APPENDIX H2

PRELIMINARY WATER QUALITY MANAGEMENT PLAN

MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

Big Box Retail - Hesperia

Prepared by:

Kimley-Horn & Associates, Inc

1100 Town and Country Road., Suite 700

Orange. CA 92868

714-939-1030

Submittal Date: 12/09/2024

Revision No. and Date: _____

Final Approval Date: _____

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for by Kimley Horn & Associates, Inc. The WQMP is intended to comply with the requirements of the city of Hesperia 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):	040506272; 040506273; 306448106; 306448107;	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			CUP: TBD

Owner's Signature			
Owner Name:			
Title			
Company			
Address			
Email			
Telephone #			
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	040506272; 040506273; 306448106; 306448107;	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			CUP: TBD

"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: Ryan Alvarez, P.E.		PE Stamp Below
Title	Project Manager	
Company	Kimley-Horn & Associates, Inc	
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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	Big Box Retail - Hesperia				
Project Owner Contact Name:					
Mailing Address:		E-mail Address:		Telephone:	
Permit/Application Number(s):	TBD		Tract/Parcel Map Number(s):	040506272; 040506273; 306448106; 306448107;	
Additional Information/ Comments:					
Description of Project:	Proposed big box retail wholesale center with associated fuel station and car wash. Project to include asphalt pavement, heavy duty concrete, and landscaping. To the north of Amargosa Road will consist of the big box retail store and its parking lot. Portion of this site will sheet flow to catch basins with filter inserts and then routed to the above ground infiltration system #1 located to the north. The rest of this site, along with all the project site south of Amargosa Road, will be routed to above ground infiltration system #2. The project site south of Amargosa Road will consist of the fuel stations and car wash. Stormwater will sheet flow to catch basins with filter inserts and will be routed through an oil water separator before entering the infiltration basin.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	N/A				

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 ft^2 or more of impervious surface collectively over entire site	☐ #2 Significant re-development involving the addition or replacement of 5,000 ft^2 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):	1,105,107	**3** Number of Dwelling Units:		**4** SIC Code:	5311

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 property owner (Owner) will be responsible for the long-term operations and maintenance of all WQMP stormwater facilities within the project site. The point of contact information is located under Section 1 of this WQMP.
The Owner will also be responsible for the implementation, long-term operations and maintenance, and funding of the WQMP stormwater facilities described hereon, and will amend this WQMP as needed to reflect any changes to the hydrologic conditions of the property. In addition, the Owner accepts full responsibility for the interim operation and maintenance of the WQMP stormwater facilities.

This WQMP will be reviewed with the facility operator, facility supervisors, employees, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity.

No onsite public facilities will be installed for this development but connection to existing public utilities will require the following publicly maintained offsite facilities:
Water
Sanitary Sewer

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 ☐	Pavement runoff.
Nutrients - Phosphorous	E ☒	N ☐	Primary sources of nutrients are fertilizers and eroded soils.
Nutrients - Nitrogen	E ☒	N ☐	Primary sources of nutrients are fertilizers and eroded soils.
Noxious Aquatic Plants	E ☒	N ☐	Source: Landscaping exists on site.
Sediment	E ☒	N ☐	Source: Construction and grading at landscaped areas.
Metals	E ☒	N ☐	Source: Brake pad dust and tire tread wear from vehicle traffic.
Oil and Grease	E ☒	N ☐	Source: Vehicular Traffic
Trash/Debris	E ☒	N ☐	Public waste, and general waste products on landscape.
Pesticides / Herbicides	E ☒	N ☐	At landscape areas only
Organic Compounds	E ☒	N ☐	At landscape areas only
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

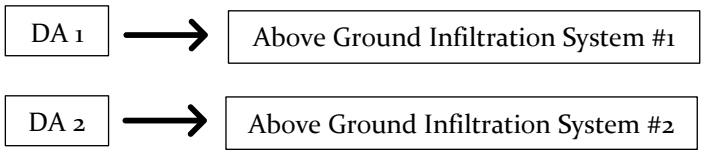
Describe the project site conditions that will facilitate the selection of BMPs through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (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 34.42956	Longitude -117.38034	Thomas Bros Map page 4,475

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
DA 1 to Above Ground Infiltration System #1	Portion of main store area draining via sheet flow and gutters to inlets with filter inserts and will be conveyed to an above ground retention basin #1.
DA 2 to Above Ground Infiltration System #2	Portion of main store are and entire fuel station and car wash area draining via sheet flow to catch basins with filter inserts to an oil water separator before entering the above ground retention basin #2.

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA 1			
1 DMA drainage area (ft^2)	396,425			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	II			
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	A			
5 Longest flowpath length (ft)	348			
6 Longest flowpath slope (ft/ft)	0.0067			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Desert Shrub			
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***	Poor			

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 2

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA 2			
1 DMA drainage area (ft^2)	708,682			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	II			
4 Hydrologic soil group *County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	A			
5 Longest flowpath length (ft)	544			
6 Longest flowpath slope (ft/ft)	0.0098			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Desert Shrub			
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*	Poor			

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	Oro Grande Wash Mojave River
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Oro Grand Wash – None Mojave River - None
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Oro Grand Wash – None Mojave River - Fluoride
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	☒	☐	The owner will provide educational information to stakeholders involved to inform the practices done for stormwater quality. This will be provided in the final water quality report
N2	Activity Restrictions	☒	☐	Activity restricions will be in place in order to limit the potential of pollutants in table 2.3.1. These restrictions can be reasonably placed by have certified persons implement necessary methods described in the practices in table 2.3.1
N3	Landscape Management BMPs	☒	☐	Landscaping and irrigation are to be maintained by the owner. Items such as fertilizers and pesticides are to be applied by certified persons. CASQA Handout "Landscape Management," is to be the minimum level of maintenance.
N4	BMP Maintenance	☒	☐	The owner is responsible for all BMPs maintenance set for non-structural and structural BMPs. See forms 4.1-1, 4.1-2, and 5-1 for list of applicable BMPs
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	There is no storage of hazardous waste.
N6	Local Water Quality Ordinances	☒	☐	The proposed project is to comply with San Bernardino County, and the City of Hesperia, and the Mojave Watershed prescribed water quality ordinances.
N7	Spill Contingency Plan	☐	☒	There is no outdoor hazardous material storage
N8	Underground Storage Tank Compliance	☒	☐	Fuel Underground storage will comply with statutes prescribed from the State Water Resources Control Board.
N9	Hazardous Materials Disclosure Compliance	☐	☒	Amount of hazardous material does not exceed levels of prescribed in the Hazardous Materials Division from San Bernadino County.

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	☐	☒	Project plans to be revied by local fire protection agency.
N11	Litter/Debris Control Program	☒	☐	Owner is responsible for training of employees servicing the site. Maintenance will be a regular practice weekly for all visible trash/debris.
N12	Employee Training	☒	☐	Training material will be provided by the owner.
N13	Housekeeping of Loading Docks	☒	☐	Loading dock areas will be cleared of trash, debris, and any other material weekly.
N14	Catch Basin Inspection Program	☒	☐	Per CASQA Handout MP-52, draining facilities will be inspected, and cleaned on an annual basis.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Street sweeping will be scheduled by the owner will be implemented per CASQA handout SC-43 or as deemed necessary.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Not applicable as this is not a public agency project.
N17	Comply with all other applicable NPDES permits	☒	☐	The project will comply with all other MPDES requirements. A Storm Water Pollution Prevention Plan will demonstrate other BMPs utilized to comply with 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)	☒	☐	All necessary signage will be implemented.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor material storage proposed.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash Storage will comply with the City of Hesperia Standards will be maintained properly to reduce pollution.
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)	☒	☐	Landscaping and irrigation will be maintained by the owner. Refer to landscaping plans to be revied by the local jurisdiction, City of Hesperia.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscape areas are to comply with the standard 1-2 inches difference in elevation to impervious areas.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☐	☒	No applicable as site is relatively flat.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☒	☐	Dock areas will be maintained in accordance with CASQA.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☒	☐	Maintenance bays will comply with CASQA
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☒	☐	Spill containment plans will comply with CASQA.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	Dock areas will be maintained in accordance with CASQA.

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 washing on this project.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☒	☐	Fuel station area will comply with standards prescribed in CASQA.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	Not appliable as site is relatively flat.
S14	Wash water control for food preparation areas	☒	☐	Wash water control will be properly implemented. See MEP plans for more details.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☒	☐	Car wash will comply with CASQA.

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: Landscaping will be provided throughout the site to comply with local jurisdiction requirements.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: Landscape and aboveground retention basins will be utilized as retention is feasible due to the underlying Soil type A.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: Increase of impervious areas will change with the proposed project.
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: Roof drainage is routed to infiltration BMPs
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: Above ground infiltration basins are utilized.
Protect existing vegetation and sensitive areas: Yes ☒ No ☐ Explanation: See landscaping plans where appliable.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☒ No ☐ Explanation: See landscaping plans where appliable.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Construction to minimize compaction.

Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: Not appliable as increase of impervious surface is best conveyed through outlets and storm drain piping.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: Landscaping will be marked during construction.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation: Above ground retention basins are utilized for infiltration.
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☐ No ☒ Explanation: There are no adjacent streams to this site.

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): 396,425	[2] Imperviousness after applying preventative site design practices (Imp%): 80.5%	[3] Runoff Coefficient (Rc): 0.605 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
[4] Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.411 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
[5] Compute P_6, Mean 6-hr Precipitation (inches): 0.508 *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): 19,961 *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 4.2-11 LID BMP Performance Criteria for Design Capture Volume (DA 2)		
[1] Project area DA 2 (ft^2): 708,682	[2] Imperviousness after applying preventative site design practices (Imp%): 45.2%	[3] Runoff Coefficient (Rc): 0.452 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
[4] Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.411 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
[5] Compute P_6, Mean 6-hr Precipitation (inches): 0.508 *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): 26,645 *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** 95,052 *Form 4.2-3 Item 12*	**2** 20.45 *Form 4.2-4 Item 13*	**3** 26.63 *Form 4.2-5 Item 10*
Post-developed	**4** 312,513 *Form 4.2-3 Item 13*	**5** 8.59 *Form 4.2-4 Item 14*	**6** 57.27 *Form 4.2-5 Item 14*
Difference	**7** *217,461* *Item 4 – Item 1*	**8** *11.86* *Item 2 – Item 5*	**9** *30.64* *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *229%* *Item 7 / Item 1*	**11** *58%* *Item 8 / Item 2*	**12** *115%* *Item 9 / Item 3*

Forms 4-2.3 to 4-2.5 omitted and values from AES.

AES is a computer software analysis that that can be utilized to assess HCOC and replace Forms 4.2-3 through 4.2-5.

The methodology for the program is based off the San Bernardino County Hydrology Manual. A HCOC summary is provided on Pg. 4-11 and the calculations can be found in Section 6.5.

HCOC Summary

	$Tc_{10\text{-}Yr}$ (Min)	$Q_{10\text{-}Yr}$ (CFS)	$V_{10\text{-}Yr,\ 24\text{-}Hr}$ (CF)
Pre-Development	20.45	26.63	95,052
Post-Development	8.59	57.27	312,513
HCOC Requirement *(0.95*Post-Pre)*	10.84	27.78	201,835
Basin Requirement	19.43 *(Min TC allowed for post-development conditions w/ Basin*	29.49 *(Max allowable flow for a 10-year storm)*	201,835 *(Required onsite retention)*

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

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 1 DMA A Roof Drains	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)	163,829		
3 Ratio of pervious area receiving runoff to impervious area	0.47		
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*	3,208		
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 3,208 $V_{retention}$ *=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)*			

Form 4.3-2 Site Design BMPs

13 Runoff volume retention from on-lot infiltration (ft^3): *$V_{retention}$ =Sum of Item 12 for all BMPs*

Form 4.3-2 cont. Site Design BMPs

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.

Form 4.3-3 Infiltration LID BMP - including underground BMPs

1 Remaining LID DCV not met by site design BMP (ft^3): 0 *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 Above Ground Retention Basin	DA 2 DMA 2 Above Ground Retention Basin	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*	4.4	4.4	
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3	3	
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.46	1.46	
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48	48	
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	5.8	5.8	
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	5.8	5.8	
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*	14,311	21,565	
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	N/A	
10 Amended soil porosity	N/A	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	N/A	
12 Gravel porosity	N/A	N/A	
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	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))]*	79,489	132,252	
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	N/A	N/A	

16 Total Retention Volume from LID Infiltration BMPs: 211,741 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 106% *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

N/A

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): *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.*		

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 (Total)

1 Total LID DCV for the Project (ft^3): 46,606 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design BMP (ft^3): 0 *Copy Item18 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 211,741 *Copy Item 16 in Form 4.3-3*

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-4*

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *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 (Total)

1 Volume reduction needed for hydromodification performance criteria (ft^3): 201,835 *(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): 211,741 *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): 0 *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site BMPs (ft^3): N/A

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
Landscape Areas	Owner	Mow, weed, trim, and remove accumlation of trash and debris	Twice a month
Irrigation Systems	Owner	Raplce/repair leaking or broken sprinklers	As needed
Infiltration Systems	Owner	Remove accumulation of trash and debris, and sediment accumulation at the start and end of the wet season	Semi-annual at the beginning and end of the wet season
Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	Owner	Paved with an impervious surface, designed not to allow run-on from adjoining areas, designed to divert drainage from adjoining roofs and pavements diverted around the area, screened, or walled to prevent off-site transport of trash	Ongoing
Vacuum Sweeping of Private Streets and Parking Lots	Owner	All landscape maintenance contractors will be required to sweep up all landscape cutting, mowings, and fertilizer materials off paved areas weekly and dispose of properly. Parking areas and driveways will be swept monthly by sweeping contractor.	Monthly

Oil Water Separator	Owner	Pump-out liquid contents of OWS sediment chamber, gauge the level of sand, dirt, or debris with gauge stick. Remove accumulated waste with a suction hose.	Annualy

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

6.4.1 Vicinity Map
6.4.2 NOAA Atlas Table
6.4.3 BMP Sizing Calculations
6.4.4 HCOC Calculations
6.4.5 Geotechnical Report
6.4.6 Educational Materials

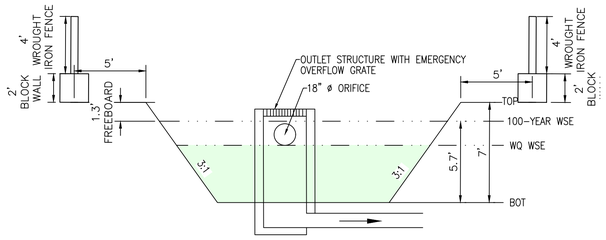
Section 6.1 Site and Drainage Plan

CITY OF HESPERIA

WQMP BMP SITE EXHIBIT

FOR

APN 0405-062-72 & 73



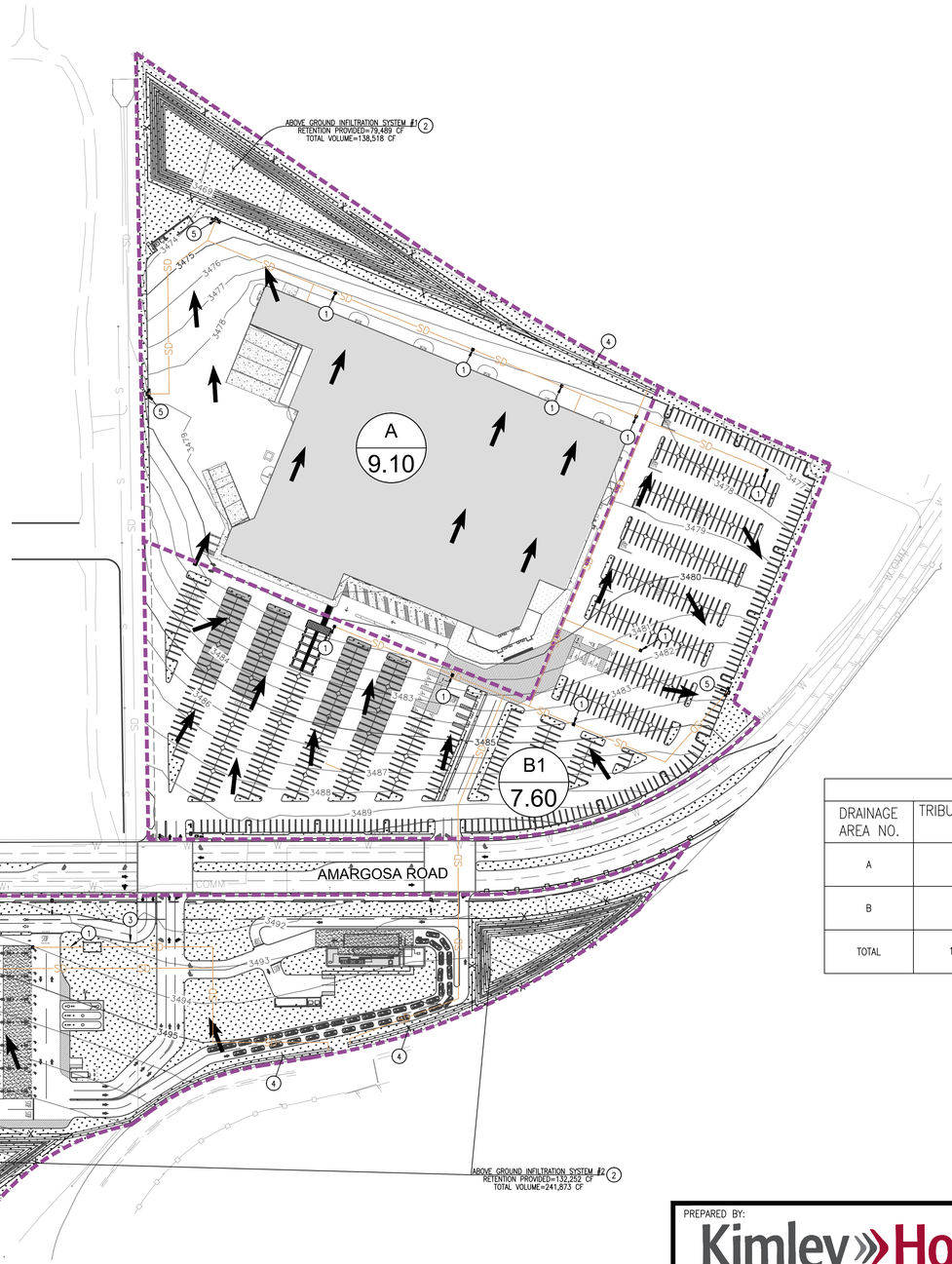
ABOVE INFILTRATION SYSTEM #1 SECTION

NTS



ABOVE INFILTRATION SYSTEM #2 SECTION

NTS



LEGEND:

- DRAINAGE AREA BOUNDARY
- 3440 — PROPOSED CONTOUR ELEVATION
- SD — PROPOSED STORMWATER LINE
- PROPOSED FLOW DIRECTION ARROW
- X / XXX — DRAINAGE AREA DESIGNATION / AREA (AC)
- BUILDING AREA
- LANDSCAPE

DRAINAGE NOTES:

1. PROPOSED CATCH BASIN
2. PROPOSED ABOVE GROUND INFILTRATION BASIN
3. PROPOSED OIL AND WATER SEPARATOR
4. PROPOSED SWALE
5. PROPOSED CURB OPENING CATCH BASIN

HYDROLOGY INFORMATION

SITE AREA:	25.37 ACRES	
SOIL TYPE:	A	(NRCS WEB SOIL SURVEY)
IMPERVIOUS:	71%	(PER CALCULATIONS)
ISOHYETALS:	0.411 INCH	(2-YEAR, 1-HR)
	1.18 INCH	(100-YEAR, 1-HR)
CURVE NUMBER	32	(SOIL GROUP A)
FREQUENCY:	10-YEAR	(FOR STORMWATER QUALITY)
	100-YEAR	(FOR STORM DRAIN DESIGN)
METHOD:	SAN BERNARDINO COUNTY HYDROLOGY MANUAL	

STRUCTURAL & NON-STRUCTURAL SOURCE CONTROL BMPS:

- S1 – STORM DRAIN SIGNAGE (SD-13)
- S3 – TRASH STORAGE AREAS (SD-32)
- S4 – EFFICIENT IRRIGATION SYSTEMS (SD-12)
- S5 – FINISH GRADE OF LANDSCAPE AREAS AT MINIMUM 2" BELOW ADJACENT TOP OF CURB, SIDEWALK, OR PAVEMENT.
- S7 – COVERED DOCK AREAS
- S8 – COVERED MAINTENANCE BAYS
- S9 – VEHICLE WASH AREAS
- N1 – EDUCATION MATERIAL ON STORMWATER BMPS AND TRAINING
- N2 – ACTIVITY RESTRAINTS
- N3 – LANDSCAPE MANAGEMENT BMPS
- N4 – BMP MAINTENANCE
- N11 – LITTER/DEBRIS CONTROL
- N12 – EMPLOYEE TRAINING
- N14 – CATCH BASIN INSPECTION PROGRAM
- N15 – VACUUM SWEEPING OF PRIVATE STREETS AND PARKING LOTS

HYDROLOGY SUMMARY

DRAINAGE AREA NO.	TRIBUTARY AREA (SF)	TRIBUTARY AREA (AC)	IMPERVIOUS RATIO	Q_{100} (CFS)	V_{100} (CF)	RETENTION PROVIDED (CF)	STORAGE PROVIDED (CF)
A	396,425	9.10	0.81	37.08	217,630	79,489 (ABOVE GROUND INFILTRATION SYSTEM #1)	138,518 (ABOVE GROUND INFILTRATION SYSTEM #1)
B	708,682	16.27	0.65	61.52	391,792	132,252 (ABOVE GROUND INFILTRATION SYSTEM #2)	241,873 (ABOVE GROUND INFILTRATION SYSTEM #2)
TOTAL	1,105,107	25.37	0.71	98.60	609,422	211,741 (ABOVE GROUND INFILTRATION SYSTEM #1 AND #2)	380,391 (ABOVE GROUND INFILTRATION SYSTEM #1 AND #2)

NORTH

GRAPHIC SCALE IN FEET
0 50 100 200

SCALE: 1" = 100'
WHEN PRINTED AT FULL SIZE 24"X36"

PREPARED BY:
Kimley»Horn

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1100 W TOWN AND COUNTRY ROAD,SUITE 700,
ORANGE, CA 92868
PHONE: 714-939-1030 FAX: 714-938-9488
WWW.KIMLEY-HORN.COM

WQMP BMP SITE EXHIBIT

APN 0405-062-72 & 73

CITY OF HESPERIA

DATE: DEC 2024

SHEET 1 OF 1

Plotted By: emelissa.rosas
Plot Date/Time: 12/9/2024 10:40:24 AM
File Name: C:\Users\emelissa.rosas\Kimley-Horn and Associates, Inc\Documents - CITY OF HESPERIA\WQMP BMP SITE EXHIBIT.dwg

