	2 4 4	10	103	**@ 10.0 feet - SAME**		CN	
2335										
	15		⧓	14 22 37	6	124	**Older Alluvium (Qoa):** **@ 15.0 feet - Silty SAND (SM):** grey-brown, fine to medium-grained, some mica grains, little quartz grains, little feldspar grains, damp, dense.		CN	
2330										
	20		◩	24 26 34			**@ 20.0 feet - SAME:** trace gravel up to 3/4".			
2325										
	25		⧓	23 34 50/4"	11	117	**@ 25.0 feet - SAME:** large vein of calcium carbonate, trace gravel up to 1/4", very dense.			
2320										

LOG OF EXPLORATORY BORING

Sheet **2** of **2**

Project: **Jack Rabbit Trail**
Project Number: **18060-01**
Date Drilled: **6/25/19**
Logged By: **DKL**

Boring No.: **KB-1**
Driller: **Cal Pac Drilling**
Drill Type: **Hollow Stem**
Hammer Wt. / Drop: **140lb / 30in**
Ground Elev. [ft]: **2348.0**

◩ Standard Split Spoon
■ Shelby Tube
∇ Water Level ATD
⧗ California
☒ Bulk Sample
▼ Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
			◩	21 34 44			@ **30.0 feet - <u>Silty SAND (SM):</u>** light grey-brown, fine-grained, some mica grains, some quartz grains, damp, very dense.			
2315										
	35		⧗	21 50/3"	28	99	@ **35.0 feet - <u>Silty SAND (SM):</u>** grey-brown, fine to medium-grained, some mica grains, little gravel up to 1.0", trace clay, moist, very dense.			@ 35.0 feet - thin clay layer at the top of the sample.
2310										
	40		◩	24 50/5"			@ **40.0 feet - <u>Sandy SILT (ML):</u>** olive, trace clay, moist, hard.			
2305										
	45		⧗	27 50/3"	19	101	@ **45.0 feet - <u>Sandy SILT (ML):</u>** grey-brown, some mica grains, trace clay, some orange staining, moist, hard.			
2300										
	50		◩	15 37 50			@ **50.0 feet - SAME:** no clay, no staining.			
							Total Depth: 51.5 feet. No groundwater. No caving. Hole backfilled on 6/25/2019.			

LOG OF EXPLORATORY BORING

Sheet **1** of **2**

Project: **Jack Rabbit Trail**
Project Number: **18060-01**
Date Drilled: **6/25/19**
Logged By: **DKL**

Boring No.: **KB-2**
Driller: **Cal Pac Drilling**
Drill Type: **Hollow Stem**
Hammer Wt. / Drop: **140lb / 30in**
Ground Elev. [ft]: **2343.0**

◩ Standard Split Spoon
■ Shelby Tube
▽ Water Level ATD
⧗ California
☒ Bulk Sample
▼ Static Water Table

Elevation [ft]	Depth [ft]	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
		☒				**@ Surface - TOPSOIL**			
						Younger Alluvium (Qa): **@ 0.5 feet - Sandy SILT (ML):** olive-brown, trace clay, trace rootlets, moist.			
2340		⧗	2 2 2	9	101	**@ 2.5 feet - SAME:** medium stiff.		EI	
	5	⧗	2 3 5	8	107	**@ 5.0 feet - SAME:** trace mica grains, trace coarse sand, no roots.			
2335		⧗	3 3 4	11	104	**@ 7.5 feet - SAME**			
	10	⧗	3 3 5	11	107	**@ 10.0 feet - SAME:** trace gravel up to 1/4".		CN	
2330									
	15	⧗	4 4 5	11	107	**@ 15.0 feet - SAME**			
2325									
	20	◩	3 5 7			**@ 20.0 feet - SAME:** no gravel, stiff.			
2320									
	25	⧗	6 7 8	10	110	**@ 25.0 feet - Silty SAND (SM):** brown, fine to medium-grained, little mica grains, few quartz grains, moist, medium dense.		CN	
2315									

LOG OF EXPLORATORY BORING

Sheet **2** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-2**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/25/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2343.0**

◩ Standard Split Spoon ■ Shelby Tube ▽ Water Level ATD

⧗ California ☒ Bulk Sample ▼ Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
			◩	2 3 4			@ **30.0 feet - <u>Sandy SILT (ML):</u>** olive-brown, trace medium and coarse sand, moist, medium stiff.			
2310										
	35		⧗	5 5 8	12	110	@ **35.0 feet - SAME:** trace calcium carbonate, stiff.		CN	
2305										
	40		◩	8 15 29			**<u>Older Allluvium (Qoa):</u>** @ **40.0 feet - SAME:** some calcium carbonate, few mica grains, hard.			
2300										
	45		⧗	32 50/3"	11	111	@ **45.0 feet - <u>SILT (ML):</u>** brown, some mica grains, trace calcium carbonate, trace orange staining, moist, hard.			
2295										
	50		◩	29 50/6"			@ **50.0 feet - <u>Silty SAND (SM):</u>** grey-brown, fine to coarse-grained, some mica grains, trace granitic gravel up to 3/4", damp, very dense.			

Total Depth: 51.0 feet.
No groundwater.
No caving.
Hole backfilled on 6/25/2019.

LOG OF EXPLORATORY BORING

Sheet **1** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-3**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/24/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2334.0**

◩ Standard Split Spoon
■ Shelby Tube
∇ Water Level ATD
⧓ California
⊠ Bulk Sample
▼ Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
			⊠				@ **Surface - TOPSOIL**			
							Younger Alluvium (Qa): @ **0.5 feet - Sandy SILT (ML):** olive-brown, some mica grains, some calcium carbonate, trace rootlets, damp.			
			⧓	2 3 3	10	96	@ **2.5 feet - SAME:** medium stiff.		EI	
2330										
	5		⧓	3 2 4	14	104	@ **5.0 feet - SAME:** trace gravel up to 1/8", moist.			
			⧓	6 8 8	5	114	@ **7.5 feet - Silty SAND (SM):** olive-brown, fine to coarse-grained, some gravel up to 1/4", some mica grains, moist, medium dense.		GS	
2325										
	10		⧓	8 7 8	6	111	@ **10.0 feet - SAME**		CN	
2320										
	15		⧓	10 10 11	11	104	@ **15.0 feet - SAME:** some gravel up to 1.0".		GS	
2315										
	20		◩	10 7 7			@ **20.0 feet - SAME:** some gravel up to 1/2".			
2310										
	25		⧓	8 10 14	6	109	@ **25.0 feet - SAME**			
2305										

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LOG OF EXPLORATORY BORING

Sheet **2** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-3**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/24/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2334.0**

◩ Standard Split Spoon ■ Shelby Tube ▽ Water Level ATD

⧓ California ⊠ Bulk Sample ▼ Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
			◩	7 13 22			@ **30.0 feet - <u>Silty fine SAND (SM)</u>:** grey-brown, fine-grained, some mica grains, moist, dense.			
2300										
	35		⧓	50/6"	11	106	**<u>Older Alluvium (Qoa)</u>:** @ **35.0 feet - SAME:** very dense.			
2295										
	40		◩	22 50/3"			@ **40.0 feet - SAME:** olive.			
2290										
	45		⧓	23 50/3"	16	105	@ **45.0 feet - SAME:** grey-brown.			
2285										
	50		◩	34 50/4"			@ **50.0 feet - SAME**			

Total depth: 50.9 feet.
No groundwater.
No caving.
Hole backfilled on 6/24/2019.

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LOG OF EXPLORATORY BORING

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-4**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/24/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2308.0**

◩ Standard Split Spoon ■ Shelby Tube ▽ Water Level ATD

⧓ California ☒ Bulk Sample ▼ Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
			☒				**@ Surface - TOPSOIL**			
							Younger Alluvium (Qa): **@ 0.5 feet - Sandy SILT (ML):** grey-brown, trace calcium carbonate, trace rootlets, damp.			
2305			⧓	3 5 6	5	101	**@ 2.5 feet - SAME:** medium stiff.		DS	
	5		⧓	4 5 5	8	108	**@ 5.0 feet - SAME:** moist.			
2300			⧓	4 4 7	8	106	**@ 7.5 feet - SAME**			
	10		⧓	5 5 9	8	109	**@ 10.0 feet - SAME:** some calcium carbonate.			
2295										
	15		⧓	8 9 11	6	110	**@ 15.0 feet - Silty SAND (SM):** brown, fine to medium-grained, some mica grains, damp, medium dense.		CN	
2290										
	20		◩	3 7 8			**@ 20.0 feet - Silty fine SAND (SM):** olive-brown, fine-grained, some mica grains, moist, medium dense.			
2285										
	25		⧓	5 8 9	7	107	**@ 25.0 feet - Silty SAND (SM):** olive-brown, fine to medium-grained, some mica grains, some quartz grains, moist, medium dense.		CN	
2280										

LOG OF EXPLORATORY BORING

Sheet **2** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-4**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/24/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2308.0**

◩ Standard Split Spoon ■ Shelby Tube ▽ Water Level ATD

⧓ California ☒ Bulk Sample ▼ Static Water Table

Elevation [ft]	Depth [ft]	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
	30	◩	9 10 11			@ **30.0 feet** - **Silty gravelly SAND (SM):** olive-brown, fine to coarse-grained, gravel up to 1/2", some mica grains, some quartz grains, moist, medium dense.			
2275									
	35	⧓	6 7 7	12	107	@ **35.0 feet** - **SAME:** gravel up to 1/4", trace feldspar grains.			
2270									
	40	◩	11 11 12			@ **40.0 feet** - **SAME:** trace clay.			
2265									
	45	⧓	7 15 13	4	114	@ **45.0 feet** - **Gravelly silty SAND (SP):** grey-brown, fine to coarse-grained, gravel up to 1/2", some mica grains, some quartz grains, damp, medium dense.			
2260									
	50	◩	14 50/6"			**Older Alluvium (Qoa):** @ **50.0 feet** - **Silty fine SAND (ML):** olive, some calcium carbonate veins, some mica grains, moist, very hard.			

Total depth: 51.0 feet.
No groundwater.
No caving.
Hole backfilled on 6/24/2019.

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LOG OF EXPLORATORY BORING

Sheet **1** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-5**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/24/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2261.0**

◩ Standard Split Spoon ■ Shelby Tube ▽ Water Level ATD

⧓ California ☒ Bulk Sample ▼ Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
			☒				@ Surface - **TOPSOIL**			
2260			☒				**Younger Alluvium (Qa):** @ **0.5 feet - Sandy SILT (ML):** brown, some calcium carbonate, little rootlets, damp.			
			⧓	4 3 4	6	99	@ **2.5 feet - SAME:** medium stiff.		EI	
2255	5		⧓	3 3 3	10	98	@ **5.0 feet - SAME:** moist.			
			⧓	1 2 4	9	99	@ **7.5 feet - SAME:** trace gravel up to 1/4".			
2250	10		⧓	7 8 9	5	100	@ **10.0 feet - Sandy CLAY (CL):** brown, some calcium carbonate, little rootlets, damp, stiff.		CN AL	
2245	15		⧓	10 11 11	5	117	@ **15.0 feet - SAME:** trace calcium carbonate, damp, very stiff.			
2240	20		◩	6 6 9			@ **20.0 feet - SAME:** stiff.			
2235	25		⧓	10 12 12	3	115	@ **25.0 feet - Silty clayey SAND (SM):** brown, fine to coarse-grained, some gravel up to 1/2", trace mica grains, damp, medium dense.		CN	

LOG OF EXPLORATORY BORING

Sheet **2** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-5**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/24/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2261.0**

◩	Standard Split Spoon	■	Shelby Tube	▽	Water Level ATD
⧓	California	☒	Bulk Sample	▼	Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
2230			◩	4 10 14			@ **30.0 feet - <u>Silty SAND (SM):</u>** brown, fine to coarse-grained, some gravel up to 3/4", little mica grains, moist, medium dense.			
2225	35		⧓	6 6 10	15	109	@ **35.0 feet - <u>Silty SAND (SM):</u>** olive-brown, fine to medium-grained, trace clay, trace mica grains, moist, medium dense.			
2220	40		◩	9 15 19			▽ @ **40.0 feet - <u>Silty SAND (SM):</u>** grey-brown, fine to coarse-grained, some mica grains, some gravel up to 1/4", moist, dense.			
2215	45		⧓	2 7 11	16	113	@ **45.0 feet - <u>Clayey SAND (SC):</u>** olive-brown, fine to ▼ medium-grained, some mica grains, wet, stiff.			
2210	50		◩	6 8 10			@ **50.0 feet - <u>Silty SAND (SM):</u>** brown, fine to coarse-grained, some mica grains, trace clay, wet, medium dense.			

Total depth: 51.5 feet.
Groundwater encountered at 40.0 feet.
No caving.
Hole backfilled on 6/24/2019.

LOG OF EXPLORATORY BORING

Sheet **1** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-6**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/24/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2276.0**

◩ Standard Split Spoon ■ Shelby Tube ▽ Water Level ATD

⧓ California ☒ Bulk Sample ▼ Static Water Table

Elevation [ft]	Depth [ft]	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
						@ Surface - TOPSOIL			
2275		☒				**<u>Younger Alluvium (Qa)</u>:** **@ 0.5 feet - <u>Sandy SILT (ML)</u>:** brown, trace mica grains, trace rootlets, moist.			
		⧓	2 1 2	11	96	**@ 2.5 feet - SAME:** medium stiff.		DS	
2270	5	⧓	2 2 3	11	102	**@ 5.0 feet - SAME**			
		⧓	3 4 6	9	110	**@ 7.5 feet - <u>Silty SAND (SM)</u>:** olive-brown, fine-grained, some mica grains, trace clay, moist, loose.		GS	
2265	10	⧓	3 4 6	12	106	**@ 10.0 feet - <u>Silty SAND (SM)</u>:** olive-brown, fine to coarse-grained, some mica grains, moist, loose.			
2260	15	⧓	14 17 24	11	112	**@ 15.0 feet - <u>Silty gravelly SAND (SM)</u>:** brown, fine to coarse-grained, some feldspar grains, some mica grains, moist, dense.		CN	
2255	20	◩	9 11 14			**@ 20.0 feet - <u>Sandy SILT (ML)</u>:** brown, some mica grains, trace quartz grains, moist, very stiff.			
2250	25	⧓	25 50	4	114	**<u>Older Alluvium (Qoa)</u>:** **@ 25.0 feet - <u>Gravelly silty SAND (SP)</u>:** light brown, fine to coarse-grained, gravel up to 1.0", damp, very dense.		CN	

LOG OF EXPLORATORY BORING

Sheet **2** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-6**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/24/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2276.0**

◩ Standard Split Spoon	■ Shelby Tube	∇ Water Level ATD
⧗ California	☒ Bulk Sample	▼ Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
			◩	20 50			@ **30.0 feet - SAME:** trace quartz grains, moist.			
2245										
	35		⧗	9 41 50/3"	20	111	@ **35.0 feet - <u>Silty sandy CLAY (CL):</u>** olive, some orange staining, moist, hard.			
2240										
	40		◩	20 30 50			@ **40.0 feet - <u>Silty fine SAND (ML):</u>** olive-brown, some mica grains, moist, hard.			
2235										
	45		⧗	37 50/3"	11	141	@ **45.0 feet - <u>Silty SAND (SM):</u>** brown, fine to medium-grained, some mica grains, trace clay, moist, very dense.			
2230										
	50		◩	50			@ **50.0 feet - SAME:** fine-grained, no clay.			@ 50.0 feet - Poor recovery

Total depth: 50.5 feet.
No groundwater
No caving.
Hole backfilled on 6/24/2019.

LOG OF EXPLORATORY BORING

Sheet **1** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-7**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/26/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2238.0**

◩ Standard Split Spoon
■ Shelby Tube
▽ Water Level ATD
⧗ California
☒ Bulk Sample
▼ Static Water Table

Elevation [ft]	Depth [ft]	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
		☒				@ Surface - **TOPSOIL**			
						Younger Alluvium (Qa):			
						@ **0.5 feet** - **SILT (ML):** olive-brown, trace mica grains, trace rootlets, moist.			
2235		⧗	2 2 4	11	99	@ **2.5 feet - SAME:** medium stiff.			
	5	⧗	4 4 5	12	106	@ **5.0 feet - SAME:** few calcium carbonate stringers.			
2230		⧗	4 4 6	11	106	@ **7.5 feet - SAME:** few mica grains, no rootlets.			
	10	⧗	3 3 5	13	112	@ **10.0 feet** - **Sandy SILT (ML):** olive-brown, little mica grains, trace calcium carbonate, moist, medium stiff.			
2225									
	15	⧗	3 3 3	12	106	@ **15.0 feet - SAME:** trace clay.		CN	
2220									
	20	◩	2 2 4			@ **20.0 feet** - **Sandy SILT (ML):** brown, few mica grains, trace clay, moist, medium stiff.			
2215									
	25	⧗	4 4 6	12	116	@ **25.0 feet - SAME:** little mica grains, trace gravel up to 1/4".			
2210									

LOG OF EXPLORATORY BORING

Sheet **2** of **2**

Project: **Jack Rabbit Trail**
Project Number: **18060-01**
Date Drilled: **6/26/19**
Logged By: **DKL**

Boring No.: **KB-7**
Driller: **Cal Pac Drilling**
Drill Type: **Hollow Stem**
Hammer Wt. / Drop: **140lb / 30in**
Ground Elev. [ft]: **2238.0**

◩ Standard Split Spoon
■ Shelby Tube
▽ Water Level ATD
⧗ California
⊠ Bulk Sample
▼ Static Water Table

Elevation [ft]	Depth [ft]	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
		◩	9 8 7			@ **30.0 feet** - **Sandy SILT (ML):** olive-brown, little quartz grains, trace quartz gravel up to 3/4", trace clay, moist, stiff.			
2205									
	35	⧗	6 6 8	15	113	@ **35.0 feet** - **Sandy SILT (ML):** olive-brown, little mica grains, few clay, moist, stiff.		CN	
2200									
	40	◩	4 6 10			@ **40.0 feet** - **Silty CLAY (CL):** grey-brown, few mica grains, moist, very stiff.			
2195									
	45	⧗	14 24 41	16	120	**Older Alluvium (Qoa):** @ **45.0 feet** - **Clayey sandy SILT (ML):** olive, fine sand, few mica grains, moist, hard.			
2190						▼			
	50	◩	12 14 20			@ **50.0 feet** - **SAME**			

Total depth: 51.5 feet.
Groundwater encountered at 48.0 feet.
No caving.
Hole backfilled on 6/26/2019.

LOG OF EXPLORATORY BORING

Sheet **1** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-8**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/26/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2295.0**

◩ Standard Split Spoon
■ Shelby Tube
▽ Water Level ATD
⧓ California
☒ Bulk Sample
▼ Static Water Table

Elevation [ft]	Depth [ft]	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
		☒				**@ Surface - TOPSOIL** **Younger Alluvium (Qa):** **@ 0.5 feet - Sandy SILT (ML):** grey-brown, fine to medium sand, trace gravel up to 1/4", damp.			
		⧓	3 3 4	8	104	**@ 2.5 feet - SAME:** medium stiff.			
2290	5	⧓	3 4 5	9	110	**@ 5.0 feet - Sandy SILT (ML):** grey-brown, few calcium carbonate stringers, trace mica grains, trace clay, moist, medium stiff.			
		⧓	3 4 5	10	110	**@ 7.5 feet - SAME**			
2285	10	⧓	4 4 5	11	107	**@ 10.0 feet - Sandy SILT (ML):** olive-brown, few calcium carbonate stringers, trace mica grains, trace clay, moist, medium stiff.			
2280	15	⧓	4 4 5	8	105	**@ 15.0 feet - SAME**		CN	
2275	20	◩	4 4 4			**@ 20.0 feet - SAME:** trace gravel up to 3/4", no calcium carbonate.			
2270	25	⧓	4 8 8	11	115	**@ 25.0 feet - SAME:** damp, stiff.		CN	

LOG OF EXPLORATORY BORING

Sheet **2** of **2**

Project: **Jack Rabbit Trail**
Project Number: **18060-01**
Date Drilled: **6/26/19**
Logged By: **DKL**

Boring No.: **KB-8**
Driller: **Cal Pac Drilling**
Drill Type: **Hollow Stem**
Hammer Wt. / Drop: **140lb / 30in**
Ground Elev. [ft]: **2295.0**

◩ Standard Split Spoon	■ Shelby Tube	▽ Water Level ATD
⧓ California	☒ Bulk Sample	▼ Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
			◩	8 8 7			@ **30.0 feet - <u>Silty fine SAND (SM):</u>** brown, fine-grained, trace mica grains, trace gravel up to 1/8", moist, medium dense.			
2260	35		⧓	7 10 12	5	114	@ **35.0 feet - <u>Silty gravelly SAND (SP):</u>** grey-brown, fine to medium-grained, gravel up to 1/4", moist, medium dense.		GS	
2255	40		◩	4 4 6			@ **40.0 feet - <u>Sandy SILT (ML):</u>** olive-brown, fine to medium sand, moist, stiff.		AL	
2250	45		⧓	18 31 50/3"	5	110	**<u>Older Alluvium (Qoa):</u>** @ **45.0 feet - <u>Silty SAND (SM):</u>** grey-brown, fine to coarse-grained, few quartz grains, damp, very dense.			
2245	50		◩	50			@ **50.0 feet - SAME**			

Total depth: 50.5 feet.
No groundwater.
No caving.
Hole backfilled on 6/26/2019.

LOG OF EXPLORATORY BORING

Sheet **1** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-9**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/26/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2239.0**

◩ Standard Split Spoon ■ Shelby Tube ▽ Water Level ATD

⧗ California ☒ Bulk Sample ▼ Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
	0		☒				@ Surface - **TOPSOIL** **Younger Alluvium (Qa):** @ **0.5 feet** - **Sandy SILT (ML):** brown, few quartz grains, few mica grains, damp.			
	2.5		⧗	3 4 6	9	109	@ **2.5 feet** - **SAME:** medium stiff.		DS	
2235										
	5		⧗	3 4 5	12	101	@ **5.0 feet** - **Sandy SILT (ML):** olive-brown, few calcium carbonate stringers, few mica grains, moist, medium stiff.			
	7.5		⧗	4 5 8	10	110	@ **7.5 feet** - **SAME:** little calcium carbonate, few gravel up to 1/2", stiff.			
2230										
	10		⧗	6 8 9	7	98	@ **10.0 feet** - **SILT (ML):** brown, some calcium carbonate, damp, stiff.		CN	
2225										
	15		⧗	10 17 17	5	117	@ **15.0 feet** - **Sandy SILT (ML):** brown, trace feldspar grains, damp, very stiff.		CN	
2220										
	20		◩	6 5 11			@ **20.0 feet** - **Sandy SILT (ML):** olive-brown, little quartz grains, little feldspar grains, trace granitic gravel up to 3/4", moist, very stiff.			
2215										
	25		⧗	7 7 7	4	114	@ **25.0 feet** - **SAME:** brown, gravel up to 1/2", little mica grains, stiff.			
2210										

LOG OF EXPLORATORY BORING

Sheet **2** of **2**

Project: **Jack Rabbit Trail**
Project Number: **18060-01**
Date Drilled: **6/26/19**
Logged By: **DKL**

Boring No.: **KB-9**
Driller: **Cal Pac Drilling**
Drill Type: **Hollow Stem**
Hammer Wt. / Drop: **140lb / 30in**
Ground Elev. [ft]: **2239.0**

◩ Standard Split Spoon
■ Shelby Tube
▽ Water Level ATD
⧗ California
⊠ Bulk Sample
▼ Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
			◩	3 4 4			@ **30.0 feet - Sandy SILT (ML):** olive-brown, moist, medium stiff.			
2205										
	35		⧗	5 6 9	9	111	@ **35.0 feet - SAME:** trace clay, stiff.		CN	
2200										
	40		◩	3 4 5			@ **40.0 feet - Silty SAND (SM):** brown, fine-grained with trace medium sand, trace mica grains, moist, loose.			
2195										
	45		⧗	6 6 9	10	109	@ **45.0 feet - SAME:** trace gravel up to 1/4", medium dense.			
2190										
	50		◩	9 20 27			**Older Alluvium (Qoa):** @ **50.0 feet - Silty SAND (SM):** olive-brown, fine to coarse-grained, trace gravel up to 1/2", trace mica grains, trace quartz grains, moist, dense.			

Total depth: 51.5 feet.
No groundwater.
No caving.
Hole backfilled on 6/26/2019.

LOG OF EXPLORATORY BORING

Sheet **1** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-10**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/26/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2258.0**

◩ Standard Split Spoon	■ Shelby Tube	▽ Water Level ATD
⧓ California	☒ Bulk Sample	▼ Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
			☒				**@ Surface - TOPSOIL** **<u>Younger Alluvium (Qa)</u>:** **@ 0.5 feet - <u>Sandy SILT (ML)</u>:** olive-brown, trace clay, trace mica grains, moist.			
2255			⧓	2 7 6	9	80	**@ 2.5 feet - SAME:** stiff.		EI	
	5		⧓	3 3 3	14	106	**@ 5.0 feet - <u>Sandy SILT (ML)</u>:** olive-brown, few calcium carbonate stringers, few mica grains, trace clay, moist, medium stiff.			
2250			⧓	3 3 5	12	104	**@ 7.5 feet - SAME**			
	10		⧓	2 3 5	16	102	**@ 10.0 feet - SAME**			
2245										
	15		⧓	4 5 8	6	104	**@ 15.0 feet - <u>Silty SAND (SM)</u>:** brown, fine to coarse-grained, few mica grains, damp, medium dense.		CN	
2240										
	20		◩	5 6 4			**@ 20.0 feet - SAME:** trace gravel up to 1/4", loose.			
2235										
	25		⧓	5 5 7	10	100	**@ 25.0 feet - <u>Silty SAND (SM)</u>:** brown, fine-grained with trace medium and coarse sand, some mica grains, damp, loose.		CN	
2230										

LOG OF EXPLORATORY BORING

Sheet **2** of **2**

Project:	**Jack Rabbit Trail**	Boring No.:	**KB-10**
Project Number:	**18060-01**	Driller:	**Cal Pac Drilling**
Date Drilled:	**6/26/19**	Drill Type:	**Hollow Stem**
Logged By:	**DKL**	Hammer Wt. / Drop:	**140lb / 30in**
		Ground Elev. [ft]:	**2258.0**

◩ Standard Split Spoon ■ Shelby Tube ∇ Water Level ATD

⧗ California ☒ Bulk Sample ▼ Static Water Table

Elevation [ft]	Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests	Remarks
			◩	9 13 9			@ **30.0 feet - <u>Silty SAND (SM):</u>** grey-brown, fine to medium-grained with few coarse sand, little mica grains, few gravel up to 3/4", damp, medium dense.			
2225										
	35		⧗	7 9 16	8	106	@ **35.0 feet - <u>Silty gravelly SAND (SP):</u>** grey-brown, fine to coarse-grained, gravel up to 1/2", some quartz grains, little feldspar grains, little mica grains, damp, medium dense.			
2220										
	40		◩	17 20 14			@ **40.0 feet - SAME:** gravel up to 1.0", dense.			
2215										
	45		⧗	7 9 9	8	108	@ **45.0 feet - <u>Silty fine SAND (SM):</u>** olive-brown, fine-grained, trace gravel up to 1/4", trace quartz grains, trace mica grains, moist, medium dense.			
2210										
	50		◩	3 5 5			@ **50.0 feet - SAME:** loose.			

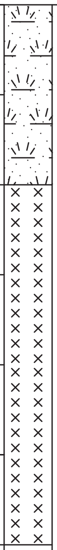
Total depth: 51.5 feet.
No groundwater.
No caving.
Hole backfilled on 6/26/2019.

LOG OF EXPLORATORY TEST PIT

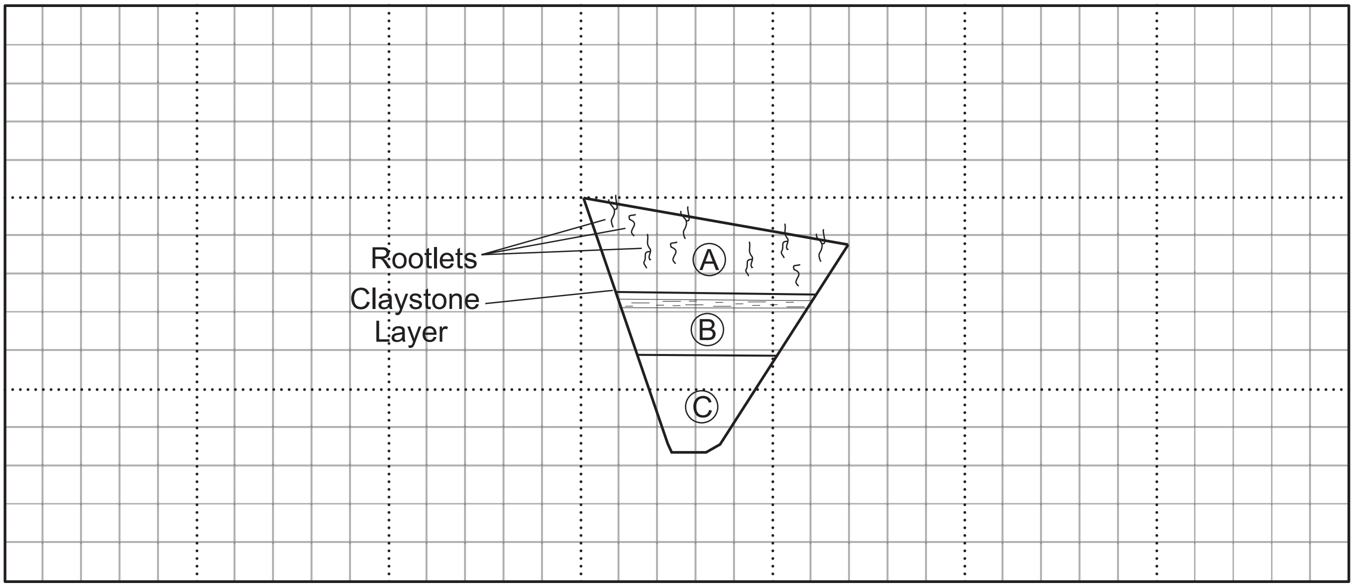
Sheet **1** of **1**

Project:	**Jack Rabbit trenches**	Test Pit No.:	**TP-1**
Project Number:	**18060-01**	Contractor:	**Bob Turner**
Date Drilled:	**7/8/19**	Backhoe:	**John Deere 410K**
Logged By:	**DKL**	Hammer Wt. / Drop:	
		Ground Elev. [ft]:	**---**

◩	Standard Split Spoon	■	Shelby Tube	∇	Water Level ATD
⧗	California	☒	Bulk Sample	▼	Static Water Table



Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	Geologic Notes	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests
							(A) **@ Surface - TOPSOIL**		
							(B)<u>San Timoteo Formation (Tst)</u>: **@ 2.0 feet - <u>SILTSTONE:</u>** olive-grey, severely weathered, closely fractured, weak, one 3" interbedded layer of polished claystone, calcium carbonate-rich, trace rootlets.		
5							**(C)** **@ 4.0 feet - <u>SILTSTONE:</u>** olive, severely weathered, moderately fractured, weak, some calicum carbonate.		
							Total depth: 6.0 feet No groundwater. No caving. Trench backfilled with spoils on 7/8/2019.		



HS BA TP 18060-01, JACK RABBIT TRENCHES.GPJ Kling Consulting Group, Inc. 7/16/19

KLING Consulting Group, Inc.

Scale: H 5 [ft]
V 5 [ft]

Pit Orientation: N 79 W
Natural Slope Angle: ~10

B - Bedding Plane
J - Joint
C - Contact
F - Fault
S - Shear

LOG OF EXPLORATORY TEST PIT

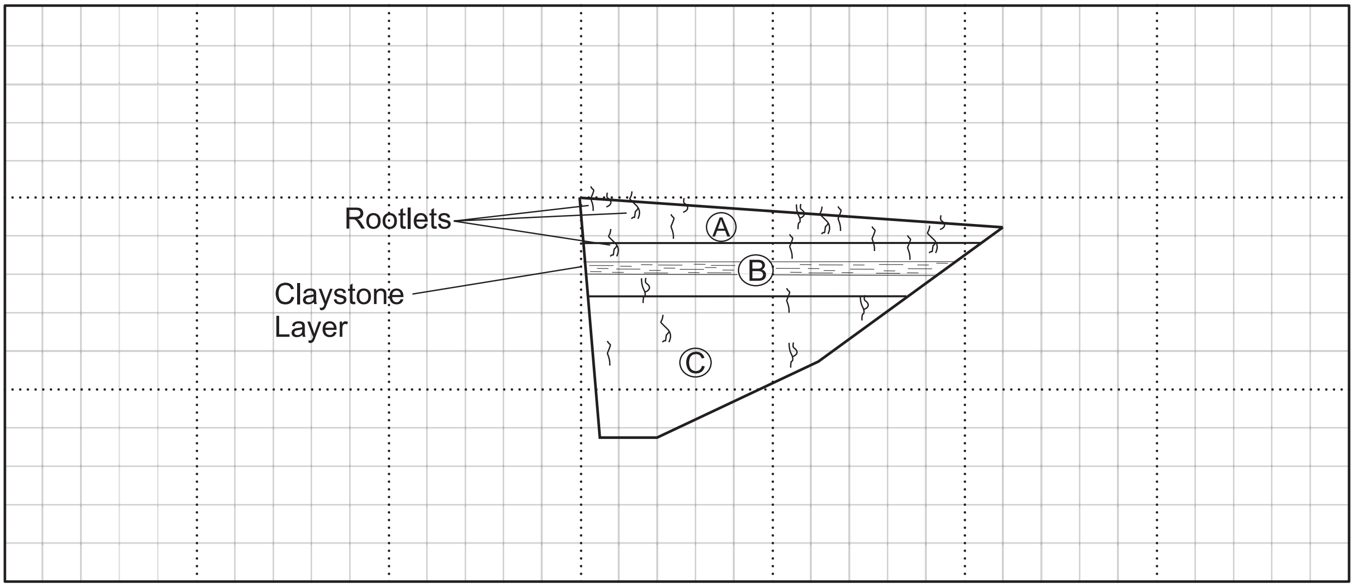
Sheet **1** of **1**

Project:	**Jack Rabbit trenches**	Test Pit No.:	**TP-2**
Project Number:	**18060-01**	Contractor:	**Bob Turner**
Date Drilled:	**7/8/19**	Backhoe:	**John Deere 410K**
Logged By:	**DKL**	Hammer Wt. / Drop:	
		Ground Elev. [ft]:	**---**

◩ Standard Split Spoon ■ Shelby Tube ▽ Water Level ATD

⧗ California ☒ Bulk Sample ▼ Static Water Table

Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	Geologic Notes	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests
							(A) **@ Surface - TOPSOIL**		
5							**(B)San Timoteo Formation (Tst):** **@ 1.0 foot - Clayey SILTSTONE:** olive-brown, severely weathered, closely fractured, weak, calcium carbonate-rich, some rootlets. **(C)** **@ 2.5 feet - Sandy SILTSTONE:** olive-brown, severely weathered, closely fractured, weak, calcium carbonate-rich, trace rootlets.		
		⧗		11	108		Total depth: 6.0 feet. No groundwater. No caving. Trench backfilled with spoils on 7/8/2019.		AL CN



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Scale: H 5 [ft]
V 5 [ft]

Pit Orientation: N 49 E
Natural Slope Angle: ~4

B - Bedding Plane
J - Joint
C - Contact
F - Fault
S - Shear

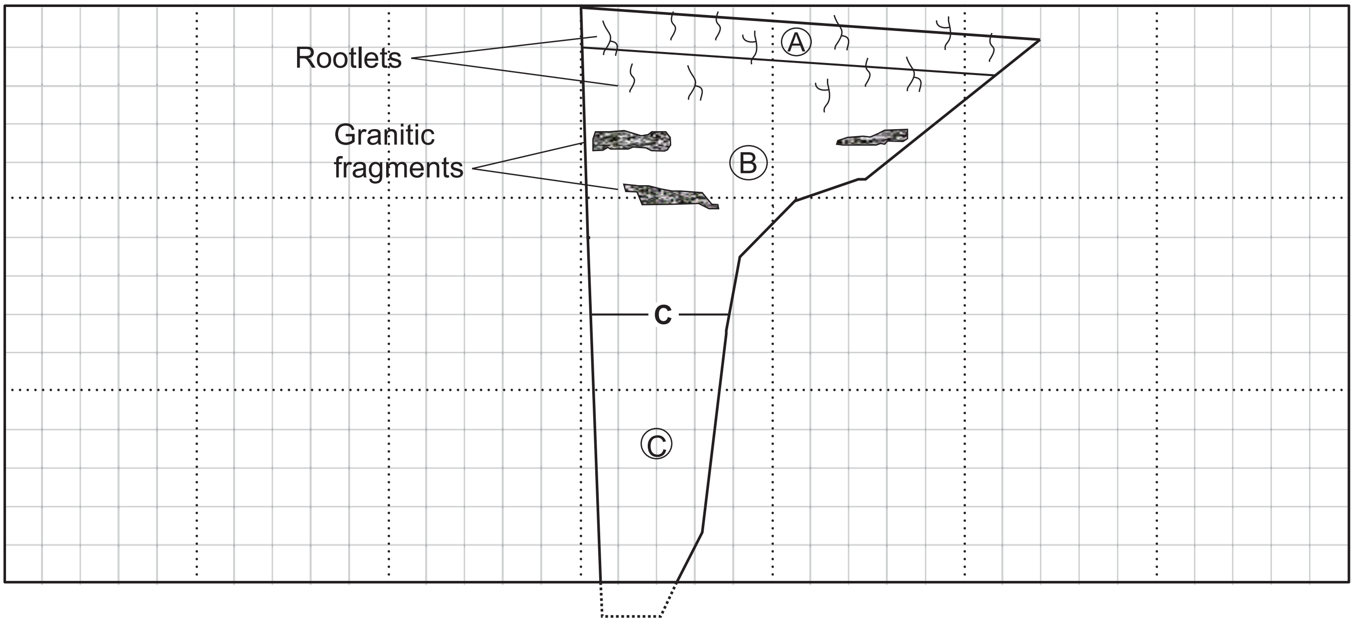
LOG OF EXPLORATORY TEST PIT

Sheet **1** of **1**

Project:	**Jack Rabbit trenches**	Test Pit No.:	**TP-3**
Project Number:	**18060-01**	Contractor:	**Bob Turner**
Date Drilled:	**7/8/19**	Backhoe:	**John Deere 410K**
Logged By:	**DKL**	Hammer Wt. / Drop:	
		Ground Elev. [ft]:	**---**

◩ Standard Split Spoon
■ Shelby Tube
▽ Water Level ATD
⧓ California
☒ Bulk Sample
▼ Static Water Table

Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	Geologic Notes	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests
0							**(A)** **@ Surface - TOPSOIL**		
1							**(B)Colluvium (Col):** **@ 1.0 foot - Silty gravelly SAND (SM):** brown, fine to coarse-grained, gravel up to 1.0", some calcium carbonate, trace granitic fragments, porous, moist.		
5		☒							
		⧓		12	114				DS RV
8		☒					**(C)San Timoteo Formation (Tst):** **@ 8.0 feet - Silty SANDSTONE:** brown, fine-grained, severely weathered, moderately fractured, weak, some calcium carbonate.		
10									
15		☒							
							Total depth: 16.0 feet. No groundwater. No caving. Trench backfilled with spoils on 7/8/2019.		



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Scale: H 5 [ft]
V 5 [ft]

Pit Orientation: N 42 W
Natural Slope Angle: ~4

B - Bedding Plane
J - Joint
C - Contact
F - Fault
S - Shear

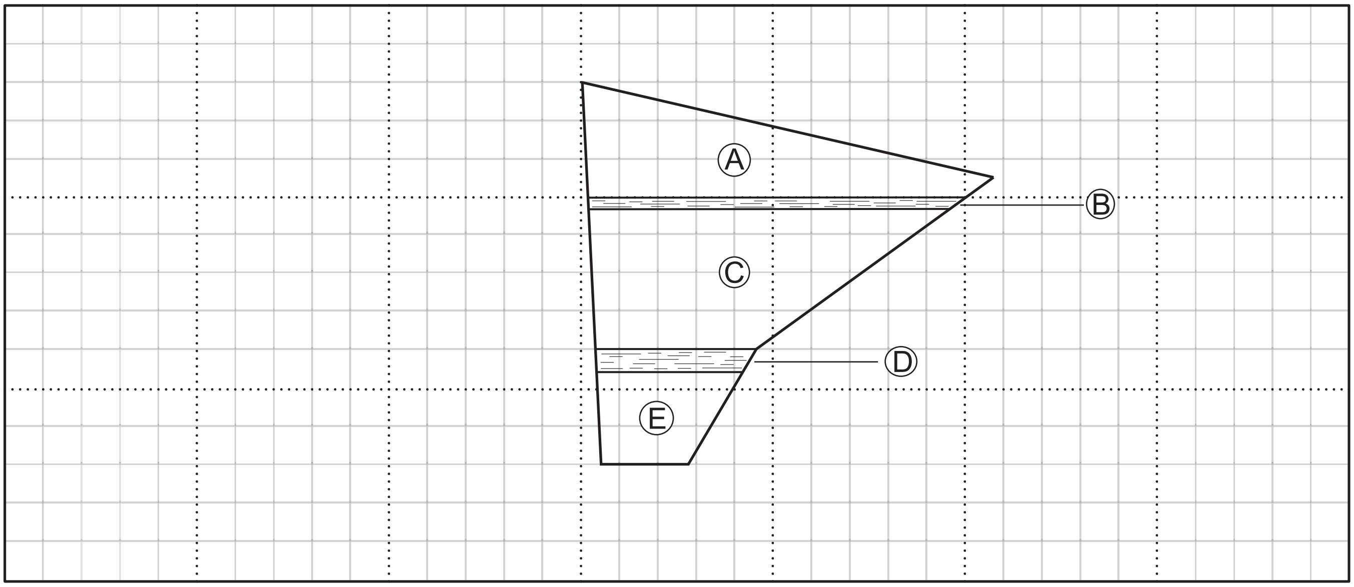
LOG OF EXPLORATORY TEST PIT

Sheet **1** of **1**

Project:	**Jack Rabbit trenches**	Test Pit No.:	**TP-4**
Project Number:	**18060-01**	Contractor:	**Bob Turner**
Date Drilled:	**7/8/19**	Backhoe:	**John Deere 410K**
Logged By:	**DKL**	Hammer Wt. / Drop:	
		Ground Elev. [ft]:	**---**

◩ Standard Split Spoon
■ Shelby Tube
▽ Water Level ATD
⧓ California
☒ Bulk Sample
▼ Static Water Table

Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density [pcf]	Geologic Notes	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests
	×××						**(A)<u>San Timoteo Formation (Tst):</u>** **@ Surface - <u>SILTSTONE:</u>** light brown, severely weathered, moderately fractured, weak, calcium carbonate-rich.		
	×××					@ 3.0 feet - B: N 55 W, 8 SW	**(B)** **@ 3.0 feet - <u>CLAY Layer:</u>** dark olive-brown, severely weathered, closely fractured, weak, highly polished, sheared, oxidized, slightly plastic.		
5	×××						**(C)** **@ 3.3 feet - <u>Sandy SILTSTONE:</u>** grey-brown, severely weathered, closely fractured, weak, calcium carbonate-rich.		
	×××	⧓		21	106		**(D)** **@ 7.0 feet - <u>CLAY Layer:</u>** dark olive-brown, severely weathered, closely fractured, weak, highly polished, sheared, oxidized, medium plasticity.		
10							**(E)** **@ 7.6 feet - <u>Clayey sandy SILTSTONE:</u>** dark brown, severely weathered, moderately fractured, moderately strong. Total depth: 10.0 feet. No groundwater. No caving. Trench backfilled with spoils on 7/8/2019.		



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Scale: H 5 [ft]
V 5 [ft]

Pit Orientation: N 57 W
Natural Slope Angle: ~13

B - Bedding Plane
J - Joint
C - Contact
F - Fault
S - Shear

LOG OF EXPLORATORY TEST PIT

Sheet **1** of **1**

Project:	**Jack Rabbit trenches**	Test Pit No.:	**TP-5**
Project Number:	**18060-01**	Contractor:	**Bob Turner**
Date Drilled:	**7/8/19**	Backhoe:	**John Deere 410K**
Logged By:	**DKL**	Hammer Wt. / Drop:	
		Ground Elev. [ft]:	**---**

◪ Standard Split Spoon
■ Shelby Tube
▽ Water Level ATD
⧗ California
☒ Bulk Sample
▼ Static Water Table

Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	Geologic Notes	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests
5									
		⧗		4	112				
10									

(A)

@ Surface - TOPSOIL

(B)San Timoteo Formation (Tst):

@ 0.5 feet - Silty SANDSTONE: grey-brown, fine to medium-grained with few gravel up to 1/2", severely weathered, closely fractured, weak, some calcium carbonate.

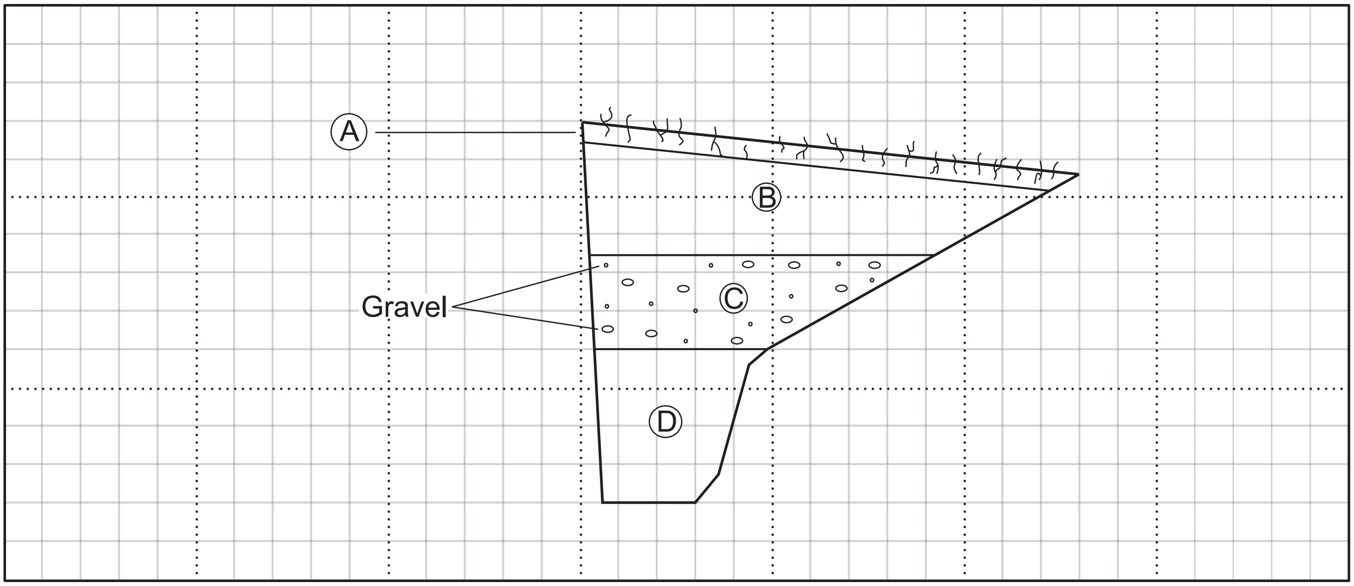
(C)

@ 3.5 feet - CONGLOMERATE: grey-brown, fine to coarse-grained with gravel up to 3" and cobbles up to 5", severely weathered, moderately fractured, weak, some calcium carbonate.

(D)

@ 6.0 feet - Silty SANDSTONE: brown, fine to medium-grained, severely weathered, moderately fractured, weak, some calcium carbonate.

Total depth: 10.0 feet.
No groundwater.
No caving.
Trench backfilled with spoils on 7/8/2019.



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Scale: H 5 [ft]
V 5 [ft]

Pit Orientation: N 5 W
Natural Slope Angle: ~6

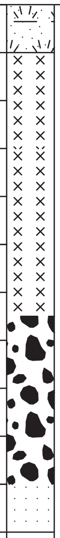
B - Bedding Plane
J - Joint
C - Contact
F - Fault
S - Shear

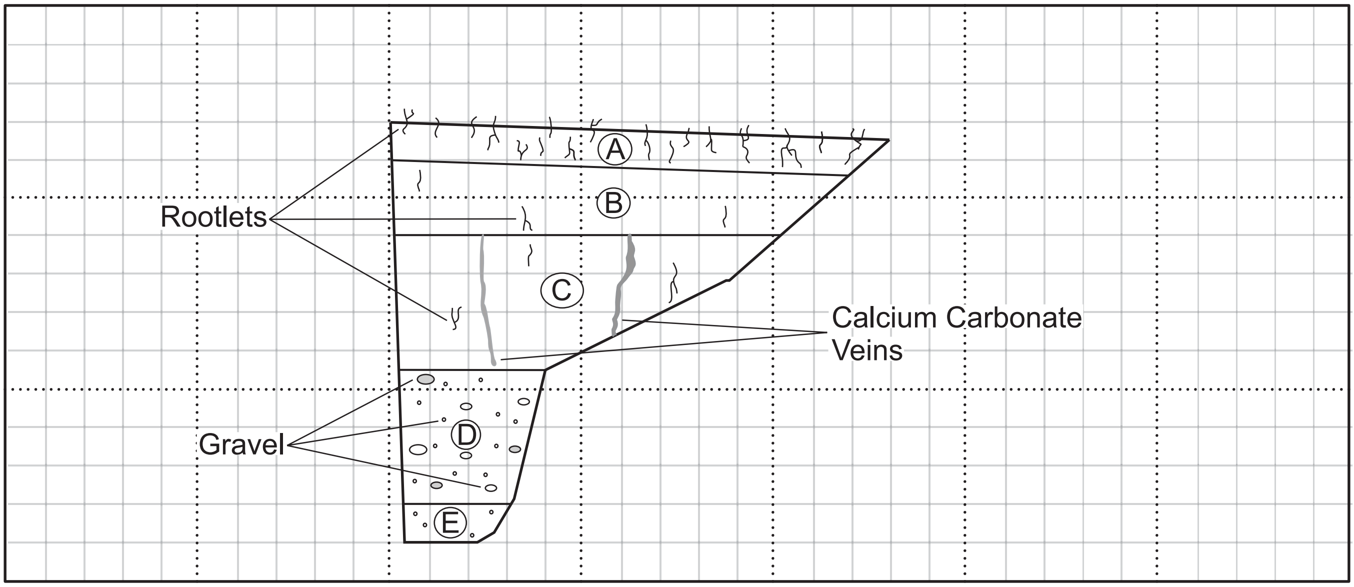
LOG OF EXPLORATORY TEST PIT

Sheet **1** of **1**

Project:	**Jack Rabbit trenches**	Test Pit No.:	**TP-6**
Project Number:	**18060-01**	Contractor:	**Bob Turner**
Date Drilled:	**7/8/19**	Backhoe:	**John Deere 410K**
Logged By:	**DKL**	Hammer Wt. / Drop:	
		Ground Elev. [ft]:	**---**

◩ Standard Split Spoon	■ Shelby Tube	▽ Water Level ATD
⧓ California	☒ Bulk Sample	▼ Static Water Table

Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	Geologic Notes	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests
5 10							**(A)** **@ Surface - TOPSOIL** **(B)San Timoteo Formation (Tst):** **@ 1.0 foot - Sandy clayey SILTSTONE:** olive-brown, severely weathered, moderately fractured, weak, trace calcium carbonate, trace rootlets. **(C)** **@ 3.0 feet - Sandy SILTSTONE:** olive-brown, severely weathered, moderately fractured, weak, few calcium carbonate veins, trace rootlets. **(D)** **@ 6.5 feet - CONGLOMERATE:** light brown, fine to coarse-grained with clasts up to 6.0", severely weathered, moderately fractured, weak, some calcium carbonate. **(E)** **@ 10.0 feet - Silty SANDSTONE:** grey-brown, fine to coarse-grained, severely weathered, moderately fractured, weak, trace gravel up to 1/2". Total depth: 11.0 feet. No groundwater. No caving. Trench backfilled with spoils on 7/8/2019.		



HS BA TP 18060-01, JACK RABBIT TRENCHES.GPJ Kling Consulting Group, Inc. 7/16/19

KLING Consulting Group, Inc.

Scale: H 5 [ft]
V 5 [ft]

Pit Orientation: N 19 E
Natural Slope Angle: ~2

B - Bedding Plane
J - Joint
C - Contact
F - Fault
S - Shear

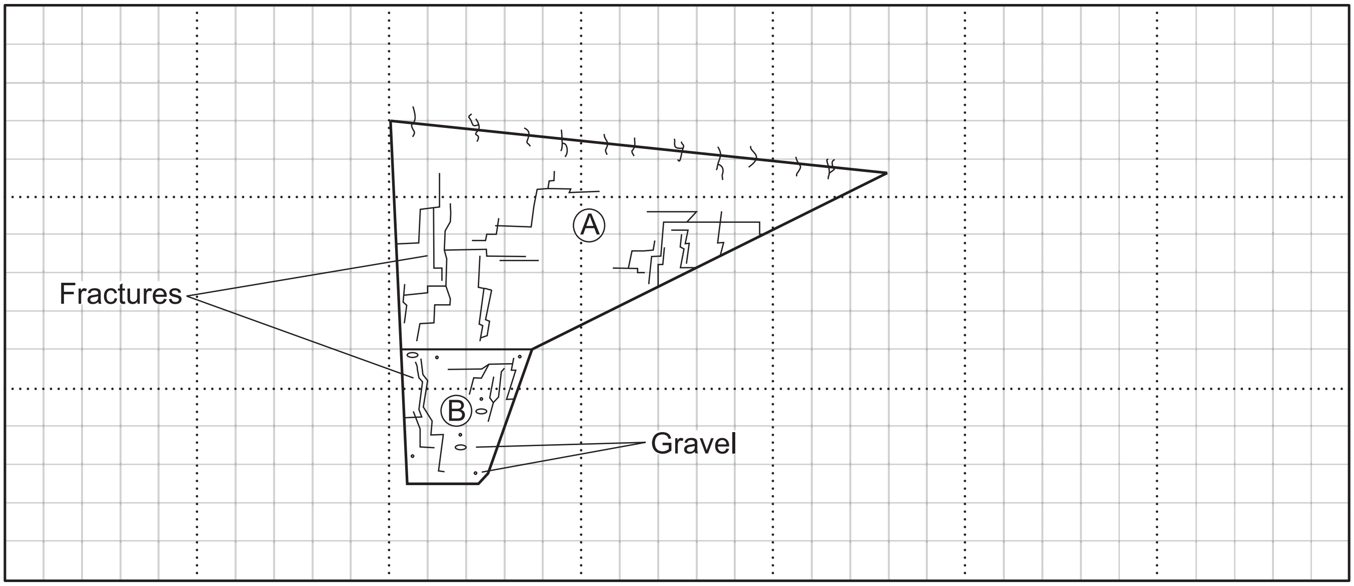
LOG OF EXPLORATORY TEST PIT

Sheet **1** of **1**

Project:	**Jack Rabbit trenches**	Test Pit No.:	**TP-7**
Project Number:	**18060-01**	Contractor:	**Bob Turner**
Date Drilled:	**7/9/19**	Backhoe:	**John Deere 410K**
Logged By:	**DKL**	Hammer Wt. / Drop:	
		Ground Elev. [ft]:	**---**

◩ Standard Split Spoon
■ Shelby Tube
▽ Water Level ATD
⧗ California
☒ Bulk Sample
▼ Static Water Table

Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	Geologic Notes	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests
							(A)<u>San Timoteo Formation (Tst):</u> **@ Surface - <u>Silty SANDSTONE:</u>** grey-brown, fine-grained, severely weathered, very closely fractured, friable, calcium carbonate-rich.		
5		☒							DS EI SU
							(B) **@ 6.0 feet - <u>Silty gravelly SANDSTONE:</u>** grey-brown, fine to medium-grained, severely weathered, closely fractured, weak, gravel up to 2.0", calcium carbonate-rich.		
							Total depth: 9.5 feet. No groundwater. No caving. Trench backfilled with spoils on 7/9/2019.		



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Scale: H 5 [ft]
V 5 [ft]

Pit Orientation: N 40 E
Natural Slope Angle: ~6

B - Bedding Plane
J - Joint
C - Contact
F - Fault
S - Shear

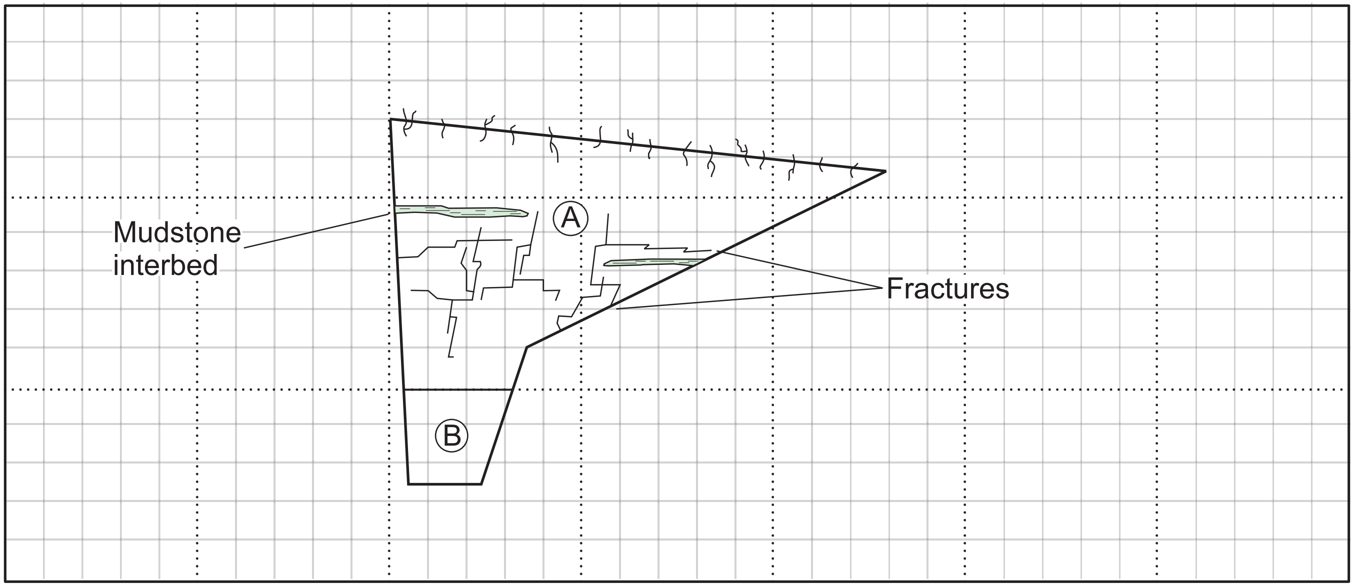
LOG OF EXPLORATORY TEST PIT

Sheet **1** of **1**

Project:	**Jack Rabbit trenches**	Test Pit No.:	**TP-8**
Project Number:	**18060-01**	Contractor:	**Bob Turner**
Date Drilled:	**7/9/19**	Backhoe:	**John Deere 410K**
Logged By:	**DKL**	Hammer Wt. / Drop:	
		Ground Elev. [ft]:	**---**

◩ Standard Split Spoon	■ Shelby Tube	▽ Water Level ATD
⧗ California	☒ Bulk Sample	▼ Static Water Table

Depth [ft]	Graphic Log	Sample Type	Blows/6"	Moisture Content [%]	Dry Density, [pcf]	Geologic Notes	SOIL DESCRIPTION and CLASSIFICATION (USCS)	Pocket Pen. [tsf]	Lab Tests
	××						**(A)<u>San Timoteo Formation (Tst):</u>** **@ Surface - <u>Sandy SILTSTONE:</u>** grey-brown, severely weathered, very closely fractured, weak, calcium carbonate-rich, trace mudstone interbedded.		
5	××								
	××	⧗		10					
	××						**(B)** **@ 7.0 feet - <u>Sandy SILTSTONE:</u>** grey-brown, severely weathered, closely fractured, weak, some calcium carbonate.		
							Total depth: 9.5 feet. No groundwater. No caving. Trench backfilled with spoils on 7/9/2019.		



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Scale: H 5 [ft]
V 5 [ft]

Pit Orientation: N 24 W
Natural Slope Angle: ~6

B - Bedding Plane
J - Joint
C - Contact
F - Fault
S - Shear

APPENDIX C

SUMMARY OF LABORTORY
TEST PROCEDURES AND RESULTS

APPENDIX C

LABORATORY TEST PROCEDURES

VISUAL CLASSIFICATION OF SOILS

As a part of the routine laboratory soil testing, the soil samples are visually classified in accordance with the Unified Soil Classification System by experienced laboratory technicians. If necessary, in order to verify the visual classification, selected samples are classified utilizing the results of Standard Classification tests performed in accordance - with ASTM D2487-00.

MOISTURE AND DENSITY TESTING

Moisture content and dry density determinations are performed on relatively undisturbed samples obtained from the exploratory excavation. The results of these tests are presented in the boring logs. Where applicable, only moisture content is determined from "undisturbed" or disturbed samples.

MAXIMUM DENSITY TESTS

The maximum dry density and optimum moisture content of typical materials is determined in accordance with ASTM D1557 (five layers). The results of these tests are presented graphically as an attachment in this Appendix.

CONSOLIDATION TESTS

Consolidation tests were performed in general accordance with ASTM D2435-96 on selected, relatively undisturbed, ring samples recovered from the exploratory excavations. Samples are placed in a consolidometer where increasing load increments are applied in geometric progression. The soil specimen is placed between porous stones that allow water to infiltrate and flow on the soil sample. During the loading stages prior to the addition of water, the soil sample is sealed in order to prevent evaporation of soil water. The load increment where water was added is indicated on the consolidation pressure curves. The percent consolidation for each load cycle is recorded as the ratio of the amount of vertical compression to the original 1-inch height. The time-rate of consolidation was also performed on each soil specimen tested. The results of this test are presented graphically as an attachment in this Appendix.

HYDRO-COLLAPSE TESTS

Hydro-collapse tests were performed in general accordance with ASTM D5333-03 on selected undisturbed ring samples to determine the hydro-collapse potential. In general, the procedure entailed the application of normal stress roughly equal to the sum of the existing overburden and final fill load prior to inundating the sample with water. The resulting change in height of the sample indicates the collapse potential. The results of these tests are presented graphically as an attachment in the appropriate Appendix.

APPENDIX C

LABORATORY TEST PROCEDURES
(Continued)

DIRECT SHEAR TESTS

Direct shear tests were performed in accordance to ASTM D3080-98 on selected remolded and/or undisturbed samples which were pre-soaked for a minimum of 24 hours. The samples were then tested under various normal loads; a different specimen being used for each normal load. The samples were sheared in a motor driven, strain-controlled direct shear testing apparatus at a strain rate of 0.01 in. per minute. The test results are presented in the Laboratory Summary.

GRAIN SIZE DISTRIBUTION

A representative sample was dried, weighed, and soaked in water until individual soil particles were separated and then washed on the No. 200 sieve. That portion of the material retained on the No. 200 sieve was oven-dried and then run through a standard set of sieves in accordance with ASTM D422-63. The grain size distribution curves are attached to the Laboratory Summary.

EXPANSION INDEX TEST

The expansion potential of selected materials was evaluated by the Expansion Index Test, U.B.C. Standard No. 18-2. The specimen was molded under a given compactive energy and moisture content to achieve approximately 50 percent saturation. The prepared 1-inch thick by 4-inch diameter specimen was then loaded with a 144 psf surcharge and inundated with water until volumetric equilibrium is reached. The result of this test is presented in the Laboratory Summary.

SOLUBLE SULFATES

Soluble sulfate tests determined in general accordance with California Test Method No. 417 were also performed on representative samples collected during the field investigation. Soils with a sulfate concentration greater than 0.10% are considered potentially harmful to concrete and would require following the current ACI or C.B.C. for "moderate" or more severe sulfate exposure requirements. The results of this test are presented in the Laboratory Summary.

GRAIN SIZE DISTRIBUTION

A representative sample was dried, weighed, and soaked in water until individual soil particles were separated and then washed on the No. 200 sieve. That portion of the material retained on the No. 200 sieve was oven-dried and then run through a standard set of sieves in accordance with ASTM D422-63. The grain size distribution curves are attached to the Laboratory Summary.

ATTERBERG LIMITS

The Atterberg limits were performed in general accordance with ASTM D4318-00 and are used frequently in soil classification and identification. The soil descriptions defined by the United Soil Classification System (USCS) are based on these limits. Fine-grained soils are classified in the laboratory by performing several tests that define the plastic and liquid limits. The results of these tests are presented graphically as an attachment in this Appendix.

LABORATORY TEST SUMMARY

Atterberg Limits

Location	**Soil Description**	**Percent Passing #200 sieve**	**Liquid Limit**	**Plastic Limit**	**Plasticity Index**
KB-5 @ 10’	Brown Sandy Clay (CL)	N/A	30	19	11
KB-8 @ 40’	Brown Clayey Silt (CL-ML)	N/A	24	20	4
KTP-2- @ 6’	Brown Silt (ML)	N/A	30	27	3

Expansion Index and Soluble Sulfate

Location	Soil Description	Expansion Index	Soluble Sulfate (%)
KB-2 @0’-5’	Brown Clayey Sand (SC)	21	0.0009
KB-3 @0’-5’	Brown Clayey Sand (SC)	37	0.0036
KB-5 @0’-5’	Brown Clayey Sand (SC)	23	0.0030
KB-10 @0’-5’	Brown Clayey Sand (SC)	24	0.0021
TP-7 @4’-6’	Light Brown Silty Sand (SM)	1	0.0012

Direct Shear

Location	**Soil Description**	**Cohesion**	**Friction angle**
KB-1 @ 0-5'	Dark Brown clayey Sand (SC)	150 psf	29 degrees
KB-4 @ 0-5'	Dark Brown clayey Sand (SC)	200 psf	29 degrees
KB-6 @ 0-5'	Dark Brown clayey Sand (SC)	200 psf	29 degrees
KB-9 @ 0-5'	Dark Brown clayey Sand (SC)	150 psf	29 degrees
TP-3 @ 6’	Red Brown Sandy Clay (CL)	400	23 degrees
TP-7 @ 4-6'	Brown silty Sand (SM)	100 psf	28 degrees

* Test also plotted graphically following the tables.

R-VALUE

The suitability of selected soil samples for support of flexible pavement was evaluated by conducting stabilometer resistance (R-Value) testing. R-value testing was performed in accordance with California Standard Test Method No. 301. The results of this test are presented in the Laboratory Summary.

CORROSION TEST (BY OTHERS)

The corrosion test, including sulfate content, was performed by Anaheim Test Laboratory, and the results are presented in the attached results in this Appendix.

PROJECT NAME :	JACK RABBIT TRAIL	PROJECT NO:	18060-01	DATE :	15-Jul-19
BORING NUMBER :	KB-5	SAMPLE NO./DEPTH :	10'	TESTED BY :	RB

SAMPLE DESCRIPTIONS/CLASSIFICATION : BROWN LEAN CLAY (CL)

PLASTIC LIMIT

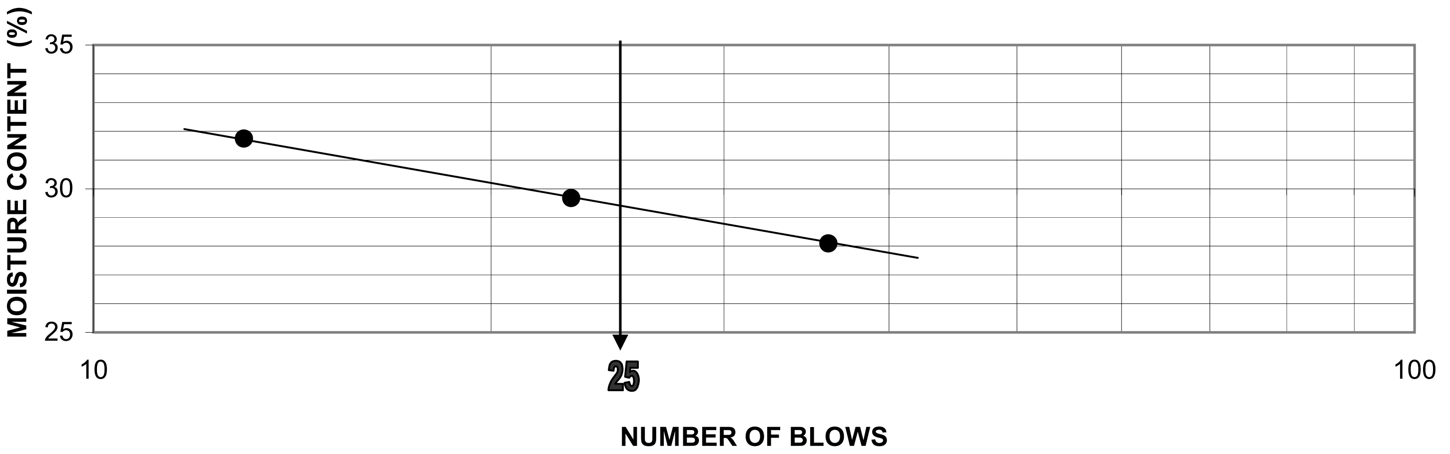
DETERMINATION NO	1	2
DISH NO.	B	
MASS OF DISH + WET SOIL,(Gms)	23.56	
MASS OF DISH + DRY SOIL,(Gms)	21.58	
MASS OF WATER,(Gms)	1.98	
MASS OF DISH,(Gms)	10.94	
MASS OF DRY SOIL,(Gms)	10.64	
MOISTURE CONTENT,(%)	18.6	

LIQUID LIMIT

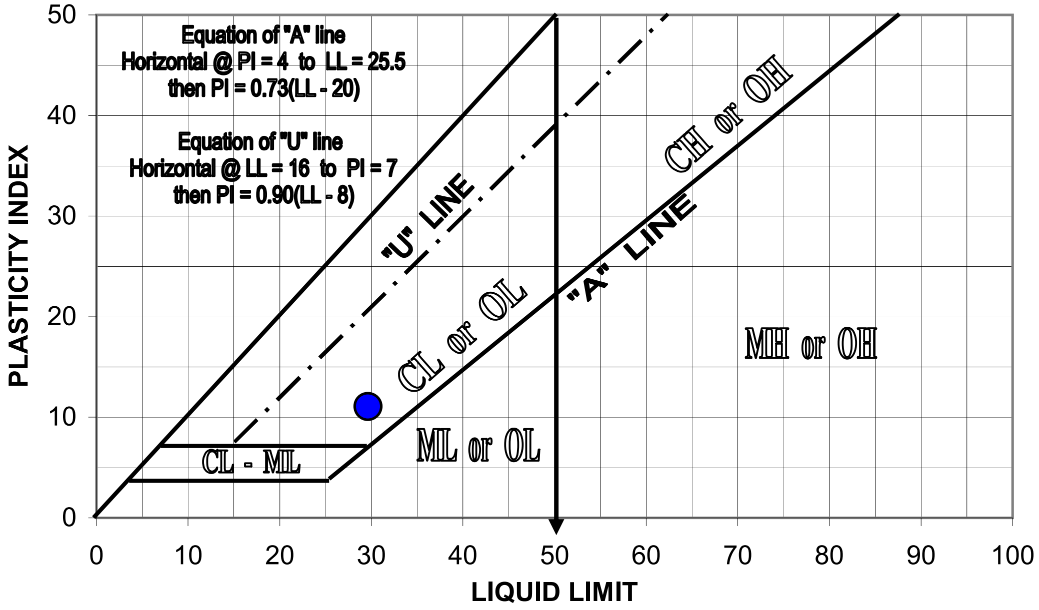
DETERMINATION NO.	1	2	3
DISH NUMBER	15C	A1	8
MASS, DISH + WET SOIL,(Gms)	12.41	11.86	11.74
MASS, DISH + DRY SOIL,(Gms)	10.49	10.16	10.13
MASS OF WATER,(Gms)	1.92	1.70	1.61
MASS OF DISH,(Gms)	4.44	4.43	4.40
MOISTURE CONTENT,(%)	31.7	29.7	28.1
NUMBER OF BLOWS	13	23	36

NATURAL MOISTURE CONTENT,%
0.00
#DIV/0!

