Preliminary Water Quality Management Plan

For:

Duke – Alabama & Palmetto

APN NO(S): 0167-391-06, 0292-041-35, 0292-041-42, 0292-041-43, 0292-041-47, AND 0292-041-48

Prepared for:

DUKE REALTY LIMITED PARTNERSHIP

200 Spectrum Center Drive, Suite 1600

Irvine, CA 91780

(949) 797-7050

Prepared by:

Albert A. Webb Associates

3788 McCray Street

Riverside, CA 92506

(949) 797-7050

Submittal Date: 4/19/2018

Revision Date(s): 7/2018

Approval Date:_____

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for Duke Realty Corporation by Albert A. Webb Associates. The WQMP is intended to comply with the requirements of the County of San Bernardino and the NPDES Area wide Stormwater Program requiring the preparation of a WQMP. 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 San Bernardino County's Municipal Storm Water Management Program and the intent of the NPDES Permit for San Bernardino County and the incorporated cities of San Bernardino County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors in interest and the city/county 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):	P20100233	Grading Permit Number(s):	***TBD**
Tract/Parcel Map Number(s):	Parcel Map No. 17279	Building Permit Number(s):	***TBD**
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			0167-391-06, 0292-041-35, 0292-041-42,0292-041-43, 0292-041-47, 0292-041-48

Owner's Signature			
Owner Name: Adam Schmid			
Title	Development Services Manager		
Company	Duke Realty Limited Parternship		
Address	200 Spectrum Center Drive, Suite 1600		
Email	adam.schmid@dukerealty.com		
Telephone #	(949) 797-7050		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	P20100233	Grading Permit Number(s):	*TBD
Tract/Parcel Map Number(s):	Parcel Map No. 17279	Building Permit Number(s):	*TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 0167-391-06, 0292-041-35, 0292-041-42,0292-041-43, 0292-041-47, 0292-041-48

"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 Regional Water Quality Control Board Order No. R8-2010-0036."

Engineer: DJ Arellano, P.E.		PE Stamp Below
Title	Associate Engineer	
Company	Albert A. Webb Associates	
Address	3788 McCray Street	
Email	dj.arellano@webbassociates.com	
Telephone #	(951) 686-1070	
Signature		
Date		

Table of Contents

Section 1 Discretionary Permits 1-1

Section 2 Project Description 2-1

2.1 Project Information 2-1
2.2 Property Ownership / Management 2-2
2.3 Potential Stormwater Pollutants 2-3
2.4 Water Quality Credits 2-4

Section 3 Site and Watershed Description 3-1

Section 4 Best Management Practices 4-1

4.1 Source Control BMP 4-1
4.1.1 Pollution Prevention 4-1
4.1.2 Preventative LID Site Design Practices 4-6
4.2 Project Performance Criteria 4-7
4.3 Project Conformance Analysis 4-12
4.3.1 Site Design Hydrologic Source Control BMP 4-14
4.3.2 Infiltration BMP 4-16
4.3.3 Harvest and Use BMP 4-18
4.3.4 Biotreatment BMP 4.19
4.3.5 Conformance Summary 4-23
4.3.6 Hydromodification Control BMP 4-24
4.4 Alternative Compliance Plan (if applicable) 4-25

Section 5 Inspection & Maintenance Responsibility Post Construction BMPs 5-1

Section 6 Site Plan and Drainage Plan 6-1

6.1. Site Plan and Drainage Plan 6-1
6.2 Electronic Data Submittal 6-1

Forms

Form 1-1 Project Information 1-1
Form 2.1-1 Description of Proposed Project 2-1
Form 2.2-1 Property Ownership/Management 2-2
Form 2.3-1 Pollutants of Concern 2-3
Form 2.4-1 Water Quality Credits 2-4
Form 3-1 Site Location and Hydrologic Features 3-1
Form 3-2 Hydrologic Characteristics 3-2
Form 3-3 Watershed Description 3-3
Form 4.1-1 Non-Structural Source Control BMP 4-2
Form 4.1-2 Structural Source Control BMP 4-4
Form 4.1-3 Site Design Practices Checklist 4-6
Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume 4-7
Form 4.2-2 Summary of HCOC Assessment 4-8
Form 4.2-3 HCOC Assessment for Runoff Volume 4-9
Form 4.2-4 HCOC Assessment for Time of Concentration 4-10

Form 4.2-5 HCOC Assessment for Peak Runoff 4-11
Form 4.3-1 Infiltration BMP Feasibility 4-13
Form 4.3-2 Site Design Hydrologic Source Control BMP 4-14
Form 4.3-3 Infiltration LID BMP 4-17
Form 4.3-4 Harvest and Use BMP 4-18
Form 4.3-5 Selection and Evaluation of Biotreatment BMP 4-19
Form 4.3-6 Volume Based Biotreatment – Bioretention and Planter Boxes w/Underdrains 4-20
Form 4.3-7 Volume Based Biotreatment- Constructed Wetlands and Extended Detention 4-21
Form 4.3-8 Flow Based Biotreatment 4-22
Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate 4-23
Form 4.3-10 Hydromodification Control BMP 4-24
Form 5-1 BMP Inspection and Maintenance 5-1

Appendix A - Maps and Site Plan

Appendix B - Water Quality BMP Calculations

Appendix C - Educational Materals (To be provided during Final WQMP Report)

Appendix D - Soils Report

Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name	Duke – Alabama & Palmetto				
Project Owner Contact Name:	Adam Schmid				
Mailing Address:	200 Spectrum Center Drive, Suite 1600	E-mail Address:	adam.schmid@dukerealty.com	Telephone:	(949) 797-7050
Permit/Application Number(s):			Tract/Parcel Map Number(s):	Parcel Map No. 17279	
Additional Information/ Comments:	None				
Description of Project:	The project is proposing an industrial warehouse (approximately 1,116,930 ft^2) on approximately 54.7 acres. The project is located near the City of Redlands in an area referred to as the "Donut Hole" in the County of San Bernardino, California. The project site is bounded by Palmetto Avenue to the south, Alabama Street to the east, and a warehouse, vacant land and a treatment plant to the west. The project is located just south of the Santa Ana River. The project proposes to treat 54.3 acres of the project runoff with an infiltration basin. The remainder 0.4 acres will be treated using a series of curb cuts that will convey flows into an infiltration trench. (Please see WQMP Site Map in Appendix A)				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	None				

Section 2 Project Description

2.1 Project Information

This section of the WQMP should 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.

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):			
☐ Significant re-development involving the addition or replacement of 5,000 ft^2 or more of impervious surface on an already developed site	☒ New development involving the creation of 10,000 ft^2 or more of impervious surface collectively over entire site	☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	☐ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft^2 or more
☐ Hillside developments of 5,000 ft^2 or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	☐ Developments of 2,500 ft^2 of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	☒ Parking lots of 5,000 ft^2 or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft^2 or more, or have a projected average daily traffic of 100 or more vehicles per day
☐ Non-Priority / Non-Category Project *May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements*.			

2 Project Area (ft2):	2,382,640	**3** Number of Dwelling Units:	N/A	**4** SIC Code:	4226

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.*

6 Does Project include roads? Yes ☐ No ☒ *If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)*

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:
Several water quality features requiring ongoing maintenance are implemented into this project, all of which will be the responsibility of the property owner. Should the property be sold to a third party at a later date, maintenance will then would be the responsibility of the new property owner. A Stormwater Best Management Practices Transfer, Access and Maintenance Agreement (Maintenance Agreement) will be signed during final approval to ensure ongoing maintenance.

2.3 Potential Stormwater Pollutants

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-3 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 ☐	Runoff from landscaped areas can bring with it nutrients including phosphorous. (Receiving water bodies: Prado Park Lake, Santa Ana River Reach -4, and -5)
Nutrients - Phosphorous	E ☒	N ☐	Runoff from landscaped areas can bring with it nutrients including phosphorous.
Nutrients - Nitrogen	E ☒	N ☐	Runoff from landscaped areas can bring with it nutrients including nitrogen.
Noxious Aquatic Plants	E ☒	N ☐	Aquatic plants are not highly expected with this project but may come from runoff from landscaped areas.
Sediment	E ☒	N ☐	Runoff along areas can erode slopes and carry sediment.
Metals	E ☒	N ☐	The primary source of metals would come from vehicular traffic. (Receiving water bodies: Santa Ana River Reach-3)
Oil and Grease	E ☒	N ☐	The primary source of oil and grease would come from vehicular traffic.
Trash/Debris	E ☒	N ☐	The primary source of oil and grease would come from parking lot area.
Pesticides / Herbicides	E ☒	N ☐	Runoff from landscaped areas can bring with it pesticides/herbicides.
Organic Compounds	E ☒	N ☐	Organic compounds can be introduced due to improper storage and disposal procedures.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

A water quality credit program is applicable for certain types of development projects if it is not feasible to meet the requirements for on-site LID. Proponents for eligible projects, as described below, can apply for water quality credits that would reduce project obligations for selecting and sizing other treatment BMP or participating in other alternative compliance programs. Refer to Section 6.2 in the TGD for WQMP to determine if water quality credits are applicable for the project.

Form 2.4-1 Water Quality Credits			
1 Project Types that Qualify for Water Quality Credits: *Select all that apply*			
☐ Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects ☐ Vertical density [20%] ☐ 7 units/ acre [5%]	☐ Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	☐ Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	☐ In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]
2 Total Credit % *(Total all credit percentages up to a maximum allowable credit of 50 percent)*			
Description of Water Quality Credit Eligibility (if applicable)	N/A - No water quality credit		

Section 3 Site and Watershed Description

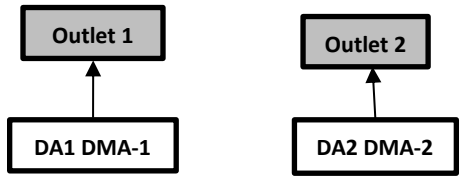
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed 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.***

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34° 5'15.0"N	Longitude117°12'38.7"W	Thomas Bros Map page Page 607, Grid G3 & H3

[1] San Bernardino County climatic region: ☒ Valley ☐ Mountain

[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*



Example only – modify for project specific WQMP using additional form

Conveyance DA1 DMA 1 flows to **Outlet 1**	Inlets and sub-surface storm drain pipes will be used to collect and convey runoff generated by 54.3 acres of the project site to a proposed infiltration basin for water quality treatment. Once the water quality volume is detained it will spill into Outlet 1. Outlet 1 will allow higher flows to bypass the basin and conveyed to the single project discharge point which is the existing Line A, Alabama Street storm drain. Outlet 1 will be a headwall with a concrete wall barrier to allow the DCV to be retained onsite.
DA2 DMA 2 flows to **Outlet 2**	The remainder 0.4 acres of the project could not be graded to drain into the infiltration basin due to existing grading conditions. Trying to change the grades in the drive aisle would cause the earthwork not to balance and would not be cost effective. The runoff from the drive aisle will instead be collected to into an infiltration trench using a series of curb cuts. Once the water quality volume is detained, the higher flows will spill out of the curb cuts and continue to flow out into Palmetto Avenue.
DA3 to Outlet 3	N/A

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA 1	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	2,366,150			
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*	III			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A			
5 Longest flowpath length (ft)	2,270			
6 Longest flowpath slope (ft/ft)	0.01			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren			
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 1 (use only as needed for additional DMA w/in DA 1)				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA E	DMA F	DMA G	DMA H
1 DMA drainage area (ft^2)				
2 Existing site impervious area (ft^2)				
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*				
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*				
5 Longest flowpath length (ft)				
6 Longest flowpath slope (ft/ft)				
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*				
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*				

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 2				
For Drainage Area 2's sub-watershed DMA, provide the following characteristics	DMA 2	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	16,490			
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*	III			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A			
5 Longest flowpath length (ft)	70			
6 Longest flowpath slope (ft/ft)	0.007			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren			
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 (use only as needed for additional DMA w/in DA 2)				
For Drainage Area 2's sub-watershed DMA, provide the following characteristics	DMA E	DMA F	DMA G	DMA H
1 DMA drainage area (ft^2)				
2 Existing site impervious area (ft^2)				
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*				
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*				
5 Longest flowpath length (ft)				
6 Longest flowpath slope (ft/ft)				
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*				
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*				

Form 3-3 Watershed Description for Drainage Area (DA1 & DA2)	
Receiving waters *Refer to Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/* *See 'Drainage Facilities" link at this website*	Prado Park Lake and Santa Ana River - Reaches 3, 4, and 5
Applicable TMDLs *Refer to Local Implementation Plan*	Middle Santa Ana River Baterial Indicator TMDL Watershed-wide Compliance Site Monitoring Prado Park Lake – Nutrients and Pathogens Santa Ana River Reach 3 – Pathogens, Lead, and Copper Santa Ana River Reach 4 – Pathogens Santa Ana River Reach 5- Nutrients and Pathogens
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	Metals, Nutirents, Pathogens
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	No
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	Yes, the Santa Ana River is unlined
Hydrologic Conditions of Concern	☐ Yes *Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal* ☒ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *More Effective than On-site LID* • *Remaining Capacity for Project DCV* • *Upstream of any Water of the US* • *Operational at Project Completion* • *Long-Term Maintenance Plan* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

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.

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 property owner(s), tenant(s), operator(s), and/or occupant(s) should receive training on the importance of water quality treatment. The training should incude reading the educational materials on Appendix C. The property owner should bring awareness to all employees of the impacts of littering and improper water disposal.
N2	Activity Restrictions	☒	☐	Restrictions will include requiring dumpster lids to be closed at all times and prohibiting the blowing, sweeping , or hosing of debris into streets, storm drain inlets, and other conveyances. In particular, pesticide application in areas must be performed by an applicator certified by the California Department of Pesticide Regulation. No activity shall be allowed for which a specific BMP has not been included.
N3	Landscape Management BMPs	☒	☐	Landscape planning shall employ strategies to maximize water storage and conservation and minimize runoff, promote infiltration, and protect slopes from erosion. Such strategies include extensive mulching, low water use shrubs, and grouping of plants with similar water requirements. Maintenance personnel will regularly mow, remove all sediment, inspect and keep any equipment in good repair, i.e. broken sprinkler heads, etc. Any repairs will be done promtly.. In addition, fertilizer and pesticide use will be consistent with instructions contained on product labels and with the regulations administered by the State Department of Pesticide Regulation
N4	BMP Maintenance	☒	☐	Create regularly scheduled times for inspection and maintenance of infiltration basin. The frequency shall meet the current minimum County standard but shall be at a minimum once a month. A time in the late summer or early fall, prior to the storm season (October 1 to May 1), shall also be part of this schedule to reduce the amount of sediment, garden waste, and trash entering the storm drain system.
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	Hazardous waste materials and wastes shall be collected and stored in covered containers in designated areas. In addition, signs shall be placed to ensure all hazardous waste is collected, removed and disposed of only at authorized disposal areas. Inspections shall be conducted regularly to check all containers and other equipment, used in handling hazardous waste, to minimize potential leaks and spills. Regular maintenance of all equipment will be conducted and repairs will be carried out promtly

Form 4.1-1 Non-Structural Source Control BMPs				
				after identification. Owner shall ensure all operations are in conformance with Title 22 Division 4.5 - Environmental Health Standards for the Management of Hazardous Materials.
N6	Local Water Quality Ordinances	☒	☐	This WQMP meets or exceeds local water quality ordinances.
N7	Spill Contingency Plan	☒	☐	Spill Contingency Plan to be determined by building owner prior to occucpancy. See SC-11 “Spill Prevention, Control, and Cleanup”, sample Spill Contingency Template, and SC-10 “Non-Storm water Discharges” in “BMP Fact Sheets”) for guidance and recommended procedures.
N8	Underground Storage Tank Compliance	☐	☒	There are no propossed underground storage tanks
N9	Hazardous Materials Disclosure Compliance	☒	☐	Compliance through the Phase 1 Site Assessments.