12/09/2024

6.2 Electronic Data Submittal

To be provided in Final Engineering

6.3 Post Construction

To be provided in Final Engineering

6.4 Other Supporting Documentation

6.4.1 Vicinity Map

6.4.2 NOAA Atlas Table

6.4.3 BMP Sizing Calculations

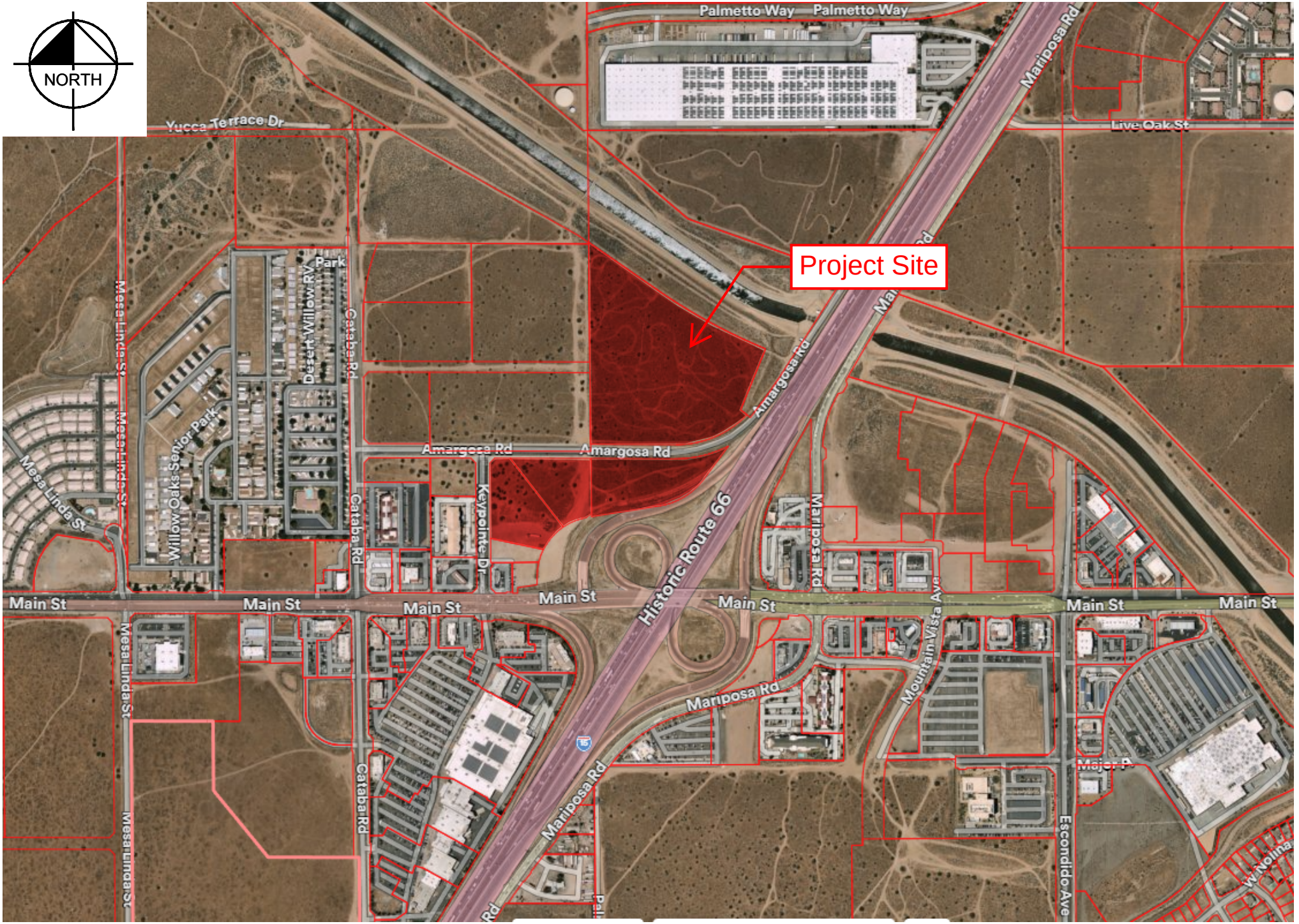
6.4.4 HCOC Calculations

6.4.5 Geotechnical Report

6.4.6 Educational Materials

6.4.1 Vicinity Map

VICINITY MAP



6.4.2 NOAA Atlas Table

NOAA Atlas 14, Volume 6, Version 2 BALDY MESA COUNTY YARD #1
Station ID: 79-6383
Location name: Victorville, California, USA*
Latitude: 34.4683°, Longitude: -117.3932°
Elevation:
Elevation (station metadata): 3320 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	**0.078** (0.064-0.095)	**0.113** (0.093-0.138)	**0.159** (0.131-0.195)	**0.196** (0.160-0.243)	**0.247** (0.195-0.316)	**0.285** (0.221-0.373)	**0.324** (0.245-0.434)	**0.365** (0.268-0.502)	**0.418** (0.295-0.600)	**0.460** (0.313-0.683)
10-min	**0.111** (0.092-0.136)	**0.162** (0.134-0.198)	**0.228** (0.188-0.280)	**0.281** (0.230-0.348)	**0.354** (0.280-0.452)	**0.409** (0.317-0.534)	**0.465** (0.351-0.622)	**0.523** (0.384-0.719)	**0.600** (0.422-0.860)	**0.660** (0.449-0.979)
15-min	**0.135** (0.111-0.165)	**0.196** (0.162-0.240)	**0.276** (0.227-0.338)	**0.340** (0.278-0.421)	**0.428** (0.338-0.547)	**0.495** (0.383-0.646)	**0.562** (0.425-0.752)	**0.632** (0.464-0.869)	**0.725** (0.511-1.04)	**0.798** (0.543-1.18)
30-min	**0.206** (0.171-0.252)	**0.300** (0.248-0.367)	**0.422** (0.348-0.518)	**0.521** (0.426-0.644)	**0.655** (0.517-0.837)	**0.757** (0.586-0.988)	**0.861** (0.650-1.15)	**0.967** (0.710-1.33)	**1.11** (0.782-1.59)	**1.22** (0.831-1.81)
60-min	**0.283** (0.234-0.345)	**0.411** (0.339-0.503)	**0.578** (0.476-0.709)	**0.714** (0.583-0.882)	**0.897** (0.709-1.15)	**1.04** (0.803-1.35)	**1.18** (0.890-1.58)	**1.32** (0.973-1.82)	**1.52** (1.07-2.18)	**1.67** (1.14-2.48)
2-hr	**0.398** (0.329-0.487)	**0.543** (0.448-0.664)	**0.739** (0.608-0.906)	**0.903** (0.738-1.12)	**1.14** (0.897-1.45)	**1.32** (1.02-1.72)	**1.51** (1.14-2.02)	**1.72** (1.26-2.36)	**2.00** (1.41-2.87)	**2.23** (1.52-3.31)
3-hr	**0.503** (0.416-0.614)	**0.672** (0.555-0.822)	**0.906** (0.746-1.11)	**1.10** (0.903-1.37)	**1.39** (1.10-1.78)	**1.62** (1.26-2.12)	**1.87** (1.41-2.50)	**2.14** (1.57-2.94)	**2.51** (1.77-3.60)	**2.82** (1.92-4.19)
6-hr	**0.691** (0.571-0.844)	**0.914** (0.755-1.12)	**1.23** (1.01-1.51)	**1.51** (1.23-1.86)	**1.91** (1.51-2.45)	**2.25** (1.74-2.94)	**2.61** (1.97-3.50)	**3.01** (2.21-4.15)	**3.60** (2.53-5.16)	**4.09** (2.78-6.07)
12-hr	**0.861** (0.712-1.05)	**1.19** (0.982-1.45)	**1.66** (1.36-2.03)	**2.06** (1.68-2.55)	**2.66** (2.10-3.40)	**3.16** (2.44-4.12)	**3.70** (2.79-4.95)	**4.30** (3.16-5.91)	**5.17** (3.64-7.41)	**5.90** (4.02-8.76)
24-hr	**1.18** (1.05-1.36)	**1.71** (1.51-1.97)	**2.45** (2.16-2.83)	**3.10** (2.72-3.62)	**4.06** (3.44-4.89)	**4.85** (4.03-5.96)	**5.71** (4.62-7.19)	**6.65** (5.24-8.62)	**8.03** (6.07-10.8)	**9.18** (6.71-12.8)
2-day	**1.27** (1.13-1.46)	**1.82** (1.61-2.10)	**2.60** (2.30-3.01)	**3.30** (2.89-3.84)	**4.32** (3.66-5.20)	**5.18** (4.30-6.36)	**6.11** (4.95-7.70)	**7.15** (5.63-9.26)	**8.68** (6.56-11.7)	**9.97** (7.28-13.9)
3-day	**1.36** (1.20-1.56)	**1.92** (1.70-2.22)	**2.73** (2.41-3.16)	**3.45** (3.02-4.02)	**4.52** (3.83-5.44)	**5.42** (4.49-6.66)	**6.40** (5.18-8.06)	**7.49** (5.90-9.70)	**9.11** (6.89-12.3)	**10.5** (7.66-14.6)
4-day	**1.46** (1.30-1.69)	**2.06** (1.83-2.38)	**2.92** (2.58-3.38)	**3.68** (3.22-4.29)	**4.81** (4.08-5.79)	**5.76** (4.78-7.08)	**6.80** (5.51-8.57)	**7.96** (6.27-10.3)	**9.67** (7.31-13.1)	**11.1** (8.12-15.5)
7-day	**1.60** (1.42-1.84)	**2.22** (1.97-2.56)	**3.12** (2.75-3.60)	**3.90** (3.42-4.55)	**5.06** (4.29-6.10)	**6.03** (5.01-7.42)	**7.09** (5.74-8.93)	**8.26** (6.50-10.7)	**9.97** (7.54-13.5)	**11.4** (8.34-15.9)
10-day	**1.72** (1.52-1.98)	**2.37** (2.10-2.73)	**3.30** (2.92-3.82)	**4.12** (3.61-4.80)	**5.32** (4.51-6.41)	**6.32** (5.24-7.77)	**7.40** (5.99-9.32)	**8.59** (6.77-11.1)	**10.3** (7.81-13.9)	**11.8** (8.61-16.5)
20-day	**2.10** (1.86-2.42)	**2.87** (2.54-3.31)	**3.96** (3.50-4.58)	**4.91** (4.30-5.72)	**6.29** (5.33-7.58)	**7.44** (6.17-9.14)	**8.67** (7.02-10.9)	**10.0** (7.89-13.0)	**12.0** (9.06-16.2)	**13.6** (9.94-19.0)
30-day	**2.48** (2.20-2.85)	**3.35** (2.97-3.86)	**4.58** (4.04-5.29)	**5.65** (4.95-6.58)	**7.21** (6.11-8.68)	**8.50** (7.05-10.4)	**9.88** (8.00-12.4)	**11.4** (8.97-14.8)	**13.6** (10.3-18.3)	**15.4** (11.2-21.5)
45-day	**2.92** (2.59-3.36)	**3.89** (3.44-4.48)	**5.25** (4.64-6.07)	**6.43** (5.64-7.50)	**8.16** (6.91-9.82)	**9.58** (7.95-11.8)	**11.1** (8.99-14.0)	**12.8** (10.0-16.5)	**15.1** (11.4-20.4)	**17.1** (12.5-23.9)
60-day	**3.30** (2.92-3.80)	**4.33** (3.83-4.99)	**5.78** (5.10-6.67)	**7.03** (6.16-8.19)	**8.86** (7.51-10.7)	**10.4** (8.60-12.7)	**12.0** (9.70-15.1)	**13.7** (10.8-17.8)	**16.2** (12.3-21.9)	**18.3** (13.4-25.6)

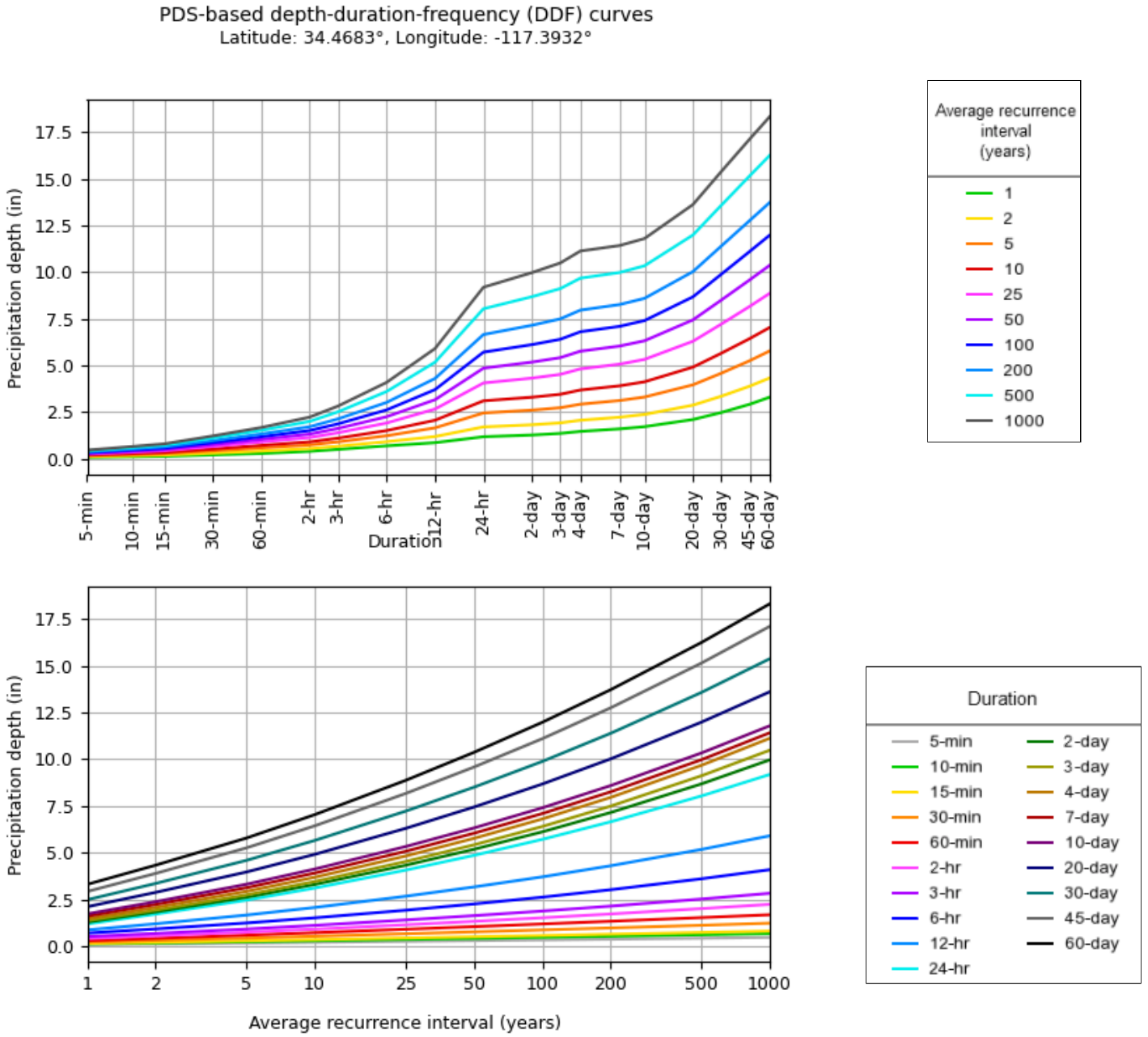
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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

Please refer to NOAA Atlas 14 document for more information.

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PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu May 9 19:41:29 2024

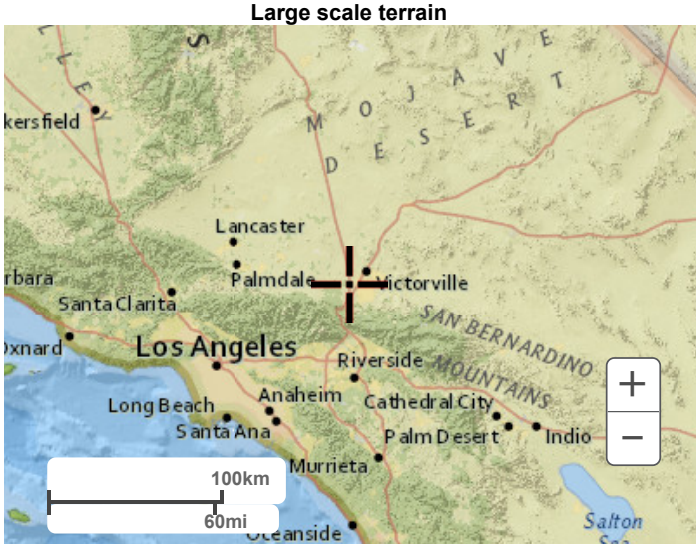
Back to Top

Maps & aerials

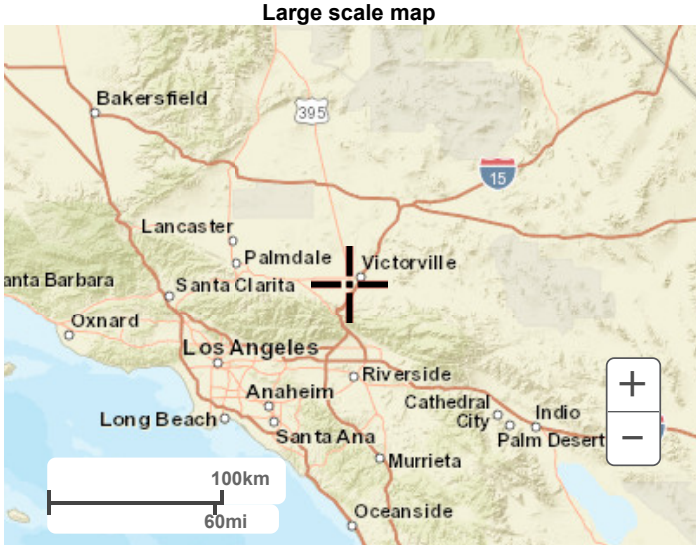
Small scale terrain



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

6.4.3 BMP Sizing Calculations

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 09 / 4 / 2024

Pond No. 1 - BASIN #1 - DA A

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
1.00	101.00	n/a	15,593	15,593
2.00	102.00	n/a	18,301	33,894
3.00	103.00	n/a	21,226	55,121
4.00	104.00	n/a	24,368	79,489
5.00	105.00	n/a	27,727	107,216
6.00	106.00	n/a	31,302	138,518
7.00	107.00	n/a	35,095	173,613

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 104.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	100.00	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	15,593	101.00	0.00	---	---	---	---	---	---	---	---	---	0.000
2.00	33,894	102.00	0.00	---	---	---	---	---	---	---	---	---	0.000
3.00	55,121	103.00	0.00	---	---	---	---	---	---	---	---	---	0.000
4.00	79,489	104.00	0.00	---	---	---	---	---	---	---	---	---	0.000
5.00	107,216	105.00	4.26 ic	---	---	---	---	---	---	---	---	---	4.265
6.00	138,518	106.00	9.51 ic	---	---	---	---	---	---	---	---	---	9.512
7.00	173,613	107.00	12.76 ic	---	---	---	---	---	---	---	---	---	12.76

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Wednesday, 09 / 4 / 2024

Pond No. 2 - BASIN #2 - DA B

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
1.00	101.00	n/a	28,816	28,816
2.00	102.00	n/a	32,858	61,674
3.00	103.00	n/a	37,102	98,776
4.00	104.00	n/a	41,548	140,324
5.00	105.00	n/a	46,198	186,522
6.00	106.00	n/a	51,056	237,578
7.00	107.00	n/a	56,119	293,697

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 104.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	100.00	---	---	---	---	0.00	---	---	---	---	---	0.000
1.00	28,816	101.00	---	---	---	---	0.00	---	---	---	---	---	0.000
2.00	61,674	102.00	---	---	---	---	0.00	---	---	---	---	---	0.000
3.00	98,776	103.00	---	---	---	---	0.00	---	---	---	---	---	0.000
4.00	140,324	104.00	---	---	---	---	0.00	---	---	---	---	---	0.000
5.00	186,522	105.00	---	---	---	---	13.32	---	---	---	---	---	13.32
6.00	237,578	106.00	---	---	---	---	37.67	---	---	---	---	---	37.67
7.00	293,697	107.00	---	---	---	---	69.21	---	---	---	---	---	69.21

6.4.4 HCOC Calculations

6.4.4 HCOC Calculations
10-Year Pre-Devolpment AES Rational Method

```
**************************************************************************
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                          Analysis prepared by:
```


```
 ************************* DESCRIPTION OF STUDY *************************
* HESPERIA PRE DEVELOPMENT RATIONAL METHOD                              *
*                                                                       *
*                                                                       *
 ************************************************************************
```


```
  FILE NAME: RATPRE.DAT
  TIME/DATE OF STUDY: 19:00 05/13/2024
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.7140

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
```

```
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE      1.10 TO NODE      1.20 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1173.00
  ELEVATION DATA: UPSTREAM(FEET) =   3491.00  DOWNSTREAM(FEET) =   3473.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   20.450
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.517
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "GRASS"                     A       16.70      0.60     1.000    67   20.45
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.60
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =     13.81
  TOTAL AREA(ACRES) =     16.70   PEAK FLOW RATE(CFS) =     13.81

****************************************************************************
  FLOW PROCESS FROM NODE      2.10 TO NODE      2.20 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   351.00
  ELEVATION DATA: UPSTREAM(FEET) =   3498.84  DOWNSTREAM(FEET) =   3491.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   11.708
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.241
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "GRASS"                     A        8.67      0.60     1.000    67   11.71
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.60
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =     12.82
  TOTAL AREA(ACRES) =      8.67   PEAK FLOW RATE(CFS) =     12.82
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.7  TC(MIN.) =     11.71
  EFFECTIVE AREA(ACRES) =      8.67  AREA-AVERAGED Fm(INCH/HR)=  0.60
  AREA-AVERAGED Fp(INCH/HR) =  0.60  AREA-AVERAGED Ap = 1.000
```

```
  PEAK FLOW RATE(CFS)   =      12.82
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```



6.4.4 HCOC Calculations
10-Year Post-Devolpment AES Rational Method

```
******************************************************************************
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                          Analysis prepared by:

                       Kimley-Horn and Associates, Inc.
                              765 The City Drive
                                  Suite 200
                               Orange, CA 92868

 ************************* DESCRIPTION OF STUDY *************************
* BIG BOX RETAIL - HESPERIA                                              *
* RATIONAL METHOD                                                        *
* 10-YEAR, POST-CONDITIONS, DA A                                         *
 ************************************************************************

  FILE NAME: SCH100A.DAT
  TIME/DATE OF STUDY: 14:17 08/28/2024
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.7140

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

******************************************************************************
  FLOW PROCESS FROM NODE      1.10 TO NODE      1.20 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   347.81
  ELEVATION DATA: UPSTREAM(FEET) =   3484.80  DOWNSTREAM(FEET) =   3482.46

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.587
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.784
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        9.10      0.98     0.100    32    8.59
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =     22.01
  TOTAL AREA(ACRES) =      9.10   PEAK FLOW RATE(CFS) =     22.01
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        9.1  TC(MIN.) =      8.59
  EFFECTIVE AREA(ACRES) =      9.10  AREA-AVERAGED Fm(INCH/HR)=  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =      22.01
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
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                          Analysis prepared by:

                       Kimley-Horn and Associates, Inc.
                              765 The City Drive
                                  Suite 200
                               Orange, CA 92868

 ************************* DESCRIPTION OF STUDY *************************
* BIG BOX RETAIL - HESPERIA                                              *
* RATIONAL METHOD                                                        *
* 10-YEAR, POST-CONDITIONS, DA B                                         *
 ************************************************************************

  FILE NAME: SCH100B.DAT
  TIME/DATE OF STUDY: 16:55 08/28/2024
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.7140

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

******************************************************************************
  FLOW PROCESS FROM NODE      2.10 TO NODE      2.20 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   389.02
  ELEVATION DATA: UPSTREAM(FEET) =   3489.01  DOWNSTREAM(FEET) =   3483.34

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.694
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.007
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        7.60      0.98     0.100    32    7.69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =     19.90
  TOTAL AREA(ACRES) =      7.60   PEAK FLOW RATE(CFS) =     19.90

****************************************************************************
  FLOW PROCESS FROM NODE      2.20 TO NODE      2.20 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.69
  RAINFALL INTENSITY(INCH/HR) =   3.01
  AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.98
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       7.60
  TOTAL STREAM AREA(ACRES) =       7.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      19.90

****************************************************************************
  FLOW PROCESS FROM NODE      3.10 TO NODE      2.20 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   389.02
  ELEVATION DATA: UPSTREAM(FEET) =   3489.01  DOWNSTREAM(FEET) =   3483.34

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.845
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.530
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
        LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A        8.67      0.98     0.500    32    9.85
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.500
  SUBAREA RUNOFF(CFS) =     15.94
  TOTAL AREA(ACRES) =      8.67   PEAK FLOW RATE(CFS) =     15.94

****************************************************************************
  FLOW PROCESS FROM NODE      2.20 TO NODE      2.20 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.85
  RAINFALL INTENSITY(INCH/HR) =   2.53
  AREA-AVERAGED Fm(INCH/HR) =  0.49
  AREA-AVERAGED Fp(INCH/HR) =  0.97
  AREA-AVERAGED Ap =  0.50
  EFFECTIVE STREAM AREA(ACRES) =       8.67
  TOTAL STREAM AREA(ACRES) =       8.67
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      15.94

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       19.90    7.69    3.007  0.98( 0.10) 0.10       7.6       2.10
      2       15.94    9.85    2.530  0.97( 0.49) 0.50       8.7       3.10

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
```

```
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1       35.26    7.69    3.007  0.97( 0.28) 0.29      14.4       2.10
     2       32.58    9.85    2.530  0.97( 0.31) 0.31      16.3       3.10

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      35.26    Tc(MIN.) =     7.69
  EFFECTIVE AREA(ACRES) =      14.38   AREA-AVERAGED Fm(INCH/HR) =  0.28
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.29
  TOTAL AREA(ACRES) =       16.3
  LONGEST FLOWPATH FROM NODE      2.10 TO NODE      2.20 =     389.02 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       16.3  TC(MIN.) =      7.69
  EFFECTIVE AREA(ACRES) =     14.38  AREA-AVERAGED Fm(INCH/HR)=  0.28
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap = 0.289
  PEAK FLOW RATE(CFS)   =      35.26

  ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1       35.26    7.69    3.007  0.97( 0.28) 0.29      14.4       2.10
     2       32.58    9.85    2.530  0.97( 0.31) 0.31      16.3       3.10
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

6.4.4 HCOC Calculations
10-Year Pre-Development Hydrograph Analysis

```
**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
==========================================================================
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                          Analysis prepared by:




**************************************************************************
--------------------------------------------------------------------------

 Problem Descriptions:
  BIG BOX RETAIL - HESPERIA
  UNIT HYDROGRAPH
  10-YEAR PRE CONDITIONS, DA A
--------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.29
    TOTAL CATCHMENT AREA(ACRES) =   16.70
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.598
    LOW LOSS FRACTION = 0.795
    TIME OF CONCENTRATION(MIN.) = 20.45
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.20
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.71
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.10
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.51
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  3.10

--------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.37
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     2.94

**************************************************************************
  TIME     VOLUME       Q    0.        5.0      10.0      15.0      20.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.32      0.0042      0.30  Q         .         .         .         .
  0.66      0.0126      0.30  Q         .         .         .         .
```

1.00	0.0210	0.30	Q	.	.	.	.
1.34	0.0296	0.31	Q	.	.	.	.
1.68	0.0382	0.31	Q	.	.	.	.
2.03	0.0470	0.31	Q	.	.	.	.
2.37	0.0558	0.32	Q	.	.	.	.
2.71	0.0648	0.32	Q	.	.	.	.
3.05	0.0738	0.32	Q	.	.	.	.
3.39	0.0830	0.33	Q	.	.	.	.
3.73	0.0923	0.33	Q	.	.	.	.
4.07	0.1017	0.34	Q	.	.	.	.
4.41	0.1113	0.34	Q	.	.	.	.
4.75	0.1209	0.35	Q	.	.	.	.
5.09	0.1308	0.35	Q	.	.	.	.
5.43	0.1407	0.36	Q	.	.	.	.
5.77	0.1508	0.36	Q	.	.	.	.
6.12	0.1611	0.37	Q	.	.	.	.
6.46	0.1715	0.37	Q	.	.	.	.
6.80	0.1822	0.38	Q	.	.	.	.
7.14	0.1930	0.39	Q	.	.	.	.
7.48	0.2040	0.40	Q	.	.	.	.
7.82	0.2152	0.40	Q	.	.	.	.
8.16	0.2266	0.41	Q	.	.	.	.
8.50	0.2382	0.42	Q	.	.	.	.
8.84	0.2501	0.43	Q	.	.	.	.
9.18	0.2623	0.44	Q	.	.	.	.
9.52	0.2748	0.45	Q	.	.	.	.
9.86	0.2875	0.46	Q	.	.	.	.
10.21	0.3006	0.47	Q	.	.	.	.
10.55	0.3140	0.48	Q	.	.	.	.
10.89	0.3279	0.50	.Q	.	.	.	.
11.23	0.3422	0.51	.Q	.	.	.	.
11.57	0.3569	0.54	.Q	.	.	.	.
11.91	0.3722	0.55	.Q	.	.	.	.
12.25	0.3874	0.54	.Q	.	.	.	.
12.59	0.4024	0.53	.Q	.	.	.	.
12.93	0.4177	0.56	.Q	.	.	.	.
13.27	0.4339	0.59	.Q	.	.	.	.
13.61	0.4511	0.64	.Q	.	.	.	.
13.95	0.4696	0.67	.Q	.	.	.	.
14.30	0.4885	0.67	.Q	.	.	.	.
14.64	0.5078	0.70	.Q	.	.	.	.
14.98	0.5296	0.85	.Q	.	.	.	.
15.32	0.5550	0.96	.Q	.	.	.	.
15.66	0.5905	1.56	. Q	.	.	.	.
16.00	0.6447	2.29	. Q	.	.	.	.
16.34	0.8715	13.81	.	.	.	Q .	.
16.68	1.0818	1.12	. Q	.	.	.	.
17.02	1.1083	0.77	.Q	.	.	.	.
17.36	1.1290	0.71	.Q	.	.	.	.
17.70	1.1476	0.61	.Q	.	.	.	.