FLOW CURVE



PLASTICITY CHART



RESULT SUMMARY

NATURAL MOISTURE CONTENT, (%)	-
LIQUID LIMIT (LL)	30
PLASTIC LIMIT (PL)	19
PLASTICITY INDEX (PI)	11
SYMBOL FROM PLASTICITY CHART	(CL)

METHOD OF PREPARATION		METHOD OF LL DETERMINATION	
DRY	X	MULTIPOINT	X
WET		ONE-POINT	

REMARKS :

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ATTERBERG LIMITS

(ASTM D4318-00)

PROJECT NAME : JACK RABBIT TRAIL
PROJECT NO: 18060-01
DATE : 24-Jul-19
BORING NUMBER : KB - 8
SAMPLE NO./DEPTH : 40'
TESTED BY : RB
SAMPLE DESCRIPTIONS/CLASSIFICATION : BROWN CLAY TO SILT (CL/ML)

PLASTIC LIMIT

DETERMINATION NO	1	2
DISH NO.	10	
MASS OF DISH + WET SOIL,(Gms)	27.46	
MASS OF DISH + DRY SOIL,(Gms)	24.81	
MASS OF WATER,(Gms)	2.65	
MASS OF DISH,(Gms)	11.37	
MASS OF DRY SOIL,(Gms)	13.44	
MOISTURE CONTENT,(%)	19.7	

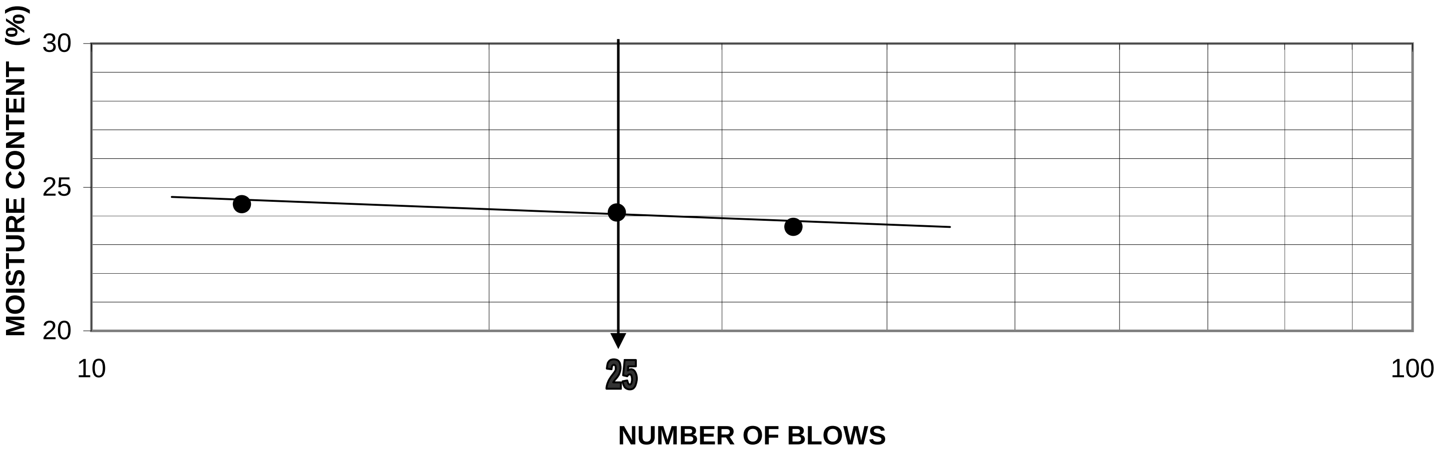
LIQUID LIMIT

DETERMINATION NO.	1	2	3
DISH NUMBER	6	8	A1
MASS, DISH + WET SOIL,(Gms)	12.00	11.84	11.60
MASS, DISH + DRY SOIL,(Gms)	10.47	10.40	10.23
MASS OF WATER,(Gms)	1.53	1.44	1.37
MASS OF DISH,(Gms)	4.20	4.43	4.43
MOISTURE CONTENT,(%)	24.4	24.1	23.6
NUMBER OF BLOWS	13	25	34

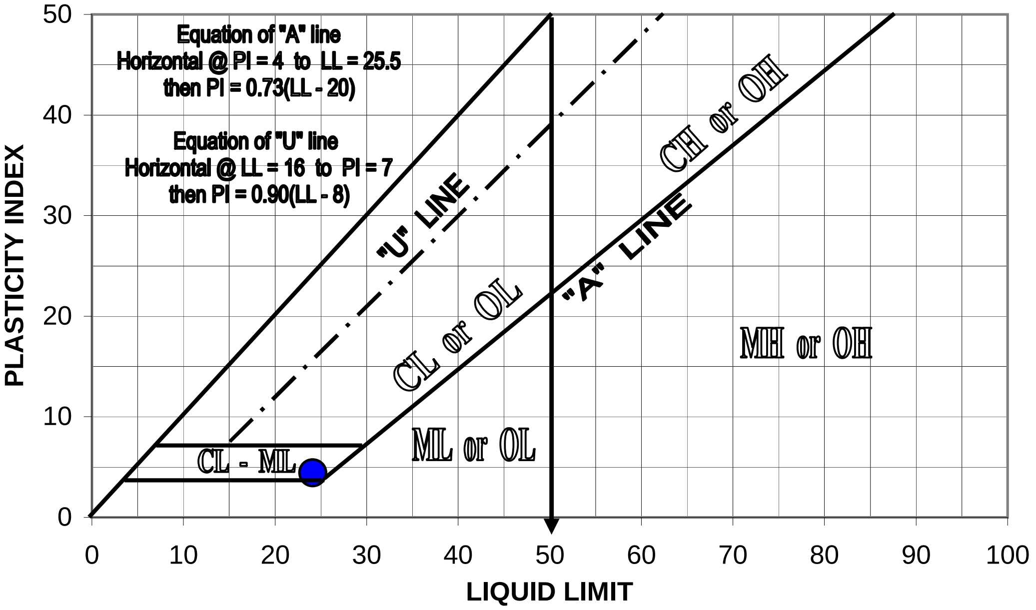
NATURAL MOISTURE CONTENT,%

0.00
#DIV/0!

FLOW CURVE



PLASTICITY CHART



RESULT SUMMARY

NATURAL MOISTURE CONTENT, (%)	-
LIQUID LIMIT (LL)	24
PLASTIC LIMIT (PL)	20
PLASTICITY INDEX (PI)	4
SYMBOL FROM PLASTICITY CHART	(CL/ML)

METHOD OF PREPARATION		METHOD OF LL DETERMINATION	
DRY	X	MULTIPOINT	X
WET		ONE-POINT	

REMARKS :

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ATTERBERG LIMITS

(ASTM D4318-00)

PROJECT NAME : JACK RABBIT TRAIL
PROJECT NO: 18060-01
DATE : 24-Jul-19
BORING NUMBER : KTP - 2
SAMPLE NO./DEPTH : 6'
TESTED BY : RB
SAMPLE DESCRIPTIONS/CLASSIFICATION : OLIVE BROWN SILT (ML)

PLASTIC LIMIT

DETERMINATION NO	1	2
DISH NO.	R	
MASS OF DISH + WET SOIL,(Gms)	26.13	
MASS OF DISH + DRY SOIL,(Gms)	22.92	
MASS OF WATER,(Gms)	3.21	
MASS OF DISH,(Gms)	10.9	
MASS OF DRY SOIL,(Gms)	12.02	
MOISTURE CONTENT,(%)	26.7	

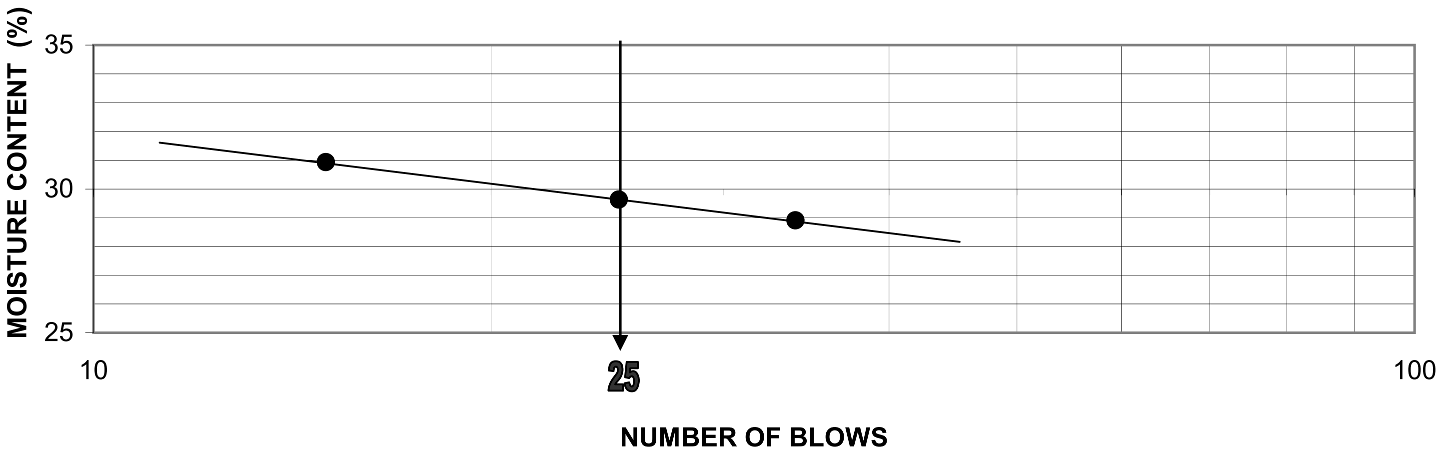
LIQUID LIMIT

DETERMINATION NO.	1	2	3
DISH NUMBER	112	12	9
MASS, DISH + WET SOIL,(Gms)	11.99	11.55	11.44
MASS, DISH + DRY SOIL,(Gms)	10.19	9.87	9.81
MASS OF WATER,(Gms)	1.80	1.68	1.63
MASS OF DISH,(Gms)	4.37	4.20	4.17
MOISTURE CONTENT,(%)	30.9	29.6	28.9
NUMBER OF BLOWS	15	25	34

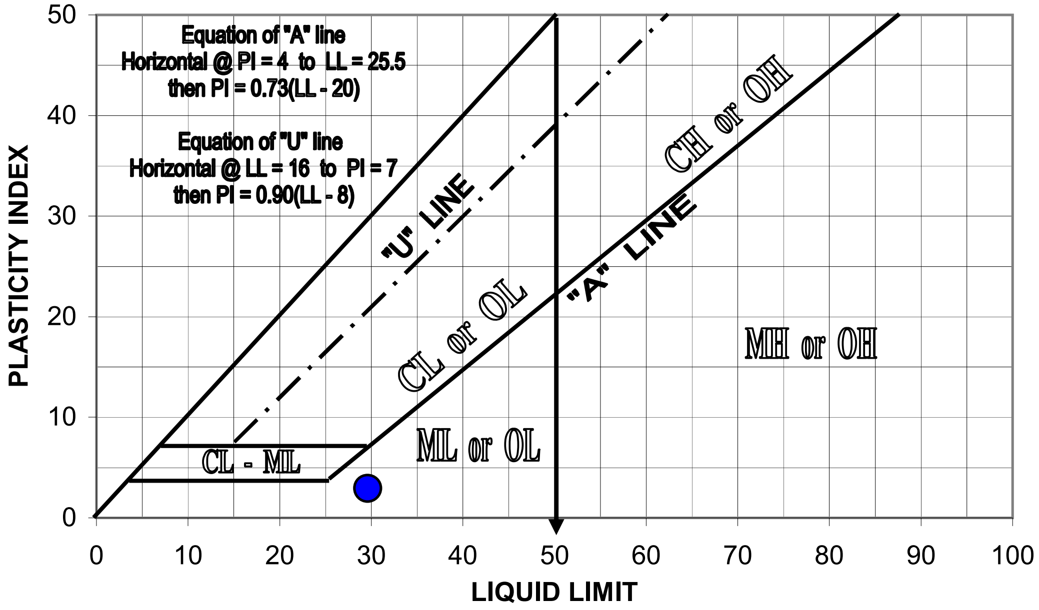
NATURAL MOISTURE CONTENT,%

0.00
#DIV/0!

FLOW CURVE



PLASTICITY CHART



RESULT SUMMARY

NATURAL MOISTURE CONTENT, (%) -
LIQUID LIMIT (LL) 30
PLASTIC LIMIT (PL) 27
PLASTICITY INDEX (PI) 3
SYMBOL FROM PLASTICITY CHART (ML)

METHOD OF PREPARATION		METHOD OF LL DETERMINATION	
DRY	X	MULTIPOINT	X
WET		ONE-POINT	

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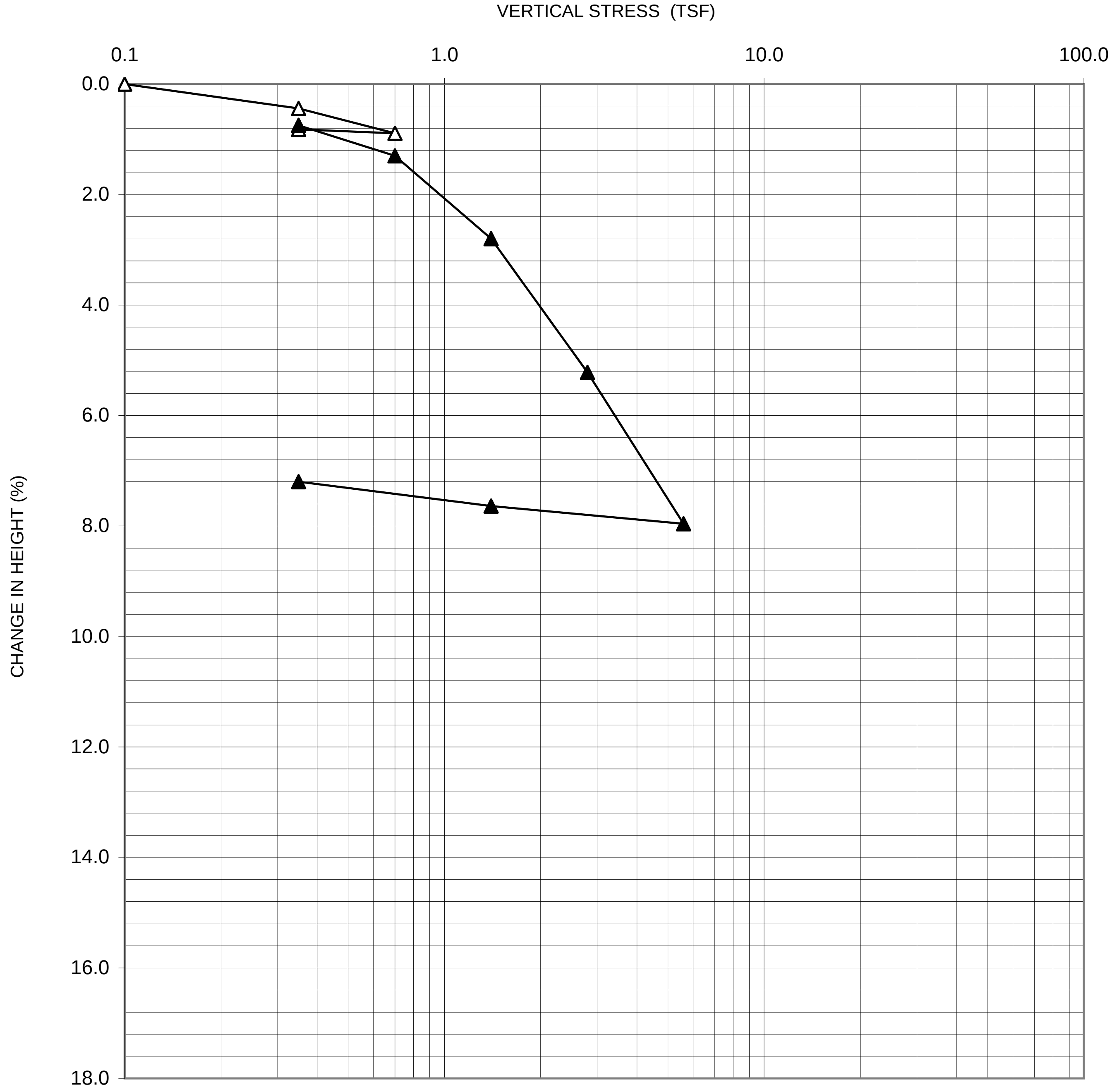
ATTERBERG LIMITS
(ASTM D4318-00)



PROJECT NO.: 18060-01

SOIL DESCRIPTIONS: DK. BROWN SANDY CLAY (CL)

BORING NO./LOCATION : KB - 1

DEPTH / ELEV. : 10'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	12.1	107.2	58.2	0.559
FINAL	0.9280	18.5	115.5	110.9	0.448

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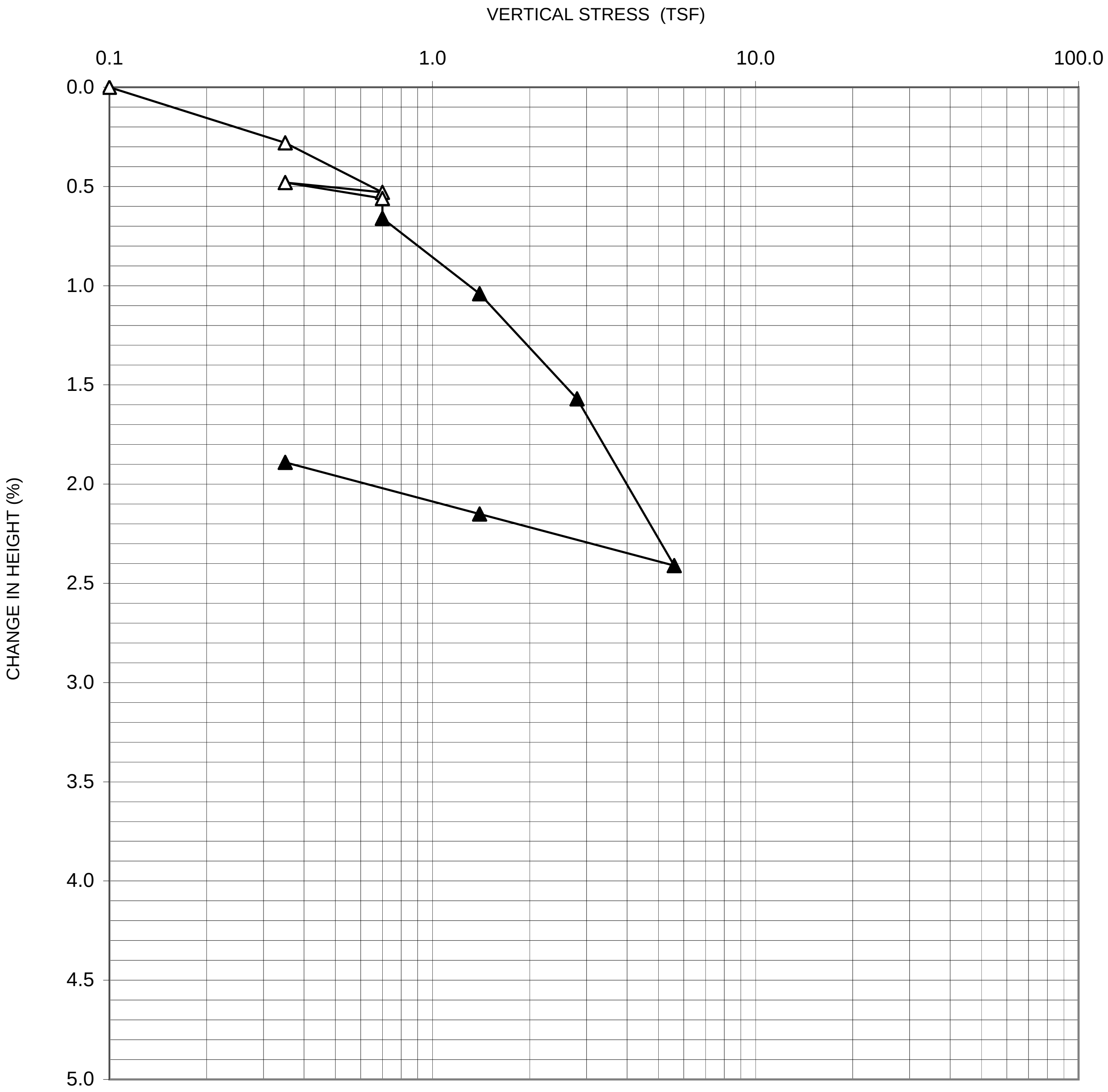
CONSOLIDATION TEST CURVE



PROJECT NO.: 18060-01

SOIL DESCRIPTIONS: LT. BROWN SILTY SAND (SM)

BORING NO./LOCATION : KB - 1

DEPTH / ELEV. : 15'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	7.8	117.8	49.7	0.420
FINAL	0.9811	18.3	120.0	124.2	0.394

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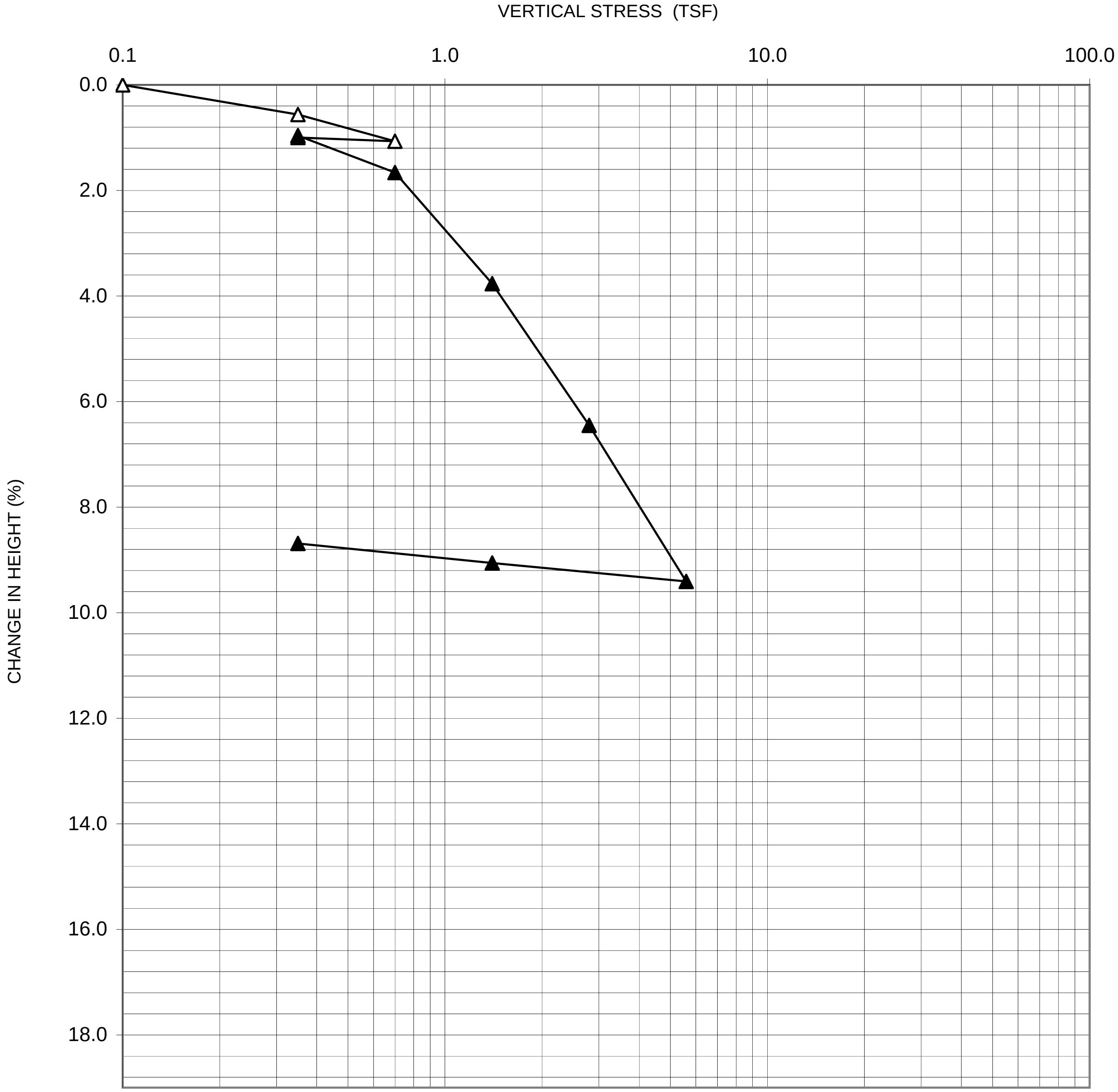
CONSOLIDATION TEST CURVE



PROJECT NO.: 18060-01

SOIL DESCRIPTIONS: DK. BROWN CLAYEY SAND (SC)

BORING NO./LOCATION : KB - 2

DEPTH / ELEV. : 10'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	11.5	109.3	58.1	0.530
FINAL	0.9131	16.8	119.6	113.4	0.398

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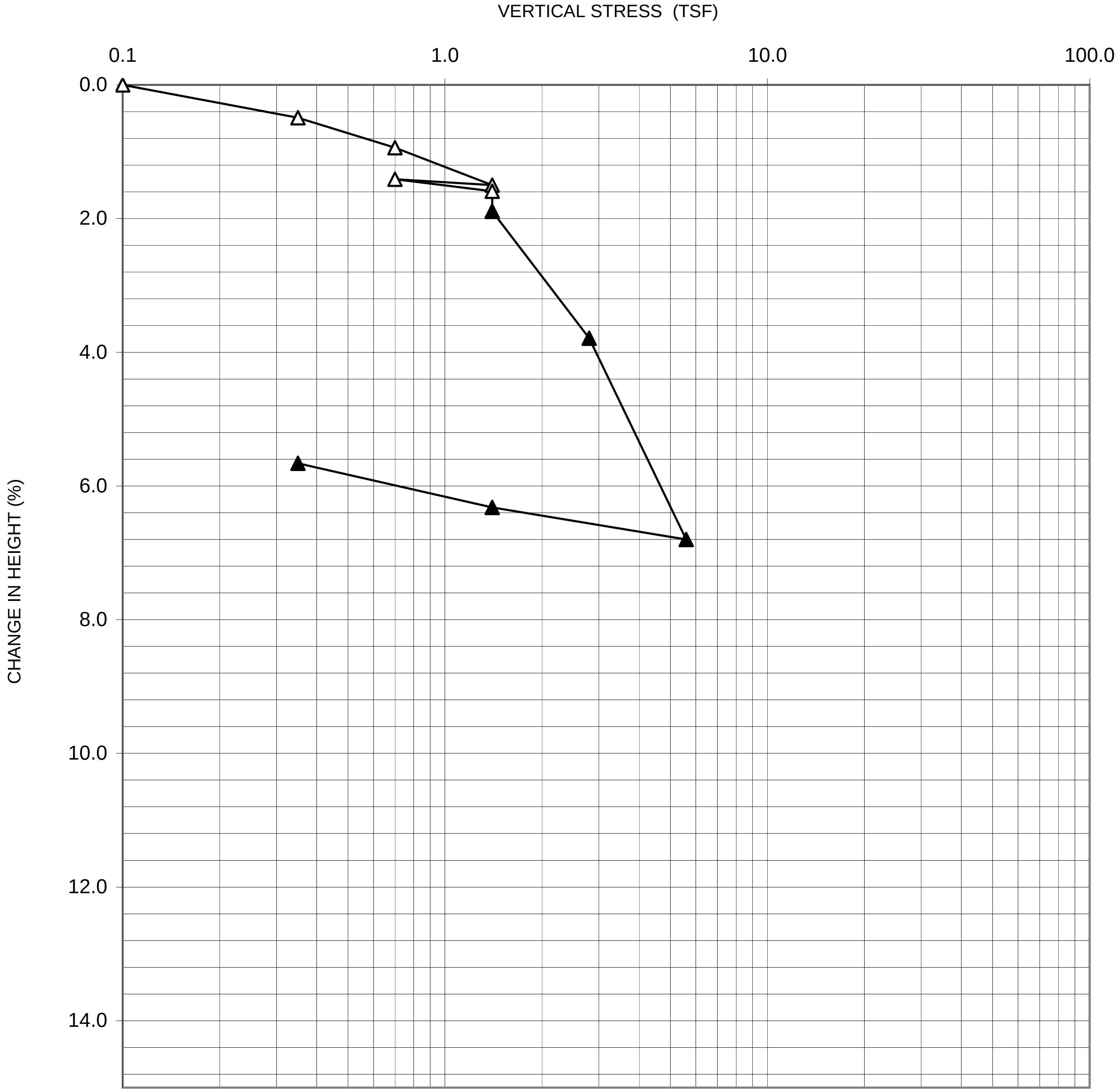
CONSOLIDATION TEST CURVE



PROJECT NO.: 18060-01 SOIL DESCRIPTIONS: DK. BROWN CLAYEY SAND (SC)

BORING NO./LOCATION : KB - 2 DEPTH / ELEV. : 25' LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed) PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	14.1	107.5	68.2	0.555
FINAL	0.9434	20.5	113.9	117.3	0.468

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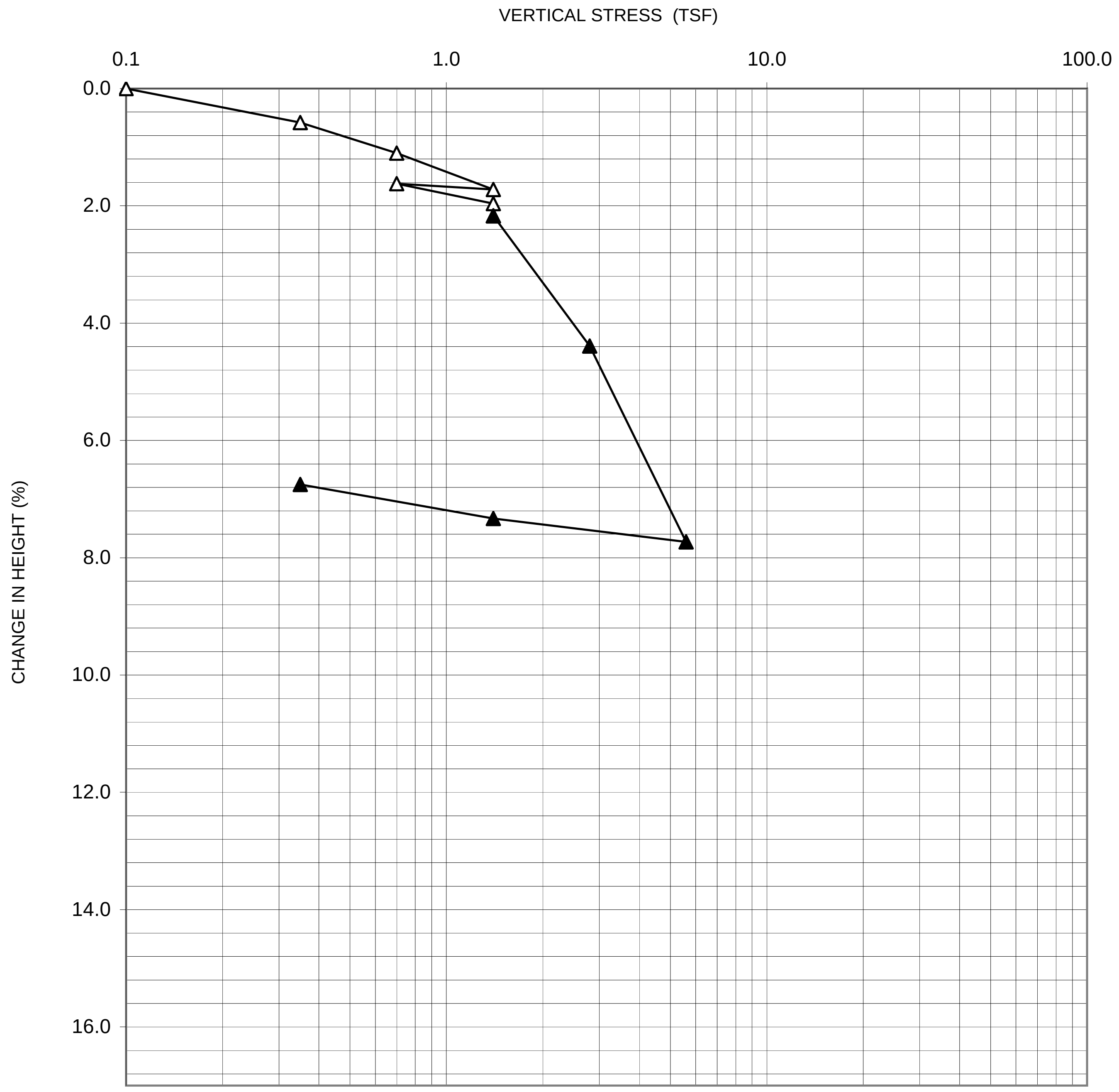
CONSOLIDATION TEST CURVE



PROJECT NO.: 18060-01

SOIL DESCRIPTIONS: DK. BROWN SANDY CLAY (CL)

BORING NO./LOCATION : KB - 2

DEPTH / ELEV. : 35'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	13.0	108.1	63.6	0.547
FINAL	0.9325	17.8	115.9	107.6	0.443

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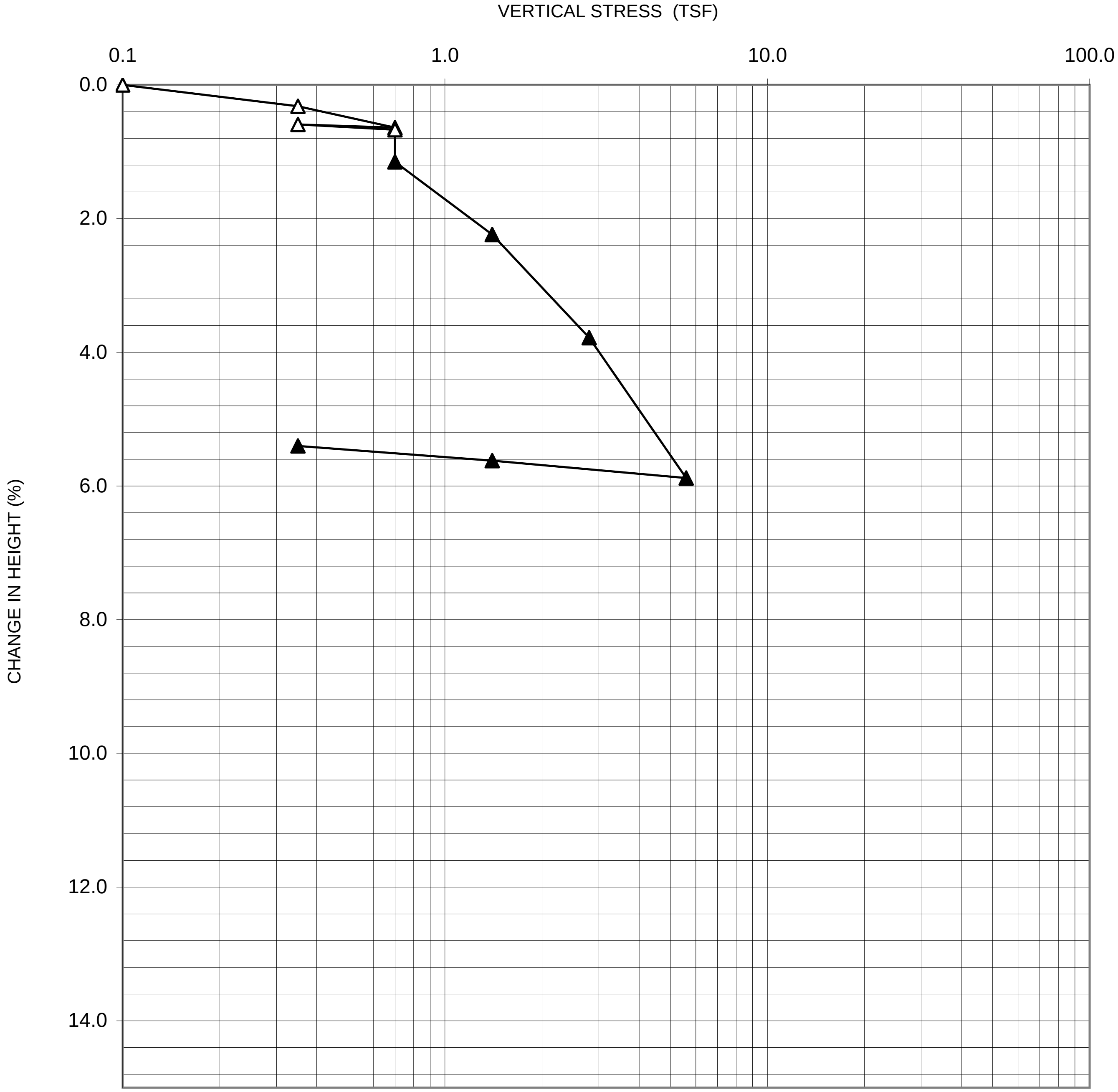
CONSOLIDATION TEST CURVE



PROJECT NO.: 18060-00

SOIL DESCRIPTIONS: BROWN SILTY SAND W/ GRAVEL (SM)

BORING NO./LOCATION : KB - 3

DEPTH / ELEV. : 10'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	6.8	112.5	37.4	0.487
FINAL	0.9460	16.4	118.9	107.9	0.407

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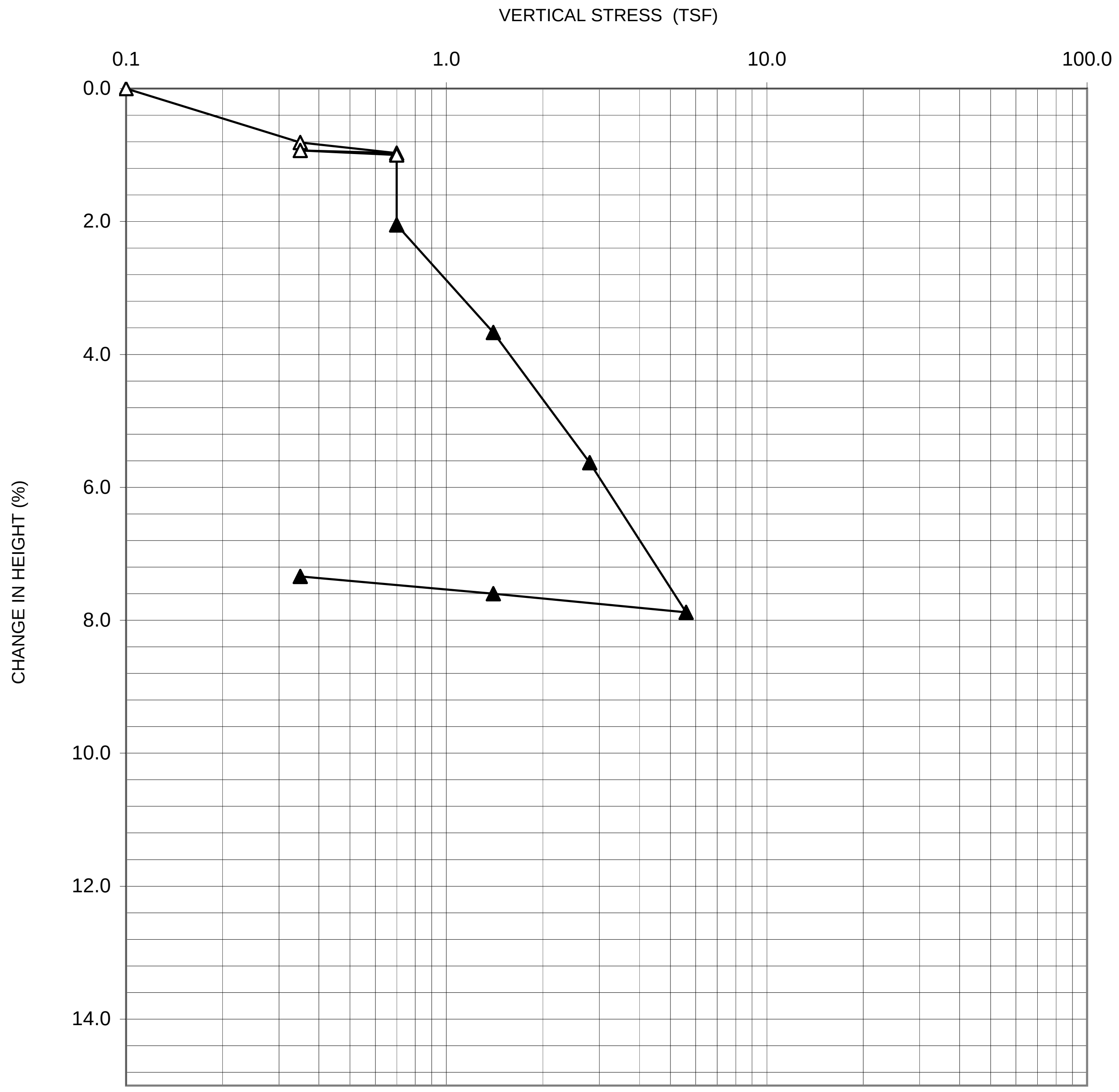

PROJECT NO.: 18060-00

SOIL DESCRIPTIONS: BROWN SILTY SAND (SM)

BORING NO./LOCATION : KB - 4

DEPTH / ELEV. : 15'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	6.5	109.8	33.4	0.523
FINAL	0.9266	18.4	118.4	119.5	0.412

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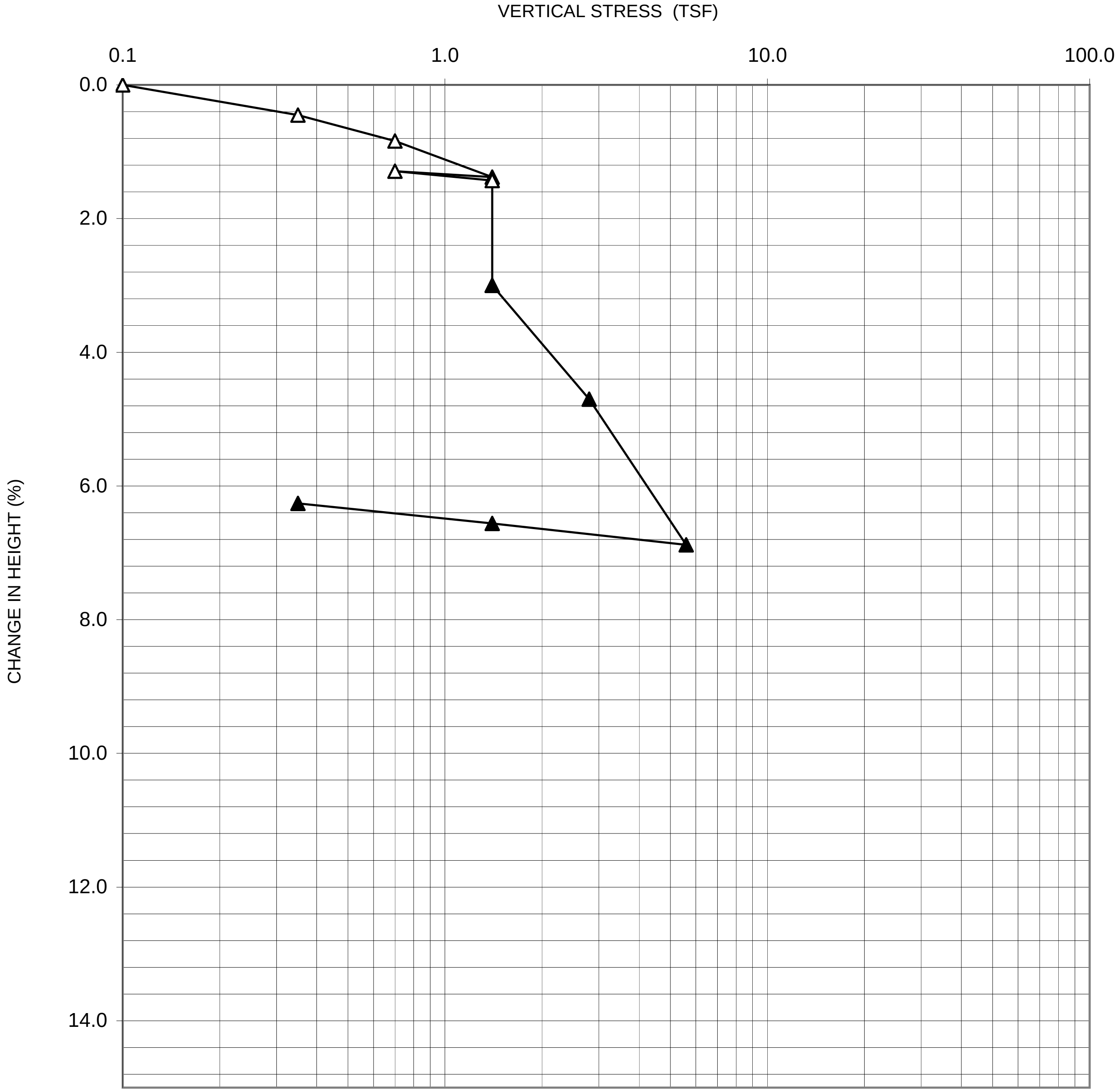

PROJECT NO.: 18060-00

SOIL DESCRIPTIONS: BR. SILTY FINE SAND W/ TR. OF CLAY (SM)

BORING NO./LOCATION : KB - 4

DEPTH / ELEV. : 25'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	7.4	105.3	33.9	0.588
FINAL	0.9374	20.8	112.3	114.3	0.489

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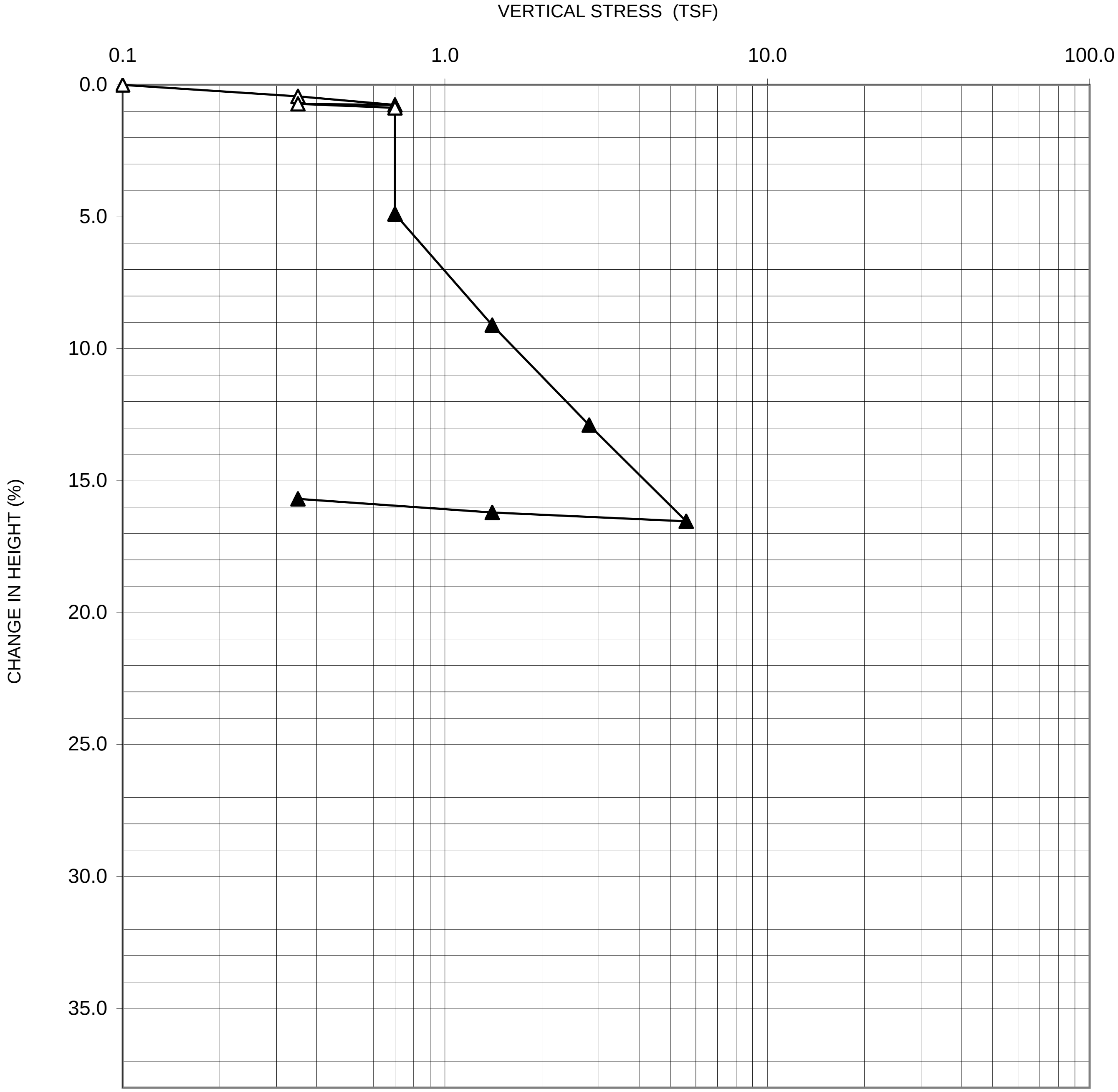

PROJECT NO.: 18060-00

SOIL DESCRIPTIONS: DK. BROWN SANDY CLAY (PORUOS) (CL)

BORING NO./LOCATION : KB - 5

DEPTH / ELEV. : 10'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	25.1	84.7	69.1	0.974
FINAL	0.8431	40.0	100.4	161.2	0.665

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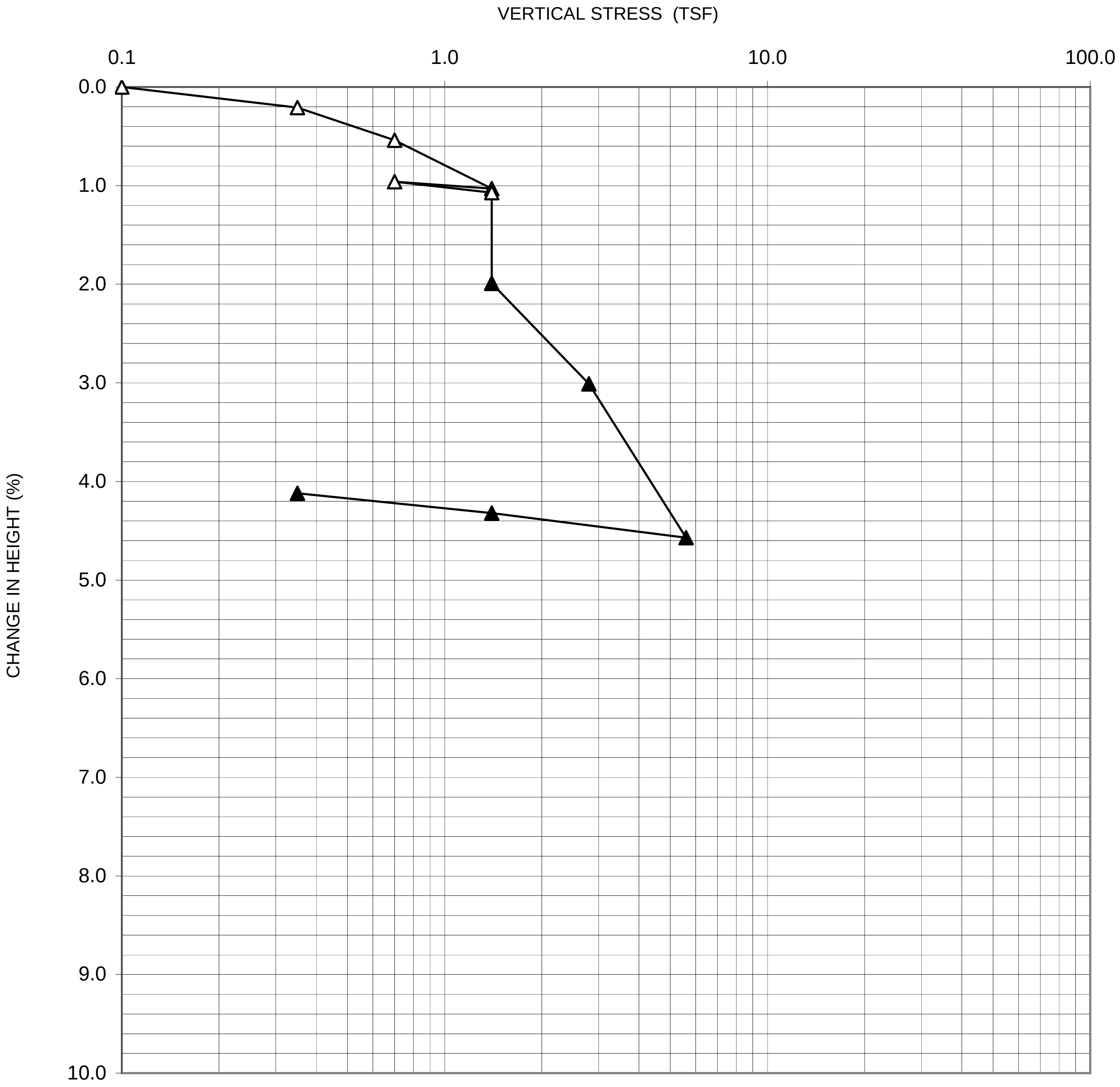


PROJECT NO.: 18060-00

SOIL DESCRIPTIONS: LT. BROWN SILTY SAND W/ GRAVEL (SP/SM)

BORING NO./LOCATION : KB - 5

DEPTH / ELEV. : 25'

LIQUID LIMIT : -

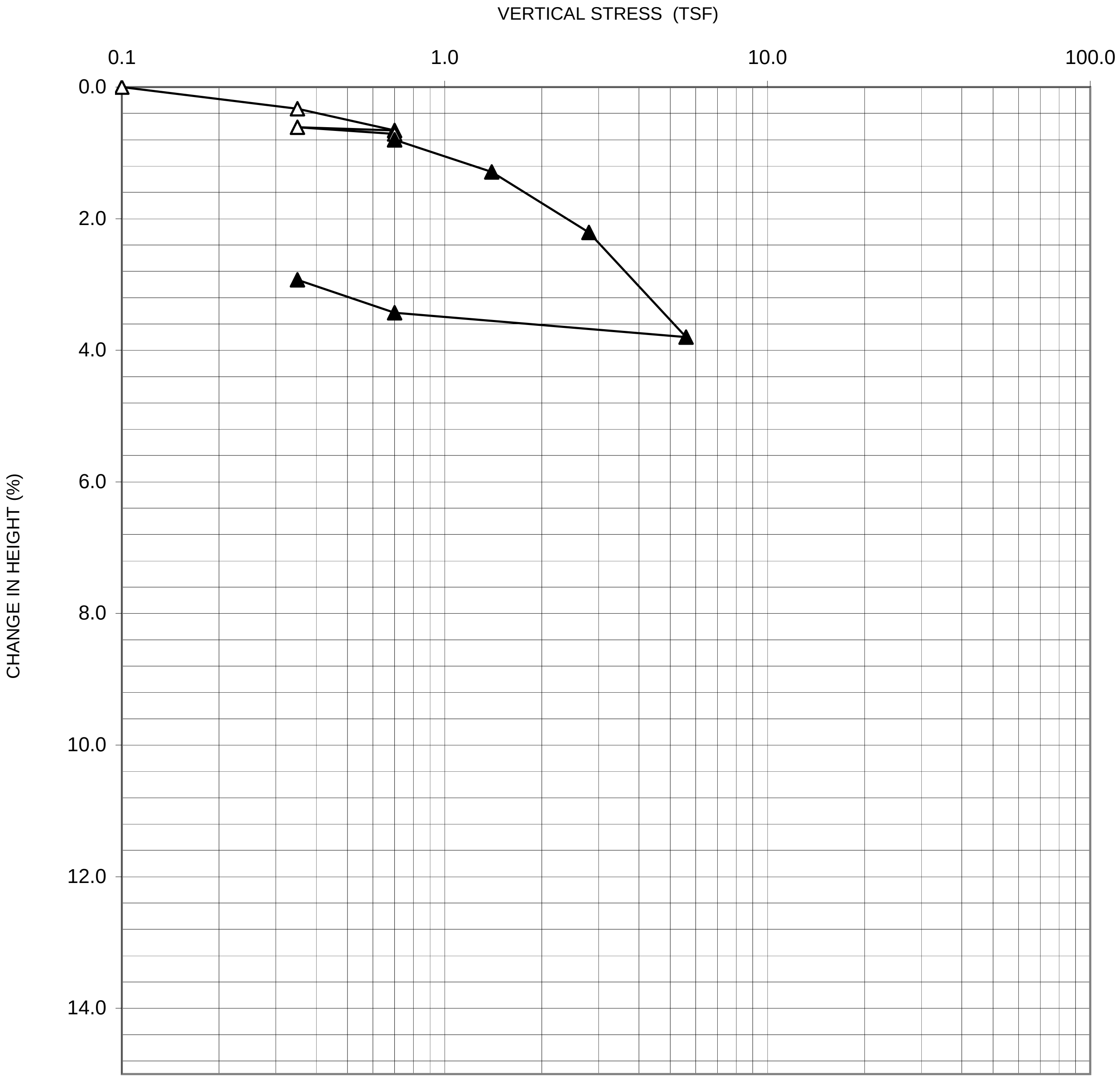
SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	3.2	117.6	20.1	0.423
FINAL	0.9588	18.9	122.6	139.0	0.365

CONSOLIDATION TEST CURVE



PROJECT NO.: 18060-00

SOIL DESCRIPTIONS: BROWN SILTY FINE SAND W/ CLAY (SM)

BORING NO./LOCATION : KB - 6

DEPTH / ELEV. : 15'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	9.9	116.1	60.2	0.440
FINAL	0.9707	18.4	119.6	123.9	0.399

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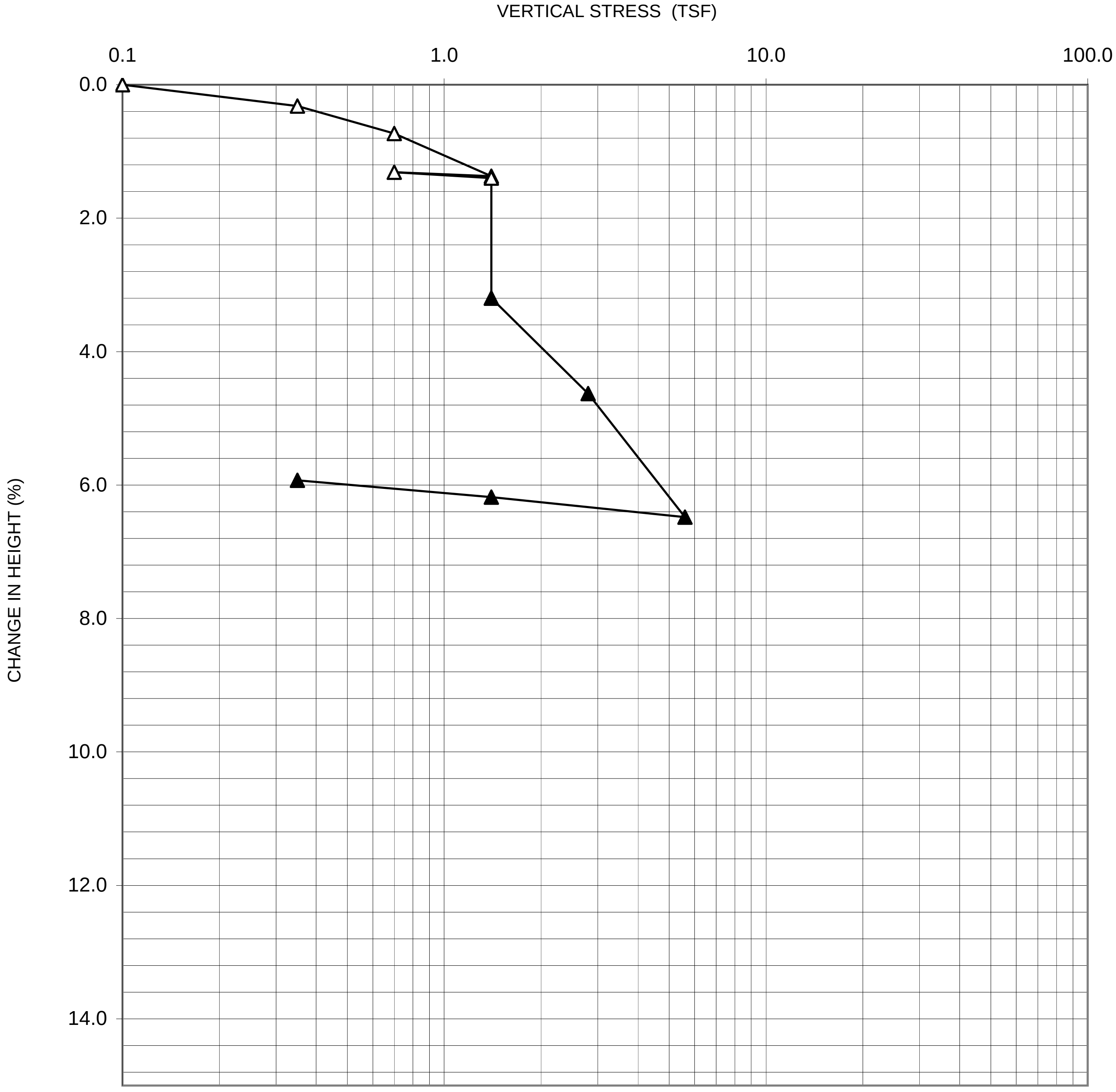

PROJECT NO.: 18060-00

SOIL DESCRIPTIONS: LT. BROWN SILTY SAND W/ GRAVEL (SP/SM)

BORING NO./LOCATION : KB - 6

DEPTH / ELEV. : 25'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	3.8	113.4	21.7	0.475
FINAL	0.9407	17.5	120.5	121.2	0.388

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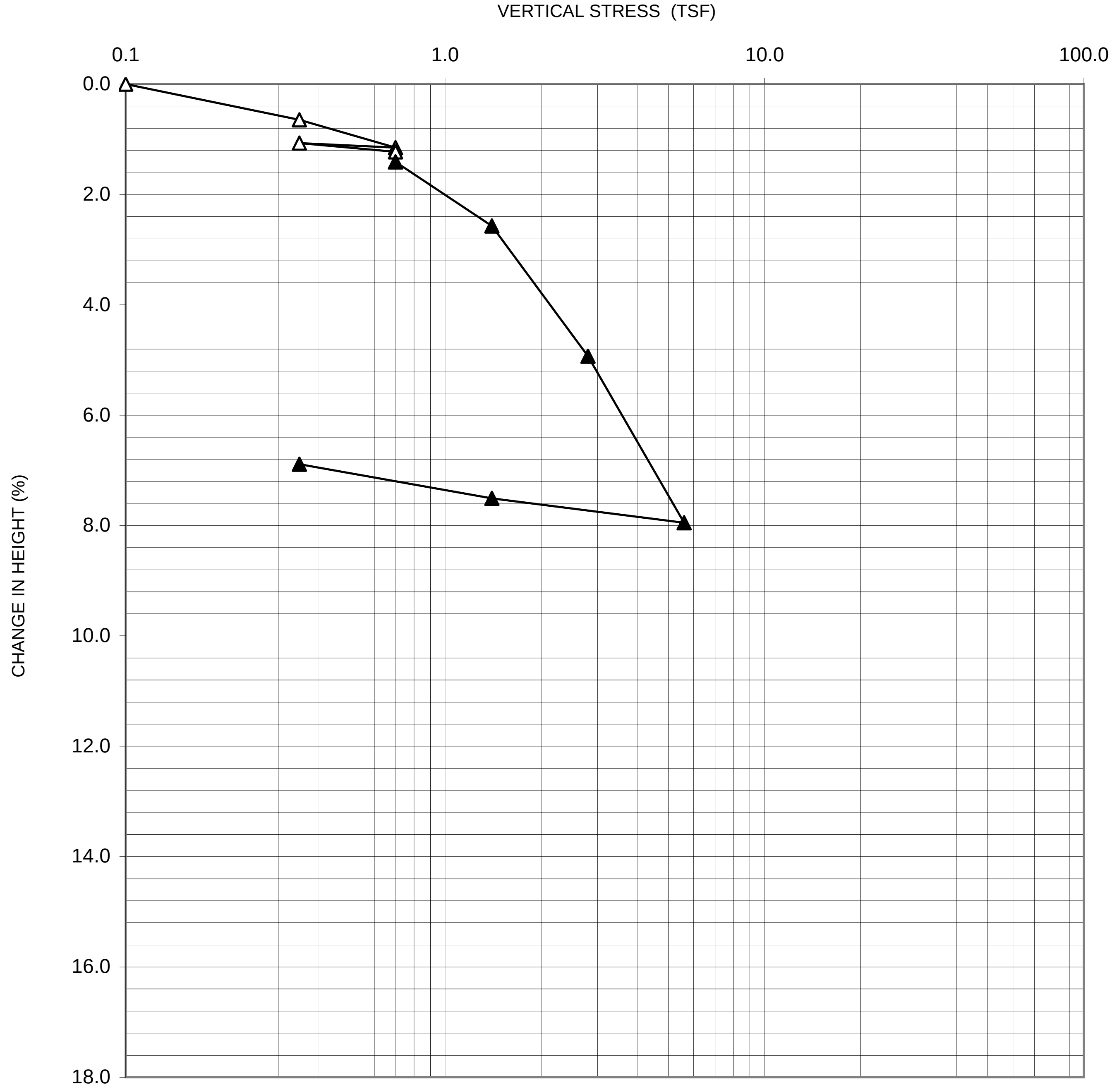

PROJECT NO.:	18060-01	SOIL DESCRIPTIONS:	DK. BROWN SANDY CLAY (CL)		
BORING NO./LOCATION :	KB - 7	DEPTH / ELEV. :	15'	LIQUID LIMIT :	-
SPECIFIC GRAVITY :	2.68 (Assumed)			PLASTIC LIMIT:	-

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	13.2	109.7	67.4	0.525
FINAL	0.9311	18.3	117.7	116.7	0.420

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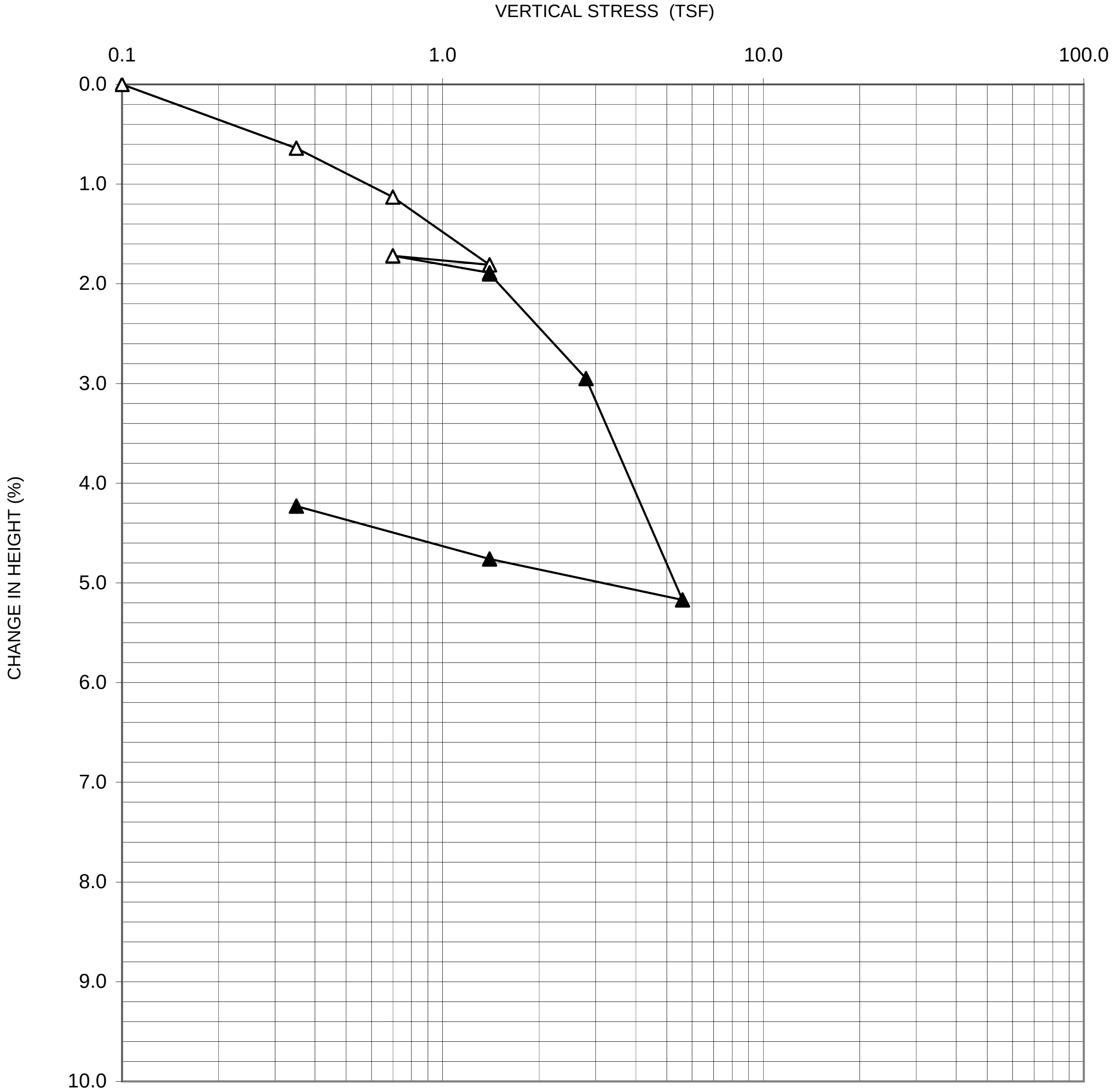
CONSOLIDATION TEST CURVE



PROJECT NO.: 18060-01

SOIL DESCRIPTIONS: DK. BROWN SANDY CLAY (CL)

BORING NO./LOCATION : KB - 7

DEPTH / ELEV. : 35'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	14.4	115.4	86.0	0.450
FINAL	0.9577	16.8	120.4	115.5	0.389

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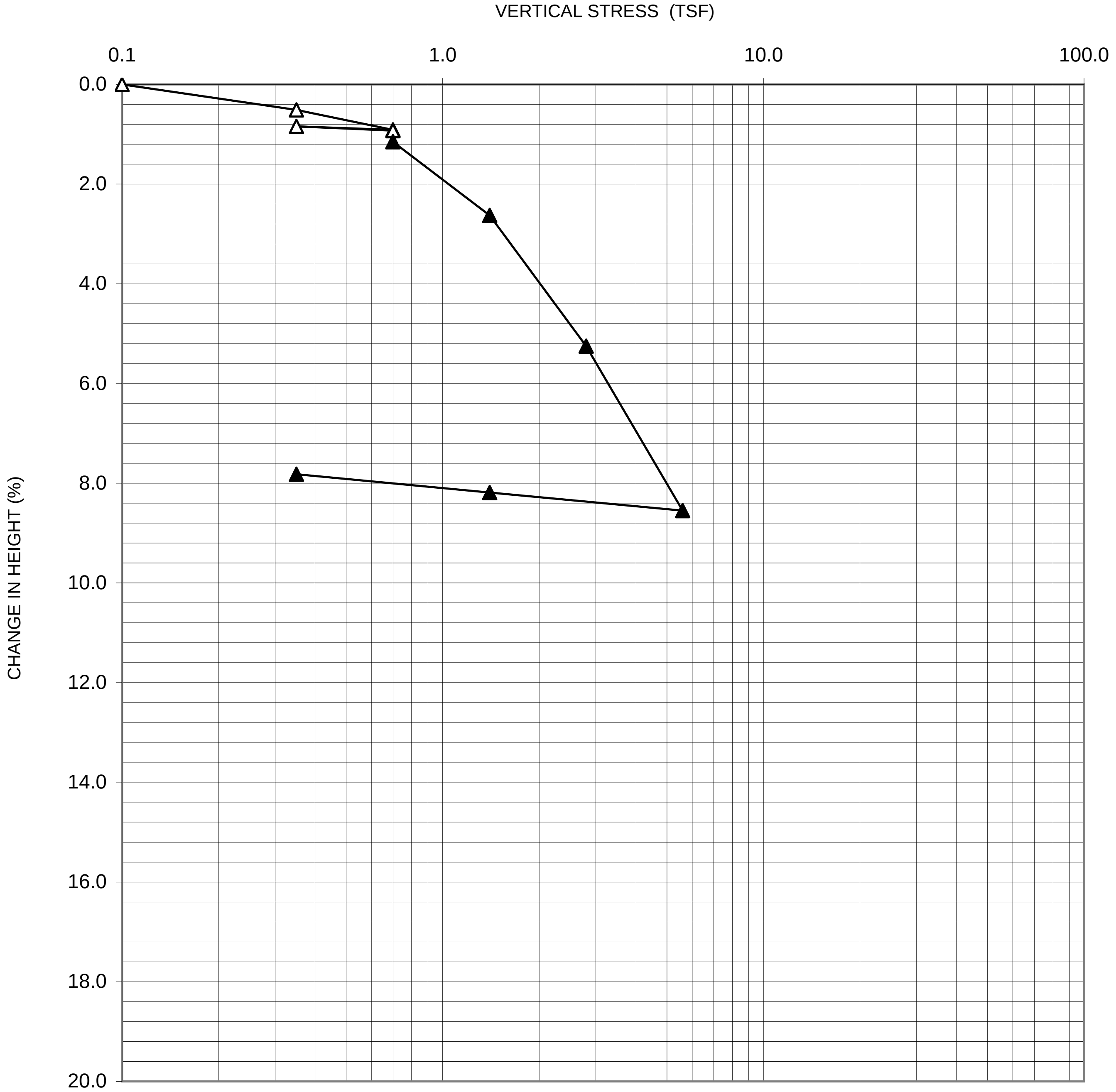