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	☒	☐	Hazardous waste materials and wastes shall be collected and stored in covered containers in designated areas. In addition, signs shall be placed to ensure all hazardous waste is collected, removed and disposed of only at authorized disposal areas. Inspections shall be conducted regularly to check all containers and other equipment, used in handling hazardous waste, to minimize potential leaks and spills. Regular maintenance of all equipment will be conducted and repairs will be carried out promtly after identification. Owner shall ensure all operations are in conformance with the Uniform Fire Code Article 80.
N11	Litter/Debris Control Program	☒	☐	Litter control and trash management will be provided by a contracted maintenance company.
N12	Employee Training	☒	☐	Training will be required within 6 months of hire dates for new employees, and then annually thereafter. Educational and training materials are included in Appendix E of this WQMP report.
N13	Housekeeping of Loading Docks	☒	☐	Employees shall be trained in loading/unloading procedures as well as proper spill containment and cleanup per the recommendations in CASQA BMP Handbook SD-31. Maintenance records shall be kept to ensure regular maintenance and inspection of loading dock areas.
N14	Catch Basin Inspection Program	☒	☐	Drainage facilities such as on-site inlets as well as the proposed treatment control BMPs shall be inspected annually, in the late summer or early fall, and cleaned as needed, or if accumulated sediment/debris fills 25% or more of the sediment /debris storage capacity of the facility. All portions of the drainage facilities will be evaluated annually to determine the adequacy of the inspection and maintenance frequency.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Create regularly scheduled times for the sweeping of drive isles and parking lot areas. The frequency should meet the current minimum County standard but shall be at a minimum once a month. A time in the late summer or early fall, prior to the storm season (October 1 to May 1), shall also be part of this schedule to reduce the amount of sediment, garden waste, and trash entering the storm drain system

N16	Other Non-structural Measures for Public Agency Projects	☐	☒	N/A. Not a Public Agency Project.
N17	Comply with all other applicable NPDES permits	☒	☐	Construction general permit compliance will be accomplished via filing an NOI with SMARTS and preparing a project specific SWPPP document.

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)	☒	☐	Storm drain signage shall be employed along with previously mentioned owner environmental awareness education prohibiting dumping, littering, or discharges into storm drain inlets. The stenciling or signage shall employ the phrase "NO DUMPING FLOWS TO OCEAN" or an equally effective and approved phrase that will be stenciled on all catch basins and inlets to alert employees and the public to the destination of pollutants discharged in the storm drains. Legibility will be checked and repainted annually. Owner will be responsible for maintaining this signage.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	Outdoor Storage is prohibited on-site.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Three trash container are proposed to be serve the proejct site. The locations will be shown on the WQMP Exhibit. Litter control and trash management will be provided by a contracted maintenance company. All trash enclosures shall be covered per County standards.
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)	☒	☐	Landscape planning shall employ strategies to maximize water storage and conservation and minimize runoff, promote infiltration, and protect slopes from erosion. Such strategies include extensive mulching, low water use shrubs, and grouping of plants with similar water requirements. Maintenance personnel will regularly inspect and keep in good repair, i.e. broken sprinkler heads, etc. will be repaired promptly. In addition, fertilizer and pesticide use will be consistent with instructions contained on product labels and with the regulations administered by the State Department of Pesticide Regulation.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Depressed landscape has been proposed in areas that are less than 10% in grade. The landscaped areas that cannot be depressed are located either immediately adjacent to the proposed building or on slopes greater than 10%.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	All side slopes (varying between 4:1 to 2:1) will be protected from erosion with landscaping in accordance with the recommendations CASQA SD-10. There are no channels proposed within this project site.

S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	There are no covered loading dock areas proposed.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	There are no outoor maintenance bays proposed.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	Vehicle washing prohibited on-site.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	There is no outdoor processing proposed for this development.

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)	☐	☒	Equipment washing is prohibited on-site.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	Fueling areas prohibited on-site.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillsides on this site.
S14	Wash water control for food preparation areas	☐	☒	Project is not a food establishment
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	Vehicle and equipmenet washing is prohibited on-site.

4.1.2 Preventative LID Site Design Practices

Site design practices associated with new LID requirements in the MS4 Permit should be considered in the earliest phases of a project. Preventative site design practices can result in smaller DCV for LID BMP and hydromodification control BMP by reducing runoff generation. 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 Preventative LID 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: This project has maximized the open landscaped areas to the maximum extent practicable and per County minimum landscape area requirements. The landscaping area is approximately 15% of the overall development area.
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: An infiltratin basin and infiltration trench is proposed.
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: Existing westerly drainage pattern is maintained, and changes to times of concentration are preserved through the use of an infiltration basin.
Disconnect impervious areas: Yes ☒ No ☐ Explanation: Impervious areas have been disconnected to the maximum extent practical given the proejct type. Runoff from the eintre site will be directd into the proposed infiltartion basin.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: The site has been used as a citrus orchard and is highly disturbed. Currently, adjacent areas are either agricultural or industrial/commercial. No environmentally sensitive or natural, undisturbed areas exist.
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: The site will be completely developed and will be paved with with asphalt and will also include landscaping. There will be no undevelped disturbed areas.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Provisions will be in place that will prevent unnecessary heavy equipement from driving over the proposed underground basin area. The area will be roped off to keep vehicles from driving within the area.This shall be noted on plans.
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: The site layout and size does not allow for surface drainage swales but the projet minimize the use of underground piping.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: All landscaped areas shall be roped off to keep unwanted equipment from driving over these areas. This shall also be noted on construction drawings

4.2 Project Performance Criteria

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in the 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 of any downstream waterbody segments with a HCOC. ***If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.***

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P_6 method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1
- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program 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 mi²), 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 HCOC 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): 2,361,832	**2** Imperviousness after applying preventative site design practices (Imp%): 85	**3** Runoff Coefficient (Rc): _0.661 *$R_c = 0.858(Imp\%)^3-0.78(Imp\%)^2+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): 0.494 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.731 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; 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): 186,684 *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 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2)		
1 Project area DA 1 (ft^2): 16,490	**2** Imperviousness after applying preventative site design practices (Imp%): 70	**3** Runoff Coefficient (Rc): _0.494 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.494 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.731 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; 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): 975 *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 HCOC Assessment (DA 1 & DA2)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☐ No ☒

Go to: *http://permitrack.sbcounty.gov/wap/*

If "Yes", then complete HCOC assessment of site hydrology for 2yr 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)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** N/A *Form 4.2-3 Item 12*	**2** N/A *Form 4.2-4 Item 13*	**3** N/A *Form 4.2-5 Item 10*
Post-developed	**4** N/A *Form 4.2-3 Item 13*	**5** N/A *Form 4.2-4 Item 14*	**6** N/A *Form 4.2-5 Item 14*
Difference	**7** *N/A* *Item 4 – Item 1*	**8** *N/A* *Item 2 – Item 5*	**9** *N/A* *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *N/A%* *Item 7 / Item 1*	**11** *N/A%* *Item 8 / Item 2*	**12** *N/A%* *Item 9 / Item 3*

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 1&DA2)

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

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

11 Precipitation for 2 yr, 24 hr storm (in):
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

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

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

14 Volume Reduction needed to meet HCOC Requirement, (ft^3):
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

Form 4.2-4 HCOC Assessment for Time of Concentration (DA 1 & DA2)

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

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

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

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

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

Form 4.2-5 HCOC Assessment for Peak Runoff (DA 1 & DA2)

Compute peak runoff for pre- and post-developed conditions

Variables		Pre-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*			Post-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*		
		DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 /60)*							
2 Drainage Area of each DMA (Acres) *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
3 Ratio of pervious area to total area *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*							
5 Maximum loss rate (in/hr) *F_m = Item 3 * Item 4* *Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*							
7 Time of concentration adjustment factor for other DMA to site discharge point *Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)*	DMA A	*n/a*			*n/a*		
	DMA B		*n/a*			*n/a*	
	DMA C			*n/a*			*n/a*

8 Pre-developed Q_p at T_c for DMA A: *Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*	**9** Pre-developed Q_p at T_c for DMA B: *Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*	**10** Pre-developed Q_p at T_c for DMA C: *Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]*

10 Peak runoff from pre-developed condition confluence analysis (cfs): *Maximum of Item 8, 9, and 10 (including additional forms as needed)*

11 Post-developed Q_p at T_c for DMA A: *Same as Item 8 for post-developed values*	**12** Post-developed Q_p at T_c for DMA B: *Same as Item 9 for post-developed values*	**13** Post-developed Q_p at T_c for DMA C: *Same as Item 10 for post-developed values*

14 Peak runoff from post-developed condition confluence analysis (cfs): *Maximum of Item 11, 12, and 13 (including additional forms as needed)*

15 Peak runoff reduction needed to meet HCOC Requirement (cfs): *$Q_{p\text{-}HCOC}$ = (Item 14 * 0.95) – Item 10*

4.3 Project Conformance Analysis

Complete the following forms for each project site DA to document that the proposed LID BMPs conform to the project DCV developed to meet performance criteria specified in the 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 MS4 Permit (see Section 5.3.1 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design and Hydrologic Source Controls (Form 4.3-2)
- Retention and Infiltration (Form 4.3-3)
- Harvested and Use (Form 4.3-4) or
- Biotreatment (Form 4.3-5).

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 5.3.2.1 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 Forms 4.3-2 and 4.3-4 to determine the feasibility of applicable HSC and harvest and use 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 HSC 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 LID HSC, retention and infiltration, and harvest and use BMPs are unable to mitigate the entire DCV, then biotreatment BMPs may be implemented by the project proponent. If biotreatment BMPs are used, then they must be sized to provide sufficient capacity for effective treatment of the remainder of the volume-based performance criteria that cannot be achieved with LID BMPs (TGD for WQMP Section 5.4.4.2). **Under no circumstances shall any portion of the DCV be released from the site without effective mitigation and/or treatment**.

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 eight 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, Harvest and Use 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, Hydrologic Source Control 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, Hydrologic Source Control BMP.

4.3.1 Site Design Hydrologic Source Control BMP

Section XI.E. of the Permit emphasizes the use of LID preventative measures; and the use of LID HSC BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable HSC 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 HSC, if a project cannot feasibly meet BMP sizing requirements or cannot fully address HCOCs, feasibility of all applicable HSC 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 HSC BMP. Refer to Section 5.4.1 in the TGD for more detailed guidance.

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1&DA2)			
1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)	N/A		
3 Ratio of pervious area receiving runoff to impervious area	N/A		
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*	N/A		
5 Sum of retention volume achieved from impervious area dispersion (ft^3): N/A $V_{retention}$ *=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)	N/A		
8 Ponding depth (ft)	N/A		
9 Surface area of amended soil/gravel (ft^2)	N/A		
10 Average depth of amended soil/gravel (ft)	N/A		
11 Average porosity of amended soil/gravel	N/A		
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*	N/A		
13 Runoff volume retention from on-lot infiltration (ft^3): N/A $V_{retention}$ *=Sum of Item 12 for all BMPs*			

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA 1 & DA2)

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ *If yes, complete Items 15-20. If no, proceed to Item 21*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Rooftop area planned for ET BMP (ft^2)	N/A		
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*	N/A		
17 Daily ET demand (ft^3/day) *Item 15 * (Item 16 / 12)*	N/A		
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*	N/A		
19 Retention Volume (ft^3) *$V_{retention}$ = Item 17 * (Item 18 / 24)*	N/A		
20 Runoff volume retention from evapotranspiration BMPs (ft^3): N/A *$V_{retention}$ =Sum of Item 19 for all BMPs*			
21 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 22-25. If no, proceed to Item 26*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
22 Number of Street Trees	N/A		
23 Average canopy cover over impervious area (ft^2)	N/A		
24 Runoff volume retention from street trees (ft^3) *$V_{retention}$ = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*	N/A		
25 Runoff volume retention from street tree BMPs (ft^3): N/A *$V_{retention}$ = Sum of Item 24 for all BMPs*			
26 Implementation of residential rain barrel/cisterns: Yes☐ No ☒ *If yes, complete Items 27-29; If no, proceed to Item 30*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
27 Number of rain barrels/cisterns	N/A		
28 Runoff volume retention from rain barrels/cisterns (ft^3) *$V_{retention}$ = Item 27 * 3*	N/A		
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): N/A *$V_{retention}$ =Sum of Item 28 for all BMPs*			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: N/A *Sum of Items 5, 13, 20, 25 and 29*			

4.3.2 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 D 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 5.5.1 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).

.

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

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 186,684 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*			
BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 DMA 1 BMP Type Infiltration Basin	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	3.0		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3.4		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	0.9		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	5		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	3.6		
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*	81,206		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	N/A		
10 Amended soil porosity	N/A		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	N/A		
12 Gravel porosity	N/A		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	310,613		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	N/A		
16 Total Retention Volume from LID Infiltration BMPs: 310,613 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: 166% *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.*			

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 2)

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 975 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*			
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 2 DMA 2 BMP Type Infiltration Trench	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	1.6		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3.4		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	0.5		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	0.5		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	0.5		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	846		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	N/A		
10 Amended soil porosity	N/A		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	4		
12 Gravel porosity	0.4		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	1,882		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	N/A		
16 Total Retention Volume from LID Infiltration BMPs: 1,882 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: 193% *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.*			

4.3.3 Harvest and Use BMP

Harvest and use BMP may be considered if the full LID DCV cannot be met by maximizing infiltration BMPs. Use Form 4.3-4 to compute on-site retention of runoff from proposed harvest and use BMPs.

Volume retention estimates for harvest and use BMPs are sensitive to the on-site demand for captured stormwater. Since irrigation water demand is low in the wet season, when most rainfall events occur in San Bernardino County, the volume of water that can be used within a specified drawdown period is relatively low. The bottom portion of Form 4.3-4 facilitates the necessary computations to show infeasibility if a minimum incremental benefit of 40 percent of the LID DCV would not be achievable with MEP implementation of on-site harvest and use of stormwater (Section 5.5.4 of the TGD for WQMP).

Form 4.3-4 Harvest and Use BMPs (DA 1& DA2)

1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft^3): N/A

V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16

BMP Type(s) *Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft^3) *Volume of cistern*			
4 Landscaped area planned for use of harvested stormwater (ft^2)			
5 Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
6 Daily water demand (ft^3/day) *Item 4 * (Item 5 / 12)*			
7 Drawdown time (hrs) *Copy Item 6 from Form 4.2-1*			
8 Retention Volume (ft^3) *$V_{retention}$ = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))*			

9 Total Retention Volume (ft^3) from Harvest and Use BMP *Sum of Item 8 for all harvest and use BMP included in plan*

10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest & use BMPs? Yes ☐ No ☐

If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.

