MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

Desert Valley Hospital-ED Expansion

WHERE APPLICABLE, INSERT GRADING PERMIT NO., BUILDING PERMIT NO., TRACT NUMBER, LAND DEVELOPMENT FILE NO., CUP, SUP AND/OR APN (SPECIFY LOT NUMBERS IF SITE IS A PORTION OF A TRACT)

Prepared for:

Desert Valley Hospital

16850 Bear Valley Rd.

Victorville, CA, 92395

Insert Telephone

Prepared by:

IMEG Corp.

901 Via Piemonte, Suite 400

Ontario, CA, 91764

909-477-6915

Submittal Date: 12/1/2023

Revision No. and Date: _____

Revision No. and Date: _____

Revision No. and Date: _____

Revision No. and Date: _____

Revision No. and Date: _____

Final Approval Date:_____

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for HMC Group by IMEG Corp. The WQMP is intended to comply with the requirements of the San Bernardino County and the Phase II Small MS4 General Permit for the Mojave River Watershed. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the Phase II Small MS4 Permit and the intent of San Bernardino County (unincorporated areas of Phelan, Oak Hills, Spring Valley Lake and Victorville) and the incorporated cities of Hesperia and Victorville and the Town of Apple Valley. Once the undersigned transfers its interest in the property, its successors in interest and the city/county/town shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	16382, 14554, 13742	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			3091-361-04, 3091-361-05, 3091-371-05, 3091-361-07, 3091-371-01, 3091-371-06, 3091-371-07, 3091-371-10, 3091-371-04

Owner's Signature			
Owner Name: Prime Healthcare-Desert Valley Hospital			
Title	Owner's representative		
Company	Desert Valley Hopsital		
Address	16850 Bear Valley Road Victorville, CA 92395		
Email			
Telephone #			
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	16382, 14554, 13742	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			3091-361-04, 3091-361-05, 3091-371-05, 3091-361-07, 3091-371-01, 3091-371-06, 3091-371-07, 3091-371-10, 3091-371-04

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of the California State Water Resources Control Board Order No. 2013-0001-DWQ.

Engineer: John M. Thompson		PE Stamp Below
Title	Client Executive	
Company	IMEG	
Address	901 Via Piemonte, Suite 400 Ontario, CA 91764	
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Signature		
Date		

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Section I – Introduction

This WQMP template has been prepared specifically for the Phase II Small MS4 General Permit in the Mojave River Watershed. This location is within the jurisdiction of the Lahontan Regional Water Quality Control Board (LRWQCB). This document should not be confused with the WQMP template for the Santa Ana Phase I area of San Bernardino County.

WQMP preparers must refer to the MS4 Permit for the Mojave Watershed WQMP template and Technical Guidance (TGD) document found at: http://cms.sbcounty.gov/dpw/Land/NPDES.aspx to find pertinent arid region and Mojave River Watershed specific references and requirements.

Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name	Desert Valley Hospital ED Expansion				
Project Owner Contact Name:	Rakesh Seth				
Mailing Address:	16850 Bear Valley Road, Victoville CA	E-mail Address:		Telephone:	
Permit/Application Number(s):		Tract/Parcel Map Number(s):	14554		
Additional Information/ Comments:					
Description of Project:	Proposed ED building with a proposed parking lot, both east of the existing building.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.					

Section 2 Project Description

2.1 Project Information

The WQMP shall provide the information listed below. The information provided for Conceptual/ Preliminary WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

2.1.1 Project Sizing Categorization

If the Project is greater than 5,000 square feet, and not on the excluded list as found on Section 1.4 of the TGD, the Project is a Regulated Development Project.

If the Project is creating and/or replacing greater than 2,500 square feet but less than 5,000 square feet of impervious surface area, then it is considered a Site Design Only project. This criterion is applicable to all development types including detached single family homes that create and/or replace greater than 2,500 square feet of impervious area and are not part of a larger plan of development.

Form 2.1-1 Description of Proposed Project

1 Regulated Development Project Category (Select all that apply):

☒ #1 New development involving the creation of 5,000 ft² or more of impervious surface collectively over entire site	☒ #2 Significant re-development involving the addition or replacement of 5,000 ft² or more of impervious surface on an already developed site	☐ #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface	☐ #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface

☐ Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft.) *Will require source control Site Design Measures. Use the "PCMP" Template. Do not use this WQMP Template.*

2 Project Area (ft2):	367,054	**3** Number of Dwelling Units:	0	**4** SIC Code:	8011

5 Is Project going to be phased? Yes ☐ No ☒ *If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.*

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:
The Desert Valley Hopspitall will be repsonsible for long term maintenance of the WQMP stormwater facilities on site.

2.3 Potential Stormwater Pollutants

Best Management Practices (BMP) measures for pollutant generating activities and sources shall be designed consistent with recommendations from the CASQA Stormwater BMP Handbook for New Development and Redevelopment (or an equivalent manual). Pollutant generating activities must be considered when determining the overall pollutants of concern for the Project as presented in Form 2.3-1.

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-2 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☐	N ☒	Per table 3-2 in TGD
Nutrients - Phosphorous	E ☐	N ☒	Per table 3-2 in TGD
Nutrients - Nitrogen	E ☐	N ☒	Per table 3-2 in TGD
Noxious Aquatic Plants	E ☐	N ☒	Per table 3-2 in TGD
Sediment	E ☒	N ☐	Per table 3-2 in TGD
Metals	E ☒	N ☐	Per table 3-2 in TGD
Oil and Grease	E ☒	N ☐	Per table 3-2 in TGD
Trash/Debris	E ☒	N ☐	Per table 3-2 in TGD
Pesticides / Herbicides	E ☒	N ☐	Per table 3-2 in TGD
Organic Compounds	E ☒	N ☐	Per table 3-2 in TGD
Other:	E ☐	N ☒	Per table 3-2 in TGD
Other:	E ☐	N ☒	Per table 3-2 in TGD
Other:	E ☐	N ☒	Per table 3-2 in TGD

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMPs through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed Drainage Management Areas (DMAs)) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site. ***If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet. A map presenting the DMAs must be included as an appendix to the WQMP document.***

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34.471819	Longitude -117.296242	Thomas Bros Map page 63-65
1 San Bernardino County climatic region: ☒ Desert			
2 Does the site have more than one drainage area (DA): Yes☒ No☐ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*			

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA C flows to DA1 DMA A	*Ex. Bioretention overflow to vegetated bioswale with 4' bottom width, 5:1 side slopes and bed slope of 0.01. Conveys runoff for 1000' through DMA 1 to existing catch basin on SE corner of property*
DA1 DMA A to Outlet 1	Water flow North-East to inlet catch basins. Conveys runoff North once caught in catch basin which is piped to the infiltration basin.
DA1 DMA B to Outlet 1	
DA2 to Outlet 2	

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	367,054			-
2 Existing site impervious area (ft^2)	288,899			-
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	AMC 2			-
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	C			-
5 Longest flowpath length (ft)	523.5			-
6 Longest flowpath slope (ft/ft)	0.029			-
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	C-9			-
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50%* ***Attach photos of site to support rating***	Fair			-

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1 (use only as needed for additional DMA w/in DA 1)

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA E	DMA F	DMA G	DMA H
1 DMA drainage area (ft^2)				
2 Existing site impervious area (ft^2)				
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*				
4 Hydrologic soil group *County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*				
5 Longest flowpath length (ft)				
6 Longest flowpath slope (ft/ft)				
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*				
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*				

Form 3-3 Watershed Description for Drainage Area

Receiving waters Refer to SWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	N/A
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	N/A
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	N/A
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	N/A
Hydromodification Assessment	☐ Yes *Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMPs and Site Design BMP Measures

The information and data in this section are required for both Regulated Development and Site Design Only Projects. Source Control BMPs and Site Design BMP Measures are the basis of site-specific pollution management.

4.1.1 Source Control BMPs

Non-structural and structural source control BMP are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities.

The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

The identified list of source control BMPs correspond to the CASQA Stormwater BMP Handbook for New Development and Redevelopment.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Landscape Management BMPs	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	
N6	Local Water Quality Ordinances	☒	☐	
N7	Spill Contingency Plan	☒	☐	
N8	Underground Storage Tank Compliance	☒	☐	
N9	Hazardous Materials Disclosure Compliance	☒	☐	

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☒	☐	
N11	Litter/Debris Control Program	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	The project does not propose to construct any loading docks.
N14	Catch Basin Inspection Program	☒	☐	
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	The development is not a part of a Public Agency Project
N17	Comply with all other applicable NPDES permits	☒	☐	

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No general outdoor material storage proposed
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☐	☒	The improvement do not require a trash storage area
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No docks are proposed.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No matienance bays are proposed.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash is proposed.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing is proposed.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment wash is proposed.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling areas are proposed.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside landscaping is proposed.
S14	Wash water control for food preparation areas	☐	☒	No food preparation areas are proposed.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No car wash is proposed

4.1.2 Site Design BMPs

As part of the planning phase of a project, the site design practices associated with new LID requirements in the Phase II Small MS4 Permit must be considered. Site design BMP measures can result in smaller Design Capture Volume (DCV) to be managed by both LID and hydromodification control BMPs by reducing runoff generation.

As is stated in the Permit, it is necessary to evaluate site conditions such as soil type(s), existing vegetation and flow paths will influence the overall site design.

Describe site design and drainage plan including:

- A narrative of site design practices utilized or rationale for not using practices
- A narrative of how site plan incorporates preventive site design practices
- Include an attached Site Plan layout which shows how preventative site design practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Site Design Practices Checklist

Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☐ No ☒ Explanation: Proposed work makes more impervious areas.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☐ No ☒ Explanation: Proposed work makes more impervious areas.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: N/A
Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain : Yes ☐ No ☒ Explanation: N/A
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: N/A
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: Proposed parking lot will be placed at that location.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☐ No ☒ Explanation: Proposed parking lot will be placed at that location.

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☐ No ☒ Explanation: N/A
Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: N/A
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☐ No ☒ Explanation: N/A
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation: N/A
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☐ No ☒ Explanation: N/A

It is noted that, in the Phase II Small MS4 Permit, site design elements for green roofs and vegetative swales are required. Due to the local climatology in the Mojave River Watershed, proactive measures are taken to maximize the amount of drought tolerant vegetation. It is not practical in this region to have green roofs or vegetative swales. As part of site design the project proponent should utilize locally recommended vegetation types for landscaping. Typical landscaping recommendations are found in following local references:

San Bernardino County Special Districts:

Guide to High Desert Landscaping -
http://www.specialdistricts.org/Modules/ShowDocument.aspx?documentid=795

Recommended High-Desert Plants -
http://www.specialdistricts.org/modules/showdocument.aspx?documentid=553

Mojave Water Agency:

Desert Ranch: http://www.mojavewater.org/files/desertranchgardenprototype.pdf

Summertree: http://www.mojavewater.org/files/Summertree-Native-Plant-Brochure.pdf

Thornless Garden: http://www.mojavewater.org/files/thornlessgardenprototype.pdf

Mediterranean Garden: http://www.mojavewater.org/files/mediterraneangardenprototype.pdf

Lush and Efficient Garden: http://www.mojavewater.org/files/lushandefficientgardenprototype.pdf

Alliance for Water Awareness and Conservation (AWAC) outdoor tips – http://hdawac.org/save-outdoors.html

4.2 Treatment BMPs

After implementation and design of both Source Control BMPs and Site Design BMP measures, any remaining runoff from impervious DMAs must be directed to one or more on-site, treatment BMPs (LID or biotreatment) designed to infiltrate, evaportranspire, and/or bioretain the amount of runoff specified in Permit Section E.12.e (ii)(c) Numeric Sizing Criteria for Storm Water Retention and Treatment.

4.2.1 Project Specific Hydrology Characterization

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in Section E.12.e.ii.c and Section E.12.f of the Phase II Small MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection from hydromodification.

If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.

It is noted that in the Phase II Small MS4 Permit jurisdictions, the LID BMP Design Capture Volume criteria is based on the 2-year rain event. The hydromodification performance criterion is based on the 10-year rain event.

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), San Bernardino County requires use of the P_6 method (Form 4.2-1) For pre- and post-development hydrologic calculation, San Bernardino County requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi^2), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for hydromodification performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
[1] Project area DA 1 (ft^2): 367,054.43	[2] Imperviousness after applying preventative site design practices (Imp%): 68%	[3] Runoff Coefficient (Rc): _0.645 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
[4] Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.375 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
[5] Compute P_6, Mean 6-hr Precipitation (inches): 0.463 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)*		
[6] Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
[7] Compute design capture volume, DCV (ft^3): 13,235.65 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-2 Summary of Hydromodification Assessment (DA 1)

Is the change in post- and pre- condition flows captured on-site? : Yes ☒ No ☐

If "Yes", then complete Hydromodification assessment of site hydrology for 10yr storm event using Forms 4.2-3 through 4.2-5 and insert results below *(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual- Addendum 1)*

If "No," then proceed to Section 4.3 BMP Selection and Sizing

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	[1] 48147 *Form 4.2-3 Item 12*	[2] 18 *Form 4.2-4 Item 13*	[3] 0.94 *Form 4.2-5 Item 10*
Post-developed	[4] 45739 *Form 4.2-3 Item 13*	[5] 7 *Form 4.2-4 Item 14*	[6] 2.04 *Form 4.2-5 Item 14*
Difference	[7] *-2408* *Item 4 – Item 1*	[8] *-11* *Item 2 – Item 5*	[9] *1.09* *Item 6 – Item 3*
Difference (as % of pre-developed)	[10] *-0.05%* *Item 7 / Item 1*	[11] *-0.611%* *Item 8 / Item 2*	[12] *1.162%* *Item 9 / Item 3*

Form 4.2-3 Hydromodification Assessment for Runoff Volume (DA 1)

Weighted Curve Number Determination for: Pre-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type	Barren							
2a Hydrologic Soil Group (HSG)	C							
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	367,054							
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	91							
Weighted Curve Number Determination for: Post-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type	Commerci							
2b Hydrologic Soil Group (HSG)	C							
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	367,054							
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	90							

5 Pre-Developed area-weighted CN: 91	**7** Pre-developed soil storage capacity, S (in): 0.99 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 0.198 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 90	**8** Post-developed soil storage capacity, S (in): 1.11 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.22 *I_a = 0.2 * Item 8*

11 Precipitation for 10 yr, 24 hr storm (in): 2.46
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 48147
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3): 45739
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet hydromodification requirement, (ft^3): -4695
*Vhydro = (Item 13 * 0.95) – Item 12*

Form 4.2-4 Hydromodification Assessment for Time of Concentration (DA 1)

Compute time of concentration for pre and post developed conditions for each DA *(For projects using the Hydrology Manual complete the form below)*

Variables	Pre-developed DA1 *Use additional forms if there are more than 4 DMA*				Post-developed DA1 *Use additional forms if there are more than 4 DMA*			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*	629.9				246.00			
2 Change in elevation (ft)	14.98				2.29			
3 Slope (ft/ft), S_o = *Item 2 / Item 1*	0.029				0.009			
4 Land cover	Barren				Graded Land			
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*	18				7			
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*	10				65			
7 Cross-sectional area of channel (ft^2)	3				3			
8 Wetted perimeter of channel (ft)	5				5			
9 Manning's roughness of channel (n)	0.015				0.015			
10 Channel flow velocity (ft/sec) V_{fps} = *(1.49 / Item 9) * (Item 7/Item 8)^0.67 * (Item 3)^0.5*	11.9				6.8			
11 Travel time to outlet (min) T_t = *Item 6 / (Item 10 * 60)*	0.014				0.159			
12 Total time of concentration (min) T_c = *Item 5 + Item 11*	18.014				7.159			

13 Pre-developed time of concentration (min): 18 *Minimum of Item 12 pre-developed DMA*

14 Post-developed time of concentration (min): 7 *Minimum of Item 12 post-developed DMA*

15 Additional time of concentration needed to meet hydromodification requirement (min): 10.1 $T_{C\text{-}Hydro}$ = *(Item 13 * 0.95) – Item 14*

Form 4.2-5 Hydromodification Assessment for Peak Runoff (DA 1)

Compute peak runoff for pre- and post-developed conditions

Variables		Pre-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*			Post-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*		
		DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.7 LOG Form 4.2-4 Item 5 /60)*		0.360			0.366		
2 Drainage Area of each DMA (Acres) *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*		8.43			8.43		
3 Ratio of pervious area to total area *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*		0.7865			0.3203		
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*		0.3			0.3		
5 Maximum loss rate (in/hr) *F_m = Item 3 * Item 4* *Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*		0.236			0.0961		
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*		0.94			2.04		
7 Time of concentration adjustment factor for other DMA to site discharge point *Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)*	DMA A	*n/a*			*n/a*		
	DMA B	1	*n/a*		1	*n/a*	
	DMA C	1		*n/a*	1		*n/a*

8 Pre-developed Q_p at T_c for DMA A: 0.94 *Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*	**9** Pre-developed Q_p at T_c for DMA B: 0.94 *Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*	**10** Pre-developed Q_p at T_c for DMA C: 0.94 *Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]*
10 Peak runoff from pre-developed condition confluence analysis (cfs): 0.95 *Maximum of Item 8, 9, and 10 (including additional forms as needed)*		
11 Post-developed Q_p at T_c for DMA A: 2.04 *Same as Item 8 for post-developed values*	**12** Post-developed Q_p at T_c for DMA B: -0.73 *Same as Item 9 for post-developed values*	**13** Post-developed Q_p at T_c for DMA C: 2.04 *Same as Item 10 for post-developed values*
14 Peak runoff from post-developed condition confluence analysis (cfs): 2.04 *Maximum of Item 11, 12, and 13 (including additional forms as needed)*		
15 Peak runoff reduction needed to meet Hydromodification Requirement (cfs): 0.992 *$Q_{p\text{-}hydro}$ = (Item 14 * 0.95) – Item 10*		

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretention) BMPs conform to the project DCV developed to meet performance criteria specified in the Phase II Small MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the Phase II Small MS4 Permit (see Section 5.3 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design Measures (Form 4.3-2)
- Retention and Infiltration BMPs (Form 4.3-3) or
- Biotreatment BMPs (Form 4.3-4).

> Please note that the selected BMPs may also be used as dual purpose for on-site, hydromodification mitigation and management.

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is "Yes," provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Form 4.3-2 to determine the feasibility of applicable Site Design BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable Site Design BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combination of site design, retention and/or infiltration BMPs is unable to mitigate the entire DCV, then the remainder of the volume-based performance criteria that cannot be achieved with site design, retention and/or infiltration BMPs must be managed through biotreatment BMPs. If biotreatment BMPs are used, then they must be sized to provide equivalent effectiveness based on Template Section 4.3.4.

4.3.1 Exceptions to Requirements for Bioretention Facilities

Contingent on a demonstration that use of bioretention or a facility of equivalent effectiveness is infeasible, other types of biotreatment or media filters (such as tree-box-type biofilters or in-vault media filters) may be used for the following categories of Regulated Projects:

1) Projects creating or replacing an acre or less of impervious area, and located in a designated pedestrian-oriented commercial district (i.e., smart growth projects), and having at least 85% of the entire project site covered by permanent structures;

2) Facilities receiving runoff solely from existing (pre-project) impervious areas; and

3) Historic sites, structures or landscapes that cannot alter their original configuration in order to maintain their historic integrity.

Form 4.3-1 Infiltration BMP Feasibility (DA 1)
Feasibility Criterion – Complete evaluation for each DA on the Project Site
[1] Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒ *Refer to Section 5.3.2.1 of the TGD for WQMP*
If Yes, Provide basis: (attach)
[2] Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒ (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert): • The location is less than 50 feet away from slopes steeper than 15 percent • The location is less than ten feet from building foundations or an alternative setback. • A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.
If Yes, Provide basis: (attach)
[3] Would infiltration of runoff on a Project site violate downstream water rights? Yes ☐ No ☒
If Yes, Provide basis: (attach)
[4] Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes ☐ No ☒
If Yes, Provide basis: (attach)
[5] Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes ☐ No ☒
If Yes, Provide basis: (attach)
[6] Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes ☐ No ☒ *See Section 3.5 of the TGD for WQMP and WAP*
If Yes, Provide basis: (attach)
[7] Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒ *If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Selection and Evaluation of Biotreatment BMP.* *If no, then proceed to Item 8 below.* [8] Any answer from Item 4 through Item 6 is "Yes": Yes ☐ No ☒ *If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Site Design BMP.* *If no, then proceed to Item 9, below.* [9] All answers to Item 1 through Item 6 are "No": *Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP.* *Proceed to Form 4.3-2, Site Design BMPs.*

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design Measures reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design Measures shall be provided except where they are mutually exclusive

with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design BMPs (DA 1)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3):	$V_{retention}$ *=Sum of Item 4 for all BMPs*		
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft) (min. 0.5 ft.)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3):	$V_{retention}$ *=Sum of Item 12 for all BMPs*		

Form 4.3-2 Site Design BMPs (DA 1)

Form 4.3-2 cont. Site Design BMPs (DA 1)

14 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 14-18. If no, proceed to Item 19*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Number of Street Trees			
16 Average canopy cover over impervious area (ft^2)			
17 Runoff volume retention from street trees (ft^3) *$V_{retention}$ = Item 15 * Item 16 * (0.05/12) assume runoff retention of 0.05 inches*			
18 Runoff volume retention from street tree BMPs (ft^3): *$V_{retention}$ = Sum of Item 17 for all BMPs*			
19 Total Retention Volume from Site Design BMPs: *Sum of Items 5, 13 and 18*			

4.3.3 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix C of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3.

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5 of the TGD for WQMP)

If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

4.3.3.1 Allowed Variations for Special Site Conditions

The bioretention system design parameters of this Section may be adjusted for the following special site conditions:

1) Facilities located within 10 feet of structures or other potential geotechnical hazards established by the geotechnical expert for the project may incorporate an impervious cutoff wall between the bioretention facility and the structure or other geotechnical hazard.

2) Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities located where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner and may locate the underdrain discharge at the bottom of the subsurface drainage/storage layer (this configuration is commonly known as a “flow-through planter”).

3) Facilities located in areas of high groundwater, highly infiltrative soils or where connection of underdrain to a surface drain or to a subsurface storm drain are infeasible, may omit the underdrain.

4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites may be required to provide adequate pretreatment to address pollutants of concern unless these high-risk areas are isolated from storm water runoff or bioretention areas with no chance of spill migration.

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Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 1)

1 Remaining LID DCV not met by site design BMP (ft^3): 13235.65 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 DMA 1 BMP Type Basin	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods*	16.8		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	5.6		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	1		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	1.5		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	10,016.42		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	N/A		
10 Amended soil porosity	N/A		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	N/A		
12 Gravel porosity	N/A		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	23,707.81		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	N/A		

16 Total Retention Volume from LID Infiltration BMPs: 23,707.81 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 179% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-4 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV. Biotreatment computations are included as follows:

- Use Form 4.3-5 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-6 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-7 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-4 Selection and Evaluation of Biotreatment BMP (DA 1)

1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): c *Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-5 and 4.3-6 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-7 to compute treated flow*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-5 Item 15 + Form 4.3-6 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-5 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains

Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*			
2 Amended soil infiltration rate *Typical ~ 5.0*			
3 Amended soil infiltration safety factor *Typical ~ 2.0*			
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*			
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*			
8 Amended soil surface area (ft^2)			
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity, *n*			
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
12 Gravel porosity, *n*			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Biotreated Volume (ft^3) $V_{biotreated}$ *= Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: *Sum of Item 14 for all volume-based BMPs included in this form*			

Form 4.3-6 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type *Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (E.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.*	DA DMA BMP Type		DA DMA BMP Type *(Use additional forms for more BMPs)*	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft^2) A_{bottom} = *Item 2 * Item 3*				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft^2) $A_{surface}$ =*(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))*				
8 Storage volume (ft^3) *For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details* V =*Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]*				
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*				
10 Outflow rate (cfs) Q_{BMP} = *(Item* $8_{forebay}$ *+ Item* 8_{basin}*) / (Item 9 * 3600)*				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft^3) $V_{biotreated}$ = *(Item* $8_{forebay}$ *+ Item* 8_{basin}*) +(Item 10 * Item 11 * 3600)*				
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-7 Flow Based Biotreatment (DA 1)

Biotreatment BMP Type *Vegetated swale, vegetated filter strip, or other comparable proprietary BMP*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5*			
2 Flow depth for water quality treatment (ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
3 Bed slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
4 Manning's roughness coefficient			
5 Bottom width (ft) b_w *= (Form 4.3-5 Item 6 * Item 4) / (1.49 * Item 2^1.67 * Item 3^0.5)*			
6 Side Slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Cross sectional area (ft^2) *A = (Item 5 * Item 2) + (Item 6 * Item 2^2)*			
8 Water quality flow velocity (ft/sec) *V = Form 4.3-5 Item 6 / Item 7*			
9 Hydraulic residence time (min) *Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Length of flow based BMP (ft) *L = Item 8 * Item 9 * 60*			
11 Water surface area at water quality flow depth (ft^2) SA_{top} *= (Item 5 + (2 * Item 2 * Item 6)) * Item 10*			

4.3.5 Conformance Summary

Complete Form 4.3-8 to demonstrate how on-site LID DCV is met with proposed site design, infiltration, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1 Total LID DCV for the Project DA-1 (ft^3): *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design BMP (ft^3): *Copy Item18 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): *Copy Item 16 in Form 4.3-3*

4 On-site biotreatment with volume based biotreatment BMP (ft^3): *Copy Item 3 in Form 4.3-4*

5 Flow capacity provided by flow based biotreatment BMP (cfs): *Copy Item 6 in Form 4.3-4*

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☐ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

4.3.6 Hydromodification Control BMP

Use Form 4.3-9 to compute the remaining runoff volume retention, after Site Design BMPs are implemented, needed to address hydromodification, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential hydromodification. Describe the proposed hydromodification treatment control BMP. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-9 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for hydromodification performance criteria (ft^3): *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design and infiltration, BMP (ft^3): *Sum of Form 4.3-8 Items 2, 3, and 4. Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving hydromodification volume reduction*
3 Remaining volume for hydromodification volume capture (ft^3): *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site BMPs (ft^3):

5 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☐

If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP ☐
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐

6 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☐

If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs ☐

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance.