PROJECT NO.: 18060-01

SOIL DESCRIPTIONS: BROWN CLAYEY SAND W/ GRAVEL (SC)

BORING NO./LOCATION : KB - 8

DEPTH / ELEV. : 15'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	9.5	105.6	43.5	0.584
FINAL	0.9218	19.4	114.5	112.8	0.460

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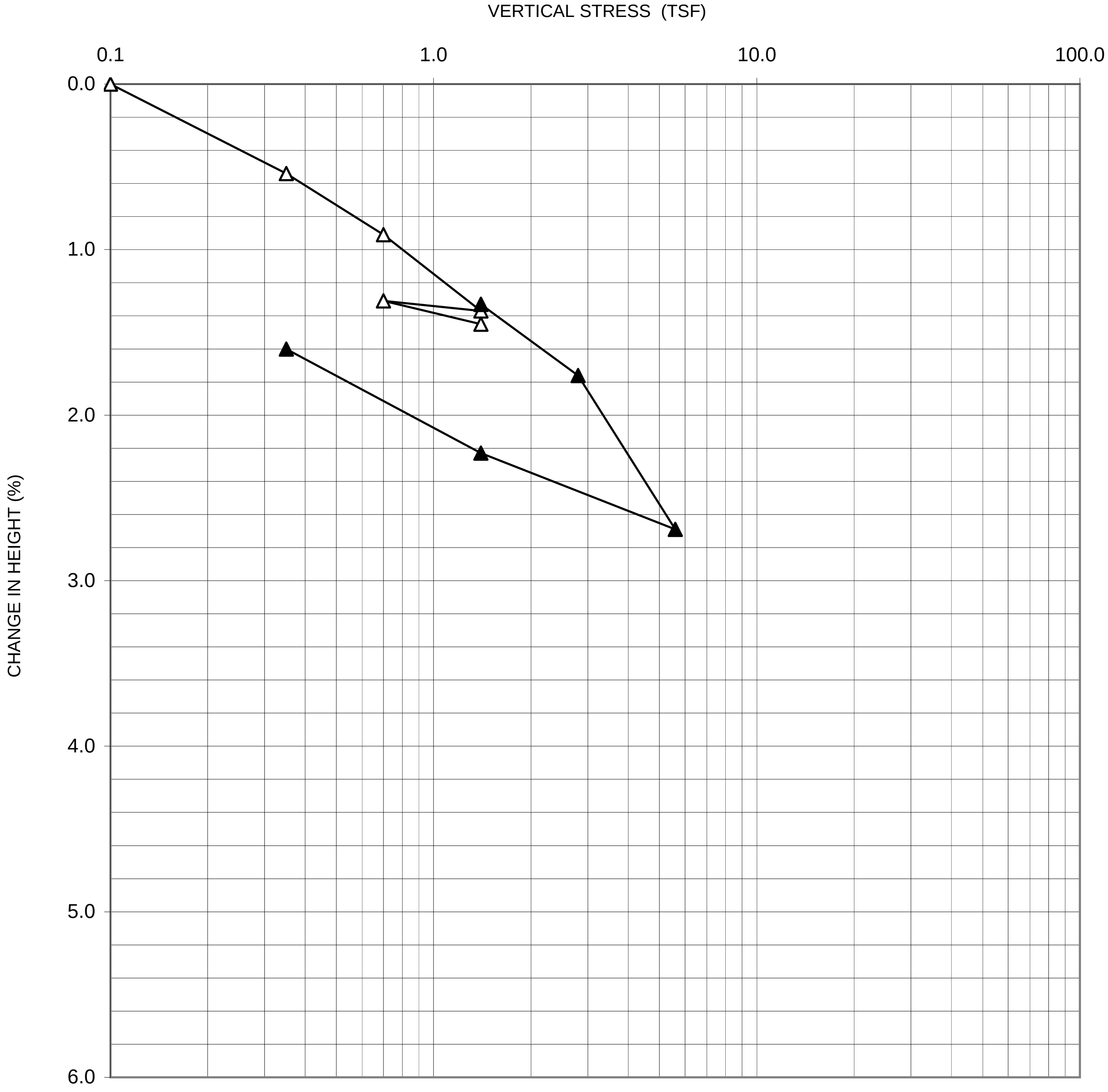

PROJECT NO.: 18060-01

SOIL DESCRIPTIONS: BROWN SANDY CLAY (CL)

BORING NO./LOCATION : KB - 8

DEPTH / ELEV. : 25'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	12.9	120.1	88.1	0.392
FINAL	0.9840	17.1	122.1	123.6	0.370

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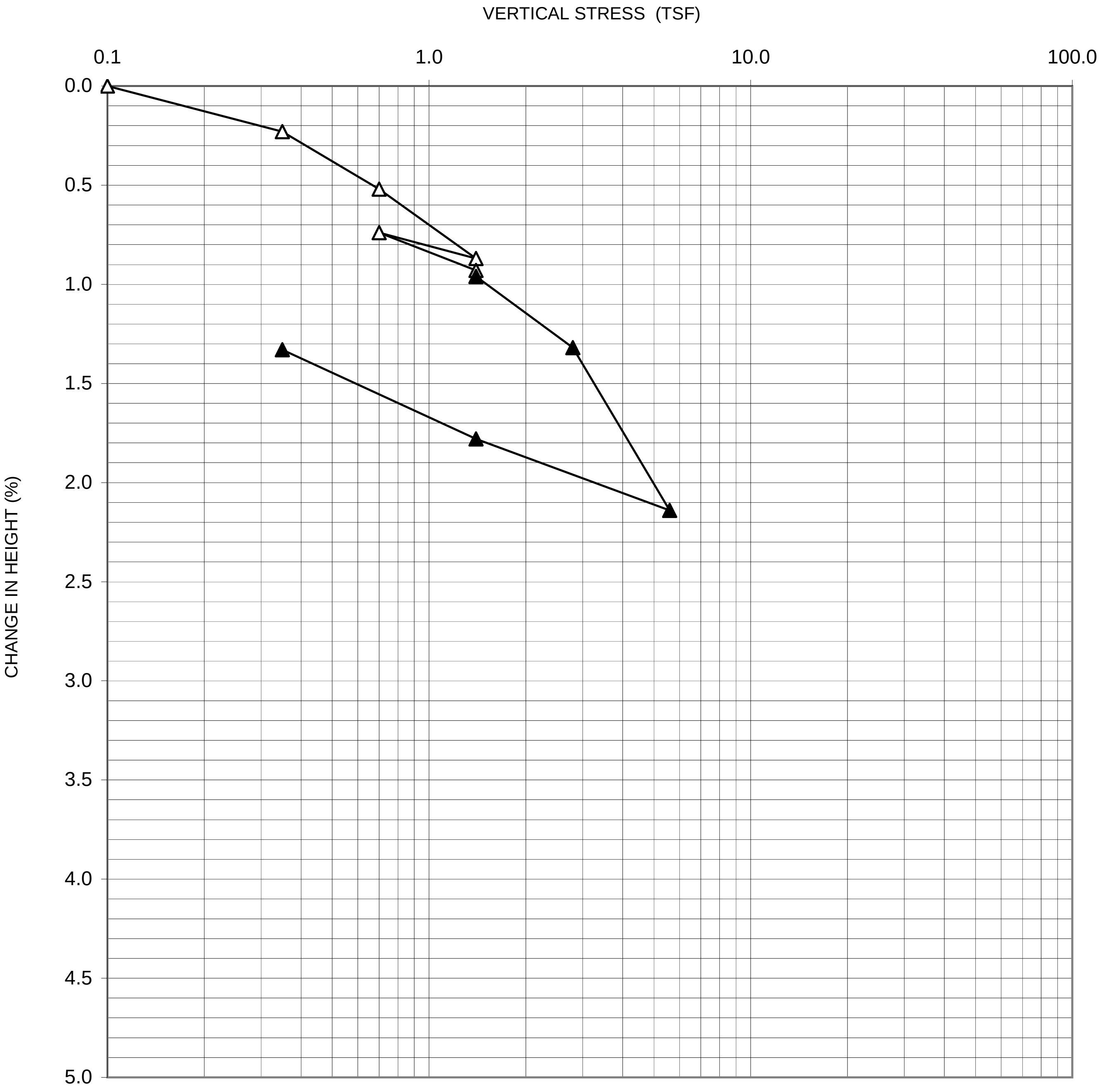


PROJECT NO.: 18060-01

SOIL DESCRIPTIONS: BROWN SILTY SAND (SM)

BORING NO./LOCATION : KB - 8

DEPTH / ELEV. : 35'

LIQUID LIMIT : -

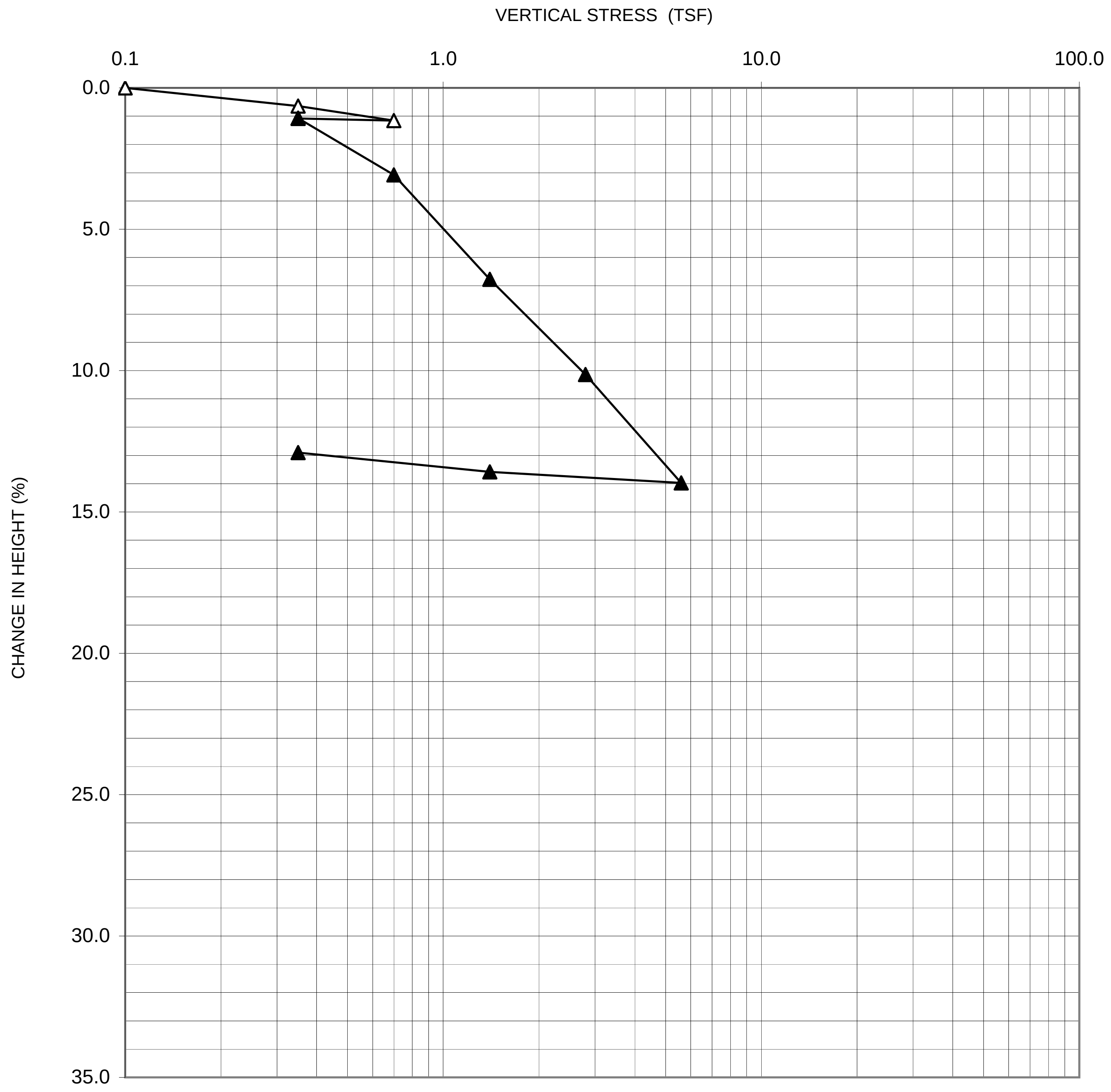
SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	10.0	113.8	57.4	0.469
FINAL	0.9867	18.4	115.3	109.6	0.450

CONSOLIDATION TEST CURVE



PROJECT NO.: 18060-01

SOIL DESCRIPTIONS: DK. BROWN SANDY CLAY (CL)

BORING NO./LOCATION : KB - 9

DEPTH / ELEV. : 10'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	9.1	102.7	39.0	0.629
FINAL	0.8710	20.3	117.8	130.0	0.419

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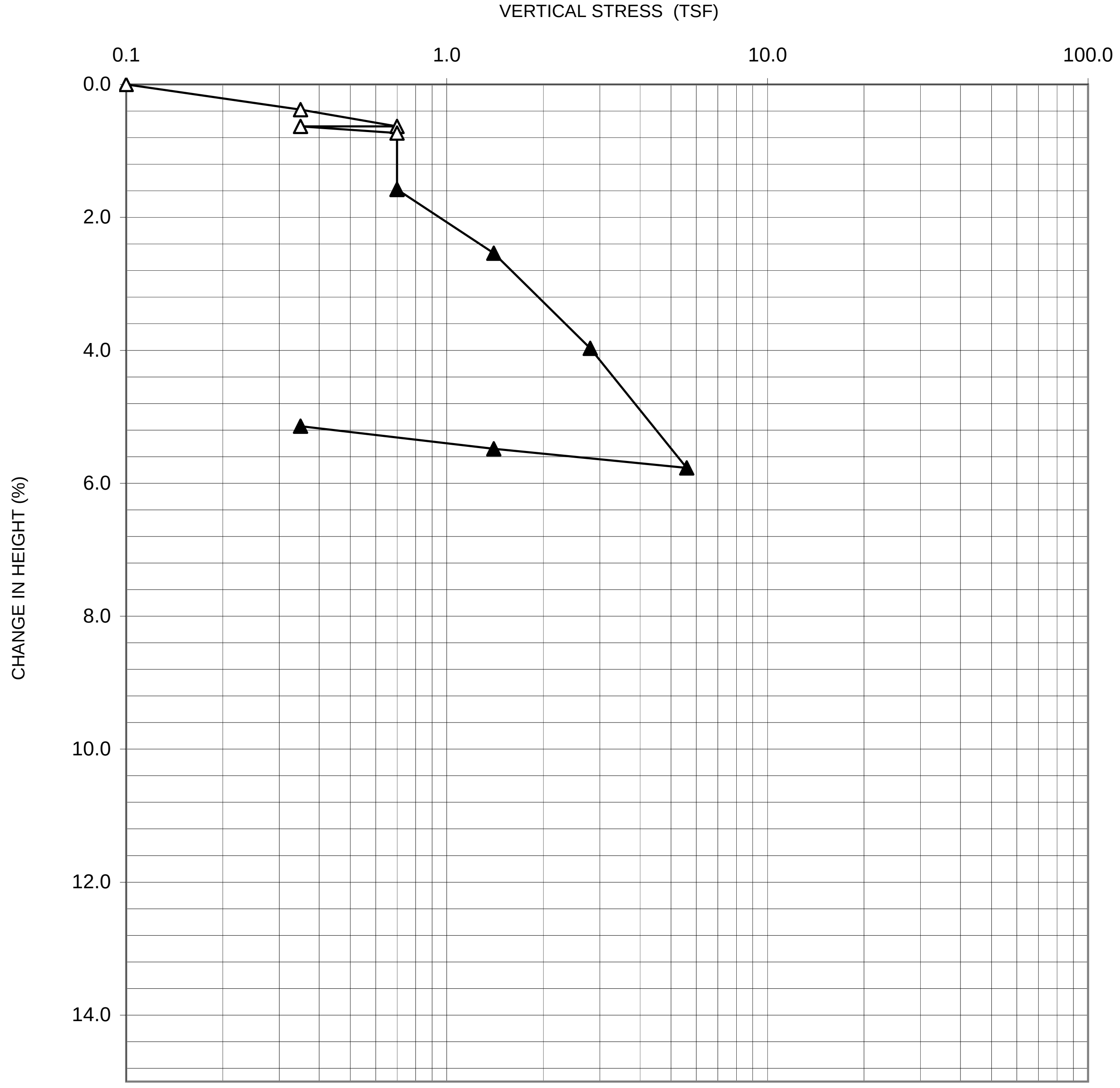
CONSOLIDATION TEST CURVE



PROJECT NO.: 18060-01

SOIL DESCRIPTIONS: BROWN CLAYEY SAND W/ GRAVEL (SC)

BORING NO./LOCATION : KB - 9

DEPTH / ELEV. : 15'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	4.2	118.1	26.9	0.415
FINAL	0.9486	15.8	124.5	123.4	0.343

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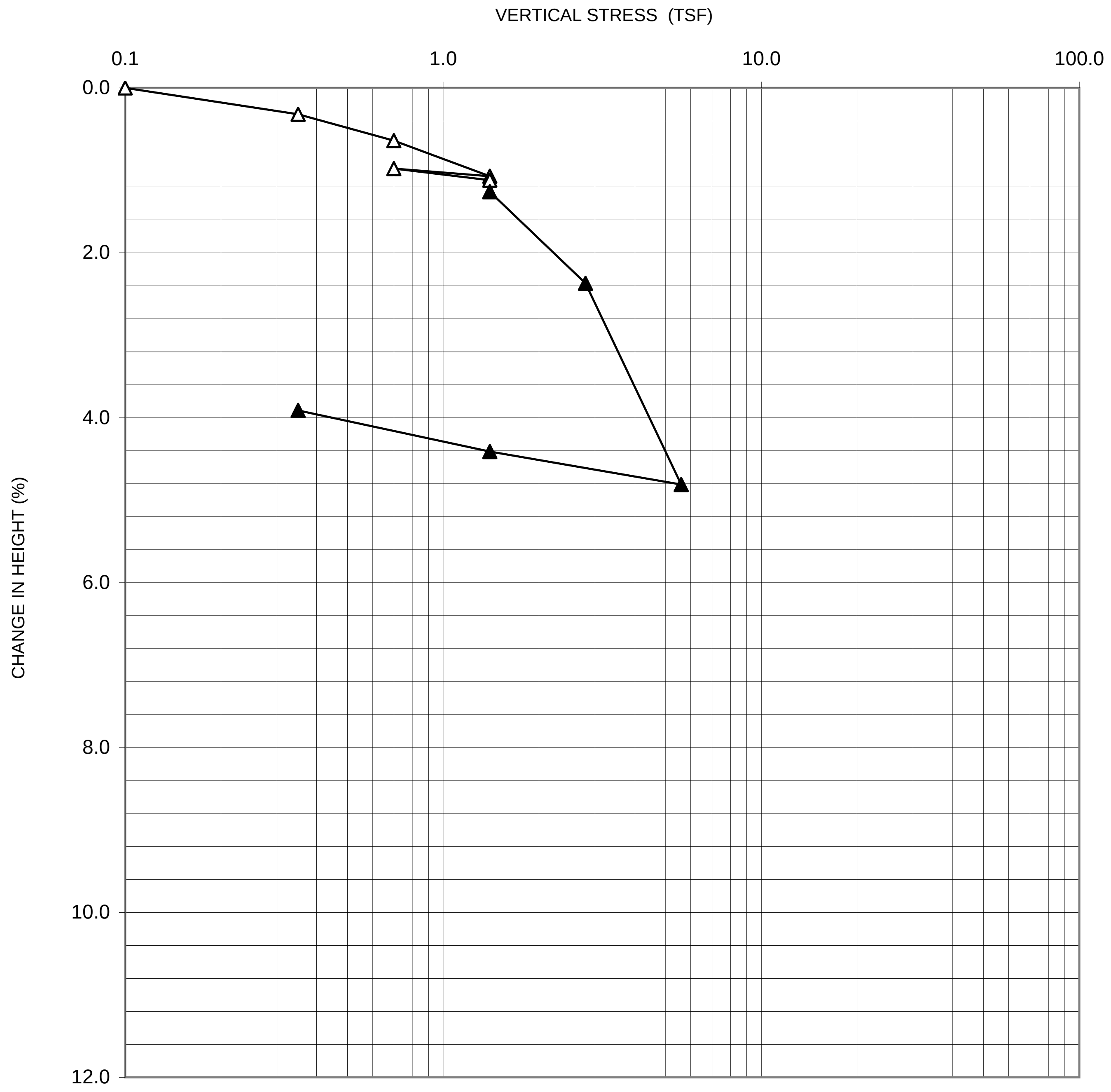
CONSOLIDATION TEST CURVE



PROJECT NO.: 18060-01

SOIL DESCRIPTIONS: BROWN CLAYEY SAND (SC)

BORING NO./LOCATION : KB - 9

DEPTH / ELEV. : 35'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	10.7	104.5	47.6	0.601
FINAL	0.9609	19.8	108.7	98.3	0.539

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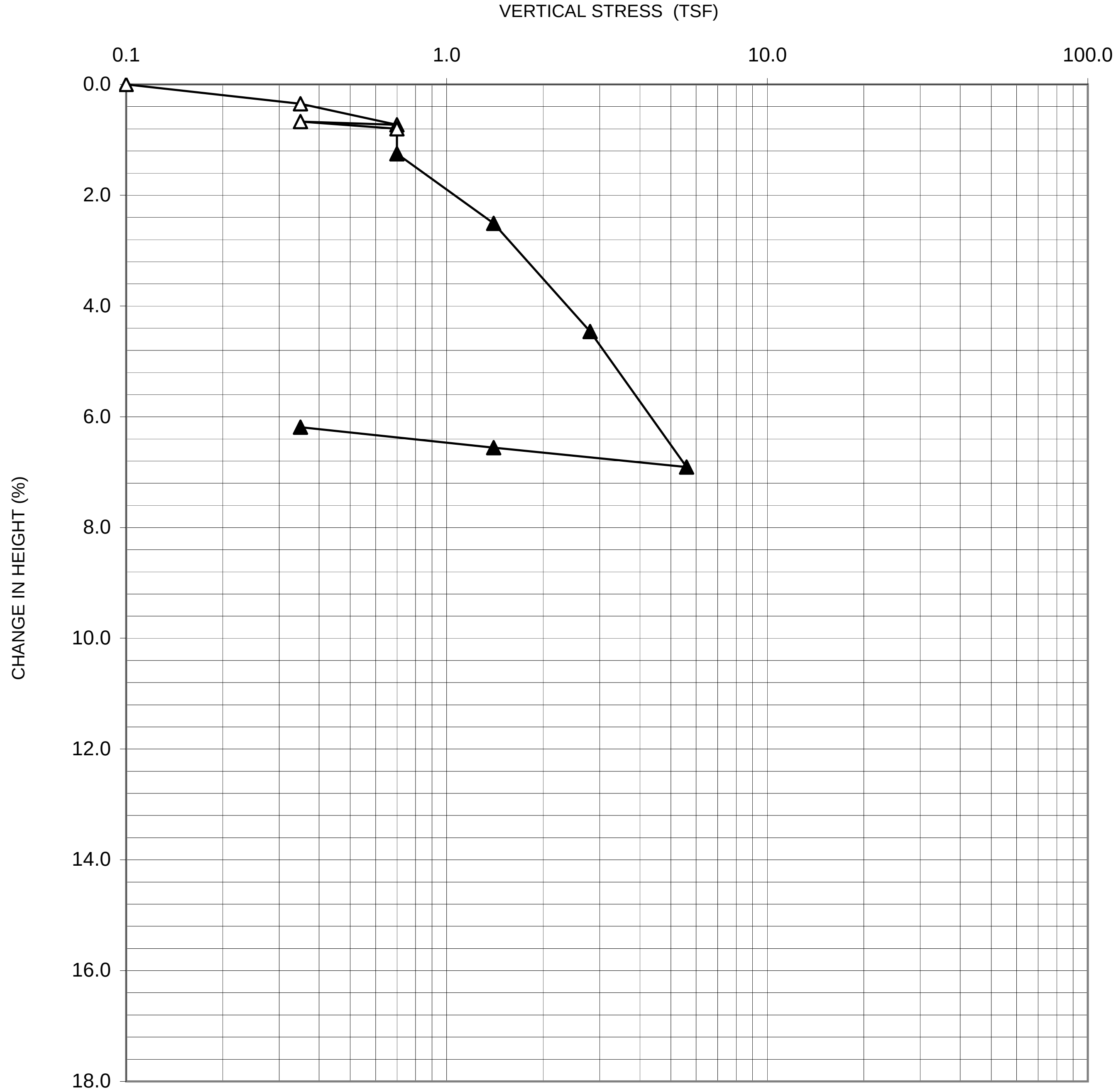

PROJECT NO.: 18060-01

SOIL DESCRIPTIONS: BROWN CLAYEY SAND (SC)

BORING NO./LOCATION : KB - 10

DEPTH / ELEV. : 15'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	7.3	111.7	39.6	0.497
FINAL	0.9381	17.7	119.0	117.4	0.405

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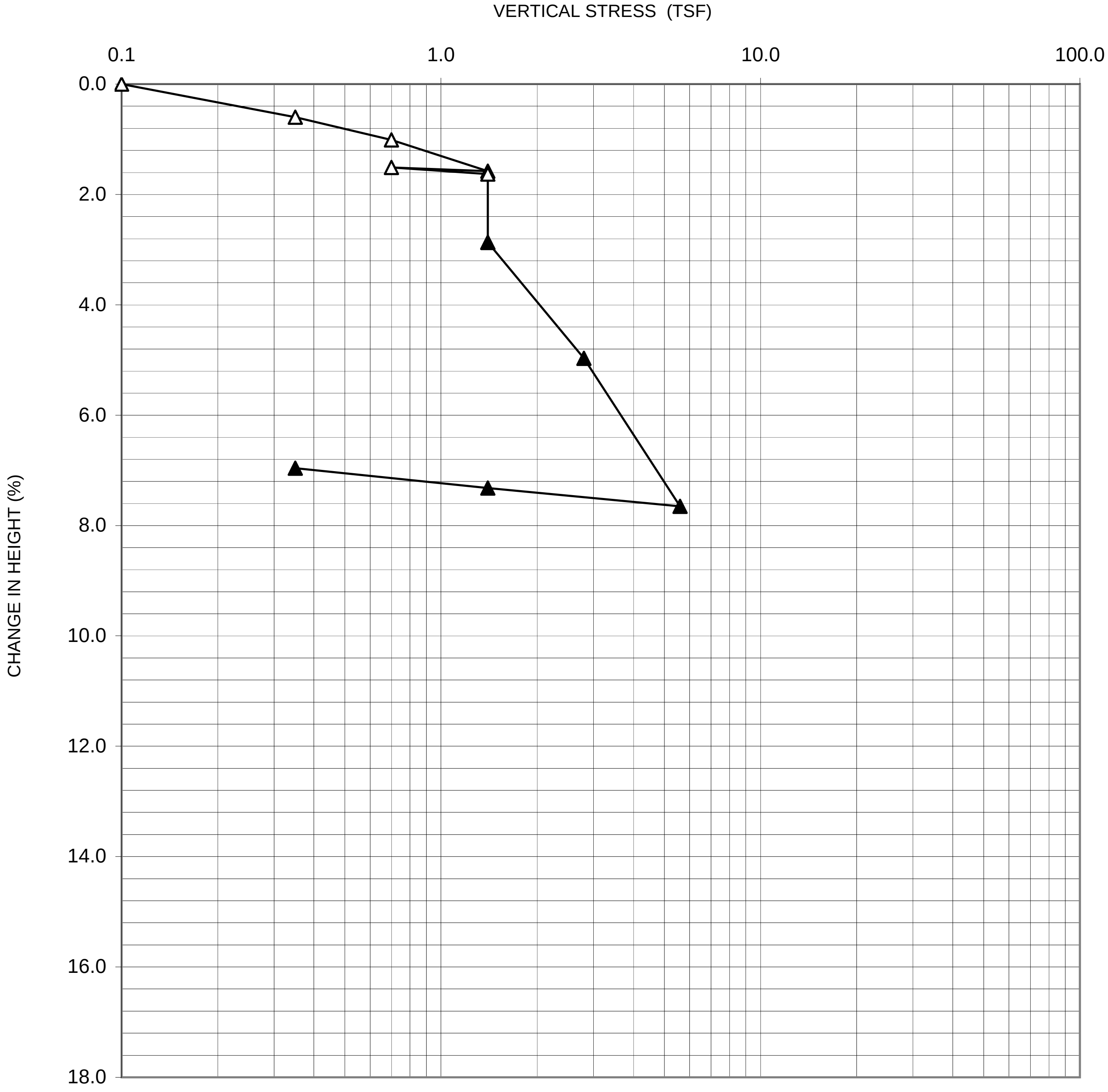

PROJECT NO.: 18060-00

SOIL DESCRIPTIONS: BROWN CLAYEY SAND (SC)

BORING NO./LOCATION : KB - 10

DEPTH / ELEV. : 25'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	10.1	103.2	43.8	0.620
FINAL	0.9304	22.7	110.9	119.8	0.508

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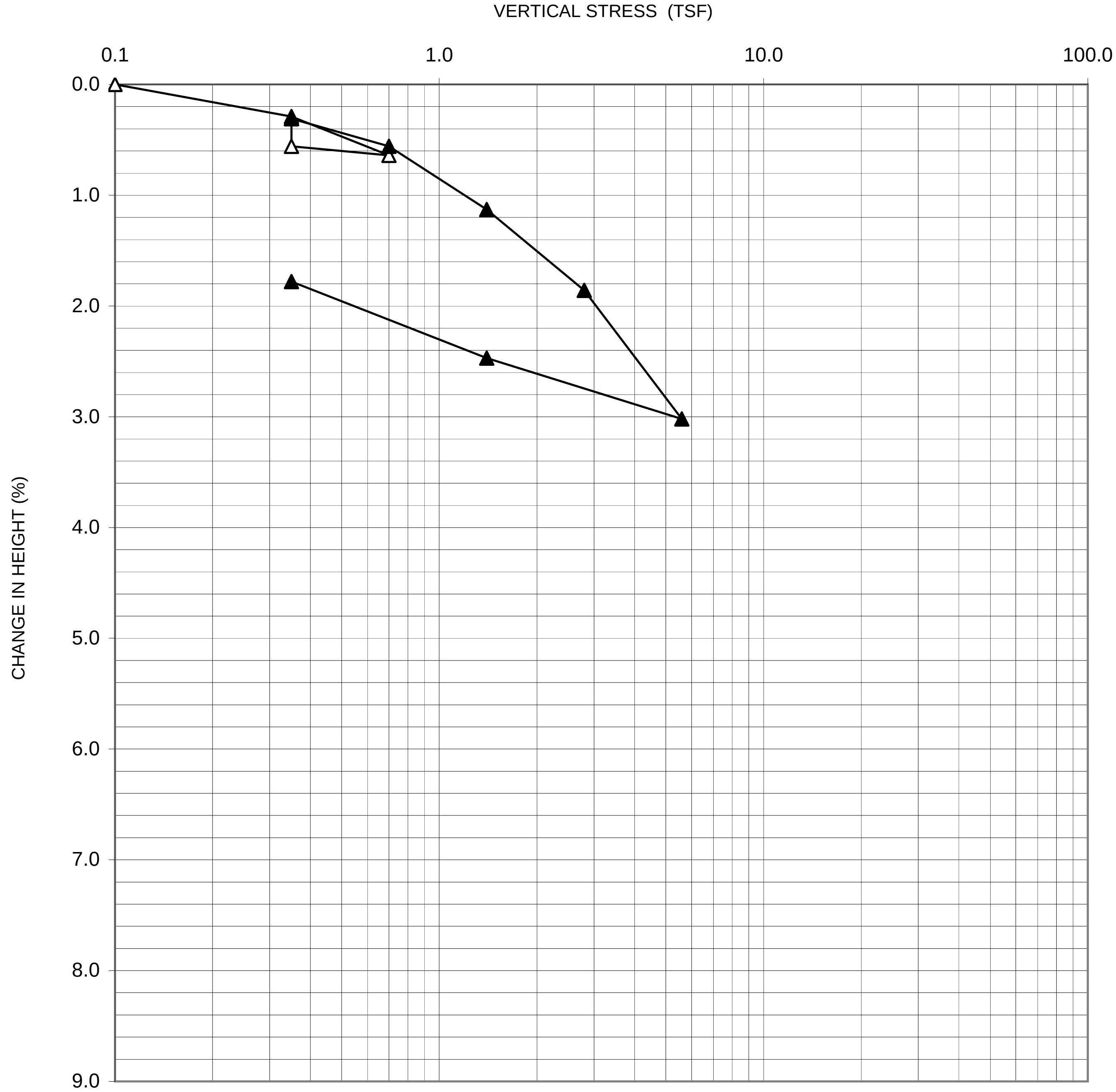
CONSOLIDATION TEST CURVE



PROJECT NO.: 18060-01

SOIL DESCRIPTIONS: OLIVE BROWN CLAYEY SAND (SC)

BORING NO./LOCATION : KTP - 2

DEPTH / ELEV. : 6'

LIQUID LIMIT : -

SPECIFIC GRAVITY : 2.68 (Assumed)

PLASTIC LIMIT: -

REMARKS :

	SPECIMEN HEIGHT (INCHES)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SATURATION (%)	VOID RATIO
INITIAL	1.0000	14.3	104.5	64.1	0.600
FINAL	0.9822	22.7	106.4	106.2	0.572

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CONSOLIDATION TEST CURVE

Project Name : JACK RABBIT TRAIL
Project No. : 18060-01
Boring / Sample No : B - 2 / KB - 6
Depth : 0' - 5' (ft.)
Tested By : RB
Date: 16-Jul-19
Sample Descriptions / Classification : DK BROWN CLAYEY SAND (SC)

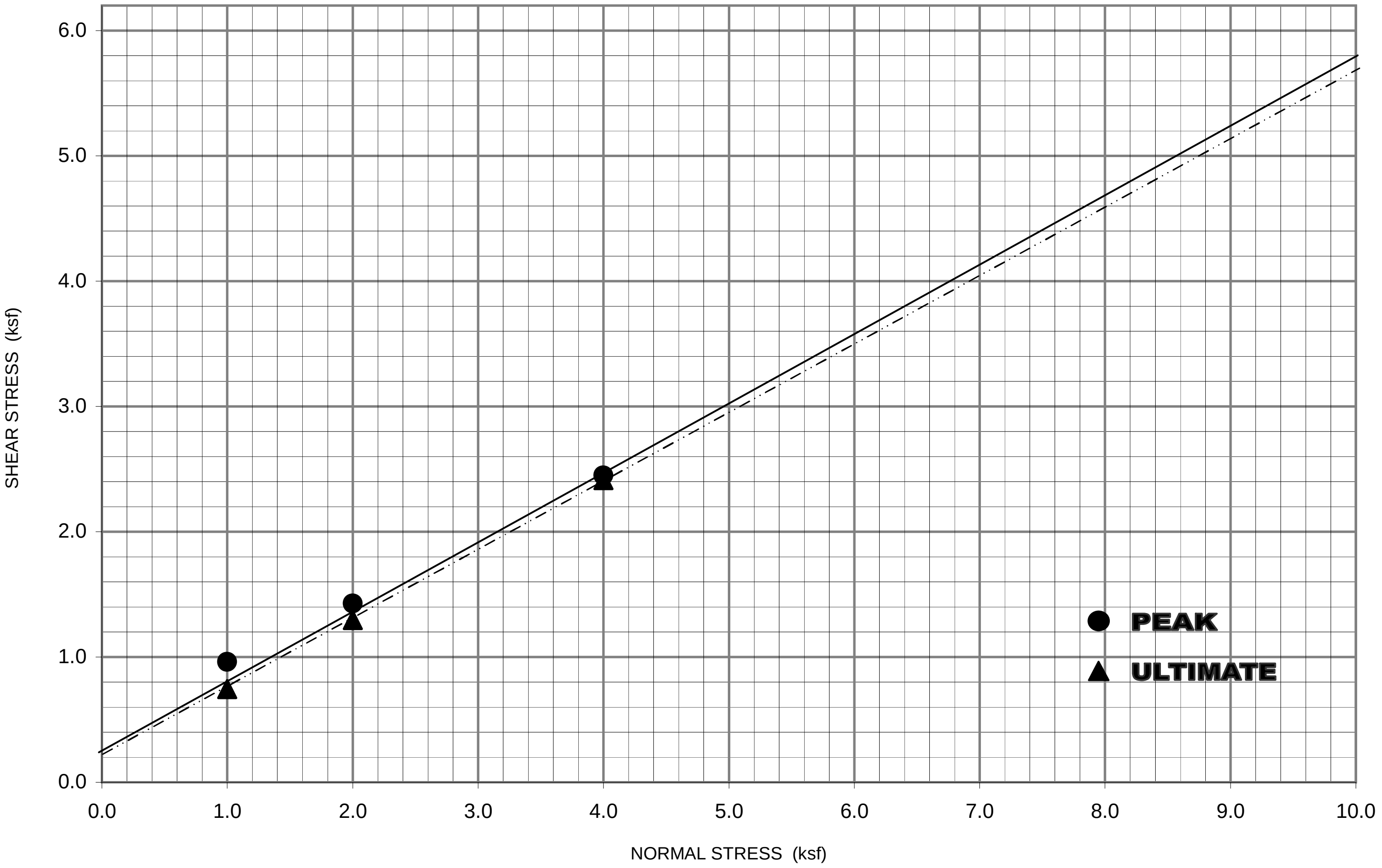
Applied Normal Load	(ksf)	1.0		2.0		4.0	
Shear Stress,(Peak)	(ksf)	0.960		1.428		2.448	
Shear Stress,(Ultimate)	(ksf)	0.744		1.296		2.412	
Density and Saturation		Initial	Final	Initial	Final	Initial	Final
Wet Weight of Soil + Ring	(gms)	196.32	203.02	197.2	204.88	196.81	203.48
Dry Weight of Soil + Ring	(gms)		181.66		182.54		182.15
Weight of Water	(gms)	-	46.54	-	47.28	-	45.81
Weight of Ring	(gms)	-	42.04	-	42.92	-	42.53
Weight of Dry Soil	(gms)	-	139.62	-	139.62	-	139.62
Moisture Content	(%)	10.5	33.3	10.5	33.9	10.5	32.8
Wet Density	(pcf)	128.8	134.4	128.8	135.2	128.8	134.3
Dry Density	(pcf)	-	100.8	-	101.0	-	101.2
Specific Gravity,G_s	(Assumed)	2.68					
Thickness of Specimen,	(in.)	1.00					
Degree of Saturation,	(%)	42.7	135.5	42.9	138.3	43.1	134.6
Void Ratio		-	0.659	-	0.656	-	0.653

Lateral Displacement, d_h 0.36 (in.)
Displacement Rate, d_r 0.05 (in./min.)
Elapsed Time of Test, t_e 7.20 (min.)

Specimen :
Undisturbed : -
Remolded : X
Reconstituted : -

	PEAK	ULTIMATE
Cohesion,c (psf)	250	200
Friction Angle, ϕ	29	29

Remarks : SAMPLE REMOLDED TO 90% OF (129.5 PCF @ 10.5%)



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DIRECT SHEAR TEST
(ASTM D3080)

Project Name : JACK RABBIT TRAIL
Project No. : 18060-00
Boring / Sample No : B - 4 / KB - 4
Depth : 0' - 5' (ft.)
Tested By : RB
Date: 9-Jul-19
Sample Descriptions / Classification : DK. BROWN CLAYEY SAND (SC)

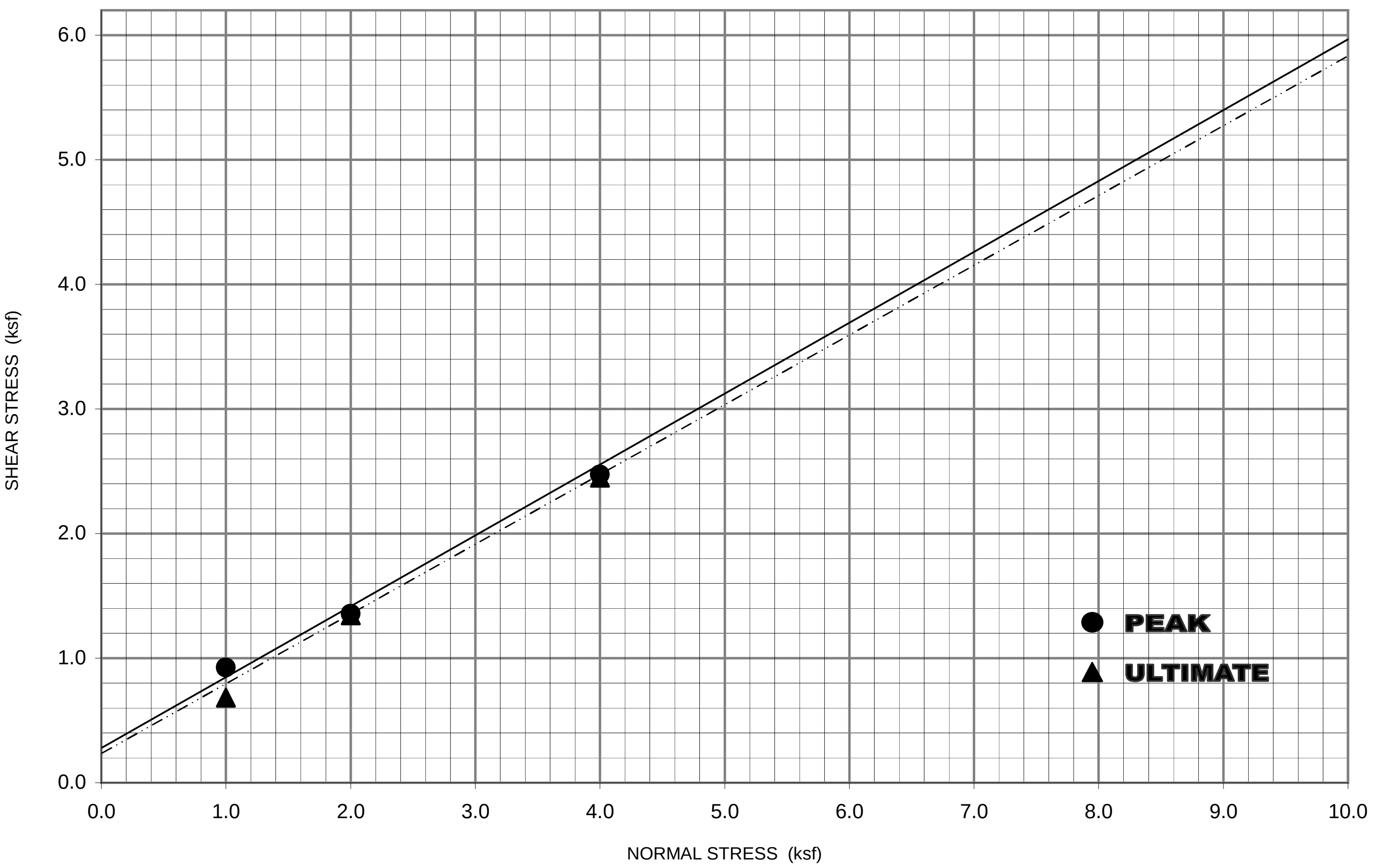
Applied Normal Load	(ksf)	1.0		2.0		4.0	
Shear Stress,(Peak)	(ksf)	0.924		1.356		2.472	
Shear Stress,(Ultimate)	(ksf)	0.684		1.344		2.448	
Density and Saturation		Initial	Final	Initial	Final	Initial	Final
Wet Weight of Soil + Ring	(gms)	198.07	206.36	199.88	208.53	196.33	205.13
Dry Weight of Soil + Ring	(gms)		185.36		187.17		183.78
Weight of Water	(gms)	-	46.54	-	47.28	-	45.81
Weight of Ring	(gms)	-	44.12	-	45.93	-	44.38
Weight of Dry Soil	(gms)	-	141.24	-	141.24	-	139.40
Moisture Content	(%)	9.0	33.0	9.0	33.5	9.0	32.9
Wet Density	(pcf)	128.5	135.4	128.5	135.7	126.9	134.2
Dry Density	(pcf)	-	101.9	-	101.7	-	101.0
Specific Gravity,G_s	(Assumed)	2.68					
Thickness of Specimen,	(in.)	1.00					
Degree of Saturation,	(%)	37.6	137.6	37.4	139.2	36.8	134.3
Void Ratio		-	0.642	-	0.645	-	0.656

Lateral Displacement, d_h 0.36 (in.)
Displacement Rate, d_r 0.05 (in./min.)
Elapsed Time of Test, t_e 7.20 (min.)

Specimen : Undisturbed : -
Remolded : X
Reconstituted : -

	PEAK	ULTIMATE
Cohesion,c (psf)	250	200
Friction Angle, ϕ	30	29

Remarks : SAMPLE REMOLDED
TO 90% OF (131.0 PCF @ 9.0%)



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Irvine, Ca. 92614
Tel: (949)797-6241 Fax: (949)797-6260

DIRECT SHEAR TEST

(ASTM D3080)

Project Name : JACK RABBIT TRAIL

Project No. : 18060-01

Boring / Sample No : B - 5 / KB - 1

Depth : 0' - 5' (ft.)

Tested By : RB

Date: 23-Jul-19

Sample Descriptions / Classification : DK. BROWN CLAYEY SAND (SC)

Applied Normal Load	(ksf)	1.0		2.0		4.0	
Shear Stress,(Peak)	(ksf)	0.924		1.320		2.328	
Shear Stress,(Ultimate)	(ksf)	0.672		1.224		2.328	
Density and Saturation		Initial	Final	Initial	Final	Initial	Final
Wet Weight of Soil + Ring	(gms)	197.51	204.07	197.94	205.22	197.84	205.39
Dry Weight of Soil + Ring	(gms)		182.96		183.39		183.29
Weight of Water	(gms)	-	46.54	-	47.28	-	45.81
Weight of Ring	(gms)	-	44.42	-	44.85	-	44.75
Weight of Dry Soil	(gms)	-	138.54	-	138.54	-	138.54
Moisture Content	(%)	10.5	33.6	10.5	34.1	10.5	33.1
Wet Density	(pcf)	127.8	133.3	127.8	133.9	127.8	134.1
Dry Density	(pcf)	-	99.8	-	99.8	-	100.8
Specific Gravity,G_s	(Assumed)	2.68					
Thickness of Specimen,	(in.)	1.00					
Degree of Saturation,	(%)	41.6	133.1	41.6	135.3	42.7	134.3
Void Ratio		-	0.676	-	0.676	-	0.660

Lateral Displacement, d_h 0.36 (in.)

Displacement Rate, d_r 0.05 (in./min.)

Elapsed Time of Test, t_e 7.20 (min.)

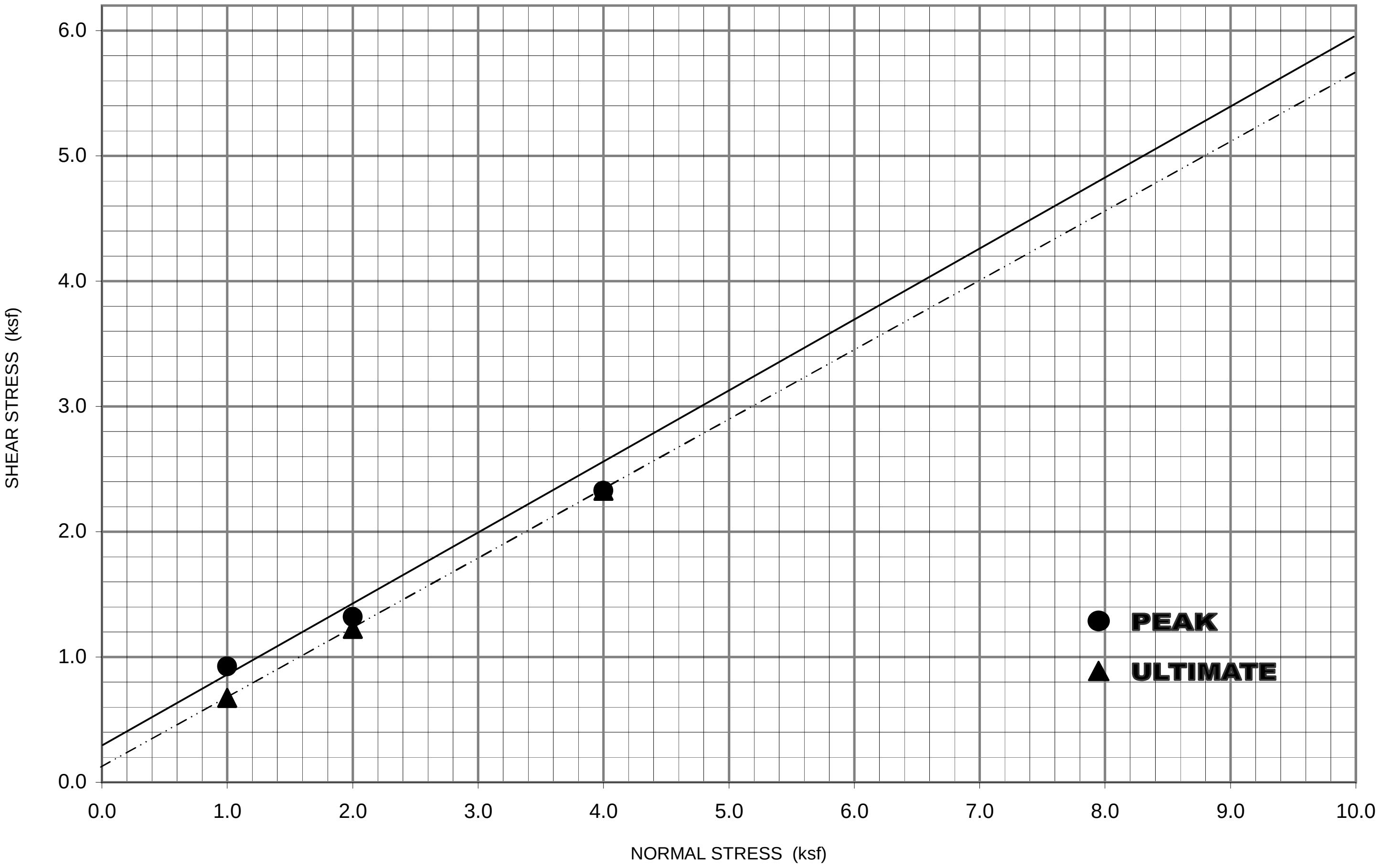
Specimen : Undisturbed : -

Remolded : X

Reconstituted : -

	PEAK	ULTIMATE
Cohesion,c (psf)	350	150
Friction Angle, ϕ	29	29

Remarks : SAMPLE REMOLDED TO 90% OF (128.5 PCF @ 10.5%)



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DIRECT SHEAR TEST

(ASTM D3080)

Project Name : JACK RABBIT TRAIL

Project No. : 18060-01

Boring / Sample No : B - 7 / KB - 9

Depth : 0' - 5' (ft.)

Tested By : RB

Date: 23-Jul-19

Sample Descriptions / Classification : DK. BROWN CLAYEY SAND (SC)

Applied Normal Load (ksf)	**1.0**		**2.0**		**4.0**	
Shear Stress,(Peak) (ksf)	0.780		1.344		2.352	
Shear Stress,(Ultimate) (ksf)	0.672		1.236		2.316	
Density and Saturation	Initial	Final	Initial	Final	Initial	Final
Wet Weight of Soil + Ring (gms)	200.57	207.75	201.14	207.68	201.15	208.59
Dry Weight of Soil + Ring (gms)		187.10		187.67		187.68
Weight of Water (gms)	-	46.54	-	47.28	-	45.81
Weight of Ring (gms)	-	45.33	-	45.90	-	45.91
Weight of Dry Soil (gms)	-	141.77	-	141.77	-	141.77
Moisture Content (%)	9.5	32.8	9.5	33.3	9.5	32.3
Wet Density (pcf)	129.6	135.6	129.6	135.0	129.6	135.8
Dry Density (pcf)	-	102.1	-	101.3	-	102.6
Specific Gravity,G_s (Assumed)	2.68					
Thickness of Specimen, (in.)	1.00					
Degree of Saturation, (%)	39.9	137.8	39.1	137.2	40.4	137.5
Void Ratio	-	0.638	-	0.651	-	0.630

Lateral Displacement, d_h	0.36	(in.)
Displacement Rate, d_r	0.05	(in./min.)
Elapsed Time of Test, t_e	7.20	(min.)

Specimen :

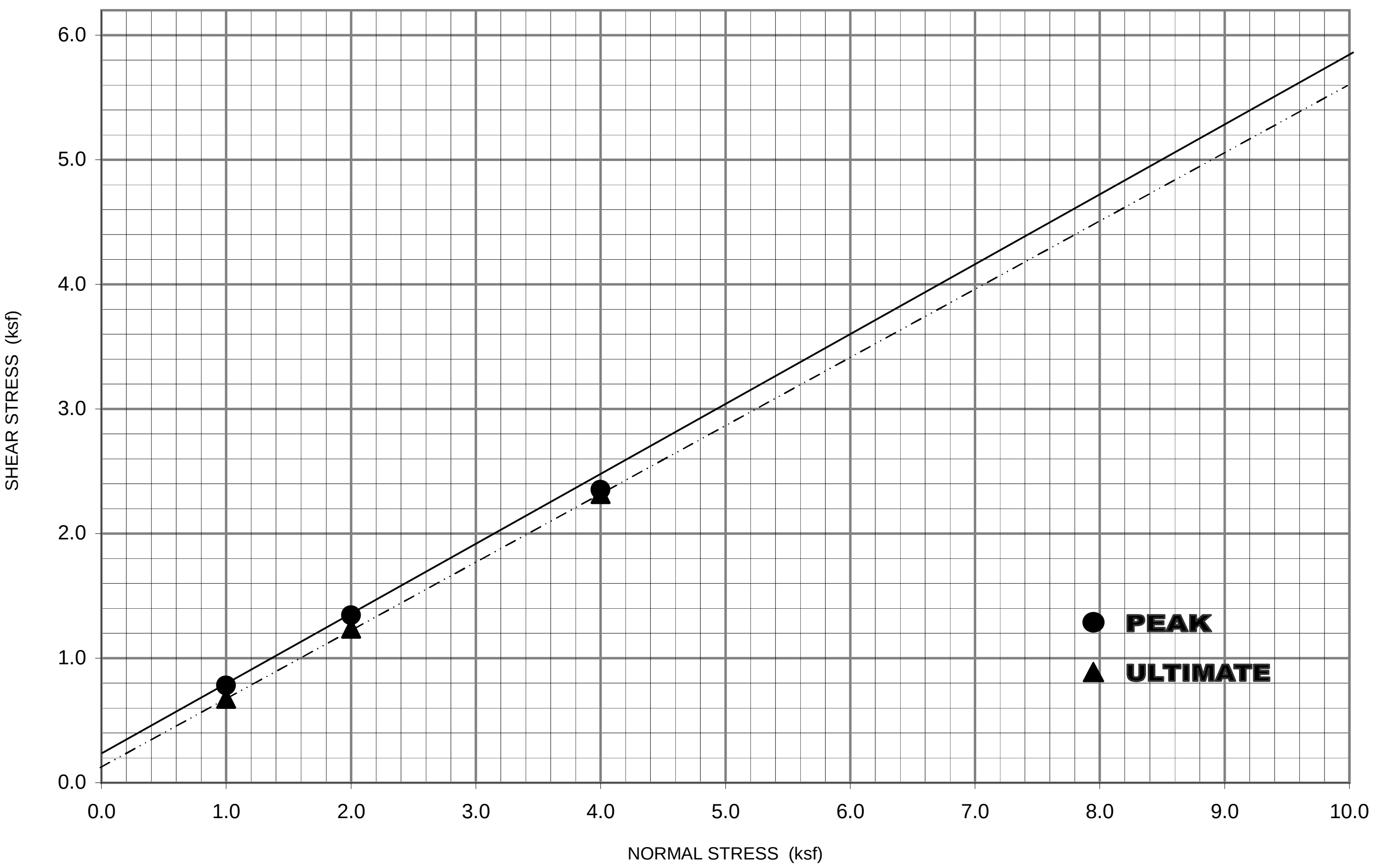
Undisturbed : -

Remolded : X

Reconstituted : -

	PEAK	ULTIMATE
Cohesion,c (psf)	300	150
Friction Angle, ϕ	29	29

Remarks : SAMPLE REMOLDED TO 90% OF (131.5 PCF @ 9.5%)



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DIRECT SHEAR TEST

(ASTM D3080)

Project Name : JACK RABBIT TRAIL
Project No. : 18060-01

Boring / Sample No : B - 11 / KTP-3
Depth : 6' (ft.)
Tested By : RB
Date: 24-Jul-19

Sample Descriptions / Classification : REDDISH BROWN SANDY CLAY (CL)

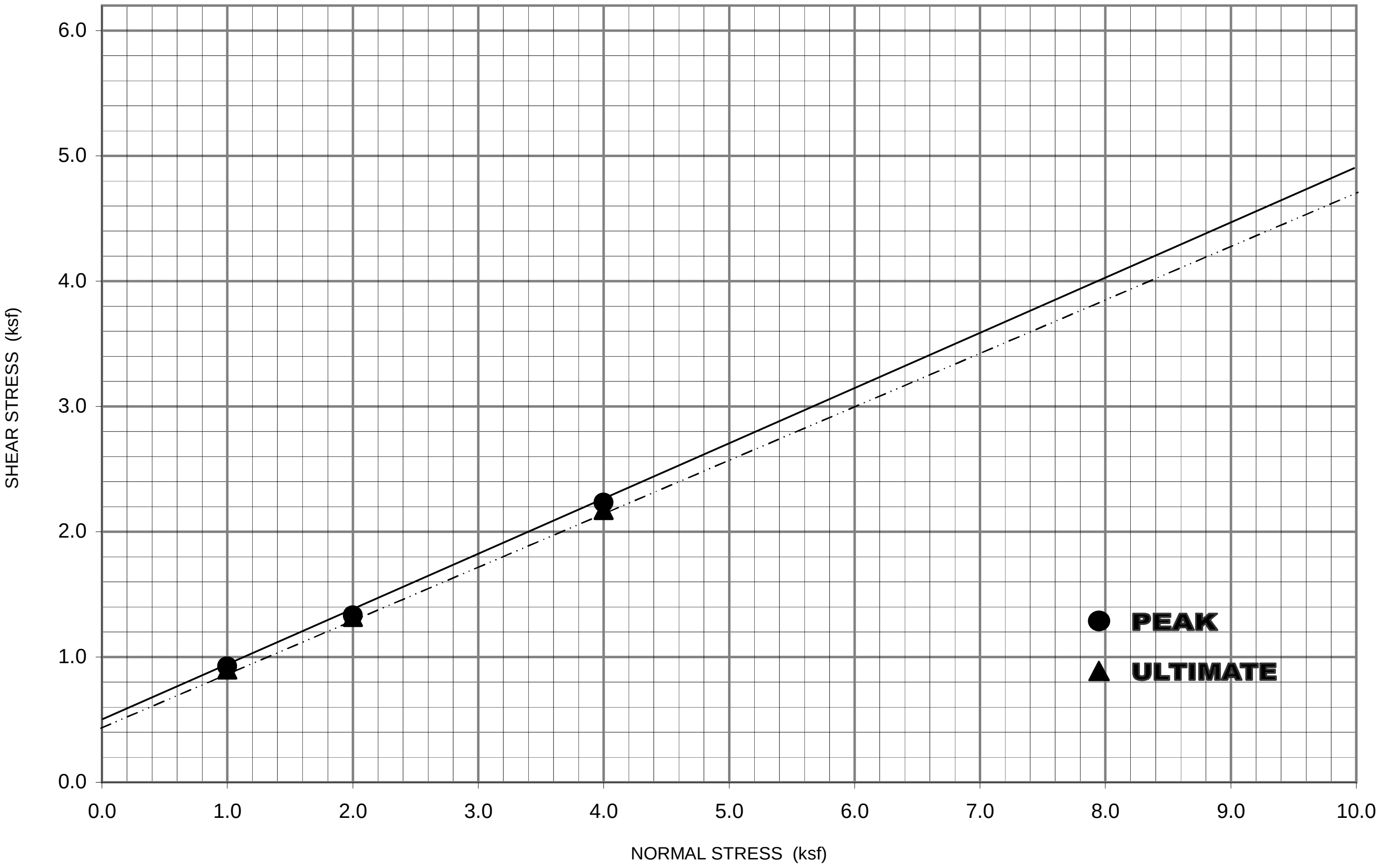
Applied Normal Load	(ksf)	1.0		2.0		4.0	
Shear Stress,(Peak)	(ksf)	0.924		1.332		2.232	
Shear Stress,(Ultimate)	(ksf)	0.900		1.320		2.172	
Density and Saturation		Initial	Final	Initial	Final	Initial	Final
Wet Weight of Soil + Ring	(gms)	195.39	204.04	195.23	204.01	194.96	203.91
Dry Weight of Soil + Ring	(gms)		179.35		179.19		178.92
Weight of Water	(gms)	-	46.54	-	47.28	-	45.81
Weight of Ring	(gms)	-	45.66	-	45.5	-	45.23
Weight of Dry Soil	(gms)	-	133.69	-	133.69	-	133.69
Moisture Content	(%)	12.0	34.8	12.0	35.4	12.0	34.3
Wet Density	(pcf)	125.0	132.2	125.0	132.3	125.0	132.5
Dry Density	(pcf)	-	98.1	-	97.7	-	98.6
Specific Gravity,G_s	(Assumed)	2.68					
Thickness of Specimen,	(in.)	1.00					
Degree of Saturation,	(%)	45.6	132.3	45.2	133.3	46.3	132.1
Void Ratio		-	0.705	-	0.711	-	0.695

Lateral Displacement, d_h 0.36 (in.)
Displacement Rate, d_r 0.05 (in./min.)
Elapsed Time of Test, t_e 7.20 (min.)

Specimen : Undisturbed : -
Remolded : X
Reconstituted : -

	PEAK	ULTIMATE
Cohesion,c (psf)	500	400
Friction Angle, ϕ	24	23

Remarks : SAMPLE REMOLDED TO 90% OF (124.0 PCF @ 12.0%)



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DIRECT SHEAR TEST

(ASTM D3080)

Project Name : JACK RABBIT TRAIL

Project No. : 18060-01

Boring / Sample No : B - 13 / KTP - 7

Depth : 4' - 6' (ft.)

Tested By : RB

Date: 29-Jul-19

Sample Descriptions / Classification : LT. BROWN SILTY FINE SAND (SM)

Applied Normal Load (ksf)	1.0		2.0		4.0	
Shear Stress,(Peak) (ksf)	0.708		1.188		2.244	
Shear Stress,(Ultimate) (ksf)	0.624		1.188		2.244	
Density and Saturation	Initial	Final	Initial	Final	Initial	Final
Wet Weight of Soil + Ring (gms)	191.98	200.61	192.02	200.63	191.74	199.86
Dry Weight of Soil + Ring (gms)		175.74		175.78		175.50
Weight of Water (gms)	-	46.54	-	47.28	-	45.81
Weight of Ring (gms)	-	45.83	-	45.87	-	45.59
Weight of Dry Soil (gms)	-	129.91	-	129.91	-	129.91
Moisture Content (%)	12.5	35.8	12.5	36.4	12.5	35.3
Wet Density (pcf)	122.0	129.2	122.0	129.2	122.0	128.8
Dry Density (pcf)	-	95.1	-	94.7	-	95.2
Specific Gravity,G_s (Assumed)	2.68					
Thickness of Specimen, (in.)	1.00					
Degree of Saturation, (%)	44.2	126.6	43.7	127.4	44.3	124.9
Void Ratio	-	0.758	-	0.766	-	0.757

Lateral Displacement, d_h 0.36 (in.)

Displacement Rate, d_r 0.05 (in./min.)

Elapsed Time of Test, t_e 7.20 (min.)

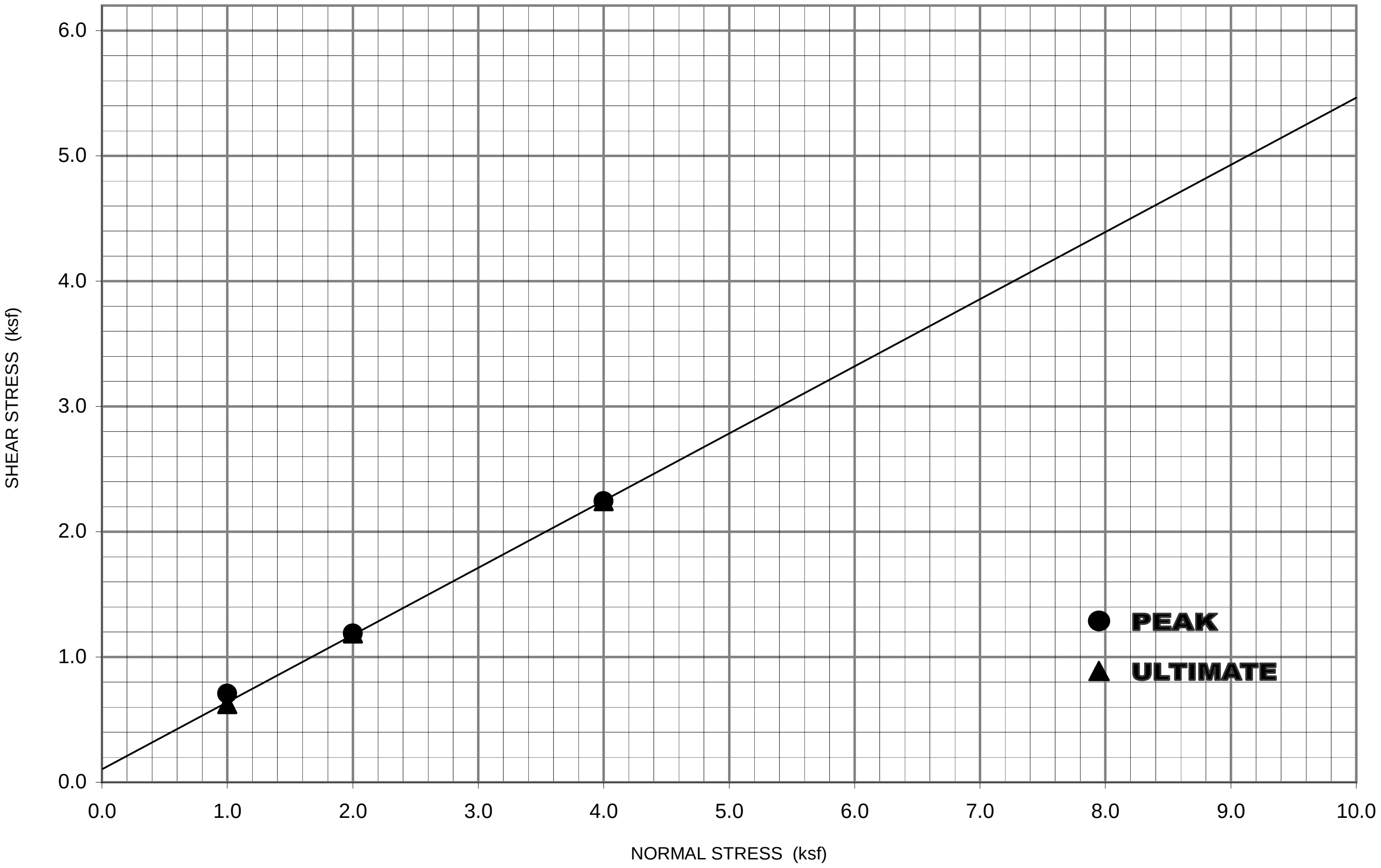
Specimen : Undisturbed : -

Remolded : x

Reconstituted : -

	PEAK	ULTIMATE
Cohesion,c (psf)	100	100
Friction Angle, ϕ	28	28

Remarks : SAMPLE REMOLDED TO 90% OF (120.5 PCF @ 12.5%)



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DIRECT SHEAR TEST
(ASTM D3080)

PROJECT NAME : JACK RABBIT TRAIL
PROJECT NUMBER : 18060-01
TRACT NUMBER :
TESTED BY : RB DATE : 17-Jul-19
LOT NUMBER :
SAMPLED BY: DKL DATE : 25-Jun-19
SAMPLE NO. :
LOCATION : B - 1 / KB - 5 @ 0' - 5'
SOIL DESCRIPTIONS / CLASSIFICATION : DK. BROWN CLAYEY SAND (SC)

TRIAL NUMBER		1	2	3	4
WET WT. OF SOIL + RING	(g)	619.35	627.48		
WEIGHT OF RING	(g)	204.33	204.33		
WET WEIGHT OF SOIL	(g)	415.02	423.15		
FACTOR		0.3030	0.3030		
WET DENSITY	(pcf)	125.8	128.2		
DRY DENSITY	(pcf)	117.4	119.0		
DEGREE OF SATURATION	(%)	44.0	50.1		

MOISTURE DETERMINATION

WET WEIGHT OF SOIL	(g)	347.58	321.05		
DRY WEIGHT OF SOIL	(g)	324.59	298.10		
MOISTURE CONTENT	(%)	7.1	7.7		

RACK NO. : 4
SURCHARGE : 144 psf

FINAL DENSITY & SATURATION

WET WT. + RING	(g)	
DRY WT. + RING	(g)	
MOISTURE CONTENT	(%)	
SAMPLE LENGTH	(cm)	
SAMPLE AREA	(cm^2)	
VOLUME	(cc)	
WT. OF RING	(g)	
DRY DENSITY	(pcf)	
SPEC.GRAVITY (assumed)		2.70
SATURATION	(%)	
% RETAINED ON #4 SIEVE		

DATE	TIME	ELAPSED TIME (min.)	DIAL READING (in.)	DEFLECTION (in.)
17-Jul	8:38		0.443	
18-Jul	5:07		0.466	
18-Jul	10:40		0.466	0.023

E. I. 23
SO_4 30 ppm

REMARKS :

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EXPANSION INDEX
(UBC 18-2)

PROJECT NAME : JACK RABBIT TRAIL
PROJECT NUMBER : 18060-01
TRACT NUMBER :
TESTED BY : RB DATE : 17-Jul-19
LOT NUMBER :
SAMPLED BY: DKL DATE : 25-Jun-19
SAMPLE NO. :
LOCATION : B - 3 / KB - 3 @ 0' - 5'
SOIL DESCRIPTIONS / CLASSIFICATION : DK. BROWN CLAYEY SAND (SC)

TRIAL NUMBER		1	2	3	4
WET WT. OF SOIL + RING	(g)	644.75	617.66		
WEIGHT OF RING	(g)	204.45	204.45		
WET WEIGHT OF SOIL	(g)	440.30	413.21		
FACTOR		0.3030	0.3030		
WET DENSITY	(pcf)	133.4	125.2		
DRY DENSITY	(pcf)	120.6	115.6		
DEGREE OF SATURATION	(%)	72.2	49.0		

MOISTURE DETERMINATION

WET WEIGHT OF SOIL	(g)	320.50	307.16		
DRY WEIGHT OF SOIL	(g)	289.76	283.62		
MOISTURE CONTENT	(%)	10.6	8.3		

RACK NO. : 3
SURCHARGE : 144 psf

FINAL DENSITY & SATURATION

WET WT. + RING	(g)	
DRY WT. + RING	(g)	
MOISTURE CONTENT	(%)	
SAMPLE LENGTH	(cm)	
SAMPLE AREA	(cm^2)	
VOLUME	(cc)	
WT. OF RING	(g)	
DRY DENSITY	(pcf)	
SPEC.GRAVITY (assumed)		2.70
SATURATION	(%)	
% RETAINED ON #4 SIEVE		

DATE	TIME	ELAPSED TIME (min.)	DIAL READING (in.)	DEFLECTION (in.)
17-Jul	7:54		0.589	
18-Jul	5:07		0.626	
18-Jul	10:38		0.626	0.037
E. I.	37		SO_4	36 ppm

REMARKS :

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EXPANSION INDEX

(UBC 18-2)

PROJECT NAME : JACK RABBIT TRAIL

PROJECT NUMBER : 18060-01

TRACT NUMBER :

TESTED BY : RB DATE : 17-Jul-19

LOT NUMBER :

SAMPLED BY: DKL DATE : 25-Jun-19

SAMPLE NO. :

LOCATION : B - 6 / KB - 2 @ 0' - 5'

SOIL DESCRIPTIONS / CLASSIFICATION : DK. BROWN CLAYEY SAND (SC)

TRIAL NUMBER		1	2	3	4
WET WT. OF SOIL + RING	(g)	630.27	623.81		
WEIGHT OF RING	(g)	204.42	204.42		
WET WEIGHT OF SOIL	(g)	425.85	419.39		
FACTOR		0.3030	0.3030		
WET DENSITY	(pcf)	129.0	127.1		
DRY DENSITY	(pcf)	118.9	117.7		
DEGREE OF SATURATION	(%)	55.2	50.0		

MOISTURE DETERMINATION

WET WEIGHT OF SOIL	(g)	328.73	305.41		
DRY WEIGHT OF SOIL	(g)	302.92	282.79		
MOISTURE CONTENT	(%)	8.5	8.0		

RACK NO. : 2

SURCHARGE : 144 psf

FINAL DENSITY & SATURATION

WET WT. + RING	(g)	
DRY WT. + RING	(g)	
MOISTURE CONTENT	(%)	
SAMPLE LENGTH	(cm)	
SAMPLE AREA	(cm^2)	
VOLUME	(cc)	
WT. OF RING	(g)	
DRY DENSITY	(pcf)	
SPEC.GRAVITY (assumed)		2.70
SATURATION	(%)	
% RETAINED ON #4 SIEVE		

DATE	TIME	ELAPSED TIME (min.)	DIAL READING (in.)	DEFLECTION (in.)
17-Jul	7:34		0.234	
18-Jul	5:07		0.255	
18-Jul	10:38		0.255	0.021

E. I. 21

SO_4 9 ppm

REMARKS :

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EXPANSION INDEX

(UBC 18-2)

PROJECT NAME : JACK RABBIT TRAIL
PROJECT NUMBER : 18060-01
TRACT NUMBER :
TESTED BY : RB DATE : 16-Jul-19
LOT NUMBER :
SAMPLED BY: DKL DATE : 25-Jun-19
SAMPLE NO. :
LOCATION : B - 8 / KB - 10 @ 0' - 5'
SOIL DESCRIPTIONS / CLASSIFICATION : DK. BROWN CLAYEY SAND (SC)

TRIAL NUMBER		1	2	3	4
WET WT. OF SOIL + RING	(g)	628.32	619.06		
WEIGHT OF RING	(g)	203.61	203.61		
WET WEIGHT OF SOIL	(g)	424.71	415.45		
FACTOR		0.3030	0.3030		
WET DENSITY	(pcf)	128.7	125.9		
DRY DENSITY	(pcf)	118.0	116.3		
DEGREE OF SATURATION	(%)	57.1	49.4		

MOISTURE DETERMINATION

WET WEIGHT OF SOIL	(g)	335.51	311.46		
DRY WEIGHT OF SOIL	(g)	307.66	287.86		
MOISTURE CONTENT	(%)	9.1	8.2		

RACK NO. : 1
SURCHARGE : 144 psf

FINAL DENSITY & SATURATION

WET WT. + RING	(g)	
DRY WT. + RING	(g)	
MOISTURE CONTENT	(%)	
SAMPLE LENGTH	(cm)	
SAMPLE AREA	(cm^2)	
VOLUME	(cc)	
WT. OF RING	(g)	
DRY DENSITY	(pcf)	
SPEC.GRAVITY (assumed)		2.70
SATURATION	(%)	
% RETAINED ON #4 SIEVE		

DATE	TIME	ELAPSED TIME (min.)	DIAL READING (in.)	DEFLECTION (in.)
16-Jul	9:51		0.436	
16-Jul	11:43		0.459	
17-Jul	9:15		0.460	0.024

E. I. 24
SO_4 21 ppm

REMARKS :

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EXPANSION INDEX

(UBC 18-2)

PROJECT NAME : JACK RABBIT TRAIL
PROJECT NUMBER : 18060-01
TRACT NUMBER :
TESTED BY : RB DATE : 25-Jul-19
LOT NUMBER :
SAMPLED BY: DKL DATE : 28-Jun-19
SAMPLE NO. :
LOCATION : B - 13 / KTP - 7 @ 4' - 6'
SOIL DESCRIPTIONS / CLASSIFICATION : LT. BROWN SILTY FINE SAND (SM)

TRIAL NUMBER		1	2	3	4
WET WT. OF SOIL + RING	(g)	583.59	609.61		
WEIGHT OF RING	(g)	204.42	204.42		
WET WEIGHT OF SOIL	(g)	379.17	405.19		
FACTOR		0.3030	0.3030		
WET DENSITY	(pcf)	114.9	122.8		
DRY DENSITY	(pcf)	108.0	112.6		
DEGREE OF SATURATION	(%)	30.6	49.0		

MOISTURE DETERMINATION

WET WEIGHT OF SOIL	(g)	336.95	311.56		
DRY WEIGHT OF SOIL	(g)	316.88	285.83		
MOISTURE CONTENT	(%)	6.3	9.0		

RACK NO. : 2
SURCHARGE : 144 psf

FINAL DENSITY & SATURATION

WET WT. + RING	(g)	
DRY WT. + RING	(g)	
MOISTURE CONTENT	(%)	
SAMPLE LENGTH	(cm)	
SAMPLE AREA	(cm^2)	
VOLUME	(cc)	
WT. OF RING	(g)	
DRY DENSITY	(pcf)	
SPEC.GRAVITY (assumed)		2.70
SATURATION	(%)	
% RETAINED ON #4 SIEVE		

DATE	TIME	ELAPSED TIME (min.)	DIAL READING (in.)	DEFLECTION (in.)
25-Jul	10:47		0.255	
25-Jul	12:00		0.256	
26-Jul	12:20		0.256	0.001
E. I.	1		SO_4 12	ppm

REMARKS :

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EXPANSION INDEX

(UBC 18-2)

ANAHEIM TEST LAB, INC

197 Technology Drive, Unit D
Irvine, CA 92618
Phone (949) 336-6544

DATE: 07/03/2019

KLING CONSULTING GROUP, INC.
18008 SKY PARK CIRCLE, STE 250
IRVINE, CA 92614

P.O. NO. Verbal

LAB NO: C-3031

SPECIFICATION: CTM-417/422/643

MATERIAL: Soil

Project No.: 18060-00
Project: Jack Rabbit Trail

ANALYTICAL REPORT

CORROSION SERIES

SUMMARY OF DATA

	pH	SOLUBLE SULFATES per CT. 417 ppm	SOLUBLE CHLORIDES per CT. 422 ppm	MIN. RESISTIVITY per CT. 643 ohm-cm
B5/KB1 @ 0-5’	6.8	94	29	2,800

RESPECTFULLY SUBMITTED

WES BRIDGER LAB MANAGER

ANAHEIM TEST LAB, INC
197 Technology Drive, Unit D
Irvine, CA 92618
Phone (949) 336-6544

DATE: 07/12/2019

KLING CONSULTING GROUP, INC.
18008 SKY PARK CIRCLE, STE 250
IRVINE, CA 92614

P.O. NO. Verbal

LAB NO: C-3039

SPECIFICATION: CTM-417/422/643

MATERIAL: Soil

Project No.: 18060-01
Project: Jack Rabbit Trail

ANALYTICAL REPORT

CORROSION SERIES

SUMMARY OF DATA

	pH	SOLUBLE SULFATES per CT. 417 ppm	SOLUBLE CHLORIDES per CT. 422 ppm	MIN. RESISTIVITY per CT. 643 ohm-cm
B-1/KB-5 @ 0-5’	7.0	148	59	2,500

RESPECTFULLY SUBMITTED

WES BRIDGER LAB MANAGER

- ANALYSIS
- DESIGN

LaBelle • Marvin

PROFESSIONAL PAVEMENT ENGINEERING

A CALIFORNIA CORPORATION

- SOILS, ASPHALT TECHNOLOGY

July 11, 2019

RECEIVED
JUL 15 2019
KLING CONSULTING GROUP

Mr. Dante Domingo
Kling Consulting Group
18008 Sky Park Circle #250
Irvine, California 92614

Project No. 45094

Dear Mr. Domingo:

Testing of the bulk soil samples delivered to our laboratory on 7/9/2019 has been completed.

