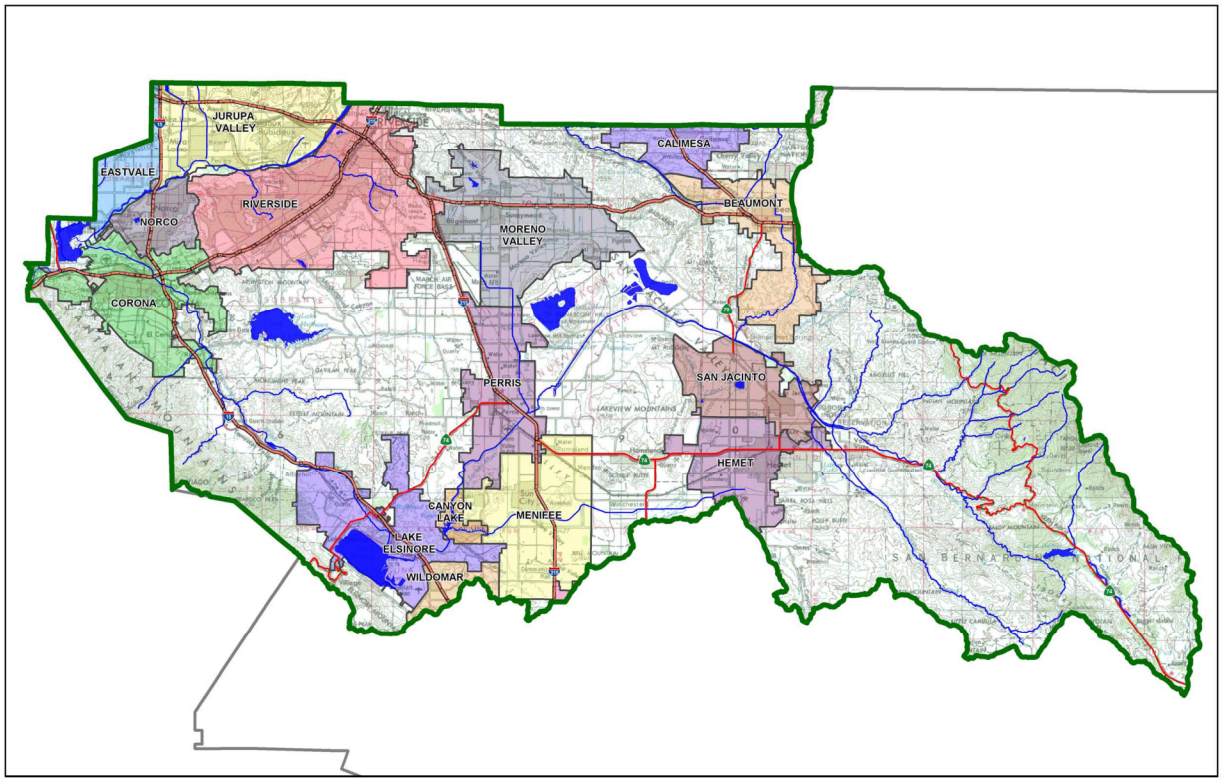
Project Specific Water Quality Management Plan

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

Project Title: Kaiser Permanente Moreno Valley

Development No: PEN18-0228 thru 0230

Design Review/Case No: LWQ 18-0037



☒ **Preliminary**
☐ **Final**

Original Date Prepared: November 2018

Revision Date(s): January 2019, June 2019, August 2019, September 2019

Prepared for Compliance with
Regional Board Order No. **R8-2010-0033**

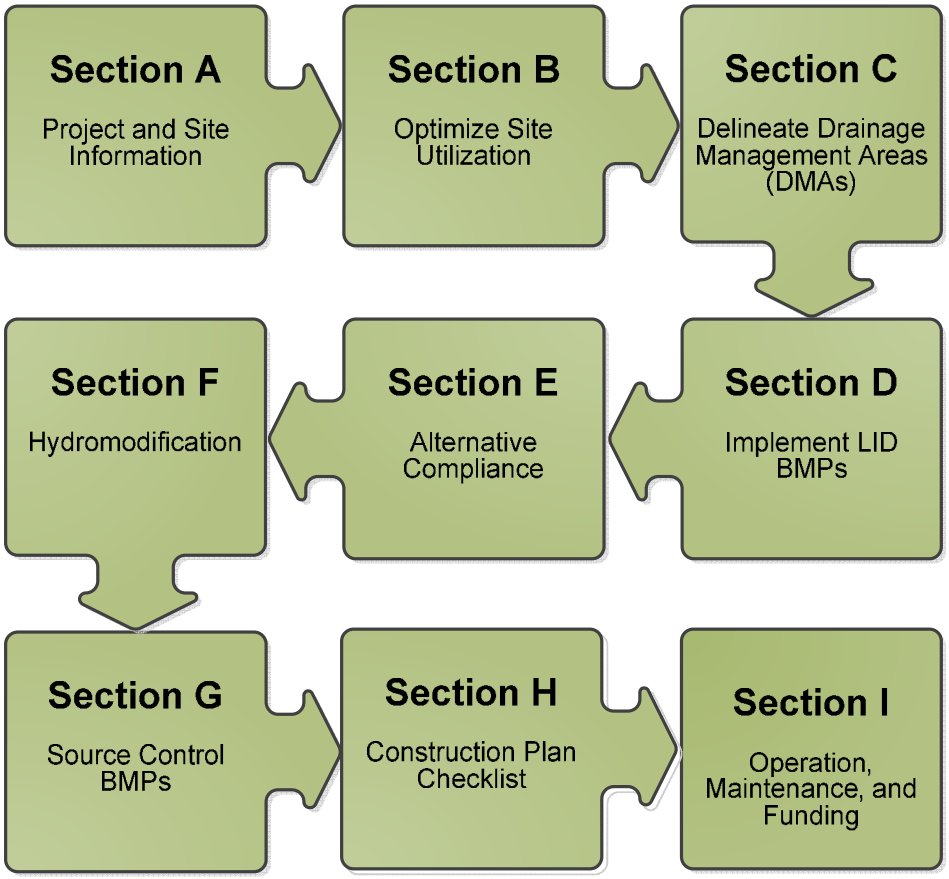
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A Brief Introduction

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 Kaiser Permanente by Michael Baker International Company for the Kaiser Permanente Moreno Valley Medical Center project.

This WQMP is intended to comply with the requirements of The City of Moreno Valley for Order No. R8-2010-0033 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 The City of Moreno Valley Water Quality Ordinance (Municipal Code Section 8.21.170).

"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
Scott Davis, PE Preparer's Printed Name	Project Manager Preparer's Title/Position

Preparer's Licensure: RCE 72281

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Section A: Project and Site Information

Project Information

Type of Project:	Medical Center
Planning Area:	N/A
Community Name:	N/A
Development Name:	N/A
Project Description:	The Kaiser Permanente Moreno Valley Medical Center site is comprised of a 29.8-acre dual parcel (APN 486-310-033 and APN 486-310-034) that is currently developed with a hospital, patient tower, medical offices and onsite parking. The proposed project will be an expansion to the existing medical campus. This study addresses the total ultimate development which will include four (4) patient bed towers, a Diagnostics and Treatment Center (D&T), and an Emergency Department. The project will also include a Central Utility Plant (CUP) and two Parking Structures. LID BMPs will be implemented onsite to mitigate for water quality impacts. The subject study area encompasses a combined area of 29.5-acres. The project site is divided into two areas: west (DMA's A-C) and east (DMA's D-F). DMA's A-D drain to a proposed bioretention basin for treatment. Storage vaults/pipes are not provided for DMA's A-C due to post-development peak flows being lower than pre-development peak flows. DMA D's basin is designed with excess volume to attenuate post-development flows per drainage report. DMA's E-F drain to proposed modular wetland systems for treatment (E & F – two units in parallel) and bypass to proposed underground vaults/pipes for storage in peak storms, due to post-development flows being higher than pre-development flows. The treatment and storage systems are two separate systems to prevent comingling of treated and untreated flows. Both systems exit north of the site. The storage system design is outside the scope of this water quality study. Diversion manholes with an internal weir is provided upstream of the modular wetland systems for bypass for DMA's E-F. Modular wetland systems have been approved by City of Moreno Valley as biofiltration BMPs (biotreatment).

Project Location

Latitude & Longitude (DMS): N33° 53' 48" & W117° 11' 08"

Project Watershed and Sub-Watershed: Santa Ana River Watershed and San Jacinto Sub-Watershed

APN(s): 486-310-033 & 486-310-034

Map Book and Page No.: Book 486 Page 31

Project Characteristics

Proposed or Potential Land Use(s)	Medical Center
Proposed or Potential SIC Code(s)	8011, 8050, 8051, 8071
Area of Impervious Project Footprint (SF)	623,435
Total Area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement	988,598
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 (SF)	623,435
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	N/A
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)	See attached report
What is the Water Quality Design Storm Depth for the project?	0.66 inches

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:

- Drainage Management Areas
- Proposed Structural BMPs
- Drainage Path
- Drainage Infrastructure, Inlets, Overflows
- Source Control BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces
- Standard Labeling

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
Perris Valley Storm Drain	N/A	N/A	Not classified
San Jacinto River, Reach 3	N/A	AGR, GWR, REC1, REC2, WARM, WILD	Not classified
Railroad Canyon Reservoir - San Jacinto River, Reach 2	Nutrients (No TMDL date has been recorded by EPA for this waterbody)	N/A	Not classified
San Jacinto River, Reach 1	N/A	MUN, AGR, GWR, REC1, REC2, WARM, WILD	Not classified
Lake Elsinore	Nutrients (No TMDL date has been recorded by EPA for this waterbody), organic enrichment, DDT	COMM, WARM	Not classified
Lee Lake	N/A	MUN, AQUA, WARM, REC1, REC2, WILD, SHELL	Not classified
Temescal Creek, Reach 2	N/A	MUN, AQUA, WARM, REC1, REC2, WILD, SHELL	Not classified

Prado Flood Control Basin	pH	N/A	Not classified
Santa Ana River, Reach 2	N/A	MUN, AQUA, WARM, REC1, REC2, WILD, SHELL	Not classified
Santa Ana River, Reach 1	N/A	MUN, AQUA, WARM, REC1, REC2, WILD, SHELL	Not classified

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)*	☐ 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.

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?

The proposed master grading preserves existing drainage patterns entirely. Under existing conditions, the site generally drains northwest towards Nason Street to an existing canal which conveys onsite flows southwest to San Jacinto River, Canyon Lake (Railroad Canyon Reservoir) and discharges to Lake Elsinore. The existing project site covers two parcels, each parcel is contained individually with a single stormwater outlet via concrete spillway. The master site plan will maintain the same two outlet locations and improved as deemed based on ultimate site design. There is offsite flow contribution from the eastern undeveloped parcel. These offsite flows were not accounted for in the sizing of onsite permanent BMPs. Offsite flows shall be evaluated during ultimate site design. Iris Avenue is a public paved road with curb, gutter and storm drain infrastructure conveying offsite flows from the south. There's an existing earthen berm along the western property line.

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

Minimal existing vegetation will remain undisturbed under ultimate buildout. New landscape will be provided wherever applicable and to the maximum extend feasible.

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

Michael Baker International (MBI) obtained available infiltration data from the existing Medical Office Building development at Kaiser Permanente Moreno Valley. Infiltration rates were documented in the geotechnical report titled: Geotechnical Investigation, Kaiser Permanente, Iris MOB 2 – Phase I, 27300 Iris Avenue, Moreno Valley, California, dated May 24, 2011. Two infiltration tests were performed for the MOB project revealing infiltration rates of 0.05 inches/hour in the northern portion of the eastern parcel. Soils

encountered during testing were Sandy Silt (ML). A second infiltration report was conducted to obtain infiltration rates on the southern portion of the eastern parcel and western portion of the western parcel. The report was titled: Moreno Valley Medical Center Infiltration Report, dated June 1, 2019. Infiltration rates varied from 0.48 to 1.07 in/hour. Based on the above infiltration rates, infiltration BMPs should not be used for the northern portion and should be used in the southern portions of the project.

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

Impervious areas have been minimized to the maximum extent practicable. However, due to the nature of the project (Medical Center), substitution of impervious areas for landscaping is not feasible. The runoff of impervious areas drains to proposed BMPs when possible. Each DMA's Design Flow Rate (Q_{BMP})/ Design Capture Volume (V_{BMP}) is handled by its respective BMPs.

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

Impervious area runoff drains to landscaped areas to the maximum extent possible. Due to low infiltration rates, drain inlets are provided for the majority of landscaped areas to capture and route runoff to Modular Wetland Systems/Bioretention Basins for treatment and underground storage vaults/pipes for peak storms.

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]	Area (Sq. Ft.)	DMA Type
DMA A	Mix (Concrete, Asphalt, Roof, Landscape)	202,537	Type D
DMA B	Mix (Concrete, Asphalt, Roof, Landscape)	94,376	Type D
DMA C	Mix (Concrete, Asphalt, Roof, Landscape)	139,988	Type D
DMA D	Mix (Concrete, Asphalt, Roof, Landscape)	220,970	Type D
DMA E	Mix (Concrete, Asphalt, Roof, Landscape)	330,177	Type D
DMA F	Mix (Concrete, Asphalt, Roof, Landscape)	302,450	Type D

[1]*Reference Table 2-1 in the WQMP Guidance Document to populate this column*

Table C.2 Type 'A', Self-Treating Areas

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)
N/A			

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) [A]	Storm Depth (inches) [B]	DMA Name / ID	[C] from Table C.4 = [C]	Required Retention Depth (inches) [D]
N/A						

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

Table C.4 Type 'C', Areas that Drain to Self-Retaining Areas

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

Table C.5 Type 'D', Areas Draining to BMPs

DMA Name or ID	BMP Name or ID
DMA A	Bioretention Basin A (BRB A)
DMA B	Bioretention Basin B (BRB B)
DMA C	Bioretention Basin C (BRB C)
DMA D	Bioretention Basin C (BRB D)
DMA E	Modular Wetland System E (MWS E): Consists of (2) Modular Wetland System Units: MWS E1 & MWS E2
DMA F	Modular Wetland System F (MWS F): Consists of (2) Modular Wetland System Units: MWS F1 & MWS F2

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. 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: Potentially all DMAs. The assumed infiltration rate is less than 1.6 inches/hour.		
…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:		
…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 neither 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

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: 6.8 acres

Type of Landscaping (Conservation Design or Active Turf): Conservative 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: 22.6 acres

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: 1.05

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: 23.7 acres

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)
23.7 acres	6.8 acres

Toilet Use Feasibility

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 shut downs or other lapses in occupancy:

Projected Number of Daily Toilet Users: TBD

Project Type: Commercial

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: 22.6 acres

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: 141 tu/ac

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: 3,187

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)
3,187	TBD

Other Non-Potable Use Feasibility

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 shut downs or other lapses in occupancy or operation.

Average Daily Demand: N/A

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: 22.6 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 2-3: 1,018 gpd/acre

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

Minimum required use: 23,007 gpd

Step 5: Determine if harvesting stormwater runoff for other non-potable 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 non-potable use (Step 4)	**Projected average daily use (Step 1)**
23,007 gpd	N/A

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, unless a site-specific analysis has been completed that demonstrates technical infeasibility as noted in D.3 below.

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	
A	☐	☐	☒	☐	☐
B	☐	☐	☒	☐	☐
C	☐	☐	☒	☐	☐
D	☐	☐	☒	☐	☐
E	☐	☐	☐	☒	☐
F	☐	☐	☐	☒	☐

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.

Infiltration – Infiltration testing revealed rates of 0.05 inches/hour in the northern portion of the eastern parcel. Per WQMP guidelines, infiltration BMPs should not be used for the project if rates are less than 0.3 inches/hour.

Harvest and Use – The minimum required irrigated area is approximately 3.5 times larger compared to the available irrigated landscape under the ultimate phase.

Bioretention – Infiltration testing revealed rates of 0.05 inches/hour in DMA's D-E. Per WQMP guidelines, infiltration BMPs are not suggested for the project if rates are less than 0.3 inches/hour. Biotreatment was selected over bioretention to minimize conflicts with underground utilities in landscaped areas. DMA's A-C will use bioretention BMP's due to infiltration rates ranging from 0.48-1.07 inches/hour.

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) [A]	Post-Project Surface Type	Effective Impervious Fraction, I_f [B]	DMA Runoff Factor [C]	DMA Areas x Runoff Factor [A] x [C]	*Bioretention Basin A (BRB A)*		
A Imp	*174,794*	*Concrete/ Asphalt*	*1.0*	*0.89*	*155,917*			
A Perv	*27,743*	*Mixed Surface Types*	*0.15*	*0.141*	*3,924*			
						Design Storm Depth (in)	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
A_T =	202,537			*Σ=*	159,841	0.66	V_{BMP} =8791	***V=9,306***

[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) [A]	Post-Project Surface Type	Effective Impervious Fraction, I_f [B]	DMA Runoff Factor [C]	DMA Areas x Runoff Factor [A] x [C]	*Bioretention Basin B (BRB B)*		
B Imp	*79,438*	*Concrete/ Asphalt*	*1.0*	*0.89*	*70,859*			
B Perv	*14,938*	*Mixed Surface Types*	*0.15*	*0.141*	*2,113*			
						Design Storm Depth (in)	*Design Capture Volume,* $\mathbf{V_{BMP}}$ *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
A_T =	94,377			*Σ=*	72,972	0.66	$\mathbf{V_{BMP}}$ =4,014	***V=5,865***

[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.5 DCV Calculations for LID BMPs

DMA Type/ ID	DMA Area (square feet) [A]	Post-Project Surface Type	Effective Impervious Fraction, I_f [B]	DMA Runoff Factor [C]	DMA Areas x Runoff Factor [A] x [C]	*Bioretention Basin C (BRB C)*		
C Imp	*71,833*	*Concrete/ Asphalt*	*1.0*	*0.89*	*64,075*			
C Perv	*62,156*	*Mixed Surface Types*	*0.15*	*0.141*	*8,792*			
						Design Storm Depth (in)	*Design Capture Volume,* $\mathbf{V_{BMP}}$ *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
A_T =	133,989			*Σ=*	72,866	0.66	$\mathbf{V_{BMP}}$ =4,008	***V=4,046***

[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.6 DCV Calculations for LID BMPs

DMA Type/ ID	DMA Area (square feet) [A]	Post-Project Surface Type	Effective Impervious Fraction, I_f [B]	DMA Runoff Factor [C]	DMA Areas x Runoff Factor [A] x [C]	*Bioretention Basin D (BRB D)*		
D Imp	*152,027*	*Concrete/ Asphalt*	*1.0*	*0.89*	*135,608*			
D Perv	*68,942*	*Mixed Surface Types*	*0.15*	*0.141*	*9,752*			
						Design Storm Depth (in)	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
A_T =	220,969			Σ=	145,360	0.66	V_{BMP} =7995	***V=8,580***

[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

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.

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 ft^2)	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

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]
N/A	
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

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) [A]	Post-Project Surface Type	Effective Impervious Fraction, I_f [B]	DMA Runoff Factor [C]	DMA Area x Runoff Factor [A] x [C]		*Modular Wetland System E (MWS E)* *(consists of (2) Modular Wetland System Units: MWS E1 & MWS E2)*		
E Imp	251,412	*Concrete/Asphalt*	1.0	0.89	224,260				
E Perv	78,765	*Mix Surface Types*	0.15	0.14	11,141				
						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)*
A_T =	330,177			Σ=	235,401	0.66	Q_{BMP} =1.1		***Q=****1.15*

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

Table E.4 Treatment Control BMP Sizing

DMA Type/ID	DMA Area (square feet) [A]	Post-Project Surface Type	Effective Imperviousness Fraction, I_f [B]	DMA Runoff Factor [C]	DMA Area x Runoff Factor [A] x [C]		*Modular Wetland System F (MWS F)* *(consists of (2) Modular Wetland System Units: MWS F1 & MWS F2)*		
F Imp	259,094	*Concrete /Asphalt*	1.0	0.89	231,112				
F Perv	43,356	*Mix Surface Types*	0.15	0.14	6,133				
						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)*
A_T =	302,450			Σ=	237,244	0.66	Q_{BMP} =1.1		***Q=****1.15*

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is 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.5 Treatment Control BMP Selection

Selected Treatment Control BMP Name or ID[1]	Priority Pollutant(s) of Concern to Mitigate[2]	Removal Efficiency Percentage[3]
Bioretention Basin A	Nutrients, Pesticides, Toxic Organic Compounds	High (per Appendix E in LID BMP Design Handbook)
Bioretention Basin B	Nutrients, Pesticides, Toxic Organic Compounds	High (per Appendix E in LID BMP Design Handbook)
Bioretention Basin C	Nutrients, Pesticides, Toxic Organic Compounds	High (per Appendix E in LID BMP Design Handbook)
Bioretention Basin D	Nutrients, Pesticides, Toxic Organic Compounds	High (per Appendix E in LID BMP Design Handbook)
Modular Wetland System E	Nutrients, Pesticides, Toxic Organic Compounds	Medium (per appendix E in this report)
Modular Wetland System F	Nutrients, Pesticides, Toxic Organic Compounds	Medium (per appendix E in this report)

[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	N/A	N/A	N/A
Volume (Cubic Feet)	N/A	N/A	N/A

[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 Sensitivity 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:

The project location is in a HCOC exempt area. The site generally drains northwest towards Nason Street to an existing canal which conveys onsite flows southwest to San Jacinto River, Canyon Lake (Railroad Canyon Reservoir) and Lake Elsinore. Canyon Lake and Lake Elsinore are engineered and regularly maintained. No sensitive stream habitat areas will be adversely affected. Refer to Appendix 7 for HCOC Applicability Map.

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.

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
On-site storm drain inlets	Mark all inlets with the words "Only Rain Down the Storm Drain".	Maintain and repaint/replace inlet markings; provide stormwater pollution prevention information to site owners; see applicable operational BMPs in Fact Sheet SC-44 "Drainage System Maintenance" in CASQA Stormwater Quality Handbooks
Landscape/outdoor pesticide use	Design landscaping to minimize irrigation and runoff, to minimize use of fertilizers and pesticides; use pest-resistant plants	Maintain landscaping using minimum pesticides; see applicable operational BMPs in

	(especially adjacent to hardscape); select plants appropriate to site soils, slopes, climates, etc.	"What you should know for… Landscape and Gardening"
Fire sprinkler test water	Provide a means to drain fire sprinkler test water to sanitary sewer	See note in Fact Sheet SC-41 "Building and Grounds Maintenance" in CASQA Stormwater Quality Handbooks
Roofing, gutters, and trim	Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff	N/A
Plaza, sidewalks, and parking lots	N/A	Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris
Condensate drain lines	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	N/A

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)
BRB A	Bioretention basin A located northwest of western parking structure	WQMP Site Plan / Preliminary Drawings
BRB B	Bioretention Basin B located east of western parking structure	WQMP Site Plan / Preliminary Drawings
BRB C	Bioretention Basin C located southeast of western parking structure	WQMP Site Plan / Preliminary Drawings
BRB D	Bioretention Basin D located west of southeastern parking structure	WQMP Site Plan / Preliminary Drawings
MWS E	Modular Wetland System E located south of northwest parking structure (consists of (2) Modular Wetland System units in parallel under drive aisle)	WQMP Site Plan / Preliminary Drawings
MWS F	Modular Wetland System F located north of northwest parking structure (consists of (2) Modular Wetland System units in parallel in landscape area)	WQMP Site Plan / Preliminary Drawings

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: Maintained by property owner

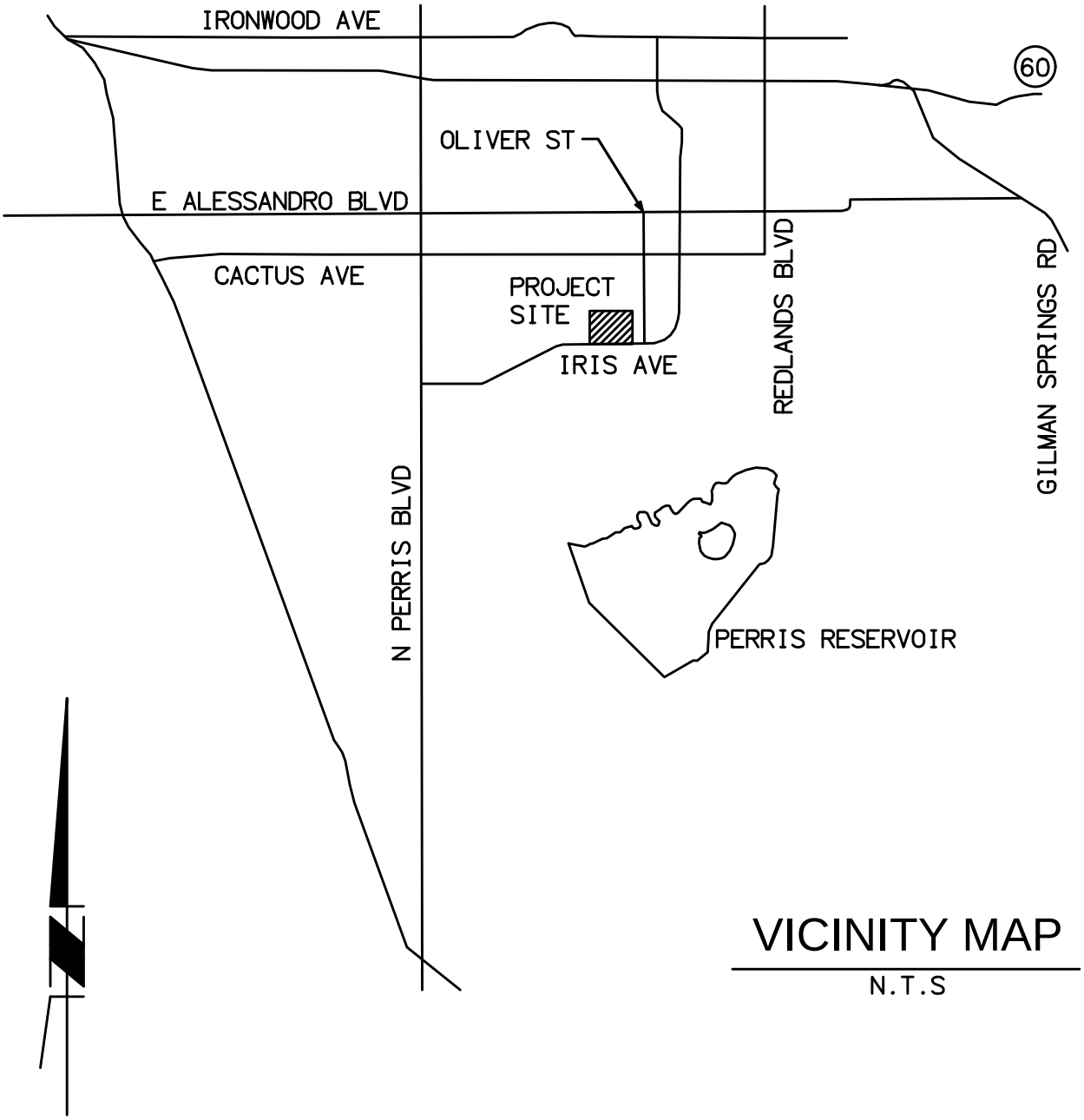
Will the proposed BMPs be maintained by a Home Owners' Association (HOA) or Property Owners Association (POA)?

☐ 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



VICINITY MAP

N.T.S

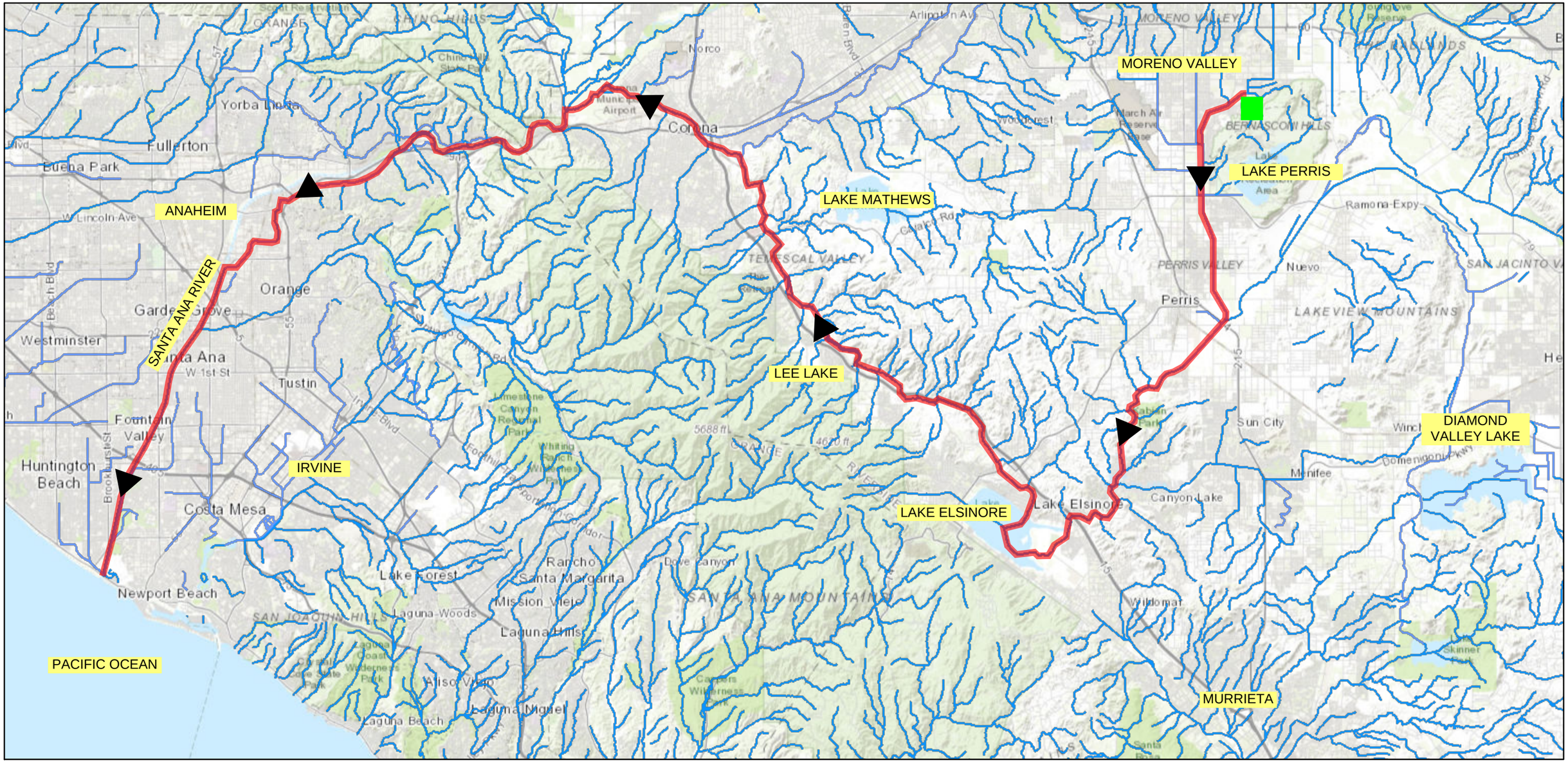
FIGURE 1

Michael Baker INTERNATIONAL
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KAISER PERMANENTE MORENO VALLEY AREAMASTER PLAN AND MEDICAL OFFICE BUILDING

VICINITY MAP

KAISER PERMANENTE MORENO VALLEY
RECEIVING WATERS MAP

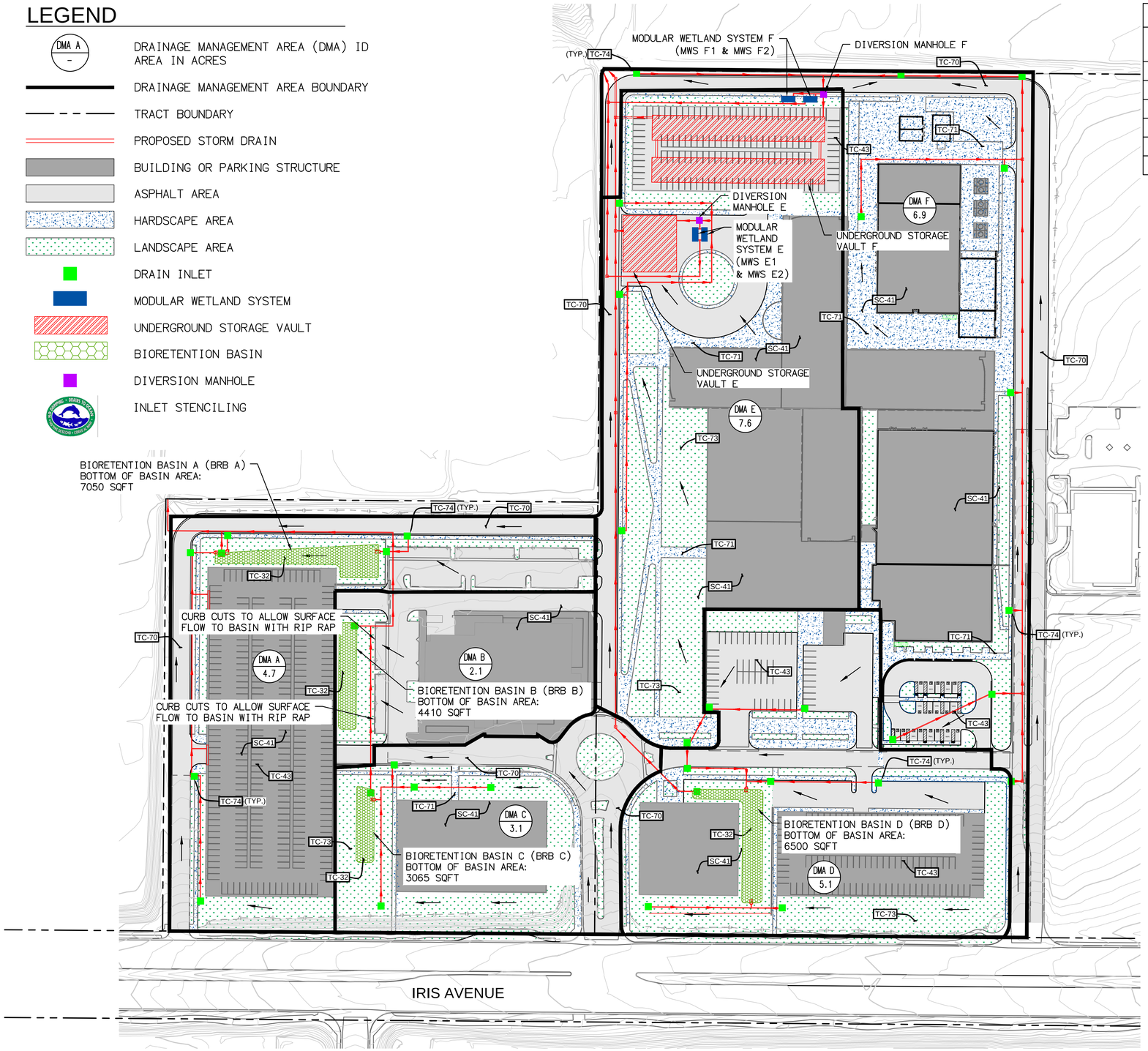


US EPA, Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the

US Environment Protection Agency
US EPA | County of Riverside, Bureau of Land Management, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS |

LEGEND

- DMA A / - — DRAINAGE MANAGEMENT AREA (DMA) ID AREA IN ACRES
- DRAINAGE MANAGEMENT AREA BOUNDARY
- TRACT BOUNDARY
- PROPOSED STORM DRAIN
- BUILDING OR PARKING STRUCTURE
- ASPHALT AREA
- HARDSCAPE AREA
- LANDSCAPE AREA
- DRAIN INLET
- MODULAR WETLAND SYSTEM
- UNDERGROUND STORAGE VAULT
- BIORETENTION BASIN
- DIVERSION MANHOLE
- INLET STENCILING



DRAINAGE MANAGEMENT AREAS

DMA AREA	IMPERVIOUS (SQ/FT)	PERVIOUS (SQ/FT)	BMP TYPE	PROPOSED BMP (SQFT/CFS)
A	174,794	27,743	BIORETENTION	7050 SQFT
B	79,439	14,938	BIORETENTION	4410 SQFT
C	71,833	62,156	BIORETENTION	3065 SQFT
D	152,027	68,942	BIORETENTION	6500 SQFT
E	251,412	78,765	BIOTREATMENT	1.15 CFS
F	259,094	43,356	BIOTREATMENT	1.15 CFS

NOTE: DMA'S E-F CONSISTS OF 2 MODULAR WETLAND SYTEMS EACH

SOURCE/TREATMENT CONTROL BMP'S

SC-41	BUILDING & GROUNDS MAINTENANCE
SC-43	PARKING MAINTENANCE
SC-60	HOUSEKEEPING PRACTICES
SC-70	ROAD AND STREET MAINTENANCE
SC-71	PLAZA AND SIDEWALK CLEANING
SC-73	LANDSCAPE MAINTENANCE
SC-74	DRAINAGE SYSTEM MAINTENANCE
TC-32	BIORETENTION

NOTE:
1. PROVIDE INLET STENCILING AT ALL ONSITE INLETS

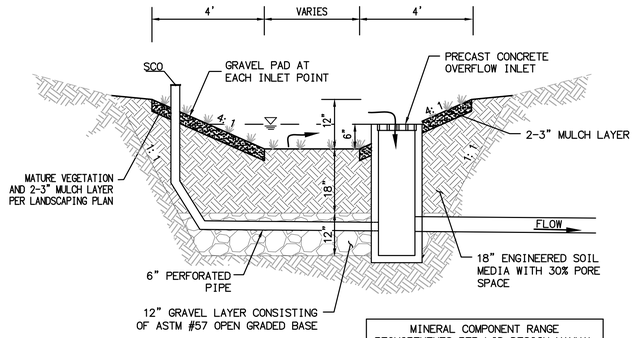
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SCALE: 1"=80'

Michael Baker INTERNATIONAL
9755 Clairemont Mesa Blvd., San Diego, CA 92124
Phone: (858) 614-5000 · MBAKERINTL.COM

WQMP EXHIBIT
MASTER SITE PLAN

KAISER MEDICAL MORENO VALLEY

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MINERAL COMPONENT RANGE REQUIREMENTS PER LID DESIGN MANUAL	
PERCENT RANGE	COMPONENT
70-80	SAND
15-20	SILT
5-10	CLAY

TYPICAL BIORETENTION BASIN SECTION

SCALE: NTS

LEGEND

- MODULAR WETLAND
- EXISTING RIGHT-OF-WAY
- DMA BOUNDARY
- DMA SUB-AREA BOUNDARY
- PROPOSED STORM DRAIN
- 5'x5' RIP RAP, 12" THICK, D50=6", UNDERLAY WITH FILTER FABRIC
- UNDERGROUND STORAGE VAULT
- DIVERSION MANHOLE
- A — DMA NUMBER
- A-1 — DMA SUB-AREA NUMBER

NOTE:

BIORETENTION BASIN SECTIONS A-G SHOWN ON NEXT SHEET

DRAINAGE MANAGEMENT AREA - A		
DMA SUB AREA	IMPERVIOUS (SQ/FT)	PERVIOUS (SQ/FT)
A-1	11,099.55	0
A-2	7,381.86	0
A-3	10,638.18	0
A-4	15,316.28	882.23
A-5	61,278.90	4,720.53
A-6	39377.84	3,399.92
A-7	405.16	11,650.67
A-8	10,668.91	0
A-9	18,627.58	7,089.86
TOTAL	174,794.26	27,743.21

DRAINAGE MANAGEMENT AREA - B		
DMA SUB AREA	IMPERVIOUS (SQ/FT)	PERVIOUS (SQ/FT)
B-1	79,438.59	14,937.99

DRAINAGE MANAGEMENT AREA - C		
DMA SUB AREA	IMPERVIOUS (SQ/FT)	PERVIOUS (SQ/FT)
C-1	16,556.09	31,582.35
C-2	22,034.62	24,152.67
C-3	33,241.85	6,421.19
TOTAL	71,832.56	62,156.21

DRAINAGE MANAGEMENT AREA - D		
DMA SUB AREA	IMPERVIOUS (SQ/FT)	PERVIOUS (SQ/FT)
D-1	88,116.08	55,428.60
D-2	8,090	5,288.20
D-3	39,175.22	7,510.24
D-4	16,645.83	715.45
TOTAL	152,027.36	68,942.49

DRAINAGE MANAGEMENT AREA - E		
DMA SUB AREA	IMPERVIOUS (SQ/FT)	PERVIOUS (SQ/FT)
E-1	53,279.49	32,593.43
E-2	8,842.15	0
E-3	189,289.96	46,171.70
TOTAL	251,411.60	78,765.13

DRAINAGE MANAGEMENT AREA - F		
DMA SUB AREA	IMPERVIOUS (SQ/FT)	PERVIOUS (SQ/FT)
F-1	6,188.51	717.31
F-2	31,586.47	11,811.17
F-3	82,640.82	9,580.26
F-4	66,796.49	0
F-5	11,922.48	6,235.56
F-6	52,041.88	11,755.41
F-7	7,917.31	3,256.75
TOTAL	259,093.96	43,356.46
TOTAL SUMMATION	988,598.33	295,901.49

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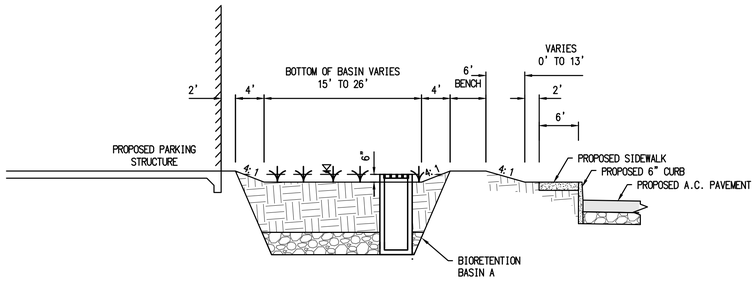
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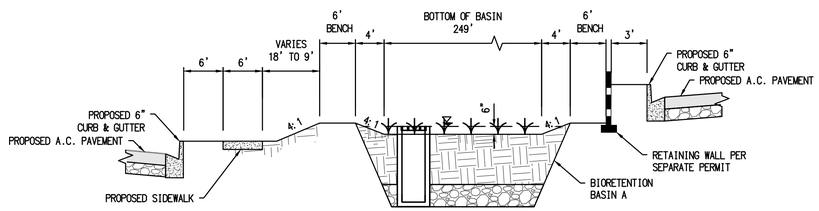
WQMP DMA EXHIBIT
MASTER SITE PLAN

KAISER MEDICAL MORENO VALLEY

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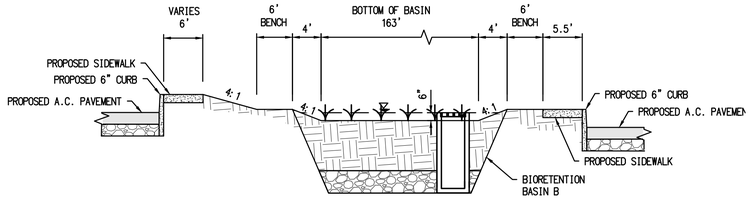
SECTION A-A



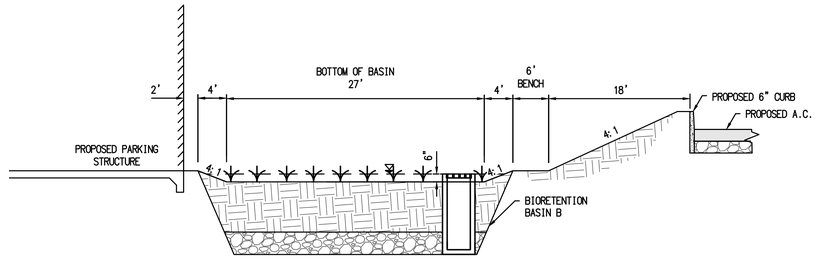
SECTION B-B

BIORETENTION BASIN A

SCALE: N.T.S



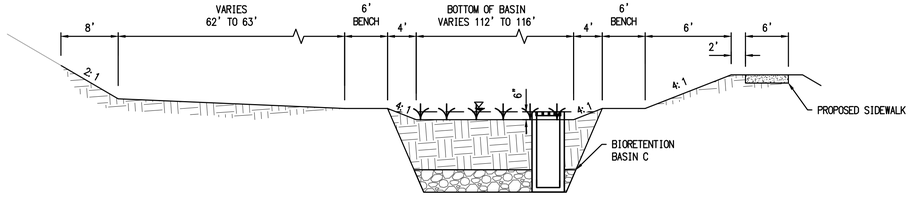
SECTION C-C



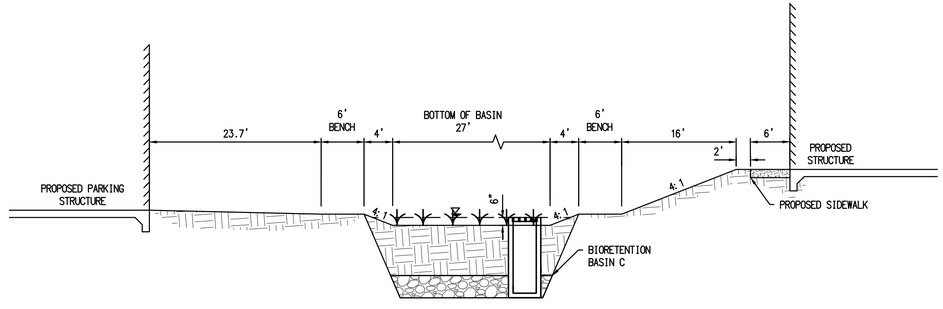
SECTION D-D

BIORETENTION BASIN B

SCALE: N.T.S



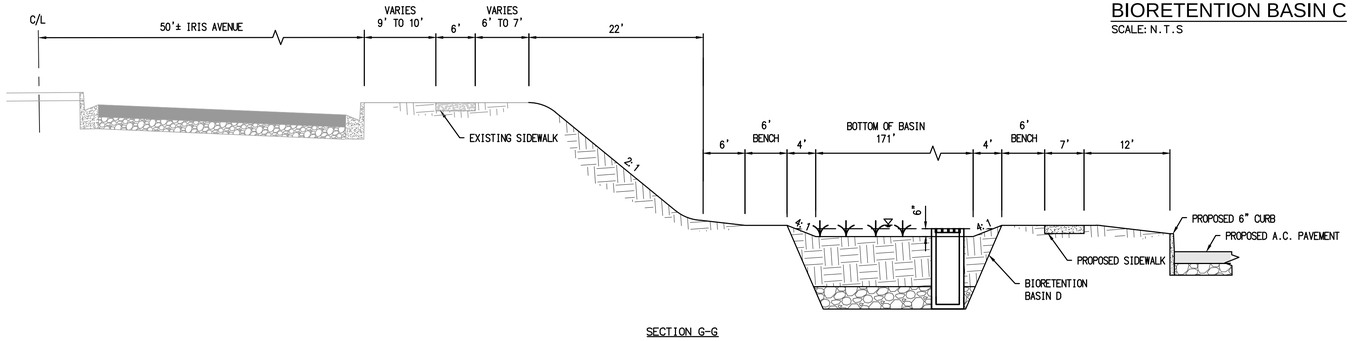
SECTION E-E



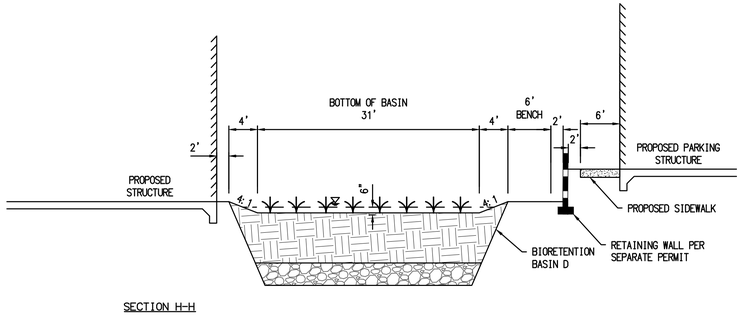
SECTION F-F

BIORETENTION BASIN C

SCALE: N.T.S



SECTION G-G



SECTION H-H

BIORETENTION BASIN D

SCALE: N.T.S

NOTE

FOR TYPICAL BIORETENTION BASIN CROSS SECTION, SEE PREVIOUS SHEET.

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BIORETENTION BASIN SECTIONS

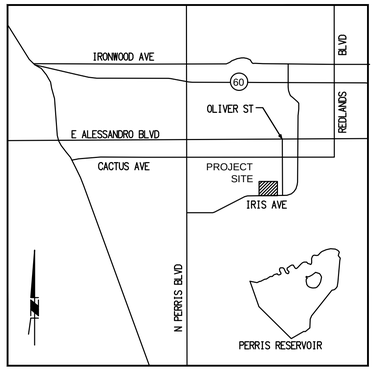
MASTER SITE PLAN

KAISER MEDICAL MORENO VALLEY

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Appendix 2: Construction Plans

Grading and Drainage Plans



VICINITY MAP
N.T.S.

LEGEND

- RIGHT-OF-WAY
- PROPERTY LINE
- EASEMENT
- MAJOR CONTOUR (420)
- MINOR CONTOUR (420)
- CURB
- CURB AND GUTTER
- RETAINING WALL
- AC PAVING
- CONCRETE PAVEMENT
- DIRECTION OF FLOW
- PRECAST CATCH BASIN
- CURB INLET
- STORM DRAIN/SEWER TYPE CLEANOUT
- STORM DRAIN LINE
- WING HEADWALL

OWNER/DEVELOPER

KAISER PERMANENTE
MORENO VALLEY MEDICAL CENTER
393 E. WALNUT STREET, 4TH FLOOR
CONTACT PERSON: SKYLER DENNISTON
PHONE NO. (626) 405-6333

CIVIL ENGINEER

MICHAEL BAKER INTERNATIONAL
9755 CLAIREMONT MESA BOULEVARD, SUITE 100
SAN DIEGO, CA 92124
PHONE NO. (858) 614-5000

STORM WATER NOTE

A STORMWATER POLLUTION PREVENTION PLAN (SWPPP), WHICH INCLUDES BEST MANAGEMENT PRACTICES TO REDUCE POLLUTANTS REACHING DOWNSTREAM WATER BODIES, WILL BE PREPARED PRIOR TO ISSUANCE OF GRADING PERMIT AND A NOTICE OF INTENT SUBMITTED TO THE STATE REGIONAL WATER QUALITY CONTROL BOARD.

LEGAL DESCRIPTION

APN 486-310-033
LOT/PARCEL: LOTS 2 AND 7 OF PARCEL 1

APN 486-310-034
LOT/PARCEL: LOT 6 OF PARCEL 1

PARCEL 1: LOTS 2,6 AND 7 IN BLOCK 158 OF MAP NO.1 BEAR VALLEY AND ALESSANDRO DEVELOPMENT COMPANY AS PER MAP RECORDED IN BOOK 11, PAGE 10 OF MAPS, RECORDS OF THE COUNTY OF SAN BERNARDINO, IN THE CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA.
ABOVE LEGAL DESCRIPTION IS PURSUANT TO LOT LINE ADJUSTMENT NO. 1015/AND CERTIFICATE OF COMPLIANCE RECORDED JANUARY 19, 2012, AS INSTRUMENT NO. 2012-0023631 OF OFFICIAL RECORDS OF SAID COUNTY RECORDS.

EARTHWORK

CUT: 50,000 CY
FILL: 50,000 CY

LAND USE

EXISTING: COMMERCIAL AND OFFICE
PROPOSED: COMMERCIAL AND OFFICE

FEMA ZONE

FEMA ZONE X AND A. MAJORITY ZONE X

DISTURBED AREA

GROSS DISTURBED AREA: 22.0 ACRES

ARCHITECT

CO ARCHITECTS
5055 WILSHIRE BOULEVARD, 9TH FLOOR
LOS ANGELES, CA 90036
PHONE NO. (323) 525-0500

EXISTING UTILITY NOTE

EXISTING UTILITIES HAVE BEEN SHOWN BASED ON THE BEST AVAILABLE INFORMATION. CONTRACTOR SHALL LOCATE AND MARK OUT ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION. CONTRACTOR SHALL CONTACT THE ENGINEER IF ANY UTILITIES ARE LOCATED THAT ARE NOT IDENTIFIED ON THESE PLANS.

TOPOGRAPHY SOURCE

AEROTECH MAPPING, INC.
29970 TECHNOLOGY DRIVE, SUITE 220-C
MURRIETA, CA 92563
PHONE NO. (619) 606-5020
TOPO SOURCE: AERIAL TOPO
TOPO SOURCE DATE: JULY 21, 2017

SITE ADDRESS

D&T: 27300 IRIS AVENUE
MORENO VALLEY, CA 92555
ENERGY CENTER: 27370 IRIS AVENUE
MORENO VALLEY, CA 92555

UTILITY COMPANIES

BOX SPRINGS MUTUAL WATER COMPANY	(951) 653-6419
CHARTER SPECTRUM	(877) 906-9121
EASTERN MUNICIPAL WATER DISTRICT	(951) 928-3777
EDGEMONT COMMUNITY SERVICE DISTRICT	(951) 784-2632
FRONTIER COMMUNICATION	(800) 921-8101
SOUTHERN CALIFORNIA EDISON COMPANY	(800) 655-4555
SOUTHERN CALIFORNIA GAS COMPANY	(800) 427-2200
SUNESYS	(951) 278-0400
RIVERSIDE TRANSIT AGENCY	(951) 565-5164
UNDERGROUND SERVICE ALERT	(800) 227-2600
MORENO VALLEY UTILITY ADMINISTRATION	(951) 413-3500
SPECIAL DISTRICTS ADMINISTRATION	(951) 413-3480
VERIZON WIRELESS	(800) 922-0204

GENERAL NOTES

PARKING LOTS SHALL BE DESIGNED CONSISTENT WITH THE CITY'S MUNICIPAL CODE (9.11 AND 9.17.050) REQUIREMENTS TO INCLUDE THE FOLLOWING:

1. PARKING LOT DESIGN SHALL INCLUDE OPENINGS IN CURBS TO CONVEY WATER RUNOFF INTO LANDSCAPE AREAS FOR WATER QUALITY, RETENTION AND ABSORPTION.
2. AUTO PARKING SPACES SHALL BE CLEARLY OUTLINED WITH WHITE DOUBLE LINES ON THE SURFACE OF THE PARKING FACILITY (THREE-INCH LINE - SIX INCH SPACE - THREE INCH LINE) FOR A TOTAL OF TWELVE (12) INCHES OR AS OTHERWISE SPECIFIED BY THE BUILDING OFFICIAL.
3. AUTO HEADLIGHTS IN PARKING AREAS SHALL BE SCREENED SO THAT THEY DO NOT SHINE INTO ADJACENT PROPERTIES OR THE PUBLIC RIGHT-OF-WAY. LOW HEDGE PLANTING OR WALL MAY BE REQUIRED.
4. FINGER PLANTERS SHALL HAVE A MINIMUM INTERIOR DIMENSION OF FIVE (5) FEET BY SIXTEEN (16) FEET, EXCLUSIVE OF CURBS, STEP-OUTS AND OTHER HARD SURFACES. A FINGER PLANTER WITH PARKING ON ONE SIDE HAS A MINIMUM CURB TO CURB FACE DIMENSION OF SEVEN FEET. A FINGER PLANTER WITH PARKING ON BOTH SIDES HAS A MINIMUM CURB-FACE-TO-CURB-FACE DIMENSION OF EIGHT (8) FEET.
5. DIAMOND PLANTERS ARE REQUIRED WHERE DOUBLE ROWS OF PARKING ARE PROVIDED.
6. DIAMOND PLANTERS HAVE A MINIMUM OF TWENTY-FIVE (25) SQUARE FOOT INTERIOR AREA (EXCLUSIVE OF PERIMETER CURBING) WITH MINIMUM INTERIOR DIMENSIONS OF FIVE FEET BY FIVE FEET.
7. END ISLANDS, OR FINGER PLANTERS ARE PROVIDED AT THE END OF EACH AISLE OF PARKING TO DEFINE PARKING LOT CIRCULATION, PROVIDE SIGHT DISTANCE AT THE INTERSECTION OF DRIVE AISLES AND PLACES FOR TREES.
8. END PLANTERS, FINGER PLANTERS, AND DIAMOND PLANTERS SHALL BE DESIGNED FOR LANDSCAPING PURPOSES ONLY AND SHALL NOT INCLUDE LIGHT POLES, FIRE HYDRANTS OR UTILITY CABINETS. DESIGN PLANTERS IN EXCESS OF REQUIRED DIMENSIONS IF THESE ITEMS WILL BE INCORPORATED INTO THE OVERALL DESIGN OF THE PROJECT.
9. PERVIOUS SURFACES ARE RECOMMENDED WHERE FEASIBLE AND REQUIRED FOR PARKING AREAS PROVIDED IN EXCESS OF CITY REQUIREMENTS.

