APPENDIX H

WATER QUALITY MANAGEMENT PLAN

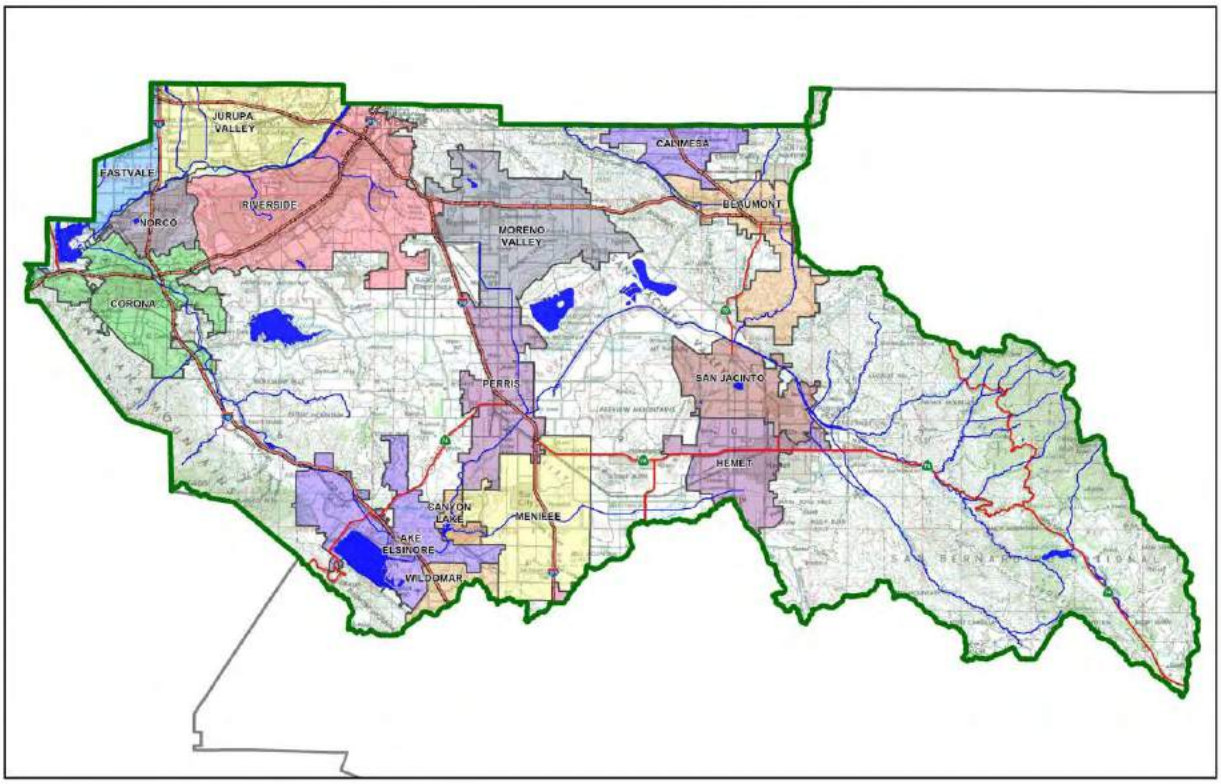
Project Specific Water Quality Management Plan

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

Project Title: KA Enterprises Mega Mart

Development No: PW18-0099

Design Review/Case No: P18-0028(R2), P18-0029(VC), P18-0030(VC-S), P18-0031, 32 (CUP), P18-0033(DR), P18-0034(PM)



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☒ **Preliminary**
☐ **Final**

Original Date Prepared: 01/08/2017

Revision Date(s):

Prepared for Compliance with
Regional Board Order No. **R8-2010-0033**
Template revised June 30, 2016

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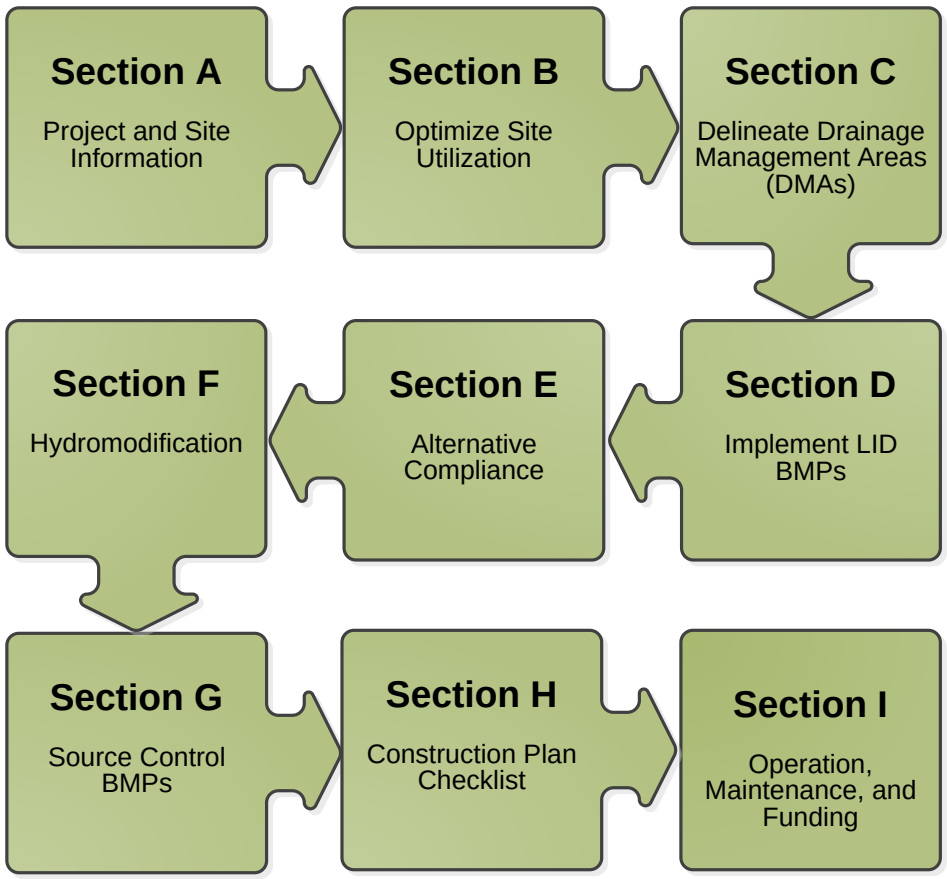
A Brief Introduction

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



OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for KA Enterprises by Omega Engineering Consultants, Inc for the KA Enterprise Mega Mart.

This WQMP is intended to comply with the requirements of **City of Riverside** for **R9-2010-0016** which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under **The City of Riverside** Water Quality Ordinance (Municipal Code Section **14.12.316**).

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

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

PREPARER'S CERTIFICATION

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

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

Preparer's Licensure:

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Commercial (Convenience Store/Restaurant)
Planning Area:	N/A
Community Name:	City of Riverside
Development Name:	KA Enterprise Mega Mart
PROJECT LOCATION	
Latitude & Longitude (DMS): 33°57'32''N , 117°18'39''W	
Project Watershed and Sub-Watershed: Santa Ana Watershed and Middle Santa Ana Watershed	
Gross Acres: 2.19 acres APN(s): 256-050-007 Map Book and Page No.:	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Commercial Use
Proposed or Potential SIC Code(s)	3312
Area of Impervious Project Footprint (SF)	Vacant Lot
Total Area of proposed Impervious Surfaces within the Project Footprint (SF)/or Replacement	61,680 sf
Does the project consist of offsite road improvements?	☐ Y ☒ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the Project limits Footprint (SF)	0 sf
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	N/A
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☒ Y ☐ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	
What is the Water Quality Design Storm Depth for the project?	0.62 in

A.1 Maps and Site Plans

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

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

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

A.2 Identify Receiving Waters

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

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Santa Ana River, Reach 3	Copper, Lead, and Pathogens	AGR, GWR, RARE, REC1, REC2, WILD, WARM	N/A
Santa Ana River, Reach 4	Pathogens	GWR, REC1, REC2, WARM, WILD	N/A

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

Table A.2 Other Applicable Permits

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

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

Section B: Optimize Site Utilization (LID Principles)

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

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

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

Site Optimization

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

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

No natural drainage patterns exist on the project site as the entire site has been previous disturbed and mass graded.

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

The entire site has been previously disturbed. No significant vegetation exists on site.

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

The site has been previously mass graded and the artificial fill materials according to the Storm Water Infiltration letter prepared by Southern California Geotechnical, is prone to collapse when inundated with water. The site is also prone for water to laterally migrate creating additional hydrostatic pressures on the

proposed structures. According to the Storm Water Infiltration Letter, infiltration is not recommended at this site.

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

All impervious areas have been identified on the WQMP site plan included with this report. All design aspects that required to be impervious were designed to occupy the smallest foot print and maximizing landscape areas while still meeting the intent of design.

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

Runoff will not be directed to the adjacent pervious areas since infiltration is infeasible. However, all other runoff from impervious areas will be directed to one of the four biofiltration areas.

Section C: Delineate Drainage Management Areas (DMAs)

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

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1][2]	Area (Sq. Ft.)	DMA Type
DMA-1	Roof, Paving & Landscaping	9,518	Type 'D': Area drains to BMP-1
DMA-2	Paving and Landscaping	20,417	Type 'D': Area drains to BMP-2
DMA-3	Paving and Landscaping	5,128	Type 'D': Area drains to BMP-3
DMA-4	Roof, Paving & Landscaping	36,928	Type 'D': Area drains to BMP-4
DMA-5	Paving and Landscaping	14,055	Type 'C': Area drains to Self-Retaining Areas
DMA-6	Paving and Landscaping	9,199	Type 'C': Area drains to Self-Retaining Areas

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

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

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

Table C.3 Type 'B', Self-Retaining Areas

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

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

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

DMA					Receiving Self-Retaining DMA		
DMA Name/ ID	Area (square feet)	Post-project surface type	Impervious fraction	Product		Area (square feet)	Ratio
	[A]		[B]	[C] = [A] x [B]	DMA name /ID	[D]	[C]/[D]
DMA-5	14,055	Driveway	0.13	1,827	DMA-5	12,228	0.15
DMA-6	9,199	Driveway	0.58	5,335	DMA-6	3,864	1.38
-	-	-	-	-			
-	-	-	-	-			

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

DMA Name or ID	BMP Name or ID
DMA-1	BMP-1
DMA-2	BMP-2
DMA-3	BMP-3
DMA-4	BMP-4

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

Section D: Implement LID BMPs

D.1 Infiltration Applicability

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

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

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

Geotechnical Report

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

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

Infiltration Feasibility

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

Table D.1 Infiltration Feasibility

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

**REFER TO GEOTECHNICAL REPORT- STORMWATER INFILTRATION INFEASIBILITY LETTER (APPENDIX 3)

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

D.2 Harvest and Use Assessment

Please check what applies*:*

N/A- Reclaimed water will be used for the non-potable water demands for the project.

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

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

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

Irrigation Use Feasibility

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

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

Total Area of Irrigated Landscape: **0.70 acres**

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

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

Total Area of Impervious Surfaces: **1.48 acres (Roof & Paving Areas)**

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

Enter your EIATIA factor: **0.81**

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

Minimum required irrigated area: **0.14 acres**

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

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)
1.20	**0.7**

***Harvesting Stormwater runoff is not feasible for irrigation**

Toilet Use Feasibility

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

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

Projected Number of Daily Toilet Users: ***100***

Project Type: ***Commercial***

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

Total Area of Impervious Surfaces: ***1.48 acres***

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

Enter your TUTIA factor: ***201***

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

Minimum number of toilet users: ***297***

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

Minimum required Toilet Users (Step 4)	Projected number of toilet users (Step 1)
297	100

Other Non-Potable Use Feasibility

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

N/A

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

Average Daily Demand: ***N/A***

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

Total Area of Impervious Surfaces: ***N/A***

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

Enter the factor from Table 2-4: ***N/A***

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

Minimum required use: ***N/A***

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

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
N/A	**N/A**

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

D.3 Bioretention and Biotreatment Assessment

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

Select one of the following:

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

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

D.4 Feasibility Assessment Summaries

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

Table D.2 LID Prioritization Summary Matrix

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

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

N/A

D.5 LID BMP Sizing

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

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*BMP-1*		
	[A]		[B]	[C]	[A] x [C]			
DMA-1	*9,518*	*Mixed*	*0.92*	*0.76*	*7,234*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	A_T = 9,518				Σ= 7,234 [D]	0.62 [E]	[F] = 374	[G] = 375

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*BMP-2*		
	[A]		[B]	[C]	[A] x [C]			
DMA-2	*20,417*	*Mixed*	*0.87*	*0.69*	*14,047*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	A_T = 20,417				Σ= 14,047[D]	0.62	[F] = 726	1,018 [G]

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*BMP-3*		
	[A]		[B]	[C]	[A] x [C]			
DMA-3	*5,128*	*Mixed*	*0.87*	*0.69*	*3,528*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	A_T = 5,128				Σ= 3,528 [D]	0.62	[F] = 182	191 [G]

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*BMP-4*		
	[A]		[B]	[C]	[A] x [C]			
DMA-4	*36,928*	*Mixed*	*0.83*	*0.64*	*23,474*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	A_T = 36,928				Σ= 23,474 [D]	0.62	[F] = 1213	1250 [G]

Section E: Alternative Compliance (LID Waiver Program)

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

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

- *Or* -

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

N/A

E.1 Identify Pollutants of Concern

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

Table E.1 Potential Pollutants by Land Use Type

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

P = Potential

N = Not Potential

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

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

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

(4) Specifically petroleum hydrocarbons

(5) Specifically solvents

(6) Bacterial indicators are routinely detected in pavement runoff

E.2 Stormwater Credits

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

Table E.2 Water Quality Credits

Qualifying Project Categories	Credit Percentage[2]
N/A	N/A
Total Credit Percentage[1]	

[1]*Cannot Exceed 50%*
[2]*Obtain corresponding data from Table 3-8 in the WQMP Guidance Document*

E.3 Sizing Criteria

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

Table E.3 Treatment Control BMP Sizing

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

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is for Flow-Based Treatment Control BMPs [E] = .2, for Volume-Based Control Treatment BMPs, [E] obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

E.4 Treatment Control BMP Selection

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

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

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

Table E.4 Treatment Control BMP Selection

Selected Treatment Control BMP Name or ID[1]	Priority Pollutant(s) of Concern to Mitigate[2]	Removal Efficiency Percentage[3]
N/a	N/a	N/a

[1] Treatment Control BMPs must not be constructed within Receiving Waters. In addition, a proposed Treatment Control BMP may be listed more than once if they possess more than one qualifying pollutant removal efficiency.
[2] Cross Reference Table E.1 above to populate this column.
[3] As documented in a Co-Permittee Approved Study and provided in Appendix 6.

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

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

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

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

If Yes, HCOC criteria do not apply.

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

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

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

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

Table F.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	**Post-condition**	**% Difference**
Time of Concentration			
Volume (Cubic Feet)			

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

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

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

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

INSERT TEXT HERE

F.2 HCOC Mitigation

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

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

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

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

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

-Refer to Appendix 7 for calculations and analysis indicating the post-development for a 2-year storm event mimics the pre-development storm water runoff condition.

Section G: Source Control BMPs

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

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

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

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

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

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
On-site Storm Drain Inlets	Mark all inlets with the words "Only Rain Down the Storm Drain" or Similar	-Maintain and periodically repaint or replace inlet markings. -Provide stormwater pollution prevention information to new site owners, lessees, or operators. -Apply applicable operational BMPs from fact sheet SC-44 -Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to strom drains or to store or deposit

		materials so as to create a potential discharge to storm drains."
Landscape/Outdoor Pesticide Use	Final landscape plans will accomplish all of the following. -Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. -Where landscaped areas are used to retain or detain stromwater, specify plants that are tolerant of saturated soil conditions. -Use pert resistant plants when applicable -Currently a graded lot so preservation of existing is limited.	-Maintain landscaping using minimum or no pesticides. -Apply applicable operational BMPs in "What you should know for landscape and gardening" -Provide Integrated pest management information to new owners, lessees, and operators.
Food Service	-Describe the location and features of the designated cleaning area. -Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.	- State how the following will be implemented: Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control material available on site. See Fact Sheet SC-34, " Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
Refuse areas	-State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar -Final plan for refuse handling will be provided in final WQMP	With final WQMP, explanation will be given on providing adequate number of receptacles and performing operational BMPs

Vehicle and Equipment Cleaning	-If a car wash area is not provided, describe any measures taken to discourage on –site car washing and explain how these will be enforced.	-Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. Refer to "Outdoor Cleaning activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://recflood.org /stormwater/
Fuel Dispensing Areas		-The property owner shall dry sweep the fueling area routinely. -See the Fact Sheet SD-30, Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
Fire Sprinkler Test Water	Provide means to drain fire sprinkler test water to sewer	Test water disposed per CASQA fact sheet SC-41
Roofing, Gutter, and Trim	Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	
Plazas, sidewalks, and parking lots.		Sweep plazas, sidewalks, and parking lots regularly to percent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Section H: Construction Plan Checklist

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

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)
BMP-1	BMP-1	Preliminary Grading – Sheet 2 and 3
BMP-2	BMP-2	Preliminary Grading – Sheet 2 and 3
BMP-3	BMP-3	Preliminary Grading – Sheet 2 and 3
BMP-4	BMP-4	Preliminary Grading – Sheet 2 and 3

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

Section I: Operation, Maintenance and Funding

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

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

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

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

Maintenance Mechanism:

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

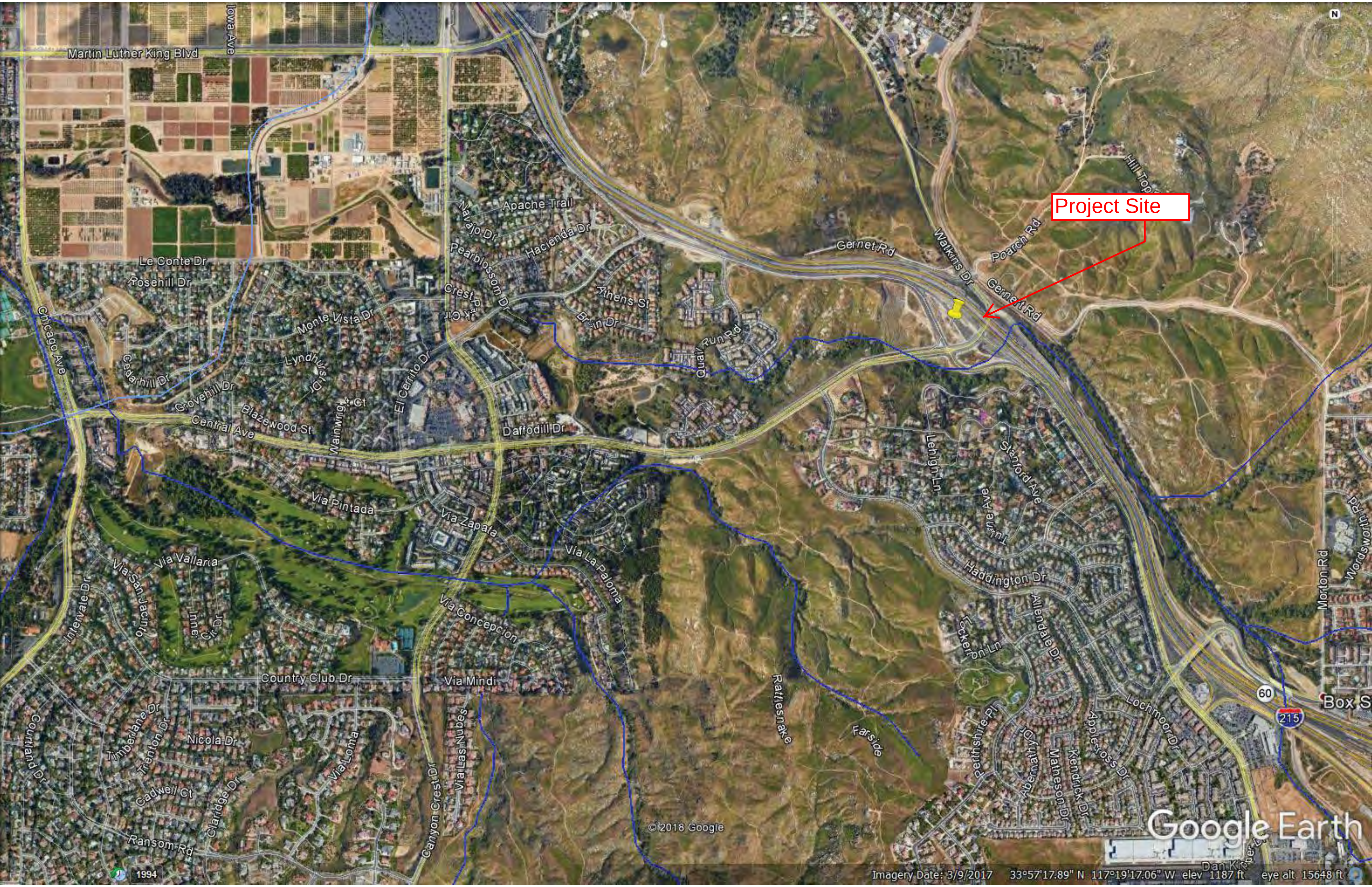
☐ Y ☒ N

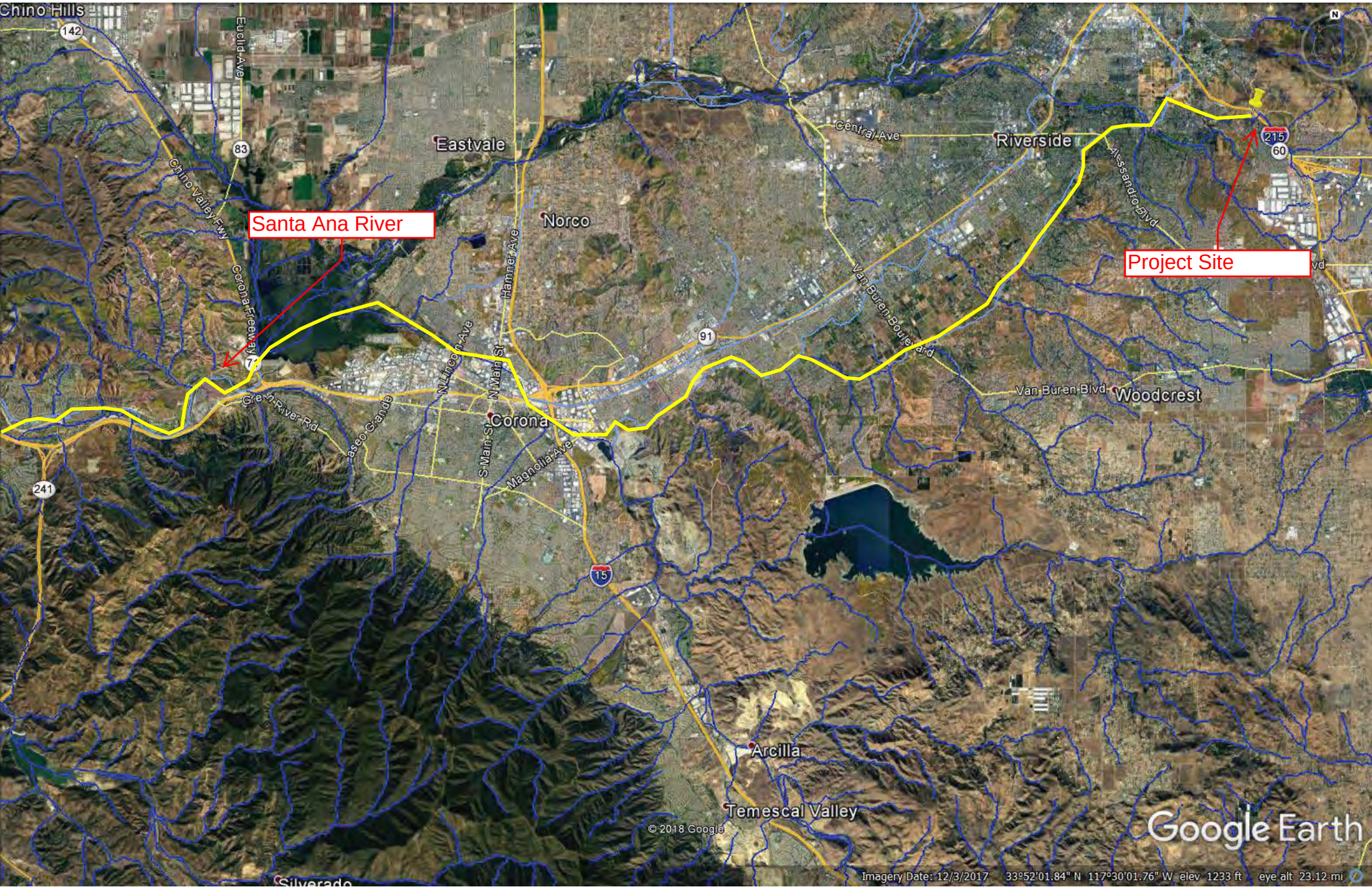
Include your Operation and Maintenance Plan and Maintenance Mechanism in Appendix 9. Additionally, include all pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP in Appendix 10.

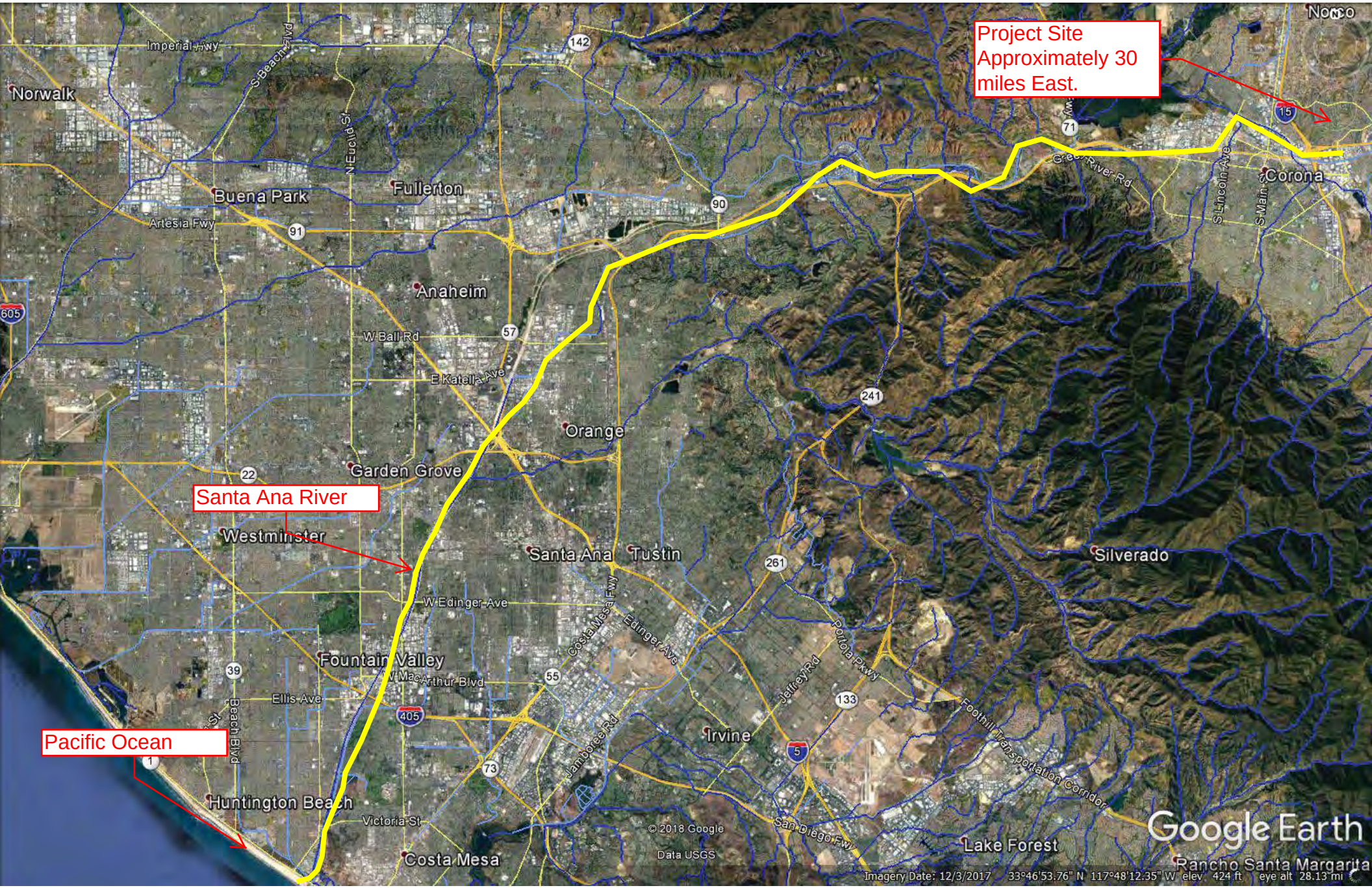
Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

SEE MAP POCKET FOR WQMP SITE PLAN


Project Site
Martin Luther King Blvd
Iowa Ave
Apache Trail
Navajo Dr
Hacienda Dr
Pearblossom Dr
Gernet Rd
Watkins Dr
Poarch Rd
Hill Top
Le Conte Dr
Rosehill Dr
Athens St
Monte Vista Dr
Chicago Ave
Lyndhurst Dr
El Cerrito Dr
Quail Run Rd
Cedarhill Dr
Grovehill Dr
Blazewood St
Central Ave
Wainwright Ct
Daffodill Dr
Lehigh Ln
Stanford Ave
Via Pintada
Via Zapata
Tulane Ave
Haddington Dr
Via Vallarta
Via San Jacinto
Via La Paloma
Via Concepcion
Allendale Dr
Intervale Dr
Morton Rd
Wordsworth
Country Club Dr
Via Mindi
Rattlesnake
Farside
Lochmoor Dr
Box S
60
215
Nicola Dr
Timberlane Dr
Trenton Dr
Cadwell Ct
Claridge Dr
Via Loma
Courtland Dr
Ransom Rd
Canyon Crest Dr
Via Las Nubes
Perthshire Pl
Abernathy Dr
Matheson Dr
Kendrick Dr
Applecross Dr
©2018 Google
Google Earth
1994
Imagery Date: 3/9/2017 33°57'17.89" N 117°19'17.06" W elev 1187 ft eye alt 15648 ft
N


Santa Ana River
Project Site
Chino Hills
Eastvale
Norco
Riverside
Corona
Woodcrest
Arcilla
Temescal Valley
Silverado
Euclid Ave
Chino Valley Fwy
Corona Freeway
Hamner Ave
N Lincoln Ave
N Main St
S Main St
Green River Rd
Paseo Grande
Magnolia Ave
Central Ave
Van Buren Boulevard
Van Buren Blvd
Alessandro Blvd
142
83
71
91
241
15
215
60
© 2018 Google
Google Earth
Imagery Date: 12/3/2017 33°52'01.84" N 117°30'01.76" W elev 1233 ft eye alt 23.12 mi


Project Site
Approximately 30
miles East.
Santa Ana River
Pacific Ocean
Norwalk
Buena Park
Fullerton
Anaheim
Orange
Garden Grove
Westminster
Santa Ana
Tustin
Silverado
Irvine
Lake Forest
Rancho Santa Margarita
Corona
Huntington Beach
Fountain Valley
Costa Mesa
Imperial Hwy
Artesia Fwy
W Ball Rd
E Katella Ave
W Edinger Ave
Ellis Ave
Victoria St
Jamboree Rd
Jeffrey Rd
Portola Pkwy
Foothill Transportation Corridor
San Diego Fwy
Costa Mesa Fwy
Edinger Ave
Beach Blvd
S Lincoln Ave
S Main St
Green River Rd
© 2018 Google
Data USGS
Google Earth
Imagery Date: 12/3/2017 33°46'53.76" N 117°48'12.35" W elev 424 ft eye alt 28.13 mi

Appendix 2: Construction Plans

Grading and Drainage Plans

APPLICABLE PRELIMINARY GRADING PLAN SHEETS HAVE BEEN INCLUDED IN MAP POCKET

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

GEOTECHNICAL INVESTIGATION
PROPOSED RETAIL DEVELOPMENT

NEC Sycamore Canyon Boulevard and Central Avenue
Riverside, California
For
KA Enterprises

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

December 11, 2017

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

KA Enterprises
5820 Oberlin Drive, Suite 201
San Diego, California 92121

Attention: Mr. Eugene Marini

Project No.: **17G134-3**

Subject: **Geotechnical Investigation**
Proposed Retail Development
NEC Sycamore Canyon Boulevard and Central Avenue
Riverside, California

Gentlemen:

In accordance with your request, we have conducted a geotechnical investigation at the subject site. We are pleased to present this report summarizing the conclusions and recommendations developed from our investigation.

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.

REGISTERED PROFESSIONAL ENGINEER
DANIEL W. NIELSEN
No. 77915
CIVIL
STATE OF CALIFORNIA

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Distribution: (1) Addressee

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

Presented below is a brief summary of the conclusions and recommendations of this investigation. Since this summary is not all inclusive, it should be read in complete context with the entire report.

Site Preparation

- Initial site preparation should include stripping of any surficial vegetation. The surficial vegetation, weeds, grasses, shrubs and any organic soils should be properly disposed of off-site.
- Artificial fill soils were encountered at several of the boring and all of the trench locations, extending from the ground surface to depths of 1 to 9½± feet. Bedrock was encountered at the ground surface and beneath the fill soils at all of the boring and trench locations.
- The fill soils possess occasional to extensive debris content and possess varying strengths. In addition, the existing fill soils are considered to represent undocumented fill. These soils, in their present condition, are not considered suitable for support of the foundation loads of the new structures.
- Remedial grading is recommended to be performed within the new building pad areas. The existing soils within the building pad areas should be overexcavated to a depth of 2 feet below existing grade and to a depth of 2 feet below proposed pad grade, whichever is greater. All existing artificial fill materials should also be removed from the new building pad areas. The soils within the proposed foundation influence zones should be overexcavated to a depth of at least 2 feet below proposed foundation bearing grades.
- After overexcavation has been completed, the resulting subgrade soils should be evaluated by the geotechnical engineer to identify any additional soils that should be overexcavated, moisture conditioned, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill.
- The new parking area subgrade soils are recommended to be scarified to a depth of 12± inches, thoroughly moisture conditioned and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Building Foundations

- Conventional shallow foundations, supported in newly placed compacted fill.
- 2,500 lbs/ft^2 maximum allowable soil bearing pressure.
- Reinforcement consisting of at least two (2) No. 5 rebars (1 top and 1 bottom) in strip footings. Additional reinforcement may be necessary for structural considerations.

Building Floor Slab

- Conventional Slab-on-Grade, 5 inches thick.
- Minimum reinforcement not required for geotechnical considerations assuming a very low expansion index pad. The actual floor slab reinforcement should be determined by the structural engineer, based upon the imposed loading.

Pavements

ASPHALT PAVEMENTS (R = 40)		
Materials	**Thickness (inches)**	
	Auto Parking and Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic (TI = 6.0)
Asphalt Concrete	3	3½
Aggregate Base	4	6
Compacted Subgrade	12	12

PORTLAND CEMENT CONCRETE PAVEMENTS		
Materials	**Thickness (inches)**	
	Autos Parking and Drive Lanes (TI = 4.0 & 5.0)	Truck Traffic (TI = 6.0)
PCC	5	5½
Compacted Subgrade (95% minimum compaction)	12	12

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in general accordance with our Proposal No. 17P350, dated September 25, 2017. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to provide criteria for preparing the design of the building foundations, building floor slabs, and parking lot pavements along with site preparation recommendations and construction considerations for the proposed development. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical investigation.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located at the northeast corner of Sycamore Canyon Boulevard and Central Avenue in Riverside, California. The site is bounded to the north and east by the Central Avenue off-ramp of the eastbound Moreno Valley Freeway (Highway 60), to the south by Central Avenue, and to the west by Sycamore Canyon Boulevard. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The subject site consists of several irregular-shaped contiguous parcels which total 2.5± acres in size. The site is currently vacant and undeveloped except for a cell phone tower located near the north corner of the site. A soil stockpile, approximately 50 feet in diameter and 6 to 8 feet in height, is located in the central area of the site. A slope is present along the western property line which descends downward toward Sycamore Canyon Boulevard. The height of the slope ranges from approximately 3 to 15± feet with an inclination of approximately 2h:1v. The ground surface consists of exposed soil with sparse native grass and weed growth and exposed soil with moderate to heavy grass and weed growth on the existing slope.

Topographical information for the subject site was obtained from a map provided by Omega Engineering Consultants, Inc., the project civil engineer. The site topography ranges from 1370± feet mean sea level (msl) in the northern area of the site to 1353± feet msl in the southwestern corner of the site. The maximum elevation differential across the site is approximately 17 feet.

3.2 Proposed Development

Based on a conceptual grading plan prepared by Omega Engineering Consultants, Inc., the site will be developed with a convenience store and a restaurant building. The convenience store will be located in the south-central region of the site and will be 3,200± ft² in size. A fuel island and canopy structure will be constructed south of the convenience store and a car wash building will be located in the southeastern area of the site. The restaurant building will be located in the north-central area of the site and will be 3,800± ft² in size. A drive-thru lane will be constructed along the northern, western, and southern sides of the restaurant. The buildings will be surrounded by asphaltic concrete pavements in the parking and drive areas, Portland cement concrete pavements in the drive-thru lanes, concrete flatwork, and limited areas of landscape planters. A slope will be constructed along the northern portion of the western property line. The slope will be approximately 6 feet in height and have an inclination of 2h:1v. Retailing walls will also be located in the western portion of the site. The northern wall will range from 1 to 13± feet in height and the southern wall will range from 2 to 12½± feet in height. A retaining wall will also be constructed along the southern portion of the eastern property line. This retaining wall will range from 1 to 7± feet in height.

Detailed structural information has not been provided. It is assumed that the new buildings will be single -story structures of wood frame or masonry block construction and supported on

conventional shallow foundations with concrete slab-on-grade floors. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 30 kips and 1 to 3 kips per linear foot, respectively.

No significant amounts of below grade construction, such as basements or crawl spaces, are expected to be included in the proposed development. Based on the conceptual grading plan provided to our office, cuts of up to 8± feet and fills of up to 8± feet are expected to be necessary to achieve the proposed site grades.

3.3 Previous Studies

Southern California Geotechnical, Inc. (SCG) previously performed two investigations for the subject site. The results of the previous investigations are documented in the reports referenced below:

> Results of Limited Geotechnical Reconnaissance and Research, Proposed Retail Development, Northeast Corner of Sycamore Canyon Boulevard and Central Avenue, Riverside, California, prepared by Southern California Geotechnical, Inc. (SCG) for KA Enterprises, SCG Project No. 17G134-1, dated April 10, 2017.

SCG performed visual reconnaissance and performed research of the available geologic literature for this site. Our observations and the results of this study are presented in the report referenced above. As part of this study, an SCG certified engineering geologist (CEG) conducted a site reconnaissance. No subsurface exploration was performed as part of this study. Bedrock materials were observed at the ground surface in limited areas along the southern property line and on a portion of the surface of the slope along the western property line. In addition, bedrock materials were observed beneath the surficial soils at a couple locations in the central area of the site. SCG reported that the site was likely underlain by Val Verde Formation tonalite bedrock. SCG recommended that a geophysical rippability study be performed at the subject site.

> Seismic Refraction Study, Proposed Retail Development, Northeast Corner of Sycamore Canyon Boulevard and Central Avenue, Riverside, California, prepared by SCG for KA Enterprises, SCG Project No. 17G134-2, dated April 25, 2017.

SCG previously performed a seismic refraction study at the subject site. Four (4) 150-foot long seismic refraction lines were performed at the site. SCG concluded that the very weathered tonalite bedrock was considered marginally rippable to depths of 7 to 30 feet. However, SCG did indicate that if deeper cuts were expected, blasting would be expected in any areas where less weathered bedrock materials would be encountered.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of five (5) soil borings drilled to depths of 10 to 25± feet below existing site grades and six (6) trenches excavated to depths of 4 to 15± feet below currently existing site grades. All of the borings and trenches were logged during drilling and trenching by our engineering geology personnel.

The trenches were excavated using a track mounted excavator equipped with a 24-inch wide bucket. All of the borings were advanced with hollow-stem augers, by a conventional truck-mounted drilling rig. Representative bulk and relatively undisturbed soil samples were taken during drilling and trenching. Relatively undisturbed samples were taken with a split barrel "California Sampler" containing a series of one inch long, 2.416± inch diameter brass rings. This sampling method is described in ASTM Test Method D-3550. Relatively undisturbed samples were also taken using a 1.4± inch inside diameter split spoon sampler, in general accordance with ASTM D-1586. Both of these samplers are driven into the ground with successive blows of a 140-pound weight falling 30 inches. The blow counts obtained during driving are recorded for further analysis. Bulk samples were collected in plastic bags to retain their original moisture content. The relatively undisturbed ring samples were placed in molded plastic sleeves that were then sealed and transported to our laboratory.

The approximate locations of the borings and trenches are indicated on the Boring and Trench Location Plan, included as Plate 2 in Appendix A of this report. The Boring Logs and Trench Logs, which illustrate the conditions encountered at the boring and trench locations, as well as the results of some of the laboratory testing, are included in Appendix B.

4.2 Geotechnical Conditions

Artificial Fill

Artificial fill soils were encountered at the ground surface at three (3) of the boring locations and all of the trench locations extending to depths of 1 to 9½± feet below the existing site grades. The fill soils generally consist of silty fine to coarse sands with varying amounts of gravel content. Construction debris including concrete, asphalt, tile, metal, plastic, and rebar were observed within Trench Nos. T-3, T-4, and T-5. The construction debris ranged in size from 1-inch to 4-feet. The fill soils possess abundant debris content, variable strengths and a disturbed appearance, resulting in their classification as fill.

Alluvium

Native alluvial soil were encountered beneath the fill soils at Trench No T-6 and Boring No. B-4. The native soils extended to depths of 12 to 13± feet below the existing site grades. The alluvial soils consist of loose to medium dense silty fine to medium sands and silty fine to coarse sands.

Val Verde Tonalite

Val Verde Formation Tonalite bedrock was encountered at the ground surface or beneath the fill or alluvium at all of the boring and trench locations. The bedrock materials encountered throughout the site consists of dense to very dense, light brown to dark gray brown fine to coarse grained tonalite, jointed, weathered and friable. Gouge filled joints were observed at Trench Nos. T-2 and T-3. Joints with no gouge were observed at Trench No. T-5. The bedrock was generally massive.

Groundwater

Free water was not encountered during excavation of any of the borings or trenches. Based on the lack of any water within the borings and trenches, and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 25± feet at the time of the subsurface exploration.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the groundwater depths in this area is the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. However, there are no wells within 1 mile of the subject site.

4.3 Geologic Conditions

Regional geologic conditions were obtained from the Preliminary Geologic Map of the Riverside East 7.5 Minute Quadrangle, Riverside County, California, published by the California Geological Survey (CGS) by Morton and Cox, 1997. This map indicates that the site is underlain by Cretaceous age Val Verde Formation tonalite (Map Symbol Kvt). The Val Verde Formation is described as gray, weathered, relatively homogeneous, massive, medium- to coarse-grained tonalite. A portion of this map, indicating the location of the subject site, is included as Plate 3 in Appendix A.

Based on the materials encountered in the exploratory borings and trenches, it is our opinion the site is underlain by Val Verde Tonalite. Bedrock was encountered at all of the boring and trench locations. The bedrock consists of dense to very dense, fine to coarse grained, jointed, weathered tonalite of the Val Verde formation. The geologic conditions at the site are consistent with the mapped geologic conditions.