Reference:	J.N. 18060-01 (JB)
Project:	Jack Rabbit Trail
Samples:	B-9 / KB-7 @ 0'-5' B-10 / KB-8 @ 0'-5'

Data sheets are attached for your use and file. Any untested portion of the sample will be retained for a period of 60 days prior to disposal. The opportunity to be of service is sincerely appreciated and should you have any questions, kindly call.

Respectfully Submitted,

STEVEN R. MARVIN
NO. 30659

Steven R. Marvin
RCE 30659

SRM:jw
Enclosure

2700 S. GRAND AVENUE • SANTA ANA, CA 92705-5404 • (714) 546-3468 • FAX (714) 546-5841
INFO@LABELLEMARVIN.COM

LaBelle Marvin

R - VALUE DATA SHEET

PROJECT No. 45094
DATE: 7/11/2019

BORING NO. B-9 / KB-7 @ 0'-5'
Jack Rabbit Trail
P.N. 18060-01

SAMPLE DESCRIPTION: Brown Silty Fine Sand

R-VALUE TESTING DATA | CA TEST 301

	SPECIMEN ID		
	a	b	c
Mold ID Number	4	5	6
Water added, grams	75	55	39
Initial Test Water, %	12.7	10.7	9.2
Compact Gage Pressure,psi	70	185	350
Exudation Pressure, psi	171	296	553
Height Sample, Inches	2.62	2.57	2.43
Gross Weight Mold, grams	3121	3076	3079
Tare Weight Mold, grams	1957	1944	1955
Sample Wet Weight, grams	1164	1132	1124
Expansion, Inches x 10exp-4	5	26	68
Stability 2,000 lbs (160psi)	47 / 111	28 / 62	19 / 39
Turns Displacement	4.72	4.00	3.92
R-Value Uncorrected	19	50	66
R-Value Corrected	20	52	65
Dry Density, pcf	119.5	120.5	128.3

DESIGN CALCULATION DATA

Traffic Index Assumed:	4.0	4.0	4.0
G.E. by Stability	0.82	0.49	0.36
G. E. by Expansion	0.17	0.87	2.27

Equilibrium R-Value	**41** by EXPANSION	Examined & Checked: 7 /11/ 19
REMARKS:	Gf = 1.25 0.6% Retained on the 3/4" Sieve.	C 30659 Steven R. Marvin, RCE 30659

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

R-VALUE GRAPHICAL PRESENTATION

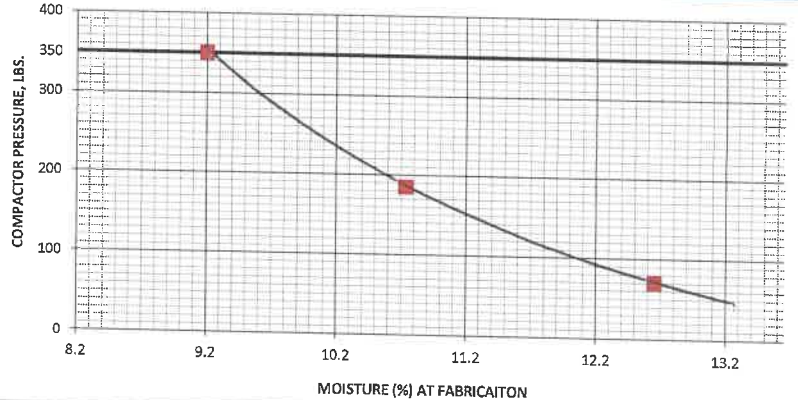
PROJECT NO. 45094

DATE: 7 /11/ 19

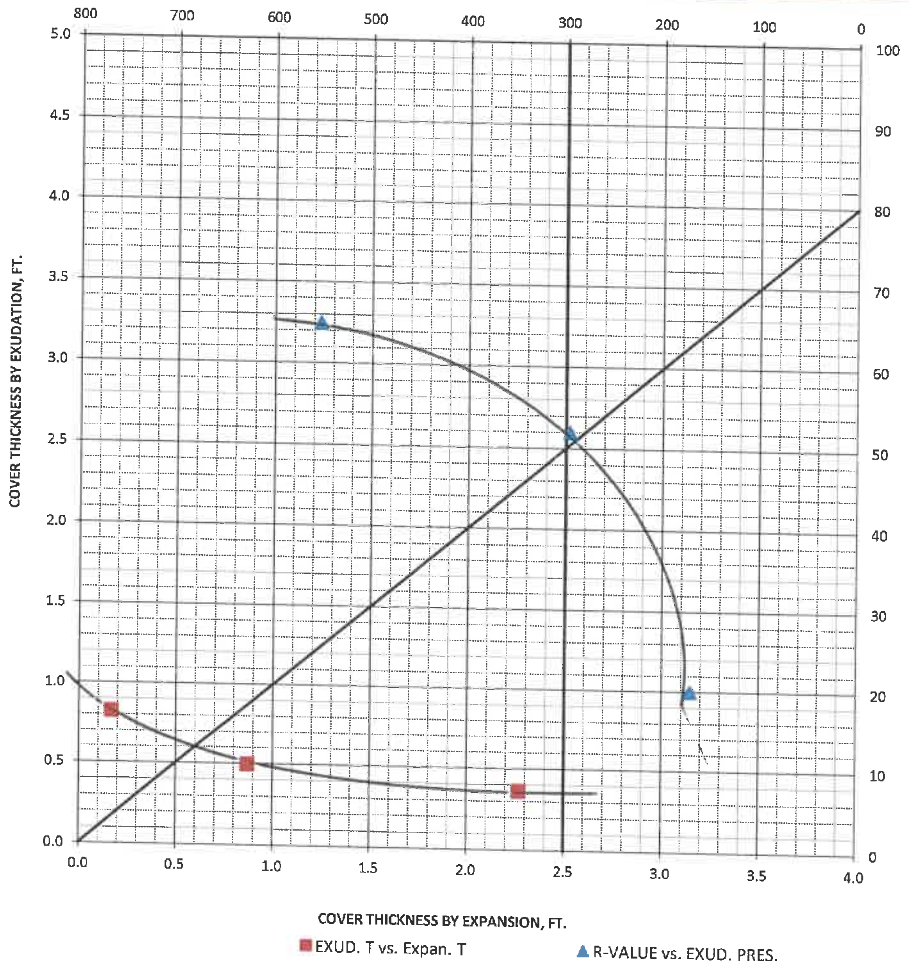
REMARKS:

BORING NO. B-9 / KB-7 @ 0'-5'
Jack Rabbit Trail
P.N. 18060-01

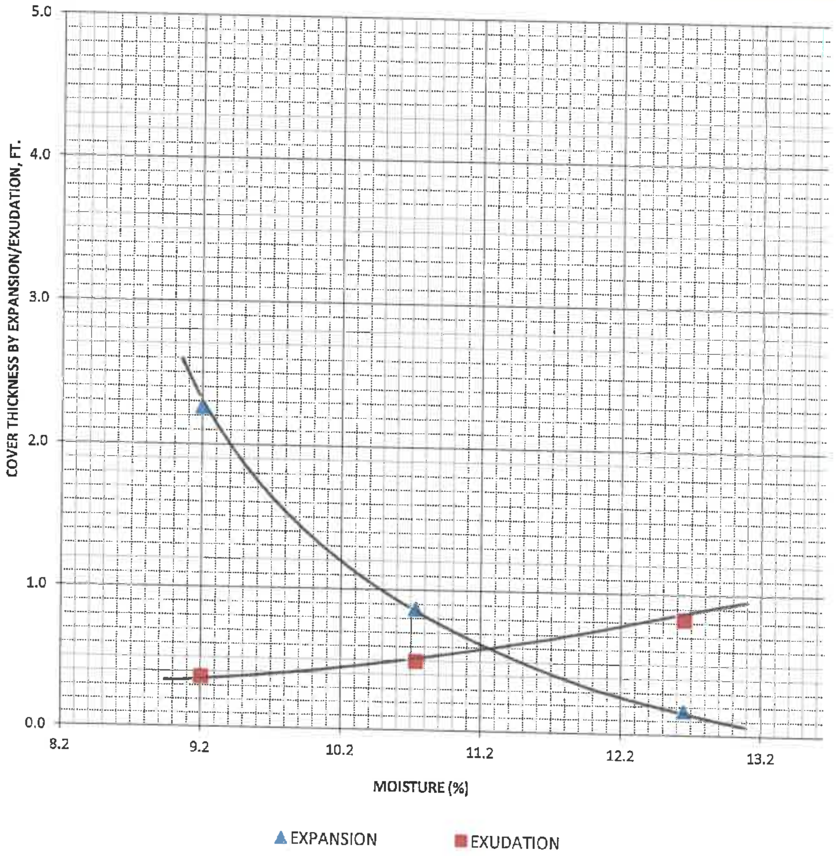
COMPACTOR PRESSURE vs MOISTURE %



COVER THICKNESS BY EXUDATION vs COVER THICKNESS BY EXPANSION



COVER THICKNESS vs MOISTURE %



LM
LaBelle Marvin

R - VALUE DATA SHEET

PROJECT No. 45094
DATE: 7/11/2019

BORING NO. B-10 / KB-8 @ 0'-5'
Jack Rabbit Trail
P.N. 18060-01

SAMPLE DESCRIPTION: Brown Silty Fine Sand

R-VALUE TESTING DATA | CA TEST 301

	SPECIMEN ID		
	a	b	c
Mold ID Number	1	2	3
Water added, grams	85	66	57
Initial Test Water, %	11.1	9.3	8.4
Compact Gage Pressure,psi	90	350	350
Exudation Pressure, psi	188	417	669
Height Sample, Inches	2.58	2.49	2.45
Gross Weight Mold, grams	3122	3099	3109
Tare Weight Mold, grams	1954	1946	1958
Sample Wet Weight, grams	1168	1153	1151
Expansion, Inches x 10exp-4	2	12	33
Stability 2,000 lbs (160psi)	43 / 96	24 / 61	15 / 27
Turns Displacement	4.73	3.88	3.65
R-Value Uncorrected	26	51	77
R-Value Corrected	27	51	77
Dry Density, pcf	123.5	128.4	131.3

DESIGN CALCULATION DATA

Traffic Index Assumed:	4.0	4.0	4.0
G.E. by Stability	0.75	0.50	0.24
G. E. by Expansion	0.07	0.40	1.10

Equilibrium R-Value	**40** by EXUDATION	Examined & Checked: 7 /11/ 19

REMARKS:

Gf = 1.25
0.5% Retained on the
3/4" Sieve.

REGISTERED PROFESSIONAL ENGINEER
STEVEN R. MARVIN
C 30659
CIVIL
STATE OF CALIFORNIA

Steven R. Marvin, RCE 30659

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

LaBelle Marvin

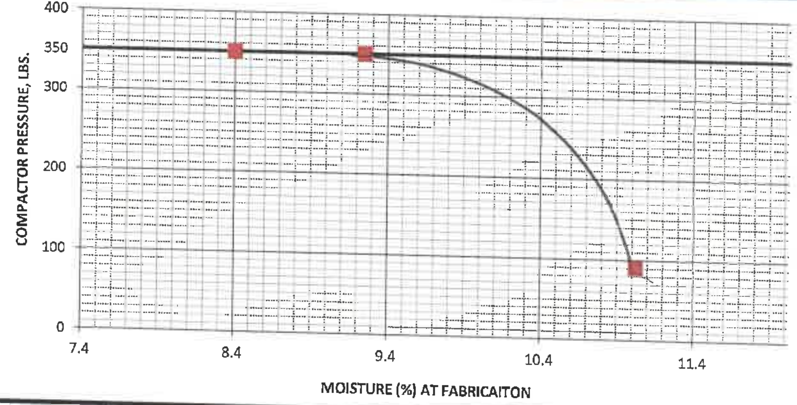
R-VALUE GRAPHICAL PRESENTATION

PROJECT NO. 45094
DATE: 7 /11/ 19

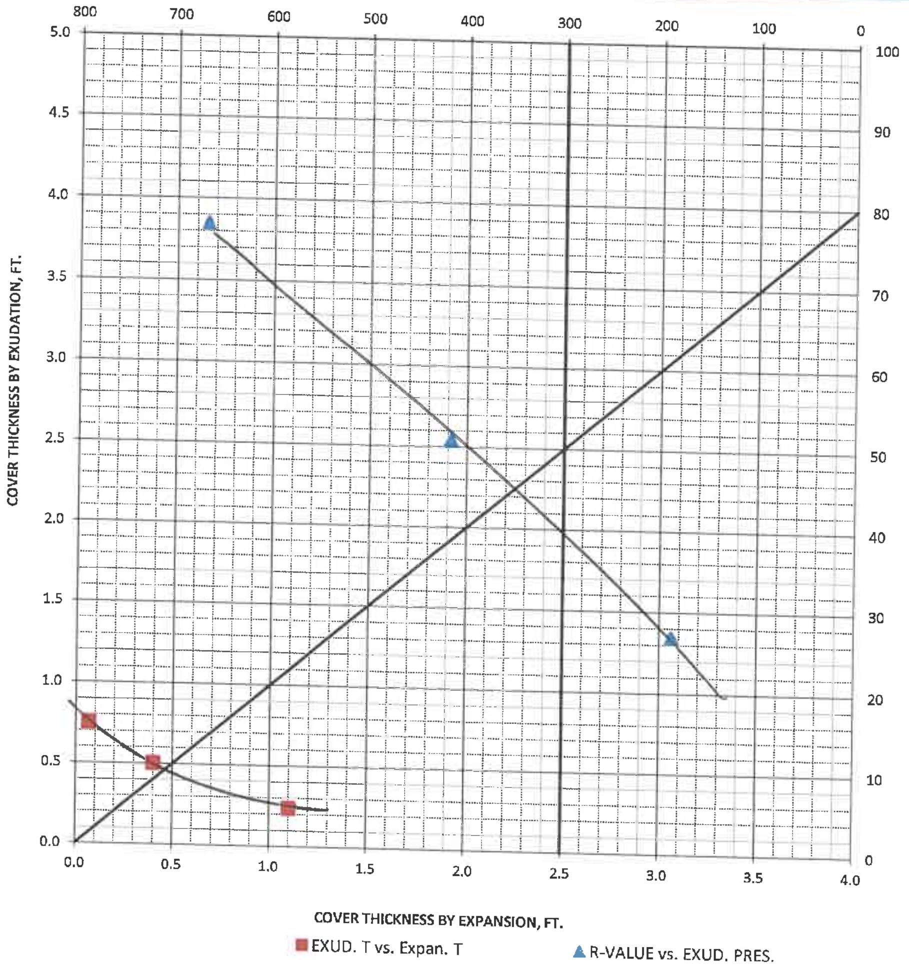
BORING NO. B-10 / KB-8 @ 0'-5'
Jack Rabbit Trail
P.N. 18060-01

REMARKS:

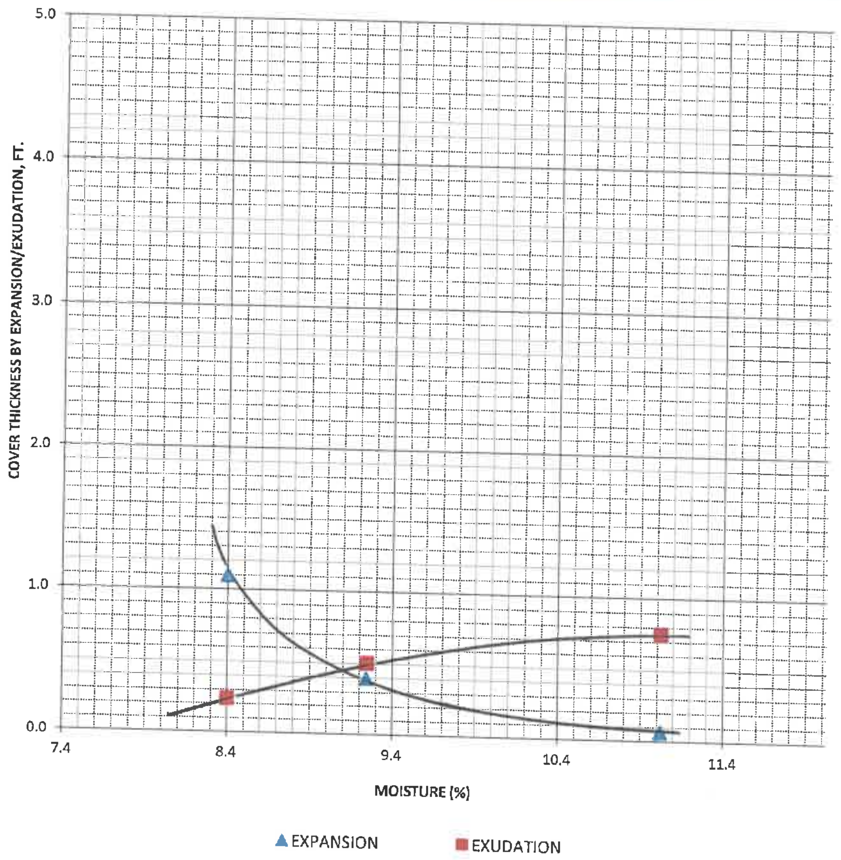
COMPACTOR PRESSURE vs MOISTURE %



COVER THICKNESS BY EXUDATION vs COVER THICKNESS BY EXPANSION



COVER THICKNESS vs MOISTURE %



- ANALYSIS
- DESIGN

LaBelle • Marvin

PROFESSIONAL PAVEMENT ENGINEERING

A CALIFORNIA CORPORATION

- SOILS, ASPHALT TECHNOLOGY

July 25, 2019

Mr. Dante Domingo
Kling Consulting Group
18008 Sky Park Circle #250
Irvine, California 92614

Project No. 45149

Dear Mr. Domingo:

Testing of the bulk soil sample delivered to our laboratory on 7/23/2019 has been completed.

Reference: J.N. 18060-01
Project: Jack Rabbit Trail, 7/8/2019
Sample: KTP-3 @ 6'

Data sheets are attached for your use and file. Any untested portion of the sample will be retained for a period of 60 days prior to disposal. The opportunity to be of service is sincerely appreciated and should you have any questions, kindly call.

Respectfully Submitted,

STEVEN R. MARVIN
NO. 30659
CIVIL

Steven R. Marvin
RCE 30659

SRM:jw
Enclosure

LM
LaBelle Marvin

R - VALUE DATA SHEET

PROJECT No. 45149
DATE: 7/25/2019

BORING NO. KTP-3 @ 6'
Jack Rabbit Trail, 7/8/19
P.N. 18060-01

SAMPLE DESCRIPTION: Brown Sandy Clay

R-VALUE TESTING DATA | CA TEST 301

	SPECIMEN ID		
	a	b	c
Mold ID Number	4	5	6
Water added, grams	80	55	122
Initial Test Water, %	15.7	13.2	20.0
Compact Gage Pressure,psi	60	140	30
Exudation Pressure, psi	320	504	215
Height Sample, Inches	2.55	2.42	2.67
Gross Weight Mold, grams	3070	3031	3057
Tare Weight Mold, grams	1957	1944	1955
Sample Wet Weight, grams	1113	1087	1102
Expansion, Inches x 10exp-4	32	95	0
Stability 2,000 lbs (160psi)	53 / 127	36 / 90	69 / 150
Turns Displacement	3.78	3.25	5.27
R-Value Uncorrected	15	37	3
R-Value Corrected	15	35	3
Dry Density, pcf	114.3	120.2	104.2

DESIGN CALCULATION DATA

Traffic Index Assumed:	4.0	4.0	4.0
G.E. by Stability	0.87	0.67	0.99
G. E. by Expansion	1.07	3.17	0.00

Equilibrium R-Value

13
by
EXUDATION

Examined & Checked: 7 /25/ 19

STEVEN R. MARVIN
C 30659

Steven R. Marvin, RCE 30659

REMARKS:
Gf = 1.25
0.0% Retained on the
3/4" Sieve.

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

R-VALUE GRAPHICAL PRESENTATION

LaBelle Marvin

PROJECT NO. 45149

DATE: 7 /25/ 19

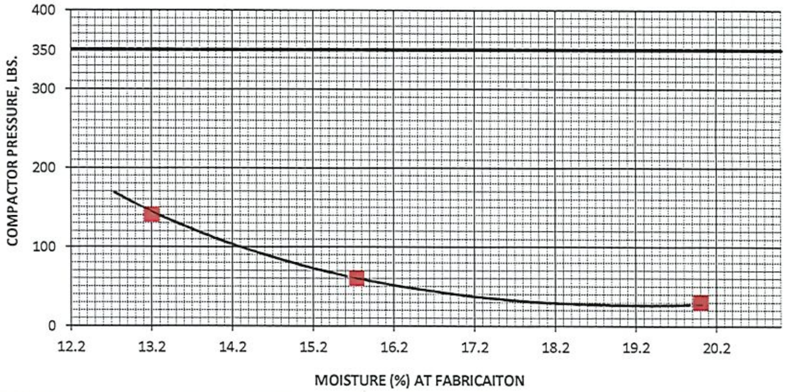
REMARKS:

BORING NO. KTP-3 @ 6'

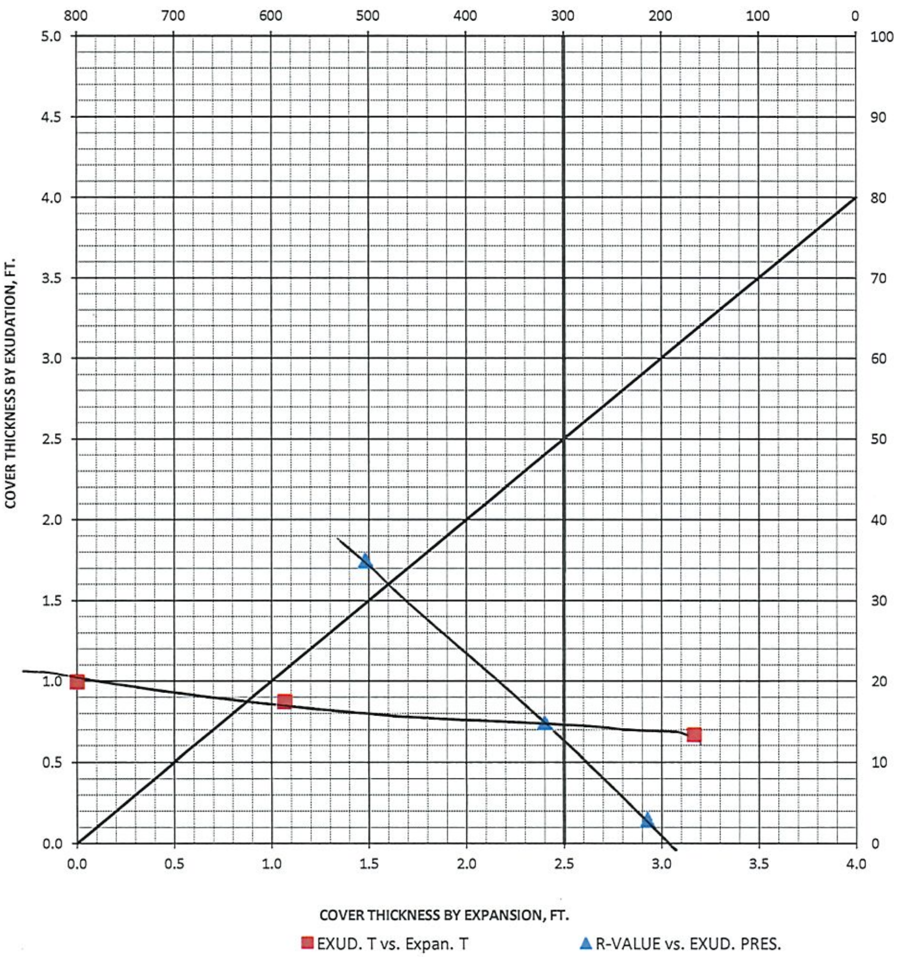
Jack Rabbit Trail, 7/8/19

P.N. 18060-01

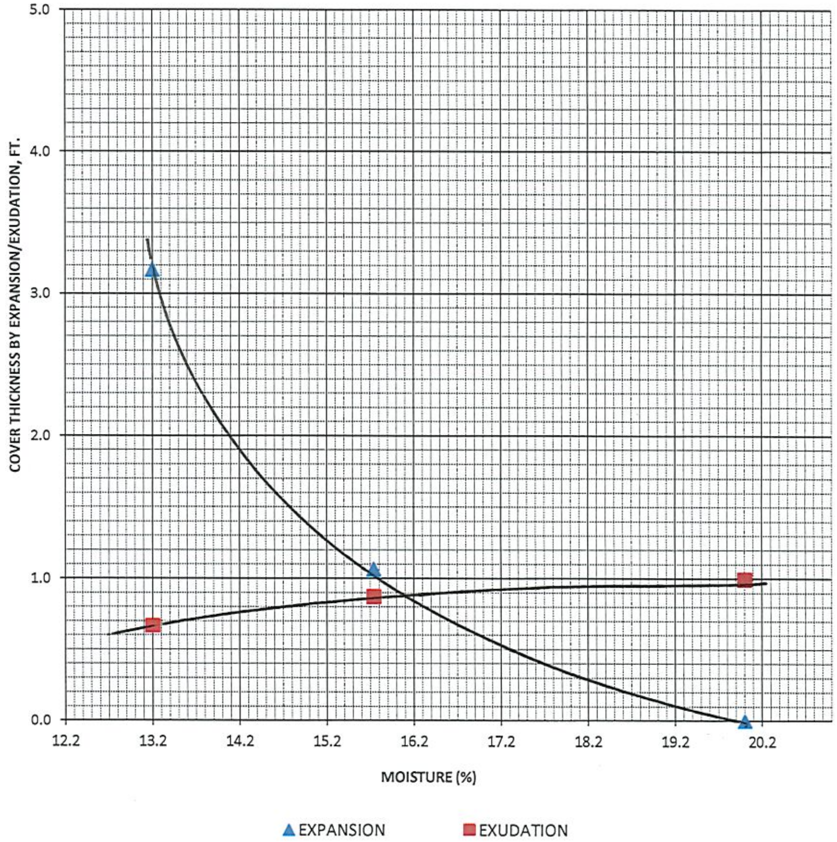
COMPACTOR PRESSURE vs MOISTURE %



COVER THICKNESS BY EXUDATION vs COVER THICKNESS BY EXPANSION



COVER THICKNESS vs MOISTURE %



JOB NAME : JACK RABBIT TRAIL
JOB NUMBER: 18060-00
SAMPLE NUMBER :
TESTED BY : RB
SAMPLE LOCATION : B - 2 / KB - 6 @ 0' - 5'
DATE : 12-Jul-19
SAMPLE DESCRIPTIONS / CLASSIFICATION : DK. BROWN CLAYEY SAND (SC)

TEST STANDARD	ASTM D-698 - 00			**ASTM D 1557-02**		
METHOD	A	B	C	**A**	B	C

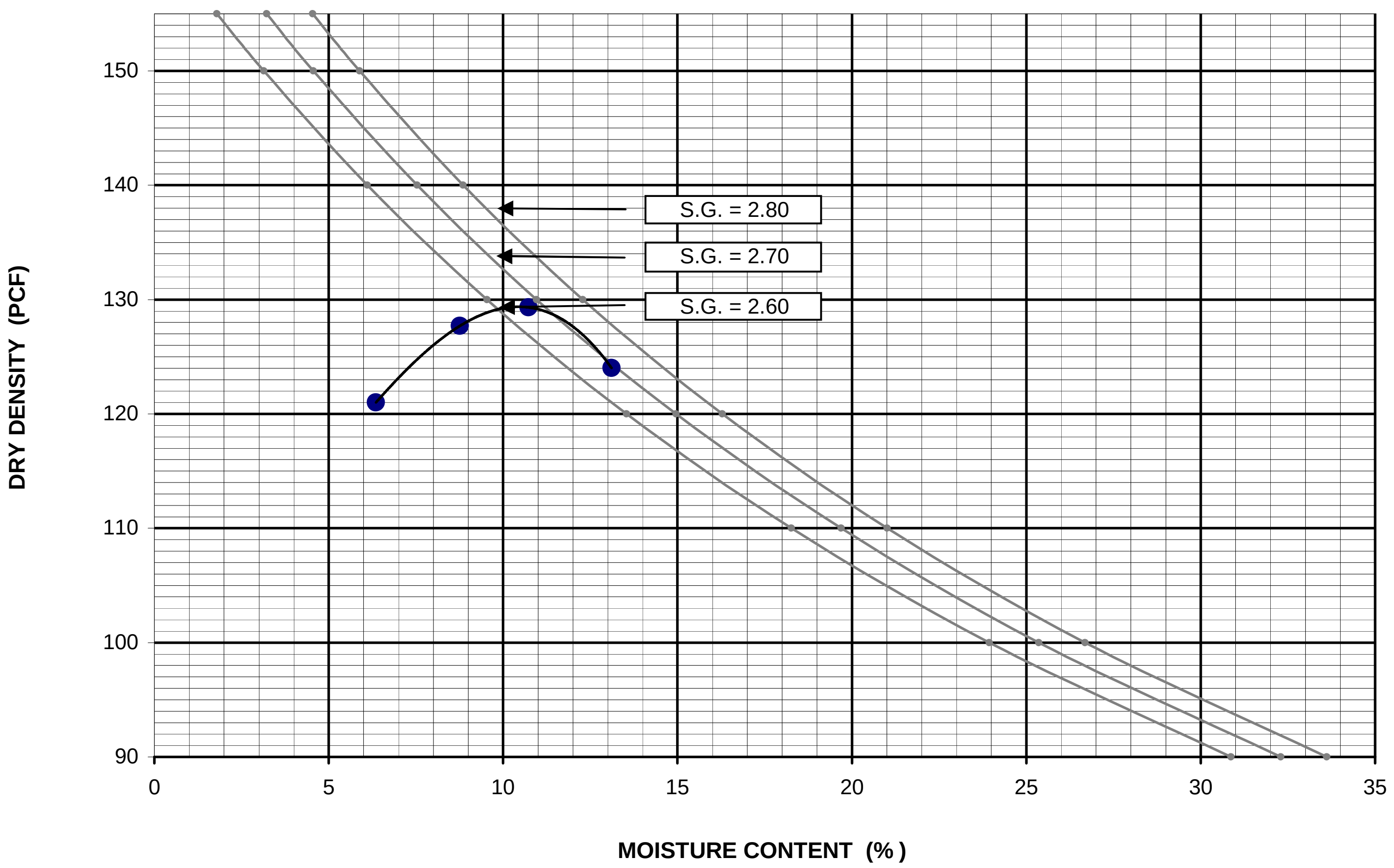
TRIAL NUMBER	1	2	3	4	5
WATER ADDED (ML)	-100	-50	0	50	
WT. SOIL + MOLD (GMS)	3920	4074	4139	4095	
WT.OF MOLD (GMS)	1974	1974	1974	1974	
WT. OF WET SOIL (GMS)	1946	2100	2165	2121	
WET DENSITY (PCF)	128.7	138.9	143.2	140.3	
CAN NUMBER	R	M	N	S	
WET SOIL + TARE (GMS)	306.04	310.51	316.51	319.81	
DRY SOIL + TARE (GMS)	287.75	285.50	285.85	282.75	
TARE (GMS)	0.00	0.00	0.00	0.00	
DRY SOIL (GMS)	287.75	285.50	285.85	282.75	
WATER (GMS)	18.29	25.01	30.66	37.06	
MOISTURE CONTENT (%)	6.4	8.8	10.7	13.1	
DRY DENSITY (PCF)	121.0	127.7	129.3	124.0	

DIAMETER OF MOLD: 4 In.
VOLUME OF MOLD: 0.0333 Cu.Ft.
SCALPED ON SIEVE SIZE/NO.: #4
PERCENT RETAINED,(%) :
MAXIMUM DRY DENSITY: 129.5 Pcf.
OPT. MOIST. CONTENT : 10.5 %

FOR OVERSIZE CORRECTION (ASTM D4718):

%,Finer Fraction = - % Moisture = -
%,Oversize Fraction = - Assumed Sp.Gr. 2.64
Corrected MDD of Total Materials,(PCF) = **-**
Corrected OMC of Total Materials, (%) = **-**

REMARKS :



KCG KLING Consulting Group, Inc.

18008 Sky Park Circle, Suite 250
Irvine,Ca. 92614
Tel: (949)797-6241 Fax: (949)797-6260

MAXIMUM DENSITY TEST

JOB NAME : JACK RABBIT TRAIL

JOB NUMBER: 18060-00

SAMPLE NUMBER :

TESTED BY : RB

SAMPLE LOCATION : B - 4 / KB - 4 @ 0' - 5'

DATE : 3-Jul-19

SAMPLE DESCRIPTIONS / CLASSIFICATION : DK. BROWN CLAYEY SAND (SC)

TEST STANDARD	ASTM D-698 - 00			**ASTM D 1557-02**		
METHOD	A	B	C	**A**	B	C

TRIAL NUMBER	1	2	3	4	5
WATER ADDED (ML)	0	50	100	150	
WT. SOIL + MOLD (GMS)	4018	4119	4144	4090	
WT.OF MOLD (GMS)	1974	1974	1974	1974	
WT. OF WET SOIL (GMS)	2044	2145	2170	2116	
WET DENSITY (PCF)	135.2	141.9	143.5	139.9	
CAN NUMBER	M	N	S	R	
WET SOIL + TARE (GMS)	308.45	311.01	315.00	319.81	
DRY SOIL + TARE (GMS)	289.89	286.79	285.84	284.59	
TARE (GMS)	0.00	0.00	0.00	0.00	
DRY SOIL (GMS)	289.89	286.79	285.84	284.59	
WATER (GMS)	18.56	24.22	29.16	35.22	
MOISTURE CONTENT (%)	6.4	8.4	10.2	12.4	
DRY DENSITY (PCF)	127.1	130.8	130.2	124.5	

DIAMETER OF MOLD: 4 In.

VOLUME OF MOLD: 0.0333 Cu.Ft.

SCALPED ON SIEVE SIZE/NO.: #4

PERCENT RETAINED,(%) : -

MAXIMUM DRY DENSITY: 131.0 Pcf.

OPT. MOIST. CONTENT : 9.0 %

FOR OVERSIZE CORRECTION (ASTM D4718):

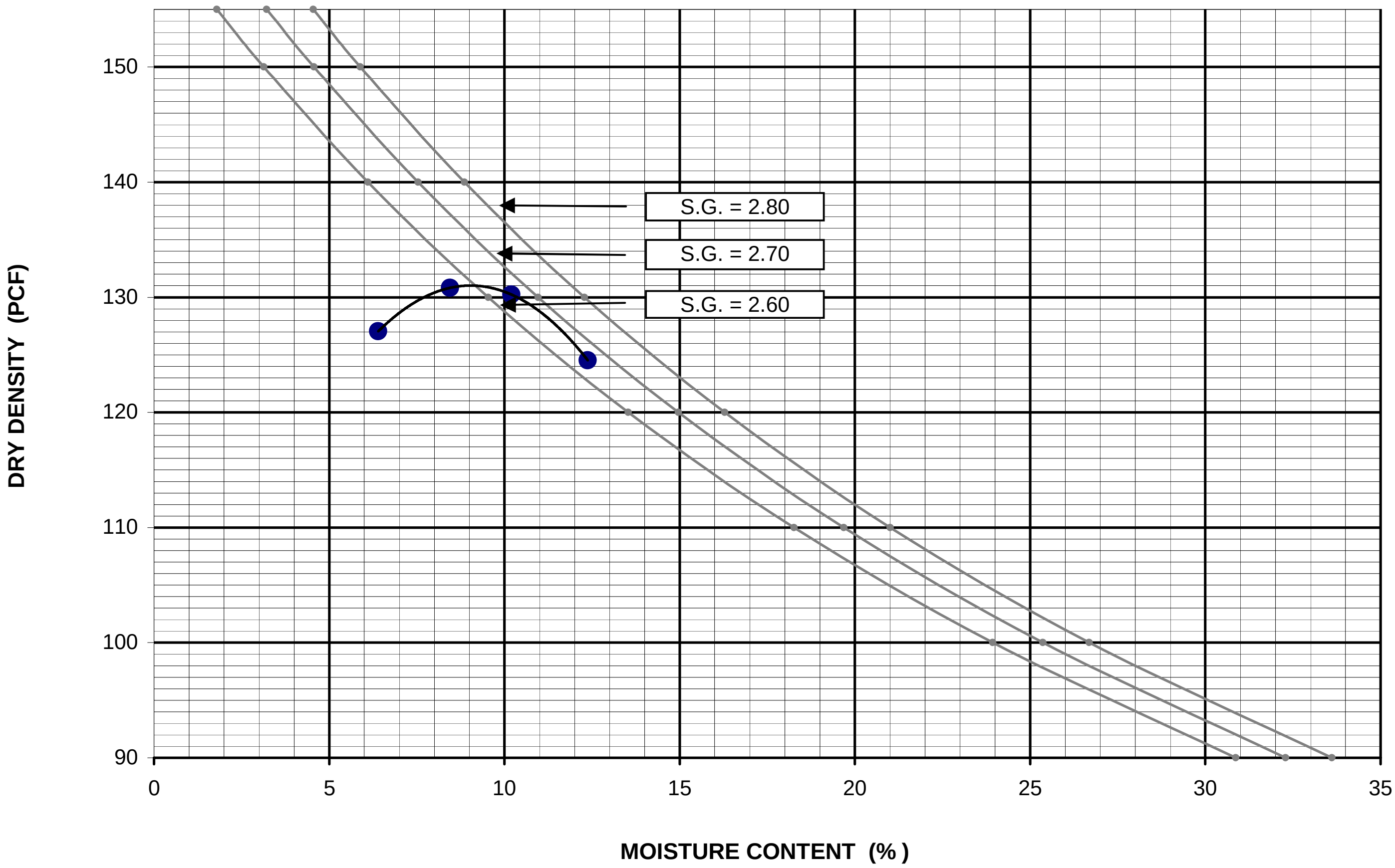
%,Finer Fraction = - % Moisture = -

%,Oversize Fraction = - Assumed Sp.Gr. 2.64

Corrected MDD of Total Materials,(PCF) = **-**

Corrected OMC of Total Materials, (%) = **-**

REMARKS :



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Irvine,Ca. 92614
Tel: (949)797-6241 Fax: (949)797-6260

MAXIMUM DENSITY TEST

JOB NAME : JACK RABBIT TRAIL

JOB NUMBER: 18060-01

SAMPLE NUMBER :

TESTED BY : RB

SAMPLE LOCATION : B - 5 / KB - 1 @ 0' - 5'

DATE : 18-Jul-19

SAMPLE DESCRIPTIONS / CLASSIFICATION : DK. BROWN CLAYEY SAND (SC)

TEST STANDARD	ASTM D-698 - 00			**ASTM D 1557-02**		
METHOD	A	B	C	**A**	B	C

TRIAL NUMBER	1	2	3	4	5
WATER ADDED (ML)	-	0	50	100	
WT. SOIL + MOLD (GMS)	3999	4095	4123	4052	
WT.OF MOLD (GMS)	1974	1974	1974	1974	
WT. OF WET SOIL (GMS)	2025	2121	2149	2078	
WET DENSITY (PCF)	133.9	140.3	142.1	137.4	
CAN NUMBER		M	R	N	
WET SOIL + TARE (GMS)	308.74	316.16	318.83	322.53	
DRY SOIL + TARE (GMS)	287.02	288.70	286.42	284.41	
TARE (GMS)	0.00	0.00	0.00	0.00	
DRY SOIL (GMS)	287.02	288.70	286.42	284.41	
WATER (GMS)	21.72	27.46	32.41	38.12	
MOISTURE CONTENT (%)	7.6	9.5	11.3	13.4	
DRY DENSITY (PCF)	124.5	128.1	127.7	121.2	

DIAMETER OF MOLD:	4	In.
VOLUME OF MOLD:	0.0333	Cu.Ft.
SCALPED ON SIEVE SIZE/NO.:	#4	
PERCENT RETAINED,(%) :	-	
MAXIMUM DRY DENSITY:	**128.5**	Pcf.
OPT. MOIST. CONTENT :	**10.5**	%

FOR OVERSIZE CORRECTION (ASTM D4718):

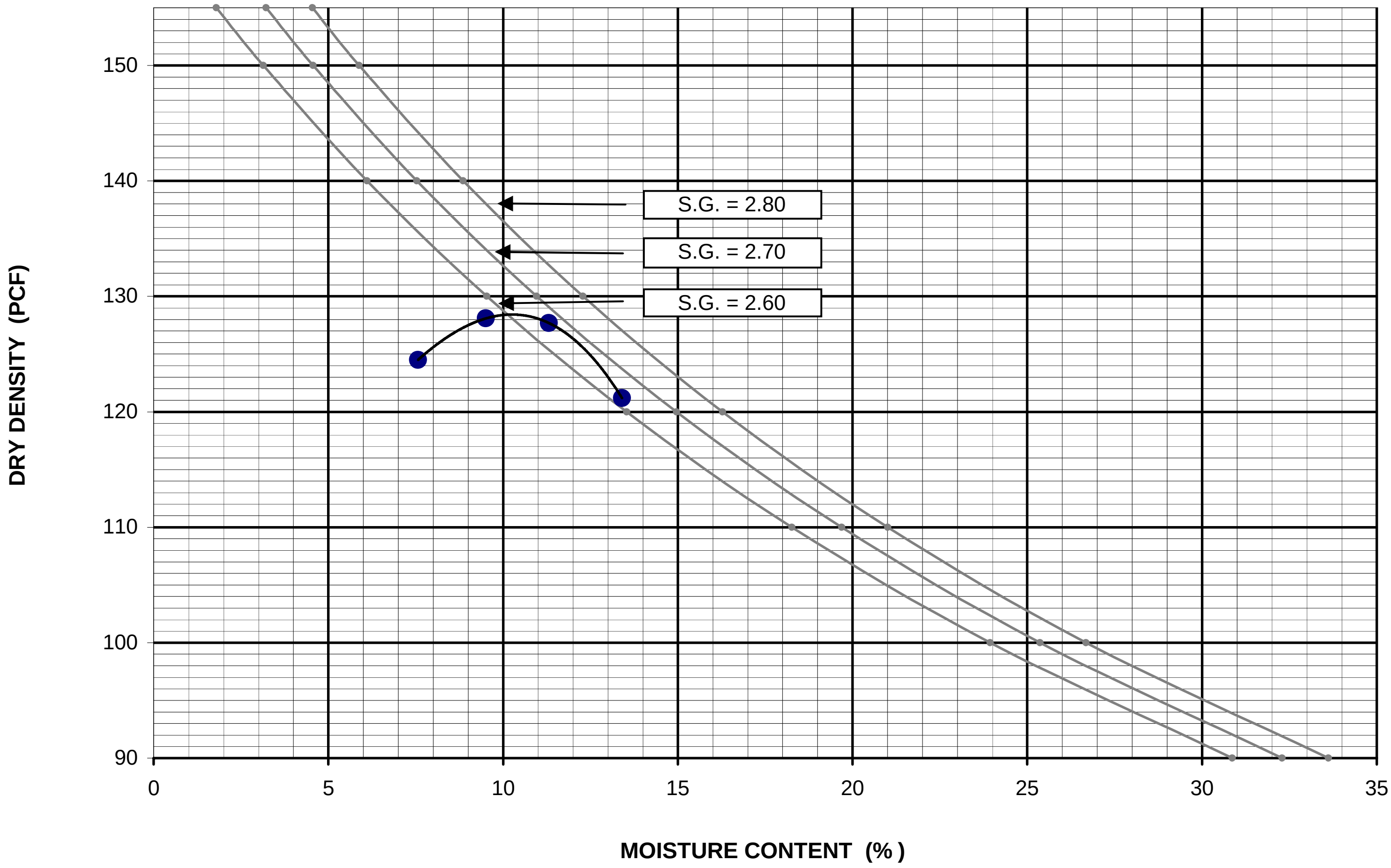
%,Finer Fraction = - % Moisture = -

%,Oversize Fraction = - Assumed Sp.Gr. 2.64

Corrected MDD of Total Materials,(PCF) = **-**

Corrected OMC of Total Materials, (%) = **-**

REMARKS :



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MAXIMUM DENSITY TEST

JOB NAME : JACK RABBIT TRAIL
JOB NUMBER: 18060-01
SAMPLE NUMBER :
TESTED BY : RB
SAMPLE LOCATION : B - 7 / KB - 9 @ 0' - 5'
DATE : 19-Jul-19
SAMPLE DESCRIPTIONS / CLASSIFICATION : DK. BROWN CLAYEY SAND (SC)

TEST STANDARD	ASTM D-698 - 00			**ASTM D 1557-02**		
METHOD	A	B	C	**A**	B	C

TRIAL NUMBER	1	2	3	4	5
WATER ADDED (ML)	-	0	50	100	
WT. SOIL + MOLD (GMS)	3967	4054	4143	4116	
WT.OF MOLD (GMS)	1974	1974	1974	1974	
WT. OF WET SOIL (GMS)	1993	2080	2169	2142	
WET DENSITY (PCF)	131.8	137.6	143.5	141.7	
CAN NUMBER	N	M	R	S	
WET SOIL + TARE (GMS)	307.32	310.19	313.99	318.89	
DRY SOIL + TARE (GMS)	290.52	289.04	287.39	286.34	
TARE (GMS)	0.00	0.00	0.00	0.00	
DRY SOIL (GMS)	290.52	289.04	287.39	286.34	
WATER (GMS)	16.80	21.15	26.60	32.55	
MOISTURE CONTENT (%)	5.8	7.3	9.3	11.4	
DRY DENSITY (PCF)	124.6	128.2	131.3	127.2	

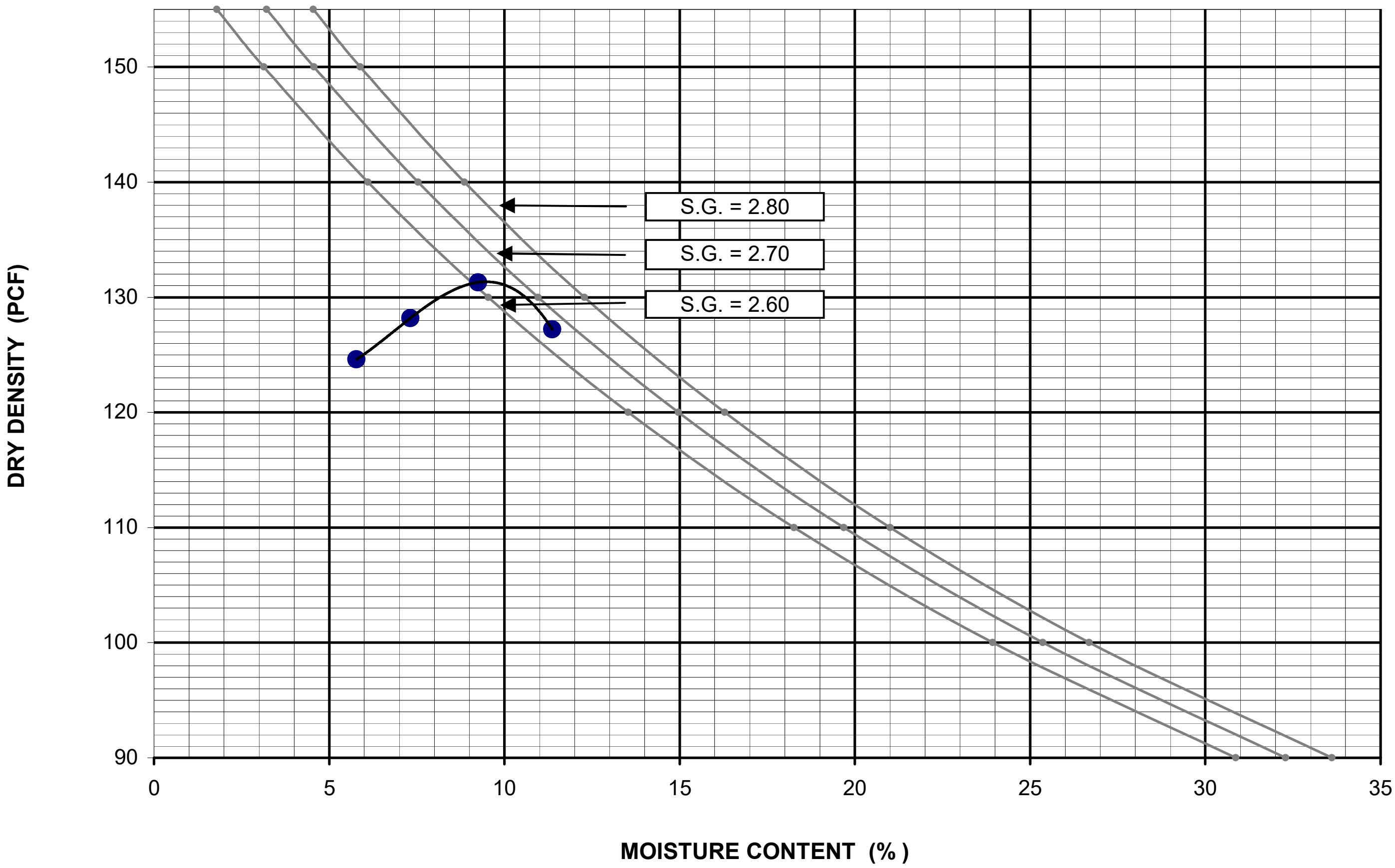
DIAMETER OF MOLD:	4	In.
VOLUME OF MOLD:	0.0333	Cu.Ft.
SCALPED ON SIEVE SIZE/NO.:	#4	
PERCENT RETAINED,(%) :	5.9	
MAXIMUM DRY DENSITY:	**131.5**	Pcf.
OPT. MOIST. CONTENT :	**9.5**	%

FOR OVERSIZE CORRECTION (ASTM D4718):

%,Finer Fraction =	-	% Moisture =	-
%,Oversize Fraction =	-	Assumed Sp.Gr.	2.64

Corrected MDD of Total Materials,(PCF) = **-**
Corrected OMC of Total Materials, (%) = **-**

REMARKS :



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Irvine,Ca. 92614
Tel: (949)797-6241 Fax: (949)797-6260

MAXIMUM DENSITY TEST

JOB NAME : JACK RABBIT TRAIL

JOB NUMBER: 18060-01

SAMPLE NUMBER :

TESTED BY : RB

SAMPLE LOCATION : B - 13 / KTP - 7 @ 4' - 6'

DATE : 26-Jul-19

SAMPLE DESCRIPTIONS / CLASSIFICATION : LT. BROWN SILTY FINE SAND (SM)

TEST STANDARD	ASTM D-698 - 00			**ASTM D 1557-02**		
METHOD	A	B	C	**A**	B	C

TRIAL NUMBER	1	2	3	4	5
WATER ADDED (ML)	50	100	150	200	
WT. SOIL + MOLD (GMS)	3899	3967	4019	4012	
WT.OF MOLD (GMS)	1974	1974	1974	1974	
WT. OF WET SOIL (GMS)	1925	1993	2045	2038	
WET DENSITY (PCF)	127.3	131.8	135.3	134.8	
CAN NUMBER	R	S	N	M	
WET SOIL + TARE (GMS)	311.18	315.68	321.64	325.12	
DRY SOIL + TARE (GMS)	288.26	286.01	286.23	284.16	
TARE (GMS)	0.00	0.00	0.00	0.00	
DRY SOIL (GMS)	288.26	286.01	286.23	284.16	
WATER (GMS)	22.92	29.67	35.41	40.96	
MOISTURE CONTENT (%)	8.0	10.4	12.4	14.4	
DRY DENSITY (PCF)	117.9	119.4	120.4	117.8	

DIAMETER OF MOLD:	4	In.
VOLUME OF MOLD:	0.0333	Cu.Ft.
SCALPED ON SIEVE SIZE/NO.:	#4	
PERCENT RETAINED,(%) :		
MAXIMUM DRY DENSITY:	**120.5**	Pcf.
OPT. MOIST. CONTENT :	**12.5**	%

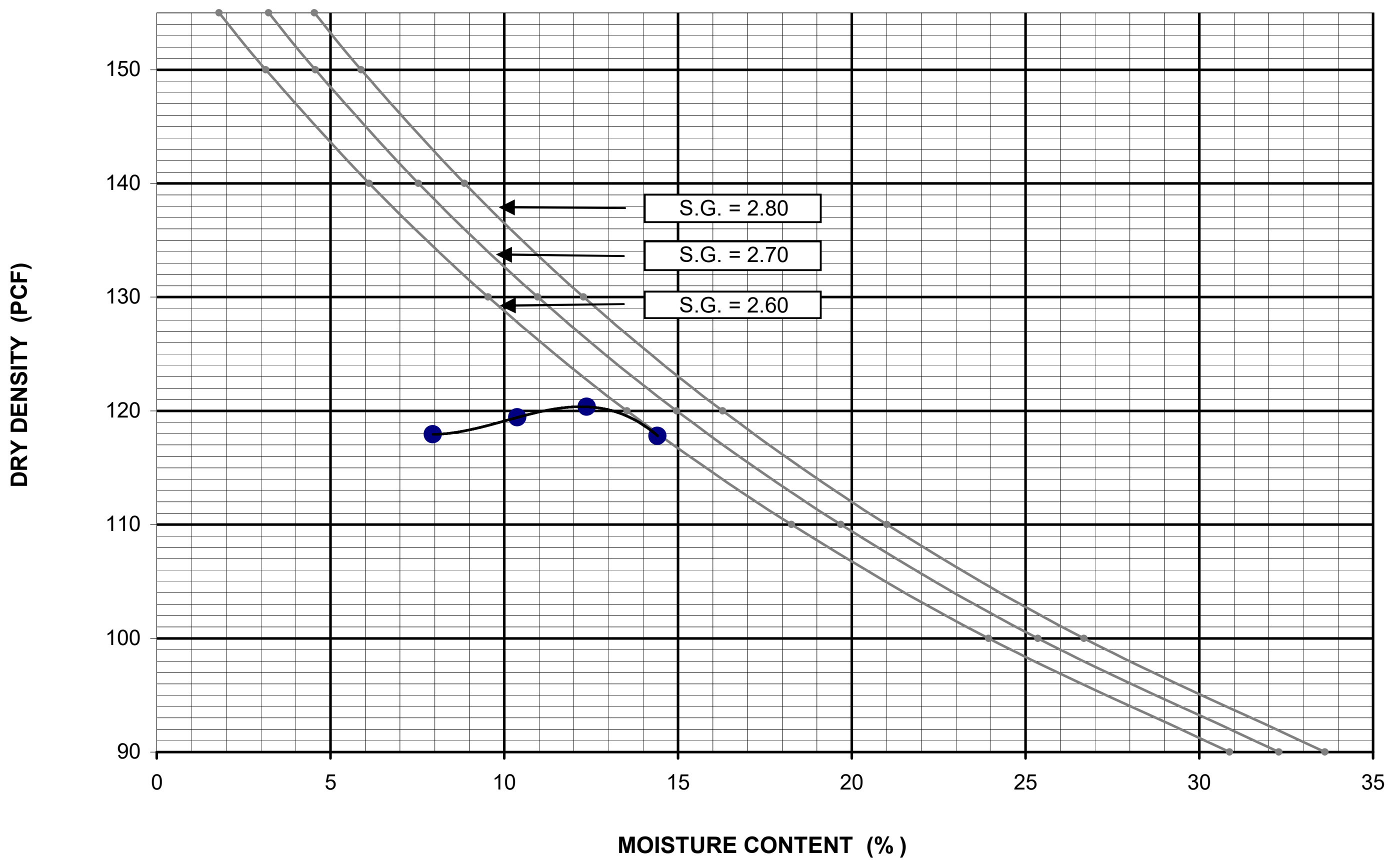
FOR OVERSIZE CORRECTION (ASTM D4718):

%,Finer Fraction =	-	% Moisture =	-
%,Oversize Fraction =	-	Assumed Sp.Gr.	2.64

Corrected MDD of Total Materials,(PCF) = **-**

Corrected OMC of Total Materials, (%) = **-**

REMARKS :



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Irvine,Ca. 92614
Tel: (949)797-6241 Fax: (949)797-6260

MAXIMUM DENSITY TEST

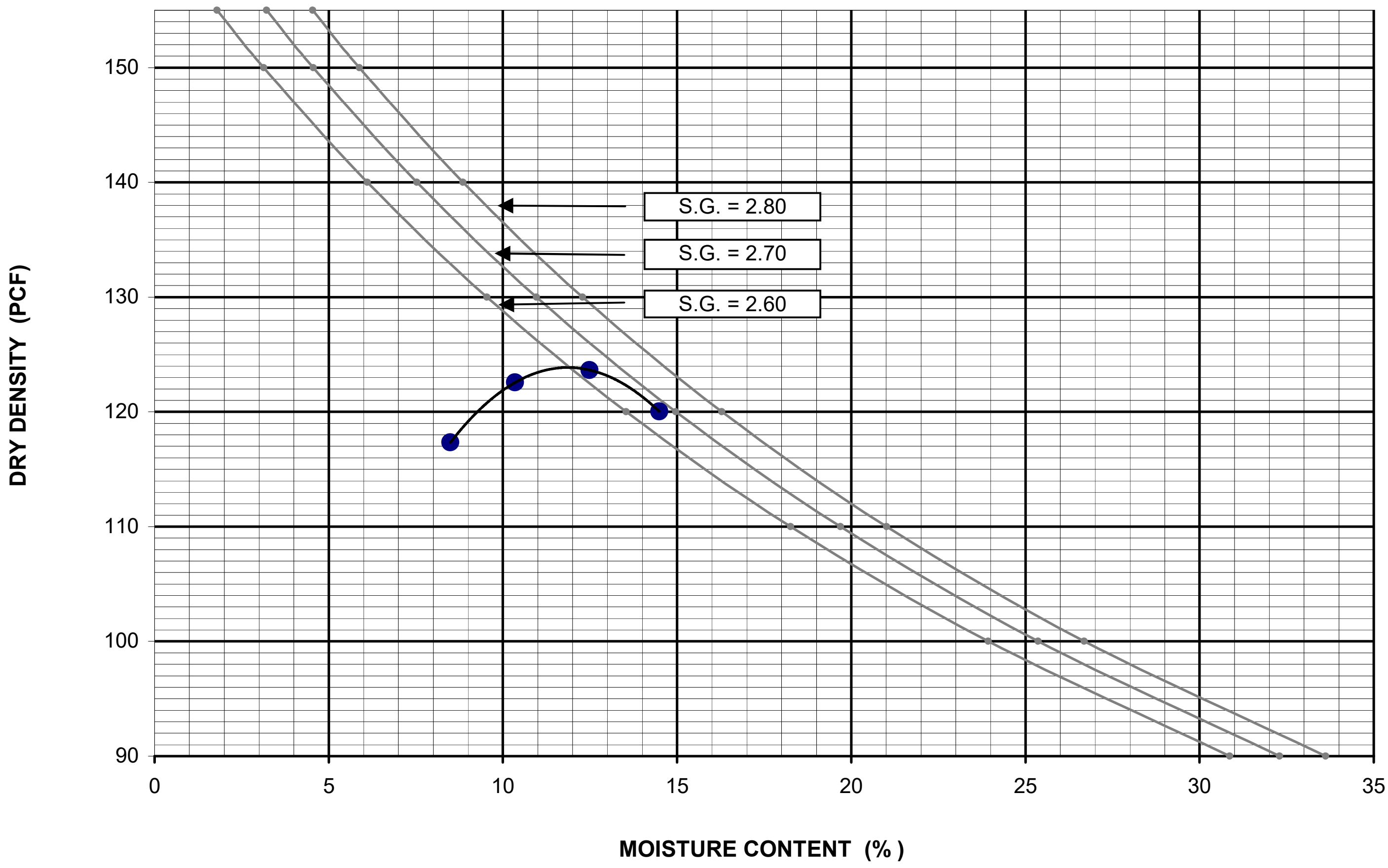
JOB NAME : JACK RABBIT TRAIL
JOB NUMBER: 18060-01
SAMPLE NUMBER :
TESTED BY : RB
SAMPLE LOCATION : KTP - 3 / B - 11 @ 6'
DATE : 22-Jul-19
SAMPLE DESCRIPTIONS / CLASSIFICATION : REDDISH BROWN SANDY CLAY (CL)

TEST STANDARD	ASTM D-698 - 00			ASTM D 1557-02		
METHOD	A	B	C	**A**	B	C

TRIAL NUMBER	1	2	3	4	5
WATER ADDED (ML)	-	0	50	100	
WT. SOIL + MOLD (GMS)	3899	4019	4077	4052	
WT.OF MOLD (GMS)	1974	1974	1974	1974	
WT. OF WET SOIL (GMS)	1925	2045	2103	2078	
WET DENSITY (PCF)	127.3	135.3	139.1	137.4	
CAN NUMBER	N	S	R	M	
WET SOIL + TARE (GMS)	307.52	315.56	320.22	323.81	
DRY SOIL + TARE (GMS)	283.44	285.96	284.67	282.83	
TARE (GMS)	0.00	0.00	0.00	0.00	
DRY SOIL (GMS)	283.44	285.96	284.67	282.83	
WATER (GMS)	24.08	29.60	35.55	40.98	
MOISTURE CONTENT (%)	8.5	10.4	12.5	14.5	
DRY DENSITY (PCF)	117.3	122.6	123.6	120.0	

DIAMETER OF MOLD: 4 In.
VOLUME OF MOLD: 0.0333 Cu.Ft.
SCALPED ON SIEVE SIZE/NO.: #4
PERCENT RETAINED,(%) : -
MAXIMUM DRY DENSITY: 124.0 Pcf.
OPT. MOIST. CONTENT : 12.0 %

FOR OVERSIZE CORRECTION (ASTM D4718):
%,Finer Fraction = - % Moisture = -
%,Oversize Fraction = - Assumed Sp.Gr. 2.64
Corrected MDD of Total Materials,(PCF) = -
Corrected OMC of Total Materials, (%) = -
REMARKS :



KCG KLING Consulting Group, Inc.