80 40 0 80 160 240
SCALE: 1"=80'

CO ARCHITECTS
5055 Wilshire Boulevard, 9th Floor
Los Angeles, California 90036
323.525.0500 phone, 323.525.0955 fax

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Phone: (858) 614-5000 · MBAKERINTL.COM

AGENCY STAMP

KAISER PERMANENTE
MORENO VALLEY MEDICAL CENTER
CAMPUS MASTER PLAN
PHASE 1 DIAGNOSTIC & TREATMENT
EXPANSION AND ENERGY CENTER
27300 IRIS AVENUE MORENO VALLEY, CA 92555
KAISER Proj: K0130 OSHPD FACILITY: 106334048

OSHPD PROJECT #

N

MASTER PRELIMINARY GRADING & DRAINAGE PLAN

SCALE: AS INDICATED
DATE OF ISSUE: MARCH 12, 2019

CONDITIONAL USE PERMIT AND PLANNED DEVELOPMENT PERMIT
CO - PROJECT NO.: 17009.000

DP-08

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Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

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GEOTECHNICAL CONSULTANTS

June 1, 2019

RMA Job No.: 19-0918-0

National Facilities Services
Riverside Service Delivery Team
182 Granite Street, Suite 106
Corona, CA 92879

Attention: Scott L. Drane,
Senior Project Manager

Subject: Soil Infiltration Report
Moreno Valley Medical Center
27300 Iris Avenue
Moreno Valley, CA

Dear Mr. Drane:

In accordance with the District's request and authorization, a soil infiltration report has been prepared for Moreno Valley Medical Center in Moreno Valley, California.

Our scope of work included the following:

- Review regional geologic and groundwater data.
- Review an Infiltration Test Locations exhibit provided by Kaiser personnel.
- Review of a previous geotechnical investigation report prepared by Geobase in August 2017.
- Drilling of five exploratory boring.
- Drilling of ten infiltration test holes and performance of ten soil infiltration tests using the bore hole percolation test procedure.
- Backfilling of the boring and test holes.
- Analysis of the complied data and preparation of this report.

Proposed Construction

An exhibit provided by representatives from Kaiser (Figure 1) shows the proposed infiltration basins located in the northern portion of the site and two general infiltration areas on the south side of the site. They also provided the requested test depth of 5 feet.

The area of the proposed basins on the north side of the site is vacant land. The southern study areas are currently used as parking lots and landscape areas.

Geologic Setting

The site is located within a large geologic structural mass known as the Perris Block. This block is composed of granitic bedrock that in places is overlain by alluvium and thin sedimentary and volcanic units. The granitic bedrock was formed during Cretaceous time, some 90 to 100 million years ago, and is part of a much larger mass of plutonic rocks known as the Southern California Batholith. After formation of the granitic rocks, the Perris Block experienced vertical movements that produced several nearly flat erosional surfaces. Sediments emanating from the elevated portions of the Perris Block fill low lying areas in the region.

According to regional geologic mapping by Morton and Matti (2002), northern portion of the study area is underlain by Holocene to late Pleistocene age younger alluvium and the southern portion of the study area is underlain by late to middle Pleistocene age older alluvium. As discussed below, our boring encountered both younger and older alluvium.

Subsurface Conditions

During our subsurface investigation, we encountered older alluvium. The older alluvium encountered in the three basins on the north side of the site consisted of light brown to brown sandy silt. The locations on the south side of the site encountered brown silty sand. Logs of the borings are presented in Appendix A.

Groundwater was not encountered during our subsurface investigation for this study. According to the California Department of Water Resources (2006) depth to groundwater beneath the site is on the order of 60 feet.

Infiltration Test Procedure

Ten soil infiltration tests were performed using the bore hole percolation test procedure described in Appendix A of the Riverside County Low Impact Development BMP Design Handbook. An exploratory boring and test holes were drilled with a truck mounted CME-75 drill rig equipped with 8-inch diameter hollow stem augers. The exploratory boring was drilled to a depth of 15 feet. Test holes were extended to a depth of approximately 5 feet below the existing ground surface, the approximate depths of the proposed subsurface infiltration basins. A three inch diameter perforated pipe wrapped in a filter sock was placed through the augers prior into each test hole prior to removal of the augers. Each hole was presoaked by filling the holes with approximately 5 gallons water as per the Riverside County guidelines.

The percolation rate in each test hole was measured for two 25 minute periods to determine if the soil met the sandy soils criteria. Three tests exhibited more than 6 inches of water seeped away during two consecutive measurements at each location, consequently the sandy soils criteria was used during testing. The remaining seven tests, did not pass the sandy soil criteria, and hence utilized a 30 minute time interval. Water levels in the test holes were maintained approximately 5 times the hole radius or slightly higher. Water levels were measured to the nearest hundredth of a foot using a well sounder. A total of 7 to 13 measurements, dependant on the sandy soil criteria, were made following completion of presoaking, after which time testing was stopped. The pipes were pulled from the test holes after completion of testing. The holes were then backfilled and capped with asphaltic cold patch.

Infiltration Test Results

The percolation rates obtained from the bore hole percolation test method are not equivalent to infiltration rates obtained from single or double ring infiltrometer tests. This is because both downward and horizontal fluxes of water occur during bore hole percolation tests, whereas infiltration refers to only the downward flux of water. For our study, we used the Porchet Method to convert percolation rates to infiltration rates.

Test Location	Infiltration Rate
P-1	0.51 in/hr
P-2	0.10 in/hr
P-3	0.13 in/hr
P-4	0.21 in/hr
P-5	0.60 in/hr
P-6	0.26 in/hr
P-7	1.07 in/hr
P-8	0.68 in/hr
P-9	0.84 in/hr
P-10	0.48 in/hr

Soil percolation test sheets are presented in Appendix A.

Discussion and Recommendations

Per the Santa Ana Regional Water Quality Control Board Water Quality Management Plan Guidance Document for Riverside County (Page 33), pre-development "in-situ" tested infiltration rates of soil must be greater than 1.6 in/hr to be considered acceptable for storm water infiltration.

Because the calculated infiltration rates for this study are less than 1.6 inches per hour, we conclude that infiltration of stormwater into soils at the site is not feasible. Since the tested soils extend to ground surface, we also conclude that infiltration of stormwater into soils above the depths tested and in the tested area are not feasible.

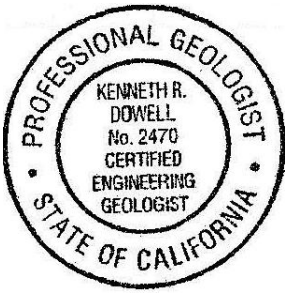
Since some of our testing indicates that the tested infiltration rates on the south side of the site are greater than 0.3 inches per hour, but less than 1.6 in/hr, use of bioretention BMPs are feasible according to the LID BMP Feasibility Flow Chart in the Santa Ana Regional Water Quality Control Board Water Quality Management Plan Guidance Document for Riverside County (Figure 3-6, page 58). For areas where the lowest tested infiltration rate is less than 0.3 inches per hour, at the test locations on the north side of the site, biotreatment BMPs may be used. This would include the areas tested on the north side of the site. Information on types of bioretention and biotreatment BMPs can be found in the LID BMP Feasibility Flow Chart in the Santa Ana Regional Water Quality Control Board Water Quality Management Plan Guidance Document for Riverside County

We trust this letter will serve your needs at this time. In you have any questions or require further assistance, please do not hesitate to contact us.

Respectfully,

RMA Group

Kenneth Dowell, CEG, PG
Project Geologist
CEG 2470

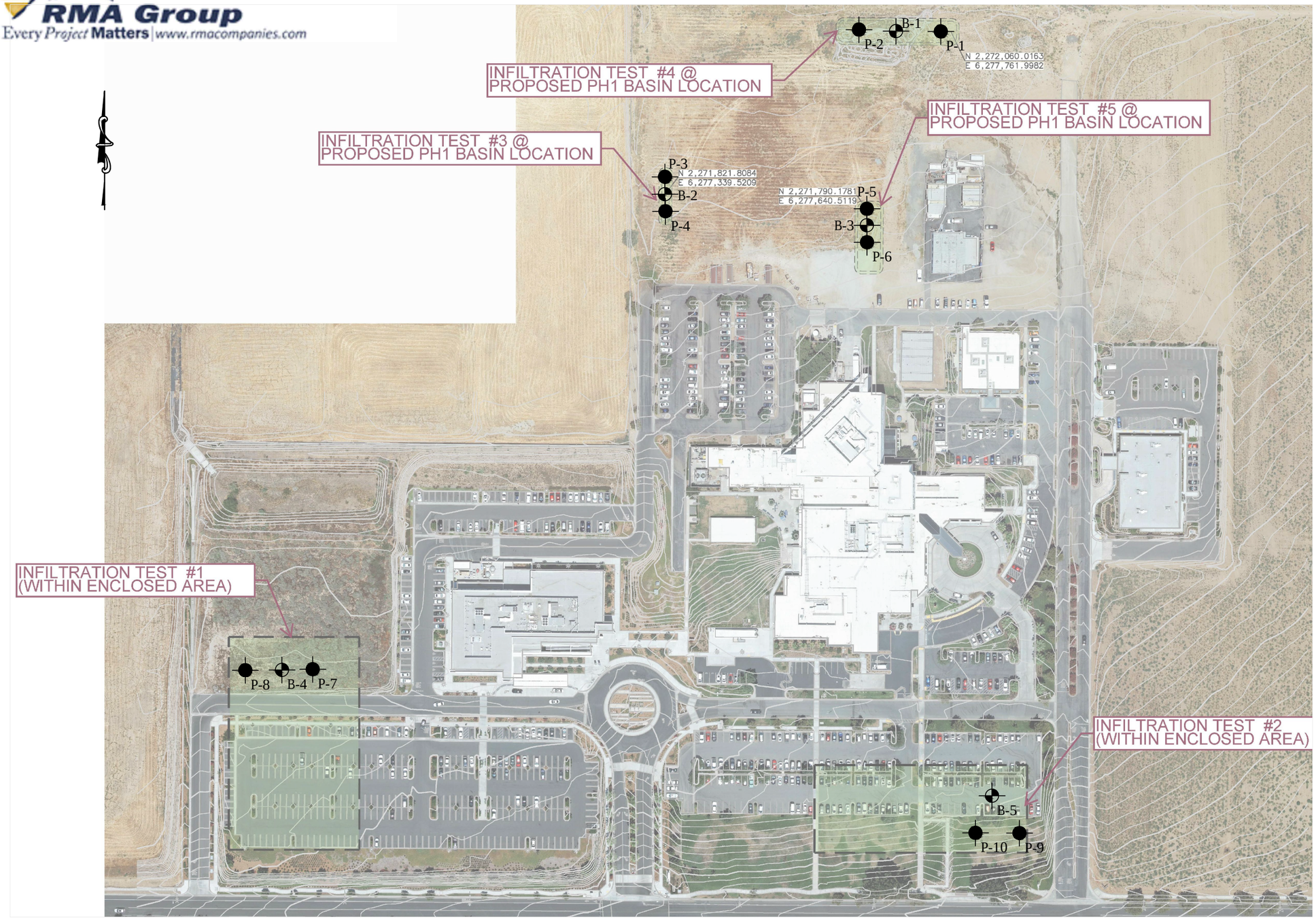


Attachments: Figure 1: Test Location Map
Figure 2: Regional Geologic Map
Appendix A: Boring/Test Hole Logs and Percolation Test Data Sheets
Appendix B: References

FIGURES

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GEOTECHNICAL CONSULTANTS



BORING AND INFILTRATION TEST LOCATION MAP
Not to Scale

Legend

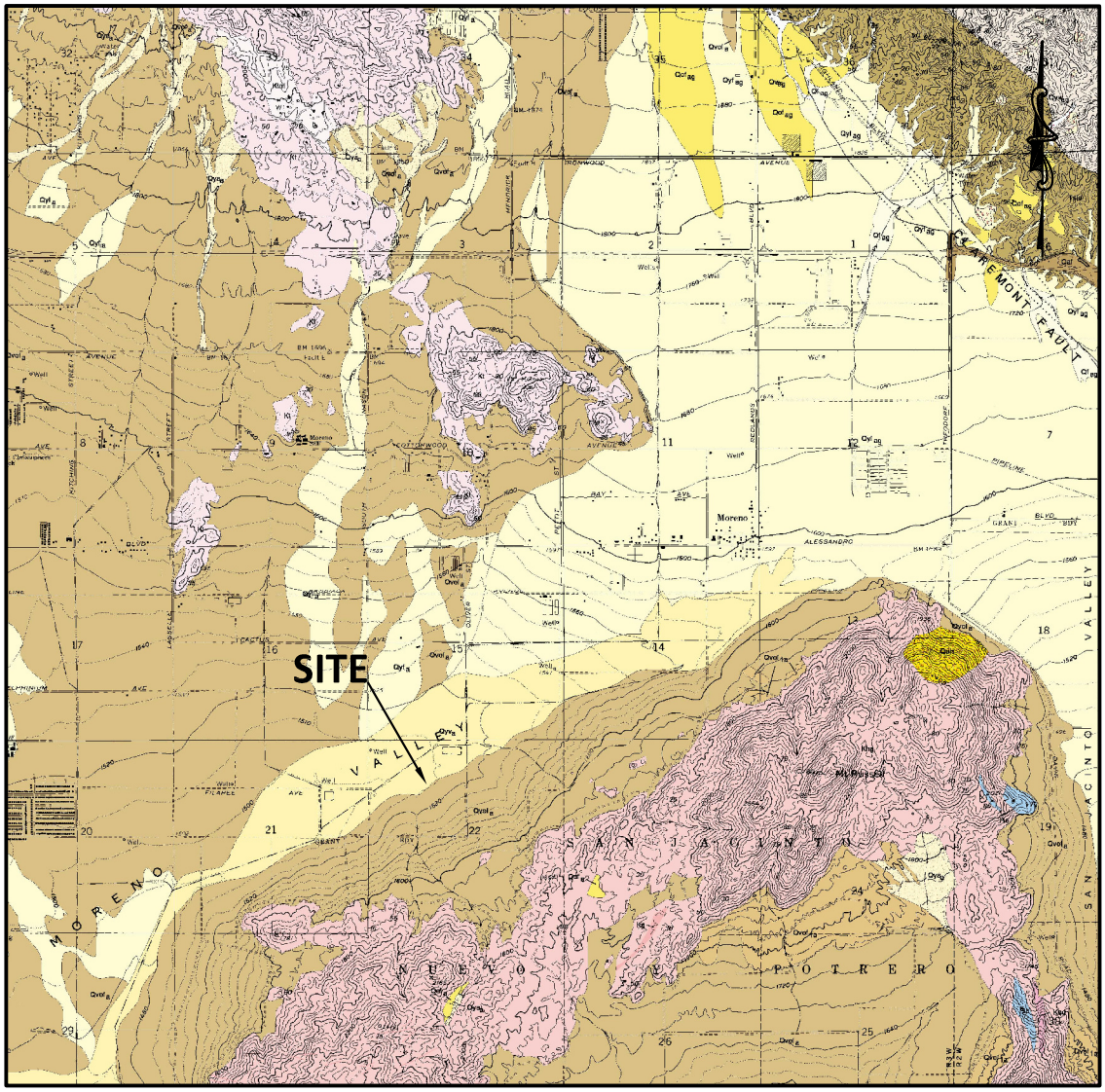
B-5 - Approximate location of exploratory boring

P-10 - Approximate location of infiltration test

Base map provided by Kaiser Permanente

Kaiser Permanente Health Plan, Inc.
Moreno Valley Medical Center
Moreno Valley, CA

RMA Job No.: 19-0918-0
Figure 1



REGIONAL GEOLOGIC MAP

Scale: 1" ≈ 2,000'

Partial Legend

Qyv - Young Alluvial Valley Deposits
Qvof - Very old alluvial fan deposits
Khg - Granitic rock

Source: Morton, M.M. and Matti J.C., Geologic Map of the Sunnymead 7.5-Minute Quadrangle, California, 2001.

APPENDIX A

BORING/TEST HOLE LOGS
AND
PERCOLATION TEST DATA SHEETS

APPENDIX A

FIELD INVESTIGATION

A-1.00 FIELD EXPLORATION

A-1.01 Number of Borings and Test Holes

Our current subsurface exploration consisted of 5 boring and 10 test holes. The borings and test holes were drilled with a CME-75 drill rig equipped with 8-inch hollow stem augers.

A-1.02 Location of Boring and Test Holes

A map showing the approximate locations of boring and test holes is presented as Figure 1.

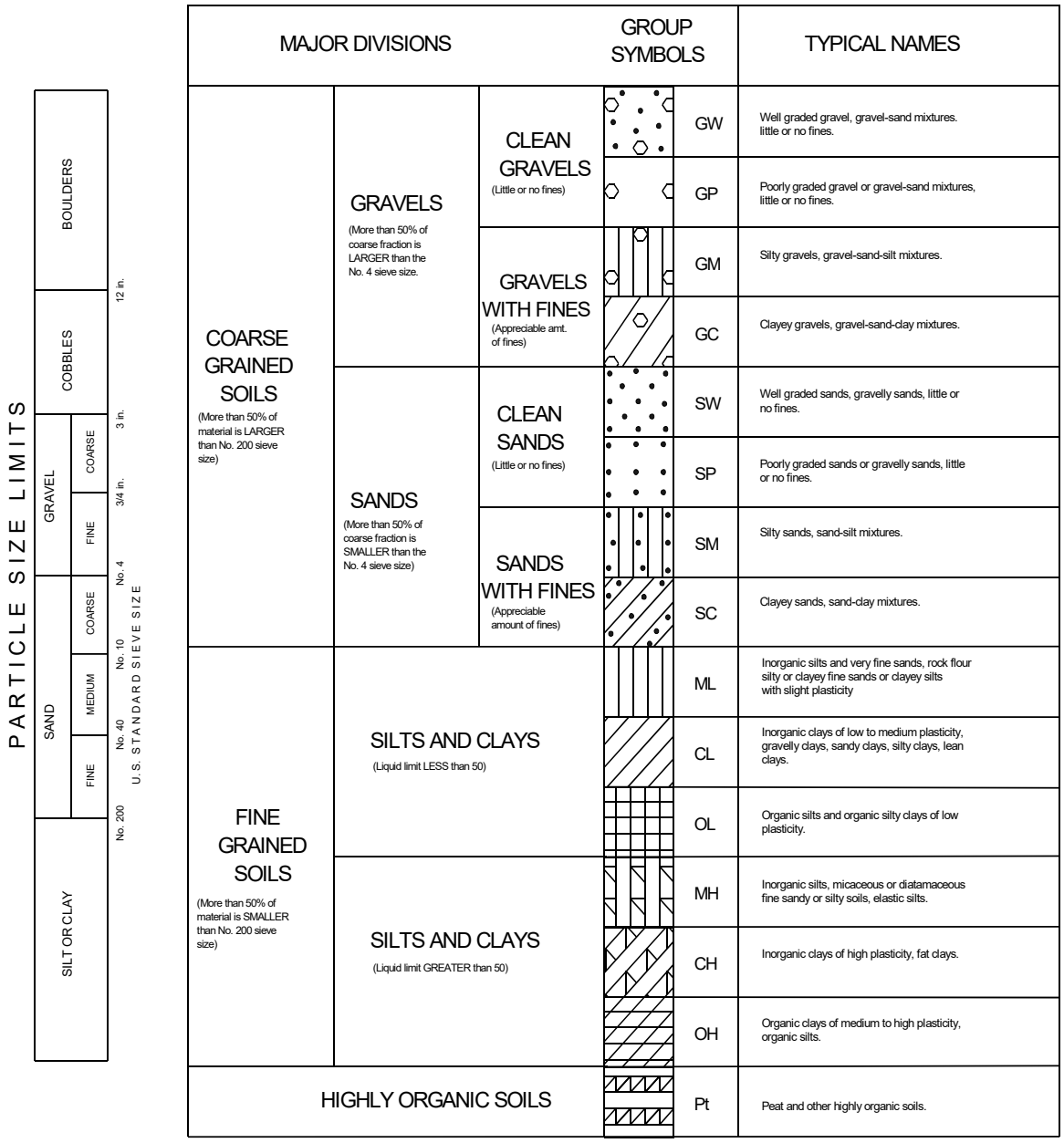
A-1.03 Boring Logging

A log of the boring was prepared by one of our staff and is attached in this appendix. The log contains factual information and interpretation of subsurface conditions between samples. The strata indicated on the log represent the approximate boundary between earth units and the transition may be gradual. The logs show subsurface conditions at the dates and locations indicated, and may not be representative of subsurface conditions at other locations and times.

Identification of the soils encountered during the subsurface exploration was made using the field identification procedure of the Unified Soils Classification System (ASTM D2488). A legend indicating the symbols and definitions used in this classification system and a legend defining the terms used in describing the relative compaction, consistency or firmness of the soil are attached in this appendix.

A-1.04 Soil Infiltration Testing

Three soil infiltration tests were performed using the bore hole percolation test procedure described in the Riverside County Flood Control District Design Handbook for Low Impact Development Best Management Practices. Locations of the tests are shown on Figure 1.



BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

UNIFIED SOIL CLASSIFICATION SYSTEM

I. SOIL STRENGTH/DENSITY

BASED ON STANDARD PENETRATION TESTS

Compactness of sand		Consistency of clay	
Penetration Resistance N (blows/Ft)	Compactness	Penetration Resistance N (blows/ft)	Consistency
0-4	Very Loose	<2	Very Soft
4-10	Loose	2-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
>50	Very Dense	15-30	Very Stiff
		>30	Hard

N = Number of blows of 140 lb. weight falling 30 in. to drive 2-in OD sampler 1 ft.

BASED ON RELATIVE COMPACTION

Compactness of sand		Consistency of clay	
% Compaction	Compactness	% Compaction	Consistency
<75	Loose	<80	Soft
75-83	Medium Dense	80-85	Medium Stiff
83-90	Dense	85-90	Stiff
>90	Very Dense	>90	Very Stiff

II. SOIL MOISTURE

Moisture of sands		Moisture of clays	
% Moisture	Description	% Moisture	Description
<5%	Dry	<12%	Dry
5-12%	Moist	12-20%	Moist
>12%	Very Moist	>20%	Very Moist, wet

SOIL DESCRIPTION LEGEND

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Exploratory Boring Log

Boring No. B-1

Sheet 1 of 1

Date Drilled:	05-06-19	Drilling Equipment:	CME-75
Logged By:	KRD	Boring Hole Diameter:	8"
Location:	See Boring Location Map	Drive Weights:	140 lbs.
		Drop:	30"

Depth (ft)	Samples: Sample Type	Samples: Blows (blows/ft)	Samples: Bulk Sample	Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
						ML		Older Alluvium: Light brown sandy silt, trace carbonate stringers, slightly moist, medium stiff to stiff with depth.
5	S	13						
10	S	55						Becomes light brown to light reddish brown, dry, hard.
15	S	28						Becomes very stiff.
								Total depth 16.5' No groundwater encountered. Hole backfilled the same day with soil cuttings.
20								
25								

This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log show subsurface conditions at the date and location indicated, and may not be representative of subsurface conditions at other locations and times.

Sample Types:

R - Ring Sample | Bulk Sample | Groundwater

T - Tube Sample | S - SPT Sample | End of Boring

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Exploratory Boring Log

Boring No. B-2

Sheet 1 of 1

Date Drilled:	05-06-19	Drilling Equipment:	CME-75
Logged By:	KRD	Boring Hole Diameter:	8"
Location:	See Boring Location Map	Drive Weights:	140 lbs.
		Drop:	30"

Depth (ft)	Samples: Sample Type	Samples: Blows (blows/ft)	Samples: Bulk Sample	Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
						ML		Older Alluvium: Brown sandy silt, slightly moist, upper 1' soft (plowed zone) to medium stiff to stiff with depth.
5	S	12						Gray brown sandy silt, moist, non-porous, stiff.
10	S	24						Brown sandy silt, fine sand with trace coarse sand, slightly moist, stiff to very stiff.
15	S	25						Total depth 16.5' No groundwater encountered. Hole backfilled the same day with soil cuttings.
20								
25								

This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log show subsurface conditions at the date and location indicated, and may not be representative of subsurface conditions at other locations and times.

Sample Types:

R - Ring Sample | Bulk Sample | Groundwater

T - Tube Sample | S - SPT Sample | End of Boring

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Exploratory Boring Log

Boring No. B-3

Sheet 1 of 1

Date Drilled:	05-06-19	Drilling Equipment:	Geoprobe 7822DT
Logged By:	KRD	Boring Hole Diameter:	8"
Location:	See Boring Location Map	Drive Weights:	140 lbs.
		Drop:	30"

Depth (ft)	Samples: Sample Type	Samples: Blows (blows/ft)	Samples: Bulk Sample	Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
						ML		Older Alluvium: Brown sandy silt, fine to medium sand with minor coarse sand, slightly moist, upper 1' soft (plowed zone) to medium stiff to stiff with depth.
								@2', Becomes dry.
5	S	62						Becomes hard.
10	S	51						
15	S	49						
								Total depth 16.5'
								No groundwater encountered.
								Hole backfilled the same day with soil cuttings.
20								
25								

This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log show subsurface conditions at the date and location indicated, and may not be representative of subsurface conditions at other locations and times.

Sample Types:

R - Ring Sample | - Bulk Sample | - Groundwater

T - Tube Sample | S - SPT Sample | - End of Boring

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Exploratory Boring Log

Boring No. B-4

Sheet 1 of 1

Date Drilled:	05-07-19	Drilling Equipment:	CME-75
Logged By:	KRD	Boring Hole Diameter:	8"
Location:	See Boring Location Map	Drive Weights:	140 lbs.
		Drop:	30"

Depth (ft)	Samples: Sample Type	Samples: Blows (blows/ft)	Samples: Bulk Sample	Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
5	S	20				SM		Older Alluvium: Brown sandy silt, fine to coarse sand, slightly moist, medium dense.
10	S	17						
15	S	22						Total depth 16.5' No groundwater encountered. Hole backfilled the same day with soil cuttings.
20								
25								

This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log show subsurface conditions at the date and location indicated, and may not be representative of subsurface conditions at other locations and times.

Sample Types:

R - Ring Sample | Bulk Sample | Groundwater

T - Tube Sample | S - SPT Sample | End of Boring

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Exploratory Boring Log

Boring No. B-5

Sheet 1 of 1

Date Drilled:	05-07-19	Drilling Equipment:	CME-75
Logged By:	KRD	Boring Hole Diameter:	8"
Location:	See Boring Location Map	Drive Weights:	140 lbs.
		Drop:	30"

Depth (ft)	Samples: Sample Type	Samples: Blows (blows/ft)	Samples: Bulk Sample	Moisture Content (%)	Dry Density (pcf)	USCS	Graphic Symbol	Material Description
						SM		6" Asphaltic Concrete, 4" Base Older Alluvium: Brown sandy silt to silty sand, fine to medium sand, slightly cohesive, moist, loose.
5	S	7						
10	S	13						Becomes brown to reddish brown, occasional coarse sand.
15	S	51						Becomes reddish brown, fine to coarse sand, moist, very dense.
								Total depth 16.5' No groundwater encountered. Hole backfilled the same day with soil cuttings.
20								
25								

This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log show subsurface conditions at the date and location indicated, and may not be representative of subsurface conditions at other locations and times.

Sample Types:

R - Ring Sample | Bulk Sample | Groundwater

T - Tube Sample | S - SPT Sample | End of Boring

Percolation Test Data Sheet

Project:	Kaiser Moreno Valley	Project No.:	19-0918-0	Date:	5/7/2019
Test Hole No.:	P-1	Tested By:	520STA		
Test Hole Depth (In.) , D_T:	60	USCS Soil Classification:	SM		
Test Hole Dimensions (inches)			Length	Width	
Diameter In.) if round=	8	Sides (if rectangular)=	n/a	n/a	

Sandy Soil Criteria*

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or equal to 6"? (y/n)
1	7:23 AM	7:48 AM	25	38.6	44.4	5.76	No
2	7:53 AM	8:18 AM	25	44.4	46.8	2.40	No

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximate 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (In.)	D_f Final Depth to Water (In.)	ΔD Change in Water Level (In.)	Percolation Rate (min./in.)
1	7:21 AM	7:51 AM	30	35.6	41.4	5.8	5.2
2	7:52 AM	8:22 AM	30	35.0	39.1	4.1	7.4
3	8:23 AM	8:53 AM	30	35.8	39.6	3.8	7.8
4	8:54 AM	9:24 AM	30	35.4	38.9	3.5	8.6
5	9:24 AM	9:54 AM	30	36.0	39.2	3.2	9.3
6	9:55 AM	10:25 AM	30	36.5	39.5	3.0	10.0
7	10:26 AM	10:56 AM	30	35.9	39.0	3.1	9.6
8	10:57 AM	11:27 AM	30	35.8	38.8	3.0	10.0
9	11:28 AM	11:58 AM	30	36.0	39.0	3.0	10.0
10	11:59 AM	12:30 PM	31	35.4	38.5	3.1	9.9
11	12:31 PM	1:01 PM	30	36.0	39.0	3.0	10.0
12	1:02 PM	1:32 PM	30	35.2	38.4	3.2	9.3

COMMENTS: Sunny, low 60s, dry

Infiltration Rate (in/hr) = $(\Delta H*60min/hr*r)/\Delta t\ (r+2Havg)$

H avg = $(H_o - Hf)/2$

Infiltration Rate (in/hr): 0.51

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GEOTECHNICAL CONSULTANTS

Percolation Test Data Sheet

Project:	Kaiser Moreno Valley	Project No.:	19-0918-0		Date:	5/7/2019
Test Hole No.:	P-2	Tested By:	520STA			
Test Hole Depth (In.) , DT:	60	USCS Soil Classification:	SM			
Test Hole Dimensions (inches)				Length	Width	
Diameter In.) if round=	8	Sides (if rectangular)=		n/a	n/a	

Sandy Soil Criteria*

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or equal to 6"? (y/n)
1	7:55 AM	8:20 AM	25	33.8	34.8	1.00	No
2	8:20 AM	8:45 AM	25	34.8	35.5	0.70	No

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximate 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (In.)	D_f Final Depth to Water (In.)	ΔD Change in Water Level (In.)	Percolation Rate (min./in.)
1	7:21 AM	7:51 AM	30	31.8	33.0	1.2	25.0
2	7:52 AM	8:22 AM	30	33.0	33.7	0.7	41.7
3	8:23 AM	8:53 AM	30	33.7	34.6	0.8	35.7
4	8:54 AM	9:24 AM	30	34.6	35.8	1.2	25.0
5	9:24 AM	9:54 AM	30	35.8	35.9	0.1	250.0
6	9:55 AM	10:25 AM	30	35.9	36.4	0.5	62.5
7	10:26 AM	10:56 AM	30	35.4	36.0	0.6	50.0
8	10:57 AM	11:27 AM	30	36.0	36.6	0.6	50.0
9	11:28 AM	11:58 AM	30	36.6	37.2	0.6	50.0
10	11:59 AM	12:30 PM	33	37.2	37.8	0.6	55.0
11	12:31 PM	1:01 PM	30	36.2	36.8	0.6	50.0
12	1:02 PM	1:32 PM	30	36.8	37.4	0.6	50.0

COMMENTS: Sunny, low 60s, dry

Infiltration Rate (in/hr) = $(\Delta H*60min/hr*r)/\Delta t\ (r+2Havg)$

H avg = $(H_o - Hf)/2$

Infiltration Rate (in/hr): 0.10

Percolation Test Data Sheet

Project:	Kaiser Moreno Valley	Project No.:	19-0918-0	Date:	5/7/2019
Test Hole No.:	P-3	Tested By:	520STA		
Test Hole Depth (In.) , DT:	60	USCS Soil Classification:	SM		
Test Hole Dimensions (inches)			Length	Width	
Diameter In.) if round=	8	Sides (if rectangular)=	n/a	n/a	

Sandy Soil Criteria*

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or equal to 6"? (y/n)
1	8:04 AM	8:29 AM	25	43.6	43.8	0.20	No
2	8:29 AM	8:54 AM	25	43.8	44.2	0.40	No

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximate 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	Do Initial Depth to Water (In.)	Df Final Depth to Water (In.)	ΔD Change in Water Level (In.)	Percolation Rate (min./in.)
1	7:43 AM	8:13 AM	30	36.0	42.4	6.4	4.7
2	8:14 AM	8:44 AM	30	36.0	39.5	3.5	8.6
3	8:45 AM	9:15 AM	30	35.4	38.2	2.8	10.9
4	9:16 AM	9:46 AM	30	35.6	37.7	2.0	14.7
5	9:47 AM	10:17 AM	30	35.4	37.4	2.0	14.7
6	10:18 AM	10:48 AM	30	35.4	37.3	1.9	15.6
7	10:49 AM	11:19 AM	30	35.4	37.0	1.6	19.2
8	1:20 AM	11:50 AM	30	36.0	37.2	1.2	25.0
9	11:51 AM	12:21 PM	30	36.0	37.0	1.0	31.3
10	12:22 PM	12:52 PM	30	36.0	37.0	1.0	31.3
11	12:53 PM	1:23 PM	30	36.1	37.0	0.8	35.7
12	1:24 PM	1:54 PM	30	36.2	37.1	0.8	35.7

COMMENTS: Sunny, low 60s, dry

Infiltration Rate (in/hr) = (ΔH*60min/hr*r)/Δt (r+2Havg)

H avg = (Ho- Hf)/2

Infiltration Rate (in/hr): 0.13

Percolation Test Data Sheet

Project:	Kaiser Moreno Valley	Project No.:	19-0918-0	Date:	5/7/2019
Test Hole No.:	P-4	Tested By:	520STA		
Test Hole Depth (In.) , DT:	60	USCS Soil Classification:	SM		
Test Hole Dimensions (inches)			Length	Width	
Diameter In.) if round=	8	Sides (if rectangular)=	n/a	n/a	

Sandy Soil Criteria*

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or equal to 6"? (y/n)
1	8:35 AM	8:59 AM	25	38.4	41.3	2.90	No
2	8:59 AM	9:24 AM	25	41.3	44.4	3.10	No

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximate 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (In.)	D_f Final Depth to Water (In.)	ΔD Change in Water Level (In.)	Percolation Rate (min./in.)
1	7:41 AM	8:11 AM	30	35.2	43.9	8.8	3.4
2	8:12 AM	8:42 AM	30	36.5	43.7	7.2	4.2
3	8:43 AM	9:13 AM	30	35.6	42.0	6.4	4.7
4	9:14 AM	9:44 AM	30	35.3	40.7	5.4	5.6
5	9:45 AM	10:15 AM	30	35.9	40.9	5.0	6.0
6	10:16 AM	10:46 AM	30	36.2	40.8	4.6	6.6
7	10:47 AM	11:17 AM	30	35.2	37.9	2.8	10.9
8	11:18 AM	11:48 AM	30	35.4	36.8	1.4	20.8
9	11:49 AM	12:20 PM	30	35.4	36.6	1.2	25.0
10	12:21 PM	12:51 PM	30	35.8	37.2	1.4	20.8
11	12:52 PM	1:22 PM	30	36.1	37.9	1.8	16.7
12	1:23 PM	1:53 PM	30	36.1	37.4	1.3	22.7
13	1:54 PM	2:24 PM	30	36.1	37.4	1.3	22.7

COMMENTS: Sunny, low 60s, dry

Infiltration Rate (in/hr) = $(\Delta H*60min/hr*r)/\Delta t\ (r+2Havg)$

H avg = $(H_o - Hf)/2$

Infiltration Rate (in/hr): 0.21

Percolation Test Data Sheet

Project:	Kaiser Moreno Valley	Project No.:	19-0918-0	Date:	5/7/2019
Test Hole No.:	P-5	Tested By:	520STA		
Test Hole Depth (In.) , DT:	60	USCS Soil Classification:	SM		
Test Hole Dimensions (inches)			Length	Width	
Diameter In.) if round=	8	Sides (if rectangular)=	n/a	n/a	

Sandy Soil Criteria*

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or equal to 6"? (y/n)
1	9:36 AM	10:01 AM	25	34.8	42.6	7.80	Yes
2	10:07 AM	10:32 AM	25	42.6	47.0	4.40	No

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximate 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (In.)	D_f Final Depth to Water (In.)	ΔD Change in Water Level (In.)	Percolation Rate (min./in.)
1	7:32 AM	8:02 AM	30	36.0	41.6	5.6	5.3
2	8:03 AM	8:33 AM	30	36.0	40.6	4.6	6.6
3	8:34 AM	9:04 AM	30	36.6	40.7	4.1	7.4
4	9:05 AM	9:35 AM	30	36.4	40.3	4.0	7.6
5	9:36 AM	10:06 AM	30	35.3	39.4	4.1	7.4
6	10:07 AM	10:37 AM	30	36.4	40.1	3.7	8.1
7	10:38 AM	11:09 AM	31	34.4	38.8	4.3	7.2
8	11:10 AM	11:40 AM	30	34.6	38.6	4.1	7.4
9	11:41 AM	12:11 PM	30	35.6	39.2	3.6	8.3
10	12:12 PM	12:42 PM	30	35.8	39.4	3.6	8.3
11	12:43 PM	1:13 PM	30	36.2	39.8	3.6	8.3
12	1:14 PM	1:44 PM	30	36.0	39.6	3.6	8.3

COMMENTS: Sunny, low 60s, dry

Infiltration Rate (in/hr) = $(\Delta H*60min/hr*r)/\Delta t\ (r+2Havg)$

H avg = $(H_o - Hf)/2$

Infiltration Rate (in/hr): 0.60

Percolation Test Data Sheet

Project:	Kaiser Moreno Valley	Project No.:	19-0918-0	Date:	5/7/2019
Test Hole No.:	P-6	Tested By:	520STA		
Test Hole Depth (In.) , DT:	60	USCS Soil Classification:	SM		
Test Hole Dimensions (inches)			Length	Width	
Diameter In.) if round=	8	Sides (if rectangular)=	n/a	n/a	

Sandy Soil Criteria*

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or equal to 6"? (y/n)
1	9:39 AM	10:04 AM	25	26.2	30.5	4.30	No
2	10:07 AM	10:32 AM	25	30.5	34.2	3.70	No

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximate 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (In.)	D_f Final Depth to Water (In.)	ΔD Change in Water Level (In.)	Percolation Rate (min./in.)
1	7:35 AM	8:05 AM	30	36.0	38.5	2.5	11.9
2	8:06 AM	8:36 AM	30	34.9	37.2	2.3	13.2
3	8:37 AM	9:07 AM	30	35.6	37.7	2.0	14.7
4	9:08 AM	9:38 AM	30	35.9	37.6	1.7	17.9
5	9:39 AM	10:09 AM	30	35.5	37.3	1.8	16.7
6	10:10 AM	10:40 AM	30	35.5	37.2	1.7	17.9
7	10:41 AM	11:11 AM	30	35.2	37.1	1.9	15.6
8	11:12 AM	11:42 AM	30	34.4	36.2	1.8	16.7
9	11:43 AM	12:13 PM	30	35.3	37.0	1.7	17.9
10	12:14 PM	12:44 PM	30	36.1	37.8	1.7	17.9
11	12:45 PM	1:15 PM	30	36.5	38.2	1.7	17.9
12	1:16 PM	1:46 PM	30	35.5	37.2	1.7	17.9

COMMENTS: Sunny, low 60s, dry

Infiltration Rate (in/hr) = $(\Delta H*60min/hr*r)/\Delta t\ (r+2Havg)$

H avg = $(H_o - Hf)/2$

Infiltration Rate (in/hr): 0.26

Percolation Test Data Sheet

Project:	Kaiser Moreno Valley	Project No.:	19-0918-0	Date:	5/8/2019
Test Hole No.:	P-7	Tested By:	520STA		
Test Hole Depth (In.) , DT:	60	USCS Soil Classification:	SM		
Test Hole Dimensions (inches)			Length	Width	
Diameter In.) if round=	8	Sides (if rectangular)=	n/a	n/a	

Sandy Soil Criteria*

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or equal to 6"? (y/n)
1	8:12 AM	8:37 AM	25	26.0	40.0	14.00	Yes
2	10:00 AM	10:25 AM	25	24.0	33.0	9.00	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximate 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	Do Initial Depth to Water (In.)	Df Final Depth to Water (In.)	ΔD Change in Water Level (In.)	Percolation Rate (min./in.)
1	8:21 AM	8:31 AM	10	47.3	50.3	3.0	3.3
2	8:32 AM	8:42 AM	10	48.0	50.2	2.2	4.6
3	8:43 AM	8:53 AM	10	47.9	49.7	1.8	5.6
4	8:54 AM	9:04 AM	10	48.0	49.8	1.8	5.6
5	9:05 AM	9:15 AM	10	48.0	49.6	1.6	6.4
6	9:16 AM	9:26 AM	10	48.0	49.1	1.1	9.3
7	9:27 AM	9:37 AM	10	47.9	49.1	1.2	8.3
8	9:38 AM	9:48 AM	10	47.9	49.1	1.2	8.3
9							
10							
11							
12							

COMMENTS: Sunny, low 60s, dry

Infiltration Rate (in/hr) = (ΔH*60min/hr*r)/Δt (r+2Havg)

H avg = (Ho- Hf)/2

Infiltration Rate (in/hr): 1.07

Percolation Test Data Sheet

Project:	Kaiser Moreno Valley	Project No.:	19-0918-0	Date:	5/8/2019
Test Hole No.:	P-8	Tested By:	520STA		
Test Hole Depth (In.) , DT:	60	USCS Soil Classification:	SM		
Test Hole Dimensions (inches)			Length	Width	
Diameter In.) if round=	8	Sides (if rectangular)=	n/a	n/a	

Sandy Soil Criteria*

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or equal to 6"? (y/n)
1	8:10 AM	8:35 AM	25	29.0	42.0	13.00	Yes
2	9:57 AM	10:22 AM	25	26.5	36.0	9.50	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximate 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (In.)	D_f Final Depth to Water (In.)	ΔD Change in Water Level (In.)	Percolation Rate (min./in.)
1	8:23 AM	8:33 AM	10	39.6	41.6	2.0	4.9
2	8:34 AM	8:44 AM	10	39.0	40.7	1.7	6.0
3	8:45 AM	8:55 AM	10	37.9	39.7	1.8	5.6
4	8:56 AM	9:06 AM	10	37.7	39.2	1.6	6.4
5	9:07 AM	9:17 AM	10	38.2	39.6	1.4	6.9
6	9:18 AM	9:28 AM	10	38.2	39.6	1.4	6.9
7	9:29 AM	9:39 AM	10	37.9	39.2	1.3	7.6
8							
9							
10							
11							
12							

COMMENTS: Sunny, low 60s, dry

Infiltration Rate (in/hr) = $(\Delta H*60min/hr*r)/\Delta t\ (r+2Havg)$

H avg = $(H_o - Hf)/2$

Infiltration Rate (in/hr): 0.68

Percolation Test Data Sheet

Project:	Kaiser Moreno Valley	Project No.:	19-0918-0	Date:	5/8/2019
Test Hole No.:	P-9	Tested By:	520STA		
Test Hole Depth (In.) , DT:	60	USCS Soil Classification:	SM		
Test Hole Dimensions (inches)			Length	Width	
Diameter In.) if round=	8	Sides (if rectangular)=	n/a	n/a	

Sandy Soil Criteria*

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or equal to 6"? (y/n)
1	9:23 AM	9:48 AM	25	15.0	29.0	14.00	Yes
2	9:48 AM	10:13 AM	25	13.0	24.0	11.00	Yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximate 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (In.)	D_f Final Depth to Water (In.)	ΔD Change in Water Level (In.)	Percolation Rate (min./in.)
1	10:14 AM	10:24 AM	10	35.4	37.7	2.3	4.4
2	10:25 AM	10:35 AM	10	36.0	37.8	1.8	5.6
3	10:36 AM	10:46 AM	10	35.8	37.7	1.9	5.2
4	10:47 AM	10:57 AM	10	35.4	37.2	1.8	5.6
5	10:58 AM	11:08 AM	10	35.4	37.2	1.8	5.6
6	11:09 AM	11:19 AM	10	35.5	37.3	1.8	5.6
7	11:20 AM	11:30 AM	10	35.4	37.2	1.8	5.6
8							
9							
10							
11							
12							

COMMENTS: Sunny, low 60s, dry

Infiltration Rate (in/hr) = (ΔH*60min/hr*r)/Δt (r+2Havg)

H avg = (H_o - Hf)/2

Infiltration Rate (in/hr): 0.84

Percolation Test Data Sheet

Project:	Kaiser Moreno Valley	Project No.:	19-0918-0	Date:	5/8/2019
Test Hole No.:	P-10	Tested By:	520STA		
Test Hole Depth (In.) , DT:	60	USCS Soil Classification:	SM		
Test Hole Dimensions (inches)			Length	Width	
Diameter In.) if round=	8	Sides (if rectangular)=	n/a	n/a	

Sandy Soil Criteria*

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or equal to 6"? (y/n)
1	9:26 AM	9:51 AM	25	16.0	24.0	8.00	Yes
2	9:51 AM	10:16 AM	25	9.0	13.0	4.00	No

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximate 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (In.)	D_f Final Depth to Water (In.)	ΔD Change in Water Level (In.)	Percolation Rate (min./in.)
1	10:12 AM	10:42 AM	30	35.0	39.0	4.0	7.6
2	10:43 AM	11:13 AM	30	35.4	39.0	3.6	8.3
3	11:14 AM	11:44 AM	30	35.6	39.0	3.4	8.9
4	11:45 AM	12:15 PM	30	35.5	39.0	3.5	8.6
5	12:16 PM	12:46 PM	30	35.5	38.8	3.2	9.3
6	12:47 PM	1:17 PM	30	35.6	38.8	3.1	9.6
7	1:18 PM	1:48 PM	30	35.4	38.5	3.1	9.6
8	1:49 PM	2:19 PM	30	35.8	38.8	3.0	10.0
9	2:20 PM	2:50 PM	30	35.5	38.8	3.2	9.3
10	2:51 PM	3:21 PM	30	35.8	38.8	3.0	10.0
11	3:22 PM	3:52 PM	30	35.4	38.4	3.0	10.0
12	3:53 PM	4:23 PM	30	35.5	38.5	3.0	10.0

COMMENTS: Sunny, low 60s, dry

Infiltration Rate (in/hr) = $(\Delta H*60min/hr*r)/\Delta t\ (r+2Havg)$

H avg = $(H_o - Hf)/2$

Infiltration Rate (in/hr): 0.48

APPENDIX B

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APPENDIX B

REFERENCES

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GEOTECHNICAL REPORT

KAISER PERMANENTE

MORENO VALLEY MEDICAL CENTER
CENTRAL UTILITY PLANT (CUP)
27300 IRIS AVENUE
MORENO VALLEY, CALIFORNIA

GEOBASE, INC.

GEOTECHNICAL REPORT

KAISER PERMANENTE

MORENO VALLEY MEDICAL CENTER
CENTRAL UTILITY PLANT (CUP)
27300 IRIS AVENUE
MORENO VALLEY, CALIFORNIA

Prepared for:

Kaiser Foundation Health Plan, Inc.
Moreno Valley, California

By:
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GEOBASE INC (June 2010)

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GeoVision Geophysical Services, Inc. (July 21, 2017)

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I. INTRODUCTION

1.1 General

Kaiser Foundation Health Plan, Inc. is planning the construction of a new Central Utility Plant (CUP) on the Moreno Valley Medical Center (MVMC) campus, located at 27300 Iris Avenue, in the City of Moreno Valley, California. The MVMC campus location is shown on Figure A-1, Appendix A and the proposed new CUP location is shown on Figure A-2, Appendix A. GEOBASE, INC. (GEOBASE) was retained by Kaiser Foundation Health Plan, Inc. to complete a geotechnical investigation for the proposed new CUP.

For this geotechnical investigation we were provided with:

- A site plan, prepared by CO Architects, showing the existing Hospital and existing CUP, and proposed new CUP. This plan is reproduced herein as Figure A-2, Appendix A, Site, Boring and CPT Locations Plan.
- Topographic Survey Plan prepared by SB&O Inc. dated October 27, 2009 showing the layout of the existing buildings and site features. The location of the proposed New CUP, borings, CPT's and geophysical survey lines have been added to this plan which is presented herein as Figure A-3, Appendix A, Site Topographic Survey Plan.
- Geotechnical reports pertinent to the site (see references).

This geotechnical report incorporates results of the field and laboratory testing, and the geologic-seismic study, as required by the guidelines prepared by the Department of Conservation, California Geological Survey (CGS) and the California Office of Statewide Health and Planning Department (OSHPD). Both general and specific recommendations pertinent to suitable site development and foundation design, respectively, are provided. Construction guidelines related to the geotechnical aspects of the project are also addressed.

1.2 Objectives of the Geotechnical Investigation

The objectives of the geotechnical investigation are to obtain soil parameters and an understanding of site geologic conditions in order to provide recommendations pertinent to suitable site development and foundation design. These recommendations will assist with final design and construction of the project as planned.

1.3 Scope of Services

To achieve the objectives of the geotechnical investigation, stated above, the services provided during the course of this investigation included:

- a review of available published and unpublished geotechnical, geological and seismological reports, and maps pertinent to the site.
- Field exploration program consisting of advancing eleven (11) borings, fourteen (14) Cone Penetration Tests (CPT) and one (1) test pit;
- Logging the borings and test pit, and selection of samples representative of the materials encountered for laboratory testing;
- Field testing consisting of the Standard Penetration Test (SPT) and CPT, including shear wave velocity measurements;
- Field testing consisting of two (2) geophysical survey lines, utilizing multi–channel array surface wave (MASW) methods.
- Selection of appropriate laboratory tests and laboratory testing;
- Evaluation of data obtained from the above, and engineering analyses; and,
- Preparation of this report describing the field investigation, summarizing the results of field testing, laboratory testing and engineering analyses, and providing appropriate recommendations for site development and foundation design.

II. PREVIOUS RELEVANT REPORT

GEOBASE has completed a geotechnical investigation of the existing hospital addition and existing CUP for Kaiser Foundation Health Plan, Inc. The results of this investigation were presented in a report titled "Geotechnical Investigation, Kaiser Permanente MVCH, Hospital Addition and CUP, 27300 Iris Avenue, Moreno Valley, California" (GEOBASE, 2010). This report was approved by the regulating agencies and the Emergency Room Expansion was built. Relevant field boring logs, CPT's and laboratory test results of the aforementioned geotechnical investigation have been evaluated and are incorporated in this investigation as supplemental data.

The locations of the pertinent borings and CPT's are shown on Figures A-2 and A-3, Appendix A. Relevant laboratory test data are presented in Appendices B and C.

III. SITE AND PROJECT DESCRIPTIONS

3.1 Site Description

The Kaiser Permanente - Moreno Valley Medical Center (MVMC) site is located on an approximately twenty (20) acre site at 27300 Iris Avenue, in the City of Moreno Valley, California. The MVMC site is bounded by medical office buildings to the east and west, Iris Avenue to the south, and an empty/vacant lot to the north. The site is gently sloping to the north and is occupied by the Hospital, the CUP, a medical office building (MOB), and at-grade parking and driveways.

3.2 Project Description

The proposed new CUP is located at the northeast corner of the MVMC site, as shown on the Site, Boring and CPT Locations Plan, Figure A-2, Appendix A.

The new CUP project area consists of vacant land and slopes gently to the northwest, approximately two (2) percent. Proposed construction is anticipated to consist of a three (3) storey at-grade structure. Column loads were not available at the time of writing this report.

IV. SITE INVESTIGATION

4.1 Field Program

The field investigation for the proposed MVMC site was carried out on June 07, 08, 09 and 22, 2017 by advancing eleven (11) borings using a truck-mounted CME-75 drill rig fitted with hollow-stem augers, fourteen (14) CPT's and one (1) test pit. The borings, CPT's and test pit were located in the field by utilizing a Trumeter 550SE (roll-a-tape) and elevations were estimated from Site, Boring, CPT Locations Plan and Site Topographic Survey Plan (Figures A-2 and A-3, respectively, Appendix A). Therefore, the locations and elevations should be considered accurate only to the degree implied by the methods used.

Geophysical survey lines, utilizing multi-channel array surface wave (MASW) methods, were

conducted by GeoVision Geophysical Services, Inc. on July 10, 2017.

Three (3) borings (B-9 thru B-11, inclusive) and four (4) CPT's (CPT-6 and CPT-12 thru CPT-14, inclusive) advanced during this investigation are considered relevant to the proposed new CUP. All borings and CPT's at the MVMC site were advanced to maximum penetration depths of seventy-one and one-half (71.5) feet and seventy-five (75) feet, respectively, except for CPT-2 and CPT-5 locations where refusal was obtained at shallow depths. In this respect, the test pit was excavated at CPT-5 location and advanced to eighteen (18) feet depth, beyond the depth at which refusal was obtained, to confirm that refusal was due to a hard soil layer. Two (2) seismic CPT's (SCPT-4 and SCPT-12) were advanced to a depth of 100 feet to determine shear wave velocities of the subsoils. All borings were hand-augered in the upper five (5) feet.

The Log of Borings, together with the Explanation of Terms and Symbols used are shown on Figures B-1 thru B-12, inclusive, CPT plots are presented on Figures B-13 thru B-26, inclusive, and the Log of Test Pit on Figure B-27, Appendix B. Relevant borings and CPT's from a previous investigation (GEOBASE, 2010) are presented herein as Figures B-28 thru B-31, inclusive, Appendix B.

Field testing consisted of: Standard Penetration Test (SPT); Cone Penetration Tests (CPT's), including Seismic Cone Penetration Testing at two (2) CPT locations (SCPT-4 and SCPT-12) to determine the shear wave velocities of the subsoils; and, geophysical survey lines to determine shear wave velocities of the subsoils.

- The SPT test (ASTM D 1586) involves failure of the soil around the tip of a split spoon sampler for a condition of constant energy transmittal. The split spoon, two (2) inches outside diameter and one and three-eights (1-3/8) inches inside diameter, is driven eighteen (18) inches and the number of blows required to drive the sampler the last foot is recorded as the "N" value, or SPT blow count. The driving energy is provided by a 140-pound weight dropping thirty (30) inches.

- The Cone Penetration Tests (CPT's) were performed in accordance with ASTM D 3441. The CPT equipment consists of a cone assembly mounted at the end of a series of hollow sounding rods. A set of hydraulic rams is used to push the cone and rods into the soil, and a continuous record of cone tip resistance, friction resistance and pore water pressures versus depth is obtained in digital form at the ground surface. A specially designed truck

is used to transport and house the test equipment and to provide a ten (10) ton reaction to the thrust of the hydraulic rams. Near-continuous CPT records provide: approximate correlations with soil classification; relatively accurate definition of the thickness of various soil layers; subsoils data for liquefaction and seismic settlement analyses; and, engineering properties of the subsoils for static settlement analyses.

- Shear wave velocity measurements were carried out at five (5) foot intervals at two (2) CPT locations, SCPT-4 and SCPT-12.

- Two (2) geophysical survey lines utilizing multi-channel array surface wave (MASW) methods were completed to obtain the shear wave velocity profile of the subsoils. A discussion of field procedures, geophysical techniques, data processing and interpretation, and the results of the geophysical survey are given in Appendix B.

Sampling consisted of:

- Collection of bulk samples at selected locations retrieved from the auger;

- Collection of samples retrieved from the Standard Penetration Test (SPT) split spoon sampler; and,

- Collection of soil samples at selected locations using a Modified California Sampler. The soil samples were retained in a series of brass rings, each having an inside diameter of 2.41 inches and a height of one (1) inch. These ring samples were placed in close- fitting, moisture-tight containers for shipment to the laboratory.

4.2 Laboratory Testing

The samples obtained during the field program were returned to the laboratory for visual examination and testing. The soils were classified in accordance with ASTM D 2487 and D 2488.

The laboratory testing program consisted of the following:

- Laboratory determination of water (moisture) content of soils, rock, and soil-aggregate mixtures (ASTM D 2216), and dry density (ASTM D 2937);

- Particle size analysis of soils (ASTM D 422);
- Standard test methods for amount of material in soils finer than the No. 200 Sieve (ASTM D1140); and,
- Atterberg Limits (ASTM D 4318);
- Direct shear test of soils (ASTM D 3080);
- Consolidation tests (ASTM D 2435);
- Maximum dry density and optimum moisture content (ASTM D 1557);
- Expansion potential of soils (ASTM D 4829);
- Resistance R-Value (CT 301); and,
- Water soluble sulfate content of soils (CT 417); pH and electrical resistivity (CT 643); and water soluble chlorides (CT 422).

The laboratory test results from this investigation and previous investigation (GEOBASE, 2010) are presented on the Log of Borings, Figures B-2 thru B-12, inclusive, and B-28 and B-29, Appendix B, where applicable and in Appendix C.

V. GEOLOGIC SETTING

5.1 Regional Geology

The MVMC site is located in the Northern portion of the Peninsular Ranges Physiographic Province of California on a structural unit known as the Perris Block (CGS, 2002). The Perris Block is bounded on the northeast by the San Jacinto Fault Zone, on the southwest by the Elsinore Fault Zone, and on the north by the Cucamonga Fault Zone. The southern boundary of the Perris Block is not as distinct, but is believed to coincide with a complex group of faults trending southeast from the Murrieta, California area (Kennedy, 1977 and Mann, 1955). The Peninsular Ranges are characterized by northwest trending elongated alluvial valleys and by elevated Mesozoic age intrusive rock masses of the California batholith, flanked by metavolcanic and metasedimentary rocks that form the mountainous portions of the province. Various thicknesses of alluvial sediments derived from the erosion of the elevated portions of the region fill the low-lying areas such as the Moreno Valley where the site is located. According to Morton

and Matti (2001), the sediments that infill the Moreno Valley have been differentiated into Holocene and late Pleistocene age young alluvial fan and alluvial valley deposits and into very old alluvial fan deposits of early Pleistocene age. Maximum depths of valley fill in the area are reported to reach approximately 900 feet in the western and northern portions of the San Jacinto Groundwater Basin, where the site is located, but may exceed 5,000 feet in the eastern part of the same basin between the Casa Loma and Claremont faults (CDWR, 2006). Morton and Matti (2001) indicate that the young alluvial fan and valley deposits consist predominantly of sandy materials with silty, gravelly and cobbly interbeds. The very old alluvial fan deposits are reported to consist of mostly well-dissected, well-indurated sand deposits that typically flank the bedrock outcrops in the immediate vicinity. Very old alluvium underlies the subject site whereas Cretaceous age quartz diorite constitutes the hilly areas of the Perris State Recreational area to the south. The alluvial sequence at the site is inferred to rest unconformably on Cretaceous age crystalline bedrock. Figure A-4, Appendix A, presents the Regional Geology Map.