5.0 LABORATORY TESTING

The soil samples recovered from the subsurface exploration were returned to our laboratory for further testing to determine selected physical and engineering properties of the soils. The tests are briefly discussed below. It should be noted that the test results are specific to the actual samples tested, and variations could be expected at other locations and depths.

Classification

All recovered soil samples were classified using the Unified Soil Classification System (USCS), in accordance with ASTM D-2488. The field identifications were then supplemented with additional visual classifications and/or by laboratory testing. The USCS classifications are shown on the Boring and Trench Logs and are periodically referenced throughout this report.

Density and Moisture Content

The density has been determined for selected relatively undisturbed ring samples. These densities were determined in general accordance with the method presented in ASTM D-2937. The results are recorded as dry unit weight in pounds per cubic foot. The moisture contents are determined in accordance with ASTM D-2216, and are expressed as a percentage of the dry weight. These test results are presented on the Boring and Trench Logs.

Consolidation

Selected soil samples from our previous geotechnical investigation have been tested to determine their consolidation potential, in accordance with ASTM D-2435. The testing apparatus is designed to accept either natural or remolded samples in a one-inch high ring, approximately 2.416 inches in diameter. Each sample is then loaded incrementally in a geometric progression and the resulting deflection is recorded at selected time intervals. Porous stones are in contact with the top and bottom of the sample to permit the addition or release of pore water. The samples are typically inundated with water at an intermediate load to determine their potential for collapse or heave. The results of the consolidation testing are plotted on Plates C-1 through C-8 in the Appendix of this report.

Maximum Dry Density and Optimum Moisture Content

Representative bulk samples were tested for their maximum dry densities and optimum moisture contents. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557. These tests are generally used to compare the in-situ densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil type or soil mixes may be necessary at a later date. The results of the testing are plotted on Plates C-9 and C-10 in Appendix C of this report.

Soluble Sulfates

Representative samples of the near-surface soils were submitted to a subcontracted analytical laboratory for determination of soluble sulfate content. Soluble sulfates are naturally present in

soils, and if the concentration is high enough, can result in degradation of concrete which comes into contact with these soils. The results of the soluble sulfate testing are presented below, and are discussed further in a subsequent section of this report.

Sample Identification	Soluble Sulfates (%)	ACI Classification
B-2 @ 0 to 5 feet	0.005	Negligible
B-4 @ 0 to 5 feet	0.008	Negligible

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our review, field exploration, laboratory testing and geotechnical analysis, the proposed development is considered feasible from a geotechnical standpoint. The recommendations contained in this report should be taken into the design, construction, and grading considerations.

The recommendations are contingent upon all grading and foundation construction activities being monitored by the geotechnical engineer of record. The recommendations are provided with the assumption that an adequate program of client consultation, construction monitoring, and testing will be performed during the final design and construction phases to verify compliance with these recommendations. Maintaining Southern California Geotechnical, Inc., (SCG) as the geotechnical consultant from the beginning to the end of the project will provide continuity of services. The geotechnical engineering firm providing testing and observation services shall assume the responsibility of Geotechnical Engineer of Record.

The Grading Guide Specifications, included as Appendix D, should be considered part of this report, and should be incorporated into the project specifications. The contractor and/or owner of the development should bring to the attention of the geotechnical engineer any conditions that differ from those stated in this report, or which may be detrimental for the development.

6.1 Seismic Design Considerations

The subject site is located in an area which is subject to strong ground motions due to earthquakes. The performance of a site specific seismic hazards analysis was beyond the scope of this investigation. However, numerous faults capable of producing significant ground motions are located near the subject site. Due to economic considerations, it is not generally considered reasonable to design a structure that is not susceptible to earthquake damage. Therefore, significant damage to structures may be unavoidable during large earthquakes. The proposed structures should, however, be designed to resist structural collapse and thereby provide reasonable protection from serious injury, catastrophic property damage and loss of life.

Faulting and Seismicity

Research of available maps indicates that the subject site is not located within an Alquist-Priolo Earthquake Fault Zone. Furthermore, SCG did not identify any evidence of faulting during the geotechnical investigation. Therefore, the possibility of significant fault rupture on the site is considered to be low.

The potential for other geologic hazards such as seismically induced settlement, lateral spreading, tsunamis, inundation, seiches, flooding, and subsidence affecting the site is considered low.

Seismic Design Parameters

Based on standards in place at the time of this report, the proposed development is expected to be designed in accordance with the requirements of the 2016 edition of the California Building Code (CBC). The CBC provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configurations of the structures including the structural system and height. The seismic design parameters presented below are based on the soil profile and the proximity of known faults with respect to the subject site.

The 2016 CBC Seismic Design Parameters have been generated using U.S. Seismic Design Maps, a web-based software application developed by the United States Geological Survey. This software application, available at the USGS web site, calculates seismic design parameters in accordance with the 2016 CBC, utilizing a database of deterministic site accelerations at 0.01 degree intervals. The table below is a compilation of the data provided by the USGS application. A copy of the output generated from this program is included in Appendix E of this report. A copy of the Design Response Spectrum, as generated by the USGS application is also included in Appendix E. Based on this output, the following parameters may be utilized for the subject site:

2016 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S_S	1.500
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.611
Site Class	---	C
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.500
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	0.794
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.000
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.529

Liquefaction

Liquefaction is the loss of strength in generally cohesionless, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors which influence the potential for liquefaction include groundwater table elevation, soil type and grain size characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d_{50}) grain size in the range of 0.075 to 0.2 mm (Seed and Idriss, 1971). Clayey (cohesive) soils or soils which possess clay particles (d<0.005mm) in excess of 20 percent (Seed and Idriss, 1982) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

Based on mapping performed by the California Geological Survey (CGS) the subject site is not located within a designated liquefaction hazard zone. In addition, the subsurface conditions encountered at the boring and trench locations are not considered to be conducive to liquefaction. Based on the mapping performed by CGS and the conditions encountered at the boring locations, liquefaction is not considered to be a design concern for this project.

6.2 Geotechnical Design Considerations

General

The subject site is underlain by artificial fill soils, extending to depths of up to 9½± feet. All of the fill soils on site are considered to be undocumented fill since the fill soils were not placed under engineering controlled conditions. The fill soils possess extensive debris content, variable strengths, and based on the results of laboratory testing, are highly collapsible. Therefore, remedial grading is recomended to overexcavate and recompact these soils.

The most significant geotechnical design consideration that will impact the proposed development is the excavation characteristics of the bedrock that underlies the subject site. Bedrock was encountered at the ground surface, and beneath the fill and native alluvial soils, where present. Based on conditions encountered at the boring, trench, and seismic refraction line locations, the bedrock is considered marginally rippable within the depths of the expected cut depths. Gouge filled joints were observed at two of the trench locations. If the gouge filled joints are exposed during the grading operation, an engineering geologist or geotechnical engineer should evaluate the gouge filled joints to determine the appropriate remediation, if necessary.

Another geotechnical design consideration is the differing support conditions of engineered fill and bedrock at foundation bearing surfaces. A portion of the near-surface bedrock is recommended to be overexcavated and recompacted as structural fill in order to provide more uniform support characteristics for the proposed structures.

Potential Surcharge Loads

Based on our review of the preliminary grading plan, the proposed restaurant building will be located near the proposed retaining wall along the western property line. The restaurant building foundation may induce a surcharge load on the western retaining wall if the retaining wall is located within the foundation influence zone of the building foundations. For the purpose of detrmining the surcharge potential, the foundation influence zone is considered to be the area within a 1h:1v projection downward from the bottom of the building foundation. Therefore, in order to avoid potential surcharge of the retaining wall, we recommend that the building foundation along the western wall be placed at a depth such that the retaining wall is not located within the foundation influence zone.

Settlement

The recommended remedial grading will remove all of the existing undocumented fill, as well as a portion of the near-surface bedrock, and replace them as compacted fill soils. The underlying

bedrock is not considered to be susceptible to significant settlement from the foundation loads of the proposed structures. Provided that the recommended remedial grading is completed, the post-construction static settlement of the proposed structure is expected to be within tolerable limits.

Expansion

The near-surface soils generally consist of silty sands and tonalite bedrock. These materials have been visually classified as very low to non-expansive. Therefore, no design considerations related to expansive soils are considered warranted for this site.

Shrinkage/Subsidence

Removal and recompaction of the fill soils is estimated to result in an average shrinkage of 12 to 16 percent. Excavation of the bedrock and placement as compacted fill is estimated to result in bulking of 0 to 5 percent.

No significant subsidence is expected to occur in excavations that are underlain by bedrock materials.

These estimates are based on previous experience and the subsurface conditions encountered at the trench and boring locations. The actual amount of subsidence is expected to be variable and will be dependent on the type of machinery used, repetitions of use, and dynamic effects, all of which are difficult to assess precisely.

Grading and Foundation Plan Review

This report was prepared in consideration of the preliminary grading plan that was provided to our office. However, foundation plans were not available at the time of this report. It is therefore recommended that we be provided with copies of precise grading and preliminary foundation plans, when they become available, for review with regard to the conclusions, recommendations, and assumptions contained within this report.

6.3 Site Grading Recommendations

The grading recommendations presented below are based on the subsurface conditions encountered at the boring and trench locations and our understanding of the proposed development. We recommend that all grading activities be completed in accordance with the Grading Guide Specifications included as Appendix D of this report, unless superseded by site-specific recommendations presented below.

Site Stripping and Demolition

Initial site stripping should include removal of any surficial vegetation. This should include any weeds, grasses, and shrubs. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

Treatment of Existing Soils: Building Pads

Remedial grading should be performed within the proposed building areas in order to remove all existing fill soils. Based on conditions encountered at the boring and trench locations, the existing materials within the proposed building pad areas are recommended to be overexcavated to a depth of at least 2 feet below proposed building pad subgrade elevation and to a depth of at least 2 feet below existing grade, whichever is greater. **The depth of the overexcavation should also extend to a depth sufficient to remove all undocumented fill soils**. The undocumented fill soils at extend to depths up to 9½± feet. Additional overexcavation should be performed within the influence zones of the new foundations, to provide for a new layer of compacted structural fill extending to a depth of at least 2 feet below proposed bearing grades. In areas of cut/fill transitions, it is recommended that grading be performed in order to remove and replace a portion of the bedrock as compacted structural fill. This grading is considered warranted, in order to soften the transition from the fill soils to the bedrock, thereby reducing the potential for excessive future settlements.

The overexcavation areas should extend at least 5 feet beyond the building and foundation perimeters, and to an extent equal to the depth of fill below the new foundations. If the proposed structure incorporates any exterior columns (such as for a canopy or overhang) the area of overexcavation should also encompass these areas.

Following completion of the overexcavation, the subgrade soils and/or bedrock materials within the building areas should be evaluated by the geotechnical engineer to verify their suitability to serve as the structural fill subgrade, as well as to support the foundation loads of the new structures. This evaluation should include proofrolling and probing to identify any soft, loose or otherwise unstable soils that must be removed. Some localized areas of deeper excavation may be required if additional fill materials or loose, porous, or low density native soils are encountered at the base of the overexcavation.

After a suitable overexcavation subgrade has been achieved, the exposed soils and/or bedrock materials should be scarified to a depth of at least 12 inches, thoroughly moisture conditioned, and recompacted. Overexcavation bottoms should be thoroughly moisture conditioned to achieve a moisture content of 0 to 4 percent above the optimum moisture content, extending to a depth of 18 to 24 inches below the overexcavation subgrade. The previously excavated soils may then be replaced as compacted structural fill.

Treatment of Existing Soils: Cut and Fill Slopes

New cut and fill slopes will be constructed around the perimeter of the project. Maximum heights of cut and fill slopes are indicated on the plan to be 6± feet. All slopes should be at an inclination of 2h:1v. A keyway should be excavated at the toe of new fill slopes which are not located in fill areas. The keyway should be at least 15 feet in width and 3 feet deep. The recommended width of the keyway is based on 1½ times the width of typical grading equipment. If smaller equipment is utilized, a smaller keyway may be suitable, at the discretion of the geotechnical engineer. The base of the keyway should slope at least 1 foot downward into the slope. Following completion of the keyway cut, the subgrade soils should be evaluated by the geotechnical engineer to verify that the keyway is founded into competent materials. The resulting subgrade soils should then be scarified to a depth of 10 to 12 inches, moisture conditioned to 0 to 4 percent above optimum moisture content and recompacted. During

construction of the new fill slope, the existing slope should be benched in accordance with the detail presented on Plate D-4. Benches less than 4 feet in height may be used at the discretion of the geotechnical engineer.

Cut slopes in bedrock may be cut to grade, undercut and replaced as stability fills. Stability fills for cut slopes will provide a more uniform appearance and allow landscaping on the slope. A keyway should be excavated at the toe of any stability fill slope. The keyway should be at least 15 feet in width. The recommended width of the keyway is based on 1½ times the width of typical grading equipment. If smaller equipment is utilized, a smaller keyway may be suitable, at the discretion of the geotechnical engineer. Following completion of the keyway cut, the subgrade soils should be evaluated by the geotechnical engineer to verify that the keyway is founded into competent materials. The resulting subgrade soils should then be scarified to a depth of 10 to 12 inches, moisture conditioned to 0 to 4 percent above optimum moisture content and recompacted. During construction of the new fill slope, the existing slope should be benched in accordance with the detail presented on Plate D-5. Benches less than 4 feet in height may be used at the discretion of the geotechnical engineer.

Treatment of Existing Soils: Retaining Walls and Site Walls

The existing soils within the areas of proposed retaining and non-retaining site walls should be overexcavated to a depth of at least 2 feet below foundation bearing grade and replaced as compacted structural fill as discussed above for the proposed building pad. Any undocumented fill soils within any of these foundation influence areas should be removed in their entirety. The overexcavation should extend at least 5 feet beyond the foundation perimeters, and to an extent equal to the depth of fill below the new foundations. Please note that erection pads are considered to be part of the foundation system. These overexcavation recommendations apply to erection pads also. The overexcavation subgrade soils should be evaluated by the geotechnical engineer prior to scarifying, moisture conditioning, and recompacting the upper 12 inches of exposed subgrade soils, as discussed for the building areas. The previously excavated soils may then be replaced as compacted structural fill.

Treatment of Existing Soils: Parking Areas

Based on economic considerations, overexcavation of the existing near-surface existing soils in the new flatwork, parking and drive areas is not considered warranted, with the exception of areas where lower strength or unstable soils are identified by the geotechnical engineer during grading. Subgrade preparation in the new flatwork, parking and drive areas should initially consist of removal of all soils disturbed during stripping and demolition operations.

The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. Any such materials should be removed to a level of firm and unyielding soil. The exposed subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 0 to 4 percent above the optimum moisture content, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength surficial soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

The grading recommendations presented above for the proposed flatwork, parking and drive areas assume that the owner and/or developer can tolerate minor amounts of settlement within

the proposed flatwork, parking and drive areas. The grading recommendations presented above do not completely mitigate the extent of existing fill soils that may be present in the flatwork, parking and drive areas. As such, some settlement and associated pavement distress could occur. Typically, repair of such distressed areas involves significantly lower costs than completely mitigating these soils at the time of construction. If the owner cannot tolerate the risk of such settlements, the flatwork, parking and drive areas should be overexcavated to a depth of 2 feet below proposed pavement subgrade elevation, with the resulting soils replaced as compacted structural fill.

Fill Placement

- Fill soils should be placed in thin (6± inches), near-horizontal lifts, moisture conditioned to 0 to 4 percent above the optimum moisture content, and compacted.
- On-site soils may be used for fill provided they are cleaned of any debris to the satisfaction of the geotechnical engineer.
- All grading and fill placement activities should be completed in accordance with the requirements of the 2016 CBC and the grading code of the city of Riverside.
- All fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Fill soils should be well mixed.
- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

Selective Grading and Oversized Material Placement

At several of the trench locations, the existing fill soils possess occasional to extensive amounts of cobble to boulder size debris. The presence of particles greater than 3 inches in diameter within the upper 1 to 3 feet of the building pad subgrade will impact the utility and foundation excavations. Depending on the depths of fills required within the proposed parking areas, it may be feasible to sort the on-site soils, placing the materials greater than 3 inches in diameter within the lower depths of the fills, and limiting the upper 1 to 3 feet of soils to materials less than 3 inches in size. Oversized materials could also be placed within the lower depths of the recommended overexcavations. In order to achieve this grading, it would likely be necessary to use rock buckets and/or rock sieves to separate the oversized materials from the remaining soil. Although such selective grading will facilitate further construction activities, it is not considered mandatory and a suitable subgrade could be achieved without such extensive sorting. However, in any case it is recommended that all materials greater than 6 inches in size be excluded from the upper 1 foot of the surface of any compacted fills. The placement of any oversized materials should be performed in accordance with the grading guide specifications included in Appendix D of this report. If disposal of oversized materials is required, rock blankets or windrows should be used and such areas should be observed during construction and placement by a representative of the geotechnical engineer.

Imported Structural Fill

All imported structural fill should consist of very low to non-expansive (EI < 20), well graded soils possessing at least 10 percent fines (that portion of the sample passing the No. 200 sieve).

Additional specifications for structural fill are presented in the Grading Guide Specifications, included as Appendix D.

Utility Trench Backfill

In general, all utility trench backfill should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by the city of Riverside. All utility trench backfills should be witnessed by the geotechnical engineer. The trench backfill soils should be compaction tested where possible; probed and visually evaluated elsewhere.

Utility trenches which parallel a footing, and extending below a 1h:1v plane projected from the outside edge of the footing should be backfilled with structural fill soils, compacted to at least 90 percent of the ASTM D-1557 standard. Pea gravel backfill should not be used for these trenches.

6.4 Construction Considerations

Excavation Considerations

The near surface soils generally consist of silty sands. These materials will be subject to caving within shallow excavations. Where caving occurs within shallow excavations, flattened excavation slopes may be sufficient to provide excavation stability. On a preliminary basis, temporary excavation slopes should be made no steeper than 2h:1v. Deeper excavations may require some form of external stabilization such as shoring or bracing. Maintaining adequate moisture content within the near-surface soils will improve excavation stability. All excavation activities on this site should be conducted in accordance with Cal-OSHA regulations

In addition, the soils from 7 to 30± feet below the existing site grades are considered marginally rippable with a single shank dozer. If any deeper cuts are proposed at this site to facilitate construction of the proposed buildings and improvements, localized blasting could be expected in areas where the less weathered bedrock materials are encountered.

Groundwater

Based on the conditions encountered in the trenches and borings, groundwater is not present within 25± feet of the ground surface. Based on the anticipated depth to groundwater, it is not expected that the groundwater will affect excavations for the foundations or utilities.

6.5 Foundation Design and Construction

Based on the preceding grading recommendations, it is assumed that the new building pads will be underlain by structural fill soils used to replace the existing fill and bedrock materials. These new structural fill soils are expected to extend to depths of at least 2 feet below proposed foundation bearing grade, underlain by 1± foot of additional soil or bedrock that has been

scarified, moisture conditioned, and recompacted. Based on this subsurface profile, the proposed structures may be supported on conventional shallow foundations.

Building Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft^2.
- Minimum wall/column footing width: 14 inches/24 inches.
- Minimum longitudinal steel reinforcement within strip footings: Two (2) No. 5 rebars (1 top and 1 bottom).
- Minimum foundation embedment: 12 inches into suitable structural fill soils, and at least 18 inches below adjacent grade.
- It is recommended that the perimeter building foundations be continuous across all exterior doorways. Any flatwork adjacent to the exterior doors should be doweled into the perimeter foundations in a manner determined by the structural engineer.

The allowable bearing pressures presented above may be increased by 1/3 when considering short duration wind or seismic loads. The minimum steel reinforcement recommended above is based on geotechnical considerations. Additional rigidity may be necessary for structural considerations. The actual design of the foundations should be determined by the structural engineer.

Foundation Construction

The foundation subgrade soils should be evaluated at the time of overexcavation, as discussed in Section 6.3 of this report. It is further recommended that the foundation subgrade soils be evaluated by the geotechnical engineer immediately prior to steel or concrete placement. Within the new building areas, soils suitable for direct foundation support should consist of newly placed structural fill, compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Any unsuitable materials should be removed to a depth of suitable bearing compacted structural fill or competent bedrock materials, with the resulting excavations backfilled with compacted fill soils. As an alternative, lean concrete slurry (500 to 1,500 psi) may be used to backfill such isolated overexcavations.

The foundation subgrade soils should also be properly moisture conditioned to 0 to 4 percent of the Modified Proctor optimum, to a depth of at least 12 inches below bearing grade. **Since it is typically not feasible to increase the moisture content of the floor slab and foundation subgrade soils once rough grading has been completed, care should be taken to maintain the moisture content of the building pad subgrade soils throughout the construction process**.

Estimated Foundation Settlements

Post-construction total and differential settlements of shallow foundations designed and constructed in accordance with the previously presented recommendations are estimated to be less than 1.0 and 0.5 inches, respectively. Differential movements are expected to occur over a 30-foot span, thereby resulting in an angular distortion of less than 0.002 inches per inch.

Lateral Load Resistance

Lateral load resistance will be developed by a combination of friction acting at the base of foundations and slabs and the passive earth pressure developed by footings below grade. The following friction and passive pressure may be used to resist lateral forces:

- Passive Earth Pressure: 300 lbs/ft^3
- Friction Coefficient: 0.30

These are allowable values, and include a factor of safety. When combining friction and passive resistance, the passive pressure component should be reduced by one-third. These values assume that footings will be poured directly against compacted structural fill. The maximum allowable passive pressure is 2,500 lbs/ft^2.

6.6 Floor Slab Design and Construction

Subgrades which will support new floor slabs should be prepared in accordance with the recommendations contained in the ***Site Grading Recommendations*** section of this report. Based on the anticipated grading which will occur at this site, the floors of the new structures may be constructed as conventional slabs-on-grade supported on newly placed structural fill, extending to a depth of at least 2 feet below finished pad grade. Based on geotechnical considerations, the floor slab may be designed as follows:

- Minimum slab thickness: 5 inches.

- Minimum slab reinforcement: Not required for geotechnical considerations assuming a very low expansion index pad. The actual floor slab reinforcement should be determined by the structural engineer, based upon the imposed loading.

- If moisture sensitive floor coverings will be used, then minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire slab area where the moisture sensitive floor coverings are expected. The moisture vapor barrier should meet or exceed the Class A rating as defined by ASTM E 1745-97 and have a permeance rating less than 0.01 perms as described in ASTM E 96-95 and ASTM E 154-88. The moisture vapor barrier should be properly constructed in accordance with all applicable manufacturer specifications. Given that a rock free subgrade is anticipated and that a capillary break is not required, sand below the barrier is not required. The need for sand and/or the amount of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview.

- Moisture condition the floor slab subgrade soils to 0 to 4 percent of the Modified Proctor optimum moisture content, to a depth of 12 inches. The moisture content of the floor slab subgrade soils should be verified by the geotechnical engineer within 24 hours prior to concrete placement.

- Proper concrete curing techniques should be utilized to reduce the potential for slab curling or the formation of excessive shrinkage cracks.

- The floor slab should be structurally connected to the foundations as detailed by the structural engineer.

The actual design of the floor slab should be completed by the structural engineer to verify adequate thickness and reinforcement.

6.7 Retaining Wall Design and Construction

Retaining walls are will be constructed along the western property line to heights up to 13± feet and along the eastern property line to heights up to 7± feet. The parameters recommended for use in the design of these walls are presented below.

Retaining Wall Design Parameters

Based on the soil conditions encountered at the boring locations, the following parameters may be used in the design of new retaining walls for this site. The following parameters assume that only the on-site soils will be utilized for retaining wall backfill. The on-site soils generally consist of silty fine to medium sands with varying gravel content. Based on their composition, the on-site soils have been assigned a friction angle of 30 degrees.

If desired, SCG could provide design parameters for an alternative select backfill material behind the retaining walls. The use of select backfill material could result in lower lateral earth pressures. In order to use the design parameters for the imported select fill, this material must be placed within the entire active failure wedge. This wedge is defined as extending from the heel of the retaining wall upwards at an angle of approximately 60° from horizontal. If select backfill material behind the retaining wall is desired, SCG should be contacted for supplementary recommendations.

RETAINING WALL DESIGN PARAMETERS

Design Parameter		Soil Type: On-Site Sandy Soils
Internal Friction Angle (ϕ)		30°
Unit Weight		125 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	42 lbs/ft^3
	Active Condition (2h:1v backfill)	67 lbs/ft^3

	At-Rest Condition (level backfill)	63 lbs/ft^3

Regardless of the backfill type, the walls should be designed using a soil-footing coefficient of friction of 0.30 and an equivalent passive pressure of 300 lbs/ft^3. The structural engineer should incorporate appropriate factors of safety in the design of the retaining walls.

The active earth pressure may be used for the design of retaining walls that do not directly support structures or support soils that in turn support structures and which will be allowed to deflect. The at-rest earth pressure should be used for walls that will not be allowed to deflect such as those which will support foundation bearing soils, or which will support foundation loads directly.

Where the soils on the toe side of the retaining wall are not covered by a "hard" surface such as a structure or pavement, the upper 1 foot of soil should be neglected when calculating passive resistance due to the potential for the material to become disturbed or degraded during the life of the structure.

Seismic Lateral Earth Pressures

In accordance with the 2016 CBC, any retaining walls more than 6 feet in height must be designed for seismic lateral earth pressures. The recommended seismic pressure distribution is triangular in shape, with a maximum magnitude of 18H lbs/ft^2, where H is the overall height of the wall. The maximum pressure should be assumed to occur at the top of the wall, decreasing to 0 at the base of the wall. The seismic pressure distribution is based on the Mononobe-Okabe equation, utilizing a design acceleration of 0.38g. The 2016 CBC does not provide definitive guidance on determination of the design acceleration to be used in generating the seismic lateral earth pressure. In accordance with standard geotechnical practice, we have calculated the design acceleration as $^2/_3$ of the PGA_M.

Retaining Wall Foundation Design

The retaining wall foundations should be supported within newly placed compacted structural fill, extending to a depth of at least 2 feet below the proposed bearing grade. Foundations to support new retaining walls should be designed in accordance with the general Foundation Design Parameters presented in a previous section of this report.

Backfill Material

On-site soils may be used to backfill the retaining walls. However, all backfill material placed within 3 feet of the back wall face should have a particle size no greater than 3 inches. The retaining wall backfill materials should be well graded.

It is recommended that a minimum 1 foot thick layer of free-draining granular material (less than 5 percent passing the No. 200 sieve) be placed against the face of the retaining walls. This material should extend from the top of the retaining wall footing to within 1 foot of the ground surface on the back side of the retaining wall. This material should be approved by the geotechnical engineer. In lieu of the 1 foot thick layer of free-draining material, a properly installed prefabricated drainage composite such as the MiraDRAIN 6000XL (or approved

equivalent), which is specifically designed for use behind retaining walls, may be used. If the layer of free-draining material is not covered by an impermeable surface, such as a structure or pavement, a 12-inch thick layer of a low permeability soil should be placed over the backfill to reduce surface water migration to the underlying soils. The layer of free draining granular material should be separated from the backfill soils by a suitable geotextile, approved by the geotechnical engineer.

All retaining wall backfill should be placed and compacted under engineering controlled conditions in the necessary layer thicknesses to ensure an in-place density between 90 and 93 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D1557-91). Care should be taken to avoid over-compaction of the soils behind the retaining walls, and the use of heavy compaction equipment should be avoided.

Subsurface Drainage

As previously indicated, the retaining wall design parameters are based upon drained backfill conditions. Consequently, some form of permanent drainage system will be necessary in conjunction with the appropriate backfill material. Subsurface drainage may consist of either:

- A weep hole drainage system typically consisting of a series of 4-inch diameter holes in the wall situated slightly above the ground surface elevation on the exposed side of the wall and at an approximate 8-foot on-center spacing. The weep holes should include a 2 cubic foot pocket of open graded gravel, surrounded by an approved geotextile fabric, at each weep hole location.

- A 4-inch diameter perforated pipe surrounded by 2 cubic feet of gravel per linear foot of drain placed behind the wall, above the retaining wall footing. The gravel layer should be wrapped in a suitable geotextile fabric to reduce the potential for migration of fines. The footing drain should be extended to daylight or tied into a storm drainage system.

6.8 Pavement Design Parameters

Site preparation in the pavement area should be completed as previously recommended in the ***Site Grading Recommendations*** section of this report. The subsequent pavement recommendations assume proper drainage and construction monitoring, and are based on either PCA or CALTRANS design parameters for a twenty (20) year design period. However, these designs also assume a routine pavement maintenance program to obtain the anticipated 20-year pavement service life.

Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of recompacted soil and bedrock materials. The on-site soils generally consist of silty sands with varying amounts of gravel. These soils are considered to possess good pavement support characteristics with estimated R-values of 40 to 50. Since R-value testing was not included in the scope of services for this project, the subsequent pavement design is based upon a conservatively assumed R-value of 40. Any fill material imported to the site should have support characteristics equal to or greater than that of the on-site soils and be placed and

compacted under engineering controlled conditions. It is recommended that R-value testing be performed after completion of rough grading. Depending upon the results of the R-value testing, it may be feasible to use thinner pavement sections in some areas of the site.

Asphaltic Concrete

Presented below are the recommended thicknesses for new flexible pavement structures consisting of asphaltic concrete over a granular base. The pavement designs are based on the traffic indices (TI's) indicated. The client and/or civil engineer should verify that these TI's are representative of the anticipated traffic volumes. If the client and/or civil engineer determine that the expected traffic volume will exceed the applicable traffic index, we should be contacted for supplementary recommendations. The design traffic indices equate to the following approximate daily traffic volumes over a 20 year design life, assuming six operational traffic days per week.

Traffic Index	No. of Heavy Trucks per Day
4.0	0
5.0	1
6.0	3

For the purpose of the traffic volumes indicated above, a truck is defined as a 5-axle tractor trailer unit with one 8-kip axle and two 32-kip tandem axles. All of the traffic indices allow for 1,000 automobiles per day.

ASPHALT PAVEMENTS (R = 40)		
Materials	Thickness (inches)	
	Auto Parking and Drive Lanes (TI = 4.0 to 5.0)	Light Truck Traffic (TI = 6.0)
Asphalt Concrete	3	3½
Aggregate Base	4	6
Compacted Subgrade	12	12

The aggregate base course should be compacted to at least 95 percent of the ASTM D-1557 maximum dry density. The asphaltic concrete should be compacted to at least 95 percent of the Marshall maximum density, as determined by ASTM D-2726. The aggregate base course may consist of crushed aggregate base (CAB) or crushed miscellaneous base (CMB), which is a recycled gravel, asphalt and concrete material. The gradation, R-Value, Sand Equivalent, and Percentage Wear of the CAB or CMB should comply with appropriate specifications contained in the current edition of the "Greenbook" Standard Specifications for Public Works Construction.

Portland Cement Concrete

The preparation of the subgrade soils within concrete pavement areas should be performed as previously described for proposed asphalt pavement areas. The minimum recommended thicknesses for the Portland Cement Concrete pavement sections are as follows:

PORTLAND CEMENT CONCRETE PAVEMENTS		
Materials	**Thickness (inches)**	
	Autos and Drive Lanes (TI = 4.0 & 5.0)	Light Truck Traffic TI = 6.0
PCC	5	5½
Compacted Subgrade (95% minimum compaction)	12	12

The concrete should have a 28-day compressive strength of at least 3,000 psi. The maximum joint spacing within all of the PCC pavements is recommended to be equal to or less than 30 times the pavement thickness. The actual joint spacing and reinforcing of the Portland cement concrete pavements should be determined by the structural engineer.

7.0 GENERAL COMMENTS

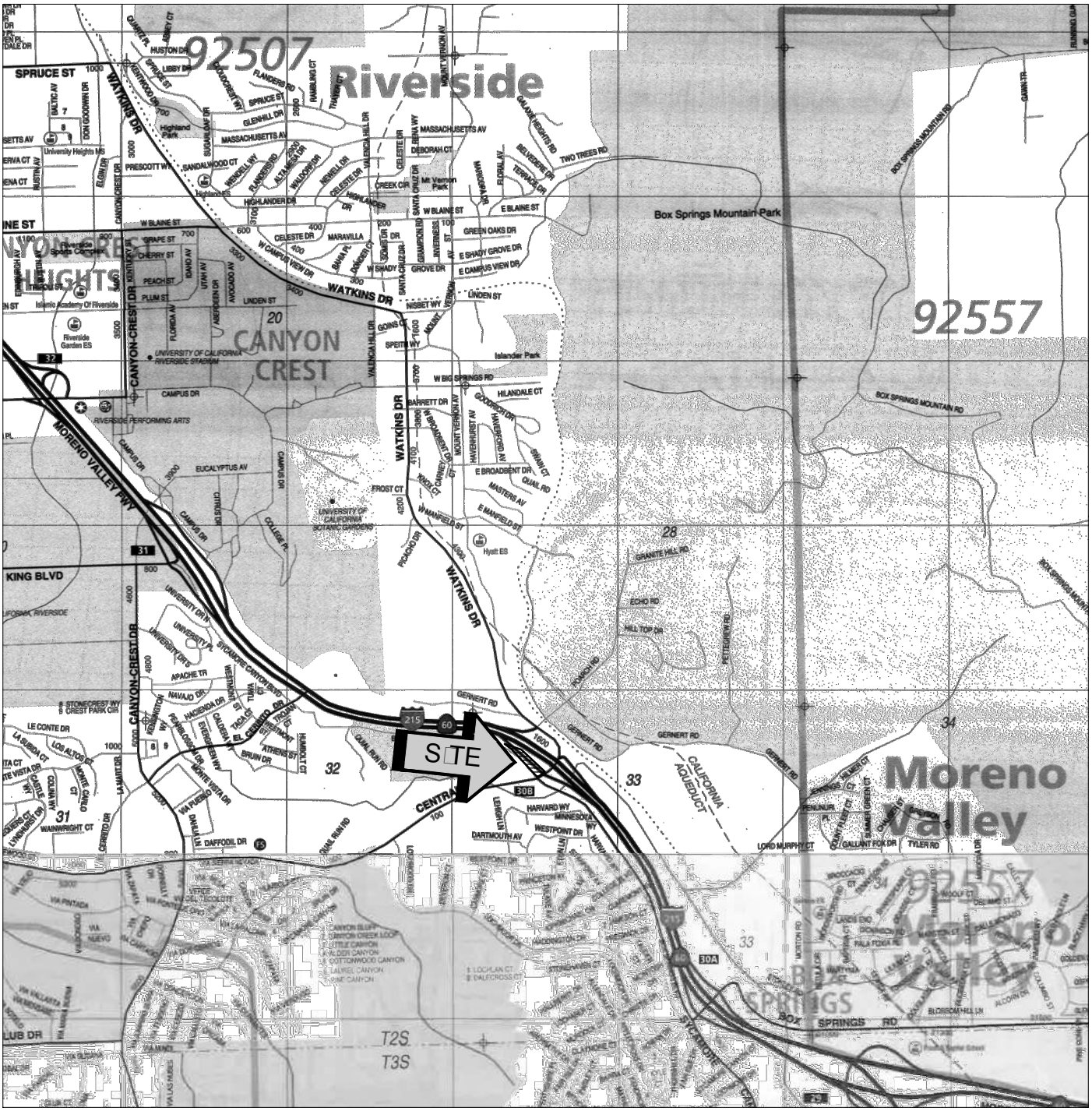
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other 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, civil engineer, and/or structural engineer. 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 client(s)' reliance upon this report is subject to the Engineering Services Agreement, incorporated into our proposal for this project.

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 boring locations and sample 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.

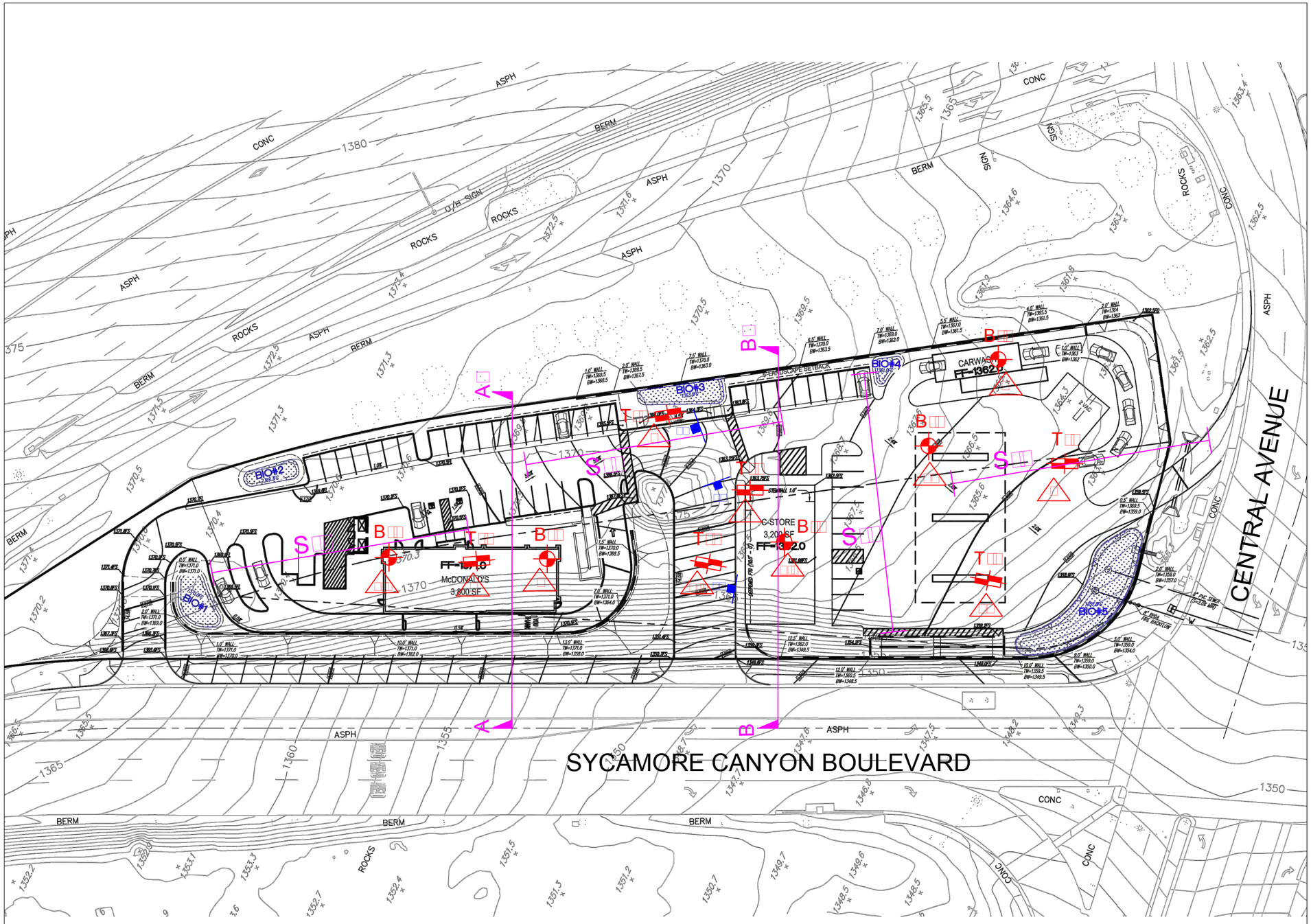
APPENDIX A



SOURCE: RIVERSIDE COUNTY
THOMAS GUIDE

SITE LOCATION MAP
PROPOSED RETAIL DEVELOPMENT
RIVERSIDE CALIFORNIA
SCALE: 1" = 2000'
DRAWN BY: CHECKED BY:
SCALE: PROJECT
PLATE 1

SOUTHERN CALIFORNIA GEOTECHNICAL



NORTH
Not to Scale

GEOTECHNICAL LEGEND

- APPROXIMATE BORING LOCATION
- APPROXIMATE TRENCH LOCATION
- POINTS
- ARTIFICIAL FILL DEPTH (FEET)
- CROSS SECTION LINE
- PREVIOUS SEISMIC LINE (SCG PROJECT NO 2000 000000)

NOTE: BASE MAP PREPARED BY OMEGA ENGINEERING CONSULTANTS, INC.

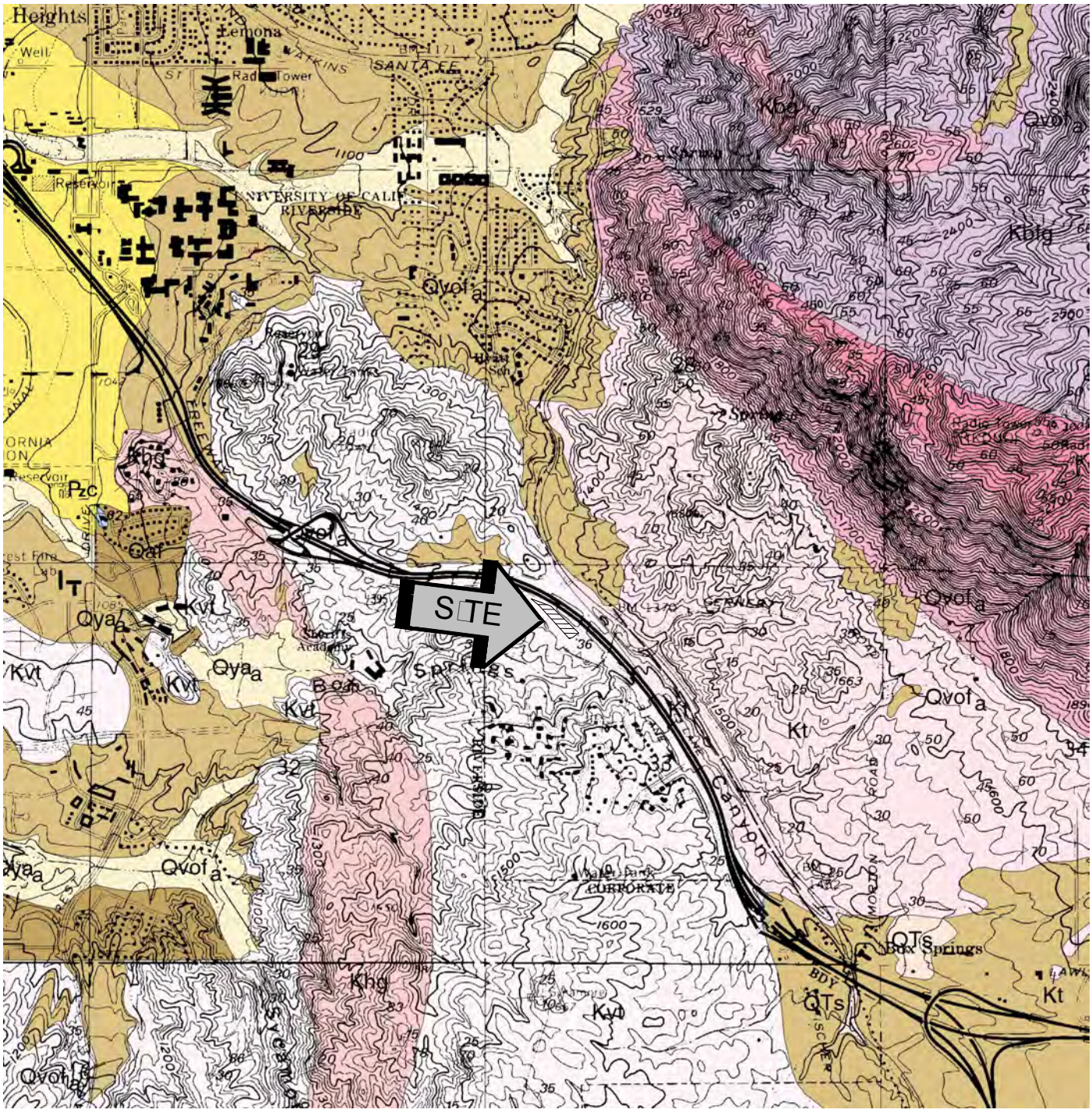
BORING AND TRENCH LOCATION PLAN

PROPOSED RETAIL DEVELOPMENT

RIVERSIDE, CALIFORNIA

SCALE: 1" = 100'	
DRAWN BY: CADD	
SCG PROJECT NO. 2000.000	
PLATE 2	

SOUTHERN CALIFORNIA GEOTECHNICAL



DESCRIPTION OF MAP UNITS

Kvt

Val Verde tonalite—Gray-weathering, relatively homogeneous, massive- to well-foliated, medium- to coarse-grained, hypautomorphic-granular biotite-hornblende tonalite; principal rock type of Val Verde pluton. Contains subequal biotite and hornblende, quartz and plagioclase. Potassium feldspar generally less than two percent of rock. Where present, foliation typically strikes northwest and dips moderately to steeply northeast. Northern part of pluton contains younger, intermittently developed, northeast-striking foliation. In central part of pluton, tonalite is mostly massive, and contains few segregational masses of mesocratic to melanocratic tonalite. Elliptical- to pancake-shaped, meso-to melanocratic inclusions are common.