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Irvine,Ca. 92614
Tel: (949)797-6241 Fax: (949)797-6260

MAXIMUM DENSITY TEST

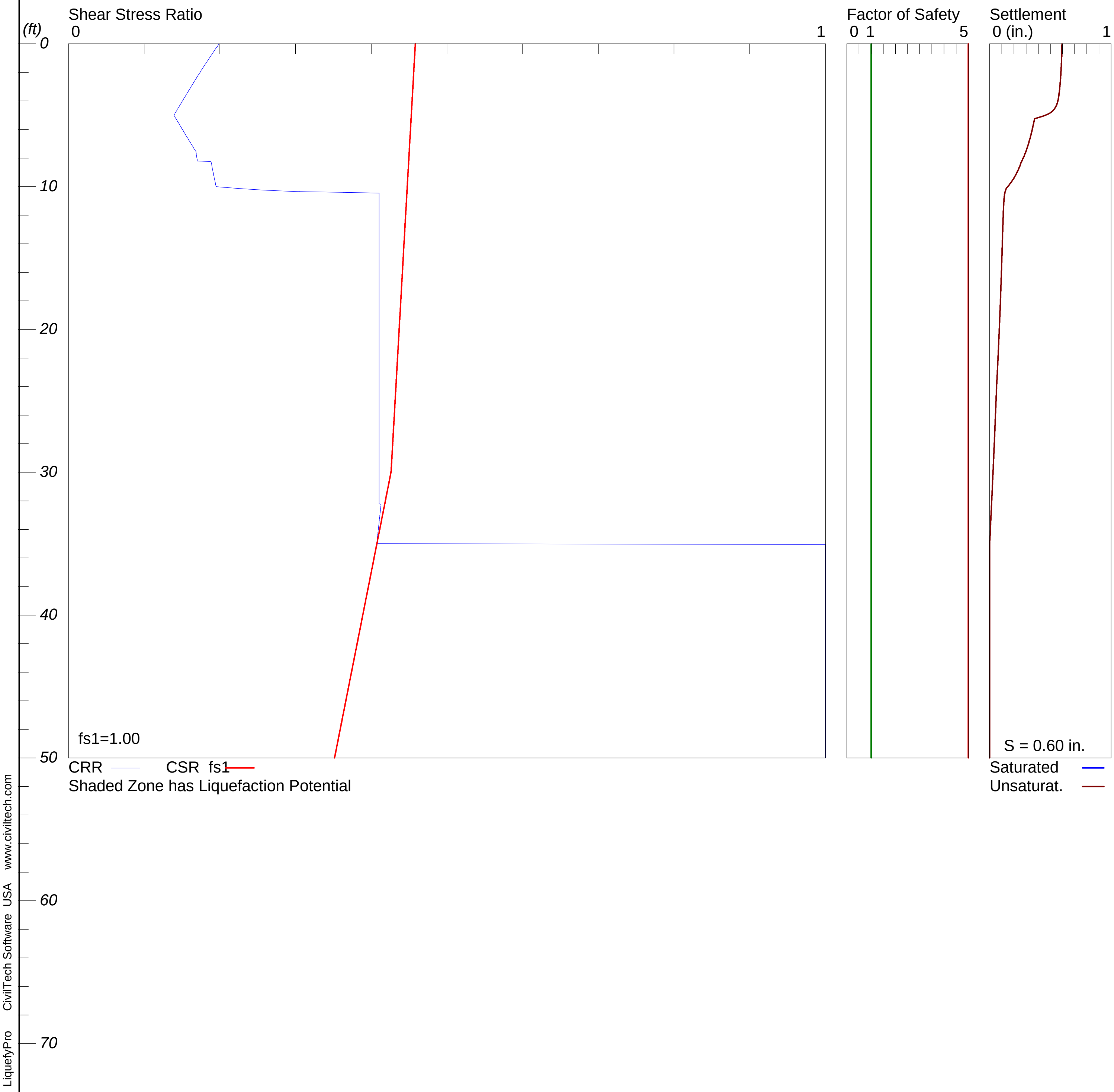
APPENDIX D

SEISMIC SETTLEMENT/LIQUEFACTION ANALYSIS

18060-00

Hole No.=KB-1 Water Depth=100 ft

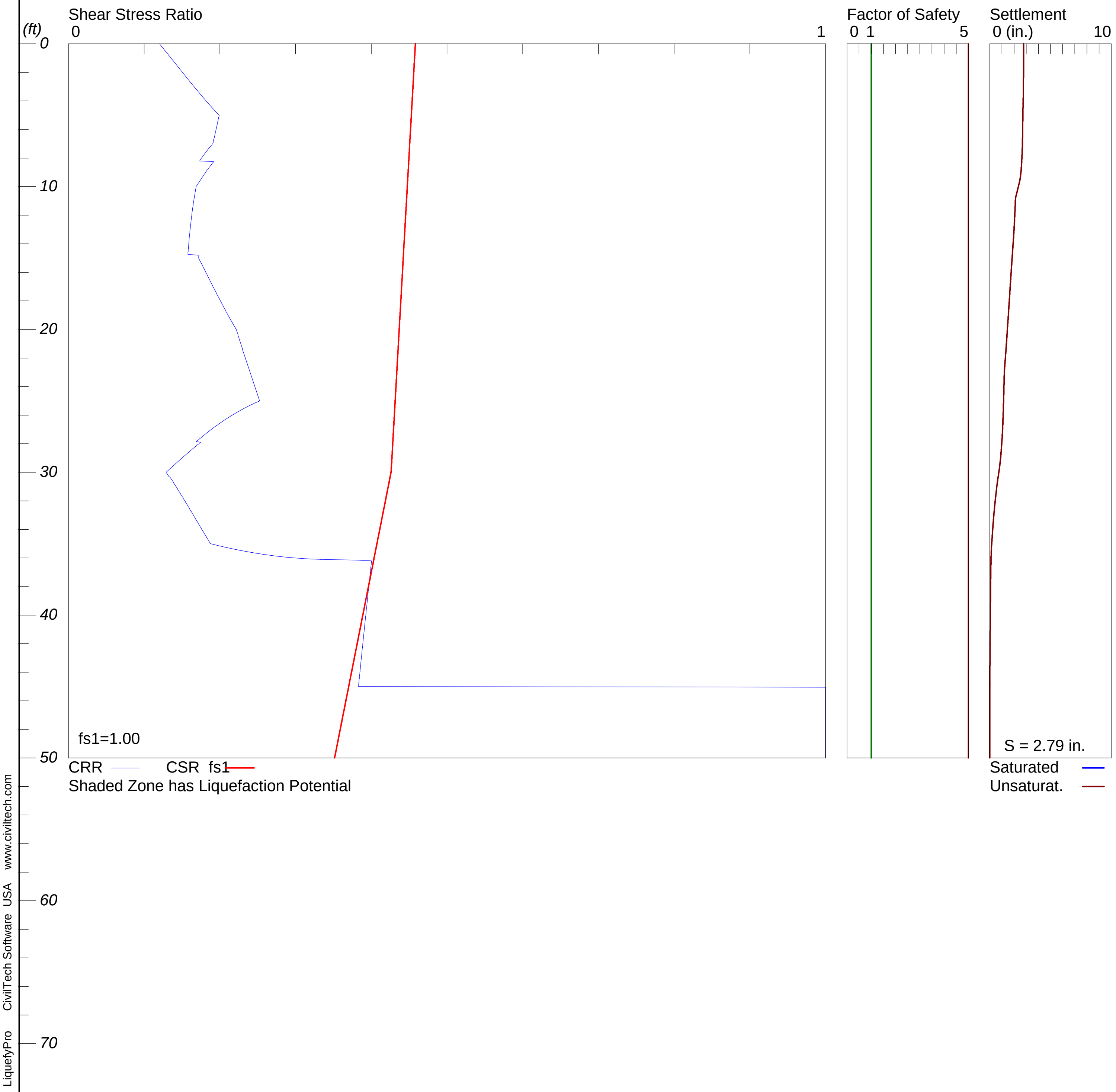
Magnitude=8.1
Acceleration=0.705g



18060-00

Hole No.=KB-2 Water Depth=100 ft

Magnitude=8.1
Acceleration=0.705g

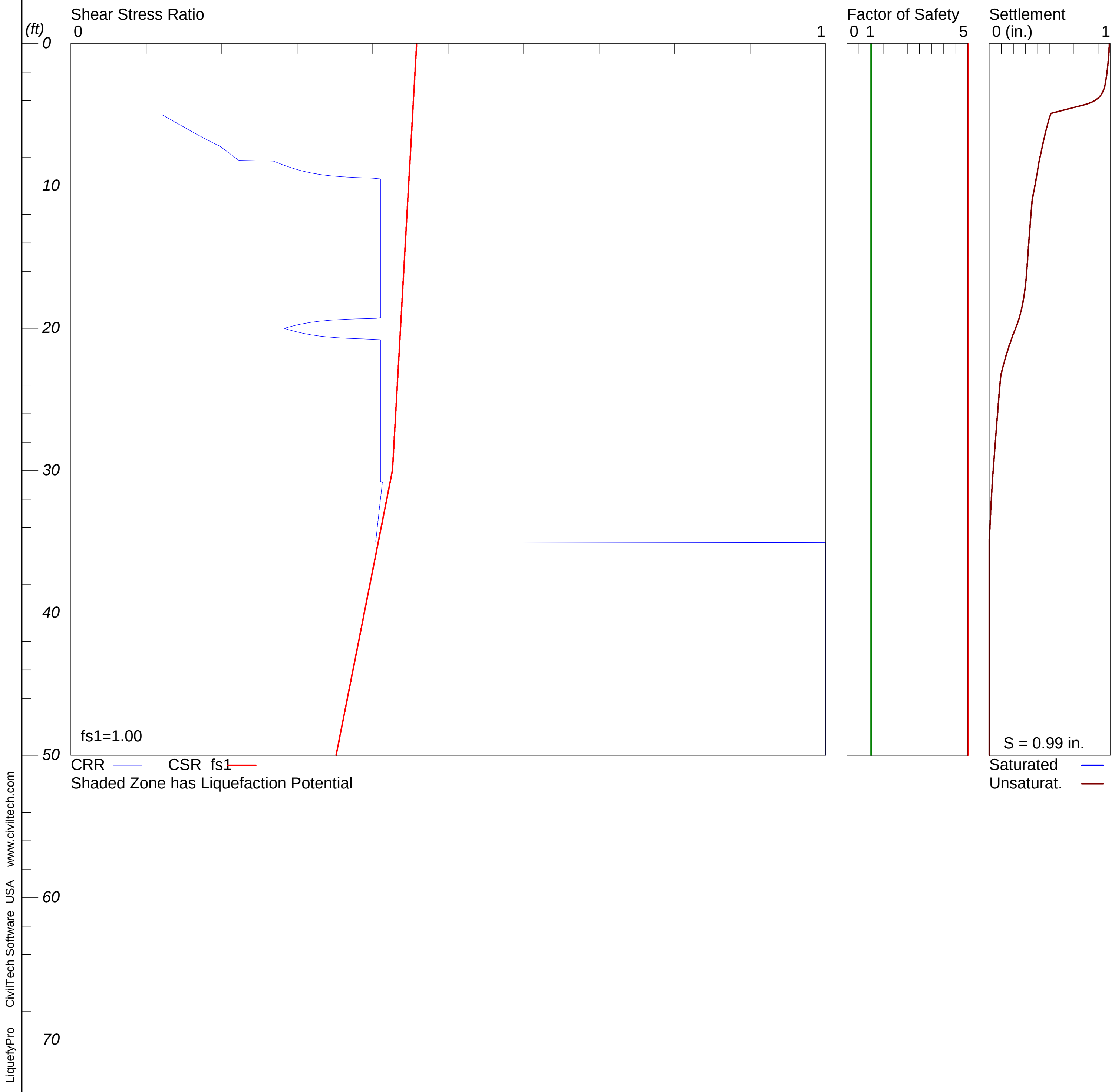


Jack Rabbit Trail **KB-2**

18060-00

Hole No.=KB-3 Water Depth=100 ft

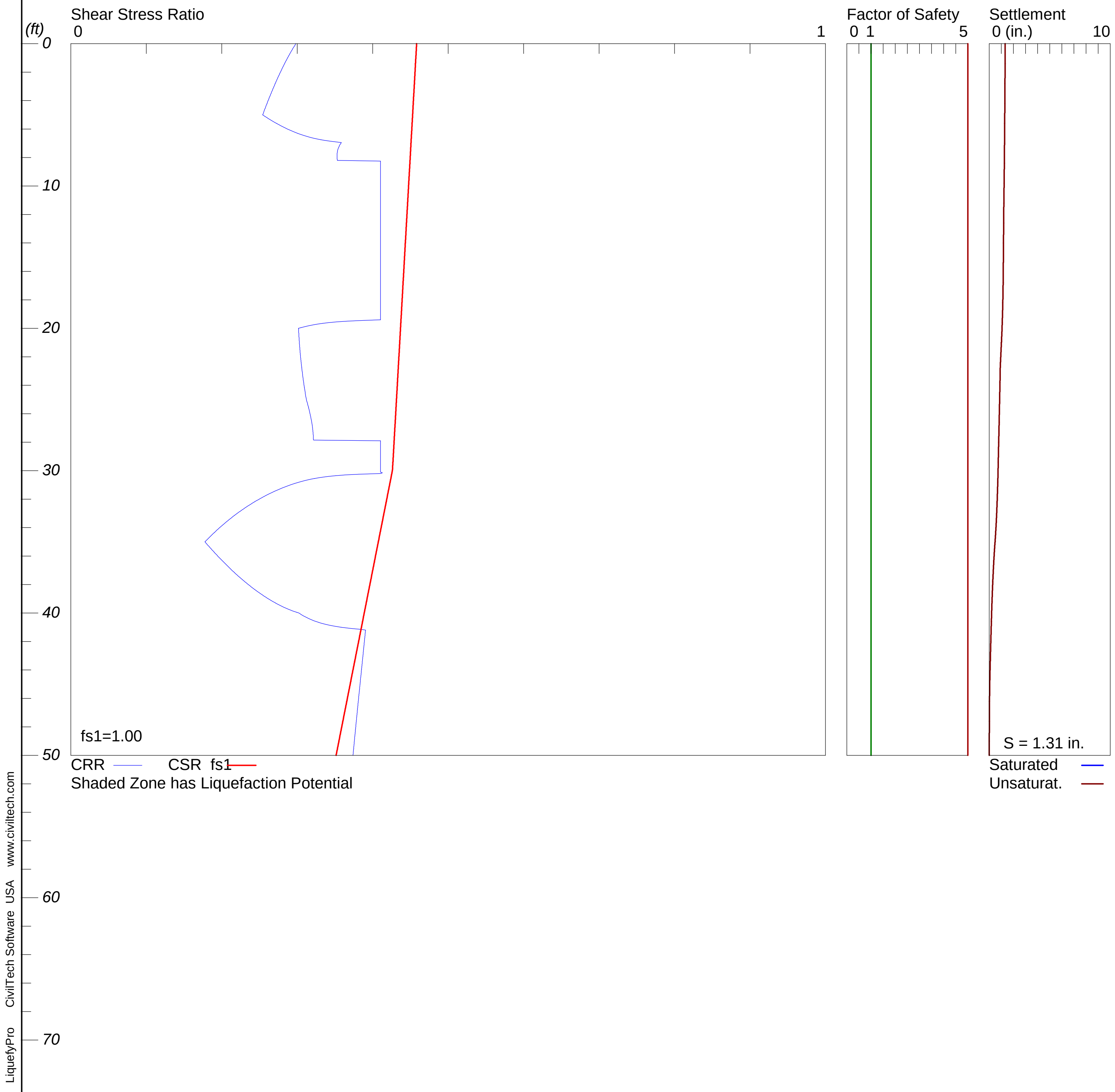
Magnitude=8.1
Acceleration=0.705g



18060-00

Hole No.=KB-4   Water Depth=100 ft

Magnitude=8.1
Acceleration=0.705g

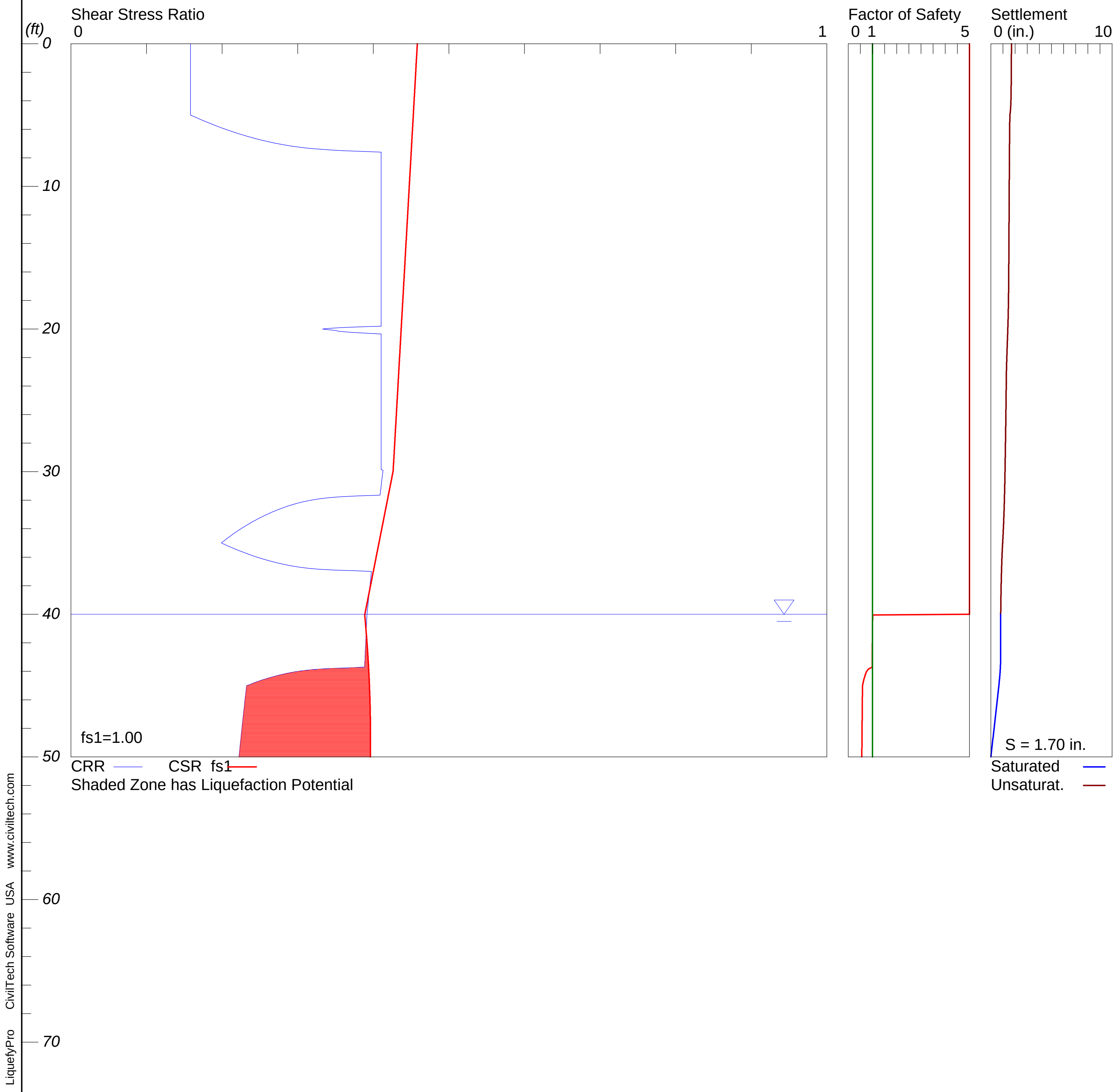


Jack Rabbit Trail **KB-4**

18060-00

Hole No.=KB-5 Water Depth=40 ft

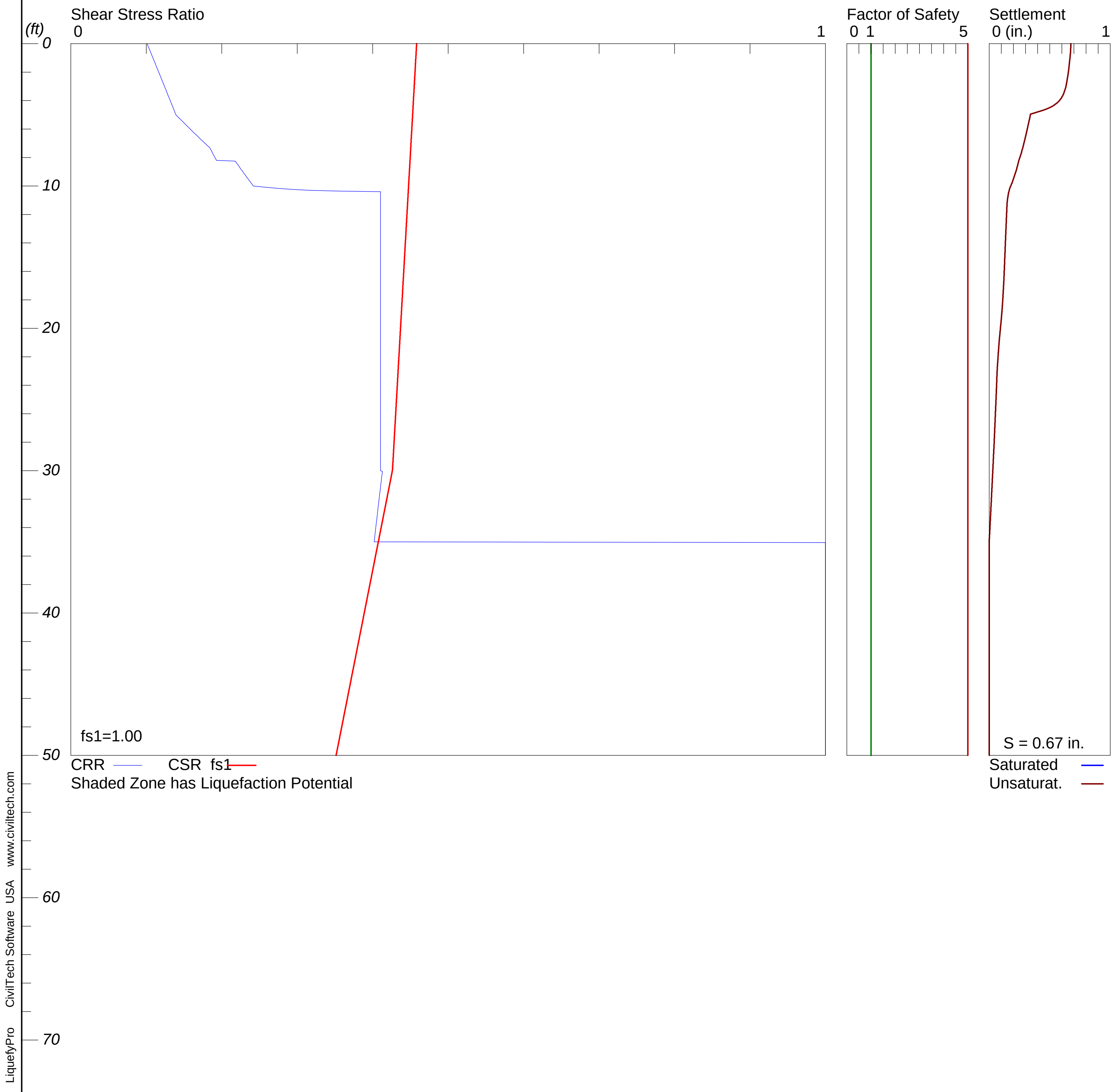
Magnitude=8.1
Acceleration=0.705g



18060-00

Hole No.=KB-6   Water Depth=100 ft

Magnitude=8.1
Acceleration=0.705g



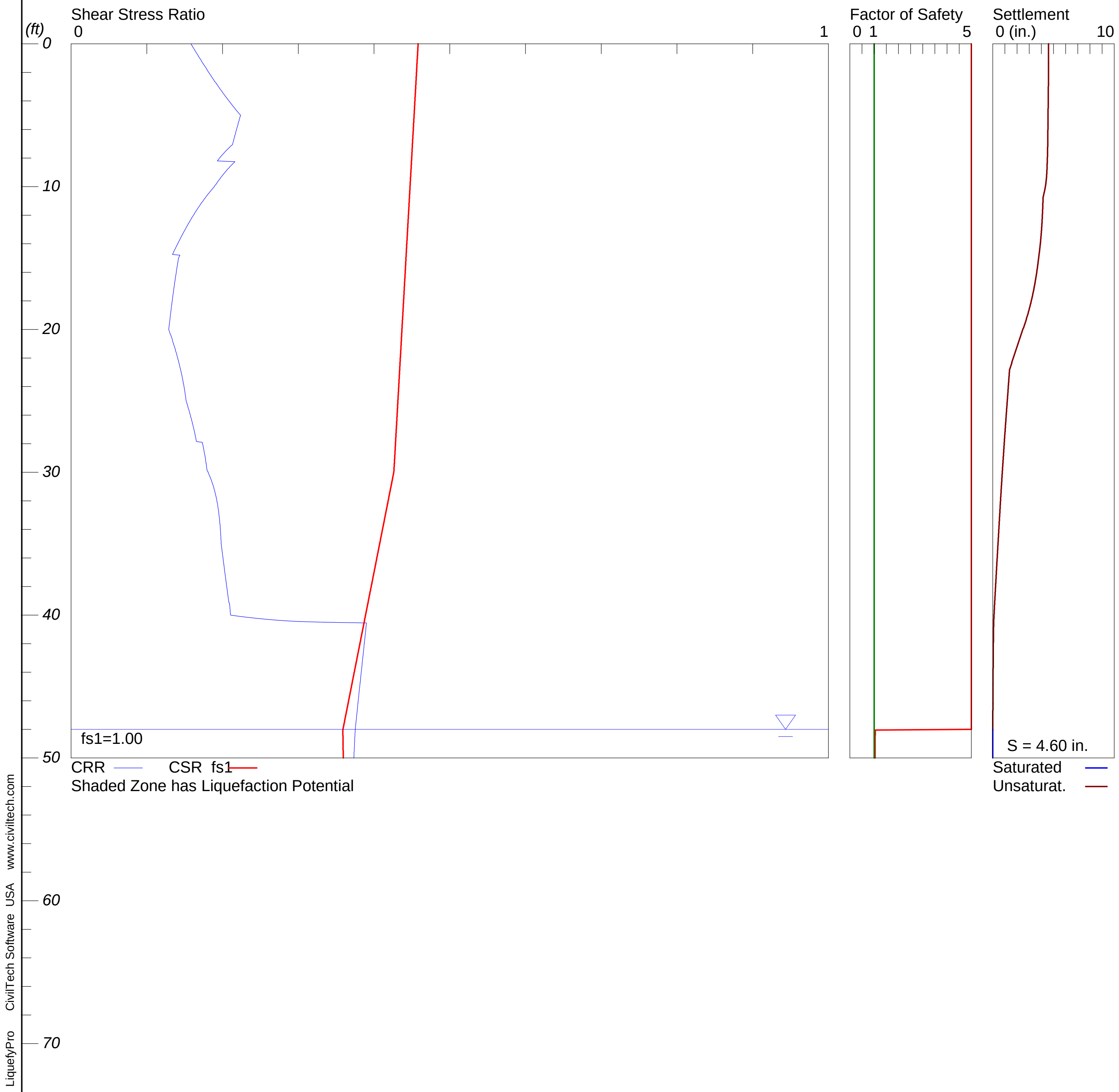
Jack Rabbit Trail

Plate A-1

18060-00

Hole No.=KB-7 Water Depth=48 ft

Magnitude=8.1
Acceleration=0.705g

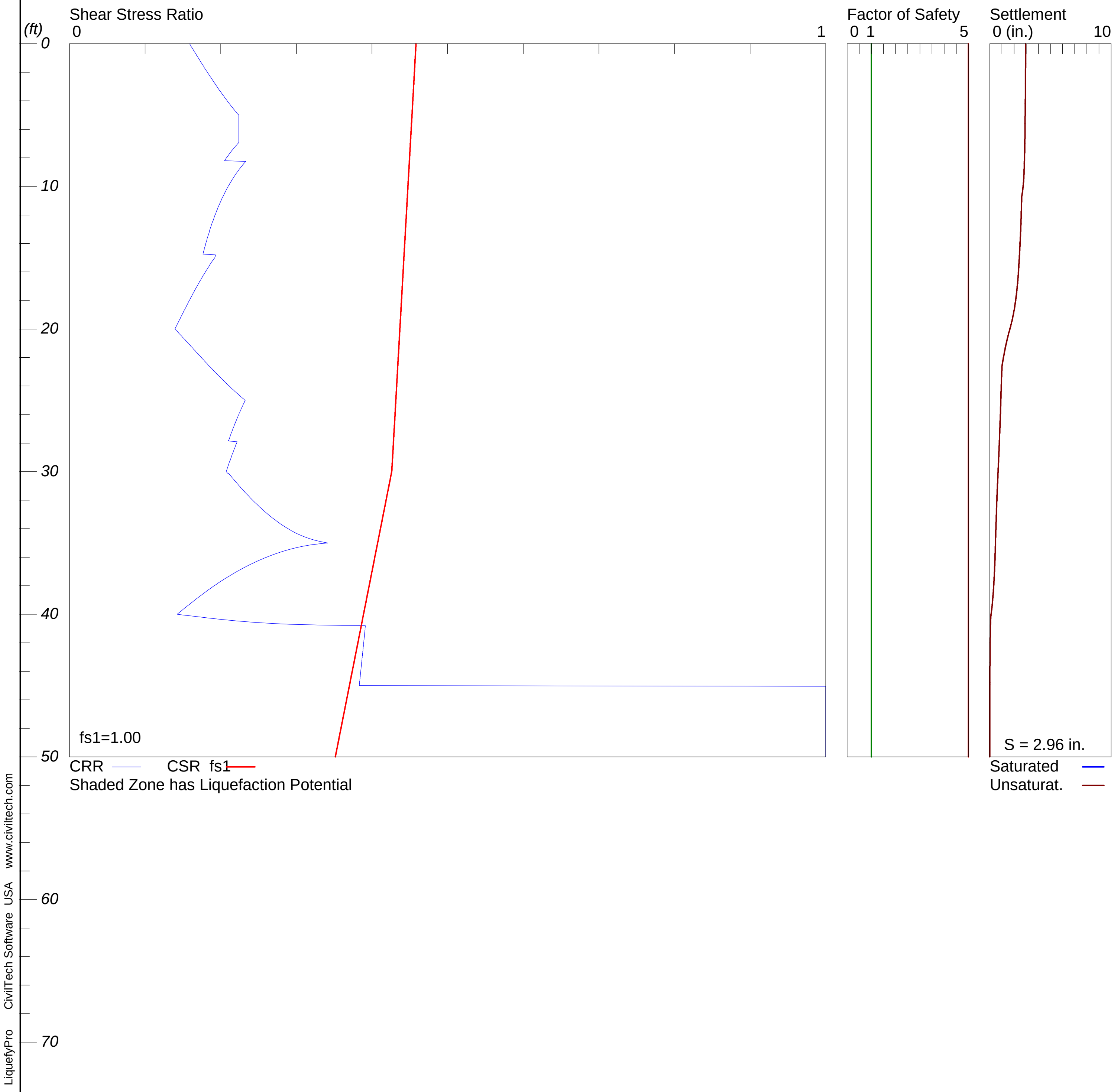


Jack Rabbit Trail **KB-7**

18060-00

Hole No.=KB-8 Water Depth=100 ft

Magnitude=8.1
Acceleration=0.705g

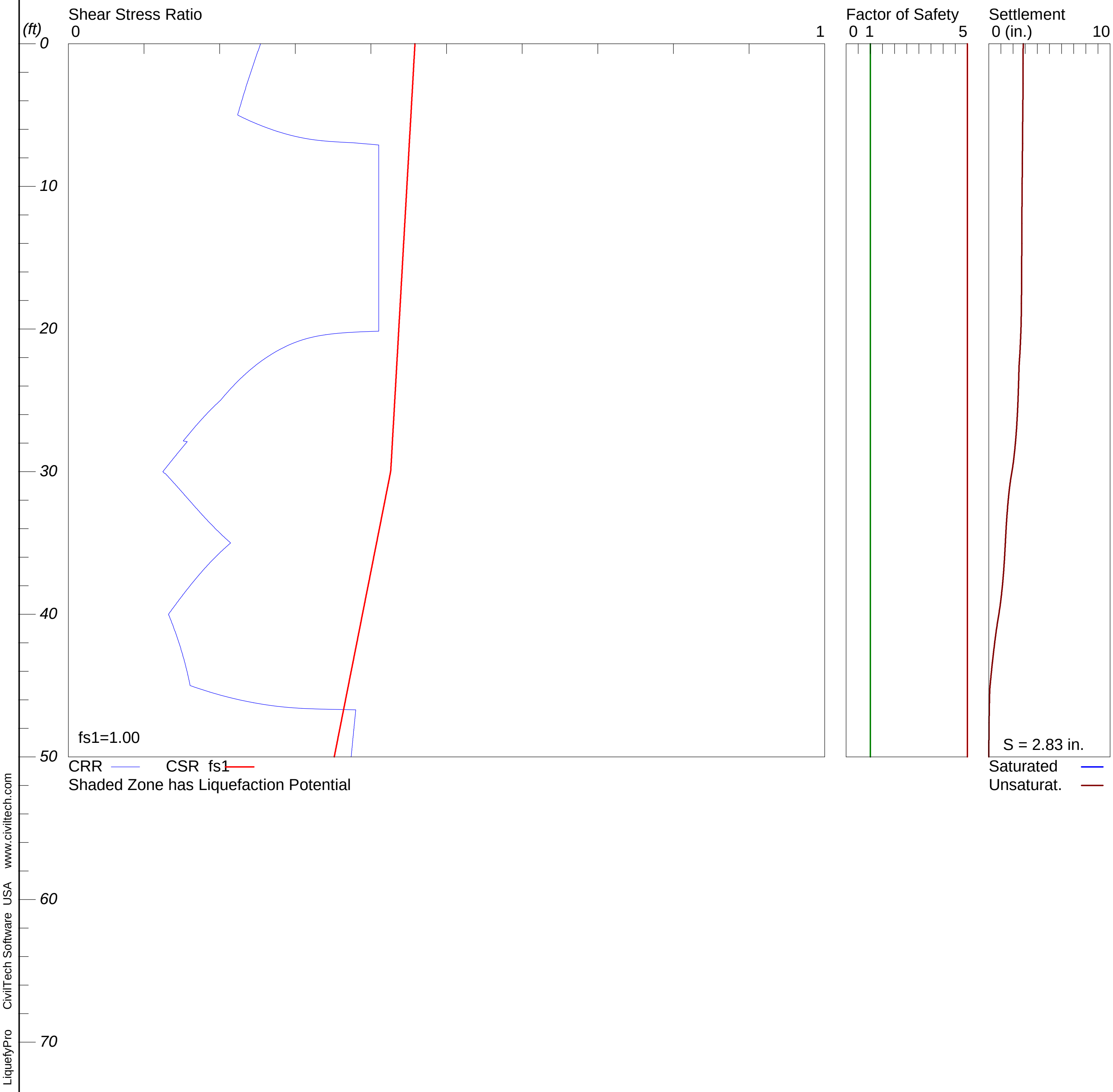


Jack Rabbit Trail **KB-8**

18060-00

Hole No.=KB-9   Water Depth=100 ft

Magnitude=8.1
Acceleration=0.705g



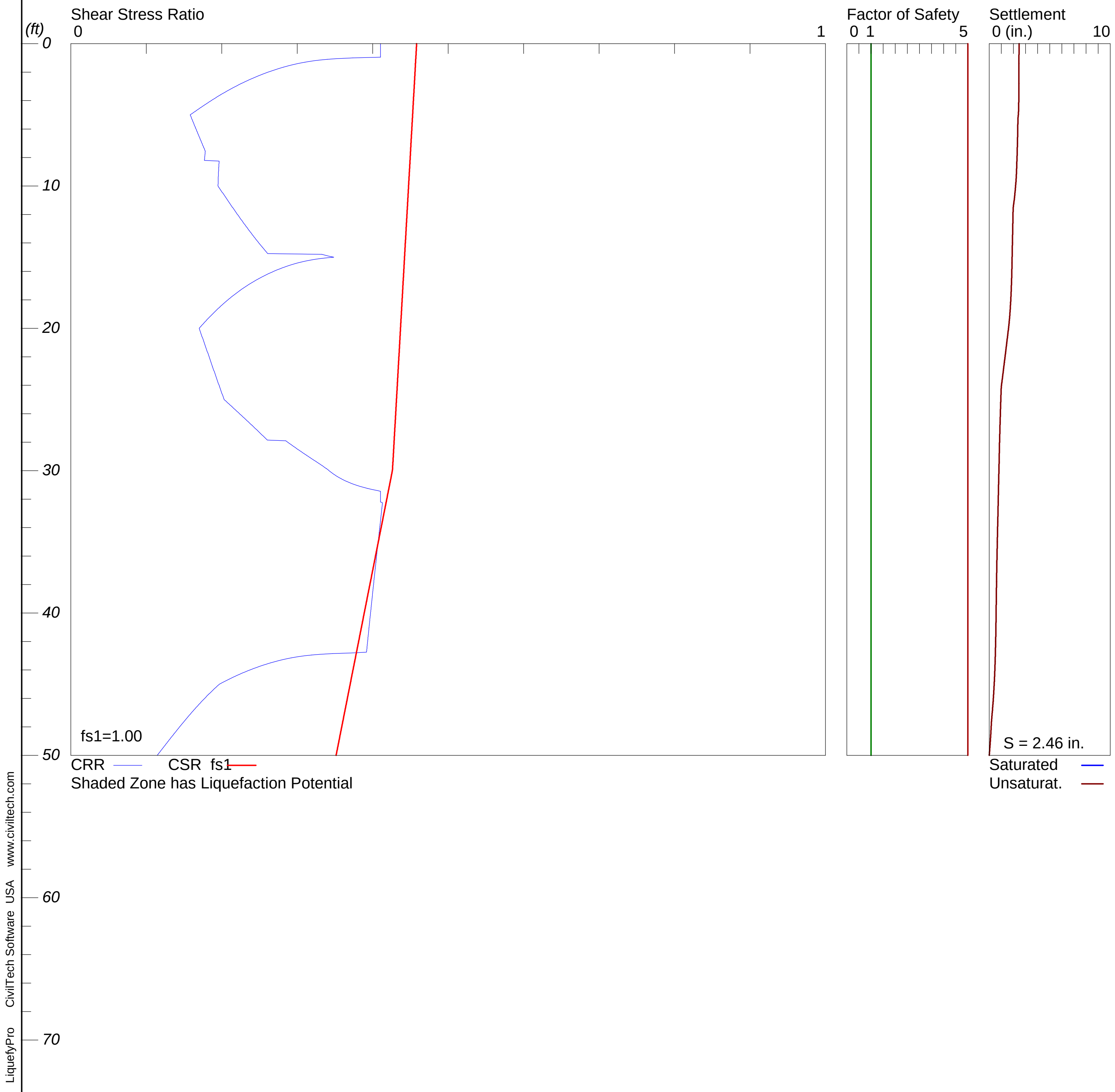
Jack Rabbit Trail

KB-9

18060-00

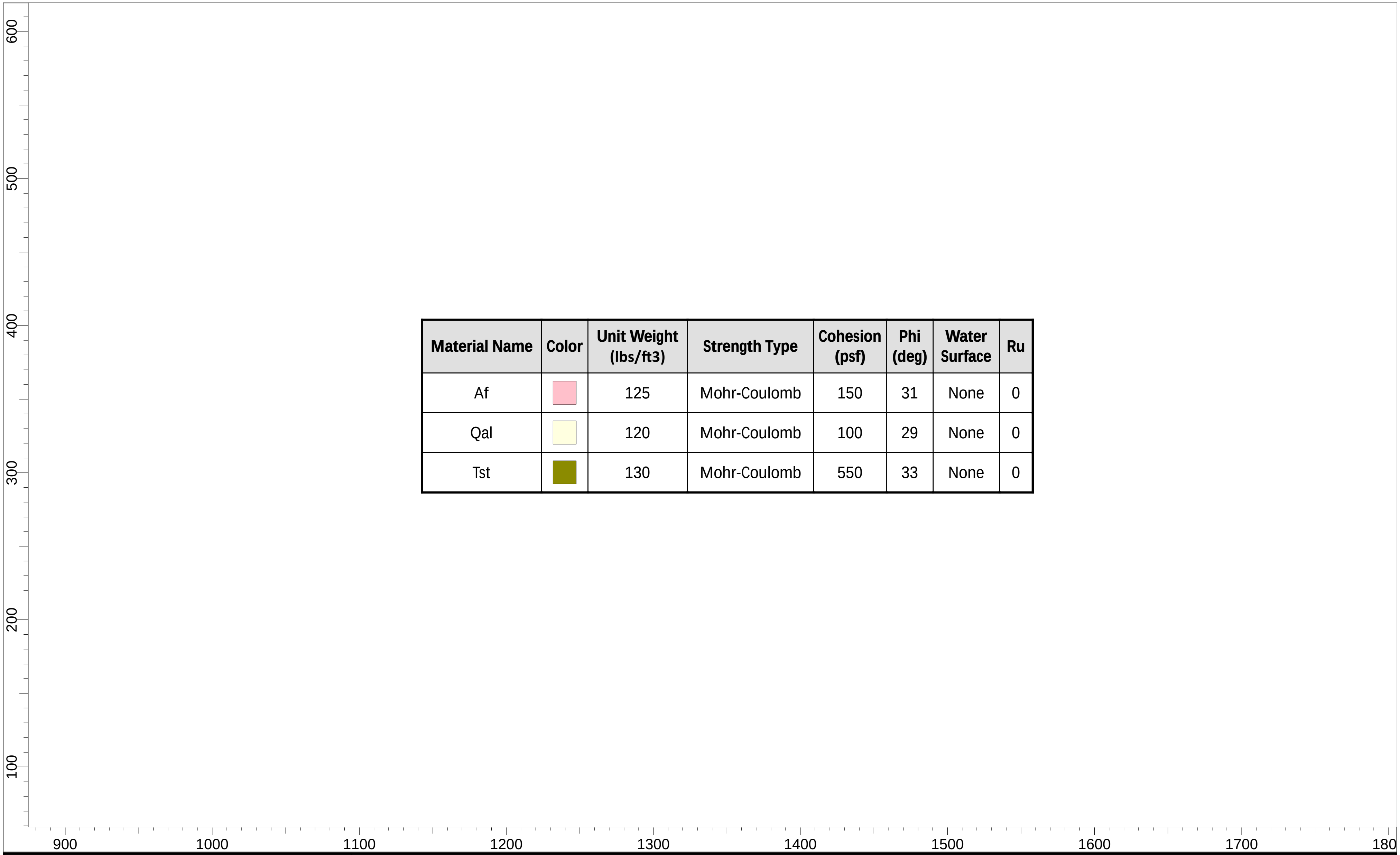
Hole No.=KB-10 Water Depth=100 ft

Magnitude=8.1
Acceleration=0.705g



APPENDIX E

SLOPE STABILITY ANALYSIS



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Af	🟥	125	Mohr-Coulomb	150	31	None	0
Qal	🟨	120	Mohr-Coulomb	100	29	None	0
Tst	🟩	130	Mohr-Coulomb	550	33	None	0

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SLIDEINTERPRET 8.016

Project 18060-00 Jack Rabbit Trail

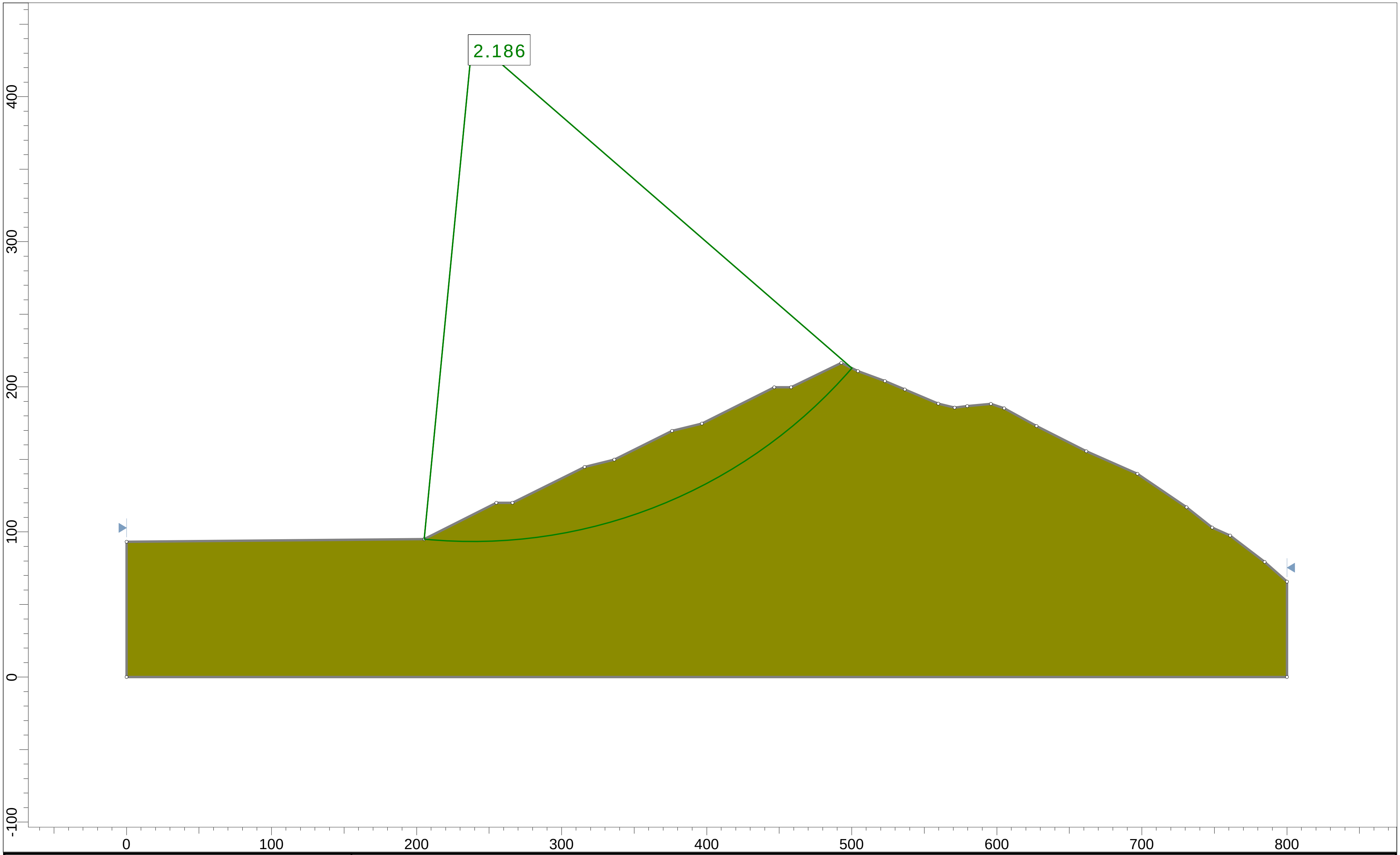
Analysis Description

Drawn By CJO

Project Number 18060-00

Date 8/16/2019

Figure

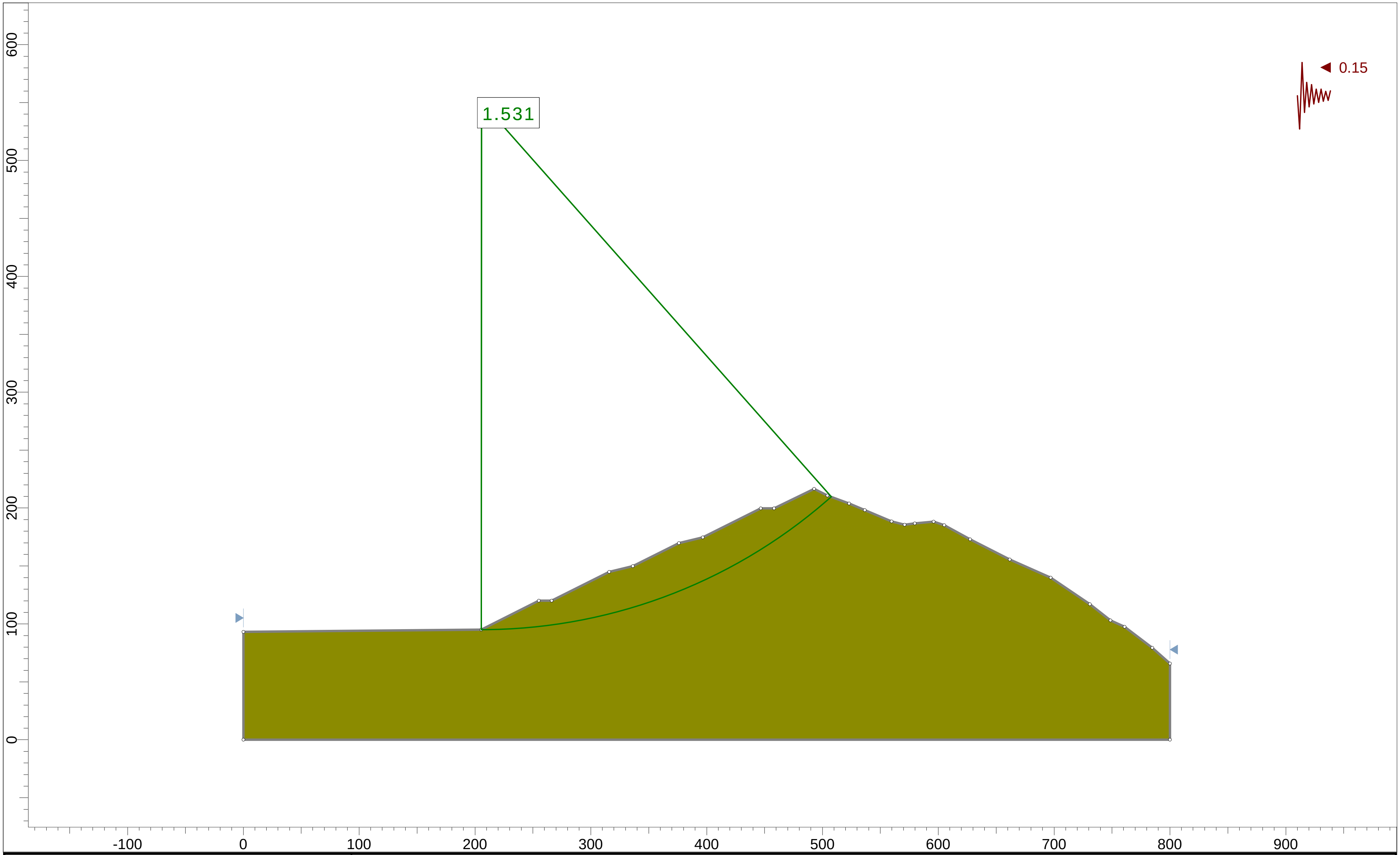


Project	18060-00 Jack Rabbit Trail
Analysis Description	Cross Section A-A' Static

Drawn By	CJO	*Project Number*	18060-00
Date	8/16/2019	*Figure*	

KCG KLING Consulting Group, Inc.

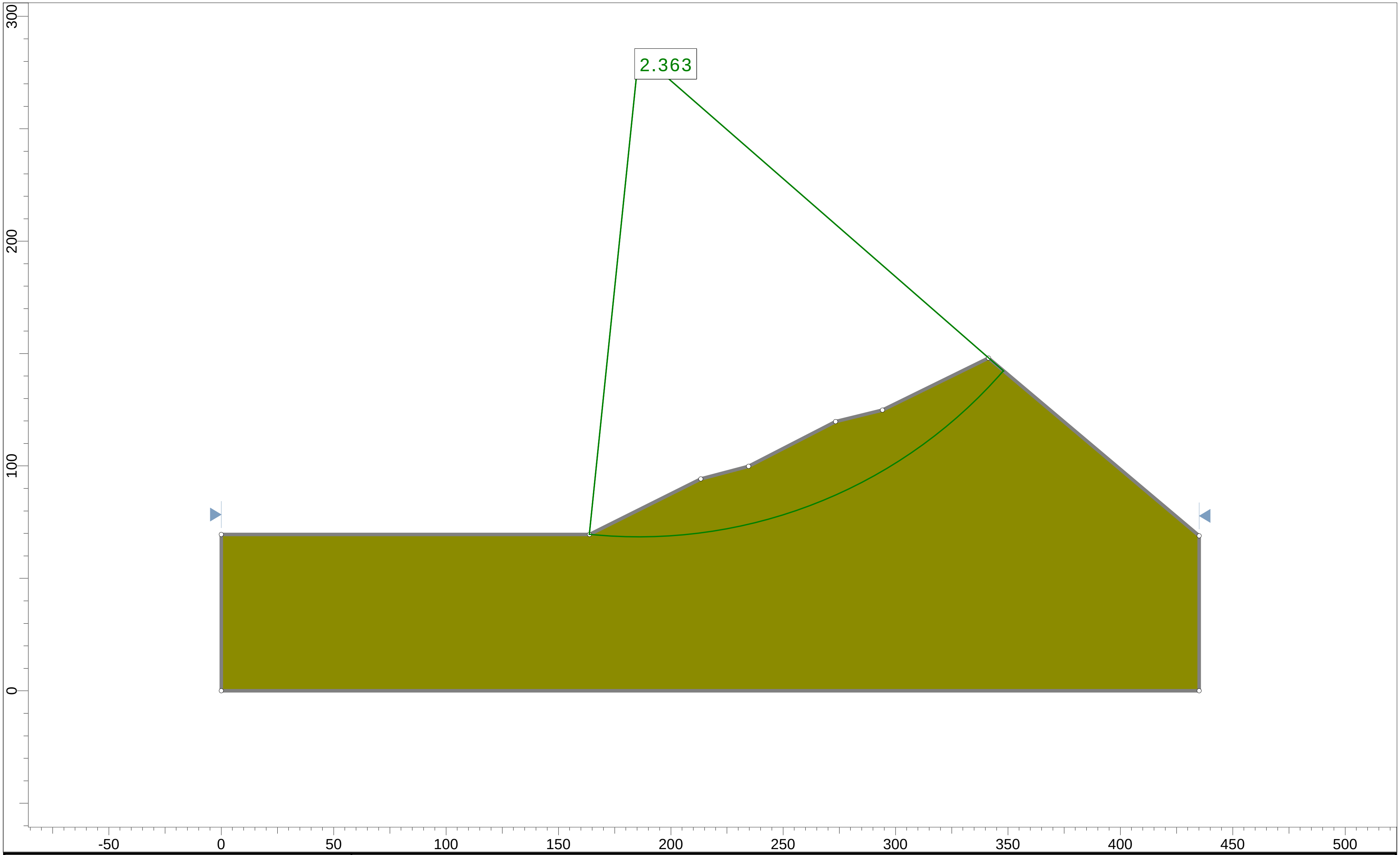
SLIDEINTERPRET 8.016



KCG KLING Consulting Group, Inc.

SLIDEINTERPRET 8.016

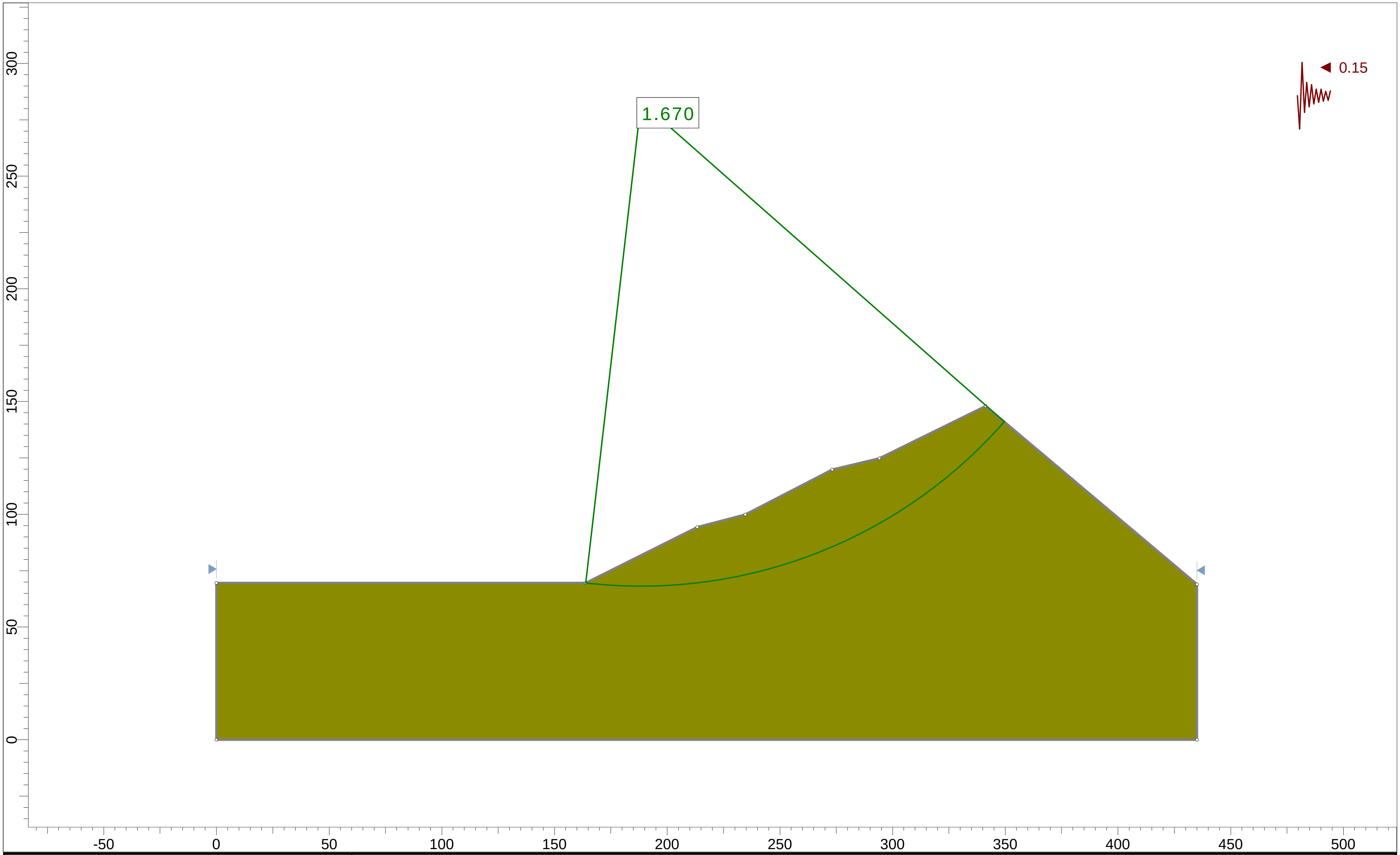
Project	18060-00 Jack Rabbit Trail		
Analysis Description	Cross Section A-A' Puesdo Static		
Drawn By	CJO	*Project Number*	18060-00
Date	8/16/2019	*Figure*	



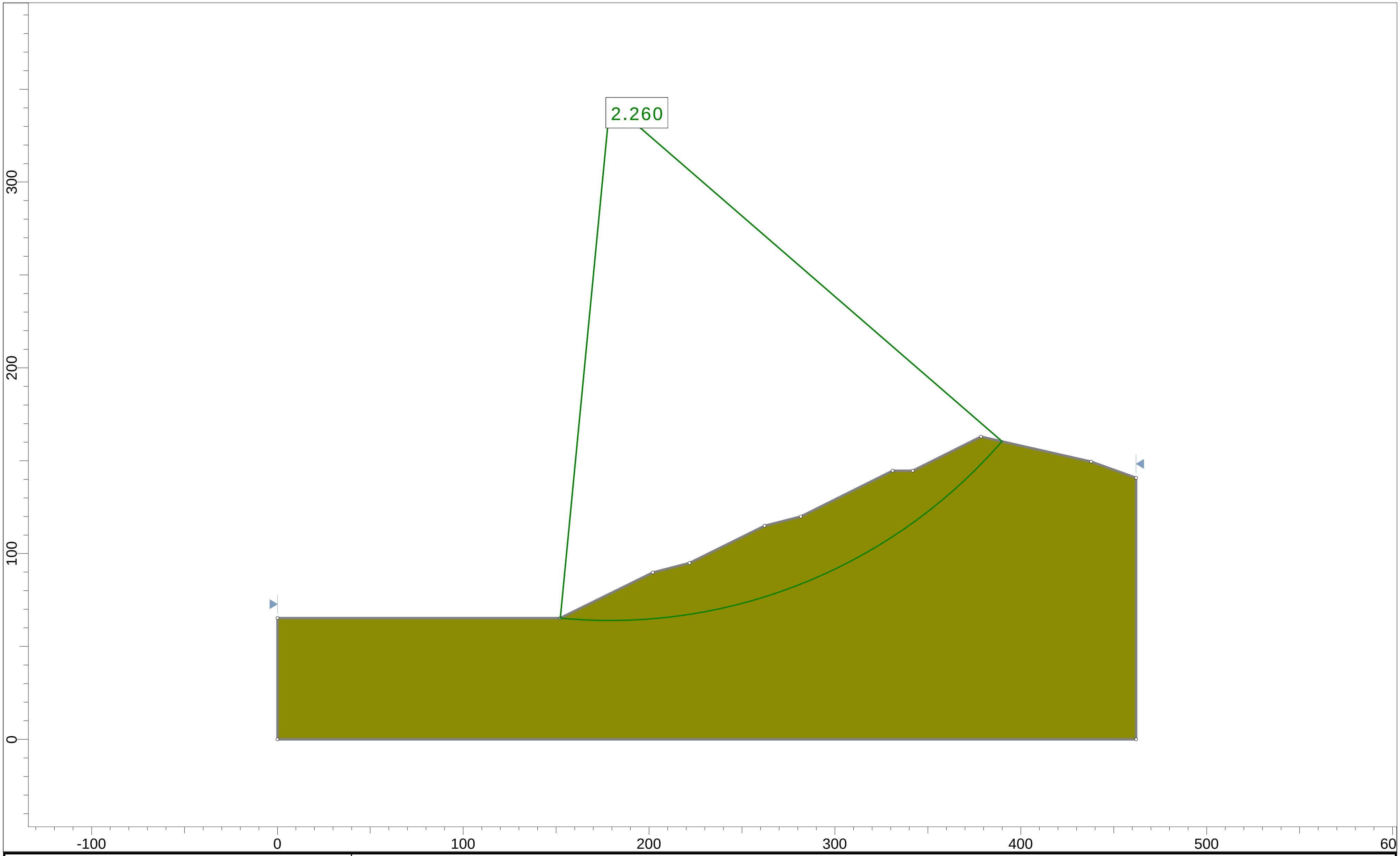
KCG KLING Consulting Group, Inc.

Project	18060-00 Jack Rabbit Trail		
Analysis Description	Cross Section B-B' Static		
Drawn By	CJO	*Project Number*	18060-00
Date	8/16/2019	*Figure*	

SLIDEINTERPRET 8.016



KCG KLING Consulting Group, Inc.	*Project* 18060-00 Jack Rabbit Trail		
	Analysis Description Cross Section B-B' Pusedo Static		
	Drawn By CJO	*Project Number* 18060-00	
SLIDEINTERPRET 8.016	*Date* 8/16/2019	*Figure*	

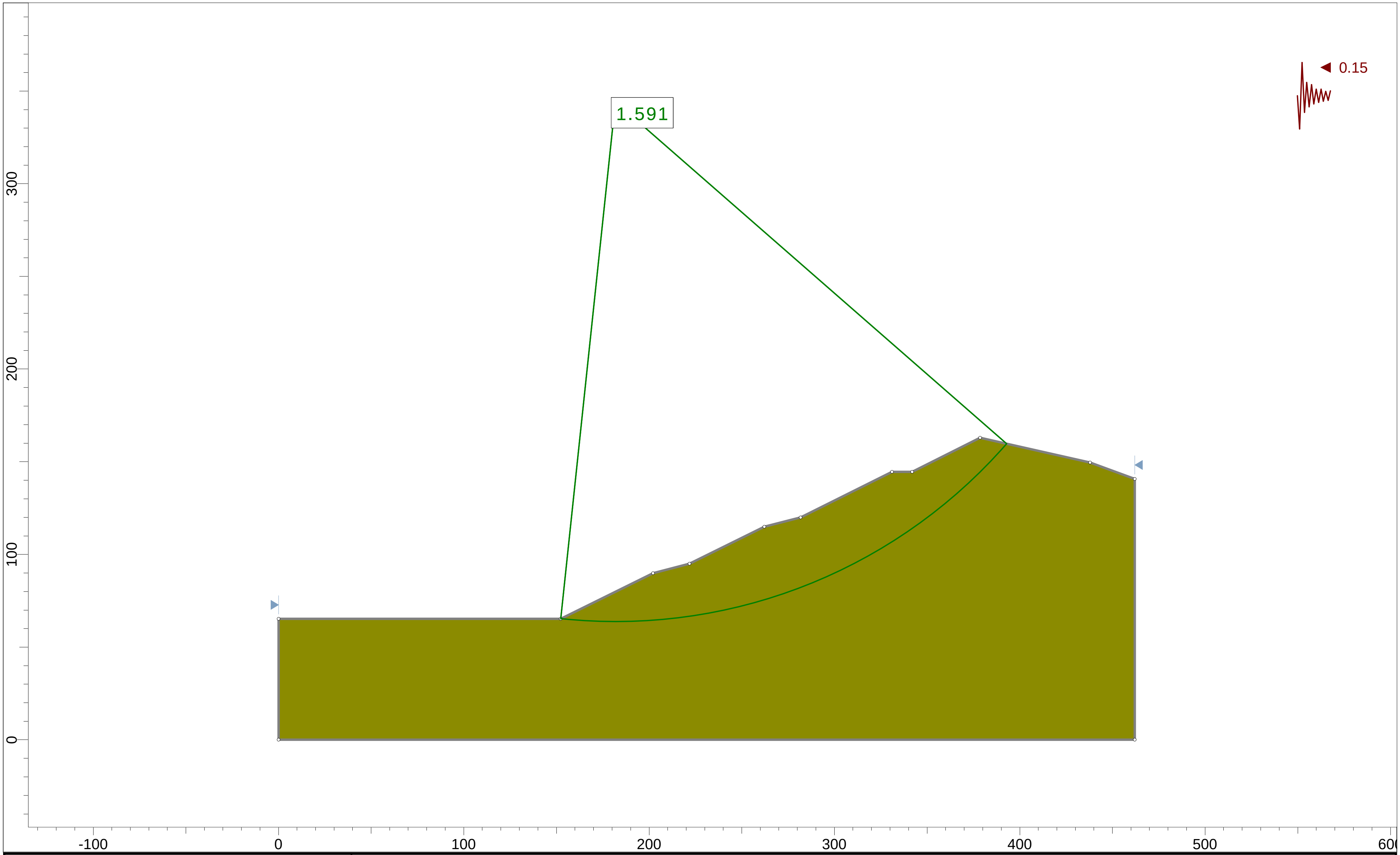


Project	18060-00 Jack Rabbit Trail
Analysis Description	Cross Section C-C' Static

Drawn By	CJO	*Project Number*	18060-00
Date	8/16/2019	*Figure*	

KCG KLING Consulting Group, Inc.

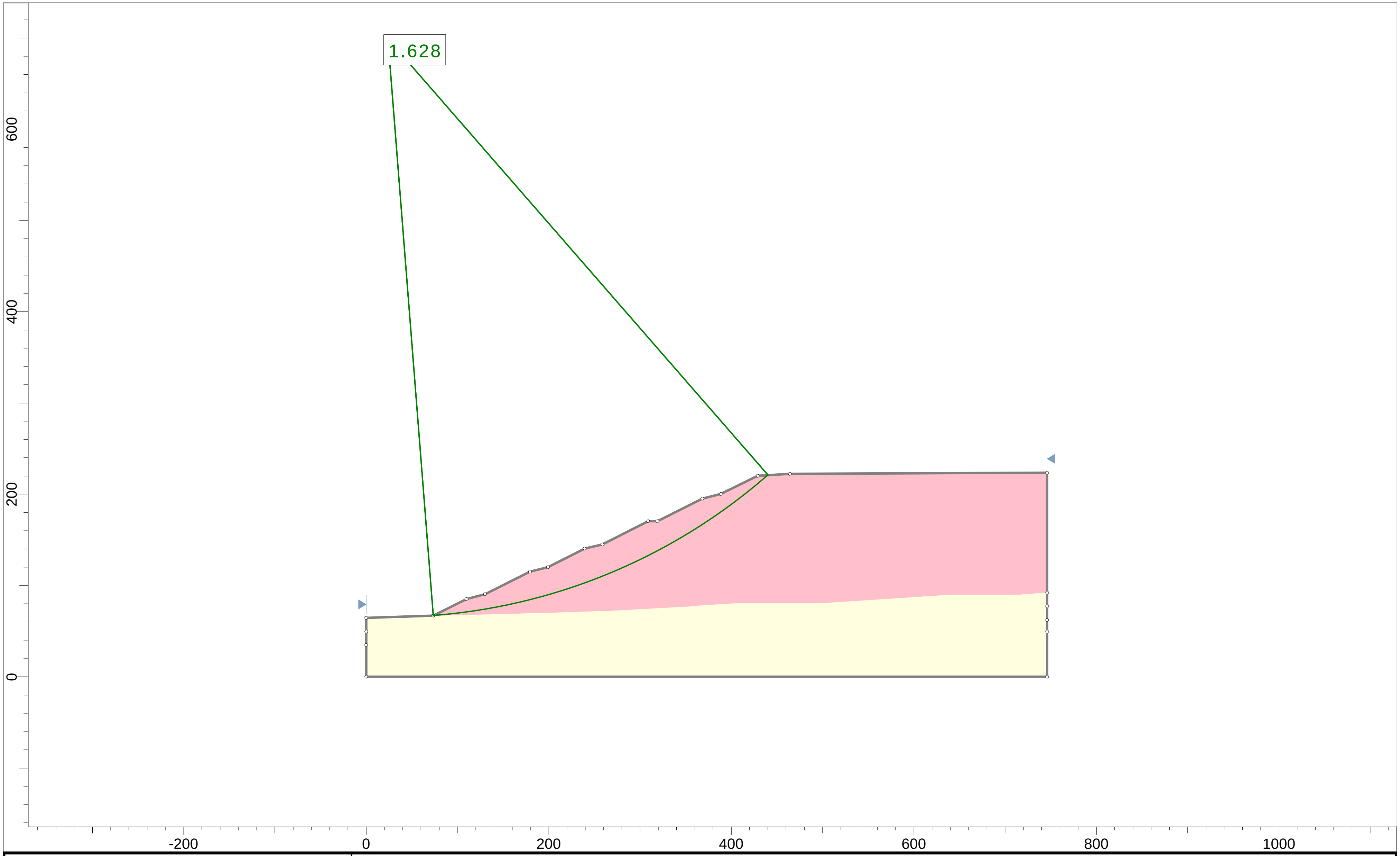
SLIDEINTERPRET 8.016



KCG KLING Consulting Group, Inc.

Project	18060-00 Jack Rabbit Trail		
Analysis Description	Cross Section C-C' Pusedo Static		
Drawn By	CJO	*Project Number*	18060-00
Date	8/16/2019	*Figure*	

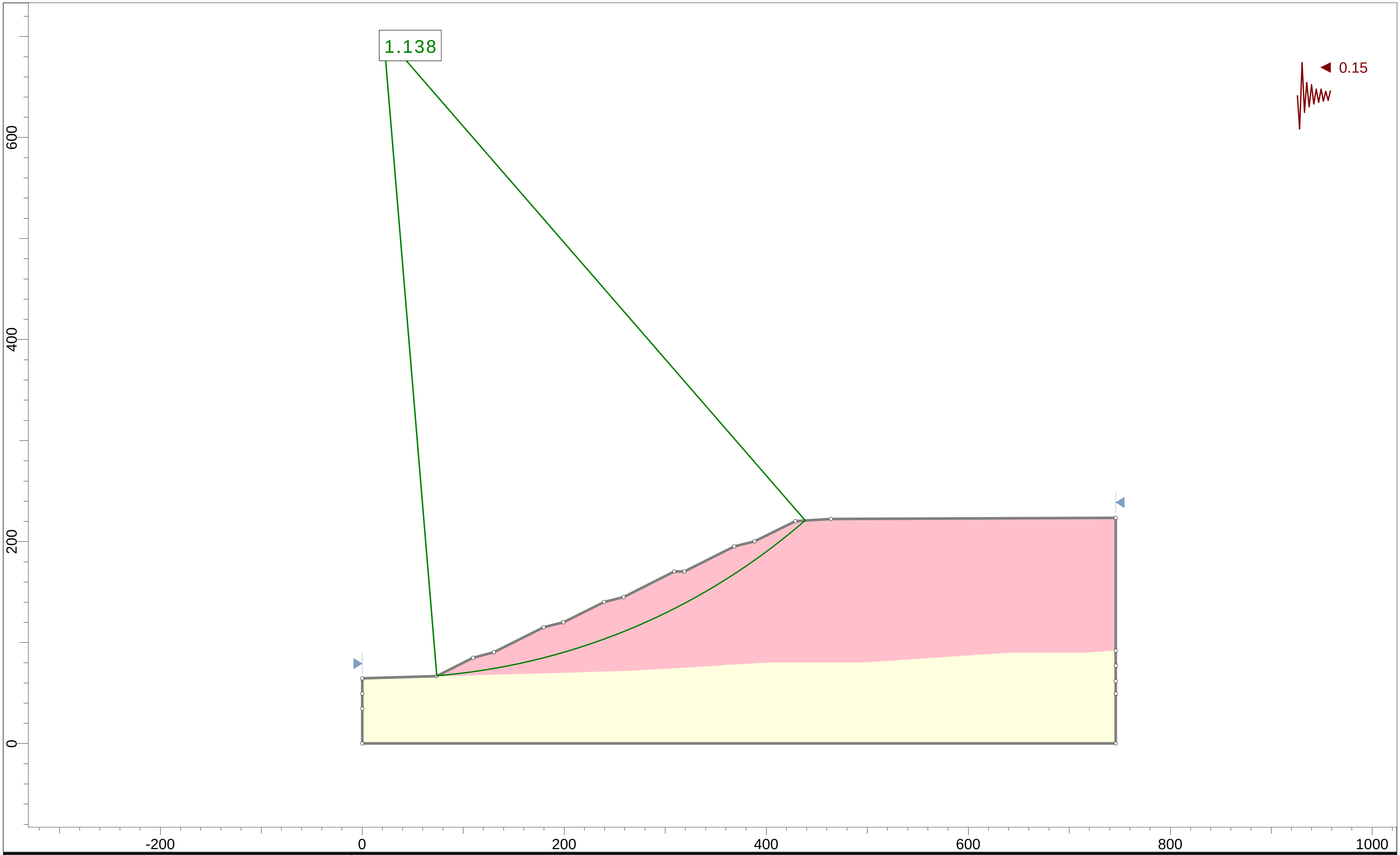
SLIDEINTERPRET 8.016



Project	18060-00 Jack Rabbit Trail		
Analysis Description	Cross Section D-D' Static		
Drawn By	CJO	*Project Number*	18060-00
Date	8/16/2019	*Figure*	

KLING Consulting Group, Inc.

SLIDEINTERPRET 8.016



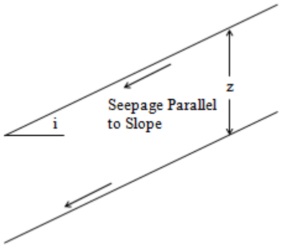
Project	18060-00 Jack Rabbit Trail		
Analysis Description	Cross Section D-D' Puesdo Static		
Drawn By	CJO	*Project Number*	18060-00
Date	8/16/2019	*Figure*	

KCG KLING Consulting Group, Inc.