18.05	1.1639	0.54	.Q	.	.	.	.
18.39	1.1794	0.56	.Q	.	.	.	.
18.73	1.1947	0.52	.Q	.	.	.	.
19.07	1.2090	0.49	Q	.	.	.	.
19.41	1.2225	0.46	Q	.	.	.	.
19.75	1.2352	0.44	Q	.	.	.	.
20.09	1.2474	0.42	Q	.	.	.	.
20.43	1.2591	0.41	Q	.	.	.	.
20.77	1.2703	0.39	Q	.	.	.	.
21.11	1.2811	0.38	Q	.	.	.	.
21.45	1.2915	0.36	Q	.	.	.	.
21.79	1.3016	0.35	Q	.	.	.	.
22.14	1.3115	0.34	Q	.	.	.	.
22.48	1.3210	0.33	Q	.	.	.	.
22.82	1.3303	0.33	Q	.	.	.	.
23.16	1.3394	0.32	Q	.	.	.	.
23.50	1.3482	0.31	Q	.	.	.	.
23.84	1.3569	0.30	Q	.	.	.	.
24.18	1.3653	0.30	Q	.	.	.	.
24.52	1.3695	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1452.0
10%	61.4
20%	20.5
30%	20.5
40%	20.5
50%	20.5
60%	20.5
70%	20.5
80%	20.5
90%	20.5

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**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
==========================================================================
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                          Analysis prepared by:




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 Problem Descriptions:
  BIG BOX RETAIL - HESPERIA
  UNIT HYDROGRAPH
  10-YEAR PRE CONDITIONS, DA B
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    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.48
    TOTAL CATCHMENT AREA(ACRES) =    8.67
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.598
    LOW LOSS FRACTION = 0.795
    TIME OF CONCENTRATION(MIN.) = 11.71
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.20
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.71
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.10
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.51
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  3.10

--------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.81
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     1.43

**************************************************************************
  TIME     VOLUME       Q    0.        5.0      10.0      15.0      20.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.19      0.0014      0.18  Q         .         .         .         .
  0.39      0.0043      0.18  Q         .         .         .         .
```

0.58	0.0071	0.18	Q	.	.	.	.
0.78	0.0100	0.18	Q	.	.	.	.
0.97	0.0129	0.18	Q	.	.	.	.
1.17	0.0159	0.18	Q	.	.	.	.
1.36	0.0188	0.18	Q	.	.	.	.
1.56	0.0218	0.18	Q	.	.	.	.
1.76	0.0247	0.19	Q	.	.	.	.
1.95	0.0277	0.19	Q	.	.	.	.
2.15	0.0308	0.19	Q	.	.	.	.
2.34	0.0338	0.19	Q	.	.	.	.
2.54	0.0368	0.19	Q	.	.	.	.
2.73	0.0399	0.19	Q	.	.	.	.
2.93	0.0430	0.19	Q	.	.	.	.
3.12	0.0462	0.19	Q	.	.	.	.
3.32	0.0493	0.20	Q	.	.	.	.
3.51	0.0525	0.20	Q	.	.	.	.
3.71	0.0557	0.20	Q	.	.	.	.
3.90	0.0589	0.20	Q	.	.	.	.
4.10	0.0621	0.20	Q	.	.	.	.
4.29	0.0654	0.20	Q	.	.	.	.
4.49	0.0687	0.21	Q	.	.	.	.
4.68	0.0720	0.21	Q	.	.	.	.
4.88	0.0754	0.21	Q	.	.	.	.
5.07	0.0787	0.21	Q	.	.	.	.
5.27	0.0821	0.21	Q	.	.	.	.
5.46	0.0856	0.21	Q	.	.	.	.
5.66	0.0890	0.22	Q	.	.	.	.
5.85	0.0925	0.22	Q	.	.	.	.
6.05	0.0961	0.22	Q	.	.	.	.
6.24	0.0996	0.22	Q	.	.	.	.
6.44	0.1032	0.22	Q	.	.	.	.
6.63	0.1068	0.23	Q	.	.	.	.
6.83	0.1105	0.23	Q	.	.	.	.
7.02	0.1142	0.23	Q	.	.	.	.
7.22	0.1179	0.23	Q	.	.	.	.
7.41	0.1217	0.24	Q	.	.	.	.
7.61	0.1255	0.24	Q	.	.	.	.
7.80	0.1294	0.24	Q	.	.	.	.
8.00	0.1333	0.24	Q	.	.	.	.
8.19	0.1373	0.25	Q	.	.	.	.
8.39	0.1413	0.25	Q	.	.	.	.
8.58	0.1453	0.25	Q	.	.	.	.
8.78	0.1494	0.26	Q	.	.	.	.
8.98	0.1536	0.26	Q	.	.	.	.
9.17	0.1578	0.26	Q	.	.	.	.
9.37	0.1620	0.27	Q	.	.	.	.
9.56	0.1663	0.27	Q	.	.	.	.
9.76	0.1707	0.27	Q	.	.	.	.
9.95	0.1752	0.28	Q	.	.	.	.
10.15	0.1797	0.28	Q	.	.	.	.

10.34	0.1843	0.29	Q	.	.	.	.
10.54	0.1889	0.29	Q	.	.	.	.
10.73	0.1937	0.30	Q	.	.	.	.
10.93	0.1985	0.30	Q	.	.	.	.
11.12	0.2034	0.31	Q	.	.	.	.
11.32	0.2084	0.31	Q	.	.	.	.
11.51	0.2135	0.32	Q	.	.	.	.
11.71	0.2187	0.32	Q	.	.	.	.
11.90	0.2240	0.33	Q	.	.	.	.
12.10	0.2294	0.34	Q	.	.	.	.
12.29	0.2347	0.31	Q	.	.	.	.
12.49	0.2397	0.32	Q	.	.	.	.
12.68	0.2449	0.33	Q	.	.	.	.
12.88	0.2502	0.33	Q	.	.	.	.
13.07	0.2558	0.35	Q	.	.	.	.
13.27	0.2615	0.36	Q	.	.	.	.
13.46	0.2674	0.38	Q	.	.	.	.
13.66	0.2736	0.39	Q	.	.	.	.
13.85	0.2800	0.41	Q	.	.	.	.
14.05	0.2867	0.42	Q	.	.	.	.
14.24	0.2933	0.39	Q	.	.	.	.
14.44	0.2998	0.41	Q	.	.	.	.
14.63	0.3067	0.45	Q	.	.	.	.
14.83	0.3143	0.48	Q	.	.	.	.
15.02	0.3225	0.54	.Q	.	.	.	.
15.22	0.3316	0.59	.Q	.	.	.	.
15.41	0.3422	0.72	.Q	.	.	.	.
15.61	0.3554	0.92	.Q	.	.	.	.
15.80	0.3742	1.41	. Q	.	.	.	.
16.00	0.4011	1.93	. Q	.	.	.	.
16.20	0.5201	12.82	.	.	.	Q	.	.
16.39	0.6320	1.05	. Q	.	.	.	.
16.59	0.6456	0.64	.Q	.	.	.	.
16.78	0.6549	0.51	.Q	.	.	.	.
16.98	0.6624	0.43	Q	.	.	.	.
17.17	0.6692	0.42	Q	.	.	.	.
17.37	0.6758	0.40	Q	.	.	.	.
17.56	0.6820	0.37	Q	.	.	.	.
17.76	0.6877	0.34	Q	.	.	.	.
17.95	0.6931	0.32	Q	.	.	.	.
18.15	0.6982	0.31	Q	.	.	.	.
18.34	0.7034	0.33	Q	.	.	.	.
18.54	0.7086	0.32	Q	.	.	.	.
18.73	0.7136	0.30	Q	.	.	.	.
18.93	0.7184	0.29	Q	.	.	.	.
19.12	0.7231	0.28	Q	.	.	.	.
19.32	0.7276	0.28	Q	.	.	.	.
19.51	0.7320	0.27	Q	.	.	.	.
19.71	0.7362	0.26	Q	.	.	.	.
19.90	0.7404	0.25	Q	.	.	.	.

20.10	0.7444	0.25	Q	.	.	.	.
20.29	0.7484	0.24	Q	.	.	.	.
20.49	0.7522	0.24	Q	.	.	.	.
20.68	0.7560	0.23	Q	.	.	.	.
20.88	0.7597	0.23	Q	.	.	.	.
21.07	0.7633	0.22	Q	.	.	.	.
21.27	0.7669	0.22	Q	.	.	.	.
21.46	0.7704	0.21	Q	.	.	.	.
21.66	0.7738	0.21	Q	.	.	.	.
21.85	0.7772	0.21	Q	.	.	.	.
22.05	0.7805	0.20	Q	.	.	.	.
22.24	0.7838	0.20	Q	.	.	.	.
22.44	0.7870	0.20	Q	.	.	.	.
22.63	0.7902	0.20	Q	.	.	.	.
22.83	0.7933	0.19	Q	.	.	.	.
23.02	0.7964	0.19	Q	.	.	.	.
23.22	0.7994	0.19	Q	.	.	.	.
23.42	0.8024	0.18	Q	.	.	.	.
23.61	0.8054	0.18	Q	.	.	.	.
23.81	0.8083	0.18	Q	.	.	.	.
24.00	0.8112	0.18	Q	.	.	.	.
24.20	0.8126	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1440.1
10%	35.1
20%	11.7
30%	11.7
40%	11.7
50%	11.7
60%	11.7
70%	11.7
80%	11.7
90%	11.7

6.4.4 HCOC Calculations
10-Year Post-Development Hydrograph Analysis

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******************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
==============================================================================
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                          Analysis prepared by:

                      Kimley-Horn and Associates, Inc.
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                                 Suite 200
                              Orange, CA 92868

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 Problem Descriptions:
  BIG BOX RETAIL - HESPERIA
  UNIT HYDROGRAPH
  10-YEAR, POST-CONDITIONS, DA A
------------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.47
    TOTAL CATCHMENT AREA(ACRES) =    9.10
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.190
    LOW LOSS FRACTION = 0.255
    TIME OF CONCENTRATION(MIN.) =  8.59
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.20
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.71
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.10
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.51
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  3.10

------------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     2.60
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =    -0.25

******************************************************************************
  TIME     VOLUME       Q    0.        7.5      15.0      22.5      30.0
 (HOURS)    (AF)      (CFS)
------------------------------------------------------------------------------
  0.11      0.0031      0.67  Q         .         .         .         .
  0.26      0.0110      0.67  Q         .         .         .         .
  0.40      0.0190      0.67  Q         .         .         .         .
  0.54      0.0269      0.67  Q         .         .         .         .
  0.69      0.0349      0.68  Q         .         .         .         .
  0.83      0.0430      0.68  Q         .         .         .         .
  0.97      0.0510      0.68  Q         .         .         .         .
  1.12      0.0592      0.69  Q         .         .         .         .
  1.26      0.0673      0.69  Q         .         .         .         .
  1.40      0.0755      0.69  Q         .         .         .         .
  1.55      0.0837      0.70  Q         .         .         .         .
  1.69      0.0920      0.70  Q         .         .         .         .
  1.83      0.1003      0.70  Q         .         .         .         .
  1.97      0.1086      0.71  Q         .         .         .         .
  2.12      0.1170      0.71  Q         .         .         .         .
  2.26      0.1254      0.71  Q         .         .         .         .
  2.40      0.1339      0.72  Q         .         .         .         .
  2.55      0.1424      0.72  Q         .         .         .         .
  2.69      0.1509      0.73  Q         .         .         .         .
  2.83      0.1595      0.73  Q         .         .         .         .
  2.98      0.1682      0.73  Q         .         .         .         .
```

3.12	0.1769	0.74	Q	.	.	.	.
3.26	0.1856	0.74	Q	.	.	.	.
3.41	0.1944	0.74	Q	.	.	.	.
3.55	0.2032	0.75	Q	.	.	.	.
3.69	0.2121	0.75	.Q	.	.	.	.
3.84	0.2210	0.76	.Q	.	.	.	.
3.98	0.2300	0.76	.Q	.	.	.	.
4.12	0.2390	0.77	.Q	.	.	.	.
4.26	0.2481	0.77	.Q	.	.	.	.
4.41	0.2572	0.77	.Q	.	.	.	.
4.55	0.2664	0.78	.Q	.	.	.	.
4.69	0.2756	0.78	.Q	.	.	.	.
4.84	0.2849	0.79	.Q	.	.	.	.
4.98	0.2943	0.79	.Q	.	.	.	.
5.12	0.3037	0.80	.Q	.	.	.	.
5.27	0.3131	0.80	.Q	.	.	.	.
5.41	0.3227	0.81	.Q	.	.	.	.
5.55	0.3322	0.81	.Q	.	.	.	.
5.70	0.3419	0.82	.Q	.	.	.	.
5.84	0.3516	0.83	.Q	.	.	.	.
5.98	0.3614	0.83	.Q	.	.	.	.
6.12	0.3712	0.84	.Q	.	.	.	.
6.27	0.3812	0.84	.Q	.	.	.	.
6.41	0.3911	0.85	.Q	.	.	.	.
6.55	0.4012	0.85	.Q	.	.	.	.
6.70	0.4113	0.86	.Q	.	.	.	.
6.84	0.4215	0.86	.Q	.	.	.	.
6.98	0.4318	0.87	.Q	.	.	.	.
7.13	0.4422	0.88	.Q	.	.	.	.
7.27	0.4526	0.89	.Q	.	.	.	.
7.41	0.4631	0.89	.Q	.	.	.	.
7.56	0.4737	0.90	.Q	.	.	.	.
7.70	0.4844	0.91	.Q	.	.	.	.
7.84	0.4952	0.92	.Q	.	.	.	.
7.99	0.5061	0.92	.Q	.	.	.	.
8.13	0.5170	0.93	.Q	.	.	.	.
8.27	0.5281	0.94	.Q	.	.	.	.
8.41	0.5392	0.95	.Q	.	.	.	.
8.56	0.5505	0.95	.Q	.	.	.	.
8.70	0.5618	0.97	.Q	.	.	.	.
8.84	0.5733	0.97	.Q	.	.	.	.
8.99	0.5849	0.98	.Q	.	.	.	.
9.13	0.5965	0.99	.Q	.	.	.	.
9.27	0.6083	1.00	.Q	.	.	.	.
9.42	0.6203	1.01	.Q	.	.	.	.
9.56	0.6323	1.02	.Q	.	.	.	.
9.70	0.6445	1.03	.Q	.	.	.	.
9.85	0.6568	1.05	.Q	.	.	.	.
9.99	0.6692	1.06	.Q	.	.	.	.
10.13	0.6818	1.07	.Q	.	.	.	.
10.28	0.6945	1.08	.Q	.	.	.	.
10.42	0.7073	1.10	.Q	.	.	.	.
10.56	0.7204	1.11	.Q	.	.	.	.
10.70	0.7336	1.12	.Q	.	.	.	.
10.85	0.7469	1.13	.Q	.	.	.	.
10.99	0.7605	1.15	.Q	.	.	.	.
11.13	0.7742	1.16	.Q	.	.	.	.
11.28	0.7881	1.19	.Q	.	.	.	.
11.42	0.8022	1.20	.Q	.	.	.	.
11.56	0.8165	1.22	.Q	.	.	.	.
11.71	0.8310	1.23	.Q	.	.	.	.
11.85	0.8458	1.26	.Q	.	.	.	.
11.99	0.8608	1.28	.Q	.	.	.	.
12.14	0.8752	1.16	.Q	.	.	.	.
12.28	0.8890	1.17	.Q	.	.	.	.
12.42	0.9029	1.20	.Q	.	.	.	.
12.57	0.9172	1.21	.Q	.	.	.	.
12.71	0.9318	1.25	.Q	.	.	.	.
12.85	0.9467	1.27	.Q	.	.	.	.

12.99	0.9620	1.31	.Q . . . .
13.14	0.9776	1.34	.Q . . . .
13.28	0.9937	1.38	.Q . . . .
13.42	1.0103	1.41	.Q . . . .
13.57	1.0273	1.47	.Q . . . .
13.71	1.0448	1.50	.Q . . . .
13.85	1.0629	1.57	. Q . . . .
14.00	1.0817	1.60	. Q . . . .
14.14	1.0998	1.46	.Q . . . .
14.28	1.1173	1.50	.Q . . . .
14.43	1.1356	1.60	. Q . . . .
14.57	1.1549	1.66	. Q . . . .
14.71	1.1753	1.79	. Q . . . .
14.86	1.1970	1.87	. Q . . . .
15.00	1.2203	2.06	. Q . . . .
15.14	1.2454	2.18	. Q . . . .
15.28	1.2729	2.48	. Q . . . .
15.43	1.3034	2.68	. Q . . . .
15.57	1.3410	3.68	. Q . . . .
15.71	1.3871	4.11	. Q . . . .
15.86	1.4505	6.61	. Q . . . .
16.00	1.5413	8.75	. .Q . . .
16.14	1.7232	22.01	. . . Q. .
16.29	1.8840	5.18	. Q . . . .
16.43	1.9345	3.35	. Q . . . .
16.57	1.9681	2.32	. Q . . . .
16.72	1.9934	1.96	. Q . . . .
16.86	2.0152	1.72	. Q . . . .
17.00	2.0345	1.55	. Q . . . .
17.14	2.0534	1.64	. Q . . . .
17.29	2.0721	1.53	. Q . . . .
17.43	2.0897	1.44	.Q . . . .
17.57	2.1062	1.36	.Q . . . .
17.72	2.1219	1.29	.Q . . . .
17.86	2.1368	1.23	.Q . . . .
18.00	2.1511	1.18	.Q . . . .
18.15	2.1657	1.29	.Q . . . .
18.29	2.1807	1.25	.Q . . . .
18.43	2.1953	1.21	.Q . . . .
18.58	2.2094	1.18	.Q . . . .
18.72	2.2231	1.14	.Q . . . .
18.86	2.2364	1.11	.Q . . . .
19.01	2.2495	1.09	.Q . . . .
19.15	2.2622	1.06	.Q . . . .
19.29	2.2746	1.04	.Q . . . .
19.43	2.2868	1.02	.Q . . . .
19.58	2.2987	1.00	.Q . . . .
19.72	2.3104	0.98	.Q . . . .
19.86	2.3219	0.96	.Q . . . .
20.01	2.3331	0.94	.Q . . . .
20.15	2.3442	0.93	.Q . . . .
20.29	2.3550	0.91	.Q . . . .
20.44	2.3657	0.90	.Q . . . .
20.58	2.3762	0.88	.Q . . . .
20.72	2.3866	0.87	.Q . . . .
20.87	2.3968	0.86	.Q . . . .
21.01	2.4069	0.84	.Q . . . .
21.15	2.4168	0.83	.Q . . . .
21.30	2.4266	0.82	.Q . . . .
21.44	2.4362	0.81	.Q . . . .
21.58	2.4457	0.80	.Q . . . .
21.72	2.4551	0.79	.Q . . . .
21.87	2.4644	0.78	.Q . . . .
22.01	2.4736	0.77	.Q . . . .
22.15	2.4827	0.76	.Q . . . .
22.30	2.4917	0.75	.Q . . . .
22.44	2.5005	0.75	Q . . . .
22.58	2.5093	0.74	Q . . . .
22.73	2.5180	0.73	Q . . . .