Alternative Designs — Facilities, or a combination of facilities, of a different design than in Permit Section E.12.e.(ii)(f) may be permitted if all of the following measures of equivalent effectiveness are demonstrated:

1) Equal or greater amount of runoff infiltrated or evapotranspired;

2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment;

3) Equal or greater protection against shock loadings and spills;

4) Equal or greater accessibility and ease of inspection and maintenance.

The Project Proponent will need to obtain written approval for an alternative design from the Lahontan Regional Water Board Executive Officer (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMPs included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance (refer to Section 8, Post Construction BMP Requirements, in the TGD for WQMP). Fully complete Form 5-1 summarizing all BMP included in the WQMP. Attach additional forms as needed. The WQMP shall also include a detailed Operation and Maintenance Plan for all BMP and a Maintenance Agreement. The Maintenance Agreement must also be attached to the WQMP.

Note that at time of Project construction completion, the Maintenance Agreement must be completed, signed, notarized and submitted to the County Stormwater Department

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
N1-Education for Property Owners, Tenants, and Occupants	Owner	Owner will provide BMP educational information materials to all employees and occupants.	As needed
N2-Activity Restrictions	Owner	Activity restriction signs to prevent pollution to stormater bmp.	As needed
N3-Landscape Management	Owner	Install irrigation timed system to avoid overwatering and repair as needed.	As needed
N4-BMP Maitenance	Owner	Inspect, clean, repair and maintain BMP as described in operations and maintenance guide.	Monthly

N11- Litter Control	Owner	Inspect and clean site for trash and debris.	Weekly
N12- Employee Training	Owner	Education materials on general housekeeping practices shall be provided to all employees to ensure protection of storm water quality.	Yearly
N15- Vacuum sweep private streets and parking lots	Owner	Parking lots shall be swept and vacuumed regularly.	Weekly

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

6.2 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3 Post Construction

Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

- BMP Educational Materials
- Activity Restriction – C,C&R's & Lease Agreements

Appendix A
Existing and Proposed Site Maps



VICINITY MAP

NOT TO SCALE

IMEG
901 VIA PIEMONTE
SUITE 400
ONTARIO, CA 91764
PH: 909.477.6915
www.imegcorp.com

DESERT VALLEY HOSPITAL

16850 BEAR VALLEY ROAD VICTORVILLE, CA

VICINITY MAP

EXHIBIT

-

11/29/23 \\FILES\ACTIVE\PROJECTS\2022\22006870.00\DESIGN\CIVIL\C3D\EXHIBIT\CONCEPT\WQMP EXHIBIT\VICINITY MAP.DWG

LEGEND

- ASPHALT PAVEMENT
- UNDEVELOPED AREA
- WATERSHED BOUNDARY
- SUBDRAINAGE AREA
- PROPERTY LINE
- STORM DRAIN LINE
- LONGEST PATH
- FLOW DIRECTION

DMA 1 / 1.00 AC — DMA NUMBER / AREA (ACRES)

DMA SUMMARY TABLE

	UNDEVELOPED AREA (ACRES)	PAVEMENT AREA (ACRES)	TOTAL (ACRES)	PERCENT IMPERVIOUS (%)
DMA 1	6.63 AC	1.8 AC	8.43	21.35%

DMA 1
8.43 AC

3037.01 ELEV. 1

3022.03 ELEV. 2

L=523.5

BEAR VALLEY ROAD

BEAR VALLEY ROAD

FIRST AVENUE

NITE AVE

30 15 0 30 60
SCALE: 1" = 30'

REVISIONS

No.	DESCRIPTION	DATE

IMEG
PH: 602.371.1333
www.imegcorp.com
4300 N. MILLER ROAD
SUITE 122
SCOTTSDALE, ARIZONA 85251

DESERT VALLEY HOSPITAL
16850 BEAR VALLEY ROAD VICTORVILLE, CA 92396

EXISTING CONDITION WQMP EXHIBIT

IMEG Project No: 22006870
File Name: 6870 WQMP SITE MAP EXISTING.dwg
© COPYRIGHT 2023
ALL RIGHTS RESERVED
Field Book No:
Drawn By: AF
Checked By: KM
Date: ----

EXH

Sheet 1 of 2

Wednesday, November 29, 2023 10:28:30 AM
V:\FILES ACTIVE\PROJECTS\2022\22006870.00\DESIGN CIVIL\C3D\EXHIBIT\CONCEPT\WQMP EXHIBIT\6870 WQMP SITE MAP EXISTING.DWG

BMP#1 INFILTRATION BASIN
BOTTOM=3017.5'
AREA (SF)=10,016.42

LEGEND

- ROOF
- ASPHALT PAVEMENT
- UNDEVELOPED AREA
- WATERSHED BOUNDARY
- SUBDRAINAGE AREA
- PROPERTY LINE
- SD — STORM DRAIN LINE
- LONGEST PATH
- FLOW DIRECTION
- DMA 1 / 1.00 AC — DMA NUMBER / AREA (ACRES)

DMA SUMMARY TABLE

	UNDEVELOPED AREA (ACRES)	ROOF AREA (ACRES)	PAVEMENT AREA (ACRES)	TOTAL (ACRES)	PERCENT IMPERVIOUS (%)
DMA 1	1.64 AC	1.06 AC	5.73 AC	8.43 AC	67.97%

BMP SUMMARY TABLE

	DCV (VOLUME REQUIRED)	BASIN CAPACITY (VOLUME PROVIDED)
DMA1	13,235.65 CF	23,707.8 CF

DMA 1
8.43 AC

10,000 ft²

2 3030.47 ELEV.

1 3032.76 ELEV.

L=246.0'

BEAR VALLEY ROAD

1ST AVENUE

SCALE: 1" = 30'

REVISIONS

No.	DESCRIPTION	DATE

IMEG
PH: 602.371.1333
www.imegcorp.com
4300 N. MILLER ROAD
SUITE 122
SCOTTSDALE, ARIZONA 85251

DESERT VALLEY HOSPITAL
16850 BEAR VALLEY ROAD VICTORVILLE, CA 92396

PROPOSED CONDITION WQMP EXHIBIT

IMEG Project No: 22006870
File Name: 6870 WQMP SITE MAP PROPOSED.dwg
© COPYRIGHT 2023
ALL RIGHTS RESERVED
Field Book No:
Drawn By: AF
Checked By: KM
Date: ----

EXH

Sheet 2 of 2

Wednesday, November 29, 2023, 5:19:36 PM
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Appendix B
BMP Design Calculations and Supporting Details

NOAA Atlas 14, Volume 6, Version 2
Location name: Victorville, California, USA*
Latitude: 34.4717°, Longitude: -117.2977°
Elevation: 3037 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.089** (0.073-0.108)	**0.124** (0.102-0.152)	**0.172** (0.142-0.212)	**0.214** (0.174-0.264)	**0.272** (0.215-0.348)	**0.319** (0.247-0.417)	**0.369** (0.279-0.494)	**0.423** (0.310-0.582)	**0.499** (0.351-0.715)	**0.561** (0.381-0.832)
10-min	**0.127** (0.105-0.155)	**0.178** (0.147-0.217)	**0.247** (0.203-0.303)	**0.306** (0.250-0.379)	**0.390** (0.308-0.499)	**0.458** (0.354-0.598)	**0.529** (0.400-0.708)	**0.606** (0.445-0.834)	**0.715** (0.504-1.02)	**0.803** (0.547-1.19)
15-min	**0.153** (0.127-0.188)	**0.215** (0.177-0.263)	**0.299** (0.246-0.367)	**0.370** (0.302-0.458)	**0.472** (0.373-0.603)	**0.554** (0.428-0.723)	**0.640** (0.483-0.857)	**0.733** (0.538-1.01)	**0.865** (0.609-1.24)	**0.972** (0.661-1.44)
30-min	**0.214** (0.177-0.261)	**0.299** (0.247-0.366)	**0.416** (0.343-0.511)	**0.516** (0.421-0.638)	**0.657** (0.519-0.841)	**0.771** (0.596-1.01)	**0.892** (0.673-1.19)	**1.02** (0.749-1.40)	**1.20** (0.848-1.73)	**1.35** (0.921-2.01)
60-min	**0.268** (0.221-0.327)	**0.375** (0.309-0.459)	**0.522** (0.429-0.640)	**0.646** (0.527-0.799)	**0.823** (0.650-1.05)	**0.966** (0.747-1.26)	**1.12** (0.843-1.50)	**1.28** (0.939-1.76)	**1.51** (1.06-2.16)	**1.70** (1.15-2.52)
2-hr	**0.378** (0.313-0.463)	**0.509** (0.421-0.624)	**0.690** (0.568-0.847)	**0.843** (0.688-1.04)	**1.06** (0.838-1.36)	**1.24** (0.957-1.62)	**1.42** (1.07-1.90)	**1.62** (1.19-2.23)	**1.90** (1.34-2.73)	**2.13** (1.45-3.16)
3-hr	**0.462** (0.382-0.565)	**0.614** (0.507-0.752)	**0.824** (0.678-1.01)	**1.00** (0.818-1.24)	**1.26** (0.991-1.61)	**1.46** (1.13-1.91)	**1.68** (1.26-2.24)	**1.91** (1.40-2.62)	**2.23** (1.57-3.20)	**2.50** (1.70-3.70)
6-hr	**0.632** (0.522-0.773)	**0.834** (0.689-1.02)	**1.11** (0.914-1.36)	**1.35** (1.10-1.66)	**1.68** (1.33-2.15)	**1.95** (1.51-2.54)	**2.23** (1.68-2.98)	**2.53** (1.86-3.48)	**2.96** (2.08-4.24)	**3.30** (2.25-4.90)
12-hr	**0.810** (0.669-0.990)	**1.09** (0.897-1.33)	**1.46** (1.20-1.79)	**1.78** (1.45-2.20)	**2.22** (1.76-2.84)	**2.58** (1.99-3.36)	**2.95** (2.22-3.94)	**3.34** (2.45-4.60)	**3.89** (2.74-5.58)	**4.34** (2.95-6.44)
24-hr	**1.07** (0.952-1.24)	**1.47** (1.30-1.70)	**2.01** (1.78-2.32)	**2.46** (2.16-2.87)	**3.09** (2.62-3.72)	**3.59** (2.98-4.41)	**4.11** (3.33-5.17)	**4.66** (3.67-6.03)	**5.42** (4.10-7.32)	**6.04** (4.41-8.43)
2-day	**1.22** (1.08-1.40)	**1.69** (1.50-1.95)	**2.33** (2.06-2.70)	**2.87** (2.51-3.34)	**3.62** (3.07-4.36)	**4.22** (3.50-5.18)	**4.84** (3.92-6.10)	**5.50** (4.33-7.12)	**6.43** (4.86-8.68)	**7.17** (5.24-10.0)
3-day	**1.32** (1.17-1.52)	**1.84** (1.63-2.12)	**2.55** (2.25-2.94)	**3.14** (2.75-3.66)	**3.97** (3.36-4.78)	**4.63** (3.84-5.69)	**5.32** (4.31-6.70)	**6.06** (4.77-7.84)	**7.10** (5.36-9.58)	**7.93** (5.80-11.1)
4-day	**1.41** (1.25-1.62)	**1.96** (1.74-2.26)	**2.72** (2.40-3.15)	**3.36** (2.94-3.91)	**4.25** (3.60-5.11)	**4.95** (4.11-6.09)	**5.69** (4.61-7.17)	**6.48** (5.11-8.39)	**7.59** (5.74-10.2)	**8.48** (6.20-11.9)
7-day	**1.53** (1.36-1.76)	**2.12** (1.88-2.45)	**2.93** (2.58-3.38)	**3.60** (3.15-4.19)	**4.54** (3.85-5.47)	**5.29** (4.39-6.50)	**6.07** (4.92-7.64)	**6.89** (5.43-8.93)	**8.05** (6.09-10.9)	**8.98** (6.56-12.5)
10-day	**1.62** (1.44-1.87)	**2.24** (1.99-2.59)	**3.09** (2.73-3.57)	**3.79** (3.32-4.42)	**4.78** (4.05-5.75)	**5.56** (4.61-6.83)	**6.37** (5.16-8.03)	**7.23** (5.70-9.37)	**8.44** (6.38-11.4)	**9.41** (6.87-13.1)
20-day	**1.90** (1.68-2.18)	**2.63** (2.33-3.03)	**3.63** (3.20-4.19)	**4.46** (3.91-5.20)	**5.65** (4.79-6.80)	**6.59** (5.47-8.10)	**7.57** (6.13-9.54)	**8.61** (6.78-11.2)	**10.1** (7.61-13.6)	**11.2** (8.21-15.7)
30-day	**2.17** (1.92-2.50)	**3.01** (2.67-3.47)	**4.18** (3.69-4.82)	**5.16** (4.52-6.01)	**6.56** (5.56-7.90)	**7.68** (6.37-9.44)	**8.85** (7.17-11.1)	**10.1** (7.96-13.1)	**11.9** (8.96-16.0)	**13.3** (9.69-18.5)
45-day	**2.54** (2.26-2.93)	**3.53** (3.13-4.07)	**4.91** (4.34-5.67)	**6.09** (5.34-7.10)	**7.80** (6.61-9.39)	**9.18** (7.62-11.3)	**10.6** (8.62-13.4)	**12.2** (9.61-15.8)	**14.4** (10.9-19.5)	**16.2** (11.8-22.6)
60-day	**2.81** (2.49-3.24)	**3.89** (3.44-4.48)	**5.40** (4.77-6.24)	**6.72** (5.89-7.83)	**8.63** (7.32-10.4)	**10.2** (8.47-12.5)	**11.9** (9.63-15.0)	**13.7** (10.8-17.7)	**16.3** (12.3-22.0)	**18.4** (13.5-25.8)

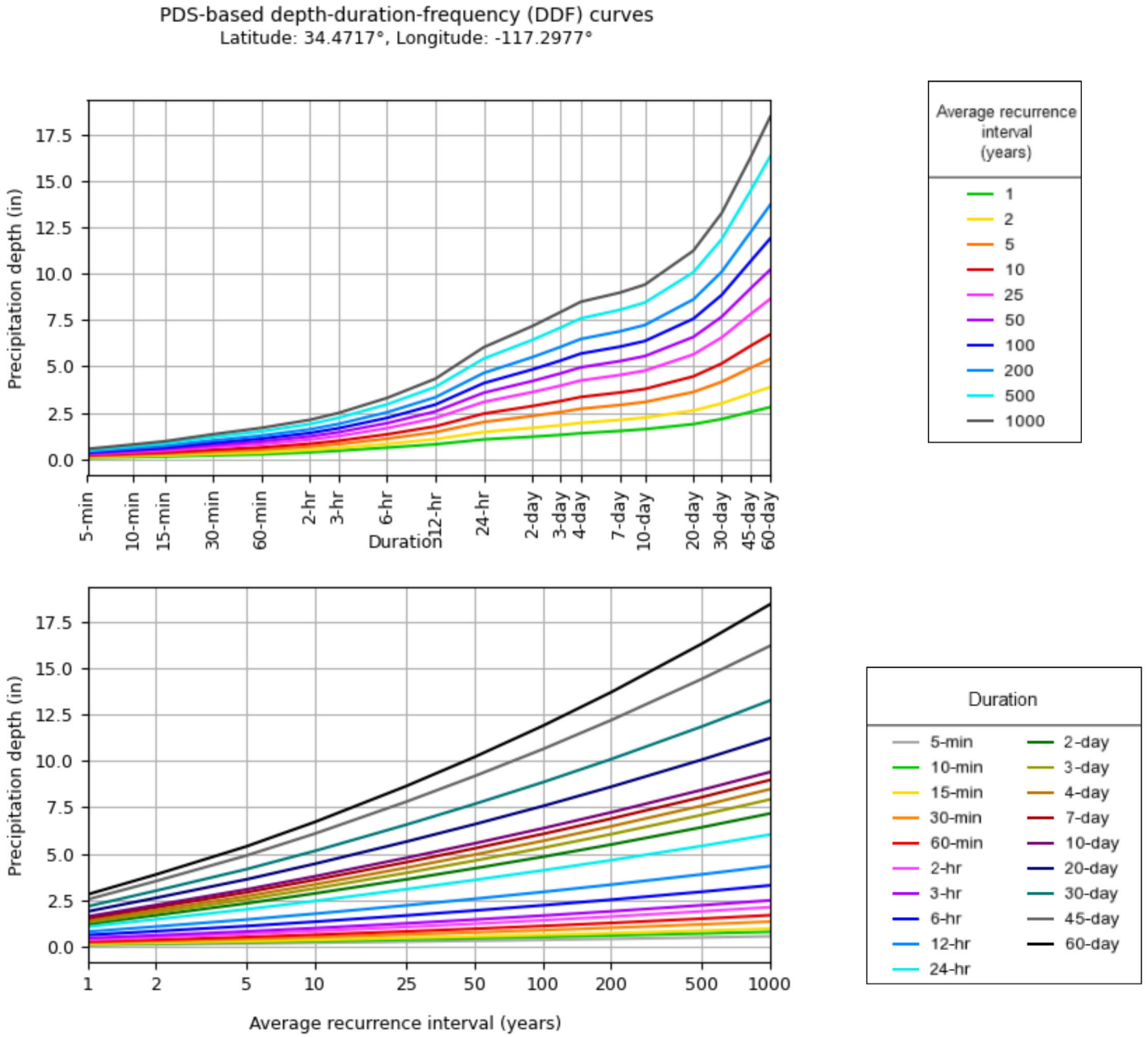
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



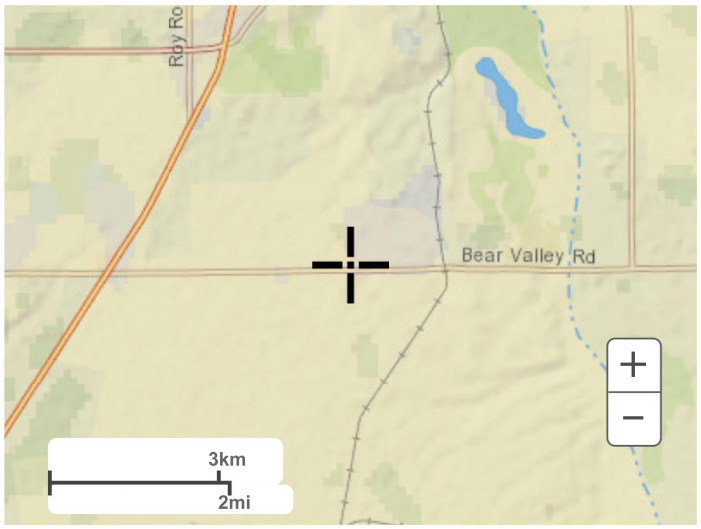
NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Wed Nov 15 22:30:37 2023

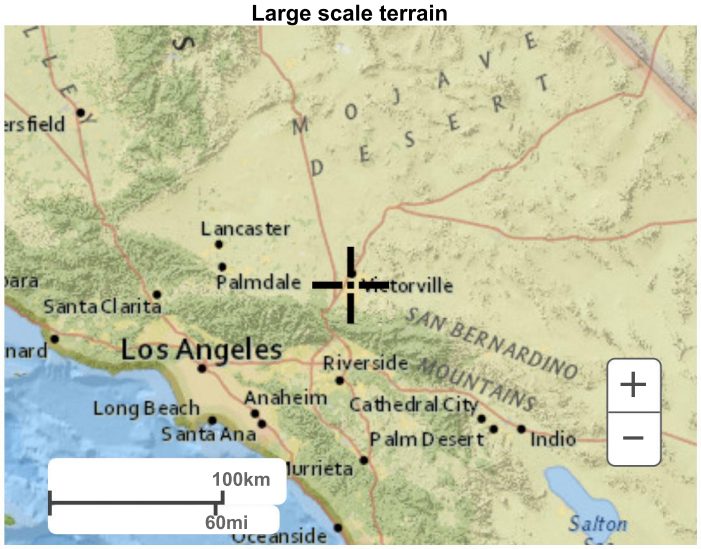
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Maps & aerials

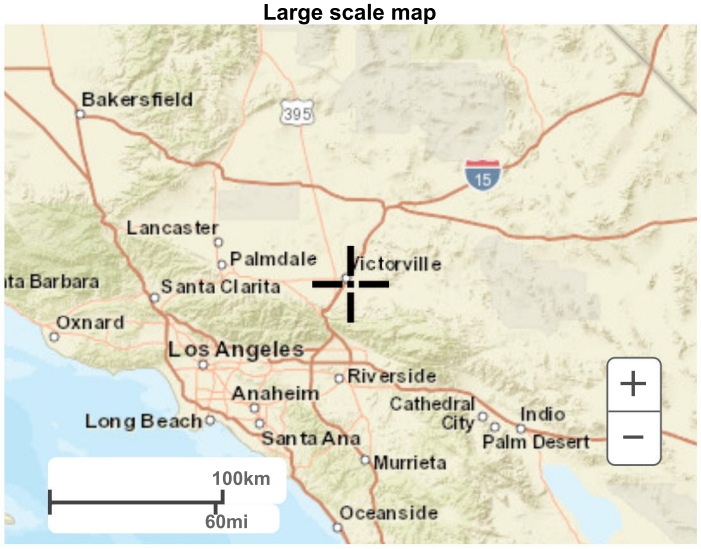
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

R1W R2W R3W

T4N T3N T2N T1N T1S

SOURCE: GEOLOGY MAP

SOURCE: 1970 SCS SURVEY

EDWARDS AIR FORCE BASE

MOJAVE DESERT

MOJAVE

GEORGE AIR FORCE BASE

MARINE CORPS SUPPLY CENTER (YERMO AREA)

MARINE CORPS LOGISTICS BASE (DAGGETT AREA)

MARINE CORPS BASE

TWENTYNINE PALMS

JOSHUA TREE NATIONAL MONUMENT

Victorville

Apple Valley

Barstow

Yermo

Daggett

Newberry Springs

Lenwood

Hinkley

Helendale

Lucerne Valley

Johnson Valley

Sidewinder Mountain

Rodman Mountains

Bullion Mountains

Cady Mountains

Ord Mountains

Rainbow Basin

Black Mountain

Rattlesnake Canyon

Mud Lake

Soda Lake

Coyote Lake

Harper Lake

Superior Valley

Upper Johnson Valley

Means Valley

Lucerne Valley

Mojave River

Mojave River Forks Reservoir

Silverwood Lake

Lake Arrowhead

Big Bear Lake

Big Bear City

Fawnskin

Running Springs

Crestline

Lake Gregory

Arrowbear Lake

Yucaipa

Redlands

Loma Linda

Highland

San Bernardino

Colton

Rialto

Fontana

Ontario

Upland

Montclair

Chino

Chino Hills

Pomona

Claremont

La Verne

San Dimas

Glendora

Azusa

Monrovia

Arcadia

Baldwin Park

Irwindale

Duarte

Sierra Madre

Pasadena

Altadena

Glendale

Burbank

Los Angeles County

Kern County

Riverside County

San Bernardino County

Orange County

Edwards AFB

Rogers Lake

Lockwood Valley

Tehachapi Mountains

Antelope Valley

Lancaster

Palmdale

Littlerock

Pearblossom

Big Pines

Wrightwood

Cajon Pass

Devil Canyon

Lytle Creek

Cucamonga Peak

Mount Baldy

Mount San Antonio

Mount Harvard

Mount Wilson

Mount Lowe

Eaton Canyon

Arroyo Seco

Big Tujunga Canyon

Tujunga

Sunland

Verdugo Mountains

San Gabriel Mountains

San Gabriel River

Santa Ana River

Mojave River

Cajon Creek

Lytle Creek

Cucamonga Creek

Chino Creek

Day Creek

Etiwanda Creek

Deer Creek

Warm Creek

Waterman Canyon

Devil Canyon

Alder Creek

Bear Creek

Grass Valley Creek

Rattlesnake Creek

Holcomb Creek

Metate Lake

Arrowhead Lake

Baldwin Lake

Green Valley Lake

Fish Lake

Silverwood Lake

Big Bear Lake

Lake Gregory

Lake Arrowhead

Arrowbear Lake

Lake Elsinore

Lake Perris

Lake Matthews

Lake Mathews

Prado Dam

Prado Flood Control Basin

Santa Ana River

Riverside County

Orange County

Los Angeles County

Kern County

San Bernardino County

Riverside Co.