SLIDEINTERPRET 8.016

Jack Rabbit Trail
Surficial Stability Calculation 2:1 Cut Slope

August, 2019



Soil Properties

$\gamma := 130\ \text{pcf}$	Unit Weight of Soil	$\phi' := 33\ \text{deg}$	Angle of Internal Friction
$\gamma_w := 62.4\ \text{pcf}$	Unit Weight of Water	$i := 26.6\ \text{deg}$	Slope Angle
$c := 550\ \text{psf}$	Cohesion	$z := 4\ \text{ft}$	Depth of Saturation

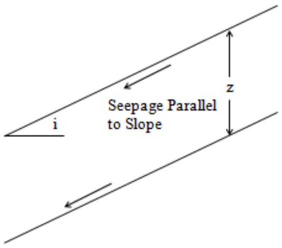
Surficial Stability Calculation

$$FS := \frac{c + \left(\left(\gamma - \gamma_w\right) \cdot z \cdot \cos\left(i\right)^2 \cdot \tan\left(\phi'\right)\right)}{\gamma \cdot z \cdot \sin\left(i\right) \cdot \cos\left(i\right)} = 3.32$$

KCG KLING Consulting Group, Inc.

Jack Rabbit Trail
Surficial Stability Calculation 2:1 Fill Slope

August, 2019



Soil Properties

$\gamma := 125 \text{ pcf}$	Unit Weight of Soil	$\phi' := 31 \text{ deg}$	Angle of Internal Friction
$\gamma_w := 62.4 \text{ pcf}$	Unit Weight of Water	$i := 26.6 \text{ deg}$	Slope Angle
$c := 350 \text{ psf}$	Cohesion	$z := 4 \text{ ft}$	Depth of Saturation

Surficial Stability Calculation

$$FS := \frac{c + \left(\left(\gamma - \gamma_w\right) \cdot z \cdot \cos(i)^2 \cdot \tan(\phi')\right)}{\gamma \cdot z \cdot \sin(i) \cdot \cos(i)} = 2.35$$

APPENDIX F

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

1.0 GENERAL INTENT

These specifications present general procedures and requirements for grading and earthwork as shown on the project grading plans, including preparation of areas to be filled, placement of fill, installation of subsurface drainage, and excavations. The recommendations contained in the geotechnical report(s) are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict. Evaluations performed by the geotechnical consultant during the course of grading may result in new specifications or recommendations in addition to those contained in the geotechnical report(s).

2.0 EARTHWORK OBSERVATION AND TESTING

Prior to the commencement of grading, a qualified geotechnical consultant (soils engineer and engineering geologist, and their representatives) shall be employed for the purpose of observing earthwork procedures and testing the fills for conformance with the recommendations of the geotechnical report and these specifications. It will be necessary that the geotechnical consultant provide adequate testing and observation so that he may determine that the work was accomplished as specified. If conditions exposed during grading differ significantly from those interpreted during the preliminary design investigation, the geotechnical consultant shall inform the client, recommend appropriate changes in the geotechnical design to account for the observed conditions, and notify City or County grading authorities, as necessary. It shall be the responsibility of the contractor to assist the geotechnical consultant and keep him apprised of work schedules and changes so that he may schedule his personnel accordingly.

The Project Geotechnical Consultant shall observe processing, moisture conditioning, and compaction of fill and subgrade materials. Testing of compacted fill in representative locations shall be performed by the Project Geotechnical Consultant’s field representative. Daily reports and test results shall be provided to the client representative on a regular and frequent basis. Maximum dry density tests used to determine the degree of compaction and optimum moisture content shall be performed in accordance with the American Society for Testing and Materials test method ASTM D1557.

It shall be the sole responsibility of the contractor to provide adequate equipment and methods to accomplish the work in accordance with the geotechnical report(s) applicable grading codes and project grading plans. If, in the opinion of the geotechnical consultant, unsatisfactory conditions, such as questionable soil, poor moisture condition, inadequate compaction, adverse weather, etc., are resulting in the quality of work less than required in these specifications, the geotechnical consultant will be empowered to reject the work and recommend that construction be stopped until the conditions are rectified.

3.0 PREPARATION OF AREA TO BE FILLED

3.1 Clearing and Grubbing

All brush, vegetation, trash, debris and other deleterious material shall be removed from fill areas and disposed of off site. Vegetation cleared from the site shall not be placed within engineered compacted fill areas.

3.2 Processing

The existing ground which is determined to be satisfactory for support of fill shall be scarified to a minimum depth of six (6) inches. Existing ground which is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until the soils are broken down and free of large clay lumps or clods and until the working surface is reasonably uniform and free of uneven features which would inhibit uniform compaction.

3.3 Overexcavation

Soft, dry, spongy, highly fractured or otherwise unsuitable ground, extending to such a depth that surface processing cannot adequately improve the condition, shall be overexcavated to firm ground, and verified by the project geotechnical consultant.

3.4 Moisture Conditioning

Overexcavated and processed soils shall be watered, dried-back, blended, and/or mixed as required to attain a uniform moisture content near optimum.

3.5 Recompaction

Overexcavated and processed soils which have been properly mixed and moisture-conditioned shall be recompacted to a minimum relative compaction of 90 percent, ASTM D1557.

3.6 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal: vertical units), the ground shall be stepped or benched. The lowest bench shall be a minimum of 15 feet wide, shall be at least 2 feet deep, shall expose firm material, and shall be verified by the geotechnical consultant. Other benches shall be excavated in firm material for a minimum width of 4 feet. Ground sloping flatter than 5:1 shall be benched or otherwise overexcavated when considered necessary by the geotechnical consultant.

3.7 Evaluation of Areas to Receive Fill

All areas to receive fill, including processed areas, removal areas and toe-of-fill benches shall be observed, tested, and/or mapped by the geotechnical consultant prior to fill placement. A written evaluation of the area to be filled shall be obtained by the Contractor prior to placement of fill.

4.0 FILL MATERIAL

4.1 General

Material to be placed as fill shall be free of roots, grasses, branches, wood or other organic matter and other deleterious materials, and shall be tested by the geotechnical consultant prior to use as fill. Soils of poor gradation, expansion, or strength characteristics shall be placed in areas designated by the geotechnical consultant or shall be mixed with other soils to serve as satisfactory fill material.

4.2 Oversize Material

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fills, unless the location, materials, and disposal methods are specifically recommended by the geotechnical consultant. Oversized disposal operations shall be such that nesting of oversize material does not occur, and such that the oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet vertically of finish grade or construction, unless specifically recommended by the geotechnical consultant.

4.3 Import

If importing of fill material is required for grading, the import material shall meet the requirements of Section 4.1. Samples of import soils shall be provided for testing a minimum of 48 hours before the import materials are brought on site.

5.0 FILL PLACEMENT AND COMPACTION

5.1 Fill Lifts

Fill material shall be placed in prepared areas in near-horizontal layers not exceeding 8 inches in loose thickness. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to attain uniformity of material and moisture in each layer.

5.2 Fill Moisture

Fill layers at a moisture content less than optimum shall be watered and mixed, and wet fill layers shall be aerated by scarification or shall be blended with drier material. Moisture-conditioning and mixing of fill layers shall continue until the fill material is at a uniformly processed at a minimum of 125 percent of the optimum moisture content.

5.3 Fill Compaction

Each layer of fill shall be evenly spread, moisture-conditioned, mixed, and shall be uniformly compacted to not less than 90 percent of the maximum dry density at a minimum of 125 percent of the optimum moisture content. Compaction equipment shall be adequately sized and shall be either specifically designed for soil compaction or of proven reliability, to efficiently achieve the specified degree of compaction.

5.4 Fill Slopes

Compacting of slopes shall be accomplished, in addition to normal compacting procedures, by overfilling and compacting the slope face a minimum of four feet horizontally from finish grade, and cutting the slope face back to the core of compacted fill. In restricted spaces where overfilling is not possible, fill slopes may be compacted by back-rolling of slopes, with sheepsfoot rollers at frequent increments of 1 to 2 feet in fill elevation gain. At the completion of grading, the relative compaction of the slope out to the slope face shall be a minimum of 90 percent.

5.5 Compaction Testing

Field tests to check the fill moisture and degree of compaction will be performed by the geotechnical consultant. The location and frequency of tests shall be at the geotechnical consultant's discretion. In general, the tests will be taken at an interval not exceeding 2 feet in vertical elevation and/or 1,000 cubic yards of fill placed.

6.0 SUBDRAIN INSTALLATION

Subdrain systems shall be installed in locations recommended by the geotechnical consultant to conform to the approximate alignment and details shown on the plans or herein. The subdrain location or materials shall not be changed or modified without the recommendation of the geotechnical consultant. The geotechnical consultant; however, may recommend changes in subdrain line, grade or material. All subdrains should be surveyed for line and grade after installation. Sufficient time shall be allowed for the surveys, prior to commencement of filling over subdrain areas.

7.0 EXCAVATION

Excavation and cut slopes will be geologically mapped and examined during grading. Sufficient time shall be allowed by the contractor to permit geologic mapping of excavation bottoms and cut slopes. If directed by the geotechnical consultant, further excavation or overexcavation and refilling of cut areas shall be performed, and/or remedial grading of cut slopes. All fill-over-cut slopes are to be graded, unless otherwise stated, shall be constructed as a fill slope with the use of minimum width stabilization fills, as necessary.

APPENDIX G

SLOPE MAINTENANCE GUIDELINES

SLOPE MAINTENANCE GUIDELINES

INTRODUCTION

Permanent slope maintenance measures should be initiated as soon as possible after completion of slope construction. However, all soil slopes will undergo some erosion when subjected to sustained water application. To reduce long-term erosion, we have outlined below some important points to be considered when planning, designing, and installing or implementing slope erosion control plans. The following general guidelines are provided to mitigate slope maintenance problems and should be implemented by the responsible party, during landscaping improvements and subsequent maintenance:

1. Manufactured or natural slopes, terraces, berms (ridges at crown of slopes) and proper drainage should not be disturbed or altered. Surface drainage should be positively maintained to the street.

2. Construction delays, climate/weather conditions, and plant growth rates may be such that additional short-term, non-plant erosion control measures may be needed; examples would be matting, netting, plastic sheets, deep (5-feet) staking, etc.

3. Roof, and drive runoff should be positively conducted away from structures to either the street or storm drain by nonerosive devices such as sidewalks, drainage pipes, ground gutters, and driveway pavement. Drainage should meet the minimum requirements of Section 1804 of the California Building Code.

4. Drains and "V" ditches, etc., should be periodically cleared and unclogged, including gutters and downspouts. During heavy rain periods, drainage should be inspected for performance often, as this is when trouble occurs. Problems such as gullying or ponding should be corrected as soon as possible.

5. High water content in slope soils is a major factor in slope erosion or slope failures. Therefore, all possible precautions should be taken to minimize soil moisture. Leakage from waterlines, irrigation systems, etc., or bypassing of clogged drains should be promptly repaired.

6. Animal burrows should be periodically filled or eliminated in order to minimize infiltration of water and slope failures.

7. If completion of new slopes occurs during the rainy season, contingency plans should be developed to provide prompt temporary protection against major erosion or sloughing. One method would be to place plastic sheeting over the slopes. This should be carefully coordinated with the Landscape Architect/Contractor.

8. The above guidelines are general maintenance procedures but may be superseded under specific direction of the geotechnical consultant/landscape architect/contractor.

APPENDIX H

AFSE INSERT

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from alight industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ-sometimes significantly from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the express purpose of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in-this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer For Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone:' 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

EXPLANATION

Locations Approximate

Qal	Alluvium and Older Alluvium undifferentiated.
Tst	San Timoteo Formation- sandstone, siltstone, and conglomerate, undifferentiated.
┴	Strike and dip of bedding
🟩	Approximate Geologic Contact
KB-5	Approximate Boring Location
◣	Approximate Trench/Test Pit Location
D D'	Approximate Location of Geologic Cross Section

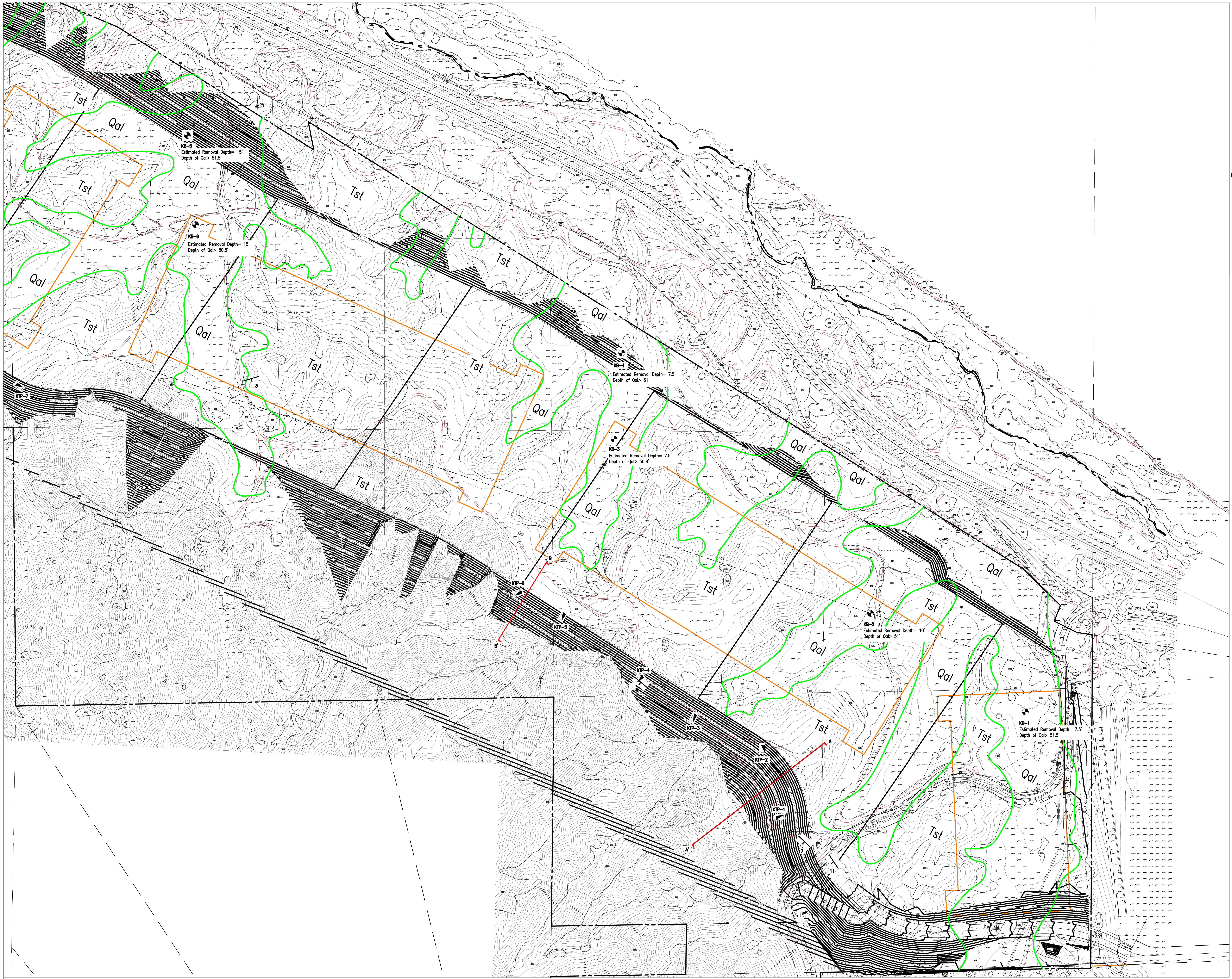
N

150 0 150

KCG KLING Consulting Group, Inc.

Beaumont Pointe Specific Plan
Beaumont, CA

Plate: 1
PN: 18060-01
Date: July 23, 2021



EXPLANATION

Locations Approximate

Qal	Alluvium and Older Alluvium undifferentiated.
Tst	San Timoteo Formation- sandstone, siltstone, and conglomerate, undifferentiated.
┴	Strike and dip of bedding
━	Approximate Geologic Contact
KB-5	Approximate Boring Location
◣	Approximate Trench/Test Pit Location
D D'	Approximate Location of Geologic Cross Section

N

150 0 150

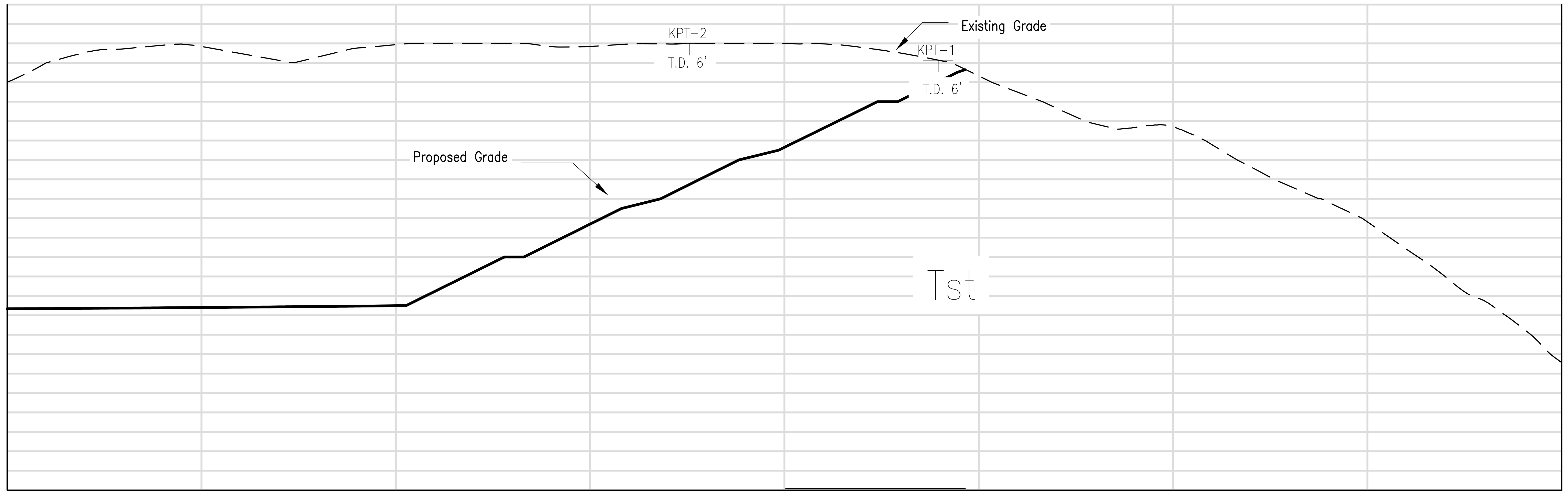
KLING Consulting Group, Inc.

Beaumont Pointe Specific Plan
Beaumont, CA

Plate: 2
PN: 18060-01
Date: July 23, 2021

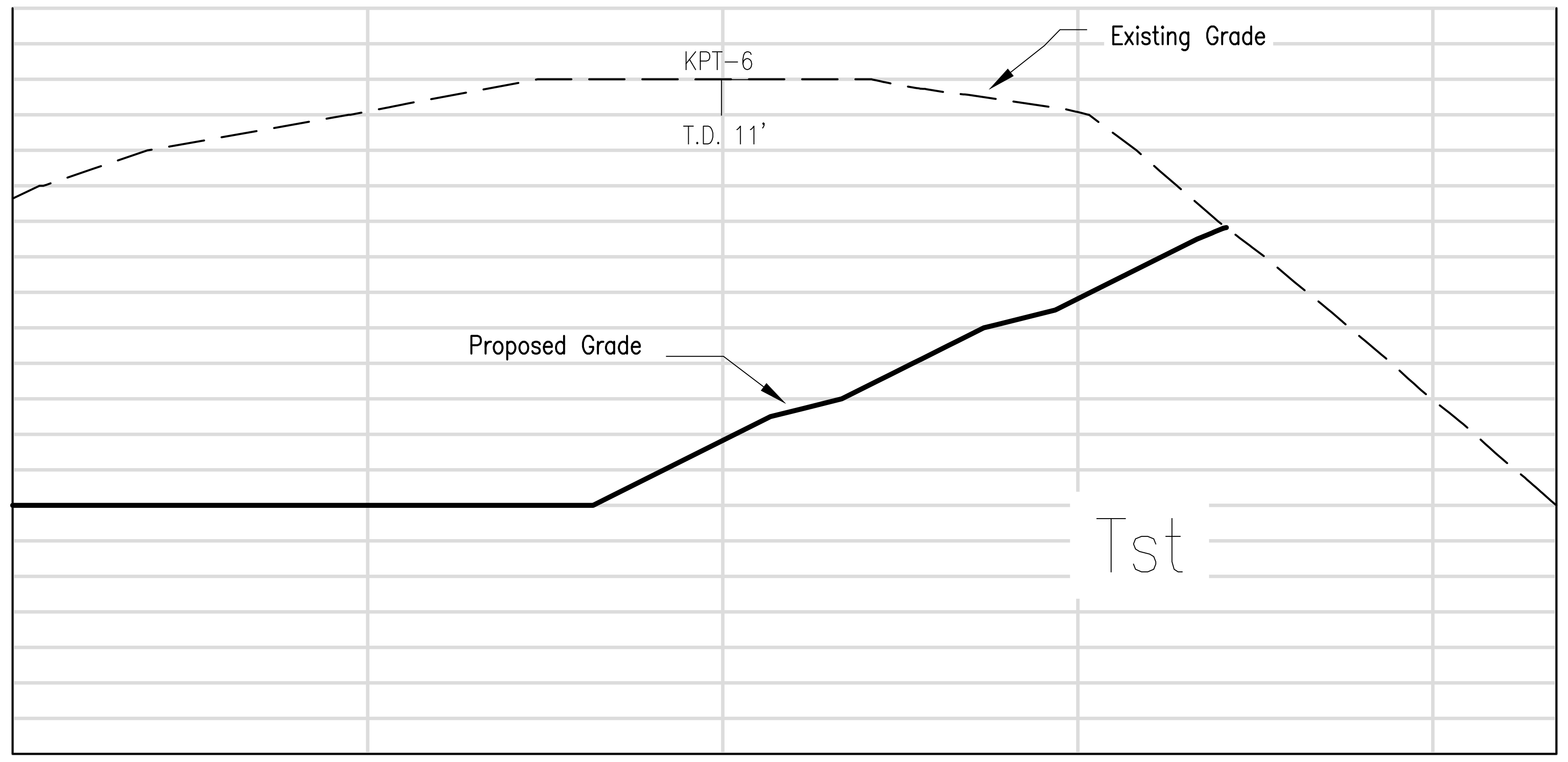
Cross Section A–A'

N 57 E



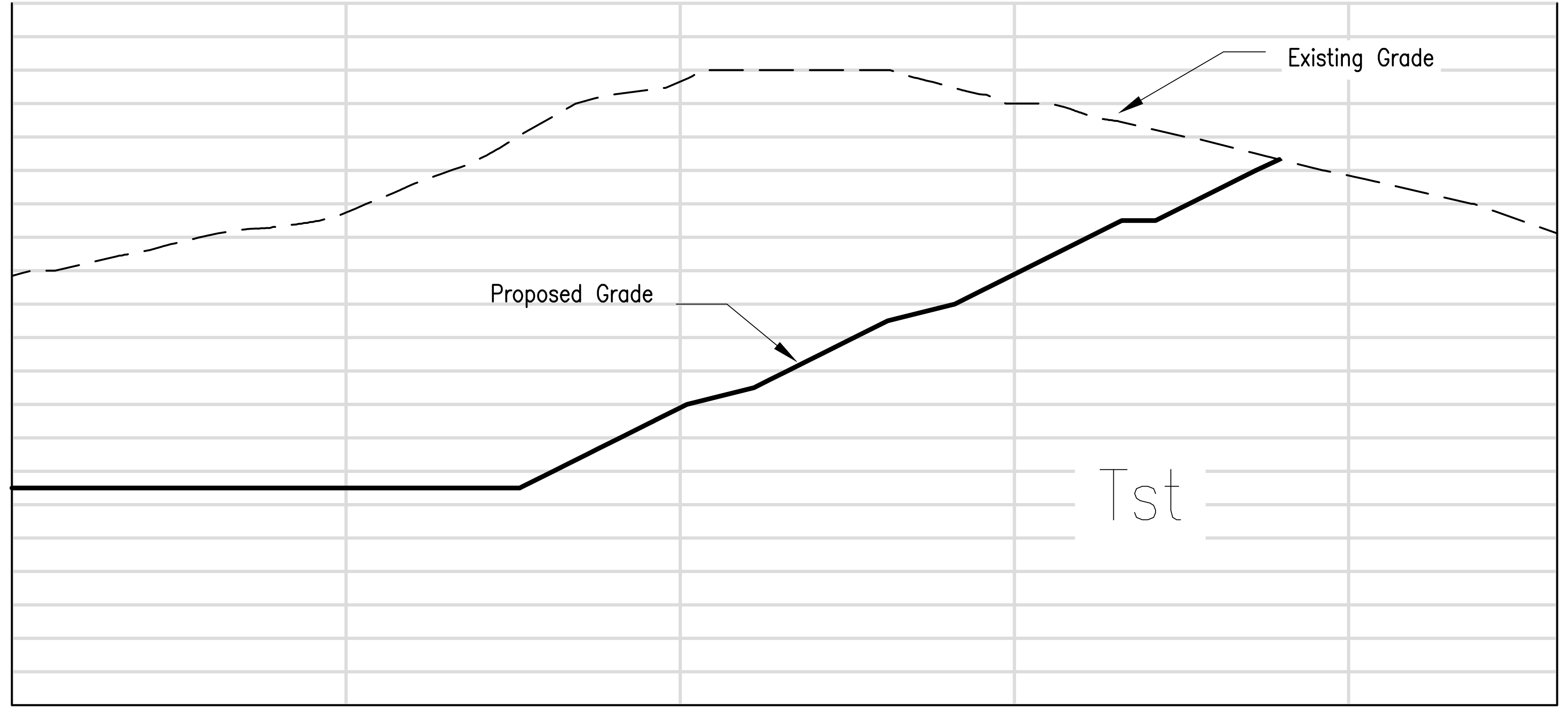
Cross Section B–B'

N 29 E



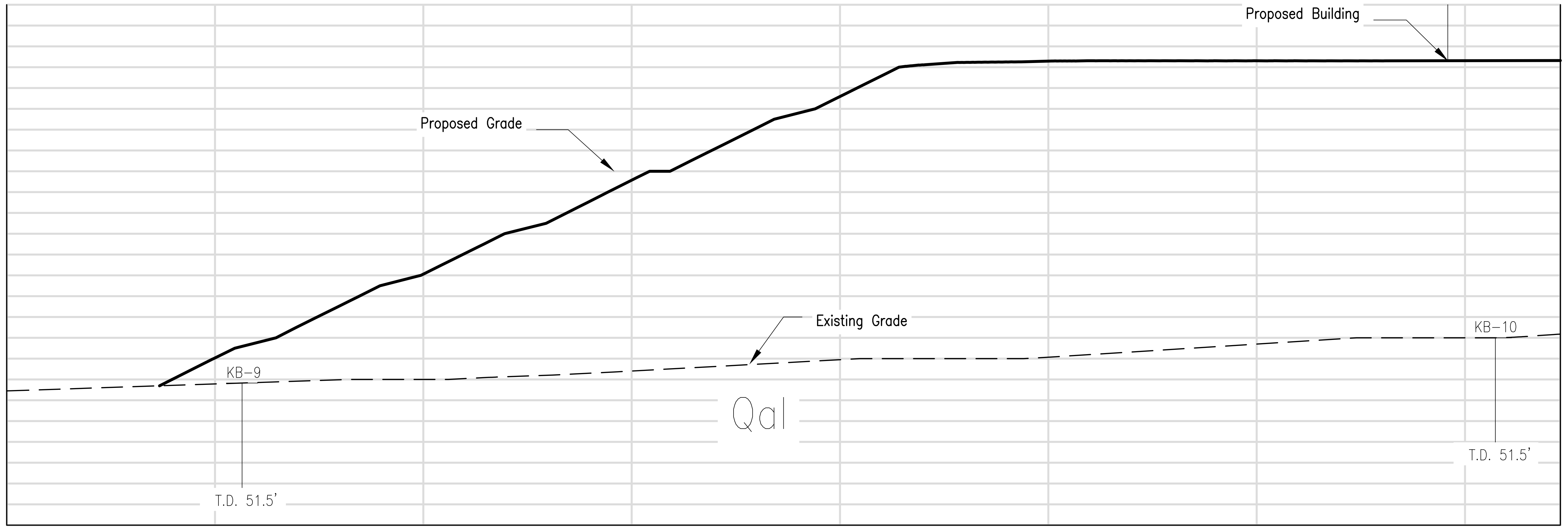
Cross Section C–C'

N 32 E



Cross Section D–D'

N 10 W



KCG KLING Consulting Group, Inc.	Cross Sections **Beaumont Pointe Specific Plan** Beaumont, CA	Plate: 3 PN: 18060–01 Date: July 23, 2021

Appendix 4: Historical Site Conditions

Phase I Environmental Site Assessment or Other Information on Past Site Use

Report pending. To be included with next submittal.

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

NOT APPLICABLE

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: 🟦 Required Entries
▨ Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name Proactive Engineering Consultants
Date 4/8/2022
Designed by A. Jaramillo
Case No TBD
Company Project Number/Name Beaumont Pointe

BMP Identification

BMP NAME / ID DMA 1 / Basin 4

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.75 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Industrial Imp. (1)	*2722393*	*Concrete or Asphalt*	*1*	*0.89*	*2428374.6*			
Industrial Perv. (1)	*259555*	*Ornamental Landscaping*	*0.1*	*0.11*	*28669.9*			
BMP Basin (1)	*101335*	*Ornamental Landscaping*	*0.1*	*0.11*	*11193.3*			
	3083283	***Total***			**2468237.8**	**0.75**	**154264.9**	**416869**

Notes:

Extended Detention Basin Design Procedure	BMP Subarea No. AREA 1	Legend:	Required Entries Calculated Cells

Company Name: Proactive Engineering Consultants West, Inc. Date: ########

Designed by: A. Jaramillo County/City Case No.: TBD

Design Volume

Tributary Area (BMP Subarea) A_T = 70.78 acres

Enter $V_{BMP,}$ determined from Section 2.1 of this Handbook V_{BMP}= 154,265 ft^3

Basin Footprint

Overall Geometry

Length at Basin Bottom Surface Length = 750 ft

Width at Basin Bottom Surface Width = 145 ft

Meets 1.5 : 1 requirement? ✓

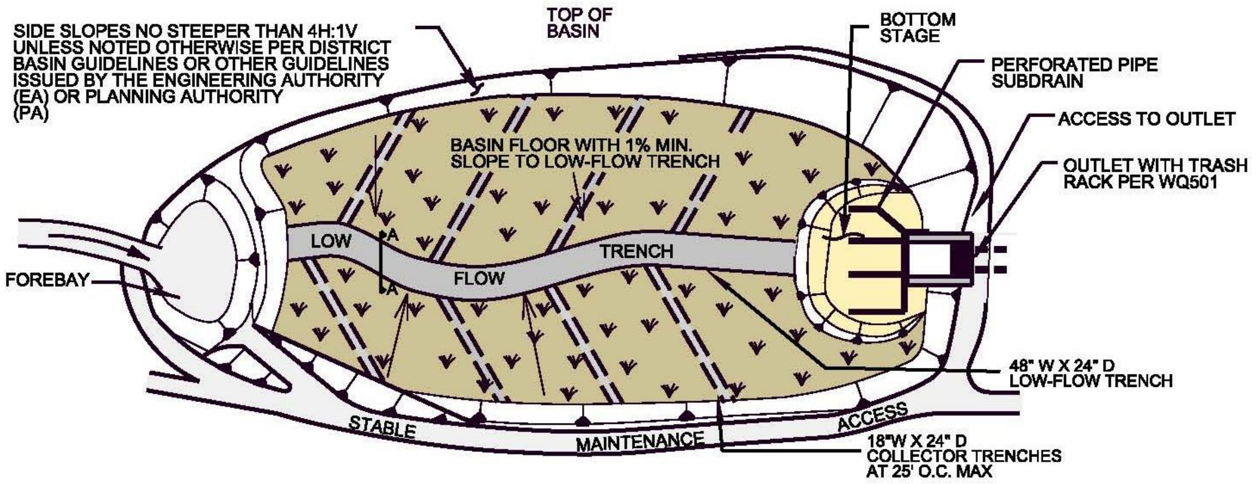
Side Slopes per "Basin Guidelines", Sect. 1.2 z = 4 :1

Proposed Basin Depth (with no freeboard) D_B = 5.00 ft

Depth of freeboard (if used) D_{FB} = 1.00 ft

Minimum Required Allowance for Total Depth (including proposed basin depth, freeboard, minimum depth of bottom stage (D_{BS}=0.33') and minimum filter depth (D_{FD}=2.33')) D_{REQ} = 8.7 ft

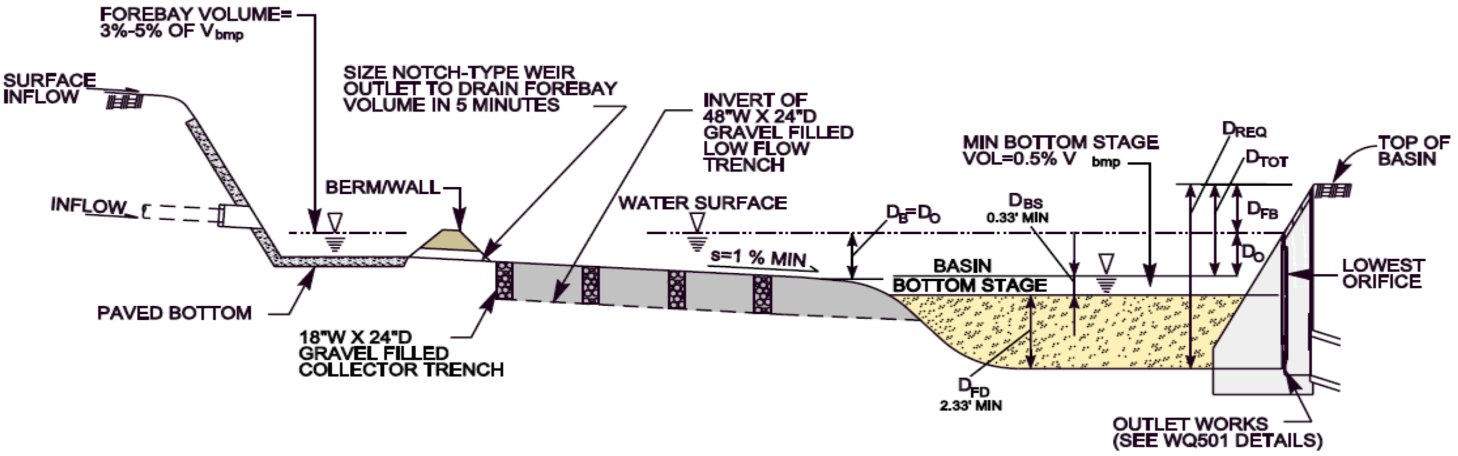
Depth from design water surface elevation to lowest orifice D_O = 5.0 ft



Basin Design

Basin Design

Proposed Total Basin Depth (proposed depth plus freeboard)	D_{TOT} =	6.00	ft
Basin Invert Longitudinal Slope	Slope =	✓ 1.00	%
Basin Invert Transverse Slope (1% min)	Slope =	✓ 1	%
Basin Volume	V_{Basin} =	✓ 416869	ft^3



Forebay Design

Forebay Volume (3 - 5% V_{BMP})	V_{FB} =	✓ 7710	ft^3
Forebay Depth (height of berm)	D_{FBY} =	1	ft
Minimum Forebay Surface Area	A_{FB} =	7710	ft^2
Rectangular weir (notch)	W =	✓ 8.00	in

Dry Weather and Low-Flow Management

Low-Flow Trench (see graphic below)

Depth (24 inches minimum, gravel filled) Depth = ✓ 24 inches

Width (48 inches minimum) Width = ✓ 48 inches

Trench Invert Longitudinal Slope Slope = ✓ 0.5 %

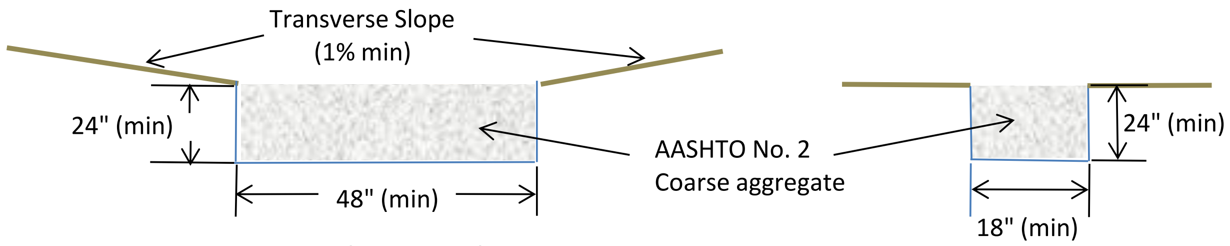
Collector Trenches (see graphic below)

Depth (24 inches minimum) Depth = ✓ 24 inches

Width (18 inches minimum) Width = ✓ 18 inches

Trench Invert Longitudinal Slope Slope = ✓ 0.5 %

Spacing (25 feet on center maximum) S = ✓ 25 feet



Low-Flow Trench

Collector Trench

Bottom Stage (Sand Filter) Design

Depth of the Bottom Stage (4" minimum ponding) D_{BS} = ✓ 6 in

Surface Area of Bottom Stage A_{BS} = 4100 ft^2

Dry Weather Ponded Volume (above sand layer) V_{BS} = 2050 ft^3

Is V_{BS} no less than 0.5% V_{BMP}? OK

Depth of ASTM-C33 sand (18 inch minimum)

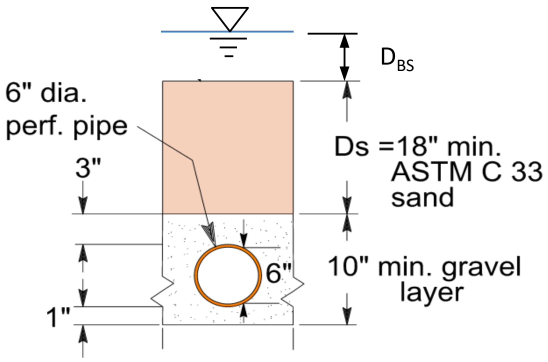
Ds = ✓ 18 inches

Diameter of Subdrains

ϕ = ✓ 8 in

Subdrain Spacing

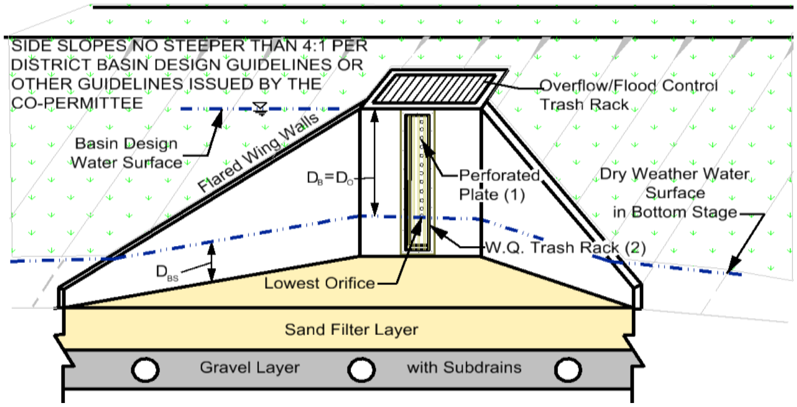
s = 8 ft. on center



Basin Outlet Design

Outlet Design

Assume an orifice area. Based on the information provided above, the spreadsheet provides discharge vs. stage data. Enter the volume vs. stage data for each interval. This information is used to route the volume through the basin. The size of the orifice is acceptable when the data shows that less than 50% of V_{BMP} has drained in 24 hours, and that 100% drawdown occurs within 72 hours.



Flow Rate, Q (cfs)

$$Q=CA[2g(H-H_o)]^{0.5}$$

Discharge Coefficient,

Default, C = 0.66

Other, C =

Orifice Area (ft^2)

Orifice Diameter, d; number of orifices per row, n; and number of orifice rows, N (from the bottom up).

d = ✓ 5.403 inches

n = 1 per row

N = 1 rows

Aeff = 0.159 ft^2 per row

or

Aeff = 22.916 in^2 per row

From outflow hydrograph, the time where 50% of V_{BMP} has drained from the basin (24 hour minimum):

Time (50%) = ✗ 24.00 hrs

Redesign. 24 hour minimum

From outflow hydrograph, the time where 100% V_{BMP} has drained from the basin(within 72 hours):

Time (100 %) = ✗ 72.09 hrs

Redesign. 72 hour maximum

Headwater Elev. / Stage (ft)	Discharge (cfs)	Volume (acre-ft)	Δt (hrs.)
0	0.0000	0.0000	
0.33	0.4864	0.530	26.37
0.67	0.6884	1.060	10.92
1.00	0.8429	1.600	8.53
1.33	0.9731	2.160	7.46
1.67	1.0883	2.730	6.69
2.00	1.1920	3.320	6.26
2.33	1.2874	3.920	5.86
2.67	*1.3765*	*4.550*	
3.00	*1.4599*	*5.190*	
3.33	*1.5388*	*5.860*	
3.67	*1.6141*	*6.540*	
4.00	*1.6858*	*7.240*	
4.33	*1.7545*	*7.970*	
4.67	*1.8209*	*8.750*	
5.00	*1.8847*	*9.570*	
5.33			
5.67			
6.00			
6.33			
6.67			
7.00			
7.33			
7.67			
8.00			
8.33			
8.67			
9.00			
9.33			
9.67			
10.00			
		∑ =	72.09

Notes:

Santa Ana Watershed - BMP Design Volume, $\mathbf{V_{BMP}}$

(Rev. 10-2011)

Legend: 🟦 Required Entries
▨ Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Proactive Engineering Consultants	Date	4/8/2022
Designed by	A. Jaramillo	Case No	TBD
Company Project Number/Name	Beaumont Pointe		

BMP Identification

BMP NAME / ID DMA 6 / Basin 3

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.75 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, $\mathbf{V_{BMP}}$ (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Industrial Imp. (6)	*1089536*	*Concrete or Asphalt*	*1*	*0.89*	*971866.1*			
Industrial Perv. (6)	*274540*	*Ornamental Landscaping*	*0.1*	*0.11*	*30325.1*			
BMP Basin (6)	*106385*	*Ornamental Landscaping*	*0.1*	*0.11*	*11751.1*			
	1470461	***Total***			**1013942.3**	**0.75**	***63371.4***	***412,284***

Notes:

Extended Detention Basin Design Procedure	BMP Subarea No. AREA 6	Legend:	Required Entries Calculated Cells

Company Name: PEC WEST, INC.

Date: ########

Designed by: A. Jaramillo

County/City Case No.:

Design Volume

Tributary Area (BMP Subarea) A_T = 33.76 acres

Enter V_{BMP}, determined from Section 2.1 of this Handbook V_{BMP}= 63,372 ft^3

Basin Footprint

Overall Geometry

Length at Basin Bottom Surface Length = 1079 ft

Width at Basin Bottom Surface Width = 100 ft

Meets 1.5 : 1 requirement? ✓

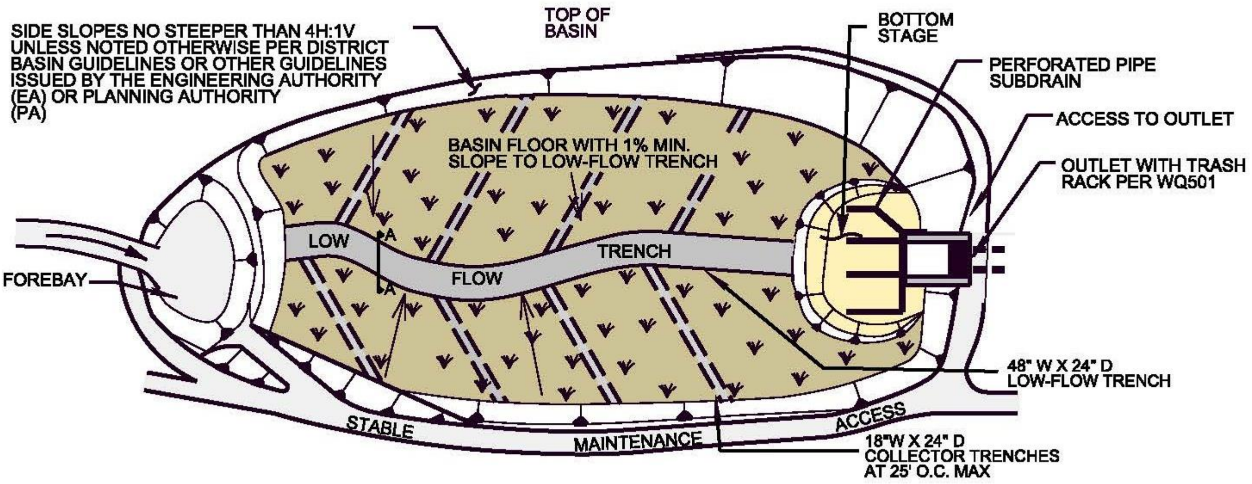
Side Slopes per "Basin Guidelines", Sect. 1.2 z = 4 :1

Proposed Basin Depth (with no freeboard) D_B = 5.00 ft

Depth of freeboard (if used) D_{FB} = 1.00 ft

Minimum Required Allowance for Total Depth (including proposed basin depth, freeboard, minimum depth of bottom stage (D_{BS}=0.33') and minimum filter depth (D_{FD}=2.33')) D_{REQ} = 8.7 ft

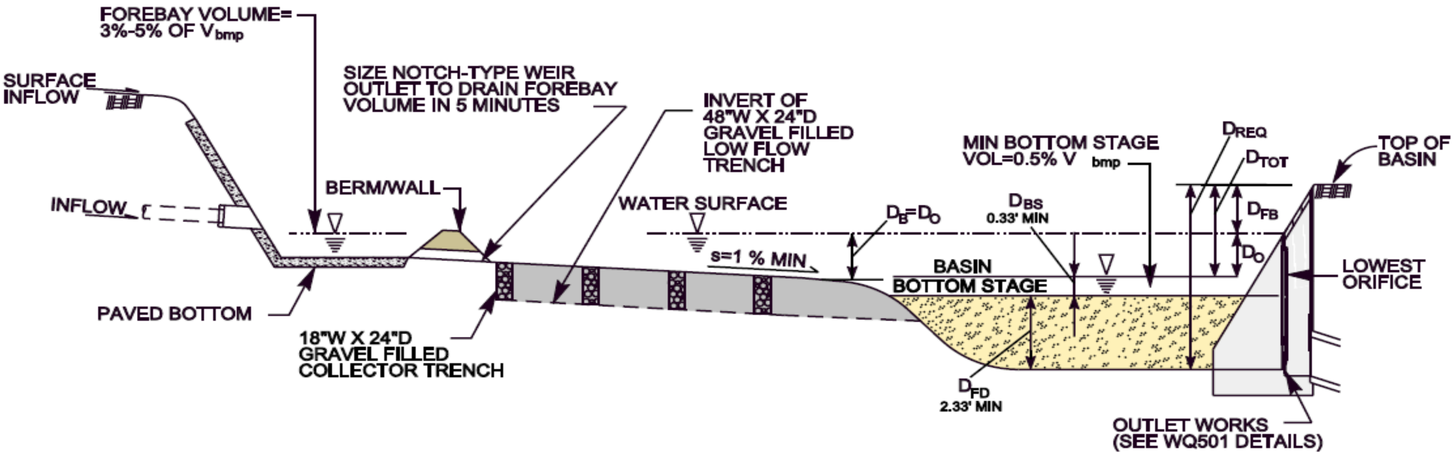
Depth from design water surface elevation to lowest orifice D_O = 5.0 ft



Basin Design

Basin Design

Proposed Total Basin Depth (proposed depth plus freeboard)	D_{TOT} =	6.00	ft
Basin Invert Longitudinal Slope	Slope =	✓ 1.00	%
Basin Invert Transverse Slope (1% min)	Slope =	✓ 1	%
Basin Volume	V_{Basin} =	✓ 412284	ft^3



Forebay Design

Forebay Volume (3 - 5% V_{BMP})	V_{FB} =	✓ 2000	ft^3
Forebay Depth (height of berm)	D_{FBY} =	1	ft
Minimum Forebay Surface Area	A_{FB} =	2000	ft^2
Rectangular weir (notch)	W =	✓ 8.00	in

Dry Weather and Low-Flow Management

Low-Flow Trench (see graphic below)

Depth (24 inches minimum, gravel filled) Depth = ✓ 24 inches

Width (48 inches minimum) Width = ✓ 48 inches

Trench Invert Longitudinal Slope Slope = ✓ 0.5 %

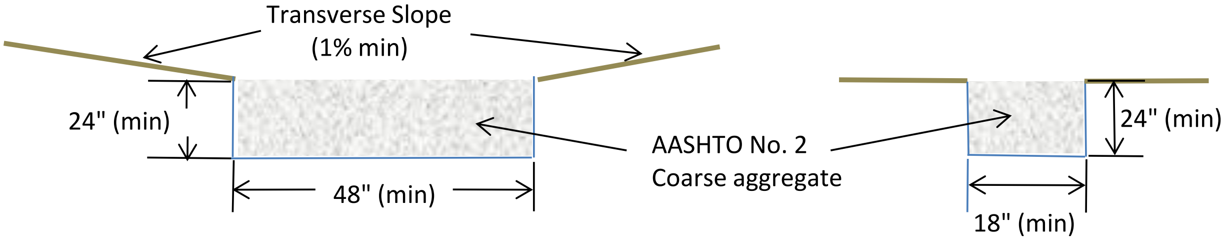
Collector Trenches (see graphic below)

Depth (24 inches minimum) Depth = ✓ 24 inches

Width (18 inches minimum) Width = ✓ 18 inches

Trench Invert Longitudinal Slope Slope = ✓ 0.5 %

Spacing (25 feet on center maximum) S = ✓ 25 feet



Low-Flow Trench

Collector Trench

Bottom Stage (Sand Filter) Design

Depth of the Bottom Stage (4" minimum ponding) D_{BS} = ✓ 6 in

Surface Area of Bottom Stage A_{BS} = 4150 ft^2

Dry Weather Ponded Volume (above sand layer) V_{BS} = 2075 ft^3

Is V_{BS} no less than 0.5% V_{BMP}? OK

Depth of ASTM-C33 sand (18 inch minimum)

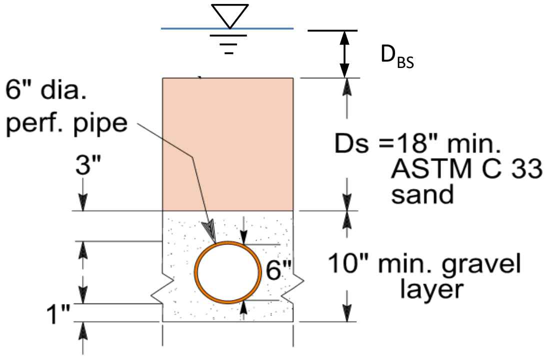
Ds = ✓ 18 inches

Diameter of Subdrains

ϕ = ✓ 8 in

Subdrain Spacing

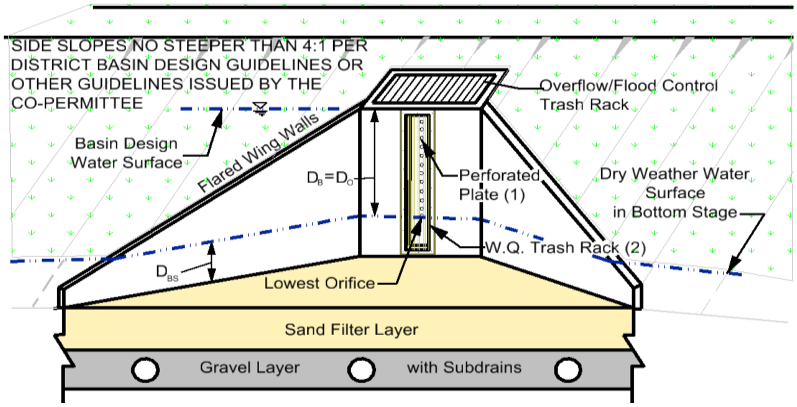
s = 8 ft. on center



Basin Outlet Design

Outlet Design

Assume an orifice area. Based on the information provided above, the spreadsheet provides discharge vs. stage data. Enter the volume vs. stage data for each interval. This information is used to route the volume through the basin. The size of the orifice is acceptable when the data shows that less than 50% of V_{BMP} has drained in 24 hours, and that 100% drawdown occurs within 72 hours.



Flow Rate, Q (cfs)

$$Q=CA[2g(H-H_o)]^{0.5}$$

Discharge Coefficient,

Default, C = 0.66

Other, C =

Orifice Area (ft^2)

Orifice Diameter, d; number of orifices per row, n; and number of orifice rows, N (from the bottom up).

d = ✓ 3.98 inches

n = 1 per row

N = 1 rows

Aeff = 0.086 ft^2 per row

or

Aeff = 12.435 in^2 per row

From outflow hydrograph, the time where 50% of V_{BMP} has drained from the basin (24 hour minimum):

Time (50%) = ✓ 24.06 hrs

OK

From outflow hydrograph, the time where 100% V_{BMP} has drained from the basin(within 72 hours):

Time (100 %) = ✗ 76.93 hrs

Redesign. 72 hour maximum

Headwater Elev. / Stage (ft)	Discharge (cfs)	Volume (acre-ft)	Δt (hrs.)
0	0.0000	0.0000	
0.33	0.2639	0.470	43.10
0.67	0.3735	0.970	18.98
1.00	0.4574	1.480	14.85
1.33	*0.5281*	*2.020*	
1.67	*0.5905*	*2.580*	
2.00	*0.6468*	*3.170*	
2.33	*0.6986*	*3.770*	
2.67	*0.7469*	*4.400*	
3.00	*0.7922*	*5.060*	
3.33	*0.8350*	*5.730*	
3.67	*0.8758*	*6.430*	
4.00	*0.9147*	*7.150*	
4.33	*0.9520*	*7.900*	
4.67	*0.9881*	*8.670*	
5.00	*1.0227*	*9.460*	
5.33			
5.67			
6.00			
6.33			
6.67			
7.00			
7.33			
7.67			
8.00			
8.33			
8.67			
9.00			
9.33			
9.67			
10.00			
		∑ =	76.93

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: 🟦 Required Entries
▨ Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name Proactive Engineering Consultants
Date 4/8/2022
Designed by A. Jaramillo
Case No TBD
Company Project Number/Name Beaumont Pointe

BMP Identification

BMP NAME / ID DMA 13 / Basin 2

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.75 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, **V_{BMP}** (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Industrial Imp. (13)	*3075717*	*Concrete or Asphalt*	*1*	*0.89*	*2743539.6*			
Industrial Perv. (13)	*674044*	*Ornamental Landscaping*	*0.1*	*0.11*	*74453.6*			
BMP Basin	*115084*	*Ornamental Landscaping*	*0.1*	*0.11*	*12711.9*			
	3864845	***Total***			**2830705.1**	**0.75**	***176919.1***	***484817***

Notes:

Extended Detention Basin Design Procedure	BMP Subarea No. AREA 13	Legend:	Required Entries Calculated Cells

Company Name: PEC WEST, INC.
Designed by: A. Jaramillo
Date: 4/12/2022
County/City Case No.: TBD

Design Volume

Tributary Area (BMP Subarea) A_T = 88.72 acres

Enter $V_{BMP,}$ determined from Section 2.1 of this Handbook V_{BMP}= 176,919 ft^3

Basin Footprint

Overall Geometry

Length at Basin Bottom Surface Length = 715 ft

Width at Basin Bottom Surface Width = 165 ft

Meets 1.5 : 1 requirement? ✓

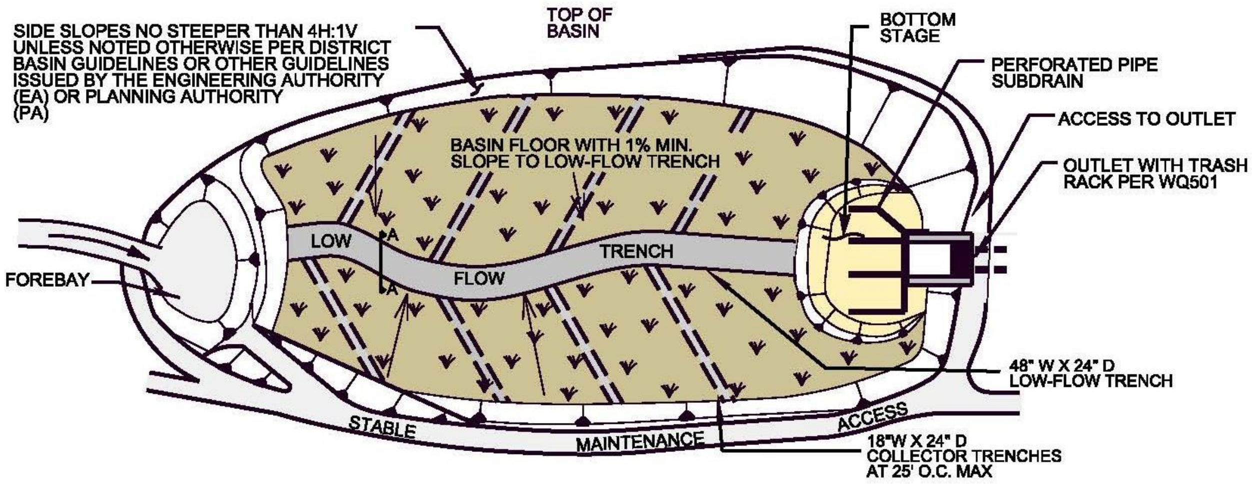
Side Slopes per "Basin Guidelines", Sect. 1.2 z = 4 :1

Proposed Basin Depth (with no freeboard) D_B = 5.00 ft

Depth of freeboard (if used) D_{FB} = 1.00 ft

Minimum Required Allowance for Total Depth (including proposed basin depth, freeboard, minimum depth of bottom stage (D_{BS}=0.33') and minimum filter depth (D_{FD}=2.33')) D_{REQ} = 8.7 ft

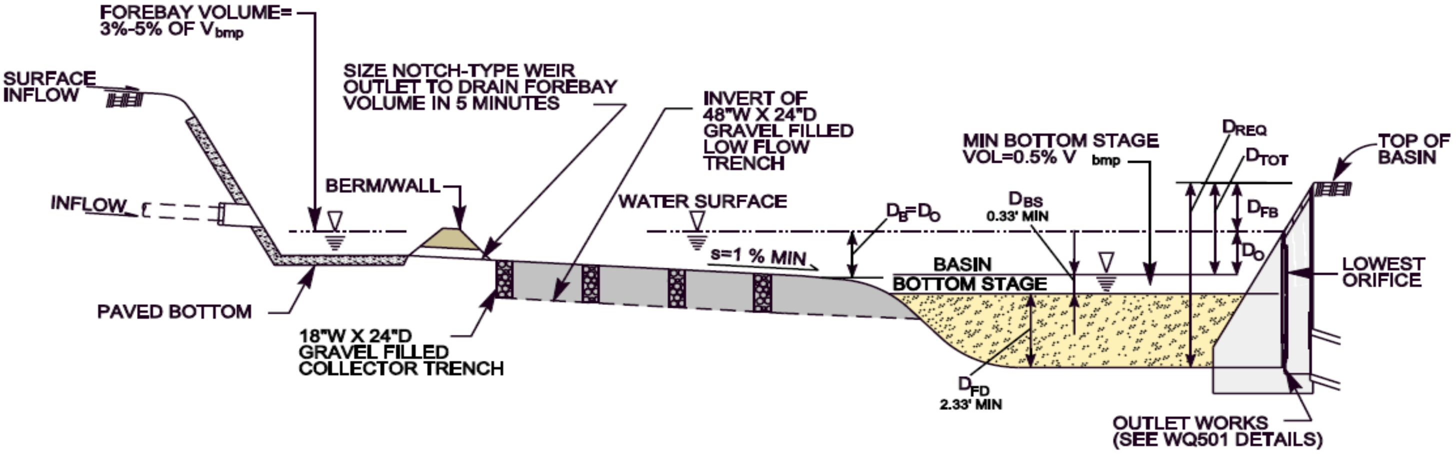
Depth from design water surface elevation to lowest orifice D_O = 5.0 ft



Basin Design

Basin Design

Proposed Total Basin Depth (proposed depth plus freeboard)	D_{TOT} = 6.00	ft
Basin Invert Longitudinal Slope	Slope = ✓ 1.00	%
Basin Invert Transverse Slope (1% min)	Slope = ✓ 1	%
Basin Volume	V_{Basin} = ✓ 484817	ft^3



Forebay Design

Forebay Volume (3 - 5% V_{BMP})	V_{FB} = ✓ 8711	ft^3
Forebay Depth (height of berm)	D_{FBY} = 1	ft
Minimum Forebay Surface Area	A_{FB} = 8711	ft^2
Rectangular weir (notch)	W = ✓ 8.00	in

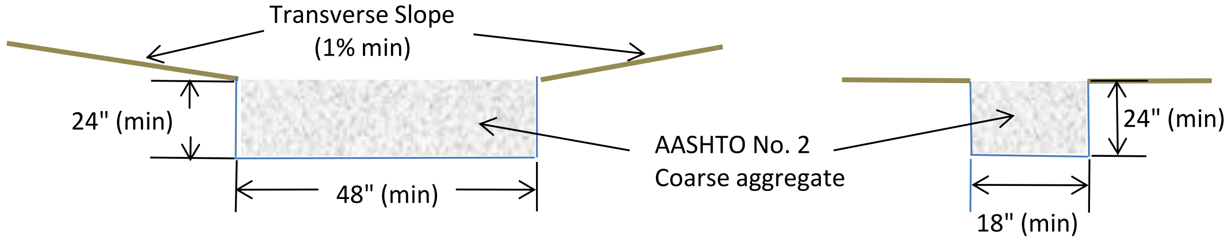
Dry Weather and Low-Flow Management

Low-Flow Trench (see graphic below)

Depth (24 inches minimum, gravel filled)	Depth =	✓ 24	inches
Width (48 inches minimum)	Width =	✓ 48	inches
Trench Invert Longitudinal Slope	Slope =	✓ 0.5	%

Collector Trenches (see graphic below)

Depth (24 inches minimum)	Depth =	✓ 24	inches
Width (18 inches minimum)	Width =	✓ 18	inches
Trench Invert Longitudinal Slope	Slope =	✓ 0.5	%
Spacing (25 feet on center maximum)	S =	✓ 25	feet



Low-Flow Trench

Collector Trench

Bottom Stage (Sand Filter) Design

Depth of the Bottom Stage (4" minimum ponding)	D_{BS} =	✓ 6	in
Surface Area of Bottom Stage	A_{BS} =	4100	ft^2
Dry Weather Ponded Volume (above sand layer)	V_{BS} =	2050	ft^3

Is V_{BS} no less than 0.5% V_{BMP}? OK

Depth of ASTM-C33 sand (18 inch minimum)

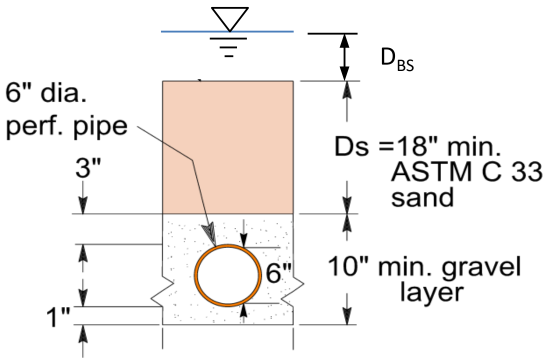
Ds = ✓ 18 inches

Diameter of Subdrains

ϕ = ✓ 8 in

Subdrain Spacing

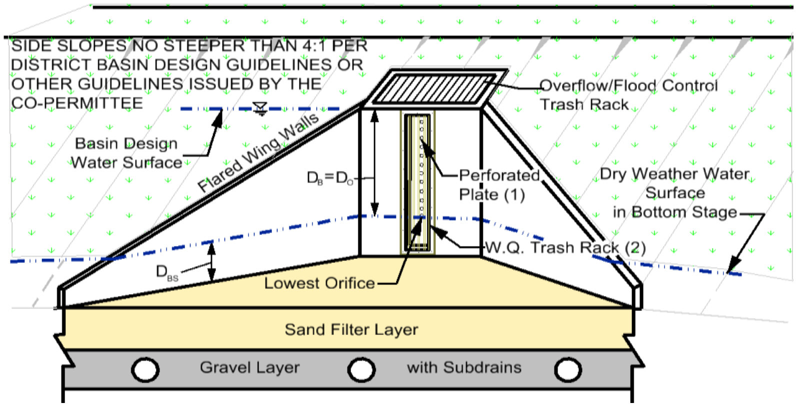
s = 8 ft. on center



Basin Outlet Design

Outlet Design

Assume an orifice area. Based on the information provided above, the spreadsheet provides discharge vs. stage data. Enter the volume vs. stage data for each interval. This information is used to route the volume through the basin. The size of the orifice is acceptable when the data shows that less than 50% of V_{BMP} has drained in 24 hours, and that 100% drawdown occurs within 72 hours.



Flow Rate, Q (cfs)

$$Q=CA[2g(H-H_o)]^{0.5}$$

Discharge Coefficient,

Default, C = 0.66

Other, C =

Orifice Area (ft^2)

Orifice Diameter, d; number of orifices per row, n; and number of orifice rows, N (from the bottom up).

d = ✓ 6 inches

n = 1 per row

N = 1 rows

Aeff = 0.196 ft^2 per row

or

Aeff = 28.260 in^2 per row

From outflow hydrograph, the time where 50% of V_{BMP} has drained from the basin (24 hour minimum):

Time (50%) = ✓ 24.52 hrs

OK

From outflow hydrograph, the time where 100% V_{BMP} has drained from the basin(within 72 hours):

Time (100 %) = ✓ 69.92 hrs

OK

Headwater Elev. / Stage (ft)	Discharge (cfs)	Volume (acre-ft)	Δt (hrs.)
0	0.0000	0.0000	
0.33	0.5998	0.620	25.01
0.67	0.8489	1.270	10.86
1.00	1.0394	1.920	8.33
1.33	1.2001	2.600	7.35
1.67	1.3420	3.290	6.57
2.00	1.4700	3.990	6.02
2.33	1.5876	4.720	5.78
2.67	*1.6975*	*5.460*	
3.00	*1.8004*	*6.220*	
3.33	*1.8976*	*6.990*	
3.67	*1.9905*	*7.780*	
4.00	*2.0789*	*8.590*	
4.33	*2.1637*	*9.420*	
4.67	*2.2455*	*10.270*	
5.00	*2.3242*	*11.130*	
5.33			
5.67			
6.00			
6.33			
6.67			
7.00			
7.33			
7.67			
8.00			
8.33			
8.67			
9.00			
9.33			
9.67			
10.00			
		∑ =	69.92

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: ▭ Required Entries
▨ Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name Proactive Engineering Consultants
Date 4/8/2022
Designed by A. Jaramillo
Case No TBD
Company Project Number/Name Beaumont Pointe

BMP Identification

BMP NAME / ID DMA 16 / Basin 1

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.75 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Industrial Imp. (16)	*2816060*	*Concrete or Asphalt*	*1*	*0.89*	*2511925.5*			
Industrial Perv. (16)	*801273*	*Ornamental Landscaping*	*0.1*	*0.11*	*88507*			
BMP Basin	*111618*	*Ornamental Landscaping*	*0.1*	*0.11*	*12329.1*			
	3728951	***Total***			**2612761.6**	**0.75**	***163297.6***	***447431***

Notes:

Extended Detention Basin Design Procedure	BMP Subarea No. AREA 16	Legend:	Required Entries Calculated Cells

Company Name: PEC WEST, INC.

Date: ########

Designed by: A. Jaramillo

County/City Case No.:

Design Volume

Tributary Area (BMP Subarea) A_T = 85.6 acres

Enter $V_{BMP,}$ determined from Section 2.1 of this Handbook V_{BMP}= 163,298 ft^3

Basin Footprint

Overall Geometry

Length at Basin Bottom Surface Length = 750 ft

Width at Basin Bottom Surface Width = 145 ft

Meets 1.5 : 1 requirement? ✓

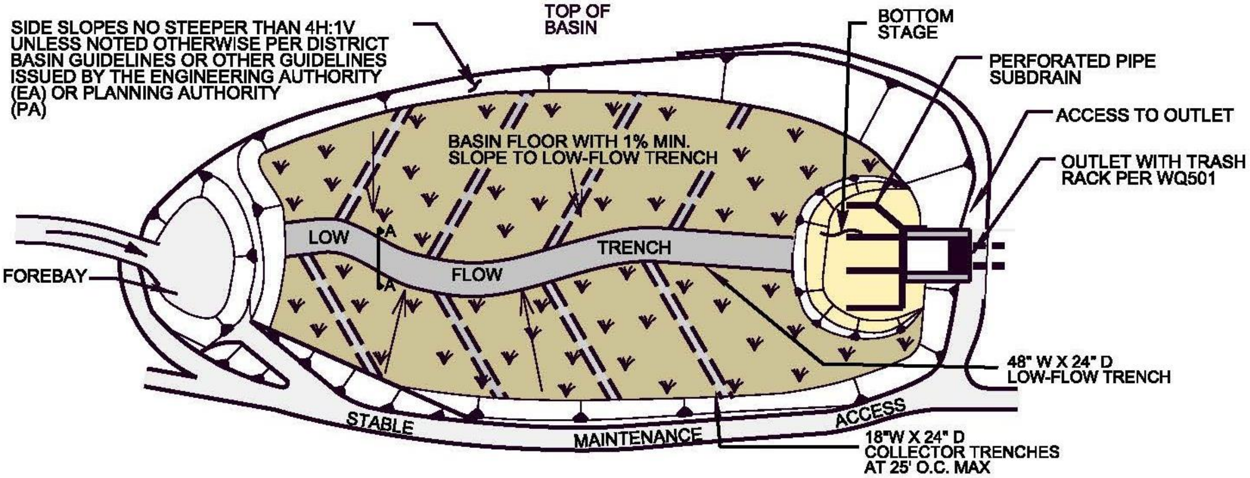
Side Slopes per "Basin Guidelines", Sect. 1.2 z = 4 :1

Proposed Basin Depth (with no freeboard) D_B = 5.00 ft

Depth of freeboard (if used) D_{FB} = 1.00 ft

Minimum Required Allowance for Total Depth (including proposed basin depth, freeboard, minimum depth of bottom stage (D_{BS}=0.33') and minimum filter depth (D_{FD}=2.33')) D_{REQ} = 8.7 ft

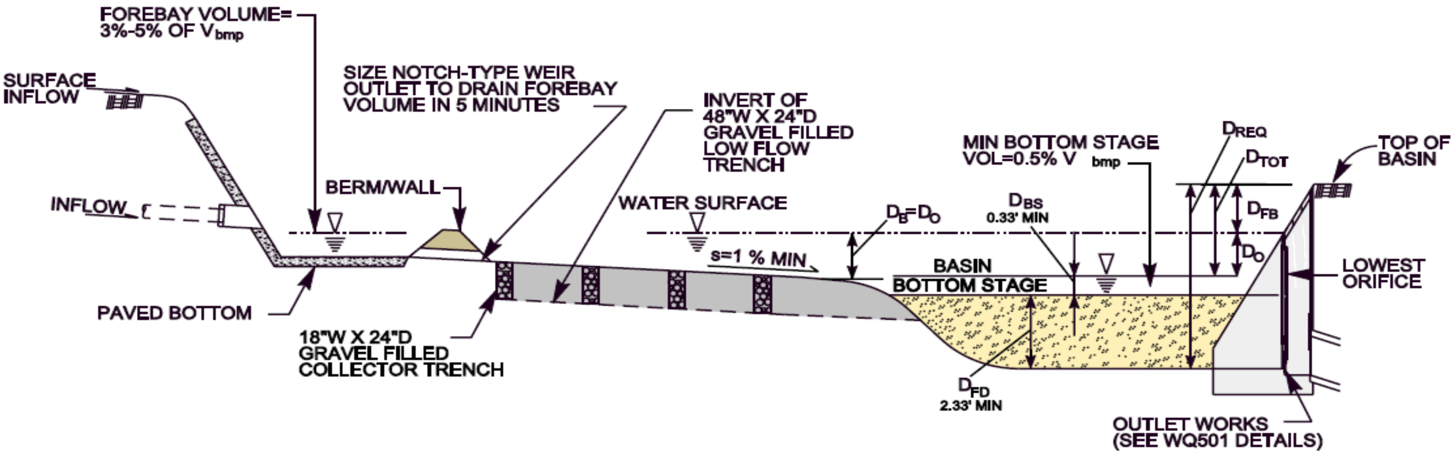
Depth from design water surface elevation to lowest orifice D_O = 5.0 ft



Basin Design

Basin Design

Proposed Total Basin Depth (proposed depth plus freeboard)	D_{TOT} =	6.00	ft
Basin Invert Longitudinal Slope	Slope =	✓ 1.00	%
Basin Invert Transverse Slope (1% min)	Slope =	✓ 1	%
Basin Volume	V_{Basin} =	✓ 447431	ft^3



Forebay Design

Forebay Volume (3 - 5% V_{BMP})	V_{FB} =	✓ 4900	ft^3
Forebay Depth (height of berm)	D_{FBY} =	1	ft
Minimum Forebay Surface Area	A_{FB} =	4900	ft^2
Rectangular weir (notch)	W =	✓ 8.00	in

Dry Weather and Low-Flow Management

Low-Flow Trench (see graphic below)

Depth (24 inches minimum, gravel filled) Depth = ✓ 24 inches

Width (48 inches minimum) Width = ✓ 48 inches

Trench Invert Longitudinal Slope Slope = ✓ 0.5 %

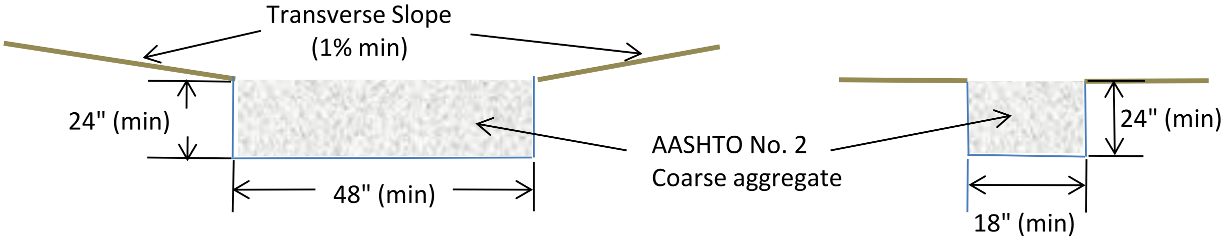
Collector Trenches (see graphic below)

Depth (24 inches minimum) Depth = ✓ 24 inches

Width (18 inches minimum) Width = ✓ 18 inches

Trench Invert Longitudinal Slope Slope = ✓ 0.5 %

Spacing (25 feet on center maximum) S = ✓ 25 feet



Low-Flow Trench

Collector Trench

Bottom Stage (Sand Filter) Design

Depth of the Bottom Stage (4" minimum ponding) D_{BS} = ✓ 6 in

Surface Area of Bottom Stage A_{BS} = 4100 ft^2

Dry Weather Ponded Volume (above sand layer) V_{BS} = 2050 ft^3

Is V_{BS} no less than 0.5% V_{BMP}? OK

Depth of ASTM-C33 sand (18 inch minimum)

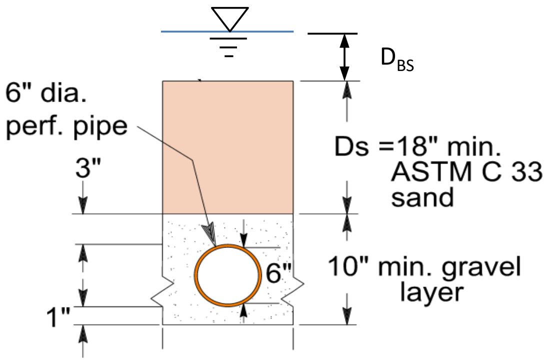
Ds = ✓ 18 inches

Diameter of Subdrains

ϕ = ✓ 8 in

Subdrain Spacing

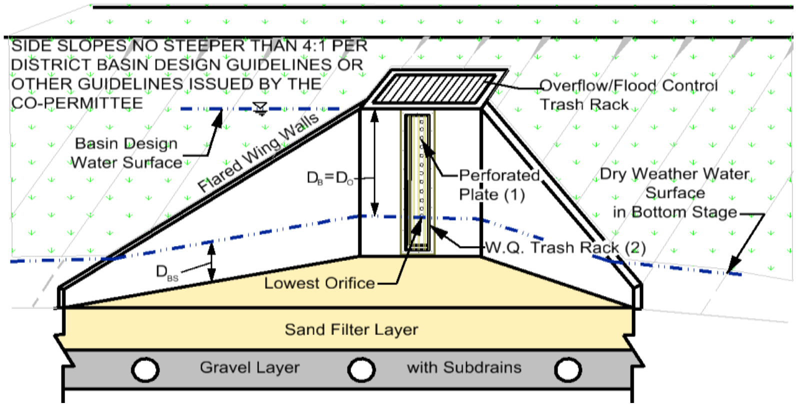
s = 8 ft. on center



Basin Outlet Design

Outlet Design

Assume an orifice area. Based on the information provided above, the spreadsheet provides discharge vs. stage data. Enter the volume vs. stage data for each interval. This information is used to route the volume through the basin. The size of the orifice is acceptable when the data shows that less than 50% of V_{BMP} has drained in 24 hours, and that 100% drawdown occurs within 72 hours.