4.3.4 Biotreatment BMP

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

Use Form 4.3-5 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV w. Biotreatment computations are included as follows:

- Use Form 4.3-6 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-7 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-8 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1&DA2)

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): N/A *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	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 4.3-6 and 4.3-7 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
	☐ 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 4.3-6 Item 15 + Form 4.3-7 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-6 Volume Based Biotreatment (DA 1&DA2) – Bioretention and Planter Boxes with Underdrains

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

Form 4.3-7 Volume Based Biotreatment (DA 1&DA2) – Constructed Wetlands and Extended Detention

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

Form 4.3-8 Flow Based Biotreatment (DA 1&DA2)

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

4.3.5 Conformance Summary

Complete Form 4.3-9 to demonstrate how on-site LID DCV is met with proposed site design hydrologic source control, infiltration, harvest and use, 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 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1 Total LID DCV for the Project DA-1 (ft^3): 186,684 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): N/A *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 310,613 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): N/A *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): N/A *Copy Item 3 in Form 4.3-5*

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

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

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use 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 and biotreatment BMP provide 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

8 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 HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, 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)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 2)

1 Total LID DCV for the Project DA-1 (ft^3): 975 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): N/A *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 1,882 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): N/A *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): N/A *Copy Item 3 in Form 4.3-5*

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

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

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use 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 and biotreatment BMP provide 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

8 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 HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, 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)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

4.3.6 Hydromodification Control BMP

Use Form 4.3-10 to compute the remaining runoff volume retention, after LID BMP are implemented, needed to address HCOC, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential HCOC. Describe hydromodification control BMP that address HCOC, which may include off-site BMP and/or in-stream controls. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-10 Hydromodification Control BMPs (DA 1&DA2)	
1 Volume reduction needed for HCOC performance criteria (ft^3): N/A *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): *Sum of Form 4.3-9 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 HCOC volume reduction*
3 Remaining volume for HCOC volume capture (ft^3): *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*
5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ *Attach in-stream control BMP selection and evaluation to this WQMP*	
6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☐ *If yes, HCOC 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 or off-site retention BMP ☐ *BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)* • 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 ☐ • Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐	
7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☐ *If yes, HCOC 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 or off-site retention BMPs ☐ *BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)* • Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐	

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, harvest and use, 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 compliance plans may include one or more of the following elements:

- On-site structural treatment control BMP - All treatment control BMP should be located as close to possible to the pollutant sources and should not be located within receiving waters;
- Off-site structural treatment control BMP - Pollutant removal should occur prior to discharge of runoff to receiving waters;
- Urban runoff fund or In-lieu program, if available

Depending upon the proposed alternative compliance plan, approval by the executive officer may or may not be required (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMP 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 may require a Maintenance Agreement (consult the jurisdiction's LIP). If a Maintenance Agreement is required, it must also be attached to the WQMP.

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Education for Property Owners and Employees	Property Owner	Distribute educational materials and conduct annual awareness training	Upon first occupancy and yearly thereafter
Activity Restrictions	Property Owner	The owner will restrict activities which may have a negative impact on storm water quality. Restrictions shall include prohibiting the storage of outdoor material, vehicle and equipment washing, outdoor processing, fueling up and wash water control for food preparation.	Continuous
Street Sweeping of Private Street & Parking Lots	Property Owner	Inspect parking lots for trash and accumulation of dust and debris. Street sweeping shall be conducted monthly.	Inspections -Monthly. Maintenance - Monthly.
Drainage Facility Inspection and Maintenance	Property Owner	Inspect twice annually in the early fall before the rainy season and in the late Spring after the rainy season. Remove debris/sediment build-up.	Inspect twice annually, once before and after the rainy season and after extreme storm events. Maintenance as needed.
Landscape Planning & maintenance . See below.	Property Owner	Mow, weed, & trim vegetation. Inspect inlet & outlet structures. Re-vegetate bare areas. See below for further details.	Inspect weekly. Maintenance as needed.
Efficient Irrigation	Property Owner	Repair and maintain leaky/broken sprinkler heads. See below for further details.	Inspect weekly and maintain as needed

Litter Control	Property Owner	Inspect areas for accumulation of trash and debris and haul trash off-site to City refuse.	Check Daily and empty as needed.
Water Quality Basin	Property Owner	Monthly inspections should occur for debris and litter removal and signs of ponding issues such as odors, insects, and overgrowth. Prior to October 1, conduct annual inspections and maintenance for erosion, clogging of outlets, standing water issues, and adequacy of infiltration. Visually inspect infiltration basin on a monthly basis because of their importance for water quality management and post-construction storm water pollution prevention. One of these inspections should be before October 1 and one should be after May 1. Remove litter, debris, and dead vegetation. Re-vegetate as needed. Check for signs of ponding issues such as odors, clogging of outlets, standing water, erosion, and adequacy of infiltration. Remove accumulated sediment and re-grade when the accumulated sediment volume is greater than 10% of the basin volume.	Inspect twice annually, once before and after the rainy season and after extreme storm events. Maintenance as needed.

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

6.3 Post Construction

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

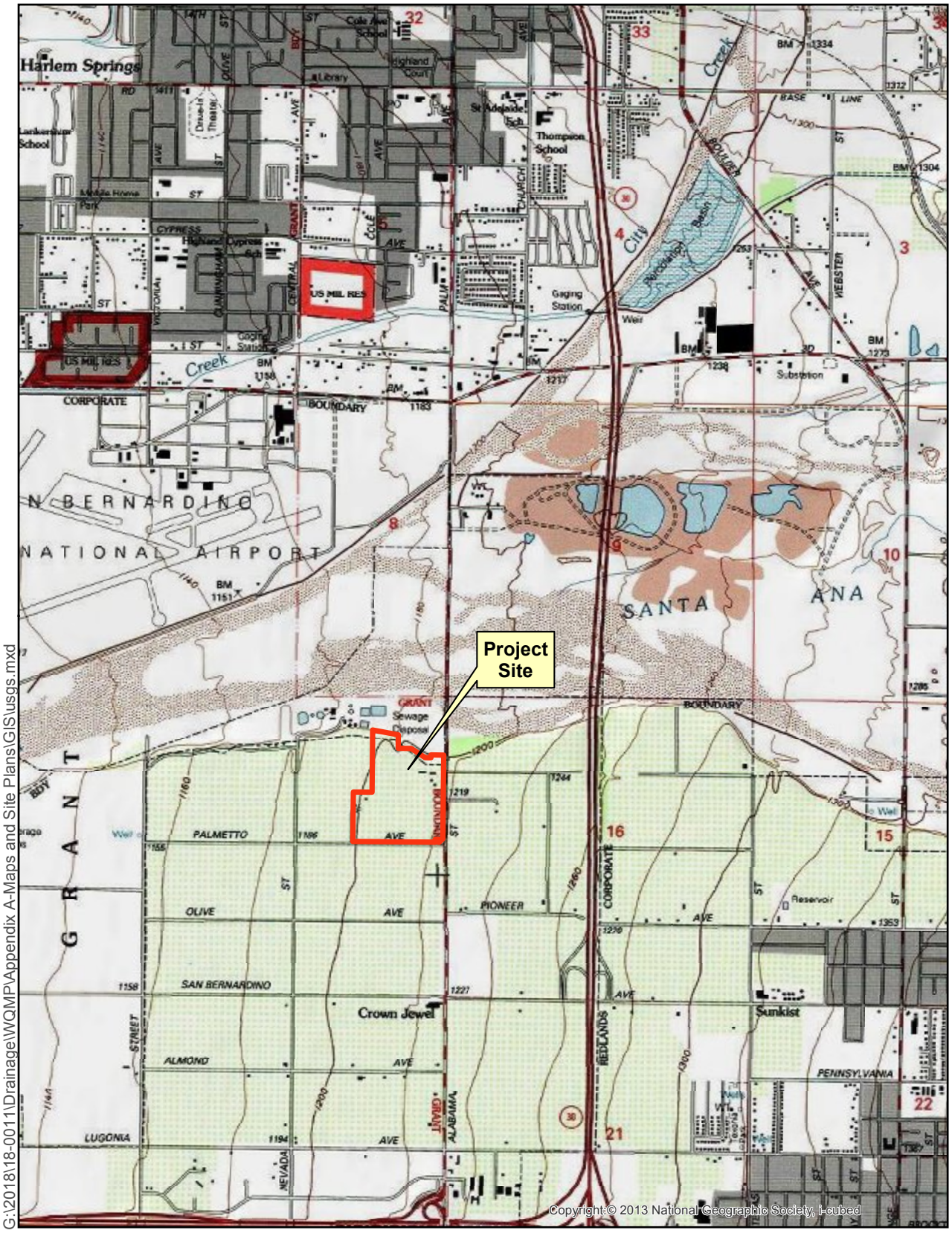
6.4 Other Supporting Documentation

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

APPENDIX A – MAPS AND SITE PLAN

Figure 1. Vicinity Map

0 2.5 5 Miles



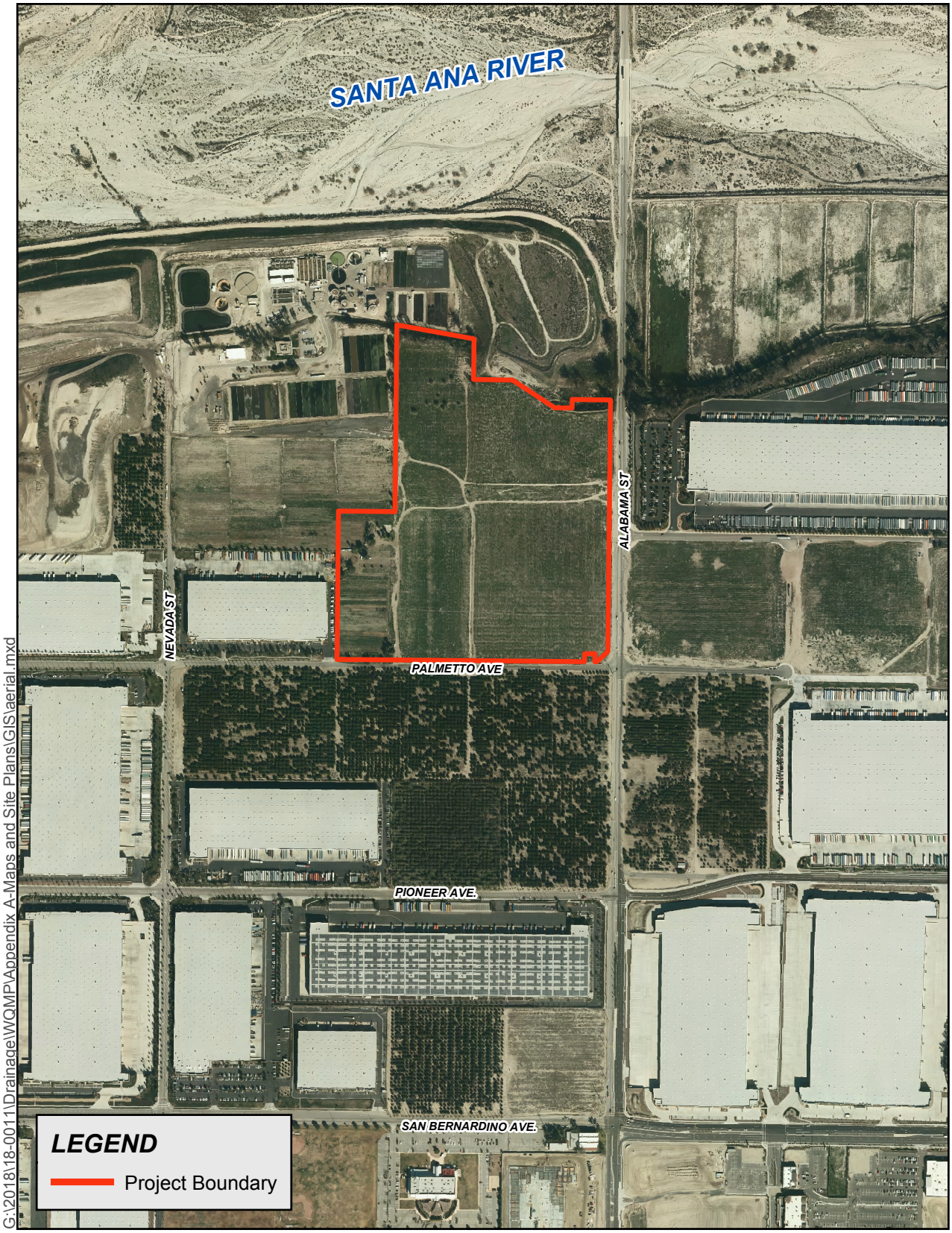
G:\2018\18-0011\Drainage\WQMP\Appendix A-Maps and Site Plans\GIS\usgs.mxd

Sources: ESRI / USGS 7.5min Quad

Figure 2. USGS Topography Map

0 1,000 2,000
Feet

Albert A. WEBB Associates

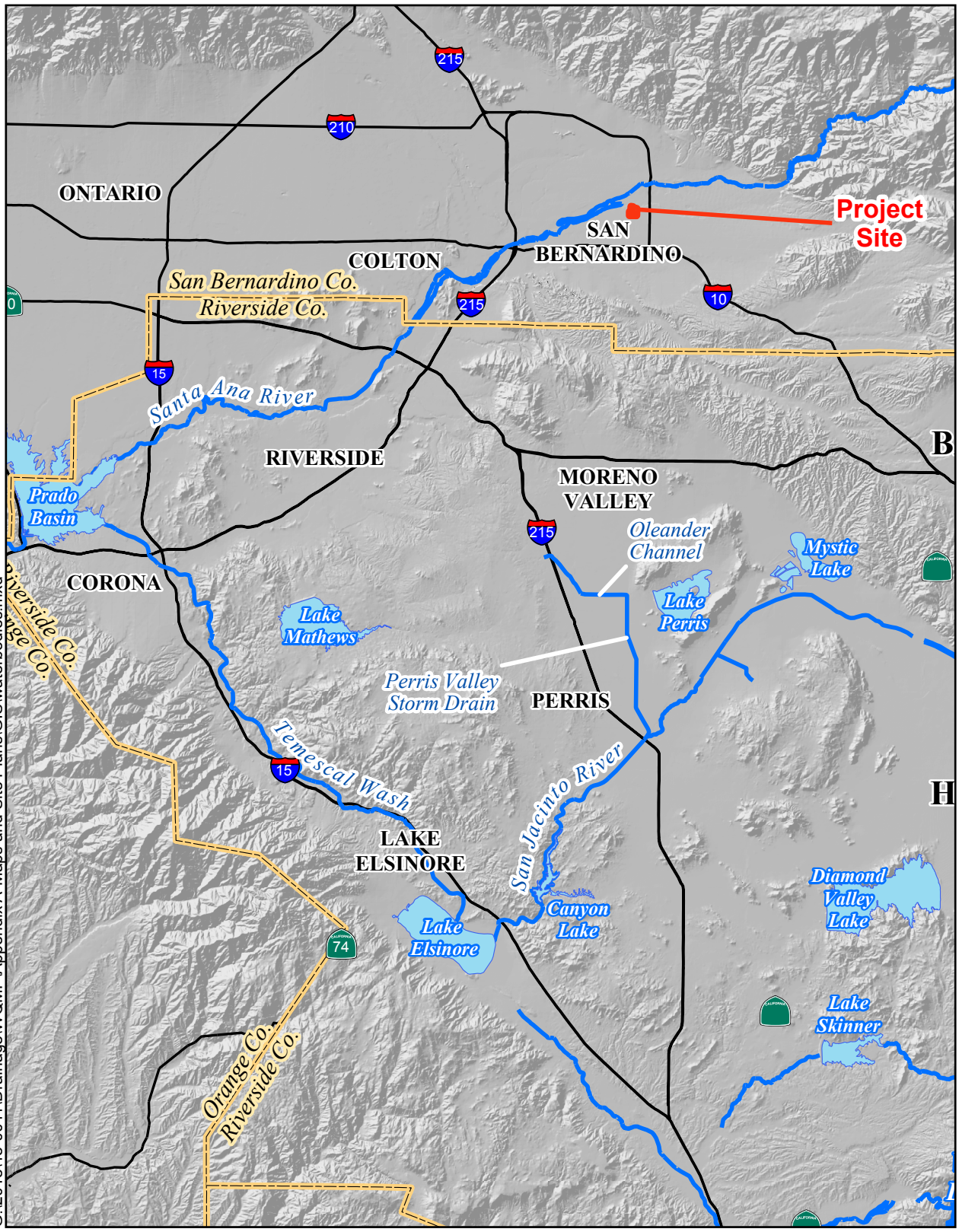


G:\2018\18-0011\Drainage\WQMP\Appendix A-Maps and Site Plans\GIS\aerial.mxd

Sources: County of Riverside GIS, 2013;
Eagle Aerial, April 2012.