Orange Co.

Los Angeles Co.

Kern Co.

San Bernardino Co.

LEGEND

SOIL GROUP BOUNDARY

A SOIL GROUP DESIGNATION

BOUNDARY OF INDICATED SOURCE

INDEX MAP

C-1 C-2 C-3 C-4 C-5 C-6 C-7 C-8

SAN BERNARDINO CO.

Scale 1:250,000

5 0 5 10 15 20 Statute Miles

5 0 5 10 15 20 25 30 Kilometers

5 0 5 10 15 Nautical Miles

CONTOUR INTERVAL 200 FEET

WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS

TRANSVERSE MERCATOR PROJECTION

BLACK NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 11

1965 MAGNETIC DECLINATION FROM TRUE NORTH VARIES FROM 15½° (266 MILS) EASTERLY FOR THE CENTER OF THE WEST EDGE TO 15° (270 MILS) EASTERLY FOR THE CENTER OF THE EAST EDGE

BASE MAP REPRODUCED FROM U.S.G.S. "SAN BERNARDINO" TOPOGRAPHIC MAP

SCALE REDUCED BY 1/2

LOCATION DIAGRAM

NEVADA

CALIFORNIA

UNITED STATES

ARIZONA

MEXICO

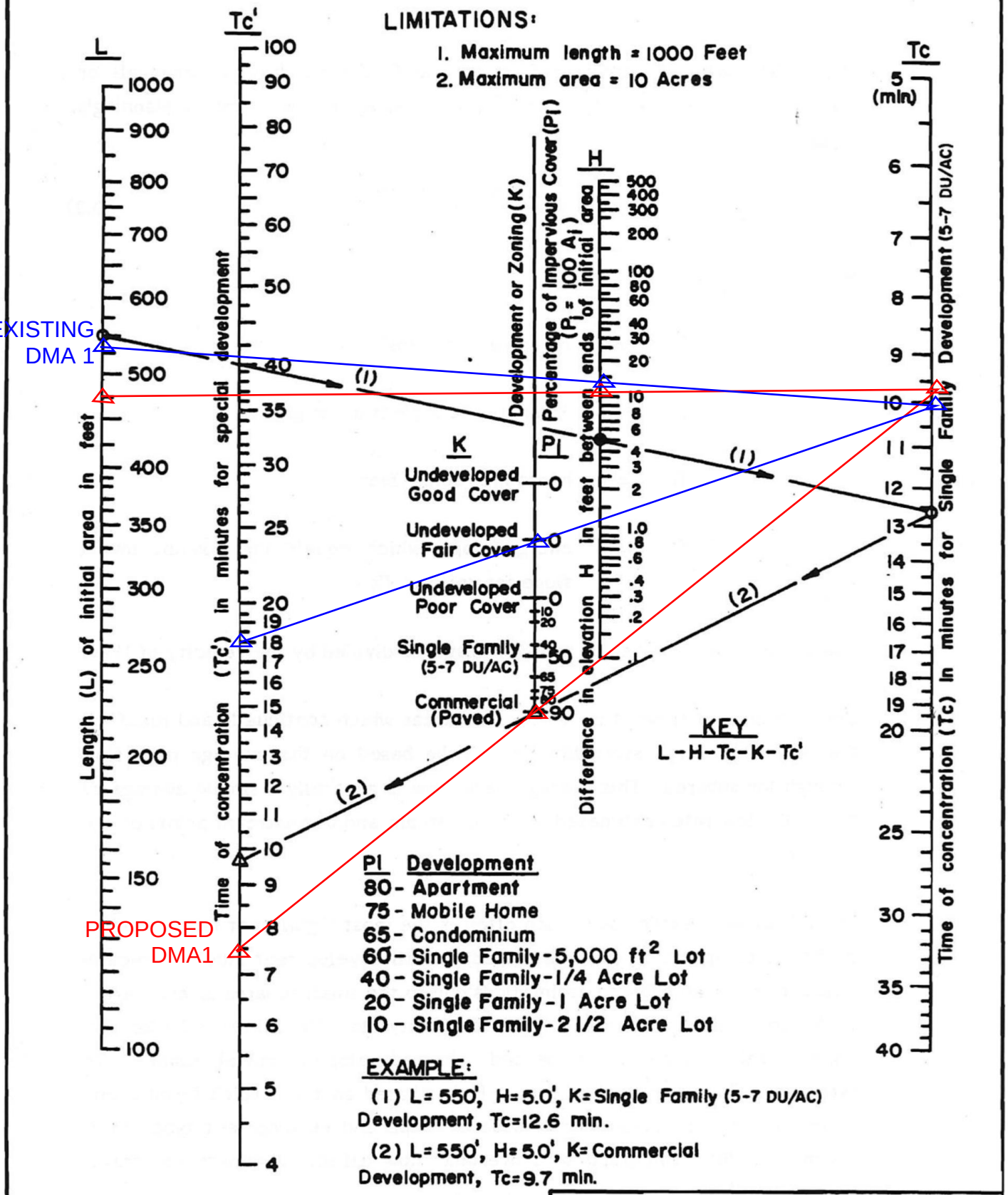
BAJA CALIFORNIA

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP FOR SOUTHCENTRAL AREA

FIGURE C-11



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

DCV CALCULATION

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume								
DA ID	Area (ft^2)	Imp %	R_c	$P_{2yr-1hr}$ (in)	C_1	P_6 (in)	C_2	DCV (ft^3)
1	367054.4	68%	0.47516	0.375	1.2371	0.463913	1.963	13235.65

Appendix C
Education Materials

SAN BERNARDINO COUNTY STORMWATER PROGRAM

WHERE WATER MEETS COMMUNITY

Regulatory Information

The Federal Water Pollution Control Act prohibits the discharge of any pollutant to navigable waters from a point source unless the discharge is authorized by a National Pollutant Discharge Elimination System (NPDES) permit. The 1987 passage of the Water Quality Act established NPDES permit requirements for discharges of storm water. The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

Industrial facilities and construction sites are regulated by the Regional Water Quality Control Board and State Water Resources Control Board, through general storm water permits. Most industrial, manufacturing or transportation businesses that store materials, products or equipment outdoors, or conduct vehicle washing or process operations outdoors are required to obtain coverage under the State Water Resources Control Board's General Industrial Activities Stormwater Permit. For more information about this permit, visit *http://www.waterboards.ca.gov/centralcoast/water_issues/programs/stormwater/industrial.shtml* or contact your local storm water coordinator.

If your business conducts construction activities, including clearing, grading, stockpiling or excavation that results in soil disturbances of at least one acre, you are subject to the State Water Resources Control Board's General Construction Activities Stormwater Permit. To find out more about this storm water permit for construction, visit *https://www.waterboards.ca.gov/centralcoast/water_issues/programs/stormwater/construction_new.shtml.*
Cities and counties are regulated through permits issued by the Regional Boards. Since 1990 operators of large storm drain systems such as San Bernardino County's have been required to:

- Develop a storm water management program designed to prevent harmful pollutants from being dumped or washed by storm water runoff, into the storm water system, then discharged into local water bodies; and
- Obtain a National Pollutant Discharge Elimination System (NPDES) permit.

The NPDES permit programs in California are administered by the State Water Resources Control Board and by nine regional boards that issue NPDES permits and enforce regulations within their respective region.

San Bernardino County lies within the jurisdiction of the Santa Ana Region. This regional board issues a permit to the San Bernardino County Permittees, which includes the County of San Bernardino, San Bernardino County Flood Control District and incorporated cities of San Bernardino County. Since the program's inception, the County of San Bernardino has served as the principal permittee.

SAN BERNARDINO COUNTY STORMWATER PROGRAM

WHERE WATER MEETS COMMUNITY

Documents & Reports:

The following documents describe the regulations and programs for water quality in San Bernardino County. You can review the latest Basin Plan. National Pollutant Discharge Elimination System (NPDES) Permit and Drainage Area Management Plan (DAMP).

- **Basin Plans:** The document for each region of the State Water Quality Board's jurisdiction, including Santa Ana, is the Water Quality Control Plan, commonly referred to as the Basin Plan. It is the foundation for the regulatory programs of each regional board. The Basin Plan documents the beneficial uses of the region's ground and surface waters, existing water quality conditions, problems, and goals, and actions by the regional board and others that are necessary to achieve and maintain water quality standards.

Water Control Plan for the Santa Ana River Basin

- **Municipal National Pollutant Discharge Elimination System (NPDES) Permits:** The permits of each region outline additional steps for a storm water management program and specify requirements to help protect the beneficial uses of the receiving waters. They require permittees to develop and implement Best Management Practices (BMPs) to control/reduce the discharge of pollutants to waters of the United States to the maximum extent practicable (MEP).

Santa Ana Regional Water Quality Control Board Municipal NPDES Permit Order No. R8-2002-0Q12

- **Report of Waste Discharge:** The Report of Waste Discharge (ROWD) describes the San Bernardino Stormwater Program, implemented by the County and cities to comply with their jointly held stormwater permit. It is the principle policy and guidance document for the NPDES Stormwater Program.

Report of Waste Discharge 2000

- **San Bernardino County Storm Water Program Annual Status Report:** The Annual Status Report is a requirement of the NPDES permit for submittal to the Regional Boards and United States Environmental Protection Agency. The report presents an analysis and assessment of permit compliance activities.

Annual Report - will be posted soon

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

STORMWATER POLLUTION PREVENTION

Best Management Practices for San Bernardino County Homeowner's Associations, Property Managers and Property Owners

Your Guide To Maintaining Water Friendly Standards In Your Community

SAN BERNARDINO COUNTY STORMWATER PROGRAM

WHERE WATER MEETS COMMUNITY

sbcountystormwater.org

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GENERAL HOA





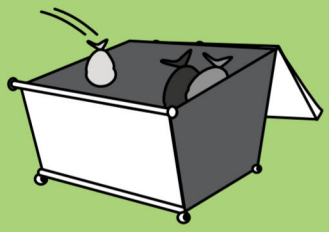


COMMERCIAL **TRASH ENCLOSURES** REQUIREMENTS

In San Bernardino County, stormwater pollution is caused by food waste, landscape waste, chemicals, and other debris that are washed into storm drains and end up in our waterways - untreated! You can be part of the solution by maintaining a water-friendly trash enclosure.

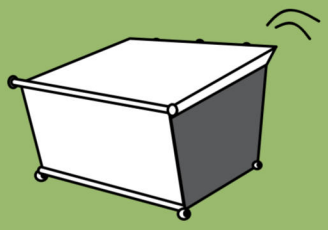
FOLLOW THESE REQUIREMENTS TO KEEP OUR WATERWAYS CLEAN

PUT TRASH INSIDE



Place trash inside the bin (preferably in sealed bags).

CLOSE THE LID



Prevent rain from entering the bin in order to avoid leakage of polluted water runoff.

KEEP TOXICS OUT



NO:

- Paint
- Grease
- Fats
- Used Oils
- Batteries
- Electronics
- Fluorescent Lights

These items should be disposed of at a local hazardous waste collection center

SWEEP FREQUENTLY

Sweep trash enclosure areas frequently, instead of hosing them down, to prevent polluted water from flowing into the streets and storm drains.

FIX LEAKS

Address trash bin leaks immediately by using dry clean-up methods and reporting to your waste hauler to receive a replacement.

CONSTRUCT ROOF

Construct a solid cover roof over the existing trash enclosure structure to prevent rainwater from coming into contact with trash and garbage. Check with your local City/County for Building Codes.

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

To report illegal dumping or toxic spills, call **(877) WASTE18**
or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

sbcountystormwater.org

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SIDEWALK + PARKING LOT CLEANING

Littering and vehicle use can leave behind pollutants on sidewalks, plazas, and other pedestrian traffic areas. Properly inspecting, cleaning, and repairing pedestrian areas and HOA-owned surfaces and structures can reduce pollutant runoff from these areas.

Maintain these areas by following the best management practices listed below.

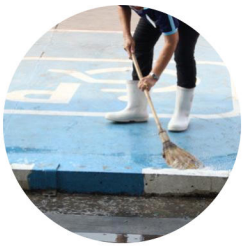


LITTER CONTROL

- Enforce anti-litter laws.
- Place trash cans in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- Ensure trash cans remain covered at all times.
- Clean out trash cans frequently to prevent leaking/spillage or overflow.

TIP: POST "NO LITTERING" SIGNS.

SIDEWALKS AND PLAZAS



- When cleaning sidewalks and plazas, use dry methods such as sweeping, vacuuming, and using backpack blowers whenever practical, rather than hosing, pressure washing, or steam cleaning.
- **DO NOT** sweep or blow material into the street or gutter.

PARKING AREAS, DRIVEWAYS, DRIVE-THRU

- Sweep or vacuum parking facilities on a regular basis.
- Sweep all parking lots at least once before the onset of the wet season.
- Use absorbents to pick up oil; then dry sweep.
- Appropriately dispose of spilled materials and absorbents.
- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, and proximity to water courses.

TIP: IF WATER MUST BE USED, BLOCK STORM DRAIN INLETS TO CONTAIN RUNOFF. WHEN DONE, DISCHARGE WASH WATER TO LANDSCAPING OR CONTAIN AND DISPOSE OF PROPERLY.

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

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sbcountystormwater.org

SURFACE CLEANING

Proper inspection, cleaning, and repair of pedestrian areas and HOA-owned surfaces and structures can reduce pollutant runoff from these areas. Discharges of wash water to the stormwater drainage system from cleaning or hosing of impervious surfaces is prohibited.

Maintain these areas by following the best management practices listed below.



WHEN CLEANING BUILDING SURFACES

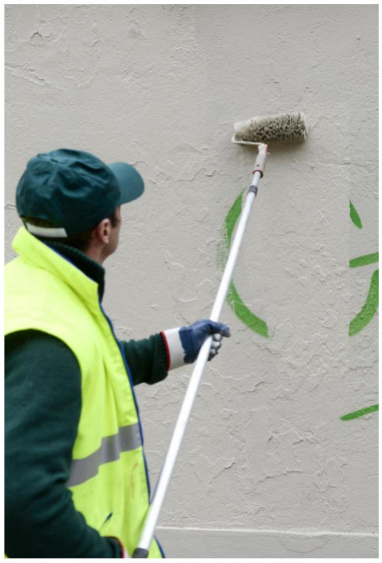
If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

BUILDING SURFACES, DECKS, ETC., WITHOUT LOOSE PAINT

- Use high-pressure water, no soap.

UNPAINTED BUILDING SURFACES, WOOD DECKS, ETC.

- If using a biodegradable or another cleaning agent to remove deposits, contain and dispose of them properly.



GRAFFITI REMOVAL

- Avoid graffiti abatement activities during rain events.
- Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterward by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.
- Take care when disposing of water since it may need to be disposed of as hazardous waste.

TIP: CONSIDER USING A WATERLESS AND NON-TOXIC CHEMICAL CLEANING METHOD FOR GRAFFITI REMOVAL (E.G. GELS OR SPRAY COMPOUNDS).

CONCRETE + SIDEWALK REPAIR

Properly inspecting and repairing pedestrian areas and HOA-owned surfaces and structures can reduce pollutant runoff.

Maintain these areas by following the best management practices listed below.

CONCRETE INSTALLATION + REPAIR

- Avoid mixing excess amounts of fresh concrete or cement mortar on-site. Only mix what is needed for the job.
- Wash concrete trucks off-site or in designated areas on-site, such that there is no discharge of concrete wash water into storm drain inlets, open ditches, streets, or other stormwater conveyance structures.
- Store dry and wet concrete materials under cover, protected from rainfall and runoff, and away from drainage areas. After the job is complete, remove temporary stockpiles such as asphalt materials and sand as soon as possible.
- Return leftover materials to the transit mixer. Dispose of small amounts of excess concrete, grout, and mortar in the trash.
- When washing concrete to remove fine particles and expose the aggregate, contain the wash water for proper disposal.
- **DO NOT** wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose of in the trash.
- Protect applications of fresh concrete from rainfall and runoff until the material has hardened.

SIDEWALK REMOVAL + REPAIR

- Schedule surface removal activities for dry weather.
- Avoid creating excess dust when breaking asphalt or concrete.



PROTECT NEARBY STORM DRAIN INLETS

- Prior to breaking up asphalt or concrete, take measures such as placing straw waddles or gravel bags around inlets. Clean afterward by sweeping up material.
- During the sawing operation, cover each storm drain inlet with filter fabric and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets.



CLEAN UP

- Designate an area for clean-up and proper disposal of excess materials.
- Remove and recycle as much of the broken pavement as possible.
- When making saw cuts in the pavement, use as little water as possible. After the liquid drains, shovel or vacuum the slurry, remove it from the site, and dispose of it properly.
- Once dry sweeping is complete, the area may be hosed down if needed.
- Discharge wash water to landscaping, pump to the sanitary sewer if permitted to do so, or contain and dispose of properly.
- **ALWAYS** dry sweep first with a street sweeper or vacuum truck to clean up tracked dirt. **DO NOT** dump vacuumed liquid in storm drains.

To report illegal dumping or toxic spills, call **(877) WASTE18** or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

sbcountystormwater.org

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

When Working Outdoors Use the 3Cs

CUANDO TRABAJE AL AIRE LIBRE UTILICE LAS 3Cs



CONTROL • CONTROL

Locate the nearest storm drain and ensure nothing can enter or be discharged into it.

Ubique el desagüe de aguas pluviales más cercano y asegúrese de que nada pueda ingresar a éste ni descargarse en él.



CONTAIN • CONTENER

Isolate your area to prevent material from potentially flowing or being blown away.

Aísle su área para evitar que el material pueda discurrirse o ser llevado por el viento.



CAPTURE • CAPTURAR

Sweep up debris and place it in the trash. Clean up spills with an absorbent material (e.g. kitty litter) or vacuum with a Wet-Vac and dispose of properly.

Recoja los restos y colóquelos en la basura. Limpie los derrames con un material absorbente (como la arena para gatos) o aspírelos con una Wet-Vac (aspiradora de humedad) y deséchelos correctamente.

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

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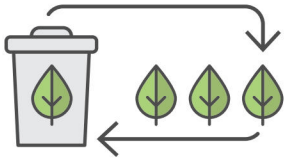
sbcountystormwater.org

DISCHARGE TO THE STORM DRAIN, ACCIDENTAL OR NOT, COULD LEAD TO ENFORCEMENT ACTIONS AND FINES

Sustainable Practices for Landscape Maintenance

Your contributions make a difference in the way you maintain your yard. Learn how to truly be a "green" thumb and prevent stormwater pollution.

Recycle Yard Waste



Yard waste, like grass and leaves, can block the storm drain or carry harmful chemicals into it.

- Recycle yard waste by placing them into your greenwaste container.
- Do not blow, sweep, rake, or hose yard waste into the street or catch basin.
- Try grasscycling by leaving clippings on the lawn when mowing.

For more information, visit www.calrecycle.ca.gov/organics/grasscycling.

Use Safe Products



Fertilizers, herbicides, and pesticides are often carried into the storm drain by sprinkler runoff.

- Use natural and non-toxic alternatives as often as possible.
- Spot-apply, rather than blanketing entire areas.

Apply chemicals directly to the area that needs treatment.

- Read the product label and use only as directed.
- Never apply before a rain.

Use Water Wisely



Conserving water minimizes the amount of urban runoff going into the street.

- Control the amount of water and direction of sprinklers.

The average lawn only needs about an inch of water a week or 10 to 20 minutes of watering.

- Periodically inspect and fix sprinklers for leaks.

Realign sprinkler heads to make sure water is distributed onto the lawn and not onto the sidewalk.

- Plant native vegetation to reduce the need of water.

HOMEOWNERS

Keep these tips in mind when hiring professional landscapers and remind them as necessary.



Leftover pesticides, fertilizers, and herbicides contaminate landfills and should be disposed of through a Household Hazardous Waste Center*.

For more information on proper disposal, call 1 (800) OILYCAT or visit tootoxictotrash.com.

**FREE for San Bernardino County residents.*
Businesses can call for cost inquiries and to schedule an appointment.

To report illegal dumping or toxic spills, call **(877) WASTE18** or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

sbcountystormwater.org

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

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POOL MAINTENANCE

When discharged to the street, gutters, or storm drains, pool chemicals and filter solids DO NOT GET TREATED before reaching the Santa Ana River.

FOLLOW THESE TIPS FOR PROPER DISPOSAL OF POOL WATER:

- ✔ **De-chlorinate** – Chlorine naturally dissipates over time and should be completely gone if the water is left standing for 3-5 days. Use a pool testing kit prior to discharge to ensure the concentration of chlorine is zero.
- **Check pH** – determine the pH of the pool water before discharging on your own or ask your pool maintenance company to check it for you. It should be between 6.5 and 8.5.
- ✔ **Free and clear** – Make certain the water is free of any discoloration, dirt or algae.
- ✔ **Use your grass** – When discharging to a grassy area, the flow should be controlled so it doesn't cause any erosion problems or enter a neighbor's property.
- ✔ **Avoid metal-based algaecides** (i.e. copper sulfate). If used, empty your pool or spa into the sewer.

Chlorine, acid cleaning chemicals and metal-based algaecides used in pools can kill beneficial organisms in the food chain and pollute our drinking water.

WHEN ACID CLEANING OR OTHER CHEMICAL CLEANING:

Neutralize the pool water to pH of 6.5 to 8.5, then discharge to the sewer.

WHEN DRAINING YOUR POOL:

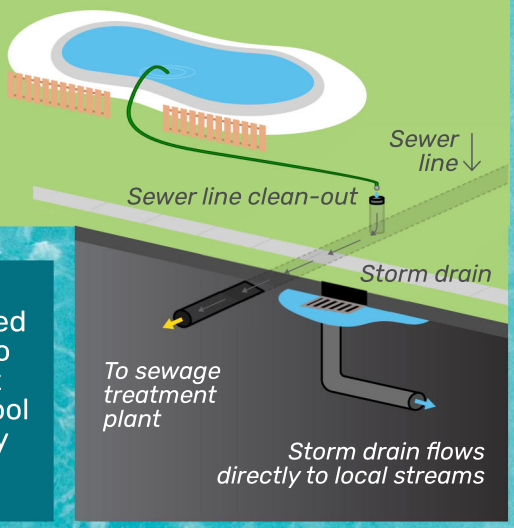
- ✔ Before draining your pool, contact your city for approval to drain your pool water into the sewer or storm drain.
- ✔ Saltwater pools must only be drained to the sewer or hauled away. Check with your pool maintenance company for draining requirements.

FOR SWIMMING POOL AND SPA FILTER BACKWASH:

- ✔ Dispose of solids into trash bag, then wash filter into a landscape area. Discharge water to the sewer, never to the storm drain.

Many pools are plumbed to discharge directly to the sanitary sewer but call your plumber or pool maintenance company if you are unsure.

What's the difference between discharging to the sewer vs storm drain?



SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

To report illegal dumping or toxic spills, call **(877) WASTE18** or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

sbcountystormwater.org

HHW RESOURCES

Here are some resources with useful information for your HOA residents. You may add these free resources to your newsletters, websites, and any other communication channels you use.