SOURCE□"□EOLO□IC MA□ O□ T□E R□VERS□DE EAST □□□□UADRAN□LE□ R□VERS□DE COUNTY□CAL□□ORN□A" MORTON AND CO□□□□□□□REV□SED □□□□□□□□□

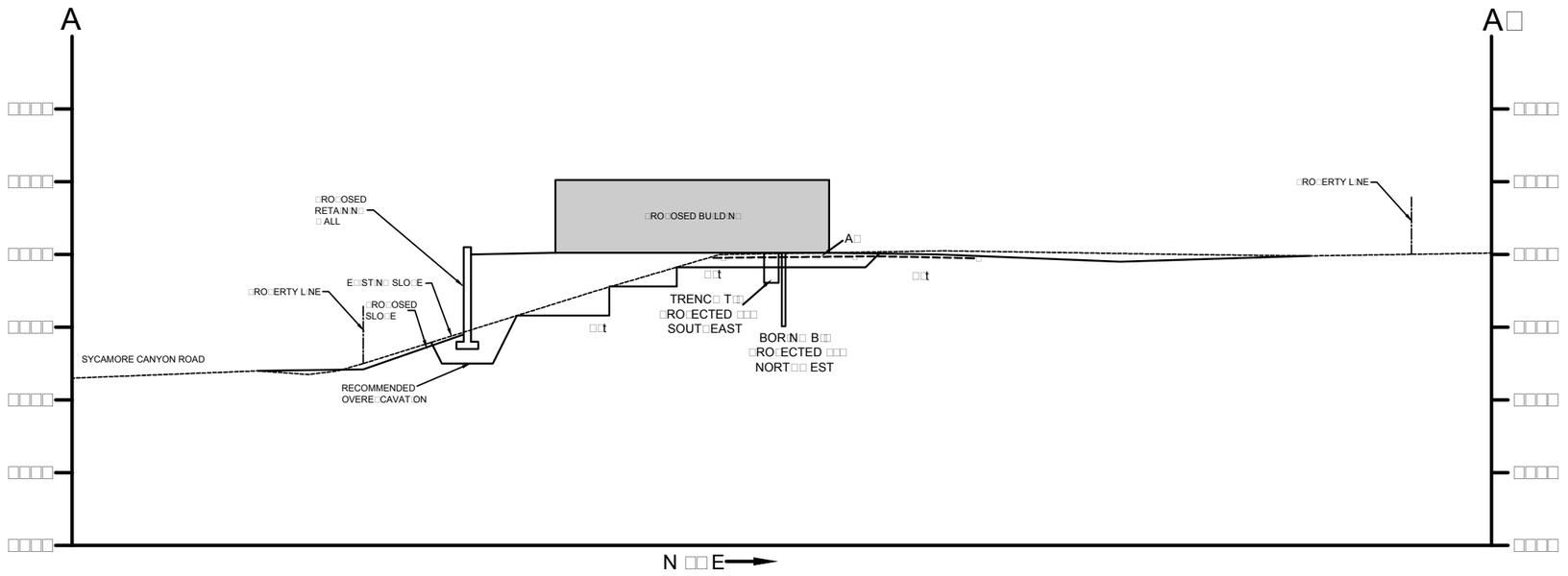
GEOLOGIC MAP

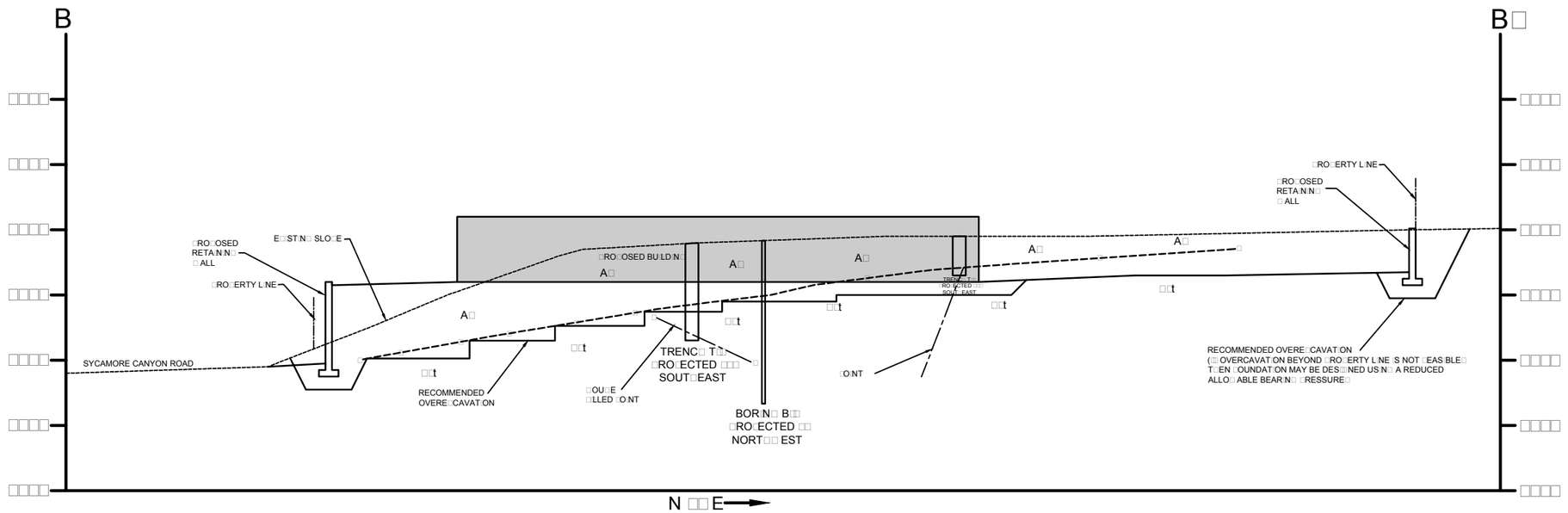
□RO□OSED RETA□L DEVELO□MENT

R□VERS□DE□CAL□□ORN□A

SCALE□□" □ □□□□□	
DRA□ N□ □LL C□□D□R□T	
SC□ □RO□ECT □□□ □□□□□	
PLATE 3	

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL





□EOTEC□N□CAL LE□END

A□□Arti□icial □ill

□□t □Val Verde □ormation Bedroc□

------ □eolo□ic Contact (□ueried □□ere Uncertain□

CROSS-SECTION A-A' AND B-B'

□RO□OSED RETA□L DEVELO□MENT

R□VERS□DE□CAL□□ORN□A

SCALE□□" □ □□□

DRA□ N□DR□ C□□D□ R□T

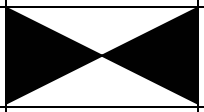
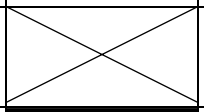
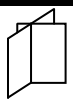
SC□ □RO□ECT □□□ □□□□□

PLATE 4

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX B

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

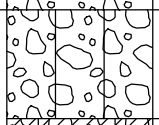
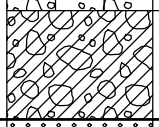
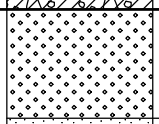
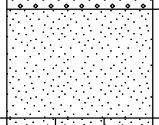
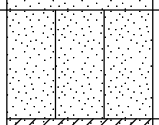
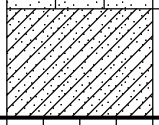
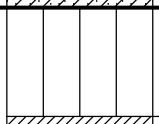
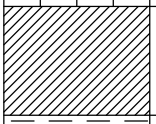
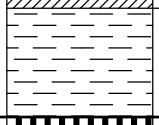
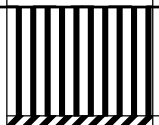
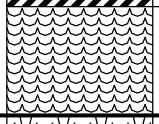
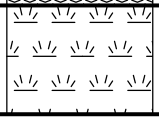
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-1

JOB NO.: 17G134-3 | DRILLING DATE: 11/10/17 | WATER DEPTH: Dry
PROJECT: Proposed Retail Development | DRILLING METHOD: Hollow Stem Auger | CAVE DEPTH: 9 feet
LOCATION: Riverside, California | LOGGED BY: Daryl Kas | READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1370.5 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					FILL: Light Brown coarse Gravel, trace to little fine to coarse Sand, very dense-dry		1					
		67/10"				111	2					
					VAL VERDE FORMATION BEDROCK: Light Brown fine to coarse grained Tonalite Bedrock, friable, slightly weathered, very dense-dry							
		100/6"				109	2					
5												
		50/3"					2					
		50/3"					1					
10					Boring Terminated at 10'							

TBL 17G134.GPJ SOCALGEO.GDT 12/11/17

TEST BORING LOG

PLATE B-1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-2

JOB NO.: 17G134-3
PROJECT: Proposed Retail Development
LOCATION: Riverside, California

DRILLING DATE: 11/10/17
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daryl Kas

WATER DEPTH: Dry
CAVE DEPTH: 5.5 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1370.5 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
		50/3"			VAL VERDE FORMATION BEDROCK: Light Gray fine to coarse grained Tonalite Bedrock, friable, slightly weathered, very dense-dry to damp		1					Disturbed Sample
		50/5"					1					
5												
		66/9"					3					
		50/2"										No Sample Recovered
10					Boring Terminated at 10'							

TBL 17G134.GPJ SOCALGEO.GDT 12/11/17

TEST BORING LOG

PLATE B-2

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-3

JOB NO.: 17G134-3 | DRILLING DATE: 11/10/17 | WATER DEPTH: Dry
PROJECT: Proposed Retail Development | DRILLING METHOD: Hollow Stem Auger | CAVE DEPTH: 13.5 feet
LOCATION: Riverside, California | LOGGED BY: Daryl Kas | READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1368 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
		38			FILL: Gray Brown Silty fine to coarse Sand, trace fine Gravel, medium dense-damp	111	4					
		21				115	3					
5		28				108	4					
		6			FILL: Brown fine to coarse Sand, trace to little Silt, loose-damp	98	3					
		48			VAL VERDE FORMATION BEDROCK: Light Gray fine to coarse grained Tonalite Bedrock, friable, weathered, dense to very dense-dry	121	1					
10												
		50/3"					1					
15												
		50/4"					1					
20												
		50/3"					1					
25					Boring Terminated at 25'							

TBL 17G134.GPJ SOCALGEO.GDT 12/11/17

TEST BORING LOG **PLATE B-3**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 17G134-3
PROJECT: Proposed Retail Development
LOCATION: Riverside, California

DRILLING DATE: 11/10/17
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daryl Kas

WATER DEPTH: Dry
CAVE DEPTH: 8.5 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1367 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
		29			FILL: Brown Silty fine to coarse Sand, loose to medium dense-damp	106	4					
		10				103	5					
5		9				105	2					
		6			@ 7 to 8 feet, very loose to loose	94	5					
		7			ALLUVIUM: Brown Silty fine to medium Sand, little coarse Sand, loose-damp	93	4					
10												
					VAL VERDE FORMATION BEDROCK: Light Gray fine to coarse grained Tonalite Bedrock, friable, highly weathered, very dense-dry to damp							
		69/"				103	3					
15					Boring Terminated at 15'							

TBL 17G134.GPJ SOCALGEO.GDT 12/11/17

TEST BORING LOG **PLATE B-4**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-5

JOB NO.: 17G134-3
PROJECT: Proposed Retail Development
LOCATION: Riverside, California

DRILLING DATE: 11/10/17
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Daryl Kas

WATER DEPTH: Dry
CAVE DEPTH:
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1365.5 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
		50/5"			VAL VERDE FORMATION BEDROCK: Light Gray Brown fine to coarse grained Tonalite Bedrock, friable, slightly weathered, very dense-dry		2					
		67/9"					2					
5		50/5"					2					
		50/4"					1					
10												
		50/5"					1					
15					Boring Terminated at 15'							

TBL 17G134.GPJ SOCALGEO.GDT 12/11/17

TEST BORING LOG

PLATE B-5

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. T-1

□OB NO□□□□□ □□□□□

□RO□ECT□□roposed Retail De□elopment

LOCAT□ON□Ri□erside□CA

DATE□□□□□□□□□□□

E□U□□MENT USED□Bac□□oe

LO□□ED BY□Daryl □as

OR□ENTAT□ON□N □□ □

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READ□N□S TA□EN□At Completion

DE□T□	SAM□LE	DRY DENS□TY (□C□□	MO□STURE (□ □	EART□ MATER□ALS DESCR□□T□ON
□	b		□	A□□LL□Bro□n Silty □ine to coarse Sand□little □ine to coarse □ra□el□trace □lastic □ra□ments□loose to medium dense □dry
	b		□	B□VAL VERDE □ORMAT□ON BEDROC□□Li□□t □ray □ine to coarse □rained Tonalite Bedroc□□sli□□tly □eat□ered□sli□□tly □riable□□ery dense □ dry
	b		□	Trenc□ Terminated □ □□eet
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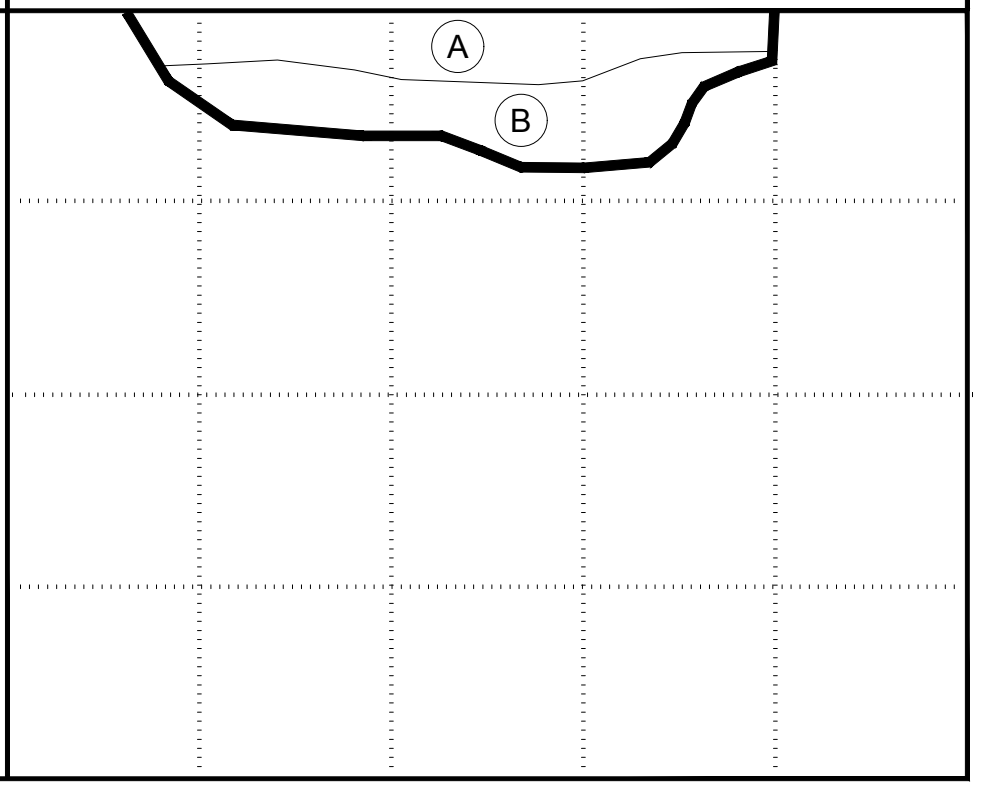

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TRENCH LOG

PLATE B-6

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. T-2

□OB NO□□□□□ □□□□□□

□RO□ECT□□roposed Retail De□elopment

LOCAT□ON□Ri□erside□CA

DATE□□□□□□□□□□□

E□U□□MENT USED□Bac□□oe

LO□ □ED BY□Daryl □as

OR□ENTAT□ON□N □□ □

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READ□N□S TA□EN□At Completion

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	b		□	B□VAL VERDE □ORMAT□ON BEDROC□□Dar□ □ray □ine to coarse □rained Tonalite Bedroc□□sli□□tly □eat□ered□sli□□tly □riable□□ointed□□ery dense □dry
	b		□	□oint□N□□E□□□N□
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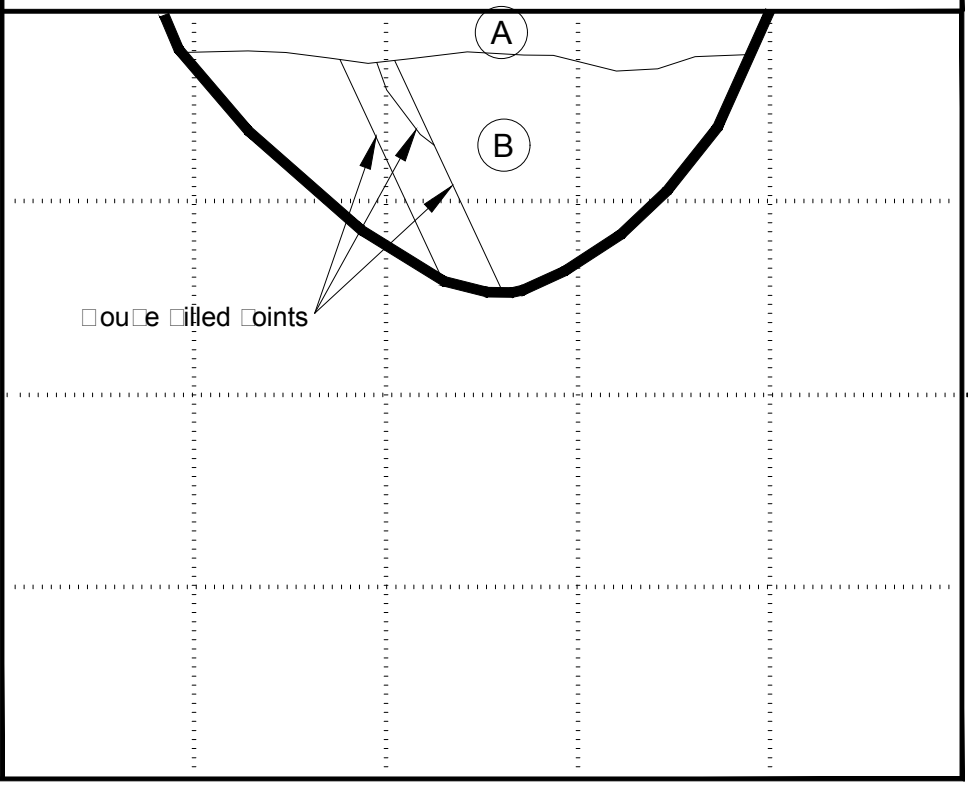

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TRENCH LOG

PLATE B-7

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO.
T-3

□OB NO□□□□□□ □□□□□□

□RO□ECT□□roposed Retail De□elopment

LOCAT□ON□Ri□erside□CA

DATE□□□□□□□□□□□□

E□U□□MENT USED□Bac□□oe

LO□□ED BY□Daryl □as

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□ ATER DE□T□□Dry

SEE□A□E DE□T□□Dry

READ□N□S TA□EN□At Completion

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	b		□	B□□□LL□□ray Bro□n Silty □ine to coarse Sand□trace □ine □ra□el□medium dense □damp
	b		□	
□□	b		□	C□□□LL□□ray Bro□n □ine to coarse Sand□trace Silt□abundant Debris (Concrete□Bric□□Tiles□medium dense □dry
	b		□	
	b		□	D□VAL VERDE □ORMAT□ON BEDROC□□Dar□ □ray to Li□□t □ray □ine to coarse □rained Tonalite Bedroc□□□riable□sli□□tly □eat□ered□ointed□ dense to □ery dense □dry
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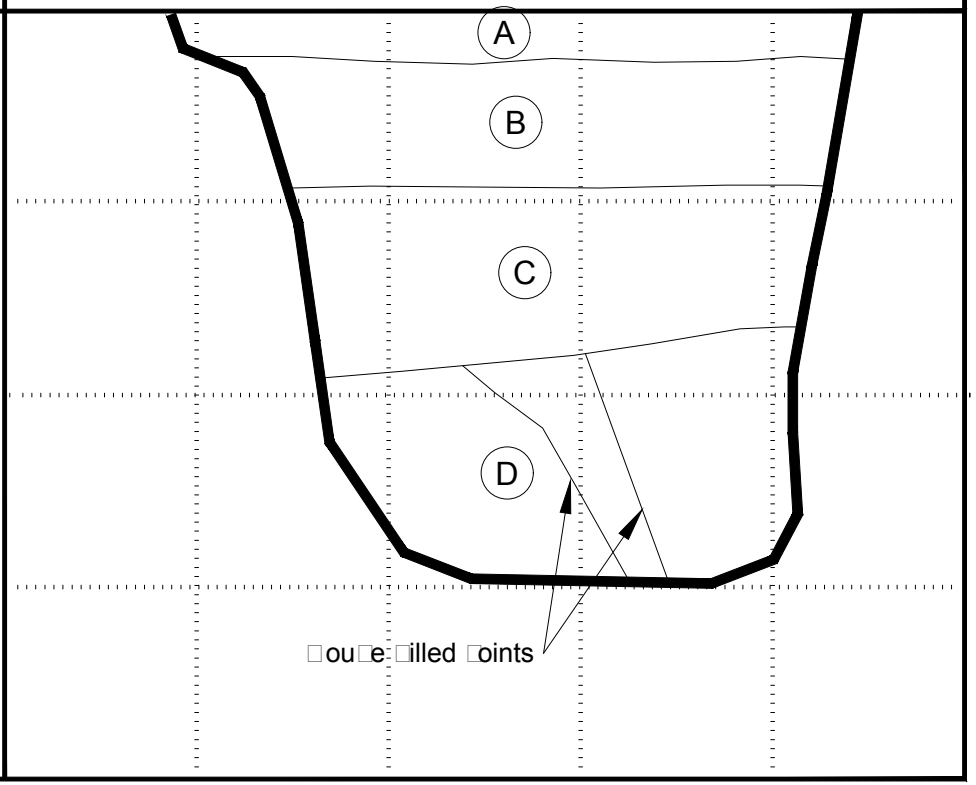

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TRENCH LOG

PLATE B-8

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. T-4

□OB NO□□□□□ □□□□□

□RO□ECT □□roposed Retail De□elopment

LOCAT□ON □Ri□erside□CA

DATE□□□□□□□□□□

E□U□MENT USED□Bac□□oe

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□	b		□	A□□□LL□Bro□n Silty □ine to coarse Sand□loose □dry
	b		□	B□□□LL□□ray Bro□n □ra□elly □ine to coarse Sand□abundant Debris (Concrete□Asp□alt□Metal□Tile□ □ra□ments□Debris up to □ □eet in diameter□loose □dry
□□	b		□	C□□□LL□□ray Bro□n Silty □ine to coarse Sand□abundant Debris (Concrete□Asp□alt□Metal□□ra□ments□loose to medium dense dry
□□				D□□□LL□□ray Bro□n Silty □ine to coarse Sand□trace □ine □ra□el□medium dense □dry to damp
				E□VAL VERDE □ORMAT□ON BEDROC□□Dar□ □ray □ine to coarse □rained Tonalite Bedroc□□sli□□tly □eat□ered□sli□□tly □riable□□ery dense □ dry
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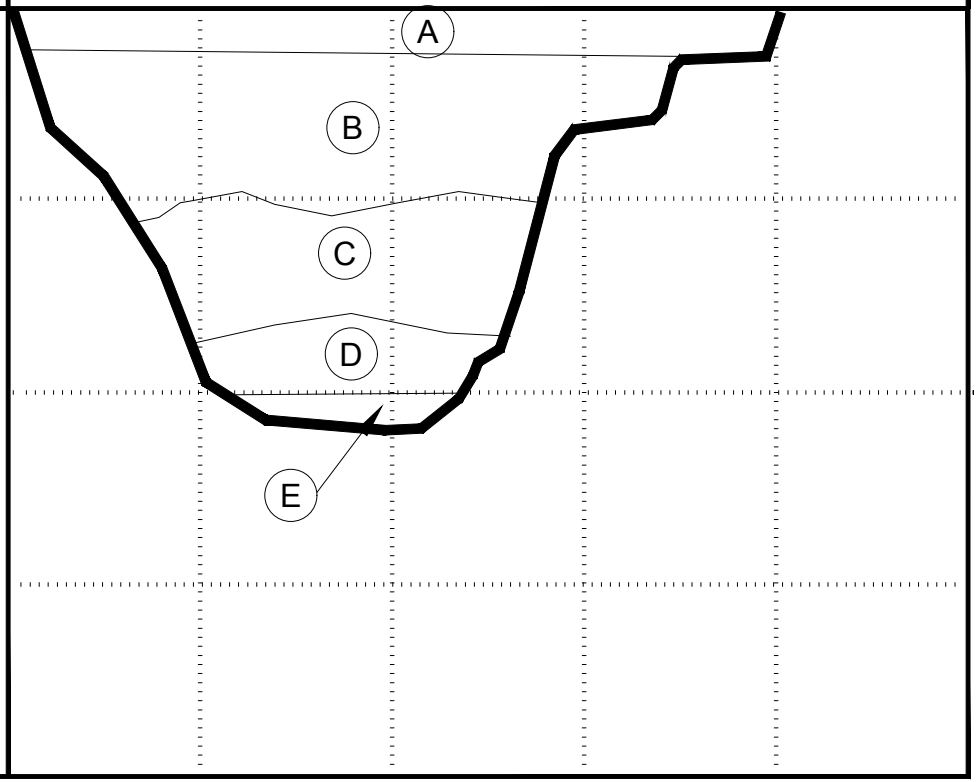

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TRENCH LOG

PLATE B-9

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. T-5

□OB NO□□□□□ □□□□□

□RO□ECT□□roposed Retail De□elopment

LOCAT□ON□Ri□erside□CA

DATE□□□□□□□□□□□

E□U□□MENT USED□Bac□□oe

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READ□N□S TA□EN□At Completion

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□	b		□	A□□□LL□Bro□n Silty □ine to coarse Sand□abundant □ine to coarse □ra□el□ trace Asp□alt and Concrete □ra□ments□loose □dry
□□	b		□	B□BASE□Crus□ed A□□re□ate Base (CAB□appro□imately □inc□es t□ic□□ C□VAL VERDE □ORMAT□ON BEDROC□□Li□□t □ray □ine to coarse □rained Tonalite Bedroc□□sli□□tly □eat□ered□sli□□tly □riable□ointed□□ery dense □dry
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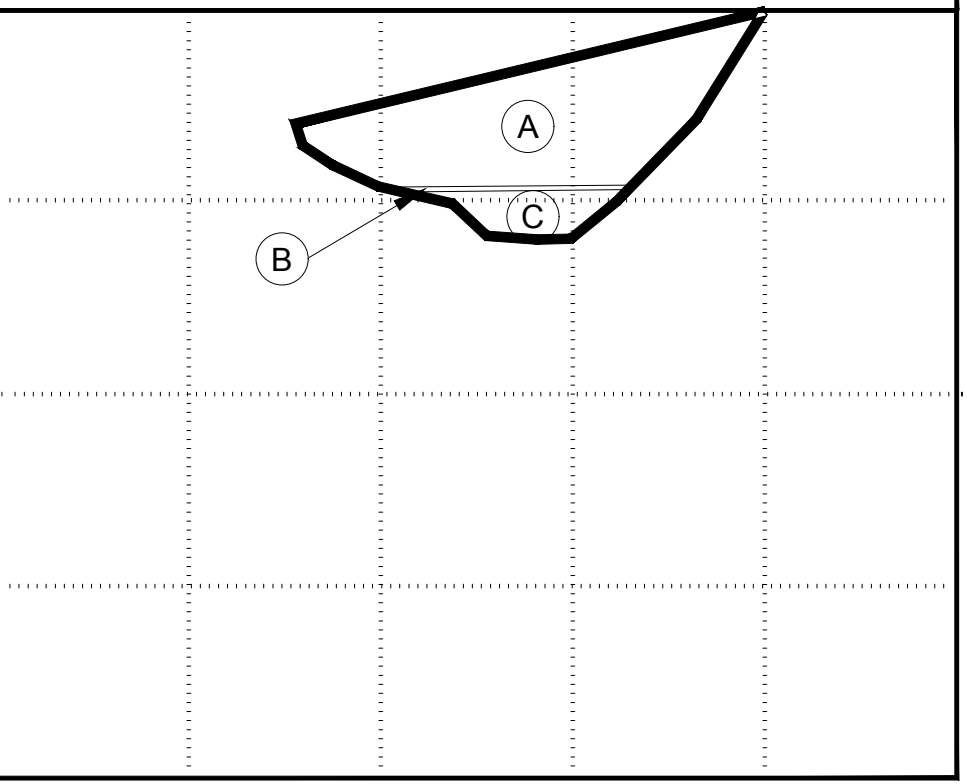

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TRENCH LOG

PLATE B-10

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. T-6

□OB NO□□□□□□ □□□□□□

□RO□ECT□□roposed Retail De□elopment

LOCAT□ON□Ri□erside□CA

DATE□□□□□□□□□□□□

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□	b		□	A□□□LL□□ray Bro□n Silty □ine to coarse Sand trace □ine to coarse □ra□el□ Occasional Cobbles and Boulders□loose □dry
	b		□	
□□	b		□	B□ALLUV□UM□Bro□n Silty □ine to coarse Sand□medium dense □dry
	b		□	C□VAL VERDE □ORMAT□ON BEDROC□□Dar□ □ray □ine to coarse □rained Tonalite Bedroc□□sli□□tly □eat□ered□sli□□tly □riable□□ery dense □ dry
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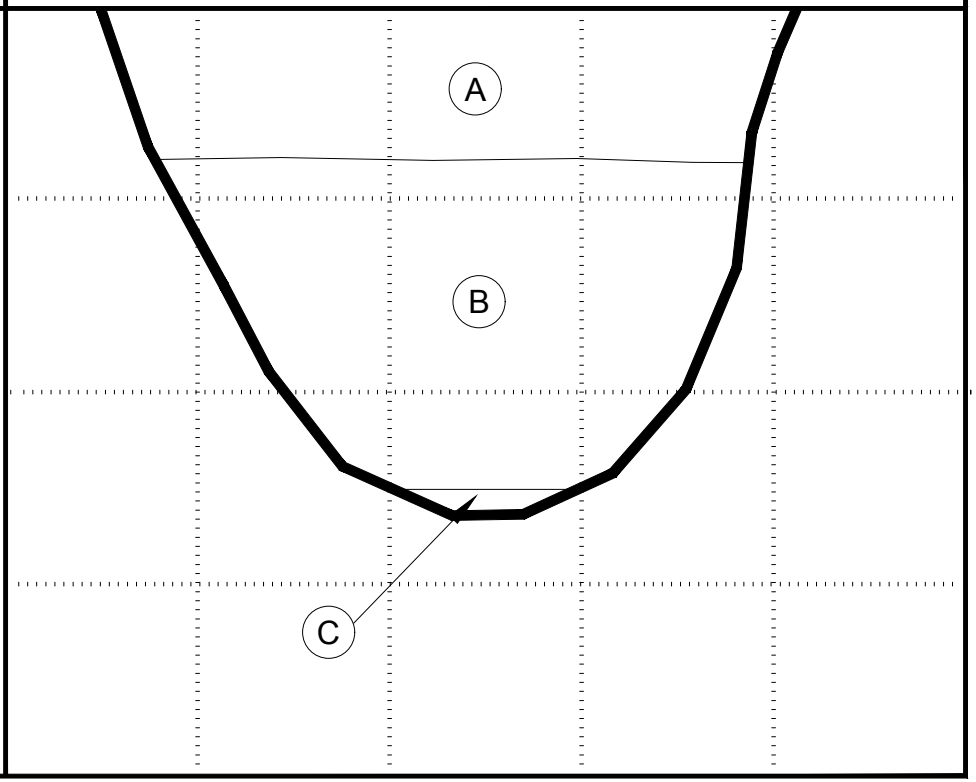

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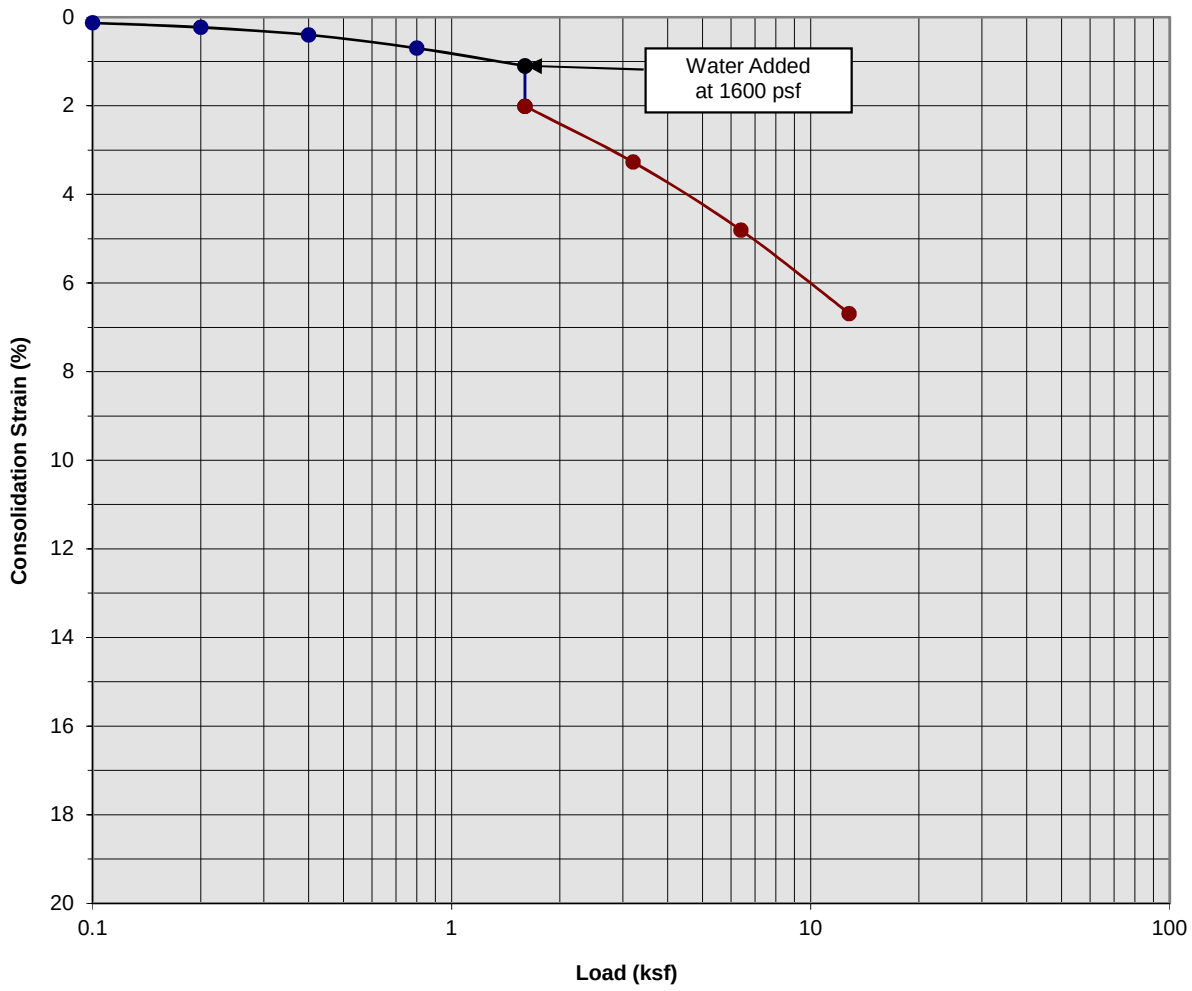
TRENCH LOG

PLATE B-11

APPENDIX C

Consolidation/Collapse Test Results



Classification: FILL: Gray Brown Silty fine to coarse Sand, trace fine Gravel

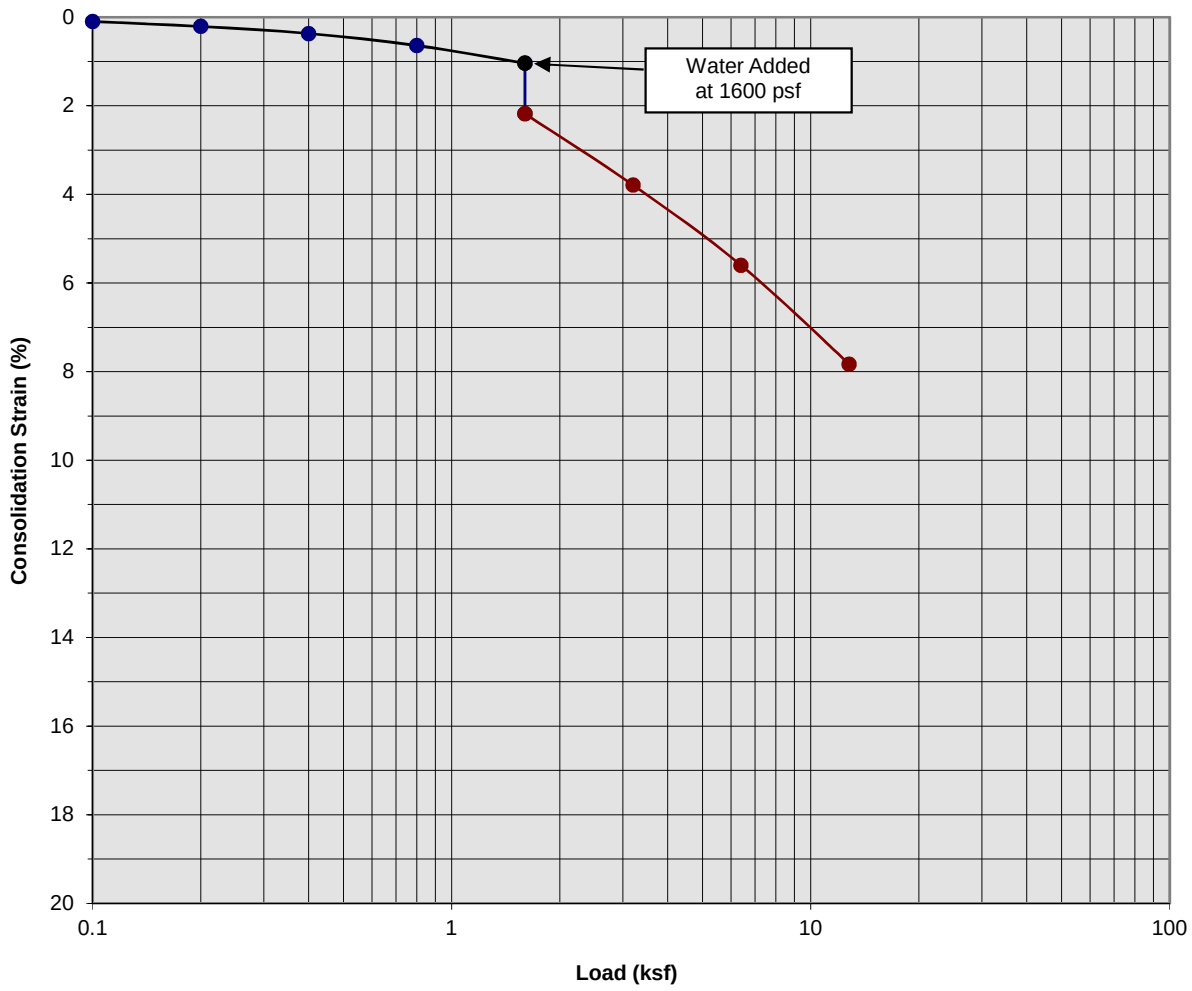
Boring Number:	B-3	Initial Moisture Content (%)	3
Sample Number:	---	Final Moisture Content (%)	11
Depth (ft)	3 to 4	Initial Dry Density (pcf)	115.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	124.4
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.91

Proposed Retail Development
Riverside, California
Project No. 17G134-3

PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



Classification: FILL: Gray Brown Silty fine to coarse Sand, trace fine Gravel

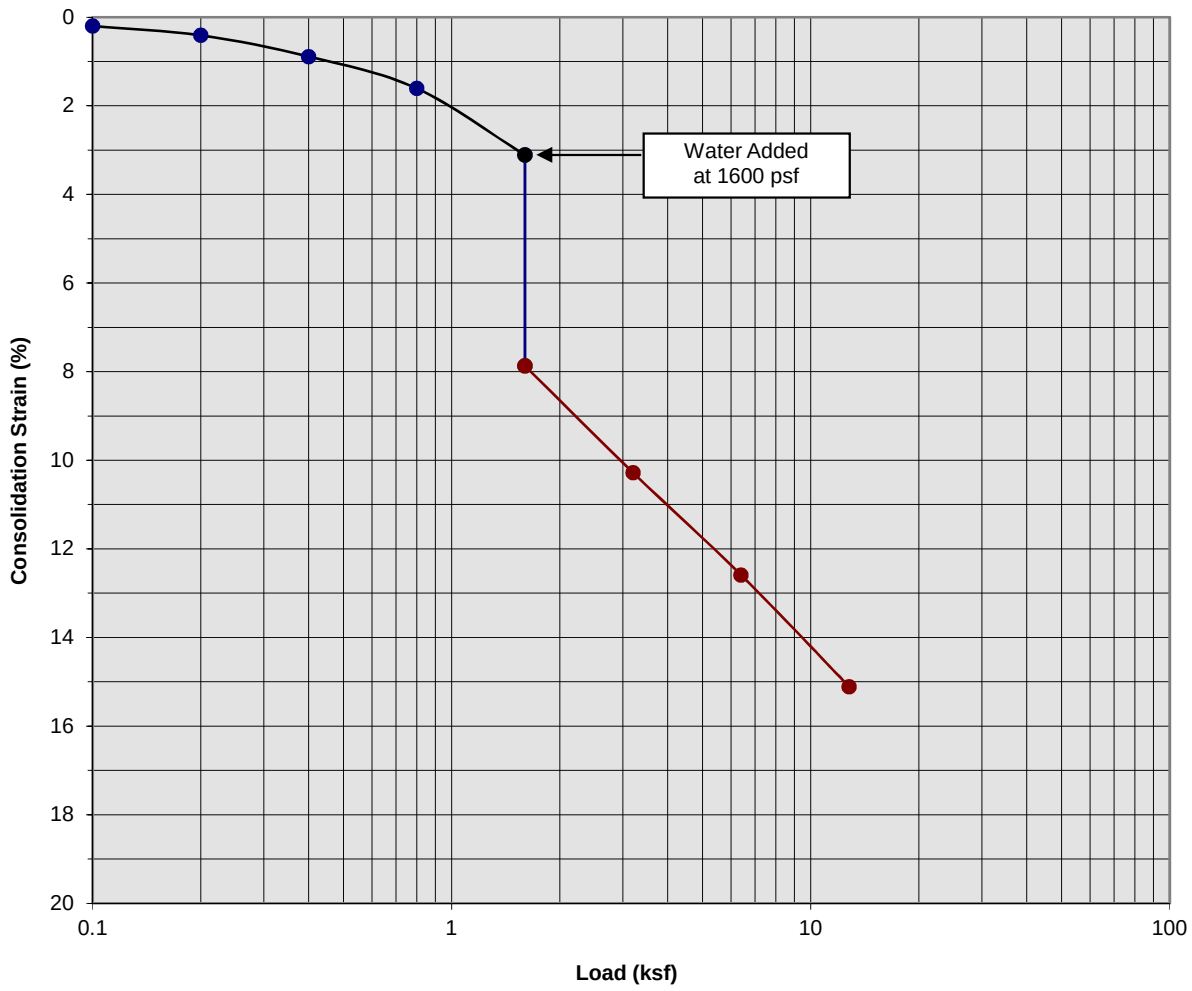
Boring Number:	B-3	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	5 to 6	Initial Dry Density (pcf)	108.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	118.3
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.14

Proposed Retail Development
Riverside, California
Project No. 17G134-3

PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



Classification: FILL: Brown fine to coarse Sand, trace to little Silt

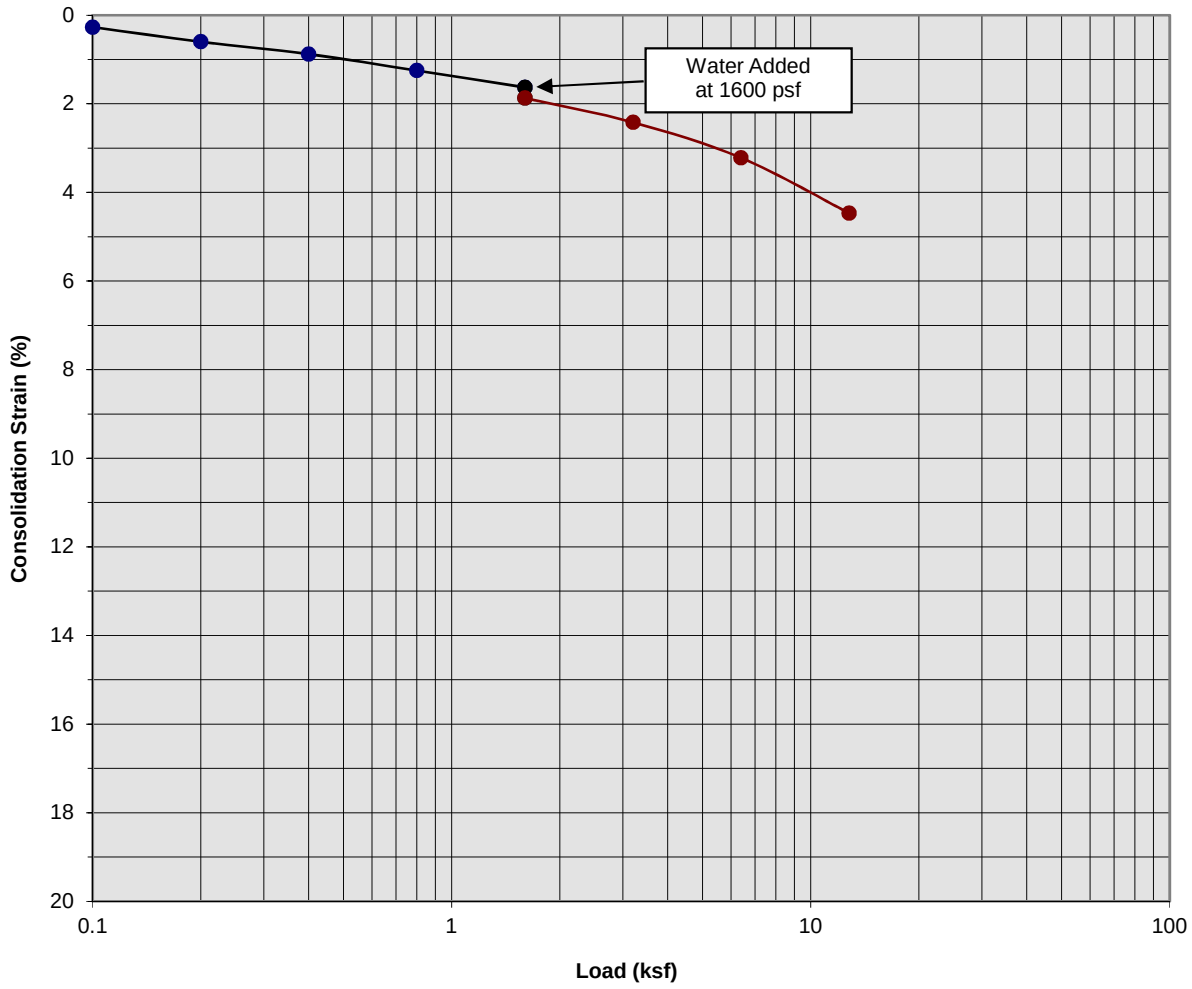
Boring Number:	B-3	Initial Moisture Content (%)	3
Sample Number:	---	Final Moisture Content (%)	14
Depth (ft)	7 to 8	Initial Dry Density (pcf)	98.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	115.5
Specimen Thickness (in)	1.0	Percent Collapse (%)	4.76

Proposed Retail Development
Riverside, California
Project No. 17G134-3

PLATE C- 3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



Classification: Light Gray fine to coarse grained Tonalite Bedrock

Boring Number:	B-3	Initial Moisture Content (%)	1
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	9 to 10	Initial Dry Density (pcf)	120.4
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	125.4
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.24

Proposed Retail Development
Riverside, California
Project No. 17G134-3

PLATE C- 4

SoCalGeo
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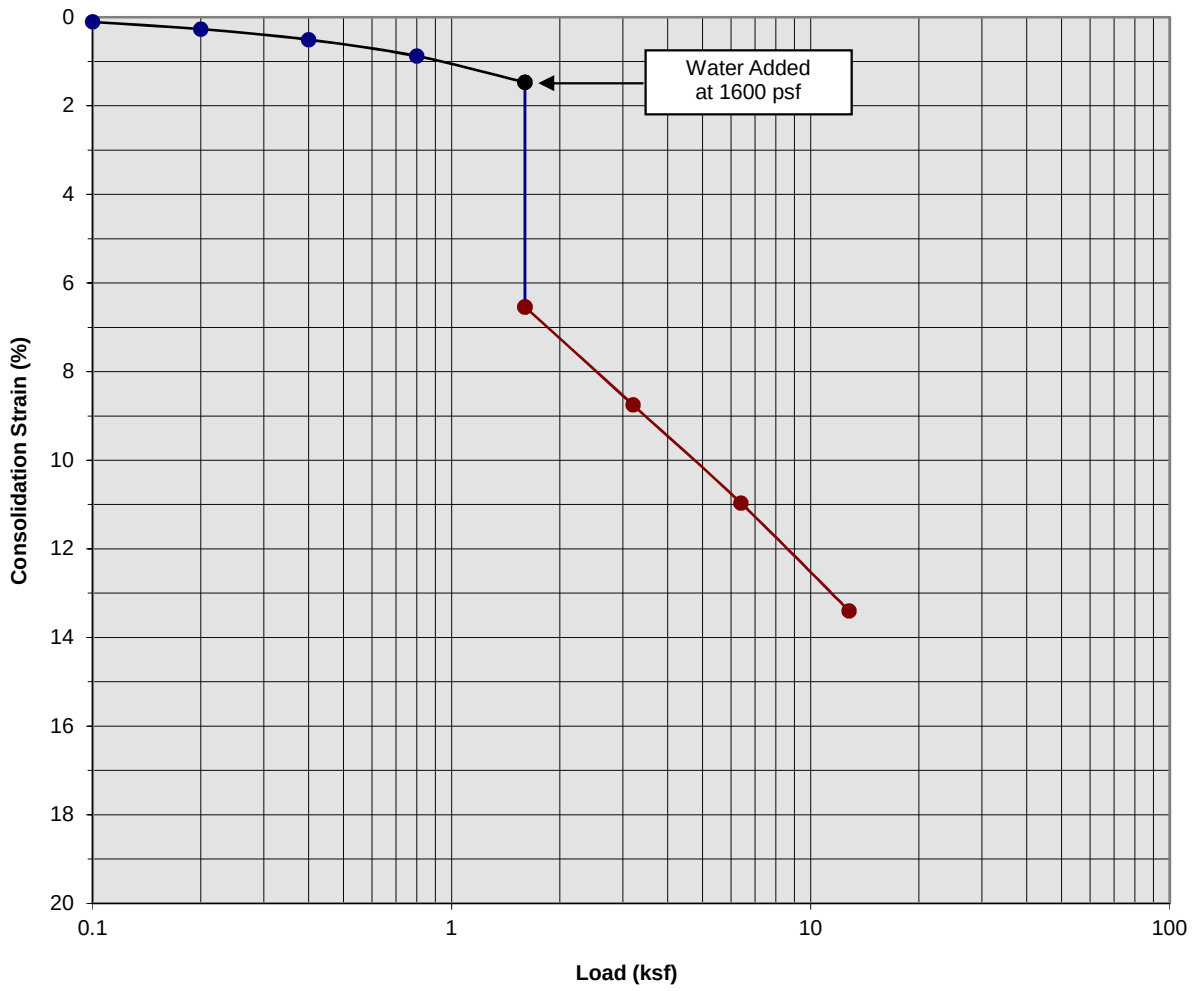
Consolidation/Collapse Test Results



Classification: FILL: Brown Silty fine to coarse Sand

Boring Number:	B-4	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	3 to 4	Initial Dry Density (pcf)	103.5
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	122.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	5.07

Proposed Retail Development
Riverside, California
Project No. 17G134-3

PLATE C- 5

SoCalGeo
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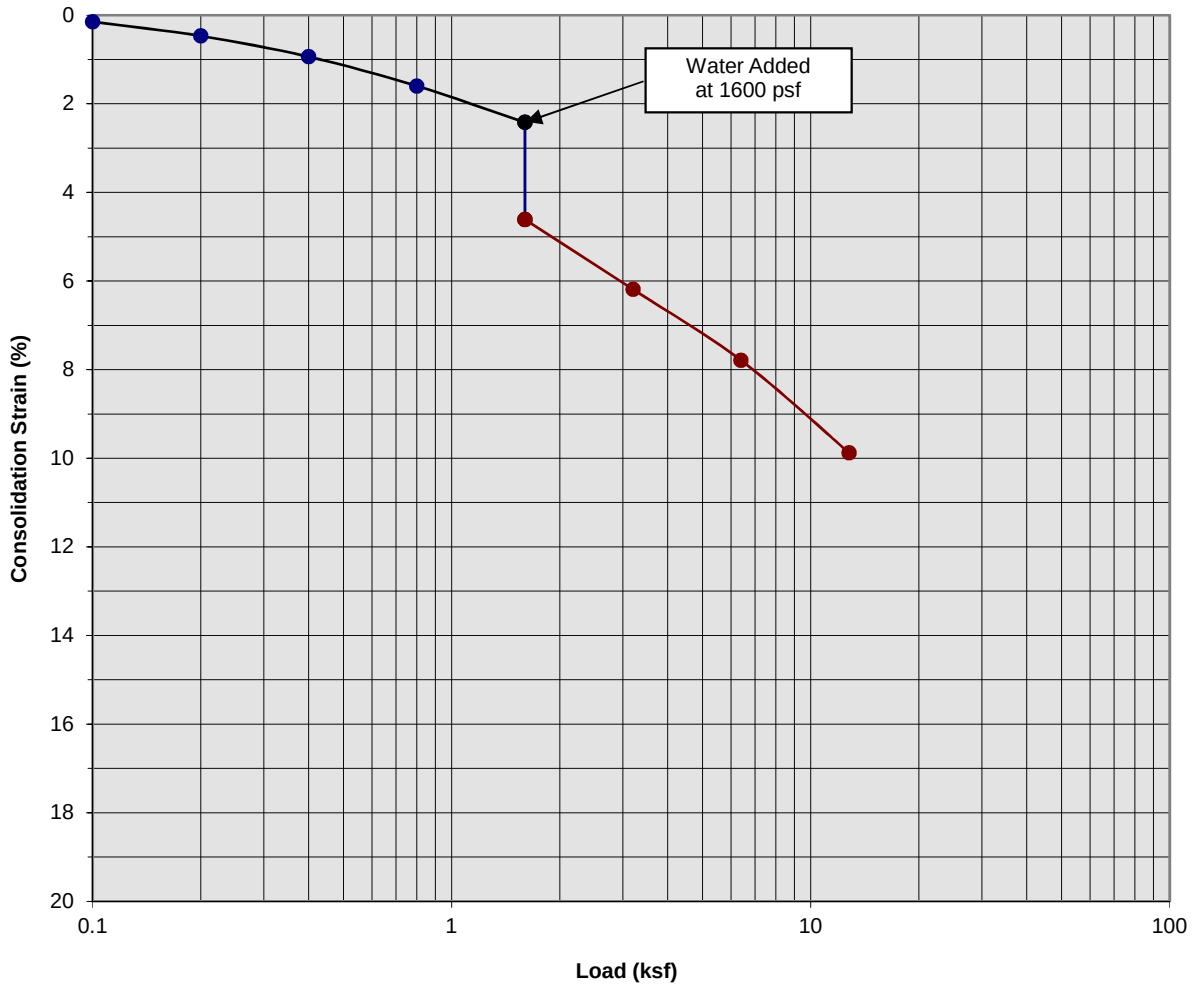
Consolidation/Collapse Test Results



Classification: FILL: Brown Silty fine to coarse Sand

Boring Number:	B-4	Initial Moisture Content (%)	2
Sample Number:	---	Final Moisture Content (%)	11
Depth (ft)	5 to 6	Initial Dry Density (pcf)	105.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	119.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	2.19

Proposed Retail Development
Riverside, California
Project No. 17G134-3

PLATE C- 6

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
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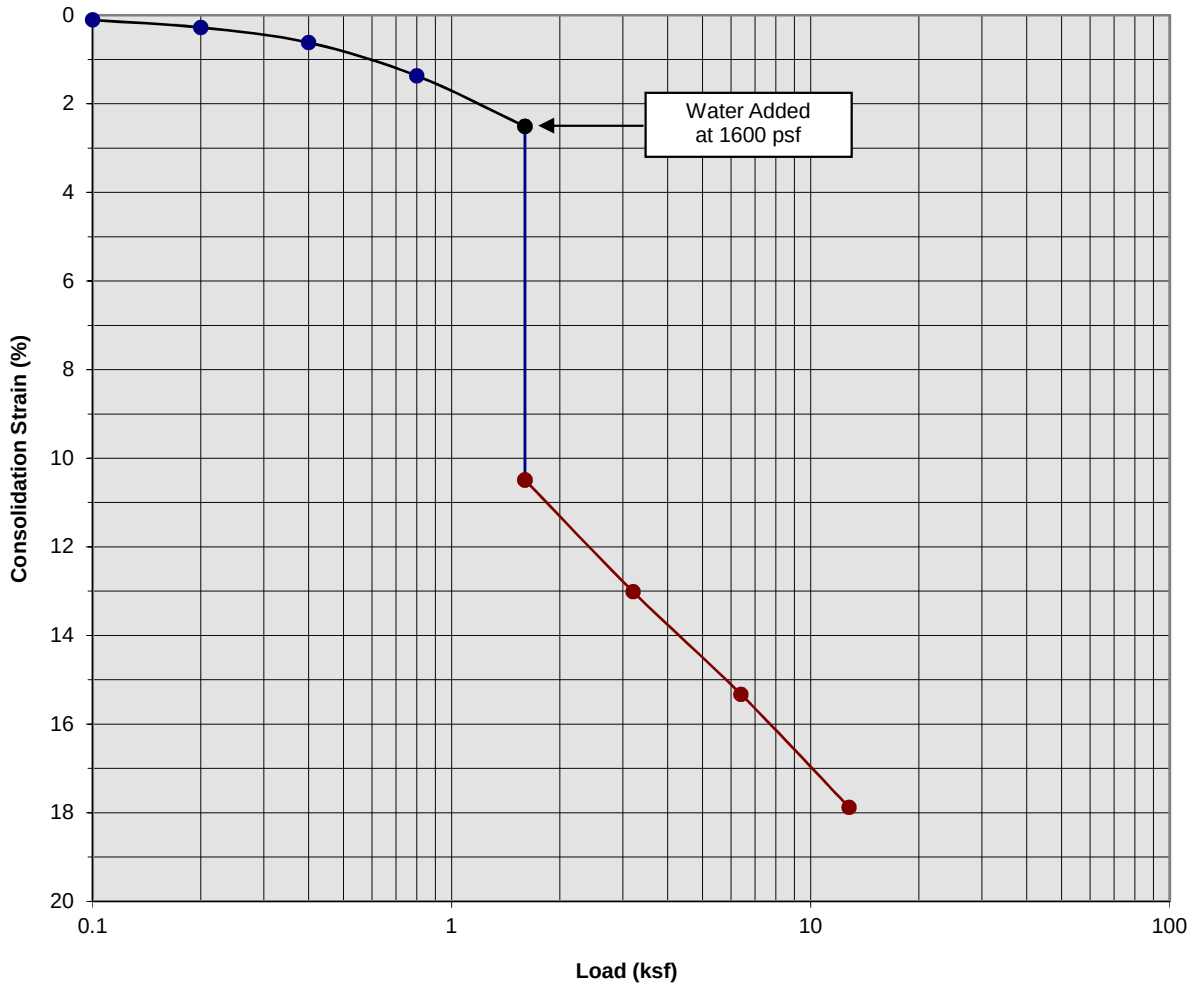
Consolidation/Collapse Test Results



Classification: FILL: Brown Silty fine to coarse Sand

Boring Number:	B-4	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	13
Depth (ft)	7 to 8	Initial Dry Density (pcf)	95.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	118.2
Specimen Thickness (in)	1.0	Percent Collapse (%)	7.98

Proposed Retail Development
Riverside, California
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PLATE C- 7

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
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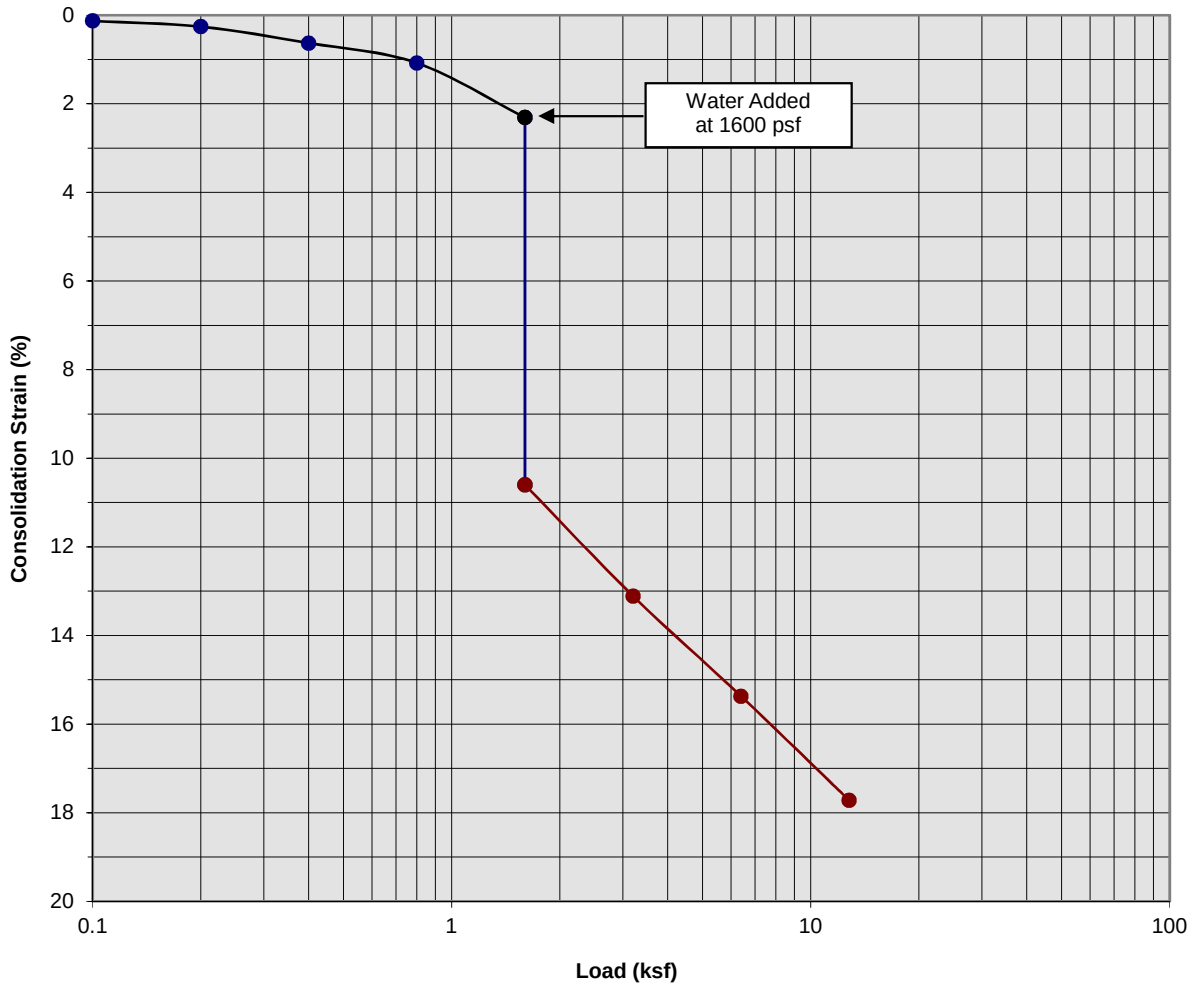
Consolidation/Collapse Test Results



Classification: Brown Silty fine to medium Sand, little coarse Sand

Boring Number:	B-4	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	14
Depth (ft)	9 to 10	Initial Dry Density (pcf)	93.6
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	121.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	8.29

Proposed Retail Development
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PLATE C- 8

SoCalGeo
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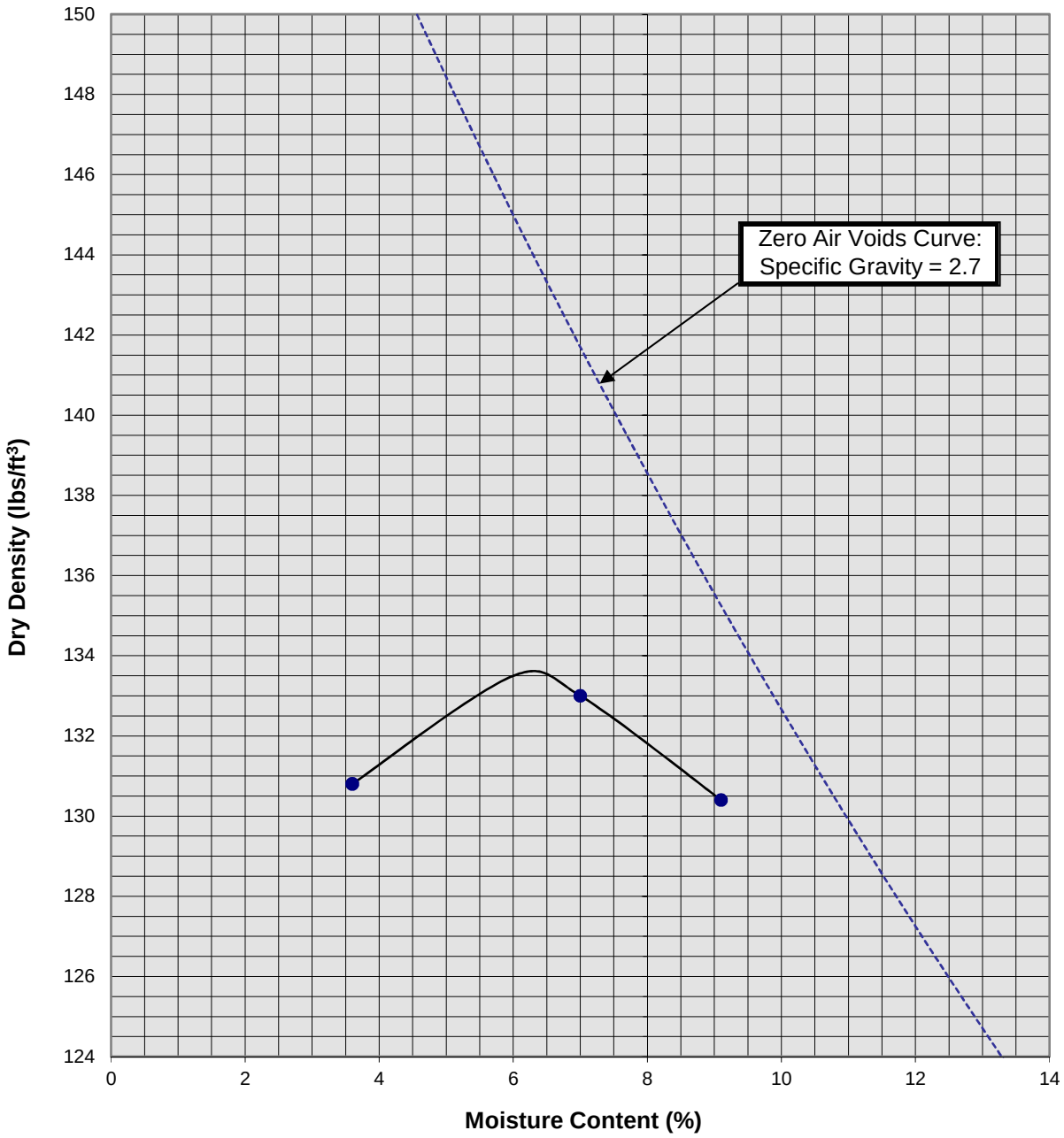
Moisture/Density Relationship
ASTM D-1557



Soil ID Number	B-2 @ 0 to 5'
Optimum Moisture (%)	6
Maximum Dry Density (pcf)	133.5
Soil Classification	Derived from Crushed Bedrock: Light Gray fine to coarse Sand trace Gravel

Proposed Retail Development
Riverside, California
Project No. 17G134-3

PLATE C-9

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
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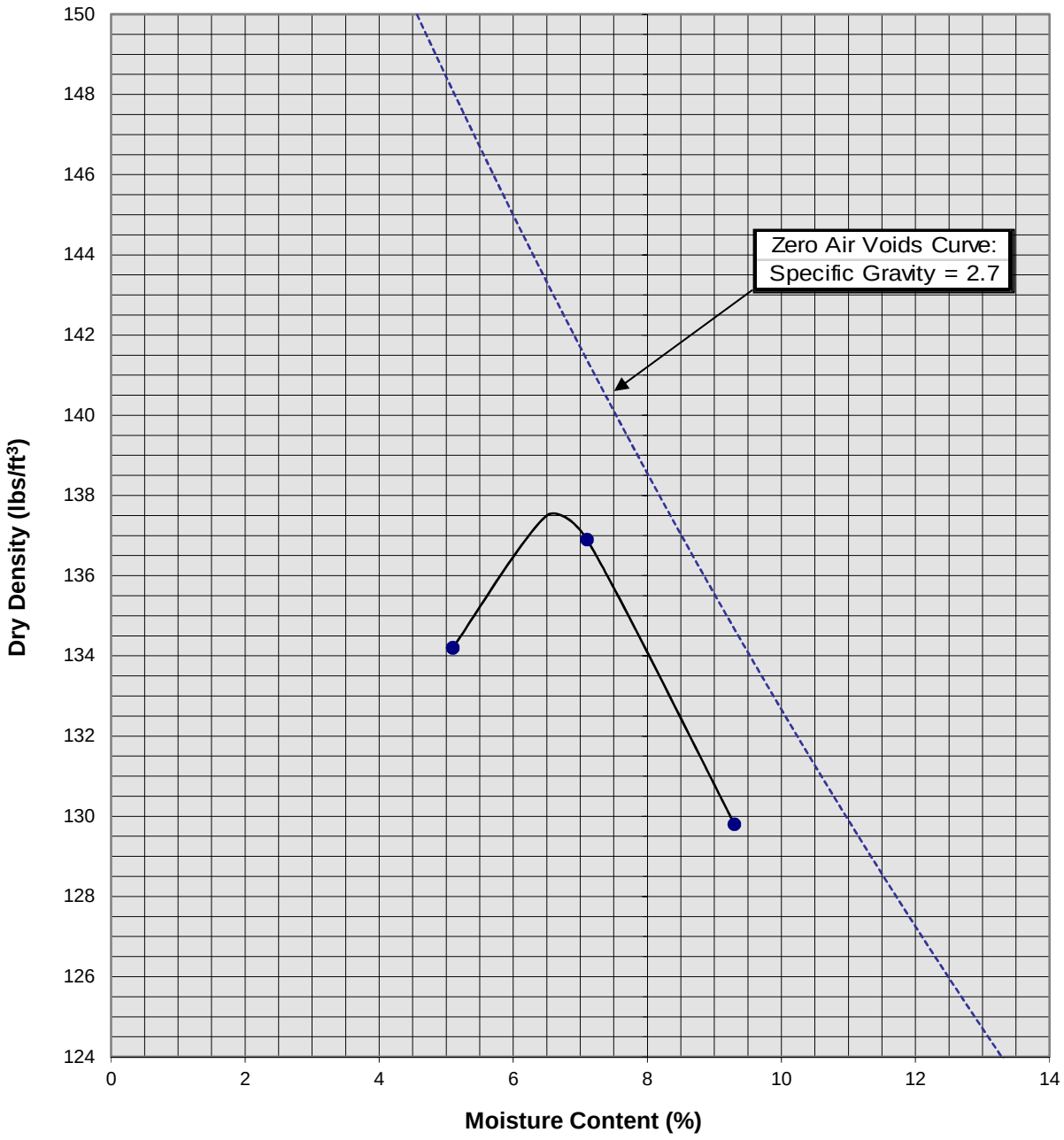
Moisture/Density Relationship
ASTM D-1557



Soil ID Number	B-4 @ 0 to 5'
Optimum Moisture (%)	6.5
Maximum Dry Density (pcf)	137.5
Soil Classification	Brown Silty fine to coarse Sand

Proposed Retail Development
Riverside, California
Project No. 17G134-3

PLATE C-10

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APPENDIX D

GRADING GUIDE SPECIFICATIONS

These grading guide specifications are intended to provide typical procedures for grading operations. They are intended to supplement the recommendations contained in the geotechnical investigation report for this project. Should the recommendations in the geotechnical investigation report conflict with the grading guide specifications, the more site specific recommendations in the geotechnical investigation report will govern.

General

- The Earthwork Contractor is responsible for the satisfactory completion of all earthwork in accordance with the plans and geotechnical reports, and in accordance with city, county, and applicable building codes.

- The Geotechnical Engineer is the representative of the Owner/Builder for the purpose of implementing the report recommendations and guidelines. These duties are not intended to relieve the Earthwork Contractor of any responsibility to perform in a workman-like manner, nor is the Geotechnical Engineer to direct the grading equipment or personnel employed by the Contractor.

- The Earthwork Contractor is required to notify the Geotechnical Engineer of the anticipated work and schedule so that testing and inspections can be provided. If necessary, work may be stopped and redone if personnel have not been scheduled in advance.

- The Earthwork Contractor is required to have suitable and sufficient equipment on the job-site to process, moisture condition, mix and compact the amount of fill being placed to the approved compaction. In addition, suitable support equipment should be available to conform with recommendations and guidelines in this report.

- Canyon cleanouts, overexcavation areas, processed ground to receive fill, key excavations, subdrains and benches should be observed by the Geotechnical Engineer prior to placement of any fill. It is the Earthwork Contractor's responsibility to notify the Geotechnical Engineer of areas that are ready for inspection.

- Excavation, filling, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working surface. The Geotechnical Engineer must be informed of springs or water seepage encountered during grading or foundation construction for possible revision to the recommended construction procedures and/or installation of subdrains.

Site Preparation

- The Earthwork Contractor is responsible for all clearing, grubbing, stripping and site preparation for the project in accordance with the recommendations of the Geotechnical Engineer.

- If any materials or areas are encountered by the Earthwork Contractor which are suspected of having toxic or environmentally sensitive contamination, the Geotechnical Engineer and Owner/Builder should be notified immediately.

- Major vegetation should be stripped and disposed of off-site. This includes trees, brush, heavy grasses and any materials considered unsuitable by the Geotechnical Engineer.

- Underground structures such as basements, cesspools or septic disposal systems, mining shafts, tunnels, wells and pipelines should be removed under the inspection of the Geotechnical Engineer and recommendations provided by the Geotechnical Engineer and/or city, county or state agencies. If such structures are known or found, the Geotechnical Engineer should be notified as soon as possible so that recommendations can be formulated.

- Any topsoil, slopewash, colluvium, alluvium and rock materials which are considered unsuitable by the Geotechnical Engineer should be removed prior to fill placement.

- Remaining voids created during site clearing caused by removal of trees, foundations basements, irrigation facilities, etc., should be excavated and filled with compacted fill.

- Subsequent to clearing and removals, areas to receive fill should be scarified to a depth of 10 to 12 inches, moisture conditioned and compacted

- The moisture condition of the processed ground should be at or slightly above the optimum moisture content as determined by the Geotechnical Engineer. Depending upon field conditions, this may require air drying or watering together with mixing and/or discing.

Compacted Fills

- Soil materials imported to or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable in the opinion of the Geotechnical Engineer. Unless otherwise approved by the Geotechnical Engineer, all fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as “contaminated,” and shall be very low to non-expansive with a maximum expansion index (EI) of 50. The top 12 inches of the compacted fill should have a maximum particle size of 3 inches, and all underlying compacted fill material a maximum 6-inch particle size, except as noted below.

- All soils should be evaluated and tested by the Geotechnical Engineer. Materials with high expansion potential, low strength, poor gradation or containing organic materials may require removal from the site or selective placement and/or mixing to the satisfaction of the Geotechnical Engineer.

- Rock fragments or rocks less than 6 inches in their largest dimensions, or as otherwise determined by the Geotechnical Engineer, may be used in compacted fill, provided the distribution and placement is satisfactory in the opinion of the Geotechnical Engineer.

- Rock fragments or rocks greater than 12 inches should be taken off-site or placed in accordance with recommendations and in areas designated as suitable by the Geotechnical Engineer. These materials should be placed in accordance with Plate D-8 of these Grading Guide Specifications and in accordance with the following recommendations:

    - Rocks 12 inches or more in diameter should be placed in rows at least 15 feet apart, 15 feet from the edge of the fill, and 10 feet or more below subgrade. Spaces should be left between each rock fragment to provide for placement and compaction of soil around the fragments.

    - Fill materials consisting of soil meeting the minimum moisture content requirements and free of oversize material should be placed between and over the rows of rock or

concrete. Ample water and compactive effort should be applied to the fill materials as they are placed in order that all of the voids between each of the fragments are filled and compacted to the specified density.

- Subsequent rows of rocks should be placed such that they are not directly above a row placed in the previous lift of fill. A minimum 5-foot offset between rows is recommended.

- To facilitate future trenching, oversized material should not be placed within the range of foundation excavations, future utilities or other underground construction unless specifically approved by the soil engineer and the developer/owner representative.

- Fill materials approved by the Geotechnical Engineer should be placed in areas previously prepared to receive fill and in evenly placed, near horizontal layers at about 6 to 8 inches in loose thickness, or as otherwise determined by the Geotechnical Engineer for the project.

- Each layer should be moisture conditioned to optimum moisture content, or slightly above, as directed by the Geotechnical Engineer. After proper mixing and/or drying, to evenly distribute the moisture, the layers should be compacted to at least 90 percent of the maximum dry density in compliance with ASTM D-1557-78 unless otherwise indicated.

- Density and moisture content testing should be performed by the Geotechnical Engineer at random intervals and locations as determined by the Geotechnical Engineer. These tests are intended as an aid to the Earthwork Contractor, so he can evaluate his workmanship, equipment effectiveness and site conditions. The Earthwork Contractor is responsible for compaction as required by the Geotechnical Report(s) and governmental agencies.

- Fill areas unused for a period of time may require moisture conditioning, processing and recompaction prior to the start of additional filling. The Earthwork Contractor should notify the Geotechnical Engineer of his intent so that an evaluation can be made.

- Fill placed on ground sloping at a 5-to-1 inclination (horizontal-to-vertical) or steeper should be benched into bedrock or other suitable materials, as directed by the Geotechnical Engineer. Typical details of benching are illustrated on Plates D-2, D-4, and D-5.

- Cut/fill transition lots should have the cut portion overexcavated to a depth of at least 3 feet and rebuilt with fill (see Plate D-1), as determined by the Geotechnical Engineer.

- All cut lots should be inspected by the Geotechnical Engineer for fracturing and other bedrock conditions. If necessary, the pads should be overexcavated to a depth of 3 feet and rebuilt with a uniform, more cohesive soil type to impede moisture penetration.

- Cut portions of pad areas above buttresses or stabilizations should be overexcavated to a depth of 3 feet and rebuilt with uniform, more cohesive compacted fill to impede moisture penetration.

- Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure that excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below grade walls must be properly tested and approved by the Geotechnical Engineer with consideration of the lateral earth pressure used in the design.

Foundations

- The foundation influence zone is defined as extending one foot horizontally from the outside edge of a footing, and proceeding downward at a ½ horizontal to 1 vertical (0.5:1) inclination.

- Where overexcavation beneath a footing subgrade is necessary, it should be conducted so as to encompass the entire foundation influence zone, as described above.

- Compacted fill adjacent to exterior footings should extend at least 12 inches above foundation bearing grade. Compacted fill within the interior of structures should extend to the floor subgrade elevation.

Fill Slopes

- The placement and compaction of fill described above applies to all fill slopes. Slope compaction should be accomplished by overfilling the slope, adequately compacting the fill in even layers, including the overfilled zone and cutting the slope back to expose the compacted core

- Slope compaction may also be achieved by backrolling the slope adequately every 2 to 4 vertical feet during the filling process as well as requiring the earth moving and compaction equipment to work close to the top of the slope. Upon completion of slope construction, the slope face should be compacted with a sheepsfoot connected to a sideboom and then grid rolled. This method of slope compaction should only be used if approved by the Geotechnical Engineer.

- Sandy soils lacking in adequate cohesion may be unstable for a finished slope condition and therefore should not be placed within 15 horizontal feet of the slope face.

- All fill slopes should be keyed into bedrock or other suitable material. Fill keys should be at least 15 feet wide and inclined at 2 percent into the slope. For slopes higher than 30 feet, the fill key width should be equal to one-half the height of the slope (see Plate D-5).

- All fill keys should be cleared of loose slough material prior to geotechnical inspection and should be approved by the Geotechnical Engineer and governmental agencies prior to filling.

- The cut portion of fill over cut slopes should be made first and inspected by the Geotechnical Engineer for possible stabilization requirements. The fill portion should be adequately keyed through all surficial soils and into bedrock or suitable material. Soils should be removed from the transition zone between the cut and fill portions (see Plate D-2).

Cut Slopes

- All cut slopes should be inspected by the Geotechnical Engineer to determine the need for stabilization. The Earthwork Contractor should notify the Geotechnical Engineer when slope cutting is in progress at intervals of 10 vertical feet. Failure to notify may result in a delay in recommendations.

- Cut slopes exposing loose, cohesionless sands should be reported to the Geotechnical Engineer for possible stabilization recommendations.

- All stabilization excavations should be cleared of loose slough material prior to geotechnical inspection. Stakes should be provided by the Civil Engineer to verify the location and dimensions of the key. A typical stabilization fill detail is shown on Plate D-5.

- Stabilization key excavations should be provided with subdrains. Typical subdrain details are shown on Plates D-6.

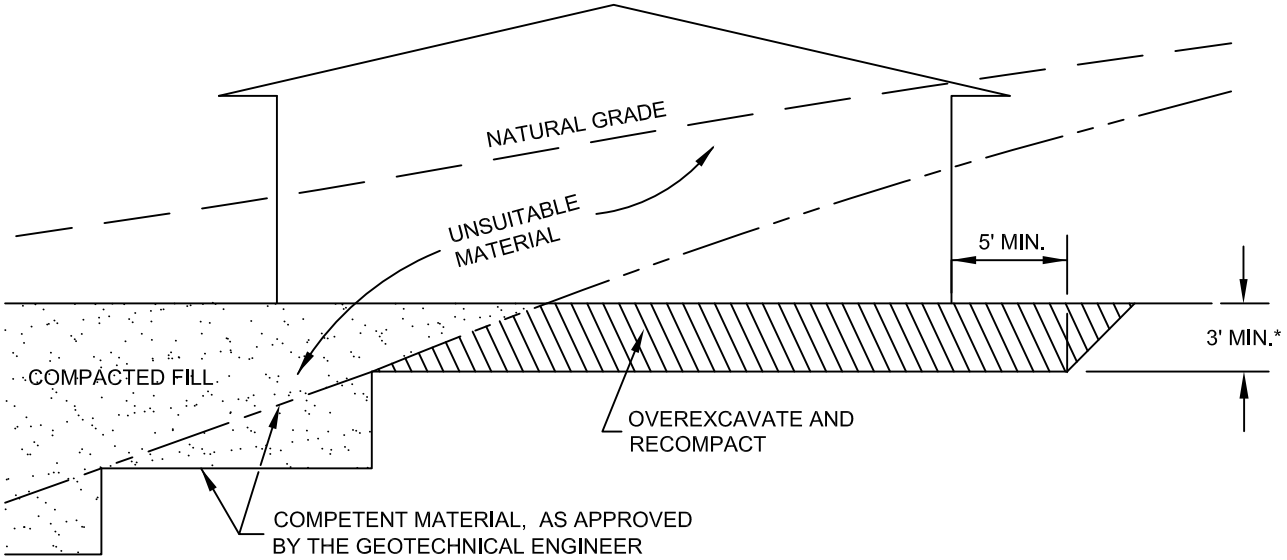
Subdrains

- Subdrains may be required in canyons and swales where fill placement is proposed. Typical subdrain details for canyons are shown on Plate D-3. Subdrains should be installed after approval of removals and before filling, as determined by the Soils Engineer.

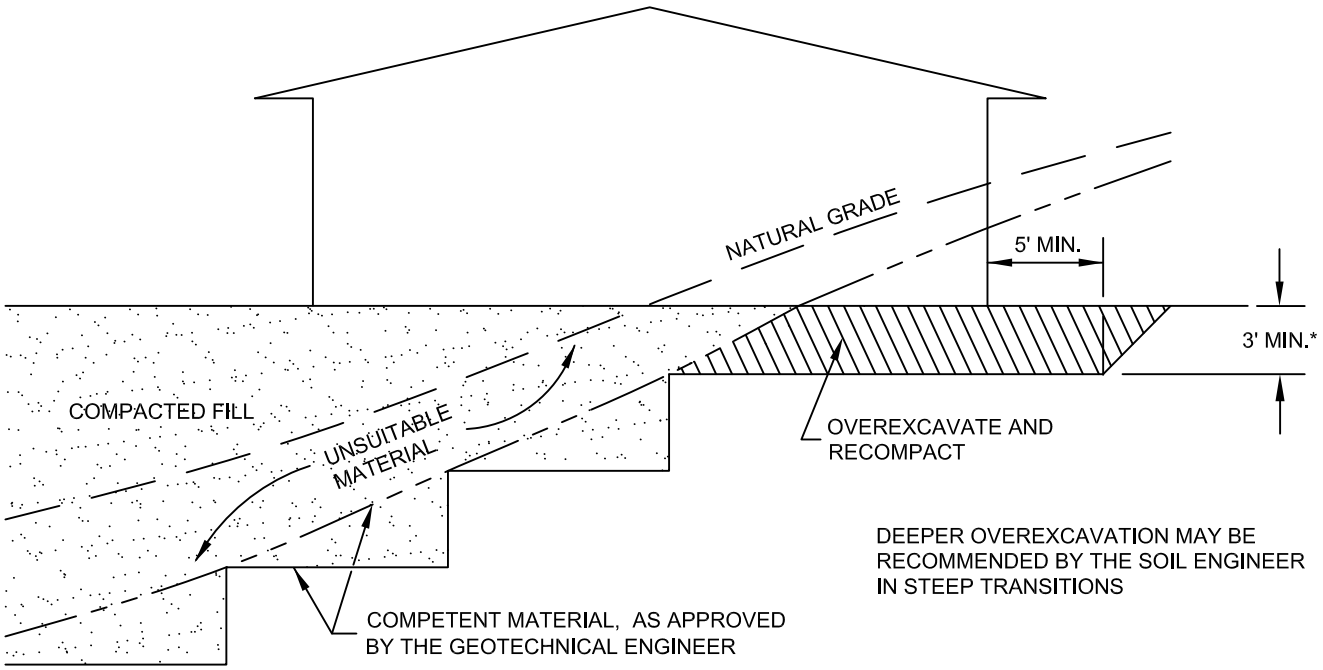
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

- Filter material for subdrains should conform to CALTRANS Specification 68-1.025 or as approved by the Geotechnical Engineer for the specific site conditions. Clean ¾-inch crushed rock may be used provided it is wrapped in an acceptable filter cloth and approved by the Geotechnical Engineer. Pipe diameters should be 6 inches for runs up to 500 feet and 8 inches for the downstream continuations of longer runs. Four-inch diameter pipe may be used in buttress and stabilization fills.

CUT LOT



CUT/FILL LOT (TRANSITION)



*SEE TEXT OF REPORT FOR SPECIFIC RECOMMENDATION. ACTUAL DEPTH OF OVEREXCAVATION MAY BE GREATER.

TRANSITION LOT DETAIL

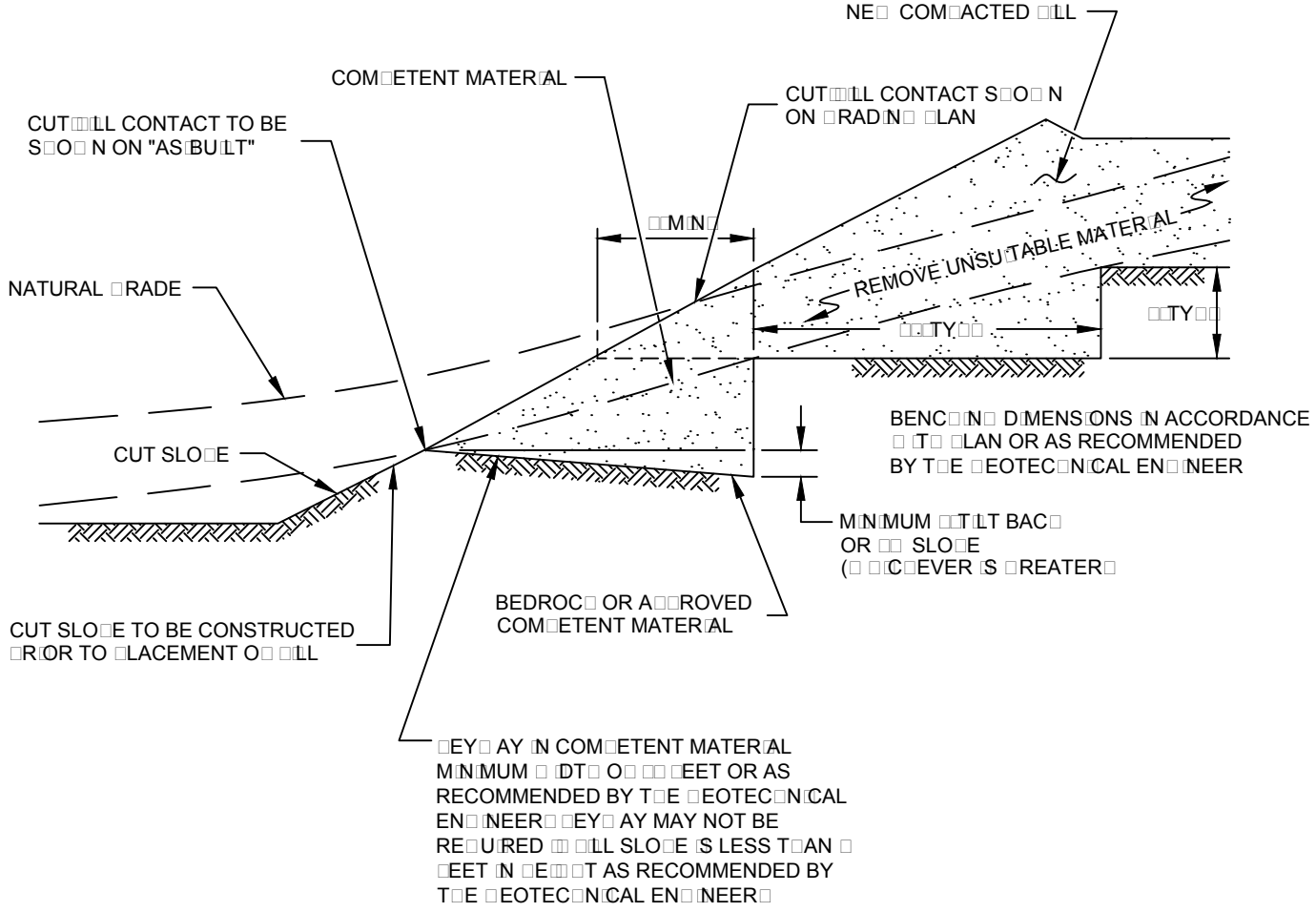
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



□ILL ABO□E C□T SLOPE DETAIL

□RAD□N□ □U□DE S□EC□□□CAT□ONS

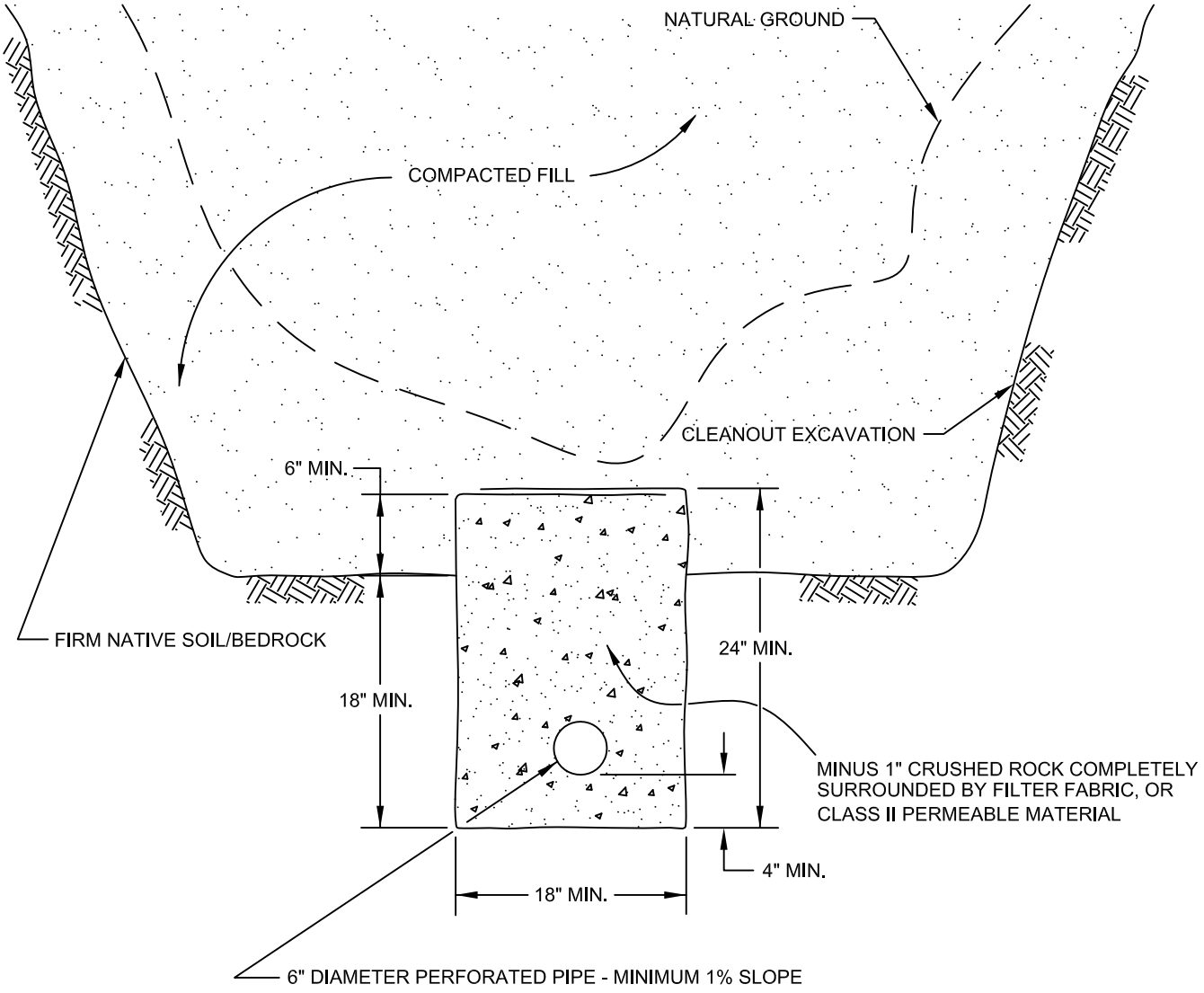
NOT TO SCALE

DRA□ N□ □AS C□□D□ □□M

PLATE D-2

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



PIPE MATERIAL	DEPTH OF FILL OVER SUBDRAIN
ADS (CORRUGATED POLETHYLENE)	8
TRANSITE UNDERDRAIN	20
PVC OR ABS: SDR 35	35
SDR 21	100

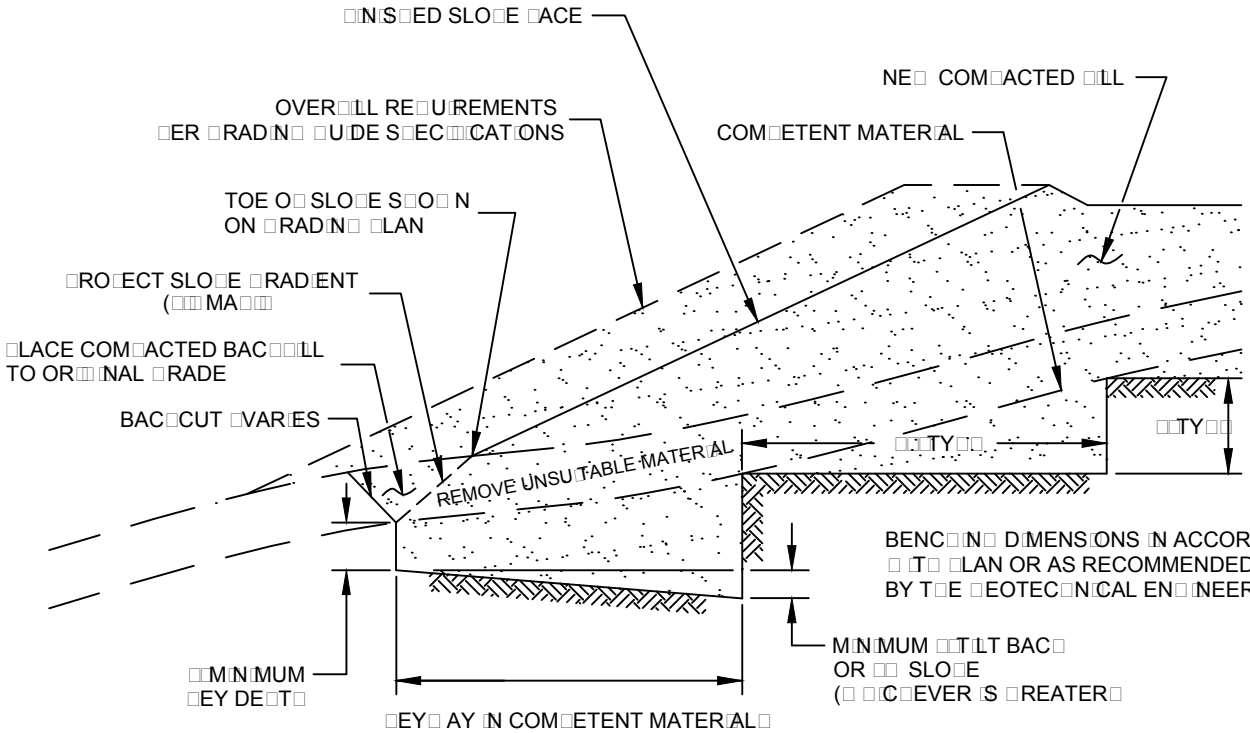
SCHEMATIC ONLY
NOT TO SCALE

CANYON SUBDRAIN DETAIL
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE
DRAWN: JAS
CHKD: GKM

PLATE D-3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



NOTE□
BENC□□N□ S□ALL BE RE□U□RED
□ □EN NATURAL SLO□ES ARE
E□UAL TO OR STEE□ER T□AN □□□
OR □ □EN RECOMMENDED BY
T□E □EOTEC□N□CAL EN□□NEER□

□ILL ABO□E NAT□RAL SLOPE DETAIL

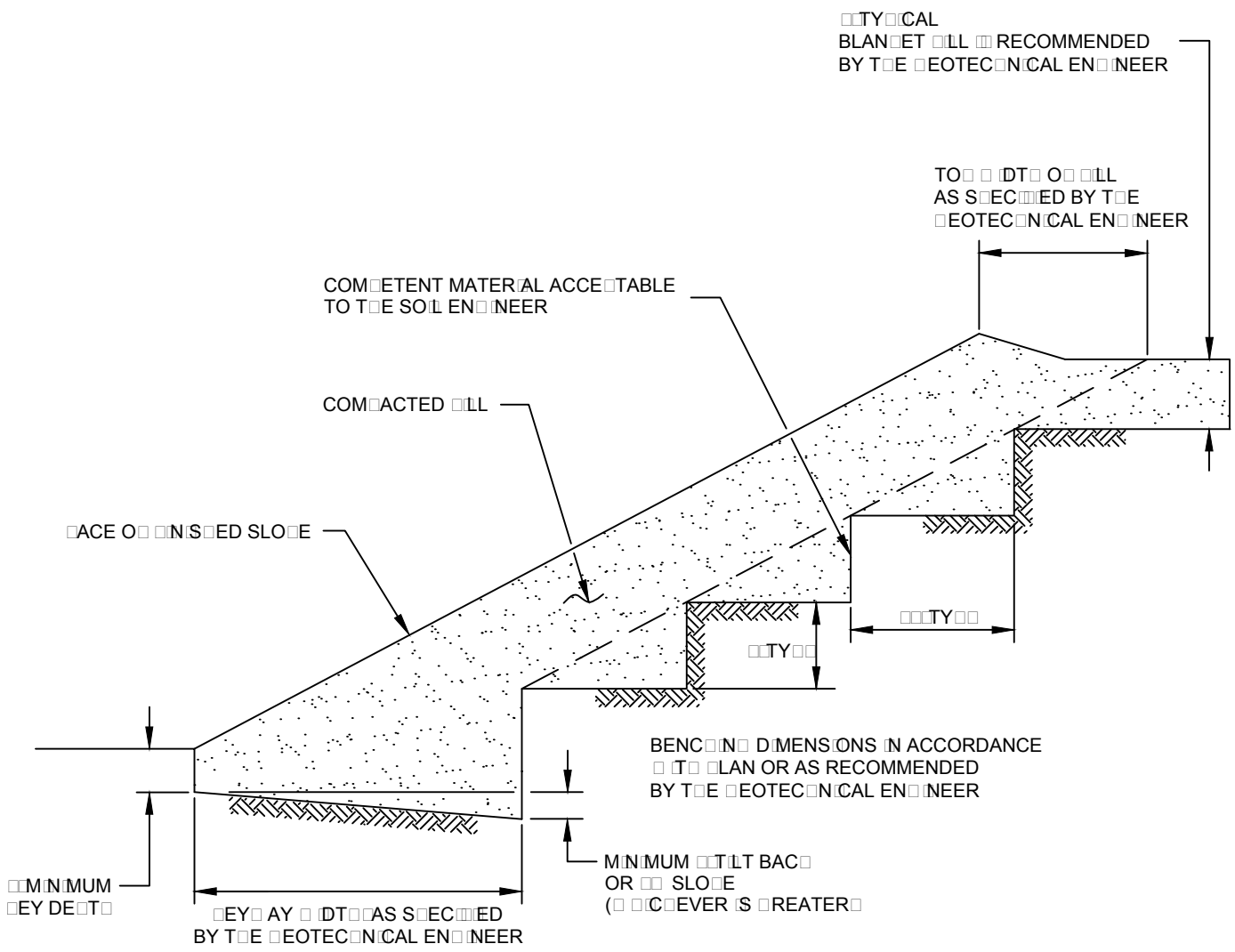
□RAD□N□ □U□DE S□EC□□□CAT□ONS

NOT TO SCALE

DRA□ N□□AS
C□□D□□□M

PLATE D-4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



STABILI□ATION □ILL DETAIL

□RAD□N□ □U□DE S□EC□□□CAT□ONS

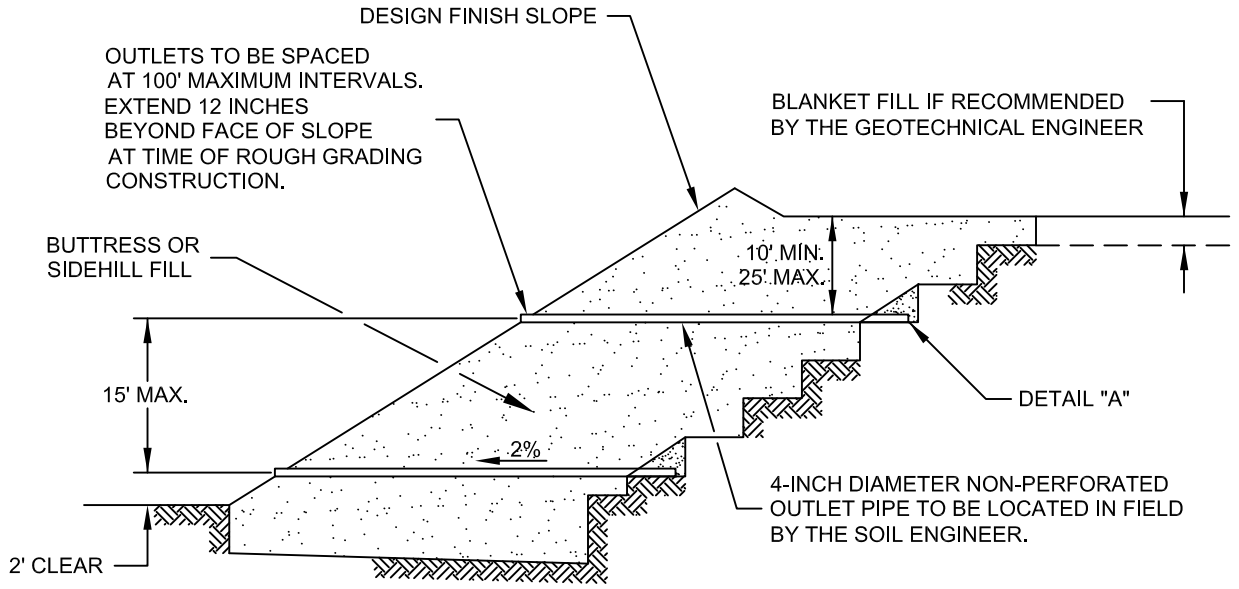
NOT TO SCALE

DRA□ N□ □AS C□□D□ □□M

PLATE D-5

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



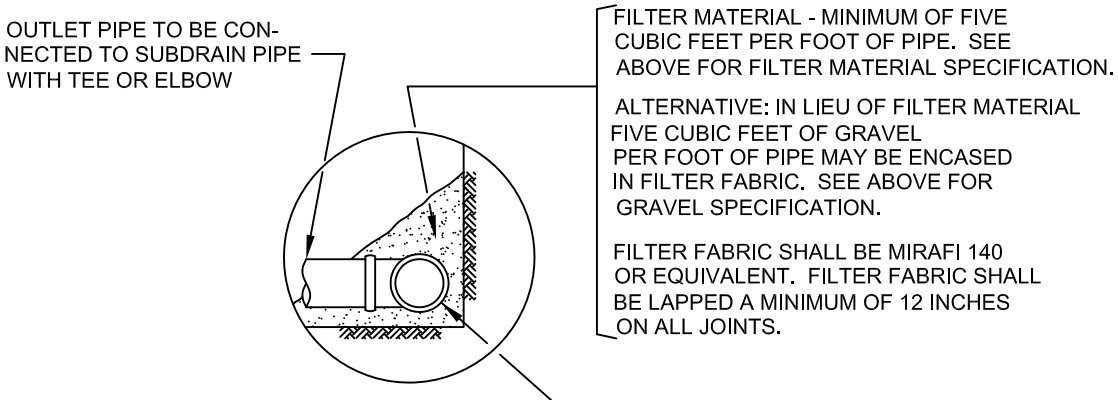
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50



DETAIL "A"

NOTES:
1. TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON-SITE SOIL.

SLOPE FILL SUBDRAINS

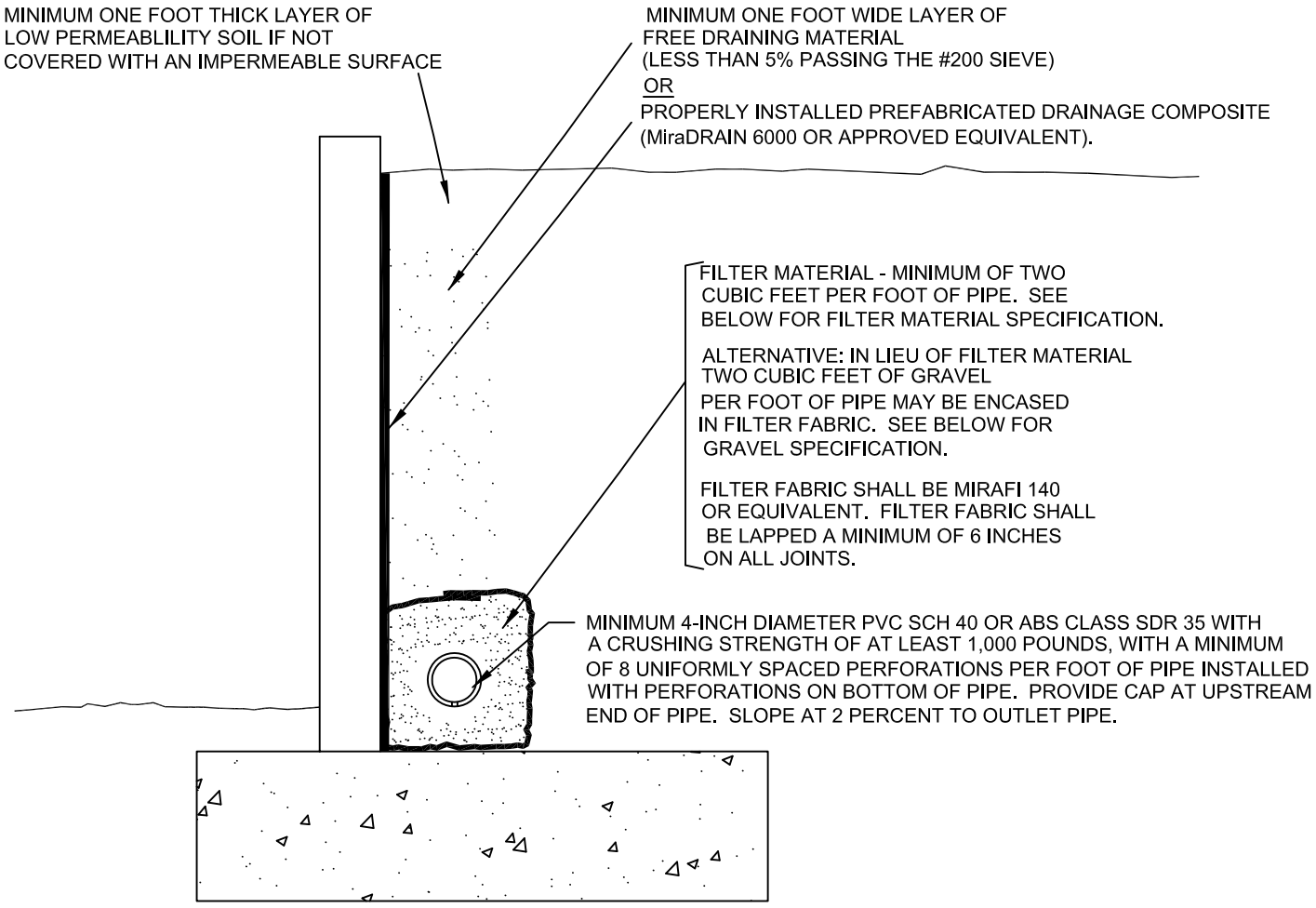
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-6

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50

RETAINING WALL BACKDRAINS

GRADING GUIDE SPECIFICATIONS

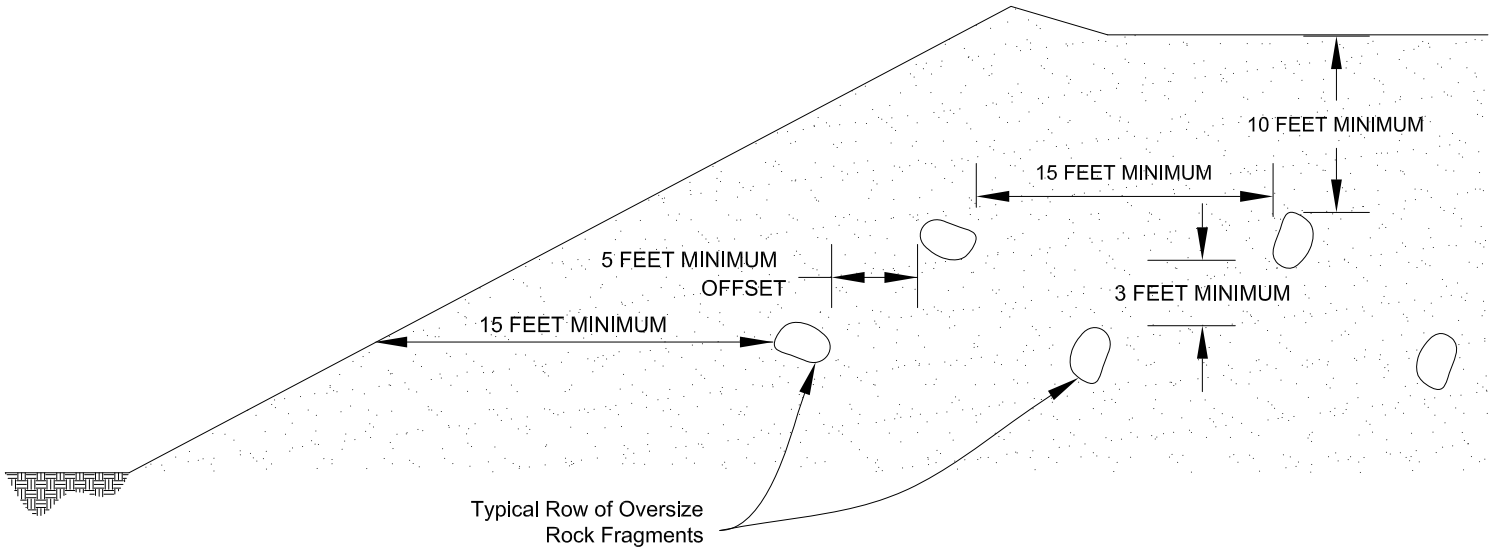
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

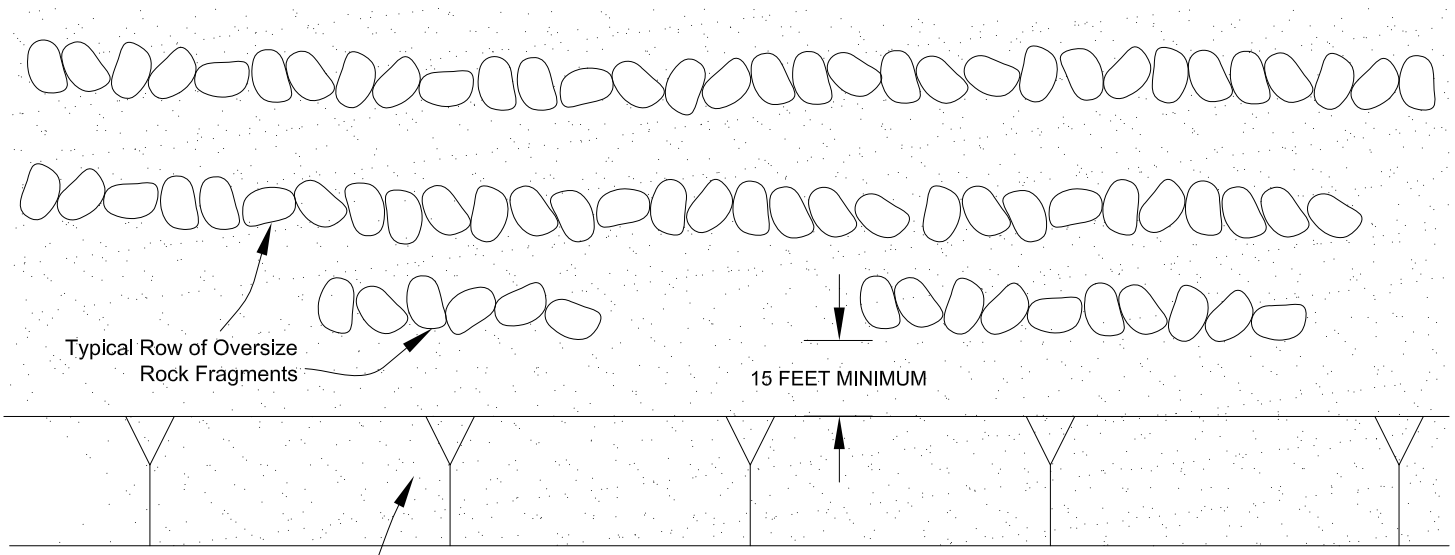
PLATE D-7

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



Section View



Plan View

PLACEMENT OF OVERSIZED MATERIAL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: PM
CHKD: GKM

PLATE D-8

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX E

USGS Design Maps Summary Report

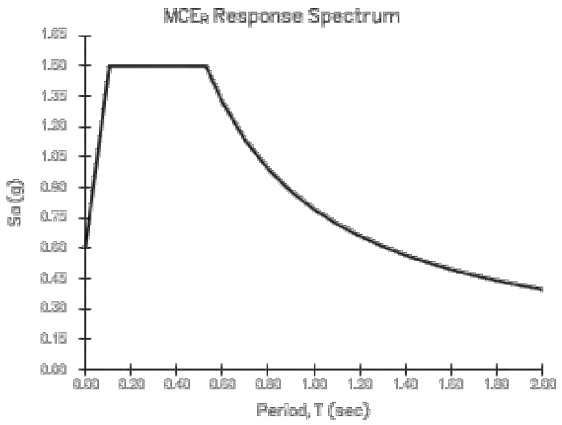
User–Specified Input

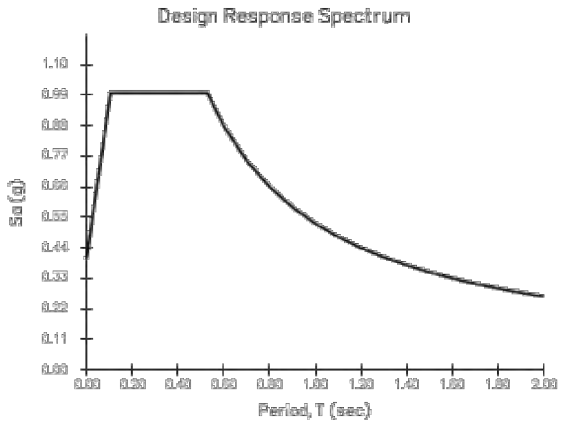
Report Title	Proposed Retail Development Mon December 11, 2017 18:18:18 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	33.95882°N, 117.31104°W
Site Soil Classification	Site Class C – "Very Dense Soil and Soft Rock"
Risk Category	I/II/III

USGS–Provided Output

S_S =	1.500 g	S_{MS} =	1.500 g	S_{DS} =	1.000 g
S_1 =	0.611 g	S_{M1} =	0.794 g	S_{D1} =	0.529 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





SOURCE: U.S. GEOLOGICAL SURVEY (USGS)
http://earthquake.usgs.gov/hazards/designmaps/usapplication.php

SEISMIC DESIGN PARAMETERS

PROPOSED RETAIL DEVELOPMENT

RIVERSIDE, CALIFORNIA

DRAWING CONTENT

SCALE: AS SHOWN

PLATE E-1

SOUTHERN CALIFORNIA GEOTECHNICAL

December 15, 2017

KA Enterprises
5820 Oberlin Drive, Suite 201
San Diego, California 92121

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Attention: Mr. Eugene Marini

Project No.: **17G143-4**

Subject: **Storm Water Infiltration**
Proposed Retail Development
NEC Sycamore Canyon Boulevard and Central Avenue
Riverside, California

Reference: Geotechnical Investigation, Proposed Retail Development, NEC Sycamore Canyon Boulevard and Central Avenue, Riverside, California, prepared for KA Enterprises by Southern California Geotechnical, Inc. (SCG), SCG Project No. 17G134-1, dated December 12, 2017.

Dear Mr. Marini:

At your request, we have prepared this letter discuss the use of on-site storm water infiltration systems at the subject site. For the reasons discussed below, we do not recommend that storm water infiltration systems be used at this site.

As discussed in the referenced geotechnical report, the site is underlain by very dense Val Verde Formation tonalite bedrock and undocumented fill soils. Native alluvium was also encountered beneath the artificial fill soils in a localized portion of the southern part of the site.

The artificial fill materials are generally loose and the results of laboratory testing indicate that these soils are prone to collapse when inundated with water. The fill and native alluvium is underlain by very dense tonalite bedrock. Based on our experience with other projects in the riverside county area, Valverde Formation tonalite is relatively impermeable to water. Therefore, infiltration is not considered feasible at this site since it is underlain by relatively impermeable bedrock. Furthermore, storm water infiltration is not considered prudent at this site, from a geotechnical standpoint because the geologic contact between the bedrock and the overlying fill materials generally slopes downward toward the western portion of the site (which is illustrated on the cross-section provided with the referenced geotechnical report). Water would migrate downward until it reached the relatively impermeable bedrock, then it would flow along the surface of the rock to the western portion of the site and accumulate behind the proposed retaining walls. This accumulation would create additional hydrostatic pressures on the proposed retaining walls. Additionally, the lateral migration of water may cause soils below structures to become saturated, altering their engineering properties. Therefore, we do not recommend the use of storm water infiltration systems at this site.

We appreciate the opportunity to be of continued service on this project. If we may be of further assistance in any manner, please contact our office at your convenience.

Respectfully Submitted,
SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

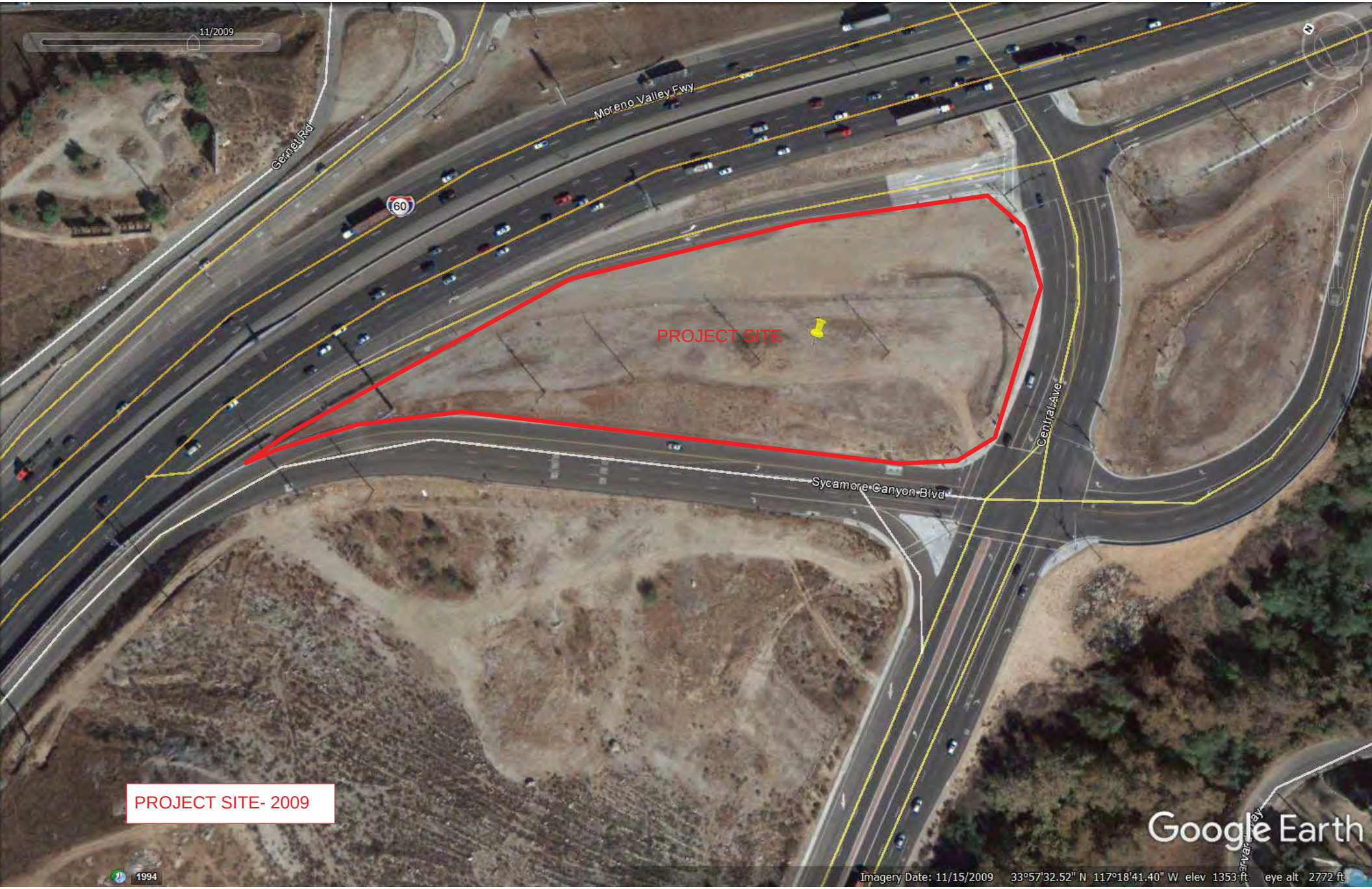
Daniel W. Nielsen, RCE 77915
Project Engineer

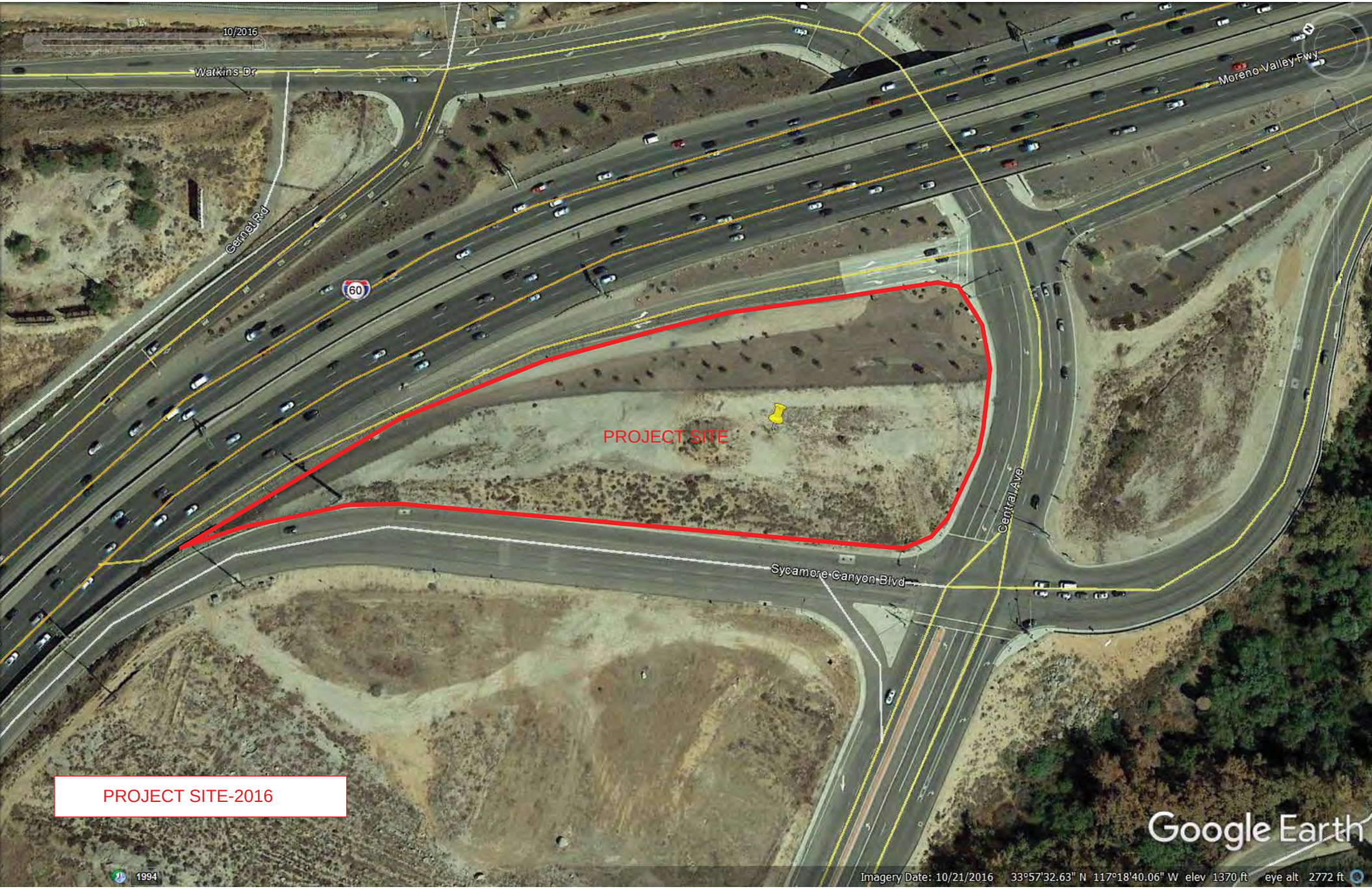
Distribution: (1) Addressee

Appendix 4: Historical Site Conditions

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

PROJECT SITE - 1994


11/2009
Gernet Rd
Moreno Valley Fwy
60
PROJECT SITE
Central Ave
Sycamore Canyon Blvd
PROJECT SITE- 2009
Google Earth
1994
Imagery Date: 11/15/2009 33°57'32.52" N 117°18'41.40" W elev 1353 ft eye alt 2772 ft


10/2016
Watkins Dr
Gernel Rd
60
Moreno Valley Fwy
PROJECT SITE
Central Ave
Sycamore Canyon Blvd
PROJECT SITE-2016
Google Earth
1994
Imagery Date: 10/21/2016 33°57'32.63" N 117°18'40.06" W elev 1370 ft eye alt 2772 ft

Original
2015-0312282 12/28

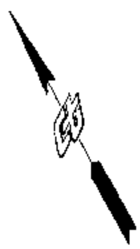
STATE OF CALIFORNIA
CALIFORNIA STATE TRANSPORTATION AGENCY
DEPARTMENT OF TRANSPORTATION

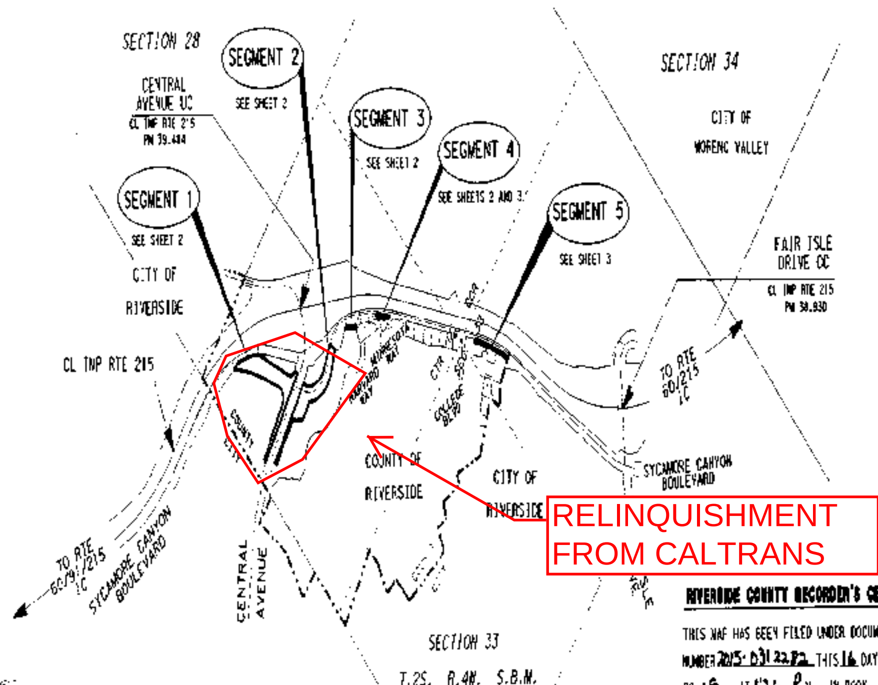
STATE ROUTE 215

INDEX MAP TO PROPOSED RELINQUISHMENT OF
COLLATERAL FACILITIES AND RELOCATED COUNTY ROADS
IN THE COUNTY OF RIVERSIDE, SECTION 33, T2S, R4W, S.B.M.

APPROVAL RECOMMENDED
RENE' FLETCHER
DEPUTY DISTRICT DIRECTOR
R/W & LAND SURVEYS

PROFESSIONAL LAND SURVEYOR
7-10-2015
DATE APPROVED





CF=0.99993651
INDEX MAP SCALE:
1" = 800'

SURVEYOR'S NOTES

1. BASIS OF BEARINGS AS SHOWN ON THIS MAP IS REFERENCED FROM THE PROJECT CONTROL RECORD OF SURVEY FILED IN BOOK 69, PAGES 61 THROUGH 66 OF RECORDS OF SURVEYS, RECORDS OF RIVERSIDE COUNTY. THIS PROJECT UTILIZED THE STATE OF CALIFORNIA COORDINATE SYSTEM OF 1983, ZONE 6 AS SHOWN ON SAID RECORD OF SURVEY.

2. THE PROJECT R/W MAPPING AND ACQUISITION DOCUMENTS WERE COMPLETED WITH A DUAL-UNIT FORMAT USING METRIC DISTANCES TOGETHER WITH EQUIVALENT U.S. SURVEY FEET IN PARENS. THIS MAP REFERENCES GRID FEET DISTANCES OR CONVERTS THE PROJECT GRID METRIC DATA AS REQUIRED. GROUND FEET DISTANCES CAN BE OBTAINED BY DIVIDING GRID FEET DISTANCES AS SHOWN BY THE PROJECT COMBINATION FACTOR. C.F.= 0.99993651.

3. THIS RECORD DATA MAP REFERENCES RECORDED PROJECT ACQUISITION DOCUMENTS AS NOTED ON SHEETS 2 AND 3, PRIOR TO OR UPON COMPLETION OF THIS RELINQUISHMENT, ANY SUBSEQUENT CADASTRE SHALL REFERENCE SAID RECORDED DOCUMENTS TO MAINTAIN THE CHAIN OF TITLE OR TO IMPART CONSTRUCTIVE NOTICE WITHIN THE GRANTOR/GRANTEE INDEX. BOTH SHEETS 2 AND 3 SHOW REFERENCE TABLES INDICATING THE RECORDED SOURCE DOCUMENTS.

4. IN ADDITION, THIS RECORD DATA MAP REFERENCES PROJECT APPRAISAL MAPS, RECORD MAPS, HARDCOPIES, OR MONUMENTATION MAPS FILED IN DISTRICT 8 AS NOTED ON SHEETS 2 AND 3. SAID PROJECT MAPPING WAS REFERENCED WHEN PROJECT DOCUMENTS DO NOT ESTABLISH THE REQUIRED BEARING OR DISTANCE. SHEETS 2 AND 3 SHOW REFERENCE TABLES INDICATING THE PROJECT MAPPING SOURCE.

RELINQUISHMENT NOTES

1. PRIOR TO CTC APPROVAL OF THIS PROPOSED RELINQUISHMENT, THIS MAP WILL BE RECORDED IN THE STATE HIGHWAY MAP BOOK IN THE OFFICE OF THE RIVERSIDE COUNTY RECORDER. UPON CTC REVIEW AND APPROVAL, THE "RESOLUTION OF RELINQUISHMENT" WILL BE RECORDED IN THE OFFICIAL RECORDS OF SAID COUNTY RECORDER. NOT BEING A RECORDED GRANT DEED, THE RECORDED CTC RESOLUTION DOES NOT APPEAR IN THE GRANTOR/GRANTEE INDEX OF FEE OWNERSHIP. THIS MAP AND ANY SUBSEQUENT CADASTRE SHALL REFERENCE SAID RECORDED DOCUMENTS TO MAINTAIN THE CHAIN OF TITLE WITHIN SAID INDEX.

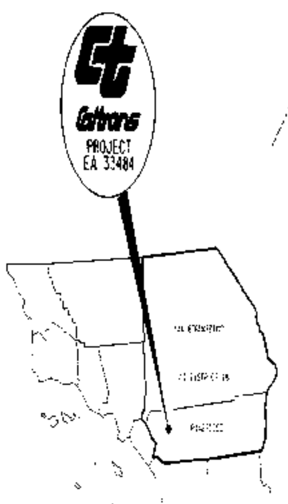
2. TITLE HELD BY THE STATE OF CALIFORNIA IS RELINQUISHED TO THE COUNTY OF RIVERSIDE UPON FINAL CTC REVIEW AND APPROVAL TOGETHER WITH THE RECORDATION OF THE CTC RESOLUTION OF RELINQUISHMENT. THIS MAP SHOWS TWO EXCEPTIONS AND RESERVATIONS TO BE HELD BY THE STATE AS SHOWN HEREON:

A. STATE EXCEPTION & RESERVATION FOR A PERMANENT EASEMENT FOR RETAINING WALL PURPOSES AND INCIDENTS THERETO BEING A PORTION OF SEGMENT 2. SEE SHEET 2. SEE ALSO DETAIL "A" ON SHEET 3. SAID PARCEL IS SHOWN AS CT PROJECT PARCEL NO. 19314-6 PAVEL ON R/W.

B. STATE EXCEPTION & RESERVATION FOR AN EASEMENT FOR RETAINING WALL PURPOSES AND INCIDENTS THERETO BEING A PORTION OF SEGMENT 3 SEE SHEET 2. SEE ALSO DETAIL "B" ON SHEET 3. SAID PARCEL IS SHOWN AS CT PROJECT PARCEL NO. 19314-7 PAVEL ON R/W.

3. THE PROJECT REQUIRED SEVERAL STATE EASEMENTS LOCATED WITHIN PREVIOUSLY RELINQUISHED COUNTY-MAINTAINED ROAD, NOT BEING WITHIN ANY PROPOSED RELINQUISHMENT SEGMENT, THESE STATE EASEMENTS CAN ONLY BE SHOWN ON THE R/W APPRAISAL MAP OR RECORD MAP. SAID EASEMENTS WILL BE SHOWN AS ACCEPTED BY THE STATE IN ACCORDANCE WITH THE FREEWAY AGREEMENT AND THE STREETS AND HIGHWAYS CODE. FOR SPECIFIC INFORMATION AND LOCATION, SEE R/W MAP "8UR400023-1 TO 3" FILED IN DISTRICT MAP FILES OR DISTRICT RECORD MAPS. THIS MAP WILL DESIGNATE SAID R/W MAP NO. 8U00023-1 TO 3 AS PRIOR NOTED ON SHEETS 2 AND 3 IN THE RECORD REFERENCES TABLE.

4. AN IMPORTANT POINT TO CONSIDER IS CT ACQUIRES THE REQUIRED PARCEL TO THE STATE. WALL NO. RW 514 THROUGH THREE PARCELS FITTING TOGETHER TO FORM ONE EASEMENT. THERE ARE THE TWO PARCELS MENTIONED ABOVE AND A THIRD PARCEL LYING BETWEEN THESE TWO. THE THIRD PARCEL IS SHOWN AS BEING A LOCAL ROAD ACQUISITION FOR THE AGREEMENT AND THE S.&H.C. SEE PARCEL 1A DESCRIBED IN NOTE 1 ON PROCESS 1 UNDER LOCAL STREETS. THIS PROVIDES THE EASEMENT INTEREST. HOWEVER, A COPY OF THIS MAP WITH A LETTER OF ACQUISITION WILL BE PROVIDED TO COUNTY OF RIVERSIDE.



LEGEND

- - - COUNTY / CITY LIMITS

☐ PROPOSED RELINQUISHED SEGMENT OR PORTION

NOTES

BEARINGS SHOWN HEREON ARE BASED UPON THE CALIFORNIA COORDINATE SYSTEM OF 1983, ZONE 6. GRID DISTANCES SHOWN HEREON ARE IN U.S. SURVEY FEET. DIVIDE GRID DISTANCES BY THE COMBINATION FACTOR (C.F.) TO OBTAIN GROUND DISTANCES.
C.F.= 0.99993651

RIVERSIDE COUNTY RECORDER'S CERTIFICATE

THIS MAP HAS BEEN FILED UNDER DOCUMENT NUMBER 2015-0312282 THIS 16 DAY OF July 20 15, AT 1:26 P.M., IN BOOK 12 OF STATE HIGHWAY MAP BOOK AT PAGE 28-30 AT THE REQUEST OF CAL Trans IN THE AMOUNT OF $ 0 .

PETER ALDANA
~~AUDITOR~~ - COUNTY CLERK - RECORDER
COUNTY OF RIVERSIDE, CALIFORNIA

BY: [signature]
DEPUTY RECORDER

FREE RECORDING: THIS INSTRUMENT IS AN OFFICIAL PRODUCT OF AND BY THE STATE OF CALIFORNIA, THEREFORE, THIS INSTRUMENT IS ENTITLED TO RECORDATION WITHOUT FEE (GOVT. CODE 6103).

STATE OF CALIFORNIA
CALIFORNIA STATE TRANSPORTATION AGENCY
DEPARTMENT OF TRANSPORTATION

INDEX MAP OF PROPOSED RELINQUISHMENT TO THE COUNTY OF RIVERSIDE REQUEST NO. 477-R

R/W INFORMATION MAY BE OBTAINED FROM THE FOLLOWING PUBLIC COUNTERS: DISTRICT 08 MAP FILES OR DISTRICT 08 RECORD MAPS IN THE DISTRICT OFFICE AT 464 W. FOURTH ST, SAN BERNARDINO, CA 92401

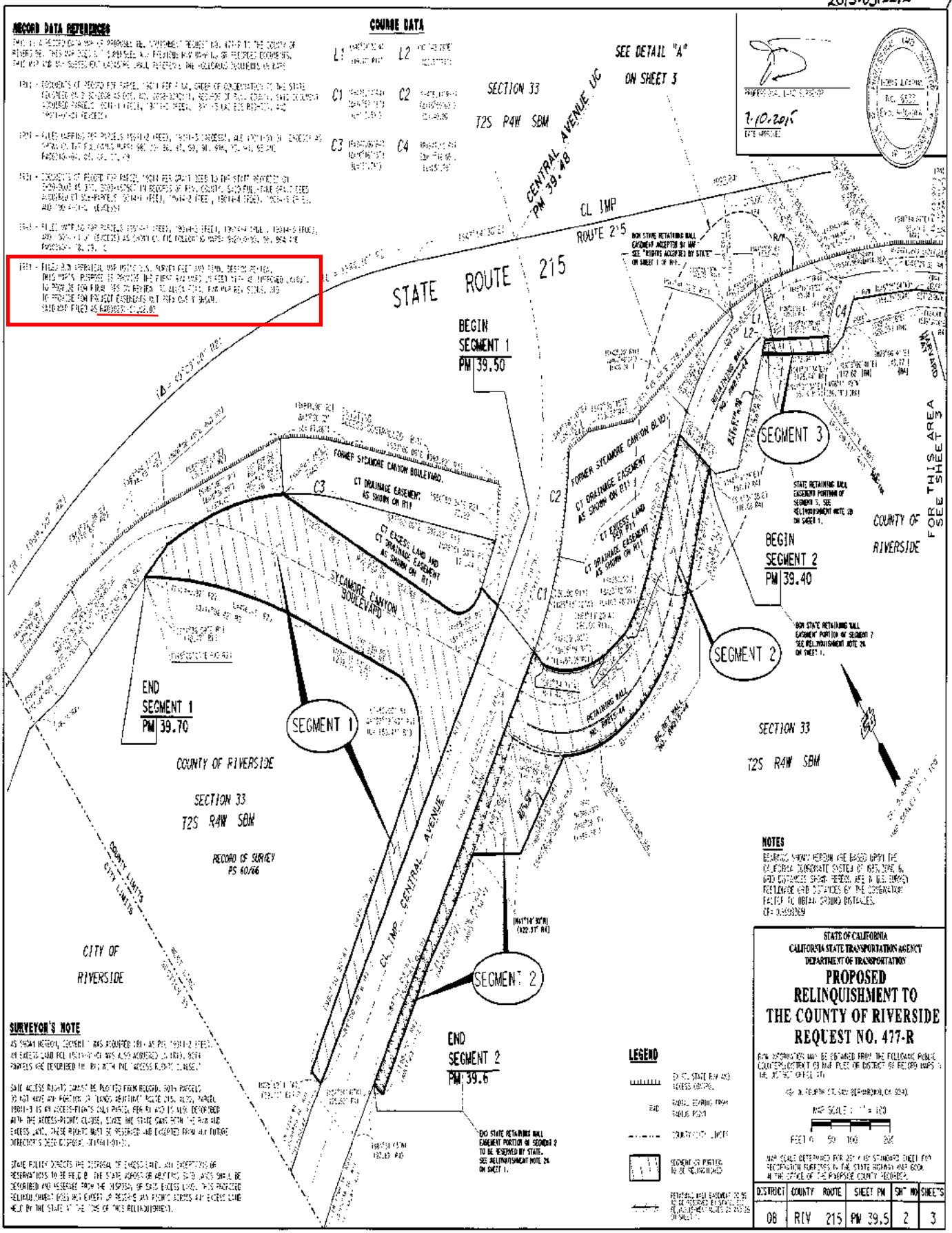
INDEX MAP SCALE: 1" = 800'

FEET 0 400 800 1600

MAP SCALE DETERMINED FOR 24" X 18" REPROGRAPHIC SHEET FOR RECORDATION PURPOSES IN THE STATE HIGHWAY MAP BOOK IN THE OFFICE OF THE RIVERSIDE COUNTY RECORDER.

DISTRICT	COUNTY	ROUTE	POST MILE RANGE	SHT NO	SHEETS
08	RIV	215	38.9 - 39.7	1	3

original 12/29
2015-0312202



Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

No LID infeasibility analysis was required for this project. The project will employ on-site pollutant and source control LID and BMP features. These are detailed in the body of this report.

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Bioretention Facility - Design Procedure	BMP ID: BIO-1	Legend:	Required Entries / Calculated Cells

Company Name: Omega Engineering Consultants, Inc Date: 4/4/2018

Designed by: County/City Case No.:

Design Volume

Enter the area tributary to this feature A_T= 0.22 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 374 ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb w_T = 9.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ d_E = 1.27 ft

Minimum Surface Area, A_m

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

A_M = 294 ft^2

Proposed Surface Area A= 295 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = N/A :1

Diameter of Underdrain 6 inches

Longitudinal Slope of Site (3% maximum) 0 %

6" Check Dam Spacing 0 feet

Describe Vegetation: Shrubs

Notes:

Bioretention Facility - Design Procedure	BMP ID: BIO-2	Legend:	Required Entries / Calculated Cells

Company Name: Omega Engineering Consultants, Inc Date: 4/4/2018

Designed by: County/City Case No.:

Design Volume

Enter the area tributary to this feature A_T= 0.47 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 726 ft^3

Type of Bioretention Facility Design

○ Side slopes required (parallel to parking spaces or adjacent to walkways)

◉ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb w_T = 10.0 ft

Total Effective Depth, d_E

$d_E = [(0.3) \times d_S + (0.4) \times 1] + 0.5$ d_E = 1.35 ft

Minimum Surface Area, A_m

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

A_M = 538 ft^2

Proposed Surface Area A= 754 ft^2

Minimum Required Length of Bioretention Facility, L L = 53.8 ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = N/A :1

Diameter of Underdrain 6 inches

Longitudinal Slope of Site (3% maximum) %

6" Check Dam Spacing feet

Describe Vegetation: Shrubs

Notes:

Bioretention Facility - Design Procedure	BMP ID: BIO-3	Legend:	Required Entries / Calculated Cells

Company Name: Omega Engineering Consultants, Inc Date: 4/4/2018

Designed by: County/City Case No.:

Design Volume

Enter the area tributary to this feature A_T= 0.12 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 182 ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb w_T = 9.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ d_E = 1.27 ft

Minimum Surface Area, A_m

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

A_M = 144 ft^2

Proposed Surface Area A= 150 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = N/A :1

Diameter of Underdrain 6 inches

Longitudinal Slope of Site (3% maximum) 0 %

6" Check Dam Spacing 0 feet

Describe Vegetation: Shrubs

Notes:

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries	
	BIO-4		Calculated Cells	

Company Name: Omega Engineering Consultants, Inc Date: 4/4/2018

Designed by: County/City Case No.:

Design Volume

Enter the area tributary to this feature A_T= 0.85 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 1,213 ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb w_T = 12.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ d_E = 1.29 ft

Minimum Surface Area, A_m

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

A_M = 940 ft^2

Proposed Surface Area A= 969 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = N/A :1

Diameter of Underdrain 6 inches

Longitudinal Slope of Site (3% maximum) 0 %

6" Check Dam Spacing 0 feet

Describe Vegetation: Shrubs

Notes:

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

NOAA Atlas 14, Volume 6, Version 2
Location name: Riverside, California, USA*
Latitude: 33.958°, Longitude: -117.311°
Elevation: 1347.79 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.092** (0.077-0.112)	**0.120** (0.100-0.145)	**0.157** (0.131-0.191)	**0.188** (0.155-0.231)	**0.232** (0.185-0.295)	**0.267** (0.208-0.346)	**0.303** (0.230-0.403)	**0.341** (0.252-0.468)	**0.395** (0.279-0.565)	**0.439** (0.299-0.650)
10-min	**0.132** (0.110-0.160)	**0.172** (0.143-0.208)	**0.225** (0.187-0.274)	**0.270** (0.223-0.331)	**0.333** (0.265-0.422)	**0.382** (0.298-0.496)	**0.434** (0.330-0.578)	**0.489** (0.361-0.670)	**0.566** (0.400-0.810)	**0.629** (0.428-0.932)
15-min	**0.160** (0.133-0.193)	**0.208** (0.173-0.252)	**0.272** (0.226-0.331)	**0.327** (0.269-0.400)	**0.402** (0.320-0.511)	**0.462** (0.360-0.600)	**0.525** (0.399-0.699)	**0.592** (0.436-0.811)	**0.685** (0.484-0.980)	**0.760** (0.518-1.13)
30-min	**0.240** (0.200-0.291)	**0.312** (0.260-0.378)	**0.409** (0.340-0.498)	**0.491** (0.404-0.602)	**0.605** (0.481-0.767)	**0.695** (0.541-0.902)	**0.789** (0.599-1.05)	**0.889** (0.656-1.22)	**1.03** (0.727-1.47)	**1.14** (0.779-1.69)
60-min	**0.348** (0.291-0.422)	**0.453** (0.378-0.549)	**0.594** (0.494-0.722)	**0.713** (0.587-0.874)	**0.878** (0.699-1.11)	**1.01** (0.786-1.31)	**1.15** (0.870-1.53)	**1.29** (0.952-1.77)	**1.50** (1.06-2.14)	**1.66** (1.13-2.46)
2-hr	**0.498** (0.416-0.603)	**0.640** (0.533-0.776)	**0.828** (0.688-1.01)	**0.984** (0.811-1.21)	**1.20** (0.954-1.52)	**1.37** (1.06-1.77)	**1.54** (1.17-2.05)	**1.72** (1.27-2.36)	**1.97** (1.39-2.82)	**2.17** (1.48-3.21)
3-hr	**0.607** (0.506-0.734)	**0.776** (0.647-0.941)	**1.00** (0.831-1.22)	**1.19** (0.976-1.45)	**1.44** (1.14-1.83)	**1.64** (1.27-2.12)	**1.84** (1.39-2.44)	**2.05** (1.51-2.80)	**2.33** (1.65-3.34)	**2.56** (1.75-3.80)
6-hr	**0.833** (0.695-1.01)	**1.07** (0.887-1.29)	**1.37** (1.14-1.66)	**1.62** (1.33-1.98)				**2.76** (2.04-3.78)	**3.14** (2.22-4.49)	**3.43** (2.34-5.09)
12-hr	**1.09** (0.913-1.32)	**1.41** (1.17-1.71)	**1.82** (1.51-2.21)	**2.15** (1.78-2.64)				**3.69** (2.72-5.05)	**4.18** (2.96-5.99)	**4.57** (3.12-6.78)
24-hr	**1.45** (1.28-1.67)	**1.89** (1.67-2.18)	**2.46** (2.17-2.85)	**2.93** (2.57-3.42)	**3.57** (3.02-4.30)	**4.06** (3.37-5.00)	**4.56** (3.69-5.74)	**5.08** (4.00-6.57)	**5.77** (4.37-7.78)	**6.32** (4.62-8.80)
2-day	**1.75** (1.55-2.02)	**2.32** (2.05-2.68)	**3.07** (2.71-3.55)	**3.68** (3.22-4.29)	**4.51** (3.82-5.44)	**5.16** (4.28-6.35)	**5.82** (4.71-7.33)	**6.50** (5.12-8.41)	**7.42** (5.62-10.0)	**8.14** (5.96-11.3)
3-day	**1.88** (1.66-2.17)	**2.53** (2.23-2.92)	**3.38** (2.98-3.91)	**4.08** (3.57-4.76)	**5.04** (4.26-6.07)	**5.78** (4.79-7.11)	**6.54** (5.30-8.24)	**7.33** (5.78-9.49)	**8.40** (6.36-11.3)	**9.25** (6.77-12.9)
4-day	**2.03** (1.80-2.34)	**2.76** (2.44-3.18)	**3.71** (3.27-4.30)	**4.50** (3.93-5.25)	**5.58** (4.72-6.72)	**6.42** (5.33-7.90)	**7.28** (5.90-9.17)	**8.18** (6.45-10.6)	**9.41** (7.12-12.7)	**10.4** (7.59-14.5)
7-day	**2.34** (2.07-2.70)	**3.20** (2.83-3.70)	**4.35** (3.83-5.03)	**5.30** (4.63-6.18)	**6.60** (5.59-7.95)	**7.62** (6.32-9.37)	**8.66** (7.02-10.9)	**9.75** (7.69-12.6)	**11.3** (8.52-15.2)	**12.4** (9.10-17.3)
10-day	**2.53** (2.24-2.91)	**3.48** (3.08-4.02)	**4.76** (4.19-5.51)	**5.81** (5.08-6.78)	**7.27** (6.16-8.76)	**8.41** (6.98-10.3)	**9.58** (7.76-12.1)	**10.8** (8.52-14.0)	**12.5** (9.46-16.8)	**13.8** (10.1-19.3)
20-day	**3.06** (2.71-3.53)	**4.25** (3.76-4.91)	**5.86** (5.17-6.78)	**7.20** (6.30-8.40)	**9.07** (7.68-10.9)	**10.5** (8.75-13.0)	**12.1** (9.78-15.2)	**13.7** (10.8-17.7)	**15.9** (12.1-21.5)	**17.7** (13.0-24.7)
30-day	**3.64** (3.22-4.20)	**5.07** (4.48-5.85)	**6.99** (6.16-8.09)	**8.61** (7.53-10.0)	**10.9** (9.20-13.1)	**12.7** (10.5-15.6)	**14.5** (11.8-18.3)	**16.5** (13.0-21.4)	**19.3** (14.6-26.0)	**21.6** (15.8-30.0)
45-day	**4.34** (3.84-5.01)	**6.00** (5.31-6.93)	**8.26** (7.29-9.57)	**10.2** (8.90-11.9)	**12.9** (10.9-15.5)	**15.0** (12.5-18.5)	**17.3** (14.0-21.8)	**19.7** (15.5-25.5)	**23.1** (17.5-31.2)	**25.9** (18.9-36.1)
60-day	**5.07** (4.48-5.84)	**6.94** (6.13-8.01)	**9.50** (8.38-11.0)	**11.7** (10.2-13.6)	**14.8** (12.5-17.8)	**17.2** (14.3-21.2)	**19.8** (16.1-25.0)	**22.6** (17.8-29.3)	**26.6** (20.1-35.8)	**29.8** (21.8-41.6)

1.89 INCHES
FOR A 2-YEAR 24 HOUR
STORM EVENT

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

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

Please refer to NOAA Atlas 14 document for more information.

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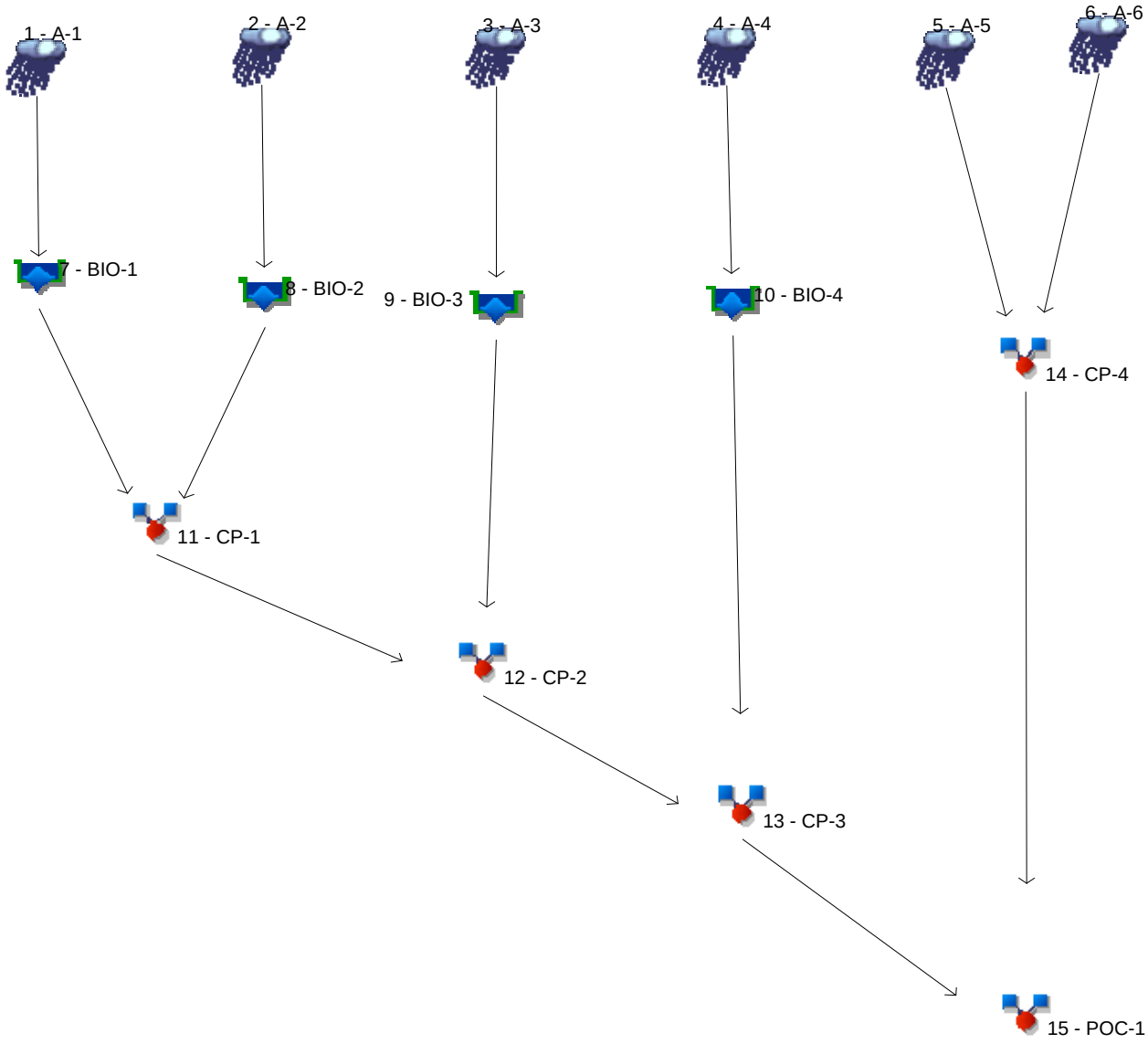
Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	Manual	A-1
2	Manual	A-2
3	Manual	A-3
4	Manual	A-4
5	Manual	A-5
6	Manual	A-6
7	Reservoir	BIO-1
8	Reservoir	BIO-2
9	Reservoir	BIO-3
10	Reservoir	BIO-4
11	Combine	CP-1
12	Combine	CP-2
13	Combine	CP-3
14	Combine	CP-4
15	Combine	POC-1

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	0.405	1	6	146	------	------	------	A-1
2	Rational	0.795	1	7	334	------	------	------	A-2
3	Rational	0.224	1	5	67	------	------	------	A-3
4	Rational	1.531	1	5	459	------	------	------	A-4
5	Rational	0.396	1	5	119	------	------	------	A-5
6	Rational	0.345	1	5	104	------	------	------	A-6
7	Reservoir	0.265	1	8	145	1	100.58	64.4	BIO-1
8	Reservoir	0.348	1	11	333	2	100.85	194	BIO-2
9	Reservoir	0.031	1	9	65	3	100.16	58.5	BIO-3
10	Reservoir	0.719	1	8	459	4	103.16	236	BIO-4
11	Combine	0.742	1	5	222	5, 6,	------	------	CP-4
12	Combine	0.591	1	9	478	7, 8,	------	------	CP-1
13	Combine	0.622	1	9	543	9, 12	------	------	CP-2
14	Combine	1.323	1	8	1,002	10, 13	------	------	CP-3
15	Combine	1.709	1	7	1,224	11, 14	------	------	P.O.C
16	Rational	3.228	1	9	1,743	------	------	------	EX-1

PROPOSED DISCHARGE CONDITION

EXISTING DISCHARGE CONDITION

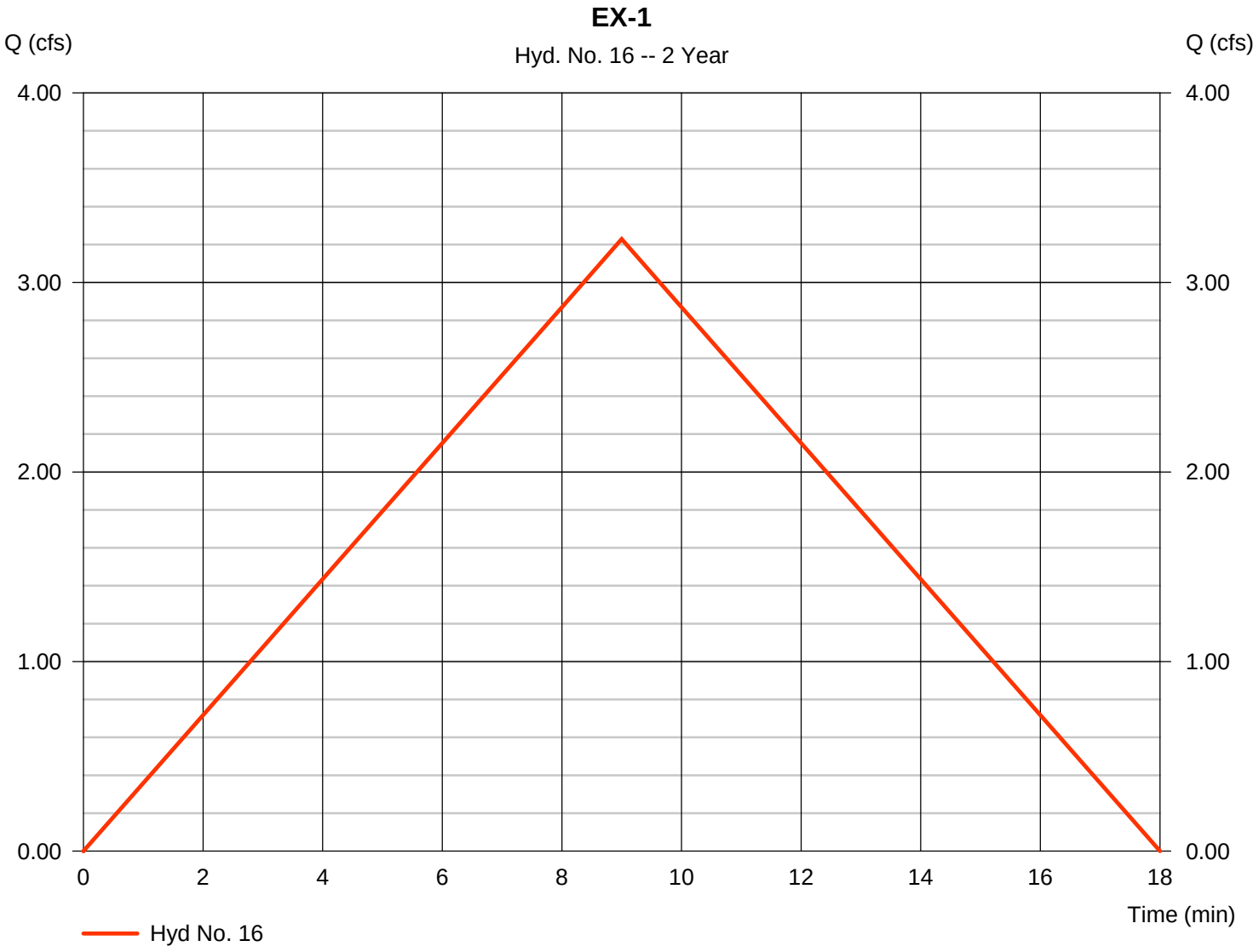
Hydrograph Report

Hyd. No. 16

EX-1

EXISTING PEAK DISCHARGE

Hydrograph type	= Rational	Peak discharge	= 3.228 cfs
Storm frequency	= 2 yrs	Time to peak	= 9 min
Time interval	= 1 min	Hyd. volume	= 1,743 cuft
Drainage area	= 2.190 ac	Runoff coeff.	= 0.79
Intensity	= 1.866 in/hr	Tc by User	= 9.00 min
IDF Curve	= SampleFHA.idf	Asc/Rec limb fact	= 1/1

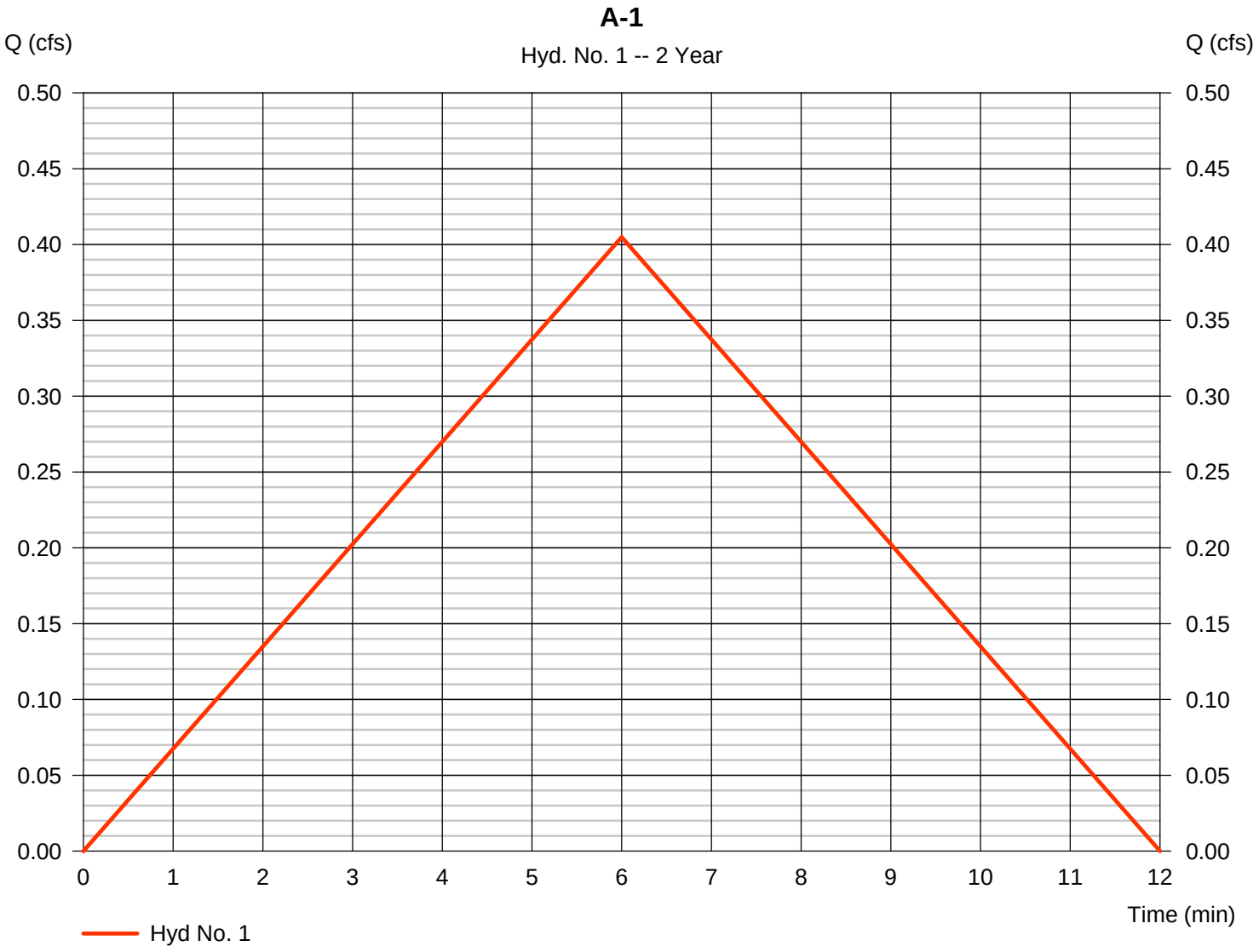


Hydrograph Report

Hyd. No. 1

A-1

Hydrograph type	=	Rational	Peak discharge	=	0.405 cfs
Storm frequency	=	2 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	146 cuft
Drainage area	=	0.220 ac	Runoff coeff.	=	0.86
Intensity	=	2.140 in/hr	Tc by User	=	6.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1

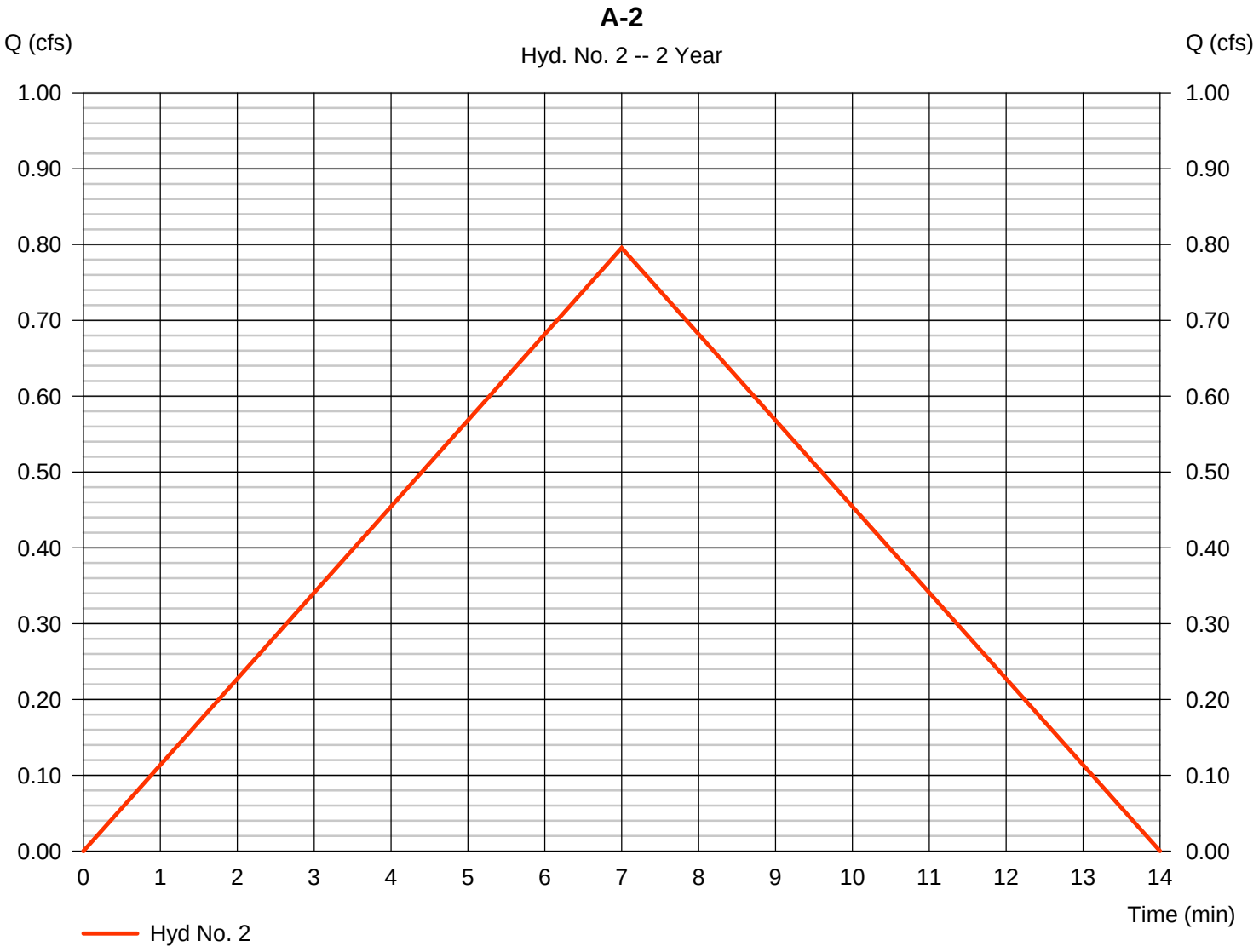


Hydrograph Report

Hyd. No. 2

A-2

Hydrograph type	=	Rational	Peak discharge	=	0.795 cfs
Storm frequency	=	2 yrs	Time to peak	=	7 min
Time interval	=	1 min	Hyd. volume	=	334 cuft
Drainage area	=	0.470 ac	Runoff coeff.	=	0.83
Intensity	=	2.039 in/hr	Tc by User	=	7.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1

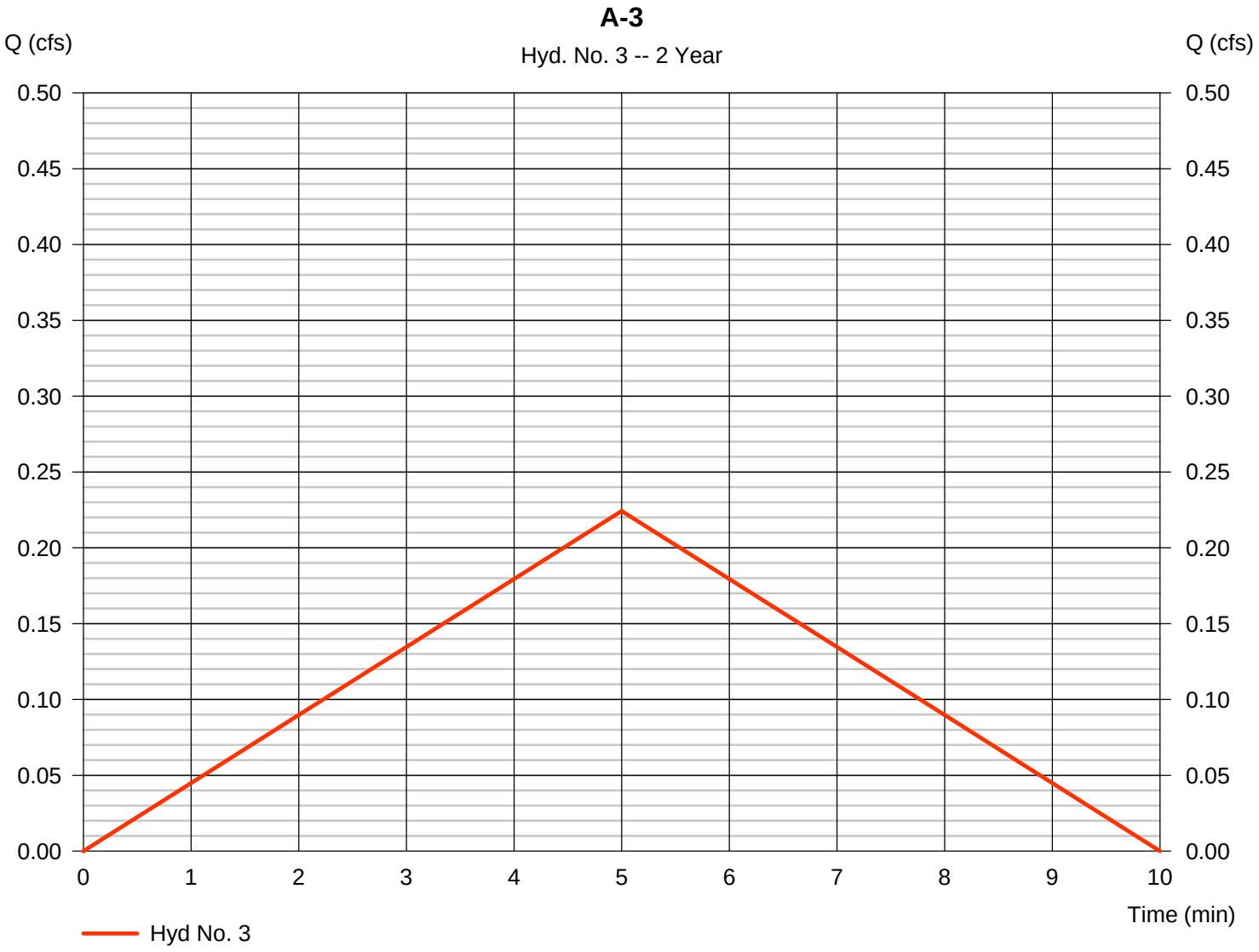


Hydrograph Report

Hyd. No. 3

A-3

Hydrograph type	=	Rational	Peak discharge	=	0.224 cfs
Storm frequency	=	2 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	67 cuft
Drainage area	=	0.120 ac	Runoff coeff.	=	0.83
Intensity	=	2.252 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1

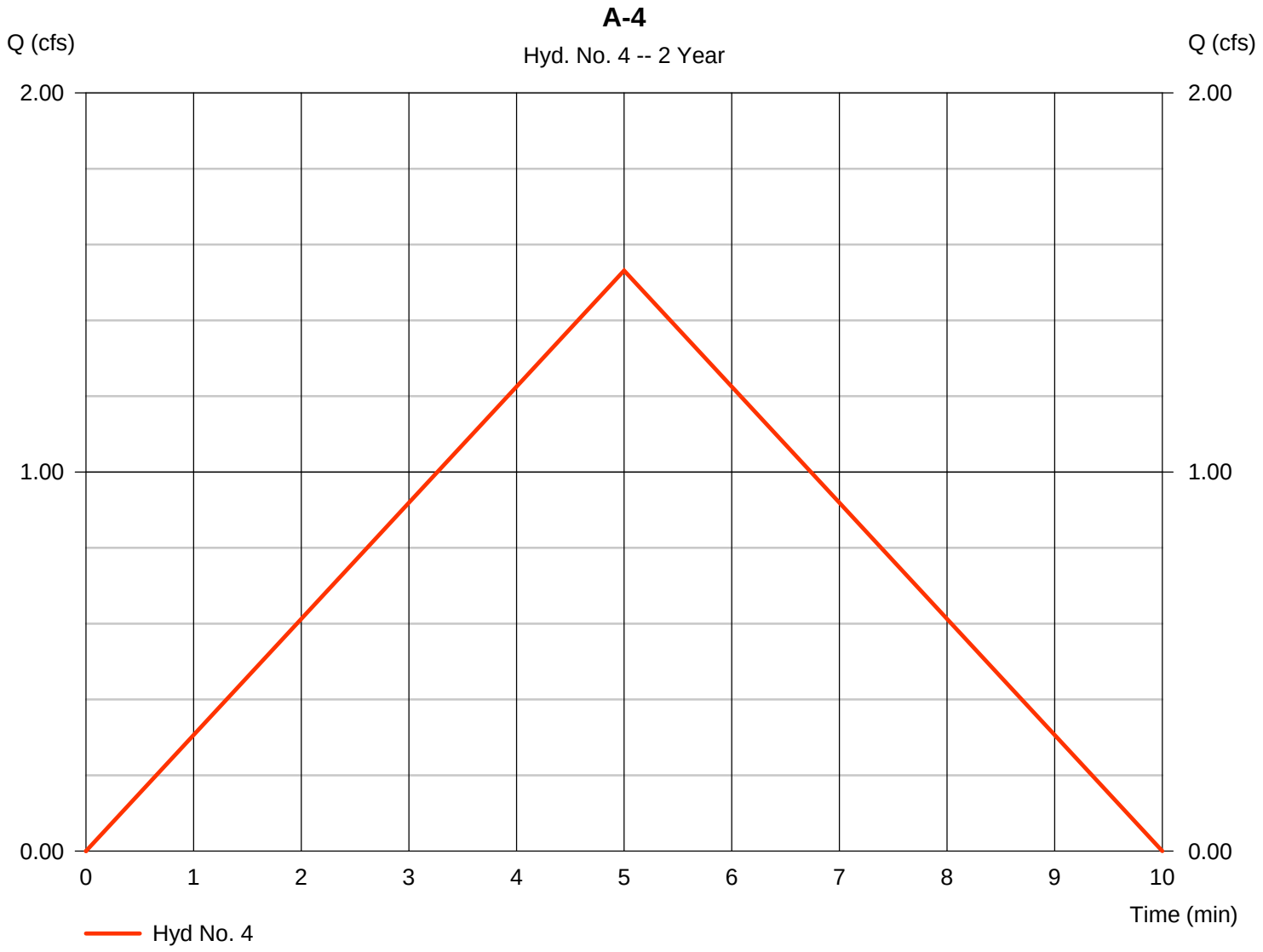


Hydrograph Report

Hyd. No. 4

A-4

Hydrograph type	=	Rational	Peak discharge	=	1.531 cfs
Storm frequency	=	2 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	459 cuft
Drainage area	=	0.850 ac	Runoff coeff.	=	0.8
Intensity	=	2.252 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1

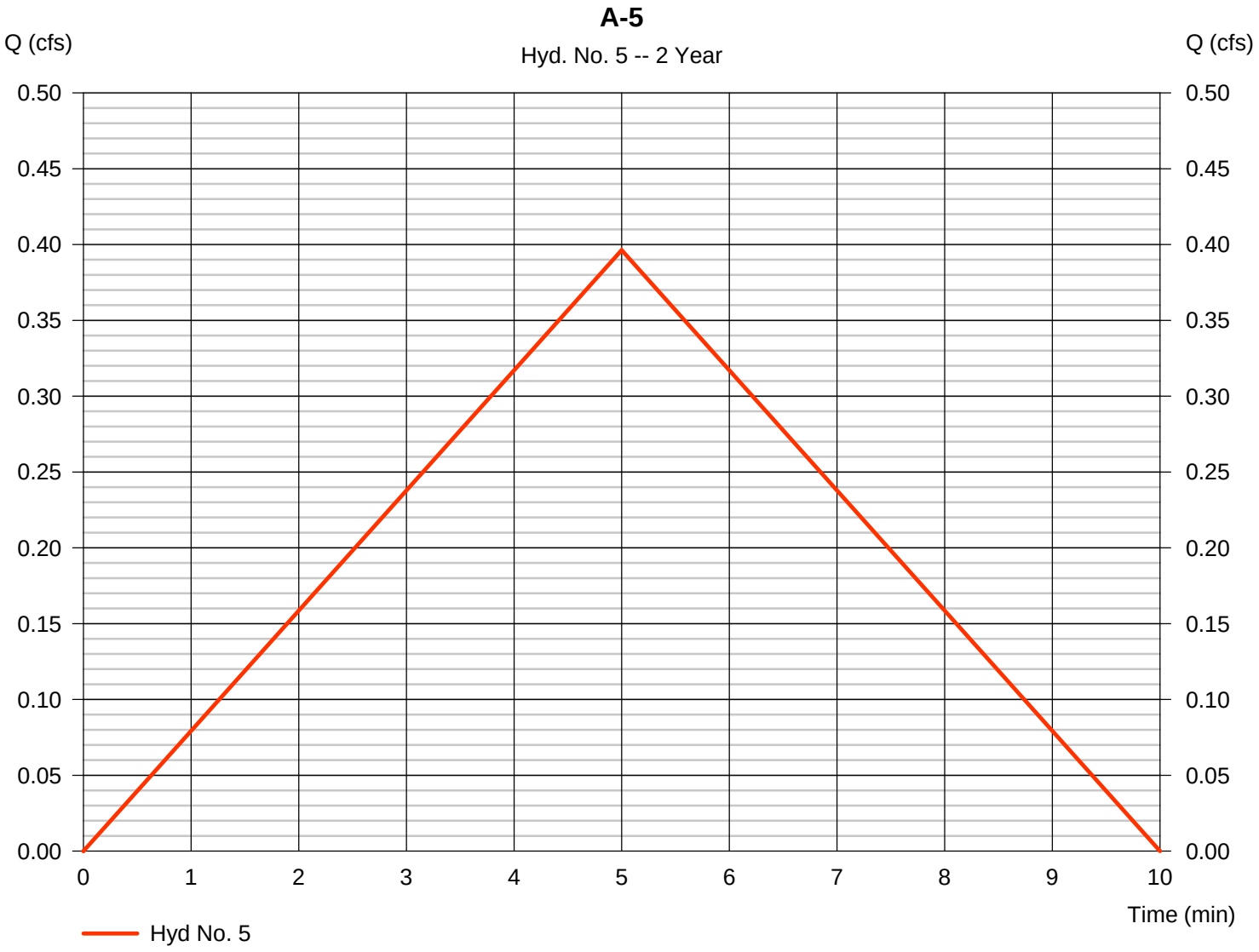


Hydrograph Report

Hyd. No. 5

A-5

Hydrograph type	=	Rational	Peak discharge	=	0.396 cfs
Storm frequency	=	2 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	119 cuft
Drainage area	=	0.320 ac	Runoff coeff.	=	0.55
Intensity	=	2.252 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1

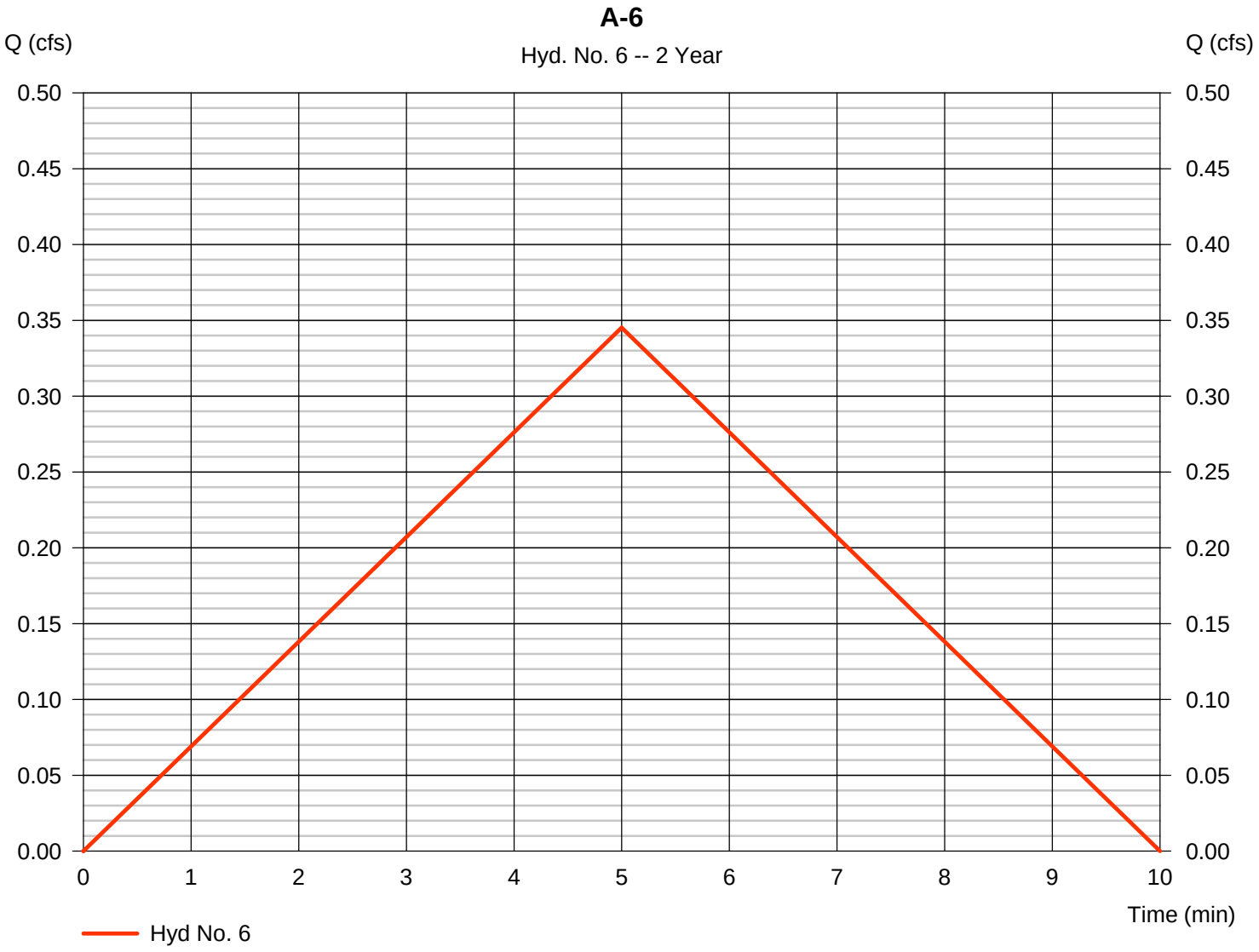


Hydrograph Report

Hyd. No. 6

A-6

Hydrograph type	=	Rational	Peak discharge	=	0.345 cfs
Storm frequency	=	2 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	104 cuft
Drainage area	=	0.210 ac	Runoff coeff.	=	0.73
Intensity	=	2.252 in/hr	Tc by User	=	5.00 min
IDF Curve	=	SampleFHA.idf	Asc/Rec limb fact	=	1/1



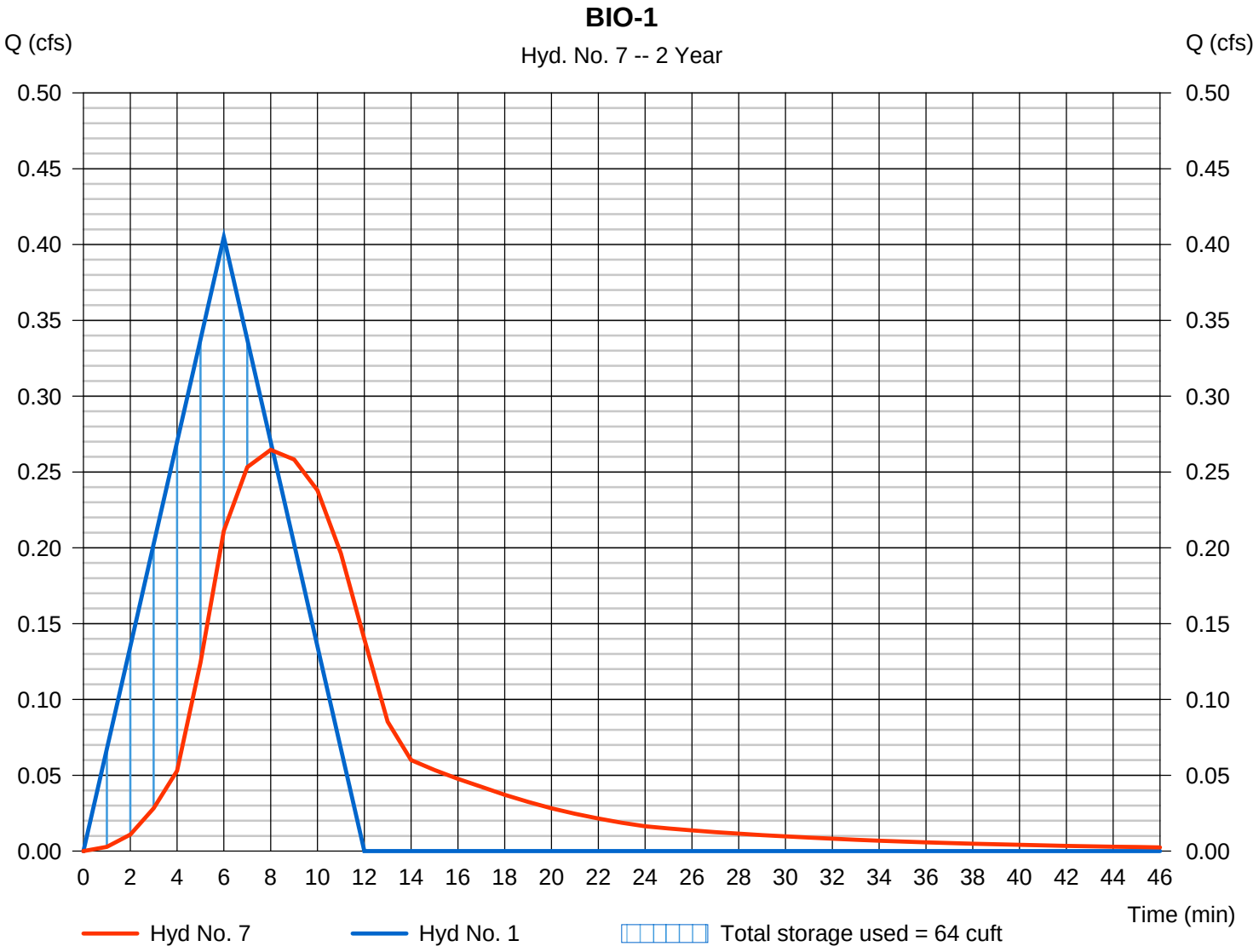
Hydrograph Report

Hyd. No. 7

BIO-1

Hydrograph type	=	Reservoir	Peak discharge	=	0.265 cfs
Storm frequency	=	2 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	145 cuft
Inflow hyd. No.	=	1 - A-1	Max. Elevation	=	100.58 ft
Reservoir name	=	BIO-1	Max. Storage	=	64 cuft

Storage Indication method used.



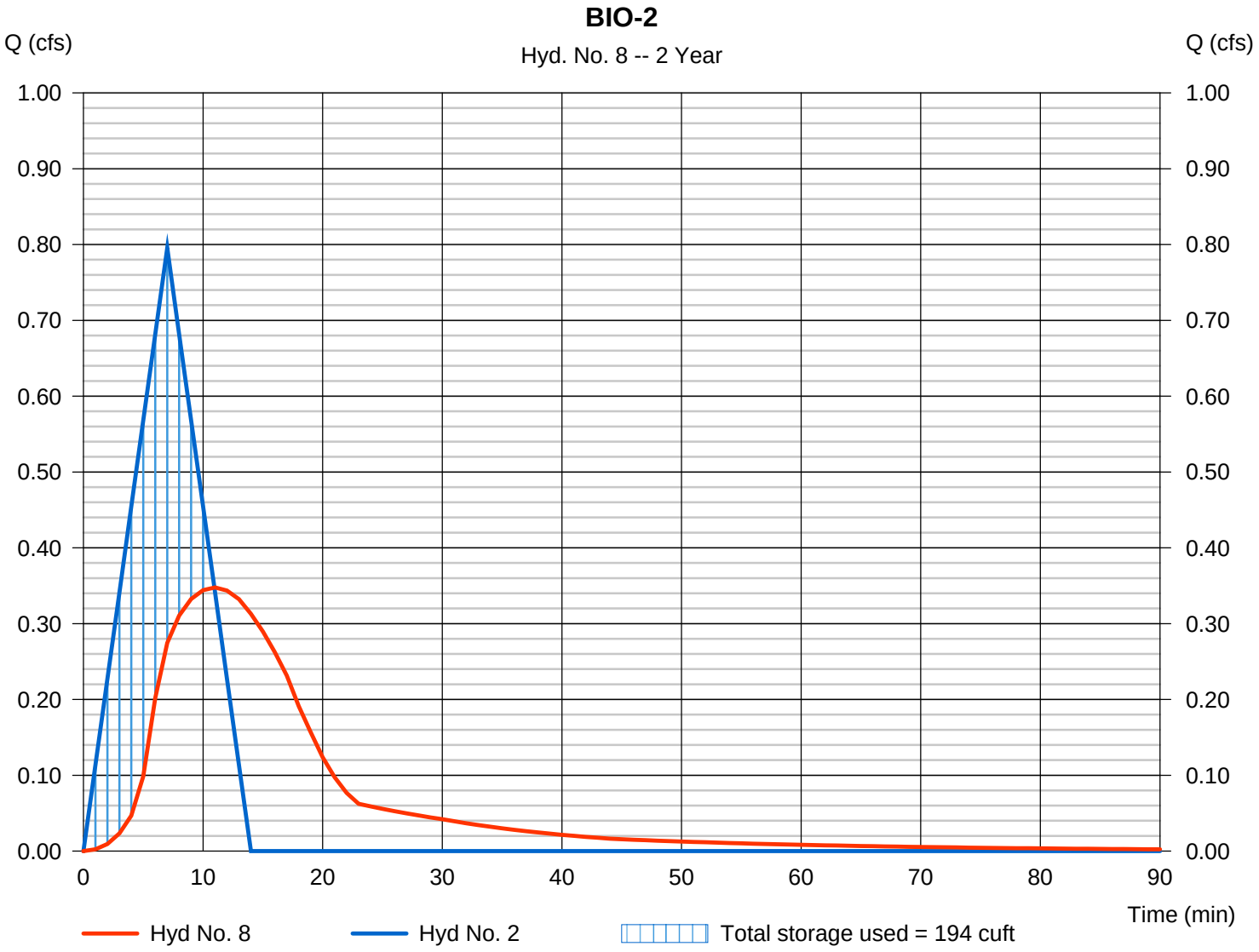
Hydrograph Report

Hyd. No. 8

BIO-2

Hydrograph type	=	Reservoir	Peak discharge	=	0.348 cfs
Storm frequency	=	2 yrs	Time to peak	=	11 min
Time interval	=	1 min	Hyd. volume	=	333 cuft
Inflow hyd. No.	=	2 - A-2	Max. Elevation	=	100.85 ft
Reservoir name	=	BIO-2	Max. Storage	=	194 cuft

Storage Indication method used.



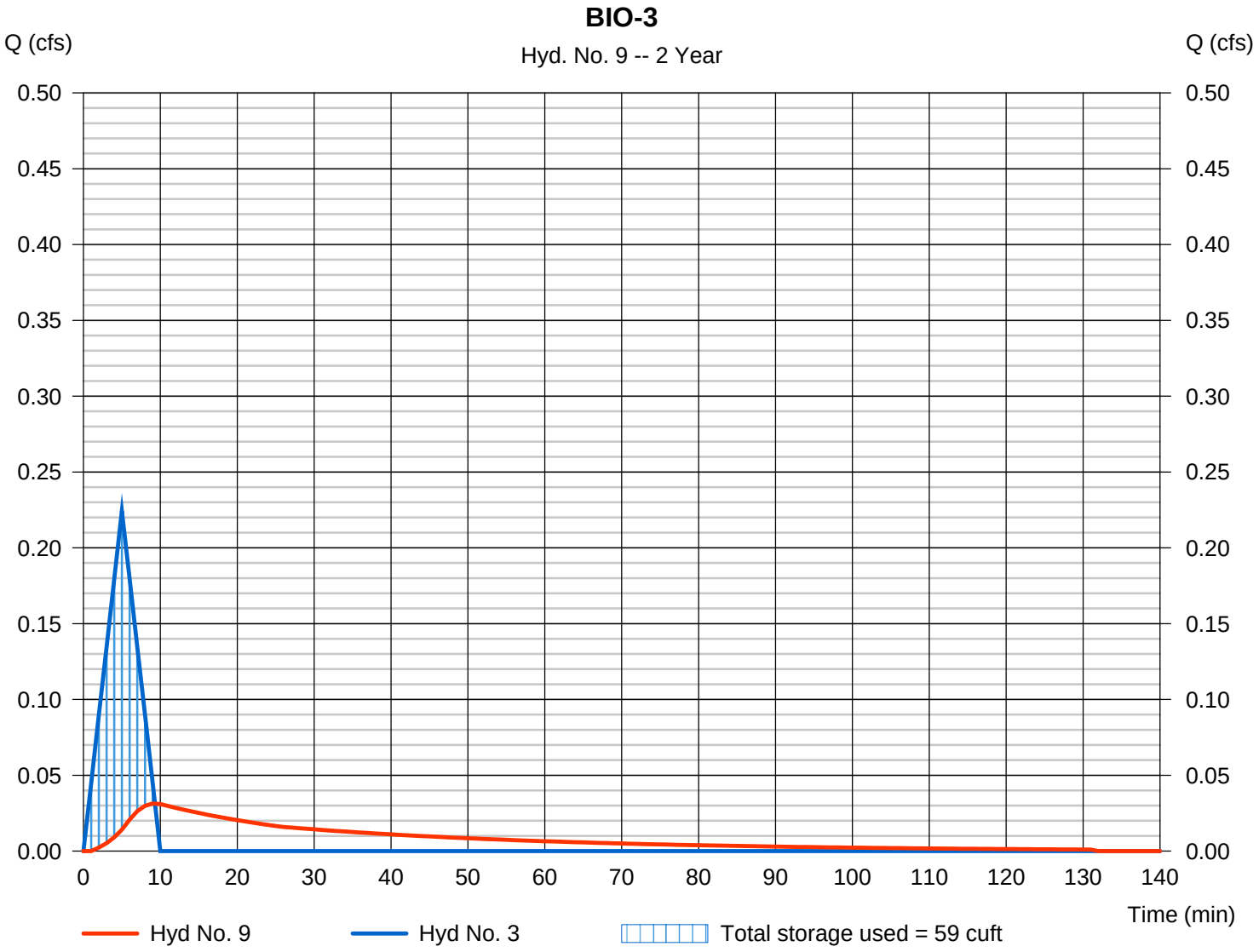
Hydrograph Report

Hyd. No. 9

BIO-3

Hydrograph type	=	Reservoir	Peak discharge	=	0.031 cfs
Storm frequency	=	2 yrs	Time to peak	=	9 min
Time interval	=	1 min	Hyd. volume	=	65 cuft
Inflow hyd. No.	=	3 - A-3	Max. Elevation	=	100.16 ft
Reservoir name	=	BIO-3	Max. Storage	=	59 cuft

Storage Indication method used.



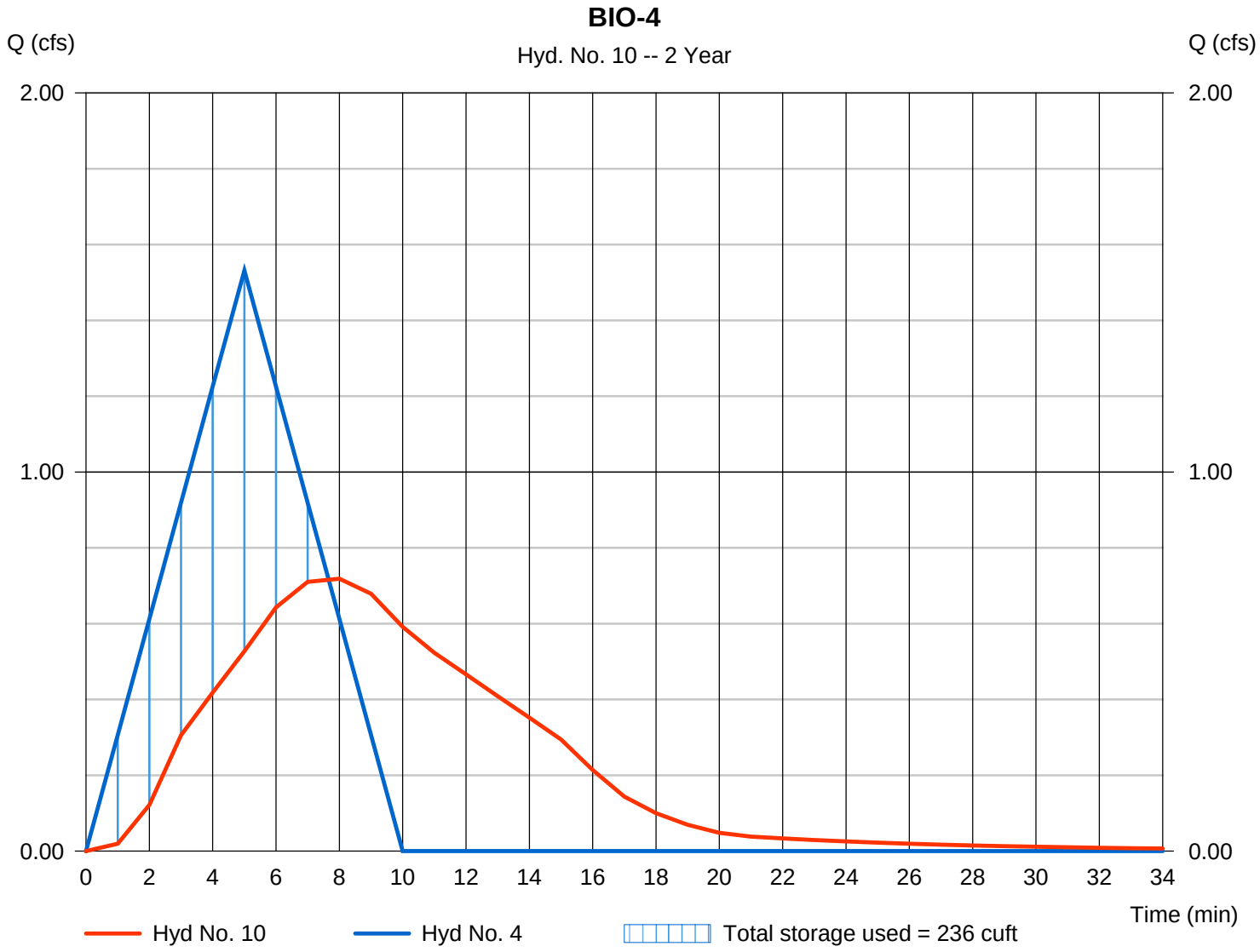
Hydrograph Report

Hyd. No. 10

BIO-4

Hydrograph type	=	Reservoir	Peak discharge	=	0.719 cfs
Storm frequency	=	2 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	459 cuft
Inflow hyd. No.	=	4 - A-4	Max. Elevation	=	103.16 ft
Reservoir name	=	BIO-4	Max. Storage	=	236 cuft

Storage Indication method used.

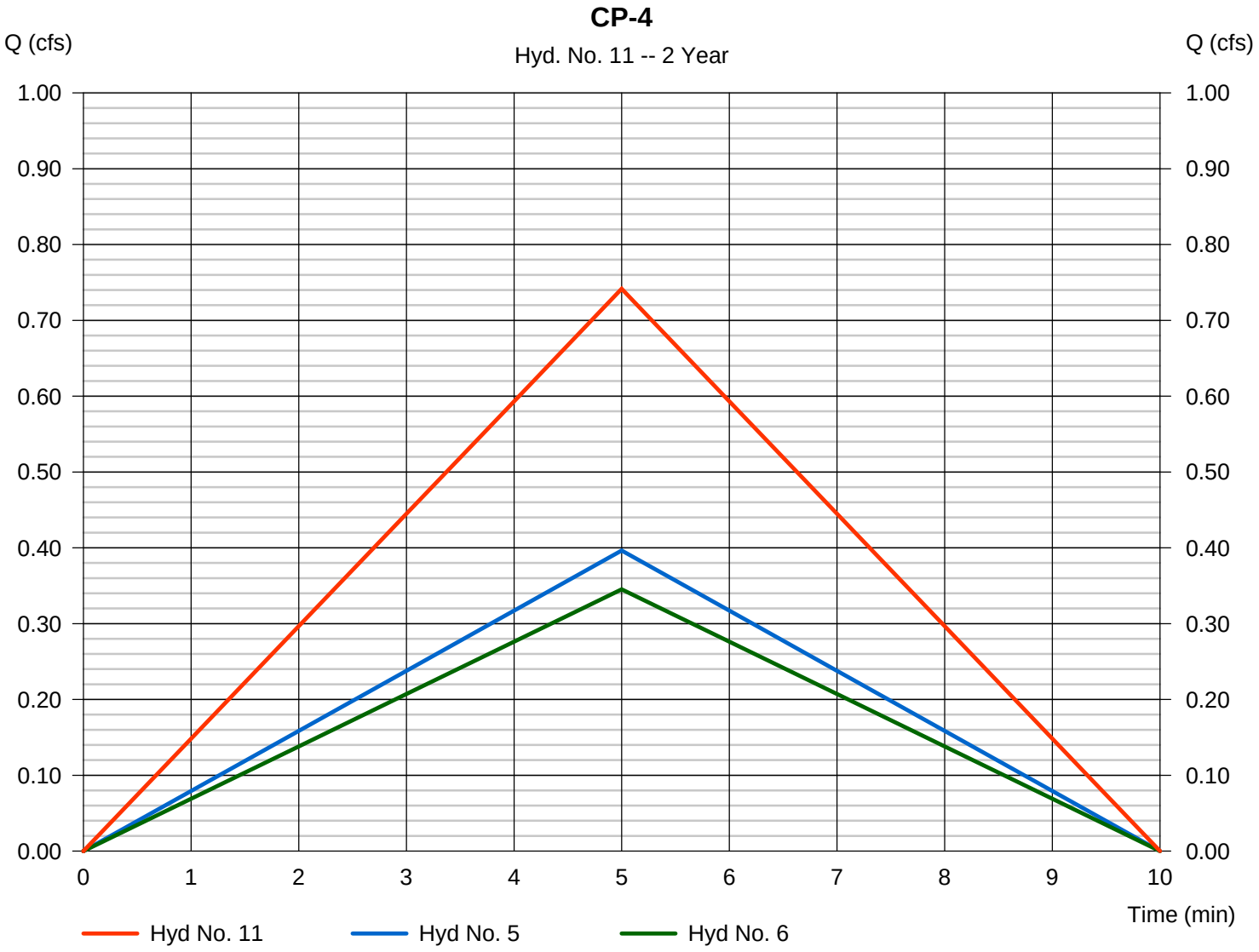


Hydrograph Report

Hyd. No. 11

CP-4

Hydrograph type	= Combine	Peak discharge	= 0.742 cfs
Storm frequency	= 2 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 222 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.530 ac

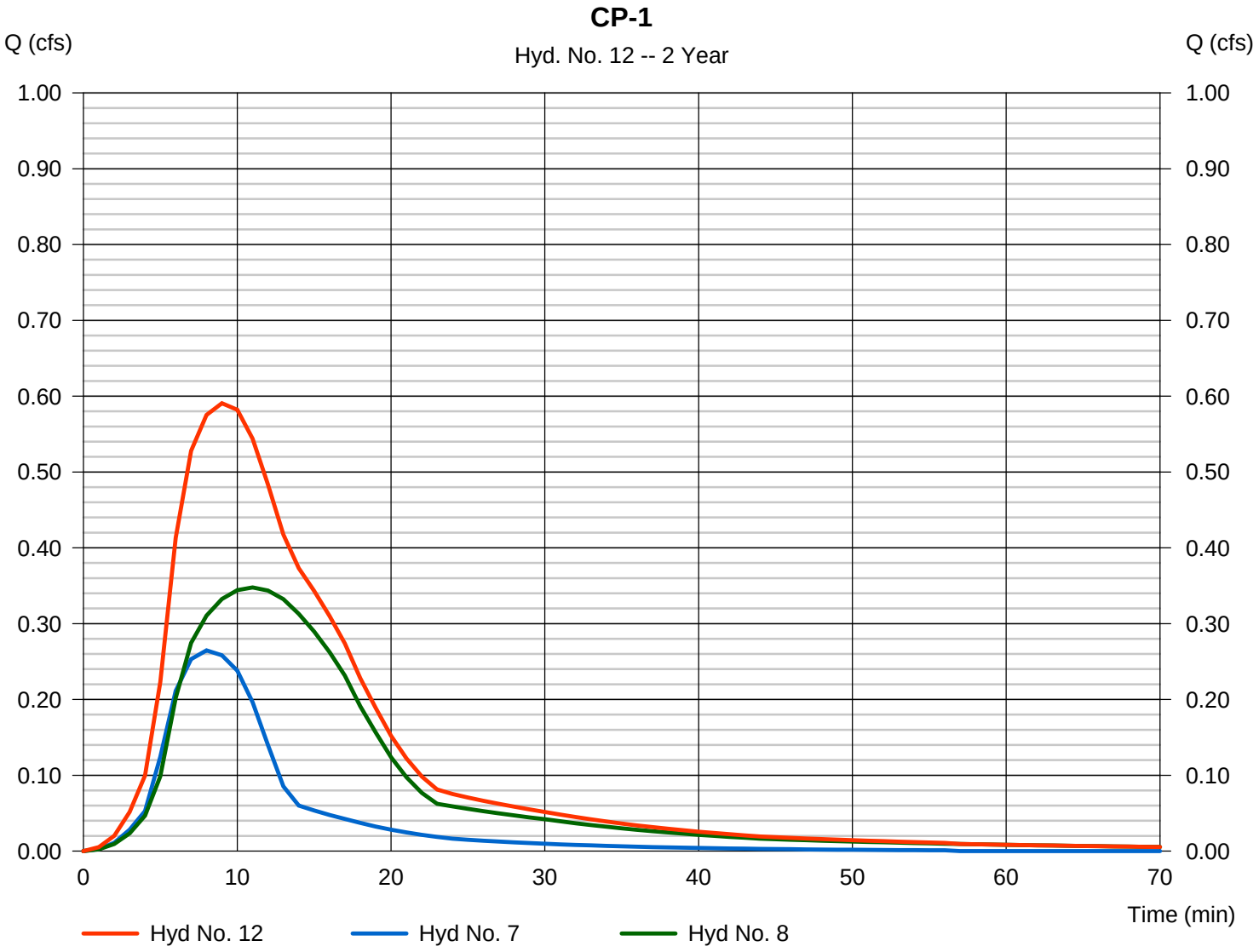


Hydrograph Report

Hyd. No. 12

CP-1

Hydrograph type	=	Combine	Peak discharge	=	0.591 cfs
Storm frequency	=	2 yrs	Time to peak	=	9 min
Time interval	=	1 min	Hyd. volume	=	478 cuft
Inflow hyds.	=	7, 8	Contrib. drain. area	=	0.000 ac

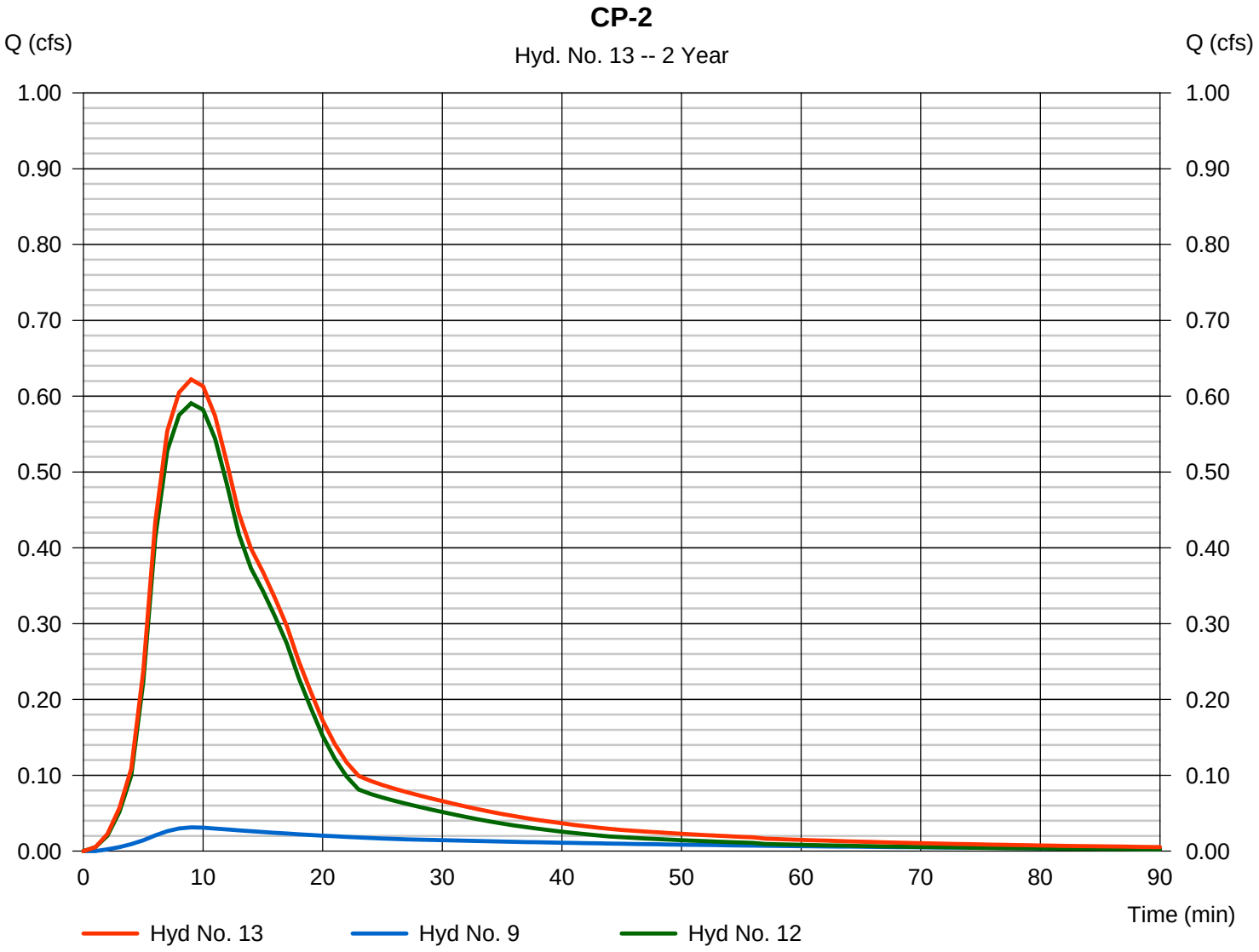


Hydrograph Report

Hyd. No. 13

CP-2

Hydrograph type	=	Combine	Peak discharge	=	0.622 cfs
Storm frequency	=	2 yrs	Time to peak	=	9 min
Time interval	=	1 min	Hyd. volume	=	543 cuft
Inflow hyds.	=	9, 12	Contrib. drain. area	=	0.000 ac

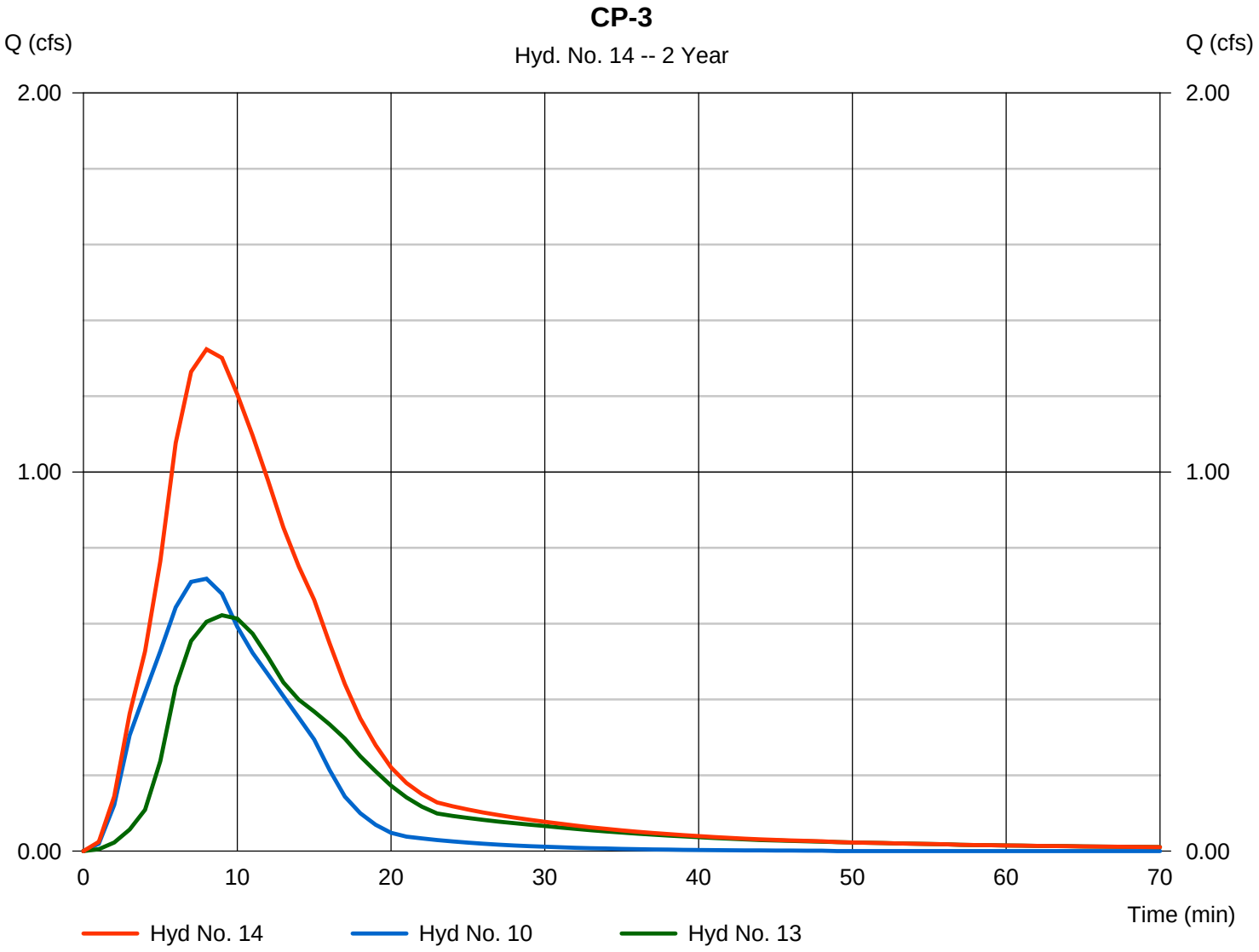


Hydrograph Report

Hyd. No. 14

CP-3

Hydrograph type	=	Combine	Peak discharge	=	1.323 cfs
Storm frequency	=	2 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	1,002 cuft
Inflow hyds.	=	10, 13	Contrib. drain. area	=	0.000 ac



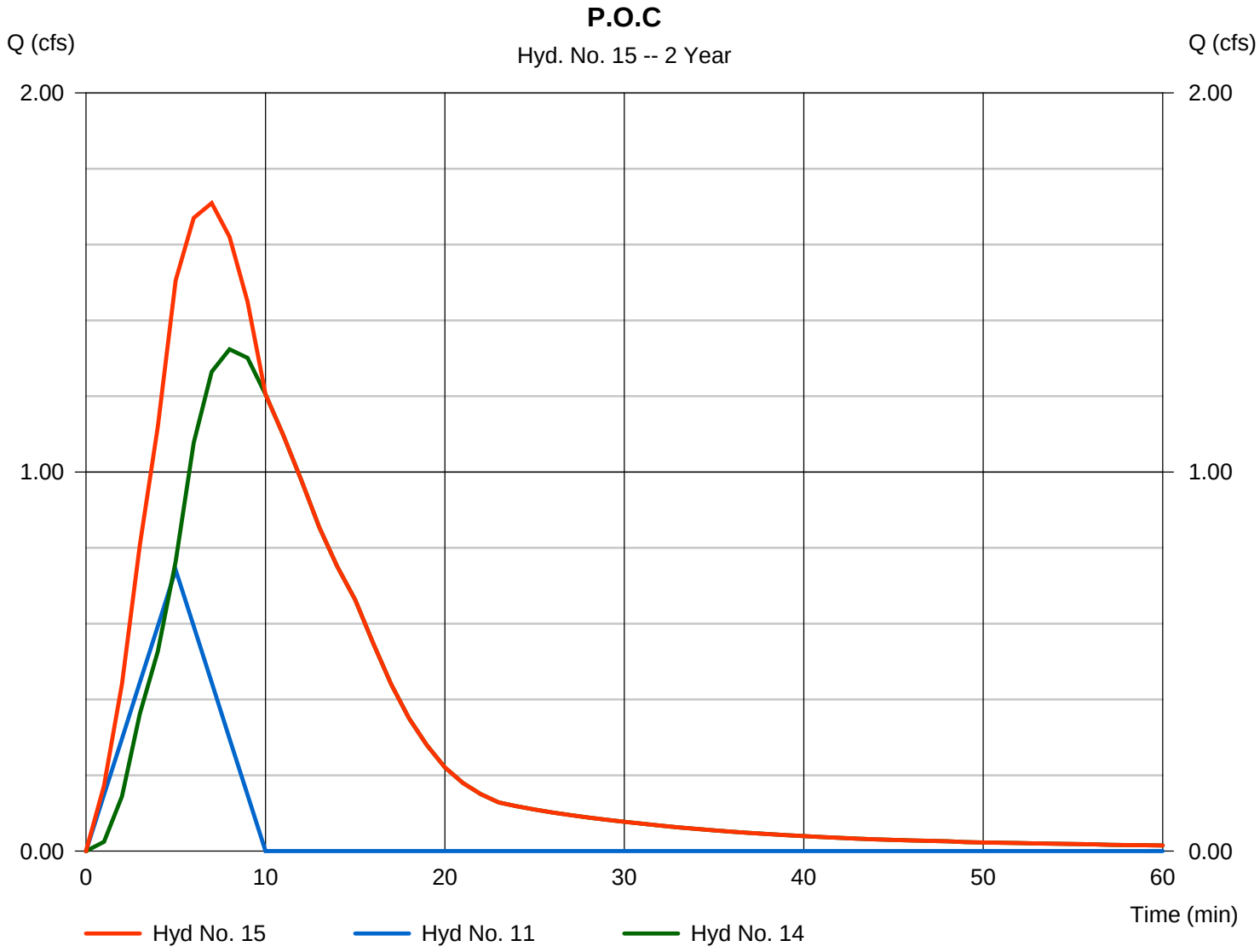
Hydrograph Report

Hyd. No. 15

P.O.C

PROPOSED DISCHARGE WITH FLOW CONTROL MITIGATION

Hydrograph type	=	Combine	Peak discharge	= 1.709 cfs
Storm frequency	=	2 yrs	Time to peak	= 7 min
Time interval	=	1 min	Hyd. volume	= 1,224 cuft
Inflow hyds.	=	11, 14	Contrib. drain. area	= 0.000 ac



Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

How to use this worksheet (also see instructions in Section G of the WQMP Template):

1. Review Column 1 and identify which of these potential sources of stormwater pollutants apply to your site. Check each box that applies.
2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your WQMP Exhibit.
3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in your WQMP. Use the format shown in Table G.1on page 23 of this WQMP Template. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternative BMPs for those shown here.

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	**... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE**		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on WQMP Drawings**	**3** **Permanent Controls—List in WQMP Table and Narrative**	**4** **Operational BMPs—Include in WQMP Table and Narrative**
☒ **A.** On-site storm drain inlets	☒ Locations of inlets.	☒ Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.	☒ Maintain and periodically repaint or replace inlet markings. ☒ Provide stormwater pollution prevention information to new site owners, lessees, or operators. ☒ See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com ☐ Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."
☐ **B.** Interior floor drains and elevator shaft sump pumps		☐ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	☐ Inspect and maintain drains to prevent blockages and overflow.
☐ **C.** Interior parking garages		☐ State that parking garage floor drains will be plumbed to the sanitary sewer.	☐ Inspect and maintain drains to prevent blockages and overflow.

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on WQMP Drawings**	**3** **Permanent Controls—List in WQMP Table and Narrative**	**4** **Operational BMPs—Include in WQMP Table and Narrative**
☐ **D1.** Need for future indoor & structural pest control		☐ Note building design features that discourage entry of pests.	☐ Provide Integrated Pest Management information to owners, lessees, and operators.
☒ **D2.** Landscape/ Outdoor Pesticide Use	☐ Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained. ☐ Show self-retaining landscape areas, if any. ☐ Show stormwater treatment and hydrograph modification management BMPs. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)	State that final landscape plans will accomplish all of the following. ☐ Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. ☒ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. ☒ Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. ☒ Consider using pest-resistant plants, especially adjacent to hardscape. To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	☒ Maintain landscaping using minimum or no pesticides. ☒ See applicable operational BMPs in "What you should know for.....Landscape and Gardening" at http://rcflood.org/stormwater/Error! Hyperlink reference not valid. ☒ Provide IPM information to new owners, lessees and operators.

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Show on WQMP Drawings**	3 **Permanent Controls—List in WQMP Table and Narrative**	4 **Operational BMPs—Include in WQMP Table and Narrative**
☐ **E.** Pools, spas, ponds, decorative fountains, and other water features.	☒ Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)	If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	☐ See applicable operational BMPs in "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at http://rcflood.org/stormwater/
☒ **F.** Food service	☒ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ☒ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	☒ Describe the location and features of the designated cleaning area. ☒ Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.	☐ See the brochure, "The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries" at http://rcflood.org/stormwater/ Provide this brochure to new site owners, lessees, and operators.
☐ **G.** Refuse areas	☐ Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ☒ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area. ☐ Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	☐ State how site refuse will be handled and provide supporting detail to what is shown on plans. ☒ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	☒ State how the following will be implemented: Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Show on WQMP Drawings**	3 **Permanent Controls—List in WQMP Table and Narrative**	4 **Operational BMPs—Include in WQMP Table and Narrative**
❑ **H.** Industrial processes.	❑ Show process area.	❑ If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."	❑ See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com See the brochure "Industrial & Commercial Facilities Best Management Practices for: Industrial, Commercial Facilities" at http://rcflood.org/stormwater/

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on WQMP Drawings**	**3** **Permanent Controls—List in WQMP Table and Narrative**	**4** **Operational BMPs—Include in WQMP Table and Narrative**
❑ **I.** Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)	❑ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area. ❑ Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults. ❑ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for: ▪ Hazardous Waste Generation ▪ Hazardous Materials Release Response and Inventory ▪ California Accidental Release (CalARP) ▪ Aboveground Storage Tank ▪ Uniform Fire Code Article 80 Section 103(b) & (c) 1991 ▪ Underground Storage Tank www.cchealth.org/groups/hazmat/	❑ See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

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1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Show on WQMP Drawings**	3 **Permanent Controls—List in WQMP Table and Narrative**	4 **Operational BMPs—Include in WQMP Table and Narrative**
☒ **J.** Vehicle and Equipment Cleaning	☐ Show on drawings as appropriate: (1) Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	☐ If a car wash area is not provided, describe any measures taken to discourage on-site car washing and explain how these will be enforced.	Describe operational measures to implement the following (if applicable): ☒ Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/ ☐ Car dealerships and similar may rinse cars with water only.

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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☐ **K.** Vehicle/Equipment Repair and Maintenance	☐ Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater. ☐ Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas. ☐ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.	☐ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ☐ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ☐ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the Stormwater Control Plan, note that all of the following restrictions apply to use the site: ☐ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains. ☐ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately. ☐ No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment. Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations". Brochure can be found at http://rcflood.org/stormwater/ Refer to Outdoor Cleaning Activities and Professional Mobile Service Providers for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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☒ **L.** Fuel Dispensing Areas	☒ Fueling areas[6] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable. ☒ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.		☒ The property owner shall dry sweep the fueling area routinely. ☒ See the Fact Sheet SD-30 , "Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

[6] The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Show on WQMP Drawings**	3 **Permanent Controls—List in WQMP Table and Narrative**	4 **Operational BMPs—Include in WQMP Table and Narrative**
❑ **M.** Loading Docks	❑ Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer. ❑ Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. ❑ Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.		❑ Move loaded and unloaded items indoors as soon as possible. ❑ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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☒ **N.** Fire Sprinkler Test Water		☒ Provide a means to drain fire sprinkler test water to the sanitary sewer.	☒ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
O. Miscellaneous Drain or Wash Water or Other Sources ☐ Boiler drain lines ☐ Condensate drain lines ☐ Rooftop equipment ☐ Drainage sumps ☒ Roofing, gutters, and trim. ☐ Other sources		☐ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ☐ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ☐ Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ☐ Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. ☒ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff. Include controls for other sources as specified by local reviewer.	

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Show on WQMP Drawings**	3 **Permanent Controls—List in WQMP Table and Narrative**	4 **Operational BMPs—Include in WQMP Table and Narrative**
☒ **P.** Plazas, sidewalks, and parking lots.			☒ Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Appendix 9: O&M

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

TO BE PROVIDED AT FINAL DESIGN

Appendix 10: Educational Materials

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

Help Protect Our Waterways!

Use These Guidelines For Outdoor Cleaning Activities and Wash Water Disposal

DO NOT . . . dispose of water containing soap or any other type of cleaning agent into a storm drain or water body. This is a direct violation of state and/or local regulations. Because wash water from cleaning parking areas may contain metallic brake pad dust, oil and other automotive fluids, litter, food wastes and other materials, if should never be discharged to a street, gutter or storm drain.

DO . . . dispose of small amounts of wash water from cleaning building exteriors, sidewalks or plazas onto landscaped or unpaved surfaces, provided you have the owner's permission and the discharge will not cause nuisance problems or flow into a street or storm drain.

DO . . . check with your sanitary sewer agency's policies and requirements concerning wash water disposal. Wash water from outdoor cleaning activities may be acceptable for disposal to the sanitary sewer with specific permission. See the list on the back of this flyer for phone numbers of the sanitary sewer agencies in your area.

DO . . . Understand that mobile auto detailers should divert wash water to landscaped or dirt areas. Be aware that soapy wash water may damage landscaping. Residual wash water may remain on paved surfaces to evaporate. Residues should be swept up and disposed of.

DO NOT . . . Dispose of leftover cleaning agents into the gutter. storm drain or sanitary sewer.

DO . . . understand that wash water (without soap) used to remove dust from a clean vehicle may be discharged to a street or drain. Wash water from sidewalk, plaza, and building surface cleaning may go into a street or storm drain **IF ALL** of the following conditions are met:

1. The surface being washed is free of residual oil, debris and other materials by using dry cleanup methods (i.e., sweeping, and cleaning any oil or chemical spills with rags or other absorbent materials before using water).
2. Washing is done with water only, not with soap or other cleaning materials.
3. You have not used the water to remove paint from surfaces during cleaning.

CALL 1-800-506-2555
TO REPORT ILLEGAL POLLUTING OF STORM DRAINS

or visit
www.floodcontrol.co.riverside.ca.us

USING CLEANING AGENTS:

If you must use soap, use biodegradable/ phosphate-free cleaners. Although the use of nontoxic cleaning products is strongly encouraged, do understand that these products can degrade water quality. The discharge of these products into the street, gutters, storm drain system or waterways is prohibited by local ordinances and the State Water Code. Avoid use of petroleum-based cleaning products.

When cleaning surfaces with a high-pressure washer or steam cleaning methods, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning, as compared to the use of a low-pressure hose, can remove additional materials that can contaminate local waterways.

OTHER TIPS TO HELP PROTECT OUR WATER . . .

SCREENING WASH WATER

A thorough dry cleanup before washing exterior surfaces such as building and decks without loose paint, sidewalks, or plaza areas, should be sufficient to protect receiving waters. HOWEVER, if any debris (solids) could enter storm drains or remain in the gutter or street after cleaning, wash water should first pass through a "20 mesh" or finer screen to catch the solid materials, the mesh should then be disposed of in the trash.

DRAIN INLET PROTECTION/CONTAINMENT & COLLECTION OF WASH WATER

- Sand bags can be used to create a barrier around storm drain inlets.
- Plugs or rubber mats can be used to temporarily seal storm drain openings.
- Containment pads, temporary berms or vacuum brooms can be used to contain and collect wash water.

EQUIPMENT AND SUPPLIES

Special materials such as absorbents, storm drain plugs and seals, small sump pumps, and vacuum booms are available from many vendors. For more information, check catalogs such as New Pig (800-468-4647, www.newpig.com), Lab Safety Supply (800-356-0783), C&H (800-558-9966), and W.W. Grainger (800-994-9174); or call the Cleaning Equipment Trade Association (800-441-0111) or the Power Washers of North America (800-393-PWNA).

Helpful telephone numbers and links:

WATER AGENCY LIST in Riverside County

City of Banning	(951) 922-3130
City of Beaumont	(951) 769-8520
City of Blythe	(760) 922-6161
City of Coachella	(760) 398-3502
Coachella Valley Water District	(760) 398-2651
City of Corona	(951) 736-2259
Desert Center, CSA #51	(760) 227-3203
Eastern Municipal Water District	(951) 928-3777
Elsinore Valley MWD	(951) 674-3146
Farm Mutual Water Company	(951) 244-4198
City of Hemet	(951) 765-3712
Idyllwild Water District	(951) 659-2143
Jurupa Community Services District	(951) 360-8795
Lake Hemet MWD	(951) 658-3241
Lee Lake Water District	(951) 277-1414
March Air Force Base	(951) 656-7000
Mission Springs Water District	(760) 329-6448
City of Palm Springs	(760) 323-8253
Rancho Caballero	(951) 780-9272
Rancho California Water District	(951) 296-6900
Ripley, CSA #62	(760) 922-4951
City of Riverside	(951) 351-6170
Rubidoux Community Services District	(951) 684-7580
Silent Valley Club, Inc	(951) 849-4501
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(951) 789-5000
Yucaipa Valley Water District	(909) 797-5117

To report illegal dumping into storm drains or clogged storm drains, please call:

1-800-506-2555

Online resources include:

Riverside County Flood Control District outreach materials page:
www.floodcontrol.co.riverside.ca.us

California Storm Water Quality Association
www.casqa.org or www.cabmphandbooks.com

State Water Resources Control Board, Water Quality
www.swrcb.ca.gov/stormwtr/index.html

U.S. Environmental Protection Agency
www.epa.gov/oppt/p2home/programs/busprac.htm

StormWater Pollution

What you should know for...

OUTDOOR CLEANING ACTIVITIES AND NON-POINT SOURCE DISCHARGES

For disposal of wash water from:

- Sidewalk, plaza or parking lot cleaning
- Vehicle washing or detailing
- Building exterior cleaning
- Waterproofing
- Equipment cleaning or degreasing

Do you know . . . where the water actually goes?

Storm Drains are not connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry rain water away from developed areas to prevent flooding. Pollutants discharged to storm drains are conveyed directly into rivers, lakes and streams. Soaps, degreasers, automotive fluids, litter and a host of other materials washed off buildings, sidewalks, plazas, parking areas, vehicles and equipment must be properly managed to prevent the pollution of rivers, lakes and streams.

Preventing pollution is the best way to protect the environment. In addition, it is much easier and less costly than cleaning up "after the fact."

The Cities and County of Riverside Regional Water Quality Control Board

A WATERSHED is an area of land that catches rain and snow, then drains or seeps into a marsh, stream, river, lake or groundwater. Watersheds come in all shapes and sizes, crossing county, state, and national boundaries, therefore many of our activities at home, work or play affect the quality of our watersheds.

In accordance with state and federal law to protect our watersheds, the CITIES AND COUNTY OF RIVERSIDE have adopted ordinances for stormwater management and discharge control to prohibit the discharge of wastes into the storm drain system or local surface waters. This INCLUDES discharge of wash water from outdoor cleaning activities which may contain pollutants such as oil, grease, detergent, degreasers, trash, pet waste or other materials.

PLEASE NOTE: Check with your Regional Water Quality Control Board, local municipal government and water agencies on what the restrictions are in your area.

3.5 Bioretention Facility

Type of BMP	LID – Bioretention
Treatment Mechanisms	Infiltration, Evapotranspiration, Evaporation, Biofiltration
Maximum Drainage Area	This BMP is intended to be integrated into a project's landscaped area in a distributed manner. Typically, contributing drainage areas to Bioretention Facilities range from less than 1 acre to a maximum of around 10 acres.
Other Names	Rain Garden, Bioretention Cell, Bioretention Basin, Biofiltration Basin, Landscaped Filter Basin, Porous Landscape Detention

Description

Bioretention Facilities are shallow, vegetated basins underlain by an engineered soil media. Healthy plant and biological activity in the root zone maintain and renew the macro-pore space in the soil and maximize plant uptake of pollutants and runoff. This keeps the Best Management Practice (BMP) from becoming clogged and allows more of the soil column to function as both a sponge (retaining water) and a highly effective and self-maintaining biofilter. In most cases, the bottom of a Bioretention Facility is unlined, which also provides an opportunity for infiltration to the extent the underlying onsite soil can accommodate. When the infiltration rate of the underlying soil is exceeded, fully biotreated flows are discharged via underdrains. Bioretention Facilities therefore will inherently achieve the maximum feasible level of infiltration and evapotranspiration and achieve the minimum feasible (but highly biotreated) discharge to the storm drain system.

Siting Considerations

These facilities work best when they are designed in a relatively level area. Unlike other BMPs, Bioretention Facilities can be used in smaller landscaped spaces on the site, such as:

- ✓ Parking islands
- ✓ Medians
- ✓ Site entrances

Landscaped areas on the site (such as may otherwise be required through minimum landscaping ordinances), can often be designed as Bioretention Facilities. This can be accomplished by:

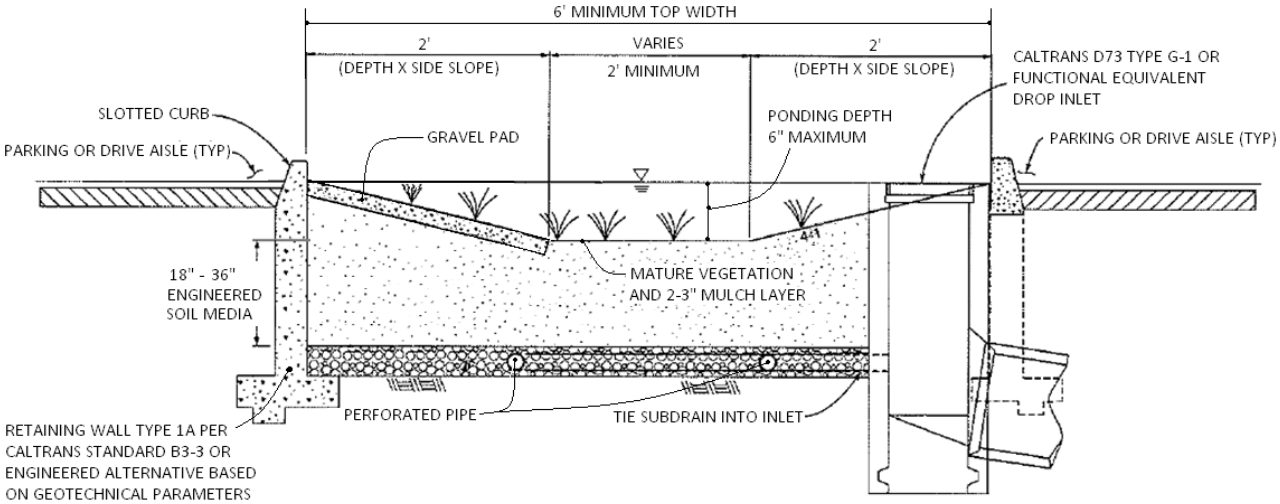
- *Depressing* landscaped areas below adjacent impervious surfaces, rather than elevating those areas
- Grading the site to direct runoff from those impervious surfaces *into* the Bioretention Facility, rather than away from the landscaping
- Sizing and designing the depressed landscaped area as a Bioretention Facility as described in this Fact Sheet

Bioretention Facilities should however not be used downstream of areas where large amounts of sediment can clog the system. Placing a Bioretention Facility at the toe of a steep slope should also be avoided due to the potential for clogging the engineered soil media with erosion from the slope, as well as the potential for damaging the vegetation.

Design and Sizing Criteria

The recommended cross section necessary for a Bioretention Facility includes:

- Vegetated area
- 18' minimum depth of engineered soil media
- 12' minimum gravel layer depth with 6' perforated pipes (added flow control features such as orifice plates may be required to mitigate for HCOC conditions)



While the 18-inch minimum engineered soil media depth can be used in some cases, it is recommended to use 24 inches or a preferred 36 inches to provide an adequate root zone for the chosen plant palate. Such a design also provides for improved removal effectiveness for nutrients. The recommended ponding depth inside of a Bioretention Facility is 6 inches; measured from the flat bottom surface to the top of the water surface as shown in Figure 1.

Because this BMP is filled with an engineered soil media, pore space in the soil and gravel layer is assumed to provide storage volume. However, several considerations must be noted:

- Surcharge storage above the soil surface (6 inches) is important to assure that design flows do not bypass the BMP when runoff exceeds the soil's absorption rate.
- In cases where the Bioretention Facility contains engineered soil media deeper than 36 inches, the pore space within the engineered soil media can only be counted to the 36-inch depth.
- A maximum of 30 percent pore space can be used for the soil media whereas a maximum of 40 percent pore space can be use for the gravel layer.

Figure 1: Standard Layout for a Bioretention Facility

Engineered Soil Media Requirements

The engineered soil media shall be comprised of 85 percent mineral component and 15 percent organic component, by volume, drum mixed prior to placement. The mineral component shall be a Class A sandy loam topsoil that meets the range specified in Table 1 below. The organic component shall be nitrogen stabilized compost[1], such that nitrogen does not leach from the media.

Table 1: Mineral Component Range Requirements

Percent Range	Component
70-80	Sand
15-20	Silt
5-10	Clay

The trip ticket, or certificate of compliance, shall be made available to the inspector to prove the engineered mix meets this specification.

Vegetation Requirements

Vegetative cover is important to minimize erosion and ensure that treatment occurs in the Bioretention Facility. The area should be designed for at least 70 percent mature coverage throughout the Bioretention Facility. To prevent the BMP from being used as walkways, Bioretention Facilities shall be planted with a combination of small trees, densely planted shrubs, and natural grasses. Grasses shall be native or ornamental; preferably ones that do not need to be mowed. The application of fertilizers and pesticides should be minimal. To maintain oxygen levels for the vegetation and promote biodegradation, it is important that vegetation not be completely submerged for any extended period of time. Therefore, a maximum of 6 inches of ponded water shall be used in the design to ensure that plants within the Bioretention Facility remain healthy.

A 2 to 3-inch layer of standard shredded aged hardwood mulch shall be placed as the top layer inside the Bioretention Facility. The 6-inch ponding depth shown in Figure 1 above shall be measured from the top surface of the 2 to 3-inch mulch layer.

Curb Cuts

To allow water to flow into the Bioretention Facility, 1-foot-wide (minimum) curb cuts should be placed approximately every 10 feet around the perimeter of the Bioretention Facility. Figure 2 shows a curb cut in a Bioretention Facility. Curb cut flow lines must be at or above the V_{BMP} water surface level.

[1] For more information on compost, visit the US Composting Council website at: http://compostingcouncil.org/

Figure 2: Curb Cut located in a Bioretention Facility

To reduce erosion, a gravel pad shall be placed at each inlet point to the Bioretention Facility. The gravel should be 1- to 1.5-inch diameter in size. The gravel should overlap the curb cut opening a minimum of 6 inches. The gravel pad inside the Bioretention Facility should be flush with the finished surface at the curb cut and extend to the bottom of the slope.

In addition, place an apron of stone or concrete, a foot square or larger, inside each inlet to prevent vegetation from growing up and blocking the inlet. See Figure 3.

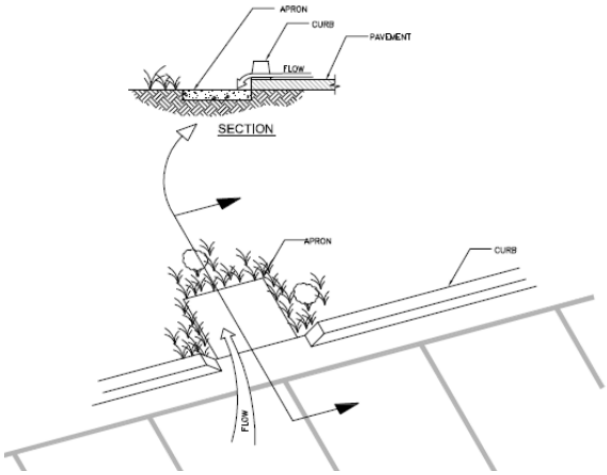


Figure 3: Apron located in a Bioretention Facility

Terracing the Landscaped Filter Basin

It is recommended that Bioretention Facilities be level. In the event the facility site slopes and lacks proper design, water would fill the lowest point of the BMP and then discharge from the basin without being treated. To ensure that the water will be held within the Bioretention Facility on sloped sites, the BMP must be terraced with nonporous check dams to provide the required storage and treatment capacity.

The terraced version of this BMP shall be used on non-flat sites with no more than a 3 percent slope. The surcharge depth cannot exceed 0.5 feet, and side slopes shall not exceed 4:1. Table 2 below shows the spacing of the check dams, and slopes shall be rounded up (i.e., 2.5 percent slope shall use 10' spacing for check dams).

Table 2: Check Dam Spacing

6" Check Dam Spacing	
Slope	**Spacing**
1%	*25'*
2%	*15'*
3%	*10'*

Roof Runoff

Roof downspouts may be directed towards Bioretention Facilities. However, the downspouts must discharge onto a concrete splash block to protect the Bioretention Facility from erosion.

Retaining Walls

It is recommended that Retaining Wall Type 1A, per Caltrans Standard B3-3 or equivalent, be constructed around the entire perimeter of the Bioretention Facility. This practice will protect the sides of the Bioretention Facility from collapsing during construction and maintenance or from high service loads adjacent to the BMP. Where such service loads would not exist adjacent to the BMP, an engineered alternative may be used if signed by a licensed civil engineer.

Side Slope Requirements

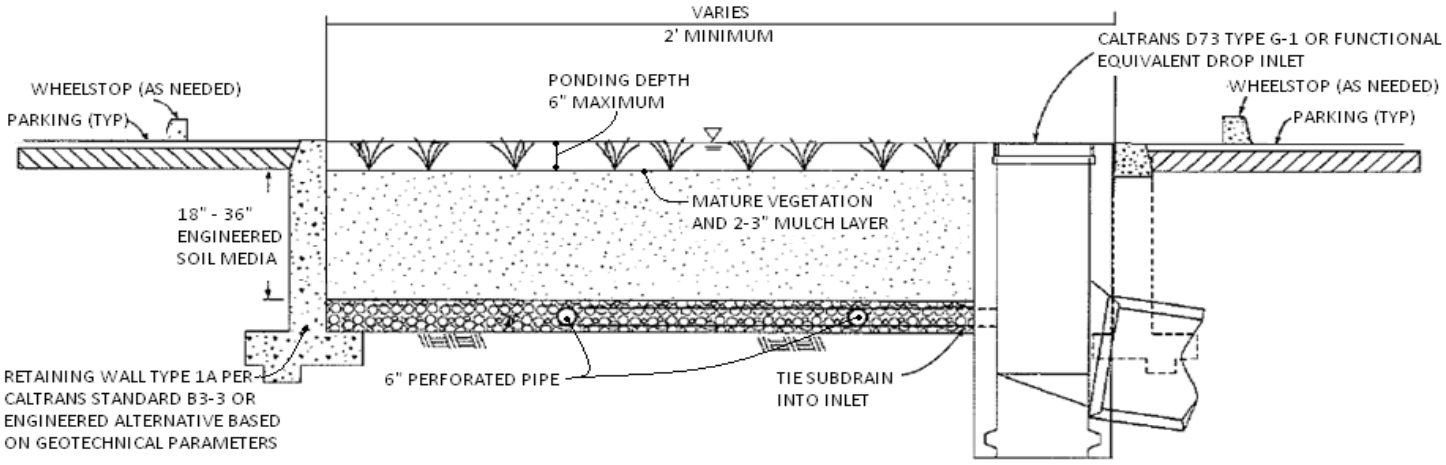
Bioretention Facilities Requiring Side Slopes

The design should assure that the Bioretention Facility does not present a tripping hazard. Bioretention Facilities proposed near pedestrian areas, such as areas parallel to parking spaces or along a walkway, must have a gentle slope to the bottom of the facility. Side slopes inside of a Bioretention Facility shall be 4:1. A typical cross section for the Bioretention Facility is shown in Figure 1.

Bioretention Facilities Not Requiring Side Slopes

Where cars park perpendicular to the Bioretention Facility, side slopes are not required. A 6-inch maximum drop may be used, and the Bioretention Facility must be planted with trees and shrubs to prevent pedestrian access. In this case, a curb is not placed around the Bioretention Facility,

but wheel stops shall be used to prevent vehicles from entering the Bioretention Facility, as shown in Figure 4.



Planter Boxes

Bioretention Facilities can also be placed above ground as planter boxes. Planter boxes must have a minimum width of 2 feet, a maximum surcharge depth of 6 inches, and no side slopes are necessary. Planter boxes must be constructed so as to ensure that the top surface of the engineered soil media will remain level. This option may be constructed of concrete, brick, stone or other stable materials that will not warp or bend. Chemically treated wood or galvanized steel, which has the ability to contaminate stormwater, should not be used. Planter boxes must be lined with an impermeable liner on all sides, including the bottom. Due to the impermeable liner, the inside bottom of the planter box shall be designed and constructed with a cross fall, directing treated flows within the subdrain layer toward the point where subdrain exits the planter box, and subdrains shall be oriented with drain holes oriented down. These provisions will help avoid excessive stagnant water within the gravel underdrain layer. Similar to the in-ground Bioretention Facility versions, this BMP benefits from healthy plants and biological activity in the root zone. Planter boxes should be planted with appropriately selected vegetation.

Figure 5: Planter Box
Source: LA Team Effort

Overflow

An overflow route is needed in the Bioretention Facility design to bypass stored runoff from storm events larger than V_{BMP} or in the event of facility or subdrain clogging. Overflow systems must connect to an acceptable discharge point, such as a downstream conveyance system as shown in Figure 1 and Figure 4. The inlet to the overflow structure shall be elevated inside the Bioretention Facility to be flush with the ponding surface for the design capture volume (V_{BMP}) as shown in Figure 4. This will allow the design capture volume to be fully treated by the Bioretention Facility, and for larger events to safely be conveyed to downstream systems. The overflow inlet shall **not** be located in the entrance of a Bioretention Facility, as shown in Figure 6.

Underdrain Gravel and Pipes

An underdrain gravel layer and pipes shall be provided in accordance with Appendix B – Underdrains.

Figure 6: Incorrect Placement of an Overflow Inlet.

Inspection and Maintenance Schedule

The Bioretention Facility area shall be inspected for erosion, dead vegetation, soggy soils, or standing water. The use of fertilizers and pesticides on the plants inside the Bioretention Facility should be minimized.

Schedule	Activity
Ongoing	• Keep adjacent landscape areas maintained. Remove clippings from landscape maintenance activities. • Remove trash and debris • Replace damaged grass and/or plants • Replace surface mulch layer as needed to maintain a 2-3 inch soil cover.
After storm events	• Inspect areas for ponding
Annually	• Inspect/clean inlets and outlets

Bioretention Facility Design Procedure

1) Enter the area tributary, A_T, to the Bioretention Facility.

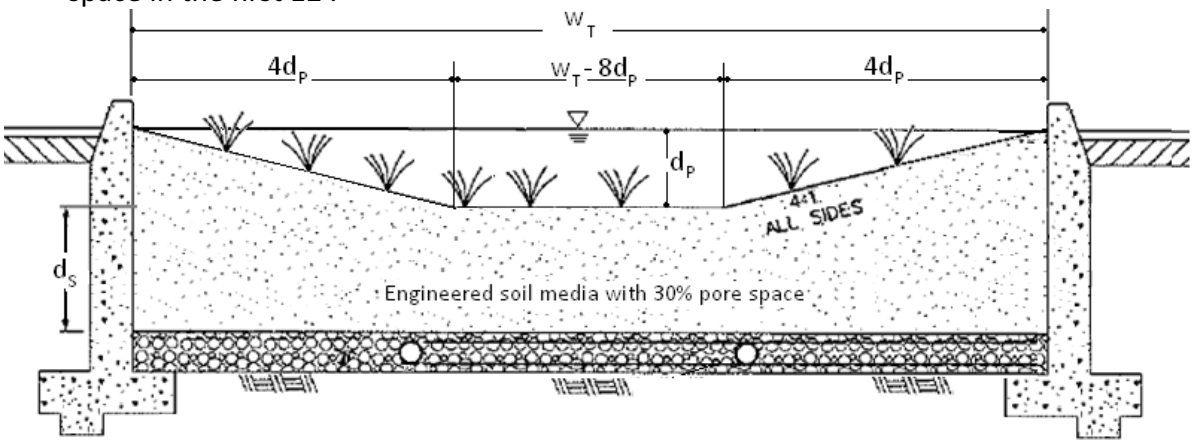
2) Enter the Design Volume, $V_{BMP,}$ determined from Section 2.1 of this Handbook.

3) Select the type of design used. There are two types of Bioretention Facility designs: the standard design used for most project sites that include side slopes, and the modified design used when the BMP is located perpendicular to the parking spaces or with planter boxes that do not use side slopes.

4) Enter the depth of the engineered soil media, d_S. The minimum depth for the engineered soil media can be 18' in limited cases, but it is recommended to use 24' or a preferred 36' to provide an adequate root zone for the chosen plant palette. Engineered soil media deeper than 36' will only get credit for the pore space in the first 36'.

5) Enter the top width of the Bioretention Facility.

6) Calculate the total effective depth, d_E, within the Bioretention Facility. The maximum allowable pore space of the soil media is 30% while the maximum allowable pore space for the gravel layer is 40%. Gravel layer deeper than 12' will only get credit for the pore space in the first 12'.



a. For the design with side slopes the following equation shall be used to determine the total effective depth. Where, d_P is the depth of ponding within the basin.

$$d_E(\text{ft}) = \frac{0.3 \times \left[\left(w_T(\text{ft}) \times d_S(\text{ft})\right) + 4\left(d_P(\text{ft})\right)^2\right] + 0.4 \times 1(\text{ft}) + d_P(\text{ft})\left[4d_P(\text{ft}) + \left(w_T(\text{ft}) - 8d_P(\text{ft})\right)\right]}{w_T(\text{ft})}$$

This above equation can be simplified if the maximum ponding depth of 0.5' is used. The equation below is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\text{ft}) = (0.3 \times d_S(\text{ft}) + 0.4 \text{ x } 1(\text{ft})) - \left(\frac{0.7\ (\text{ft}^2)}{w_T(\text{ft})}\right) + 0.5(\text{ft})$$

b. For the design without side slopes the following equation shall be used to determine the total effective depth:

$$d_E(\text{ft}) = d_P(\text{ft}) + [(0.3) \times d_S(\text{ft}) + (0.4) \times 1(\text{ft})]$$

The equation below, using the maximum ponding depth of 0.5', is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\text{ft}) = 0.5\ (\text{ft}) + [(0.3) \times d_S(\text{ft}) + (0.4) \times 1(\text{ft})]$$

7) Calculate the minimum surface area, A_M, required for the Bioretention Facility. This does not include the curb surrounding the Bioretention Facility or side slopes.

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

8) Enter the proposed surface area. This area shall not be less than the minimum required surface area.

9) Verify that side slopes are no steeper than 4:1 in the standard design, and are not required in the modified design.

10) Provide the diameter, minimum 6 inches, of the perforated underdrain used in the Bioretention Facility. See Appendix B for specific information regarding perforated pipes.

11) Provide the slope of the site around the Bioretention Facility, if used. The maximum slope is 3 percent for a standard design.

12) Provide the check dam spacing, if the site around the Bioretention Facility is sloped.

13) Describe the vegetation used within the Bioretention Facility.

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