Figure 3. Aerial Photograph

0 400 800
Feet

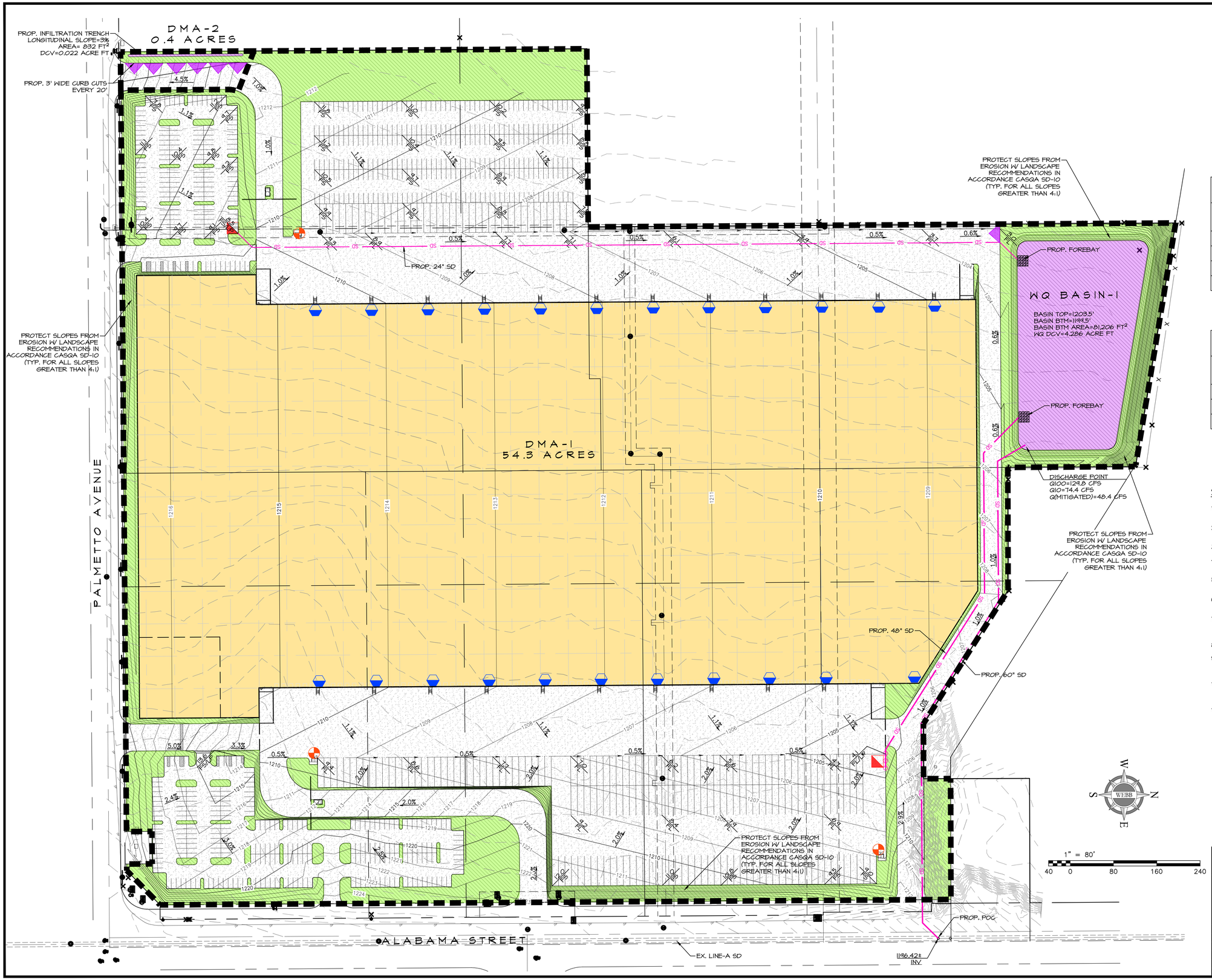


Sources: USGS 30 Meter DEM;
USGS Digital Line Graph

Figure 4. Receiving Waterbodies

0 2 4 6
Miles

Flowpath



LEGEND

- DRAINAGE MANAGEMENT BOUNDARY
- LANDSCAPING
- ROOF
- CONCRETE OR ASPHALT
- LID BMP
- FLOW DIRECTION
- SD — STORM DRAIN PIPE
- ROOF DRAIN DOWNSPOUT
- CURB OPENING/CUT
- STORM INLET
- TRASH ENCLOSURE

DRAINAGE MANAGEMENT AREA - 1

LEGEND	DMA-ID	TYPE	AREA (SF)
	L-1	LANDSCAPE	276712
	R-1	ROOF	1116934
	H-1	HARDSCAPE	907189
	BMP-1	LANDSCAPE	81206

%IMPERVIOUS=85%
%PERVIOUS=15%

DRAINAGE MANAGEMENT AREA - 2

LEGEND	DMA-ID	TYPE	AREA (SF)
	L-A	LANDSCAPE	4234
	H-A	HARDSCAPE	11410
	BMP-A	LANDSCAPE	846

%IMPERVIOUS=70%
%PERVIOUS=30%

SOURCE CONTROL NOTES

1. ALL INLETS SHALL BE MARK WITH THE WORDS "NO DUMPING DRAINS TO OCEAN" OR SIMILAR.
2. INTERIOR FLOOR DRAINS AND ELEVATOR SHAFT SUMP PUMPS WILL BE PLUMBED TO SANITARY SEWER.
3. MAINTAIN LANDSCAPING USING MINIMUM OR NO PESTICIDES.
4. ALL SLOPES GREATER THAN 4:1 SHOULD BE PROTECTED FROM EROSION USING CASQA SD-10 LANDSCAPE RECOMMENDATIONS
5. TRASH ENCLOSURE AREA SHALL BE COVERED PER COUNTY STANDARDS AND SHALL HAVE A SIGN THAT STATES "DO NOT DUMP HAZARDOUS MATERIALS HERE".
6. ALL INDUSTRIAL PROCESS ACTIVITIES ARE TO BE PERFORMED INDOORS. NO PROCESSES SHALL DRAIN TO EXTERIOR STORM DRAIN SYSTEM.
7. ROOF DOWNSPOUTS SHALL BE POSITIONED TO DIRECT STORMWATER AWAY FROM LOADING AREA. PROVIDE ROOF OVERHANG OVER THE LOADING AREA OR INSTALL DOOR SKIRTS AT EACH BAY THAT ENCLOSE THE END OF THE TRAILER.
8. PROVIDE A MEANS TO DRAIN FIRE SPRINKLER WATER TO SANITARY SEWER SYSTEM.
9. BOILER DRAIN LINES AND CONDENSATE DRAIN LINES SHALL BE DIRECTLY OR INDIRECTLY CONNECTED TO THE SANITARY SEWER SYSTEM AND MAY NOT DISCHARGE TO THE STORM DRAIN SYSTEM.
10. ROOFTOP EQUIPMENT WITH POTENTIAL TO PRODUCE POLLUTANTS SHALL BE ROOFED OR HAVE A SECONDARY CONTAINMENT.
11. ANY DRAINAGE SUMPS ON-SITE SHALL FEATURE SEDIMENT SUMP TO REDUCE THE QUANTITY OF SEDIMENT IN PUMPED WATER.

SITE PLAN RESTRICTION

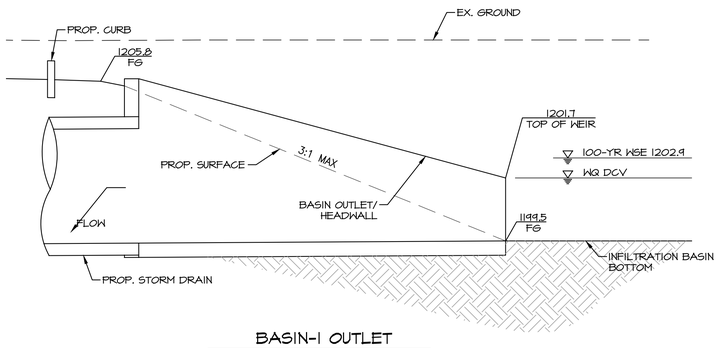
1. THE USE OF OUTDOOR STORAGE OF EQUIPMENT AND MATERIALS ARE NOT PERMITTED.
2. VEHICLE AND EQUIPMENT CLEANING ARE NOT PERMITTED ON-SITE.
3. NO VEHICLE/EQUIPMENT REPAIR OR MAINTENANCE WILL BE DONE OUTDOORS.
4. NO TANKS, CONTAINERS, OR SINKS ARE TO BE USED FOR PARTS CLEANING OR RINSING.
5. NO FUELING AREAS ARE PERMITTED ON-SITE.
6. OWNER MUST IMPLEMENT THESE ACTIVITY RESTRICTIONS.

COUNTY OF SAN BERNARDINO

POST CONSTRUCTION BMP SITE PLAN
DUKE ALABAMA & PALMETTO

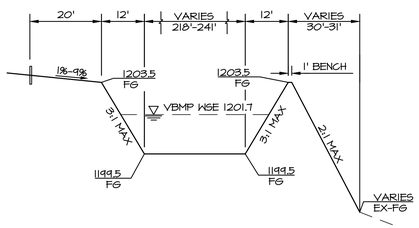
SCALE: AS SHOWN	ALBERT A. WEBB ASSOCIATES — ENGINEERING CONSULTANTS, 3788 McCRAY STREET, RIVERSIDE CA. 92506, PH. (951) 686-1070, FAX (951) 788-1256	W.O. 18-0011
DATE: 7/26/18		SHEET 1 OF 2 SHEETS
DESIGNED: MJS		
CHECKED: CRC		
PLN CK REF:		DWG. NO.
F.B.		

G:\2018\18-0011\DRAINAGE\WQMP\DWG DRAWINGS\18-0011-C-PWQMP.DWG 7/26/2018 6:52:46 PM



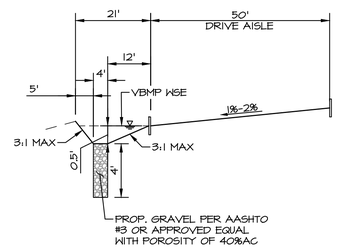
BASIN-1 OUTLET

NTS



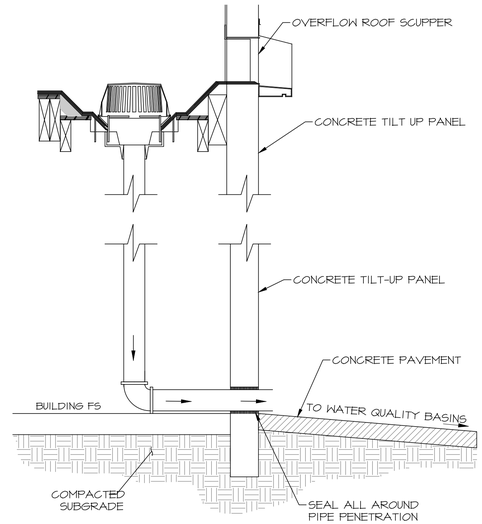
BASIN-1 TYPICAL SECTION

NTS



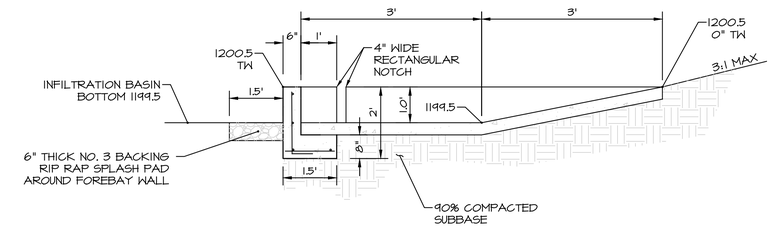
INFILTRATION TRENCH TYPICAL SECTION

NTS



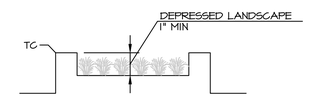
ROOF DRAIN DETAIL

N.T.S.



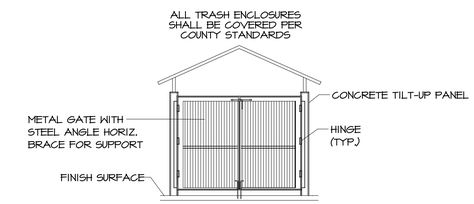
TYPICAL FOREBAY DETAIL

N.T.S



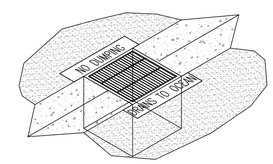
TYPICAL SECTION FOR SELF-RETAINING AREAS

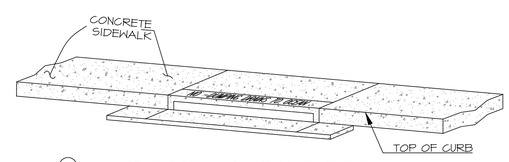
N.T.S



TRASH ENCLOSURE GATE ELEVATION

N.T.S.

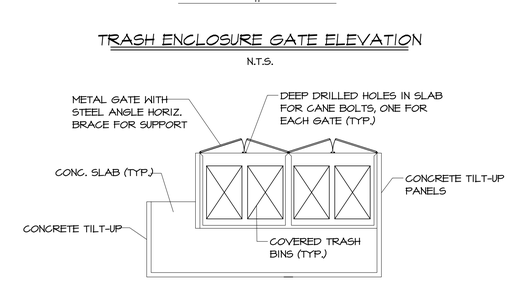




1. STENCILS TO HAVE 2" LETTERS AS FOLLOWS: "NO DUMPING - DRAINS TO OCEAN"
2. PLACE BOTH STENCILS CENTERED WITHIN THE CATCHBASIN OPENINGS AND WITHIN THE TOP OF THE CURB.
3. SPRAY BOTH STENCILS WITH WHITE PAINT.
4. REMOVE STENCILS WHEN PAINT IS DRY.

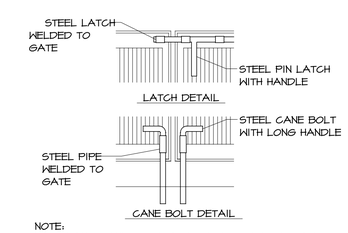
CATCH BASIN STENCILING DETAIL

NTS



TRASH ENCLOSURE PLAN DETAIL

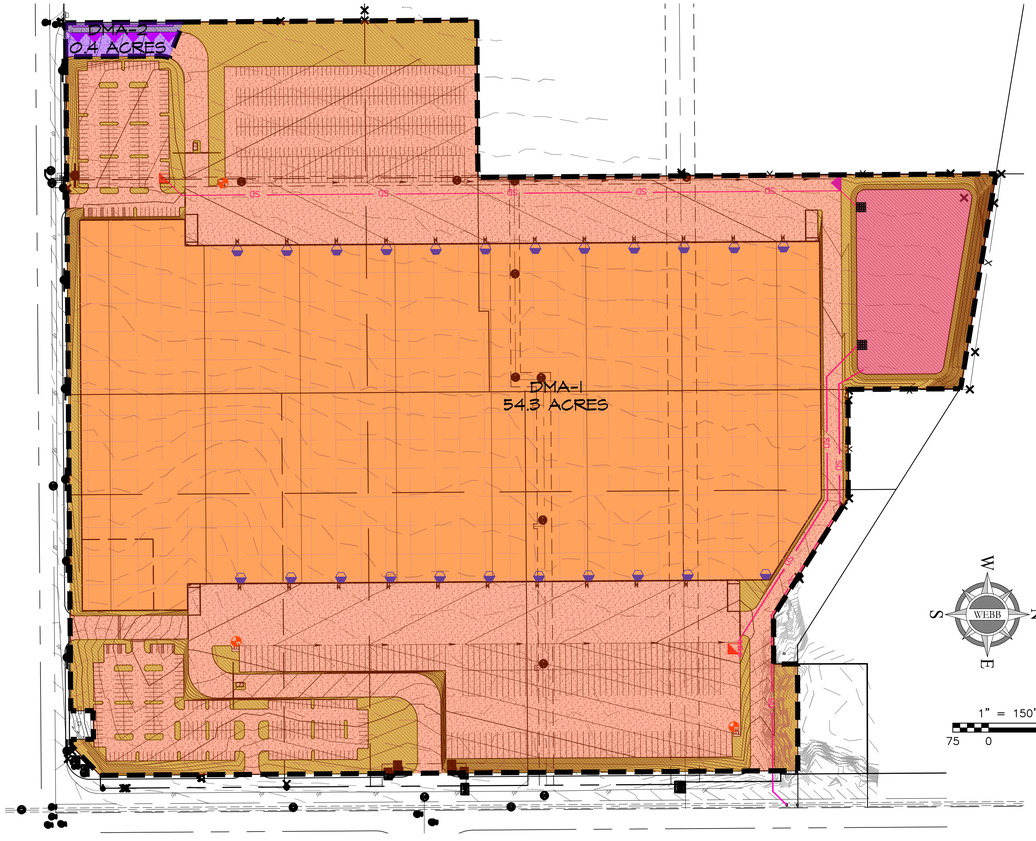
N.T.S.