HHW Materials Insert
Ideal for newsletters



HHW Locations Insert
Ideal for newsletters



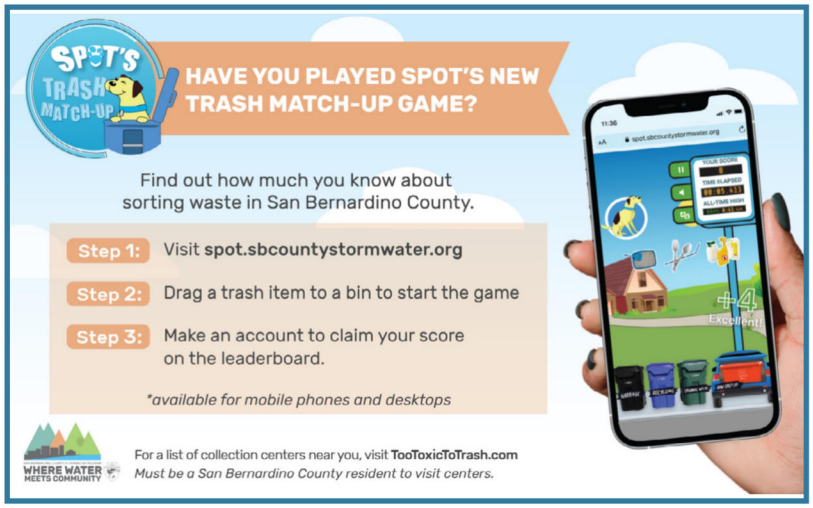
HHW Tote Bin Insert
Ideal for newsletters



HHW Flyer
Ideal for printing

PET WASTE DISPOSAL RESOURCES

Here are some resources with useful information for your HOA residents. You may add these free resources to your newsletters, websites, and any other communication channels you use.



Spot's Trash Match-Up Game Insert
Ideal for newsletters



Dog Waste Insert
Ideal for newsletters



Dog Waste Insert
Ideal for newsletters



Dog Waste Coupon Insert
Ideal for newsletters

RESIDENTS





WE DID IT OURSELVES **AND WE DID IT RIGHT**

WHEN PAINTING YOUR HOME, PROTECT YOUR FAMILY AND COMMUNITY.



PAINTS that are water-based are less toxic and should be used whenever possible.

BRUSHES with water-based paint should be washed in the sink. Those with oil-based paint should be cleaned with paint thinner.

SAFELY dispose of unwanted paint and paint thinner at a household hazardous waste collection center near you.

For a list of acceptable materials, location information, and hours of operation, visit TooToxicToTrash.com.

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

To report illegal dumping or toxic spills, call **(877) WASTE18**
or visit **sbcountystormwater.org/report**

To dispose of hazardous waste, call **1 (800) OILYCAT**

sbcountystormwater.org

Big Bear Lake • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

Vehicle Cleaning and Maintenance

Discharge into storm drain, accidental or not, can lead to enforcement actions which can include fines.

Follow these best practices to prevent polluted water and other materials from flowing into the street, gutter, and storm drain. Residents should first check HOA rules to see if vehicle maintenance is allowed on site.

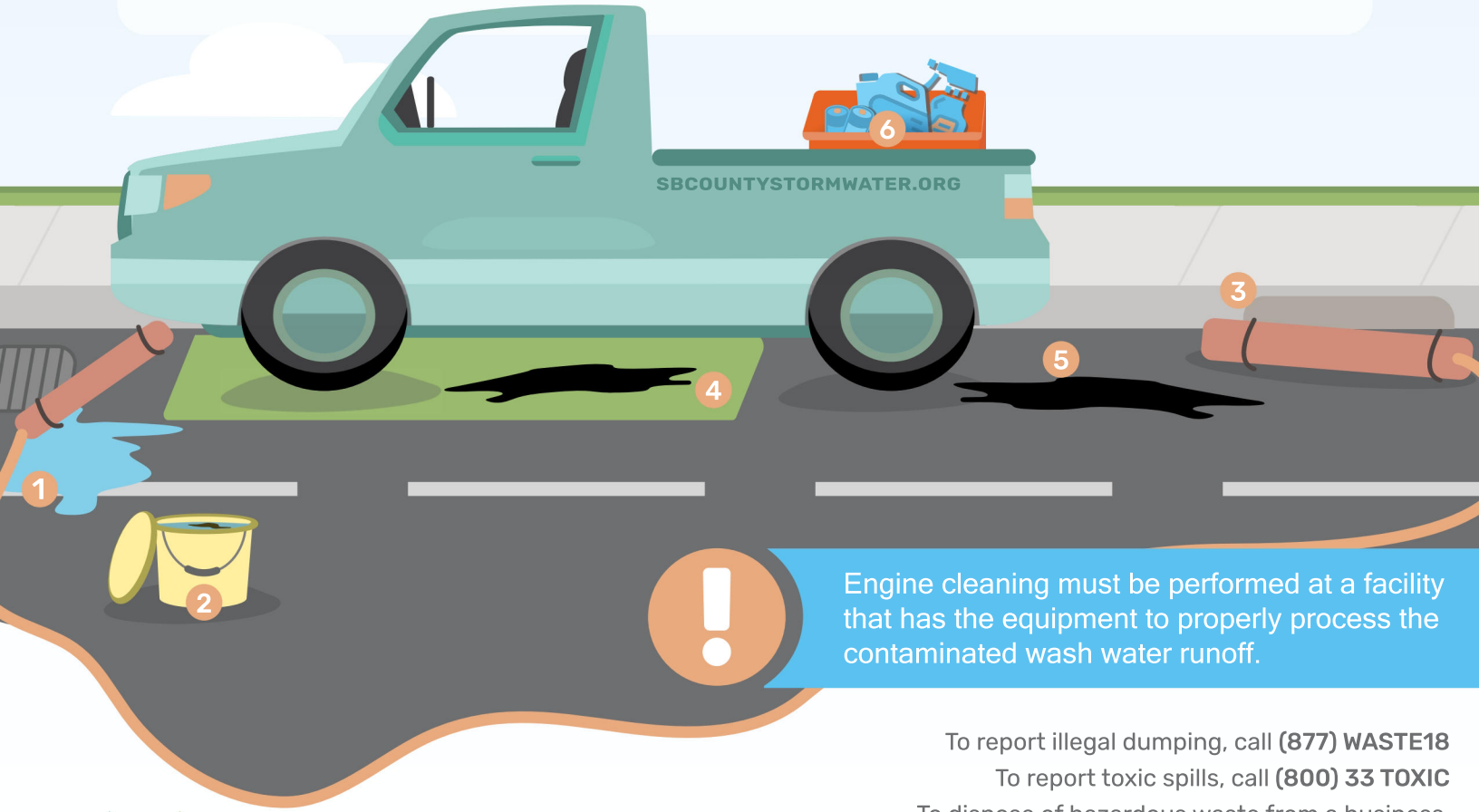
Wash Water Disposal

1. Wash in a contained area that has been bermed up to contain the wash water.
2. If washing items contaminated by hazardous materials, ensure the wash water is collected and hauled off-site for proper disposal.
3. Locate the nearest storm drain and place a barrier in front to ensure nothing can enter or be discharged into it.

Hazardous Waste Spill Clean-Up and Disposal

4. Use a tarp to catch drips and contain spills.
5. If a spill occurs, use absorbent material like kitty litter or absorbent pads to soak up the spill, then place in a bucket and properly dispose of at a local household hazardous waste facility.
6. Properly dispose of toxic materials at your local household hazardous waste facility.

Motor Oil	Batteries
Oil Filters	Gasoline
Antifreeze	



Engine cleaning must be performed at a facility that has the equipment to properly process the contaminated wash water runoff.

To report illegal dumping, call **(877) WASTE18**
To report toxic spills, call **(800) 33 TOXIC**
To dispose of hazardous waste from a business, call San Bernardino County Fire at **(909) 386-8401**

sbcountystormwater.org

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

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Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

PICK UP AFTER YOUR PET



BAG IT AND TRASH IT!

Steps and Tips

WHY SHOULD I PICK UP?

- Dog waste can infect children and adults with disease-causing bacteria and parasites.
- Your dog can get infected from the waste of other dogs.
- Dog waste can affect the quality of our rivers and oceans and make the water unsafe for swimming, drinking, or fishing.

Step 1: Keep a supply of bags tied to your dog leash.

Step 2: Bag the poop and tie the bag.

Step 3: Dispose of the tied bag properly by throwing it into a trash can.

NEED A **DOGGIE CANISTER?**

#SBCFreeCanister

@sbcountystormwater

Scan code for a **FREE CANISTER**

freedoggiebags.com

SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

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Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

GET IN TOUCH WITH US ONLINE!

Website
sbcountystormwater.org

Facebook
facebook.com/sbcountystormwater

Instagram
instagram.com/sbcountystormwater

Youtube
youtube.com/sbcountystormwater

Report Pollution Violations
sbcountystormwater.org/report

Email
info@sbcountystormwater.org



SAN BERNARDINO COUNTY STORMWATER PROGRAM
WHERE WATER MEETS COMMUNITY

Appendix D
Operations and Maintenance

RECORDING REQUESTED BY:
County of San Bernardino
Department of Public Works

AND WHEN RECORDED MAIL TO:
County of San Bernardino
Department of Public Works
825 E. Third Street, Room 117
San Bernardino, CA 92415-0835

SPACE ABOVE THIS LINE FOR RECORDER'S USE

COVENANT AND AGREEMENT REGARDING WATER QUALITY MANAGEMENT PLAN AND STORMWATER BEST MANAGEMENT PRACTICES TRANSFER, ACCESS AND MAINTENANCE

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

OWNER NAME: _____

PROPERTY ADDRESS: _____

_____

APN: _____

THIS AGREEMENT is made and entered into in

_____ ,California, this _____ day of

_____ , by and between

_____ , hereinafter

referred to as Owner, and the COUNTY OF SAN BERNARDINO, a political subdivision of the State of California, hereinafter referred to as "the County";

WHEREAS, the Owner owns real property ("Property") in the County of San Bernardino, State of California, more specifically described in Exhibit "A" and depicted in Exhibit "B", each of which exhibits is attached hereto and incorporated herein by this reference; and

WHEREAS, at the time of initial approval of development project known as

_____ within the Property described herein, the County required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff; and

WHEREAS, the Owner has chosen to install and/or implement BMPs as described in the Water Quality Management Plan, dated _____, on file with the County and incorporated herein by this reference, hereinafter referred to as "WQMP", to minimize pollutants in urban runoff and to minimize other adverse impacts of urban runoff; and

WHEREAS, said WQMP has been certified by the Owner and reviewed and approved by the County; and

WHEREAS, the Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of all BMPs in the WQMP and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs.

NOW THEREFORE, it is mutually stipulated and agreed as follows:

1. Owner shall comply with the WQMP.

2. All maintenance or replacement of BMPs proposed as part of the WQMP are the sole responsibility of the Owner in accordance with the terms of this Agreement.

3. Owner hereby provides the County's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by the County Director of Public Works, no advance notice, for the purpose of inspection, sampling, testing of the BMPs, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 5 below. The County shall make every effort at all times to minimize or avoid interference with Owner's use of the Property. Denial of access to any premises or facility that contains WQMP features is a breach of this Agreement and may also be a violation of the County's Pollutant Discharge Elimination System regulations, which on the effective date of this Agreement are found in County Code Sections 35.0101 et seq. If there is reasonable cause to believe that an illicit discharge or breach of this Agreement is occurring on the premises then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction in addition to other enforcement actions. Owner recognizes that the County may perform routine and regular inspections, as well as emergency inspections, of the BMPs. Owner or Owner's successors or assigns shall pay County for all costs incurred by County in the inspection, sampling, testing of the BMPs within thirty (30) calendar days of County invoice.

4. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the County, the Owner shall provide the County with documentation identifying the material(s) removed, the quantity, and disposal destination), testing construction or reconstruction.

5. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) business days of being given written notice by the County , the County is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense against the Property and/or to the Owner or Owner's successors or assigns, including administrative costs, attorneys fees and interest thereon at the maximum rate authorized by the County Code from the date of the notice of expense until paid in full. Owner or Owner's successors or assigns shall pay County within thirty (30) calendar days of County invoice.

6. The County may require the owner to post security in form and for a time period satisfactory to the County to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the County may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the surety(ies) to perform the obligations of this Agreement.

7. The County agrees, from time to time, within ten (10) business days after request of Owner, to execute and deliver to Owner, or Owner's designee, an estoppel certificate requested by Owner, stating that this Agreement is in full force and effect, and that Owner is not in default hereunder with regard to any maintenance or payment obligations (or specifying in detail the nature of Owner's default). Owner shall pay all costs and expenses incurred by the County in its investigation of whether to issue an estoppel certificate within thirty (30) calendar days after receipt of a County invoice and prior to the County's issuance of such certificate. Where the County cannot issue an estoppel certificate, Owner shall pay the County within thirty (30) calendar days of receipt of a County invoice.

8. Owner shall not change any BMPs identified in the WQMP without an amendment to this Agreement approved by authorized representatives of both the County and the Owner.

9. County and Owner shall comply with all applicable laws, ordinances, rules, regulations, court orders and government agency orders now or hereinafter in effect in carrying out the terms of this Agreement. If a provision of this Agreement is terminated or held to be invalid, illegal or unenforceable, the validity, legality and enforceability of the remaining provisions shall remain in full effect.

10. In addition to any remedy available to County under this Agreement, if Owner violates any term of this Agreement and does not cure the violation within the time already provided in this Agreement, or, if not provided, within thirty (30) calendar days, or within such time authorized by the County if said cure reasonably requires more than the subject time, the County may bring an action at law or in equity in a court of competent jurisdiction to enforce compliance by the Owner with the terms of this Agreement. In such action, the County may recover any damages to which the County may be entitled for the violation, enjoin the violation by temporary or permanent injunction without the necessity of proving actual damages or the inadequacy of otherwise available legal remedies, or obtain other equitable relief, including, but not limited to, the restoration of the Property and/or the BMPs identified in the WQMP to the condition in which it/they existed prior to any such violation or injury.

11. This Agreement shall be recorded in the Office of the Recorder of San Bernardino County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the County, including interest as herein above set forth, subject to foreclosure in event of default in payment.

12. In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to hold the County harmless and pay all costs incurred by the County in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

13. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.

14. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of this Agreement. Owner shall provide such notice prior to such successor obtaining an

interest in all or part of the Property. Owner shall provide a copy of such notice to the County at the same time such notice is provided to the successor.

15. Time is of the essence in the performance of this Agreement.

16. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

17. Owner agrees to indemnify, defend (with counsel reasonably approved by the County) and hold harmless the County and its authorized officers, employees, agents and volunteers from any and all claims, actions, losses, damages, and/or liability arising out of this Agreement from any cause whatsoever, including the acts, errors or omissions of any person and for any costs or expenses incurred by the County on account of any claim except where such indemnification is prohibited by law. This indemnification provision shall apply regardless of the existence or degree of fault of indemnitees. The Owner's indemnification obligation applies to the County's "active" as well as "passive" negligence but does not apply to the County's "sole negligence" or "willful misconduct" within the meaning of Civil Code Section 2782, or to any claims, actions, losses, damages, and/or liabilities, to the extent caused by the acts or omissions of any third party contractors undertaking any work (other than field inspections) or other maintenance on the Property on behalf of the County under this Agreement..

[REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK]

IF TO COUNTY :

Director of Public Works

825 E. Third Street, Room 117

San Bernardino, CA 92415-0835

IF TO OWNER:

_____

_____

_____

IN WITNESS THEREOF, the parties hereto have affixed their signatures as of the date first written above.

OWNER:

Company/Trust:_____

Signature: _____

Name: _____

Title: _____

Date: _____

OWNER:

Company/Trust:_____

Signature: _____

Name: _____

Title: _____

Date: _____

FOR: Maintenance Agreement, dated

_____, for the project known as

_____

_____

(APN)_____,

As described in the WQMP dated

_____.

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation.

ACCEPTED BY:

BRENDON BIGGS, M.S., P.E., Director of Public Works

Date: _____

Attachment: Notary Acknowledgement

ATTACHMENT 1
Notary Acknowledgement)

EXHIBIT A
(Legal Description)

EXHIBIT B
(Map/illustration)

Appendix E
Soils Report

Geotechnical Engineering Report

Proposed Desert Valley Hospital Addition
Victorville, San Bernardino County, California
March 6, 2023
Terracon Project No. CB225235

Prepared for:
Prime Healthcare Management, Inc.
Ontario, CA

Prepared by:
Terracon Consultants, Inc.
Colton, California

March 6, 2023

Prime Healthcare Management, Inc.
3300 E. Guasti Road, 3rd Floor
Ontario, CA 91761

Attn: Mr. Robert T. Escareno
P: (760) 713 0021
E: REscareno@primehealthcare.com

Re: Geotechnical Engineering Report
Proposed Desert Valley Hospital Addition
16850 Bear Valley Rd.
Victorville, San Bernardino County, California
Terracon Project No. CB225235

Dear Mr. Escareno:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PCB225235 dated December 21, 2022. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

REGISTERED PROFESSIONAL ENGINEER SEYEDALI TABATABAEI No. 3159 GEOTECHNICAL STATE OF CALIFORNIA

Ali Tabatabaei, Ph.D., G.E. 3159
Geotechnical Project Engineer

Keith P. Askew, P.E., G.E.
Geotechnical Department Manager

John S. McKeown, E.G. 2396
Senior Geologist

REPORT TOPICS

INTRODUCTION 1
SITE CONDITIONS 1
PROJECT DESCRIPTION 2
GEOTECHNICAL CHARACTERIZATION 3
SEISMIC CONSIDERATIONS 7
LIQUEFACTION AND SEISMIC SETTLEMENT 11
GEOTECHNICAL OVERVIEW 12
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Note: This report was originally delivered in a web-based format. Orange Bold text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the *GeoReport* logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
SITE LOCATION AND EXPLORATION PLANS
EXPLORATION RESULTS
SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report

Proposed Desert Valley Hospital Addition
16850 Bear Valley Road
Victorville, San Bernardino County, California

Terracon Project No. CB225235

March 6, 2023

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed new building to be located at 16850 Bear Valley Road in Victorville, San Bernardino County, California. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions and historic high groundwater
- 2022 California Building Code (CBC) seismic design parameters
- Liquefaction analysis
- Subgrade preparation/earthwork recommendations
- Foundation design and concrete slabs-on-grade
- Preliminary pavement section design
- Infiltration and drainage

The geotechnical engineering Scope of Services for this project included the advancement of eleven test borings to depths ranging from approximately 5 to 51½ feet below existing site grades, percolation testing, laboratory testing, and preparation of this report.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and/or as separate graphs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at the 16850 Bear Valley Road in Victorville, San Bernardino County, California. The addition is planned at the east side of an existing 2-story stucco building. The footprint (per plans provided to us) for the new structure is approximately 39,280 square feet. Center of the proposed structure is Latitude 34.4717° N / Longitude 117.2973° W (approximate) See **Site Location**
Existing Improvements	Site for the new building is currently an asphalt concrete parking lot.
Current Ground Cover	Asphalt concrete parking, trees and shrubs and concrete flatwork.
Existing Topography	The site is relatively flat with approximately elevations ranging from 280 to 298 feet and generally slopes down towards the southeast.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Proposed Development	Project plans include an approximate footprint measuring 39,280 square feet. The existing building is described as a two-story stucco building. We assume a similar configuration for the planned addition. We understand that the proposed construction is classified as an HCAI project and will be subject to review by the California Geological Survey (CGS).
Building Construction	Not provided. A likely construction would be steel moment frame with a slab on grade, using spread footings or a mat foundation.
Finished Floor Elevation	Unknown, assumed to be close to existing grade.
Structural Loads (assumed)	■ Columns: 100-200 kips ■ Walls: 2 to 4 kips per linear foot (klf) ■ Slabs: 150 pounds per square foot (psf)
Grading Requirements	Up to 5 feet of cut and fill may be required to develop final grade, excluding remedial grading. Permanent slopes are not anticipated.
Below Grade Structures	Not specified.
Infiltration Systems	An on-site stormwater retention/infiltration system is planned; therefore, we have included infiltration testing in this current scope of work and report.
Free-Standing Retaining Wall	Not anticipated

Item	Description
Pavements	Paved driveway and parking will be constructed on site. We assume both rigid (concrete) and flexible (asphalt) pavement sections should be considered. Please confirm this assumption. Anticipated traffic indices (TIs) are as follows for asphalt pavement: ■ Auto Parking Areas: TI=5.0 ■ Drive Lanes TI=5.5 ■ Truck Delivery Areas: TI=7.0 ■ The pavement design period is 20 years. Anticipated average daily truck traffic (ADTT) is as follows for concrete pavement: ■ Light Duty: ADTT=1 (Category A) ■ Medium Duty: ADTT=25 (Category B) ■ Heavy Duty: ADTT=700 (Category C)

GEOTECHNICAL CHARACTERIZATION

Site Geology

The site is located in the Mojave Desert on an alluvial plain formed along the northern flank of the San Bernardino Mountains. The Mojave River is approximately 2.4 miles east of the site. The Mojave Desert Province is an interior region characterized by isolated mountains and hills separated by broad alluvial plains. Playa lakes are common in the lower basins and faults trend east-west and northwest to southeast.

Based on geologic mapping by Dibblee and Minch (2008), the site is underlain by older alluvium. As encountered in our site explorations, these materials include interlayered mixtures of silt and sand.

Subsurface Profile

We have developed a general characterization of the subsurface soil and groundwater conditions based upon our review of the data and our understanding of the geologic setting and planned construction. The table below summarizes our geotechnical characterization.

The geotechnical characterization forms the basis of our geotechnical calculations and evaluation of site preparation, foundation options and pavement options. As noted in **General Comments**, the characterization is based upon widely spaced exploration points across the site, and variations are likely.

Conditions encountered at each boring location are indicated on the individual boring logs shown in the **Exploration Results** section and are attached to this report. Stratification boundaries on

the boring logs represent the approximate location of changes in native soil types; in situ, the transition between materials may be gradual.

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description [1]	Consistency/Density
Surface Cover	---	Asphalt Concrete (AC), approximately 1.5" to 2" thick	---
	----	Aggregate Base (AB), approximately 6" thick	---
Stratum I	51 ½ (maximum depth of the explorations)	Interbedded layers of poorly graded sand, silty sand, brown	Medium dense to very dense

1. Aggregate base was encountered in borings B-1, B-3 and B-7 only.

Hydroconsolidation

To evaluate the potential deformation that may be caused by the addition of water to subsurface soils, hydroconsolidation testing was performed on two selected, representative relatively undisturbed samples. The results are provided in the Exploration Results section. The test results indicate a collapse potential of 0.4% and 1.2% for B-1 at 5 feet, and B-8 at 5 feet, respectively. The soil sample was saturated under an axial pressure of 2,000 psf.

Groundwater Conditions

The following table summarizes groundwater depth information for a well located near the site.

Well No.	Reference Point Elevation (feet)	Date of Measurement	Depth to Water (feet)	Distance to Site	Direction
05N04W34N001S	3003	8/1/1992	239	1440 feet	NE
		3/1/2006	250		
		2/2/2011	240		
		5/12/2014	252		

Groundwater was not encountered within the maximum 51½ foot depth of borings drilled for the project.

The borings were advanced using continuous flight auger drilling techniques that allow short-term groundwater observations to be made while drilling. Groundwater seepage was not observed within the maximum depths of exploration during or at the completion of drilling.

Groundwater level fluctuations can occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. We do not anticipate groundwater to impact construction.

Regional Faulting

The tectonics of the Southern California area are dominated by the interaction of the North American and Pacific tectonic plates, which are sliding past each other in transform motion. Although some of the motion may be accommodated by rotation of crustal blocks such as the western Transverse Ranges (Dickinson, 1996), the San Andreas fault zone represents the major surface expression of the tectonic boundary and accommodates a significant portion of the slip between the Pacific and North American plates. Some of the slip is accommodated by other northwest-trending strike-slip faults that are related to the San Andreas system, such as the San Jacinto and Elsinore faults. The Mojave Desert region contains a portion of the Eastern California Shear Zone, a system of northwest-southeast trending faults that extend across the eastern Mojave region. Active faults in this zone include the Helendale-South Lockhart, Lenwood-Lockhart, and Johnson Valley faults. Several of the ECSZ faults ruptured during the Landers earthquake in 1992 forming a broad zone of surface rupture distributed across multiple fault stands. The Hector Mine earthquake of 1999 similarly ruptured along several mapped fault strands. A Regional Fault Map is presented in **Supplemental Figures**.