Flow Rate, Q (cfs)

$$Q=CA[2g(H-H_o)]^{0.5}$$

Discharge Coefficient,

Default, C = 0.66

Other, C =

Orifice Area (ft^2)

Orifice Diameter, d; number of orifices per row, n; and number of orifice rows, N (from the bottom up).

d = ✓ 5.55 inches

n = 1 per row

N = 1 rows

Aeff = 0.168 ft^2 per row

or

Aeff = 24.180 in^2 per row

From outflow hydrograph, the time where 50% of V_{BMP} has drained from the basin (24 hour minimum):

Time (50%) = ✓ 24.31 hrs

OK

From outflow hydrograph, the time where 100% V_{BMP} has drained from the basin(within 72 hours):

Time (100 %) = ✓ 71.48 hrs

OK

Headwater Elev. / Stage (ft)	Discharge (cfs)	Volume (acre-ft)	Δt (hrs.)
0	0.0000	0.0000	
0.33	0.5132	0.530	24.99
0.67	0.7263	1.090	10.93
1.00	0.8894	1.660	8.54
1.33	1.0268	2.260	7.58
1.67	1.1483	2.880	6.90
2.00	1.2578	3.520	6.44
2.33	1.3584	4.180	6.11
2.67	*1.4524*	*4.860*	
3.00	*1.5404*	*5.570*	
3.33	*1.6237*	*6.300*	
3.67	*1.7031*	*7.050*	
4.00	*1.7787*	*7.820*	
4.33	*1.8513*	*8.610*	
4.67	*1.9213*	*9.430*	
5.00	*1.9887*	*10.270*	
5.33			
5.67			
6.00			
6.33			
6.67			
7.00			
7.33			
7.67			
8.00			
8.33			
8.67			
9.00			
9.33			
9.67			
10.00			
		∑ =	71.48

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: 🟦 Required Entries
▨ Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name Proactive Engineering Consultants
Date 4/8/2022
Designed by A. Jaramillo
Case No TBD
Company Project Number/Name Beaumont Pointe

BMP Identification

BMP NAME / ID DMA 17 / Basin 5

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

$D_{85}=$ 0.75 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Streets Imperv.	*144682*	*Concrete or Asphalt*	*1*	*0.89*	*129056.3*			
Streets Pervious	*61102*	*Ornamental Landscaping*	*0.1*	*0.11*	*6749.2*			
BMP Basin	*32386*	*Ornamental Landscaping*	*0.1*	*0.11*	*3577.3*			
	238170	***Total***			**139382.8**	**0.75**	***8711.4***	***36191***

Notes:

Bioretention Facility - Design Procedure	BMP ID DMA-17	Legend:	Required Entries 🟦 Calculated Cells ▨

Company Name: Proactive Engineering Consultants West, Inc.

Date: 4/8/2022

Designed by: A. Jaramillo

County/City Case No.:

Design Volume

Enter the area tributary to this feature A_T= 5.47 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 8,711 ft^3

Type of Bioretention Facility Design

● Side slopes required (parallel to parking spaces or adjacent to walkways)

○ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 2.0 ft

Top Width of Bioretention Facility, excluding curb w_T = 100.0 ft

Total Effective Depth, d_E

$$d_E = (0.3) \text{ x } d_S + (0.4) \text{ x } 1 - (0.7/w_T) + 0.5$$

d_E = 1.49 ft

Minimum Surface Area, A_m

$$A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$$

A_M = 5,835 ft^2

Proposed Surface Area A= 24,289 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = 4 :1

Diameter of Underdrain 8 inches

Longitudinal Slope of Site (3% maximum) 0 %

6" Check Dam Spacing 0 feet

Describe Vegetation: Natural Grasses

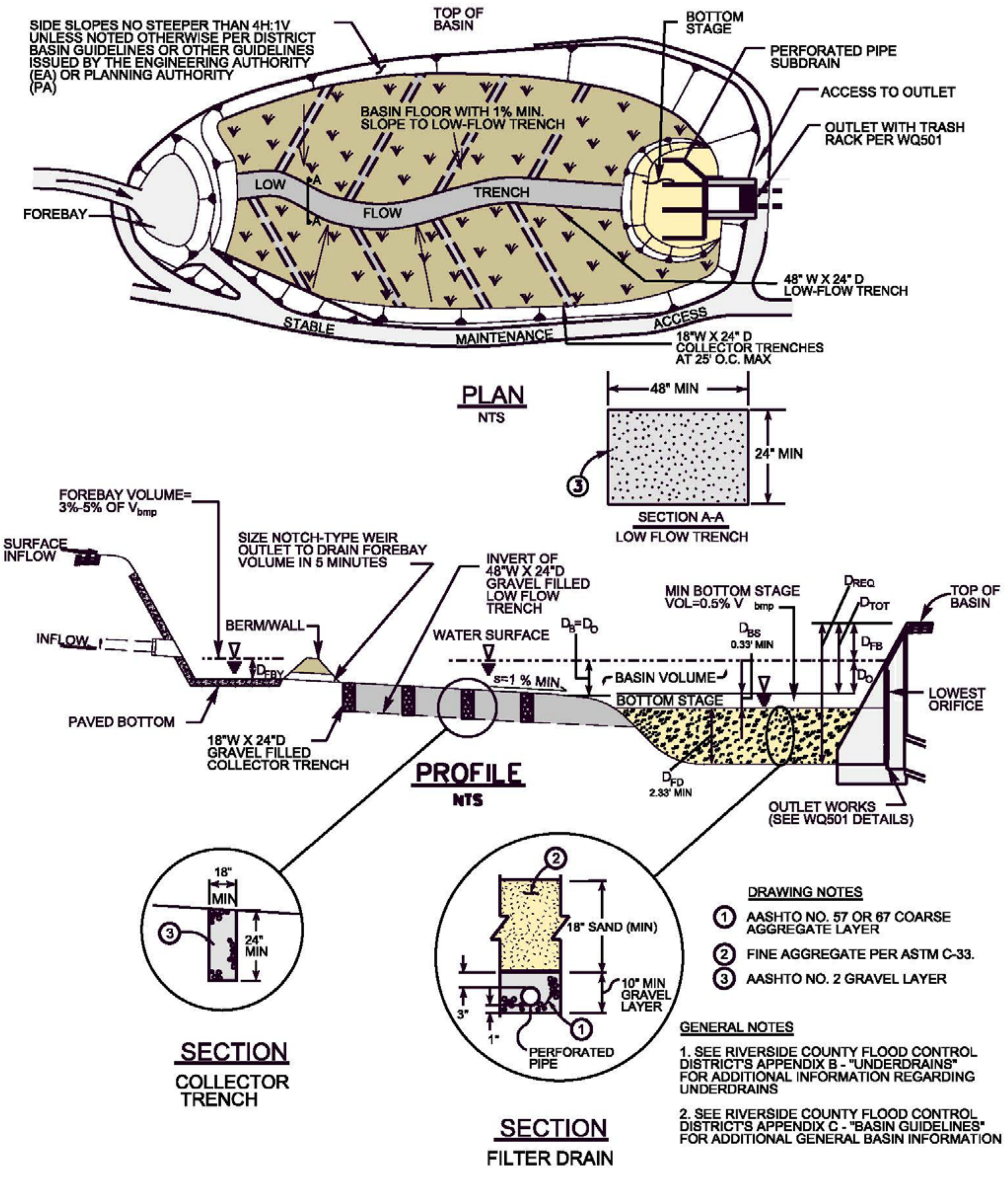
Notes:

3.6 Extended Detention Basin

Type of BMP	LID - Biotreatment
Treatment Mechanisms	Sedimentation, Infiltration, Biofiltration, Evapotranspiration, and Evaporation
Minimum Tributary Drainage Area	5 acres
Other Names	Enhanced Water Quality Basin

Overview

The Extended Detention Basin (EDB) is designed to detain the design volume of stormwater, V_{BMP}, and maximize opportunities for volume losses through infiltration, evaporation, evapotranspiration and surface wetting. Additional pollutant removal is provided through sedimentation, in which pollutants can attach to sediment accumulated in the basin through the process of settling. Stormwater enters the EDB through a *forebay* where any trash, debris, and sediment accumulate for easy removal. Flows from the forebay enter the basin which is vegetated with native grasses that enhance infiltration and evapotranspiration, and which is interspersed with gravel-filled trenches that help further enhance infiltration. Water that does not get infiltrated or evapotranspired is conveyed to the *bottom stage* of the basin. At the bottom stage of the basin, low or incidental dry weather flows will be treated through a sand filter and collected in a subdrain structure. Any additional flows will be detained in the basin for an extended period by incorporating an outlet structure that is more restrictive than a traditional detention basin outlet. The restrictive outlet structure extends the drawdown time of the basin which further allows particles and associated pollutants to settle out before exiting the basin, while maximizing opportunities for additional incidental volume losses.



DRAWING NOTES

① AASHTO NO. 57 OR 67 COARSE AGGREGATE LAYER

② FINE AGGREGATE PER ASTM C-33.

③ AASHTO NO. 2 GRAVEL LAYER

GENERAL NOTES

1. SEE RIVERSIDE COUNTY FLOOD CONTROL DISTRICT'S APPENDIX B - "UNDERDRAINS" FOR ADDITIONAL INFORMATION REGARDING UNDERDRAINS

2. SEE RIVERSIDE COUNTY FLOOD CONTROL DISTRICT'S APPENDIX C - "BASIN GUIDELINES" FOR ADDITIONAL GENERAL BASIN INFORMATION

Figure 1 – Extended Detention Basin

Siting Considerations

Soils: EDBs can be used with almost all soils and geology. However, pollutant removal effectiveness is greatly improved when the underlying soil permits at least some infiltration.

Tributary Area: EDBs should only be used where the tributary drainage area is at least 5 acres, since meeting the draw-down requirements (discussed below) for smaller areas would result in very small outlet orifice diameters which would be prone to clogging.

Proximity to Receiving Waters: All site runoff must be treated to the MEP with appropriate BMPs *before* being discharged into Receiving Waters; as such the EDB cannot be constructed in-line within Receiving Waters.

Setbacks: Due to the infiltration characteristics incorporated into the EDB design, the lowest pervious point (beneath the filter drain) of the extended detention facility should be a minimum of 10' above the seasonal high groundwater table. All other setbacks shall be in accordance with applicable standards of the “Basin Guidelines” (Appendix C) or other guidelines issued by the Engineering Authority (EA).

Basin Guidelines: See Section 1 of the “Basin Guidelines” (Appendix C) for additional requirements (i.e., fencing, maintenance access, etc.) that may be required by the Engineering Authority (EA).

Landscaping Requirements

Basin vegetation provides erosion protection, enhances evapotranspiration and infiltration, and improves pollutant removal. The upper stage basin surface, berms and side slopes shall be planted with native grasses. Proper landscape management is also required to ensure that the vegetation does not contribute to water pollution through the use of pesticides, herbicides, or fertilizers. Landscaping shall be in accordance with applicable standards of the “Basin Guidelines” (Appendix C) or other guidelines issued by the EA.

Maintenance Guidelines

Schedule	Inspection and Maintenance Activity
During every scheduled maintenance check (per below), and *as needed* at other times	• Maintain vegetation as needed. Use of fertilizers, pesticides and herbicides should be strongly avoided to ensure they don't contribute to water pollution. If appropriate native plant selections and other IPM methods are used, such products shouldn't be needed. If such projects are used: o Care should be taken to avoid contact with the low-flow or other trenches, and the media filter in the bottom stage. o Products shall be applied in accordance with their labeling, especially in relation to application to water, and in areas subjected to flooding. o Fertilizers should not be applied within 15 days before, after, or during the rainy season. • No ponded water should be present for more than 72 hours to avoid nuisance or vector problems. No algae formation should be visible. Correct problems as needed.
Annually. If possible, schedule these inspections before the beginning of the rain season to allow for any repairs to occur before rains occur.	• Remove debris and litter from the entire basin • Inspect hydraulic and structural facilities. Examine the outlet for clogging, the embankment and spillway integrity, as well as damage to any structural element. • Check for erosion, slumping and overgrowth. Repair as needed. • Inspect sand media at the filter drain to verify it is allowing acceptable infiltration. **Scarify top <u>3 inches</u> by raking the filter drain's sand surface annually.** • Check the media filter underdrains (via the cleanout) for damage or clogging. Repair as needed. • Remove accumulated sediment and debris from the forebay, and ensure that the notch weir is clear and will allow proper drainage. • Check gravel filled low flow and collector trenches for sediment buildup and repair as needed.
Every 5 years or sooner (depending on whether observed drain times to empty the basin are less than 72 hours).	• Remove the top 3 inches of sand from the filter drain and backfill with 3 inches of new sand to return the sand layer to its original depth. When scarification or removal of the top 3 inches of sand is no longer effective, remove and replace sand filter layer.
Whenever substantial sediment accumulation has occurred.	• Remove accumulated sediment from the bottom of the basin. Removal should extend to original basin depth.

Design Summary

Design Parameter	Extended Detention Basin
Drawdown time (total)	72 hours [2,3]
Minimum drawdown time for 50% V_{BMP}	24 hours [2]
Minimum tributary area	5 acres [2]
Outlet erosion control	Energy dissipaters to reduce velocities[1]
Forebay volume	3 to 5 % of V_{BMP} [3]
Basin Invert Longitudinal Slope (min.)	1%
Basin Invert Transverse (cross) Slope (min)	1%
Low-flow trench width (min.)	48 inches
Low-flow trench depth (min.)	24 inches
Slope of low-flow trench along bottom excavated Surface (max.)	1%
Slope of gravel collector trenches along bottom excavated surface (max.)	1 %
Length to width ratio (min.)	1.5:1
Basin depth (min.)	1 foot [3]
Bottom stage volume	0.5 % of V_{BMP} [3]
Bottom stage depth (min)	0.33 feet [3]
Filter drain depth (min)	2.33 feet [3]

1. **Ventura County's Technical Guidance Manual for Stormwater Quality Control Measures**
2. **CA Stormwater BMP Handbook for New Development and Significant Redevelopment**
3. **Denver, Colorado's UDFCD Drainage Criteria Manual, Volume 3**

Note: The information contained in this BMP Factsheet is intended to be a summary of design considerations and requirements. Additional information which applies to all detention basins may be found in the "Basin Guidelines" (Appendix C). In addition, information herein may be superseded by other guidelines issued by the Engineering Authority.

Design Procedure

These steps correspond to and provide a description of the information required in the EDB Design Worksheet.

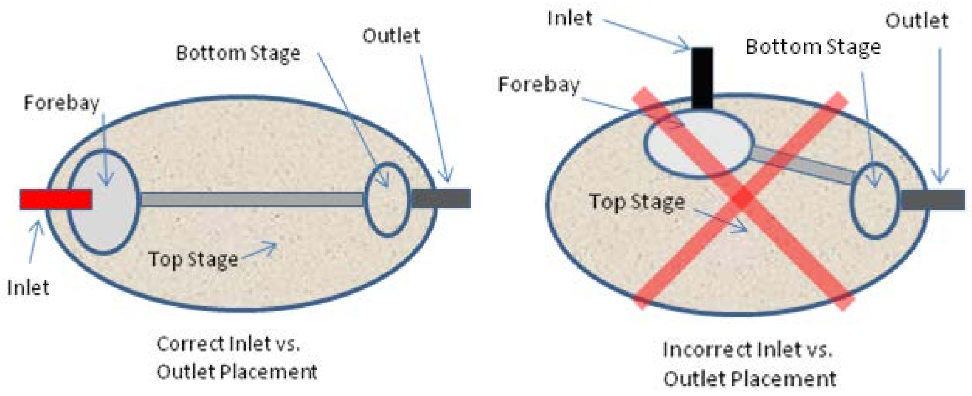
1. Find the Design Volume, V_{BMP}.

a) Enter the tributary area, A_T to the BMP. The minimum tributary area is 5 acres.

b) Enter the Design Volume, V_{BMP}, determined from Section 2.1 of this Handbook.

2. Basin Footprint

a) Enter the length and width of the EDB. The length shall be measured between the inlet to the basin and the outlet structure; and the width shall be measured at the widest point of the basin invert. The length to width ratio should be 1.5:1 or longer to prevent short-circuiting and increase the overall effectiveness of the BMP.



b) Enter the internal basin side slopes. See the "Basin Guidelines" (Appendix C) for side slope requirements. If variable internal side-slopes are used, enter the steepest slope that will be used.

c) Using Figure 1 as a guide, enter the proposed basin depth, D_B, and the freeboard depth, D_{FB}. Based on the information provided, the spreadsheet will calculate the minimum total depth required, D_{REQ}, for this BMP. D_{REQ} is the depth from the bottom of the underdrain layer in the bottom stage (see step 5c), to the top of the freeboard. This calculated minimum required depth can be used to determine if enough elevation difference is available within the design topography to allow for use of this BMP.

d) Additionally, the basin depth D_B is equal to $D_{O,}$ which is the depth from the design pond water surface elevation to the lowest orifice in the outlet structure. D_O is confirmed by the spreadsheet and is used in the Basin Outlet Design described in step 6 below. It should be noted that this lowest orifice is a critical elevation in the design of this BMP. The Volume of the Basin V_{Basin} described in step 3d) is the volume of water above this lowest orifice. This lowest-orifice also represents the dry weather ponded water surface discussed in step 5c below. Below this elevation there must be a minimum of a 4-inch drop down to the surface of the Sand Filter in the bottom stage.

3. Basin Design

a) The Total Basin Depth, D_{TOT}, is calculated automatically, and is the sum of the basin depth D_B plus the freeboard depth D_{FB}.

b) Enter the longitudinal slope of the basin invert. This slope must be at least 1% and is measured along the low flow trench between the forebay and the bottom stage. Note that the surface of the sand layer in the bottom stage must be level (see Figure 1).

c) Enter the transverse slope of the basin invert. This transverse (cross sectional) slope must be at least 1% sloped toward the low flow trench.

d) Enter the Volume of the Basin, V_{Basin}. This volume must be the actual volume of water held within the basin as substantiated by modeling or appropriate volumetric calculations, and must be equal to or greater than V_{BMP}. This volume must be held above the lowest orifice in the Basin Outlet Design described in step 6 below.

4. Forebay Design

All flows must enter the basin through the forebay. The forebay provides a location for the settlement and collection of larger particles, and any other trash or debris. A relatively smooth and level concrete bottom surface should be provided to facilitate mechanical removal of any accumulated sediment, trash and debris.

Figure 2: Forebay filled with storm water

a) Enter the Forebay Volume VFB. This volume must be from 3 to 5 percent of V_{BMP}.

b) A rock or concrete berm must be constructed to detain water before it drains into the basin. The top of the berm shall be set no higher than the invert of the inlet conveyance. Enter the Forebay Depth, D_{FBY}.

c) The spreadsheet will calculate the minimum surface area of the forebay, A_{FB}, based on the provided Forebay Volume and Depth. Ensure that the plans provide for a forbay area at least this large.

d) Although the forebay will be well submerged in the design event, a full height rectangular notch-type weir shall be constructed through the berm to prevent permanent ponding in the forebay, and allow water to slowly and fully drain to the main body of the basin. This notch should be offset from the inflow streamline to prevent low-flows from short circuiting. Enter the width, W, of this rectangular notch weir. The width shall not be less than 1.5 inches to prevent clogging. Additionally, immediately outside the notch construct a minimum 1-foot by 1-foot gravel pad to prevent vegetative growth within the basin invert from blocking the notch.

5. Dry Weather and Low-Flow Management

The basin shall have both a low-flow gravel trench and a network of gravel collector trenches across the invert of the basin, as well as a bottom stage sand filter to treat low flows and dry weather flows (see Figure 1).

a) Low Flow Trench: The low-flow gravel trench conveys flow from the forebay to the bottom stage, while allowing for maximum incidental infiltration and volume loss. The trench shall be a minimum of 48 inches wide by 24 inches deep. This trench shall be unlined and backfilled with AASHTO No. 2 gravel (or similar) to the finished surface of the basin invert, and shall not use underdrains. The bottom excavated surface of the low-flow trench shall be 1 percent or flatter to promote infiltration.


Figure 3: Gravel filled low-flow trench

b) Collector Trenches: Gravel collector trenches beneath the top stage shall be arranged as illustrated in Figure 1 of Appendix C with minimal slope (1% maximum) along their bottom excavated surface to promote infiltration, and must extend from the low-flow trench to the toe of the basin side slopes. They shall be a minimum of 18-inches wide by 24-inches deep, unlined and backfilled with AASHTO No. 2 gravel (or similar) to the finished basin invert surface. The gravel collector trenches shall not use underdrains and shall be constructed with a maximum spacing of 25 feet, center to center. See Figure 1 of Appendix C.

c) Bottom Stage: A depressed sand filter drain area, referred to as the bottom stage, must be constructed adjacent to the outlet structure to treat any dry weather flows. To ensure that dry weather flows are treated through the sand filter and not discharged through the orifice plate, the top surface of the sand filter must be depressed at least 4 inches below the lowest orifice in the outlet structure. This depressed area will create a micro pool of water that is then filtered down through the sand filter and out through underdrains. Based on the minimum dimensions described below, the minimum depth of excavation below the lowest orifice in the outlet structure is 2.33 feet.

   i. Enter the Depth of the bottom stage, D_{BS}. As mentioned above, this depth must be at least 4 inches, and extend down below the lowest orifice in the outlet structure.

   ii. Enter the area of the bottom stage, A_{BS}.

iii. Based on the D_{BS} and A_{BS} entered, the spreadsheet will calculate V_{BS}. This volume is the volume of ponded water that will be held below the lowest orifice in the outlet structure, and above the surface of the sand filter. This volume must be at least 0.5% of V_{BMP}.

iv. Enter the thickness of the ASTM C-33 sand layer that will be provided, D_S. A minimum thickness of 18 inches is required.

v. Below the sand layer, a minimum 10-inch thick layer of gravel shall be installed with underdrains to drain the water that has been treated through the sand filter. The underdrains shall connect into the outlet structure. See Appendix B for standard underdrain construction. Enter the diameter of the underdrain pipe (minimum 6” dia.), and the spacing of the underdrains. The maximum spacing of the underdrains is 20 feet on center, however where the area of the bottom stage is particularly small (less than 500 square feet), the underdrain pipes shall be placed at no more than a 10-foot separation on center.

6. Basin Outlet Design

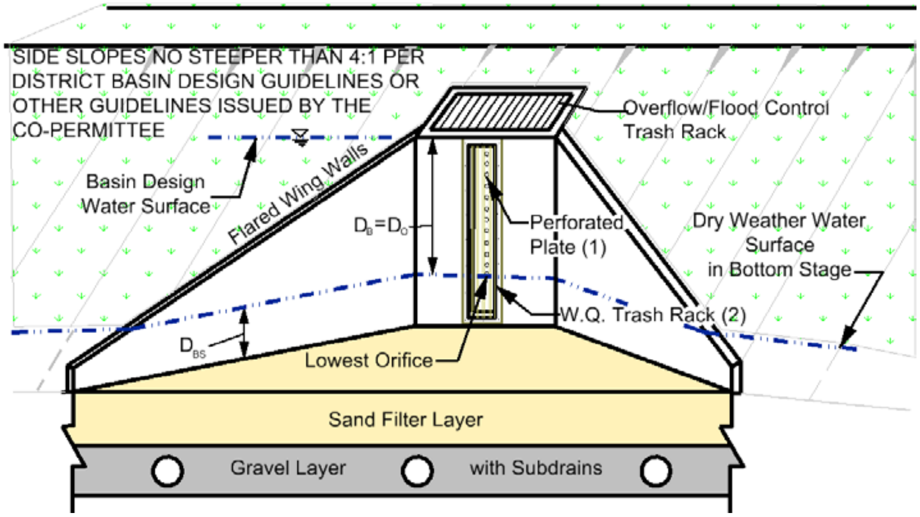


Figure 4: Basin Outlet Structure with Bottom Stage Shown

Outlet structures for publicly maintained basins shall conform to District Standard Drawings WQ501 unless approved in advance by the local Engineering Authority (EA). This standardization is to provide for efficient maintenance. The basin outlet should be sized to release the design volume, VBMP, within a 72-hour period but 50 percent of VBMP within 24 hours. This is an iterative design process where an appropriate control orifice can be selected using the following steps:

a. Develop a Stage vs. Discharge Curve for the Outlet Structure

Estimate the orifice size and outlet plate configuration (number per row, etc.). Based on D_O provided in the Basin Footprint section, the spreadsheet will automatically generate the stage vs. discharge relationship for this outlet:

$$Q = C*A*[2*g*(H-H_o)]^{0.5}$$

Where:

Q = discharge (ft^3/s)

C = orifice coefficient

A = area of the orifice (ft)

g = gravitational constant (32.2 ft2/s)

H = water surface elevation (ft)

H_o = orifice elevation (ft)

The lowest orifice shall be located with its centerline at the top of the bottom stage; at least 4 inches above the surface of the sand filter drain. To help avoid clogging, the minimum orifice diameter is limited to 3/8 inch. Since the 1/4 inch thickness of the orifice plate will be less than the orifice diameter, a value for C of 0.66 may be used. If another value for C is used, justification may be required.

b. Develop a Discharge/Volume vs. Stage Table for the Basin

Based on the shape and size of the basin, develop a relationship between the stage and the volume of water in the basin. Since the orifice spacing is 4 inches on center for the standard orifice plate, the stage intervals must also be 4 inches. Enter the basin volume at each interval starting at the centerline of the lowest orifice.

c. Route the Design Volume through the Basin

The spreadsheet assumes that the Design Volume, $V_{BMP,}$ enters the basin instantaneously and as such, no inflow/outflow hydrograph is necessary. The drawdown time for each stage becomes:

$$\Delta t = V_i/Q$$

Where:

Δt = drawdown time for each stage

V_i = the volume at each stage

Q = the flow rate corresponding to the headwater elevation at each stage.

The spreadsheet automatically determines the drawdown time from the sum of the Δt values for each stage. If the orifice size and plate configuration estimate meets the hydraulic retention time requirements (50% of the volume empties in not less than 24 hours, 100% of the volume empties in no more than 72 hours), the outlet is correctly sized. If these requirements are not met, select a new orifice size or configuration and repeat the process starting at Step 6a.

7. Outlet Protection

To prevent the orifices from clogging, trash racks are required where perforated vertical outlet control plates are used. This allows for easier access to outlet orifices for inspection and cleaning. Trash racks shall be sized to prevent clogging of the primary water quality outlet without restricting the hydraulic capacity of the outlet control orifices. The orifice plate shall be protected with a trash rack conforming to Standard Drawing WQ501 (at end of this section) with at least six square feet of open surface area or 25 times the total orifice area, whichever is greater. The rack shall be adequately secured to prevent it from being removed or opened when maintenance is not occurring.

Overflow Structure Similar to Standard Drawing Number WQ 501

(Photo courtesy of Colorado Association of Stormwater Floodplain Managers)

Trash rack with screen

8. Overflow Outlet

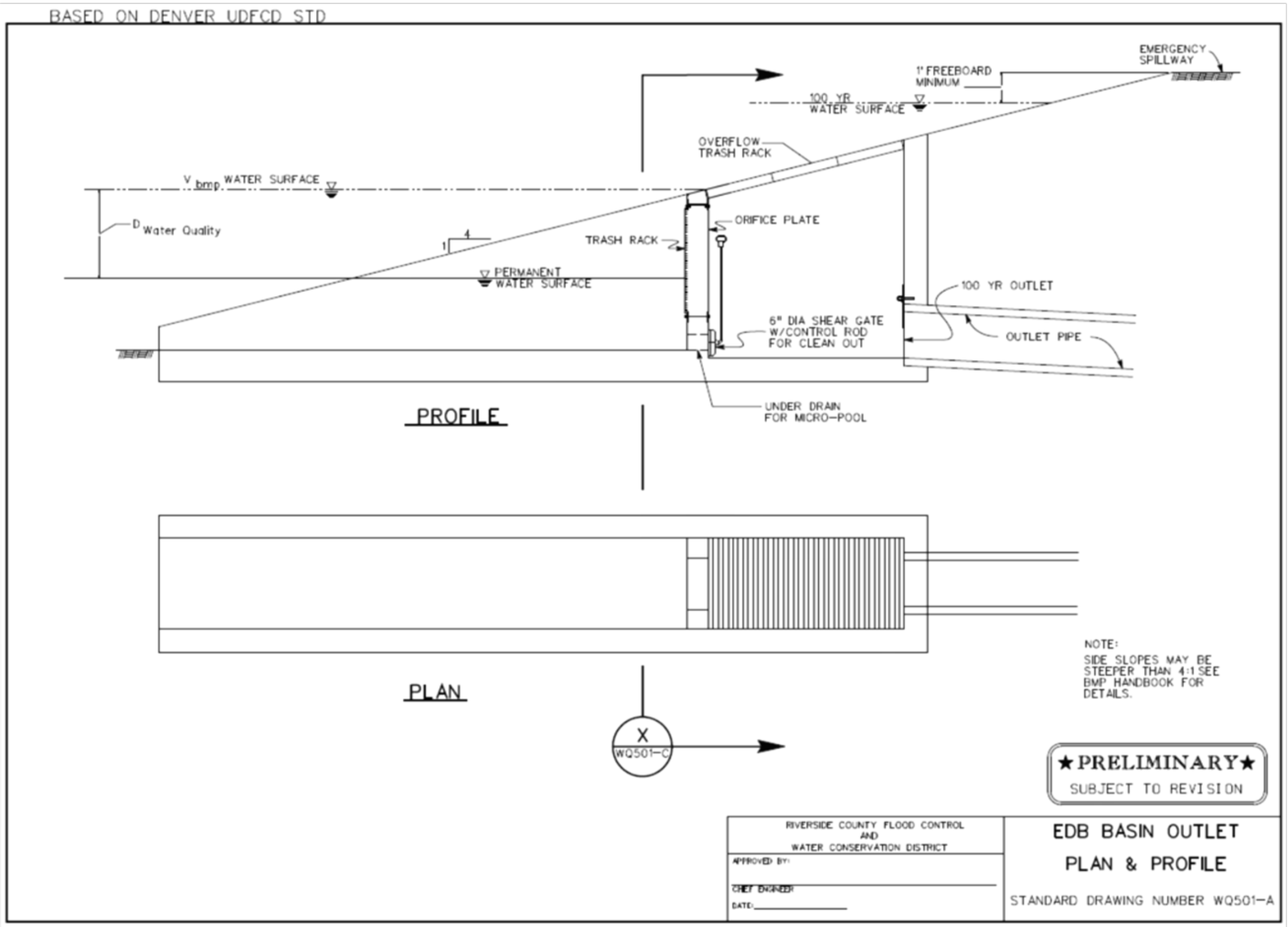
Overflow outlets for publicly maintained basins shall conform to Standard Drawing WQ501 (at end of this section) unless approved in advance by the Engineering Authority (EA).

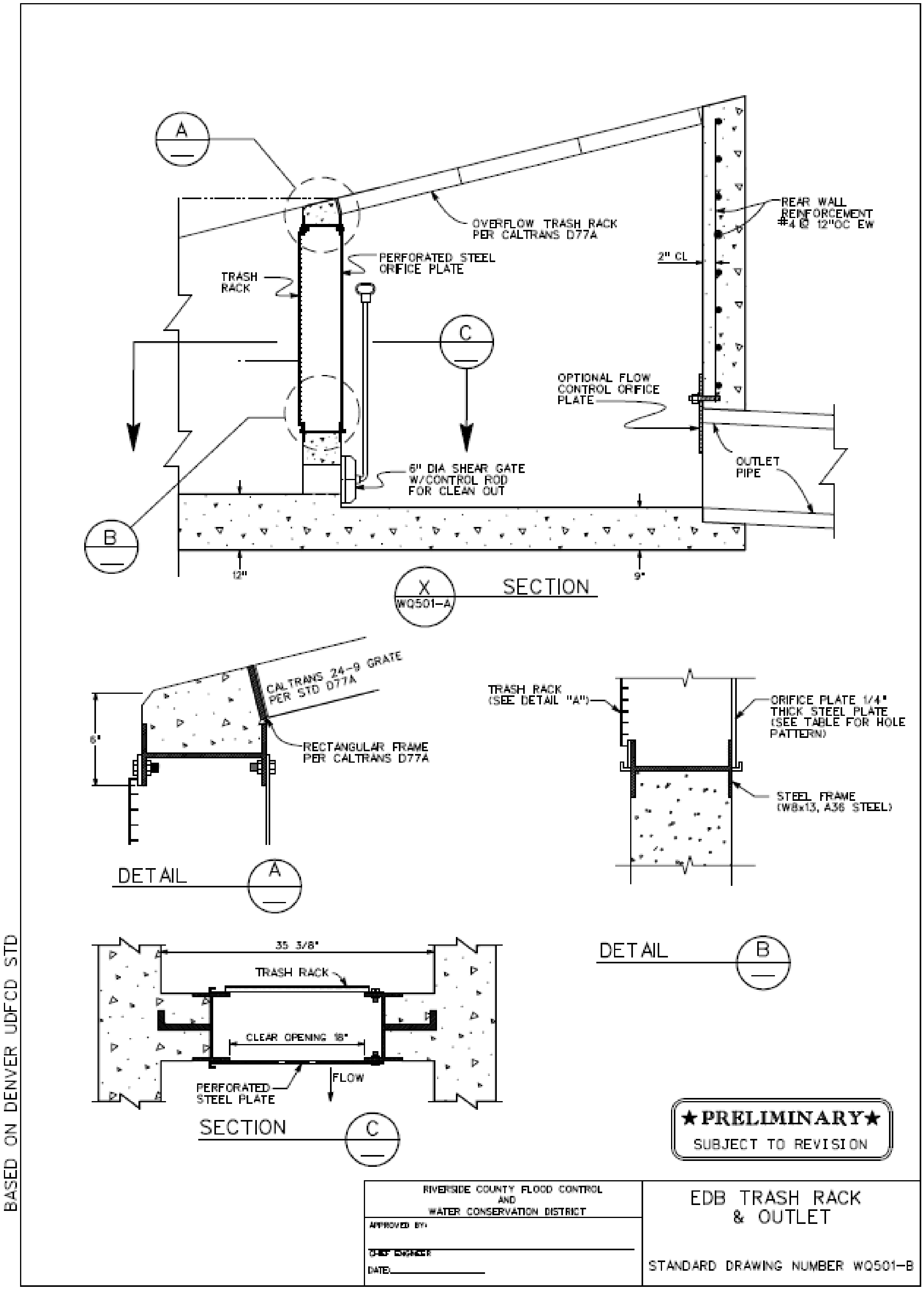
9. Embankment

Embankments shall be designed in accordance with applicable standards of Riverside County Flood Control District's "Basin Guidelines" (Appendix C) or other guidelines issued by the Engineering Authority (EA). Where applicable, embankment designs must additionally conform to the requirements of the State of California Division of Safety of Dams.

10. Spillway and Overflow Structures

Spillway and overflow structures should be designed in accordance with applicable standards of the "Basin Guidelines" (Appendix C) or other guidelines issued by the Engineering Authority (EA).


BASED ON DENVER UDFCD STD
EMERGENCY SPILLWAY
1' FREEBOARD MINIMUM
100 YR WATER SURFACE
OVERFLOW TRASH RACK
V bmp WATER SURFACE
D Water Quality
4
1
ORIFICE PLATE
TRASH RACK
PERMANENT WATER SURFACE
100 YR OUTLET
6" DIA SHEAR GATE W/CONTROL ROD FOR CLEAN OUT
OUTLET PIPE
UNDER DRAIN FOR MICRO-POOL
PROFILE
PLAN
X
WQ501-C
NOTE: SIDE SLOPES MAY BE STEEPER THAN 4:1 SEE BMP HANDBOOK FOR DETAILS.
★PRELIMINARY★
SUBJECT TO REVISION
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE:
EDB BASIN OUTLET
PLAN & PROFILE
STANDARD DRAWING NUMBER WQ501-A


A
OVERFLOW TRASH RACK PER CALTRANS D77A
REAR WALL REINFORCEMENT #4 @ 12"OC EW
PERFORATED STEEL ORFICE PLATE
TRASH RACK
2" CL
C
OPTIONAL FLOW CONTROL ORFICE PLATE
OUTLET PIPE
6" DIA SHEAR GATE W/CONTROL ROD FOR CLEAN OUT
B
12"
9"
X
WQ501-A
SECTION
CALTRANS 24-9 GRATE PER STD D77A
6"
RECTANGULAR FRAME PER CALTRANS D77A
DETAIL
A
TRASH RACK (SEE DETAIL "A")
ORIFICE PLATE 1/4" THICK STEEL PLATE (SEE TABLE FOR HOLE PATTERN)
STEEL FRAME (W8x13, A36 STEEL)
DETAIL
B
35 3/8"
TRASH RACK
CLEAR OPENING 18"
FLOW
PERFORATED STEEL PLATE
SECTION
C
BASED ON DENVER UDFCD STD
★PRELIMINARY★
SUBJECT TO REVISION
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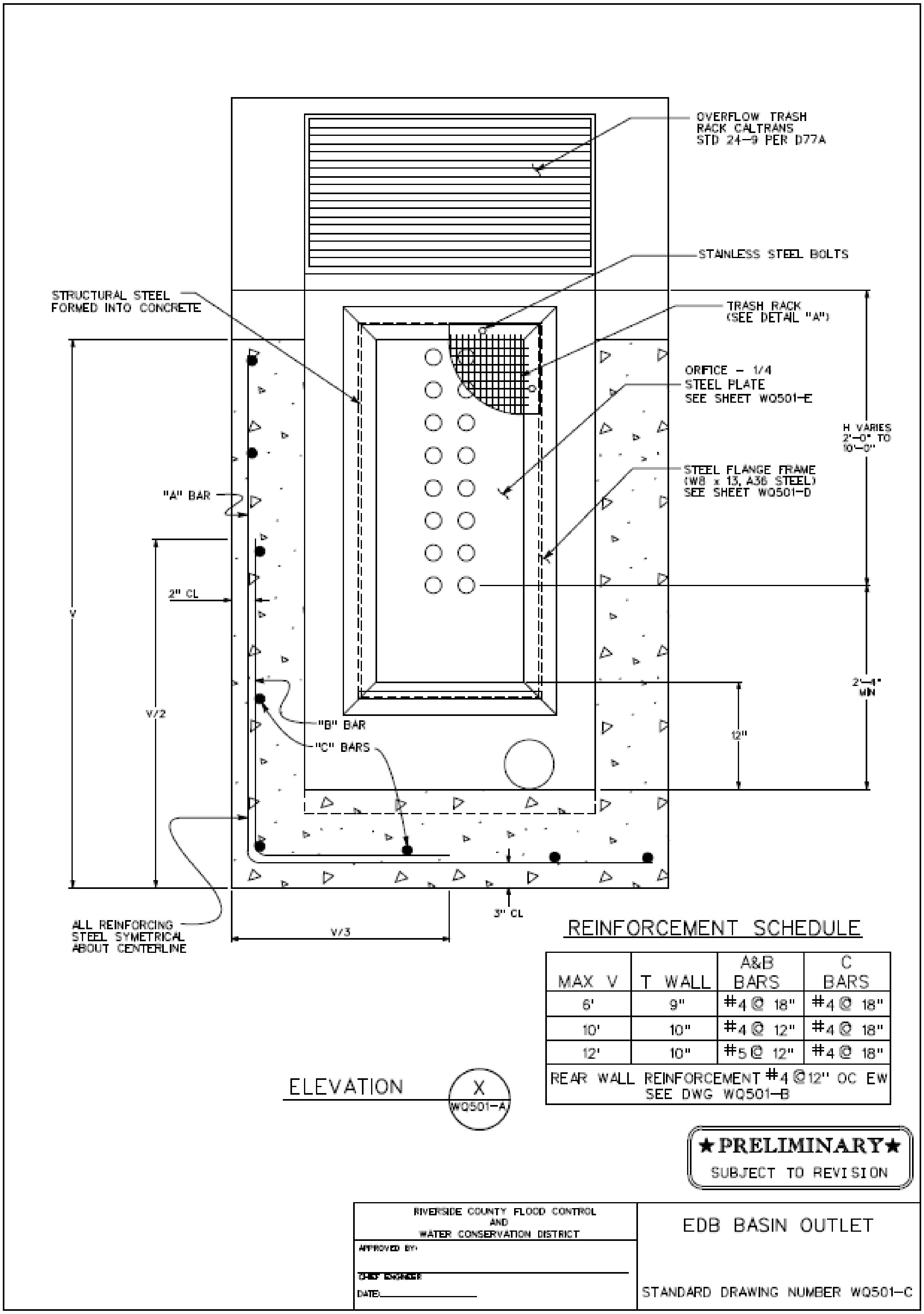
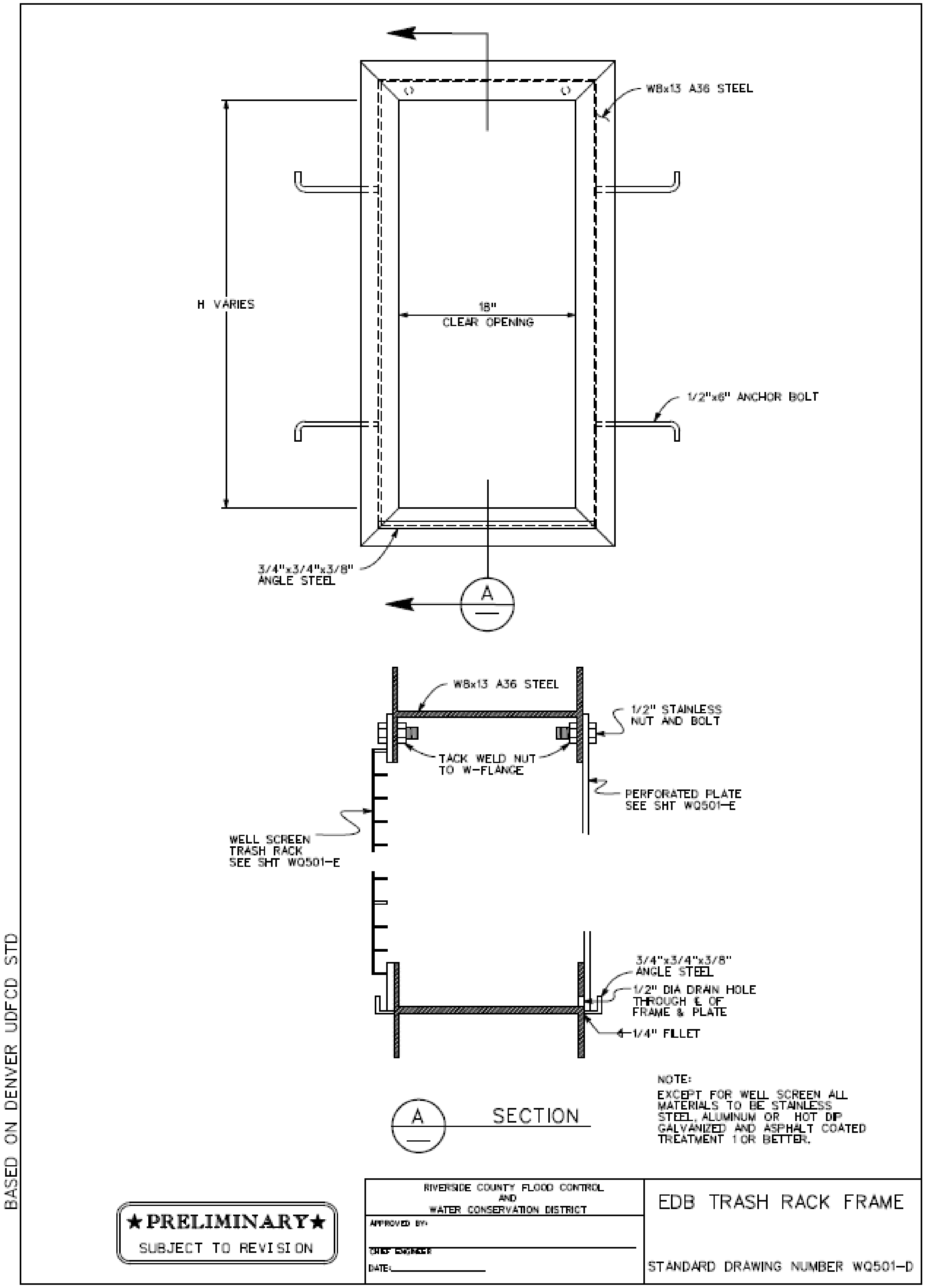
APPROVED BY:
CHIEF ENGINEER
DATE:
EDB TRASH RACK & OUTLET
STANDARD DRAWING NUMBER WQ501-B

EXTENDED DETENTION BASIN BMP FACT SHEET

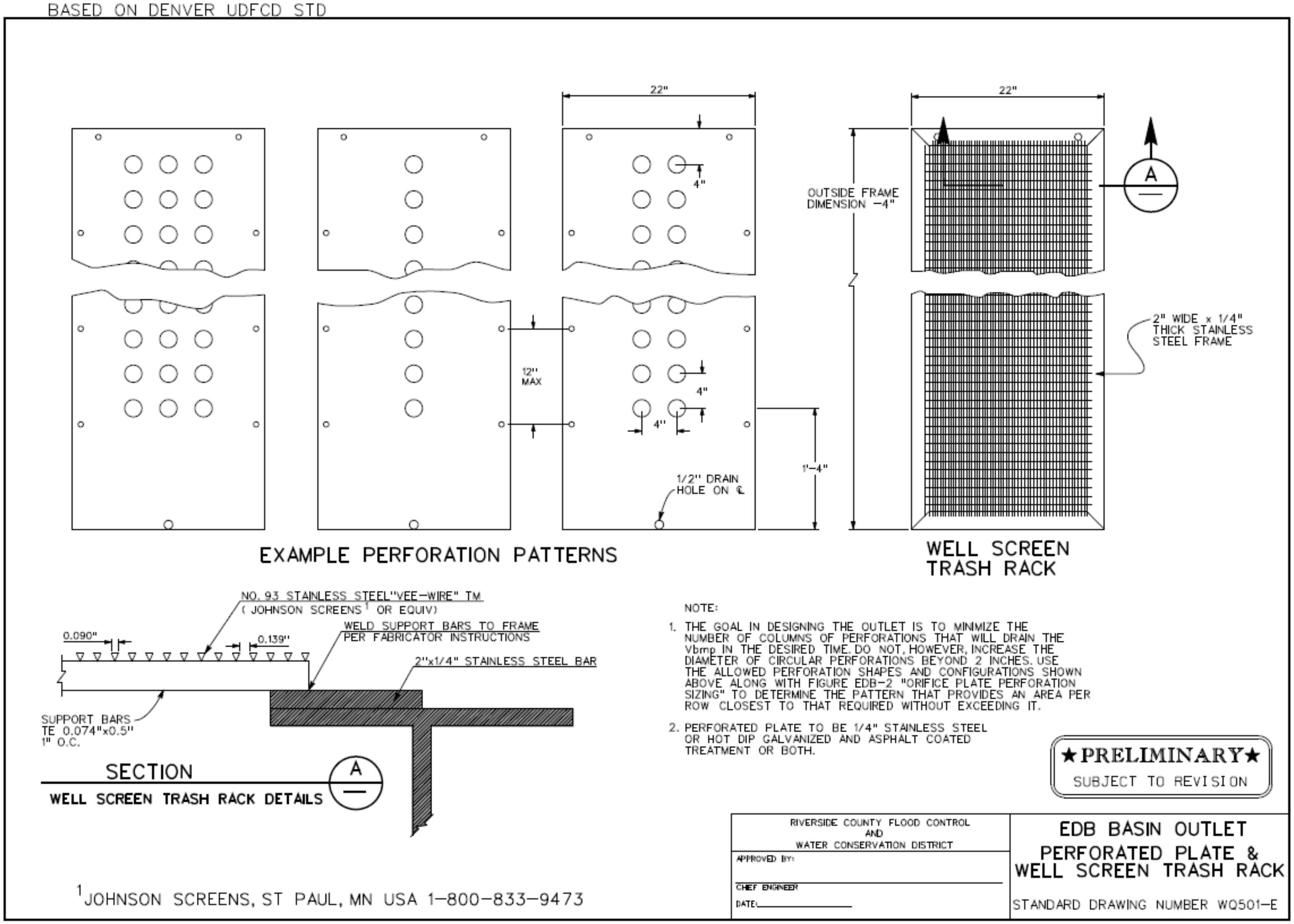


REINFORCEMENT SCHEDULE

MAX V	T WALL	A&B BARS	C BARS
6'	9"	#4 @ 18"	#4 @ 18"
10'	10"	#4 @ 12"	#4 @ 18"
12'	10"	#5 @ 12"	#4 @ 18"
REAR WALL REINFORCEMENT #4 @12" OC EW SEE DWG WQ501-B			


W8x13 A36 STEEL
H VARIES
18"
CLEAR OPENING
1/2"x6" ANCHOR BOLT
3/4"x3/4"x3/8"
ANGLE STEEL
A
W8x13 A36 STEEL
1/2" STAINLESS
NUT AND BOLT
TACK WELD NUT
TO W-FLANGE
PERFORATED PLATE
SEE SHT WQ501-E
WELL SCREEN
TRASH RACK
SEE SHT WQ501-E
3/4"x3/4"x3/8"
ANGLE STEEL
1/2" DIA DRAIN HOLE
THROUGH ℄ OF
FRAME & PLATE
1/4" FILLET
A
SECTION
NOTE:
EXCEPT FOR WELL SCREEN ALL
MATERIALS TO BE STAINLESS
STEEL, ALUMINUM OR HOT DIP
GALVANIZED AND ASPHALT COATED
TREATMENT 1 OR BETTER.
BASED ON DENVER UDFCD STD
★PRELIMINARY★
SUBJECT TO REVISION
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE:
EDB TRASH RACK FRAME
STANDARD DRAWING NUMBER WQ501-D

BASED ON DENVER UDFCD STD



NOTE:

1. THE GOAL IN DESIGNING THE OUTLET IS TO MINIMIZE THE NUMBER OF COLUMNS OF PERFORATIONS THAT WILL DRAIN THE Vbmp IN THE DESIRED TIME. DO NOT, HOWEVER, INCREASE THE DIAMETER OF CIRCULAR PERFORATIONS BEYOND 2 INCHES. USE THE ALLOWED PERFORATION SHAPES AND CONFIGURATIONS SHOWN ABOVE ALONG WITH FIGURE EDB-2 "ORIFICE PLATE PERFORATION SIZING" TO DETERMINE THE PATTERN THAT PROVIDES AN AREA PER ROW CLOSEST TO THAT REQUIRED WITHOUT EXCEEDING IT.
2. PERFORATED PLATE TO BE 1/4" STAINLESS STEEL OR HOT DIP GALVANIZED AND ASPHALT COATED TREATMENT OR BOTH.

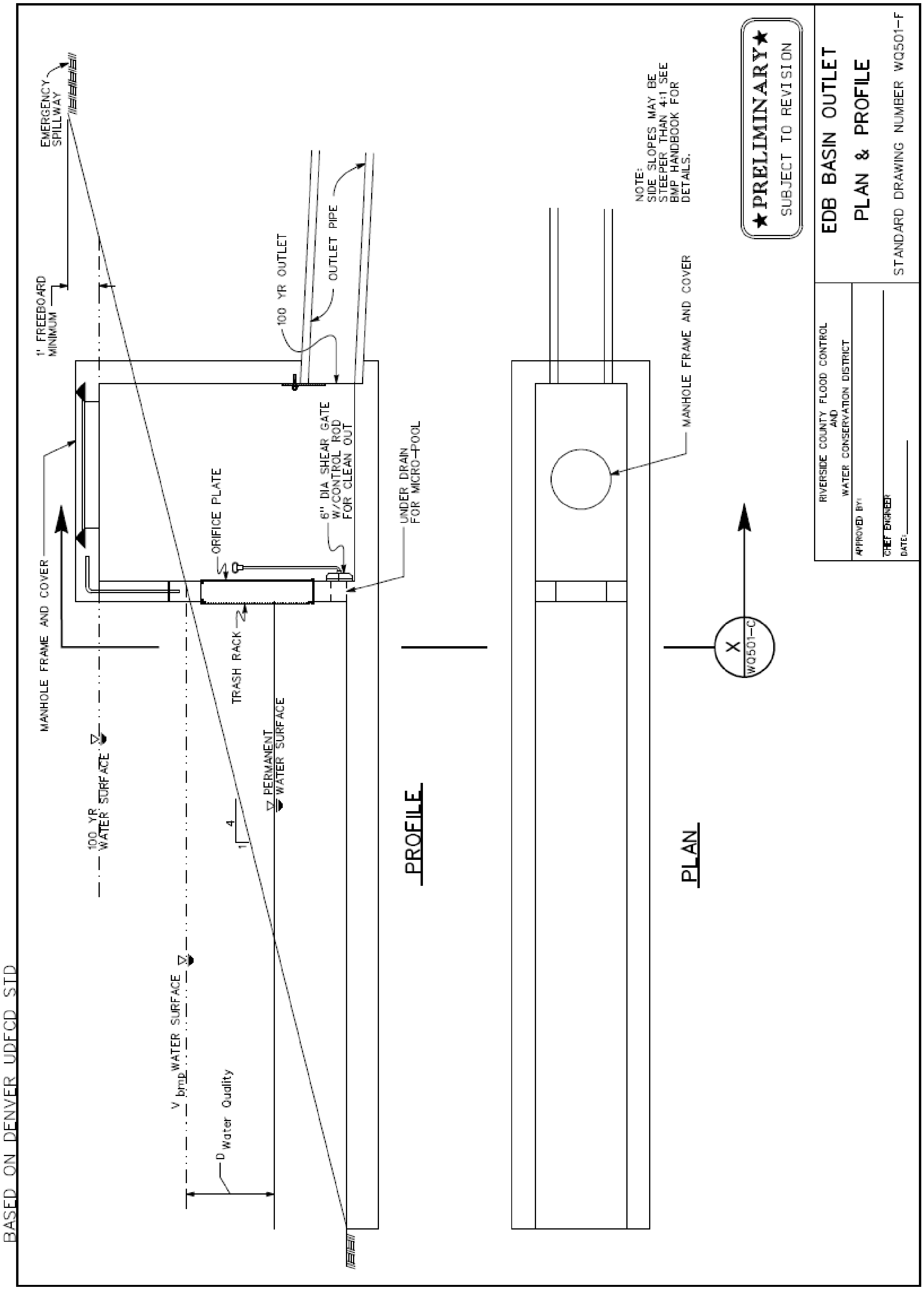
★PRELIMINARY★
SUBJECT TO REVISION

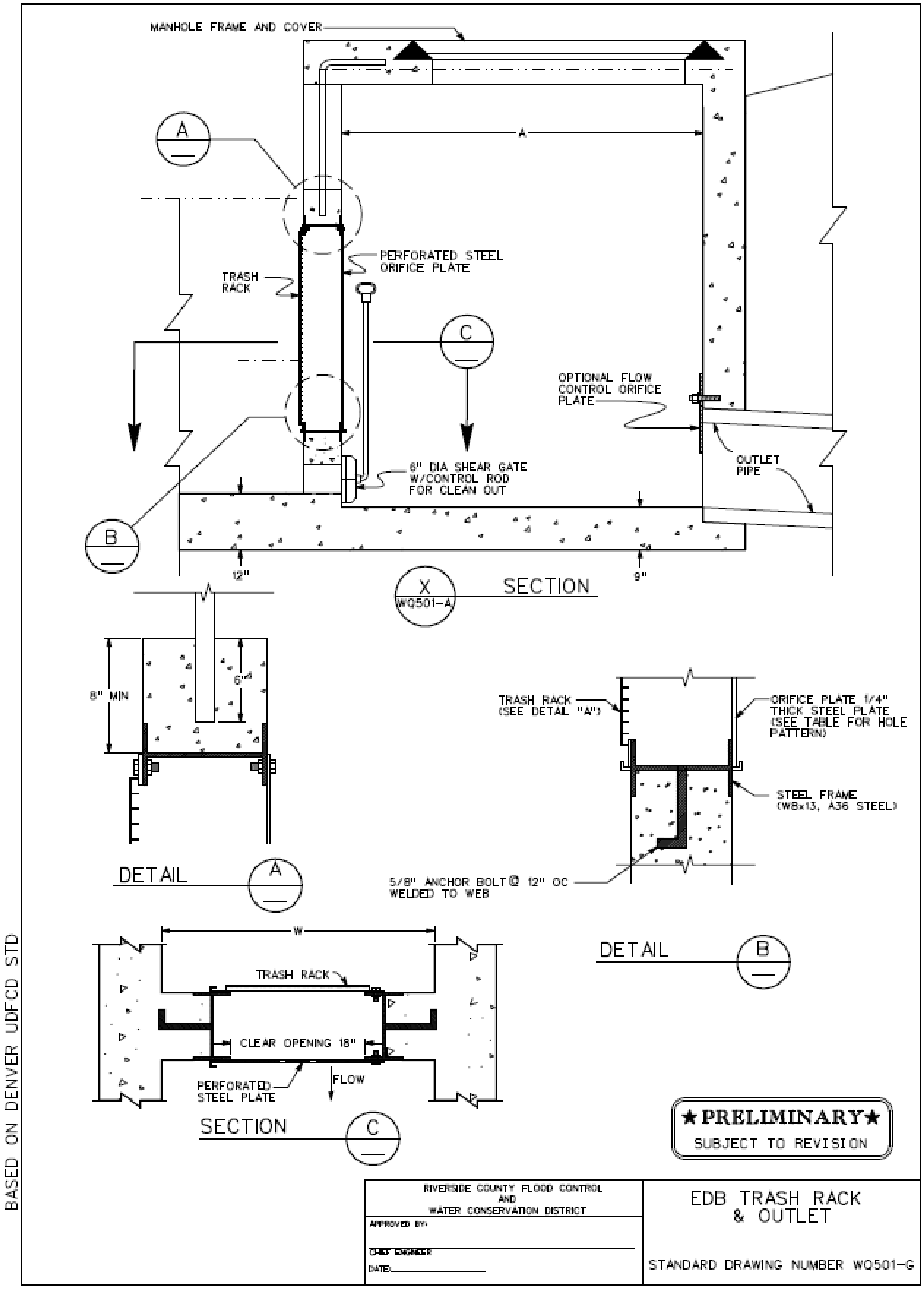
¹JOHNSON SCREENS, ST PAUL, MN USA 1-800-833-9473

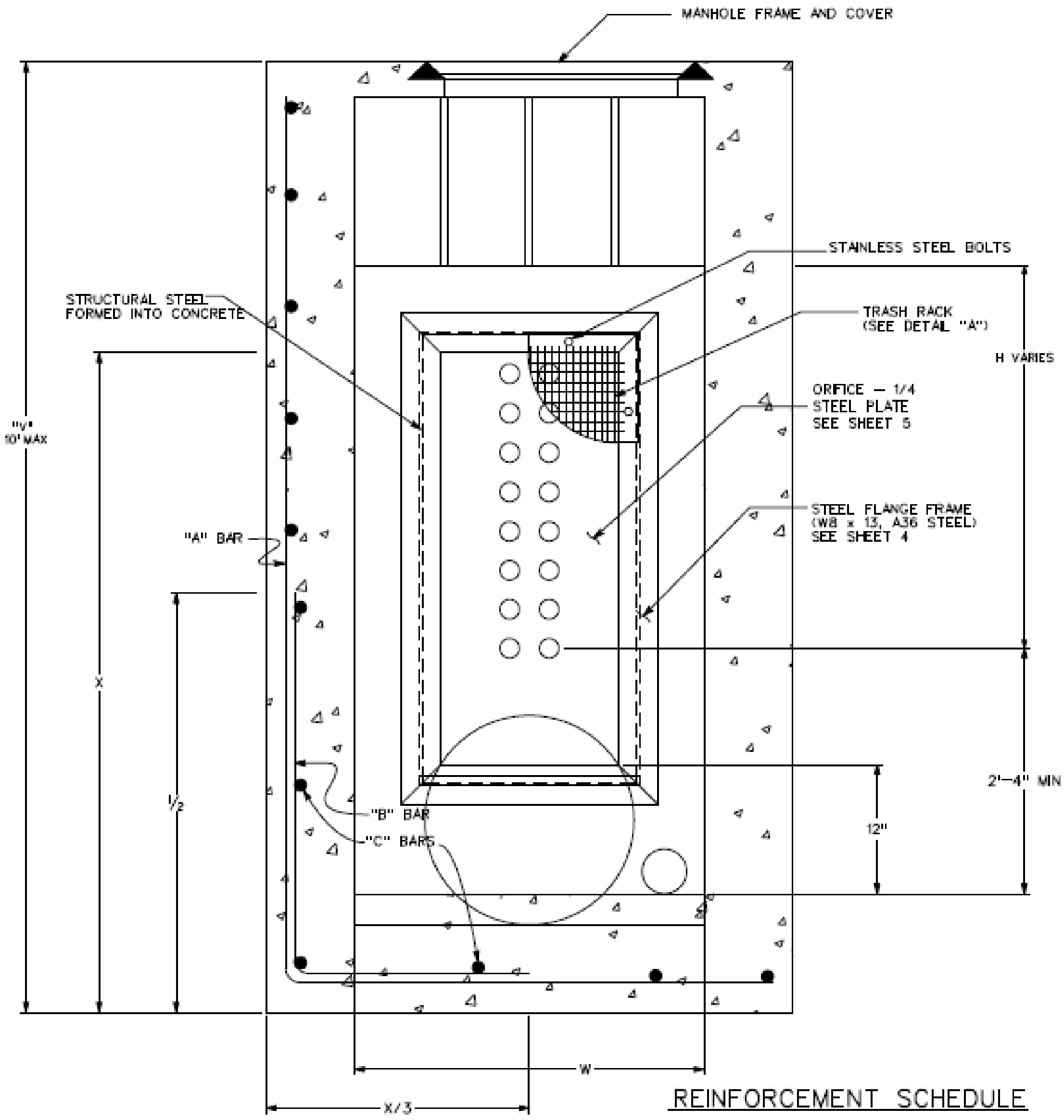
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE:

EDB BASIN OUTLET
PERFORATED PLATE &
WELL SCREEN TRASH RACK

STANDARD DRAWING NUMBER WQ501-E


EMERGENCY SPILLWAY
1' FREEBOARD MINIMUM
100 YR OUTLET
OUTLET PIPE
MANHOLE FRAME AND COVER
ORIFICE PLATE
6" DIA SHEAR GATE W/CONTROL ROD FOR CLEAN OUT
UNDER DRAIN FOR MICRO-POOL
TRASH RACK
100 YR WATER SURFACE
PERMANENT WATER SURFACE
4
1
V bmp WATER SURFACE
D Water Quality
BASED ON DENVER UDFCD STD
PROFILE
PLAN
MANHOLE FRAME AND COVER
X
WQ501-C
NOTE: SIDE SLOPES MAY BE STEEPER THAN 4:1 SEE BMP HANDBOOK FOR DETAILS.
★PRELIMINARY★
SUBJECT TO REVISION
EDB BASIN OUTLET
PLAN & PROFILE
STANDARD DRAWING NUMBER WQ501-F
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE:


MANHOLE FRAME AND COVER
A
PERFORATED STEEL ORIFICE PLATE
TRASH RACK
C
OPTIONAL FLOW CONTROL ORIFICE PLATE
OUTLET PIPE
6" DIA SHEAR GATE W/CONTROL ROD FOR CLEAN OUT
B
12"
9"
X
WQ501-A
SECTION
8" MIN
6"
DETAIL
A
TRASH RACK (SEE DETAIL "A")
ORIFICE PLATE 1/4" THICK STEEL PLATE (SEE TABLE FOR HOLE PATTERN)
STEEL FRAME (W8x13, A36 STEEL)
5/8" ANCHOR BOLT @ 12" OC WELDED TO WEB
DETAIL
B
W
TRASH RACK
CLEAR OPENING 18"
PERFORATED STEEL PLATE
FLOW
SECTION
C
★PRELIMINARY★
SUBJECT TO REVISION
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE:
EDB TRASH RACK & OUTLET
STANDARD DRAWING NUMBER WQ501-G
BASED ON DENVER UDFCD STD



ELEVATION X WQ501-A

BASED ON DENVER UDFCD STD

REINFORCEMENT SCHEDULE

MAX V	T WALL	A&B BARS	C BARS
6'	9"	#4 @ 18"	#4 @ 18"
10'	10"	#4 @ 12"	#4 @ 18"
12'	10"	#5 @ 12"	#4 @ 18"

★PRELIMINARY★
SUBJECT TO REVISION

RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

APPROVED BY:

CHIEF ENGINEER

DATE:

EDB BASIN OUTLET

STANDARD DRAWING NUMBER WQ501–H

3.5 Bioretention Facility

Type of BMP	LID – Bioretention
Treatment Mechanisms	Infiltration, Evapotranspiration, Evaporation, Biofiltration
Maximum Drainage Area	This BMP is intended to be integrated into a project's landscaped area in a distributed manner. Typically, contributing drainage areas to Bioretention Facilities range from less than 1 acre to a maximum of around 10 acres.
Other Names	Rain Garden, Bioretention Cell, Bioretention Basin, Biofiltration Basin, Landscaped Filter Basin, Porous Landscape Detention

Description

Bioretention Facilities are shallow, vegetated basins underlain by an engineered soil media. Healthy plant and biological activity in the root zone maintain and renew the macro-pore space in the soil and maximize plant uptake of pollutants and runoff. This keeps the Best Management Practice (BMP) from becoming clogged and allows more of the soil column to function as both a sponge (retaining water) and a highly effective and self-maintaining biofilter. In most cases, the bottom of a Bioretention Facility is unlined, which also provides an opportunity for infiltration to the extent the underlying onsite soil can accommodate. When the infiltration rate of the underlying soil is exceeded, fully biotreated flows are discharged via underdrains. Bioretention Facilities therefore will inherently achieve the maximum feasible level of infiltration and evapotranspiration and achieve the minimum feasible (but highly biotreated) discharge to the storm drain system.

Siting Considerations

These facilities work best when they are designed in a relatively level area. Unlike other BMPs, Bioretention Facilities can be used in smaller landscaped spaces on the site, such as:

- ✓ Parking islands
- ✓ Medians
- ✓ Site entrances

Landscaped areas on the site (such as may otherwise be required through minimum landscaping ordinances), can often be designed as Bioretention Facilities. This can be accomplished by:

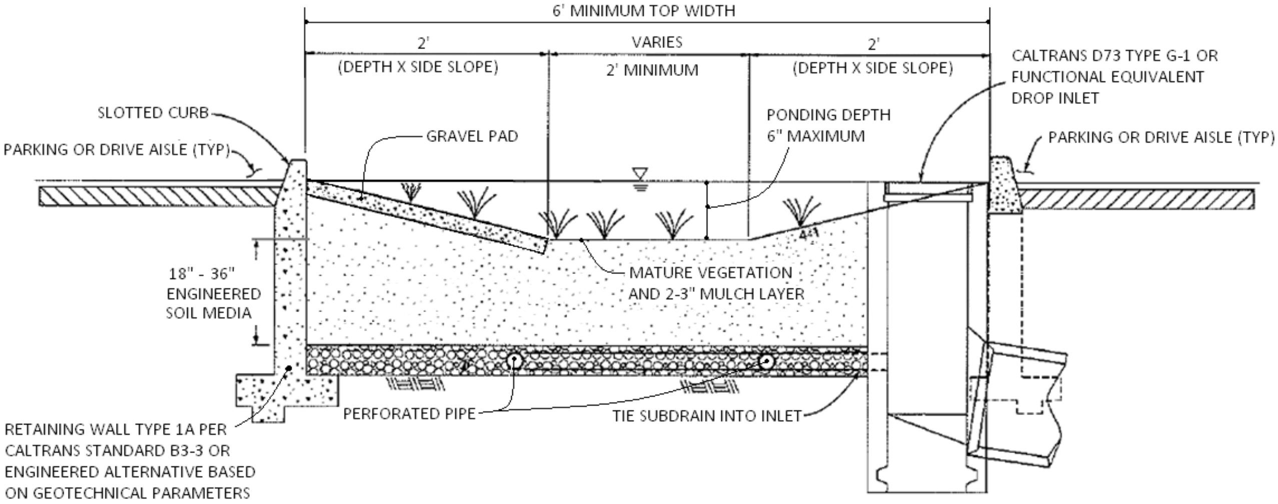
- *Depressing* landscaped areas below adjacent impervious surfaces, rather than elevating those areas
- Grading the site to direct runoff from those impervious surfaces *into* the Bioretention Facility, rather than away from the landscaping
- Sizing and designing the depressed landscaped area as a Bioretention Facility as described in this Fact Sheet

Bioretention Facilities should however not be used downstream of areas where large amounts of sediment can clog the system. Placing a Bioretention Facility at the toe of a steep slope should also be avoided due to the potential for clogging the engineered soil media with erosion from the slope, as well as the potential for damaging the vegetation.