22.87	2.5266	0.72	Q	.	.	.	.
23.01	2.5351	0.72	Q	.	.	.	.
23.16	2.5435	0.71	Q	.	.	.	.
23.30	2.5519	0.70	Q	.	.	.	.
23.44	2.5601	0.70	Q	.	.	.	.
23.59	2.5683	0.69	Q	.	.	.	.
23.73	2.5764	0.68	Q	.	.	.	.
23.87	2.5845	0.68	Q	.	.	.	.
24.01	2.5924	0.67	Q	.	.	.	.
24.16	2.5964	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1442.6
10%	85.9
20%	34.3
30%	25.8
40%	8.6
50%	8.6
60%	8.6
70%	8.6
80%	8.6
90%	8.6

```
******************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
==============================================================================
         (C) Copyright 1989-2011 Advanced Engineering Software (aes)
             Ver. 18.0  Release Date: 05/01/2011  License ID 1499

                          Analysis prepared by:

                      Kimley-Horn and Associates, Inc.
                             765 The City Drive
                                 Suite 200
                              Orange, CA 92868

******************************************************************************
------------------------------------------------------------------------------

 Problem Descriptions:
  BIG BOX RETAIL - HESPERIA
  UNIT HYDROGRAPH
  10-YEAR, POST-CONDITIONS, DA B
------------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.12
    TOTAL CATCHMENT AREA(ACRES) =   16.27
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.003
    LOW LOSS FRACTION = 0.078
    TIME OF CONCENTRATION(MIN.) =  7.69
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.20
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.71
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.10
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.51
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  3.10

------------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     4.58
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =    -0.37

******************************************************************************
  TIME     VOLUME       Q    0.       10.0      20.0      30.0      40.0
 (HOURS)    (AF)      (CFS)
------------------------------------------------------------------------------
  0.11      0.0062      1.17  .Q        .         .         .         .
  0.24      0.0186      1.17  .Q        .         .         .         .
  0.36      0.0311      1.18  .Q        .         .         .         .
  0.49      0.0436      1.18  .Q        .         .         .         .
  0.62      0.0561      1.19  .Q        .         .         .         .
  0.75      0.0687      1.19  .Q        .         .         .         .
  0.88      0.0814      1.20  .Q        .         .         .         .
  1.00      0.0941      1.20  .Q        .         .         .         .
  1.13      0.1069      1.21  .Q        .         .         .         .
  1.26      0.1197      1.21  .Q        .         .         .         .
  1.39      0.1326      1.22  .Q        .         .         .         .
  1.52      0.1455      1.23  .Q        .         .         .         .
  1.65      0.1585      1.23  .Q        .         .         .         .
  1.77      0.1716      1.24  .Q        .         .         .         .
  1.90      0.1847      1.24  .Q        .         .         .         .
  2.03      0.1979      1.25  .Q        .         .         .         .
  2.16      0.2111      1.25  .Q        .         .         .         .
  2.29      0.2244      1.26  .Q        .         .         .         .
  2.41      0.2378      1.26  .Q        .         .         .         .
  2.54      0.2512      1.27  .Q        .         .         .         .
  2.67      0.2647      1.27  .Q        .         .         .         .
```

2.80	0.2782	1.28	.Q	.	.	.	.
2.93	0.2918	1.29	.Q	.	.	.	.
3.06	0.3055	1.30	.Q	.	.	.	.
3.18	0.3193	1.30	.Q	.	.	.	.
3.31	0.3331	1.31	.Q	.	.	.	.
3.44	0.3470	1.31	.Q	.	.	.	.
3.57	0.3609	1.32	.Q	.	.	.	.
3.70	0.3749	1.33	.Q	.	.	.	.
3.82	0.3891	1.34	.Q	.	.	.	.
3.95	0.4032	1.34	.Q	.	.	.	.
4.08	0.4175	1.35	.Q	.	.	.	.
4.21	0.4318	1.35	.Q	.	.	.	.
4.34	0.4462	1.36	.Q	.	.	.	.
4.46	0.4607	1.37	.Q	.	.	.	.
4.59	0.4753	1.38	.Q	.	.	.	.
4.72	0.4899	1.39	.Q	.	.	.	.
4.85	0.5046	1.40	.Q	.	.	.	.
4.98	0.5194	1.40	.Q	.	.	.	.
5.11	0.5343	1.41	.Q	.	.	.	.
5.23	0.5493	1.42	.Q	.	.	.	.
5.36	0.5644	1.43	.Q	.	.	.	.
5.49	0.5795	1.43	.Q	.	.	.	.
5.62	0.5948	1.45	.Q	.	.	.	.
5.75	0.6101	1.45	.Q	.	.	.	.
5.87	0.6256	1.46	.Q	.	.	.	.
6.00	0.6411	1.47	.Q	.	.	.	.
6.13	0.6568	1.48	.Q	.	.	.	.
6.26	0.6725	1.49	.Q	.	.	.	.
6.39	0.6883	1.50	.Q	.	.	.	.
6.52	0.7043	1.51	.Q	.	.	.	.
6.64	0.7203	1.52	.Q	.	.	.	.
6.77	0.7365	1.53	.Q	.	.	.	.
6.90	0.7528	1.54	.Q	.	.	.	.
7.03	0.7692	1.55	.Q	.	.	.	.
7.16	0.7857	1.57	.Q	.	.	.	.
7.28	0.8023	1.57	.Q	.	.	.	.
7.41	0.8190	1.59	.Q	.	.	.	.
7.54	0.8359	1.60	.Q	.	.	.	.
7.67	0.8529	1.61	.Q	.	.	.	.
7.80	0.8700	1.62	.Q	.	.	.	.
7.93	0.8872	1.64	.Q	.	.	.	.
8.05	0.9046	1.65	.Q	.	.	.	.
8.18	0.9222	1.66	.Q	.	.	.	.
8.31	0.9398	1.67	.Q	.	.	.	.
8.44	0.9576	1.69	.Q	.	.	.	.
8.57	0.9756	1.70	.Q	.	.	.	.
8.69	0.9937	1.72	.Q	.	.	.	.
8.82	1.0120	1.73	.Q	.	.	.	.
8.95	1.0304	1.75	.Q	.	.	.	.
9.08	1.0490	1.76	.Q	.	.	.	.
9.21	1.0677	1.78	.Q	.	.	.	.
9.34	1.0867	1.79	.Q	.	.	.	.
9.46	1.1058	1.82	.Q	.	.	.	.
9.59	1.1251	1.83	.Q	.	.	.	.
9.72	1.1446	1.85	.Q	.	.	.	.
9.85	1.1642	1.86	.Q	.	.	.	.
9.98	1.1841	1.89	.Q	.	.	.	.
10.10	1.2042	1.90	.Q	.	.	.	.
10.23	1.2245	1.93	.Q	.	.	.	.
10.36	1.2450	1.94	.Q	.	.	.	.
10.49	1.2658	1.97	.Q	.	.	.	.
10.62	1.2868	1.99	.Q	.	.	.	.
10.75	1.3080	2.02	. Q	.	.	.	.
10.87	1.3295	2.04	. Q	.	.	.	.
11.00	1.3512	2.07	. Q	.	.	.	.
11.13	1.3732	2.09	. Q	.	.	.	.
11.26	1.3955	2.12	. Q	.	.	.	.
11.39	1.4181	2.14	. Q	.	.	.	.
11.51	1.4410	2.18	. Q	.	.	.	.

11.64	1.4642	2.20	. Q	.	.	.	.
11.77	1.4877	2.24	. Q	.	.	.	.
11.90	1.5116	2.27	. Q	.	.	.	.
12.03	1.5359	2.31	. Q	.	.	.	.
12.15	1.5593	2.11	. Q	.	.	.	.
12.28	1.5816	2.10	. Q	.	.	.	.
12.41	1.6040	2.13	. Q	.	.	.	.
12.54	1.6269	2.19	. Q	.	.	.	.
12.67	1.6502	2.22	. Q	.	.	.	.
12.80	1.6740	2.28	. Q	.	.	.	.
12.92	1.6983	2.31	. Q	.	.	.	.
13.05	1.7232	2.39	. Q	.	.	.	.
13.18	1.7487	2.42	. Q	.	.	.	.
13.31	1.7748	2.51	. Q	.	.	.	.
13.44	1.8016	2.55	. Q	.	.	.	.
13.56	1.8291	2.64	. Q	.	.	.	.
13.69	1.8574	2.69	. Q	.	.	.	.
13.82	1.8865	2.81	. Q	.	.	.	.
13.95	1.9165	2.87	. Q	.	.	.	.
14.08	1.9467	2.82	. Q	.	.	.	.
14.21	1.9756	2.64	. Q	.	.	.	.
14.33	2.0044	2.80	. Q	.	.	.	.
14.46	2.0346	2.89	. Q	.	.	.	.
14.59	2.0662	3.09	. Q	.	.	.	.
14.72	2.0995	3.20	. Q	.	.	.	.
14.85	2.1348	3.47	. Q	.	.	.	.
14.97	2.1724	3.62	. Q	.	.	.	.
15.10	2.2127	4.00	. Q	.	.	.	.
15.23	2.2563	4.23	. Q	.	.	.	.
15.36	2.3042	4.82	. Q	.	.	.	.
15.49	2.3607	5.85	. Q	.	.	.	.
15.62	2.4294	7.13	. Q	.	.	.	.
15.74	2.5093	7.96	. Q	.	.	.	.
15.87	2.6188	12.71	. . Q	.	.	.	.
16.00	2.7717	16.18	. . Q	.	.	.	.
16.13	3.0441	35.26	. .	.	.	. Q	.
16.26	3.2875	10.70	. Q	.	.	.	.
16.38	3.3786	6.50	. Q	.	.	.	.
16.51	3.4369	4.50	. Q	.	.	.	.
16.64	3.4808	3.80	. Q	.	.	.	.
16.77	3.5185	3.33	. Q	.	.	.	.
16.90	3.5520	2.98	. Q	.	.	.	.
17.03	3.5822	2.72	. Q	.	.	.	.
17.15	3.6121	2.93	. Q	.	.	.	.
17.28	3.6421	2.75	. Q	.	.	.	.
17.41	3.6704	2.60	. Q	.	.	.	.
17.54	3.6972	2.46	. Q	.	.	.	.
17.67	3.7227	2.35	. Q	.	.	.	.
17.79	3.7471	2.25	. Q	.	.	.	.
17.92	3.7704	2.16	. Q	.	.	.	.
18.05	3.7928	2.08	. Q	.	.	.	.
18.18	3.8160	2.29	. Q	.	.	.	.
18.31	3.8399	2.22	. Q	.	.	.	.
18.44	3.8631	2.16	. Q	.	.	.	.
18.56	3.8857	2.10	. Q	.	.	.	.
18.69	3.9077	2.05	. Q	.	.	.	.
18.82	3.9292	2.00	. Q	.	.	.	.
18.95	3.9502	1.96	.Q	.	.	.	.
19.08	3.9707	1.92	.Q	.	.	.	.
19.20	3.9908	1.88	.Q	.	.	.	.
19.33	4.0105	1.84	.Q	.	.	.	.
19.46	4.0298	1.80	.Q	.	.	.	.
19.59	4.0487	1.77	.Q	.	.	.	.
19.72	4.0673	1.74	.Q	.	.	.	.
19.84	4.0855	1.71	.Q	.	.	.	.
19.97	4.1035	1.68	.Q	.	.	.	.
20.10	4.1212	1.65	.Q	.	.	.	.
20.23	4.1386	1.63	.Q	.	.	.	.
20.36	4.1557	1.60	.Q	.	.	.	.

20.49	4.1725	1.58	.Q	.	.	.	.
20.61	4.1892	1.56	.Q	.	.	.	.
20.74	4.2055	1.54	.Q	.	.	.	.
20.87	4.2217	1.52	.Q	.	.	.	.
21.00	4.2377	1.50	.Q	.	.	.	.
21.13	4.2534	1.48	.Q	.	.	.	.
21.25	4.2689	1.46	.Q	.	.	.	.
21.38	4.2843	1.44	.Q	.	.	.	.
21.51	4.2994	1.42	.Q	.	.	.	.
21.64	4.3144	1.41	.Q	.	.	.	.
21.77	4.3292	1.39	.Q	.	.	.	.
21.90	4.3439	1.37	.Q	.	.	.	.
22.02	4.3584	1.36	.Q	.	.	.	.
22.15	4.3727	1.35	.Q	.	.	.	.
22.28	4.3869	1.33	.Q	.	.	.	.
22.41	4.4009	1.32	.Q	.	.	.	.
22.54	4.4148	1.30	.Q	.	.	.	.
22.66	4.4285	1.29	.Q	.	.	.	.
22.79	4.4421	1.28	.Q	.	.	.	.
22.92	4.4556	1.27	.Q	.	.	.	.
23.05	4.4690	1.26	.Q	.	.	.	.
23.18	4.4822	1.24	.Q	.	.	.	.
23.31	4.4953	1.23	.Q	.	.	.	.
23.43	4.5083	1.22	.Q	.	.	.	.
23.56	4.5212	1.21	.Q	.	.	.	.
23.69	4.5340	1.20	.Q	.	.	.	.
23.82	4.5467	1.19	.Q	.	.	.	.
23.95	4.5592	1.18	.Q	.	.	.	.
24.07	4.5717	1.17	.Q	.	.	.	.
24.20	4.5779	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1445.7
10%	107.7
20%	46.1
30%	30.8
40%	15.4
50%	7.7
60%	7.7
70%	7.7
80%	7.7
90%	7.7

6.4.5 Geotechnical Report

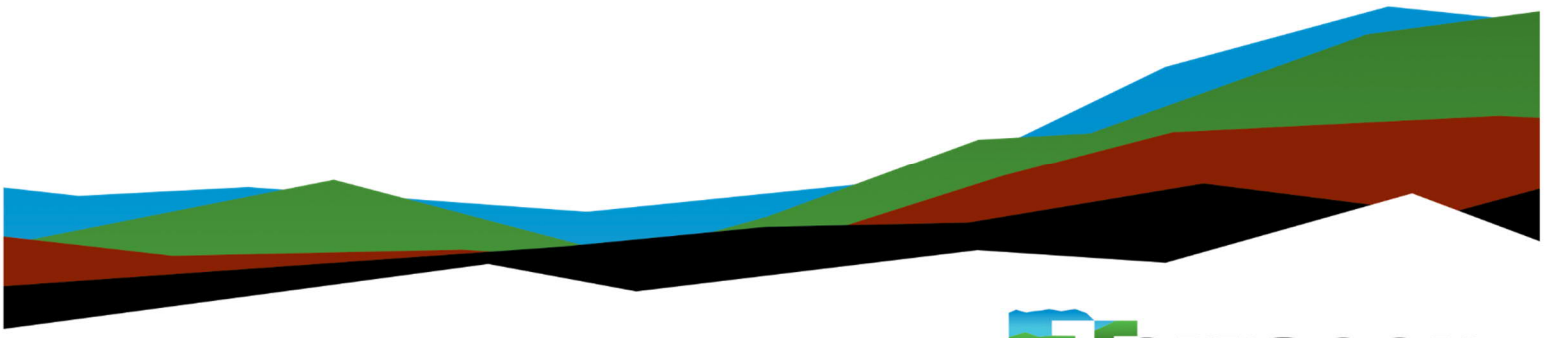
Big Box Retail– Hesperia

Geotechnical Engineering Report

August 25, 2023 | Terracon Project No. CB235111

Prepared for:

Kimley-Horn and Associates Inc.
1100 W Town and County Road, Suite 700
Orange, California



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August 25, 2023

Sam's Club and Kimley-Horn and Associates Inc.
1100 W Town and County Road, Suite 700
Orange, California

Attn: Mr. Ryan Alvarez
P: (714) 786-6322
E: ryan.alvarez@kimley-horn.com

Re: Geotechnical Engineering Report
Sam's Club – Hesperia
North of Amargosa Road and West of Highway I-15
Hesperia, San Bernardino County, California
Terracon Project No. CB235111

Dear Mr. Alvarez:

We have completed the scope of Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PCB235111 dated June 8, 2023. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs 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



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

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

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Attachments

Exploration and Testing Procedures
Site Location and Exploration Plans
Exploration and Laboratory Results
Supporting Information

Refer to each individual Attachment for a listing of contents.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed Sam's Club to be located North of Amargosa Road and West of Highway I-15 in Hesperia, San Bernardino County, California. The purpose of these services was 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
- Subgrade preparation/earthwork recommendations
- Foundation design and construction
- Floor slab design and construction
- Preliminary pavement section design
- Infiltration and drainage

The geotechnical engineering Scope of Services for this project included the advancement of forty-six test borings to depths ranging from approximately 5 to 51½ feet below existing site grades (bgs), laboratory testing, engineering analysis, and preparation of this report. Our scope also includes conducting four percolation tests at depths of 5 and 10 feet bgs.

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

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
Information Provided	An email request for proposal was provided by Kimley Horn on June 1, 2023. The request included conceptual plan drawings of the layout of the planned development.

Item	Description
Project Description	The project will consist of a new single-story Sam's Club store, paved parking and driveway, and a new fuel station with drive-thru canopies and a single-story service building.
Proposed Structure	The project generally consists of the construction of Sam's Club building with footprint area of approximately 167,050 square feet (sf). The project will also include car parking, driveways, and utilities. Fuel station with canopies and service building will be constructed. Buried fuel tanks will also be installed. We assume that stormwater diversion structures such as culverts, open channels, and storm drains will also be constructed on the site. The development will also include on-site Low Impact Development (LID) infiltration system.
Building Construction	We anticipate the Sam's Club building will be a combination of concrete masonry shear walls and steel columns, with a slab-on-grade floor. We anticipate the fuel station service building will be a combination of light gauge steel shear walls and steel columns, with a monolithic interior floor slab. We anticipate the fuel station canopy will be steel columns with a steel canopy roof.
Finished Floor Elevation	Anticipated to be within 3 feet of existing grade
Maximum Loads (assumed)	Structural loads were not provided at the time of this report. We assume that the proposed structures will have the following loads: Sam's Club Building: ■ Columns: 150 kips ■ Walls: 3 kips per linear foot (klf) ■ Slabs: 250 pounds per square foot (psf) Fuel Station Service Building: ■ Columns: 25 kips ■ Walls: 1 kip per linear foot (klf) ■ Slabs: 150 pounds per square foot (psf) Fuel Station Canopy: ■ Columns: 40 kips compression, 25 kips uplift

Item	Description
Grading/Slopes	A preliminary grading plan was not available for review at the time this report was prepared. Proposed finished grade elevation for the building pad is expected to be within 2 feet or less of existing grades, excluding remedial grading requirements. Slopes are not planned.
Below-Grade Structures	We have assumed the proposed fuel tanks will have a maximum depth on the order of 12 feet bgs.
Free-Standing Retaining Walls	None
Pavements	Paved driveway and parking will be constructed on approximately 16.7 acres of the parcel. A preferred pavement surfacing has not been identified to us as part of the preliminary information. Asphalt and concrete surfacing are common in the area for projects of this nature and is the assumed preference. Unless information is provided prior to the report, the anticipated ACI traffic categories and daily truck traffic will be assumed to consist of: ■ Category A: Car parking areas and access lanes, 10 truck per day ■ Category B: Entrance and truck service lanes, 25 trucks per day ■ Category C: Buses ■ Category D: Heavy duty trucks, 10 trucks per day ■ Category E: Garbage or fire truck lanes We assume the following traffic indices (TIs) will be used: ■ Auto Parking Areas: TI = 5.0: ■ Auto Road: TI = 5.5 ■ Truck Parking Areas: TI = 6.0 ■ Truck Ramps and Roads: TI = 8.0 ■ The pavement design period is 20 years.
Infiltration Systems	Based on review of the preliminary site plan, a shallow infiltration system consisting of a retention pond is planned on site.
Building Code	California Building Code 2022

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

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 North of Amargosa Road and West of Highway I-15 in Hesperia, San Bernardino County, California. The approximate size of the project area is approximately 20 acres. Approximate coordinates of the center of the site: Latitude: 34.4302°, Longitude: -117.3804° See Site Location
Existing Improvements	Currently consists of an undeveloped tract of land.
Current Ground Cover	Exposed soils with a light growth of grass and vegetation.
Existing Topography	Site is relatively flat.

Geotechnical Characterization

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 following table provides our geotechnical characterization. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the Exploration Results. The table below summarizes our geotechnical characterization.

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency / Density

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/ Density
Stratum I	51 ½	Interbedded layers of silty sand, silty sand with gravel and poorly graded sand with silt and gravel	medium dense to very dense

Groundwater

The borings were advanced using a hollow-stem-auger drilling technique that allows short term groundwater observations to be made while drilling. Groundwater seepage was not encountered within the maximum drilled depth of 51½ feet below ground surface (bgs) at the time of our field exploration. Our review of historical information regarding groundwater levels indicates that historical high groundwater levels are deeper than 50 feet bgs. Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed.

Lab Results

Laboratory tests were conducted on selected soil samples and the test results are presented in the Exploration Results section and on the boring logs. An Expansion Index (EI) test conducted on a near-surface sample from boring B-7 resulted in an EI value of 0 (characterized as "very low" potential).

To evaluate the potential deformation that may be caused by the addition of water to subsurface soils, hydroconsolidation testing was performed on selected, representative relatively undisturbed samples. The result is shown in Exploration Results section. The test result indicates collapse potentials of 1.8% (B-6 at 2.5 feet) and 4% (B-9 at 10 feet), boring number and sample depths summarized in parenthesizes. all samples were saturated under an axial pressure of 2,000 psf. The risk of hydro collapse can be mitigated by removal and replacement of the top 4 feet of on-site soil with engineered fill.

The soil sample with collapse potential of 4% was retrieved at a depth of 10 feet bgs (B-9). Based on the laboratory density and field blow counts, it is our opinion that sample disturbance may have contributed to the measured hydro-collapse laboratory results. Furthermore, effective stresses at such depths will be lower than 2,000 psf, which is the axial pressure the sample was tested for at.

Seismic Site Class

The 2022 California Building Code (CBC) Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool. This web-based software application calculates seismic design parameters in accordance with ASCE 7-16, and 2022 CBC. The 2022 CBC requires that a site-specific ground motion study be performed in accordance with Section 11.4.8 of ASCE 7-16 for Site Class D sites with a mapped S_s value greater than or equal 0.2.

However, Section 11.4.8 of ASCE 7-16 includes an exception from such analysis for specific structures on Site Class D sites. The commentary for Section 11 of ASCE 7-16 (Page 534 of Section C11 of ASCE 7-16) states that "In general, this exception effectively limits the requirements for site-specific hazard analysis to very tall and or flexible structures at Site Class D sites." Based on our understanding of the proposed structures, it is our assumption that the exception in Section 11.4.8 applies to the proposed structure. However, the structural engineer should verify the applicability of this exception.

Based on this exception, the spectral response accelerations presented below were determined using the site coefficients (Fa and Fv) from Tables 1613.2.3(1) and 1613.2.3(2) presented in Section 16.4.4 of the 2022 CBC.

Description	Value
2019 California Building Code Site Classification (CBC)[1]	D[2]
Site Latitude (°N)	34.4302
Site Longitude (°W)	117.3804
S_s Spectral Acceleration for a 0.2-Second Period	1.5
S_1 Spectral Acceleration for a 1-Second Period	0.584
F_a Site Coefficient for a 0.2-Second Period	1.0
F_v Site Coefficient for a 1-Second Period	1.72
Site Modified Peak Ground Acceleration (PGA_M)	0.55g
De-aggregated Modal Magnitude [3]	8.09

Description	Value

1. Seismic site classification in general accordance with the *2022 California Building Code*.
2. The 2022 California Building Code (CBC) requires a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope does not include the 100-foot soil profile determination. Borings were extended to a maximum depth of 51½ feet, and this seismic site class definition considers that similar or denser soils continue below the maximum depth of the subsurface exploration. Additional exploration to deeper depths would be required to confirm the conditions below the current depth of exploration.
3. These values were obtained using on-line Unified Hazard Tool by the USGS (https://earthquake.usgs.gov/hazards/interactive/) for return period of 2% in 50 years accessed

In some cases, a site-specific ground motion study may generate less conservative coefficients and acceleration values which may reduce construction costs. We recommend consulting with a structural engineer to evaluate the need for such study and its potential impact on construction costs. Terracon should be contacted if a site-specific ground motion study is desired.

Faulting and Estimated Ground Motions

The site is located in southern California, which is a seismically active area. The type and magnitude of seismic hazards affecting the site are dependent on the distance to causative faults, the intensity, and the magnitude of the seismic event. As calculated using the USGS Unified Hazard Tool, the San Andreas (San Bernardino N segment), which is considered to have the most significant effect at the site from a design standpoint, has a maximum magnitude of 7.92 and is located approximately 18.6 kilometers from the site. Furthermore, the site is not located within an Alquist-Priolo Earthquake Fault Zone based on our review of the State Fault Hazard Maps.

Liquefaction

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.

According to the County of San Bernardino Geologic Hazard Maps, the site is located within an area having low liquefaction potential. Moreover, historic groundwater levels are deeper than 50 feet. Based on the County mapping and encountered subsurface

conditions, it is our opinion that liquefaction potential/seismic settlement is low for this site.

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.

On-site soils generally consisted of interbedded layers of silty sand with gravel, poorly graded sand and poorly graded sand with silt and gravel extending to the maximum boring termination depth of about 51½ feet below ground surface (bgs).

Based on the conditions encountered, the proposed buildings can be supported on shallow foundations, such as spread footings, provided the recommendations outlined herein are followed.

Groundwater was not encountered within the maximum depths of exploration during or at the completion of drilling. Groundwater is not expected to affect shallow foundation construction on this site.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the Exploration Results), engineering analyses, and our current understanding of the proposed project. The General Comments section provides an understanding of the report limitations.

Earthwork

Earthwork is anticipated to include clearing and grubbing, excavations, and engineered fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

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.

Although no evidence of underground facilities such as septic tanks, cesspools, or basements were 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 4 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 and replaced with engineered compacted fill to a depth of 1 foot below existing grade, or proposed pavement sections, whichever is greater.

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 elevations per the recommendations of this report. The moisture content and compaction of subgrade soils should be maintained until foundation, slab, or pavement construction.

Based upon the subsurface conditions observed 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

Due to very dense soil encountered near the surface in some areas, excavation may require the use of specialized heavy-duty equipment. Consideration should be given to obtaining a unit price for difficult excavation in the contract documents for the project.

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 3 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 areas
- interior floor slab areas
- foundation backfill
- pavement areas
- exterior slab areas

Imported Fill Materials: Imported fill materials should meet the following material property requirements. Regardless of its source, compacted fill should consist of approved materials that are free of organic matter and debris.

Gradation	Percent Finer by Weight (ASTM C 136)
3"	100
No. 4 Sieve	50-100
No. 200 Sieve	10-40
Liquid Limit	30 (max)
Plasticity Index	15 (max)
Maximum expansion 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 and is "mildly corrosive" to ferrous metal and copper. 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.

Fill Placement and Compaction Requirements

Engineered fill should meet the following 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	-2%	+3%
Beneath interior slabs:	90	-2%	+3%
Fill greater than 5 feet in depth:	95	-2%	+3%
Miscellaneous backfill:	90	-2%	+3%
Beneath pavements:	95	-2%	+3%
Utility trenches: [1]	90	-2%	+3%
Bottom of excavation receiving fill:	90	-2%	+3%
Aggregate base (beneath pavements)	95	-2%	+3%

1. Upper 12 inches should be compacted to 95% within pavement and structural areas.

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with structural fill or bedding material in accordance with public works specifications for the utility be supported. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1:1 projection from existing foundations or existing utilities without engineering review of shoring requirements and geotechnical observation during construction.

A non-expansive granular material with a sand equivalent greater than 30 should be used for bedding and shading of utilities, unless allowed or specified otherwise by the utility manufacturer. On-site materials are considered suitable for backfill of utility and pipe trenches from 1 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.

Exterior Slab Design and Construction

Compacted subgrade composed of on-site clayey or silty soils may expand with increasing moisture content; therefore, exterior concrete slabs may heave, resulting in cracking or vertical offsets. The potential for damage would be greatest where exterior slabs are constructed adjacent to the building or other structural elements. To reduce the potential for damage caused by movement, we recommend:

- exterior slabs should be supported directly on subgrade fill (not ABC) with no, or very low expansion potential;
- strict moisture-density control during placement of subgrade fills;
- maintain proper subgrade moisture until placement of slabs;
- placement of effective control joints on relatively close centers and isolation joints between slabs and other structural elements;
- provision for adequate drainage in areas adjoining the slabs;
- use of designs which allow vertical movement between the exterior slabs and adjoining structural elements.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5% away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance

program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our scope of services does not include review of available final grading information or consider potential temporary grading performed by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/ precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent or near property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

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 site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances

shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and pavements), evaluation and remediation of existing fill materials, as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended 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. Where not specified by local ordinance, one density and water content test should be performed for every 50 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill. This testing frequency criteria may be adjusted during construction as specified by the geotechnical engineer of record.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. If unanticipated conditions are observed, 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 mat foundation.