Fault Rupture Potential: The site is not located within an Alquist-Priolo Earthquake Fault Zone (APZ) designated by the State of California for active faults (Hart, 1999). The closest APZ boundary, designated for the San Jacinto North Frontal fault zone, is located approximately 6.8 miles southeast of the site. Known faults or fault-related features are not located within the site; therefore, the potential for fault rupture within the site is considered low.

North Frontal Fault Zone: The North Frontal fault zone of the San Bernardino Mountains is located approximately 11 kilometers southeast of the site. The North frontal zone is an east-west trending fault system made up of a number of separate structural elements, each of which accommodates range-front uplift/deformation. This fault zone is characterized by a broad, complex zone of discontinuous, generally south-dipping thrust, reverse, and, locally, strike-slip faults with latest Pleistocene to Holocene offset. The western section includes the Ord Mountains fault zone which is the closest element of the zone to the site. Additional elements in the Western section include the Ocotillo Ridge fold, Sky High Ranch fault, and White Mountains Thrust. The Ord Mountains section is included in a State-designated fault hazard zone.

Helendale Fault: The northwest-striking Helendale-South Lockhart fault zone is located approximately 22 kilometers northeast of the site, is the westernmost of a series of sub-parallel right-lateral strike-slip faults in the central Mojave Desert, and is part of the eastern California shear zone. The Helendale-South Lockhart fault zone extends from its presumed junction with the Lockhart fault zone near Highway 395 to about 15 km northwest of Highway 15. The Helendale fault trends along the southwest side of the Sidewinder Mountains, through the Lucerne Valley and into the northern San Bernardino Mountains.

San Andreas Fault Zone: The San Andreas fault zone (SAFZ), a prominent geologic feature of California, traverses the Cajon Pass region and northern flank of the San Gabriel Mountains approximately 26 kilometers southwest of the site. The San Andreas fault is characterized by youthful fault scarps, aligned vegetation, topographic troughs, springs and offset drainage channels.

The greater San Andreas fault system is composed of multiple named segments extending through California that are postulated to rupture singly or together with other segments. The SAFZ is capable of producing magnitude 7.5 to 8 earthquakes under multi-segment rupture scenarios. The ShakeOut Scenario (USGS, 2008) is a study aimed at identifying the physical, social and economic effects of a major earthquake in southern California and preparing Californians before such an event occurs. The scenario earthquake selected for ShakeOut is a magnitude 7.8 event on the southern SAFZ, postulated to generate similar events on average every 150 years. Lateral slip for the scenario event is estimated as 9 to 30 feet. Fault rupture and strong ground shaking from the SAFZ present hazards to be mitigated for developments in the southern California region. Southwestward decrease in slip rates along the SAFZ northwest of its junction with the San Jacinto fault zone is suggested in studies by McGill and others (2021) and attests to the complexity of fault systems in southern California.

Cucamonga Fault : The southern margin of the San Gabriel Mountains is coincident with a series of east-west trending, predominantly reverse and thrust faults known as the Transverse Ranges frontal fault system. The San Fernando fault of this system ruptured during the 1971 magnitude 6.7 San Fernando earthquake. The Cucamonga fault of this system is located at the base of the San Gabriel Mountains, approximately 35 kilometers southwest of the site. Evidence of recent activity on this fault includes fresh scarps, sag ponds and disrupted Holocene alluvium (Dutcher and Garrett, 1963; Yerkes, 1985; Morton and Yerkes, 1987).

Historical Earthquakes

A search of the USGS earthquake catalog for earthquakes of magnitude 4.5 or greater within 150 kilometers of the site returned 340 results including 4 events of magnitude 7 or greater, 19 events of magnitude 6 to 6.9, 104 events of magnitude 5 to 6 and 248 events of magnitude 4.5 to 5. A Regional Seismicity Map based on these data is attached.

The following table summarizes selected earthquakes recorded in the site region.

Event ID	Date	Magnitude	Distance (km)	Direction
NW of San Bernardino	12-8-1812	7.5	34	WSW
Palmdale	1-16-1857	6.3	68	W
Devore area	12-16-1858	6.0	31	S
NW of San Bernardino	7-30-1894	6.2	34	SW
Cajon Pass area	7-22-1899	6.4	29	SW
Barstow Heights	7-16-1916	4.5	37	NE
SSE of Fort Irwin	4-10-1947	6.5	88	NE
Tehachapi	7-21-1952	7.3	165	W

Sylmar	2-9-1971	6.6	99	W
Landers	6-28-1992	7.3	85	ESE
Big Bear	6-28-1992	6.4	53	SE
Northridge	1-17-1994	6.7	11	WSW
Hector Mine	10-16-1999	7.1	96	E
ENE Running Springs	10-19-1999	5.6	35	SE
Searles Valley	7-6-2019	7.1	145	N

Mitigation of seismic shaking hazard includes design and construction of buildings and improvements according to applicable codes. The following section provides seismic design information specific to this project site.

SEISMIC CONSIDERATIONS

Seismic Design Parameters

The seismic design parameters, according to the ASCE 7-16 are provided in the following section based on the **site-specific method** of Section 21.2. Site Classification (soil profile type) for seismic design is based on the upper 100 feet of a site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7. We used Vs_{30} = 260 meters/second, consistent with the Site Class 'D' condition, based on blow counts measured in site borings. The site-specific Vs_{30} value was used in deterministic models and the 'D' category was applied in probabilistic spectral values using the USGS Hazard Tool. Basin factors $Z_{1.0}$ = 60 meters and $Z_{2.5}$ = 220 meters were derived from data compiled by Graves (2011) for CDMG seismic station 23321 located in a similar geologic setting approximately 3.7 kilometer southwest of the site. The site does not lie within a deep structural basin.

Subsurface explorations at this site were extended to a maximum depth of 51½ feet. The site properties to a profile depth of 100 feet (30 meters) were estimated based on our experience and knowledge of geologic conditions of the general area. The seismic design parameters are summarized in the following table according to site-specific method of ASCE 7-16, Chapter 21.

Description	Value
Site Classification [1]	D
Site Latitude	34.4717
Site Longitude	-117.2973
Mapped Spectral Acceleration Parameters [2]	S_S = 1.251 and S_1 = 0.482
Site Coefficients	F_a = 1.0[2] and F_v = 1.82[3]
Site-specific Spectral Response Acceleration Parameters [4]	SM_S = 1.47 and SM_1 = 0.963

Description	Value
Design Spectral Acceleration Parameters [4]	SD_S = 0.98 and SD_1 = 0.642
Peak Ground Acceleration [4]	0.538g
De-aggregated Magnitude [5]	7.9

2. Seismic site classification in general accordance with ASCE 7-16, Chapter 20.
3. These values were obtained using online seismic design tools provided by Structural Engineers Association of California - 'https://www.seaoc.org/page/seismicdesignmaptool.
4. ASCE 7-16 11.4.4
5. Site-specific values based on ASCE 7-16, 21.4 and 21.5
6. USGS Unified Hazard Tool https://earthquake.usgs.gov/hazards/interactive.

Site-Specific Ground Motions

A site-specific ground motion study for the project was performed and included a ground motion hazard analysis. We performed this analysis in general conformance with Chapter 21 of ASCE 7-16.

The procedures outlined in ASCE 7-16 Chapters 11, 20 and 21 were utilized for preparation of site-specific spectra for the proposed project. The site is approximately 11 kilometers northwest of the mapped trace of the North Frontal fault zone and 26 kilometers northeast of the San Andreas fault zone. We prepared deterministic and probabilistic spectra and associated limiting spectra. We used V_{S30} = 260 meters/second. Basin factors $Z_{1.0}$ and $Z_{2.5}$ were adapted from Southern California Earthquake Center (SCEC) Community Velocity Models (CVM H11) as compiled by Graves (2011). The site-specific response spectra in tabular and graphic forms and a discussion of methodology are included in this section.

Deterministic Spectrum: Deterministic MCE spectra based on scenario events on nearby faults and consistent with the Next Generation West 2 (NGA-West 2) attenuation relations (GMPEs) used for the 2014 USGS seismic source models were calculated. Basin factors were applied as defined for each GMPE. The fault properties used are summarized in the following table and are consistent with deterministic scenario values presented in BSSC (2015) https://earthquake.usgs.gov/scenarios/catalog/bssc2014.

Fault	Magnitude	Distance (km)	Direction	Type
North Frontal	7.2	11	SE	reverse
Helendale	7.4	22	NE	Strike slip
San Andreas	8.2	26	SW	Strike slip
Cucamonga	6.9	35	SW	reverse

We evaluated the deterministic spectral values from scenario fault sources that resulted in the highest amplitude at any spectral period and compiled them for the deterministic spectrum. The resulting deterministic spectrum is controlled by the North Frontal fault at periods from PGA to 2.0 seconds and the San Andreas fault at periods from 3 to 5 seconds.

The equally-weighted spectral values from the attenuation relations of Abrahamson and others (ASK 2014), Boore and others (BSSA 2014), Campbell and Borzognia (CB 2014) and Chiou and Youngs (CY 2014) were used for the deterministic MCE spectra. The MCE spectrum represents 84th-percentile, 5-percent-damped spectral response acceleration in the direction of maximum horizontal response (maximum rotated) for each spectral period. Maximum rotated values were obtained using the scaling factors of Shahi and Baker (2014). The deterministic MCE_R spectrum and associated spectra are attached in tabular and graphic forms.

Probabilistic MCE_R Spectrum: An MCE_R spectrum was developed as a probabilistic spectrum using site class D values obtained with the USGS Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/) web-based software application consistent with the Next Generation West 2 (NGA-West 2) attenuation relations (GMPEs). The equally-weighted spectral values from the attenuation relations of Abrahamson and others (ASK 2014), Boore and others (BSSA 2014), Campbell and Borzognia (CB 2014) and Chiou and Youngs (CY 2014) were used for the probabilistic spectrum. Basin factors were applied as defined for each GMPE. The values so obtained were scaled from geomean to maximum rotated values using the factors of Shahi and Baker (2014). Gridded seismic sources are included in the probabilistic model. The probabilistic MCE spectrum was converted to a risk-targeted spectrum (MCE_R) using the USGS Risk Targeted Ground Motion Calculator tool (https://code.usgs.gov/ghsc/hazdev/earthquake-rtgm-calculator).

Site-Specific MCE_R Spectrum: The lesser of the spectral values at any period from the deterministic MCE_R and probabilistic MCE_R spectra form the site-specific MCE_R spectrum per ASCE 7-16 21.2.3. For the subject site, the deterministic spectrum controls the design spectrum at all periods.

Design Spectrum: A design response spectrum was determined according to the procedure outlined in ASCE 7-16, Section 21.3, and is equal to two-thirds of the response spectral accelerations of the site-specific MCE_R. The design spectrum is limited by a 'floor' at 80 percent of spectral acceleration determined according to ASCE 7-16, Section 11.4.6. For this site, the 'floor' condition was applied for period from 1 to 5 seconds. The recommended site-specific design response spectrum is attached in tabular and graphic forms.

Peak Ground Acceleration (PGA)

According to ASCE 7-16, Section 11.4.8, the site-specific geometric mean (MCE_G) PGA used for evaluation of soil effects is based on the lesser of the site-specific deterministic and probabilistic PGA values with an adjustment to 80% of the code value if needed. The following table summarizes the PGA values considered for the project.

Site-Specific PGA Values	
Code-Based Geometric Mean PGA	0.55g
80 Percent of Code-Based PGA	0.44g
Probabilistic Geometric Mean PGA	0.69g
Deterministic Geometric Mean PGA	0.54g
Recommended Site-Specific PGA	0.54g

For the site-specific (MCE_G) PGA, the deterministic value is the lesser of the probabilistic and deterministic values and is greater than 80 percent of the code-based geometric mean PGA value. Therefore, we recommended a site-specific PGA value of 0.54g for evaluation of soil effects such as liquefaction or seismic settlement.

Tsunamis, Inundation, and Seiche and Flooding Potential

The site is not located within a 100-year flood zone or 500-year flood zone (FEMA, 2016). No evidence of recent significant flooding of the site was observed during the geologic field reconnaissance or on the aerial photographs reviewed. An evaluation of the storm-induced flood potential of the site falls under the purview of others.

The site is not located within a potential inundation zone for seismically-induced dam/reservoir failure (County of San Bernardino General Plan, 2010).

The site is not located in a coastal area. No large water storage facilities are known to exist within the area of the site. Therefore, the potential for seismically-induced flooding due to seiche or tsunami to affect the site is considered very low.

Subsidence Potential

The site is not within an area of defined subsidence hazard. Structures susceptible to subsidence include gravity sewers, surface drainage and storm drains. The proposed development is unlikely to be significantly affected should subsidence occur.

Erosion Potential

Most of the subject site will be covered with structures or flatwork. Erosion by wind and water is not considered to be a hazard at the site.

Slope Stability and Landslide Potential

The site is not located in an area identified as having a potential for landslides or lateral spreading. The site is relatively flat and level, and significant natural or manmade slopes are not located within the project boundaries. Therefore, the potential for landsliding or lateral spreading is considered very low.

Based on the relatively flat-lying site surface and planned development, significant temporary cut slopes are not expected during the proposed construction. For purposes of construction, the soils encountered in our explorations are considered type "C" materials. Accordingly, temporary slopes in near surface native soil should conform to applicable standards as outlined by Cal/OSHA for construction excavations (https://www.dir.ca.gov/title8/1541_1a.html).

LIQUEFACTION AND SEISMIC SETTLEMENT

Liquefaction is a mode of ground failure that results from the generation of high pore-water pressures during earthquake ground shaking, causing loss of shear strength, and is typically a hazard where loose sandy soils exist below groundwater. San Bernardino County has designated certain areas as potential liquefaction hazard zones. These are areas considered at a risk of liquefaction-related ground failure during a seismic event, based upon mapped surficial deposits and the presence of a relatively shallow water table.

The subsurface materials generally consist of Interbedded layers of poorly graded sand, sandy silt, and silty sand with varying amounts of silt extending to the maximum depth of the explorations approximately 51½ feet bgs. Groundwater seepage was not observed within the maximum depths of exploration during or at the completion of drilling and has historically been greater than 100 feet bgs.

According to the County of San Bernardino (2010), the site is not located within an area identified as having a liquefaction potential. Historic groundwater levels are not within 50 feet of the ground surface; therefore, liquefaction is not anticipated.

Seismic Settlement

To determine the amount of seismic settlement (dry sand), we utilized the software “LiquefyPro” by CivilTech Software, seismic settlement was estimated using the soil profile from exploratory borings B-1 and B-4. A Peak Ground Acceleration (PGA) of 0.54g and the de-aggregated mode magnitude of 7.9 were utilized as input into the liquefaction analysis program. Settlement analysis used the Ishihara / Yoshimine method and the fines percentage were corrected for liquefaction using the Modify Stark/Olson method.

We performed a seismic settlement analysis to determine the dry seismic settlement using data from boring B-1 and B-4. Based on data from these borings, seismically induced settlement (dry sand) is estimated to be less than 1-inch. Differential seismic settlement is estimated to be on the order of 2/3 of total seismic settlement over a distance of 40 feet.

GEOTECHNICAL OVERVIEW

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test borings, provided that the recommendations provided in this report are implemented in the design and construction phases of this project.

Geotechnical engineering recommendations for foundation systems and other earth connected phases of the project are outlined below. The recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and our current understanding of the proposed project.

On-site soils generally consisted of Interbedded layers of poorly graded sand, sandy silt, and silty sand with varying amounts of silt extending to the maximum depth of the explorations approximately 51½ feet bgs.

Based on the conditions encountered, the proposed building can be supported on shallow foundations, such as spread footings.

Groundwater was not encountered in the borings within the drilling depths at the time of drilling. Groundwater is not expected to affect shallow foundation construction on this site.

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

The following recommendations include site preparation, excavation, subgrade preparation and placement of engineered fills on the project. The recommendations presented for design and construction of earth supported elements including foundations, slabs, and pavements are contingent upon following the recommendations outlined in this section.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

Site Preparation

Strip and remove existing vegetation, debris, pavements and other deleterious materials from proposed building and pavement areas. Exposed surfaces should be free of mounds and depressions which could prevent uniform compaction. The site should be initially graded to create a relatively level surface to receive fill and provide for a relatively uniform thickness of fill beneath proposed building structures.

All materials derived from the demolition of existing structures and pavements should be removed from the site and not be allowed for use as on-site fill, unless processed in accordance with the fill requirements included in this report.

Existing utility lines were noted across the site. However, although no evidence of other underground facilities such as septic tanks, cesspools, and basements, was observed during the site reconnaissance, such features could be encountered during construction. If unexpected fills, utilities, or underground facilities are encountered, such features should be removed and the excavation thoroughly cleaned prior to backfill placement and/or construction.

Subgrade Preparation

We recommend that the proposed structures be supported on engineered fill extending to a minimum depth of 2 feet below the bottom of foundations, or 5 feet below existing grades, whichever is greater. Engineered fill placed beneath the entire footprint of the structures should extend horizontally a minimum distance of 3 feet beyond the outside edge of perimeter footings.

Subgrade soils beneath exterior slabs and pavements should be removed to a depth of 1 foot below the proposed pavement section, or 18 inches below the existing grade, whichever is deeper.

Exposed areas which will receive fill, once properly cleared and benched where necessary, should be scarified to a minimum depth of 10 inches, moisture conditioned, and compacted per the compaction requirements in this report. Compacted fill soils should then be placed to the design grades, and the moisture content and compaction of soils should be maintained until slab, pavement, or proposed improvements are constructed.

Based upon the subsurface conditions determined from the geotechnical exploration, subgrade soils exposed during construction are anticipated to be relatively workable. However, the workability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. If unworkable conditions develop, workability may be improved by scarifying and drying.

Excavation

We anticipate that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction.

Individual contractors are responsible for designing and constructing stable, temporary excavations. Excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

Fill Material Types

All fill materials should be inorganic soils free of vegetation, debris, and fragments larger than three inches in size. Pea gravel or other similar non-cementitious, poorly-graded materials should not be used as fill or backfill without the prior approval of the geotechnical engineer.

Clean on-site soils or approved imported materials may be used as fill material for the following:

■ general site grading	■ foundation backfill
■ foundation areas	■ pavement areas
■ interior floor slab areas	■ exterior slab areas

If imported soils are used as fill materials to raise grades, these soils should conform to low volume change materials and should conform to the following requirements:

Gradation	**Percent Finer by Weight (ASTM C 136)**
3”	100
No. 4 Sieve	50 - 100
No. 200 Sieve	20 - 50

- Liquid Limit ..... 30 (max)
- Plasticity Index ..... 15 (max)
- Maximum Expansive Index* ..... 20 (max)

*ASTM D 4829

The contractor shall notify the Geotechnical Engineer of import sources sufficiently ahead of their use so that the sources can be observed and approved as to the physical characteristic of the import material. For all import material, the contractor shall also submit current verified reports from a recognized analytical laboratory indicating that the import has a "not applicable" (Class S0) potential for sulfate attack based upon current ACI criteria. The reports shall be accompanied by a written statement from the contractor that the laboratory test results are representative of all import material that will be brought to the job.

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. Fill lifts should not exceed 10 inches loose thickness.

Compaction Requirements

Material Type and Location	Per the Modified Proctor Test (ASTM D 1557)		
	Minimum Compaction Requirement (%)	Range of Moisture Contents for Compaction Above Optimum	
		Minimum	Maximum
On-site soils and/or low volume change imported fill:			
Beneath foundations:	90	0%	+3%
Beneath interior slabs:	90	0%	+3%
Miscellaneous backfill:	90	0%	+3%
Beneath pavements:	95	0%	+3%
Utility Trenches*:	90	0%	+3%
Bottom of excavation receiving fill:	90	0%	+3%
Aggregate base (beneath pavements):	95	0%	+3%

* Upper 12 inches should be compacted to 95% within pavement and structural areas. Low-volume change imported soils should be used in structural areas.

Utility Trenches

We anticipate that the on-site soils will provide suitable support for underground utilities and piping that may be installed. Any soft and/or unsuitable material encountered at the bottom of excavations should be removed and be replaced with an adequate bedding material. A non-expansive granular material with a sand equivalent greater than 30 is recommended for bedding and shading of utilities, unless otherwise allowed by the utility manufacturer.

On-site materials are considered suitable for backfill of utility and pipe trenches from one foot above the top of the pipe to the final ground surface, provided the material is free of organic matter and deleterious substances.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed beneath slabs or footings, the backfill should satisfy the gradation and expansion index requirements of engineered fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

Grading and Drainage

Positive drainage should be provided during construction and maintained throughout the life of the development. Infiltration of water into utility trenches or foundation excavations should be prevented during construction. Planters and other surface features which could retain water in areas adjacent to the building or pavements should be sealed or eliminated. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that protective slopes be provided with a minimum grade of approximately 5 percent for at least 10 feet from perimeter walls. Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

We recommend a minimum horizontal setback distance of 10 feet from the perimeter of any building and the high-water elevation of the nearest storm-water retention basin.

Roof drainage should discharge into splash blocks or extensions when the ground surface beneath such features is not protected by exterior slabs or paving. Sprinkler systems and landscaped irrigation should not be installed within 5 feet of foundation walls.

Exterior Slab Design and Construction

Exterior slabs-on-grade, exterior architectural features, and utilities founded on, or in backfill may experience some movement due to the volume change of the backfill. To reduce the potential for damage caused by movement, we recommend:

- minimizing moisture increases in the backfill;
- controlling moisture-density during placement of backfill;
- using designs which allow vertical movement between the exterior features and adjoining structural elements;
- placing effective control joints on relatively close centers.

Construction Considerations

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab and pavement construction.

Onsite soils consist of cohesionless sandy soils. Such soils have the tendency to cave and slough during excavations. Therefore, formwork may be needed for foundation excavations.

We recommend that the earthwork portion of this project be completed during extended periods of dry weather if possible. If earthwork is completed during the wet season (typically November through April) it may be necessary to take extra precautionary measures to protect subgrade soils. Wet season earthwork operations may require additional mitigative measures beyond that which would be expected during the drier summer and fall months. This could include diversion of surface runoff around exposed soils and draining of ponded water on the site. Once subgrades are established, it may be necessary to protect the exposed subgrade soils from construction traffic.

Construction Observation and Testing

The geotechnical engineer should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation, proof-rolling, placement and compaction of controlled compacted fills, backfilling of excavations to the completed subgrade.

The exposed subgrade and each lift of compacted fill should be tested, evaluated, and reworked as necessary until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. One density and water content test for every 50 linear feet of compacted utility trench backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. In the event that unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Item	Description
Foundation Support	Engineered fill extending 2 feet below the bottom of foundations, or 5 feet below existing grades, whichever is greater.
Net Allowable Bearing pressure [1, 2] **(On-site soils or structural fill)**	2,500 psf

Item	Description
Foundation Support	Engineered fill extending 2 feet below the bottom of foundations, or 5 feet below existing grades, whichever is greater.
Minimum Foundation Dimensions	Columns: 24 inches Continuous: 18 inches
Minimum Footing Depth	24" below finish grade
Increments of Net Allowable Bearing Pressure	400 psf for each additional foot of width 800 psf for each additional foot of depth
Ultimate Passive Resistance [4]	350 pcf
Ultimate Coefficient of Sliding Friction [5]	0.32
Estimated Total Static Settlement from Structural Loads [2]	about 1 inch
Estimated Differential Settlement [2, 6]	About 1/2 of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied.
2. Values provided are for maximum loads noted in **Project Description**. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. The above settlement estimates have assumed that the maximum footing size is 6 feet for column footings and 3 feet for continuous footings.
3. Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in the **Earthwork**.
4. Use of passive earth pressures requires the footing forms be removed and compacted structural fill be placed against the vertical footing face. A factor of safety of 2.0 is recommended.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions. A factor of safety of 1.5 is recommended.
6. Differential settlements are as measured over a span of 40 feet.

Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

To ensure foundations have adequate support, special care should be taken when footings are located adjacent to trenches. The bottom of such footings should be at least 1 foot below an imaginary plane with an inclination of 1.5 horizontal to 1.0 vertical extending upward from the nearest edge of adjacent trenches.

FLOOR SLABS

DESCRIPTION	RECOMMENDATION
Interior floor system	Slab-on-grade concrete
Floor slab support	Engineered fill extending 3 feet below the bottom of foundations, or 5 feet below existing grades, whichever is greater.
Subbase	Minimum 4-inches of Aggregate Base
Modulus of subgrade reaction	150 pounds per square inch per inch (psi/in) (The modulus was obtained based on estimates obtained from NAVFAC 7.1 design charts). This value is for a small loaded area (1 Sq. ft or less) such as for forklift wheel loads or point loads and should be adjusted for larger loaded areas.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

PAVEMENTS

General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

Pavement Design Parameters

Design of asphalt concrete (AC) pavements is based on the procedures outlined in the Caltrans "Highway Design Manual for Safety Roadside Rest Areas" (Caltrans, 2016). Design of Portland

cement concrete (PCC) pavements are based upon American Concrete Institute (ACI) 330R-08; "Guide for Design and Construction of Concrete Parking Lots."