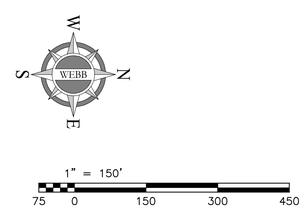
NOTE:
LATCH AND CANE TO BE AT EXTERIOR SIDE OF GATES

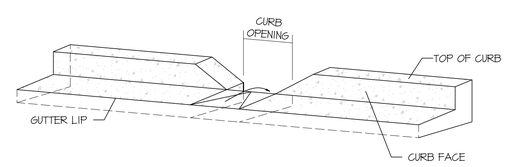
TRASH ENCLOSURE GATE LATCHES DETAIL

N.T.S.



DMA SITE MAP





TYPICAL CURB OPENING DETAIL

N.T.S.

COUNTY OF SAN BERNARDINO

POST CONSTRUCTION BMP SITE PLAN
DUKE ALABAMA & PALMETTO

SCALE: AS SHOWN	ALBERT A. WEBB ASSOCIATES	ENGINEERING CONSULTANTS 3788 McCRAY STREET RIVERSIDE CA. 92506 PH. (951) 686-1070 FAX (951) 788-1256	W.O. 18-0011
DATE: 7/26/18			SHEET 1
DESIGNED: MJS			OF 2 SHEETS
CHECKED: CRC			
PLN CK REF:			DWG. NO.
F.B.			

G:\2018\18-0011\DRAINAGE\WQMP\DWG DRAWINGS\18-0011-C-PWQMP.DWG 7/26/2018 6:50:12 PM

APPENDIX B – WATER QUALITY BMP CALCULATIONS

Underground Storage System Drawdown Calculation

ALBERT A WEBB ASSOCIATES
ENGINEERING CONSULTANTS

Designer:	MJS
Date:	4/11/2018
Project:	Duke - Alabama & Palmetto
Location:	Southeast corner of Alabama Street and Palmetto Avenue
Area:	DMA 1

(1)	VBMP =	186684	ft^3
(2)	Basin Bottom Area=	81206	ft^2
(3)	Infiltration Rate =	3	in/hr
(4)	Factor of Safety=	3.4	
(5)	Design Infiltration Rate =	0.9	in/hr

$$Drawdown = \frac{V_{BMP}\ (ft^3)}{Design\ Infiltration\ Rate\left(\frac{in}{hr}\right) \times \left(\frac{1ft}{12in}\right) \times Bottom\ Area\ (ft^2)}$$

Water Quality Drawdown Time=	31.3	hr

Volume at 1202.9'=	296143	ft^3
Basin Bottom Area=	81206	ft^2
Infiltration Rate =	0.9	in/hr

Drawdown Time for Enitre Volume=	48.0	hr

*The Geotechnical Infiltration Test Report shows recommend a design infiltration rates of 3 inches per hour at the expected depth. A factor of safety of 3.4 was determined by the PWQMP Report. The entire 100-year 24-hour volume will drain within the 48-hour mark.

APPENDIX C – EDUCATIONAL MATERIALS

(TO BE PROVIDED DURING FINAL-WQMP)

APPENDIX D – SOILS REPORT

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	2	0.5
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	2	0.5
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.5
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					3.4
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					3.0
Design Infiltration Rate, in/hr, $K_{DESIGN} = S_{TOT} \times K_M$					0.9

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

A copy of the report that was completed for the infiltration tests has been provided in Appendix D.

There will need to be additional infiltration testing during final engineering. There needs to be a total of 7 more tests at the infiltration basin and 2 tests at the infiltration trench area.

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

April 10, 2018

Duke Realty
200 Spectrum Center Drive, Suite 1600
Irvine, California 92618

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Attention: Mr. Adam Schmid
Development Services Manager

Project No.: **17G218-2**

Subject: **Results of Infiltration Testing**
Proposed Commercial/Industrial Building
NWC Alabama Street and Palmetto Avenue
San Bernardino County, California

Reference: Geotechnical Investigation, Proposed Commercial/Industrial Building, NWC Alabama Street and Palmetto Avenue, San Bernardino, California, prepared by Southern California Geotechnical, Inc. (SCG) for Duke Realty, SCG Project No. 17G218-1, dated December 15, 2017.

Dear Mr. Schmid:

In accordance with your request, we have conducted infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Change Order 17G218-CO, dated March 9, 2018. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the onsite soils. The infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Site and Project Description

The subject site is located at the northwest corner of Palmetto Avenue and Alabama Street in an unincorporated portion of San Bernardino County near Redlands, California. The site is bounded to the north by a vacant lot, to the west by vacant land and a commercial/industrial building, to the south by Palmetto Avenue, and to the east by Alabama Street. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The site consists of several parcels, which total 56± acres in size. The majority of the site is vacant and undeveloped. The ground surface cover generally consists of exposed soil with moderate to dense native grass and weed growth, with several large trees located throughout the site. The northern region of the western parcel is developed with a small farm house. The majority of this parcel is currently being utilized for agricultural purposes. Ground surface cover

in this area and surrounding the farm house consists of exposed soil with moderate to dense native grass, weed growth, and planted crops. Multiple small to large trees are located throughout this parcel. A natural drainage course is present in the northeast corner of the overall site that is 20± feet lower in elevation than the adjacent site grades.

Detailed topographic information was provided by Albert A. Webb Associates (Webb). The site topography generally ranges from 1199± feet mean sea level (msl) in northwestern corner of the site to 1226± feet msl in the southeastern corner of the site. However, the bottom of the existing drainage course, located at the northeast corner of the site is at an elevation of 1186± feet msl. With the exception of the drainage course, the site topography slopes gently downward to the northwest at a gradient of 1± percent. In the northeast corner of the site, the site grades slope downward into the drainage course at an approximate inclination of ½h:1v (horizontal to vertical).

Proposed Development

A conceptual site plan, prepared by Albert A. Webb Associates (Webb), was provided to our office by the client. The plan indicates that the subject site will be developed with one (1) new commercial/industrial building. The proposed building will be 1,192,671± ft^2 in size, located in the central area of the site. The building will be constructed in a cross-dock configuration with loading docks along both the east and west sides of the building. The building will be surrounded by asphaltic concrete pavements for automobile parking and drive lanes and Portland cement concrete pavements for the loading dock areas. Several landscape planters and concrete flatwork are expected to be included throughout the site. The site plan does not indicate any proposed development within the existing drainage course located at the northeast corner of the site.

We understand that the proposed development will include on-site infiltration to dispose of storm water. Based on an Infiltration Test Exhibit, prepared by Webb, the project civil engineer, the proposed infiltration system will consist of two (2) detention/infiltration basins. The basins will be located in the northwest corner and in the southwest region of the site. The bottoms of the basins will extend to depths ranging from 4 to 7± feet below the existing site grades.

Previous Study

Southern California Geotechnical, Inc. (SCG) previously performed a geotechnical investigation at the subject site, referenced above. As a part of this study, ten (10) borings were advanced to depths of 5 to 30± feet below existing site grades. Artificial fill soils were encountered at the ground surface at one of the boring locations, extending to a depth of 6½± feet below the existing site grades. The fill soils generally consisted of very loose to loose fine to medium sands with varying amounts of coarse sand, silt, and fine gravel content. Native alluvial soils were encountered beneath the fill soils and at the ground surface at the remaining boring locations. The near-surface alluvium possessed a disturbed appearance and was identified as disturbed alluvium. These soils generally consisted of very loose to loose silty fine sands to fine sandy silts with trace amounts of fine root fibers. Undisturbed native alluvial soils were encountered at all of the boring locations, beneath the disturbed alluvium or fill soils, extending to the maximum depth explored of 30± feet below existing site grades. The native alluvium generally consisted of very loose to medium dense silty fine sands, fine sandy silts, and fine to medium sands. Free

water was not encountered during the drilling of any of the borings. Based on the lack of any water within the borings and the moisture contents of the recovered soil samples, the static groundwater is considered to have existed at a depth in excess of 30± feet at the time of the subsurface exploration. The approximate locations of the ten (10) borings from the previous study are indicated on the Infiltration Test Location Plan, included as Plate 2 of this report.

Subsurface Exploration

Scope of Exploration

The subsurface exploration consisted of five (5) backhoe excavated trenches, extending to depths of 4 to 7± feet below existing site grades. The trenches were logged during excavation by a member of our staff. The approximate locations of the infiltration trenches (identified as I-1 through I-5) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Geotechnical Conditions

Native alluvium was encountered at the ground surface at all of the infiltration trench locations, extending to at least the maximum depth explored of 7± feet below existing site grades. The alluvial soils generally consist of very loose to medium dense silty fine sands and fine sandy silts with varying amounts of medium to coarse sands. The Trench Logs, which illustrate the conditions encountered at the infiltration trench locations, are included with this report.

Groundwater

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. Recent water level data was obtained from the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. The nearest monitoring well is located in the southeastern region of the subject site. Water level readings within this monitoring well indicates high groundwater levels of 130± feet (April 2005) below the ground surface.

Infiltration Testing

We understand that the results of the testing will be used to prepare a preliminary design for the storm water infiltration system that will be used at the subject site. As previously mentioned, the infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Two stainless steel infiltration rings were used for the infiltration testing. The outer infiltration ring is 2 feet in diameter and 20 inches in height. The inner infiltration ring is 1 foot in diameter and 20 inches in height. At the test locations, the outer ring was driven 3± inches into the soil at the base of each trench. The inner ring was centered inside the outer ring and subsequently driven 3± inches into the soil at the base of the trench. The rings were driven into the soil using a ten-pound sledge hammer. The soil surrounding the wall of the infiltration rings was only slightly disturbed during the driving process.

Infiltration Testing Procedure

Infiltration testing was performed at all five (5) of the test locations. The infiltration testing consisted of filling the inner ring and the annular space (the space between the inner and outer rings) with water, approximately 3 to 4 inches above the soil. To prevent the flow of water from one ring to the other, the water level in both the inner ring and the annular space between the rings was maintained using constant-head float valves. The volume of water that was added to maintain a constant head in the inner ring and the annular space during each time interval was determined and recorded. A cap was placed over the rings to minimize the evaporation of water during the tests.

The schedule for readings was determined based on the observed soil type at the base of each backhoe-excavated trench. Based on the existing soils at each infiltration test location, the volumetric measurements were made at increments of 10 minutes. The water volume measurements are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on these spreadsheets.

The infiltration rates for the infiltration tests are calculated in centimeters per hour and then converted to inches per hour. The rates are summarized below:

Infiltration Test No.	**Test Elevation (msl)**	**Soil Description**	**Infiltration Rate (inches/hour)**
I-1	1198.5	Silty fine Sand	3.6
I-2	1198	Silty fine Sand, trace medium Sand	3.1
I-3	1198.5	Silty fine Sand	3.2
I-4	1195	Silty fine Sand	3.7
I-5	1197	Silty fine Sand, little medium Sand	2.5

Laboratory Testing

In-situ Moisture Content

The moisture contents for selected soil samples collected from the trenches were determined in accordance with ASTM D-2216 and are expressed as a percentage of the dry weight. These test results are presented on the Trench Logs.

Grain Size Analysis

The grain size distribution of selected soils collected from the base of each infiltration test trench has been determined using a range of wire mesh screens. These tests were performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the

sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these tests are presented at the end of this report.

Design Recommendations

A total of five (5) infiltration tests were performed at the subject site. As noted above, the calculated infiltration rates at the infiltration test locations range from 2.5 to 3.7 inches per hour. The primary factors affecting the infiltration rates are the varying relative densities and silt content of the encountered soils, which vary at different depths and locations at the subject site.

Based on the infiltration test results, we recommend a design infiltration rate of 3 inches per hour be used for the proposed detention/infiltration basin located in the northwest corner of the site and a design rate of 2.5 inches per hour for the basin located in the southwest region of the subject site.

The design of the proposed storm water infiltration systems should be performed by the project civil engineer, in accordance with the County of San Bernardino guidelines. However, it is recommended that the system be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the system. The presence of such materials would decrease the effective infiltration rate. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rates recommended above is based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rates.** It should be noted that the recommended infiltration rates are based on infiltration testing at five (5) discrete locations and the overall infiltration rates of the storm water infiltration systems could vary considerably.

Infiltration versus Permeability

Infiltration rates are based on unsaturated flow. As water is introduced into soils by infiltration, the soils become saturated and the wetting front advances from the unsaturated zone to the saturated zone. Once the soils become saturated, infiltration rates become zero, and water can only move through soils by hydraulic conductivity at a rate determined by pressure head and soil permeability. The infiltration rates presented herein were determined in accordance with the ASTM Test Method D-3385-03 standard and are considered valid for the time and place of the actual test. Changes in soil moisture content will affect these infiltration rates. Infiltration rates should be expected to decrease until the soils become saturated. Soil permeability values will then govern groundwater movement. Permeability values may be on the order of 10 to 20 times less than infiltration rates. The system designer should incorporate adequate factors of safety and allow for overflow design into appropriate traditional storm drain systems, which would transport storm water off-site.

Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration areas could potentially be

damaged due to saturation of subgrade soils. **The proposed infiltration systems for this site should be located at least 25 feet away from any structures, including retaining walls.** Even with this provision of locating the infiltration system at least 25 feet from the building, it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rates contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between trench locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Scott McCann
Staff Scientist

Gregory K. Mitchell, GE 2364
Principal Engineer

Distribution: (1) Addressee

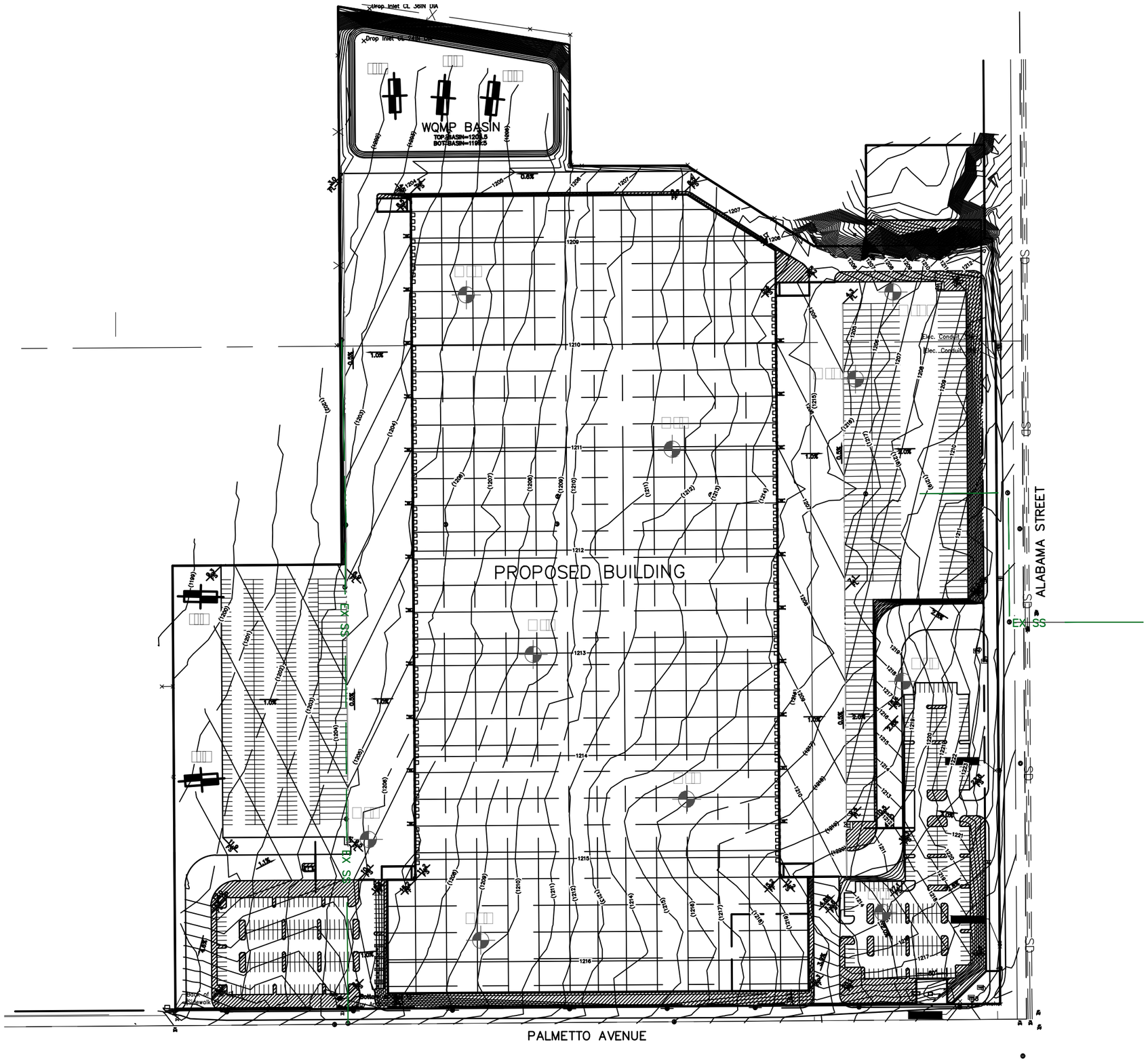
Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Trench Logs (5 pages)
Infiltration Test Results Spreadsheets (5 pages)
Grain Size Distribution Graphs (5 pages)