Design Parameters

Item	Description
Foundation Type	Shallow Spread Footings
Net Allowable Bearing Pressure [1, 2]	3,000 psf

Foundation Support [3]	Engineered fill extending 2 feet below the bottom of foundations, or 4 feet below existing grades, whichever is greater.
Minimum Foundation Dimensions	Continuous: 18 inches wide Columns: 24 inches wide
Minimum Embedment below Finished Grade [4]	18 inches
Ultimate Passive Resistance[5] (Equivalent fluid pressures)	375 pcf
Ultimate Coefficient of Sliding Friction [6]	0.36
Estimated Static Settlement from Structural Loads [2]	About 1 inch
Estimated Differential Settlement [2, 7]	About ½ 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.
2. Values provided are for maximum loads noted in Project Description. Additional geotechnical consultation will be necessary if higher loads are anticipated. Does not include seismically induced settlement.
3. Unsuitable or soft soils should be over excavated and replaced per the recommendations presented in Earthwork.
4. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
5. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed, and compacted structural fill be placed against the vertical footing face. Assumes no hydrostatic pressure.
6. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Frictional resistance for granular materials is dependent on the bearing pressure which may vary due to load combinations.
7. Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.

Shallow Foundations Designed for Uplift Conditions

Reinforced concrete footings or dead-man foundations, cast against undisturbed subsoils, are recommended for resistance to uplift. Footings may be designed using the cone method. The equation for determining the ultimate uplift capacity as a function of footing dimension, foundation depth, and soil weight is:

$$T_u = 0.8 \cdot \gamma \cdot D^2 \cdot (B + L) + W$$

Where:

Variable	Description	Unit
T_u	Ultimate uplift capacity	pounds
γ	Unit weight of soil[1]	pcf
D	Depth to base of footing/dead-man foundation below final grade	feet
B	Width of footing/dead-man foundation	feet
L	Length of footing/dead-man foundation	feet
W	Weight of footing/dead-man + weight of soil directly over the top of the footing/block	pounds

Notes: [1]A unit weight (γ) of 120 pounds per cubic foot (pcf) is recommended for soil (either undisturbed or compacted backfill) at this site.

The design uplift resistance should be calculated by dividing the ultimate resistance obtained from the equation above by an appropriate factor of safety. A factor of safety of at least 2 is recommended for live uplift loads in the analysis.

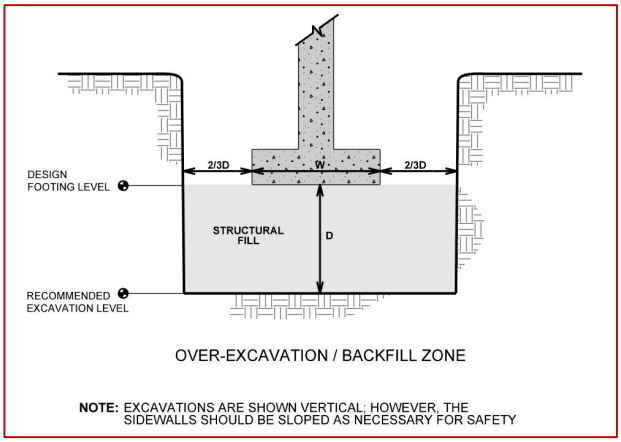
Foundations should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in masonry walls is recommended.

Foundation excavations should be observed by the geotechnical engineer. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

Foundation Construction Considerations

As noted in Earthwork, the footing excavations should be evaluated under the observation 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.

Over excavation for engineered fill placement below footings should be conducted as shown below. The over excavation should be backfilled up to the footing base elevation, with low volume change engineered fill placed, as recommended in the Earthwork section.



Floor Slabs

Design parameters for floor slabs assume the requirements for Earthwork have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor Slab Support[1]	Engineered fill extending 2 feet below the bottom of foundations, or 4 feet below existing grades, whichever is greater.
Subbase	Minimum 4 inches of Aggregate Base
Estimated Modulus of Subgrade Reaction [2]	200 pounds per square inch per inch (psi/in) for point loads. (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, when the project includes humidity-controlled areas, 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 contraction 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 waterproof, 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.

Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

Lateral Earth Pressures

Design Parameters

Lateral earth pressures are provided for below grade structures such as loading docks, and retaining walls with a height of less than 6 feet. For engineered fill comprised of on-site soils above any free water surface, recommended equivalent fluid pressures for unrestrained foundation elements are:

ITEM	VALUE[a, b]
Active Case	40 psf/ft
Passive Case	375 psf/ft
At-Rest Case	60 psf/ft

Coefficient of Friction	0.36

[a]Note: The values are based on on-site soils used as backfill.
[b]Note: Uniform, horizontal backfill, compacted to at least 90% of the ASTM D 1557 maximum dry density, rendering a maximum unit weight of 125 pcf.

The lateral earth pressures herein do not include any factor of safety and are not applicable for submerged soils/hydrostatic loading. Additional recommendations may be necessary if such conditions are to be included in the design.

Fill against foundation and retaining walls should be compacted to densities specified in the Earthwork section of this report. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors.

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" (Caltrans, 2018). 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."

During the field investigation at the site, two samples of the near surface soil taken from our borings were tested in our laboratory to determine the Hveem Stabilometer Value (R-value). The tests produced R-values of 39 and 58. A design R-Value of 35 was used to calculate the AC pavement thickness sections. A modulus of subgrade reaction of 120 pci and a modulus of rupture of 600 psi were used for the PCC pavement designs.

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 during construction when the actual subgrade soils are exposed.

Pavement Section Thicknesses

The following tables provides our opinion of minimum thickness 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]
Auto Roads	5.5	3" HMA[1]/6" Class 2 AB[2]
Truck Parking Areas	6.0	3.5" HMA[1]/7" Class 2 AB[2]
Truck Ramps and Roads	8.0	4" HMA[1]/11" 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]	Dumpster Pad[3]
PCC	5.0	6.0	7.5
Aggregate Base	4.0	4.0	4.0

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

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.

Although not required for structural support, a minimum 4-inch thick 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. PCC pavement details for joint spacing, joint reinforcement, and joint sealing should be prepared in accordance with ACI 330 and ACI 325.

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. Islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils are particular areas of concern. 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 stormwater 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.

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 upkeep should be anticipated. 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. Pavement care consists of both localized (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Additional engineering consultation 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%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install 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

Four in-situ percolation tests (falling head borehole permeability) were performed at approximate depths of 5 and 10 feet bgs within boreholes drilled with an 8-inch diameter auger. The objective of the testing is to provide infiltration rates for designing the proposed infiltration system. A 2-inch thick, 3/4-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 and 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	Water Head (ft)	Percolation Rate Average (in./hr.)	Infiltration Rate Average (in./hr.) [2]
Perc-1	5	0 to 5	SM	5	49.5	1.7

Perc-2	10	5 to 10	SM	5	171.0	6.8
Perc-3	5	0 to 5	SM	5	84.5	3.5
Perc-4	10	5 to 10	SM	5	101.5	5.5

1. Below existing ground surface.
2. If proposed infiltration system will mainly rely on vertical downward seepage, the correlated infiltration rates should be used. The correlation rate is based on the Porchet Method.

The above infiltration rates determined by the 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 tests were 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 results of laboratory sulfides, soluble sulfate, chlorides, electrical resistivity, redox

potential, total salts, and pH testing are presented in our appendix within the Exploration Results section. The 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.

Results of soluble sulfate testing indicate samples of the on-site soils tested possess negligible sulfate concentrations when classified in accordance with Table 19.3.1.1 of the ACI Design Manual. Concrete should be designed in accordance with the exposure class S0 provisions of the ACI Design Manual, Section 318, Chapter 19.

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. 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 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. The findings and recommendations presented in this report were prepared in a manner consistent with the standards of care and skill ordinarily exercised by members of its profession completing similar studies and practicing under similar conditions in the geographic vicinity and at the time these services have been performed. 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 affect 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. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. 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.

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth or Refusal (feet) [1,2]	Location
10(B-1 to B-6 & B-9 to B-12)	21 ½	Building area
2 (B-7 & B-8)	51 ½	Building area
3 (B-13 to B-15)	16 ½	Fuel Station (Canopy and Tank)
27 (P-1 to P-27)	5 to 11 ½	Parking/Driveway area
4 (Perc-1 to Perc-4)	5 to 10	Percolation Testing

1. Below ground surface.

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±10 feet) and referencing existing site features. If elevations and a more precise boring layout are desired, we recommend borings be surveyed.

Subsurface Exploration Procedures: We advanced the borings with a truck-mounted drill rig using continuous flight hollow stem augers. Four samples were generally obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. A 3-inch O.D. split-barrel sampling spoon with 2.5-inch I.D. ring lined sampler was also used for sampling soils at the project site. Ring-lined, split-barrel sampling procedures are similar to standard split spoon sampling procedure. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation

of the subsurface conditions between samples. Final boring logs were 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. The laboratory testing program included the following types of tests:

- Moisture Content
- Dry Unit Weight
- Particle-size Distribution (Gradation) of Soils Using Sieve Analysis
- Maximum Dry Density/Optimum Moisture Content
- Expansion Index
- Corrosion Suite
- Consolidation
- R-Value

The laboratory testing program often included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Site Location and Exploration Plans

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above.

Site Location

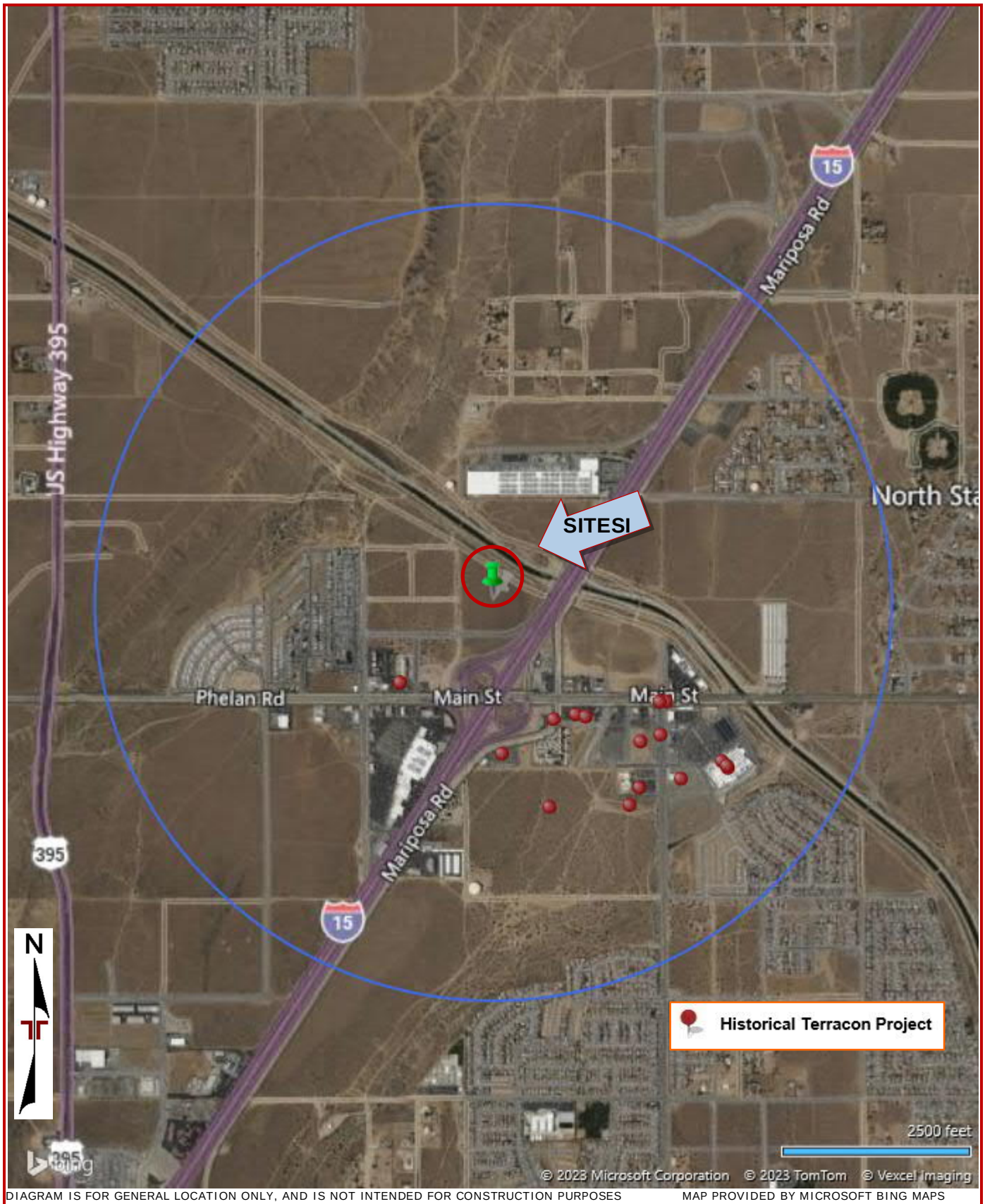


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan (11x17 Portrait)

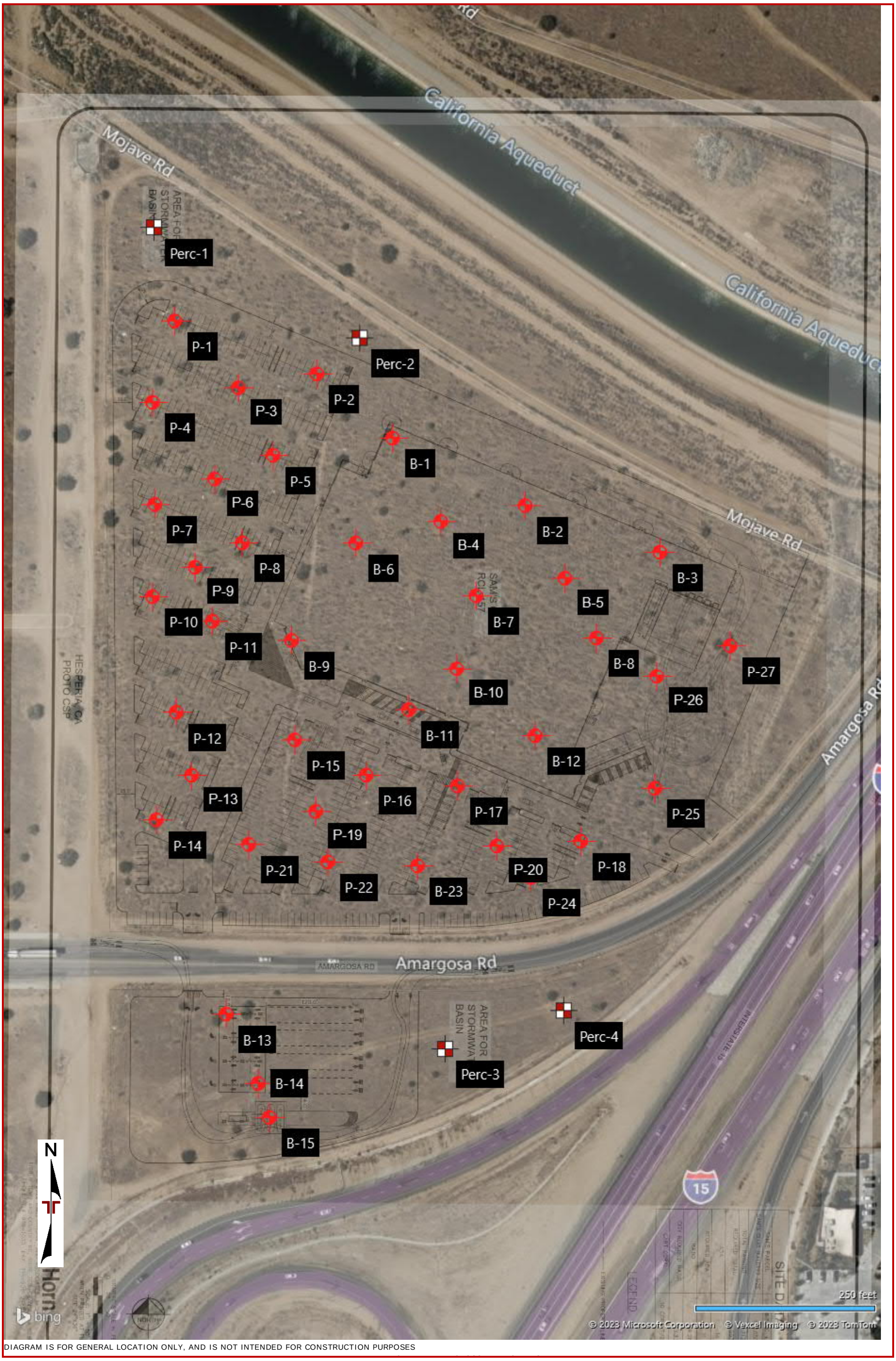


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Exploration and Laboratory Results

BORING LOG NO. B-1

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4310° Longitude: -117.3805°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND WITH GRAVEL (SM), brown, very dense							
						22-50/6"	2.7	122	30
5.0		**SILTY SAND (SM)**, brown, very dense	5			26-50/6"	2.6	127	
						26-50/6"	1.7	117	16
10.0		**POORLY GRADED SAND (SP)**, reddish brown, very dense	10			30-50/6"			
		brown, medium dense	15			6-12-13 N=25			5
		dense	20			17-19-23 N=42			
21.5		***Boring Terminated at 21.5 Feet***							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-14-2023	Boring Completed: 07-14-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-1

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-2

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4308° Longitude: -117.3799°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND (GM), light brown, very dense, with trace of gravel							
						50/6"			23
			5			50/6"			
		dense				30-37-50			16
10.0									
		POORLY GRADED SAND (SP), dense	10			31-38-50			
		medium dense	15			8-12-17 N=29			5
			20			15-18-20 N=38			
21.5		***Boring Terminated at 21.5 Feet***							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-10-2023	Boring Completed: 07-10-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-2

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-3

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4306° Longitude: -117.3792°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), brown, very dense, with trace of gravel							
					45-50/6"			
		5			25-50/6"			16
6.5								
	POORLY GRADED SAND (SP), dense				25-38-50			
	very dense	10			30-50/6"			6
		15			11-15-19 N=34			
		20			12-19-31 N=50			
21.5	***Boring Terminated at 21.5 Feet***							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-10-2023	Boring Completed: 07-10-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-4

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4307° Longitude: -117.3802°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), brown, medium dense							
					15-19-20	2.0	120	21
		5			20-16-17	1.4	116	
7.5								
	POORLY GRADED SAND (SP), brown, dense				24-34-42	2.9	122	
		10			34-43-48			7
	medium dense	15			10-10-15 N=25			7
		20			12-19-21 N=40			
21.5	***Boring Terminated at 21.5 Feet***							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023 | Boring Completed: 07-13-2023

Drill Rig: CME 75 | Driller: 2R

Project No.: CB235111 | Exhibit: A-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-5

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4305° Longitude: -117.3797°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND (SM), brown, very dense, with trace of gravel							
						36-55/6"			28
			5			45-50/5"			
		dense				21-35-52			13
10.0									
		POORLY GRADED SAND (SM), medium dense, with trace of gravel	10			22-26-28			
		dense	15			12-22-24 N=46			7
		dense	20			13-13-18 N=31			
21.5		***Boring Terminated at 21.5 Feet***							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-10-2023	Boring Completed: 07-10-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-5

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-6

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4306° Longitude: -117.3806°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND (SM), brown, medium dense, with trace of gravel							
						23-23-23	2.0	124	20
			5			11-10-17			
		reddish brown, very dense				34-50/4"	2.5	130	
		very dense	10			34-50/6"			19
15.0									
		POORLY GRADED SAND (SP), brown, dense	15			11-17-22 N=39			
			20			17-19-19 N=38			
21.5									
		Boring Terminated at 21.5 Feet							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023 | Boring Completed: 07-13-2023

Drill Rig: CME 75 | Driller: 2R

Project No.: CB235111 | Exhibit: A-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-7

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4304° Longitude: -117.3801°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
SILTY SAND WITH GRAVEL (SM), very dense					50/5"			28
		5			50			
7.5 **POORLY GRADED SAND WITH GRAVEL (SP)**, reddish brown, medium dense					19-22-25	0.7		7
dense 10' to 36.5'		10			15-23-36			
		15			10-12-23 N=35			5
		20			23-18-26 N=44			
		25			14-18-21 N=39			

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-10-2023	Boring Completed: 07-10-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-7

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4304° Longitude: -117.3801°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	POORLY GRADED SAND WITH GRAVEL (SP), reddish brown, medium dense *(continued)*							
		30			14-16-16 N=32			
		35			9-17-16 N=33			
	very dense 40' to 51.5'	40			17-23-30 N=53			
		45			20-32-32 N=64			
		50			18-31-23 N=54			
	51.5							
	Boring Terminated at 51.5 Feet							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-10-2023	Boring Completed: 07-10-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-8

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4303° Longitude: -117.3795°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND (SM), very dense, with trace of gravel							
						50/6"			20
		brown, dense	5			23-25-48	1.9	123	14
7.5		**POORLY GRADED SAND WITH GRAVEL (SP)**, medium dense				26-23-23			
		dense 10' to 25'	10			22-27-40			
			15			12-16-18 N=34			
			20			13-16-20 N=36			5
25.0		**SILTY SAND WITH GRAVEL (SM)**, light brown, dense	25			12-18-13 N=31			

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-10-2023 | Boring Completed: 07-10-2023

Drill Rig: CME 75 | Driller: 2R

Project No.: CB235111 | Exhibit: A-8

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-8

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4303° Longitude: -117.3795°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND WITH GRAVEL (SM), light brown, dense *(continued)*							
30.0		**POORLY GRADED SAND WITH GRAVEL (SP)**, dense	30			10-15-25 N=40			5
35.0		**SILTY SAND WITH GRAVEL (SM)**, dense	35			17-20-15 N=35			
			40			12-18-27 N=45			
			45			17-22-27 N=49			
		very dense	50			19-23-28 N=51			
51.5		***Boring Terminated at 51.5 Feet***							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-10-2023 | Boring Completed: 07-10-2023

Drill Rig: CME 75 | Driller: 2R

Project No.: CB235111 | Exhibit: A-8

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-9

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4303° Longitude: -117.3809°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND (SM), medium dense, with trace of gravel							
						13-16-16	1.6	121	16
			5			11-16-20	1.6	119	
7.5									
		SILTY SAND (SM), reddish brown, very dense				34-40-50/5"			
			10			23-50/5"			13
		dense	15			19-23-24 N=47			
20.0									
		POORLY GRADED SAND (SP), brown, dense	20			15-15-17 N=32			
21.5									
		Boring Terminated at 21.5 Feet							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-9

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-10

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4301° Longitude: -117.3802°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND (SM), dark brown, medium dense, with trace of gravel							
						12-16-20	2.4		22
5.0			5			50/5"			
		SILTY SAND (SM), reddish brown, very dense							
7.5									
		POORLY GRADED SAND (SP), reddish brown, dense				30-44-45	1.5	117	
			10			30-42-50			
			15			12-14-18 N=32			4
			20			12-13-17 N=30			
21.5									
		Boring Terminated at 21.5 Feet							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-10

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-11

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4300° Longitude: -117.3804°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND WITH GRAVEL (SM), dark brown, very dense							
						15-50/4"			28
5.0			5			50/4"			
		SILTY SAND (SM), reddish brown, very dense							
7.5									
		POORLY GRADED SAND (SP), reddish brown, dense				20-40-50	2.1	118	14
		very dense	10			30-50/6"			
		medium dense	15			11-14-14 N=28			
		light brown, dense	20			19-19-24 N=43			
21.5									
		Boring Terminated at 21.5 Feet							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-12

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4299° Longitude: -117.3798°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND WITH GRAVEL (SM), dark brown							
2.5									
		SILTY SAND (SM), dark brown, very dense				32-50/6"			24
		reddish brown	5			28-50/6"			22
7.5									
		POORLY GRADED SAND (SP), reddish brown, dense				22-39-50	1.7	115	
			10			35-40-48	1.2	118	
		brown	15			15-14-19 N=33			
			20			11-15-20 N=35			
21.5									
		Boring Terminated at 21.5 Feet							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-12

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-13

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4288° Longitude: -117.3812°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND WITH GRAVEL (SM), dark brown, very dense							
						44-50/4"			30
			5			30-50/6"			25
						22-50/6"			
			10			50/6"			37
15.0									
		SILTY SAND (SM), dark brown, medium dense	15			7-8-8 N=16			
16.5									
		Boring Terminated at 16.5 Feet							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-14-2023	Boring Completed: 07-14-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-13