A correlated design R-value of 35 was used for the AC pavement design. A modulus of rupture of 600 psi was used for pavement concrete. The structural sections are predicated upon proper compaction of the utility trench backfills and the subgrade soils as prescribed by in **Earthwork**, with the upper 12 inches of subgrade soils and all aggregate base material brought to a minimum relative compaction of 95 percent in accordance with ASTM D 1557 prior to paving. The aggregate base should meet Caltrans requirements for Class 2 base.

The pavement designs were based upon the results of preliminary sampling and testing and should be verified by additional sampling and testing (specifically R-value testing) during construction when the actual subgrade soils are exposed. Additionally, the preliminary sections provided are minimums based on procedures previously referenced. The project civil engineer should confirm minimum Traffic Indices and sections required by local agencies or jurisdictions if applicable.

Pavement Section Thicknesses

The following table provides options for AC and PCC Sections:

Asphalt Concrete Design		
Usage	**Assumed Traffic Index**	**Recommended Structural Section**
Auto Parking Areas	5.0	3” HMA[1]/5” Class 2 AB[2]
Drive lanes	5.5	3” HMA[1]/6” Class 2 AB[2]
Truck Delivery Areas	7.0	3.5” HMA[1]/10” Class 2 AB[2]

1. HMA = hot mix asphalt
2. AB = aggregate base

Portland Cement Concrete Design			
Layer	**Thickness (inches)**		
	Light Duty[1]	**Medium Duty[2]**	**Heavy Duty[3]**
PCC	5.0	6.0	7.5
Aggregate Base [4]	--	--	--

1. Car Parking and Access Lanes, Average Daily Truck Traffic (ADTT) = 1 (Category A).
2. Truck Parking Areas, Multiple Units, ADTT = 25 (Category B)

Portland Cement Concrete Design			
Layer	Thickness (inches)		
	Light Duty[1]	Medium Duty[2]	Heavy Duty[3]

3. In areas of anticipated heavy traffic, fire trucks, delivery trucks, or concentrated loads (e.g., dumpster pads), and areas with repeated turning or maneuvering of heavy vehicles, ADTT = 700 (Category C).
4. Aggregate base is not required. Compacted on-site material is considered competent.

Recommended structural sections were calculated based on assumed TIs and our preliminary sampling and testing.

Terracon does not practice traffic engineering. We recommend that the project civil engineer or traffic engineer verify that the TIs and ADTT traffic indices used are appropriate for this project.

Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles. A maintenance program including surface sealing, joint cleaning and sealing, and timely repair of cracks and deteriorated areas will increase the pavement's service life. As an option, thicker sections could be constructed to decrease future maintenance.

Concrete for rigid pavements should have a minimum 28-day compressive strength of 4,000 psi, and be placed with a maximum slump of 4 inches. Although not required for structural support, a minimum 4-inchthick base course layer is recommended to help reduce potential for slab curl, shrinkage cracking, and subgrade pumping through joints. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. Joints should be sealed to prevent entry of foreign material and doweled where necessary for load transfer.

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

Openings in pavements, such as decorative landscaped areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. This is especially applicable for islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils. The civil design for the pavements with these conditions should include features to restrict or collect and discharge excess water from the islands. Examples of features are edge drains connected to the storm water collection system, longitudinal subdrains, or other suitable

outlets and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

Dishing in parking lots surfaced with ACC is usually observed in frequently-used parking stalls (such as near the front of buildings), and occurs under the wheel footprint in these stalls. The use of higher-grade asphalt cement, or surfacing these areas with PCC, should be considered. The dishing is exacerbated by factors such as irrigated islands or planter areas, sheet surface drainage to the front of structures, and placing the ACC directly on a compacted clay subgrade.

PCC pavement details for joint spacing, joint reinforcement, and joint sealing should be prepared in accordance with ACI 330 and ACI 325. PCC pavements should be provided with mechanically reinforced joints (doweled or keyed) in accordance with ACI 330.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2 percent.
- Subgrade and pavement surfaces should have a minimum 2 percent slope to promote proper surface drainage.
- Install below pavement drainage systems surrounding areas anticipated for frequent wetting.

- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

STORM WATER MANAGEMENT

Three in-situ infiltration tests (falling head borehole permeability) were performed at approximate depths of 5 and 10 feet bgs. The objective of the infiltration testing is to provide infiltration rates for designing the proposed infiltration system. A 2-inch thick, 3/8-inch gravel layer was placed in the bottom of each boring after the borings were drilled to investigate the soil profile.

Three-inch diameter perforated pipes were installed on top of the gravel layer. Gravel was used to backfill between the perforated pipes and the boring sidewall. The borings were then filled with water for a pre-soak period.

At the beginning of each test, the pipes were refilled with water and readings were taken at periodic time intervals as the water level dropped. The soil at the percolation test locations was classified in the field using a visual/manual procedure. The infiltration velocity is presented as the infiltration rate and is summarized in the following table. The infiltration rates provided do not include safety factors.

Test Location	Boring Depth (ft.) [1]	Test Depth Range (ft.) [1]	Soil Type	Percolation Rate (in./hr.)	Correlated Infiltration Rate (in./hr.) [2]
P-1	5	0 to 5	SM	37.0	1.5
P-2	5	0 to 5	SM	67.8	3.4
P-3	10	5 to 10	SW-SM	316.0	16.8

The above infiltration rates determined by the shallow percolation test method are based on field test results utilizing clear water. Infiltration rates can be affected by silt buildup, debris, degree of soil saturation, site variability and other factors. The rate obtained at specific location and depth is representative of the location and depth tested and may not be representative of the entire site. Application of an appropriate safety factor is prudent to account for subsoil inconsistencies, possible compaction related to site grading, and potential silting of the percolating soils, depending on the application.

The design engineer should also check with the local agency for the limitation of the infiltration rate allowed in the design. If the maximum allowable design infiltration rate is lower than the above recommended rate, the maximum allowable design infiltration rate should be used. The designer of the basins should also consider other possible site variability in the design.

The percolation test was performed with clear water, whereas the storm water will likely not be clear, but may contain organics, fines, and grease/oil. The presence of these deleterious materials will tend to decrease the rate that water percolates from the infiltration systems. Design of the storm water infiltration systems should account for the presence of these materials and should incorporate structures/devices to remove these deleterious materials.

Based on the soils encountered in our borings, we expect the percolation rates of the soils could be different than measured in the field due to variations in fines and gravel content. The design elevation and size of the proposed infiltration system should account for this expected variability in infiltration rates.

Infiltration testing should be performed after construction of the infiltration system to verify the design infiltration rates. It should be noted that siltation and vegetation growth along with other factors may affect the infiltration rates of the infiltration areas. The actual infiltration rate may vary from the values reported here. Infiltration systems should be located at least 10 feet from any existing or proposed foundation system.

CORROSIVITY

The following table lists the laboratory electrical resistivity (standard and as-received), chlorides, soluble sulfates, and pH testing results. These values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Boring	Depth (feet)	Soluble Sulfate (mg/kg)	Soluble Chloride (mg/kg)	Total Salts (mg/kg)	pH	Resistivity (as-received) (Ohm-cm)	Resistivity (saturated) (Ohm-cm)
B-3	0 to 5	22	23	327	9.37	29,100	2,813

Results of soluble sulfate testing indicate samples of the on-site soils tested possess negligible sulfate concentrations when classified in accordance with Table 4.3.1 of the ACI Design Manual. Concrete should be designed in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 4.

For protection against corrosion to buried metals, Terracon recommends that an experienced corrosion engineer be retained to design a suitable corrosion protection system for underground metal structures or components.

If corrosion of buried metal is critical, it should be protected using a non-corrosive backfill, wrapping, coating, sacrificial anodes, or a combination of these methods, as designed by a qualified corrosion engineer.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

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Aerial Imagery Examined

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Fairchild Imagery Collection (UCSB Library), black and white aerial photograph no. AXL 6W-27, dated June 23, 1959.

Fairchild Imagery Collection (UCSB Library), black and white aerial photograph no. AXL 3JJ-149 dated May 28, 1968.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Terracon conducted eleven soil-testing borings. These borings were planned to the following extended depths below existing grades.

Number of Borings	Boring Depth (feet) [1]	Location
2 (B-1 and B-4)	51 ½	Planned building footprint
2 (B-2 and B-3)	31 ½	Planned building footprint
4 (B-5 to B-8)	26 ½	Planned building footprint
3(P-1 to P-3)	5 and 10	Infiltration system

1. Below ground surface.

Boring Layout and Elevations: Unless otherwise noted, Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet) and approximate elevations were obtained by interpolation from the Google Earth. If elevations and a more precise boring layout are desired, we recommend borings be surveyed following completion of fieldwork.

Subsurface Exploration Procedures: We advance the borings with a truck-mounted drill rig using 8-inch-diameter hollow-stem augers. Both a standard penetration test (SPT) sampler (2-inch outer diameter and 1-3/8-inch inner diameter) and a modified California ring-lined sampler (3-inch outer diameter and 2-3/8-inch inner diameter) are utilized in our investigation. The penetration resistance is recorded on the boring logs as the number of hammer blows used to advance the sampler in 6-inch increments (or less if noted). The samplers are driven with an automatic hammer that drops a 140-pound weight 30 inches for each blow. After the required seating, samplers are advanced up to 18 inches, providing up to three sets of blowcounts at each sampling interval. The sampling depths, penetration distances, and other sampling information are recorded on the field boring logs. The recorded blows are raw numbers without any corrections for hammer type (automatic vs. manual cathead) or sampler size (ring sampler vs. SPT sampler). Relatively undisturbed and bulk samples of the soils encountered are placed in sealed containers and returned to the laboratory for testing and evaluation.

We observe and record groundwater levels during drilling and sampling. For safety purposes, all borings are backfilled with auger cuttings after their completion.

Our exploration team prepares field boring logs as part of the drilling operations. These field logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs are prepared from the field logs. The

final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

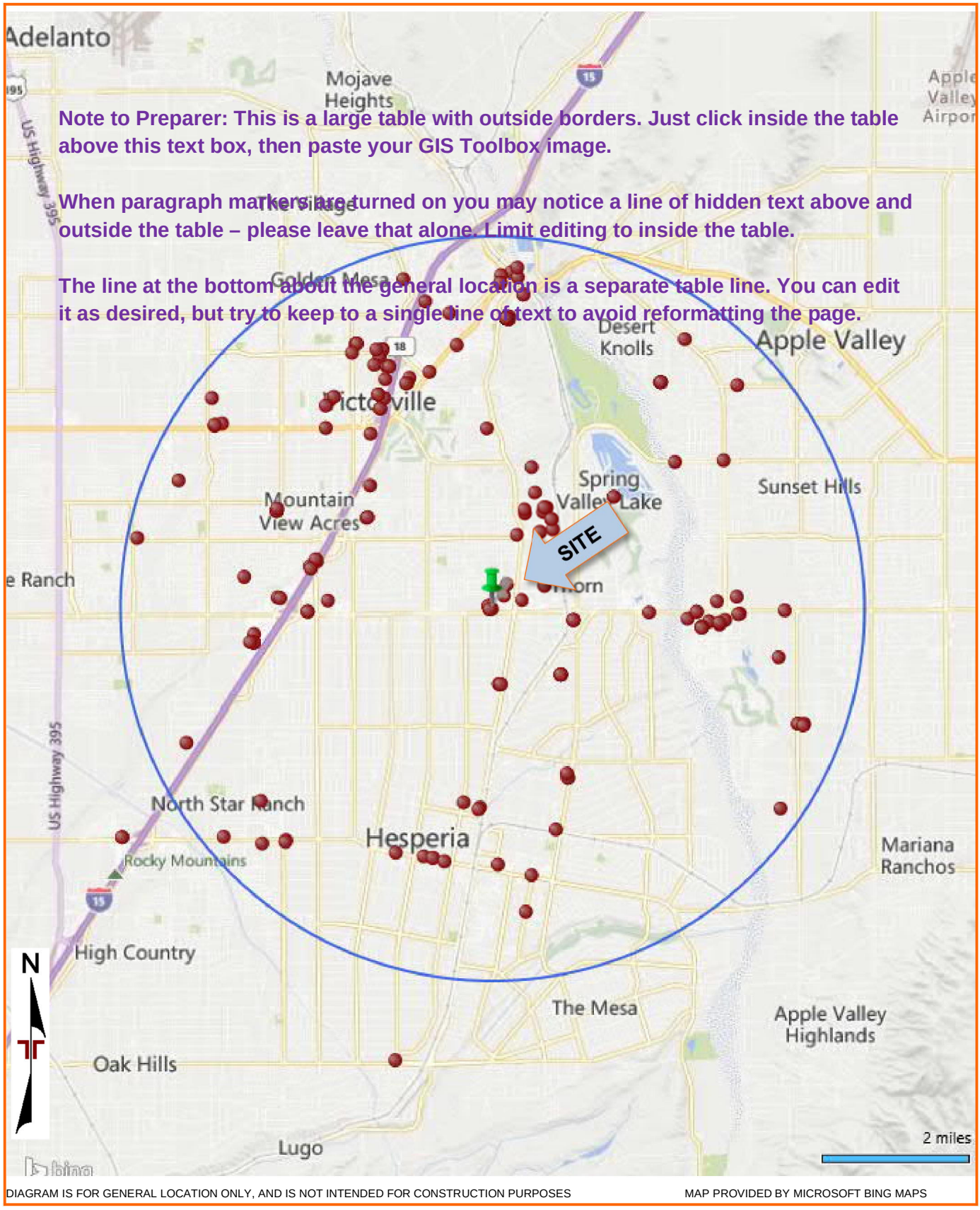
- Water (Moisture) Content of Soil by Mass
- Laboratory Determination of Density (Unit Weight) of Soil Specimens
- Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
- Hydro Consolidation test
- Modified Proctor test
- Plasticity Index test
- Corrosivity suite test

The laboratory testing program often included examination of soil samples by an engineer. Based on the material’s texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

SITE LOCATION AND EXPLORATION PLANS

SITE LOCATION

Proposed Desert Valley Hospital Addition ■ Victorville, San Bernardino County, California
March 6, 2023 ■ Terracon Project No. CB225235



Note to Preparer: This is a large table with outside borders. Just click inside the table above this text box, then paste your GIS Toolbox image.

When paragraph markers are turned on you may notice a line of hidden text above and outside the table – please leave that alone. Limit editing to inside the table.

The line at the bottom about the general location is a separate table line. You can edit it as desired, but try to keep to a single line of text to avoid reformatting the page.

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

Proposed Desert Valley Hospital Addition ■ Victorville, San Bernardino County, California
March 6, 2023 ■ Terracon Project No. CB225235

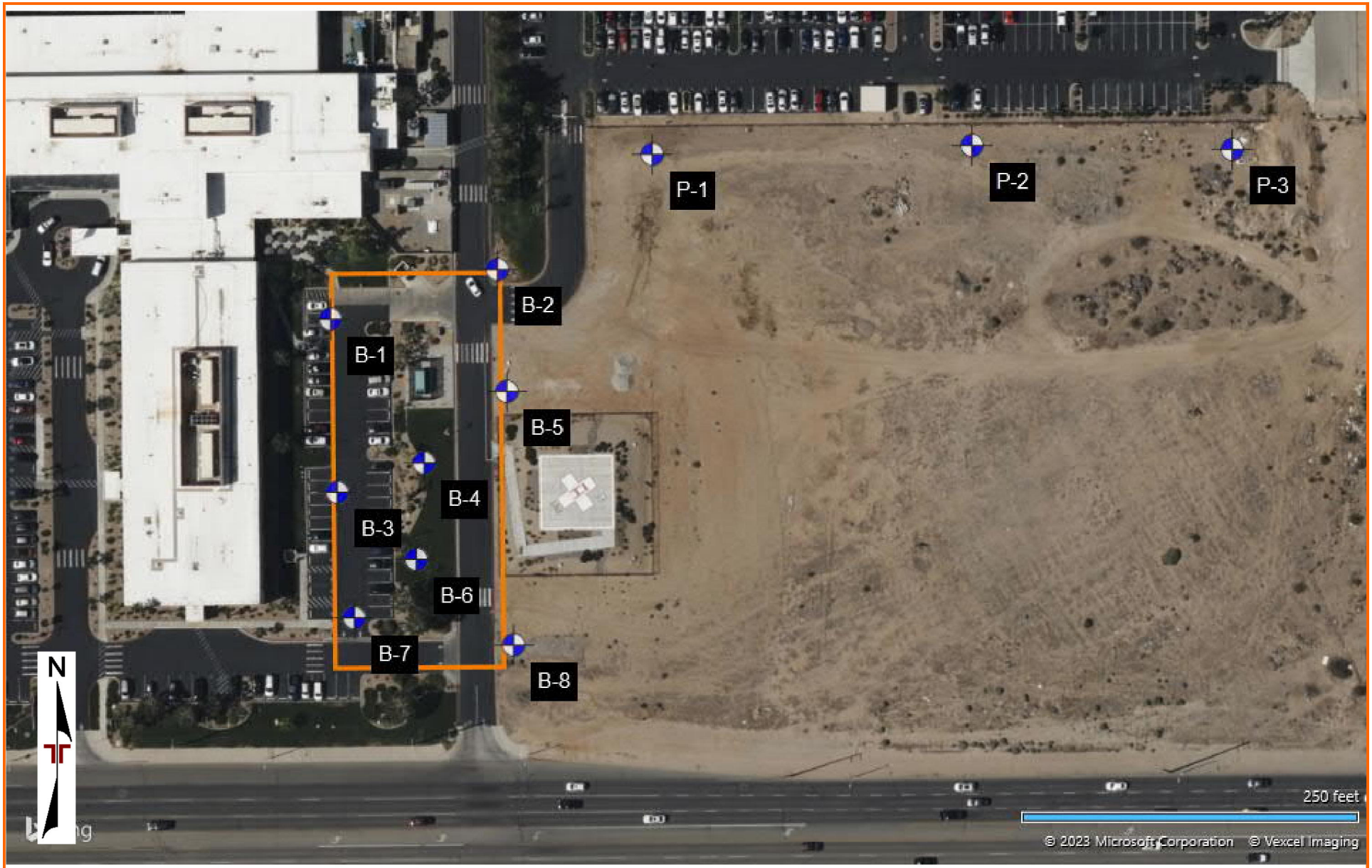


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MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

GEOLOGIC MAP

Proposed Desert Valley Hospital Addition ■ Victorville, San Bernardino County, California
March 6, 2023 ■ Terracon Project No. CB225235

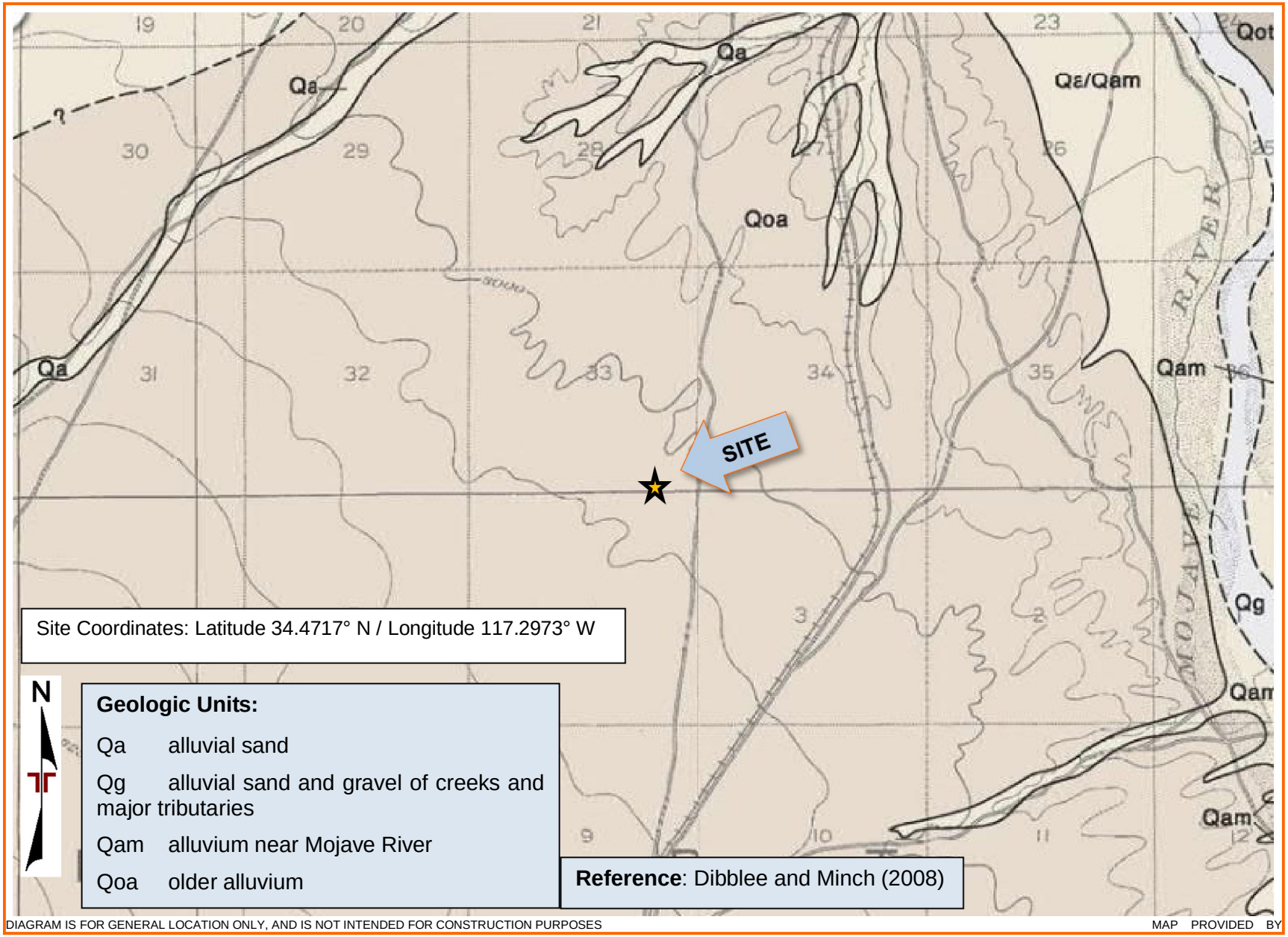


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MAP PROVIDED BY

REGIONAL FAULT MAP

Proposed Desert Valley Hospital Addition ■ Victorville, San Bernardino County, California
March 6, 2023 ■ Terracon Project No. CB225235

Terracon GeoReport

EXPLORATION PLAN

Reference: Jennings and Bryant (2010)

Geologic Time Scale			Age Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION	
						ON LAND	OFFSHORE
Quaternary	Late Quaternary	Holocene	200			Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
		Pleistocene	11,700			Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Late Pleistocene age.
	Early Quaternary		700,000			Undivided Quaternary faults show evidence of displacement during the last 1,600,000 years; possible exceptions area faults undifferentiated	Fault cuts strata of
Pre-Quaternary			1,600,000			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.
			4.5 billion (Age of earth)				