5.2 Site Geology

The MVMC is located near the foothills of the mountains that constitute the Perris State Recreational area to the south. The site is located at an approximate elevation of 1,530 feet above mean sea level (amsl) on a gently northwest sloping surface that grades down towards the Moreno Valley (Figures A-1 and A-4, Appendix A). Drainage at the site area is presently controlled by storm run-off sewers, street and/or natural drainages.

GEOBASE advanced four (4) exploratory soil borings and three (3) cone penetration tests (CPT's) at the site in 2010, and an additional eleven (11) borings, fourteen (14) CPT's and one (1) test pit in June 2017 (Figure A-2, Appendix A, Site, Boring and CPT Locations Plan). Soil borings were drilled to a maximum depth of seventy-one and one-half (71.5) feet, whereas the CPT's had a maximum depth that ranged up to 100 feet.

All the soil borings and CPT's advanced by GEOBASE to a maximum depth of seventy-one and one-half (71.5) and 100 feet below ground surface (bgs), respectively, confirm that the MVMC site is underlain by unconsolidated Quaternary alluvial fan deposits covered by a thin mantle of man-made fill (Figures B-2 thru B-31, inclusive, Appendix B). The man-made fill materials consist of approximately up to eight (8.0) feet of predominantly brown, silty sands (SM) at the boring locations. The unconsolidated alluvium consists predominantly of medium-grained brown silty sands with a five (5.0) to ten (10.0) foot thick orange to brown, silt (ML) interbed in the upper

twenty-five (25) feet. This silt (ML) interbed was not encountered at soil boring location B-4. A five (5) foot thick silty layer was also encountered at fifty (50) to fifty-five (55) and fifty-five (55) to sixty (60) feet bgs at boring locations B-6 and B-3, respectively. The density of the alluvial materials at the site generally increases with depth. Unconsolidated alluvial materials were encountered to the total depth of penetration of all the soil borings that have been advanced at the site.

Our interpreted surface distribution of geologic materials encountered during the site investigations is illustrated in Figure A-2, Appendix A. Geologic Sections A-A' and B-B' across the new CUP site are given on Figures A-5 and A-6, Appendix A, respectively.

VI. SUBSURFACE CONDITIONS

6.1 Subsoil Conditions

At the boring and CPT locations within paved areas, the pavement section consisted of approximately four (4) to six (6) inches of asphaltic concrete overlying approximately four (4) to five (5) inches of aggregate base.

The generalized stratigraphic profile, at the boring locations relevant to the new CUP, consisted of up to five (5) feet of fill soils overlying native silty sands and sands with traces of gravel to the maximum depth of exploration, sixty-one and one-half (61.5) feet. The fill soils may be thicker at other locations. Unless a compaction report is made available, these fills are considered "undocumented fills".

The SPT test results and CPT data indicate that the native silts and silty sands can be generally inferred to be in a "stiff" to "hard" and "medium dense" to "very dense" state, respectively; however, very loose silts and silty sands were encountered at shallow depths.

The silty samples tested showed non-plastic behavior, and the soil natural moisture contents ranged from four (4) to thirteen (13) percent, with the higher values measured in the siltier samples. Expansion potential of the samples tested showed "very low" potential for expansion(Expansion Indices = 4 at the new CUP location; and, 0 to 12 at the MVMC site).

6.2 Regional Groundwater Conditions

The MVMC site is located in the western portion of the San Jacinto Groundwater Basin. The San Jacinto Groundwater Basin underlies San Jacinto, Perris, Moreno, and Menifee Valleys in western Riverside County. This basin is bounded by the San Jacinto Mountains on the east, the San Timoteo Badlands on the northeast, the Box Mountains on the north, the Santa Rosa Hills and Bell Mountain on the south, and unnamed hills on the west. The valleys are drained by the San Jacinto River and its tributaries.

According to the CDWR (2006), groundwater in the western portion of the San Jacinto Basin occurs under confined conditions. The primarily source of recharge for the confined aquifers is found where the San Jacinto River and the Baustita Creek enter the San Jacinto Valley CDWR (2006). Percolation of water stored in Lake Perris has been an additional source of recharge along with reclaimed water percolation by means of storage ponds administered by Eastern Municipal Water District.

6.3 Site Groundwater Conditions

During our exploratory investigations, groundwater was not encountered to the maximum depth of boring penetration, seventy-one and one-half (71.5) feet. The exploratory soil borings drilled by GEOBASE at the MVMC site did not encounter groundwater; that is in general agreement with the conditions reported by the CDWR (2017).

6.4 Historic High Groundwater Level

Historical groundwater level data was obtained online from the Water Data Library operated by the CDWR (2017). There are five (5) monitoring wells within a two (2) kilometer radius of the site. Monitoring well locations are shown on Figure A-4, Appendix A, and pertinent data is summarized in Table I.

TABLE I
HIGHEST GROUNDWATER LEVEL OBSERVED AT MONITORING WELLS

Point	Well No.	Period of Measurements	Date of Highest Recorded Groundwater (mm/dd/yr)	Highest Recorded Groundwater Below Existing Grade (ft.)	Ground Elevation* (ft.)	Groundwater Elevation Above Mean Sea Level (ft)
1	EMWD12077	10/04/2011 to 04/11/2017	04/11/2017	34.9	1507.4	1472.5
2	EMWD25696	11/07/2011 to 04/11/2017	04/11/2017	41.0	1506.2	1465.2
3	EMWD25695	11/07/2011 to 04/11/2017	04/11/2017	44.5	1507.4	1462.9
4	EMWD10141	11/03/2011 to 04/11/2017	04/07/2017	59.8	1545.8	1486.0
5	03S03W15F001S	05/29/1951 to 09/15/1986	04/01/1952	99.8	1539.0	1439.2

* Existing Ground Surface Elevation at the Well Location

Reference : California Department of Water Resources (CDWR); http://www.well.water.ca.gov/cgi-shl/gwater.

Groundwater level reading for water well number EMWD12077 are available for the time period of 2011 to 2017. Ground surface elevation for this well is reported to be 1,507.4 feet above mean sea level (amsl), whereas the approximate elevation for the new CUP site was estimated at approximately 1,525 feet amsl (an approximate difference in elevation of 18 feet). The shallowest ground water level condition of 1,472.5 feet amsl (depth of 34.9 below ground surface [bgs]) at this well occurred on April 11, 2017. Therefore, it can be concluded that the MVMC site is located on a confined aquifer that appears to have been recharged since 2014. No historical groundwater data is available prior to 2011. Well number 03S03W115F001S has historical data dating back to 1951. Unfortunately, the data ends in 1986.

Projecting the higher groundwater elevation noted above across the MVMC site, the highest groundwater elevation is obtained to be at approximately fifty-three (53) feet bgs based on current well data. For design purposes, historic highest groundwater level in excess of fifty (50) feet bgs shall be considered for the site.

VII. SEISMOLOGY

7.1 Regional Faulting

The two principal seismic considerations for most properties in Southern California are ground surface rupture along fault traces and damage to structures due to seismically induced ground shaking. The fault classification system adopted by the California Geological Survey (CGS), relative to the State legislation, delineates Earthquake Fault Zones along active or potentially active faults (Alquist-Priolo Act). Such Earthquake Fault Zones are in turn used to establish setbacks of structures from active fault zones. An active fault is defined by the CGS as a "sufficiently active and well defined fault" that has exhibited surface displacement within Holocene time (approximately the last 11,000 years). A potentially active fault is defined by the State as a fault with a history of movement within Pleistocene time (between 11,000 and 1.6 million years ago). Any fault proven not to have moved within the last 1.6 million years is considered inactive.

The closest known active faults to the site are the San Jacinto, San Andreas and Elsinore faults. A California Fault Map, showing the geographic relationship of these faults to the site is presented as Figures A-7 and A-8, Appendix A. A brief description of these faults is provided below.

7.1.1 *San Jacinto Fault – San Jacinto Valley Segment*

The San Jacinto Fault is one of the most active faults in California, having been an important source of moderate- to large-magnitude earthquakes during this century. What makes the San Jacinto Fault of extreme interest to scientists and state building engineers is that the fault is remarkably long and has a potential of hundreds of kilometers of rupture length, thus creating larger magnitude earthquakes and potentially affecting larger areas. This fault, over approximately 210 kilometers in total length, extends to the southern border of California and joins the San Andreas Fault west of the city of San Bernardino. The sense of movement is right-lateral strike-slip. According to the Southern California Earthquake Center (SCEC,1995), slip is regularly released on this fault in the form of small earthquakes (M_L 3 and 4). Historically, this fault has experienced numerous medium sized earthquakes (M_L of upper 4's and 5's) and several large earthquakes (larger than M_L 6). In the early 1900s large earthquakes in the Hemet and San Jacinto areas produced surface rupture. Using information on fault geometry, historical seismicity, and slip-rate data, Petersen et al (1996) divided this fault into eight segments. These segments, from north to south are: San Bernardino Valley, San Jacinto Valley, Anza, Coyote Creek, Borrego

Mountain, Superstition Hills, Superstition Mountains, and Imperial.

The closest active fault segment of the San Jacinto Fault to the MVMC site is the northwest-trending, right-lateral strike-slip San Jacinto Valley fault segment, located approximately 4.8 kilometers (km) to the northeast of the site. The San Jacinto Valley fault segment extends approximately 43.0 km from the northern end of the San Jacinto Valley to the junction of the Claremont and Casa Loma faults to the south.

The San Jacinto Valley segment may have been the source of the December 25, 1899 and April 21, 1918 earthquakes with magnitudes of 6.4 and 6.8 that occurred on the Casa Loma and Claremont faults, respectively (SCEC, 1995 and Treiman and Lundbergh, 1999). Petersen et al (1996) and SCEC (1995) assigned a slip-rate of 12+/- 6 millimeters/year (mm/yr), a M_w 6.9 and a recurrence interval of sixty-five (65) to ninety-eight (98) years. Similarly, the estimate of characteristics displacement was assigned at 1.0 +/- 0.2 meters (m).

7.1.2 *San Andreas Fault – San Bernardino Mountains Segment*

The San Andreas Fault extends for several hundred miles from the Gulf of California in the south to Cape Mendocino in northern California and it is the main element of the boundary between the Pacific and North American tectonic plates. The San Andreas Fault extends as a continuous trace from Cape Mendocino to San Bernardino, bends eastward, and continues southeast near Indio. The central and southern San Andreas Fault was divided by SCEC (1995) and Petersen et al (1996) into the following five (5) fault segments: Cholame, Carrizo, Mojave, San Bernardino Mountains, and Coachella Valley. It is important to emphasize that although these segments are treated as independent sources of earthquakes, historical and paleoseismological observations show that ruptures may overlap and that some segments may both produce their own earthquakes and fail when large ruptures nucleate in an adjacent segment and propagate into them. The fault segments are composed of numerous subparallel right-lateral, strike-slip faults that range from 0.5 to 11 km in length. The Fort Tejon earthquake of approximately Mw 8, one of the greatest earthquakes ever recorded in the United States, occurred along the San Andreas Fault in January 9, 1857 and produced a surface rupture of approximately 350 km in length from Cholame on the north to the Cajon Pass on the south.

The closest significant San Andreas Fault segment to the MVMC site is the northwest-trending, right-lateral strike-slip San Bernardino Mountains segment, located approximately 23.7 km to the

northeast of the site. The San Bernardino Mountains segment is approximately 103 km long and extends from a few kilometers northwest of Cajon Creek southeast to the area between Thousand Palms and Myoma. The San Bernardino Mountains segment is characterized by a large left-restraining step between the Mojave segment to the northwest and the Coachella segment to the southeast. The San Andreas Fault Zone is very complex in this restraining step, consisting of dextral strike-slip, thrust, and oblique slip faults (Bryant and Lundbergh, 2002). According to the SCEC (1995), the past five ground surface rupture events at Wrightwood occurred approximately in 1812, 1693, 1587, 1452, and 1192 of the current era. In addition, displacements of 4 m during the 1812 event, and a cumulative offset of 7 to 8 m of right slip for the 1812 and 1693 earthquakes, have been measured in the Cajon Pass area. Therefore, based on paleoseismic studies, the San Bernardino Mountains segment is believed to have last ruptured in 1812. The Wrightwood site has averaged one surface-rupturing earthquake every 124 years since 1192. The most recent three events have been closer together, averaging 112 years between events.

Petersen et al (1996) and the SCEC (1995) assigned a slip rate of 24+/- 6 mm/yr, a M_w 7.5, and a recurrence interval of 14 (+91, -60) years to this segment.

7.1.3 *Elsinore Fault – Glen Ivy and Temecula Segments*

The Elsinore fault zone forms the northeast boundary of the Santa Ana Mountains and extends nearly 200 km from Whittier to the Mexican border. Individual segments within the Los Angeles region are three (3) to forty (40) km long and display reverse right oblique, right-lateral strike-slip, and normal-right-oblique-slip late Quaternary or Holocene offsets. Petersen et al (1996) divided this fault into six segments which from north to south are: Whittier, Glen Ivy, Temecula, Julian, Coyote Mountain, and Laguna Salada. In addition, several of the fault segments possess locally their own names. For example, the Glen Ivy North and Glen Ivy South branches are located Northwest of Lake Elsinore. Heading southeast from Lake Elsinore, the two parallel fault strands are denominated Wildomar Fault (the more easterly) and Willard Fault. At its northern end, the Glen Ivy segment splays into two (2) fault segments, the Chino – Central Avenue and the Whittier faults.

The closest significant Elsinore Fault segments to the MVMC site are the northwest-trending, right-lateral strike-slip Glen Ivy and Temecula segments, located approximately 32.1 km to the southwest of the site.

The Glen Ivy fault segment extends for approximately 38 km. According to the SCEC (1995), this segment at Glen Ivy marsh shows that five (5) and probably six (6) earthquakes have disrupted the sediments there since approximately 1060, yielding an average recurrence interval of 150 to 200 years. These events occurred in 1910, post-1660, 1360 to 1660, about 1300, 1260, and about 1060. The most recent surface rupture is associated with the 1910 Temescal Valley earthquake with an estimated magnitude MW6.0 (Ziony and Jones, 1989). The surface displacement in this event was approximately 250 to 300 millimeters (mm). This fault segment has been assigned a probable MW6.8 with a slip rate of 5 mm/yr and a recurrence interval of 340 years (Petersen et al, 1996).

The Temecula Fault segment extends for approximately 62 km. Trenching across the Wildomar Fault in the Temecula segment has yielded a late Holocene slip rate for the principal strand. A fluvial channel, dated by C-14 at about 2000 to 2400 years, is laterally displaced approximately 10+/- 1 m and yields a slip rate of about 4.2 mm/yr (SCEC, 1995). This rate is considered as minimum since several minor strands of the fault also have a geomorphic expression. Nevertheless, it is similar to the rates determined at other locations along the Elsinore Fault. SCEC (1995) concluded a maximum average recurrence interval of between 250 and 600 years and a slip rate of 5.0+/- 2.0 mm/yr for this segment. Because no measurements of characteristic displacements are available, SCEC (1995) calculated a value of 1.2+/- 0.3 m using the segment length and empirical relations postulated by Wells and Coppersmith in 1994. According to SCEC (1995), this yields an average recurrence interval of 240 (+260, -111) years.

7.2 Historic Earthquakes

A map of recorded earthquake epicenters is provided as Figure A-9, Appendix A. This map can be accessed online by the Southern California Earthquake Data Center at Cal Tech. The Southern California Earthquake Data Center identifies three major earthquakes magnitude 6.0 or greater that have occurred on the San Jacinto fault since 1899, within a fifty (50) mile radius of the subject site: North San Jacinto Fault Earthquake near Loma Linda occurred July 22, 1923 with a magnitude of 6.3; the San Jacinto Earthquake just east of Hemet occurred April 21, 1918 with a magnitude of 6.8; and, the San Jacinto Fault (Terwilliger Valley) Earthquake also known as the Borrego Springs Fault, occurred in 1937 with a magnitude of 6.0.

The only large historical earthquake that can be attributed to the Elsinore Fault is a magnitude 6.0 that occurred in 1910 in the Temescal Valley area.

Four (4) other earthquakes of magnitude 4.0 or greater are identified within this fifty (50) mile radius: the Anza Gap Earthquake M 4.8; the White Wash Earthquake east of Anza occurred on February 25, 1980, M 5.5; the Chino Hills Earthquake in 2008, M 5.4; and, the Upland Earthquake of 1990, M 5.4.

7.3 Site Accelerations

7.3.1 *Site Coordinates*

The site latitude and longitude are 33.898 degrees north and 117.186 degrees west, respectively.

7.3.2 *Site Classification*

The site classification procedure recommended by CBC 2016, subsection 1613A.3.2, which references ASCE 7-10, Chapter 20, was adhered to.

The Cone Penetration Tests (CPT's) and geophysical surveys results provided measured average shear wave velocities at a minimum 402 m/s within the top 100 feet. The shear wave velocity profiles of the CPT's and geophysical surveys presented on Figure A-10, Appendix A, show good correlation. Based on the aforementioned measured shear wave velocities, to develop seismic design criteria, the site subsoils within the top 100 feet are judged to be Site Class C.

7.3.3 *Seismic Design Criteria*

Based on CBC 2016, subsection 1616A.1.3, which references and modifies ASCE 7-10, subsection 11.4.7, since the structure is assigned to Seismic Design Category D and S_1 is less than 0.75g (see subsection 7.3.3.2), a site-specific GMHA was not completed. The following subsections present the seismic design parameters based on mapped parameters.

7.3.3.1 Mapped Accelerations Response Spectra

Mapped, risk-targeted maximum considered earthquake, MCE_R, spectral response accelerations for 0.2 and 1.0 second periods are provided in maps published in the ASCE 7-10, which is the reference used in the CBC 2016. These maps are prepared by the USGS and the California portion of the map was prepared jointly with the CGS. These maps use results of seismic hazard analyses from both probabilistic and deterministic procedures, and are applicable to Site Class

B and five (5) percent of critical damping. The mapped site accelerations are adjusted for site class effects using parameters Fa and Fv, which are functions of site class and mapped site spectral accelerations.

The mapped design horizontal spectral accelerations were evaluated in accordance with ASCE 7-10, using the US Seismic Design Maps Application (USGS, 2017) available at the USGS website: http://geohazards.gov/designmaps/us/application.php. This web application requires the inputs of site location (coordinates) and site soil classification.

The project site is Site Class C and coefficient values Fa and Fv of 1.0 and 1.3, respectively, are obtained for the site. Mapped MCE_R accelerations obtained for the project site are summarized in Table II, below.

TABLE II
MCE_R MAPPED ACCELERATIONS

		Site Class C	
PERIOD (SECONDS)	MAPPED ACCELERATION PARAMETERS (g)	MCE_R ACCELERATIONS ADJUSTED FOR SITE CLASS EFFECTS (g)	RISK COEFFICIENTS
0.2	S_s: 1.673	1.673	C_{RS} = 1.008
1.0	S_1: 0.729	0.948	C_{R1} = 0.976

Based on Table II, the mapped spectral response accelerations, adjusted for Site Class C, S_{MS} and S_{M1} are 1.673g and 0.948g, respectively.

7.3.3.2 Seismic Design Category

The mapped spectral response acceleration parameter at one (1) second period (S_1) is 0.729g which is less than 0.75g. The design spectral response acceleration coefficients S_{DS} and S_{D1} are 1.115 and 0.632g, respectively. Therefore, a Seismic Design Category D should be used for the design of the proposed structure per Section 1613A.3.5 of CBC 2016.

7.3.3.3 Design Spectra Based on Mapped Parameters

Section 11.4.5 of ASCE 7-10 describes a procedure to obtain a design response spectra curve for use in cases where a design response spectrum is required by the ASCE 7-10 standard, and site-specific ground motion procedures are not used. This procedure is based on the use of the

mapped spectral response accelerations adjusted for site class effects in the determination of the design response spectra curve. Using this procedure, numerical values of the design spectral response accelerations based on the mapped parameters for the project site are provided in Table III, below.

TABLE III

MAPPED DESIGN RESPONSE SPECTRUM

Period (Seconds)	Mapped Design Spectral Response Acceleration (g)
0.00	0.446
0.113	1.115
0.20 (S_{DS})	1.115
0.500	1.115
0.566	1.115
0.700	0.903
0.800	0.790
0.900	0.702
1.00 (S_{D1})	0.632
2.00	0.316
3.00	0.211
4.00	0.158
5.00	0.126

7.3.3.4 Maximum Considered Earthquake Geometric Mean (MCE_G) Peak Ground Accelerations

From Figure 22-7 of ASCE 7-10, PGA = 0.657g is multiplied by the site coefficient F_{PGA} = 1.0 (Table 11.8-1) to obtain the mapped MCE Geometric Mean Peak Ground Acceleration (PGA_M). For Site Class C, $PGA_M = F_{PGA} \times PGA$. Therefore, PGA_M = 0.657 may be used for evaluation of liquefaction, lateral spreading, seismic settlement and soil-related issues.

7.3.3.5 Seismic Hazard Deaggregation

Relative contributions of various combinations of earthquake magnitudes and distances to a particular seismic hazard at a site are determined using deaggregation of the seismic hazards. Magnitude-distance deaggregation, obtained from the Unified Hazard Tool "Dynamic: Conterminous US 2008 (V.3.3.1)" edition that is available on the USGS website, indicates that the deaggregated mode magnitude and distance for the peak ground acceleration at the project site are M7.5 and 7.0 kilometers, respectively.

7.4 Earthquake Effects

7.4.1 *Liquefaction*

Liquefaction occurs when the pore pressures generated within a soil mass equals the overburden pressure. This results in a loss of strength and the soil then possesses a certain degree of mobility.

Factors considered to evaluate liquefaction potential include groundwater conditions, soil type, particle size distribution, earthquake magnitude and acceleration, and soil density obtained through the Standard Penetration Test (SPT) or Cone Penetration Test (CPT). Soils subject to liquefaction comprise saturated fine-grained sands to low-plasticity silts and clays. Coarser-grained soils are considered free-draining and therefore dissipate excess pore pressures, while fine-grained soils possess undrained shear strength and are therefore less subject to liquefaction.

The liquefaction susceptibility map, Figure A-11, Appendix A, of the County of Riverside General Plan, indicates that the project site is located in an area that is subject to "low" liquefaction potential. Furthermore, the subsoils are considered "dense" to "very dense" or "stiff" to "hard" with a historic highest groundwater table at a depth greater than fifty (50) feet; therefore, the site is considered to possess a "very low" potential for liquefaction.

7.4.2 *Seismically Induced Settlements*

Based on an examination of the subsoils conditions, seismic settlement analyses were conducted at CPT-12 and CPT-13 locations. For these analyses, a PGA_M of 0.657g and an earthquake magnitude of 7.5 based on the deaggregation results, described in subsection 7.3.3.5, were used. Seismic settlements for the unsaturated cohesionless soils were estimated using the Tokimatsu and Seed (1987) Method. The results of the seismic settlement analyses are provided in Appendix D.

Based on our evaluation of the analyses results at the CPT locations, seismically induced settlements at the site are not anticipated to exceed one-half (0.5) inch for the New CUP.

7.4.3 *Seismically Induced Landsliding*

Due to the relatively flat existing topographic conditions, the MVMC site is not located within a designated area where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacement such that mitigation would be required (RCIT, 2017). In addition, based on our field reconnaissance and field investigations, there are no known landslides near or at the MVMC site, nor is the site on the path of any known or potential landslides.

7.4.4 *Ground Surface Rupture*

Ground surface displacement along a fault, although more limited in area than the ground shaking associated with it, can have disastrous consequences when structures are located straddling the fault or near the fault zone. Fault displacement involves forces so great that in most cases it is not practically feasible (structurally or economically) to design and build structures to accommodate rapid displacement and remain intact. Amounts of movement during a single earthquake can range from several inches to tens of feet. Another aspect of fault displacement comes not from the violent movement associated with earthquakes, but the barely perceptible movement along a fault called "fault creep". Damage by fault creep is usually expressed by the rupture or bending of buildings, fences, railroad tracks, streets, pipelines, curbs, and other linear features.

No faulting was observed during our field reconnaissance. In addition, active, potentially active, and other major inactive faults noted on regional geologic and fault maps do not cross nor project toward the site. Furthermore, the site is not located within any APEQFZ Map as designated by the CGS (Bryant and Hart, 2007; CDMG, 2000 and CGS, 2017). The County of Riverside (RCIT, 2017) and the USGS (2017) indicate that the closest active fault to the site is the San Jacinto Fault Zone located approximately 4.8 km to the northeast. Cracking due to shaking from distant events is not considered a significant hazard, although it is a possibility at any site.

7.4.5 *Lateral Spreading*

Seismically induced lateral spreading involves primarily movement of earth materials due to ground shaking. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. Such spreads can occur on gently sloping ground

or where nearby drainage or stream channels can lead to static shear stress biases on essentially horizontal ground. The potential for liquefaction at the site is considered very low. Therefore, the potential for lateral spreading of the subject site is very low.

7.4.6 *Subsidence*

Subsidence refers to the sudden sinking or gradual downward settling and compaction of soil and other surface material with little or no horizontal motion. It may be caused by a variety of human and natural activities, including changes in groundwater level, soil moisture and earthquakes. Alluvial valley regions are especially susceptible and according to RCIT (2017), the site is located within an area that is susceptible to subsidence (Figure A-12, Appendix A) .

7.4.7 *Tsunamis*

A tsunami is a sea wave generated by a submarine earthquake, landslide, or volcanic event. The MVMC site is not located within a coastal area; instead, it is located several tens of miles inland from the Pacific Ocean at an approximate elevation of 1525 feet amsl (GoogleEarth, 2017). Therefore, a tsunami hazard at the property is considered negligible.

7.4.8 *Seiches*

A seiche is an earthquake-induced wave in a confined body of water, such as a lake, reservoir, or bay. Resulting oscillations could cause waves up to tens of feet high, which in turn could cause extensive damage along the shoreline. The most serious consequence of a seiche would be the overtopping and failure of a dam. Based on Figure 5.5-2, Floodplains and High Fire Hazard Areas, included in the Moreno Valley General Plan (2006), the site is not located downstream of any large bodies of water that could adversely affect the site in the event of earthquake-induced failures or seiches.

7.4.9 *Flooding*

According to the Federal Emergency Management Agency (FEMA, 2017) flood map 06065C0770G, Figure A-13, Appendix A, the City of Moreno Valley (2006a) and RCIT (2017), the MVMC is located within a "Zone X", which corresponds to an area determined to be outside of a

0.2 percent annual chance of floodplain (FEMA, 2017).

It should be noted that the northwestern corner of the property is located within "Zone A", which corresponds to a 1.0 percent annual chance of flood hazard (FEMA, 2017), areas of flooding sensitivity (RCIT, 2017) and a 100-year flood plain (City of Moreno Valley, 2006a). The extent of the affected area varies according to the different agencies.

VIII. SITE DEVELOPMENT RECOMMENDATIONS

8.1 General

The proposed development, described in subsection 3.2, is feasible from a geotechnical engineering standpoint. Project plans and specifications should take into account the appropriate geotechnical features of the site and conform to the geotechnical recommendations.

8.2 Clearing

All surface vegetation, asphaltic concrete, trash, debris, underground pipes, and concrete pieces after demolishing the existing structures should be cleared and removed from the proposed site. Topsoil and soils with organic inclusions are ***not*** considered suitable for reuse as structural fill, but may be stockpiled for future use in landscape areas.

Underground facilities such as utilities, pipes or underground storage tanks may exist at the site. Removal of underground tanks is subject to state law as regulated by County or City Health and/or Fire Department agencies. If storage tanks containing hazardous or unknown substances are encountered, the proper authorities must be notified prior to any attempts at removing such objects.
Septic tanks should be removed in their entirety. Cesspools or seepage pits should be pumped of their contents and backfilled with a minimum two-sack sand-cement slurry. Any water wells, if encountered during construction, should be exposed and capped in accordance with the requirements of the regulating agencies.

Depressions resulting from the removal of buried obstructions, existing building foundations, tunnels and pipes should be backfilled with properly compacted material.

8.3 Subgrade Preparation

8.3.1 *Building Pad*

In the new CUP area, undocumented fills and "very loose" to "medium dense" silty sands to sandy silts layers were observed at the boring locations and can be observed on the data from relevant CPT's as well. These materials are not suitable for structural support and they extend to approximate elevation 1510 amsl, as shown on Figures A-5 and A-6, Appendix A. These materials may also extend deeper at other locations and, where encountered, should be removed and replaced as properly compacted fill. Notwithstanding the aforementioned, a compacted fill blanket, a minimum of five (5) feet in thickness, should be constructed below the footing bottoms. The lateral extent of overexcavation beyond the footing limits should be at least equal to the depth of fill.

Exposed bottoms of overexcavation should be observed by GEOBASE to verify the removal of all unsuitable materials.

8.3.2 *Minor Structures, Walkways, Flatwork and Pavement Areas*

In order to minimize the potential for excessive settlement of minor structures which are structurally separated from the new CUP, the footing subgrade areas should be over excavated to provide a uniform compacted fill blanket a minimum three (3) feet in thickness below adjacent grade, or at least two (2) feet below footing bottoms, whichever is greater. The lateral extent of removal beyond the footing limits should be equal to at least the depth of overexcavation. The fill should be compacted to a minimum of ninety (90) percent relative compaction (ASTM D 1557).

The subsoils within the concrete walkways, flatwork and parking areas, and within two (2) feet of their proposed limits, should be over excavated at least two (2) feet and replaced as properly compacted fills.

The above subgrade preparation recommendations may only be considered if future maintenance as a result of settlement of underlying undocumented fills can be tolerated. Alternatively, all undocumented fills should be removed and replaced as properly compacted fills.

8.4 Fill Placement

8.4.1 *Preparation of Bottom of Excavations*

Prior to placing any fill, the exposed soils at the bottom of excavations should be scarified to a minimum depth of six (6) to eight (8) inches, moisture conditioned (wetted or dried) to at least optimum moisture content and compacted to a minimum of ninety (90) percent relative compaction, based on ASTM D1557.

8.4.2 *Compaction*

Cohesive soils should be placed in loose lifts not exceeding six (6) inches, moisture-conditioned to approximately two (2) to four (4) percentage points above optimum, and compacted to the minimum relative compaction listed in Table IV below.

Granular fill materials should be placed in loose lifts of six (6) to eight (8) inches, moisture-conditioned to near optimum, and compacted to the minimum relative compaction listed in Table IV.

TABLE IV

COMPACTION REQUIREMENTS

Type of Fill/Area	Relative Compaction (ASTM D1557) Minimum Percent
Fills within building pad area	95
All other structural fill	90

8.4.3 *Fill Material*

The upper ten (10) feet of on-site soils are predominantly "very low" expansive soils (EI = 0-12). These soils may be reused as compacted fill provided they are free of organics, deleterious materials, debris and particles over six (6) inches in largest dimension.

Any soils imported to the site for use as fill for subgrade materials should be predominantly granular and "very low" expansive (Expansion Index less than twenty [20])and should contain sufficient fines (approximately twenty [20] percent passing the No. 200 sieve) so as to be relatively impermeable when compacted. The imported soils should be approved by GEOBASE prior to importing.

8.5 Drainage

To enhance future site performance, it is recommended that all pad drainage be collected and directed away from proposed structures and slopes to disposal areas off site. For soil areas, we recommend that a minimum of five (5) percent gradient away from foundation elements be maintained. It is important that drainage be directed away from foundations and that proper drainage patterns be established at the time of construction and maintained through the life of the structures. Roof gutter discharge should be directed away from the building to suitable discharge points.

All slopes should be properly drained and maintained to help control erosion. Care should be exercised in controlling surface runoff onto temporary slopes. The area back of the slope crest should be graded such that water will not be allowed to flow freely onto the slope face. If excavations of temporary slopes are carried out in the rainy season, appropriate erosion protection measures may be required to minimize erosion of the slope cuts.

8.6 Temporary Excavations

Temporary construction excavations are anticipated for construction of utility trenches, footings and overexcavation.

Temporary construction excavations to depths of approximately four (4) feet below grade may be cut vertically without shoring. Where the necessary space is available, temporary unsurcharged excavations up to fifteen (15) feet high in level ground surface may be sloped back at 1H:1V (Horizontal:Vertical) or flatter in native soils. No surcharge loads should be permitted within a horizontal distance equal to the height of cut from crest of the excavation unless the cut is properly shored. Excavations that extend below a plane drawn at 1H:1V (Horizontal:Vertical) downward from the the edge of foundations of existing buildings and underground pipelines should be properly shored to maintain foundation support of adjacent structures and utilities.

The exposed slope face should be kept moist (but not saturated) during construction to reduce local sloughing.

All excavations and shoring systems should meet, as a minimum, the requirements given in the State of California Occupational Safety and Health Administration (OSHA) and Trench Safety

Standards. Stability of temporary slopes is the responsibility of the contractor.

8.7 Trench Backfill

Underground utility trenches could be backfilled and properly compacted by mechanical means. Pipe bedding, shading, and trench backfill should conform to the requirements of appropriate utility authorities.

If utility contractors indicate that it is undesirable to use compaction equipment in close proximity to a buried conduit, other methods of utility trench compaction may also be appropriate as approved by GEOBASE at the time of construction. Jetting or flooding of backfill material is not recommended.

IX. FOUNDATION RECOMMENDATIONS

9.1 General

The following recommendations have been formulated from visual, physical and analytical considerations of the existing site conditions and are believed to be applicable for the proposed development.

The on-site soils have a "very low" expansion potential. The recommendations presented in the following subsections are based on a "very low" expansion potential for the subgrade soils. Foundations and slab reinforcement configurations should meet, as a minimum, the requirements of the regulating agencies and the 2016 CBC.

9.2 Footings

Spread or continuous footings may be used for support of the proposed new CUP. Footings should be based a minimum of three (3) feet below the lowest adjoining grade.

9.2.1 *Soil Bearing Pressures*

Footings with a minimum width of two (2) feet and maximum width of twelve (12) feet, founded on a minimum of five (5) feet of compacted fill (subsection 8.3.1), may be designed for an allowable

bearing pressure of 4,000 psf. The maximum edge pressures induced by eccentric loading or overturning moments should not be allowed to exceed the aforementioned allowable bearing value.

Footings placed closer than one (1) width apart should be structurally tied.

9.2.2 *Footings Adjacent to Trenches or Existing Footings*

Where footings are located adjacent to utility trenches, they should extend below a one-to-one plane projected upward from the inside bottom corner of the trench. Footing excavations adjacent to the footings of existing buildings should be carried out such that the existing footings are not undermined.

9.2.3 *Settlement*

For allowable dead-plus-live load bearing pressures of 4,000 psf, the total and differential settlements of the footings are not anticipated to exceed one (1.0) inch and one-half (0.5) inch, respectively. Total seismic settlements are anticipated not to exceed one-half (0.5) inch and differential seismic settlements are estimated at three-tenths (0.3) of an inch over a distance of thirty (30.0) feet.

Notwithstanding the preceding, the static settlement of the footings foundation system should be reviewed by GEOBASE once the configuration of the footings is finalized.

9.2.4 *Lateral Load Resistance*

Lateral loads (wind or seismic) against structures may be resisted by friction between the bottom of foundations and the supporting soils. An allowable friction coefficient of 0.35 between spread footing and the underlying compacted soil is recommended. An allowable lateral bearing pressure equal to an equivalent fluid weight of 200 pounds per cubic foot to a maximum of 3,000 pounds per square foot acting against the foundations may also be used, provided the foundations are poured tight against compacted fill.

9.2.5 *Footing Observations*

All foundation excavations should be observed by GEOBASE prior to the placement of forms, reinforcement, or concrete, for verification of conformance with the intent of these recommendations and confirmation of the bearing capacities. All loose or unsuitable materials should be removed prior to the placement of concrete. Materials from footing excavations should not be spread in slab-on-grade areas unless compacted.

9.3 Minor Structures

Minor structures may be designed using the presumptive load-bearing values outlined in CBC 2016, provided that the risk of future settlements and associated maintenance can be tolerated.

9.4 Ultimate Values

The recommended design values presented in this report are for use with loading determined by a conventional working stress design. When considering an ultimate design approach, the recommended design values may be multiplied by the factors given in Table V.

TABLE V
LOAD FACTORS FOR ULTIMATE DESIGN

Foundation Loading	Ultimate Design Loading
Bearing Value	3.0
Passive Pressure	1.33
Coefficient of Friction	1.25

In no event, however, should the footing sizes be reduced from those required for support of dead-plus-live loads when using the working stress values.

9.5 Floor Slabs

Concrete slab-on-grade may be used for the proposed new CUP. The subgrade of the slab-on-grade should be prepared in accordance with the recommendations provided in subsections 8.3 and 8.4.

In moisture sensitive areas, as a minimum, the floor slabs should be damproofed per CBC 2016, subsection 1805A.2; specific recommendations can be provided by a Waterproofing Consultant.

A subgrade modulus of 150 pounds per cubic inch may be used for slab design. The slab should be designed by the Structural Engineer using applicable CBC requirements, and the various anticipated loading conditions including shrinkage, temperature stresses, construction and operation conditions.

X. SOIL CORROSIVITY -- IMPLICATIONS

Electrical conductivity, pH, chloride and water soluble sulfate tests were conducted on representative samples by Anaheim Test Labs, and the results are provided in Appendix C. The tests results indicate that the subsoils at the site have a "low" corrosive potential with respect to concrete and "corrosive" potential with respect to steel and other metals. Therefore, Type II Portland Cement may be used for construction of concrete structures in contact with subgrade soils.

XI. PAVEMENT RECOMMENDATIONS

11.1 Asphaltic Concrete Pavement

Based on an R-value of fifty (50), the following alternative preliminary minimum pavement sections may be used. The traffic index assumed in Table VI, below, **should be confirmed by the Civil Engineer** and R-value tests should be performed during grading, prior to finalizing the pavement sections.

TABLE VI

ASPHALTIC CONCRETE PAVEMENT SECTIONS

PAVEMENT UTILIZATION	TRAFFIC INDEX	ASPHALTIC CONCRETE (INCHES)	CLASS II BASE (INCHES)
Automobile parking areas	5	3	3
Truck and bus loading/unloading areas and driveways	6	4	3

The upper twelve (12) inches of subgrade soils, below the aggregate base, should be scarified, moisture conditioned and recompacted to a minimum of ninety-five (95) percent relative

compaction, at to slightly above optimum moisture content, based on ASTM D 1557.

The aggregate base must meet CALTRANS "Class 2 Base" specifications and should be compacted to at least ninety-five (95) percent relative compaction based on ASTM D 1557. Asphaltic concrete should be compacted to at least ninety five (95) percent of the density obtained with the California Kneading Compactor (CAL 304).

11.2 Rigid Pavement

A Portland Cement concrete (PCC) pavement may also be used. In the design of the PCC pavement section shown in Table VII, below, the following design parameters were used:

- Modulus of subgrade reaction of the soil, k -- 240 pci
- Modulus of rupture of concrete, MR -- 500 psi
- Traffic Category, TC -- C
- Average daily truck traffic, ADTT -- 100

TABLE VII
PCC PAVEMENT SECTION

PAVEMENT UTILIZATION	PCC Minimum Thickness (inches)
Truck loading/unloading areas (TC = C)	6

The traffic category and average daily truck traffic should be confirmed by the civil engineer and R-value tests should be performed during grading, prior to finalizing PCC thickness.

Based on the design parameters presented above, the following rigid pavement section, calculated in general conformance with the procedure recommended by ACI 330R-01, may be used.

The upper twelve (12) inches of subgrade soils below the PCC should be scarified, moisture conditioned and recompacted to a minimum of ninety-five (95) percent relative compaction, at to slightly above optimum moisture content, based on ASTM D 1557.

The PCC pavement reinforcement should be designed by the structural engineer for shrinkage, temperature stresses and loading conditions including vehicular traffic. A thickened edge should

be constructed on the outside of concrete pavements subject to wheel loads. Control joints should be included in the design of the PCC by the structural engineer at a maximum spacing of fifteen (15) feet each way.

XII. PLAN REVIEW, OBSERVATIONS AND TESTING

Post-investigation services are an important and integrated part of this investigation and should be carried out by GEOBASE. The project foundation and grading plans, and specifications should be forwarded to GEOBASE for review for conformance with the intent of the soils recommendations.

Geotechnical observations of excavation bases should be carried out prior to fill placement. Observations and testing of all fill placement should be carried out on a continuous basis to verify the design assumptions and conformance with the intent of the recommendations. Observations of footings bases should be carried out prior to concrete pour.

XIII. LIMITATIONS

This investigation was performed in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

This report is intended for use by the client and its representatives, and with regard to the specific project discussed herein. Any changes in the design or location of the proposed new structure, however slight, should be brought to our attention so that we may determine how they may affect our conclusions. The conclusions and recommendations contained in this report are based on the data relating only to the specific project and location discussed herein. This report does not relate any conclusions or recommendations about the potential for hazardous and/or contaminated materials existing at the site.

The analyses and recommendations submitted in this report are based upon the observations noted during drilling of the borings, interpretation of laboratory test results, and geological evidence. This report does not reflect any variations which may occur away from the borings and which may be encountered during construction. If conditions observed during construction are at variance with the preliminary findings, we should be notified so that we may modify our conclusions and recommendations, or provide alternate recommendations, if necessary.

The recommendations presented herein assume that the plan review, observations and testing services, outlined in Section XII of the report, will be provided by GEOBASE. During execution of the aforementioned services, GEOBASE can finalize the report recommendations based on observations of actual subsurface conditions evident during construction. GEOBASE cannot assume liability for the adequacy of the recommendations if another party is retained to observe construction.

This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project, and incorporated into the plans and specifications. In this respect, it is recommended that we be allowed the opportunity to review the project plans and the specifications for conformance with the geotechnical recommendations.

This office does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and we cannot be responsible for other than our own personnel on the site. Therefore, the safety of others is the responsibility of the contractor. The contractor should notify the owner if he considers any of the recommended actions presented herein to be unsafe.

This report is subject to review by the appropriate regulating agencies.

Respectfully submitted
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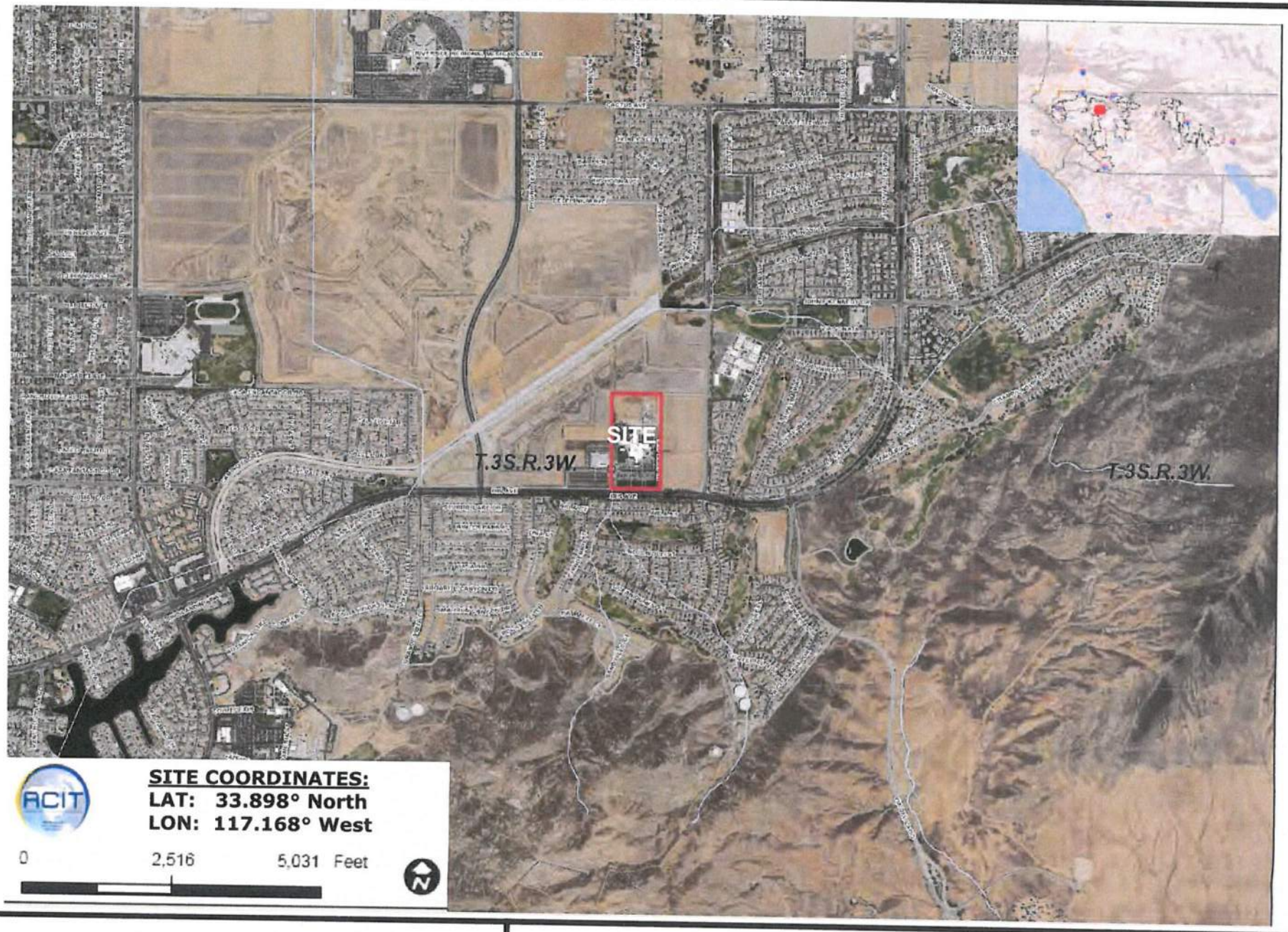
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APPENDIX A

Figure A-1	Site Location Map
Figure A-2	Site, Boring and CPT Locations Plan
Figure A-3	Site Topographic Survey Plan
Figure A-4	Regional Geologic Map
Figure A-5	Geologic Cross Section A-A'
Figure A-6	Geologic Cross Section B-B'
Figure A-7	Regional Fault Map
Figure A-8	Vicinity Fault Map
Figure A-9	Historical Earthquakes Map
Figure A-10	Shear Wave Velocity Profiles
Figure A-11	Liquefaction Susceptibility Map
Figure A-12	Subsidence Susceptibility Map
Figure A-13	FEMA Flood Map



GEOBASE

SITE LOCATION MAP
Kaiser Permanente MVMC – CUP
27300 Iris Avenue
Moreno Valley, California

C.314.82.00

FIGURE A-1

EXISTING HOSPITAL OUTLINE

NEW 6-STORY PATIENT TOWERS
84,800 SF (BLDG FP)

NEW ENTRANCE & DROP-OFF

5-TIER PARKING
STRUCTURE
41,000 SF (BLDG OUTLINE)

B-2
CPT-3
B-1
CPT-3
CPT-9
B-8
CPT-10
CPT-11
B-7
CPT-7
B-8
B-3
B-4
CPT-4
B-6
CPT-12
B-9
CPT-1
B-4
B-5
CPT-13
B-10
B-2
CPT-2
TP-1
CPT-5
CPT-6
A'
A
CPT-1
B-11
B'

QVOF

Basement
1523.45'

Hospital
FF= 1538.45'

TO BE DEMO

NEW D&T BUILDING

SERVIC E YARD

NEW CUP

STRUCTURE
OUTLINE)

AL OFFICE BUILDING
OUTLINE)

2-STORY DIAGNOSTIC & TREATMENT
(BLDG OUTLINE)

3-STORY ENERGY CENTER (CUP)
11,100 SF (BLDG OUTLINE)

UNCOVERED UTILITY YARDS
7,500 SF

EXPLANATIONS:

- Approximate Location of Boring (GEOBASE 2017)
- Approximate Location of CPTs (GEOBASE 2017)
- Approximate Location of Test Pit (GEOBASE 2017)
- Geophysical Survey Lines
- Approximate Location of Boring/CPTs (GEOBASE 2010)

A---A' Geological cross-section
LL -- Lower Level (Basement)
FF -- Finish Floor
Qvof -- Quaternary Very Old Alluvium

NOTES:

1. GEOBASE INC. has added only Geological/Geotechnical data to this plan prepared by others. We have not checked any other information on this plan and give no assurance of its accuracy.

2. This Drawing is part of GEOBASE INC.'s report no. C.314.82.00 dated August 2017 and should be read with the complete report for evaluation.

North

0 40 80 160

Approximate Scale (feet)

1 EAST PARCEL
1" = 40'-0"

SITE PLAN
07/05/17

CO ARCHITECTS
5055 Wilshire Boulevard, 8th Floor
Los Angeles, California 90036

C.314.82.00
KAISER PERMANENTE

Site, Boring and CPT Locations Plan

MORENO VALLEY MEDICAL CENTER

Figure A-2

SD-10



EXPLANATIONS:

- Approximate Location of Boring (GEOBASE 2017)
- Approximate Location of CPTs (GEOBASE 2017)
- Approximate Location of Test Pit (GEOBASE 2017)
- Geophysical Survey Lines (GEOBASE 2017)
- Approximate Location of Boring/CPTs (GEOBASE 2010)

A---A' Geological cross-section
LL -- Lower Level (Basement)
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Qvof -- Quaternary Very Old Alluvium

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2. This Drawing is part of GEOBASE INC.'s report no. C.314.82.00 dated August 2017 and should be read with the complete report for evaluation.

NOTES:

1.) THIS TOPOGRAPHIC SURVEY MAP HAS BEEN COMPILED FROM THE FOLLOWING SURVEYS PROVIDED TO S.B.&O., INC. BY KAISER PERMANENTE:

A.) A 10 ACRE ALTA SURVEY WITH A FIELD DATE OF 07/07/08

ISSUED BY: INTERNATIONAL LAND SERVICES, INC.
PREPARED BY: J.V. SURVEYING, LLC

B.) A 20 ACRE ALTA SURVEY WITH A FIELD DATE OF 02/22/08

ISSUED BY: (UNKNOWN)
PREPARED BY: (UNKNOWN)

2.) S.B.&O., INC. MAKES NO REPRESENTATION TO THE COMPLETENESS OR ACCURACY OF THE DATA PROVIDED AND SHOWN HEREON.

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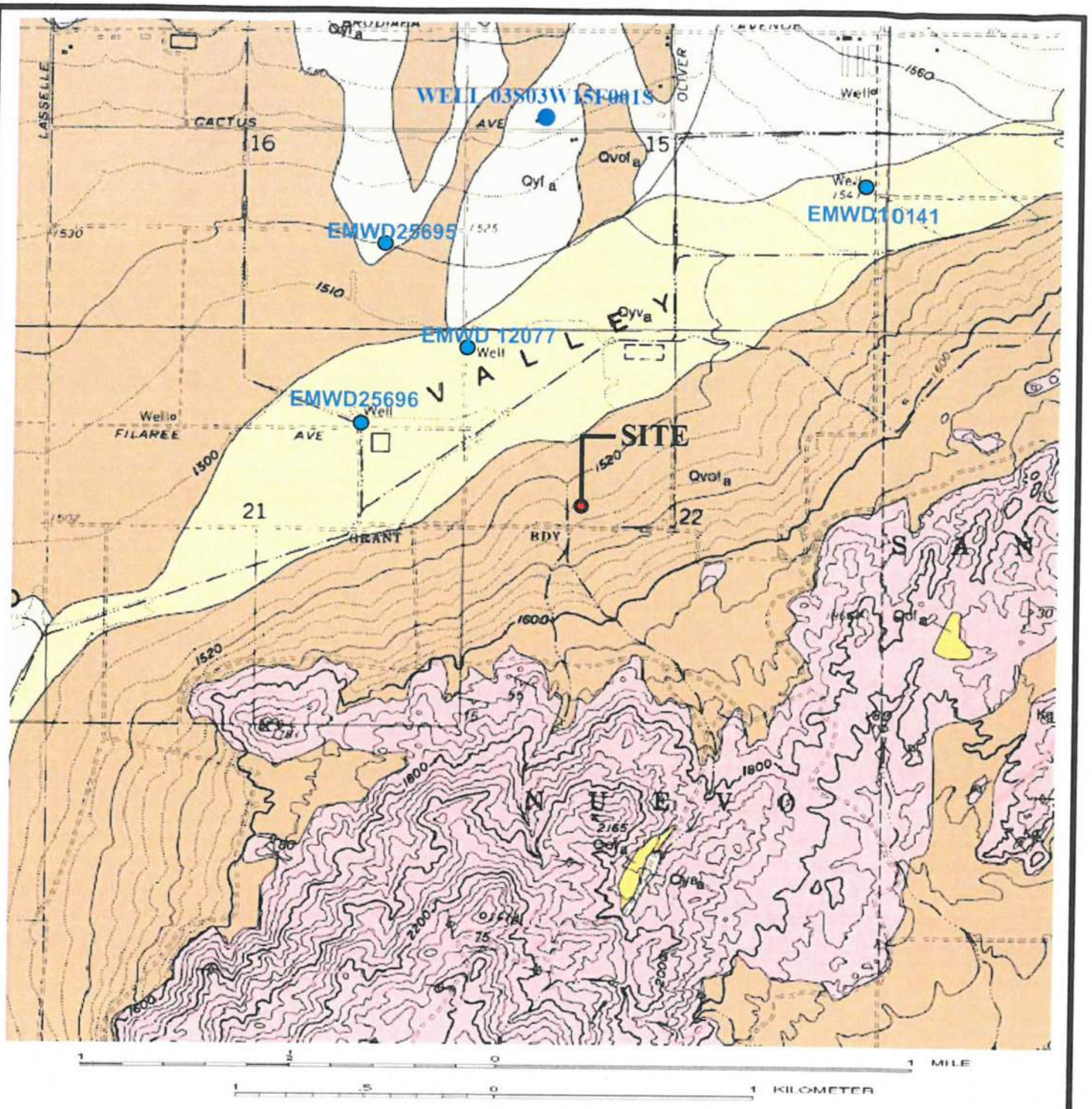
KAISER HOSPITAL
CITY OF MORENO VALLEY
TOPOGRAPHIC SURVEY

OCTOBER 27, 2009 JN 68222

C.314.82.00

SITE TOPOGRAPHIC SURVEY PLAN

FIGURE A-3



EXPLANATION

Qyf	Qyf - Quaternary Young Alluvial Fan Deposits (Holocene and late Pleistocene)
Qyv	Qyv - Quaternary Young Alluvial Valley Deposits (Holocene and late Pleistocene)
Qvof	Qvof - Quaternary Very Old Alluvial Fan Deposits (early Pleistocene)
Kqd	Kgd - Quatz Diorite, Undifferentiated (Cretaceous)

Source: Morton, D. M., and Matti, J C., 2001, Geologic Map of the Sunnymead Quadrangle, Riverside County, California: Version 1.0, Scale 1:24,000, Open File Report 01-450, Published by the United States Geological Survey in Cooperation with the California Geological Survey and the United States Air Force.