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-14

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4286° Longitude: -117.3811°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND WITH GRAVEL (SM), dark brown, dense							
						26-37-47			30
5.0			5						
		SILTY SAND (SM), dark brown, very dense				26-50/6"			27
						50/6"			
		dense	10			26-37-50			
15.0									
		POORLY GRADED SAND (SP), dark brown, dense	15			11-15-17 N=32			
16.5									
		Boring Terminated at 16.5 Feet							

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

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-14-2023	Boring Completed: 07-14-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-14

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. B-15

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4284° Longitude: -117.3810°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND (SM), trace gravel, dark brown, very dense							
						27-50/6"			30
			5			17-27-36/0"			14
						50/6"			30
10.0									
		SILTY SAND (SM), trace gravel, dark brown, very dense	10			35-50/6"			
15.0									
		POORLY GRADED SAND (SP), trace gravel, dark brown, medium dense	15			8-8-12 N=20			
16.5									
		Boring Terminated at 16.5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-14-2023	Boring Completed: 07-14-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-15

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-1

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4294° Longitude: -117.3804°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							15
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023 | Boring Completed: 07-13-2023

Drill Rig: CME 75 | Driller: 2R

Project No.: CB235111 | Exhibit: A-101

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-2

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4315° Longitude: -117.3815°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023 | Boring Completed: 07-13-2023

Drill Rig: CME 75 | Driller: 2R

Project No.: CB235111 | Exhibit: A-102

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-3

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4313° Longitude: -117.3808°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							22
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-103

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-4

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4312° Longitude: -117.3812°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023 | Boring Completed: 07-13-2023

Drill Rig: CME 75 | Driller: 2R

Project No.: CB235111 | Exhibit: A-104

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-5

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4312° Longitude: -117.3816°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							18
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-6

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4310° Longitude: -117.3810°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							27
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023 | Boring Completed: 07-13-2023

Drill Rig: CME 75 | Driller: 2R

Project No.: CB235111 | Exhibit: A-106

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-7

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4309° Longitude: -117.3813°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023 | Boring Completed: 07-13-2023

Drill Rig: CME 75 | Driller: 2R

Project No.: CB235111 | Exhibit: A-107

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-8

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4308° Longitude: -117.3816°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							24
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-108

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-9

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4306° Longitude: -117.3812°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							25
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-109

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-10

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 34.4305° Longitude: -117.3814° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-110

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-11

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4304° Longitude: -117.3816°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							30
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-111

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-12

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4303° Longitude: -117.3813°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	POORLY GRADED SAND WITH SILT (SP-SM), trace gravel, brown to reddish brown, very dense							
					29-34-40 N=74			7
		5			29-27-34 N=61			8
					24-40-47 N=87			
		10			39-50/6"			
11.5								
	Boring Terminated at 11.5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023 | Boring Completed: 07-13-2023

Drill Rig: CME 75 | Driller: 2R

Project No.: CB235111 | Exhibit: A-112

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-13

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4300° Longitude: -117.3815°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND WITH GRAVEL (SM), dark brown, very dense							
						17-30-38 N=68			30
		medium dense	5			16-15-13 N=28			
7.5		**SILTY SAND (SM)**, trace gravel, reddish brown, dense				16-26-22 N=48			
10.0		**POORLY GRADED SAND WITH GRAVEL (SP)**, reddish brown, dense	10			18-18-21 N=39			
11.5		***Boring Terminated at 11.5 Feet***							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-112

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-14

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4297° Longitude: -117.3814°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND WITH GRAVEL (SM), brown, very dense							
						8-37-50 N=87			30
			5			17-28-25 N=53			
						16-26-34 N=60			
			10			24-50/6"			
11.5		***Boring Terminated at 11.5 Feet***							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-114

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-15

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4296° Longitude: -117.3816°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND (SM), trace gravel, brown, very dense							
						28-50/6"			23
		dense	5			15-19-27 N=46			
7.5									
		POORLY GRADED SAND (SP), trace gravel, brown, medium dense				20-15-13 N=28			8
		very dense	10			15-27-32 N=59			
11.5									
		Boring Terminated at 11.5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-115

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-16

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4299° Longitude: -117.3809°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND (SM), trace gravel, dark brown, dense							
						13-20-23 N=43			
		medium dense	5			9-11-14 N=25			
		very dense				32-50/6"			
			10			15-24-19 N=43			
11.5		***Boring Terminated at 11.5 Feet***							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-116

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-17

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4297° Longitude: -117.3806°

DEPTH	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), dark brown, dense							
					28-23-26 N=49			18
	very dense	5			30-50/5"			29
7.5	**POORLY GRADED SAND (SP)**, trace gravel, reddish brown, dense				13-17-18 N=35			
		10			17-17-18 N=35			
11.5	***Boring Terminated at 11.5 Feet***							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-117

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-18

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4297° Longitude: -117.3802°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND (SM), trace gravel, dark brown, very dense							
						30-37-42 N=79			25
		medium dense	5			7-11-13 N=24			
7.5		**POORLY GRADED SAND (SP)**, trace silt, dark brown, medium dense				11-13-15 N=28			
			10			8-9-7 N=16			
11.5		***Boring Terminated at 11.5 Feet***							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-118

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-19

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 34.4295° Longitude: -117.3796° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, brown							
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-119

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-20

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4296° Longitude: -117.3808°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, brown							29
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-120

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-21

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4295° Longitude: -117.3800°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023 | Boring Completed: 07-13-2023

Drill Rig: CME 75 | Driller: 2R

Project No.: CB235111 | Exhibit: A-121

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-22

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4295° Longitude: -117.3811°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, brown							26
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-122

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-23

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 34.4294° Longitude: -117.3808° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-123

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-24

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 34.4293° Longitude: -117.3798° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							28
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-124

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-25

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4297° Longitude: -117.3793°

DEPTH	GRAPHIC LOG		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
		SILTY SAND (SM), trace gravel, brown to reddish brown, very dense							
						17-24-28 N=52			
		dense	5						
						17-20-25 N=45			
10.0			10						
		Boring Terminated at 10 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-125

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-26

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4301° Longitude: -117.3792°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, reddish brown, very dense				26-50/5"			
	medium dense	5			5-5-5 N=10			
	10.0	10						
	Boring Terminated at 10 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-126

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. P-27

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4302° Longitude: -117.3789°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, reddish brown to brown, very dense							
					23-30-30 N=60			8
		5						
					26-35-45 N=80			
	10.0	10						
	Boring Terminated at 10 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-13-2023	Boring Completed: 07-13-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-127

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. Perc-1

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4318° Longitude: -117.3816°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							29
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-14-2023 | Boring Completed: 07-14-2023

Drill Rig: CME 75 | Driller: 2R

Project No.: CB235111 | Exhibit: A-201

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. Perc-2

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	LOCATION See Exhibit A-2 Latitude: 34.4314° Longitude: -117.3806°							
	SILTY SAND (SM), trace gravel, dark brown	5						
	10.0	10						
	Boring Terminated at 10 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-14-2023	Boring Completed: 07-14-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-202

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. Perc-3

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

LOCATION See Exhibit A-2

Latitude: 34.4287° Longitude: -117.3802°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown							18
	5.0	5						
	Boring Terminated at 5 Feet							

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-14-2023	Boring Completed: 07-14-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-203

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

BORING LOG NO. Perc-4

PROJECT: Sam's Club Hesperia

CLIENT: Kimley-Horn and Associates Inc
Orange, CA

SITE: North of Amargosa Road & West of Highway I-15
Hesperia, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 34.4288° Longitude: -117.3797° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	PERCENT FINES
	SILTY SAND (SM), trace gravel, dark brown	5						
	10.0 ***Boring Terminated at 10 Feet***	10						

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

Advancement Method:
8" Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-14-2023	Boring Completed: 07-14-2023
Drill Rig: CME 75	Driller: 2R
Project No.: CB235111	Exhibit: A-204

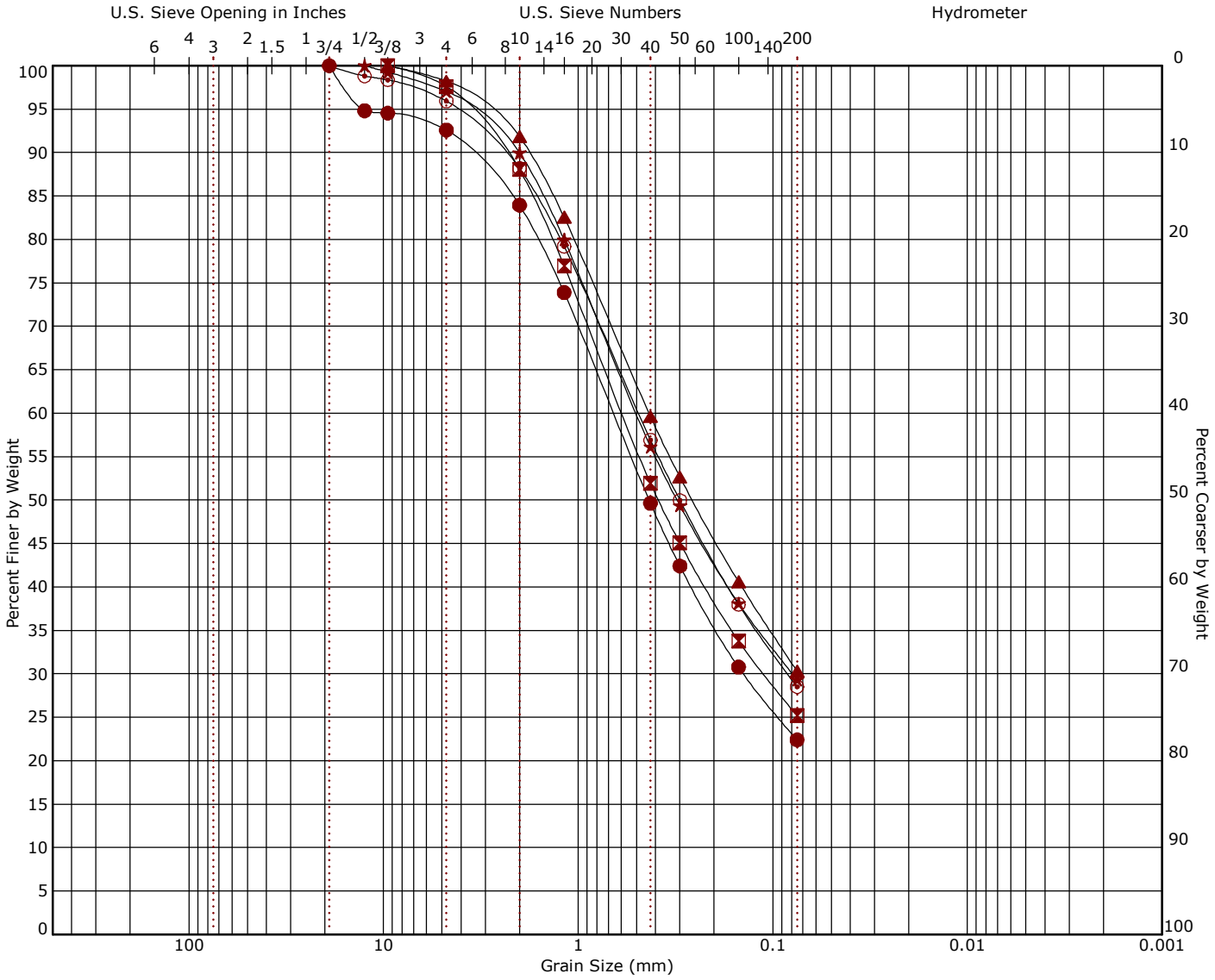
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/24/23

Sam's Club Hesperia
North of Amargosa Road & West of Highway I-15 | Hesperia, CA
Terracon Project No. CB235111

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-3	0 - 5								
⊠	P-9	0 - 5								
▲	P-13	0 - 5								
★	P-20	0 - 5								
⊙	Perc-1	0 - 5								

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
●	P-3	0 - 5	19	0.658	0.141		0.0	7.4	70.2	22.4		
⊠	P-9	0 - 5	9.5	0.591	0.11		0.0	2.4	72.4	25.2		
▲	P-13	0 - 5	9.5	0.432			0.0	1.8	67.9	30.3		
★	P-20	0 - 5	12.5	0.501	0.079		0.0	2.9	67.7	29.4		
⊙	Perc-1	0 - 5	19	0.49	0.084		0.0	4.1	67.4	28.5		

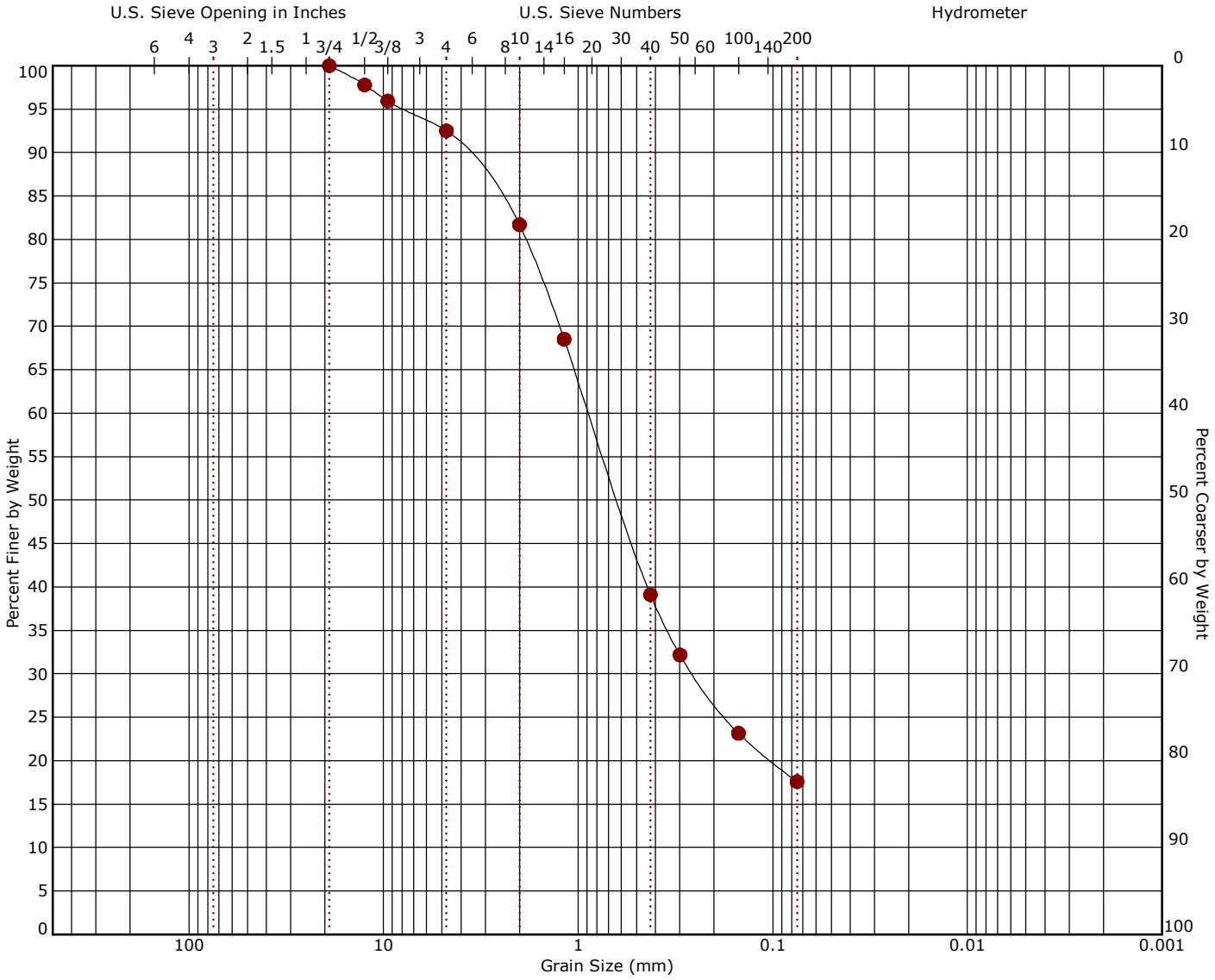
Laboratory tests are not valid if separated from original report.

Sam's Club Hesperia
North of Amargosa Road & West of Highway I-15 | Hesperia, CA
Terracon Project No. CB235111

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
Perc-3	0 - 5								

Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
Perc-3	0 - 5	19	0.878	0.254		0.0	7.5	74.9	17.6		

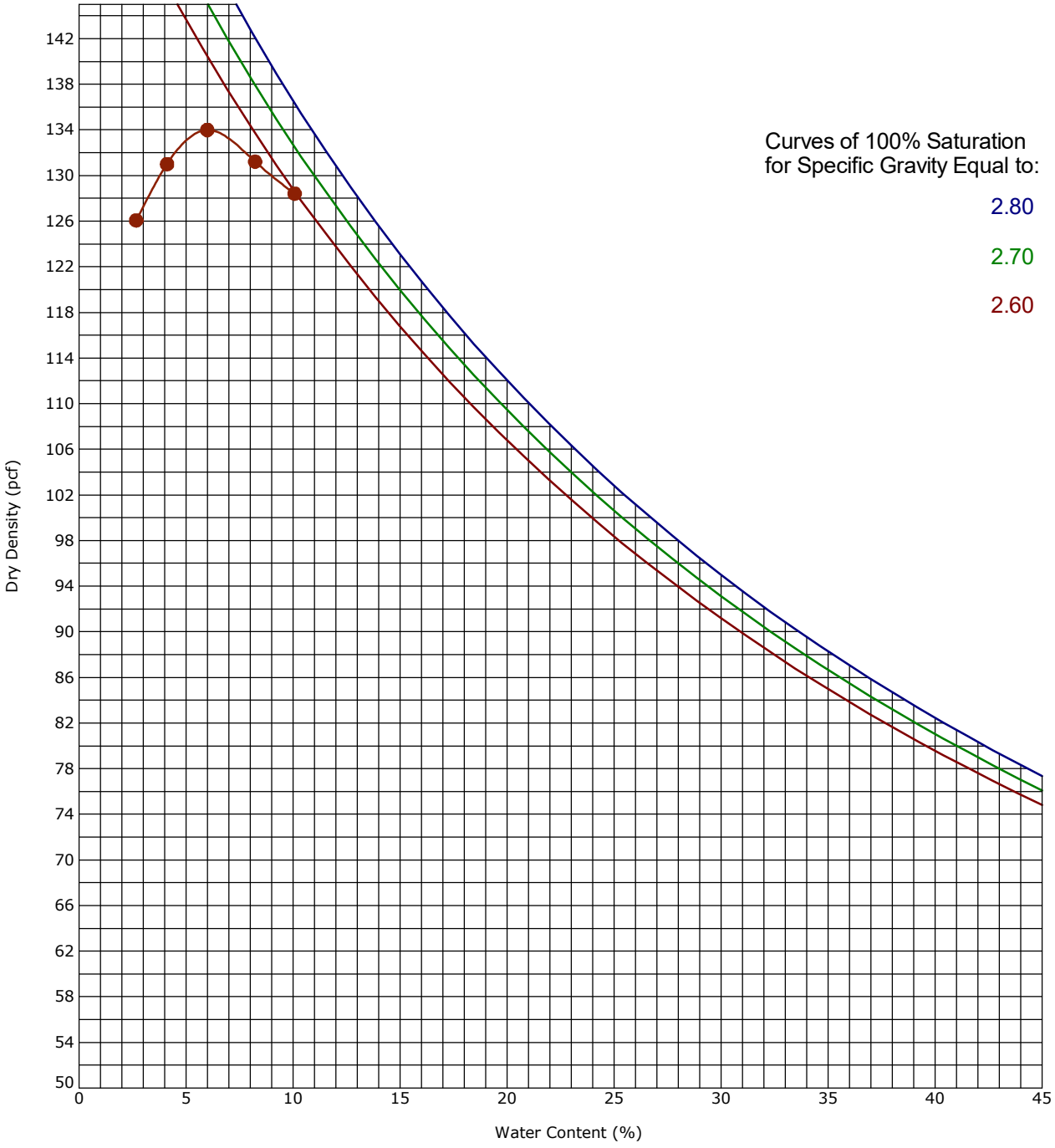
Laboratory tests are not valid if separated from original report.

Sam's Club Hesperia
North of Amargosa Road & West of Highway I-15 | Hesperia, CA
Terracon Project No. CB235111

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Moisture-Density Relationship

ASTM D1557-Method D



Boring ID	Depth (Ft)	Description of Materials
B-5	0 - 5	

Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
	0.0				ASTM D1557-Method D	134.0	6.0

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

Client

Project
Sam's Club Hesperia

Sample Submitted By: Terracon (CB) **Date Received:** 7/28/2023 **Lab No.: 23-0427**

Results of Corrosion Analysis

Sample Number	--
Sample Location	B-7
Sample Depth (ft.)	0.0-5.0
pH Analysis, ASTM G51	7.62
Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg)	23
Sulfides, AWWA 4500-S D, (mg/Kg)	Nil
Chlorides, ASTM D512, (mg/kg)	45
Red-Ox, ASTM G200, (mV)	+736
Total Salts, AWWA 2540, (mg/Kg)	47
As-Received Resitivity, ASTM G-57, (ohm-cm)	271600
Saturated Minimum Resistivity, ASTM G-57, (ohm-cm)	4850

Analyzed By N. Campo

Nathan Campo
Engineering Technician III

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.

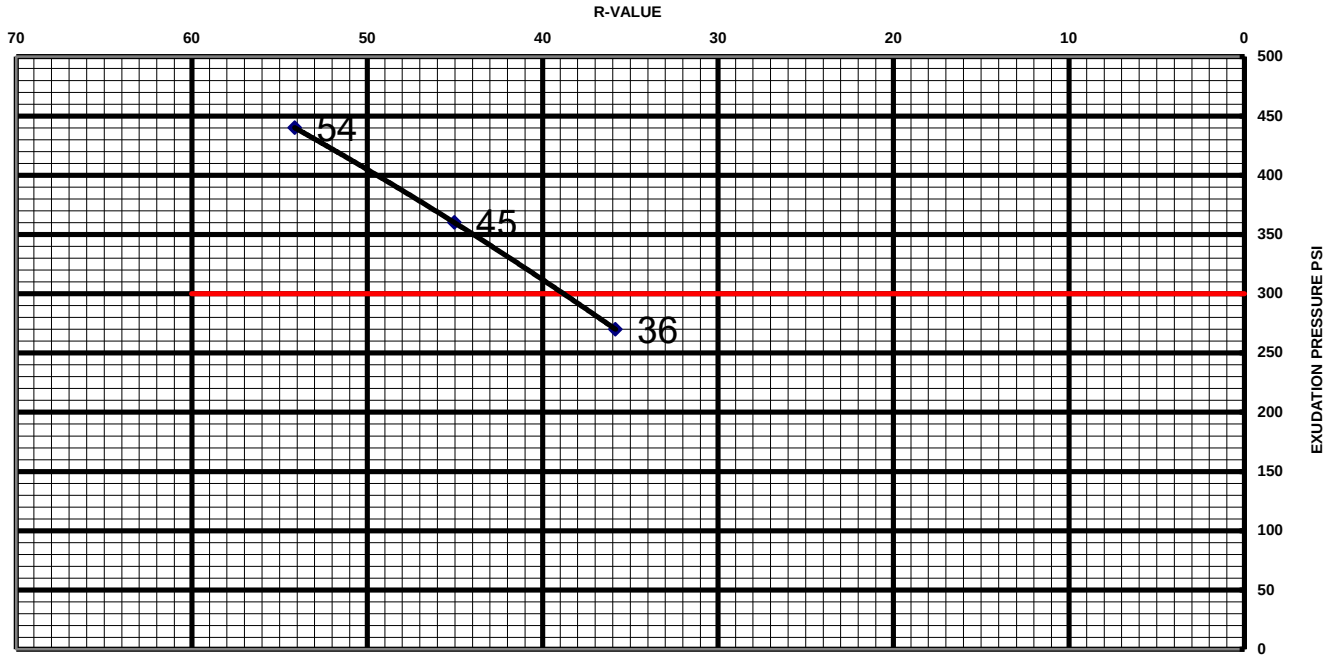
Job No. CB235111
Date. 8/16/2023

LABORATORY RECORD OF TESTS MADE ON BASE, SUBBASE, AND BASEMENT SOILS

CLIENT: **Kimley-Horn and Associate**
PROJECT **Sam's Club-Hesperia**
LOCATION: **Hesperia, CA**
R-VALUE # : **P-25**
T.I. :

	A	B	C	D
COMPACTOR AIR PRESSURE P.S.I.	350	350	350	
INITIAL MOISTURE %	2.2	2.2	2.2	
WATER ADDED, ML	75	70	65	
WATER ADDED %	6.5	6.1	5.7	
MOISTURE AT COMPACTION %	8.7	8.3	7.9	
HEIGHT OF BRIQUETTE	2.53	2.49	2.45	
WET WEIGHT OF BRIQUETTE	1177	1177	1157	
DENSITY LB. PER CU.FT.	129.7	132.3	132.6	
STABILOMETER PH AT 1000 LBS.	38	32	28	
2000 LBS.	74	63	52	
DISPLACEMENT	5.20	4.70	4.40	
R-VALUE	36	45	54	
EXUDATION PRESSURE	270	360	440	
THICK. INDICATED BY STAB.	0.00	0.00	0.00	
EXPANSION PRESSURE	0	0	4	
THICK. INDICATED BY E.P.	0.00	0.00	0.13	