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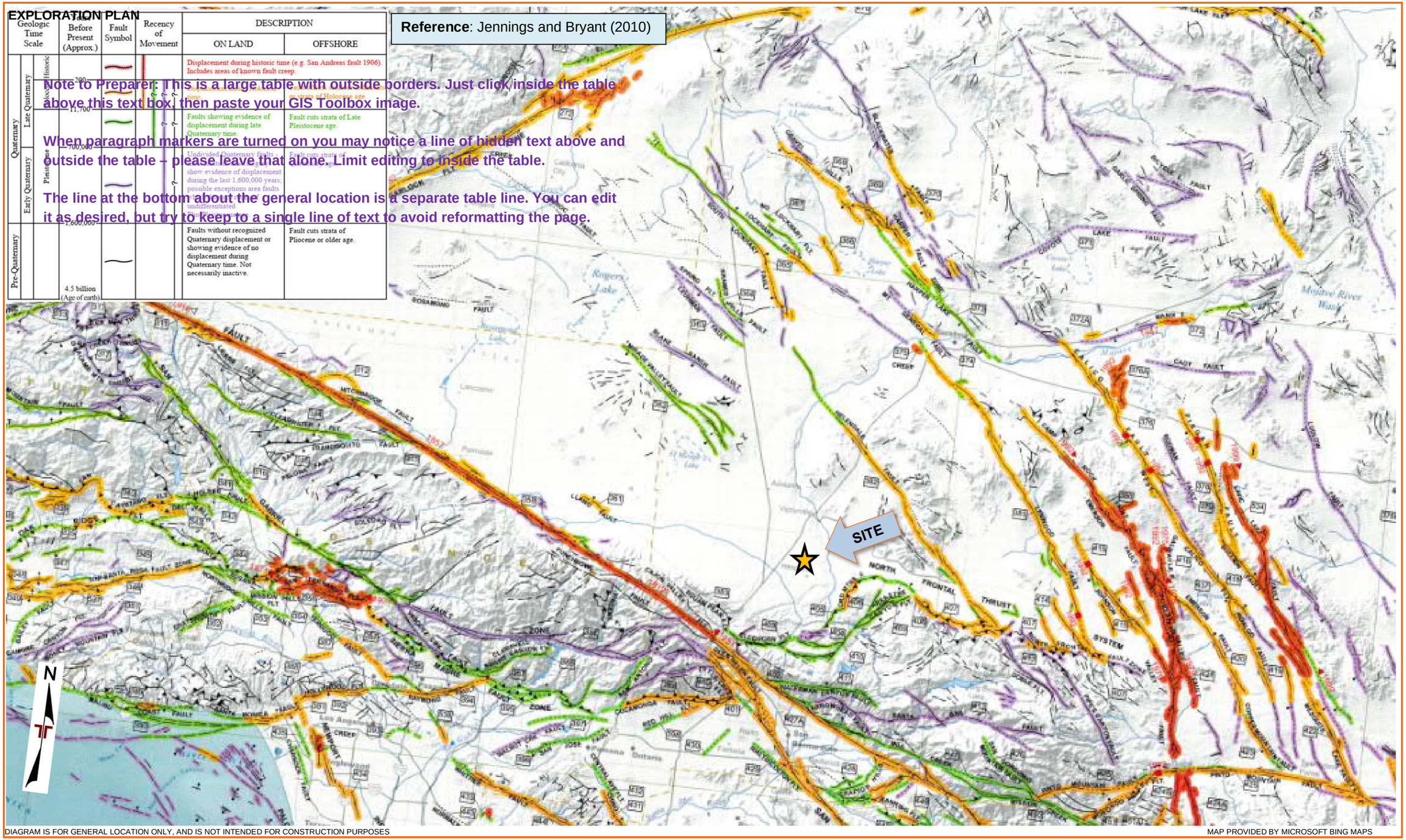
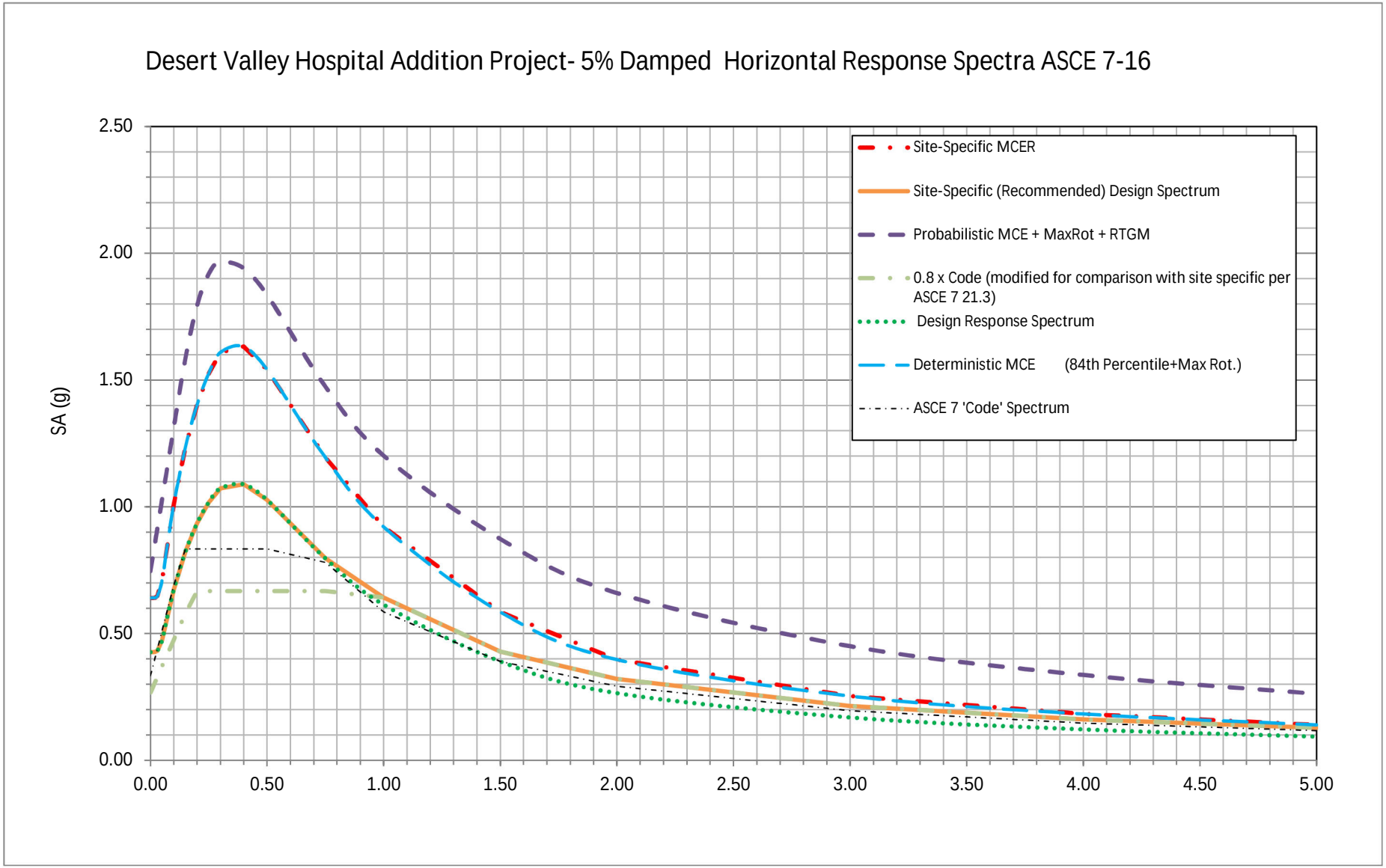


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MAP PROVIDED BY MICROSOFT BING MAPS



Source: USGS Earthquake Search https://earthquake.usgs.gov/earthquakes/search accessed January 2022.


Desert Valley Hospital Addition Project- 5% Damped Horizontal Response Spectra ASCE 7-16
SA (g)
2.50
2.00
1.50
1.00
0.50
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Site-Specific MCER
Site-Specific (Recommended) Design Spectrum
Probabilistic MCE + MaxRot + RTGM
0.8 x Code (modified for comparison with site specific per ASCE 7 21.3)
Design Response Spectrum
Deterministic MCE (84th Percentile+Max Rot.)
ASCE 7 'Code' Spectrum

Desert Valley Hospital Addition Project - Site-Specific Response Spectra ASCE 7-16							
Period (sec)	**Deterministic MCE (84th Percentile+Max Rot.)**	**Probabilistic MCE + MaxRot + RTGM**	**Site-Specific MCE_R**	**0.8 x Code (modified for comparison with site specific per ASCE 7 21.3)**	**Design Response Spectrum**	**Site-Specific (Recommended) Design Spectrum**	**ASCE 7 'Code' Spectrum**
0.000	0.640	0.746	0.640	0.267	0.427	0.427	0.334
0.010	0.641	0.803	0.641	0.288	0.427	0.427	0.369
0.020	0.641	0.859	0.641	0.308	0.427	0.427	0.405
0.030	0.648	0.916	0.648	0.329	0.432	0.432	0.441
0.050	0.711	1.029	0.711	0.371	0.474	0.474	0.512
0.075	0.864	1.171	0.864	0.423	0.576	0.576	0.601
0.100	1.010	1.313	1.010	0.475	0.673	0.673	0.690
0.150	1.235	1.585	1.235	0.579	0.823	0.823	0.834
0.200	1.403	1.794	1.403	0.667	0.935	0.935	0.834
0.250	1.526	1.919	1.526	0.667	1.017	1.017	0.834
0.300	1.609	1.965	1.609	0.667	1.073	1.073	0.834
0.400	1.633	1.941	1.633	0.667	1.088	1.088	0.834
0.500	1.541	1.836	1.541	0.667	1.027	1.027	0.834
0.750	1.195	1.474	1.195	0.667	0.797	0.797	0.780
1.000	0.921	1.202	0.921	0.642	0.614	0.642	0.585
1.500	0.585	0.873	0.585	0.428	0.390	0.428	0.390
2.000	0.397	0.660	0.397	0.321	0.265	0.321	0.293
3.000	0.253	0.450	0.253	0.214	0.169	0.214	0.195
4.000	0.183	0.336	0.183	0.161	0.122	0.161	0.146
5.000	0.140	0.262	0.140	0.128	0.093	0.128	0.117

Shahi & Baker (2014) Coefficients

Period	$Sa_{RotD100}/Sa_{RotD50}$
0.01	1.19
0.02	1.19
0.03	1.19
0.04	1.19
0.05	1.19
0.075	1.19
0.10	1.19
0.15	1.20
0.20	1.21
0.25	1.22
0.30	1.22
0.40	1.23
0.50	1.23
0.75	1.24
1.00	1.24
1.50	1.24
2.00	1.24
3.00	1.25
4.00	1.26
5.00	1.26

BORING LOG NO. B-1

PROJECT: Desert Valley Hospital Addition

CLIENT: Prime Healthcare Management Inc
Ontario, CA

SITE: 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.472° Longitude: -117.2974°

DEPTH	GRAPHIC LOG	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2		**ASPHALT**, 2" thickness								
0.7		**AGGREGATE BASE COURSE**, 6" thickness								
		POORLY GRADED SAND (SP), trace silt, brown								
5.0		**SILTY SAND (SM)**, light brown, medium dense	5			16-17-13	12	102		33
		loose				5-6-11	14	108		
10.0		**POORLY GRADED SAND WITH SILT (SP-SM)**, light brown, medium dense	10			11-17-27	4	116		
			15			5-10-9 N=19				6
20.0		**SILTY SAND (SM)**, brown, dense	20			5-12-18 N=30				
		medium dense	25			6-7-9 N=16				29
		medium dense	30			8-13-16 N=29				
			35							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

BORING LOG NO. B-1

PROJECT: Desert Valley Hospital Addition

CLIENT: Prime Healthcare Management Inc
Ontario, CA

SITE: 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.472° Longitude: -117.2974°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), brown, dense *(continued)* medium dense	40			7-10-16 N=26				
					9-18-31 N=49				29
		45			16-17-21 N=38				
		50			12-19-20 N=39				
	51.5								
	Boring Terminated at 51.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

BORING LOG NO. B-2

PROJECT: Desert Valley Hospital Addition

CLIENT: Prime Healthcare Management Inc
Ontario, CA

SITE: 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4721° Longitude: -117.297°

DEPTH	GRAPHIC LOG		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), brown, dense							
						8	125		
5		reddish brown			16-34-50	6	110		28
		brown			13-25-39	15	109		
10					16-21-26	1	119		12
10.0		**POORLY GRADED SAND WITH SILT (SP-SM)**, light brown, medium dense							
15					7-11-14 N=25				
20					7-9-11 N=20				
25.0		**SILTY SAND (SM)**, brown, medium dense							
25					5-8-15 N=23				35
30					3-6-9 N=15				
31.5		***Boring Terminated at 31.5 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

BORING LOG NO. B-3

PROJECT: Desert Valley Hospital Addition

CLIENT: Prime Healthcare Management Inc
Ontario, CA

SITE: 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4716° Longitude: -117.2974°

DEPTH	GRAPHIC LOG		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.1		**ASPHALT**, approximately 1.5" thick							
0.6		**AGGREGATE BASE COURSE**, approximately 6" thick							
		SILTY SAND (SM), brown very dense			6-50/6"				
5		dense			27-33-30	4	122		
7.5		**POORLY GRADED SAND (SP)**, trace silt, reddish brown, medium dense			11-18-21	8	125		
10.0		**SILTY SAND (SM)**, brown, medium dense			12-20-29	9	120		31
15		**POORLY GRADED SAND (SP)**, trace silt, tan, medium dense			7-11-13 N=24				
20.0		**SILTY SAND (SM)**, brown, medium dense			5-6-11 N=17				
25		dense			10-14-18 N=32				26
30		dense			10-15-19 N=34				
31.5		***Boring Terminated at 31.5 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

BORING LOG NO. B-4

PROJECT: Desert Valley Hospital Addition

CLIENT: Prime Healthcare Management Inc
Ontario, CA

SITE: 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4717° Longitude: -117.2972°

DEPTH	GRAPHIC LOG		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), brown, medium dense							
					20-16-26	8	113		31
5		reddish brown, dense			25-32-36	6	130		23
		brown, medium dense			16-16-14	24	101		
10.0									
10		**POORLY GRADED SAND WITH SILT (SP-SM)**, reddish brown, loose, soft			7-6-8				7
15		dense			13-15-15 N=30				
20.0									
20		**SILTY SAND (SM)**, brown, medium dense			7-8-9 N=17				21
25					3-5-8 N=13				
30.0									
30		**POORLY GRADED SAND (SP)**, trace silt, brown, medium dense			3-12-12 N=24				
35.0									
35									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

BORING LOG NO. B-4

PROJECT: Desert Valley Hospital Addition

CLIENT: Prime Healthcare Management Inc
Ontario, CA

SITE: 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4717° Longitude: -117.2972°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	WELL GRADED SAND WITH SILT (SW-SM), tan, dense				10-20-27 N=47				11
	40.0	40							
	SANDY SILT (ML), brown, stiff				3-5-9 N=14				
	very stiff	45			4-7-11 N=18				68
	50.0								
	POORLY GRADED SAND (SP), trace silt, brown, medium dense	50			13-11-15 N=26				
	51.5								
	Boring Terminated at 51.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

BORING LOG NO. B-5

PROJECT: Desert Valley Hospital Addition

CLIENT: Prime Healthcare Management Inc
Ontario, CA

SITE: 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4718° Longitude: -117.297°

DEPTH	GRAPHIC LOG	DESCRIPTION	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		POORLY GRADED SAND WITH SILT (SP-SM), reddish brown, medium dense							
5					6-14-19	4	111		
					12-21-21	2	114		
10		trace gravel			10-18-30	1	116		
15		dense			9-15-16 N=31				7
20		20.0 **SILTY SAND (SM)**, brown, medium dense			8-8-8 N=16				
25		26.5			8-12-13 N=25				
		Boring Terminated at 26.5 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

BORING LOG NO. B-6

PROJECT: Desert Valley Hospital Addition

CLIENT: Prime Healthcare Management Inc
Ontario, CA

SITE: 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4715° Longitude: -117.2972°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), trace gravel, brown, dense				14-37-50/6"				
	5.0	5			15-18-20				
	POORLY GRADED SAND WITH SILT (SP-SM), brown, medium dense				5-8-9				
	trace silt and gravel, loose	10			6-8-11				
		15			9-11-13 N=24				
	20.0	20			8-12-9 N=21				
	SILTY SAND (SM), trace gravel, brown, medium dense	25			5-7-9 N=16				
	26.5								
	Boring Terminated at 26.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 02-06-2023 | Boring Completed: 02-06-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

BORING LOG NO. B-7

PROJECT: Desert Valley Hospital Addition

CLIENT: Prime Healthcare Management Inc
Ontario, CA

SITE: 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4714° Longitude: -117.2973°

DEPTH		SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2	**ASPHALT**, approximately 1.5" thick						
0.7	**AGGREGATE BASE COURSE**, approximately 6" thick						
2.5	**SILTY SAND (SM)**, brown						
	POORLY GRADED SAND (SP), reddish brown, medium dense		7-17-20	5	117		
5			7-14-19	10	108		
			5-12-17	1	111		
10			13-17-24	4	104		
	loose		6-8-7				
15							
20.0							
	SILTY SAND (SM), brown, loose		4-6-8				44
20							
	medium dense		8-11-11				
25							
26.5	***Boring Terminated at 26.5 Feet***						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

BORING LOG NO. B-8

PROJECT: Desert Valley Hospital Addition

CLIENT: Prime Healthcare Management Inc
Ontario, CA

SITE: 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4713° Longitude: -117.2969°

DEPTH	GRAPHIC LOG	DESCRIPTION	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		POORLY GRADED SAND WITH SILT (SP-SM), trace gravel, light brown, medium dense							
					8-13-17	1			8
5		tan			9-11-16	2			
					10-18-23	1			
10					13-21-29	2	109		7
15					8-10-15				
20		20.0 **SILTY SAND (SM)**, brown, medium dense			7-10-14				24
25		25.0 **CLAYEY SAND (SC)**, dark brown, medium dense			6-11-15				
		26.5 ***Boring Terminated at 26.5 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

BORING LOG NO. P-1

PROJECT: Desert Valley Hospital Addition

CLIENT: Prime Healthcare Management Inc
Ontario, CA

SITE: 16850 Bear Valley Rd
Victorville, CA

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	See Exploration Plan Latitude: 34.4723° Longitude: -117.2966°								
	SILTY SAND (SM), light brown								25
	5.0	5							
	Boring Terminated at 5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

BORING LOG NO. P-2

PROJECT: Desert Valley Hospital Addition

CLIENT: Prime Healthcare Management Inc
Ontario, CA

SITE: 16850 Bear Valley Rd
Victorville, CA

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 34.4723° Longitude: -117.2958° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), light brown								
	5.0	5							
	Boring Terminated at 5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

BORING LOG NO. P-3

PROJECT: Desert Valley Hospital Addition

CLIENT: Prime Healthcare Management Inc
Ontario, CA

SITE: 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4723° Longitude: -117.2952°

GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		WELL GRADED SAND WITH SILT (SW-SM), reddish brown	5							7
	10.0	***Boring Terminated at 10 Feet***	10							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

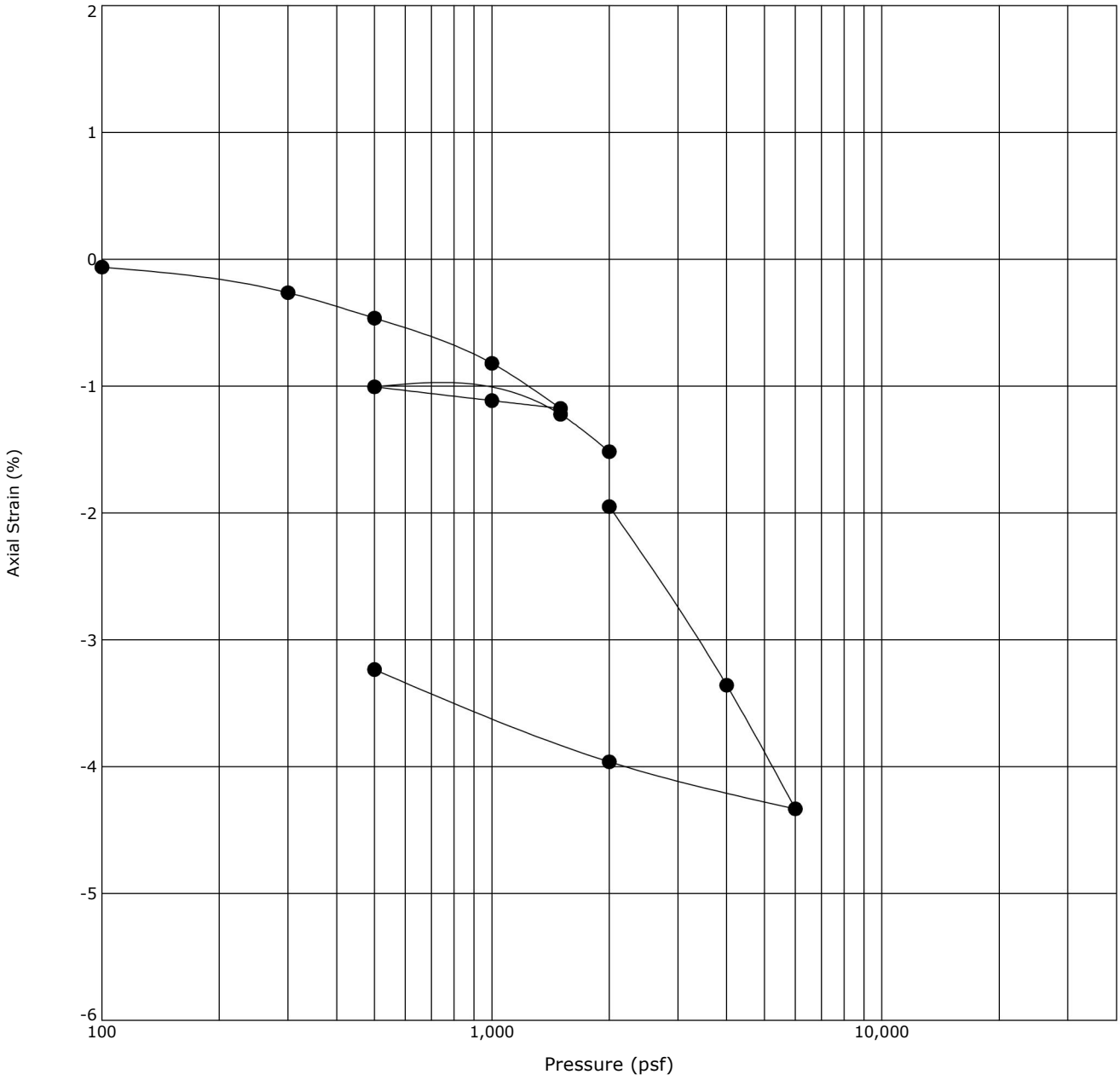
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Swell Consolidation Test

ASTM D2435



Boring ID		Depth (Ft)	Description	USCS	γ_d(pcf)	WC (%)
●	B-1	5 - 6.5			102	12.1

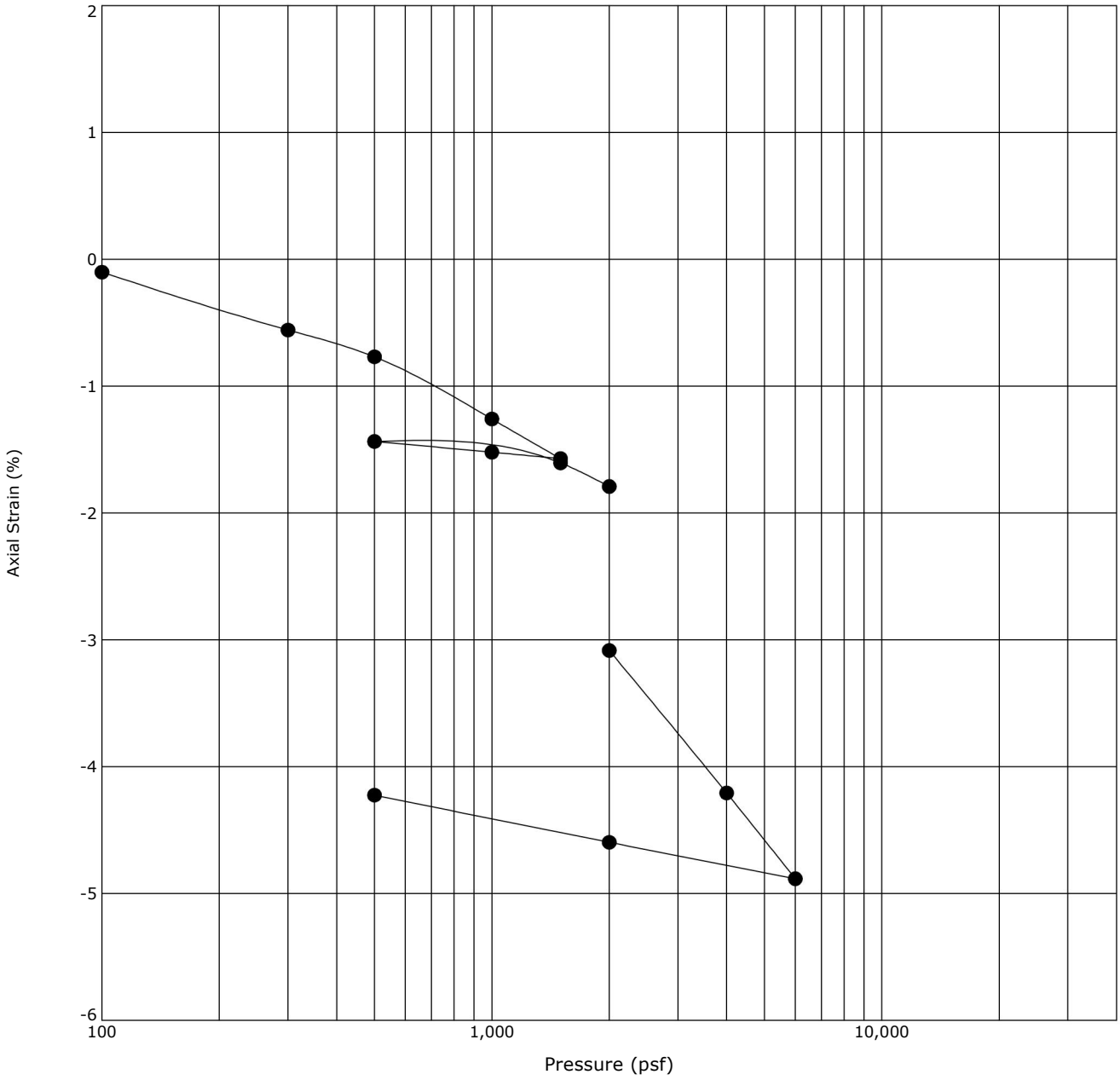
Notes:

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

1355 E Cooley Dr, Ste C
Colton, CA

Swell Consolidation Test

ASTM D2435



Boring ID		Depth (Ft)	Description	USCS	γ_d(pcf)	WC (%)
●	B-8	5 - 6.5				1.6

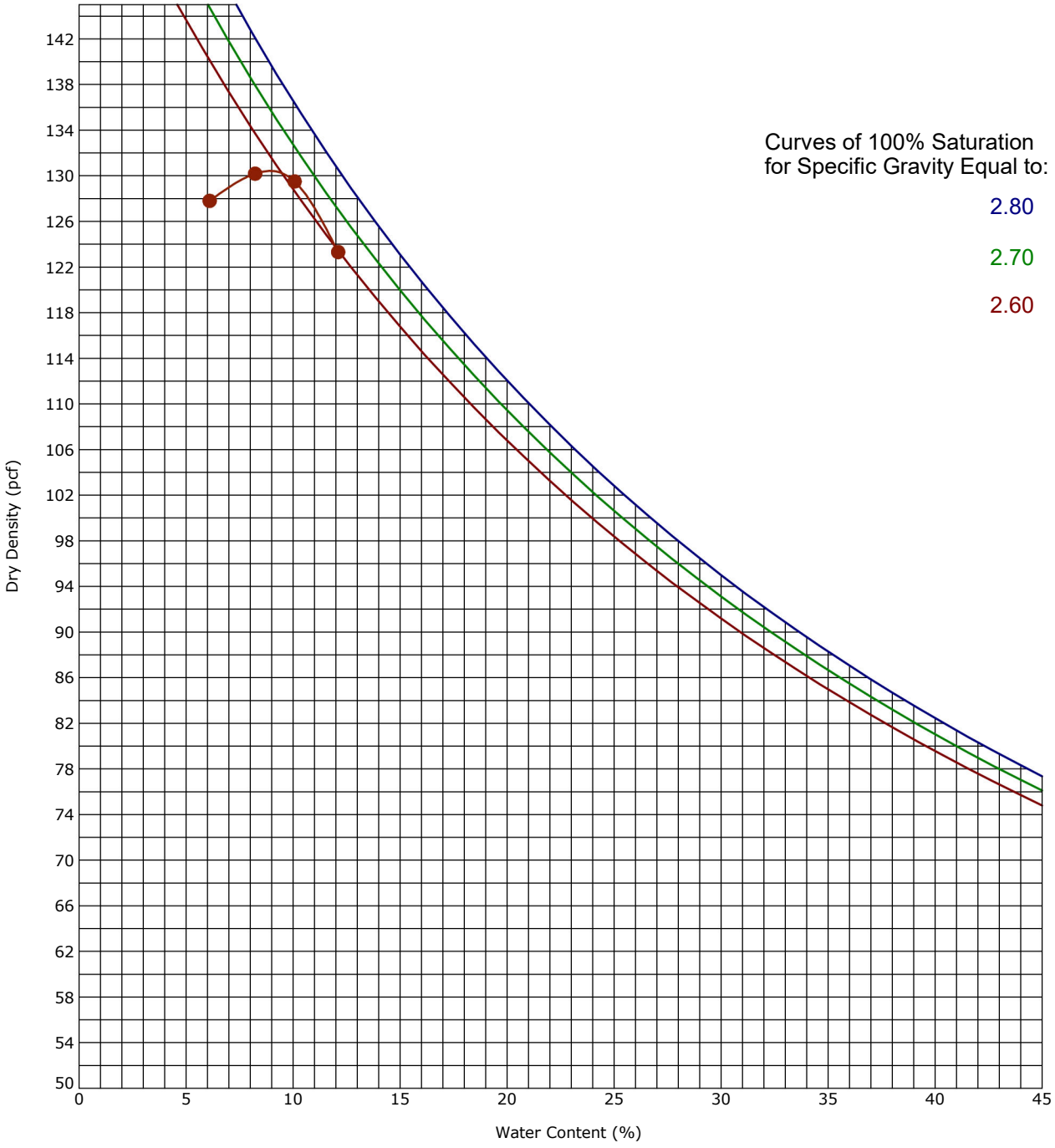
Notes:

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

1355 E Cooley Dr, Ste C
Colton, CA

Moisture-Density Relationship

ASTM D1557-Method D



Boring ID	Depth (Ft)	Description of Materials
B-1	0 - 5	POORLY GRADED SAND

Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
	0.0				ASTM D1557-Method D	130.4	8.9

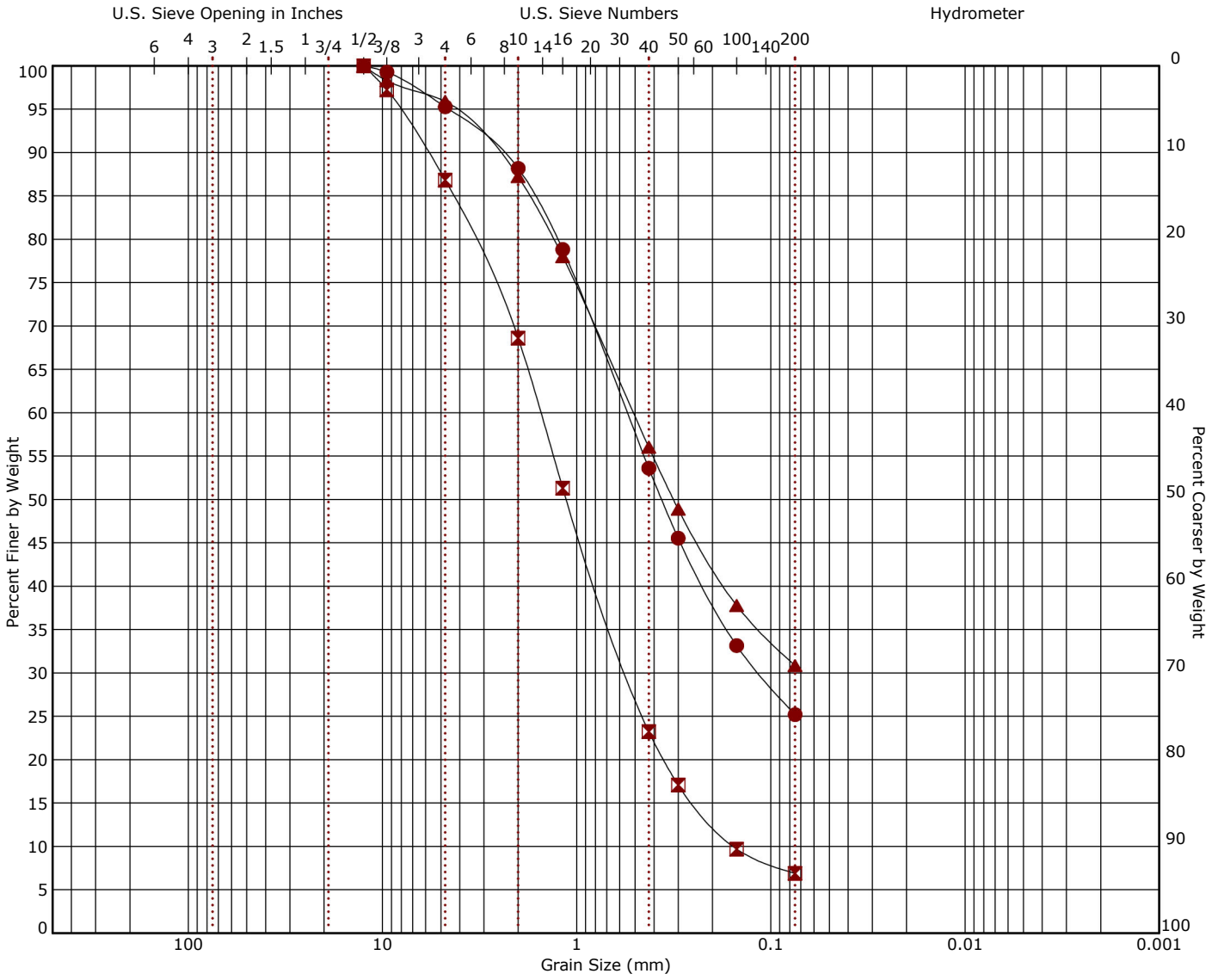
Laboratory tests are not valid if separated from original report.

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Grain Size Distribution

ASTM D422 / ASTM C136



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Boring ID		Depth (Ft)	USCS Classification	USCS	AASHTO	LL	PL	PI	Cc	Cu
●	P-1	0 - 5	SILTY SAND	SM						
⊠	P-3	5 - 10	WELL GRADED SAND WITH SILT	SW-SM					1.24	9.97
▲	B-4	0 - 5	SILTY SAND	SM						

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
●	P-1	0 - 5	12.5	0.551	0.114		0.0	4.7	70.1	25.2		
⊠	P-3	5 - 10	12.5	1.539	0.544	0.154	0.0	13.2	79.9	6.9		
▲	B-4	0 - 5	12.5	0.511			0.0	4.1	65.1	30.8		

Laboratory tests are not valid if separated from original report.

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client
Prime Healthcare Management Inc

Project
Desert Valley Hospital Addition

Sample Submitted By: Terracon (CB) **Date Received:** 1/24/2023 **Lab No.: 23-0069**

Results of Corrosion Analysis

Sample Number	--
Sample Location	B-3
Sample Depth (ft.)	0.0-5.0
pH Analysis, ASTM G 51	9.37
Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg)	22
Sulfides, AWWA 4500-S D, (mg/kg)	Nil
Chlorides, ASTM D 512, (mg/kg)	23
Red-Ox, ASTM G 200, (mV)	+732
Total Salts, AWWA 2540, (mg/kg)	327
As-Received Resistivity, ASTM G 57, (ohm-cm)	29100
Resistivity, ASTM G 57, (ohm-cm)	2813

Analyzed By:
Nathan Campo
Engineering Technician II

The tests were performed in general accordance with applicable ASTM and AWWA test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

Job No.: CB225235

PERCOLATION TEST DATA

BORING NUMBER: P-1
LOT No:
TRACT No:

CLIENT: Prime Healthcare Management Inc.
PROJECT: Desert Valley Hospital Addition

DATE OF DRILLING: January 13, 2023
DATE OF PRESOAK: January 13, 2023
DATE OF TEST: January 13, 2023
TESTED BY:

DEPTH BEFORE (ft.): 5.0
DEPTH AFTER (ft.): 5.0
PVC PIPE DIA. (in.): 3.0
PERC HOLE DIA. (in.): 8.0

Time Interval (min.)	Total Elapsed Time (min.)	Initial Water Level (in.)	Final Water Level (in.)	Change in Water Level (in.)	Initial Hole Depth (in.)	Final Hole Depth (in.)	Percolation Rate (in/hr)	Infiltration rate (Porchet Method) (in/hr)
15	15	2.5	22.0	19.5	60.0	60.0	78.0	3.14
15	30	4.0	13.0	9.0	60.0	60.0	36.0	1.35
10	40	9.0	17.0	8.0	60.0	60.0	48.0	1.96
10	50	9.0	15.0	6.0	60.0	60.0	36.0	1.44
10	60	9.0	15.0	6.0	60.0	60.0	36.0	1.44
10	70	9.0	15.5	6.5	60.0	60.0	39.0	1.57
10	80	9.0	15.0	6.0	60.0	60.0	36.0	1.44
				Average of last 3 readings:			37.00	1.48

Job No.: CB225235

PERCOLATION TEST DATA

BORING NUMBER: P-2
LOT No:
TRACT No:

CLIENT: Prime Healthcare Management Inc.
PROJECT: Desert Valley Hospital Addition

DATE OF DRILLING: January 13, 2023
DATE OF PRESOAK: January 13, 2023
DATE OF TEST: January 13, 2023
TESTED BY:

DEPTH BEFORE (ft.): 5.0
DEPTH AFTER (ft.): 5.0
PVC PIPE DIA. (in.): 3.0
PERC HOLE DIA. (in.): 8.0

Time Interval (min.)	Total Elapsed Time (min.)	Initial Water Level (in.)	Final Water Level (in.)	Change in Water Level (in.)	Initial Hole Depth (in.)	Final Hole Depth (in.)	Percolation Rate (in/hr)	Infiltration rate (Porchet Method) (in/hr)
10	10	21.0	60.0	39.0	60.0	60.0	234.0	21.77
3	13	23.0	30.8	7.8	60.0	60.0	155.0	8.83
10	23	16.0	36.0	20.0	60.0	60.0	120.0	6.67
10	33	16.0	30.0	14.0	60.0	60.0	84.0	4.31
10	43	17.0	29.0	12.0	60.0	60.0	72.0	3.69
10	53	17.0	28.0	11.0	60.0	60.0	66.0	3.34
10	63	17.0	29.0	12.0	60.0	60.0	72.0	3.69
11	64	16.0	28.0	12.0	60.0	60.0	65.5	3.27
				Average of last 3 readings:			67.82	3.44

Job No.: CB225235

PERCOLATION TEST DATA

BORING NUMBER: P-3
LOT No:
TRACT No:

CLIENT: Prime Healthcare Management Inc.
PROJECT: Desert Valley Hospital Addition

DATE OF DRILLING: January 13, 2023
DATE OF PRESOAK: January 13, 2023
DATE OF TEST: January 13, 2023
TESTED BY:

DEPTH BEFORE (ft.): 10.0
DEPTH AFTER (ft.): 10.0
PVC PIPE DIA. (in.): 3.0
PERC HOLE DIA. (in.): 8.0

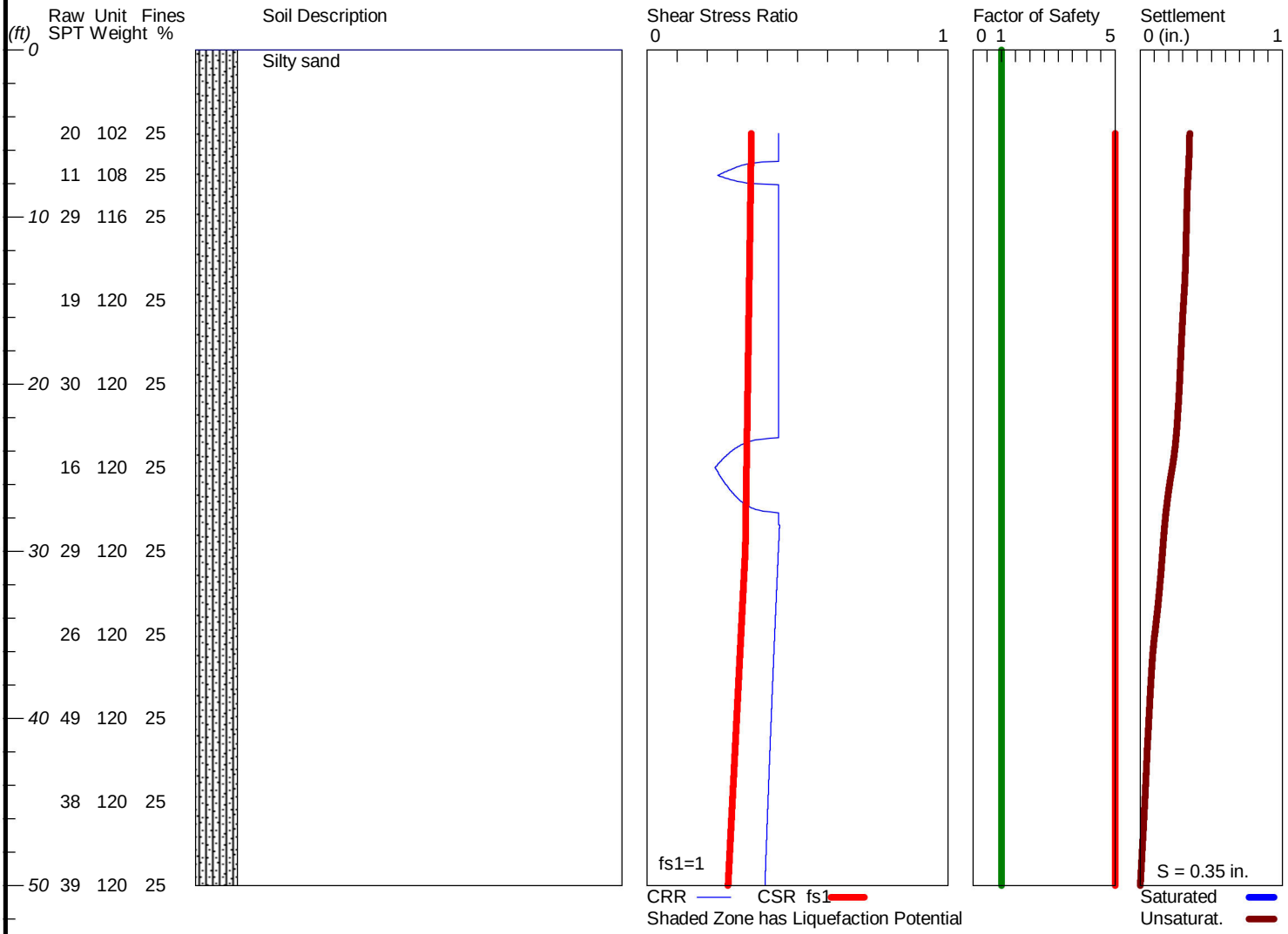
Time Interval (min.)	Total Elapsed Time (min.)	Initial Water Level (in.)	Final Water Level (in.)	Change in Water Level (in.)	Initial Hole Depth (in.)	Final Hole Depth (in.)	Percolation Rate (in/hr)	Infiltration rate (Porchet Method) (in/hr)
3	3	58.0	94.0	36.0	120.0	120.0	720.0	31.30
2	5	64.0	106.0	42.0	120.0	120.0	1260.0	68.11
10	15	58.0	113.0	55.0	120.0	120.0	330.0	18.08
10	25	58.0	112.0	54.0	120.0	120.0	324.0	17.51
10	35	58.0	112.0	54.0	120.0	120.0	324.0	17.51
10	45	58.0	110.0	52.0	120.0	120.0	312.0	16.42
10	55	58.0	111.0	53.0	120.0	120.0	318.0	16.96
10	62	58.0	111.0	53.0	120.0	120.0	318.0	16.96
				Average of last 3 readings:			316.00	16.78

LIQUEFACTION ANALYSIS

Desert Valley Hospital Addition

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

Magnitude=7.9
Acceleration=0.54g



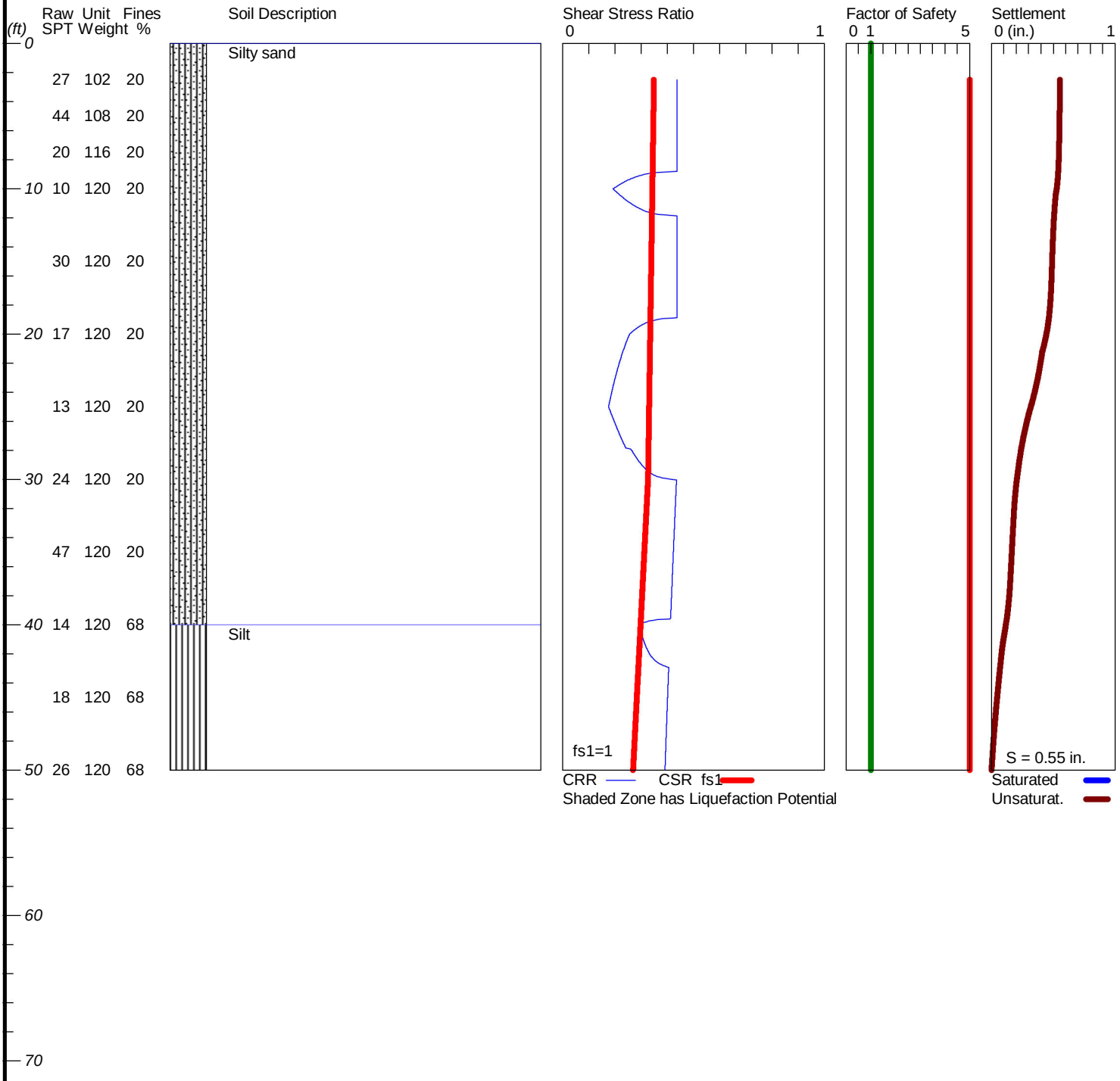
LiquefyPro CivilTech Software USA www.civiltech.com

LIQUEFACTION ANALYSIS

Desert Valley Hospital Addition

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

Magnitude=7.9
Acceleration=0.54g



LiquefyPro CivilTech Software USA www.civiltech.com

SUPPORTING INFORMATION

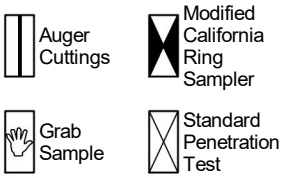
Contents:

General Notes
Unified Soil Classification System

GENERAL NOTES
DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Terracon GeoReport

SAMPLING



WATER LEVEL



Water Initially Encountered

Water Level After a Specified Period of Time

Water Level After a Specified Period of Time

Cave In Encountered

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

N	**Standard Penetration Test Resistance (Blows/Ft.)**
(HP)	**Hand Penetrometer**
(T)	**Torvane**
(DCP)	**Dynamic Cone Penetrometer**
UC	**Unconfined Compressive Strength**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium Stiff	0.50 to 1.00	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18
Very Dense	> 50	> 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42
			Hard	> 4.00	> 30	> 42

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or [Cc<1 or Cc>3.0] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or [Cc<1 or Cc>3.0] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" [J]		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay [K, L, M, N] / Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay [K, L, M, P] / Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