Design and Sizing Criteria

The recommended cross section necessary for a Bioretention Facility includes:

- Vegetated area
- 18' minimum depth of engineered soil media
- 12' minimum gravel layer depth with 6' perforated pipes (added flow control features such as orifice plates may be required to mitigate for HCOC conditions)



While the 18-inch minimum engineered soil media depth can be used in some cases, it is recommended to use 24 inches or a preferred 36 inches to provide an adequate root zone for the chosen plant palate. Such a design also provides for improved removal effectiveness for nutrients. The recommended ponding depth inside of a Bioretention Facility is 6 inches; measured from the flat bottom surface to the top of the water surface as shown in Figure 1.

Because this BMP is filled with an engineered soil media, pore space in the soil and gravel layer is assumed to provide storage volume. However, several considerations must be noted:

- Surcharge storage above the soil surface (6 inches) is important to assure that design flows do not bypass the BMP when runoff exceeds the soil's absorption rate.
- In cases where the Bioretention Facility contains engineered soil media deeper than 36 inches, the pore space within the engineered soil media can only be counted to the 36-inch depth.
- A maximum of 30 percent pore space can be used for the soil media whereas a maximum of 40 percent pore space can be use for the gravel layer.

Figure 1: Standard Layout for a Bioretention Facility

Engineered Soil Media Requirements

The engineered soil media shall be comprised of 85 percent mineral component and 15 percent organic component, by volume, drum mixed prior to placement. The mineral component shall be a Class A sandy loam topsoil that meets the range specified in Table 1 below. The organic component shall be nitrogen stabilized compost[1], such that nitrogen does not leach from the media.

Table 1: Mineral Component Range Requirements

Percent Range	Component
70-80	Sand
15-20	Silt
5-10	Clay

The trip ticket, or certificate of compliance, shall be made available to the inspector to prove the engineered mix meets this specification.

Vegetation Requirements

Vegetative cover is important to minimize erosion and ensure that treatment occurs in the Bioretention Facility. The area should be designed for at least 70 percent mature coverage throughout the Bioretention Facility. To prevent the BMP from being used as walkways, Bioretention Facilities shall be planted with a combination of small trees, densely planted shrubs, and natural grasses. Grasses shall be native or ornamental; preferably ones that do not need to be mowed. The application of fertilizers and pesticides should be minimal. To maintain oxygen levels for the vegetation and promote biodegradation, it is important that vegetation not be completely submerged for any extended period of time. Therefore, a maximum of 6 inches of ponded water shall be used in the design to ensure that plants within the Bioretention Facility remain healthy.

A 2 to 3-inch layer of standard shredded aged hardwood mulch shall be placed as the top layer inside the Bioretention Facility. The 6-inch ponding depth shown in Figure 1 above shall be measured from the top surface of the 2 to 3-inch mulch layer.

Curb Cuts

To allow water to flow into the Bioretention Facility, 1-foot-wide (minimum) curb cuts should be placed approximately every 10 feet around the perimeter of the Bioretention Facility. Figure 2 shows a curb cut in a Bioretention Facility. Curb cut flow lines must be at or above the V_{BMP} water surface level.

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[1] For more information on compost, visit the US Composting Council website at: http://compostingcouncil.org/

Figure 2: Curb Cut located in a Bioretention Facility

To reduce erosion, a gravel pad shall be placed at each inlet point to the Bioretention Facility. The gravel should be 1- to 1.5-inch diameter in size. The gravel should overlap the curb cut opening a minimum of 6 inches. The gravel pad inside the Bioretention Facility should be flush with the finished surface at the curb cut and extend to the bottom of the slope.

In addition, place an apron of stone or concrete, a foot square or larger, inside each inlet to prevent vegetation from growing up and blocking the inlet. See Figure 3.

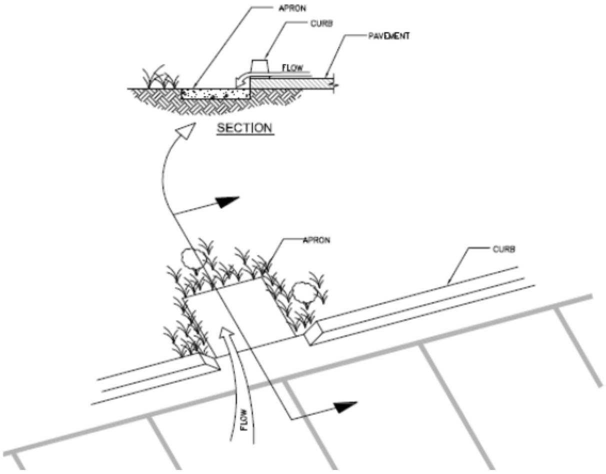


Figure 3: Apron located in a Bioretention Facility

Terracing the Landscaped Filter Basin

It is recommended that Bioretention Facilities be level. In the event the facility site slopes and lacks proper design, water would fill the lowest point of the BMP and then discharge from the basin without being treated. To ensure that the water will be held within the Bioretention Facility on sloped sites, the BMP must be terraced with nonporous check dams to provide the required storage and treatment capacity.

The terraced version of this BMP shall be used on non-flat sites with no more than a 3 percent slope. The surcharge depth cannot exceed 0.5 feet, and side slopes shall not exceed 4:1. Table 2 below shows the spacing of the check dams, and slopes shall be rounded up (i.e., 2.5 percent slope shall use 10' spacing for check dams).

Table 2: Check Dam Spacing

6” Check Dam Spacing	
Slope	**Spacing**
1%	*25'*
2%	*15'*
3%	*10'*

BIORETENTION FACILITY BMP FACT SHEET

Roof Runoff

Roof downspouts may be directed towards Bioretention Facilities. However, the downspouts must discharge onto a concrete splash block to protect the Bioretention Facility from erosion.

Retaining Walls

It is recommended that Retaining Wall Type 1A, per Caltrans Standard B3-3 or equivalent, be constructed around the entire perimeter of the Bioretention Facility. This practice will protect the sides of the Bioretention Facility from collapsing during construction and maintenance or from high service loads adjacent to the BMP. Where such service loads would not exist adjacent to the BMP, an engineered alternative may be used if signed by a licensed civil engineer.

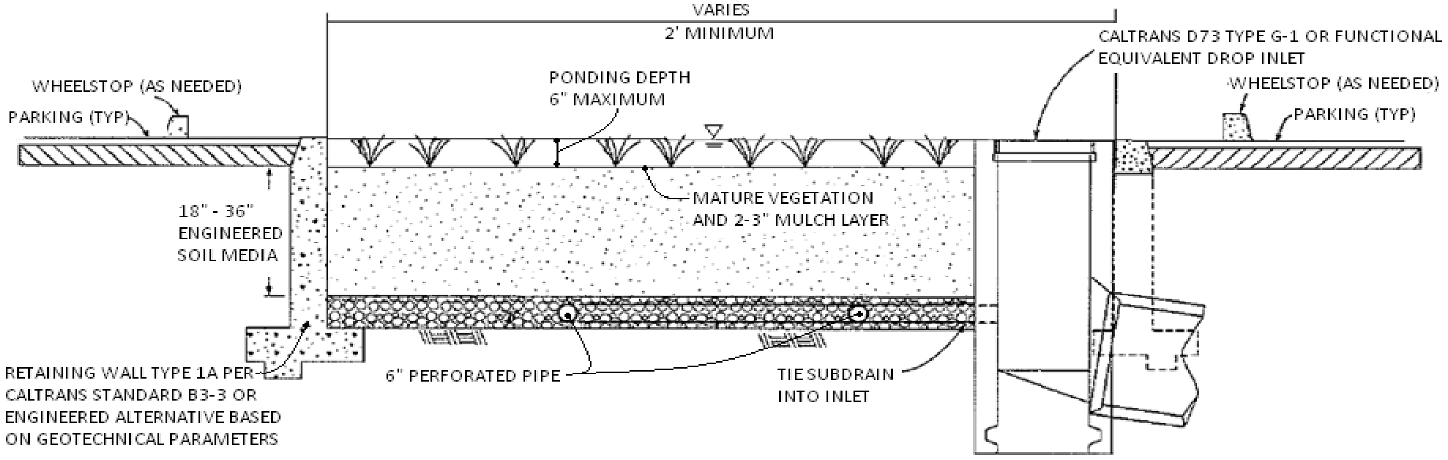
Side Slope Requirements

Bioretention Facilities Requiring Side Slopes

The design should assure that the Bioretention Facility does not present a tripping hazard. Bioretention Facilities proposed near pedestrian areas, such as areas parallel to parking spaces or along a walkway, must have a gentle slope to the bottom of the facility. Side slopes inside of a Bioretention Facility shall be 4:1. A typical cross section for the Bioretention Facility is shown in Figure 1.

Bioretention Facilities Not Requiring Side Slopes

Where cars park perpendicular to the Bioretention Facility, side slopes are not required. A 6-inch maximum drop may be used, and the Bioretention Facility must be planted with trees and shrubs to prevent pedestrian access. In this case, a curb is not placed around the Bioretention Facility,
but wheel stops shall be used to prevent vehicles from entering the Bioretention Facility, as shown in Figure 4.



Planter Boxes

Bioretention Facilities can also be placed above ground as planter boxes. Planter boxes must have a minimum width of 2 feet, a maximum surcharge depth of 6 inches, and no side slopes are necessary. Planter boxes must be constructed so as to ensure that the top surface of the engineered soil media will remain level. This option may be constructed of concrete, brick, stone or other stable materials that will not warp or bend. Chemically treated wood or galvanized steel, which has the ability to contaminate stormwater, should not be used. Planter boxes must be lined with an impermeable liner on all sides, including the bottom. Due to the impermeable liner, the inside bottom of the planter box shall be designed and constructed with a cross fall, directing treated flows within the subdrain layer toward the point where subdrain exits the planter box, and subdrains shall be oriented with drain holes oriented down. These provisions will help avoid excessive stagnant water within the gravel underdrain layer. Similar to the in-ground Bioretention Facility versions, this BMP benefits from healthy plants and biological activity in the root zone. Planter boxes should be planted with appropriately selected vegetation.

Figure 5: Planter Box

Source: LA Team Effort

Overflow

An overflow route is needed in the Bioretention Facility design to bypass stored runoff from storm events larger than V_{BMP} or in the event of facility or subdrain clogging. Overflow systems must connect to an acceptable discharge point, such as a downstream conveyance system as shown in Figure 1 and Figure 4. The inlet to the overflow structure shall be elevated inside the Bioretention Facility to be flush with the ponding surface for the design capture volume (V_{BMP}) as shown in Figure 4. This will allow the design capture volume to be fully treated by the Bioretention Facility, and for larger events to safely be conveyed to downstream systems. The overflow inlet shall **not** be located in the entrance of a Bioretention Facility, as shown in Figure 6.

Underdrain Gravel and Pipes

An underdrain gravel layer and pipes shall be provided in accordance with Appendix B – Underdrains.

Figure 6: Incorrect Placement of an Overflow Inlet.

Inspection and Maintenance Schedule

The Bioretention Facility area shall be inspected for erosion, dead vegetation, soggy soils, or standing water. The use of fertilizers and pesticides on the plants inside the Bioretention Facility should be minimized.

Schedule	Activity
Ongoing	• Keep adjacent landscape areas maintained. Remove clippings from landscape maintenance activities. • Remove trash and debris • Replace damaged grass and/or plants • Replace surface mulch layer as needed to maintain a 2-3 inch soil cover.
After storm events	• Inspect areas for ponding
Annually	• Inspect/clean inlets and outlets

Bioretention Facility Design Procedure

1) Enter the area tributary, A_T, to the Bioretention Facility.

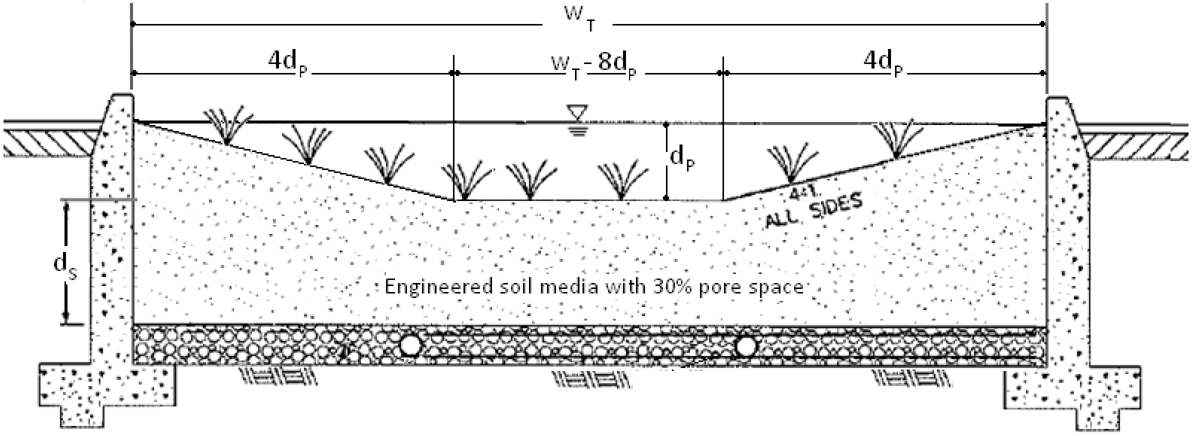
2) Enter the Design Volume, $V_{BMP,}$ determined from Section 2.1 of this Handbook.

3) Select the type of design used. There are two types of Bioretention Facility designs: the standard design used for most project sites that include side slopes, and the modified design used when the BMP is located perpendicular to the parking spaces or with planter boxes that do not use side slopes.

4) Enter the depth of the engineered soil media, d_S. The minimum depth for the engineered soil media can be 18' in limited cases, but it is recommended to use 24' or a preferred 36' to provide an adequate root zone for the chosen plant palette. Engineered soil media deeper than 36' will only get credit for the pore space in the first 36'.

5) Enter the top width of the Bioretention Facility.

6) Calculate the total effective depth, d_E, within the Bioretention Facility. The maximum allowable pore space of the soil media is 30% while the maximum allowable pore space for the gravel layer is 40%. Gravel layer deeper than 12' will only get credit for the pore space in the first 12'.



a. For the design with side slopes the following equation shall be used to determine the total effective depth. Where, d_P is the depth of ponding within the basin.

$$d_E(\mathrm{ft}) = \frac{0.3 \times \left[\left(w_T(\mathrm{ft}) \times d_S(\mathrm{ft})\right) + 4\left(d_P(\mathrm{ft})\right)^2\right] + 0.4 \times 1(\mathrm{ft}) + d_P(\mathrm{ft})\left[4d_P(\mathrm{ft}) + \left(w_T(\mathrm{ft}) - 8d_P(\mathrm{ft})\right)\right]}{w_T(\mathrm{ft})}$$

This above equation can be simplified if the maximum ponding depth of 0.5’ is used. The equation below is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\mathrm{ft}) = (0.3 \times d_S(\mathrm{ft}) + 0.4 \text{ x } 1(\mathrm{ft})) - \left(\frac{0.7\ (\mathrm{ft}^2)}{w_T(\mathrm{ft})}\right) + 0.5(\mathrm{ft})$$

b. For the design without side slopes the following equation shall be used to determine the total effective depth:

$$\mathrm{d_E(ft) = d_P(ft) + [(0.3) \times d_S(ft) + \ (0.4) \ \times 1(ft)]}$$

The equation below, using the maximum ponding depth of 0.5', is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$\mathrm{d_E(ft) = 0.5\ (ft) + [(0.3) \times d_S(ft) + \ (0.4) \ \times 1(ft)]}$$

7) Calculate the minimum surface area, A_M, required for the Bioretention Facility. This does not include the curb surrounding the Bioretention Facility or side slopes.

$$\mathrm{A_M(ft^2) = \frac{V_{BMP}(ft^3)}{d_E\ (ft)}}$$

8) Enter the proposed surface area. This area shall not be less than the minimum required surface area.

9) Verify that side slopes are no steeper than 4:1 in the standard design, and are not required in the modified design.

10) Provide the diameter, minimum 6 inches, of the perforated underdrain used in the Bioretention Facility. See Appendix B for specific information regarding perforated pipes.

11) Provide the slope of the site around the Bioretention Facility, if used. The maximum slope is 3 percent for a standard design.

12) Provide the check dam spacing, if the site around the Bioretention Facility is sloped.

13) Describe the vegetation used within the Bioretention Facility.

References Used to Develop this Fact Sheet

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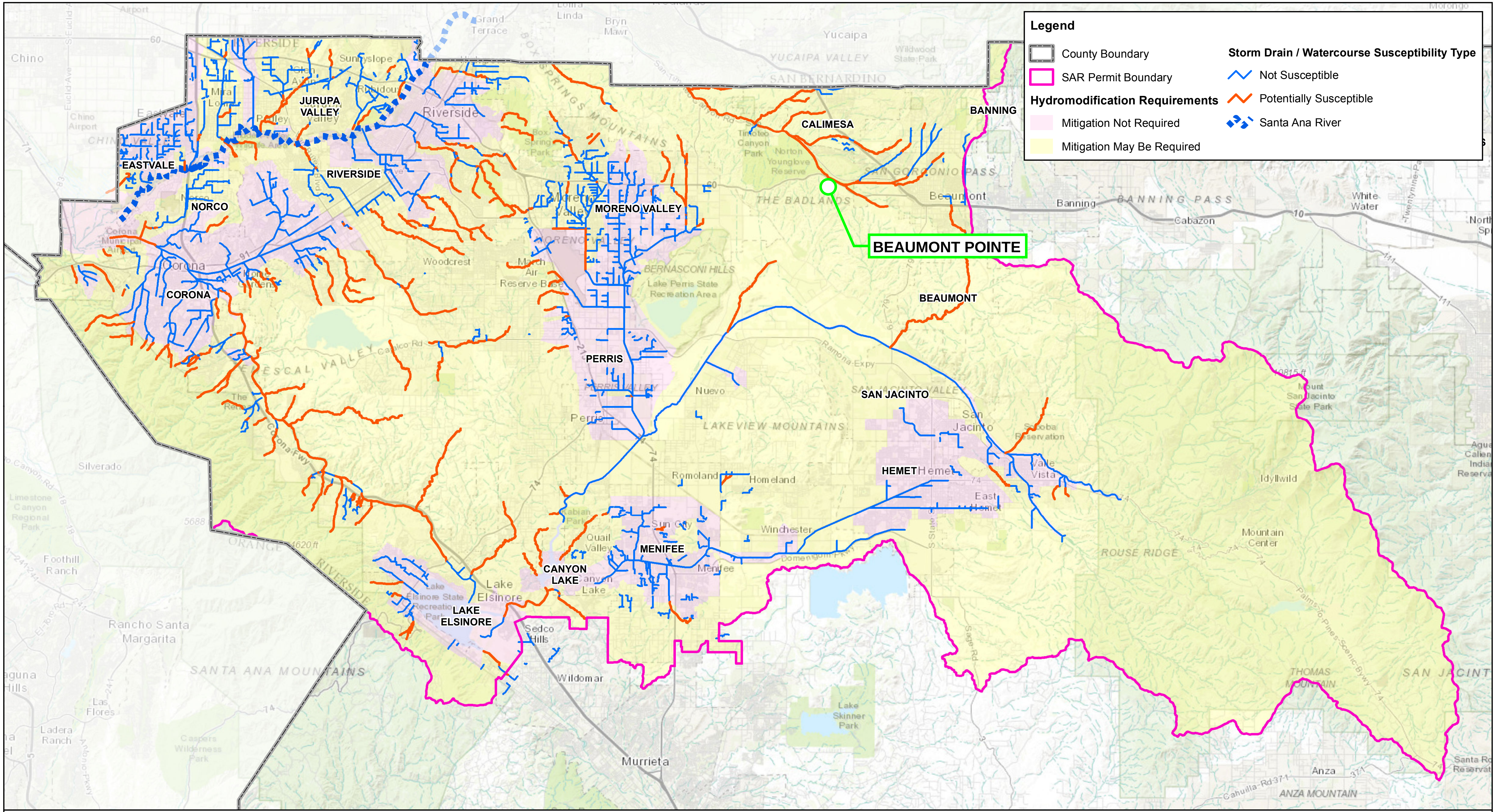
Urbonas, Ben R. Stormwater Sand Filter Sizing and Design: A Unit Operations Approach. Denver: Urban Drainage and Flood Control District, 2002.

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

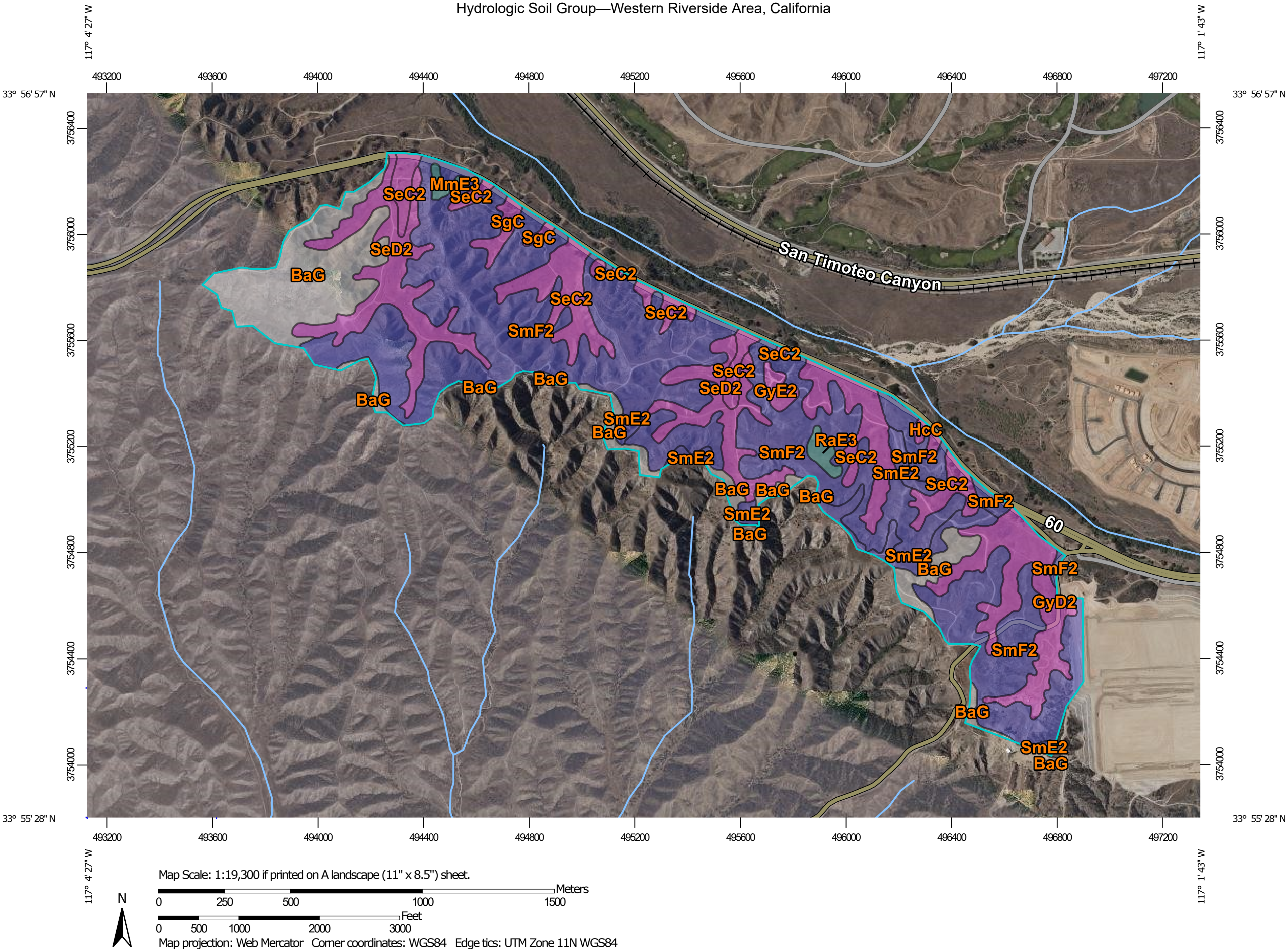


Updated February 2017

HCOC Applicability Map
SAR Permittees

Map 2

Hydrologic Soil Group—Western Riverside Area, California



Map Scale: 1:19,300 if printed on A landscape (11" x 8.5") sheet.

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

MAP LEGEND

Area of Interest (AOI)

▭ Area of Interest (AOI)

Soils

Soil Rating Polygons

- 🟪 A
- 🟩 A/D
- 🟦 B
- 🟫 B/D
- 🟦 C
- 🟨 C/D
- 🟥 D
- ⬜ Not rated or not available

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- 〰 Streams and Canals

Transportation

- ┼┼┼ Rails
- 〰 Interstate Highways
- 〰 US Routes
- 〰 Major Roads
- 〰 Local Roads

Background

- 🟩 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Western Riverside Area, California
Survey Area Data: Version 13, May 27, 2020

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

Date(s) aerial images were photographed: Apr 1, 2018—Aug 31, 2018

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BaG	Badland		69.2	13.1%
GyC2	Greenfield sandy loam, 2 to 8 percent slopes, eroded	A	0.7	0.1%
GyD2	Greenfield sandy loam, 8 to 15 percent slopes, eroded	A	32.7	6.2%
GyE2	Greenfield sandy loam, 15 to 25 percent slopes, eroded	A	3.3	0.6%
HcC	Hanford coarse sandy loam, 2 to 8 percent slopes	A	2.2	0.4%
MmE3	Monserate sandy loam, 15 to 25 percent slopes, severely eroded	C	1.9	0.4%
RaE3	Ramona sandy loam, 15 to 25 percent slopes, severely eroded	C	3.3	0.6%
SeC2	San Emigdio fine sandy loam, 2 to 8 percent slopes, eroded	A	58.4	11.1%
SeD2	San Emigdio fine sandy loam, 8 to 15 percent slopes, eroded	A	54.7	10.4%
SgC	San Emigdio loam, 2 to 8 percent slopes	A	5.3	1.0%
SmE2	San Timoteo loam, 8 to 25 percent slopes, eroded	B	20.9	4.0%
SmF2	San Timoteo loam, 25 to 50 percent slopes, eroded	B	273.7	52.0%
Totals for Area of Interest			**526.6**	**100.0%**

Description

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

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

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

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

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOAA Atlas 14, Volume 6, Version 2
Location name: Beaumont, California, USA*
Latitude: 33.9382°, Longitude: -117.051°
Elevation: 2359.04 ft**

* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.112 (0.093-0.136)	0.146 (0.121-0.177)	0.194 (0.161-0.236)	0.236 (0.194-0.289)	0.299 (0.238-0.379)	0.352 (0.274-0.457)	0.412 (0.312-0.548)	0.479 (0.353-0.656)	0.582 (0.411-0.832)	0.672 (0.459-0.996)
10-min	0.161 (0.134-0.195)	0.209 (0.174-0.253)	0.278 (0.230-0.338)	0.338 (0.278-0.415)	0.428 (0.340-0.544)	0.505 (0.393-0.655)	0.590 (0.448-0.785)	0.687 (0.506-0.941)	0.834 (0.589-1.19)	0.964 (0.657-1.43)
15-min	0.194 (0.162-0.235)	0.253 (0.210-0.307)	0.336 (0.279-0.408)	0.409 (0.336-0.501)	0.518 (0.412-0.657)	0.610 (0.475-0.792)	0.713 (0.541-0.949)	0.830 (0.612-1.14)	1.01 (0.713-1.44)	1.17 (0.795-1.73)
30-min	0.288 (0.240-0.349)	0.375 (0.312-0.455)	0.499 (0.414-0.607)	0.607 (0.500-0.745)	0.769 (0.612-0.976)	0.907 (0.706-1.18)	1.06 (0.804-1.41)	1.23 (0.909-1.69)	1.50 (1.06-2.14)	1.73 (1.18-2.57)
60-min	0.423 (0.353-0.513)	0.551 (0.458-0.668)	0.731 (0.607-0.890)	0.890 (0.733-1.09)	1.13 (0.897-1.43)	1.33 (1.03-1.73)	1.56 (1.18-2.07)	1.81 (1.33-2.48)	2.20 (1.55-3.14)	2.54 (1.73-3.76)
2-hr	0.613 (0.511-0.742)	0.777 (0.647-0.943)	1.01 (0.835-1.22)	1.20 (0.991-1.48)	1.49 (1.19-1.90)	1.73 (1.35-2.25)	1.99 (1.51-2.65)	2.28 (1.68-3.12)	2.70 (1.91-3.86)	3.05 (2.08-4.52)
3-hr	0.757 (0.631-0.917)	0.952 (0.792-1.16)	1.22 (1.01-1.49)	1.45 (1.19-1.78)	1.78 (1.42-2.26)	2.05 (1.60-2.66)	2.34 (1.78-3.12)	2.66 (1.96-3.64)	3.12 (2.20-4.45)	3.50 (2.38-5.18)
6-hr	1.09 (0.910-1.32)	1.37 (1.14-1.66)	1.74 (1.44-2.11)	2.05 (1.69-2.52)	2.49 (1.98-3.17)	2.85 (2.22-3.70)	3.22 (2.45-4.29)	3.62 (2.67-4.96)	4.19 (2.96-5.99)	4.64 (3.17-6.88)
12-hr	1.47 (1.23-1.78)	1.86 (1.55-2.26)	2.39 (1.99-2.91)	2.83 (2.33-3.47)	3.43 (2.73-4.36)	3.91 (3.04-5.07)	4.40 (3.34-5.86)	4.92 (3.62-6.73)	5.63 (3.97-8.04)	6.19 (4.22-9.17)
24-hr	1.95 (1.73-2.25)	2.54 (2.24-2.93)	3.31 (2.92-3.83)	3.94 (3.45-4.60)	4.82 (4.08-5.80)	5.49 (4.56-6.75)	6.18 (5.01-7.79)	6.90 (5.44-8.94)	7.89 (5.98-10.6)	8.66 (6.34-12.1)
2-day	2.36 (2.09-2.72)	3.13 (2.77-3.61)	4.17 (3.67-4.82)	5.03 (4.40-5.87)	6.25 (5.29-7.53)	7.22 (5.99-8.88)	8.23 (6.67-10.4)	9.30 (7.33-12.0)	10.8 (8.18-14.6)	12.0 (8.79-16.7)
3-day	2.55 (2.25-2.94)	3.41 (3.01-3.93)	4.60 (4.05-5.32)	5.61 (4.91-6.54)	7.06 (5.98-8.50)	8.23 (6.83-10.1)	9.48 (7.68-11.9)	10.8 (8.53-14.0)	12.7 (9.65-17.2)	14.3 (10.5-19.9)
4-day	2.76 (2.44-3.18)	3.72 (3.29-4.29)	5.05 (4.45-5.84)	6.19 (5.41-7.22)	7.82 (6.62-9.42)	9.15 (7.59-11.3)	10.6 (8.56-13.3)	12.1 (9.55-15.7)	14.3 (10.8-19.3)	16.1 (11.8-22.5)
7-day	3.17 (2.81-3.66)	4.30 (3.80-4.96)	5.85 (5.16-6.77)	7.17 (6.27-8.36)	9.06 (7.67-10.9)	10.6 (8.78-13.0)	12.2 (9.89-15.4)	13.9 (11.0-18.0)	16.4 (12.4-22.1)	18.5 (13.5-25.7)
10-day	3.45 (3.05-3.98)	4.69 (4.14-5.41)	6.39 (5.63-7.39)	7.83 (6.85-9.14)	9.89 (8.37-11.9)	11.5 (9.58-14.2)	13.3 (10.8-16.7)	15.2 (12.0-19.6)	17.8 (13.5-24.0)	20.0 (14.6-27.9)
20-day	4.26 (3.77-4.92)	5.84 (5.17-6.74)	8.00 (7.05-9.26)	9.82 (8.59-11.5)	12.4 (10.5-14.9)	14.5 (12.0-17.8)	16.6 (13.5-21.0)	19.0 (14.9-24.5)	22.2 (16.8-29.9)	24.8 (18.2-34.6)
30-day	5.04 (4.47-5.82)	6.92 (6.12-7.99)	9.48 (8.36-11.0)	11.6 (10.2-13.6)	14.7 (12.4-17.7)	17.1 (14.2-21.1)	19.7 (15.9-24.8)	22.4 (17.7-29.0)	26.2 (19.8-35.3)	29.3 (21.4-40.8)
45-day	6.05 (5.35-6.97)	8.27 (7.31-9.54)	11.3 (9.95-13.1)	13.8 (12.1-16.1)	17.4 (14.7-21.0)	20.2 (16.8-24.9)	23.2 (18.8-29.3)	26.4 (20.8-34.2)	30.9 (23.4-41.6)	34.4 (25.2-48.0)
60-day	7.07 (6.26-8.15)	9.59 (8.48-11.1)	13.0 (11.5-15.1)	15.9 (13.9-18.5)	19.9 (16.9-24.0)	23.2 (19.2-28.5)	26.5 (21.5-33.4)	30.1 (23.7-39.0)	35.1 (26.6-47.4)	39.2 (28.7-54.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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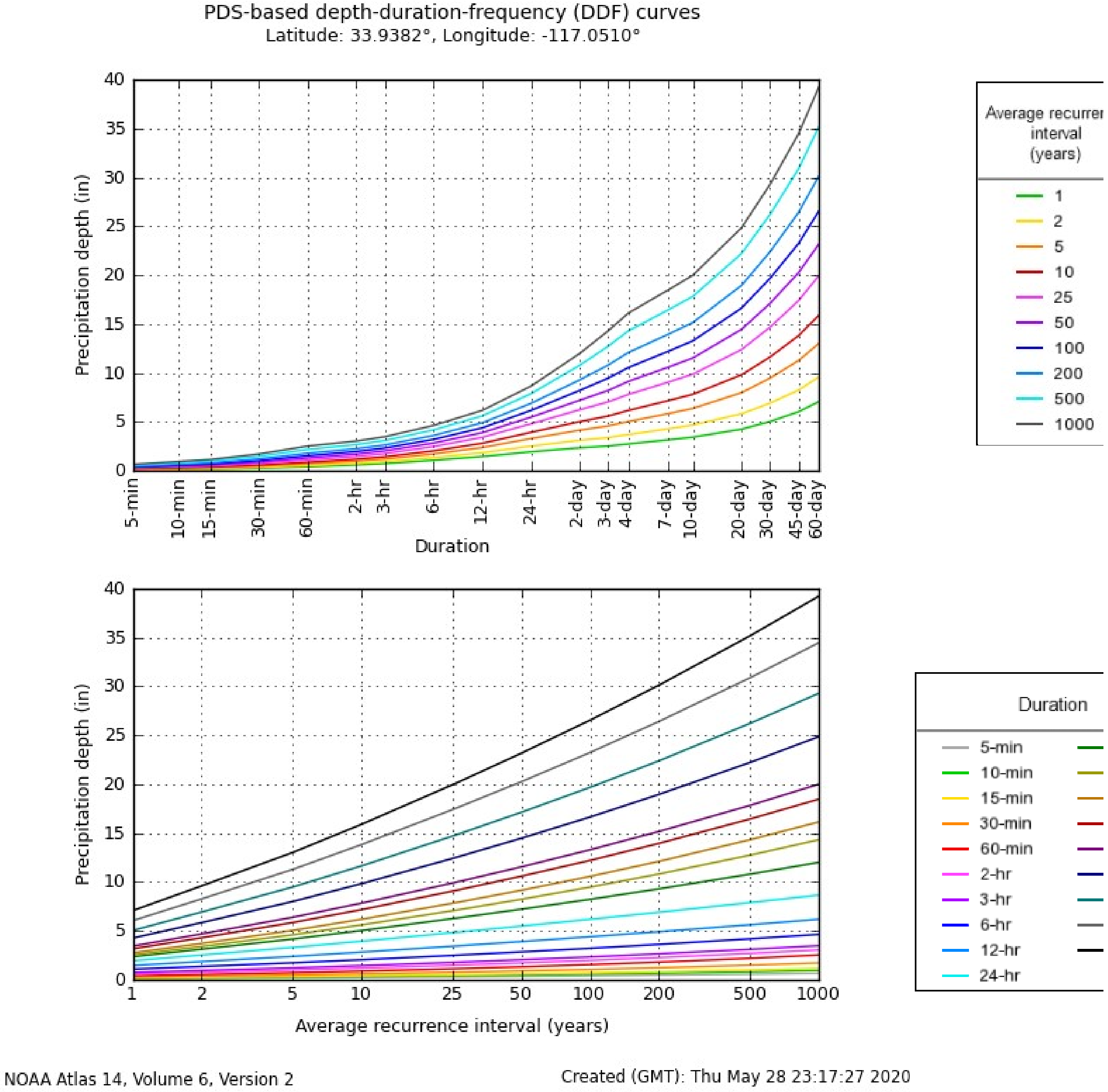
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu May 28 23:17:27 2020

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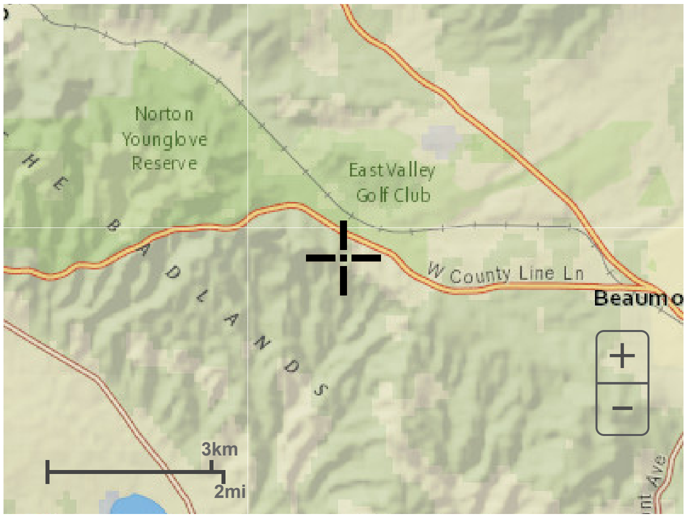
Maps & aerials

Small scale terrain



Large scale terrain

Large scale map

Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

(Method obtained from Urban Hydrology for Small Watersheds TR-55, Chapter 2 - Estimating Runoff, pg. 2-1)

HCOC RUNOFF VOLUME

PROJECT: Jackrabbit Trail Commerce Park
Hydrologic Soils G A, B, C, & D *(per TR-55)*
2-Year, 24 hr Rain 2.54 in

Total Site Area: 622.50 acres
Protected Site Area: 367.10 acres
Managed Area: 543.50 acres

Existing Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S) (in)	Q$_{in/ft}$ Runoff^1	Q Runoff^2 (ft)^3
Pasture, Dryland (Annual Grasses) [Poor]	A	6,851,988	157.30	68.0	4.71	0.94	0.41	231,510.97
Pasture, Dryland (Annual Grasses) [Poor]	B	12,832,776	294.60	79.0	2.66	0.53	0.86	924,317.46
Barren (Roackland, eroded and graded land)	C	226,512	5.20	91.0	0.99	0.20	1.65	31,085.31
Barren (Roackland, eroded and graded land)	D	3,014,352	69.20	94.0	0.64	0.13	1.91	479,180.56
TOTAL:		22,925,628	526.30	32.68326				**1,666,094**

1 Runoff Index Number per Table 2-2d of TR-55 (Ch. 2) - Sagebrush with grass understory (see site photo)

CN is a composite number see TR 55 Worksheet 2 for corresponding DMA

Developed Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S) (in)	Q$_{in/ft}$ Runoff^1	Q Runoff^2 (ft)^3
Commercial Developed^1	A	5,979,150	137.26	89.0	1.24	0.25	1.49	742,286.16
Grass Cover (Good)	A	1,096,767	25.18	39.0	15.64	3.13	0.02	2,100.74
Commercial Developed^1	B	11,264,339	258.59	92.0	0.87	0.17	1.73	1,624,142.17
Grass Cover (Good)	B	1,987,825	45.63	61.0	6.39	1.28	0.21	34,427.88
Commercial Developed^1	C	198,827	4.56	94.0	0.64	0.13	1.91	31,606.87
Grass Cover (Good)	C	35,087	0.81	74.0	3.51	0.70	0.63	1,844.62
Commercial Developed^1	D	2,645,934	60.74	95.0	0.53	0.11	2.00	441,423.81
Grass Cover (Good)	D	466,930	10.72	80.0	2.50	0.50	0.92	35,667.66
TOTAL:		23,207,930	532.78	34.6				**2,877,832**

1 Runoff Index Number (CN) per Table 2-2a-d of TR-55 (Ch. 2) - Fully Developed Open Sapce Good Condition (grass > 75%)

CN is a composite number see TR 55 Worksheet 2 for corresponding DMA

2·Year Volume Increase (ft^3): 1,045,129

2-Year Volume Increase = Developed Conditions Runoff Volume less 110% of the Existing Conditions Runoff Volume (Per Guidance Document)

1. Runoff (in) = Q = (P - 0.2S)^2 / (P+ O.8S) where
P = 2·Year Rainfall (in)
S = (1000 / CN)-10
*Ia = 0.2 * S (Initial Absorbtion)*

2. Runoff Volume (CF) = Q x Area x 1/12
Q = Runoff (in)
Area = land use area (sq. ft)
Area = land use area (sq. ft)

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

How to use this worksheet (also see instructions in Section G of the WQMP Template):

1. Review Column 1 and identify which of these potential sources of stormwater pollutants apply to your site. Check each box that applies.
2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your WQMP Exhibit.
3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in your WQMP. Use the format shown in Table G.1on page 23 of this WQMP Template. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternative BMPs for those shown here.

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	**… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE**		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on WQMP Drawings**	**3 Permanent Controls—List in WQMP Table and Narrative**	**4 Operational BMPs—Include in WQMP Table and Narrative**
☒ **A.** On-site storm drain inlets	☒ Locations of inlets. (shown on Rough Grading Plans)	☒ Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.	☒ Maintain and periodically repaint or replace inlet markings. ☒ Provide stormwater pollution prevention information to new site owners, lessees, or operators. ☒ See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
☒ **B.** Interior floor drains and elevator shaft sump pumps		☒ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	☒ Inspect and maintain drains to prevent blockages and overflow.
☐ **C.** Interior parking garages		☐ State that parking garage floor drains will be plumbed to the sanitary sewer.	☐ Inspect and maintain drains to prevent blockages and overflow.

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on WQMP Drawings**	**3 Permanent Controls—List in WQMP Table and Narrative**	**4 Operational BMPs—Include in WQMP Table and Narrative**
☐ **D1.** Need for future indoor & structural pest control		☐ Note building design features that discourage entry of pests.	☐ Provide Integrated Pest Management information to owners, lessees, and operators.
☒ **D2.** Landscape/ Outdoor Pesticide Use	☒ Landscape/ Outdoor Pesticide Use	State that final landscape plans will accomplish all of the following. ☒ Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. ☒ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater by following manufacturers guidelines. ☒ Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. ☒ Consider using pest-resistant plants, especially adjacent to hardscape. ☒ To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	☒ Maintain landscaping using minimum or no pesticides. ☒ See applicable operational BMPs in "What you should know for…..Landscape and Gardening" at http://rcflood.org/stormwater/**Error! Hyperlink reference not valid.** ☐ Provide IPM information to new owners, lessees and operators.

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	**… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE**		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on WQMP Drawings**	**3 Permanent Controls—List in WQMP Table and Narrative**	**4 Operational BMPs—Include in WQMP Table and Narrative**
☐ **E.** Pools, spas, ponds, decorative fountains, and other water features.	☐ Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)	If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	☐ See applicable operational BMPs in "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at http://rcflood.org/stormwater/
☐ **F.** Food service	☐ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ☐ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	☐ Describe the location and features of the designated cleaning area. ☐ Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.	☐ See the brochure, "The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries" at http://rcflood.org/stormwater/ Provide this brochure to new site owners, lessees, and operators.

☒ **G.** Refuse areas	☒ Show where site refuse and recycled materials will be handled and stored securely for pickup. See local municipal requirements for sizes and other details of refuse areas. ☒ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area.	☒ State how site refuse will be handled and provide supporting detail to what is shown on plans. ☒ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	☒ State how the following will be implemented: Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. See Fact Sheet WM-4 "Spill Prevention and Control" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	**… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE**		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on WQMP Drawings**	**3 Permanent Controls—List in WQMP Table and Narrative**	**4 Operational BMPs—Include in WQMP Table and Narrative**
☐ **H.** Industrial processes.	☐ Show process area.	☐ If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."	☐ See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com See the brochure "Industrial & Commercial Facilities Best Management Practices for: Industrial, Commercial Facilities" at http://rcflood.org/stormwater/

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on WQMP Drawings**	**3 Permanent Controls—List in WQMP Table and Narrative**	**4 Operational BMPs—Include in WQMP Table and Narrative**
☐ **I.** Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)	☐ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area. ☐ Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults. ☐ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for: ▪ Hazardous Waste Generation ▪ Hazardous Materials Release Response and Inventory ▪ California Accidental Release (CalARP) ▪ Aboveground Storage Tank ▪ Uniform Fire Code Article 80 Section 103(b) & (c) 1991 ▪ Underground Storage Tank www.cchealth.org/groups/hazmat	☐ See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	**… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE**		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on WQMP Drawings**	**3 Permanent Controls—List in WQMP Table and Narrative**	**4 Operational BMPs—Include in WQMP Table and Narrative**
☐ **J.** Vehicle and Equipment Cleaning	☐ Show on drawings as appropriate: (1) Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	☐ If a car wash area is not provided, describe any measures taken to discourage on-site car washing and explain how these will be enforced.	Describe operational measures to implement the following (if applicable): ☐ Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/ ☐Car dealerships and similar may rinse cars with water only.

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on WQMP Drawings**	**3 Permanent Controls—List in WQMP Table and Narrative**	**4 Operational BMPs—Include in WQMP Table and Narrative**
☐ **K.** Vehicle/Equipment Repair and Maintenance	☐ Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater. ☐ Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas. ☐ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.	☐ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ☐ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ☐ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the Stormwater Control Plan, note that all of the following restrictions apply to use the site: ☐ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains. ☐ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately. ☐ No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment. Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations". Brochure can be found at http://rcflood.org/stormwater/ Refer to Outdoor Cleaning Activities and Professional Mobile Service Providers for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on WQMP Drawings**	**3 Permanent Controls—List in WQMP Table and Narrative**	**4 Operational BMPs—Include in WQMP Table and Narrative**
☐ **L.** Fuel Dispensing Areas	☐ Fueling areas[6] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable. ☐ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.		☐ The property owner shall dry sweep the fueling area routinely. ☐ See the Fact Sheet SD-30 , "Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

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[6] The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	**… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE**		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on WQMP Drawings**	**3 Permanent Controls—List in WQMP Table and Narrative**	**4 Operational BMPs—Include in WQMP Table and Narrative**
☒ **M.** Loading Docks	☒ Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer. ☐ Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. ☐ Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.		☒ Move loaded and unloaded items indoors as soon as possible. ☒ See Fact Sheet SC-30, “Outdoor Loading and Unloading,” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on WQMP Drawings**	**3 Permanent Controls—List in WQMP Table and Narrative**	**4 Operational BMPs—Include in WQMP Table and Narrative**
☒ **N.** Fire Sprinkler Test Water		☒ Provide a means to drain fire sprinkler test water to the sanitary sewer.	☒ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
O. Miscellaneous Drain or Wash Water or Other Sources ☐ Boiler drain lines ☐ Condensate drain lines ☒ Rooftop equipment ☐ Drainage sumps ☒ Roofing, gutters, and trim. ☐ Other sources		☐ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ☐ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ☒ Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ☐ Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. ☒ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff. ☐ Include controls for other sources as specified by local reviewer.	

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on WQMP Drawings**	**3 Permanent Controls—List in WQMP Table and Narrative**	**4 Operational BMPs—Include in WQMP Table and Narrative**
☒ **P.** Plazas, sidewalks, and parking lots.			☒ Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Use absorbent to collect fluids, oil and greases and dispose of properly to prevent entry into the storm drain system. In the event washwater is required, it is to be contained and collected without entering the storm drain system.

Appendix 9: O&M

Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms

Operation and Maintenance Plan for the Stormwater Quality BMP Facilities for Beaumont Pointe

April 11, 2022

I. PURPOSE

The primary purpose of this Operations & Maintenance Plan (O&M Plan) shall be to provide a routine maintenance program that maintains the treatment facilities effectiveness.

II. COVERAGE AREA

This project will utilize 4 primary treatment facility type located on-site:

1. Extended Detention "Basin 1" – Located between proposed buildings 1 and 2.
2. Extended Detention "Basin 2" – Located between proposed buildings 2 and 3.
3. Extended Detention "Basin 3" – Located between proposed buildings 3 and 4.
4. Extended Detention "Basin 4" – Located between proposed buildings 4 and 5.
5. Bioretention "Basin 5" – Located at the northeast corner of the property, adjacent to Jackrabbit Trail.

These facilities treat stormwater runoff from the site and outlet into various natural detention areas of which all cross the 60 Freeway via existing culverts. All of the culverts confluence with the San Timoteo Creek. From here the flows drain to the Santa Ana River and ultimately ending up at the Pacific Ocean.

III. ROUTINE MAINTENANCE ACTIVITIES

Primary maintenance activities include vegetation management, trash and sediment removal, irrigation maintenance and storm drain outlet inspections. Although mosquito abatement is a concern, the basins and swales are designed to fully drain within 24-72 hours and not include permanent pools or standing water. Routine maintenance activities, and the frequency at which they will be conducted, are shown in Table 1 below.

NOTE: Landscape Maintenance Plan should also be reviewed for consistency with vegetation maintenance and any applicable needs for specific plants, shrubs or trees.

Table 1
Routine Maintenance Activities for Basins & Swales

No.	Maintenance Task	Frequency of Task
1	Conduct annual vegetation management during the summer, removing weeds and harvesting vegetation. Remove all grass cuttings and other green waste.	Once a year
2	Trim vegetation at beginning and end of wet season to prevent establishment of woody vegetation, and for aesthetics and mosquito control.	Twice a year (spring and fall)
3	Evaluate health of vegetation and remove or replace any dead or dying plants. Remove all green waste and dispose of properly.	Twice a year
4	If turf grass is included in basin/swale design, conduct regular mowing and remove all grass cuttings. Avoid producing ruts when mowing.	As necessary to not allow grass over-growth
7	Remove accumulated trash and debris from the middle and end of the wet season and dispose of trash and debris properly.	Twice a year (January and April)
8	Irrigate during dry weather.	Per Landscape Plans
9	Inspect basins and swales using the attached inspection checklists.	Quarterly, or as needed

IV. PROHIBITIONS

The use of pesticides and quick release fertilizers shall be minimized, and the principles of integrated pest management (IPM) followed:

1. Employ non-chemical controls (biological, physical and cultural controls) before using chemicals to treat a pest problem.
2. Prune plants properly and at the appropriate time of year.
3. Provide adequate irrigation for landscape plants. Do not over water.
4. Limit fertilizer use unless soil testing indicates a deficiency. Slow-release or organic fertilizer is preferable. Check with municipality for specific requirements.
5. Pest control should avoid harming non-target organisms, or negatively affecting air and water quality and public health. Apply chemical controls only when monitoring indicates that preventative and non-chemical methods are not keeping pests below acceptable levels. When pesticides are required, apply the least toxic and the least persistent pesticide that will provide adequate pest control. Do not apply pesticides on a prescheduled basis.

6. Sweep up spilled fertilizer and pesticides. Do not wash away or bury such spills.
7. Do not over apply pesticide. Spray only where the infestation exists. Follow the manufacturer’s instructions for mixing and applying materials.
8. Only licensed, trained pesticide applicators shall apply pesticides.
9. Apply pesticides at the appropriate time to maximize their effectiveness and minimize the likelihood of discharging pesticides into runoff. With the exception of pre-emergent pesticides, avoid application if rain is expected.
10. Unwanted/unused pesticides shall be disposed as hazardous waste.

Standing water shall not remain in the treatment and/or hydromodification management measures for more than five days, to prevent mosquito generation. Should any mosquito issues arise, contact the City of Beaumont for the appropriate contact for Mosquito Abatement, as needed for assistance. Mosquito larvicides shall be applied only when absolutely necessary and then only by a licensed professional or contractor. Contact information for the Riverside County Environmental Health – Vector Control is provided below.

Riverside County Department of Environmental Health – Vector Control

Downtown Riverside Office
3880 Lemon Street, 2nd Floor
Riverside, CA 92501
Phone: (951) 955-8980
Emergency After Hours: (951) 782-2968
http://www.rivcoeh.org/opencms/rivcoeh/ProgServices/Food_Program/Vector.html

V. INSPECTIONS

The attached Inspection and Maintenance Checklists shall be used to conduct inspections monthly (or as needed), identify needed maintenance, and record maintenance that is conducted.

Basin Inspection and Maintenance Checklist

Property Address: ____ Property Owner: _______________________________________

Treatment Measure No.: ____________ Date of Inspection: __________ Type of Inspection: ☐ Monthly ☐ Pre-Wet Season ☐ After heavy runoff ☐ End of Wet Season ☐ Other:_________________

Inspector(s): ________________________________

Defect	**Conditions When Maintenance Is Needed**	**Maintenance Needed? (Y/N)**	**Comments** (Describe maintenance completed and if any needed maintenance was not conducted, note when it will be done.)	**Results Expected When Maintenance Is Performed**
General				
Trash & Debris	• Trash and debris accumulated in basin. • Visual evidence of dumping.			Trash and debris cleared from site and disposed of properly.
Poisonous Vegetation and noxious weeds	Poisonous or nuisance vegetation or noxious weeds, e.g., morning glory, English ivy, reed canary grass, Japanese knotweed, purple loosestrife, blackberry, Scotch broom, poison oak, stinging nettles, or devil's club.			Use Integrated Pest Management techniques to control noxious weeds or invasive species.
Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.			No contaminants or pollutants present.
Rodent Holes	If facility acts as a dam or berm, any evidence of rodent holes, or any evidence of water piping through dam, berm or into slopes via rodent holes.			The design specifications are not compromised by holes. Any rodent control activities are in accordance with applicable laws and do not affect any protected species.
Insects	Insects such as wasps and hornets interfere with maintenance activities.			Insects do not interfere with maintenance activities.

Basin & Swales Inspection and Maintenance Checklist

Date of Inspection:________________

Property Address: ________________________

Treatment Measure No.:________________

Defect	**Conditions When Maintenance Is Needed**	**Maintenance Needed? (Y/N)**	**Comments** (Describe maintenance completed and if any needed maintenance was not conducted, note when it will be done.)	**Results Expected When Maintenance Is Performed**
Tree/Brush Growth and Hazard Trees	• Growth does not allow maintenance access or interferes with maintenance activity. • Dead, diseased, or dying trees/shrubs.			• Trees do not hinder maintenance activities. • Remove hazard trees as approved by the City. (Use a certified Arborist to determine health of tree or removal requirements).
Drainage time	Standing water remains in basin more than five days.			Correct any circumstances that restrict the flow of water from the system. Restore drainage to design condition. If the problem cannot be corrected and problems with standing water recur, then mosquitoes should be controlled with larvicides, applied by a licensed pesticide applicator.
Outfall structure	Debris or silt build-up obstructs an outfall structure.			Remove debris and/or silt build-up and dispose of properly.
Side Slopes				
Erosion	• Eroded over 2 in. deep where cause of damage is still present or where there is potential for continued erosion. • Any erosion on a compacted berm embankment.			Cause of erosion is managed appropriately. Side slopes or berm are restored to design specifications, as needed.
Storage Area				
Sediment	Accumulated sediment >10% of designed basin depth or affects inletting or outletting condition of the facility.			Sediment cleaned out to designed basin shape and depth; basin reseeded if necessary to control erosion. Sediment disposed of properly.
Liner (If Applicable)	Liner is visible and has more than three 1/4-inch holes in it.			Liner repaired or replaced. Liner is fully covered.
Emergency Overflow / Spillway and Berms				
Settlement	Berm settlement 4 inches lower than the design elevation.			Dike is built back to the design elevation.

Basin & Swales Inspection and Maintenance Checklist
Date of Inspection:________________
Property Address: ________________________
Treatment Measure No.:________________

Defect	**Conditions When Maintenance Is Needed**	**Maintenance Needed? (Y/N)**	**Comments** (Describe maintenance completed and if any needed maintenance was not conducted, note when it will be done.)	**Results Expected When Maintenance Is Performed**
Tree Growth	Tree growth on berms or emergency spillway >4 ft in height or covering more than 10% of spillway.			• Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. • A civil engineer should be consulted for proper berm/spillway restoration.
Emergency Overflow/ Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.			Rocks and pad depth are restored to design standards.
Debris Barriers (e.g., Trash Racks)				
Trash and Debris	Trash or debris is plugging openings in the barrier.			Trash or debris is removed and disposed of properly.
Damaged/ Missing Bars	Bars are missing, loose, bent out of shape, or deteriorating due to excessive rust.			Bars are repaired or replaced to allow proper functioning of trash rack.
Inlet/Outlet Pipe	Debris barrier is missing or not attached to pipe.			Debris barrier is repaired or replaced to allow proper functioning of trash rack.
Fencing and Gates				
Missing or broken parts	Any defect in or damage to the fence or gate that permits easy entry to a facility.			Fencing and gate are restored to design specifications.
Deteriorating Paint or Protective Coating	Part or parts that have a rusting or scaling condition that has affected structural adequacy.			Paint or protective coating is sufficient to protect structural adequacy of fence or gate.
Flow Duration Control Outlet (if included in design to meet Hydromodification Management Standard)				
Risers, orifices and screens	Any debris or clogging			Restore unobstructed flow through discharge structure; to meet original design; dispose of debris properly.
Drawdown time	Noticeable ponding exceeding 72-hours after a design storm event			Restore infiltration and ponded waters permeate. Scarification should only be performed when there are signs of clogging rather than on a routine basis. Always remove deposited sediments before scarification and use a hand-guided rotary tiller.
Swales (in addition to general items listed above)				

Date of Inspection:________________

Property Address: ________________________

Treatment Measure No.:________________

Defect	**Conditions When Maintenance Is Needed**	**Maintenance Needed? (Y/N)**	**Comments** (Describe maintenance completed and if any needed maintenance was not conducted, note when it will be done.)	**Results Expected When Maintenance Is Performed**
Impeded Flow	Twice annually at beginning and end of wet season. After heavy runoff. Visible blockage or impediments.			Trash and debris cleared from swale and disposed of properly especially prior to mowing.
Landscaping or Vegetative Overgrowth	Twice annually at beginning and end of wet season or as needed for aesthetics.			Maintained flow and healthy vegetation.
Miscellaneous				
Miscellaneous	Any condition not covered above that needs attention to restore infiltration basin to design conditions.			Meets the design specifications.

Recording requested by and mail to:

City Clerk
City of Beaumont
550 E. Sixth Street
Beaumont, CA 92223

SPACE ABOVE THIS LINE FOR RECORDER'S USE
EXEMPT FROM RECORDER'S FEES PURSUANT TO GOVERNMENT CODE SECTION 6103 AND 27383

APN: 422-060-002, 422-060-005, 422-060-009, 422-060-010, 422-060-016, 422-060-017, A Portion of 422-060-18, 422-060-021, 422-060-022, 422-170-005, 422-170-008, 422-170-009, 422-170-010, 422-170-010, 422-170-007, 422-170-011

STORM WATER MANAGEMENT WQMP/BMP FACILITIES
COVENANT AND AGREEMENT NO. 1

City of Beaumont, Riverside County, California

THIS COVENANT AND AGREEMENT is made and entered into this of 2022, by and between Beaumont Pointe, ("Owner"), and the City of Beaumont, California, ("City").

The Owner hereby certifies I am (we are) the sole owner of certain real property located at Jackrabbit Trail (Site Address) in the City of Beaumont, County of Riverside, State of California, more specifically described in **Exhibit "A"** and depicted in **Exhibit "B"** ("Property").

The Owner covenants and agrees to comply with the Project Water Quality Management Plan ("WQMP"), attached hereto as **Exhibit "C"**, providing for storm water quality treatment within the confines of the Property.

The Owner covenants and agrees that the health, safety and welfare of the residents of the City of Beaumont, require that the Best Management Practice ("BMP") facilities, more specifically described in the WQMP (for example bio- swales, catch basins, roof drains and appurtenances) be constructed and maintained to minimize pollutants in urban runoff by the Owner.

The Owner further covenants and agrees as follows:

1. The on-site storm water management/BMP facilities mentioned above shall be constructed by the Owner at its sole cost and expense, in accordance with the plans and specifications identified in the WQMP approved by City.

2. The Owner shall adequately maintain the storm water management/BMP facilities in a manner assuring peak performance at all times, including source control BMPs at all times as its sole responsibility, at its sole cost and expense. This includes all pipes and channels built to convey storm water on the Property, including

catch basin inserts, underground detention ponds, swales and vegetation provided to control the quantity and quality of the storm water. Adequate maintenance is herein defined as good working condition so that these facilities are performing in accordance with their design functions continuously at all times.

3. The Owner shall annually inspect the storm water management/BMP facilities mentioned above and submit an inspection report annually to the Public Works Department by the anniversary of the date of this Agreement of each year. The purpose of the inspection is to assure safe and proper functioning of the facilities. The inspection shall cover the storm water management BMPs listed in the WQMP such as bio-swales, catch basins and related filter units, etc. Deficiencies shall be noted in the inspection report and corrected by Owner promptly.

4. The Owner hereby grants permission to City, its authorized agents and employees, to enter upon the Property and to inspect the storm water management/BMP facilities, take samples and perform testing whenever the City deems necessary and as required by the City's most current National Pollutant Discharge Elimination System (NPDES) Permit. The purpose of the inspection, testing and sampling is to follow up on apparent and reported deficiencies and/or to respond to citizen complaints and meet the requirements of the City's NPDES Permit issued by the State Water Resources Control Board – Santa Ana River Region. The City shall provide the Owner with advanced notice of entering upon the Property, except in the event of an emergency, as determined by the City. The City shall provide the Owner copies of the inspection findings and a directive to commence with the repairs if necessary. Owner or Owner's successors or assigns shall pay City for all costs incurred by City in the inspection, sampling, testing of the BMPs within thirty (30) calendar days of City invoice.

5. In the event the Owner fails to maintain the storm water management/BMP facilities in good working condition acceptable to the City, upon five (5) days advanced written notice, the City may enter upon the Property and take whatever steps necessary to correct deficiencies identified in any inspection report and to charge the costs of such repairs to the Owner the cost of which shall constitute a lien against the Property. In the event of an emergency, as determined by City, advanced notice as aforesaid, shall not be required. Notwithstanding the forgoing, it is expressly understood and agreed that the City is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation to the City.

6. The Owner will perform the work necessary to keep these facilities in good working order as appropriate. The maintenance schedule for the storm water management BMP facilities (including sediment removal) is outlined in the approved WQMP and the schedule must be followed at all times. In the future, City of Beaumont may adopt an annual Stormwater Inspection Fee that would be assessed to the Owner.

7. In the event the City, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials and the like, the Owner, its successors and assigns shall reimburse the City upon demand, within thirty (30) days of receipt thereof for all actual costs incurred by the City hereunder.

8. This Agreement imposes no liability of any kind whatsoever on the City. Owner agrees to indemnify, defend (with counsel reasonably approved by the City) and hold harmless the City and its authorized officers, employees, agents and volunteers from any and all claims, actions, losses, damages, and/or liability arising out of this Agreement from any cause whatsoever, including the acts, errors or omissions of any person and

for any costs or expenses incurred by the City on account of any claim except where such indemnification is prohibited by law. This indemnification provision shall apply regardless of the existence or degree of fault of indemnitees. The Owner's indemnification obligation applies to the City's "active" as well as "passive" negligence but does not apply to the City's "sole negligence" or "willful misconduct" within the meaning of Civil Code Section 2782, or to any claims, actions, losses, damages, and/or liabilities, to the extent caused by the acts or omissions of any third party contractors undertaking any work (other than field inspections) or other maintenance on the Property on behalf of the City under this Agreement.

9. This Agreement shall be recorded with the County Recorder for the County of Riverside and shall constitute a covenant running with the land, equitable servitude and lien against the Property, and shall be binding on the Owner, its successors, assigns, transferees, administrators, executors, heirs, encumbrancers and any other successors in interests, including any homeowner's association.

10. In addition to any remedy available to City under this Agreement, if Owner violates any term of this Agreement and does not cure the violation within the time already provided in this Agreement, or, if not provided, within thirty (30) calendar days, or within such time authorized by the City if said cure reasonably requires more than the subject time, the City may bring an action at law or in equity in a court of competent jurisdiction to enforce compliance by the Owner with the terms of this Agreement. In such action, the City may recover any damages to which the City may be entitled for the violation, enjoin the violation by temporary or permanent injunction without the necessity of proving actual damages or the inadequacy of otherwise available legal remedies, or obtain other equitable relief, including, but not limited to, the restoration of the Property and/or the BMPs identified in the WQMP to the condition in which it/they existed prior to any such violation or injury.

11. Owner shall provide printed educational materials with any sale of the Property which provide information on what storm water management facilities are present, the types and locations of maintenance signs that are required and how the necessary maintenance can be maintained.

12. Owner shall provide actual notice of this Agreement and its terms to any respective buyers or successor(s) in interest.

13. In order to be valid, amendment or change to this Agreement including the WQMP and BMPs requires an amendment executed by the City and Owner which is recorded with the Riverside County Recorder.

WITNESS the following signatures:

OWNER:

By: ______________________________	By: ______________________________
Name: ____________________________	Name: ____________________________
Title: _____________________________	Title: _____________________________

CITY OF BEAUMONT

By: ______________________________________
Director of Public Works, Beaumont

ATTEST:

____
City Clerk, City of Beaumont

All signatures on this Agreement on behalf of the Owner must be acknowledged before a Notary Public. In the event that the owner is a corporation, the President/Vice President and the corporate secretary of the corporation must sign.

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

State of California)
County of Riverside)

On _______________, 2022, before me, ____________________________, notary public, personally appeared _______________ who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

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

WITNESS my hand and official seal.

Signature: _______________________________ (Seal)

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

State of California)
County of Riverside)

On _______________, 2019, before me, ___________________________, notary public, personally appeared ______________ who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.
WITNESS my hand and official seal.

Signature: (Seal)

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

State of California)
County of Riverside)

On _______________, 2022, before me, ____________________________, notary public, personally appeared _______________ who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

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

WITNESS my hand and official seal.

Signature: _______________________________ (Seal)

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

State of California)
County of Riverside)

On _______________, 2022, before me, ___________________________, notary public, personally appeared ______________ who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.
WITNESS my hand and official seal.

Signature: (Seal)

EXHIBIT “A”
LEGAL DESCRIPTION

EXHIBIT “B”
DIAGRAM OF PROPERTY

EXHIBIT “C”
WQMP

Appendix 10: Educational Materials

BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information

Site Design & Landscape Planning SD-10

Design Objectives

☑ Maximize Infiltration

☑ Provide Retention

☑ Slow Runoff

☑ Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

Contain Pollutants

Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

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

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

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

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

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

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

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

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

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

Drainage System Maintenance SC-44

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

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

Description

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

Approach

Pollution Prevention

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

Suggested Protocols

Catch Basins/Inlet Structures

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

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- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.

- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.

- Keep accurate logs of the number of catch basins cleaned.

- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.

- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.

- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.

- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.

- Conduct routine maintenance at each pump station.

- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.

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

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:

  - Is there evidence of spills such as paints, discoloring, etc?

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

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

Illegal Dumping

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

Training

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

  - OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
  - Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

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

Other Considerations (Limitations and Regulations)

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

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:
  - Purchase and installation of signs.
  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.
  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.
  - Purchase of landfill space to dispose of illegally-dumped items and material.

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

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

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

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

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

References and Resources

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

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

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

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

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

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

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

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

Efficient Irrigation SD-12

Design Objectives

☑ Maximize Infiltration

☑ Provide Retention

☑ Slow Runoff

Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

Contain Pollutants

Collect and Convey

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.

- Design irrigation systems to each landscape area's specific water requirements.

- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.

- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.

- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:

  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff

  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect

  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible

  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth

- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage

Design Objectives

Maximize Infiltration

Provide Retention

Slow Runoff

Minimize Impervious Land Coverage

☑ Prohibit Dumping of Improper Materials

Contain Pollutants

Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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Vehicle Washing Areas SD-33

Photo Credit: Geoff Brosseau

Design Objectives

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

Description

Vehicle washing, equipment washing, and steam cleaning may contribute high concentrations of metals, oil and grease, solvents, phosphates, and suspended solids to wash waters that drain to stormwater conveyance systems.

Approach

Project plans should include appropriately designed area(s) for washing-steam cleaning of vehicles and equipment. Depending on the size and other parameters of the wastewater facility, wash water may be conveyed to a sewer, an infiltration system, recycling system or other alternative. Pretreatment may be required for conveyance to a sanitary sewer.

Suitable Applications

Appropriate applications include commercial developments, restaurants, retail gasoline outlets, automotive repair shops and others.

Design Considerations

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

Designing New Installations

Areas for washing/steam cleaning should incorporate one of the following features:

- Be self-contained and/or covered with a roof or overhang
- Be equipped with a clarifier or other pretreatment facility
- Have a proper connection to a sanitary sewer

- Include other features which are comparable and equally effective

CAR WASH AREAS - Some jurisdictions' stormwater management plans include vehicle-cleaning area source control design requirements for community car wash racks in complexes with a large number of dwelling units. In these cases, wash water from the areas may be directed to the sanitary sewer, to an engineered infiltration system, or to an equally effective alternative. Pre-treatment may also be required.

Depending on the jurisdiction, developers may be directed to divert surface water runoff away from the exposed area around the wash pad (parking lot, storage areas), and wash pad itself to alternatives other than the sanitary sewer. Roofing may be required for exposed wash pads.

It is generally advisable to cover areas used for regular washing of vehicles, trucks, or equipment, surround them with a perimeter berm, and clearly mark them as a designated washing area. Sumps or drain lines can be installed to collect wash water, which may be treated for reuse or recycling, or for discharge to the sanitary sewer. Jurisdictions may require some form of pretreatment, such as a trap, for these areas.

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

After the Storm

A Citizen's Guide to Understanding Stormwater

For more information contact:

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

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What is stormwater runoff?

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

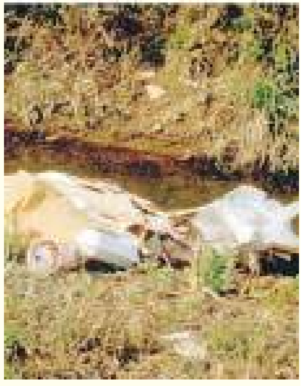
Why is stormwater runoff a problem?

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

The effects of pollution

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

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.
- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.
- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.



Stormwater Pollution Solutions

Residential

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

Lawn care

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

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

Auto care

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

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

Septic systems

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

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

Pet waste

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

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

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

Residential landscaping

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

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

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

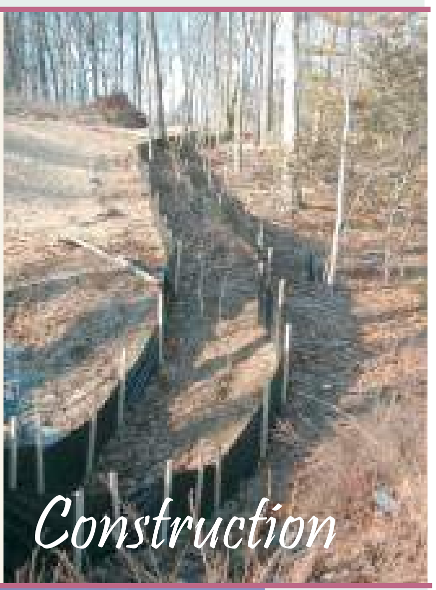
Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Commercial

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

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

Construction



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

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

Agriculture

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

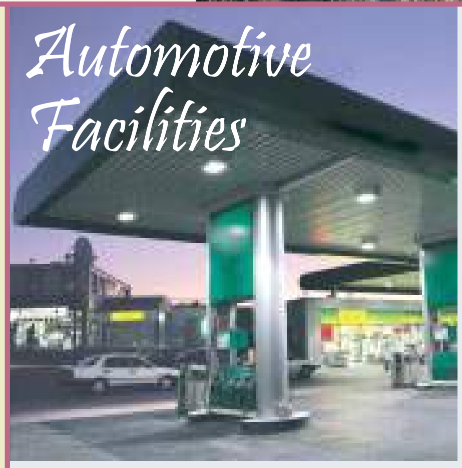
- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply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

Forestry

Improperly managed logging operations can result in erosion and sedimentation.

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

Automotive Facilities



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

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