SITE LOCATION MAP

MM

PLATE 1

SOUTHERN CALIFORNIA GEOTECHNICAL



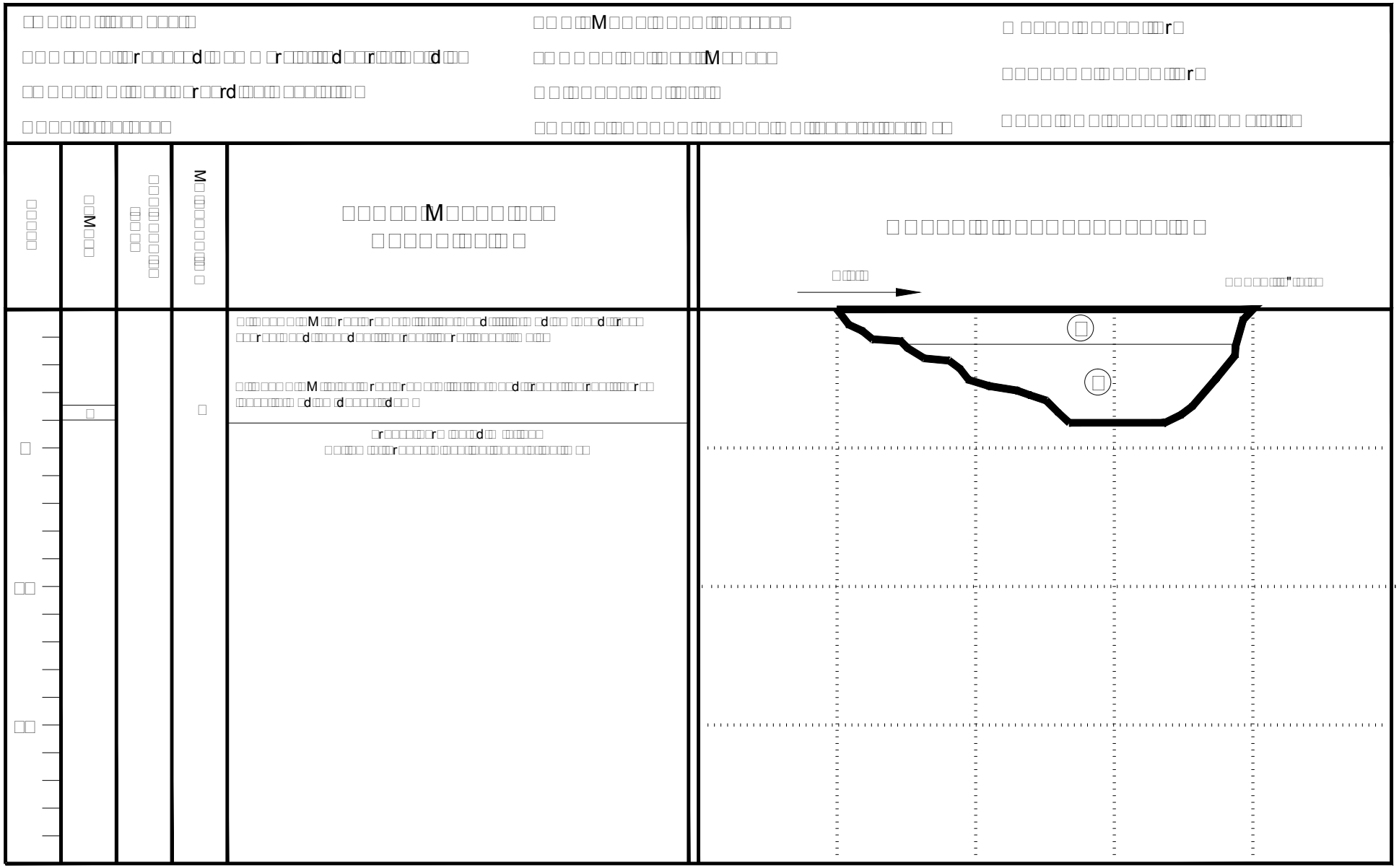
INFILTRATION TEST LOCATION PLAN

PLATE 2

SOUTHERN CALIFORNIA GEOTECHNICAL

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO.
I-1

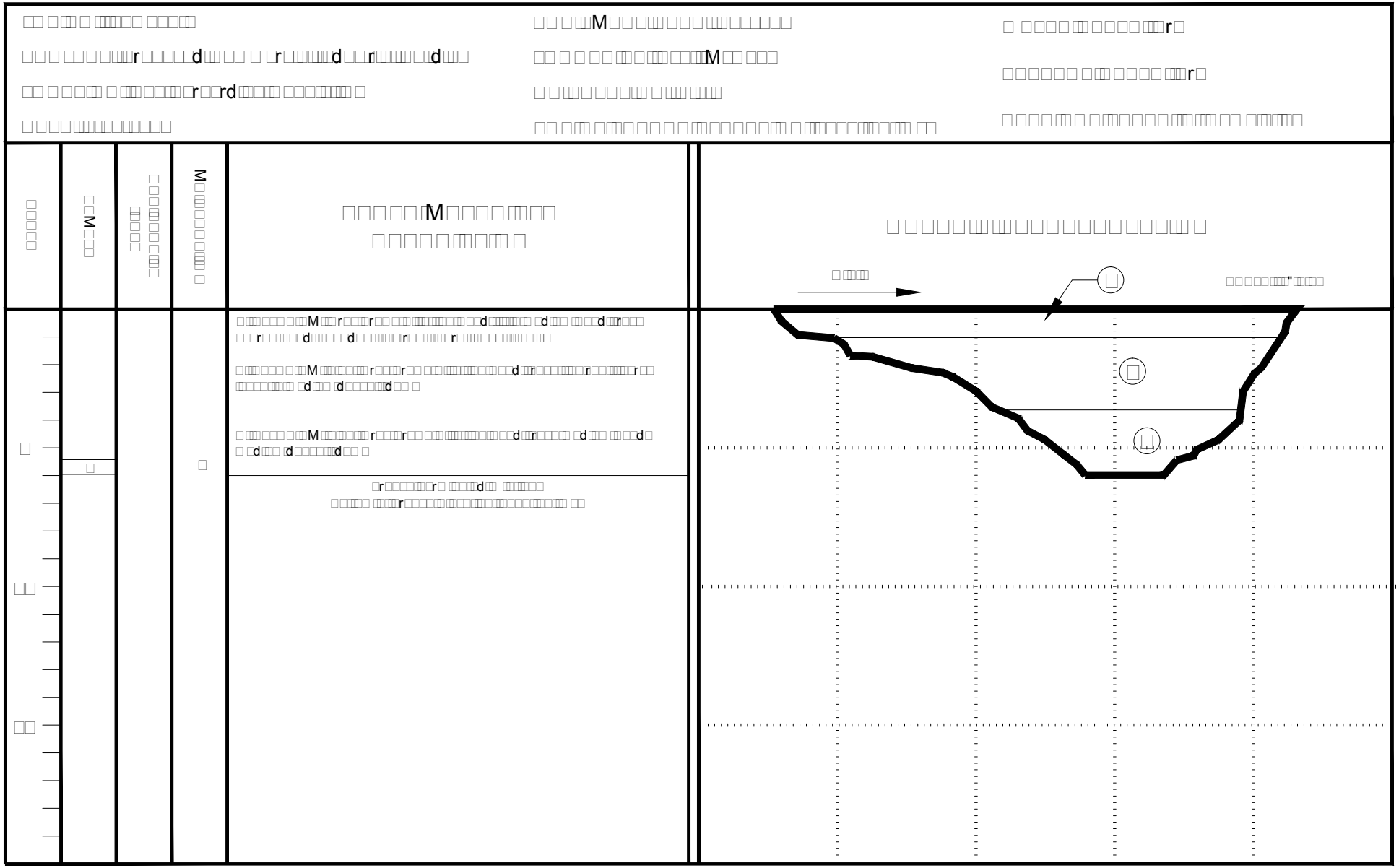


TRENCH LOG

PLATE B-1

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO.
I-2

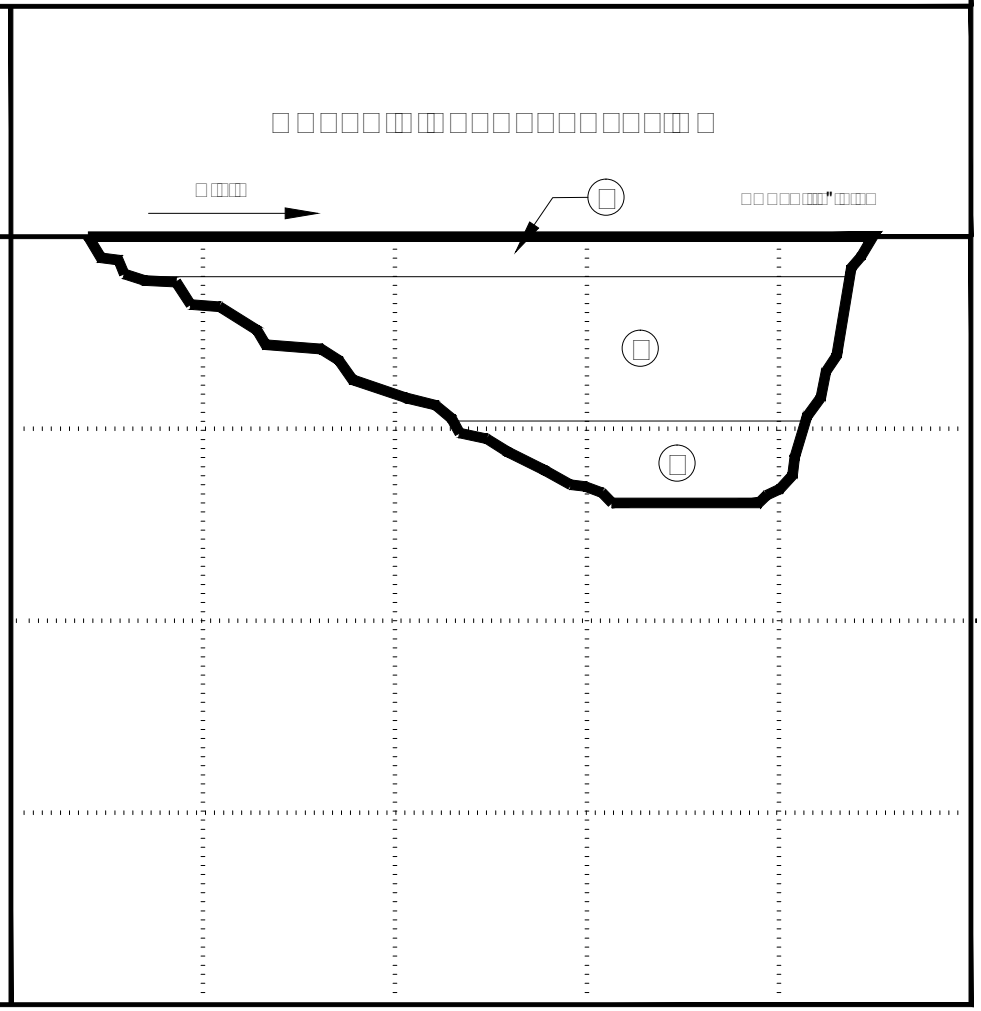


TRENCH LOG

PLATE B-2

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO.
I-3

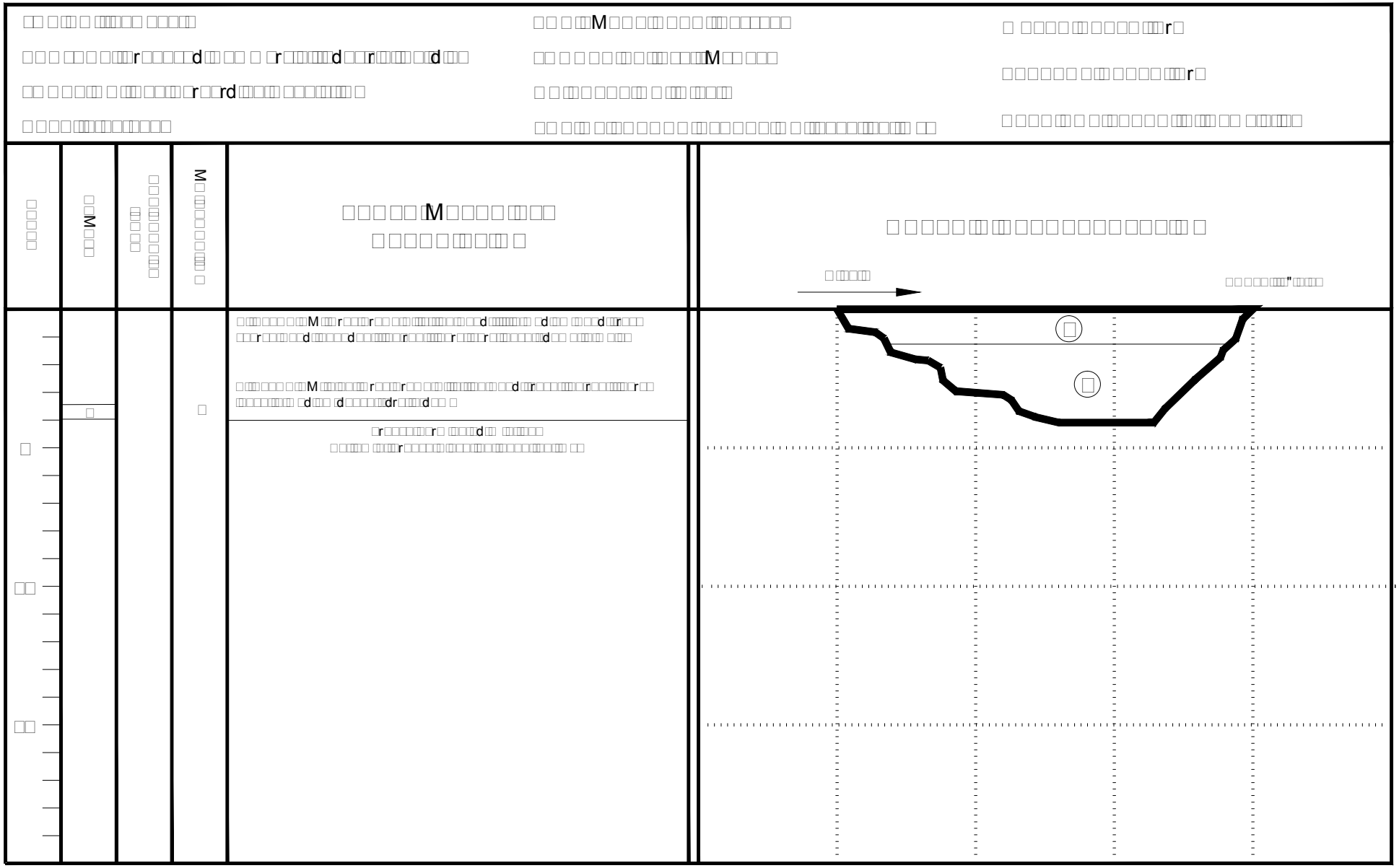


TRENCH LOG

PLATE B-3

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO.
I-4

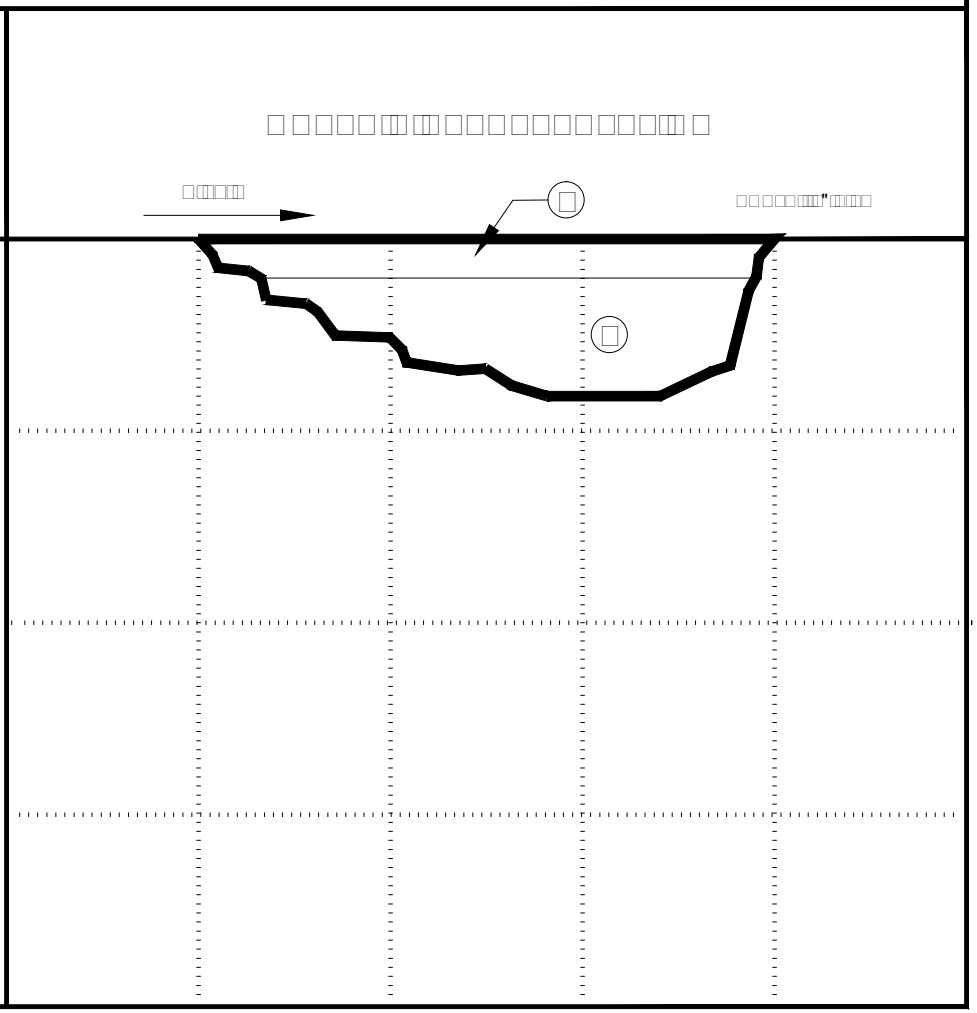


TRENCH LOG

PLATE B-4

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO.
I-5



TRENCH LOG

PLATE B-5

INFILTRATION CALCULATIONS

Project Name	Proposed Commercial/Industrial Building
Project Location	San Bernardino County, CA
Project Number	17G218-2
Engineer	Scott McCann

Infiltration Test No: I-1

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	10:45 AM	10	250	1750	1000	5450	14.39	14.94	5.67	5.88
	Final	10:55 AM	**10**	2000		6450					
2	Initial	10:56 AM	10	300	1400	200	4500	11.51	12.33	4.53	4.86
	Final	11:06 AM	**21**	1700		4700					
3	Initial	11:07 AM	10	50	1250	0	4150	10.28	11.38	4.05	4.48
	Final	11:17 AM	**32**	1300		4150					
4	Initial	11:18 AM	10	50	1175	600	3900	9.66	10.69	3.80	4.21
	Final	11:28 AM	**43**	1225		4500					
5	Initial	11:29 AM	10	150	1125	500	3900	9.25	10.69	3.64	4.21
	Final	11:39 AM	**54**	1275		4400					
6	Initial	11:40 AM	10	200	1150	350	3850	9.46	10.55	3.72	4.15
	Final	11:50 AM	**65**	1350		4200					
7	Initial	11:51 AM	10	0	1125	200	3850	9.25	10.55	3.64	4.15
	Final	12:01 PM	**75**	1125		4050					

INFILTRATION CALCULATIONS

Project Name	Proposed Commercial/Industrial Building
Project Location	San Bernardino County, CA
Project Number	17G218-2
Engineer	Scott McCann

Infiltration Test No: I-2

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	9:15 AM	10	300	1500	900	4600	12.33	12.61	4.86	4.96
	Final	9:25 AM	**10**	1800		5500					
2	Initial	9:26 AM	10	200	1175	600	4250	9.66	11.65	3.80	4.59
	Final	9:36 AM	**21**	1375		4850					
3	Initial	9:37 AM	10	0	1075	250	4100	8.84	11.24	3.48	4.42
	Final	9:47 AM	**32**	1075		4350					
4	Initial	9:48 AM	10	50	1000	100	3950	8.22	10.83	3.24	4.26
	Final	9:58 AM	**43**	1050		4050					
5	Initial	9:59 AM	10	350	950	50	3850	7.81	10.55	3.08	4.15
	Final	10:09 AM	**54**	1300		3900					
6	Initial	10:10 AM	10	250	925	500	3850	7.61	10.55	2.99	4.15
	Final	10:20 AM	**65**	1175		4350					
7	Initial	10:21 AM	10	200	950	350	3850	7.81	10.55	3.08	4.15
	Final	10:31 AM	**75**	1150		4200					

INFILTRATION CALCULATIONS

Project Name	Proposed Commercial/Industrial Building
Project Location	San Bernardino County, CA
Project Number	17G218-2
Engineer	Scott McCann

Infiltration Test No: I-3

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	7:45 AM	10	450	1450	600	5400	11.92	14.80	4.69	5.83
	Final	7:55 AM	**10**	1900		6000					
2	Initial	7:56 AM	10	0	1225	200	4950	10.07	13.57	3.97	5.34
	Final	8:06 AM	**21**	1225		5150					
3	Initial	8:07 AM	10	200	1175	250	4700	9.66	12.88	3.80	5.07
	Final	8:17 AM	**32**	1375		4950					
4	Initial	8:18 AM	10	100	1050	350	4550	8.63	12.47	3.40	4.91
	Final	8:28 AM	**43**	1150		4900					
5	Initial	8:29 AM	10	150	1025	900	4450	8.43	12.20	3.32	4.80
	Final	8:39 AM	**54**	1175		5350					
6	Initial	8:40 AM	10	150	1025	1100	4400	8.43	12.06	3.32	4.75
	Final	8:50 AM	**65**	1175		5500					
7	Initial	8:51 AM	10	300	1000	400	4300	8.22	11.79	3.24	4.64
	Final	9:01 AM	**75**	1300		4700					

INFILTRATION CALCULATIONS

Project Name	Proposed Commercial/Industrial Building
Project Location	San Bernardino County, CA
Project Number	17G218-2
Engineer	Scott McCann

Infiltration Test No: I-4

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	12:30 PM	10	250	1600	700	4850	13.16	13.29	5.18	5.23
	Final	12:40 PM	**10**	1850		5550					
2	Initial	12:41 PM	10	0	1325	800	3900	10.90	10.69	4.29	4.21
	Final	12:51 PM	**21**	1325		4700					
3	Initial	12:52 PM	10	0	1225	450	3850	10.07	10.55	3.97	4.15
	Final	1:02 PM	**32**	1225		4300					
4	Initial	1:03 PM	10	0	1175	300	3900	9.66	10.69	3.80	4.21
	Final	1:13 PM	**43**	1175		4200					
5	Initial	1:14 PM	10	125	1175	650	3750	9.66	10.28	3.80	4.05
	Final	1:24 PM	**54**	1300		4400					
6	Initial	1:25 PM	10	1350	1150	4300	3650	9.46	10.01	3.72	3.94
	Final	1:35 PM	**65**	2500		7950					
7	Initial	1:36 PM	10	2550	1150	8150	3600	9.46	9.87	3.72	3.89
	Final	1:46 PM	**75**	3700		11750					

INFILTRATION CALCULATIONS

Project Name	Proposed Commercial/Industrial Building
Project Location	San Bernardino County, CA
Project Number	17G218-2
Engineer	Scott McCann

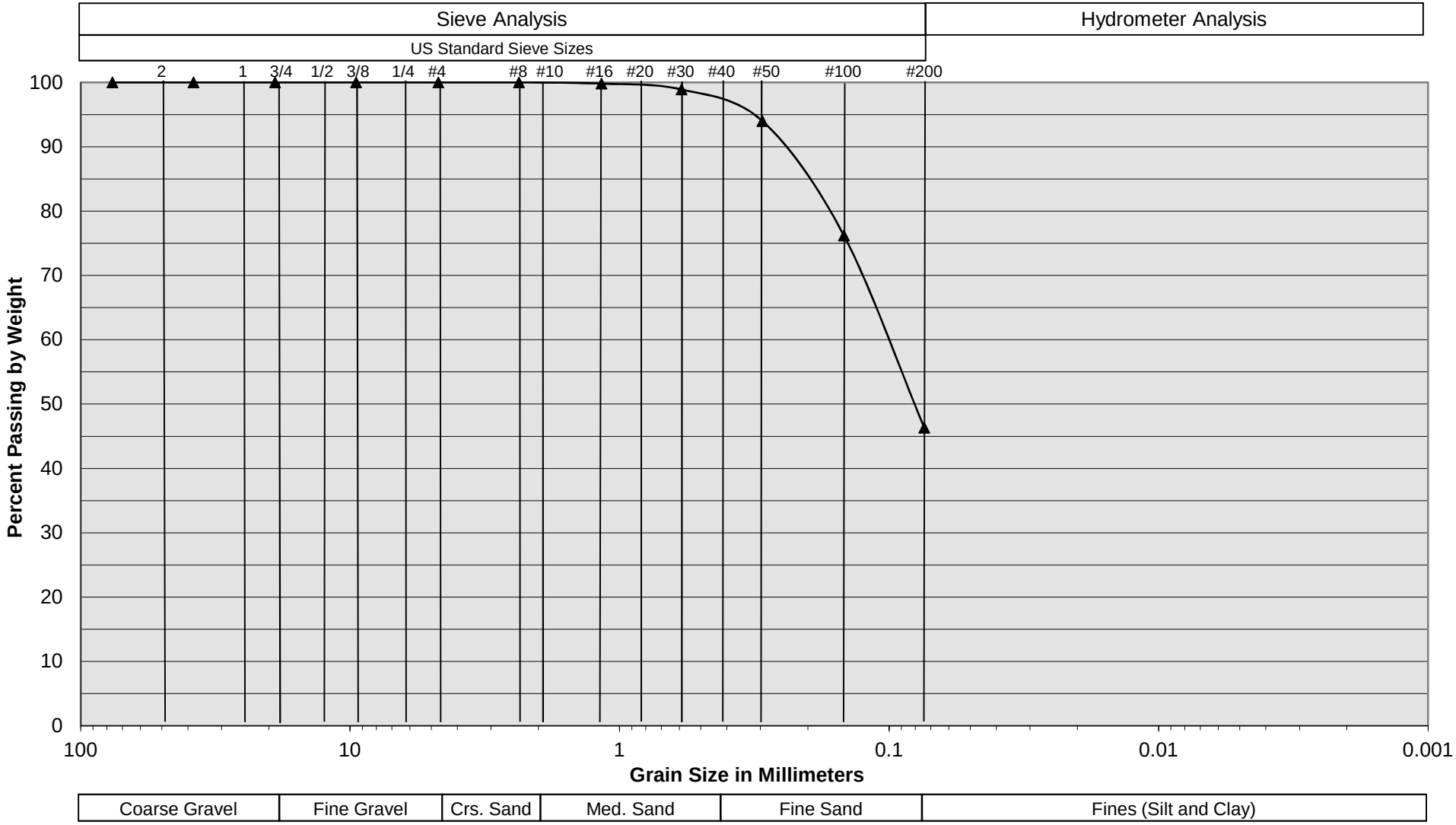
Infiltration Test No: I-5

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
1	Initial	2:10 PM	10	250	1400	900	4400	11.51	12.06	4.53	4.75
	Final	2:20 PM	**10**	1650		5300					
2	Initial	2:21 PM	10	50	950	100	3850	7.81	10.55	3.08	4.15
	Final	2:31 PM	**21**	1000		3950					
3	Initial	2:32 PM	10	50	825	300	3700	6.78	10.14	2.67	3.99
	Final	2:42 PM	**32**	875		4000					
4	Initial	2:43 PM	10	900	825	4100	3350	6.78	9.18	2.67	3.62
	Final	2:53 PM	**43**	1725		7450					
5	Initial	2:54 PM	10	50	800	300	3350	6.58	9.18	2.59	3.62
	Final	3:04 PM	**54**	850		3650					
6	Initial	3:05 PM	10	900	800	3900	3400	6.58	9.32	2.59	3.67
	Final	3:15 PM	**65**	1700		7300					
7	Initial	3:16 PM	10	1725	775	7450	3350	6.37	9.18	2.51	3.62
	Final	3:26 PM	**75**	2500		10800					