EXUDATION CHART



R-Value: **39**

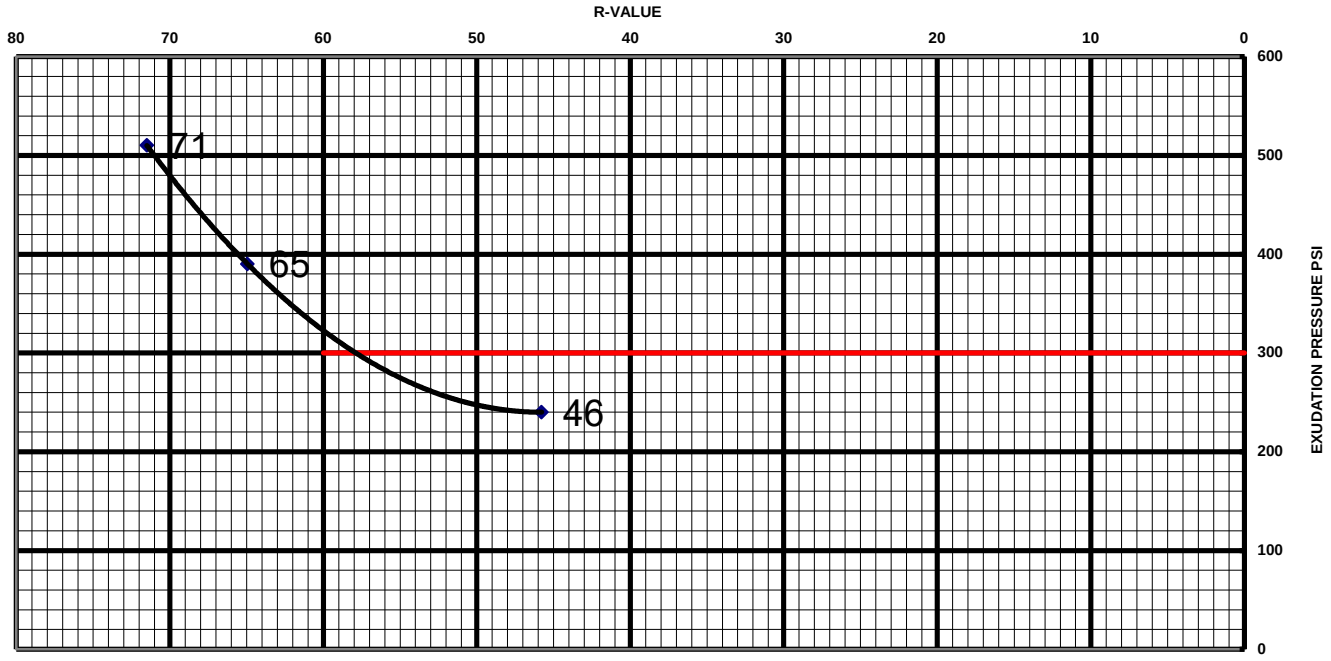
Job No. CB235111
Date. 8/16/2023

LABORATORY RECORD OF TESTS MADE ON BASE, SUBBASE, AND BASEMENT SOILS

CLIENT: **Kimley-Horn and Associate**
PROJECT **Sam's Club-Hesperia**
LOCATION: **Hesperia, CA**
R-VALUE # : **P-6**
T.I. :

	A	B	C	D
COMPACTOR AIR PRESSURE P.S.I.	350	350	350	
INITIAL MOISTURE %	1.5	1.5	1.5	
WATER ADDED, ML	85	75	70	
WATER ADDED %	7.4	6.5	6.1	
MOISTURE AT COMPACTION %	8.9	8.0	7.6	
HEIGHT OF BRIQUETTE	2.52	2.54	2.52	
WET WEIGHT OF BRIQUETTE	1169	1174	1167	
DENSITY LB. PER CU.FT.	129.1	129.7	130.4	
STABILOMETER PH AT 1000 LBS.	34	20	17	
2000 LBS.	56	32	28	
DISPLACEMENT	5.50	5.40	4.70	
R-VALUE	46	65	71	
EXUDATION PRESSURE	240	390	510	
THICK. INDICATED BY STAB.	0.00	0.00	0.00	
EXPANSION PRESSURE	0	0	0	
THICK. INDICATED BY E.P.	0.00	0.00	0.00	

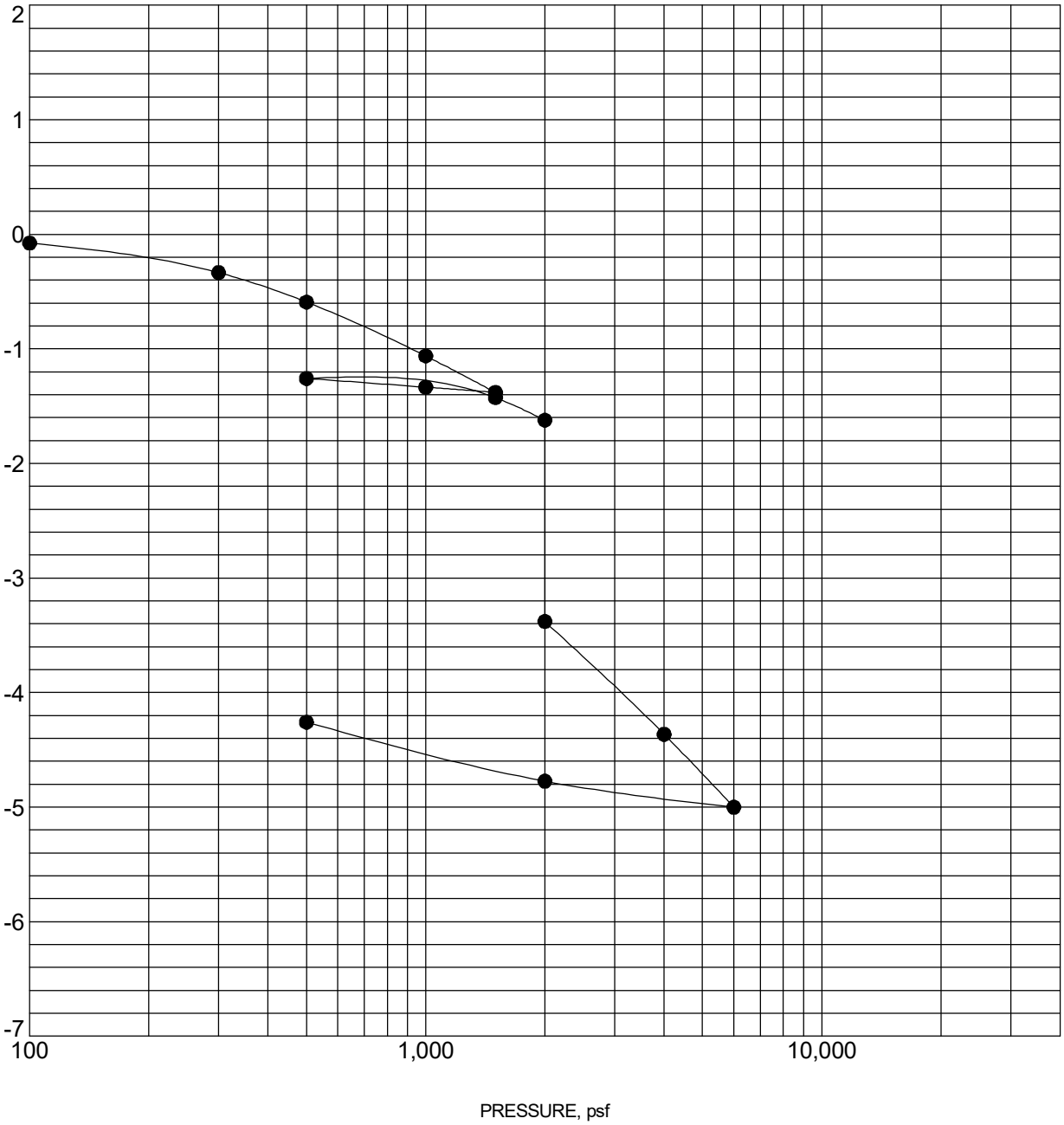
EXUDATION CHART



R-Value: **58**

SWELL CONSOLIDATION TEST

ASTM D2435



Specimen Identification		Classification	γ_d, pcf	WC, %
●	B-6 2.5 - 4 ft			

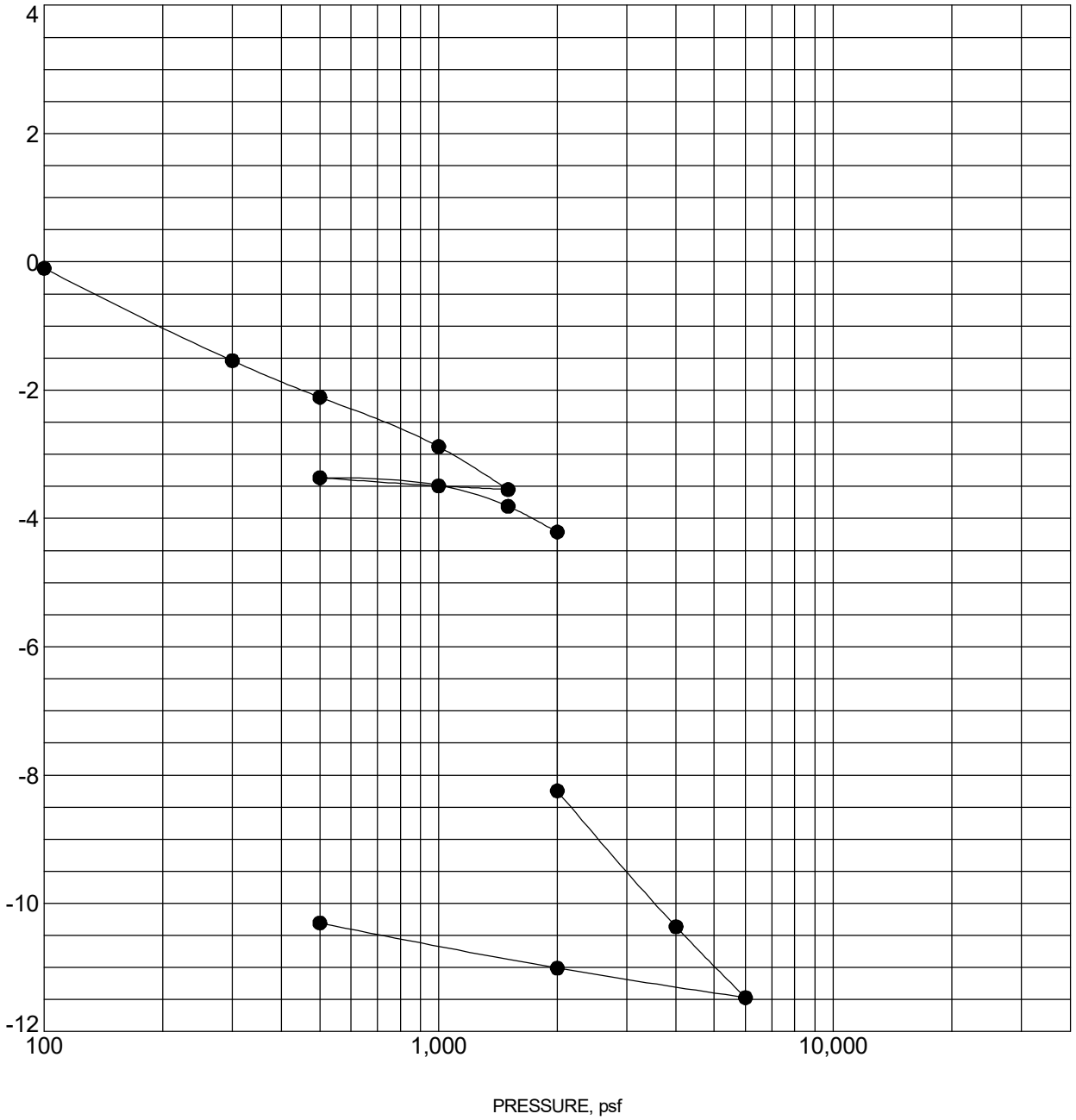
NOTES: sample was saturated at axial pressure of 2,000 psf

PROJECT: Sam's Club Hesperia	Terracon 1355 E Cooley Dr, Ste C Colton, CA	PROJECT NUMBER: CB235111
SITE: North of Amargosa Road & West of Highway I-15 Hesperia, CA		CLIENT: Kimley-Horn and Associates Inc Orange, CA
		EXHIBIT: B-1

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC_CONSOL_STRAIN-USCS CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/23/23

SWELL CONSOLIDATION TEST

ASTM D2435



Specimen Identification		Classification	γ_d, pcf	WC, %
●	B-9 10 - 11.4 ft			

NOTES: sample was saturated at axial pressure of 2,000 psf

PROJECT: Sam's Club Hesperia	Terracon 1355 E Cooley Dr, Ste C Colton, CA	PROJECT NUMBER: CB235111
SITE: North of Amargosa Road & West of Highway I-15 Hesperia, CA		CLIENT: Kimley-Horn and Associates Inc Orange, CA
		EXHIBIT: B-1

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC_CONSOL_STRAIN-USCS CB235111 SAM'S CLUB HESPER.GPJ TERRACON_DATATEMPLATE.GDT 8/23/23

Job No.: CB235111

PERCOLATION TEST DATA

BORING NUMBER: P-1
LOT No: N/A
TRACT No: N/A

CLIENT: Sams Club
PROJECT: Sams Club Hesperia

DATE OF DRILLING:
DATE OF PRESOAK:
DATE OF TEST: July 19, 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)
25	25	19.0	36.0	17.0	60.0	60.0	40.8	2.37
25	50	11.0	27.0	16.0	60.0	60.0	38.4	1.79
10	60	7.0	21.5	14.5	60.0	60.0	87.0	3.64
10	70	8.0	27.5	19.5	60.0	60.0	117.0	5.29
10	80	6.5	17.0	10.5	60.0	60.0	63.0	2.51
10	90	3.0	11.0	8.0	60.0	60.0	48.0	1.75
10	100	2.0	10.5	8.5	60.0	60.0	51.0	1.83
10	110	2.0	9.0	7.0	60.0	60.0	42.0	1.49
					Final reading:		49.50	1.79

Job No.: CB235111

PERCOLATION TEST DATA

BORING NUMBER: P-2
LOT No: N/A
TRACT No: N/A

CLIENT: Sams Club
PROJECT: Sams Club Hesperia

DATE OF DRILLING:
DATE OF PRESOAK:
DATE OF TEST: July 19, 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)
25	25	75.0	120.0	45.0	120.0	120.0	108.0	8.82
25	50	71.0	119.0	48.0	120.0	120.0	115.2	8.53
10	60	73.5	106.0	32.5	120.0	120.0	195.0	12.09
10	70	59.0	96.5	37.5	120.0	120.0	225.0	10.17
10	80	54.5	95.5	41.0	120.0	120.0	246.0	10.47
10	90	55.0	90.0	35.0	120.0	120.0	210.0	8.48
10	100	57.5	86.0	28.5	120.0	120.0	171.0	6.81
10	110	60.0	82.0	22.0	120.0	120.0	132.0	5.18
					Final reading:		171.00	6.82

Job No.: CB235111

PERCOLATION TEST DATA

BORING NUMBER: P-3
LOT No: N/A
TRACT No: N/A

CLIENT: Sams Club
PROJECT: Sams Club- Hesperia

DATE OF DRILLING:
DATE OF PRESOAK:
DATE OF TEST: July 19, 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)
25	25	25.0	60.0	35.0	60.0	60.0	84.0	8.62
25	50	21.5	60.0	38.5	60.0	60.0	92.4	8.70
10	60	18.8	38.5	19.8	60.0	60.0	118.5	7.10
10	70	11.0	30.0	19.0	60.0	60.0	114.0	5.49
10	80	10.5	26.3	15.8	60.0	60.0	94.5	4.33
10	90	8.5	23.0	14.5	60.0	60.0	87.0	3.76
10	100	7.0	21.3	14.3	60.0	60.0	85.5	3.57
10	110	7.0	20.5	13.5	60.0	60.0	81.0	3.36
					Final reading:		84.50	3.56

Job No.: CB235111

PERCOLATION TEST DATA

BORING NUMBER: P-4
LOT No: N/A
TRACT No: N/A

CLIENT: Sams Club
PROJECT: Sams Club- Hesperia

DATE OF DRILLING:
DATE OF PRESOAK:
DATE OF TEST: July 19, 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)
25	25	88.0	120.0	32.0	120.0	120.0	76.8	8.53
25	50	85.0	120.0	35.0	120.0	120.0	84.0	8.62
10	60	84.0	108.5	24.5	120.0	120.0	147.0	11.42
10	70	79.3	102.8	23.5	120.0	120.0	141.0	9.10
10	80	80.0	100.5	20.5	120.0	120.0	123.0	7.75
10	90	77.5	95.3	17.8	120.0	120.0	106.5	5.98
10	100	77.0	94.0	17.0	120.0	120.0	102.0	5.59
10	110	75.0	91.0	16.0	120.0	120.0	96.0	4.92
					Final reading:		101.50	5.50

Supporting Information

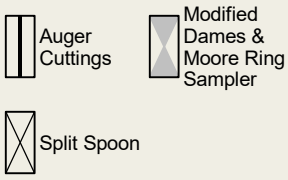
Contents:

General Notes
Unified Soil Classification System

Note: All attachments are one page unless noted above.

1355 E Cooley Dr, Ste C
Colton, CA

General Notes

Sampling	Water Level	Field Tests
	 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.	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			
Relative Density	**Standard Penetration or N-Value (Blows/Ft.)**	**Ring Sampler (Blows/Ft.)**	**Consistency**	**Unconfined Compressive Strength Qu (tsf)**	**Standard Penetration or N-Value (Blows/Ft.)**	**Ring Sampler (Blows/Ft.)**
Very Loose	0 - 3	0 - 5	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	6 - 14	Soft	0.25 to 0.50	2 - 4	3 - 5
Medium Dense	10 - 29	15 - 46	Medium Stiff	0.50 to 1.00	4 - 8	6 - 10
Dense	30 - 50	47 - 79	Stiff	1.00 to 2.00	8 - 15	11 - 18
Very Dense	> 50	> 80	Very Stiff	2.00 to 4.00	15 - 30	19 - 36
			Hard	> 4.00	> 30	> 36

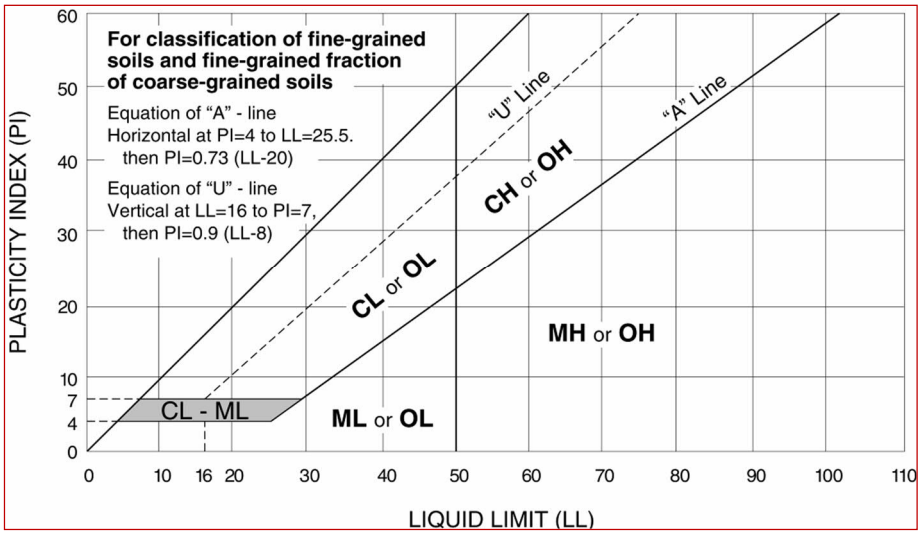
Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

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. 4 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines [C]	Cu≥4 and 1≤Cc≤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≥6 and 1≤Cc≤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 above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried}$ < 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:	$\frac{LL\ oven\ dried}{LL\ not\ dried}$ < 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] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[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.



6.4.6 Educational Materials

SAN BERNARDINO COUNTY
STORMWATER POLLUTION PREVENTION

Commercial landscape maintenance:

Yard waste, sediments and toxic lawn and garden chemicals used in commercial landscape maintenance often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates local waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution, protect public health and avoid fines or legal action.

- **Recycle Yard Waste:** Recycle leaves, grass clippings and other yard waste. Do not blow, sweep, rake or hose yard waste into the street. Let your customers know about grass cycling --the natural recycling of grass by leaving clippings on the lawn when mowing instead of using a grass catcher. Grass clippings will quickly decompose, returning valuable nutrients to the soil. You can get more information at www.ciwmb.ca.gov/Organics.
- **Use Fertilizers, Herbicides & Pesticides Safely:** Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use natural, non-toxic alternatives to traditional garden chemicals. If you must use chemical fertilizers, herbicides, or pesticides spot apply rather than blanketing entire areas, avoid applying near curbs and driveways and never apply before a rain.
- **Recycle Hazardous Waste:** Pesticides, fertilizers, herbicides and motor oil contaminate landfills and should be disposed of through a Hazardous Waste Facility. For information on proper disposal, call (909) 386-8401.
- **Use Water Wisely:** Conserve water and prevent runoff by controlling the amount of water and direction of sprinklers. Sprinklers should be on long enough to allow water to soak into the ground but not so long as to cause runoff. Periodically inspect, fix leaks and realign sprinkler heads.



- **Planting:** Plant native vegetation to reduce the need of water, fertilizers, herbicides and pesticides.
- **Prevent Erosion:** Erosion washes sediments, debris and toxic runoff into the storm drain system, polluting waterways. Prevent erosion and sediment runoff by using ground cover, berms and vegetation down-slope to capture runoff. Avoid excavation or grading during wet weather.



- **Store Materials Safely:** Keep landscaping materials and debris away from the street, gutter and storm drains. On-site stockpiles of materials should be covered with plastic sheeting to protect from rain, wind and runoff.

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

SAN BERNARDINO COUNTY
STORMWATER POLLUTION PREVENTION

Construction & development:

Soil, cement wash, asphalt, oil and other hazardous debris from construction sites often make their way into the San Bernardino County storm drain system, and flow untreated into local waterways. Follow these best management practices to prevent pollution, protect public health and avoid fines or legal action.



- **Store Materials Safely:** Keep construction materials and debris away from the street, gutter and storm drains. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.
- **Preventing Erosion:** Avoid excavation or grading during wet weather. Plant temporary vegetation or add hydro mulch on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff to a detention basin and around the construction site. Use gravel approaches where truck traffic is frequent to reduce soil compaction and limit the tracking of sediment into the streets. For more information on erosion control, call (909) 799-7407.



- **Cleaning & Preventing Spills:** Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. To report serious spills, call 911.
- **Maintaining Vehicles & Equipment:** Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, and brake and radiator fluids.
- **Ordering Materials & Recycling Waste:** Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. You can recycle broken asphalt, concrete, wood, and cleared vegetation. Dispose of hazardous materials through a hazardous waste hauler or other means in accordance with the construction permit. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.
- **Concrete and mortar application:** Never dispose of cement washout into driveways, streets, gutters or drainage ditches. Wash concrete mixers and equipment only in specified washout areas, where the water flows into lined containment ponds. Cement wash water can be recycled by pumping it back into cement mixers for reuse.

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org



General industrial & manufacturing businesses:

If you own, manage or help operate a business, especially an industrial or manufacturing company, you can help reduce storm water pollution. From environmentally friendly cleaning and maintenance activities, to recycling hazardous waste materials, businesses can do a lot to prevent storm water pollution.

- Review your cleaning and maintenance activities to look for ways to reduce runoff into the storm drain system, especially in outdoor areas like parking lots, loading docks and maintenance yards. Keep trash enclosure swept and trash bin lids closed.
- Train employees to wash vehicles and equipment indoors in a wash rack that is connected to the sanitary sewer or off-site at a commercial wash facility. Train janitorial staff to dispose of floor cleaning water in the sewer and not into the parking lot. Make sure that cooling towers, boilers, compressors, water softeners and other process equipment are connected to the sanitary sewer and do not discharge wastewater into the parking lot.
- If you use hazardous materials in your everyday business, like ink and solvents for commercial printing, or polishes and chemicals for car detailing or manufacturing after-market accessories, do not put these hazardous materials in the trash or pour them into the gutter. Take them to be recycled safely. Store chemicals, wastes, raw materials and contaminated equipment indoors or in a covered, spill contained area, to prevent exposure of these materials to storm water. For information on proper hazardous waste disposal, call (909)386-8401.
- Take advantage of less-toxic alternatives to dangerous chemicals. From detergents to drain openers, there are a lot of ways to get the same or better result without having to rely toxic substances.
- Looking for raw materials? San Bernardino County Materials Exchange Program, or SBCoMax is a partnership between the County and the California Integrated Waste Management Board, for businesses to provide used but usable materials to those interested in obtaining them. The program helps divert used materials from landfills, saves resources and can save you money.

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

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

LANDSCAPE MAINTENANCE

DISCHARGE TO THE STORM DRAIN, ACCIDENTAL OR NOT, COULD LEAD TO ENFORCEMENT ACTIONS, WHICH COULD INCLUDE FINES.

Follow the best practices below to **prevent water pollution from landscaping activities.**

RECYCLE YARD WASTE



- Recycle leaves, grass clippings and other yard waste.
- Do not blow, sweep, rake or hose yard waste into the street or catch basin.
- **Try grasscycling:** the natural recycling of grass by leaving clippings on the lawn when mowing.

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

USE FERTILIZERS, HERBICIDES AND PESTICIDES SAFELY



- Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use natural and non-toxic alternatives as often as possible.
- If you must use chemical fertilizers, herbicides or pesticides:
  - Spot apply, rather than blanketing entire areas.
  - Avoid applying near curbs and driveways, and **never** before a rain.
  - Apply fertilizers as needed: when plants could best use it and when the potential runoff would be low.
  - Follow the manufacturer's instructions carefully—this will not only give the best results, but will save money.

USE WATER WISELY



- Control the amount of water and direction of sprinklers. Sprinklers should only be on long enough to allow water to soak into the ground, but not so long as to cause runoff.
- Periodically inspect, fix leaks and realign sprinkler heads.
- Plant native vegetation to reduce the need of water, fertilizers, herbicides and pesticides.

HOMEOWNERS

KEEP THESE TIPS IN MIND WHEN HIRING PROFESSIONAL LANDSCAPERS AND REMIND AS NECESSARY.

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

For more information on proper disposal call,

(909) 382-5401 or 1-800-OILY CAT.

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

To report illegal dumping, call (877) WASTE18 or visit sbcountystormwater.org
To report toxic spills, call 1(800) 33 TOXIC
To dispose of hazardous waste, call 1(800) OILY CAT

sbcountystormwater.org

Big Bear • 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

STORMWATER Pollution Prevention

CONSTRUCTION

Cement wash, sediment, vehicle fluids, dust and hazardous debris from construction sites often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Store Materials Safely
Keep construction materials and debris away from the street, gutter and storm drains. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.



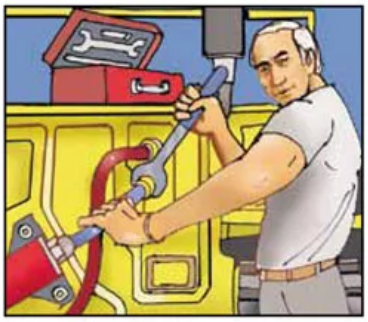
Ordering Materials & Recycling Waste
Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. You can recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.



Cleaning & Preventing Spills
Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. To report serious spills, call 911.



Preventing Erosion
Avoid excavation or grading during wet weather. Plant temporary vegetation or add hydromulch on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff to a detention basin and around the construction site. Channels can be lined with grass or roughened pavement to reduce runoff velocity.



Maintaining Vehicles & Equipment
Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.



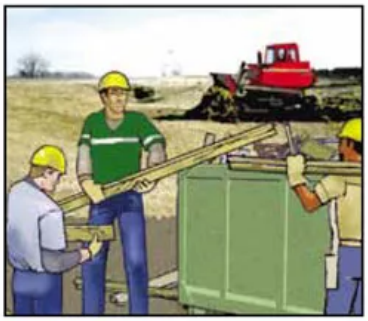
To report illegal dumping call
(877) WASTE18
sbcountystormwater.org

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

EXCAVATION AND GRADING

Sediment, cement wash, asphalt and vehicle fluids from soil excavation and grading often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Recycling Waste

Recycle broken asphalt, concrete, wood, and cleared vegetation whenever possible. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.



Maintaining Vehicles & Equipment

Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutters and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks. Use gravel approaches where truck traffic is heavy to reduce soil compaction and limit the tracking of sediment into the street.



Cleaning & Preventing Spills

Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. Prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids. To report serious spills, call 911.



Storing Materials

Keep construction materials and debris away from the street, gutter and storm drains. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.



Preventing Erosion

Avoid excavation or grading during wet weather. Plant temporary vegetation on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff. Channels can be lined with grass or roughened pavement to reduce runoff velocity.

To report illegal dumping call

(877) WASTE18

sbcountystormwater.org

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

ROADWORK AND PAVING

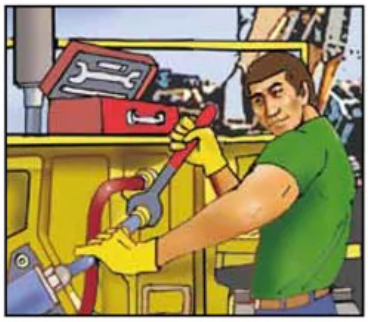
Asphalt, saw-cut slurry and excavated materials from road paving, surfacing and pavement removal often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Preventing Erosion
Schedule excavation and grading work during dry weather. Develop and implement erosion and sediment control plans for excavated embankments. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.



During Construction
Cover catch basins and maintenance holes when applying seal coat, slurry seal or fog seal. Use check dams, ditches or berms around excavations, and avoid over applying water for dust control. Never wash excess materials from exposed aggregate or concrete into the street, gutter or a storm drain.



Maintaining Vehicles & Equipment
Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.

Asphalt & Concrete Removal
Barricade storm drain openings during saw-cutting, and recycle broken up pavement at a crushing company. For recycling information, call (909) 386-8401.



Cleaning & Preventing Spills
Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. Sweep up dry spills, instead of hosing. Prevent spills from paver machines by using drip pans, or by placing absorbent materials like cloths or rags under the machines when not in use. To report serious spills, call 911.



To report illegal dumping call

(877) WASTE18

sbcountystormwater.org

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

Important Phone Numbers

San Bernardino County Flood Control
(909) 387-8112

County of San Bernardino
(909) 387-8109

City of Big Bear Lake
(909) 866-5831

City of Chino (909) 591-9850

City of Chino Hills (909) 364-2722

City of Colton (909) 370-6128

City of Fontana (909) 350-6772

City of Grand Terrace
(909) 824-6671 x 226

City of Highland (909) 864-8732 x 230

City of Loma Linda (909) 799-4405

City of Montclair (909) 625-9470

City of Ontario (909) 395-2025

City of Rancho Cucamonga
(909) 477-2740 x 4063

City of Redlands (909) 798-7655

City of Rialto (909) 421-4921

City of San Bernardino (909) 384-5154

City of Upland (909) 931-4370

City of Yucaipa (909) 797-2489 x 243

San Bernardino County
Stormwater Program
825 East Third Street • Room 201
San Bernardino, CA 94215-0835

STORMWATER

Pollution Prevention

INDUSTRIAL AND COMMERCIAL FACILITIES



Pollution STORMWATER Prevention

Industrial and Commercial Facilities

To reduce the amount of pollutants reaching our storm drain system, which leads to the Santa Ana River and Pacific Ocean, the San Bernardino County Stormwater Program has developed Best Management Practices (BMPs) for Industrial and Commercial Facilities. City and County ordinances require that businesses comply with these BMPs, where applicable, to protect local water quality. Local cities and the County are required to verify implementation of these BMPs by performing regular facility inspections.



Prohibited Discharges

- Discontinue all non-stormwater discharges to the storm drain system. It is prohibited to discharge any chemicals, wastes or wastewater into the gutter, street or storm drain.

Outdoor Storage

- Install covers and secondary containment areas for all hazardous materials and wastes stored outdoors in accordance with County and/or City standards.
- Keep all temporary waste containers covered, except when in direct use.
- Sweep outdoor areas instead of using a hose or pressure washer.

Outdoor Processes

- Move all process operations including vehicle and equipment maintenance inside of the building or into a covered and contained area.
- Wash equipment and vehicles in a contained and covered wash bay which is closed-loop or connected to a clarifier sized to city standards, then discharged to a sanitary sewer or take them to a commercial car wash.

Spills and Clean Ups

- Clean up spills immediately when they occur, using dry clean up methods such as absorbent materials and followed by proper disposal of materials.
- Always have a spill kit available near chemical loading dock doors, vehicle maintenance and fueling areas.
- Follow your Business Emergency Plan, as filed with the County Fire Department at (909) 386-8401.

- Report all prohibited discharges and non-implementation of BMPs to your local Stormwater Coordinator either at (800) CLEANUP or as listed at www.sbcounty.gov/stormwater.
- Report hazardous materials spills to (800) 33 TOXIC and your local Fire Department Hazmat Team at 911.

Training

Train employees in spill response procedures and prohibited discharges to the storm drain system, as prescribed in your local Stormwater Ordinance and in applicable Best Management Practices available at www.cabmphandbooks.com and www. sbcounty.gov/stormwater.

Permitting

Stormwater discharges associated with specific categories of commercial and industrial facilities are regulated by the State Water Resources Control Board (SWRCB) through an Industrial Storm Water General Permit. A copy of the General Permit and application forms are available at:
www.waterboards.ca.gov/stormwtr/industrial.html

To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

or visit our websites at:

www.sbcounty.gov/stormwater

www.1800cleanup.org

San Bernardino County
STORMWATER PROGRAM

San Bernardino County Stormwater Program
825 East Third Street · Room 127
San Bernardino, CA 94215-0835

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PERMIT# 000



STORMWATER Pollution Prevention

Stormwater Management Practices for Commercial Landscape Maintenance

Yard waste, sediments, and toxic lawn/garden chemicals used in commercial landscape maintenance often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates local waterways, making them unsafe for people and wildlife. Following these best management practices will prevent pollution, comply with regulations and protect public health.

Recycle Yard Waste

Recycle leaves, grass clippings and other yard waste. Do not blow, sweep, rake or hose yard waste into the street. Try grasscycling - the natural recycling of grass by leaving clippings on the lawn when mowing. Grass clippings will quickly decompose, returning valuable nutrients to the soil. Further information can be obtained at www.ciwmb.ca.gov/Organics.

Use Fertilizers, Herbicides and Pesticides Safely

Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use of natural, non-toxic alternatives to the traditional fertilizers, herbicides and pesticides is highly recommended. If you must use chemical fertilizers, herbicides, or pesticides:



- Spot apply pesticides and herbicides, rather than blanketing entire areas.
- Avoid applying near curbs and driveways, and never apply before a rain.
- Apply fertilizers as needed, when plants can best use it, and when the potential for it being carried away by runoff is low.

Recycle Hazardous Waste

Pesticides, fertilizers, herbicides and motor oil contaminate landfills and should be disposed of through a Hazardous Waste Facility, which accepts these types of materials. For information on proper disposal call, (909) 386-8401.

Use Water Wisely

Conserve water and prevent runoff by controlling the amount of water and direction of sprinklers. Sprinklers should be on long enough to allow water to soak into the ground but not so long as to cause runoff. Periodically inspect, fix leaks and realign sprinkler heads. Plant native vegetation to reduce the need of water, fertilizers, herbicides, and pesticides.

Prevent Erosion

Erosion washes sediments, debris and toxic runoff into the storm drain system, polluting waterways.

- Prevent erosion and sediment runoff by using ground cover, berms and vegetation down-slope to capture runoff.
- Avoid excavation or grading during wet weather.

Store Materials Safely

Keep landscaping materials and debris away from the street, gutter and storm drains. On-site stockpiles of materials must be covered with plastic sheeting to protect from rain, wind and runoff.

To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

or visit our websites:

www.co.san-bernardino.ca.us/flood/npdes

www.1800cleanup.org

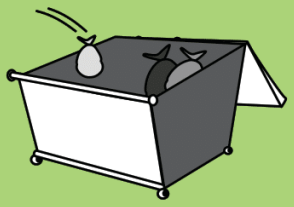
San Bernardino County STORMWATER PROGRAM

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.

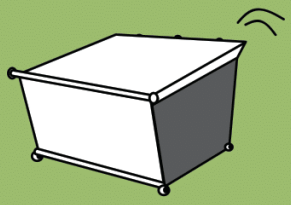
FOLLOW THESE REQUIREMENTS TO KEEP OUR WATERWAYS CLEAN

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 report 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

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

Storm Drain Signage SD-13



Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include “NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Maintenance Bays & Docks SD-31



Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach

In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications

Appropriate applications include commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

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- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.
- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.
- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.
- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.
- Other features may be comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Infiltration Basin TC-11



Design Considerations

- Soil for Infiltration
- Slope
- Aesthetics

Targeted Constituents

☑	Sediment	■
☑	Nutrients	■
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually exfiltrates through the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

California Experience

Infiltration basins have a long history of use in California, especially in the Central Valley. Basins located in Fresno were among those initially evaluated in the National Urban Runoff Program and were found to be effective at reducing the volume of runoff, while posing little long-term threat to groundwater quality (EPA, 1983; Schroeder, 1995). Proper siting of these devices is crucial as underscored by the experience of Caltrans in siting two basins in Southern California. The basin with marginal separation from groundwater and soil permeability failed immediately and could never be rehabilitated.

Advantages

- Provides 100% reduction in the load discharged to surface waters.
- The principal benefit of infiltration basins is the approximation of pre-development hydrology during which a

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significant portion of the average annual rainfall runoff is infiltrated and evaporated rather than flushed directly to creeks.

- If the water quality volume is adequately sized, infiltration basins can be useful for providing control of channel forming (erosion) and high frequency (generally less than the 2-year) flood events.

Limitations

- May not be appropriate for industrial sites or locations where spills may occur.
- Infiltration basins require a minimum soil infiltration rate of 0.5 inches/hour, not appropriate at sites with Hydrologic Soil Types C and D.
- If infiltration rates exceed 2.4 inches/hour, then the runoff should be fully treated prior to infiltration to protect groundwater quality.
- Not suitable on fill sites or steep slopes.
- Risk of groundwater contamination in very coarse soils.
- Upstream drainage area must be completely stabilized before construction.
- Difficult to restore functioning of infiltration basins once clogged.

Design and Sizing Guidelines

- Water quality volume determined by local requirements or sized so that 85% of the annual runoff volume is captured.
- Basin sized so that the entire water quality volume is infiltrated within 48 hours.
- Vegetation establishment on the basin floor may help reduce the clogging rate.

Construction/Inspection Considerations

- Before construction begins, stabilize the entire area draining to the facility. If impossible, place a diversion berm around the perimeter of the infiltration site to prevent sediment entrance during construction or remove the top 2 inches of soil after the site is stabililized. Stabilize the entire contributing drainage area, including the side slopes, before allowing any runoff to enter once construction is complete.
- Place excavated material such that it can not be washed back into the basin if a storm occurs during construction of the facility.
- Build the basin without driving heavy equipment over the infiltration surface. Any equipment driven on the surface should have extra-wide (“low pressure”) tires. Prior to any construction, rope off the infiltration area to stop entrance by unwanted equipment.
- After final grading, till the infiltration surface deeply.
- Use appropriate erosion control seed mix for the specific project and location.

Performance

As water migrates through porous soil and rock, pollutant attenuation mechanisms include precipitation, sorption, physical filtration, and bacterial degradation. If functioning properly, this approach is presumed to have high removal efficiencies for particulate pollutants and moderate removal of soluble pollutants. Actual pollutant removal in the subsurface would be expected to vary depending upon site-specific soil types. This technology eliminates discharge to surface waters except for the very largest storms; consequently, complete removal of all stormwater constituents can be assumed.

There remain some concerns about the potential for groundwater contamination despite the findings of the NURP and Nightingale (1975; 1987a,b,c; 1989). For instance, a report by Pitt et al. (1994) highlighted the potential for groundwater contamination from intentional and unintentional stormwater infiltration. That report recommends that infiltration facilities not be sited in areas where high concentrations are present or where there is a potential for spills of toxic material. Conversely, Schroeder (1995) reported that there was no evidence of groundwater impacts from an infiltration basin serving a large industrial catchment in Fresno, CA.

Siting Criteria

The key element in siting infiltration basins is identifying sites with appropriate soil and hydrogeologic properties, which is critical for long term performance. In one study conducted in Prince George's County, Maryland (Galli, 1992), all of the infiltration basins investigated clogged within 2 years. It is believed that these failures were for the most part due to allowing infiltration at sites with rates of less than 0.5 in/hr, basing siting on soil type rather than field infiltration tests, and poor construction practices that resulted in soil compaction of the basin invert.

A study of 23 infiltration basins in the Pacific Northwest showed better long-term performance in an area with highly permeable soils (Hilding, 1996). In this study, few of the infiltration basins had failed after 10 years. Consequently, the following guidelines for identifying appropriate soil and subsurface conditions should be rigorously adhered to.

- Determine soil type (consider RCS soil type 'A, B or C' only) from mapping and consult USDA soil survey tables to review other parameters such as the amount of silt and clay, presence of a restrictive layer or seasonal high water table, and estimated permeability. The soil should not have more than 30% clay or more than 40% of clay and silt combined. Eliminate sites that are clearly unsuitable for infiltration.

- Groundwater separation should be at least 3 m from the basin invert to the measured ground water elevation. There is concern at the state and regional levels of the impact on groundwater quality from infiltrated runoff, especially when the separation between groundwater and the surface is small.

- Location away from buildings, slopes and highway pavement (greater than 6 m) and wells and bridge structures (greater than 30 m). Sites constructed of fill, having a base flow or with a slope greater than 15% should not be considered.

- Ensure that adequate head is available to operate flow splitter structures (to allow the basin to be offline) without ponding in the splitter structure or creating backwater upstream of the splitter.

- Base flow should not be present in the tributary watershed.

Secondary Screening Based on Site Geotechnical Investigation

- At least three in-hole conductivity tests shall be performed using USBR 7300-89 or Bouwer-Rice procedures (the latter if groundwater is encountered within the boring), two tests at different locations within the proposed basin and the third down gradient by no more than approximately 10 m. The tests shall measure permeability in the side slopes and the bed within a depth of 3 m of the invert.

- The minimum acceptable hydraulic conductivity as measured in any of the three required test holes is 13 mm/hr. If any test hole shows less than the minimum value, the site should be disqualified from further consideration.

- Exclude from consideration sites constructed in fill or partially in fill unless no silts or clays are present in the soil boring. Fill tends to be compacted, with clays in a dispersed rather than flocculated state, greatly reducing permeability.

- The geotechnical investigation should be such that a good understanding is gained as to how the stormwater runoff will move in the soil (horizontally or vertically) and if there are any geological conditions that could inhibit the movement of water.

Additional Design Guidelines

(1) Basin Sizing - The required water quality volume is determined by local regulations or sufficient to capture 85% of the annual runoff.

(2) Provide pretreatment if sediment loading is a maintenance concern for the basin.

(3) Include energy dissipation in the inlet design for the basins. Avoid designs that include a permanent pool to reduce opportunity for standing water and associated vector problems.

(4) Basin invert area should be determined by the equation:

$$A = \frac{WQV}{kt}$$

where A = Basin invert area (m^2)

WQV = water quality volume (m^3)

k = 0.5 times the lowest field-measured hydraulic conductivity (m/hr)

t = drawdown time (48 hr)

(5) The use of vertical piping, either for distribution or infiltration enhancement shall not be allowed to avoid device classification as a Class V injection well per 40 CFR146.5(e)(4).

Maintenance

Regular maintenance is critical to the successful operation of infiltration basins. Recommended operation and maintenance guidelines include:

- Inspections and maintenance to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 72 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.
- Observe drain time for the design storm after completion or modification of the facility to confirm that the desired drain time has been obtained.
- Schedule semiannual inspections for beginning and end of the wet season to identify potential problems such as erosion of the basin side slopes and invert, standing water, trash and debris, and sediment accumulation.
- Remove accumulated trash and debris in the basin at the start and end of the wet season.
- Inspect for standing water at the end of the wet season.
- Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons.
- Remove accumulated sediment and regrade when the accumulated sediment volume exceeds 10% of the basin.
- If erosion is occurring within the basin, revegetate immediately and stabilize with an erosion control mulch or mat until vegetation cover is established.
- To avoid reversing soil development, scarification or other disturbance should only be performed when there are actual signs of clogging, rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a very light tractor.

Cost

Infiltration basins are relatively cost-effective practices because little infrastructure is needed when constructing them. One study estimated the total construction cost at about $2 per ft (adjusted for inflation) of storage for a 0.25-acre basin (SWRPC, 1991). As with other BMPs, these published cost estimates may deviate greatly from what might be incurred at a specific site. For instance, Caltrans spent about $18/ft^3 for the two infiltration basins constructed in southern California, each of which had a water quality volume of about 0.34 ac.-ft. Much of the higher cost can be attributed to changes in the storm drain system necessary to route the runoff to the basin locations.

Infiltration basins typically consume about 2 to 3% of the site draining to them, which is relatively small. Additional space may be required for buffer, landscaping, access road, and fencing. Maintenance costs are estimated at 5 to 10% of construction costs.

One cost concern associated with infiltration practices is the maintenance burden and longevity. If improperly maintained, infiltration basins have a high failure rate. Thus, it may be necessary to replace the basin with a different technology after a relatively short period of time.

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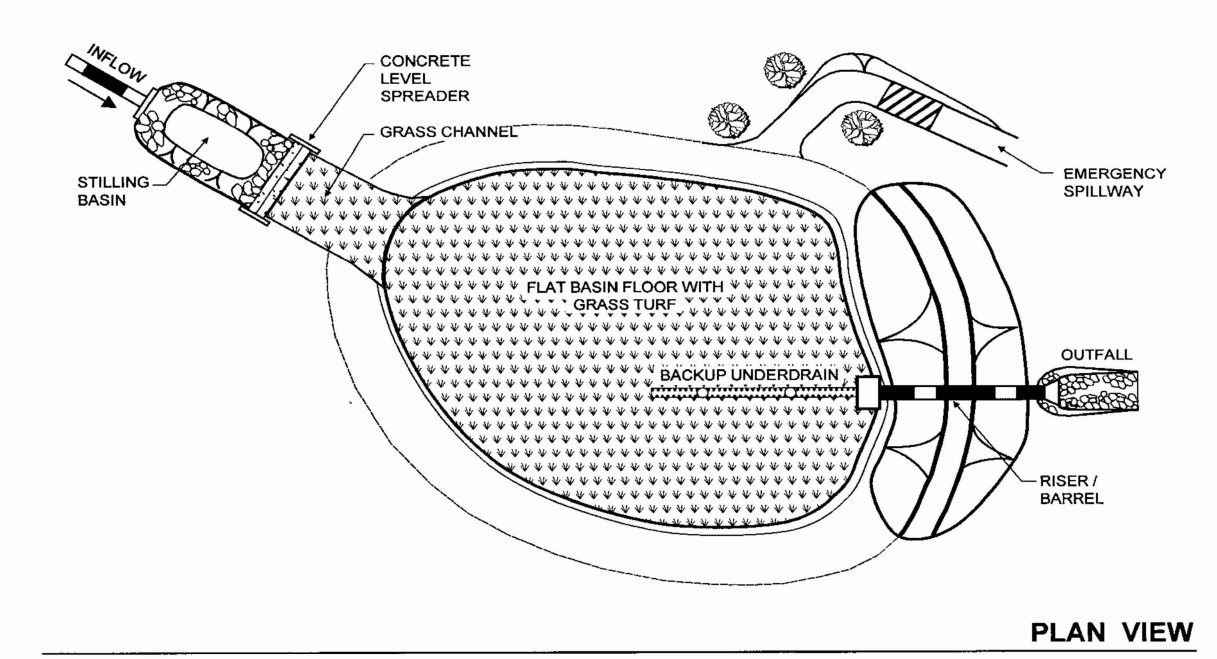
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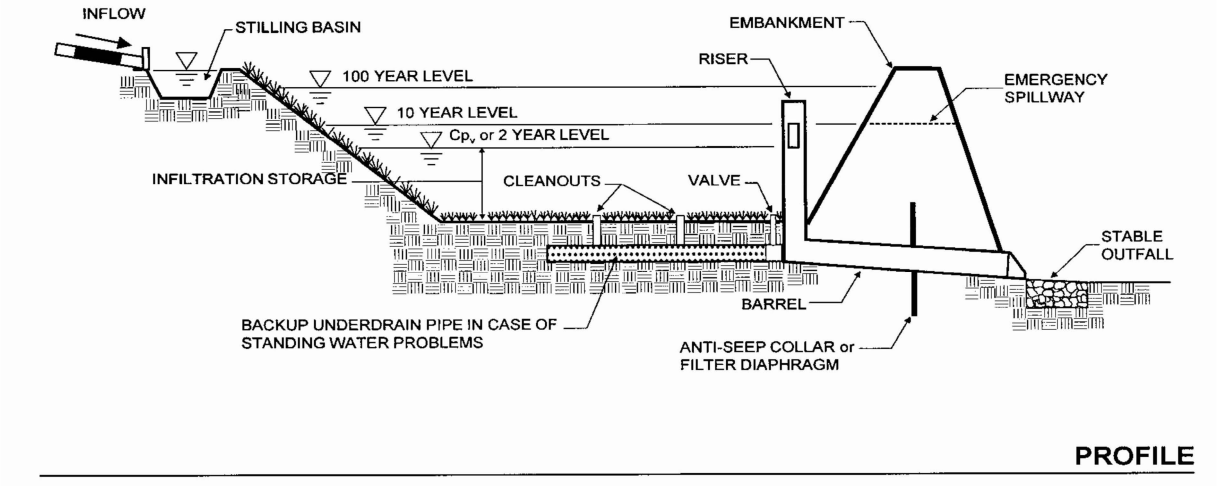
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PLAN VIEW



PROFILE

Site Design & Landscape Planning SD-10



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

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Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of “ redevelopment” must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under “designing new installations” above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Efficient Irrigation SD-12



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

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