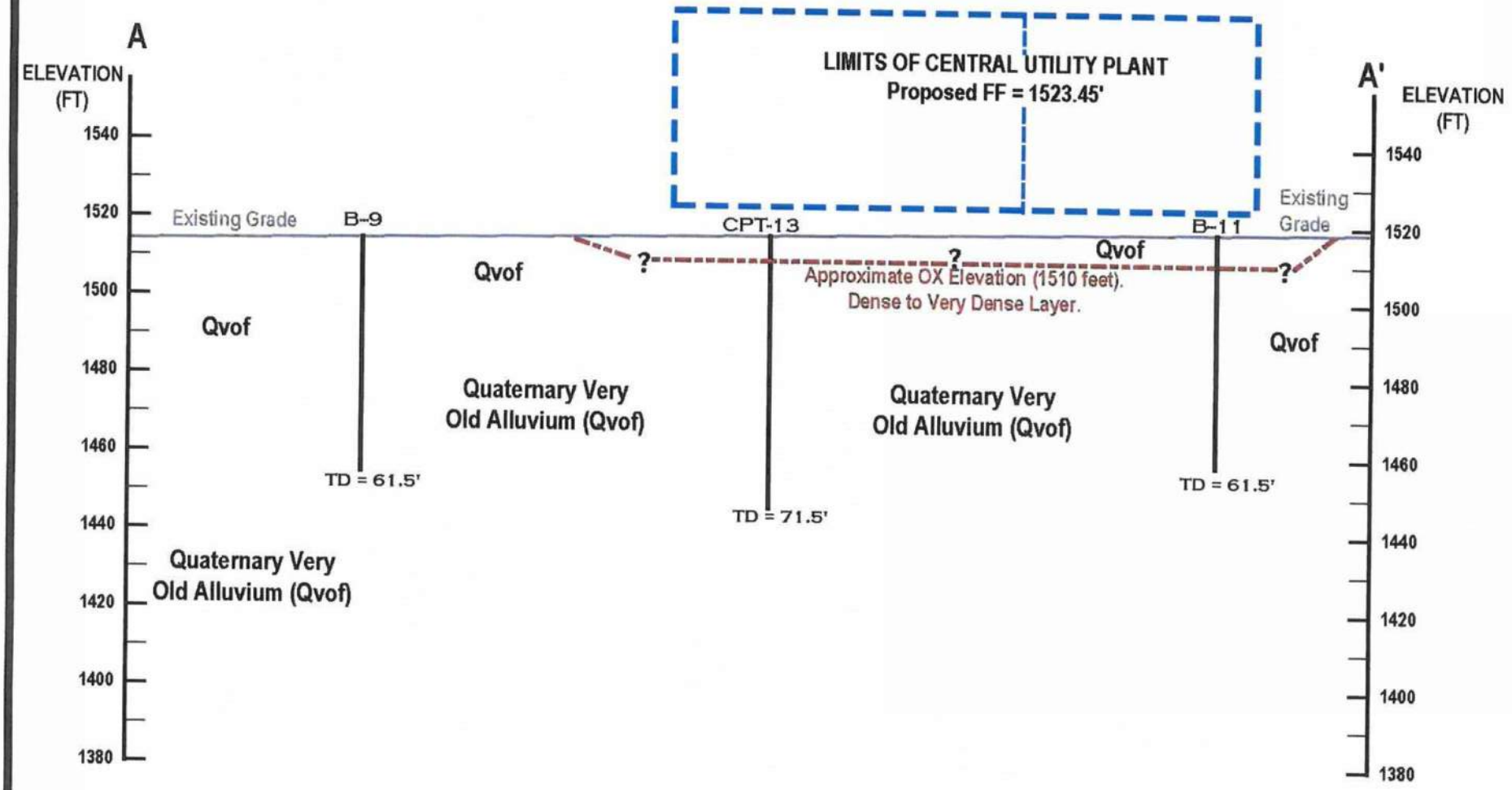
GEOBASE

REGIONAL GEOLOGIC MAP

Kaiser Permanente MVMC – CUP
27300 Iris Avenue
Moreno Valley, California

C.314.82.00

FIGURE A-4



EXPLANATIONS:

Qvof – Quaternary Very Old Alluvium

TD -- Total depth of borehole

dense to very dense layer, overexcavation bottom

NOTES:

1. Locations of the cross section are shown on Figures A-2 & A-3
2. Soil profiles are known with accuracy only at the locations observed. The subsoil condition between borehole locations has been inferred from geological or geotechnical evidence and may vary from that shown.

SCALE AS SHOWN:

HORIZONTAL 1 IN. = 40 Feet

VERTICAL 1 IN. = 40 Feet

NORTH

GEOBASE

GEOLOGIC CROSS-SECTION A-A'

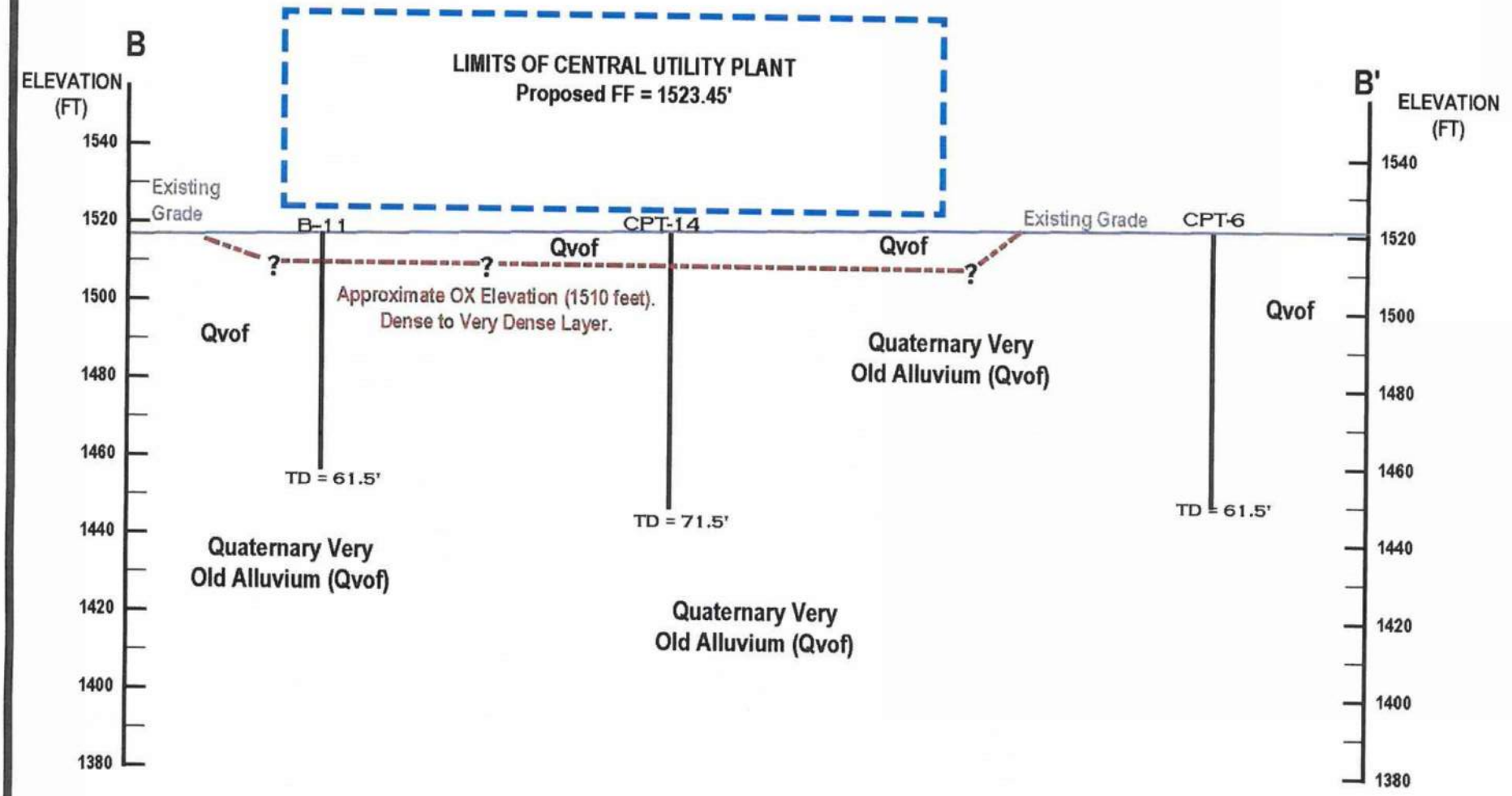
Kaiser Permanente MVMC -- CUP

27300 Iris Avenue

Moreno Valley, California

C.314.82.00

FIGURE A-5



EXPLANATIONS:

Qvof -- Quaternary Very Old Alluvium

TD -- Total depth of borehole

dense to very dense layer, overexcavation bottom

NOTES:

1. Locations of the cross section are shown on Figures A-2 & A-3
2. Soil profiles are known with accuracy only at the locations observed. The subsoil condition between borehole locations has been inferred from geological or geotechnical evidence and may vary from that shown.

SCALE AS SHOWN:

HORIZONTAL 1 IN. = 40 Feet

VERTICAL 1 IN. = 40 Feet

NORTH

GEOBASE

GEOLOGIC CROSS-SECTION B-B'

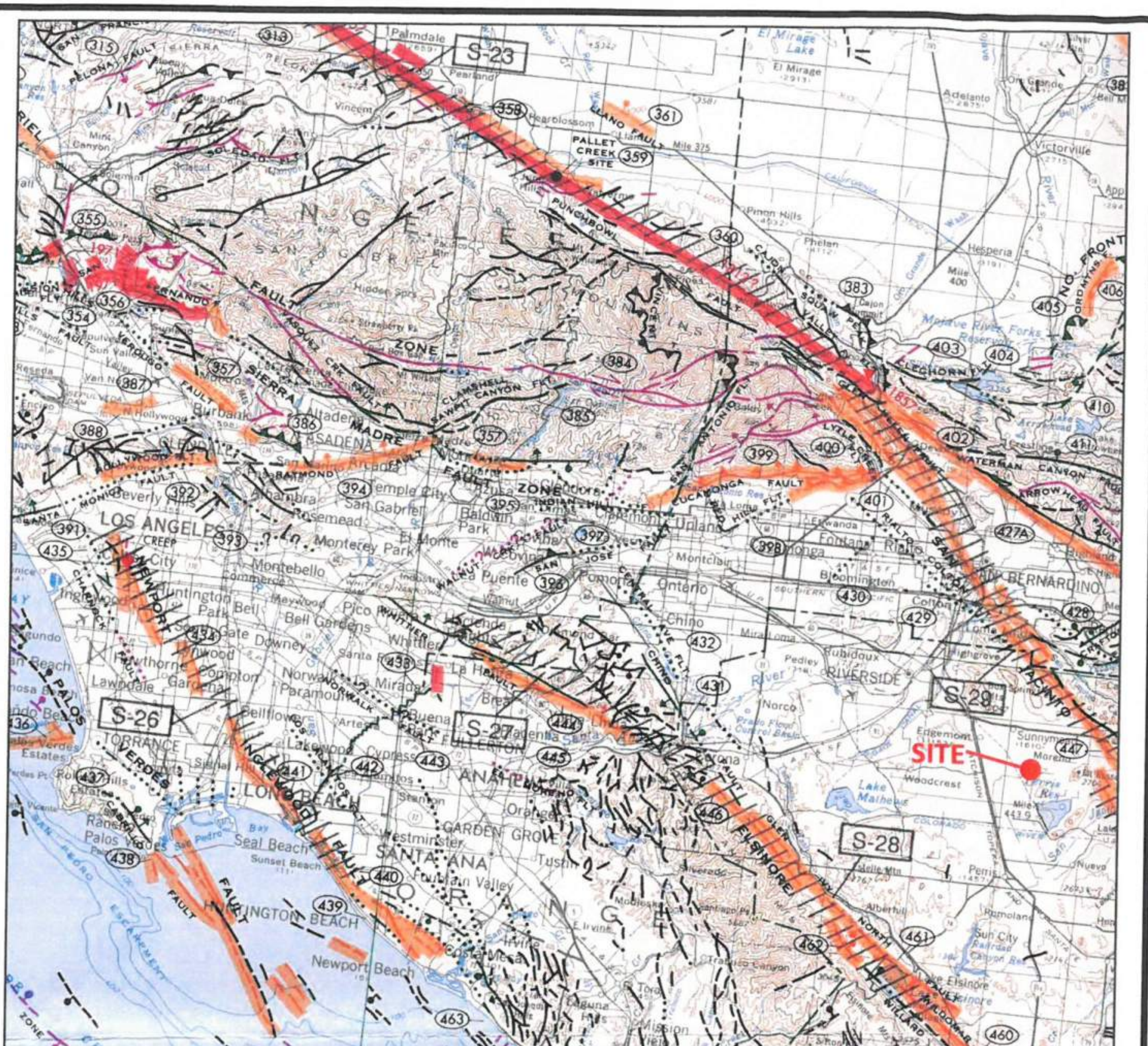
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Moreno Valley, California

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FIGURE A-6



EXPLANATION

Fault along which historic (last 200 years) displacement has occurred.

Holocene fault displacement (during past 10,000 years).

Late Quaternary fault displacement (during past 700,000 years).

Quaternary fault (age undifferentiated).

Late Cenozoic faults within the Sierra Nevada.

Pre-Quaternary fault (older than 1.6 million years) or fault without recognized Quaternary displacement.

Pink band added to emphasize location of historic fault displacement.

Approximate Scale 1 Inch Equals 10.89 Miles

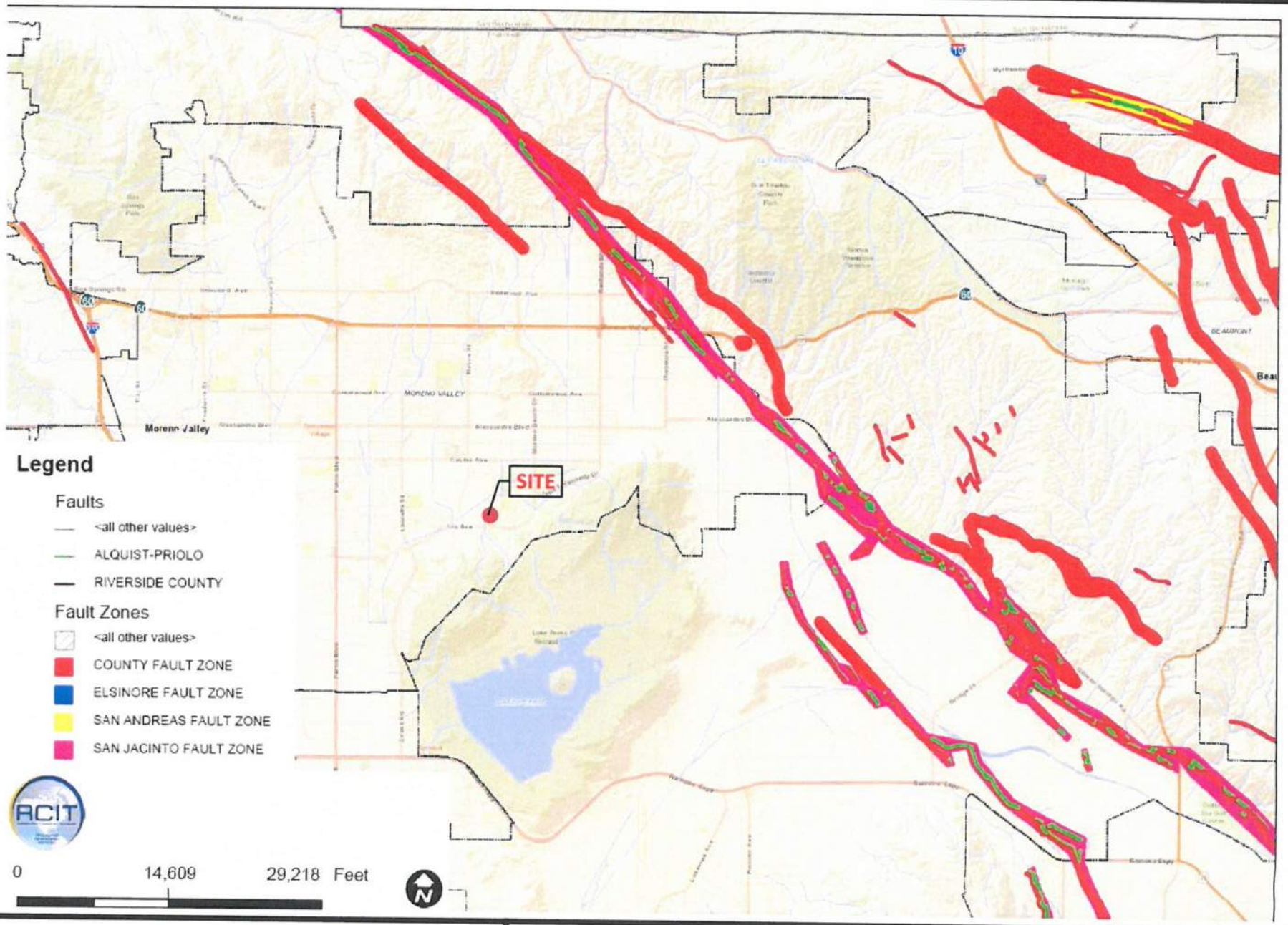
Source: Jennings, C.W., 1994. Fault Activity map of California and Adjacent Areas with Location and Ages of Recent Volcanic Eruptions: California Division of Mines and Geology, Geologic Data Map Series, Map No. 6, Scale 1 : 750,000.

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REGIONAL FAULT MAP
Kaiser Permanente MVMC – CUP
27300 Iris Avenue
Moreno Valley, California

FIGURE A-7



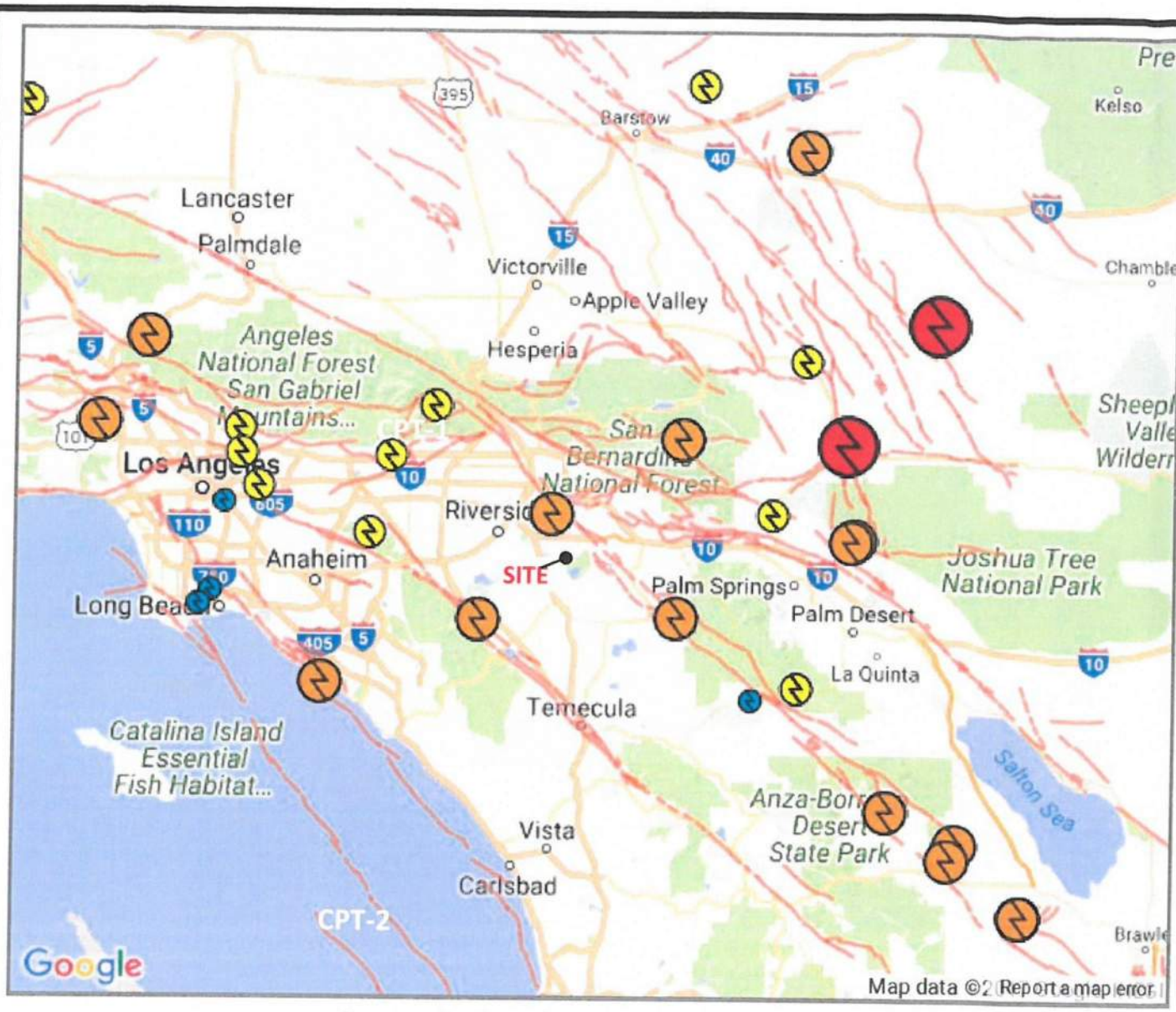
GEOBASE

VICINITY FAULT MAP

Kaiser Permanente MVMC – CUP
27300 Iris Avenue
Moreno Valley, California

C.314.82.00

FIGURE A-8



Sources: Southern CA Earthquake Center, Division of Geological and Planetary Sciences | California Institute of Technology.

Note: Fault traces are in red as shown.

Magnitude

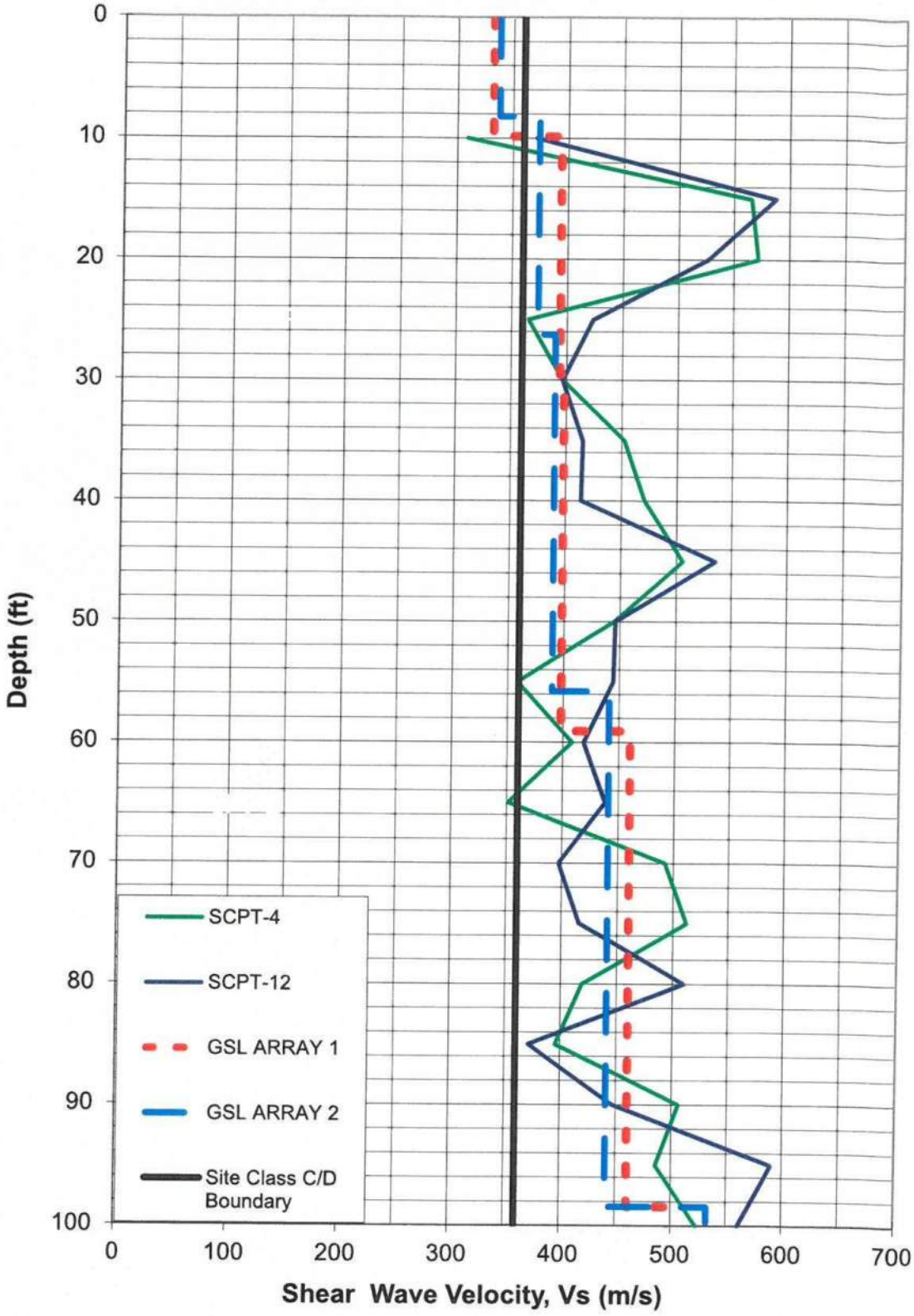
Marker	Magnitude
	☑ 4 ≤ 4.9
	☑ 5 ≤ 5.9
	☑ 6 ≤ 6.9
	☑ 7 ≤ 9.0

GEOBASE

HISTORICAL EARTHQUAKES MAP
Kaiser Permanente MVMC – CUP
27300 Iris Avenue
Moreno Valley, California

C.314.82.00

FIGURE A-9

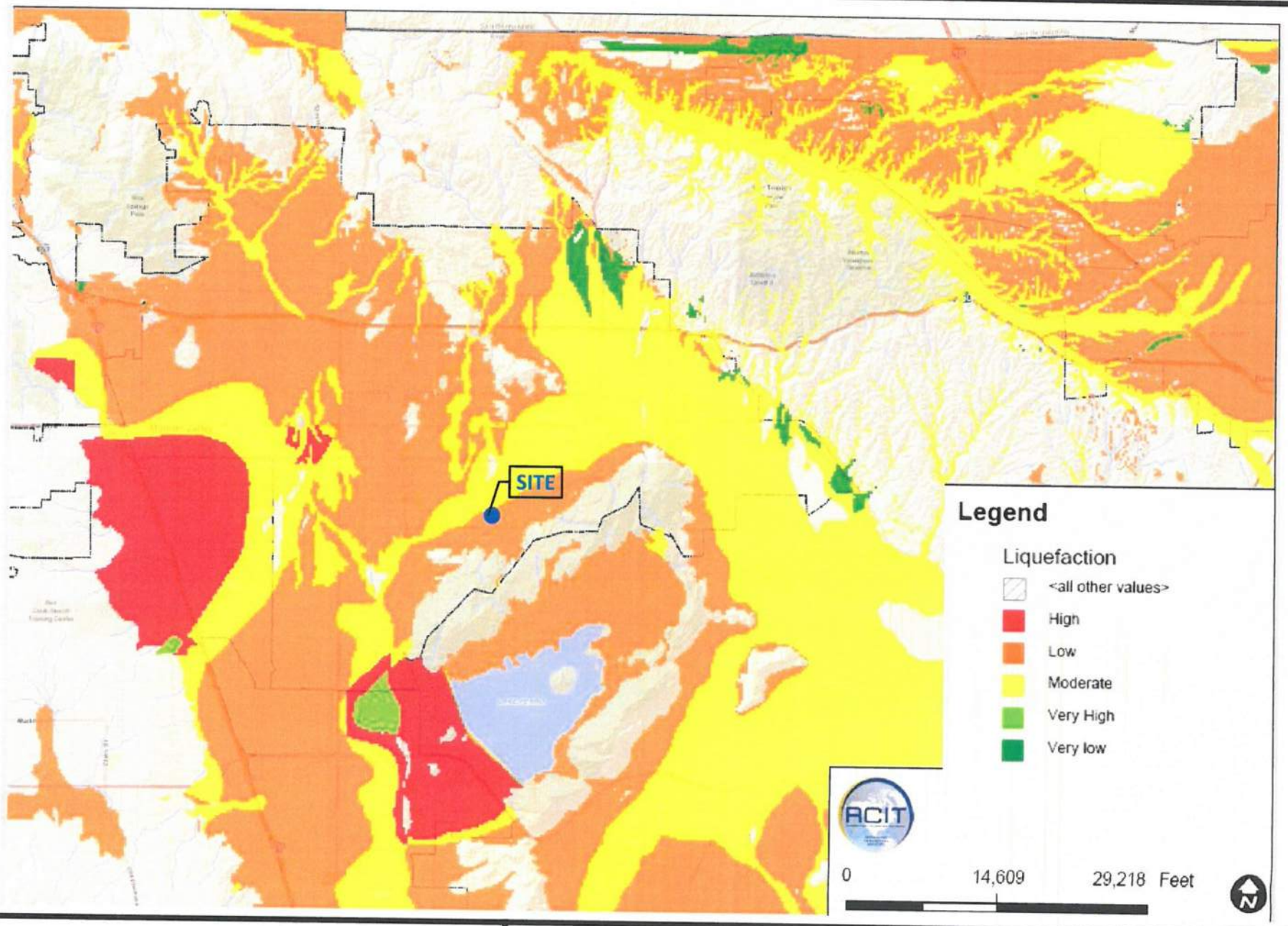


GEOBASE

SHEAR WAVE VELOCITY PROFILES
Kaiser Permanente MVMC – CUP
27300 Iris Avenue
Moreno Valley, California

C.314.82.00

FIGURE A-10

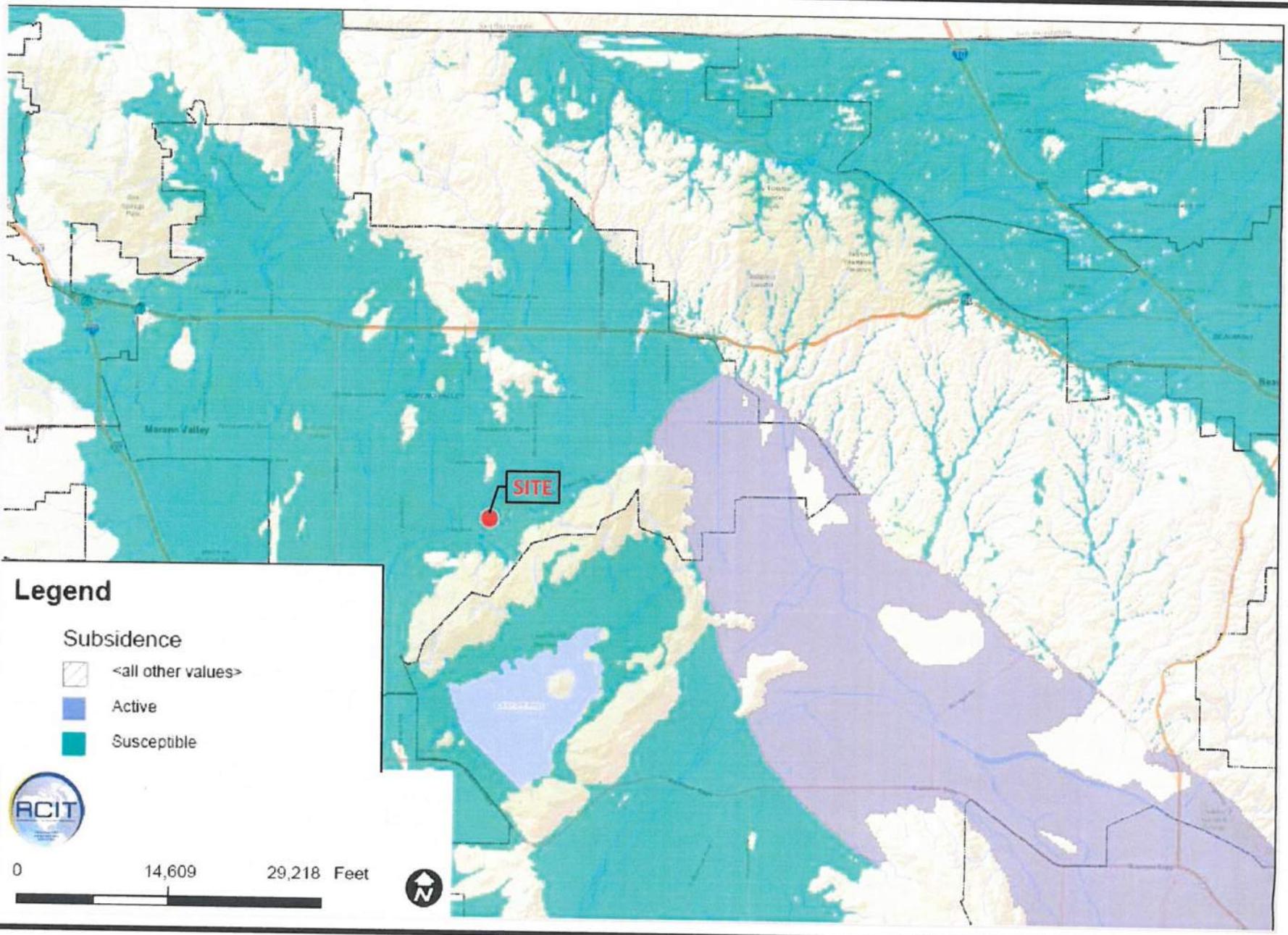


GEOBASE

LIQUEFACTION SUSCEPTIBILTY MAP
Kaiser Permanente MVMC – CUP
27300 Iris Avenue
Moreno Valley, California

C.314.82.00

FIGURE A-11

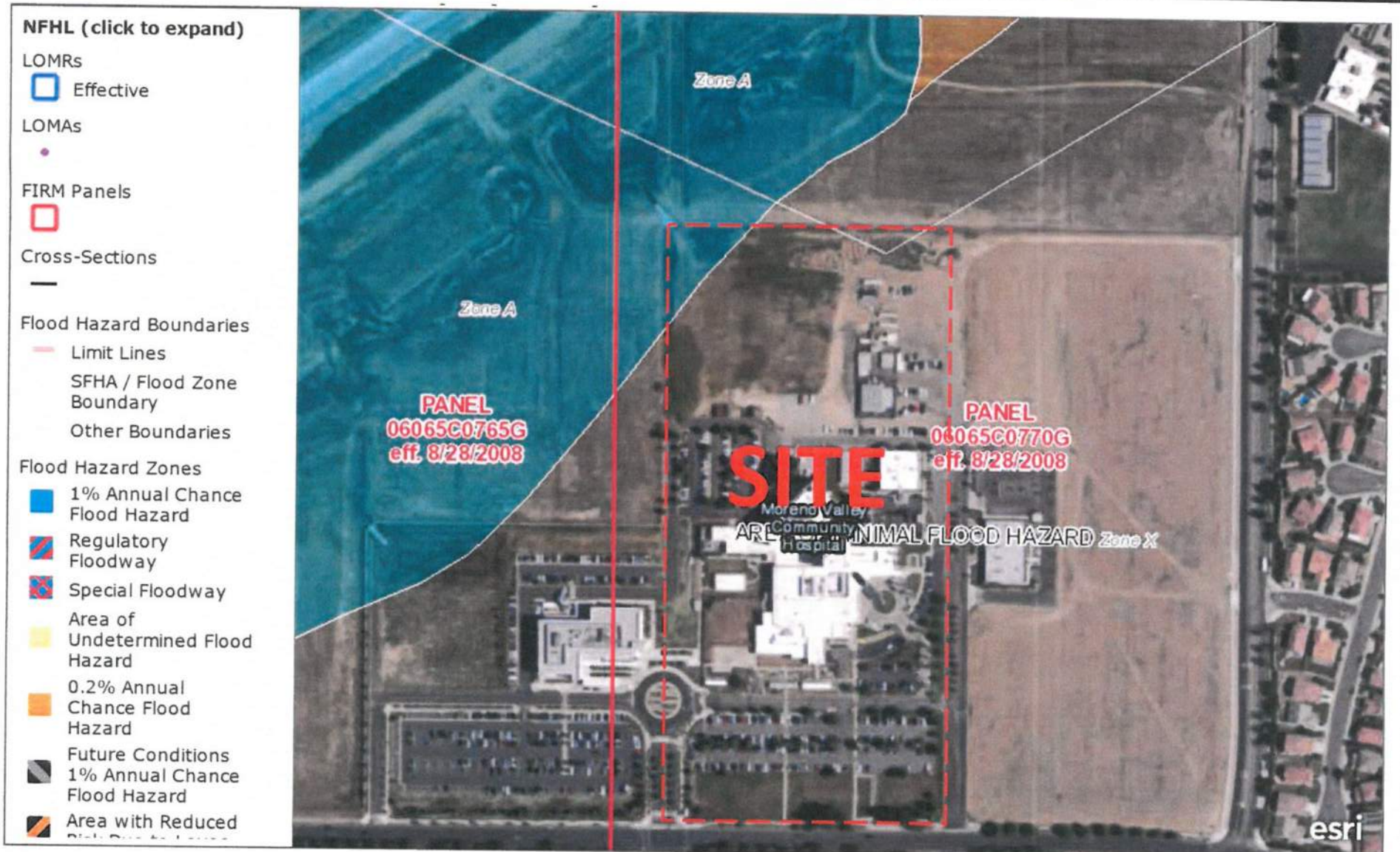


GEOBASE

SUBSIDENCE SUSCEPTIBILTY MAP
Kaiser Permanente MVMC – CUP
27300 Iris Avenue
Moreno Valley, California

C.314.82.00

FIGURE A-12



Data from Flood Insurance Rate Maps (FIRMs) where available digitally. New NFHL FIRMette Print app available:

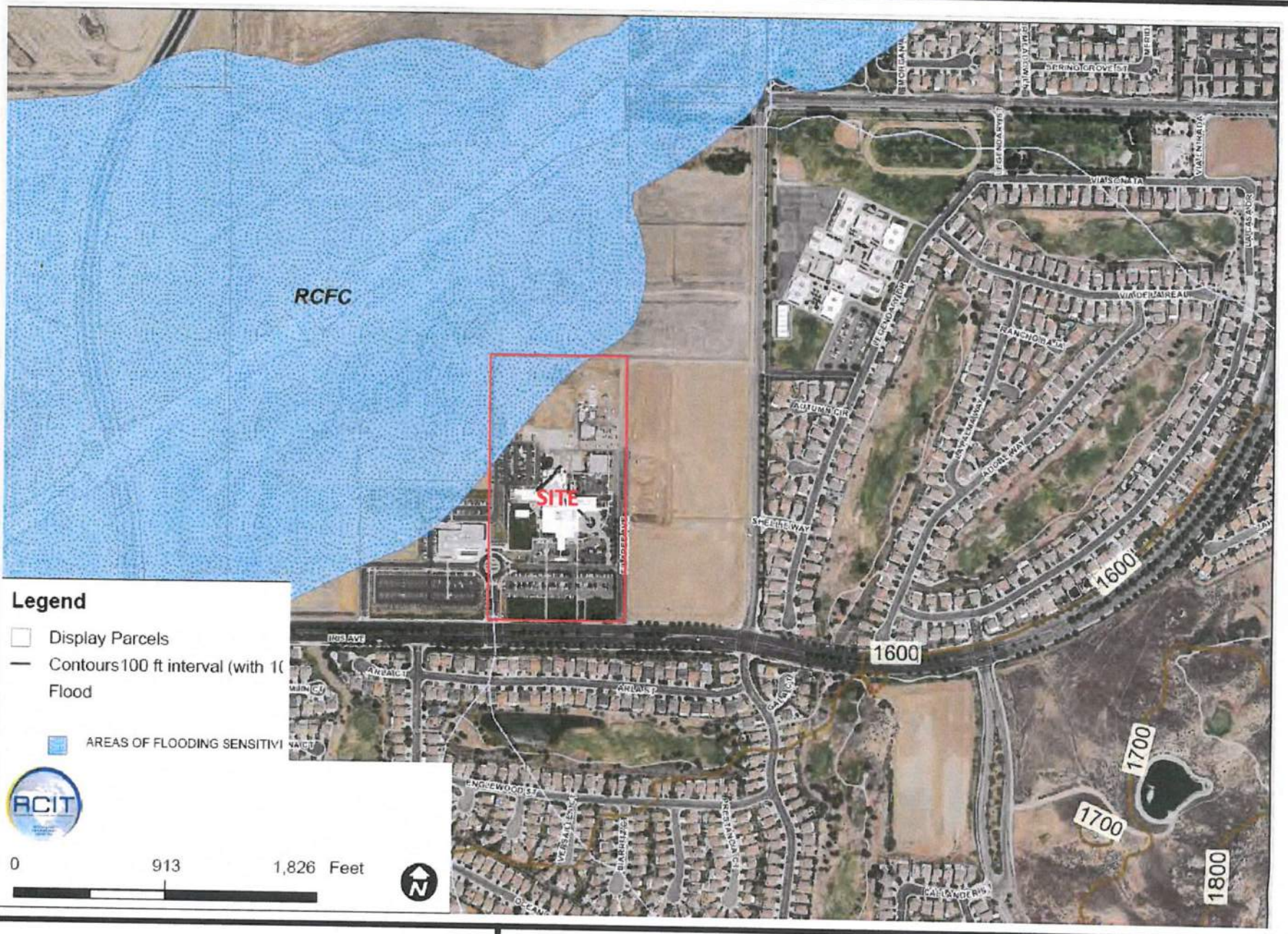
The **SITE** is in Zone X – Area determined to be outside of 0.2% annual chance of floodplain.
Zone A – 1% Annual Chance Flood Hazard

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C.314.82.00

FEMA FLOOD MAP
Kaiser Permanente MVMC – CUP
27300 Iris Avenue
Moreno Valley, California

FIGURE A-13



GEOBASE

RCIT FLOOD MAP
Kaiser Permanente MVMC – CUP
27300 Iris Avenue
Moreno Valley, California

C.314.82.00

FIGURE A-13
Page 2 of 2

APPENDIX B

Figure B-1	Explanation of Terms and Symbols
Figure B-2	Log of Boring B-1
Figure B-3	Log of Boring B-2
Figure B-4	Log of Boring B-3
Figure B-5	Log of Boring B-4
Figure B-6	Log of Boring B-5
Figure B-7	Log of Boring B-6
Figure B-8	Log of Boring B-7
Figure B-9	Log of Boring B-8
Figure B-10	Log of Boring B-9
Figure B-11	Log of Boring B-10
Figure B-12	Log of Boring B-11
Figure B-13	Log of CPT-1
Figure B-14	Log of CPT-2
Figure B-15	Log of CPT-3
Figure B-16	Log of CPT-4
Figure B-17	Log of CPT-5
Figure B-18	Log of CPT-6
Figure B-19	Log of CPT-7
Figure B-20	Log of CPT-8
Figure B-21	Log of CPT-9
Figure B-22	Log of CPT-10
Figure B-23	Log of CPT-11
Figure B-24	Log of CPT-12
Figure B-25	Log of CPT-13
Figure B-26	Log of CPT-14
Figure B-27	Log of Test Pit

GEOBASE INC (June 2010)

Figure B-28	Log of Boring B-1
Figure B-29	Log of Boring B-2
Figure B-30	Log of Boring B-4
Figure B-31	Log of CPT-3

GeoVision Geophysical Services, Inc. (July 21, 2017)

The terms and symbols used on the Log of Borings to summarize the results of the field investigation and subsequent laboratory testing are described in the following:

It should be noted that materials, boundaries, and conditions have been established only at the boring locations, and are not necessarily representative of subsurface conditions elsewhere across the site.

A. PARTICLE SIZE DEFINITION (ASTM D2487 AND D422)

Boulder	-- larger than 12-inches	Sand, medium	-- No.40 to No. 10 sieves
Cobble	-- 3-inches to 12-inches	Sand, fine	-- No.200 to No. 40 sieves
Gravel, coarse	-- 3/4-inch to 3-inches	Silt	-- 5μm to No. 200 sieves
Gravel, fine	-- No.4 sieve to 3/4 -inch	Clay	-- smaller than 5 μm
Sand, coarse	-- No.10 to No.4 sieve		

B. SOIL CLASSIFICATION

Soils and bedrock are classified and described according to their engineering properties and behavioral characteristics. The soil of each stratum is described using ASTM D2487 and D2488.

The following adjectives may be employed to define percentage ranges by weight of minor components:

trace	--	1-10%	some	--	20-35%
little	--	10-20%	"and" or "y"	--	35-50%

The following descriptive terms may be used for stratified soils:

parting	--	0 to 1/16-in. thickness;	layer	--	½-in. to 12-in. thickness;
seam	--	1/16 to ½-in. thickness;	stratum	--	greater than 12-in. thickness.

C. SOIL DENSITY AND CONSISTENCY

The density of coarse grained soils and the consistency of fine grained soils are described on the basis of the Standard Penetration Test:

COARSE GRAINED SOILS		FINE GRAINED SOILS		
Density	SPT Blows per Foot	Estimated Consistency	SPT Blows per Foot	Estimated Range of Unconfined Compressive Strength (tsf)
very loose	less than 4	very soft	less than 2	less than 0.25
loose	5 to 10	soft	2 to 4	0.25 to 0.50
medium	11 to 30	firm (medium)	5 to 8	0.50 to 1.0
dense	31 to 50	stiff	9 to 15	1.0 to 2.0
very dense	over 50	very stiff	16 to 30	2.0 to 4.0
		hard	over 30	over 4.0

GEOBASE

EXPLANATION OF TERMS AND SYMBOLS USED

Figure B-1

D. STANDARD PENETRATION TEST (SPT) -- D1586

The SPT test involves failure of the soil around the tip of a split spoon sampler for a condition of constant energy transmittal. The split spoon, 2-inches outside diameter and 1 3/8-inches inside diameter, is driven eighteen (18) inches. The sampler is seated in the first six (6) inches and the number of blows required to drive the sampler the last foot is recorded as the "N" value or SPT blow count. The driving energy is provided by a 140 pound weight dropping thirty (30) inches.

E. ABBREVIATION OF LABORATORY TEST DESIGNATIONS

C	Consolidation	pH	pH
CBR	California Bearing Ratio	pp	Pocket Penetrometer
Ch	Water Soluble Chlorides	PS	Particle Size
DS	Direct Shear	RV	R-Value
EI	Expansion Index	SE	Sand Equivalent
ER	Electrical Resistivity	SG	Specific Gravity
k	Permeability	SO_4	Water Soluble Sulfates
MD	Moisture	TX	Triaxial Compression
MP	Modified Proctor Compaction Test	TV	Torvane Shear
O	Organic Content	U	Unconfined Compression

F. STRATIFICATION LINES

The stratification lines indicated on the boring logs and profiles represent the ***approximate*** boundary between material types and the transition may be gradual.

SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

MAJOR DIVISION			GROUP SYMBOL	GRAPHIC SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
HIGHLY ORGANIC SOILS			Pt		Peat and other highly organic soils	Strong color or odor and often fibrous texture
COARSE-GRAINED SOILS (More than half by weight larger than No. 200 sieve size)	GRAVELS (More than half coarse fraction larger than No. 4 sieve size)	CLEAN GRAVELS	GW		Well-graded Gravels, Gravel-Sand mixtures (<5% fines)	$C_U = \frac{D_{60}}{D_{10}} > 4$ $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$
			GP		Poorly-graded Gravels and Gravel-Sand mixtures (<5% fines)	Not meeting all above requirements
		DIRTY GRAVELS	GM		Silty Gravels, Gravel-Sand-Silt mixtures (>12% fines)	Atterberg limits below "A" line or $I_p < 4$
			GC		Clayey Gravels, Gravel-Sand-Clay mixtures (>12% fines)	Atterberg limits above "A" line or $I_p > 7$
	SANDS (More than half coarse fraction smaller than No. 4 sieve size)	CLEAN SANDS	SW		Well-graded Sands, Gravelly Sands (<5% fines)	$C_U = \frac{D_{60}}{D_{10}} > 6$ $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$
			SP		Poorly-graded Sands or Gravelly Sands (<5% fines)	Not meeting all above requirements
		DIRTY SANDS	SM		Silty Sands, Sand-Silt mixtures (>12% fines)	Atterberg limits below "A" line or $I_p < 4$
			SC		Clayey Sands, Sand-Clay mixtures (>12% fines)	Atterberg limits above "A" line or $I_p > 7$
FINE-GRAINED SOILS (More than half by weight passes No. 200 sieve size)	SILTS Below "A" line on plasticity chart: negligible organic content		ML		Inorganic Silts and very fine Sands, Rock Flour, Silty Sands of slight plasticity	$W_L < 50$
			MH		Inorganic Silts micaceous or diatomaceous, fine Sandy or Silty soils	$W_L > 50$
	CLAYS Above "A" line on plasticity chart: negligible organic content		CL		Inorganic Clays of low plasticity, Gravelly, Sandy, or Silty Clays, lean Clays	$W_L < 30$
			CI		Inorganic Clays of medium plasticity, Silty Clays	$W_L > 30, < 50$
			CH		Inorganic Clays of high plasticity, fat Clays	$W_L > 50$
	ORGANIC SILTS & ORGANIC CLAYS Below "A" line on plasticity chart		OL		Organic Silts and organic Silty Clays of low plasticity	$W_L < 50$
			OH		Organic Clays of high plasticity	$W_L > 50$

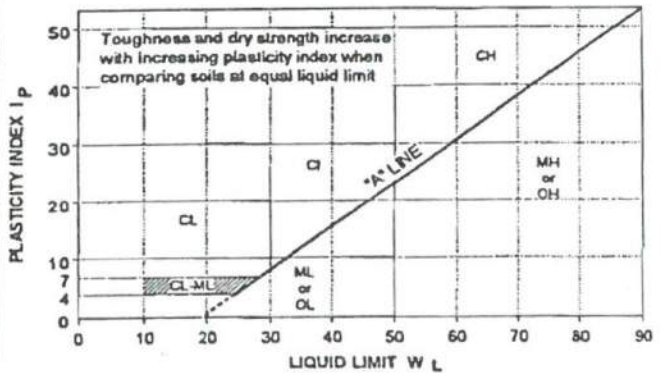
See chart below

The soil of each stratum is described using ASTM D2487 and D2488 modified slightly so that an inorganic clay of "medium plasticity" is recognized.

ADDITIONAL SOIL CLASSIFICATION

- Fill Soil
- Ss Sandstone
- Cs Claystone
- Ms Siltstone

PLASTICITY CHART



GEOBASE

EXPLANATION OF TERMS AND SYMBOLS USED

Figure B-1

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%):

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	REMARKS/ OTHER TESTS
	GRASS AND ROOTS, GRASS		
	SAND (FILL), brown, clayey, very loose.		
5	SILT, brown, fined-sands, little clay, very soft.	ML	N = PUSH 200 Wash
10	...stiff		
	SAND, brown, fine- to medium-grained, some silt.	SM	
15	...coarse-grained, little gravels, very dense		>> Blowcount = 94/12 in.
20	...medium- to coarse-grained, silty, medium dense		
25	...trace of gravels, medium dense		Blowcount = 32/12 in.
30	...poorly graded, trace to little silt, little gravels, medium dense		
35			

GEOBASE, INC.

PROJECT	KP Moreno Valley Medical Center 27300 Iris Avenue, Moreno Valley, CA		BORING NO. B-1
DEPTH TO WATER feet ▼	SURFACE ELEV. 1526 feet	LOGGED BY HDN	PROJECT NO. C.314.81.00
DEPTH TO SLOUGH ▲	DRILL RIG CME-75 HT DRILLER Martini Drilling	DATE LOGGED 06/07/2017	FIGURE NO. B-2

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	REMARKS/ OTHER TESTS
	SAND, light brown, medium- to coarse-grained, trace to little silt, little gravels, very dense.	SM	Blowcount = 78/12 in. 200 Wash
40	...silty, medium dense		200 Wash
45	...coarse-grained, some silt and fine-gravels, very dense		Blowcount = 90/12 in. 200 Wash
50	SAND, brown, little silt, trace of gravel, medium dense.	SM	
	SAND, light brown, medium- to coarse-grained, little pea gravels, trace of silt, medium dense.	SP	
55	...minor seepage at 56.5 ft		
	SAND, light brown, medium- to coarse grained, some gravels, dense	SM	
60			PS
65	...little silt, trace of gravels, dense		PS
	End of Boring at 66.5 feet. Boring dry at completion of drilling.. Backfilled with soil cuttings.		
70			

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%):

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

GEOBASE, INC.

PROJECT	KP Moreno Valley Medical Center 27300 Iris Avenue, Moreno Valley, CA		BORING NO. B-1
DEPTH TO WATER feet ▼	SURFACE ELEV. 1526 feet	LOGGED BY HDN	PROJECT NO. C.314.81.00
DEPTH TO SLOUGH ▲	DRILL RIG CME-75 HT DRILLER Martini Drilling	DATE LOGGED 06/07/2017	FIGURE NO. B-2
			page 2 of 2

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%):

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	REMARKS/ OTHER TESTS
	GRASS AND ROOTS, GRASS		
	SILT (FILL), brown, little sand and clay, soft.		
5	...some sands, very stiff		
	SAND, brown, fine- to medium-grained, sandy SILT with little clay.	SM-ML	Bulk Sample 5-10 ft. EI, MP, 95 RC, Ch, ER, pH, SO_4
10	...firm, some clay		Blowcount = 11/12 in. C, DS
15	...coarse-grained, little gravels, medium dense.		
	SAND, brown,.medium- to coarse-grained, silty, cementation, very dense	SM	
20			Blowcount = 86/12 in. C, DS
25	...trace of gravels, medium dense		
30	...poorly graded, trace to little silt, little gravels, medium dense		Blowcount = 41/12 in. C, DS
35			

GEOBASE, INC.

PROJECT	**KP Moreno Valley Medical Center** **27300 Iris Avenue, Moreno Valley, CA**		**BORING NO. B-2**
DEPTH TO WATER feet ▼	SURFACE ELEV. **1535 feet**	LOGGED BY **HDN**	PROJECT NO. **C.314.81.00**
DEPTH TO SLOUGH ▲	DRILL RIG **CME-75 HT** DRILLER **Martini Drilling**	DATE LOGGED **06/07/2017**	FIGURE NO. B- **3**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, light brown, medium- to coarse-grained, trace to little silt, little gravels, medium dense.	SP-SM			
40		...silty, white streak rock				
45		...silty				200 Wash
50		...fine-grained, silty				
55		...dense, minor seepage at 56 ft				
60		SAND, light brown, coasrse-grained, trace of silt, little gravel, dense.	SP			
65		End of Boring at 66.5 feet. Boring dry at completion of drilling. Backfilled with soil cuttings.				
70						

GEOBASE, INC.

PROJECT	**KP Moreno Valley Medical Center** **27300 Iris Avenue, Moreno Valley, CA**		**BORING NO. B-2**
DEPTH TO WATER feet ▼	SURFACE ELEV. **1535 feet**	LOGGED BY **HDN**	PROJECT NO. **C.314.81.00**
DEPTH TO SLOUGH ▲	DRILL RIG **CME-75 HT** DRILLER **Martini Drilling**	DATE LOGGED **06/07/2017**	FIGURE NO. B-**3**
Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.			page 2 of 2

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
	GRASS AND ROOTS, GRASS				
	SAND (FILL), brown, silty, very loose.				
5	SILT, brown, some fine-grained sand, soft.	ML			Bulk Sample 5-10 ft. EI, MP, 95 RC Ch, ER, pH, SO_4
10	SAND, brown, fine-grained, silty, loose.	SM			
	SILT, brown, little fine-grained sand, cementation, hard.	ML			
15					Blowcount = 72/12 in. DS, 200 Wash
	SAND, ...medium- to coarse-grained, silty.	SM			
20	...some silt, loose				
25	...trace of gravels, medium dense				Blowcount = 42/12 in.
30	...micaceous, fine- to medium-grained, silty and little gravels				
35					

GEOBASE, INC.

PROJECT	KP Moreno Valley Medical Center 27300 Iris Avenue, Moreno Valley, CA		BORING NO. B-3
DEPTH TO WATER feet ▼	SURFACE ELEV. 1525 feet	LOGGED BY HDN	PROJECT NO. C.314.81.00
DEPTH TO SLOUGH ▲	DRILL RIG CME-75 HT DRILLER Martini Drilling	DATE LOGGED 06/07/2017	FIGURE NO. B-4

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	REMARKS/ OTHER TESTS
40	SAND, light brown, medium- to coarse-grained, siltyt, trace of gravels, dense.	SM	Blowcount = 69/12 in. DS, 200 Wash
	...medium dense		
45	SAND, light brown, trace of silt and gravel, dense to very dense.	SP	Blowcount = 80/12 in.
50	...coasrse-grained, little gravels, dense ...minor seepage at 51 ft		
55	SILT, brown, little sands, stiff.	ML	
60	SAND, brown, medium-grained, little silt and trace of gravel, dense.	SM	
65	SAND, brown, coarse-grained, little gravel, trace of silt, medium dense.	SP	
70			

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%):

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

GEOBASE, INC.

PROJECT	**KP Moreno Valley Medical Center** **27300 Iris Avenue, Moreno Valley, CA**		**BORING NO. B-3**
DEPTH TO WATER feet ▼	SURFACE ELEV. **1525 feet**	LOGGED BY **HDN**	PROJECT NO. **C.314.81.00**
DEPTH TO SLOUGH ▲	DRILL RIG **CME-75 HT** DRILLER **Martini Drilling**	DATE LOGGED **06/07/2017**	FIGURE NO. B-**4**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, brown, trace of silt, some gravels, very dense.	SP			
75		End of Boring at 71.5 feet. Boring dry at completion of drilling. Backfilled with soil cuttings.				
80						
85						
90						
95						
100						
105						

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

DEPTH TO WATER feet ▼

DEPTH TO SLOUGH ▲

SURFACE ELEV. **1525 feet**

DRILL RIG **CME-75 HT**

DRILLER **Martini Drilling**

LOGGED BY **HDN**

DATE LOGGED **06/07/2017**

BORING NO. B-3

PROJECT NO. **C.314.81.00**

FIGURE NO. **B-4**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%):

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	REMARKS/ OTHER TESTS
0	SAND (FILL), brown, silty, very loose.	SM	
5	SILT, brown, little fine- to coarse-grained sand, soft.	ML	
10	...stiff		
	SAND, brown, silty, medium- to coarse grained, micaceous.	SM	
15	...dense		Blowcount = 37/12 in. C, DS, 200 Wash
20	...fine- to medium grained, little silt, medium dense		200 Wash
25	...silty, dense		Blowcount = 54/12 in.
30	SAND, light brown, fine- to medium grained, little silt, micaceous, dense.	SP	
35			

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

DEPTH TO WATER feet

DEPTH TO SLOUGH

SURFACE ELEV. **1526 feet**

DRILL RIG **CME-75 HT**
DRILLER **Martini Drilling**

LOGGED BY **HDN**

DATE LOGGED **06/08/2017**

BORING NO. B-4

PROJECT NO. **C.314.81.00**

FIGURE NO. B- **5**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%):

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	REMARKS/ OTHER TESTS
	SAND, brown, medium- to coarse-grained, little silt, very dense.	SP-SM		Blowcount = 91/10 in.
40	...silty medium dense			
45	...fine-grained, silty, medium dense			
50	...little silt, trace of gravel, dense			PS
55	SAND, brown, silty, fine-grained, medium dense. ...minor seepage at 56 ft	SM		
60	SAND, light brown, coarse-grained, trace of silt, very dense.	SP		
65	...fine- to medium-grained, dense			
70				

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

DEPTH TO WATER feet ▼

DEPTH TO SLOUGH ▲

SURFACE ELEV. **1526 feet**

DRILL RIG **CME-75 HT**
DRILLER **Martini Drilling**

LOGGED BY **HDN**

DATE LOGGED **06/08/2017**

BORING NO. B-4

PROJECT NO. **C.314.81.00**

FIGURE NO. B-**5**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, brown, coarse grained, little silt, trace of fined-gravels, very dense.	SM			N = 79, PS
75		End of Boring at 71.5 feet. Boring dry at completion of drilling. Backfilled with soil cuttings.				
80						
85						
90						
95						
100						
105						

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

DEPTH TO WATER feet ▼

DEPTH TO SLOUGH ▲

SURFACE ELEV. **1526 feet**

DRILL RIG **CME-75 HT**

DRILLER **Martini Drilling**

LOGGED BY **HDN**

DATE LOGGED **06/08/2017**

BORING NO. B-4

PROJECT NO. **C.314.81.00**

FIGURE NO. B- **5**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	REMARKS/ OTHER TESTS
	SAND (FILL), brown, silty, very loose.	SM		
5	SILT, brown, fine-grained sands, soff	ML		
10	...sandy, stiff			Blowcount = 23/12 in.
	SAND, brown, silty, cementation, micaceous, trace of gravels.	SM		
15	...white streak, very dense			N = 83
	SILT, ...some sands, very stiff.	ML		
20				Blowcount = 35/12 in.
	SAND, brown, silty, fine-grained, medium dense.	SM		
25				200 Wash
30	...light brown, silty, very dense.			>> Blowcount = 98/11 in. 200 Wash
35				

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%):

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

DEPTH TO WATER feet

DEPTH TO SLOUGH

SURFACE ELEV. **1527 feet**

DRILL RIG **CME-75 HT**

DRILLER **Martini Drilling**

LOGGED BY **HDN**

DATE LOGGED **06/08/2017**

BORING NO. B-5

PROJECT NO. **C.314.81.00**

FIGURE NO. B- **6**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, brown, medium- to coarse-grained, silty, medium dense.	SM			
40		...dense				Blowcount = 65/12 in.
45		...fine-grained, little gravels, dense				
50		SAND, light brown, fine- to medium-grained, little fine-gravels, medium dense.	SP			
55		...silty, dense ...minor seepage at 56 ft				
60		SAND, light brown, coarse-grained, little fine-gravel, dense.	SP			
65		End of Boring at 61.5 feet. Boring dry at completion of drilling. Backfilled with soil cuttings.				
70						

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

DEPTH TO WATER feet ▼
DEPTH TO SLOUGH ▲

SURFACE ELEV. **1527 feet**
DRILL RIG **CME-75 HT**
DRILLER **Martini Drilling**

LOGGED BY **HDN**
DATE LOGGED **06/08/2017**

BORING NO. B-5
PROJECT NO. **C.314.81.00**
FIGURE NO. B- **6**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND (FILL), brown, silty, very loose.	SM			
5		SILT, brown, fine-grained sands, stiff.	ML			
10		...some sands, very stiff				Blowcount = 43/12 in.
15		...little micaceous sands, white streak, cementation,, hard.				
20		...some sands, very stiff.				Blowcount = 35/12 in.
		SAND, brown, silty, fine-grained, medium dense.	SM			
25						
30		...little fine-gravel, dense				Blowcount = 64/12 in.
35						

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

DEPTH TO WATER feet ▼

DEPTH TO SLOUGH ▼

SURFACE ELEV. **1520 feet**

DRILL RIG **CME-75 HT**
DRILLER **Martini Drilling**

LOGGED BY **HDN**

DATE LOGGED **06/08/2017**

BORING NO. B-6

PROJECT NO. **C.314.81.00**

FIGURE NO. B-**7**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, brown, medium- to coarse-grained, little silt and gravels, medium dense.	SM			
40		...well-graded, trace of silt, some fine-gravels, very dense				Blowcount = 85/11 in.
45		...fine-grained, little gravels, medium dense				
50		SILT, brown, some sands, very stiff. ...minor seepage at 51.5 ft	ML			
55		SAND, light brown, coarse-grained, micaceous, fined-gravels, very dense.	SW			N = 66 PS
60		SAND, brown, coarse-grained, little fine-gravel and silt, dense.	SM			
65		SAND, light brown, coarse-grained, trace of silt and gravels, very dense.	SP			PS
70						

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

DEPTH TO WATER feet ▼

DEPTH TO SLOUGH ▲

SURFACE ELEV. **1520 feet**

DRILL RIG **CME-75 HT**
DRILLER **Martini Drilling**

LOGGED BY **HDN**

DATE LOGGED **06/08/2017**

BORING NO. B-6

PROJECT NO. **C.314.81.00**

FIGURE NO. B-**7**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, brown, silty, trace of gravels, dense.	SM			
75		End of Boring at 71.5 feet. Boring dry at completion of drilling. Backfilled with soil cuttings.				
80						
85						
90						
95						
100						
105						

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

DEPTH TO WATER feet ▼

DEPTH TO SLOUGH ▲

SURFACE ELEV. **1520 feet**

DRILL RIG **CME-75 HT**
DRILLER **Martini Drilling**

LOGGED BY **HDN**

DATE LOGGED **06/08/2017**

BORING NO. B-6

PROJECT NO. **C.314.81.00**

FIGURE NO. B-**7**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		GRASS AND ROOTS,				
		SAND, brown, silty, very loose.	SM			
5		SILT, brown, little fine-grained sands, hard.	ML			
10		...cementation, sandy, hard				Blowcount = 50/5 in. C, DS
15		...trace of sands, stiff				
20		SAND, brown, silty, fine-grained, very dense.	SM			>> Blowcount = 85/11 in.
25		...micaceous, some silt, medium dense				
30		...silty, dense				Blowcount = 60/12 in.
35						

GEOBASE, INC.

PROJECT	**KP Moreno Valley Medical Center 27300 Iris Avenue, Moreno Valley, CA**			**BORING NO. B-7**
DEPTH TO WATER	feet ▼	SURFACE ELEV. **1517 feet**	LOGGED BY **HDN**	PROJECT NO. **C.314.81.00**
DEPTH TO SLOUGH	▲	DRILL RIG **CME-75 HT** DRILLER **Martini Drilling**	DATE LOGGED **06/08/2017**	FIGURE NO. B- **8**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%):

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	REMARKS/ OTHER TESTS
	SAND, brown, medium- to coarse-grained, little silt and gravels, medium dense.	SM		PS
40	...little silt, trace of fine-gravels, very dense			Blowcount = 83/12 in.
45	SAND, light, brown, little fine-gravels, trace of silt, dense.	SP		
50	SAND, brown, some silt, little gravels, dense.	SM		Blowcount = 54/12 in.
	...minor seepage at 51.5 ft			
55	SAND, light brown, micaceous, litte silt and fine-gravels, very dense.	SP-SM		
60	...silty, little gravels, very dense			
65	...coarse-grained to fine-gravels			N = 79
70				

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

BORING NO. **B-7**

DEPTH TO WATER feet ▼ | SURFACE ELEV. **1517 feet** | LOGGED BY **HDN**

PROJECT NO. **C.314.81.00**

DEPTH TO SLOUGH ▲ | DRILL RIG **CME-75 HT** | DRILLER **Martini Drilling** | DATE LOGGED **06/08/2017**

FIGURE NO. B- **8**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, brown, little silt, some fine-gravels, very dense.	SP		N = 74	
75		End of Boring at 71.5 feet. Boring dry at completion of drilling. Backfilled with soil cuttings.				
80						
85						
90						
95						
100						
105						

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

DEPTH TO WATER feet ▼ | SURFACE ELEV. **1517 feet** | LOGGED BY **HDN**

DEPTH TO SLOUGH ▲ | DRILL RIG **CME-75 HT** | DRILLER **Martini Drilling** | DATE LOGGED **06/08/2017**

BORING NO. **B-7**

PROJECT NO. **C.314.81.00**

FIGURE NO. B-**8**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
0		GRASS AND ROOTS.				
		SAND, brown, silty, very loose.	SM			Bulk Sample 0-5 ft. EI, MP, RV, 200 Wash, 95 RC, Ch, ER, pH, SO_4
5		SILT, brown, some fine-grained sands, firm.	ML			
10		...little sands, very stiff				
15		...trace of sand				Blowcount = 43/12 in.
20		...little sands				
25		SAND, brown, fine-grained, silty, dense.	SM			Blowcount = 50/12 in.
30		...fine-grained, medium dense				
35						

GEOBASE, INC.

PROJECT	KP Moreno Valley Medical Center 27300 Iris Avenue, Moreno Valley, CA			BORING NO. B-8
DEPTH TO WATER feet ▼	SURFACE ELEV. 1514 feet		LOGGED BY HDN	PROJECT NO. C.314.81.00
DEPTH TO SLOUGH ▲	DRILL RIG CME-75 HT DRILLER Martini Drilling		DATE LOGGED 06/09/2017	FIGURE NO. B-9

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, brown, medium- to coarse-grained, little silt and gravels, dense.	SM			Blowcount = 48/12 in.
40		...light gray, fine- to medium-grained				
45		... little fine-gravels and silt, very dense.				Blowcount = 89/12 in. PS
50		brown, some silt, trace of gravels, medium dense.				
55		...silty ...minor seepage at 56 ft				
60		...silty, fine- to medium-grained, dense				
65		End of Boring at 61.5 feet. Boring dry at completion of drilling. Backfilled with soil cuttings.				
70						

GEOBASE, INC.

PROJECT	KP Moreno Valley Medical Center 27300 Iris Avenue, Moreno Valley, CA		BORING NO. B-8
DEPTH TO WATER feet ▼	SURFACE ELEV. 1514 feet	LOGGED BY HDN	PROJECT NO. C.314.81.00
DEPTH TO SLOUGH ▲	DRILL RIG CME-75 HT DRILLER Martini Drilling	DATE LOGGED 06/09/2017	FIGURE NO. B- 9

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%):

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	REMARKS/ OTHER TESTS
	GRASS AND ROOTS,		
	SAND (FILL), brown, silty, very loose.	SM	
5	SILT, brown, little fine-grained sands. ...very stiff	ML	
10	...some sands, cementation, hard		
15	...hard		
20	SAND, brown, silty, fine-grained, dense.	SM	Blowcount = 63/12 in. C, DS
25	...silty, trace of gravels, medium dense		200 Wash
30	...little fine-gravels, very dense.		Blowcount = 80/11 in.
35			

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

DEPTH TO WATER feet ▼

DEPTH TO SLOUGH ▲

SURFACE ELEV. **1516 feet**

DRILL RIG **CME-75 HT**

DRILLER **Martini Drilling**

LOGGED BY **HDN**

DATE LOGGED **06/09/2017**

BORING NO. B-9

PROJECT NO. **C.314.81.00**

FIGURE NO. B- **10**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, brown, some gravels, little silt, medium dense	SM			
40		SAND, light brown, fine-grained, trace of silt, dense.	SP			
45		SAND, brown, little to some silt, medium dense.	SM			
50		...silty, ...seepage at 51.5 ft				
55		...medium-grained				
60		SAND, light brown, coarse-grained, some gravels, trace of silt, dense.	SW			PS
65		End of Boring at 61.5 feet. Boring dry at completion of drilling. Backfilled with soil cuttings.				
70						

GEOBASE, INC.

PROJECT	**KP Moreno Valley Medical Center** **27300 Iris Avenue, Moreno Valley, CA**		**BORING NO. B-9**
DEPTH TO WATER feet ▼	SURFACE ELEV. **1516 feet**	LOGGED BY **HDN**	PROJECT NO. **C.314.81.00**
DEPTH TO SLOUGH ▲	DRILL RIG **CME-75 HT** DRILLER **Martini Drilling**	DATE LOGGED **06/09/2017**	FIGURE NO. B-**10**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%):

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	REMARKS/ OTHER TESTS
0	SAND (FILL), brown, silty, medium dense	SM	Bulk Sample 0-5 ft. EI, RV, 200 Wash, Ch, ER, pH, SO_4
5	SILT, brown, little fine-grained sands, very stiff.	ML	200 Wash
10	...very stiff		200 Wash
	SAND, brown, silty interlayers, fine- to medium-grained, cementation.	SM	
15	...very dense layer.		Blowcount = 100/11 in. 200 Wash, C, DS
20	...fine-grained, medium dense		
25	...medium-grained, dense		Blowcount = 52/12 in. C, DS
30	...silty, little fine-gravels, medium dense.		200 Wash
35			

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

BORING NO. **B-10**

DEPTH TO WATER feet ▼

DEPTH TO SLOUGH ▲

SURFACE ELEV. **1517 feet**

LOGGED BY **HDN**

DRILL RIG **CME-75 HT**

DRILLER **Martini Drilling**

DATE LOGGED **06/09/2017**

PROJECT NO. **C.314.81.00**

FIGURE NO. B- **11**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%):

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	REMARKS/ OTHER TESTS
	SAND, light brown, silty interlayer, coarse-grained, trace of fine-gravels, very dense.	SM		Blowcount = 85/11 in. PS
40	...some silt, some fine-gravels up to 1/2 in fragments, medium dense.			PS
45	...silty, little gravels, dense			Blowcount = 51/12 in.
50	...coarse-grained, some fine-gravels , medium dense.			PS
	...seepage at 51.5 ft			
55	...fine-grained, little silt, medium dense.			PS
60	...silty, fine- to medium-grained, dense.			
65	End of Boring at 61.5 feet. Boring dry at completion of drilling.. Backfilled with soil cuttings.			
70				

GEOBASE, INC.

PROJECT	**KP Moreno Valley Medical Center** **27300 Iris Avenue, Moreno Valley, CA**		**BORING NO. B-10**
DEPTH TO WATER feet ▼	SURFACE ELEV. **1517 feet**	LOGGED BY **HDN**	PROJECT NO. **C.314.81.00**
DEPTH TO SLOUGH ▲	DRILL RIG **CME-75 HT** DRILLER **Martini Drilling**	DATE LOGGED **06/09/2017**	FIGURE NO. B-**11**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	REMARKS/ OTHER TESTS
	SAND (FILL), brown, silty, medium dense	SM	
5	SILT, brown, little fine-grained sands, stiff.	ML	
10	...hard		Blowcount = 50/6 in.
15	SAND, brown, silt interlayer, coarse-grained, some gravels, dense.	SM	200 Wash
20	...fine-grained sands, medium dense		Blowcount = 33/12 in. 200 Wash
25	...silty, medium dense.		
30	...silty, dense		Blowcount = 69/12 in.200 Wash
35			

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%):

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

DEPTH TO WATER feet

DEPTH TO SLOUGH

SURFACE ELEV. **1517 feet**

DRILL RIG **CME-75 HT**
DRILLER **Martini Drilling**

LOGGED BY **HDN**

DATE LOGGED **06/09/2017**

BORING NO. B-11

PROJECT NO. **C.314.81.00**

FIGURE NO. B- **12**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
	SAND, brown, fine- to medium-grained, trace of silt, dense.	SM			200 Wash
40	SAND, light brown, coarse-grained, little silt, some fine-gravels, very dense.	SP		>>	Blowcount = 80/12 in. PS
45	...fine-to medium-grained, silty, dense				
50	SAND, brown, silty, fine-to medium grained, trace of gravel, dense.	SM			PS
55	...medium dense ...seepage at 56 ft				
60	...trace of gravels, medium dense				
65	End of Boring at 61.5 feet. Boring dry at completion of drilling. Backfilled with soil cuttings.				
70					

GEOBASE, INC.

PROJECT: **KP Moreno Valley Medical Center**
27300 Iris Avenue, Moreno Valley, CA

DEPTH TO WATER feet ▼
DEPTH TO SLOUGH ▲

SURFACE ELEV. **1517 feet**
DRILL RIG **CME-75 HT**
DRILLER **Martini Drilling**

LOGGED BY **HDN**
DATE LOGGED **06/09/2017**

BORING NO. B-11
PROJECT NO. **C.314.81.00**
FIGURE NO. B-**12**

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

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Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

CPT-1
Total depth: 75.14 ft, Date: 6/8/2017
Cone Type: Vertek

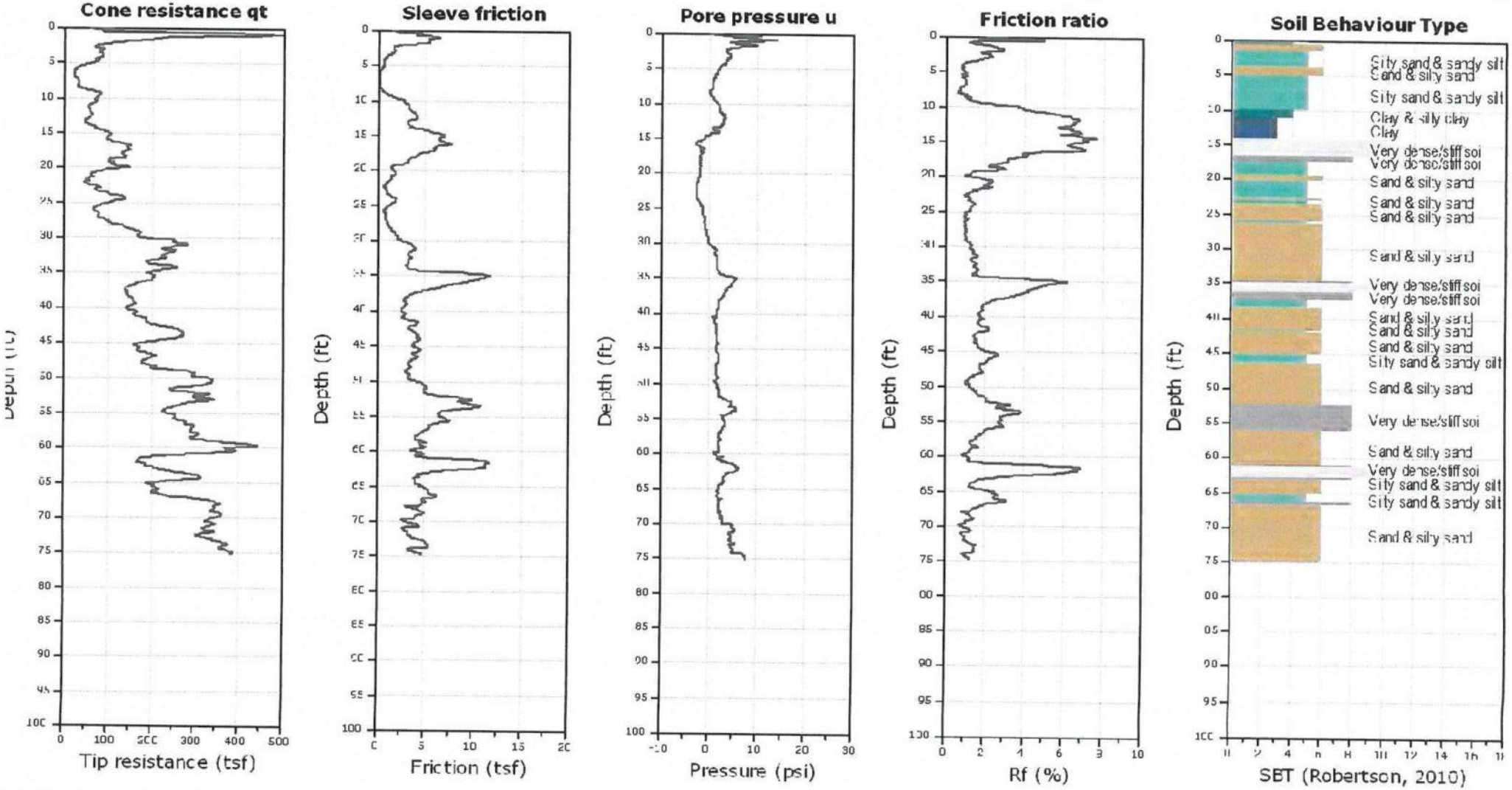
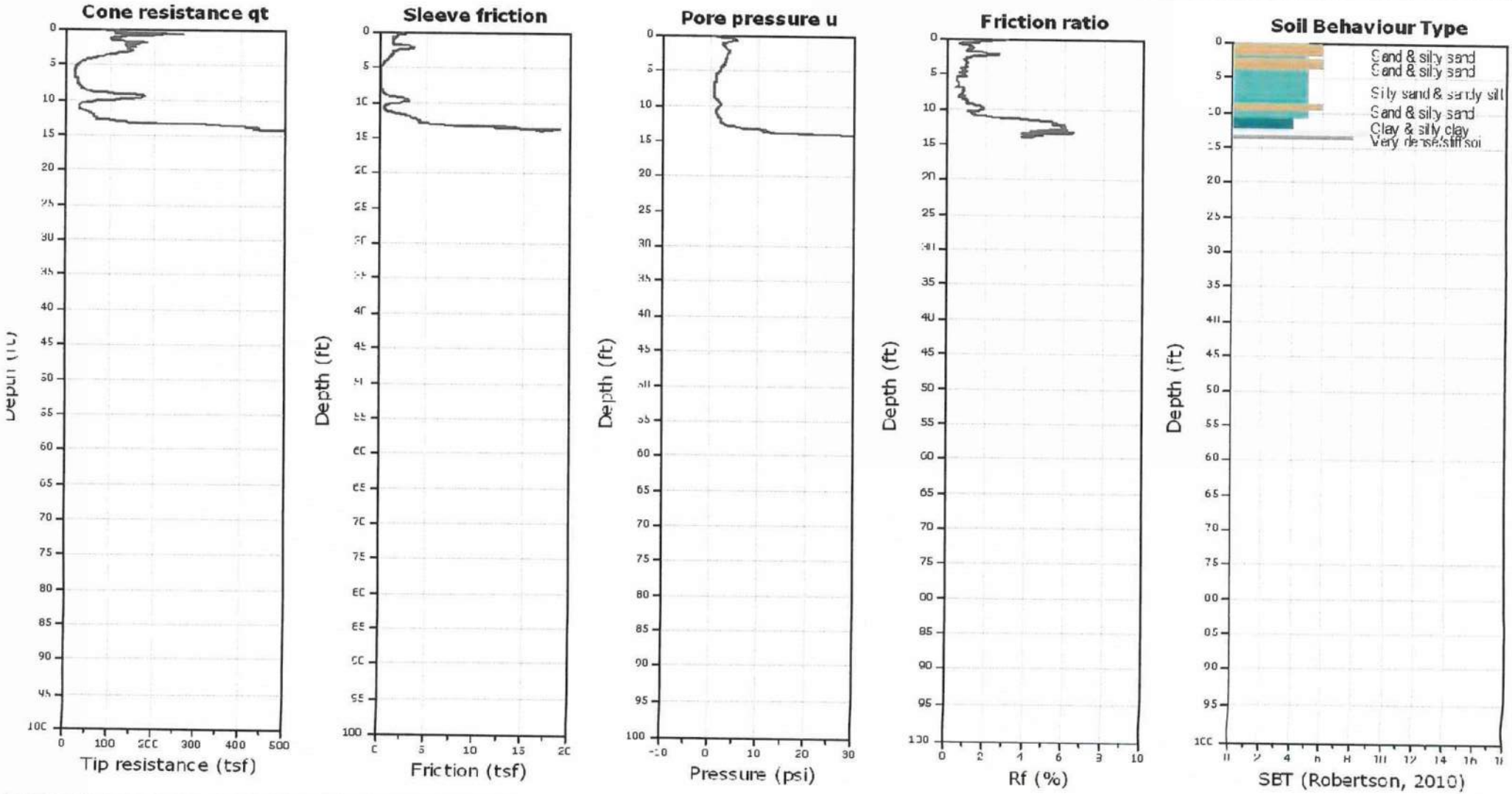


Figure B-13

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rich@kehoetesting.com
www.kehoetesting.com

Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

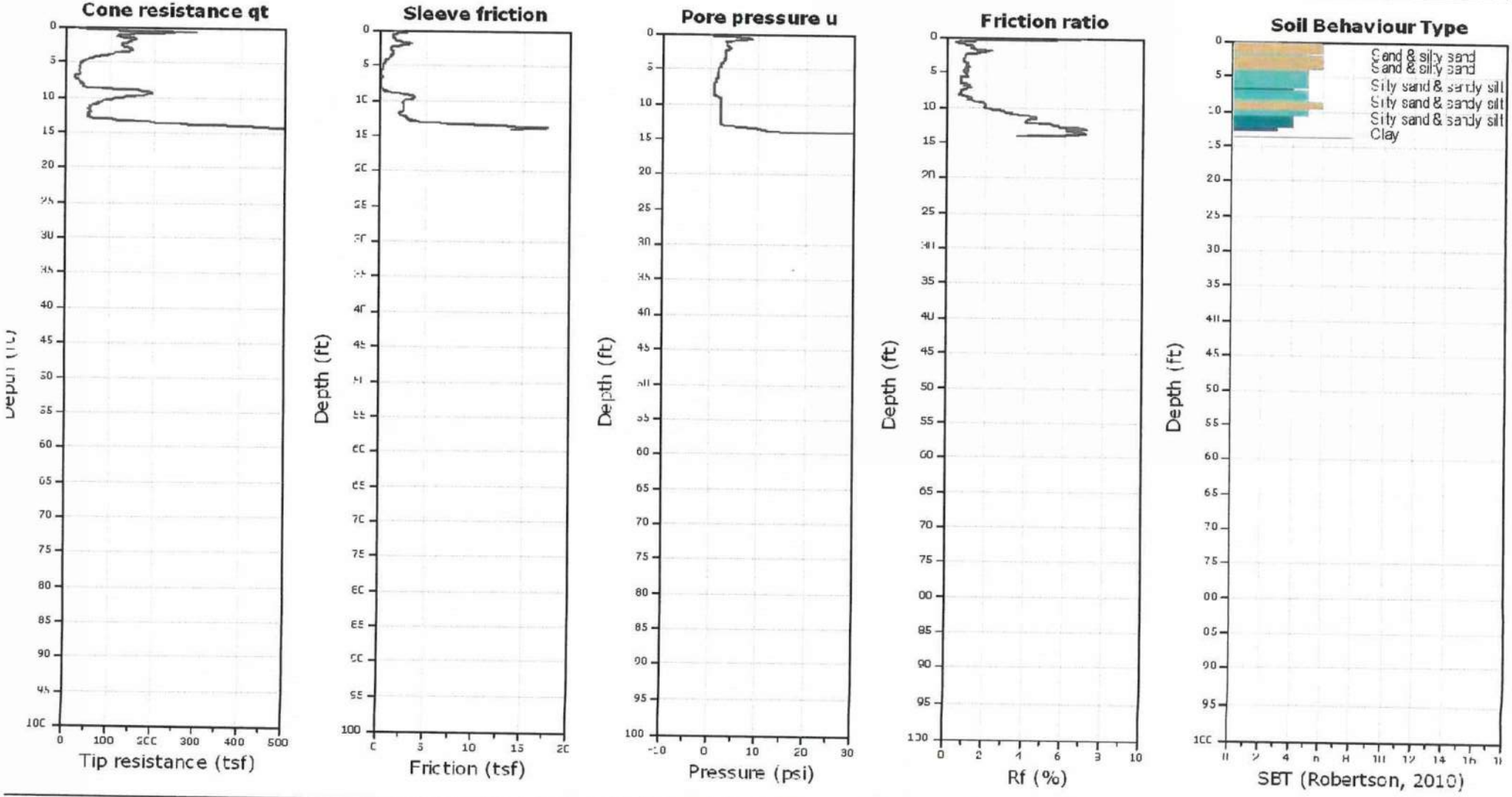
CPT-2
Total depth: 14.30 ft, Date: 6/8/2017
Cone Type: Vertek



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Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

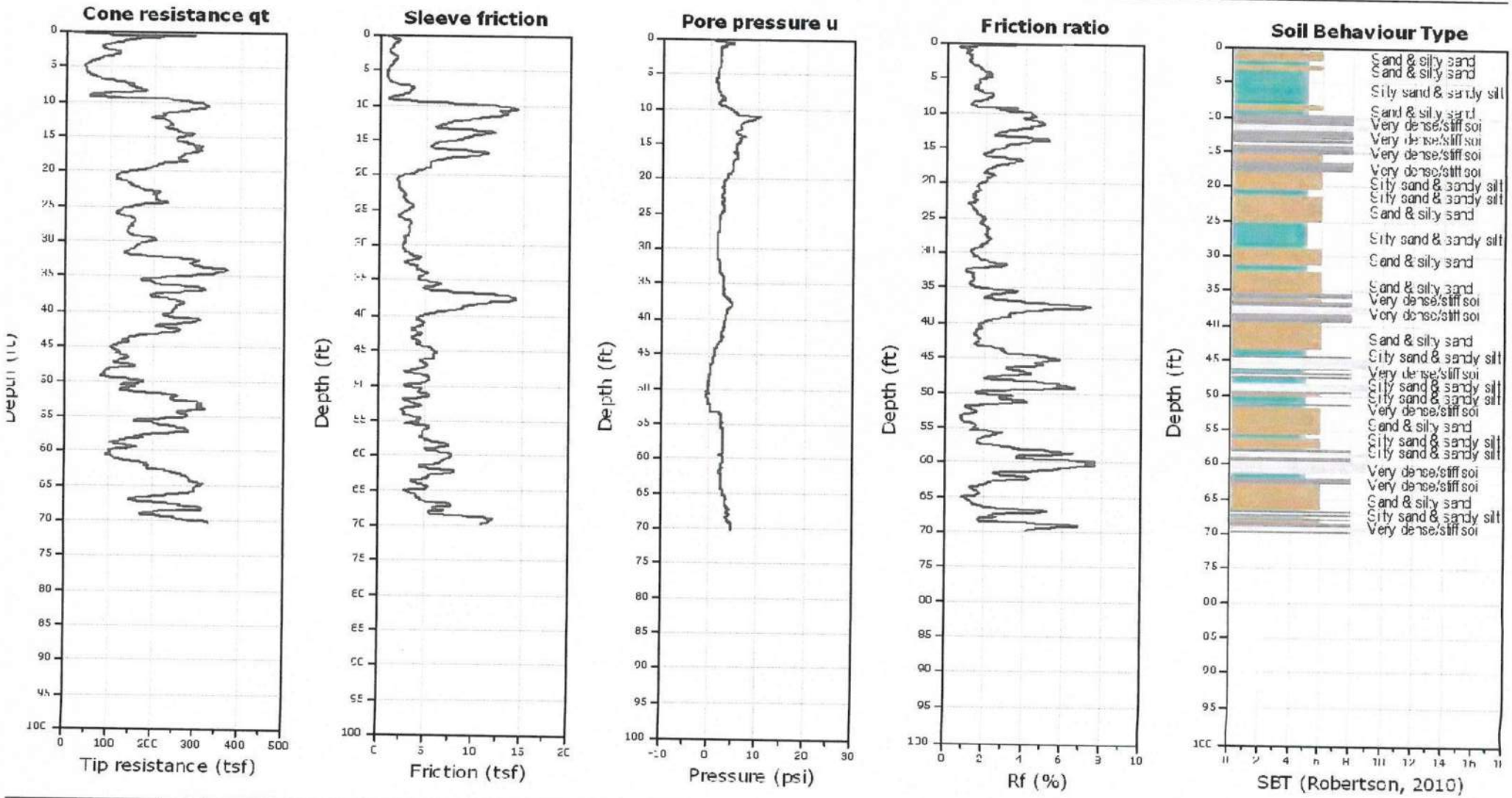
CPT-2A
Total depth: 14.33 ft, Date: 6/8/2017
Cone Type: Vertek



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Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

CPT-3
Total depth: 70.16 ft, Date: 6/8/2017
Cone Type: Vertek



C.314.81.00

Figure B-15

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Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

SCPT-4
Total depth: 100.15 ft, Date: 6/8/2017
Cone Type: Vertek

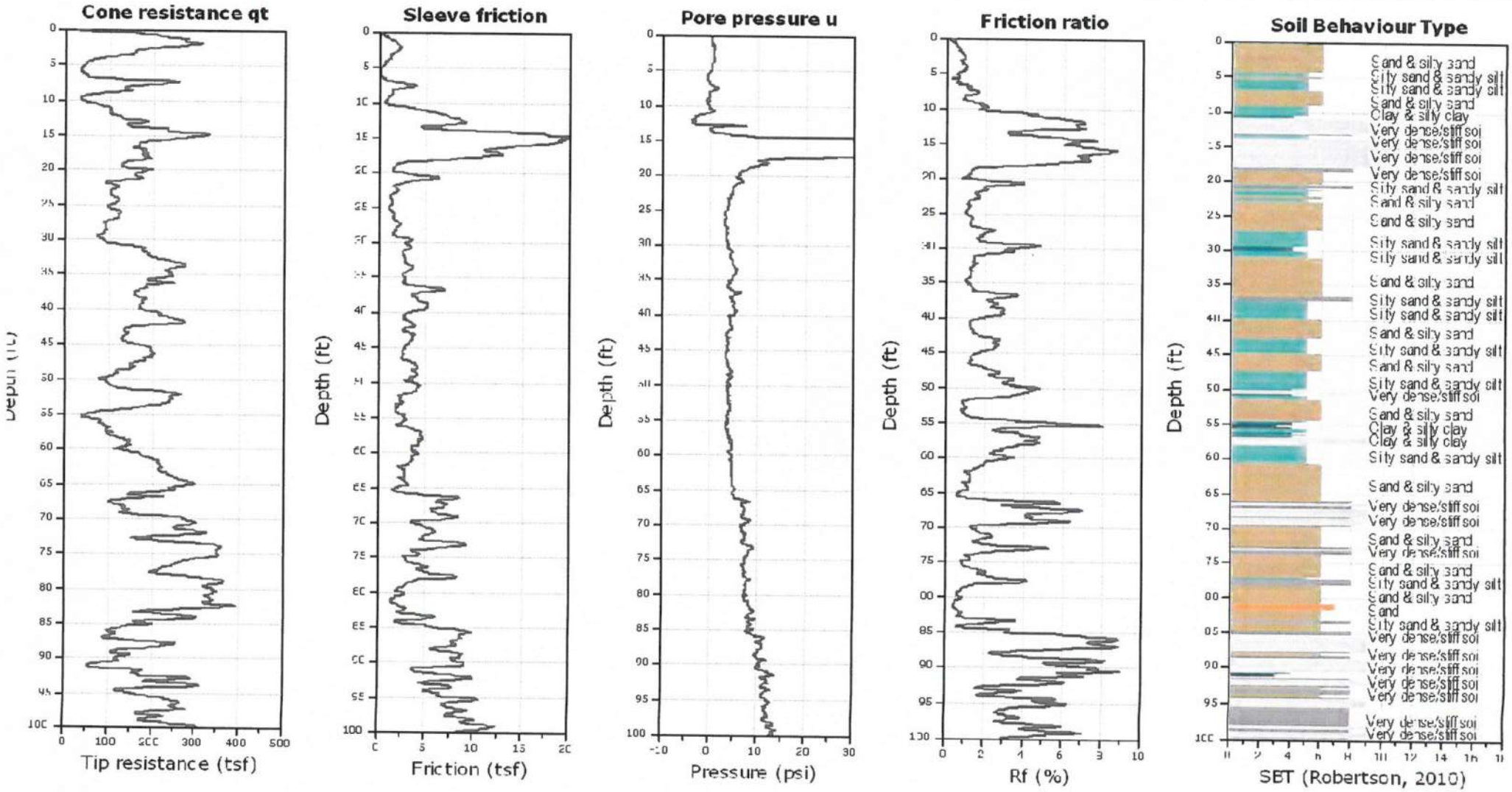
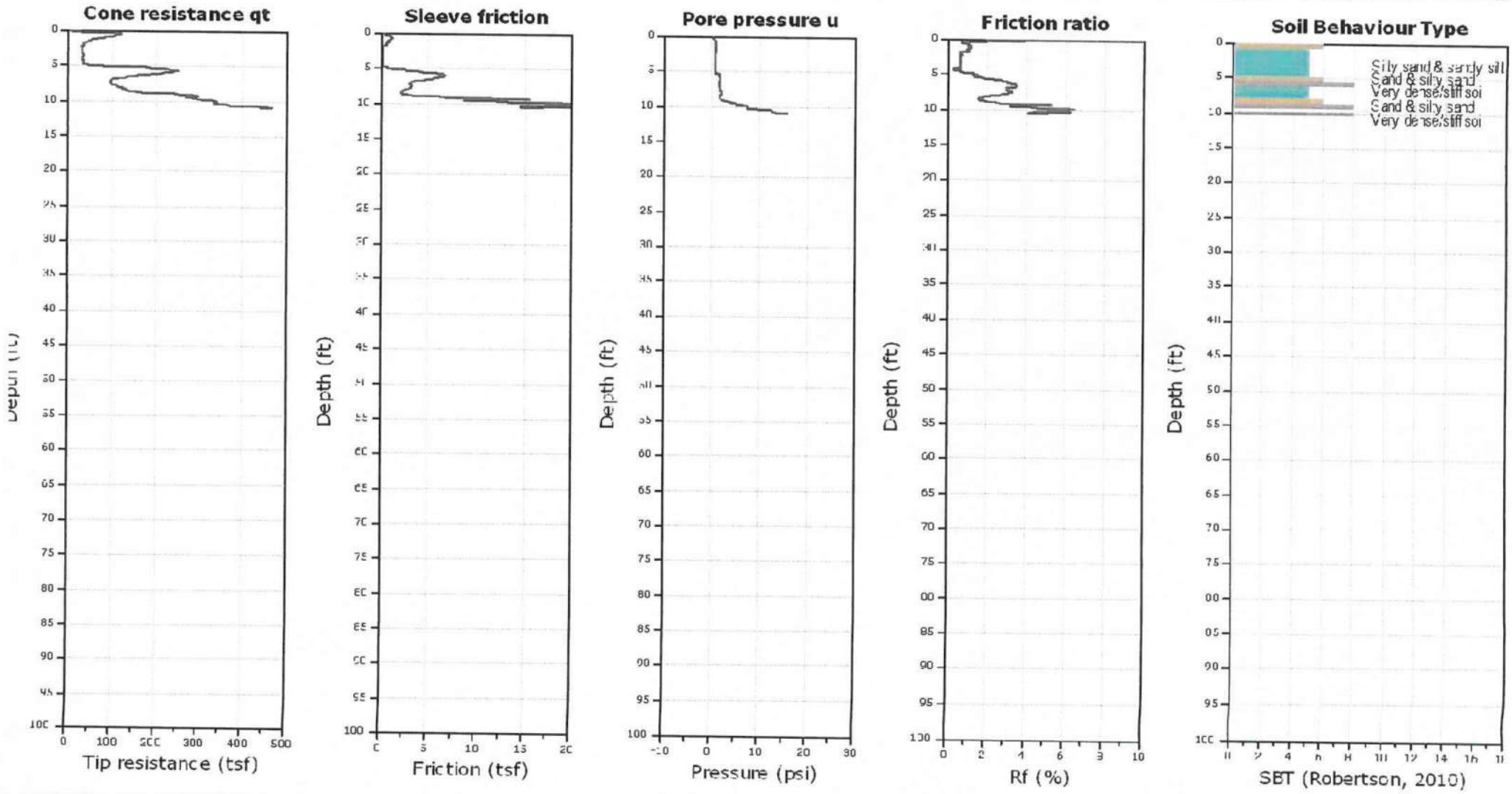


Figure B-16

Kehoe Testing and Engineering
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rich@kehoetesting.com
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Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

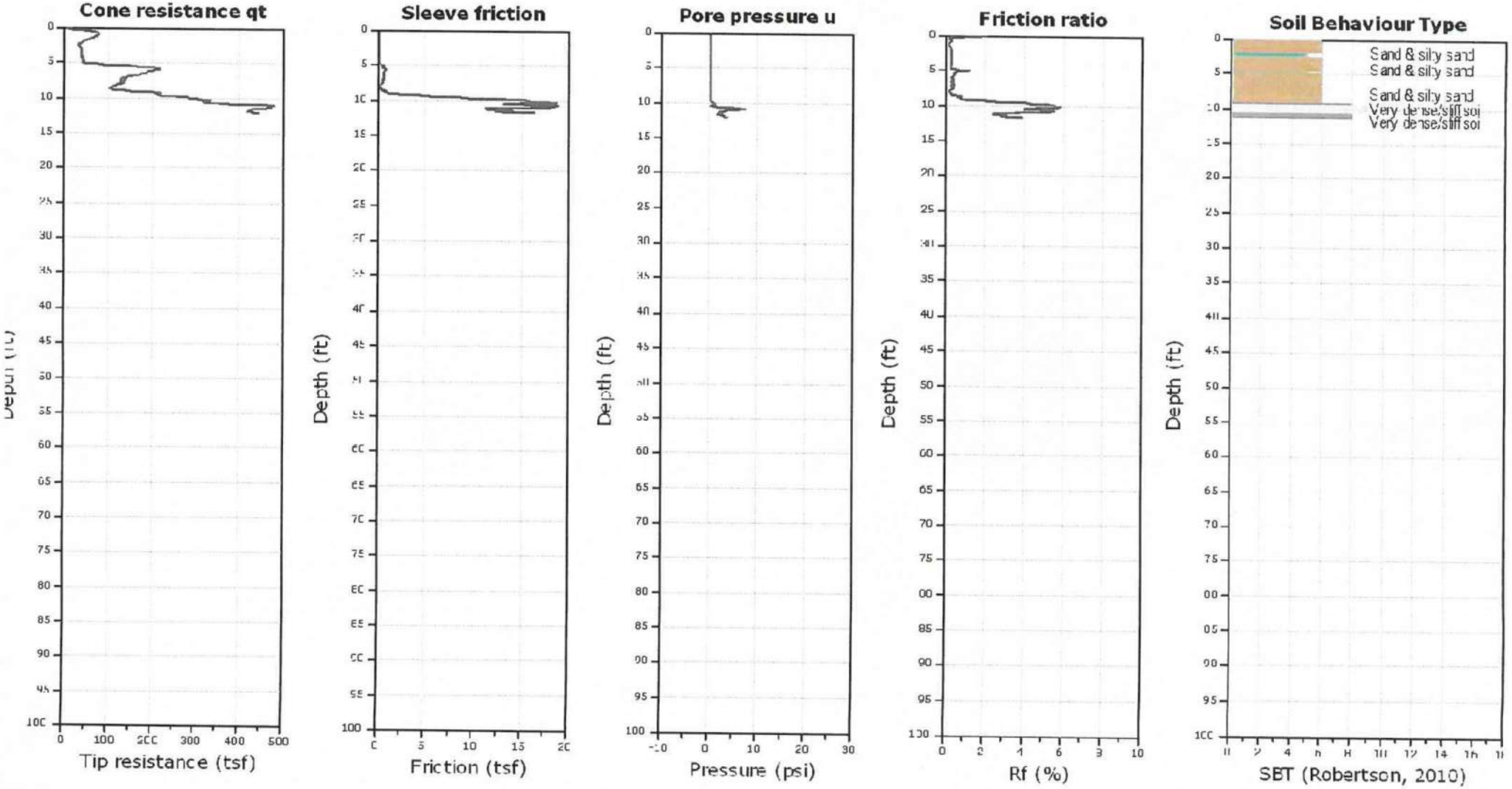
CPT-5
Total depth: 10.90 ft, Date: 6/8/2017
Cone Type: Vertek



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Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

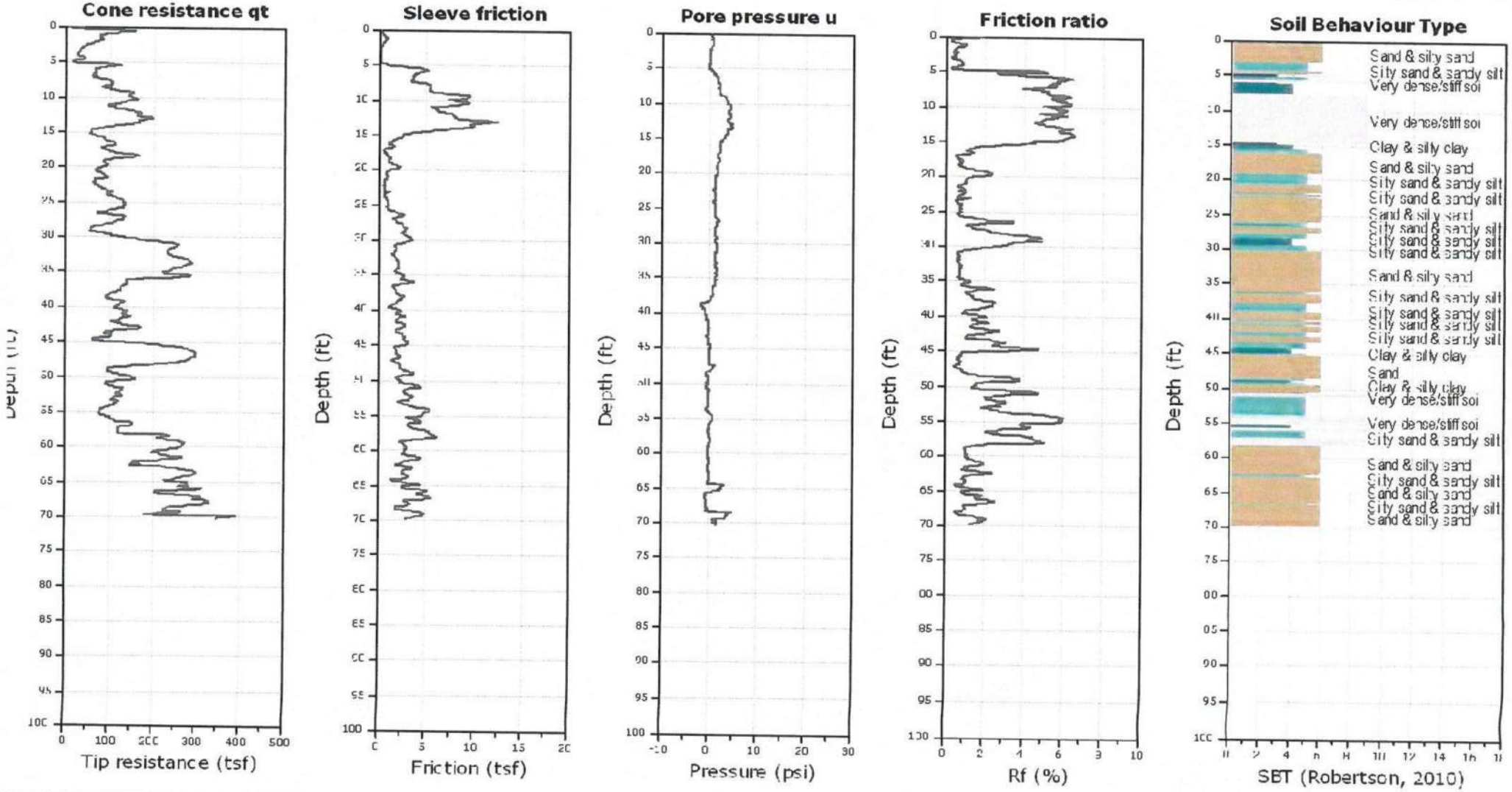
CPT-5A
Total depth: 12.01 ft, Date: 6/8/2017
Cone Type: Vertek



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Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

CPT-6
Total depth: 70.15 ft, Date: 6/8/2017
Cone Type: Vertek



CPeT-IT v.2.0.1.55 - CPTU data presentation & interpretation software - Report created on: 6/12/2017, 3:35:28 PM
Project file: C:\GeobaseMorenoValley6-17\Plot Data\Plots.cpt

0

C.314.81.00

Figure B-18

Kehoe Testing and Engineering
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rich@kehoetesting.com
www.kehoetesting.com

Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

CPT-7
Total depth: 70.22 ft, Date: 6/8/2017
Cone Type: Vertek

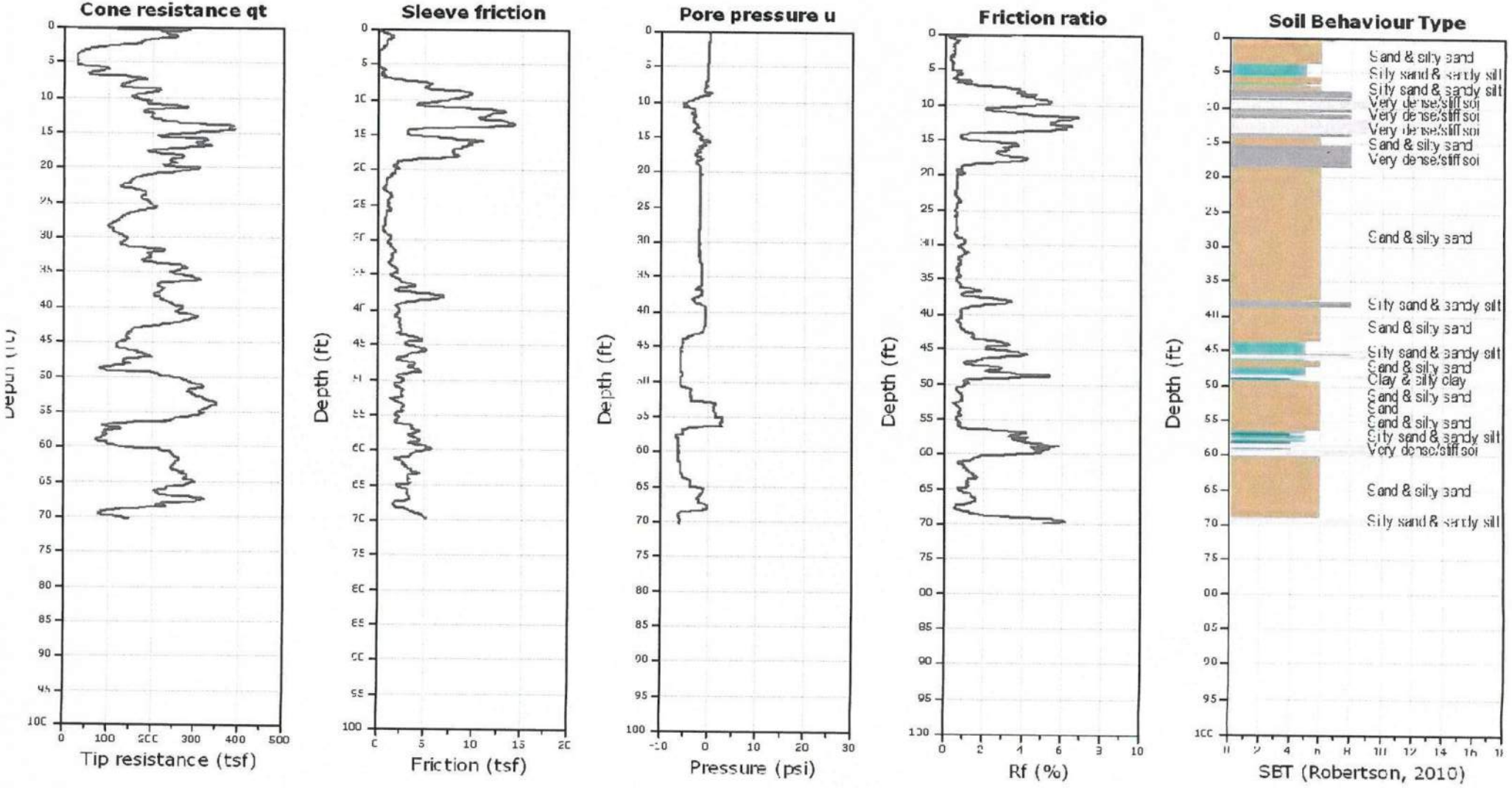


Figure B-19

Kehoe Testing and Engineering
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rich@kehoetesting.com
www.kehoetesting.com

Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

CPT-8
Total depth: 70.15 ft, Date: 6/9/2017
Cone Type: Vertek

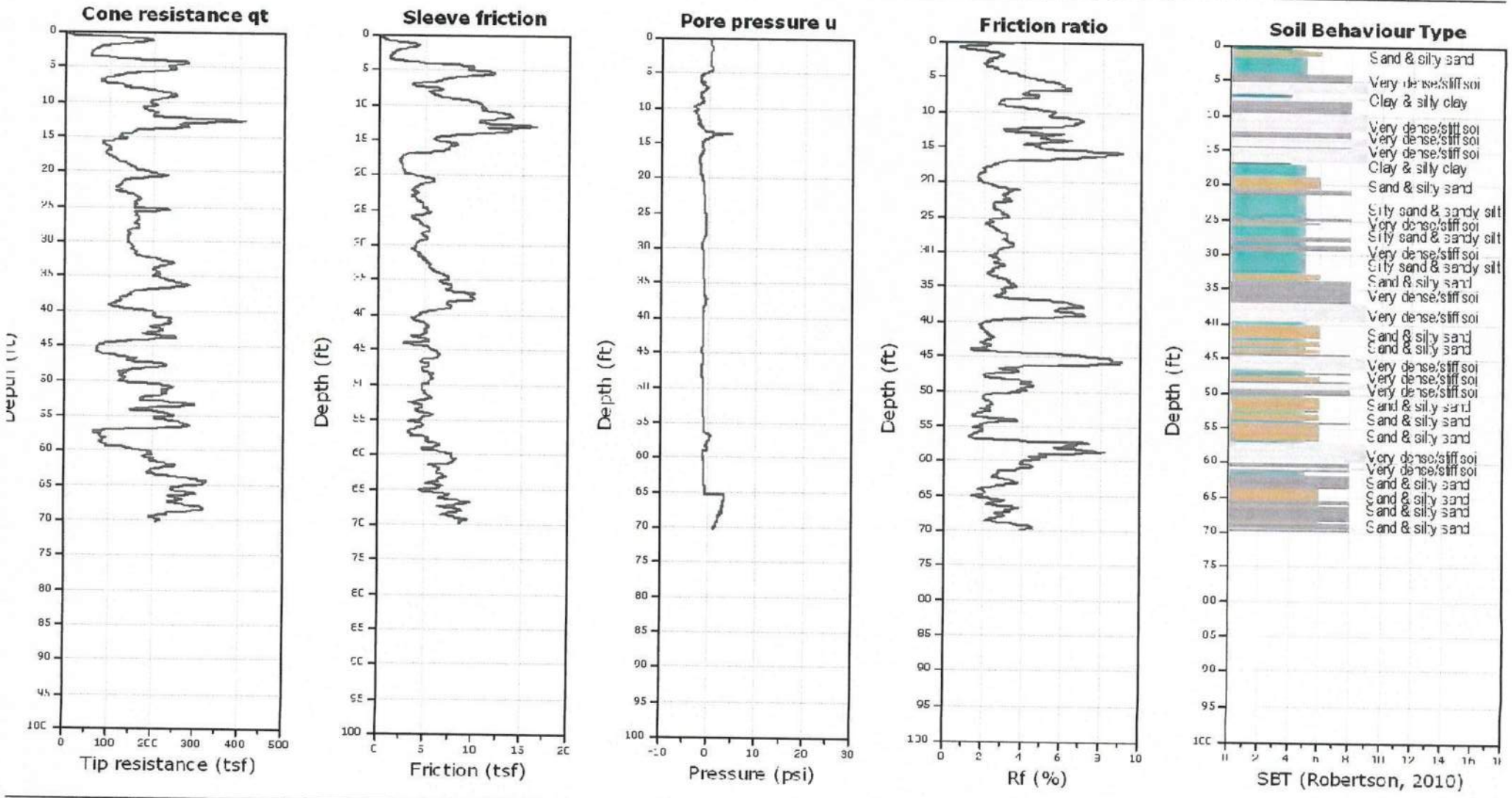


Figure B-20

Kehoe Testing and Engineering
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rich@kehoetesting.com
www.kehoetesting.com

Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

CPT-9
Total depth: 70.24 ft, Date: 6/9/2017
Cone Type: Vertek

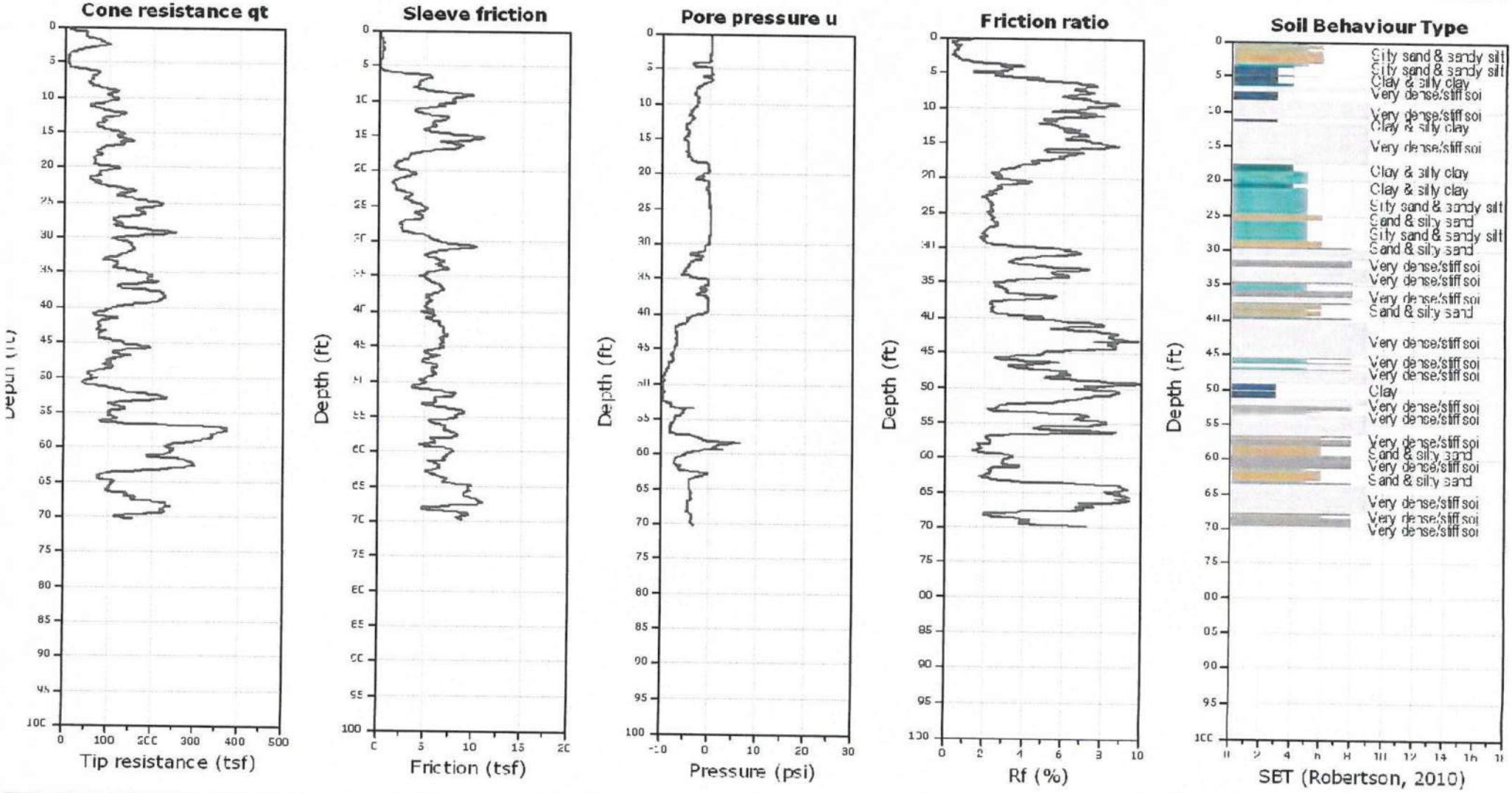
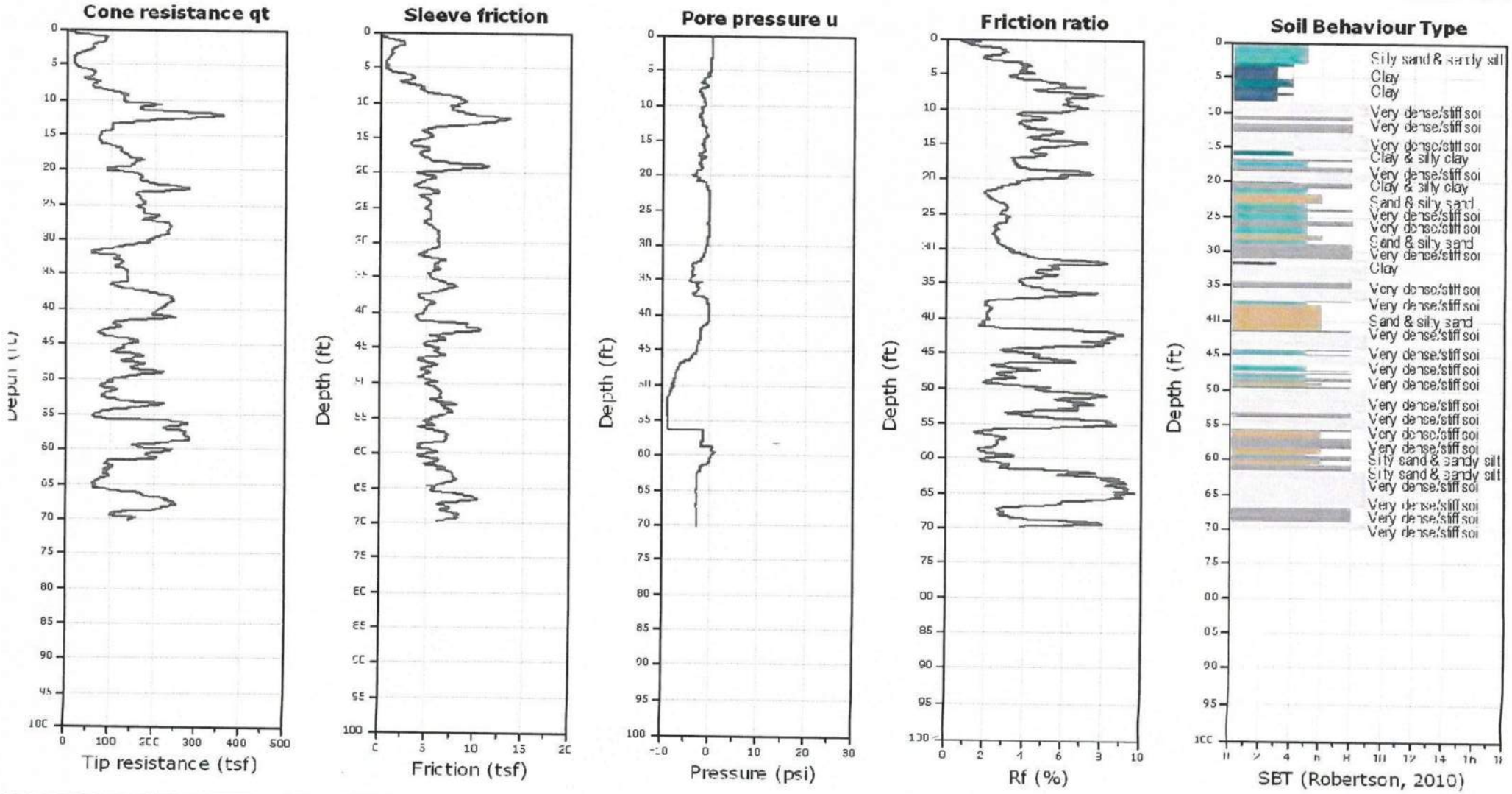


Figure B-21

Kehoe Testing and Engineering
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Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

CPT-10
Total depth: 70.15 ft, Date: 6/9/2017
Cone Type: Vertek



CPeT-IT v.2.0.1.55 - CPTU data presentation & interpretation software - Report created on: 6/12/2017, 3:36:33 PM
Project file: C:\GeobaseMorenoValley6-17\Plot Data\Plots.cpt

C.314.81.00

Figure B-22

Kehoe Testing and Engineering
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Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

CPT-11
Total depth: 70.22 ft, Date: 6/9/2017
Cone Type: Vertek

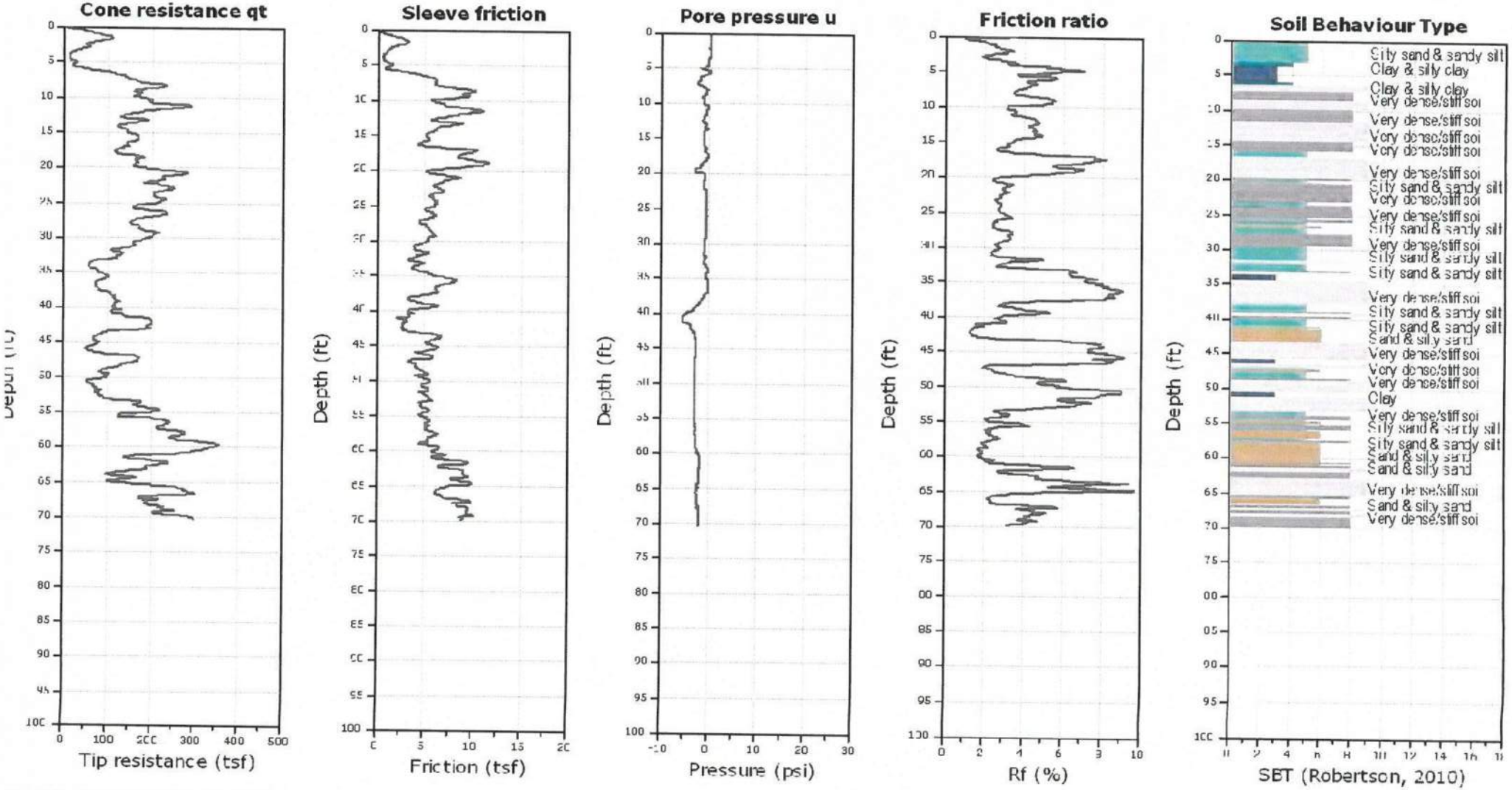


Figure B-23

Kehoe Testing and Engineering
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Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

SCPT-12
Total depth: 100.13 ft, Date: 6/9/2017
Cone Type: Vertek

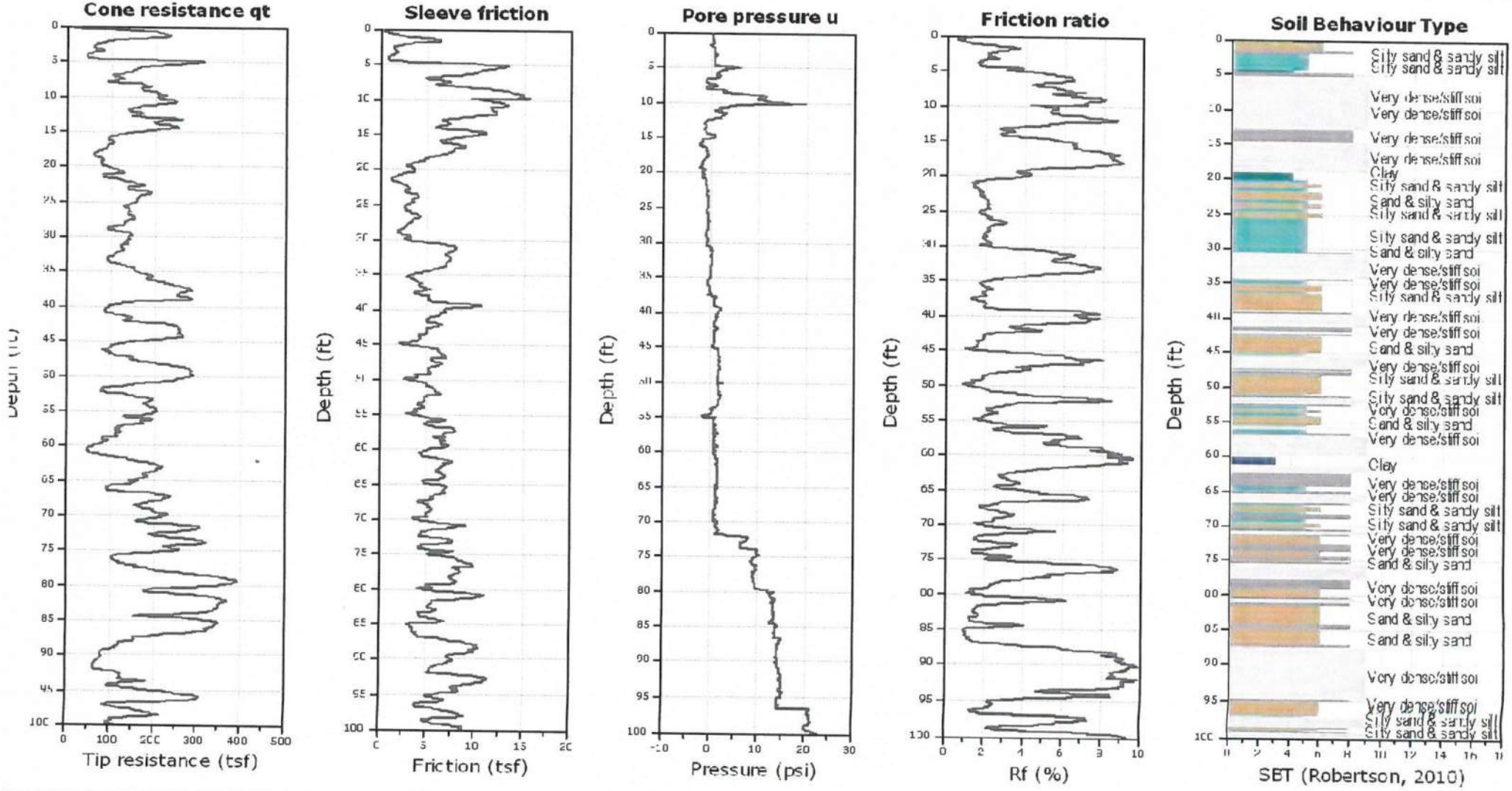
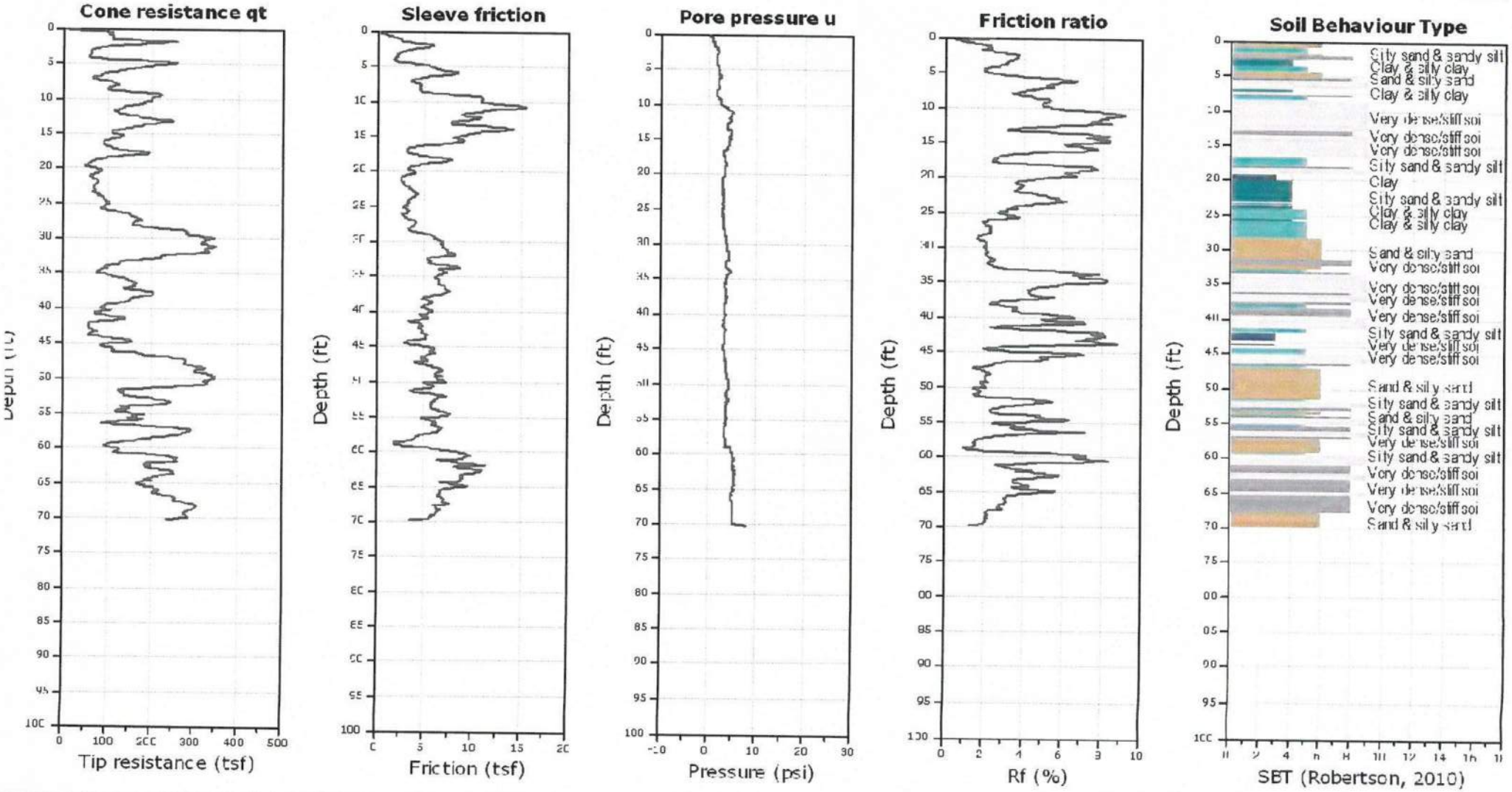


Figure B-24

Kehoe Testing and Engineering
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www.kehoetesting.com

Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

CPT-13
Total depth: 70.22 ft, Date: 6/9/2017
Cone Type: Vertek



CPeT-IT v.2.0.1.55 - CPTU data presentation & interpretation software - Report created on: 6/12/2017, 3:37:02 PM
Project file: C:\GeobaseMorenoValley6-17\Plot Data\Plots.cpt

C.314.81.00

Figure B-25

Kehoe Testing and Engineering
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rich@kehoetesting.com
www.kehoetesting.com

Project: GEOBASE, Inc.
Location: 27300 Iris Ave Moreno Valley, CA

CPT-14
Total depth: 70.21 ft, Date: 6/9/2017
Cone Type: Vertek

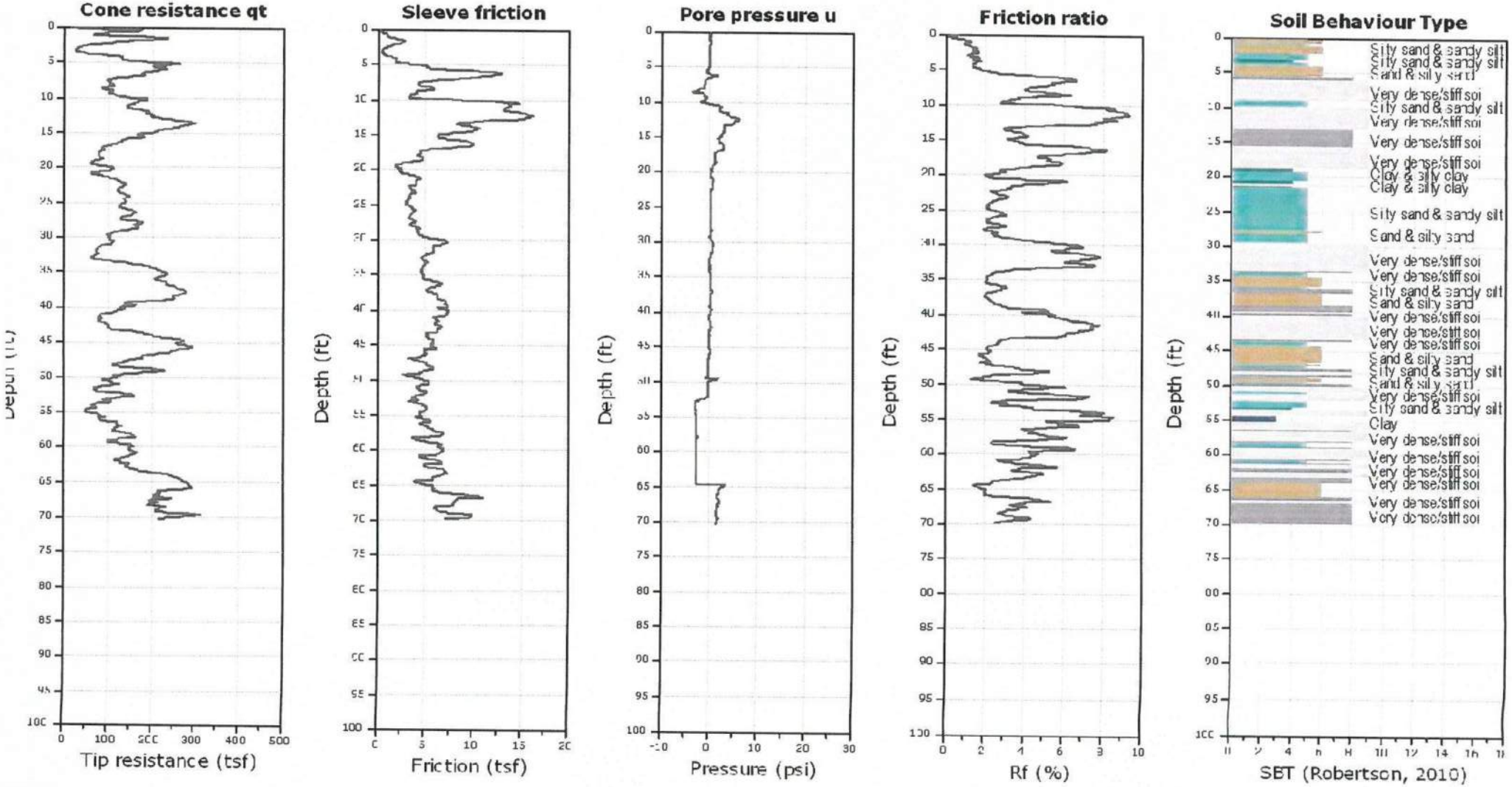


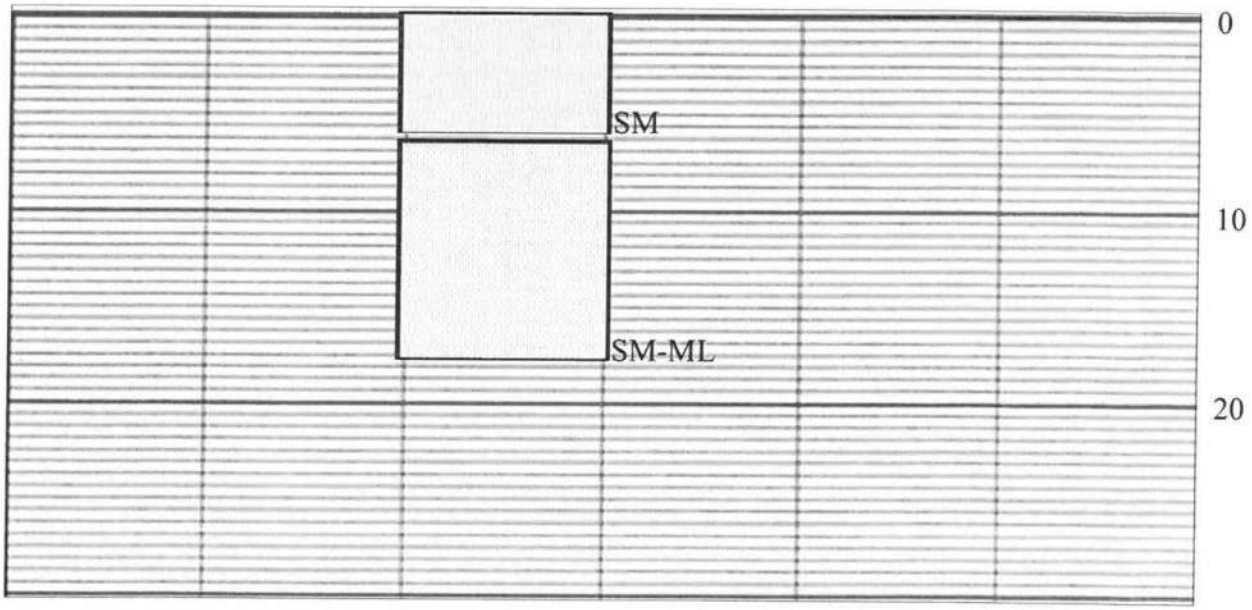
Figure B-26

LOG OF TEST PIT: TP - 1

Soil Interval	Soil Interval Depth (Feet bgs)	Soil Sample Depth (Feet bgs)	SOIL DESCRIPTION
A	0.0 – 1.0		FILL- Aggregate Bases
B	1.0 - 5.0		SAND (SM), light brown, fine- to medium grained, little to some silt, trace of gravels, moist, loose to medium dense.
C	5.0-14.0		SAND TO SILT (SM-ML), brown, fine-grained, white streak and concretion, cementation, medium dense to very stiff.
D	14.0-18.0		SAND TO SILT (SM-ML), brown, very distinct white streak, concretion, cementation, stratified, very dense. Difficult to excavate.

GRAPHIC REPRESENTATION

SCALE: 1 inch = 10 Feet **BEARING**: N **WALL**: FRONT (North)



Project Number: **C.314.81.00** Date: 5/7/2015

GEOBASE INC.

Location: Figures A-2 & A-3, Appendix A Equipment: JD410

Approx. Elevation: 1525 feet AMSL (Top) Logged By: HDN

Project: KP Moreno Valley Medical Center

FIGURE B-27

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_p) — Liquid Limit (W_L); Penetration, blows/foot 10 20 30 40 50	REMARKS/ OTHER TESTS
		PAVEMENT, AC = 5 in. and AB = 5 in.				
		SAND (FILL), brown, silty, moist	SM			
5		SILT, brown, sandy, trace of gravels, very loose, damp.	ML			PS
						Bulk Sample 5-10 FT. El Ch, ER, pH, SO_4
10		*dense, moist*				C*, DS
		SAND, brown, silty, trace of gravels, medium dense, *moist*	SM			
15		...orange to brown, damp				PS
		dense				
20		...sandy, trace of gravels				PS
25		...orange to brown, silty, medium dense				
30		some gravels, damp				
35						

GEOBASE, INC.

PROJECT: MVCH – Hospital Addition and CUP, 2300 IRIS AVENUE, Moreno Valley, California

BORING NO. B-1

DEPTH TO WATER feet ▼ | SURFACE ELEV. 1524.5 feet | LOGGED BY HDN | PROJECT NO C.314.39.00

DEPTH TO SLOUGH ▲ | DRILL RIG CME-75 HT, DRILLER MARTINI | DATE LOGGED 03/30/2010 | FIGURE NO B-2

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration blows/foot 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, brown, silty, little gravels, moist.	SM			
40		SAND, brown, white streak, trace of silt, medium dense damp	SP			
45		SAND, tan brown, silty, little gravels, medium dense, damp.	SM			
50		SAND, brown, white streak, trace of silt, dense, moist	SP			
55		SAND, brown, some silt, medium dense, damp	SM			
60		..silty, greyish brown, slightly moist				
65		brown, little silt, moist				
70						

GEOBASE, INC.

PROJECT	MVCH -- Hospital Addition and CUP 2300 IRIS AVENUE, Moreno Valley, California		BORING NO. B-1
DEPTH TO WATER feet ▼	SURFACE ELEV 1524.5 feet	LOGGED BY HDN	PROJECT NO. C.314.39.00
DEPTH TO SLOUGH ▲	DRILL RIG CME-75 HT DRILLER MARTINI	DATE LOGGED 03/30/2010	FIGURE NO. B-2

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: ■ THIN WALLED TUBE ▯ SPT SPLIT SPOON ☒ CALIFORNIA MODIFIED SAMPLER ▭ DISTURBED ◥ NO RECOVERY ▦ CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, gray to brown, little of silt, dense, moist	SM			
75		• End of Boring at 71.5 feet • Boring dry at completion of drilling				
80						
85						
90						
95						
100						
105						

GEOBASE, INC.	PROJECT: MVCH -- Hospital Addition and CUP 2300 IRIS AVENUE, Moreno Valley, California			BORING NO. B-1
	DEPTH TO WATER ▼ feet	SURFACE ELEV. 1524.5 feet	LOGGED BY HDN	PROJECT NO. C.314.39.00
	DEPTH TO SLOUGH ▲	DRILL RIG CME-75 HT DRILLER MARTINI	DATE LOGGED 03/30/2010	FIGURE NO. B-2

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

page 3 of 3

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%)

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration blows/foot: 10 20 30 40 50

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	REMARKS/ OTHER TESTS
	PAVEMENT, AC = 4.5 in. and AB = 5 in.			
	SAND (FILL), brown, silty, moist.	SM		
5	SILT, brown, sandy, trace of gravels, very soft, moist.	ML		200 Wash
10	..very stiff			PS
	..hard			PS, C*
15	SAND, olive to brown, white streak, silty, trace of gravels, dense	SM		PS
	..brown, some silt, slightly moist.			PS
20	..orange brown, silty, medium dense.			PS
25				PS
30	..light brown, some silt			200 Wash
35				

GEOBASE, INC.

PROJECT	MVCH -- Hospital Addition and CUP 2300 IRIS AVENUE, Moreno Valley, California		BORING NO. B-2
DEPTH TO WATER ▼ feet	SURFACE ELEV 1523 feet	LOGGED BY HDN	PROJECT NO C.314.39.00
DEPTH TO SLOUGH ▲	DRILL RIG CME-75 HT DRILLER MARTINI	DATE LOGGED 03/31/2010	FIGURE NO. B-3

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot: 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND light brown, little silt dense, damp	SM			
40		..medium dense				200 Wash
45		..greyish-brown, silty, medium dense, moist.				200 Wash
50		..light brown				200 Wash
55		..medium-grained				200 Wash
60		..tan brown, silty				200 Wash
65		..fined grained, little silt.				200 Wash
70						

GEOBASE, INC.

PROJECT: MVCH -- Hospital Addition and CUP
2300 IRIS AVENUE, Moreno Valley, California

DEPTH TO WATER feet ▼

DEPTH TO SLOUGH ▲

SURFACE ELEV. 1523 feet

DRILL RIG CME-75 HT

DRILLER MARTINI

LOGGED BY HDN

DATE LOGGED 03/31/2010

BORING NO. B-2

PROJECT NO C.314.39.00

FIGURE NO. B-3

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SP1 SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, light brown, trace of silt, medium dense, moist.	SP			200 Wash
75		* End of Boring at 71.5 feet. * Boring dry at completion of drilling				
80						
85						
90						
95						
100						
105						

GEOBASE, INC.

PROJECT: MVCH -- Hospital Addition and CUP
2300 IRIS AVENUE, Moreno Valley, California

BORING NO. B-2

DEPTH TO WATER feet ▼ | SURFACE ELEV 1523 foot | LOGGED BY HDN | PROJECT NO. C.314.39.00

DEPTH TO SLOUGH ▲ | DRILL RIG CME-75 HT | DRILLER MARTINI | DATE LOGGED 03/31/2010 | FIGURE NO. B-3

Note. This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%)

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	REMARKS/ OTHER TESTS
	PAVEMENT, AC = 6 in and AB = 4 in.		
	SAND (FILL), brown, silty, moist	SM	
5	SAND, light brown, little silt, medium dense	SM	200 Wash
	SILT, reddish brown, sandy, little gravels, very moist.	ML	Bulk Sample 5-10 FT 200 Wash, Ch, ER, pH SO_4
10	very loose		200 Wash
15	little clay, sandy moist		200 Wash, C*
	SAND, light brown, some silt, little gravels, medium dense, moist	SM	200 Wash
20	reddish brown, trace of gravels		>> 200 Wash, C*, DS
25	SILT, brown, sandy, hard, moist	ML	200 Wash
30	SAND, light brown, coarse grained, trace of silt and gravels.	SP	200 Wash
35			

GEOBASE, INC.

PROJECT: MVCH -- Hospital Addition and CUP
2300 IRIS AVENUE, Moreno Valley, California

BORING NO. B-4

DEPTH TO WATER feet ▼

SURFACE ELEV 1540 feet

LOGGED BY HDN

PROJECT NO. C.314.39.00

DEPTH TO SLOUGH ▲

DRILL RIG CME-75 HT
DRILLER MARTINI

DATE LOGGED 03/30/2010

FIGURE NO. B-5

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE; SPT SPLIT SPOON; CALIFORNIA MODIFIED SAMPLER; DISTURBED; NO RECOVERY; CORE

DRY DENSITY (PCF): 80 90 100 110 120

Water Content (%)

Plastic Limit (W_P) — Liquid Limit (W_L)

Penetration, blows/foot: 10 20 30 40 50

DEPTH (feet)	SOIL DESCRIPTION	SOIL CLASSIFICATION	REMARKS/ OTHER TESTS
	SAND, light brown, little silt and gravels, very dense moist	SM	200 Wash
40	SAND, brown, coarsed grained, trace of silt, damp	SP	200 Wash
45	SAND, light brown, some silt, trace of gravels, medium dense, damp	SM	200 Wash
50			200 Wash
55	..tan, little silt, dense, moist		200 Wash
60	..little silt.		200 Wash
65	..moist.		200 Wash
70			

GEOBASE, INC.

PROJECT: MVCH – Hospital Addition and CUP
2300 IRIS AVENUE, Moreno Valley, California

DEPTH TO WATER: feet ▼

DEPTH TO SLOUGH: ▲

SURFACE ELEV. 1540 feet

DRILL RIG CME-75 HT

DRILLER MARTINI

LOGGED BY HDN

DATE LOGGED 03/30/2010

BORING NO. B-4

PROJECT NO C.314.39.00

FIGURE NO B-5

Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated

LOG OF BORING

SAMPLE TYPE: THIN WALLED TUBE | SPT SPLIT SPOON | CALIFORNIA MODIFIED SAMPLER | DISTURBED | NO RECOVERY | CORE

DEPTH (feet)	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	SAMPLE	DRY DENSITY (PCF) 80 90 100 110 120; Water Content (%); Plastic Limit (W_P) — Liquid Limit (W_L); Penetration, blows/foot 10 20 30 40 50	REMARKS/ OTHER TESTS
		SAND, brown, some silt, trace of gravels, dense, moist	SM			200 Wash
75		* End of Boring at 71.5 feet * Boring dry at completion of drilling				
80						
85						
90						
95						
100						
105						

GEOBASE, INC.

PROJECT	MVCH – Hospital Addition and CUP 2300 IRIS AVENUE, Moreno Valley, California		BORING NO. B-4
DEPTH TO WATER feet ▼	SURFACE ELEV 1540 feet	LOGGED BY HDN	PROJECT NO C.314.39.00
DEPTH TO SLOUGH ▲	DRILL RIG CME-75 HT DRILLER MARTINI	DATE LOGGED 03/30/2010	FIGURE NO B-5

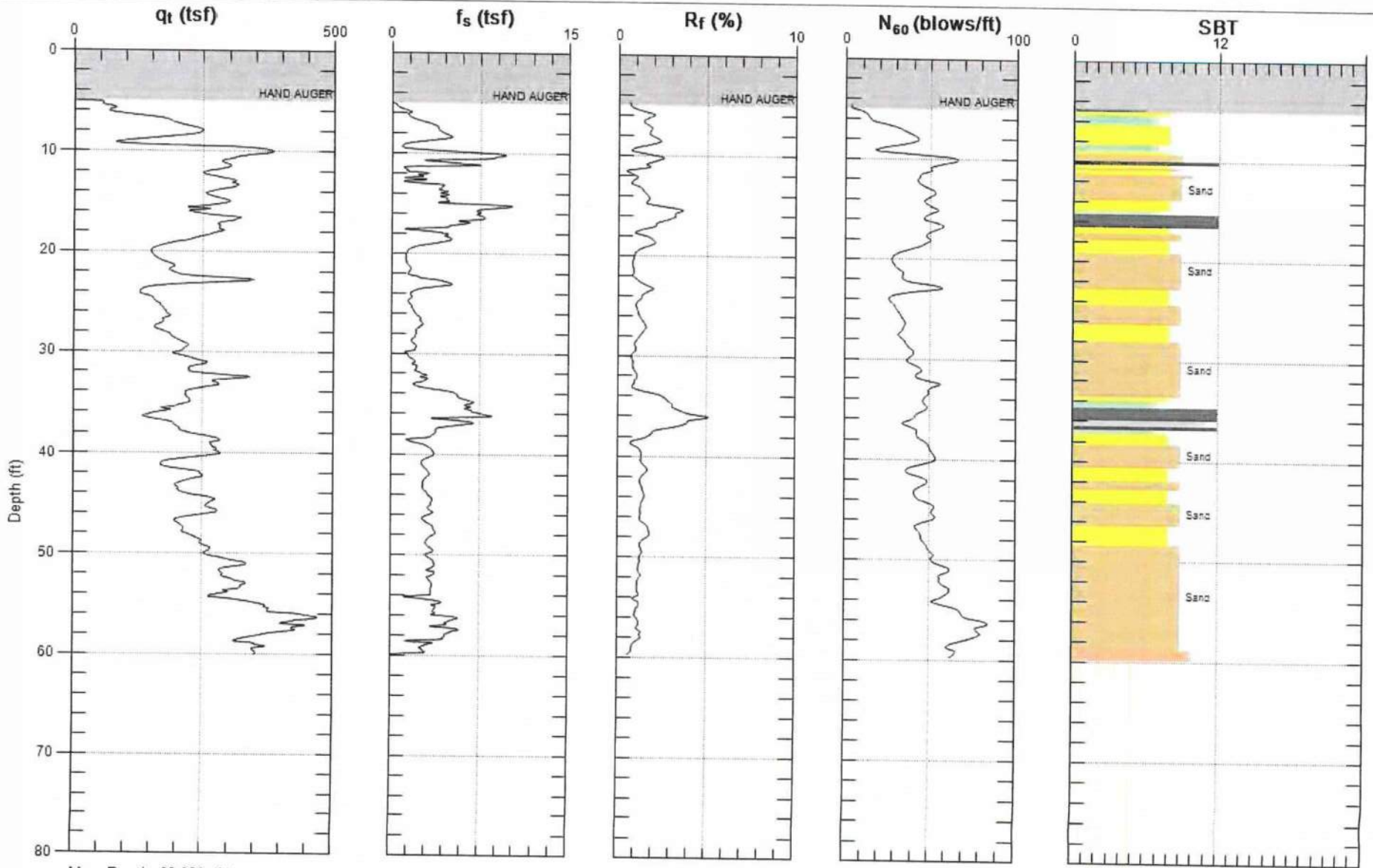
Note: This log of boring should be evaluated in conjunction with the complete geotechnical report. This log of boring represents conditions observed at the specific boring location and at the date indicated.

page 3 of 3

GREGG **GEOBASE**

Site: KAISER MORENO VALLEY Engineer: H.NGUYEN

Sounding: CPT-3 Date: 2010-03-31 10:36



Max. Depth: 60.039 (ft)
Avg. Interval: 0.328 (ft)

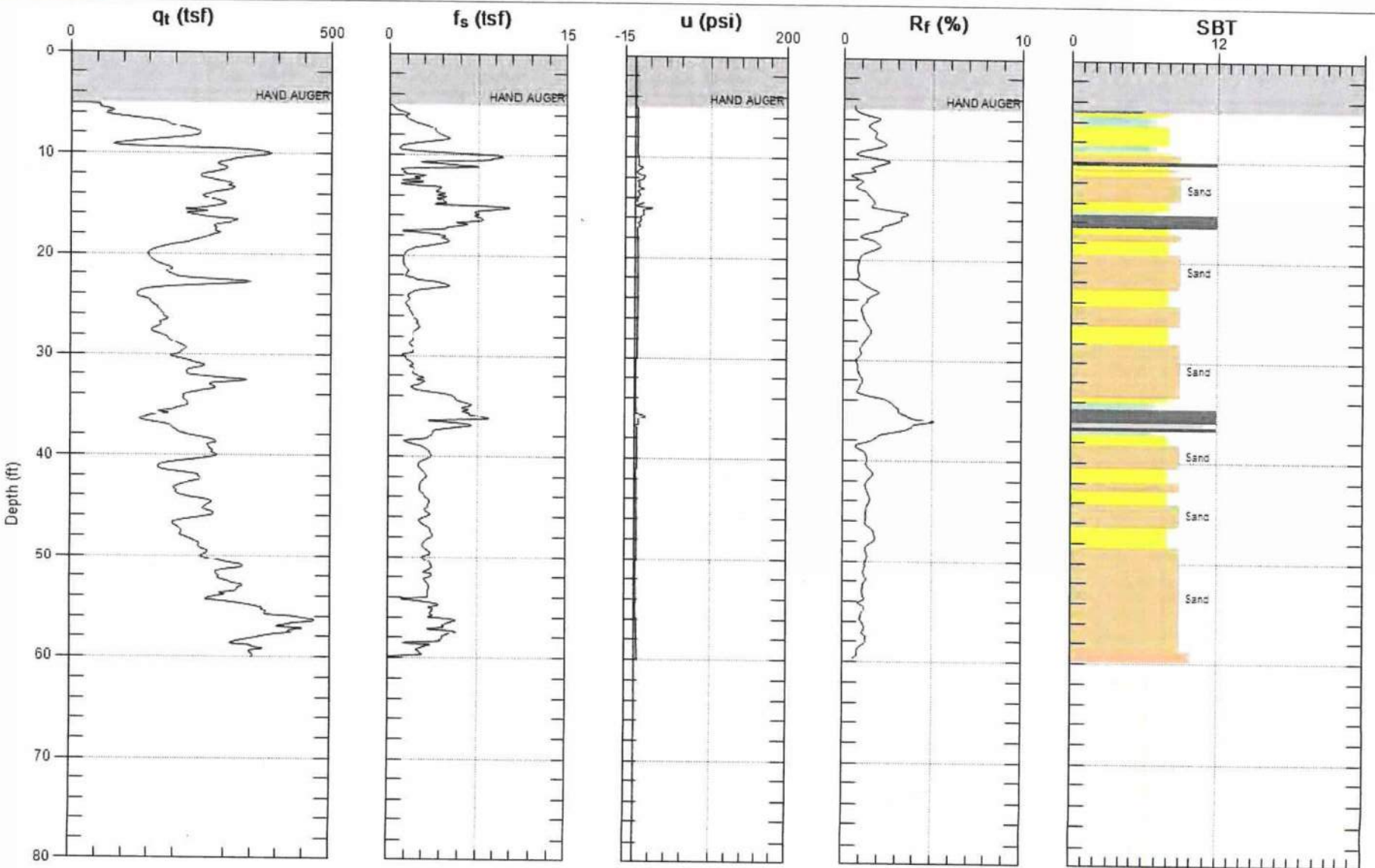
SBT: Soil Behavior Type (Robertson 1990)

C.314.81.00

GREGG **GEOBASE**

Site: KAISER MORENO VALLEY Engineer: H.NGUYEN

Sounding: CPT-3 Date: 2010-03-31 10:36



Max. Depth: 60.039 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Rcbertson 1990)

C.314.81.00

Appendix 4: Historical Site Conditions

Phase I Environmental Site Assessment or Other Information on Past Site Use

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

R 07 W | R 06 W | R 05 W | R 04 W | R 03 W | R 02 W | R 01 W | R 01 E | R 02 E | R 03 E | R 04 E | R 05 E

T 01 S
T 02 S
T 03 S
T 04 S
T 05 S
T 06 S
T 07 S
T 08 S

06	05	04	03	02	01
07	08	09	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

0.85 MiraLoma
0.61 RiversideNorth
0.54 RiversideSouth
0.68 PigeonPass
KAISER PERMANENTE MORENO VALLEY
0.66 MorenoEast
0.85 Beaumont
0.88 PradoDam
0.51 Woodcrest
0.50 LakeMathews
0.68 PerrisReservoir
0.87 VistaGrandeGS
0.70 SanJacintoNWS
1.18 Idyllwild
0.58 SunCity
0.68 Winchester
0.70 ElsinoreNWS
1.11 ElCarisoStation
0.90 HurkeyCreek
0.77 WildomarLaCresta
0.52 SkinnerLake
0.65 Anza
0.77 SantaRosaPlateau
1.00 TemeculaNWS
0.64 AguangaValley

Santa Ana River Watershed
Santa Margarita Watershed

N

Rain Gage Locations

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

Isohyetal Map for the 85th Percentile 24 hour Storm Event

July 2011

Effective Impervious Fraction

Developed Cover Types	Effective Impervious Fraction
Roofs	1.00
Concrete or Asphalt	1.00
Grouted or Gapless Paving Blocks	1.00
Compacted Soil (e.g. unpaved parking)	0.40
Decomposed Granite	0.40
Permeable Paving Blocks w/ Sand Filled Gap	0.25
Class 2 Base	0.30
Gravel or Class 2 Permeable Base	0.10
Pervious Concrete / Porous Asphalt	0.10
Open and Porous Pavers	0.10
Turf block	0.10
Ornamental Landscaping	0.10
Natural (A Soil)	0.03
Natural (B Soil)	0.15
Natural (C Soil)	0.30
Natural (D Soil)	0.40

Mixed Surface Types

Santa Ana Watershed - BMP Design Volume, V_{BMP}

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: Michael Baker International — Date: 9/25/2019
Designed by: Frankie Abbott — Case No: .
Company Project Number/Name: Kaiser Permanente Moreno Valley Medical Center

BMP Identification

BMP NAME / ID: Bioretention Basin A (BRB A)

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}= 0.66 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)*
A Imp	*174794.26*	*Concrete or Asphalt*	*1*	*0.89*	*155916.5*			
A Per	*27743.21*	*Mixed Surface Types*	*0.15*	*0.141446*	*3924.2*			
	202537.47	***Total***			**159840.7**	**0.66**	***8791.2***	***9,306***

Notes:

Proposed Volume = Proposed Area X Effective Depth
= 7,050 SQFT X 1.32 FT = 9,306

Bioretention Facility - Design Procedure	BMP ID: BRB A	Legend:	Required Entries / Calculated Cells

Company Name: Michael Baker International — Date: 9/25/2019

Designed by: Frankie Abbott — County/City Case No.:

Design Volume

Enter the area tributary to this feature — A_T = 4.6 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 8,791 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 = 1.5 ft

Top Width of Bioretention Facility, excluding curb — w_T = 25.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ — d_E = 1.32 ft

Minimum Surface Area, A_m

$$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$$

A_M = 6,650 ft^2

Proposed Surface Area — A= 7,050 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 2.5 %

6" Check Dam Spacing — 10 feet

Describe Vegetation: Shrubs

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

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	Michael Baker International	Date	9/25/2019
Designed by	Frankie Abbott	Case No	
Company Project Number/Name	Kaiser Permanente Moreno Valley Medical Center		

BMP Identification

BMP NAME / ID: Bioretention Basin B (BRB B)

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}= 0.66 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)*
B Imp	*79438.59*	*Concrete or Asphalt*	*1*	*0.89*	*70859.2*			
B Per	*14937.99*	*Mixed Surface Types*	*0.15*	*0.141446*	*2112.9*			
	94376.58		***Total***		**72972.1**	**0.66**	***4013.5***	***5,865***

Notes:

Proposed Volume = Proposed Area X Effective Depth
= 4,410 SQFT X 1.33 FT = 5,865 CF

Bioretention Facility - Design Procedure	BMP ID: BRB B	Legend:	Required Entries / Calculated Cells

Company Name: Michael Baker International | Date: 9/16/2019

Designed by: Frankie Abbott | County/City Case No.:

Design Volume

Enter the area tributary to this feature — A_T = 2.1 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 4,014 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 = 1.5 ft

Top Width of Bioretention Facility, excluding curb — w_T = 35.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ — d_E = 1.33 ft

Minimum Surface Area, A_m

$$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$$

A_M = 3,018 ft^2

Proposed Surface Area — A= 4,410 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 2.5 %

6" Check Dam Spacing — 10 feet

Describe Vegetation: Shrubs

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

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: Michael Baker International — Date: 9/25/2019
Designed by: Frankie Abbott — Case No:
Company Project Number/Name: Kaiser Permanente Moreno Valley Medical Center

BMP Identification

BMP NAME / ID: Bioretention Basin C (BRB C)

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}= 0.66 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)*
C Imp	*71832.56*	*Concrete or Asphalt*	*1*	*0.89*	*64074.6*			
C Per	*62156.21*	*Mixed Surface Types*	*0.15*	*0.141446*	*8791.7*			
	133988.77	***Total***			**72866.3**	**0.66**	***4007.6***	***4,046***

Notes:

Proposed Volume = Proposed Area X Effective Depth
= 3,065 SQFT X 1.32 FT = 4,046 CF

Bioretention Facility - Design Procedure	BMP ID: BRB D	Legend:	Required Entries / Calculated Cells

Company Name:	Michael Baker International	Date:	9/25/2019
Designed by:	Frankie Abbott	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	5.07	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	7,995	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 =	1.5	ft
Top Width of Bioretention Facility, excluding curb	w_T =	20.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.32	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	6,080	ft^2
Proposed Surface Area	A=	6,600	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		2.5	%
6" Check Dam Spacing		10	feet

Describe Vegetation: Shrubs

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

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: Michael Baker International — Date: 9/25/2019
Designed by: Frankie Abbott — Case No:
Company Project Number/Name: Kaiser Permanente Moreno Valley Medical Center

BMP Identification

BMP NAME / ID: Bioretention Basin D (BRB D)

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}= 0.66 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)*
C Imp	*152027.36*	*Concrete or Asphalt*	*1*	*0.89*	*135608.4*			
C Per	*68942.49*	*Mixed Surface Types*	*0.15*	*0.141446*	*9751.6*			
	220969.85	***Total***			**145360**	**0.66**	**7994.8**	**8,580**

Notes:

Proposed Volume = Proposed Area x Effective Depth
= 6,500 SQFT x 1.32 FT = 8,580 CF

Bioretention Facility - Design Procedure	BMP ID: BRB D	Legend:	Required Entries / Calculated Cells

Company Name:	Michael Baker International	Date:	9/25/2019
Designed by:	Frankie Abbott	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	5.07	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	7,995	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

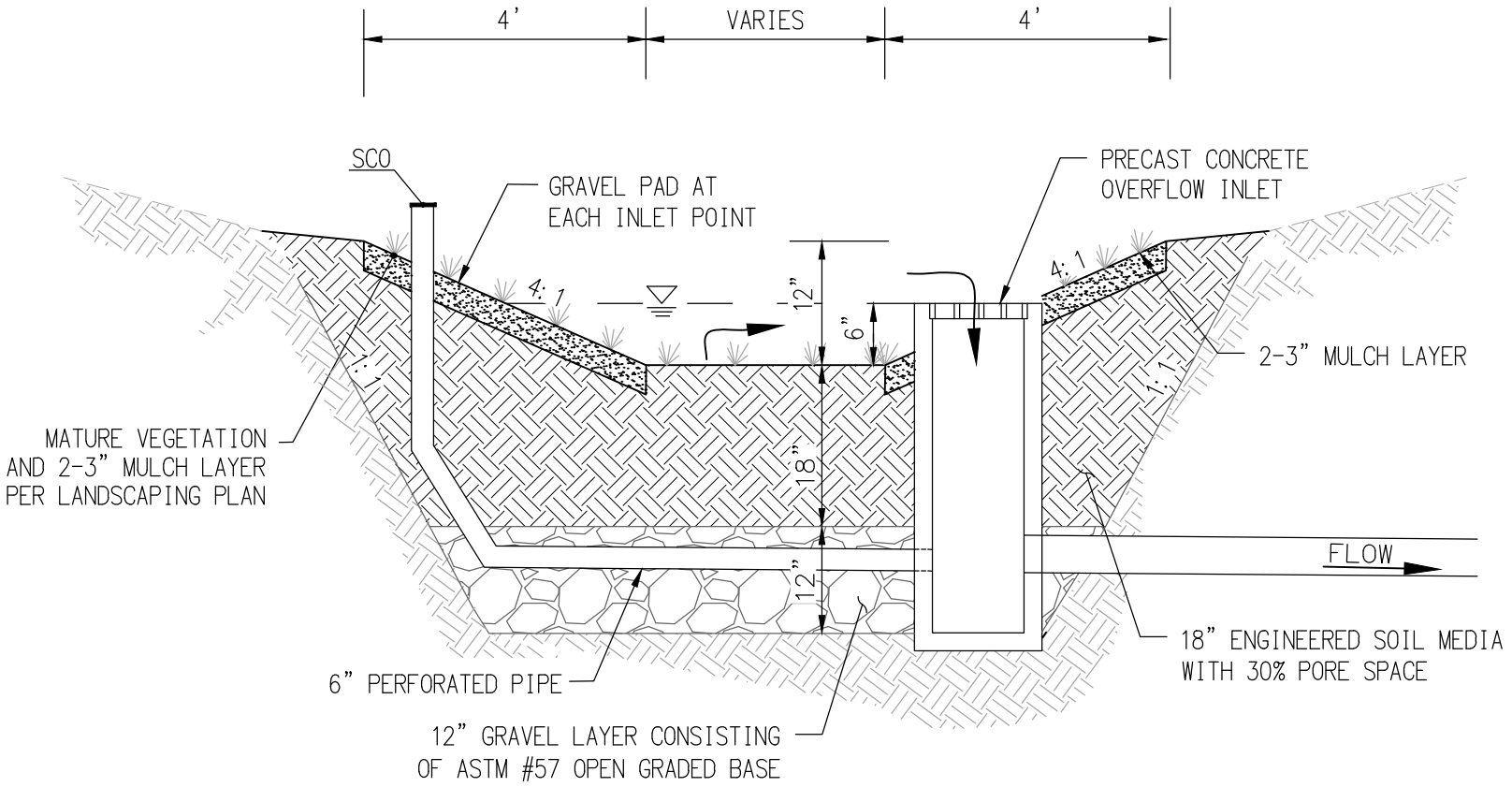
Depth of Soil Filter Media Layer	d_S =	1.5	ft
Top Width of Bioretention Facility, excluding curb	w_T =	20.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.32	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	6,080	ft^2
Proposed Surface Area	A=	6,500	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		2.5	%
6" Check Dam Spacing		10	feet

Describe Vegetation: Shrubs

Notes:



MINERAL COMPONENT RANGE REQUIREMENTS PER LID DESIGN MANUAL	
PERCENT RANGE	COMPONENT
70-80	SAND
15-20	SILT
5-10	CLAY

BIORETENTION BASIN CROSS SECTION
SCALE: NTS

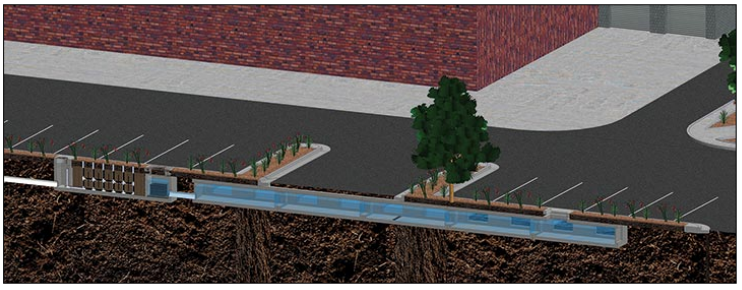
Michael Baker
INTERNATIONAL
9755 Clairemont Mesa Blvd., San Diego, CA 92124
Phone: (858) 614-5000 · MBAKERINTL.COM



Flow Based Sizing

The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

Model #	Dimensions	WetlandMEDIA Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4′ x 4′	23 sq. ft.	0.052
MWS-L-4-6	4′ x 6′	32 sq. ft.	0.073
MWS-L-4-8	4′ x 8′	50 sq. ft.	0.115
MWS-L-4-13	4′ x 13′	63 sq. ft.	0.144
MWS-L-4-15	4′ x 15′	76 sq. ft.	0.175
MWS-L-4-17	4′ x 17′	90 sq. ft.	0.206
MWS-L-4-19	4′ x 19′	103 sq. ft.	0.237
MWS-L-4-21	4′ x 21′	117 sq. ft.	0.268
MWS-L-6-8	7′ x 9′	64 sq. ft.	0.147
MWS-L-8-8	8′ x 8′	100 sq. ft.	0.230
MWS-L-8-12	8′ x 12′	151 sq. ft.	0.346
MWS-L-8-16	8′ x 16′	201 sq. ft.	0.462
MWS-L-8-20	9′ x 21′	252 sq. ft.	0.577
MWS-L-8-24	9′ x 25′	302 sq. ft.	0.693



Volume Based Sizing

Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-6-8	3191	6382
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145
MWS-L-8-20	12560	25120
MWS-L-8-24	15108	30216

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

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	Michael Baker International	Date	7/18/2019
Designed by	Charisse Garrido	Case No	
Company Project Number/Name	Kaiser Permanente Moreno Valley Medical Center		

BMP Identification

BMP NAME / ID: Modular Wetland System (MWS E)

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMAs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Rainfall Intensity (in/hr)	Design Flow Rate (cfs)	Proposed Flow Rate (cfs)
D Imp	251412	Concrete or Asphalt	1	0.89	224259.5			
D Per	78765	Mixed Surface Types	0.15	0.14145	11141			
	330177	Total			235400.5	0.20	1.1	1.15

Notes:

SITE SPECIFIC DATA

PROJECT NUMBER		9338	
ORDER NUMBER		----	
PROJECT NAME		KAISER MEDICAL MORENO VALLEY	
PROJECT LOCATION		MORENO VALLEY, CA	
STRUCTURE ID		MWS E1	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.55	
TREATMENT HGL AVAILABLE (FT)			N/K
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			BYPASS
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	1.33	HDPE	8"
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE	0.00	HDPE	8"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	5.50	5.50	5.50
SURFACE LOAD	PEDESTRIAN	PEDESTRIAN	PEDESTRIAN
FRAME & COVER	3EA ø30"	36X36", (2)30X48"	ø24"
WETLANDMEDIA VOLUME (CY)			12.67
ORIFICE SIZE (DIA. INCHES)			ø2.43" EA

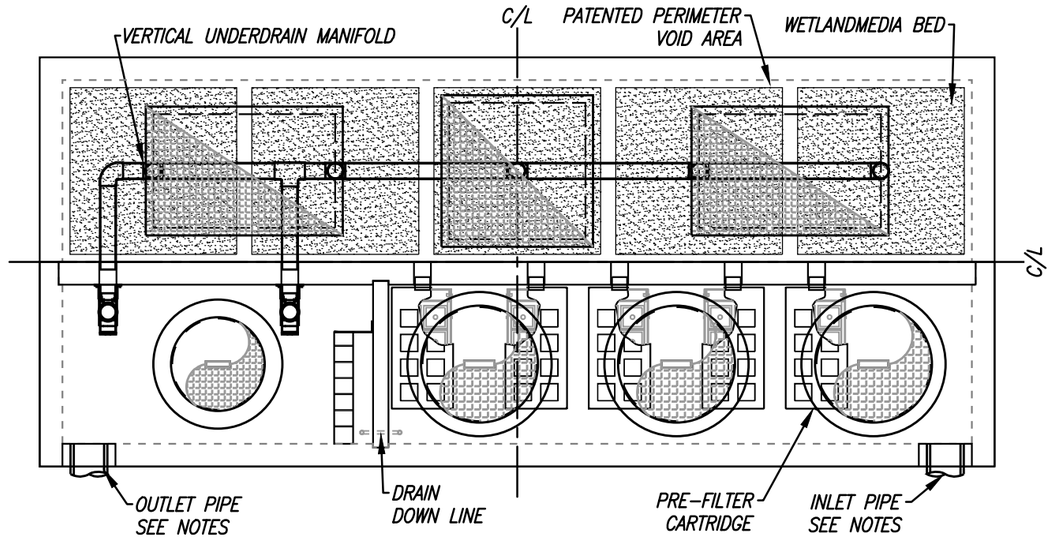
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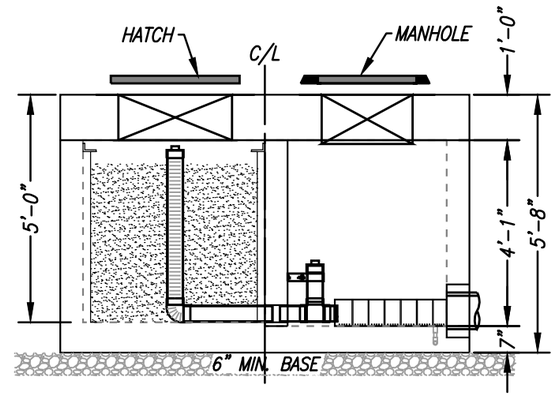
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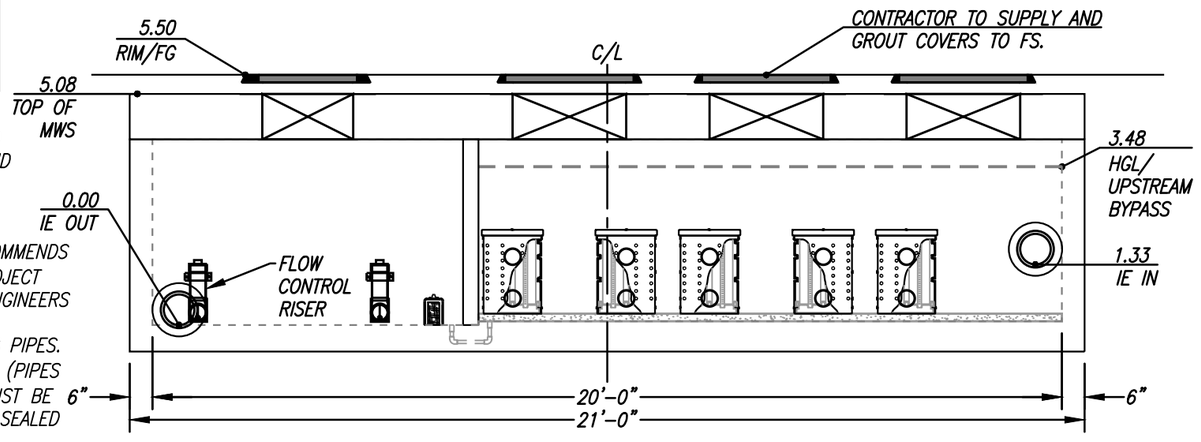
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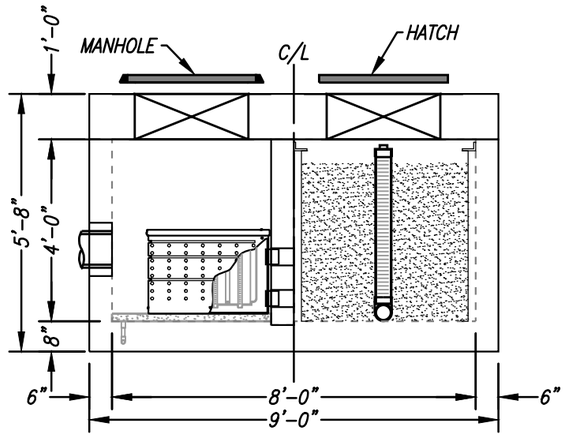
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

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

MODULAR WETLANDS

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A Forterra Company

MWS-L-8-20-5'-0"-V-UG
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

7/30/19CTORRES

SITE SPECIFIC DATA

PROJECT NUMBER		9338	
ORDER NUMBER		----	
PROJECT NAME		KAISER MEDICAL MORENO VALLEY	
PROJECT LOCATION		MORENO VALLEY, CA	
STRUCTURE ID		MWS E2	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.55	
TREATMENT HGL AVAILABLE (FT)			N/K
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			BYPASS
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	1.33	HDPE	8"
INLET PIPE 2	N/A	N/A	N/A
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RIM ELEVATION	5.50	5.50	5.50
SURFACE LOAD	PEDESTRIAN	PEDESTRIAN	PEDESTRIAN
FRAME & COVER	3EA ø30"	30X30", (2) 30X48"	ø24"
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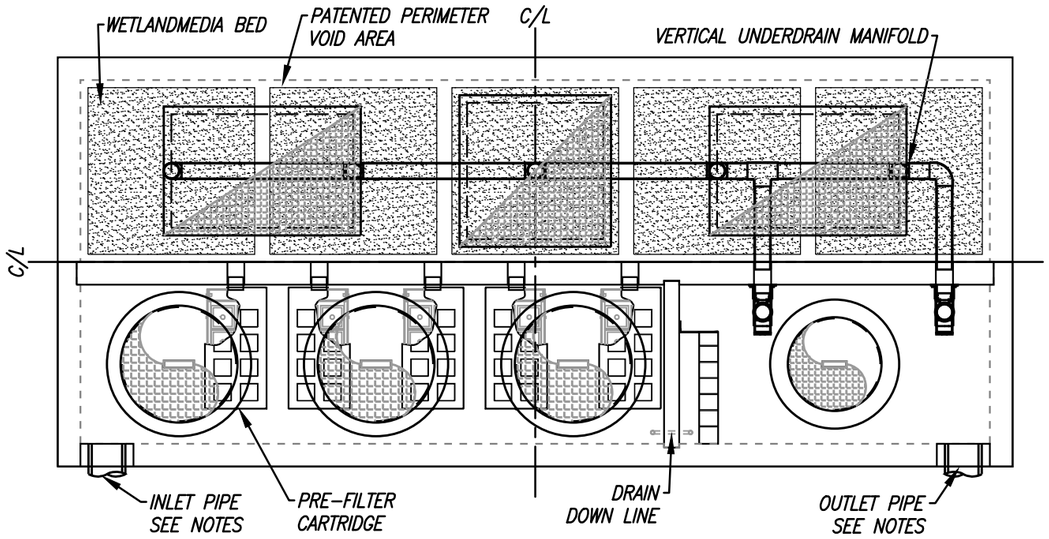
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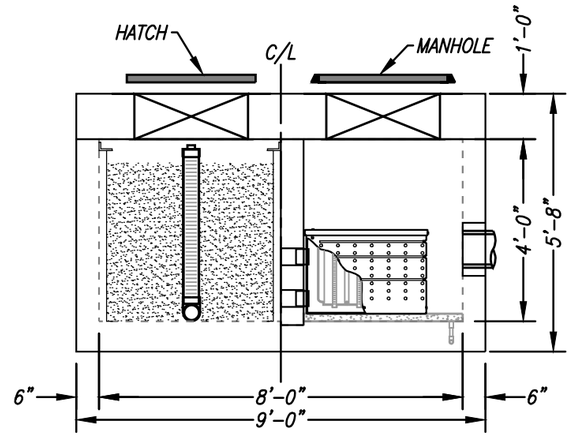
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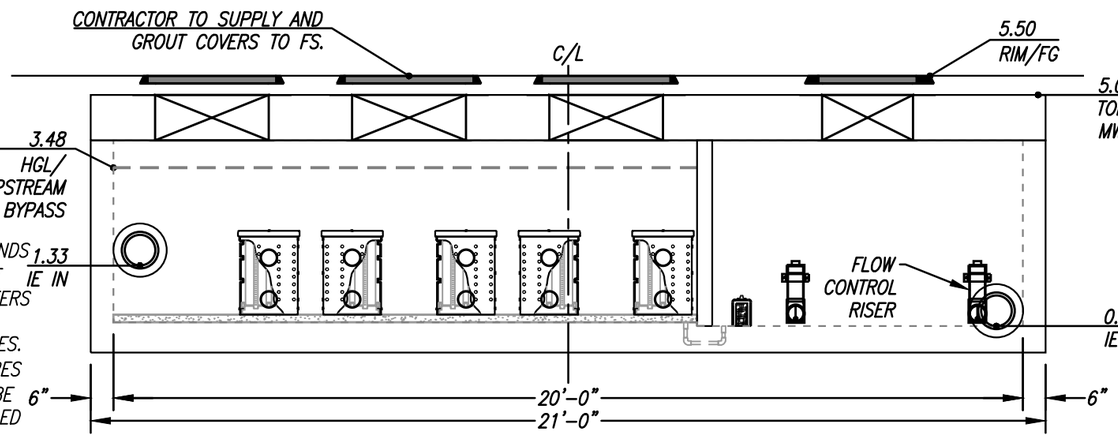
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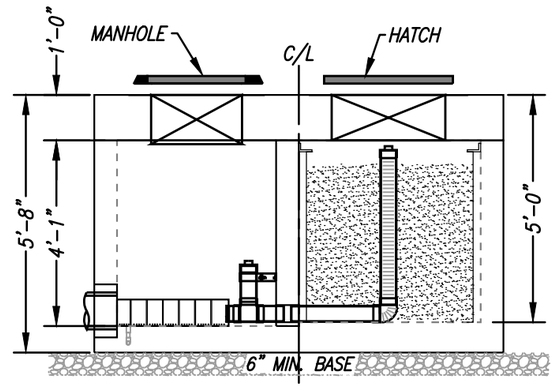
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

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

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MWS-L-8-20-5'-0"-V-UG
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

7/30/19CTORRES

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

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: Michael Baker International — Date: 7/18/2019

Designed by: Charisse Garrido — Case No:

Company Project Number/Name: Kaiser Permanente Moreno Valley Medical Center

BMP Identification

BMP NAME / ID: Modular Wetland System (MWS F)

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity — I = 0.20 in/hr

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 (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
E Imp	*259094*	*Concrete or Asphalt*	*1*	*0.89*	*231111.8*			
E Per	*43356*	*Mixed Surface Types*	*0.15*	*0.14145*	*6132.5*			
	302450	**Total**			**237244.3**	**0.20**	**1.1**	**1.15**

DMAs

Notes:

SITE SPECIFIC DATA

PROJECT NUMBER		9338	
ORDER NUMBER		----	
PROJECT NAME		KAISER MEDICAL MORENO VALLEY	
PROJECT LOCATION		MORENO VALLEY, CA	
STRUCTURE ID		MWS F1	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.55	
TREATMENT HGL AVAILABLE (FT)			N/K
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			BYPASS
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	1.33	HDPE	8"
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE	0.00	HDPE	8"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	5.08	5.08	5.08
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	3EA ø30"	OPEN PLANTER	ø24"
WETLANDMEDIA VOLUME (CY)			12.67
ORIFICE SIZE (DIA. INCHES)			ø2.43" EA

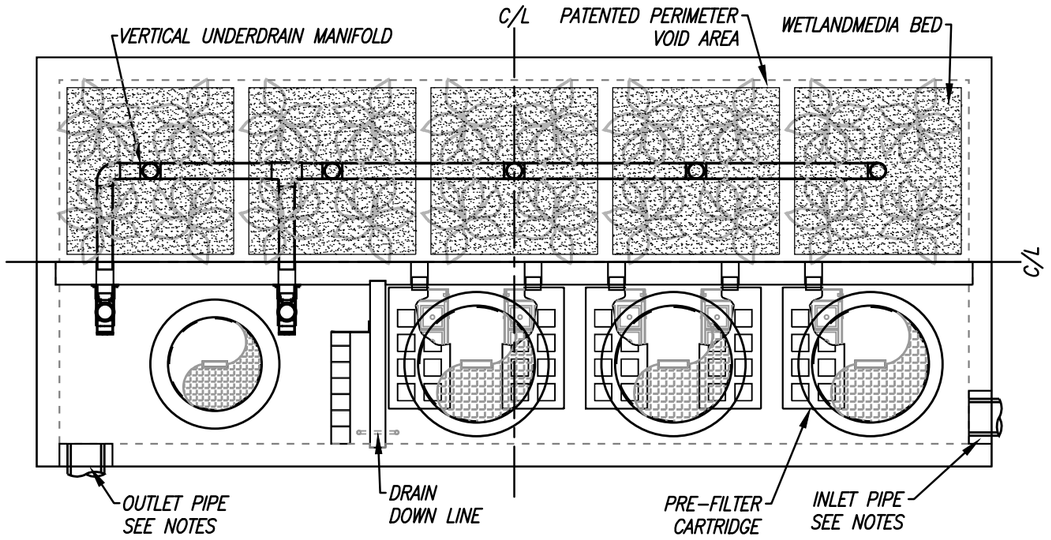
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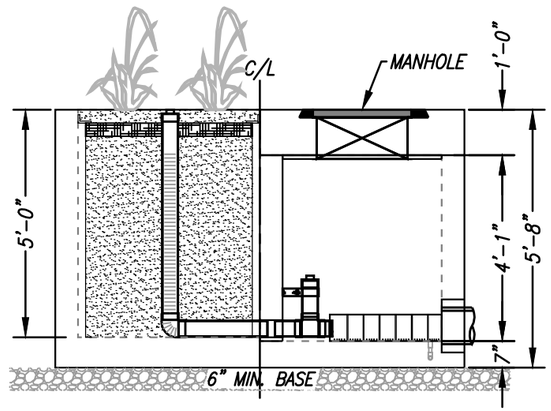
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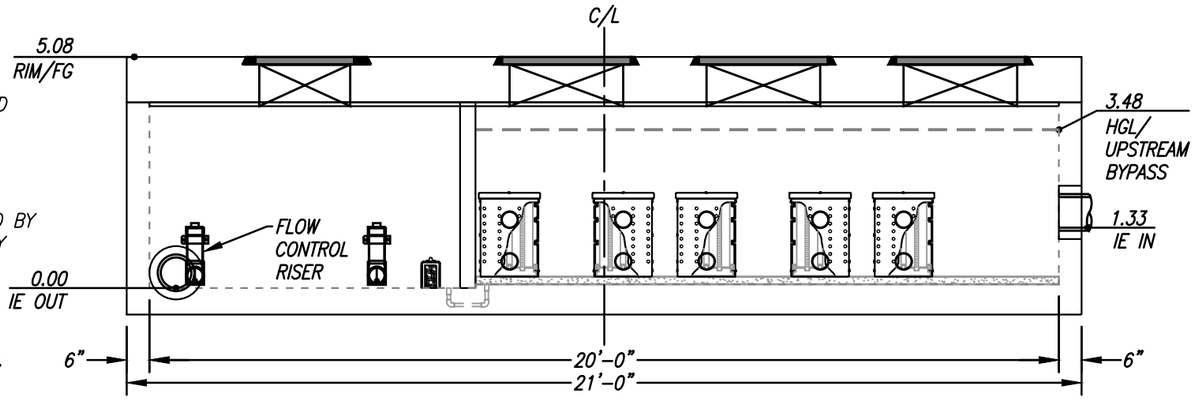
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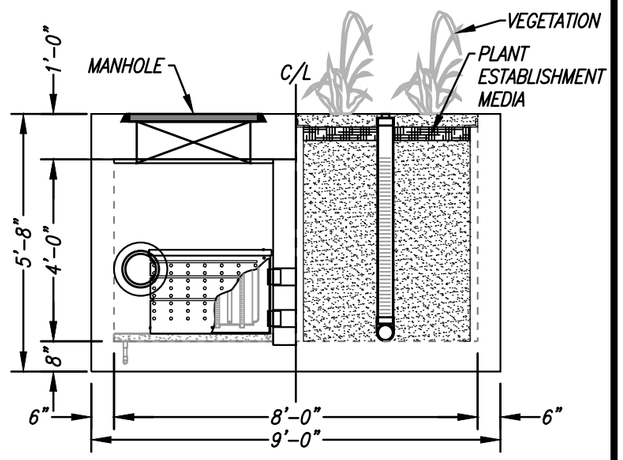
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

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MWS-L-8-20-5'-0"-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

Z:\30_19\CTORRES

SITE SPECIFIC DATA			
PROJECT NUMBER		9338	
ORDER NUMBER		----	
PROJECT NAME		KAISER MEDICAL MORENO VALLEY	
PROJECT LOCATION		MORENO VALLEY, CA	
STRUCTURE ID		MWS F2	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.55	
TREATMENT HGL AVAILABLE (FT)			N/K
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			BYPASS
PIPE DATA	I.E.	MATERIAL	DIAMETER
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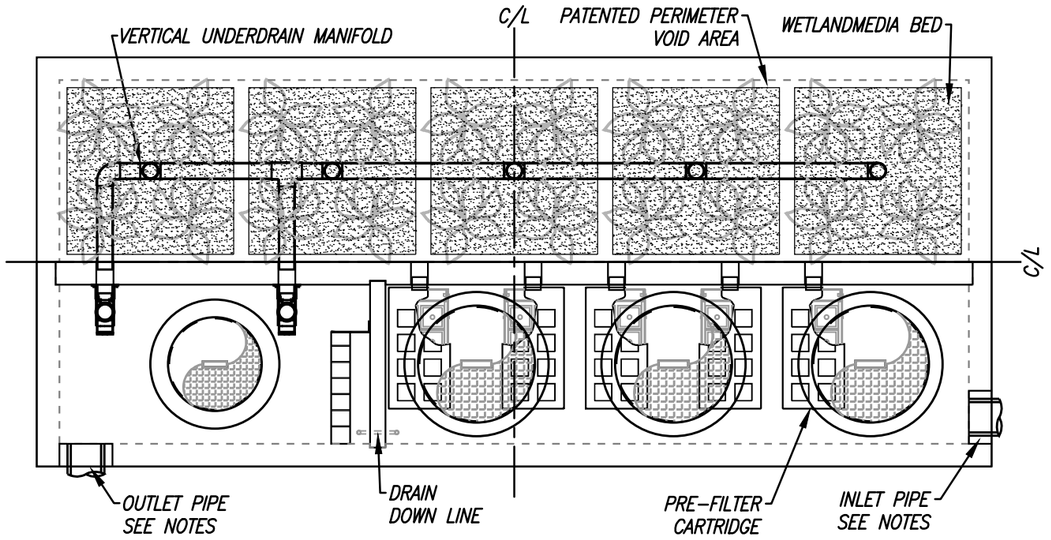
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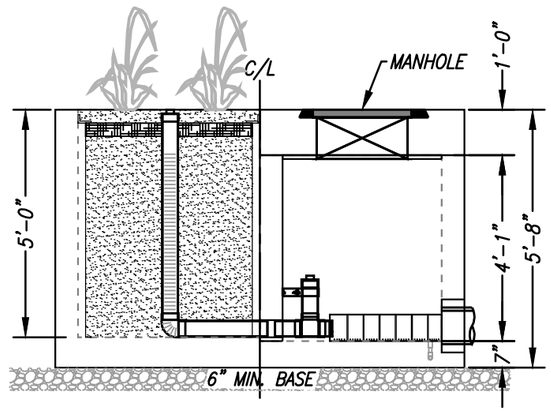
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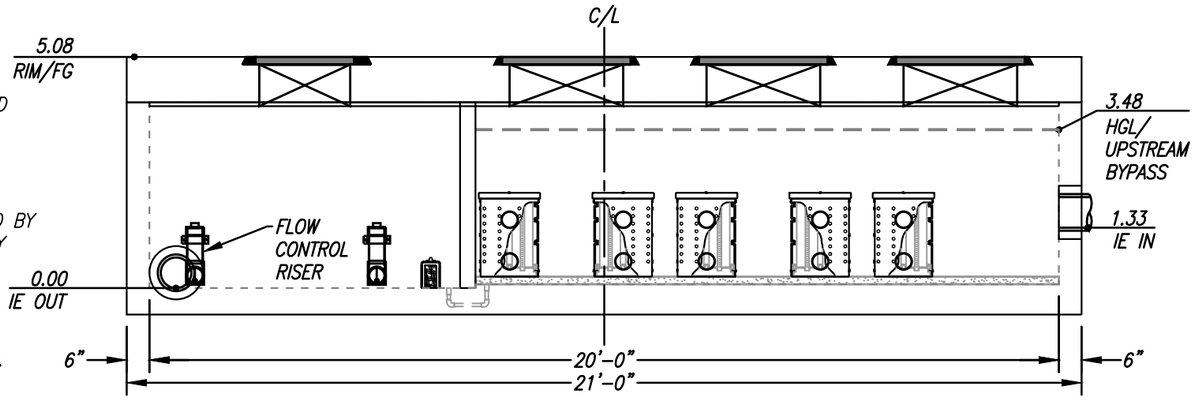
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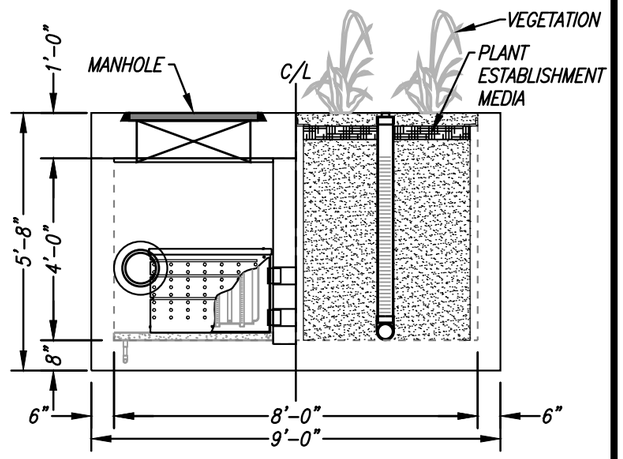
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LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

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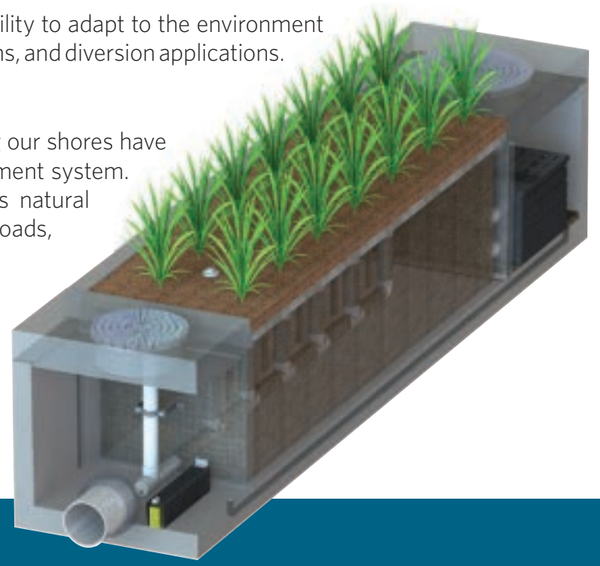
MWS-L-8-20-5'-0"-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

Z:\30_19\CTORRES

OVERVIEW

The Bio Clean Modular Wetlands® System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint, higher treatment capacity, and a wide range of versatility. While most biofilters use little or no pretreatment, the Modular Wetlands® incorporates an advanced pretreatment chamber that includes separation and pre-filter cartridges. In this chamber, sediment and hydrocarbons are removed from runoff before entering the biofiltration chamber, reducing maintenance costs and improving performance.

Horizontal flow also gives the system the unique ability to adapt to the environment through a variety of configurations, bypass orientations, and diversion applications.



The Urban Impact

For hundreds of years, natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as cities grow and develop, our environment's natural filtration systems are blanketed with impervious roads, rooftops, and parking lots.

Bio Clean understands this loss and has spent years re-establishing nature's presence in urban areas, and rejuvenating waterways with the Modular Wetlands® System Linear.

PERFORMANCE

The Modular Wetlands® continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons, and bacteria. Since 2007 the Modular Wetlands® has been field tested on numerous sites across the country and is proven to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. In fact, the Modular Wetlands® harnesses some of the same biological processes found in natural wetlands in order to collect, transform, and remove even the most harmful pollutants.

66% REMOVAL OF DISSOLVED ZINC	**69%** REMOVAL OF TOTAL ZINC	**38%** REMOVAL OF DISSOLVED COPPER	**64%** REMOVAL OF TOTAL PHOSPHORUS	
45% REMOVAL OF NITROGEN	**50%** REMOVAL OF TOTAL COPPER	**95%** REMOVAL OF MOTOR OIL	**67%** REMOVAL OF ORTHO PHOSPHORUS	**85%** REMOVAL OF TSS

APPROVALS

The Modular Wetlands® System Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation and perhaps the world. Here is a list of some of the most high-profile approvals, certifications, and verifications from around the country.

Washington State Department of Ecology TAPE Approved
The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft² loading rate. The highest performing BMP on the market for all main pollutant categories.

California Water Resources Control Board, Full Capture Certification
The Modular Wetlands® System is the first biofiltration system to receive certification as a full capture trash treatment control device.

Virginia Department of Environmental Quality, Assignment
The Virginia Department of Environmental Quality assigned the MWS Linear the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) regulation technical criteria.

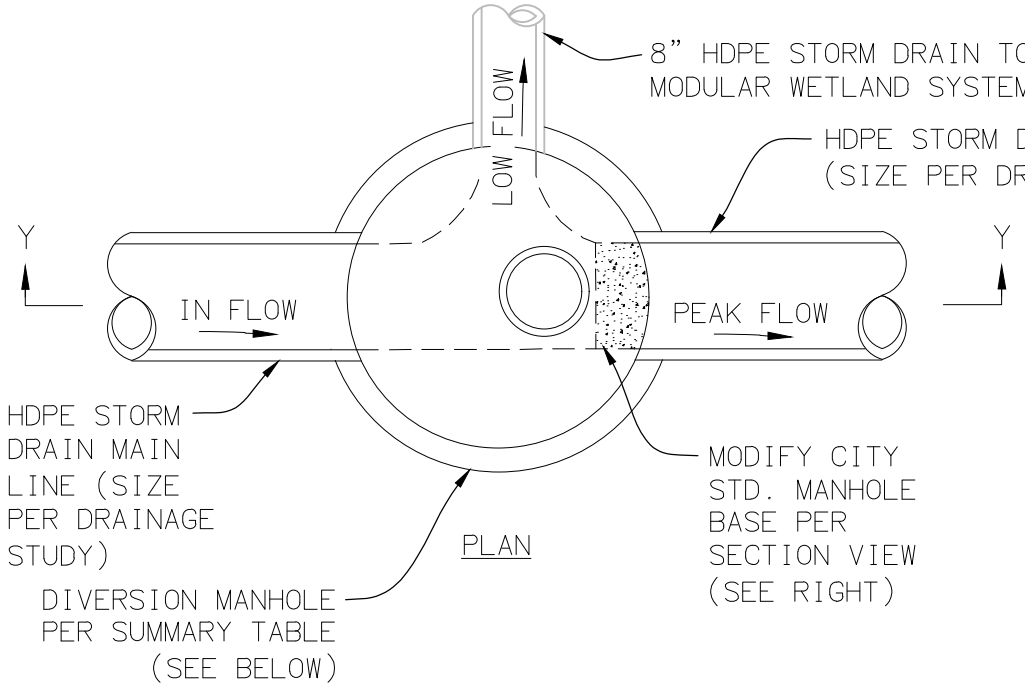
Maryland Department of the Environment, Approved ESD
Granted Environmental Site Design (ESD) status for new construction, redevelopment, and retrofitting when designed in accordance with the design manual.

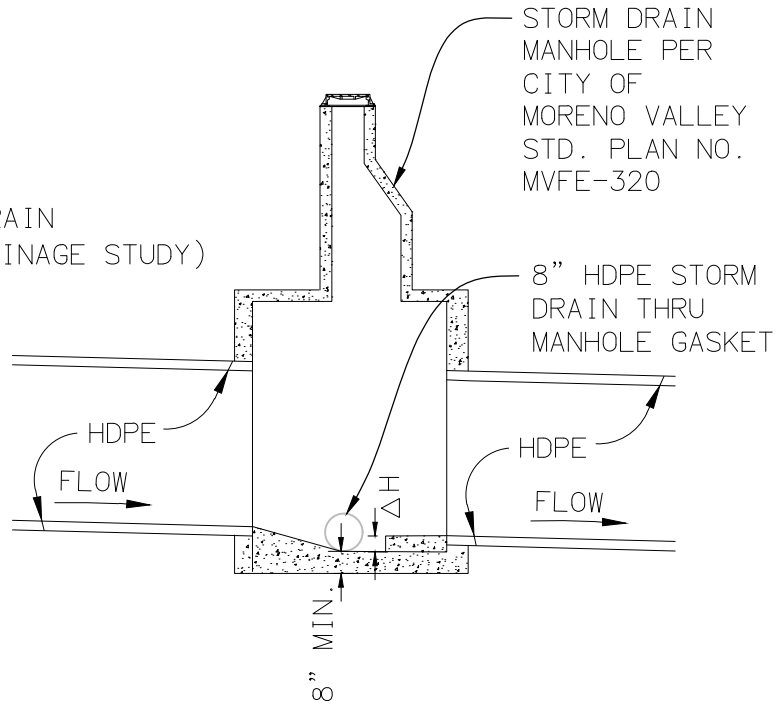
MASTEP Evaluation
The University of Massachusetts at Amherst – Water Resources Research Center issued a technical evaluation report noting removal rates up to 84% TSS, 70% total phosphorus, 68.5% total zinc, and more.

Rhode Island Department of Environmental Management, Approved BMP
Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% pathogens, 30% total phosphorus, and 30% total nitrogen.

ADVANTAGES

- HORIZONTAL FLOW BIOFILTRATION
- GREATER FILTER SURFACE AREA
- PRETREATMENT CHAMBER
- PATENTED PERIMETER VOID AREA
- FLOW CONTROL
- NO DEPRESSED PLANTER AREA
- AUTO DRAINDOWN MEANS NO MOSQUITO VECTOR





DIVERSION MANHOLE SUMMARY			
NAME	QBMP (CFS)	CALCULATED Q (CFS)	ΔH (FT)
E	1.1	1.16	0.45
F	1.1	1.16	0.45

NOTE:
1. ΔH (WEIR HEIGHT) IS BASED ON WEIR EQUATION AND QBMP FLOW RATES (SEE APPENDIX 6).

DIVERSION MANHOLE DETAIL

N.T.S.

Michael Baker INTERNATIONAL
9755 Clairemont Mesa Blvd., San Diego, CA 92124
Phone: (858) 614-5000 · MBAKERINTL.COM

H:\PDATA\169814\CADD\LAND\EXHIBITS\MASTER WQMP - DIVERSION MANHOLE EXHIBIT.DWG ABBOTT, FRANKIE 10/14/2019 7:20 PM

DIVERSION MANHOLE OUTLET PIPE SIZING

WEIR EQUATION CALCULATION

PROJECT: KAISER PERMANENTE MORENO VALLEY

JOB NUMBER: 169814

Using Weir Equation:

$$Q = C*B*(2g)^{(1/2)}*H^{(3/2)}$$

$$B = \cos^{-1}(1-(H/R))*D$$

C =	0.373	Discharge Coefficient of Weir
g =	32.2 ft^2/sec	Acceleration due to Gravity
B=	CALCULATED BELOW	Effective Perimeter
H =	VARIES BELOW	Depth (Head) at Weir
D =	0.67 ft	Diameter of Pipe
Q =	CALCULATED BELOW	Calculated Discharge

DMA E (8" HDPE OUTLET AT DIVERSION MANHOLE)

Head (ft)	Perimeter (ft)	Calculated Q (cfs)
0	-	-
0.05	0.37	0.01
0.10	0.53	0.05
0.15	0.66	0.11
0.20	0.77	0.21
0.25	0.88	0.33
0.30	0.98	0.48
0.35	1.08	0.67
0.40	1.18	0.90
0.45	1.29	1.16
0.50	1.40	1.48
0.55	1.52	1.85
0.60	1.66	2.31
0.65	1.87	2.94
0.67	2.10	3.46

DMA F (8" HDPE OUTLET AT DIVERSION MANHOLE)

Head (ft)	Perimeter (ft)	Calculated Q (cfs)
0	-	-
0.05	0.37	0.01
0.10	0.53	0.05
0.15	0.66	0.11
0.20	0.77	0.21
0.25	0.88	0.33
0.30	0.98	0.48
0.35	1.08	0.67
0.40	1.18	0.90
0.45	1.29	1.16
0.50	1.40	1.48
0.55	1.52	1.85
0.60	1.66	2.31
0.65	1.87	2.94
0.67	2.10	3.46

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

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.**	☒ **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** ☒ **Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."**
☒ 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.**
X D2. **Landscape/ Outdoor Pesticide Use**	☐ **Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained.** ☐ **Show self-retaining landscape areas, if any.** X **Show stormwater treatment and hydrograph modification management BMPs. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)**	**State that final landscape plans will accomplish all of the following.** X **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 pollution.** X **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.** X **To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.**	X **Maintain landscaping using minimum or no pesticides.** X **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.**

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.**
X G. **Refuse areas**	X **Show where site refuse and recycled materials will be handled and stored 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.** ❑ **Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.**	❑ **State how site refuse will be handled and provide supporting detail to what is shown on plans.** X **State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.**	X **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. 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**

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/

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**

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.**

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**

[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.**

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
[X] N. **Fire Sprinkler Test Water**		[X] **Provide a means to drain fire sprinkler test water to the sanitary sewer.**	[X] **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** [X] **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.** [X] **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
X P. **Plazas, sidewalks, and parking lots.**			X **Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.**

Appendix 9: O&M

Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms

Appendix 10: Educational Materials

BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information

Building & Grounds Maintenance SC-41

Description

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

Approach

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

General Pollution Prevention Protocols

- ☐ Switch to non-toxic chemicals for maintenance to the maximum extent possible.
- ☐ Choose cleaning agents that can be recycled.
- ☐ Encourage proper lawn management and landscaping, including use of native vegetation.
- ☐ Encourage use of Integrated Pest Management techniques for pest control.
- ☐ Encourage proper onsite recycling of yard trimmings.
- ☐ Recycle residual paints, solvents, lumber, and other material as much as possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Clean work areas at the end of each work shift using dry cleaning methods such as sweeping and vacuuming.



Good Housekeeping

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.

- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.

- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures on exposed soils. See also SC-40, Contaminated and Erodible Areas, for more information.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.

- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.

- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.

- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.

- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and

solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

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

Mowing, Trimming, and Planting

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

Fertilizer and Pesticide Management

- ☐ Do not use pesticides if rain is expected.
- ☐ Do not mix or prepare pesticides for application near storm drains.
- ☐ Use the minimum amount needed for the job.
- ☐ Calibrate fertilizer distributors to avoid excessive application.
- ☐ Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- ☐ Apply pesticides only when wind speeds are low.
- ☐ Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- ☐ Irrigate slowly to prevent runoff and then only as much as is needed.
- ☐ Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

Inspection

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

Building & Grounds Maintenance SC-41



Spill Response and Prevention Procedures

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



Material Handling and Waste Management

- ☐ Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- ☐ Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- ☐ Dispose of empty pesticide containers according to the instructions on the container label.
- ☐ Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- ☐ Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.



Employee Training Program

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



Quality Assurance and Record Keeping

- ☐ Keep accurate logs that document maintenance activities performed and minimum BMP measures implemented.
- ☐ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- ☐ Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Additional capital costs are not anticipated for building and grounds maintenance. Implementation of the minimum BMPs described above should be conducted as part of regular site operations.

Maintenance

- Maintenance activities for the BMPs described above will be minimal, and no additional cost is anticipated.

Supplemental Information

Fire Sprinkler Line Flushing

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

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual.*

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook.* Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control.* Available online at:

http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

US EPA, 1997. *Best Management Practices Handbook for Hazardous Waste Containers*. Available online at: http://www.epa.gov/region6/6en/h/handbk4.pdf.

Ventura Countywide Stormwater Management Program Clean Business Fact Sheets. Available online at: http://www.vcstormwater.org/documents/programs_business/building.pdf.

Parking/Storage Area Maintenance SC-43



Objectives

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

Description

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

Targeted Constituents

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

Approach

Pollution Prevention

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

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.

CASQA California Stormwater Quality Association

- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.

Controlling Litter

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

Surface cleaning

- Use dry cleaning methods (e.g. sweeping or vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- If water is used follow the procedures below:
  - Block the storm drain or contain runoff.
  - Wash water should be collected and pumped to the sanitary sewer or discharged to a pervious surface, do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- When cleaning heavy oily deposits:
  - Use absorbent materials on oily spots prior to sweeping or washing.
  - Dispose of used absorbents appropriately.

Surface Repair

- Pre-heat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination form contacting stormwater runoff.
- Cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc., where applicable. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.

- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

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

Training

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

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, nad implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

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

Requirements

Costs

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

Maintenance

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

SC-43 Parking/Storage Area Maintenance

Supplemental Information

Further Detail of the BMP

Surface Repair

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

References and Resources

http://www.stormwatercenter.net/

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

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality control Board. July 1998 (Revised February 2002 by the California Coastal Commission).

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

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

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

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)
http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf

Housekeeping Practices SC-60

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

Objectives

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

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.
- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Dispose of wash water, sweepings, and sediments, properly.
- Recycle or dispose of fluids properly.
- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.
- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).
- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

Targeted Constituents

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

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- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plant up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

Requirements

Costs

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

Maintenance

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

Supplemental Information

Further Detail of the BMP

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

Examples

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.
http://www.nalms.org/bclss/bmphome.html#bmp

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

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

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

San Mateo STOPPP - (http://stoppp.tripod.com/bmp.html)

Road and Street Maintenance SC-70



Objectives

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

Targeted Constituents

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

Description

Streets, roads, and highways are significant sources of pollutants in stormwater discharges, and operation and maintenance (O&M) practices, if not conducted properly, can contribute to the problem. Stormwater pollution from roadway and bridge maintenance should be addressed on a site-specific basis. Use of the procedures outlined below, that address street sweeping and repair, bridge and structure maintenance, and unpaved roads will reduce pollutants in stormwater.

Approach

Pollution Prevention

- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal)
- Recycle paint and other materials whenever possible.
- Enlist the help of citizens to keep yard waste, used oil, and other wastes out of the gutter.

Suggested Protocols

Street Sweeping and Cleaning

- Maintain a consistent sweeping schedule. Provide minimum monthly sweeping of curbed streets.
- Perform street cleaning during dry weather if possible.

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- Avoid wet cleaning or flushing of street, and utilize dry methods where possible.
- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc. For example:
  - Increase the sweeping frequency for streets with high pollutant loadings, especially in high traffic and industrial areas.
  - Increase the sweeping frequency just before the wet season to remove sediments accumulated during the summer.
  - Increase the sweeping frequency for streets in special problem areas such as special events, high litter or erosion zones.
- Maintain cleaning equipment in good working condition and purchase replacement equipment as needed. Old sweepers should be replaced with new technologically advanced sweepers (preferably regenerative air sweepers) that maximize pollutant removal.
- Operate sweepers at manufacturer requested optimal speed levels to increase effectiveness.
- To increase sweeping effectiveness consider the following:
  - Institute a parking policy to restrict parking in problematic areas during periods of street sweeping.
  - Post permanent street sweeping signs in problematic areas; use temporary signs if installation of permanent signs is not possible.
  - Develop and distribute flyers notifying residents of street sweeping schedules.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- If available use vacuum or regenerative air sweepers in the high sediment and trash areas (typically industrial/commercial).
- Keep accurate logs of the number of curb-miles swept and the amount of waste collected.
- Dispose of street sweeping debris and dirt at a landfill.
- Do not store swept material along the side of the street or near a storm drain inlet.
- Keep debris storage to a minimum during the wet season or make sure debris piles are contained (e.g. by berming the area) or covered (e.g. with tarps or permanent covers).

Street Repair and Maintenance

Pavement marking

- Schedule pavement marking activities for dry weather.

- Develop paint handling procedures for proper use, storage, and disposal of paints.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.
- Provide drop cloths and drip pans in paint mixing areas.
- Properly maintain application equipment.
- Street sweep thermoplastic grindings. Yellow thermoplastic grindings may require special handling as they may contain lead.
- Paints containing lead or tributyltin are considered a hazardous waste and must be disposed of properly.
- Use water based paints whenever possible. If using water based paints, clean the application equipment in a sink that is connected to the sanitary sewer.
- Properly store leftover paints if they are to be kept for the next job, or dispose of properly.

Concrete installation and repair

- Schedule asphalt and concrete activities for dry weather.
- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place san bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- When making saw cuts in pavement, use as little water as possible and perform during dry weather. Cover each storm drain inlet completely with filter fabric or plastic during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site. Alternatively, a small onsite vacuum may be used to pick up the slurry as this will prohibit slurry from reaching storm drain inlets.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

Patching, resurfacing, and surface sealing

- Schedule patching, resurfacing and surface sealing for dry weather.
- Stockpile materials away from streets, gutter areas, storm drain inlets or watercourses. During wet weather, cover stockpiles with plastic tarps or berm around them if necessary to prevent transport of materials in runoff.
- Pre-heat, transfer or load hot bituminous material away from drainage systems or watercourses.
- Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and maintenance holes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from covered maintenance holes and storm drain inlets when the job is complete.
- Prevent excess material from exposed aggregate concrete or similar treatments from entering streets or storm drain inlets. Designate an area for clean up and proper disposal of excess materials.
- Use only as much water as necessary for dust control, to avoid runoff.
- Sweep, never hose down streets to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Equipment cleaning maintenance and storage

- Inspect equipment daily and repair any leaks. Place drip pans or absorbent materials under heavy equipment when not in use.
- Perform major equipment repairs at the corporation yard, when practical.
- If refueling or repairing vehicles and equipment must be done onsite, use a location away from storm drain inlets and watercourses.
- Clean equipment including sprayers, sprayer paint supply lines, patch and paving equipment, and mud jacking equipment at the end of each day. Clean in a sink or other area (e.g. vehicle wash area) that is connected to the sanitary sewer.

Bridge and Structure Maintenance

Paint and Paint Removal

- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Do not transfer or load paint near storm drain inlets or watercourses.

- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint container.
- Plug nearby storm drain inlets prior to starting painting where there is significant risk of a spill reaching storm drains. Remove plugs when job is completed.
- If sand blasting is used to remove paint, cover nearby storm drain inlets prior to starting work.
- Perform work on a maintenance traveler or platform, or use suspended netting or tarps to capture paint, rust, paint removing agents, or other materials, to prevent discharge of materials to surface waters if the bridge crosses a watercourse. If sanding, use a sander with a vacuum filter bag.
- Capture all clean-up water, and dispose of properly.
- Recycle paint when possible (e.g. paint may be used for graffiti removal activities). Dispose of unused paint at an appropriate household hazardous waste facility.

Graffiti Removal

- Schedule graffiti removal activities for dry weather.
- Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.
- When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal above.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a landscaped or dirt area. If such an area is not available, filter runoff through an appropriate filtering device (e.g. filter fabric) to keep sand, particles, and debris out of storm drains.
- If a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound), plug nearby storm drains and vacuum/pump wash water to the sanitary sewer.
- Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).

Repair Work

- Prevent concrete, steel, wood, metal parts, tools, or other work materials from entering storm drains or watercourses.
- Thoroughly clean up the job site when the repair work is completed.
- When cleaning guardrails or fences follow the appropriate surface cleaning methods (depending on the type of surface) outlined in SC-71 Plaza & Sidewalk Cleaning fact sheet.

- If painting is conducted, follow the painting and paint removal procedures above.
- If graffiti removal is conducted, follow the graffiti removal procedures above.
- If construction takes place, see the Construction Activity BMP Handbook.
- Recycle materials whenever possible.

Unpaved Roads and Trails

- Stabilize exposed soil areas to prevent soil from eroding during rain events. This is particularly important on steep slopes.
- For roadside areas with exposed soils, the most cost-effective choice is to vegetate the area, preferably with a mulch or binder that will hold the soils in place while the vegetation is establishing. Native vegetation should be used if possible.
- If vegetation cannot be established immediately, apply temporary erosion control mats/blankets; a comma straw, or gravel as appropriate.
- If sediment is already eroded and mobilized in roadside areas, temporary controls should be installed. These may include: sediment control fences, fabric-covered triangular dikes, gravel-filled burlap bags, biobags, or hay bales staked in place.

Non-Stormwater Discharges

Field crews should be aware of non-stormwater discharges as part of their ongoing street maintenance efforts.

- Refer to SC-10 Non-Stormwater Discharges
- Identify location, time and estimated quantity of discharges.
- Notify appropriate personnel.

Training

- Train employees regarding proper street sweeping operation and street repair and maintenance.
- Instruct employees and subcontractors to ensure that measures to reduce the stormwater impacts of roadway/bridge maintenance are being followed.
- Require engineering staff and/or consulting A/E firms to address stormwater quality in new bridge designs or existing bridge retrofits.
- Use a training log or similar method to document training.
- Train employees on proper spill containment and clean up, and in identifying non-stormwater discharges.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Densely populated areas or heavily used streets may require parking regulations to clear streets for cleaning.
- No currently available conventional sweeper is effective at removing oil and grease. Mechanical sweepers are not effective at removing finer sediments.
- Limitations may arise in the location of new bridges. The availability and cost of land and other economic and political factors may dictate where the placement of a new bridge will occur. Better design of the bridge to control runoff is required if it is being placed near sensitive waters.

Requirements

Costs

- The maintenance of local roads and bridges is already a consideration of most community public works or transportation departments. Therefore, the cost of pollutant reducing management practices will involve the training and equipment required to implement these new practices.
- The largest expenditures for street sweeping programs are in staffing and equipment. The capital cost for a conventional street sweeper is between $60,000 and $120,000. Newer technologies might have prices approaching $180,000. The average useful life of a conventional sweeper is about four years, and programs must budget for equipment replacement. Sweeping frequencies will determine equipment life, so programs that sweep more often should expect to have a higher cost of replacement.
- A street sweeping program may require the following.
  - Sweeper operators, maintenance, supervisory, and administrative personnel are required.
  - Traffic control officers may be required to enforce parking restrictions.
  - Skillful design of cleaning routes is required for program to be productive.
  - Arrangements must be made for disposal of collected wastes.

- If investing in newer technologies, training for operators must be included in operation and maintenance budgets. Costs for public education are small, and mostly deal with the need to obey parking restrictions and litter control. Parking tickets are an effective reminder to obey parking rules, as well as being a source of revenue.

Maintenance

- Not applicable

Supplemental Information

Further Detail of the BMP

Street sweeping

There are advantages and disadvantages to the two common types of sweepers. The best choice depends on your specific conditions. Many communities find it useful to have a compliment of both types in their fleet.

Mechanical Broom Sweepers - More effective at picking up large debris and cleaning wet streets. Less costly to purchase and operate. Create more airborne dust.

Vacuum Sweepers - More effective at removing fine particles and associated heavy metals. Ineffective at cleaning wet streets. Noisier than mechanical broom sweepers which may restrict areas or times of operation. May require an advance vehicle to remove large debris.

Street Flushers - Not affected by biggest interference to cleaning, parked cars. May remove finer sediments, moving them toward the gutter and stormwater inlets. For this reason, flushing fell out of favor and is now used primarily after sweeping. Flushing may be effective for combined sewer systems. Presently street flushing is not allowed under most NPDES permits.

Cross-Media Transfer of Pollutants

The California Air Resources Board (ARB) has established state ambient air quality standards including a standard for respirable particulate matter (less than or equal to 10 microns in diameter, symbolized as PM10). In the effort to sweep up finer sediments to remove attached heavy metals, municipalities should be aware that fine dust, that cannot be captured by the sweeping equipment and becomes airborne, could lead to issues of worker and public safety.

Bridges

Bridges that carry vehicular traffic generate some of the more direct discharges of runoff to surface waters. Bridge scupper drains cause a direct discharge of stormwater into receiving waters and have been shown to carry relatively high concentrations of pollutants. Bridge maintenance also generates wastes that may be either directly deposited to the water below or carried to the receiving water by stormwater. The following steps will help reduce the stormwater impacts of bridge maintenance:

- Site new bridges so that significant adverse impacts to wetlands, sensitive areas, critical habitat, and riparian vegetation are minimized.

- Design new bridges to avoid the use of scupper drains and route runoff to land for treatment control. Existing scupper drains should be cleaned on a regular basis to avoid sediment/debris accumulation.
- Reduce the discharge of pollutants to surface waters during maintenance by using suspended traps, vacuums, or booms in the water to capture paint, rust, and paint removing agents. Many of these wastes may be hazardous. Properly dispose of this waste by referring to CA21 (Hazardous Waste Management) in the Construction Handbook.
- Train employees and subcontractors to reduce the discharge of wastes during bridge maintenance.

De-icing

- Do not over-apply deicing salt and sand, and routinely calibrate spreaders.
- Near reservoirs, restrict the application of deicing salt and redirect any runoff away from reservoirs.
- Consider using alternative deicing agents (less toxic, biodegradable, etc.).

References and Resources

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

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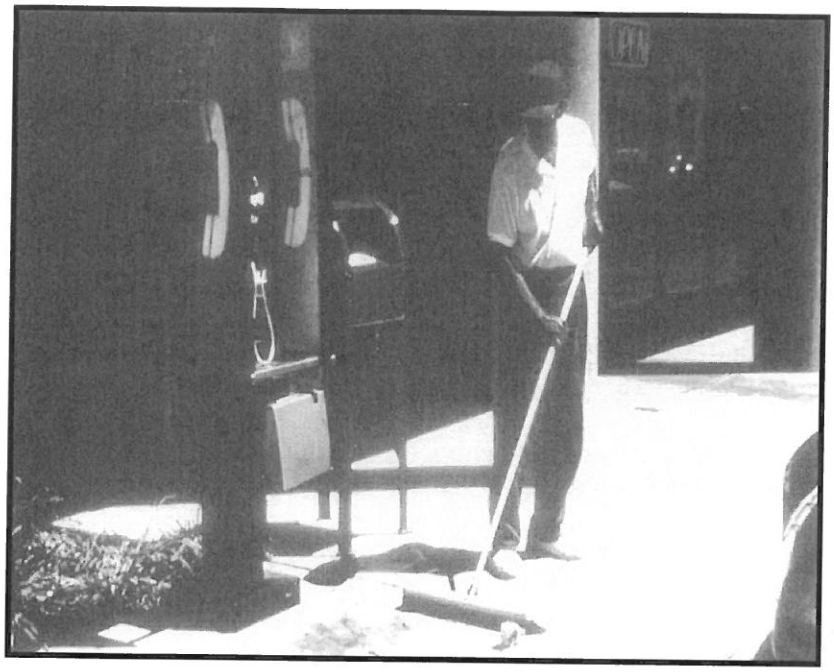
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Plaza and Sidewalk Cleaning SC-71



Objectives

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

Targeted Constituents

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

Description

Pollutants on sidewalks and other pedestrian traffic areas and plazas are typically due to littering and vehicle use. This fact sheet describes good housekeeping practices that can be incorporated into the municipality's existing cleaning and maintenance program.

Approach

Pollution Prevention

- Use dry cleaning methods whenever practical for surface cleaning activities.
- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal).

Suggested Protocols

Surface Cleaning

- Regularly broom (dry) sweep sidewalk, plaza and parking lot areas to minimize cleaning with water.
- Dry cleanup first (sweep, collect, and dispose of debris and trash) when cleaning sidewalks or plazas, then wash with or without soap.
- Block the storm drain or contain runoff when cleaning with water. Discharge wash water to landscaping or collect water and pump to a tank or discharge to sanitary sewer if allowed. (Permission may be required from local sanitation district.)

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- Block the storm drain or contain runoff when washing parking areas, driveways or drive-throughs. Use absorbents to pick up oil; then dry sweep. Clean with or without soap. Collect water and pump to a tank or discharge to sanitary sewer if allowed. Street Repair and Maintenance.

Graffiti Removal

- Avoid graffiti abatement activities during rain events.
- Implement the procedures under Painting and Paint Removal in SC-70 Roads, Streets, and Highway Operation and Maintenance fact sheet when graffiti is removed by painting over.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a dirt or landscaped area after treating with an appropriate filtering device.
- Plug nearby storm drain inlets and vacuum/pump wash water to the sanitary sewer if authorized to do so if a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound). Ensure that a non-hazardous cleaning compound is used or dispose as hazardous waste, as appropriate.

Surface Removal and Repair

- Schedule surface removal activities for dry weather if possible.
- Avoid creating excess dust when breaking asphalt or concrete.
- Take measures to protect nearby storm drain inlets prior to breaking up asphalt or concrete (e.g. place hay bales or sand bags around inlets). Clean afterwards by sweeping up as much material as possible.
- Designate an area for clean up and proper disposal of excess materials.
- Remove and recycle as much of the broken pavement as possible to avoid contact with rainfall and stormwater runoff.
- When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet completely with filter fabric during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site.
- Always dry sweep first to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains. Once dry sweeping is complete, the area may be hosed down if needed. Wash water should be directed to landscaping or collected and pumped to the sanitary sewer if allowed.

Concrete Installation and Repair

- Schedule asphalt and concrete activities for dry weather.

- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place san bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- Protect applications of fresh concrete from rainfall and runoff until the material has dried.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- Cover litter receptacles and clean out frequently to prevent leaking/spillage or overflow.
- Clean parking lots on a regular basis with a street sweeper.

Training

- Provide regular training to field employees and/or contractors regarding surface cleaning and proper operation of equipment.
- Train employee and contractors in proper techniques for spill containment and cleanup.
- Use a training log or similar method to document training.

Spill Response and Prevention

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

Other Considerations

- Limitations related to sweeping activities at large parking facilities may include current sweeper technology to remove oil and grease.
- Surface cleaning activities that require discharges to the local sewering agency will require coordination with the agency.
- Arrangements for disposal of the swept material collected must be made, as well as accurate tracking of the areas swept and the frequency of sweeping.

Requirements

Costs

- The largest expenditures for sweeping and cleaning of sidewalks, plazas, and parking lots are in staffing and equipment. Sweeping of these areas should be incorporated into street sweeping programs to reduce costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Community education, such as informing residents about their options for recycling and waste disposal, as well as the consequences of littering, can instill a sense of citizen responsibility and potentially reduce the amount of maintenance required by the municipality.

Additional BMPs that should be considered for parking lot areas include:

- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Structural BMPs such as storm drain inlet filters can be very effective in reducing the amount of pollutants discharged from parking facilities during periods of rain.

References and Resources

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

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

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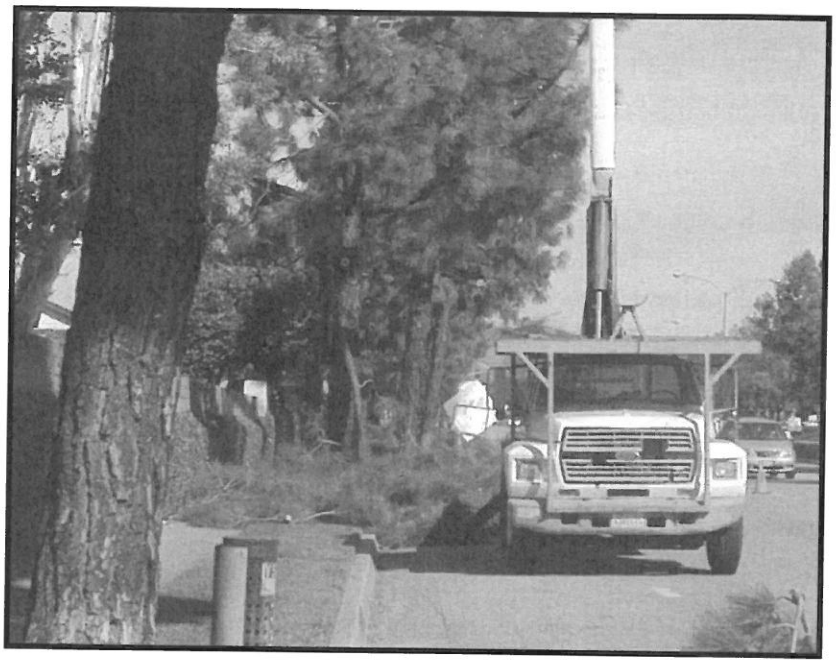
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San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Plan. 2001. Municipal Activities Model Program Guidance. November.

Landscape Maintenance SC-73



Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

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

Description

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

Approach

Pollution Prevention

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

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

Suggested Protocols

Mowing, Trimming, and Weeding

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

Planting

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

Waste Management

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

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

Irrigation

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

Fertilizer and Pesticide Management

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

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

Inspection

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

Training

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

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

Spill Response and Prevention

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

Other Considerations

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

Requirements

Costs

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

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Waste Management

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

Contractors and Other Pesticide Users

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

References and Resources

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

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

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Drainage System Maintenance SC-74



Photo Credit: Geoff Brosseau

Objectives

- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Targeted Constituents

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

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure 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 SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

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- 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.
- Record the amount of waste collected.
- 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 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 of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

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 flushed effluent and pump to the sanitary sewer for treatment.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to 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

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
  - 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 up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil 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

- Regularly inspect and clean up hot spots and other storm drainage areas 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.

- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).
- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Only properly trained individuals are allowed to handle hazardous materials/wastes.
- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.
- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.
- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

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

Other Considerations

- Cleanup 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 disposal of flushed effluent to sanitary sewer may be prohibited in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Private property access rights may be needed to track illegal discharges up gradient.

- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.

- 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. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from "environmental fees" or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.

- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.

- Arrangements must be made for proper disposal of collected wastes.

- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. The 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, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect 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 re-collect 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 percent for organics and 55-65 percent 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 drain flushing.

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows we allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for steam alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to he reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank aid watershed instability arid floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

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Retention/Irrigation TC-12

General Description

Retention/irrigation refers to the capture of stormwater runoff in a holding pond and subsequent use of the captured volume for irrigation of landscape or natural pervious areas. This technology is very effective as a stormwater quality practice in that, for the captured water quality volume, it provides virtually no discharge to receiving waters and high stormwater constituent removal efficiencies. This technology mimics natural undeveloped watershed conditions wherein the vast majority of the rainfall volume during smaller rainfall events is infiltrated through the soil profile. Their main advantage over other infiltration technologies is the use of an irrigation system to spread the runoff over a larger area for infiltration. This allows them to be used in areas with low permeability soils.

Capture of stormwater can be accomplished in almost any kind of runoff storage facility, ranging from dry, concrete-lined ponds to those with vegetated basins and permanent pools. The pump and wet well should be automated with a rainfall sensor to provide irrigation only during periods when required infiltration rates can be realized. Generally, a spray irrigation system is required to provide an adequate flow rate for distributing the water quality volume (LCRA, 1998). Collection of roof runoff for subsequent use (rainwater harvesting) also qualifies as a retention/irrigation practice.

Inspection/Maintenance Considerations

Pollutant removal rates are estimated to be nearly 100% for all pollutants in the captured and irrigated stormwater volume. However, relatively frequent inspection and maintenance is necessary to verify proper operation of these facilities.

Maintenance Concerns, Objectives, and Goals

- Sediment Accumulation
- Mechanical Malfunction
- Vector Control

Targeted Constituents

✓	Sediment	■
✓	Nutrients	■
✓	Trash	■
✓	Metals	■
✓	Bacteria	■
✓	Oil and Grease	■
✓	Organics	■
✓	Oxygen Demanding	■

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

CASQA California Stormwater Quality Association

Inspection Activities	Suggested Frequency
■ The irrigation system should be inspected and tested (or observed while in operation) to verify proper operation multiple times annually. Two of these inspections should occur during or immediately following wet weather. Any leaks, broken spray heads, or other malfunctions with the irrigation system should be repaired immediately.	Frequently (3-6 times per year)
Maintenance Activities	**Suggested Frequency**
■ The upper stage, side slopes, and embankment of a retention basin must be mowed regularly to discourage woody growth and control weeds.	Frequently
■ Remove sediment from inlet structure/sediment forebay, and from around the sump area at least 2 times annually or when depth reaches 3 inches. When sediment in other areas of the basin fills the volume allocated for sediment accumulation, all sediment should be removed and disposed of properly. ■ Grass areas in and around basins must be mowed at least twice annually to limit vegetation height to 18 inches. More frequent mowing to maintain aesthetic appeal may be necessary in landscaped areas. When mowing is performed, a mulching mower should be used, or grass clippings should be caught and removed. ■ Debris and litter will accumulate near the basin pump and should be removed during regular mowing operations and inspections. Particular attention should be paid to floating debris that can eventually clog the irrigation system.	Semi-annual
■ The pond side slopes and embankment may periodically suffer from slumping and erosion, although this should not occur often if the soils are properly compacted during construction. Regrading and revegetation may be required to correct the problems.	Infrequently

Bioretention

TC-32



Maintenance Concerns, Objectives, and Goals

- Clogged Soil or Outlet Structures
- Invasive Species
- Vegetation/Landscape Maintenance
- Erosion
- Channelization of Flow
- Aesthetics

General Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through a sand bed and is subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

Targeted Constituents

✓	Sediment	■
✓	Nutrients	▲
✓	Trash	■
✓	Metals	■
✓	Bacteria	■
✓	Oil and Grease	■
✓	Organics	■
✓	Oxygen Demanding	■

Legend ***(Removal Effectiveness)***

- ● Low
- ■ High
- ▲ Medium

Inspection/Maintenance Considerations

Bioretention requires frequent landscaping maintenance, including measures to ensure that the area is functioning properly, as well as maintenance of the landscaping on the practice. In many cases, bioretention areas initially require intense maintenance, but less maintenance is needed over time. In many cases, maintenance tasks can be completed by a landscaping contractor, who may already be hired at the site. In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

CASQA California Stormwater Quality Association

Inspection Activities	Suggested Frequency
■ Inspect soil and repair eroded areas.	Monthly
■ Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is desirable.	Semi-annual inspection
■ Inspect to ensure grass is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket.	
■ Check for debris and litter, and areas of sediment accumulation.	
■ Inspect health of trees and shrubs.	

Maintenance Activities	Suggested Frequency
■ Water plants daily for 2 weeks.	At project completion
■ Remove litter and debris.	Monthly
■ Remove sediment.	As needed
■ Remulch void areas.	
■ Treat diseased trees and shrubs.	
■ Mow turf areas.	
■ Repair erosion at inflow points.	
■ Repair outflow structures.	
■ Unclog underdrain.	
■ Regulate soil pH regulation.	
■ Remove and replace dead and diseased vegetation.	Semi-annual
■ Add mulch.	Annual
■ Replace tree stakes and wires.	
■ Mulch should be replaced every 2 to 3 years or when bare spots appear. Remulch prior to the wet season.	Every 2-3 years, or as needed

Additional Information

Landscaping is critical to the function and aesthetic value of bioretention areas. It is preferable to plant the area with native vegetation, or plants that provide habitat value, where possible. Another important design feature is to select species that can withstand the hydrologic regime they will experience. At the bottom of the bioretention facility, plants that tolerate both wet and dry conditions are preferable. At the edges, which will remain primarily dry, upland species will be the most resilient. It is best to select a combination of trees, shrubs, and herbaceous materials.

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Adopt a pet from your local animal shelter or adoption centers at pet stores. A variety of animals, from purebred to mixed breed are waiting for loving arms and good homes. Consider volunteering at your local animal shelters. Volunteers, donations, food, newspapers, old towels and linens are needed to help the animals.



RIVERSIDE COUNTY
ANIMAL SHELTER LOCATIONS:

BLYTHE
16450 West Hobson Way
Blythe, CA 92225
760-921-7857

HEMET
800 South Sanderson
Hemet, CA 92545
909 925-8025

INDIO
45-355 Van Buren
Indio, CA 92201
760-347-2319

RIVERSIDE
5950 Wilderness Avenue
Riverside, CA 92504
909-358-7387

FOR ALL OTHER AREAS
CALL 1-888-636-7387

Riverside County gratefully acknowledges the City of Los Angeles Stormwater Program for the design concept of this brochure.

What's the Scoop?



TIPS FOR A HEALTHY PET AND A HEALTHIER ENVIRONMENT

CREATE A HEALTHY ENVIRONMENT in and around your home by following these simple pet practices. Your pet, family and neighbors will appreciate their clean comfortable surroundings.

HOUSEHOLD PETS

We all love our pets, but pet waste is a subject everyone likes to avoid. Pet waste left on trails, sidewalks, streets, and grassy areas is immediately flushed into the nearest waterway when it rains. Even if you can't see water near you, the rain or waste water WASHES all that PET WASTE and BACTERIA INTO THE STORMDRAIN, where it travels to your neighborhood creek or lake untreated. These animal droppings also contain nutrients that can promote the growth of algae, if they enter our streams and lakes. The risk of STORMWATER CONTAMINATION INCREASES, if pet wastes is allowed to accumulate in animal pen areas or left on sidewalks, streets, or driveways where runoff can carry them to storm sewers.

Some of the DISEASES THAT CAN SPREAD from pet waste are:
Campylobacteriosis — a bacterial infection that causes diarrhea in humans.
Salmonellosis — the most common bacterial infection transmitted to humans from animals.
Toxocarisis — roundworms transmitted from animals to humans.

Flies and other pest insects can also increase when pet waste is disposed of improperly, becoming a nuisance and adding yet another vector for disease transmission.

WHAT CAN YOU DO?

- SCOOP up pet waste and flush it down the toilet.
- NEVER DUMP pet waste into a storm drain or catch basin.
- USE the complimentary BAGS or mutt mitts offered in dispensers at local parks.
- CARRY EXTRA BAGS when walking your dog and make them available to other pet owners who are without.
- TEACH CHILDREN how to properly clean up after a pet.
- TELL FRIENDS AND NEIGHBORS about the ill effects of animal waste on the environment. Encourage them to clean up after pets.

Did You Know . . .
that Californians illegally dump about 80 million gallons of motor oil each year?

Many communities have “Scoop the Poop” laws that govern pet waste cleanup. Some of these laws specifically require anyone who walks an animal off of their property to carry a bag, shovel, or scooper. Any waste left by the animal must be cleaned up immediately. CALL YOUR LOCAL CODE ENFORCEMENT OFFICER to find out more about pet waste regulations.

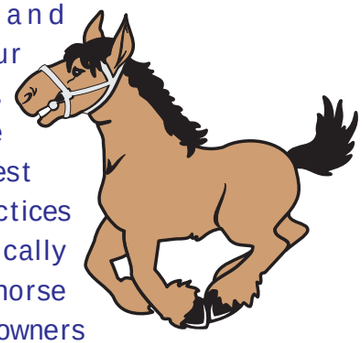


Pets are only one of the many fixtures of suburban America that add to water pollution. Lawn fertilizers, rinse water from driveways and motor oil commonly end up in streams and lakes. CALL 1-800-506-2555 FOR HOUSEHOLD HAZARDOUS WASTE COLLECTION LOCATION AND DATES. Maintain your automobile to avoid leaks. Dispose of used vehicle fluids properly. Your pets can be poisoned if they ingest gas, oil or antifreeze that drips onto the pavement or is stored in open containers.

NEVER HOSE VEHICLE FLUIDS into the street or gutter. USE ABSORBENT MATERIALS such as cat litter to clean-up spills. SWEEP UP used absorbent materials and place in the trash.

HORSES AND LIVESTOCK

Fortunate enough to own a horse or livestock? You, too, can play a part in protecting and cleaning up our water resources. The following are a few simple Best Management Practices (BMPs) specifically designed for horse owners and landowners with horses.



- STORE your manure properly. Do not store unprotected piles of manure in places where runoff may enter streams, or flood waters may wash the manure away. Place a cover or tarp over the pile to keep rainwater out.
- CHECK with your local conservation district to design manure storage facilities to protect water quality. These structures usually consist of a concrete pad to protect ground water and a short wall on one or two sides to make manure handling easier.
- TRY composting – A vegetative cover placed around buildings or on steeper slopes can help minimize erosion and absorb nutrients while improving the appearance of your property. In addition, avoid costlier erosion controls, vegetative covers will provide animals with better traction during wet or icy conditions.



- KEEP animals out of steams – Designed stream crossings provide a safe, easy way for horses and livestock to ford streams. Fencing encourages the use of the crossing instead of the streambed to navigate streams. This will allow vegetation to stabilize stream banks and reduce sediment pollution.
- MOW pastures to proper height, six inches is typically recommended.
- Material STORAGE SAFETY TIPS – Many of the chemicals found in barns require careful handling and proper disposal. When using these chemicals, be certain to follow these common sense guidelines:
  - Buy only what you need.
  - Treat spills of hoof oils like fuel spill. Use kitty litter to soak up the oil and dispose in a tightly sealed plastic bag.
  - Store pesticides in a locked, dry, well-ventilated area.
  - Protect stored fertilizer and pesticides from rain and surface water.

Call 1-800-506-2555 to locate your local conservation district to find out what to do with your current backyard manure pile, how to re-establish a healthy pasture, what to do about weeds, and what grasses grow best in your soils.

Thank you for doing your part to protect your watershed, the environment, and the equestrian way of life in your community!



After the Storm

A Citizen's Guide to Understanding Stormwater

EPA 833-B-03-002

January 2003

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

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.



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.

Why is stormwater runoff a problem?

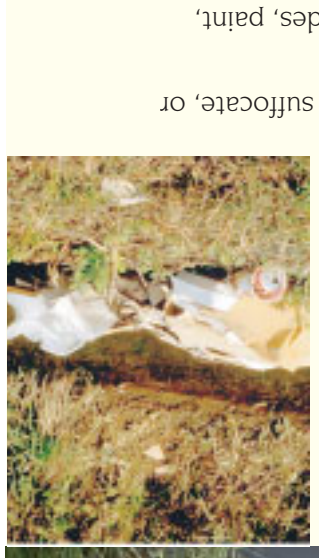


The effects of pollution

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.

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.

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.

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

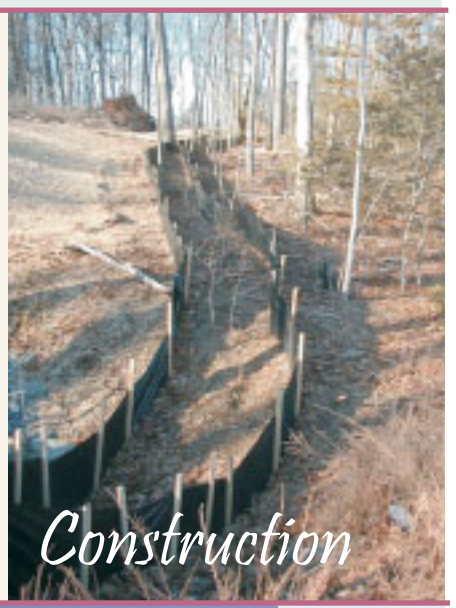
Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- 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.



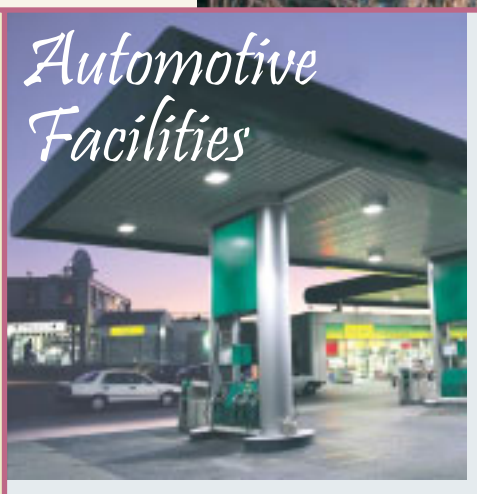
- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply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

AUTO MAINTENANCE



Oil and grease from cars, asbestos worn from brake linings, zinc from tires, and toxics from spilled fluids often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

Cleanin' Work Sites...



Avoid hosing down your garage floor and driveway; instead, sweep regularly. Also, use non-toxic cleaning products. A water and baking soda mixture works great on removing corrosion from battery terminals and cleaning chrome; mix the soda with a mild, biodegradable dishwashing soap to clean wheels and tires. Additionally, a mixture of white vinegar or lemon juice with water can be used to clean windows.

Spills...

Avoid accidental spills by using a drip pan and funnel when draining or pouring fluids. Be ready for unexpected spills by preparing and using spill containment and cleanup kits. Kits should include safety equipment and cleanup materials such as kitty litter, sawdust or cornmeal. Furthermore, prevent leaks from stored vehicles by draining gas, hydraulic oil, and transmission, brake & radiator fluid. To report serious spills, call 1-800-33-TOXIC.

Recycling...

The law requires people to recycle motor oil and lead acid batteries. REMEMBER: Never dump them down storm drains. Other items which can be recycled include oil filters, antifreeze, cleaning solutions, hydraulic & transmission fluids, metal scraps, water-based paints, and used tires. For recycling information, call 386-8401.

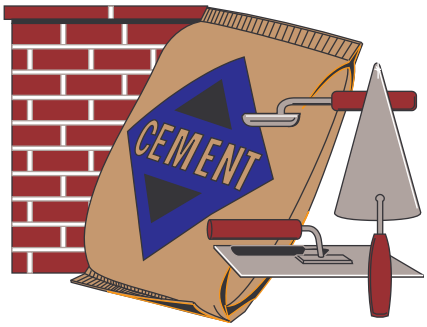
Washin' Vehicles...

Take vehicles to a washing facility to prevent oil & grease, suspended solids and other toxics from washing into our storm drains. Otherwise, use bermed wash areas to prevent contact with stormwater. Discharge wash water to sewer only after contacting local sewer authority to find out if pretreatment is required. At home, vehicles should be washed on the lawn, which can absorb unwanted runoff.



For more information, call your city's stormwater representative

FRESH CONCRETE & MORTAR APPLICATION



Cement, cement wash, gravel, asphalt, solvents, and motor oil from fresh concrete and mortar activities often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

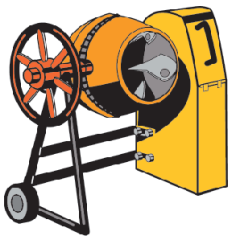
General Business Practices...

Schedule excavation and grading work during dry weather, and in case it rains, prevent materials from contacting stormwater by storing them under cover. Also, secure open bags of cement to keep wind-blown cement powder away from streets, gutters and storm drains.



During Construction...

Prevent mortar and cement from entering the storm drains by placing erosion controls (i.e., berms or temporary vegetation) down-slope to capture runoff. When breaking up paving, be sure to pick up all pieces and recycle them at a crushing company; small amounts of excess dry concrete, grout and mortar can be disposed of in the trash. Setup small mixers on tarps or heavy drop cloths to allow for easy cleanup of debris. REMEMBER: Never bury waste material -- recycle or dispose of it as hazardous waste. Call 386-8401 for recycling and disposal information.

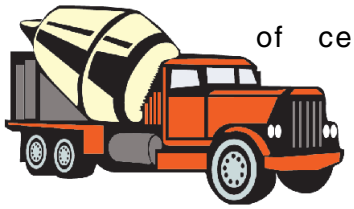


Handling Materials & Wastes...

Minimize wastes when ordering materials by ordering only the amounts needed to complete the job. Whenever possible, use recycled or recyclable materials. Recycle broken asphalt, concrete, wood, and cleared vegetation. Unrecyclable materials must be taken to an appropriate landfill or disposed of as hazardous waste. For recycling and disposal information, call 386-8401.

Cleaning up...

When cleaning up after driveway or sidewalk construction, wash concrete dust onto designated dirt areas, not down the driveway or into the street or storm drain. Also, wash out concrete mixers and equipment only in specified wash-out areas, where the water flows into containment ponds. Cement washwater can be recycled by pumping it back into cement mixers for reuse. REMEMBER: Never dispose of cement washout into driveways, streets, gutters, storm drains or drainage ditches.



For more information, call your city's stormwater representative

For Information:

For more information on the General Industrial Storm Water Permit contact:

State Water Resources Control Board (SWRCB)
(916) 657-1146 or www.swrcb.ca.gov/ or, at your Regional Water Quality Control Board (RWQCB).

Santa Ana Region (8)
California Tower
3737 Main Street, Ste. 500
Riverside, CA 92501-3339
(909) 782-4130

San Diego Region (9)
9771 Clairemont Mesa Blvd., Ste. A
San Diego, CA 92124
(619) 467-2952

Colorado River Basin Region (7)
73-720 Fred Waring Dr., Ste. 100
Palm Desert, CA 92260
(760) 346-7491

SPILL RESPONSE AGENCY:
HAZ-MAT: (909) 358-5055
HAZARDOUS WASTE DISPOSAL: (909) 358-5055
RECYCLING INFORMATION: 1-800-366-SAVE
TO REPORT ILLEGAL DUMPING OR A CLOGGED STORM DRAIN: 1-800-506-2555

To order additional brochures or to obtain information on other pollution prevention activities, call:
(909) 955-1111.

StormWater CleanWater
PROTECTION PROGRAM

Riverside County gratefully acknowledges the State Water Quality Control Board and the American Public Works Association, Storm Water Quality Task Force for the information provided in this brochure.

DID YOU KNOW . . .

YOUR FACILITY MAY NEED A STORM WATER PERMIT?



Many industrial facilities and manufacturing operations must obtain coverage under the Industrial Activities Storm Water General Permit

FIND OUT
IF YOUR FACILITY MUST OBTAIN A PERMIT

StormWater Pollution . . . What you should know

Riverside County has two drainage systems - sanitary sewers and storm drains. The storm drain system is designed to help prevent flooding by carrying excess rainwater away from streets. Since the storm drain system does not provide for water treatment, it also serves the *unintended* function of transporting pollutants directly to our waterways.

Unlike sanitary sewers, storm drains are not connected to a treatment plant - they flow directly to our local streams, rivers and lakes.



In recent years, awareness of the need to protect water quality has increased. As a result, federal, state, and local programs have been established to reduce polluted stormwater discharges to our waterways. The emphasis of these programs is to prevent stormwater pollution since it's much easier, and less costly, than cleaning up "after the fact."

National Pollutant Discharge Elimination System (NPDES)

In 1987, the Federal Clean Water Act was amended to establish a framework for regulating industrial stormwater discharges under the NPDES permit program. In California, NPDES permits are issued by the State Water Resources Control Board (SWRCB) and the nine (9) Regional Water Quality Control Boards (RWQCB). In general, certain industrial facilities and manufacturing operations must obtain coverage under the Industrial Activities Storm Water General Permit if the type of facilities or operations falls into one of the several categories described in this brochure.

How Do I Know If I Need A Permit?

Following are ***general descriptions*** of the industry categories types that are regulated by the Industrial Activities Storm Water General Permit. Contact your local Region Water Quality Control Board to determine if your facility/operation requires coverage under the Permit.

➜ Facilities such as cement manufacturing; feedlots; fertilizer manufacturing; petroleum refining; phosphate manufacturing; steam electric power generation; coal mining; mineral mining and processing; ore mining and dressing; and asphalt emulsion;

➜ Facilities classified as lumber and wood products (except wood kitchen cabinets); pulp, paper, and paperboard mills; chemical producers (except some pharmaceutical and biological products); petroleum and coal products; leather production and products; stone, clay and glass products; primary metal industries; fabricated structural metal; ship and boat building and repairing;

➜ Active or inactive mining operations and oil and gas exploration, production, processing, or treatment operations;

➜ Hazardous waste treatment, storage, or disposal facilities;

➜ Landfills, land application sites and open dumps that receive or have received any industrial waste; unless there is a new overlying land use such as a golf course, park, etc., and there is no discharge associated with the landfill;

➜ Facilities involved in the recycling of materials, including metal scrap yards, battery reclaimers, salvage yards, and automobile junkyards;

➜ Steam electric power generating facilities, facilities that generate steam for electric power by combustion;

➜ Transportation facilities that have vehicle maintenance shops, fueling facilities, equipment cleaning operations, or airport deicing operations. This includes school bus maintenance facilities operated by a school district;

➜ Sewage treatment facilities;

➜ Facilities that have areas where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, or industrial machinery are exposed to storm water.

How do I obtain coverage under the Industrial Activities Storm Water General Permit?

Obtain a permit application package from your local Regional Water Quality Control Board listed on the back of this brochure or the State Water Resources Control Board (SWRCB). Submit a completed Notice of Intent (NOI) form, site map and the appropriate fee ($250 or $500) to the SWRCB. Facilities must submit an NOI thirty (30) days prior to beginning operation. Once you submit the NOI, the State Board will send you a letter acknowledging receipt of your NOI and will assign your facility a waste discharge identification number (WDID No.). You will also receive an annual fee billing. These billings should roughly coincide with the date the State Board processed your original NOI submittal.

What are the requirements of the Industrial Activities Storm Water General Permit?

The basic requirements of the Permit are:

1. The facility must eliminate any non-stormwater discharges or obtain a separate permit for such discharges.

2. The facility must develop and implement a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP must identify sources of pollutants that may be exposed to stormwater. Once the sources of pollutants have been identified, the facility operator must develop and implement Best Management Practices (BMPs) to minimize or prevent polluted runoff.

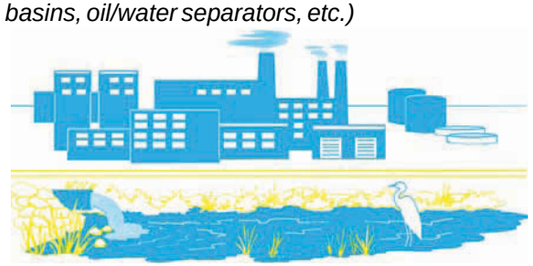
   Guidance in preparing a SWPPP is available from a document prepared by the California Storm Water Quality Task Force called the California Storm Water Best Management Practice Handbook.

3. The facility must develop and implement a Monitoring Program that includes conducting visual observations and collecting samples of the facility's storm water discharges associated with industrial activity. The General Permit requires that the analysis be conducted by a laboratory that is certified by the State of California.

4. The facility must submit to the Regional Board, every July 1, an annual report that includes the results of its monitoring program.

A Non-Storm Water Discharge is... *any discharge to a storm drain system that is not composed entirely of storm water. The following non-storm water discharges are authorized by the General Permit: fire hydrant flushing; potable water sources, including potable water related to the operation, maintenance, or testing of potable water systems; drinking fountain water; atmospheric condensates including refrigeration, air conditioning, and compressor condensate; irrigation drainage; landscape watering; springs; non-contaminated ground water; foundation or footing drainage; and sea water infiltration where the sea waters are discharged back into the sea water source.*

A BMP is . . . *a technique, process, activity, or structure used to reduce the pollutant content of a storm water discharge. BMPs may include simple, non-structural methods such as good housekeeping, staff training and preventive maintenance. Additionally, BMPs may include structural modifications such as the installation of berms, canopies or treatment control (e.g. setting basins, oil/water separators, etc.)*



WARNING*: There are significant penalties for non-compliance: a minimum fine of $5,000 for failing to obtain permit coverage, and, up to $10,000 per day, per violation plus $10 per gallon of discharge in excess of 1,000 gallons.*

HOME & GARDEN



Yard waste and household toxics such as paints, solvents, and pesticides often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

In Your Home...

Household products such as paints, paint thinners, drain openers, motor oil, wood polishes, insecticides & herbicides, oven cleaners, and many other general cleaners frequently get dumped on the ground, or into a gutter, street or storm drain. Instead of polluting our stormwaters, take these items to a household hazardous waste collection facility. Call 1-800-OILY-CAT for a facility in your area.



Fertilizers and Pesticides...

Fertilizers and pesticides are often carried into our storm drains by sprinkler runoff. To minimize stormwater pollution, use organic or non-toxic pesticides and fertilizers as directed, and keep them away from ditches, gutters and storm drains. Store them in a covered area, off the ground, to prevent contact with water. For additional gardening questions, call the San Bernardino Master Gardeners at 387-2182.



Trimmin' the Garden...

Decaying organic materials that enter our storm drains, such as grass, leaves, yard clippings, and pet waste, will use up oxygen in nearby streams, stressing aquatic life. Prevent stormwater pollution by not blowing, sweeping, raking or hosing yard waste into the street, gutter, or storm drain. Alternatively, leave grass clippings on your lawn after mowing, or compost your clippings and yard waste. Pet waste should not be composted, but rather disposed of in the trash to prevent the potential spread of diseases.



Planting In The Yard

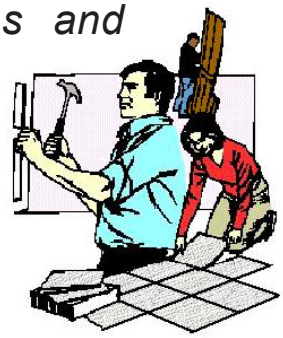
Produce less yard waste and save water by planting low maintenance trees and shrubs. Also, conserve water and minimize unwanted runoff by using drip irrigation, soaker hoses, or micro-spray systems to water vegetation.



For more information, call your city's stormwater representative

HOME REPAIR & REMODELING

Paints, solvents, adhesives, dusts, sediments, pesticides and household toxics commonly associated with home repair and remodeling activities often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.



Follow these practices to help prevent stormwater pollution...

Household Hazardous Wastes...

Common household cleaners, paint products, and wallpaper & tile adhesives contain toxic substances. Dispose of these products properly. REMEMBER: Toxic wastes should never enter the storm drain system. For disposal information, call 1-800-OILY-CAT.



Construction...

Keep all construction debris away from the street, gutter and storm drain, and if possible, schedule grading and excavation projects for dry weather. Cover excavated material and stockpiles of asphalt, sand, etc. with plastic tarps, and prevent erosion by planting fast-growing annual and perennial grasses, which will shield and bind the soil.

Landscape & Gardening...

Use fertilizers and pesticides as directed. Keep them away from ditches, gutters and storm drains, and store them in a covered area to prevent contact with rain water. Also, minimize runoff and conserve water by using drip irrigation, soaker hoses, or micro-spray systems. REMEMBER: Do not deposit leaves into the street, gutter, or storm drain.



Painting...

CLEANUP... Avoid cleaning brushes or rinsing paint containers into a street, gutter, or storm drain. For water-based paints, “brush out” as much paint as possible, and rinse in the sink. For oil-based paints, “brush out” as much paint as possible, clean with thinner, and then filter and reuse thinner or solvent.



REMOVAL... Paint stripping residue, chips & dust from marine paints, and paints containing lead or tributyl tin are hazardous wastes. Sweep them up and call 1-800-OILY-CAT for disposal information.

RECYCLING... Recycle or reuse leftover paint by using it for touch-ups, or by giving it to someone who can us it, such as a theatre group, school, city or other community organization. If you’re unable to give it away, contact 1-800-OILY-CAT for disposal information.

Concrete & Masonry...

Store bags of cement and plaster away from gutters and storm drains, and under cover, protected from rainfall, runoff and wind. REMEMBER: Never dispose of cement washout or concrete dust onto driveways, streets, gutters or storm drains.

For more information, call your city’s stormwater representative

Helpful telephone numbers and links:

Riverside County Water Agencies

City of Banning	(951) 922-3130
City of Beaumont/Cherry Valley	(951) 845-9581
City of Blythe	(760) 922-6161
City of Coachella	(760) 398-3502
City of Corona	(951) 736-2263
City of Hemet	(951) 765-3710
City of Norco	(951) 270 5607
City of Riverside Public Works	(951) 351-6140
City of San Jacinto	(951) 654-4041
Coachella Valley Water District	(760) 398-2651
Desert Water Agency (Palm Springs)	(760) 323-4971
Eastern Municipal Water District	(951) 928-3777
Elsinore Valley Municipal Water District	(951) 674 3146
Elsinore Water District	(951) 674-2168
Farm Mutual Water Company	(951) 244-4198
Idyllwild Water District	(951) 659-2143
Indio Water Authority	(760) 391-4129
Jurupa Community Services District	(951) 685-7434
Lee Lake Water	(951) 658-3241
Mission Springs Water	(760) 329-6448
Rancho California Water District	(951) 296-6900
Ripley, CSA #62	(760) 922-4951
Riverside Co. Service Area #51	(760) 227-3203
Rubidoux Community Services District	(951) 684-7580
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(951) 789-5000
Yucaipa Valley Water District	(909) 797-5117

REPORT ILLEGAL STORM DRAIN DISPOSAL

1-800-506-2555 or e-mail us at
fcnpdes@rcflood.org

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

Online resources include:

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

Stormwater Pollution

What you should know for...

Outdoor Cleaning Activities and Professional Mobile Service Providers



Storm drain pollution prevention information for:

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

Do you know where street flows actually go?

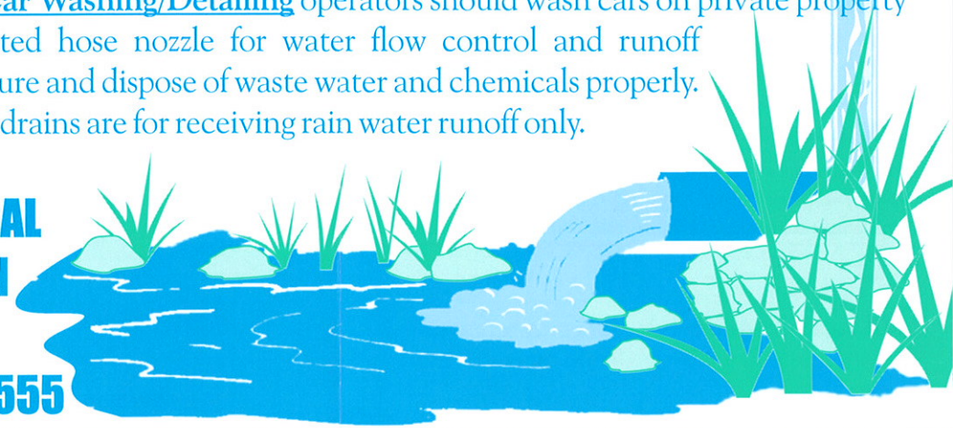
Storm drains are NOT connected to sanitary sewer systems and treatment plants!



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

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

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



Help Protect Our Waterways!

Use these guidelines for Outdoor Cleaning Activities and Wash Water Disposal

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

Best Management Practices

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

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

Simple solutions for both light and heavy duty jobs:

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

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

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

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

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

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

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

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



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

Using Cleaning Agents

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



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

Think Water Conservation

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

Screening Wash Water

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

Drain Inlet Protection & Collection of Wash Water

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

Concrete/Coring/Saw Cutting and Drilling Projects

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

For Information:

Local Sewering Agencies in Riverside County:

City of Beaumont	(909) 769-8520
Belair Homeowners Association	(909) 277-1414
City of Banning	(909) 922-3130
City of Blythe	(760) 922-6161
City of Coachella	(760) 391-5008
Coachella Valley Water District	(760) 398-2651
City of Corona	(909) 736-2259
Desert Center, CSA #51	(760) 227-3203
Eastern Municipal Water District	(909) 928-3777
Elsinore Valley MWD	(909) 674-3146
Farm Mutual Water Company	(909) 244-4198
Idyllwild Water District	(909) 659-2143
Jurupa Community Services Dist.	(909) 685-7434
Lake Hemet MWD	(909) 658-3241
Lee Lake Water District	(909) 277-1414
March Air Force Base	(909) 656-7000
Mission Springs Water District	(760) 329-6448
City of Palm Springs	(760) 323-8242
Rancho Caballero	(909) 780-9272
Rancho California Water Dist.	(909) 676-4101
Ripley, CSA #62	(760) 922-4909
Rubidoux Community Services Dist.	(909) 684-7580
City of Riverside	(909) 782-5341
Silent Valley Club, Inc	(909) 849-4501
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(909) 780-4170

Spill Response Agency:
Haz-Mat: (909) 358-5055
Hazardous Waste Disposal: (909) 358-5055
To Report Illegal Dumping or a Clogged Storm Drain: 1-800-506-2555

StormWater CleanWater
PROTECTION PROGRAM

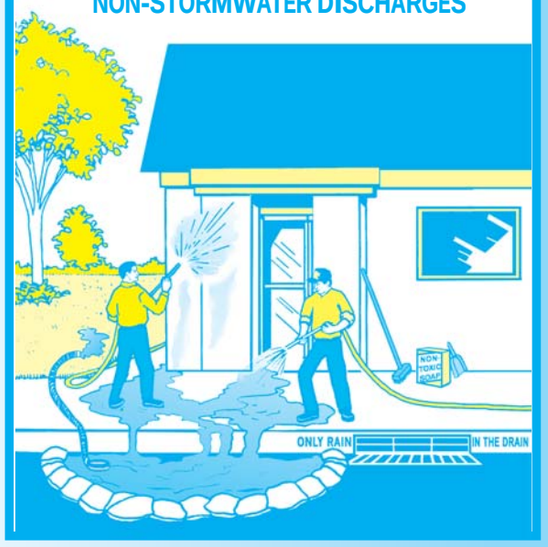
Riverside County gratefully acknowledges the Bay Area Stormwater Management Agencies Association and the Cleaning Equipment Trade Association for information provided in this brochure.

StormWater Pollution

What you should know for...

OUTDOOR CLEANING ACTIVITIES

NON-STORMWATER DISCHARGES



GUIDELINES for disposal of washwater from:

- Sidewalk, plaza or parking lot cleaning
- Vehicle washing or detailing
- Building exterior cleaning
- Waterproofing
- Equipment cleaning or degreasing

Do you know . . . where the water should go?



Riverside County has two drainage systems - sanitary sewers and storm drains. The storm drain system is designed to prevent flooding by carrying excess rainwater away from streets. . . it's not designed to be a waste disposal system. Since the storm drain system does not provide for water treatment, it often serves the unintended function of transporting pollutants directly to our waterways.

Unlike sanitary sewers, storm drains are not connected to a treatment plant - they flow directly to our local streams, rivers and lakes.

Non-stormwater discharges such as washwater generated from outdoor cleaning projects often transport harmful pollutants into storm drains and our local waterways. Polluted runoff contaminates local waterways and poses a threat to groundwater resources.

Soaps, degreasers, automotive fluids, litter, and a host of other materials washed off buildings, sidewalks, plazas, parking areas, vehicles, and equipment can all pollute our waterways.

The Cities and County of Riverside StormWater/CleanWater Protection Program

Since preventing pollution is much easier, and less costly than cleaning up "after the fact," the Cities and County of Riverside StormWater/CleanWater Protection Program informs residents and businesses of pollution prevention activities such as those described in this pamphlet.

The Cities and County of Riverside have adopted ordinances for stormwater management and discharge control. In accordance with state and federal law, these local stormwater ordinances **prohibit** the discharge of wastes into the storm drain system or local surface waters. This includes non-stormwater discharges containing oil, grease, detergents, degreasers, trash, or other waste materials.



PLEASE NOTE: The discharge of pollutants into the street, gutters, storm drain system, or waterways - without a Regional Water Quality Control Board permit or waiver - is ***strictly prohibited*** by local ordinances and state and federal law.

Help Protect Our Waterways!

Use These Guidelines For Outdoor Cleaning Activities and Washwater Disposal

DO . . . Dispose of **small amounts** of **washwater from cleaning building exteriors, sidewalks, or plazas** onto landscaped or unpaved surfaces provided you have the owner's permission and the discharge will not cause flooding or nuisance problems, or flow into a storm drain.

DO NOT . . . Discharge **large amounts** of these types of washwater onto landscaped areas or soil where water may run to a street or storm drain. Wastewater from exterior cleaning may be pumped to a sewer line with specific permission from the local sewering agency.

DO . . . Check with your local sewering agency's policies and requirements concerning waste water disposal. **Water from many outdoor cleaning activities** may be acceptable for disposal to the sewer system. See the list on the back of this flyer for phone numbers of the sewering agencies in your area.

DO NOT . . . Pour **hazardous wastes** or toxic materials into the storm drain or sewer system . . . properly dispose of it instead. When in doubt, contact the local sewering agency! The agency will tell you what types of liquid wastes can be accepted.

DO . . . Understand that **water (without soap) used to remove dust from clean vehicles** may be discharged to a street or storm drain. **Washwater from sidewalk, plaza, and building surface cleaning** may go into a street or storm drain if ALL of the following conditions are met:

1) The surface being washed is free of residual oil stains, debris and similar pollutants by using dry cleanup methods (sweeping, and cleaning any oil or chemical spills with rags or other absorbent materials before using water).
2) Washing is done with water only - no soap or other cleaning materials.
3) You have not used the water to remove paint from surfaces during cleaning.

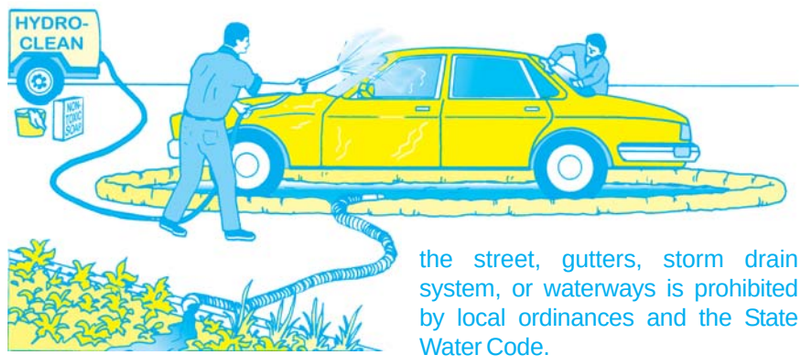
DO NOT . . . Dispose of water containing **soap or any other type of cleaning agent** into a storm drain or water body. This is a direct violation of state and/or local regulations. Because **wastewater from cleaning parking areas or roadways** normally contains metallic brake pad dust, oil and other automotive fluids, it should never be discharged to a street, gutter, or storm drain.

DO . . . Understand that **mobile auto detailers** should divert washwater to landscaped or dirt areas. Note: Be aware that soapy washwater may adversely affect landscaping; consult with the property owner. Residual washwater may remain on paved surfaces to evaporate; sweep up any remaining residue. If there is sufficient water volume to reach the storm drain, collect the runoff and obtain permission to pump it into the sanitary sewer. Follow local sewering agency's requirements for disposal.

DO NOT . . . Dispose of left over cleaning agents into the gutter, storm drain or sanitary sewer.

Regarding Cleaning Agents:

If you must use soap, use biodegradable/phosphate free cleaners. Avoid use of petroleum based cleaning products. Although the use of nontoxic cleaning products is strongly encouraged, ***do*** understand that these products can still degrade water quality and, therefore, the discharge of these products into



the street, gutters, storm drain system, or waterways is prohibited by local ordinances and the State Water Code.

Note: When cleaning surfaces with a high pressure washer or steam cleaning methods, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning, as compared to the use of a low pressure hose, can remove additional materials that can contaminate local waterways.

Other Tips to Help Protect Our Water . . .

Screening Wash Water

A thorough dry cleanup before washing (without soap) surfaces such as building exteriors and decks without loose paint, sidewalks, or plaza areas, *should be sufficient to protect storm drains.* **However**, if any debris (solids) could enter storm drains or remain in the gutter or street after cleaning, washwater should first pass through a "20 mesh" or finer screen to catch the solid material, which should then be disposed of in the trash.

Drain Inlet Protection/ Containing & Collecting Wash Water

- Sand bags can be used to create a barrier around storm drain inlets.
- Plugs or rubber mats can be used to temporarily seal storm drain openings.
- You can also use vacuum booms, containment pads, or temporary berms to keep wash water away from the street, gutter, or storm drain.

Equipment and Supplies

Special materials such as absorbents, storm drain plugs and seals, small sump pumps, and vacuum booms are available from many vendors. For more information check catalogs such as New Pig (800-468-4647), Lab Safety Supply (800-356-0783), C&H (800-558-9966), and W.W. Grainger (800-994-9174); or call the Cleaning Equipment Trade Association (800-441-0111) or the Power Washers of North America (800-393-PWNA).



PAINTING

Paints, solvents, adhesives, and toxic chemicals from painting operations often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

General Business Practices...

Keep all paint products and wastes away from the street, gutter, and storm drains. Reuse paint thinner by setting used thinner aside in a closed, labeled jar to settle out paint particles, and then pouring off the clear liquid for future use. Wrap dried paint residue in newspaper and dispose of it in the trash.

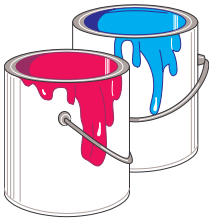
Water-Based Paints...

Purchase water-based paints whenever possible. Look for products labeled “latex” or “clean up with water.”

Recycle or Reuse Paints...

Recycle/reuse leftover paint by using it for touch-ups, or by giving it to someone who can use it, such as a theatre group, school, city or other community organization. If you’re unable to give it away, contact 386-8401 for information on hazardous waste pick-up.

Paint Cleanup...



Avoid cleaning brushes and rinsing paint containers in a street, gutter, or storm drain. For water-based paints, “brush out” as much paint as possible and and rinse in the sink. For oil-based paints, “brush out” as much paint as possible, clean with thinner, and then filter and reuse thinner or solvent.

Paint Removal...

Chemical paint stripping residue, chips & dust from marine paints, and paints containing lead or tributyl tin are hazardous wastes. For disposal information, call 386-8401. Also, when stripping or cleaning building exteriors with high-pressure water, block storm drains and divert the washwater onto a designated dirt area. Check with your local wastewater treatment authority to find out if you can collect building cleaning water and discharge it to the sewer.



For more information, call your city’s stormwater representative

Helpful telephone numbers and links:

Riverside County Water Agencies:

City of Banning	(951) 922-3130
City of Beaumont	(951) 769-8520
City of Blythe	(760) 922-6161
City of Coachella	(760) 398-3502
Coachella Valley Water District	(760) 398-2651
City of Corona	(951) 736-2259
Desert Center, CSA #51	(760) 227-3203
Eastern Municipal Water District	(951) 928-3777
Elsinore Valley MWD	(951) 674-3146
Farm Mutual Water Company	(951) 244-4198
City of Hemet	(951) 765-3712
Idyllwild Water District	(951) 659-2143
Jurupa Community Services District	(951) 360-8795
Lake Hemet MWD	(951) 658-3241
Lee Lake Water District	(951) 277-1414
March Air Force Base	(951) 656-7000
Mission Springs Water District	(760) 329-6448
City of Palm Springs	(760) 323-8253
Rancho Caballero	(951) 780-9272
Rancho California Water District	(951) 296-6900
Ripley, CSA #62	(760) 922-4951
City of Riverside	(951) 351-6170
Rubidoux Community Services District	(951) 684-7580
Silent Valley Club, Inc	(951) 849-4501
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(951) 789-5000
Yucaipa Valley Water District	(909) 797-5117

CALL 1-800-506-2555 to:

- Report clogged storm drains or illegal storm drain disposal from residential, industrial, construction and commercial sites into public streets, storm drains and/or water bodies.
- Find out about our various storm drain pollution prevention materials.
- Locate the dates and times of Household Hazardous Waste (HHW) Collection Event.
- Request adult, neighborhood, or classroom presentations.
- Locate other County environmental services.
- Receive grasscycling information and composting workshop information.

Or visit our (Riverside County Flood Control District website at:
www.floodcontrol.co.riverside.ca.us

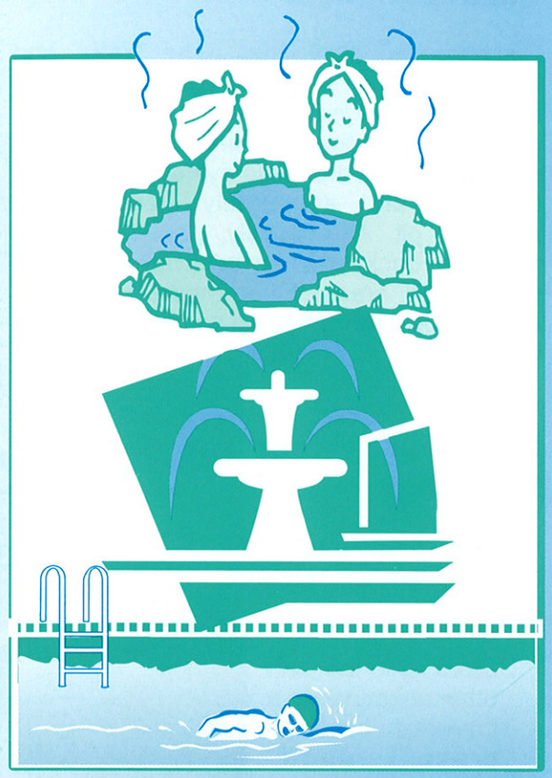
Other links to additional storm drain pollution information:

- County of Riverside Environmental Health:
  www.rivcoeh.org
- California State Water Resource Conservation Board:
  www.swrcb.ca.gov/stormwtr/links.html
- California Water Quality Task Force:
  www.cabmphandbooks.com/
- United State Environmental Protection Agency (EPA):
  www.epa.gov/opptintr/p2home/programs/busprc.htm
  (compliance assistance information)

Riverside County Only Rain in the Storm Drain Pollution Protection Program gratefully acknowledges the Bay Area Stormwater Management Agencies Association and the Cleaning Equipment Trade Association for information provided in this brochure.

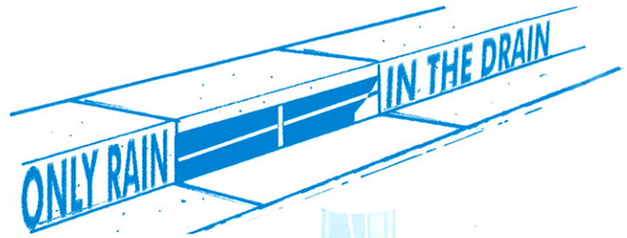
StormWater Pollution

What you should know for...



Swimming Pool, Jacuzzi and Fountain Maintenance

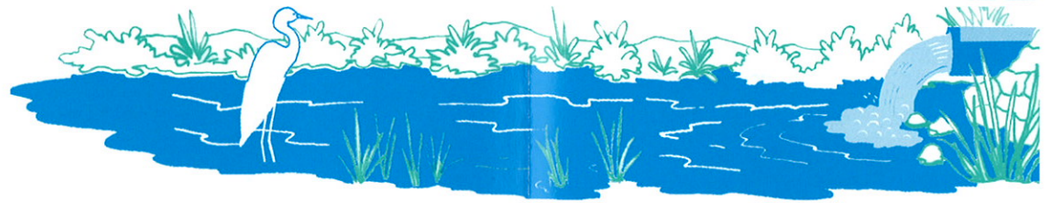
Do you know . . . where the water actually goes?



Storm Drains are not connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry rain water away from developed areas to prevent flooding. Untreated storm water and the pollutants it carries flow directly into rivers, lakes, and streams. Wastewater from residential swimming pools, jacuzzis, fishponds, and fountains often contain chemicals used for sanitizing or cleansing purposes. Toxic chemicals (such as chlorine or copper-based algaecides) can damage the environment when wastewater is allowed to flow into our local rivers, lakes, and streams by way of the storm drain system. Each of us can do our part to help clean our water, and that adds up to a pollution solution.

The Cities and County of Riverside have adopted ordinances for storm drain pollution management to maintain discharge control and prevent illegal storm drain discharge. In accordance with state and federal law, these local storm water ordinances prohibit the discharge of pollutants into the storm drain system or local surface waters. The Only Rain in the Storm Drain Pollution Program informs residents and businesses of storm drain pollution prevention activities such as those described in this brochure.



PLEASE NOTE: The discharge of pollutants into the street, gutters, storm drain system, or waterways – without a Regional Water Quality Control board permit or waiver – is strictly prohibited by local ordinances and state and federal law.

Do Your Part to Protect Our Waterways!

Use These Guidelines For Proper Draining of Your Swimming Pool, Jacuzzi and Fountain Water

Discharge Regulations



Requirements for pool draining may differ from city to city. Check with your water agency to see if disposal to the sanitary sewer line is allowed for pool discharges (see reverse side for Riverside County water purveyors).

If sewer discharge is allowed, a hose can be run from your swimming pool pump to the washing machine drain or a sink or bathtub. If sewer discharge is not allowed, or if your house is served by a septic tank, review the options presented below.

Discharge Options

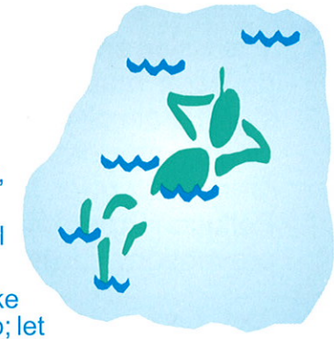
If your local sewer agency will not accept pool water into their system, or if you are on a septic tank system, follow these guidelines:

1. Reduce or eliminate solids (e.g., debris, leaves or dirt) in the pool water.
2. Allow the chemicals in the pool water to dissipate. This could take up to seven (7) days depending on the time of year. Create a co-op; let your neighbor share your pool while theirs is being prepared for draining, then use their pool while yours is being drained. Chlorinated water should not be discharged into the storm drain or surface waters. This includes large pools such as community swimming pools or spas.
3. When the pool water is free of all chemicals (verify by a home pool water test kit) drain pool water to landscaped areas, lawns, yards, or any areas that will absorb the water.
4. You may have to drain the pool water over a period of a few days to allow the landscape areas to absorb most of the water.
5. Control the flow of the draining pool water to prevent soil erosion. Do not allow sediment to enter the street, gutter or storm drain.
6. Avoid discharging pool water into the street and storm drain system. Water runoff that enters the street can pick up motor oil, pet waste, trash and other pollutants, eventually carrying them into the storm drain system and local surface waters.

Refinishing Pool Surfaces

If you are resurfacing your pool, or resurfacing the pool patio area, be sure to hose down mixers, tools and trailers in a dirt area where rinse water won't flow into the street, gutter or storm drain. Local storm water ordinances strictly prohibit the discharge of pollutants into the storm drain system.

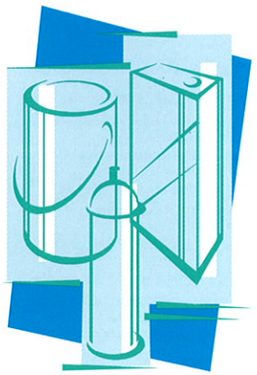
Residues from acid washing and similar activities require special handling. Never discharge low or high pH wastewater into the street, gutter or storm drain.



Cleaning Filters

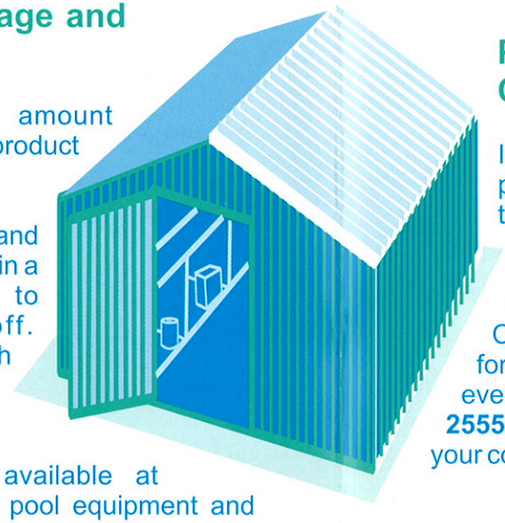
Discharge of pool filter rinse water and backflush to a stream, ditch, or storm drain is prohibited. Backflush from pool filters must be discharged to the sanitary sewer, on-site septic tank and drainfield system (if properly designed and adequately sized), or a seepage pit. Alternatively, pool filter rinse water and backwash may be diverted to dirt or landscaped areas. Filter media and other solids should be picked up and disposed of in the trash.

Algaecides



Avoid using copper-based algaecides unless absolutely necessary. Control algae with chlorine, organic polymers or other alternatives to copper-based pool chemicals. Copper is a heavy metal that can be toxic to aquatic life.

Chemical Storage and Handling



- Use only the amount indicated on product labels.
- Store chlorine and other chemicals in a covered area to prevent runoff. Keep out of reach of children and pets.
- Chlorine kits, available at retail swimming pool equipment and supply stores, should be used to monitor the chlorine and pH levels.
- Chlorine and other pool chemicals should never be allowed to flow into the gutter or the storm drain system.

Proper Disposal of Pool Chemicals

If you need to dispose of unwanted pool chemicals, first try giving them to a neighbor with a pool. If that doesn't work, bring unwanted pool chemicals to a Household Hazardous Waste (HHW) Collection Event. There's no cost for bringing HHW items to collection events - it's FREE! Call **1-800-506-2555** for a schedule of HHW events in your community.

NEVER put unused chemicals into the trash, onto the ground or down a storm drain.