Grain Size Distribution

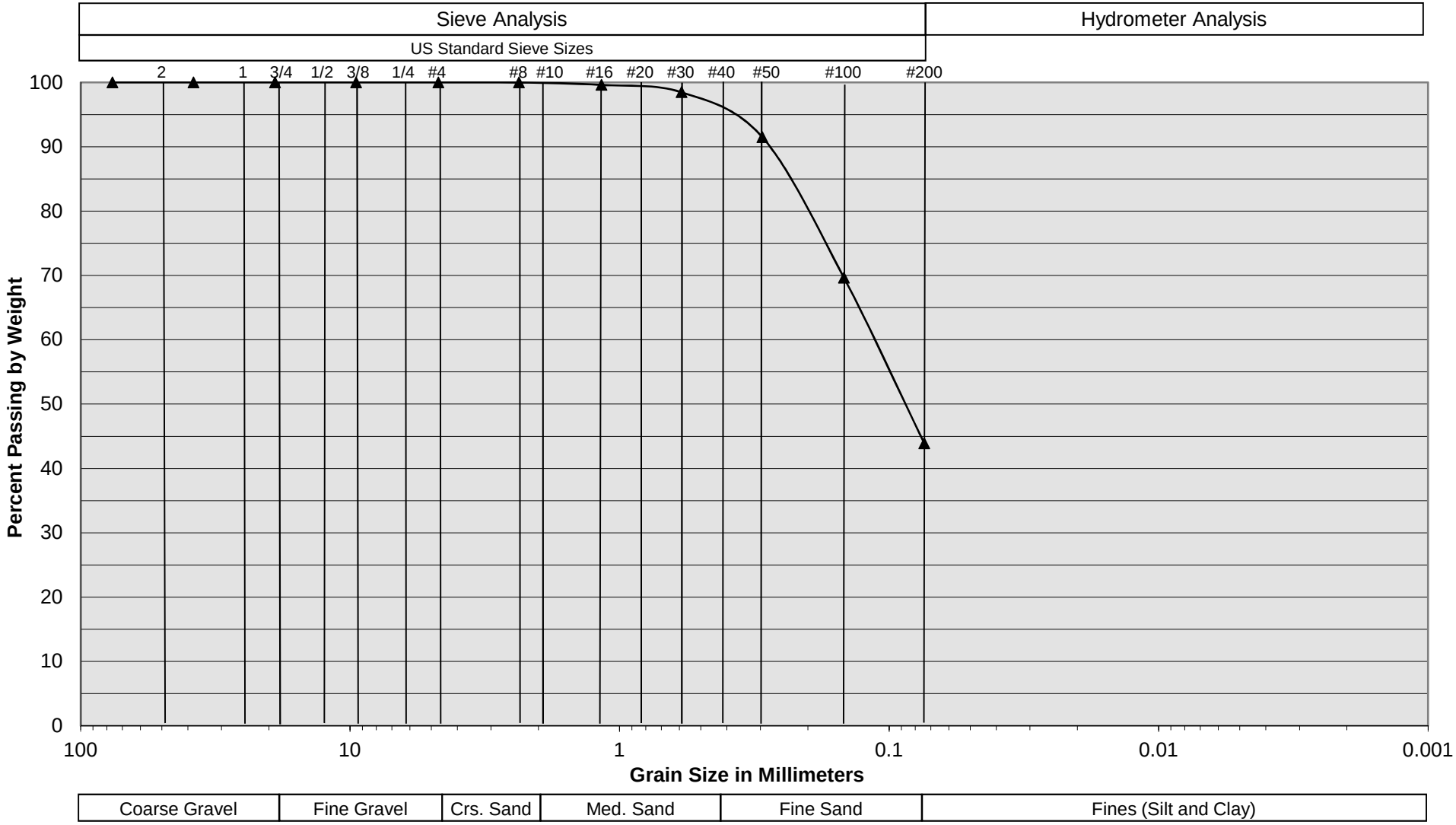


Sample Description	I-1 @ 4 feet
Soil Classification	Light Gray Brown Silty fine Sand

Proposed Commercial/Industrial Building
San Bernardino County, CA
Project No. 17G218-2
PLATE C-1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

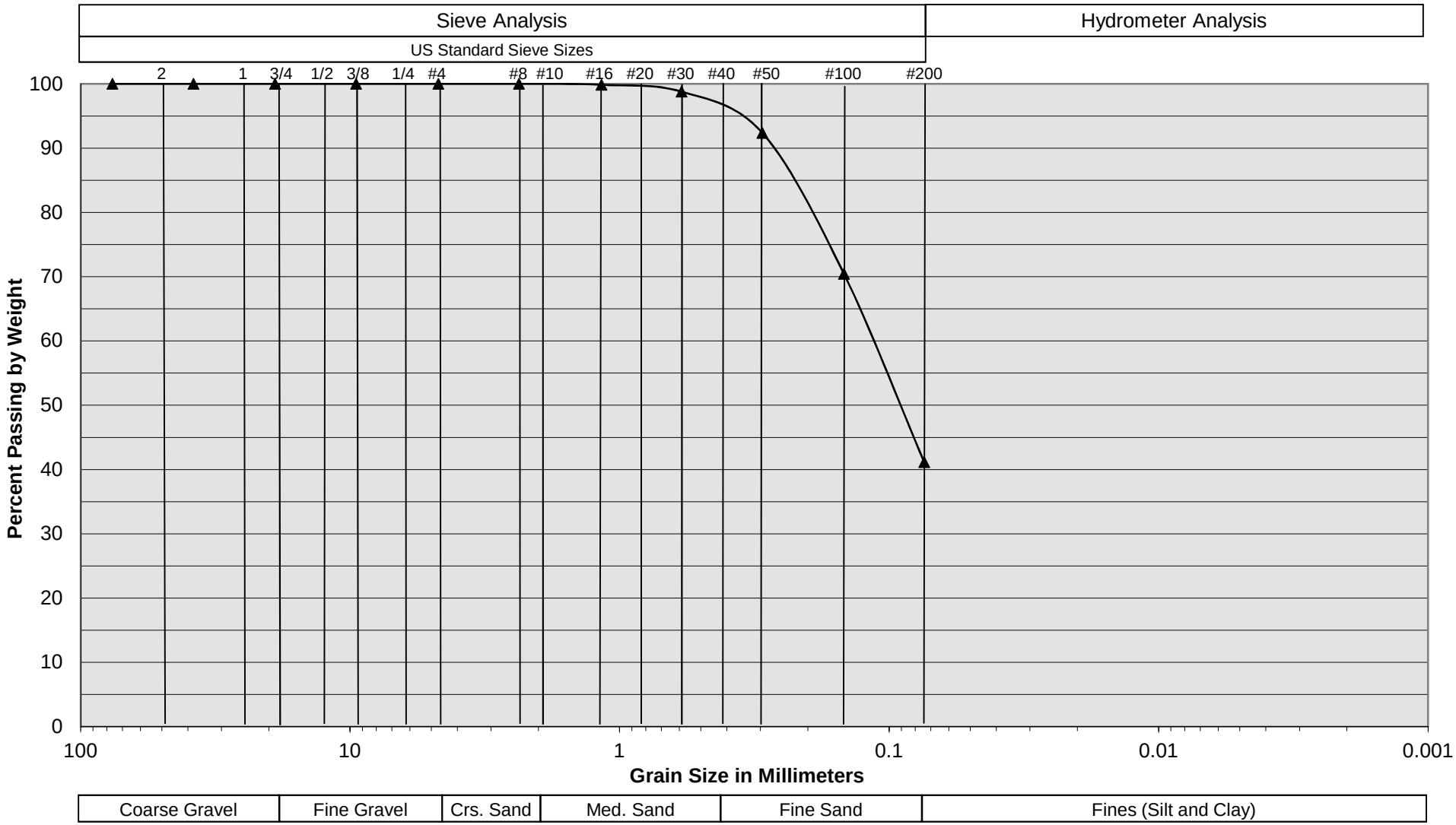


Sample Description	I-2 @ 6 feet
Soil Classification	Light Gray Brown Silty fine Sand, trace medium Sand

Proposed Commercial/Industrial Building
San Bernardino County, CA
Project No. 17G218-2
PLATE C-2

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

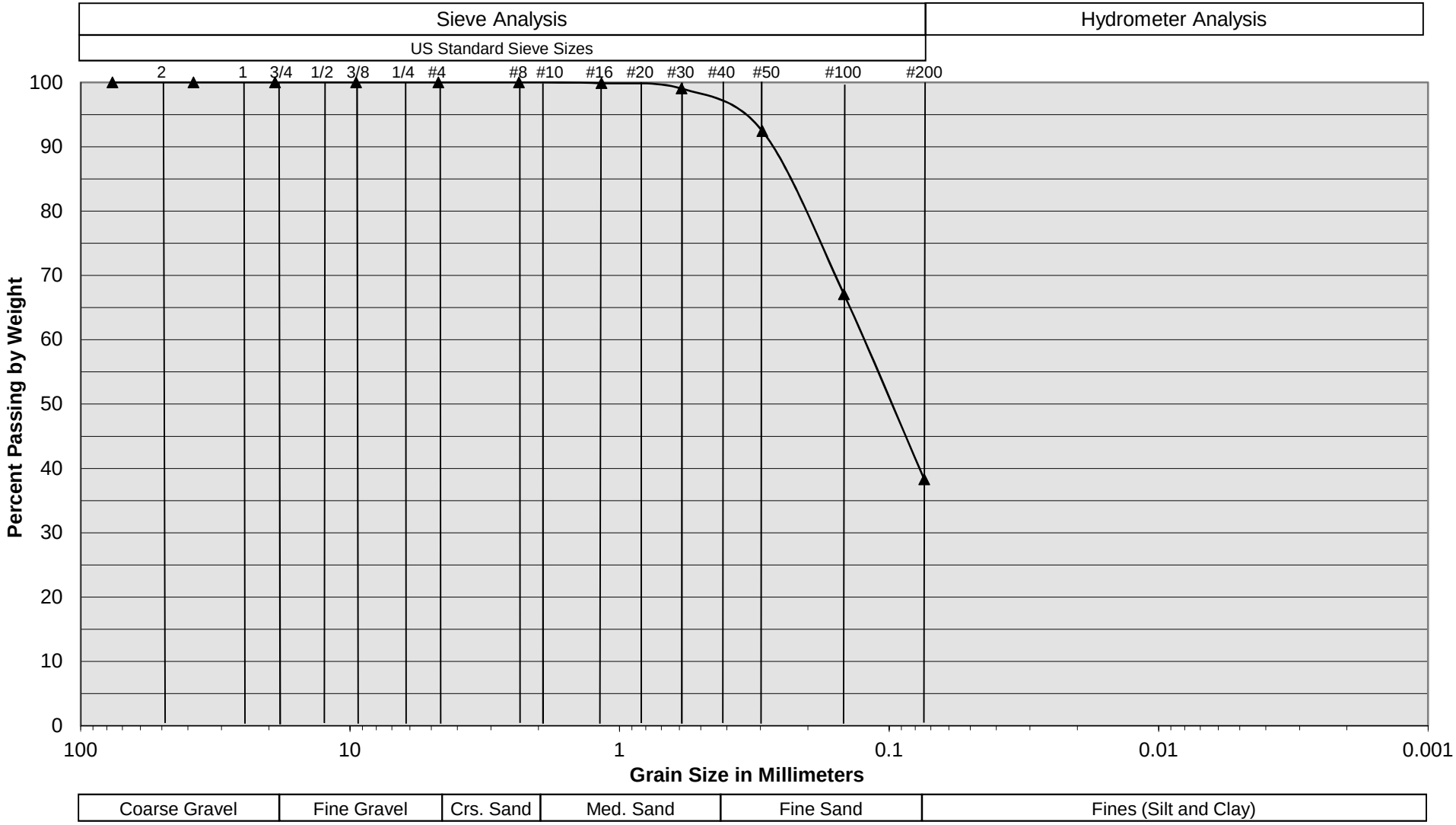


Sample Description	I-3 @ 7 feet
Soil Classification	Light Gray Brown Silty fine Sand

Proposed Commercial/Industrial Building
San Bernardino County, CA
Project No. 17G218-2
PLATE C-3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

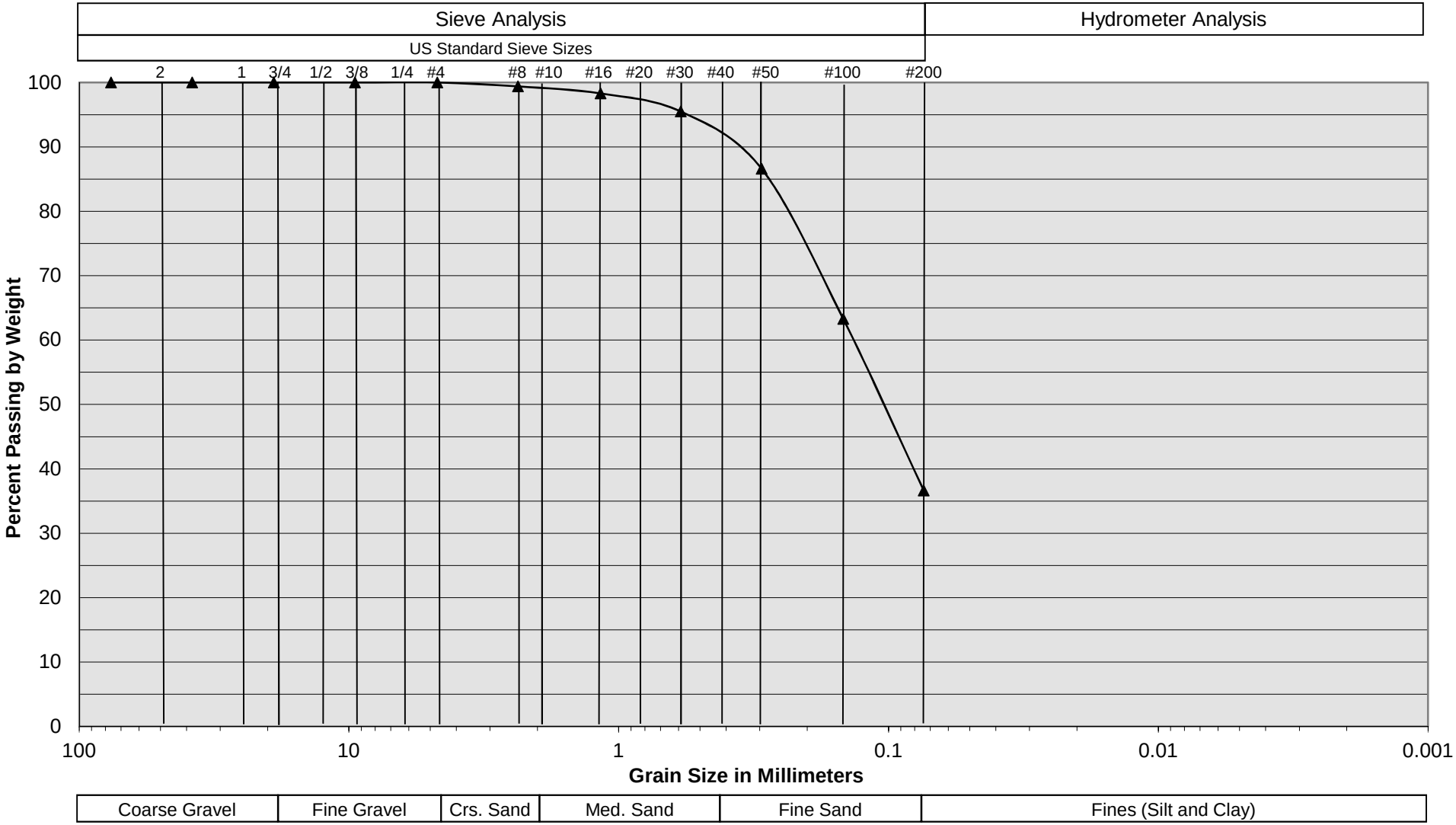


Sample Description	I-4 @ 4 feet
Soil Classification	Light Gray Brown Silty fine Sand

Proposed Commercial/Industrial Building
San Bernardino County, CA
Project No. 17G218-2
PLATE C-4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-5 @ 4 feet
Soil Classification	Light Gray Brown Silty fine Sand, little medium Sand

Proposed Commercial/Industrial Building
San Bernardino County, CA
Project No. 17G218-2
PLATE C-5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation