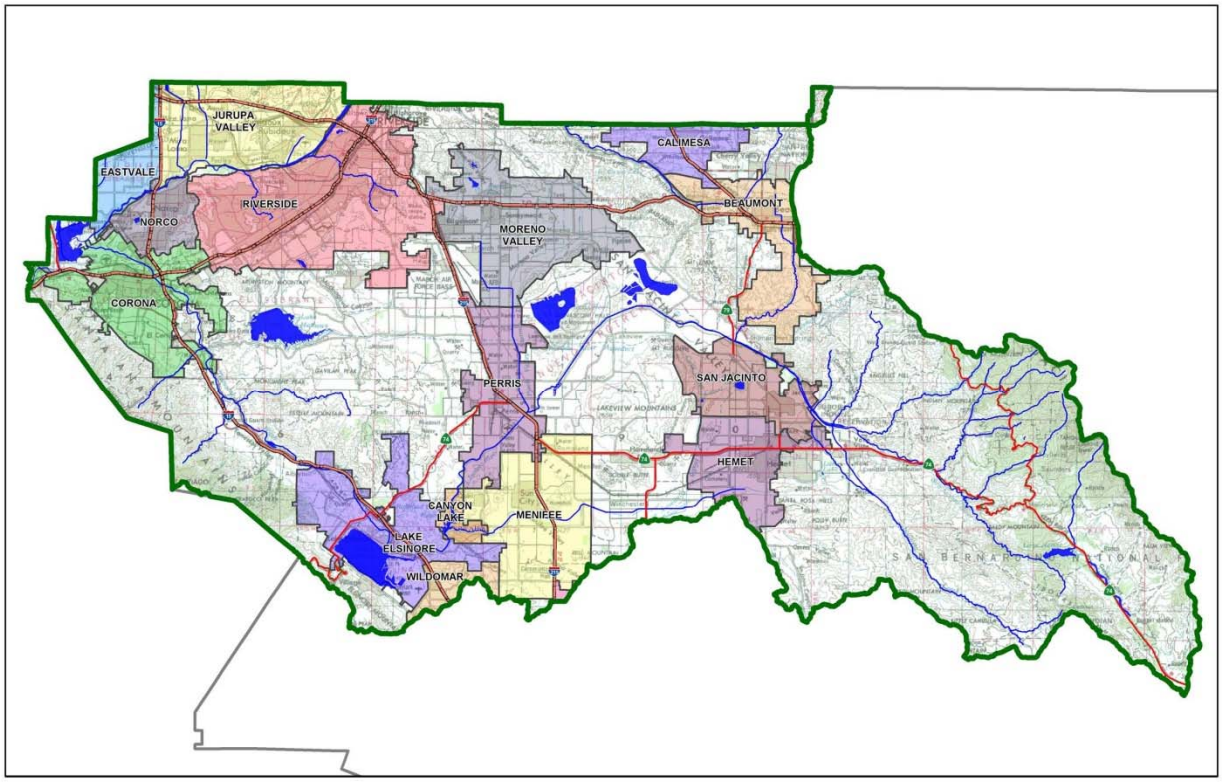
Project Specific Water Quality Management Plan

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

Project Title: Tentative Tract Map 37439

Development No: Tentative Tract Map 37439

Design Review/Case No: Preliminary



☒ **Preliminary**
☐ **Final**

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

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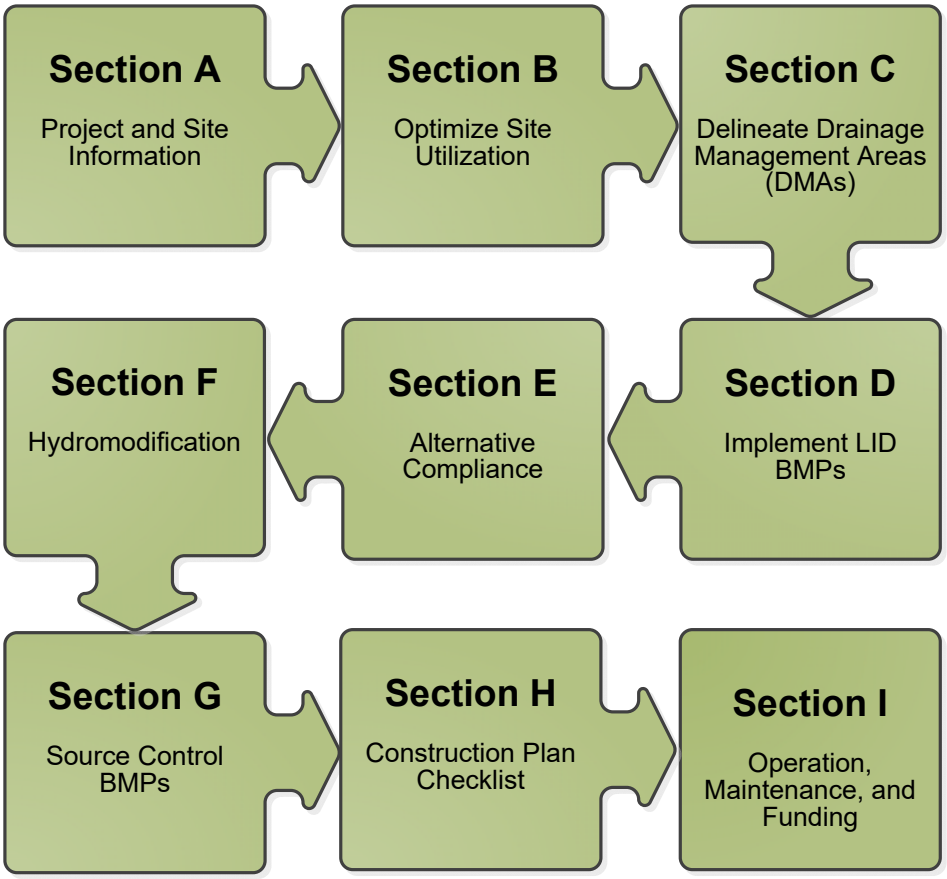
A Brief Introduction

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



OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for Global Investment Pool, LLC by JLC Engineering and Consulting, Inc. for Tract Map 36785.

This WQMP is intended to comply with the requirements of the County of Riverside for Ordinance No. 754.2 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 County of Riverside Water Quality Ordinance (Municipal Code Section754.2).

"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
Joseph L. Castaneda Preparer's Printed Name	P.E. / Project Manager Preparer's Title/Position

Preparer's Licensure:

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Residential
Planning Area:	N/A
Community Name:	County of Riverside
Development Name:	Tentative Tract Map 37439
PROJECT LOCATION	
Latitude & Longitude (DMS): 33°40'01"N 117°06'54"W	
Project Watershed and Sub-Watershed: Santa Ana River Watershed, San Jacinto River Sub-Watershed	
APN(s): Portions of 466-310-025, 466-310-026	
Map Book and Page No.: Book 466 page 31	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Residential
Proposed or Potential SIC Code(s)	N/A
Area of Total Project Project Footprint (SF)	6,299,212
Total Area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement	3,779,701
Does the project consist of offsite road improvements?	☒ Y ☐ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the project limits (SF)	0
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)	Hydrologic Soil "A", "B", "C" and "D"
What is the Water Quality Design Storm Depth for the project?	0.60

A.1 Maps and Site Plans

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

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

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

A.2 Identify Receiving Waters

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

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Improved Channel through Project Site	N/A	N/A	N/A
RCFC&WCD Improved Channel	N/A	N/A	N/A
Private Lake Through Tract 31229	N/A	N/A	N/A
Lindenberger Crossing	N/A	N/A	N/A
Private Lakes	N/A	N/A	N/A
Salt Creek	N/A	N/A	N/A
Canyon Lake	Nutrients, Pathogens (Bacteria & Viruses)	MUN, AGR, GWR, REC1, REC2, WAR, WILD	Not a RARE-designated water body
San Jacinto River	N/A	MUN, AGR, GWR, REC1, REC2, WARM, WILD	Not a RARE-designated water body
Lake Elsinore	Metals (Mercury), Nutrients, Organic Enrichment/Low Dissolved Oxygen, Polychlorinated biphenyls, sediment Toxicity, Sedimentation, Unknown Toxicity	REC1, REC2, WARM, WILD	Not a RARE-designated water body

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

Table A.2 Other Applicable Permits

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

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

Section B: Optimize Site Utilization (LID Principles)

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

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

Site Optimization

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

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

The project site currently drains from easterly to westerly, and the post-project condition will mimic these flows.

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

The project site does not preserve existing vegetation.

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

The infiltration rates for the project site are very low, therefore infiltration was not preserved. However, several open space areas have been provided where opportunities for micro infiltration shall occur.

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

The project site minimizes impervious areas, where feasible.

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

The project site will direct roof runoff through adjacent landscaping, and the exterior streets will discharge into the adjacent landscape buffer areas, where feasible.

Section C: Delineate Drainage Management Areas (DMAs)

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

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1]	Area (Sq. Ft.)	DMA Type
DMA A	Roof, Landscaping, Street	403,367	Type "D"
DMA B	Roof, Landscaping, Street	1,151,726	Type "D"
DMA C	Roof, Landscaping, Street	1,239,282	Type "D"
DMA D	Roof, Landscaping, Street	16,480	Type "D"
DMA E	Roof, Landscaping, Street	584,140	Type "D"
DMA F	Roof, Landscaping, Street	756,202	Type "D"
DMA G	Roof, Landscaping, Street	677,794	Type "D"
DMA H	Roof, Landscaping, Street	678,665	Type "D"
DMA I	Roof, Landscaping, Street	225,641	Type "D"

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

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

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

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]

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

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

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

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

DMA Name or ID	BMP Name or ID
DMA A	Bioretention Basin A
DMA B	Bioretention Basin B
DMA C	Bioretention Basin C
DMA D	Bioretention Basin D
DMA E	Bioretention Basin E
DMA F	Bioretention Basin F
DMA G	Bioretention Basin G
DMA H	Bioretention Basin H
DMA I	Bioretention Basin I

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

Section D: Implement LID BMPs

D.1 Infiltration Applicability

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

If yes has been checked, Infiltration BMPs shall not be used for the site. If no, continue working through this section to implement your LID BMPs. It is recommended that you contact your Co-Permittee to verify whether or not your project discharges to an approved downstream 'Highest and Best Use' feature.

Geotechnical Report

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

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

Infiltration Feasibility

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

Table D.1 Infiltration Feasibility

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

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

The infiltration rates for the project site range from 0.03 in/hr to 0.04 in/hr, which are significantly lower than 1.60 in/hr, therefore the project site does not have sufficient infiltration rates to utilize infiltration based BMPs.

D.2 Harvest and Use Assessment

Please check what applies*:*

- ☐ Reclaimed water will be used for the non-potable water demands for the project.
- ☐ Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Copermittee).
- ☐ The Design Capture Volume will be addressed using Infiltration Only BMPs. In such a case, Harvest and Use BMPs are still encouraged, but it would not be required if the Design Capture Volume will be infiltrated or evapotranspired.

If any of the above boxes have been checked, Harvest and Use BMPs need not be assessed for the site. If neither of the above criteria applies, follow the steps below to assess the feasibility of irrigation use, toilet use and other non-potable uses (e.g., industrial use).

Irrigation Use Feasibility

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

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

Total Area of Irrigated Landscape: 57.84

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

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: 86.77

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

Enter your EIATIA factor: 1.08

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: 93.71

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)
93.71	57.84

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: 1,719

Project Type: Residential

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: 86.77

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-1 in Chapter 2 to determine the minimum number or toilet users per tributary impervious acre (TUTIA).

Enter your TUTIA factor: 101

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: 8,764

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)
8,764	1,719

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 2-3 in Chapter 2 to determine the minimum demand for non-potable uses per tributary impervious acre.

Enter the factor from Table 2-3: N/A

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

Minimum required use: N/A

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

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
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, unless a site-specific analysis has been completed that demonstrates technical infeasibility as noted in D.3 below.

Based upon the Harvest and Use analysis, the project site does not have sufficient irrigated landscaped area or toilet users in order to be required to use harvest and use BMPs.

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 A	☐	☐	☒	☐	☐
DMA B	☐	☐	☒	☐	☐
DMA C	☐	☐	☒	☐	☐
DMA D	☐	☐	☒	☐	☐
DMA E	☐	☐	☒	☐	☐
DMA F	☐	☐	☒	☐	☐
DMA G	☐	☐	☒	☐	☐
DMA H	☐	☐	☒	☐	☐
DMA I	☐	☐	☒	☐	☐

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.

The project site will utilize bioretention basins to treat for water quality purposes. The required water quality volume was determined by using the Santa Ana Watershed BMP Design Volume Spreadsheets. The effective impervious fraction was calculated based upon the tributary land use designations.

The bioretention basins have been designed so that the water quality volume will not pond higher than 6" above the soil media using the Bioretention Basin Design Spreadsheets. Flows in excess of the water quality volume will be conveyed through outlet structures within the basins that incorporate weir structures or orifice holes with inverts at 6" above the soil media. For the basins in which the 100-year back water condition ponds higher than 6" above the soil media, an orifice hole will be provided at 6" above the soil media to allow flows to exit, and the overflow weir for the peak 100-year flow rate will be located above the 100-year back water elevation.

The project site is exempt from addressing the Hydrologic Conditions of Concern (HCOCs) since (with the construction of the proposed RCFC&WCD channel that is required to be constructed prior to this project) the project site will have engineered and maintained systems from the project site to Canyon Lake.

The water quality volume calculations and effective impervious fraction calculations have been included in Appendix 6.

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	*Bioretention Basin A*		
	[A]		[B]	[C]	[A] x [C]			
DMA A-1	*242019.36*	*Concrete or Asphalt*	*1.0*	*0.89*	*215881.3*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA A-2	*161346.24*	*Ornamental Landscaping*	*0.10*	*0.11*	*17822*			
	403365.6				233703.3	0.60	11685.2	14,722

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Table D.4 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Bioretention Basin B*		
	[A]		[B]	[C]	[A] x [C]			
DMA B-1	*691035.84*	*Concrete or Asphalt*	*1.0*	*0.89*	*616404*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA B-2	*460690.56*	*Ornamental Landscaping*	*0.10*	*0.11*	*50887*			
	1151726.4				667291	0.60	33364.6	35,567

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Table D.5 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Bioretention Basin C*		
	[A]		[B]	[C]	[A] x [C]			
DMA C-1	*743569.2*	*Concrete or Asphalt*	*1.0*	*0.89*	*663263.7*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA C-2	*495712.8*	*Ornamental Landscaping*	*0.10*	*0.11*	*54755.4*			
	1239282				718019.1	0.60	35901	37,708

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

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Table D.6 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Bioretention Basin D*		
	[A]		[B]	[C]	[A] x [C]			
DMA D-1	*341336.16*	*Concrete or Asphalt*	*1.0*	*0.89*	*304471.9*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA D-2	*227557.44*	*Ornamental Landscaping*	*0.10*	*0.11*	*25135.5*			
	568893.6				329607.4	0.60	16480.4	18,227

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

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Table D.7 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	*Bioretention Basin E*		
	[A]		[B]	[C]	[A] x [C]			
DMA E-1	*361199.52*	*Concrete or Asphalt*	*1.0*	*0.89*	*322190*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA E-2	*240799.68*	*Ornamental Landscaping*	*0.10*	*0.11*	*26598.3*			
	601999.2				348788.3	0.60	17439.4	25,244

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

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Table D.8 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	*Bioretention Basin F*		
	[A]		[B]	[C]	[A] x [C]			
DMA F-1	*453720.93*	*Concrete or Asphalt*	*1.0*	*0.89*	*404719.1*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA F-2	*302480.64*	*Ornamental Landscaping*	*0.10*	*0.11*	*33411.4*			
	756201.6				438130.5	0.60	21906.5	26,509

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

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Table D.9 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	*Bioretention Basin G*		
	[A]		[B]	[C]	[A] x [C]			
DMA G-1	*406676.16*	*Concrete or Asphalt*	*1.0*	*0.89*	*362755.1*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA G-2	*271117.44*	*Ornamental Landscaping*	*0.10*	*0.11*	*29947.1*			
	677793.6				392702.2	0.60	19635.1	30,292

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

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Table D.10 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	*Bioretention Basin H*		
	[A]		[B]	[C]	[A] x [C]			
DMA H-1	*407198.88*	*Concrete or Asphalt*	*1.0*	*0.89*	*363221.4*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA H-2	*271465.92*	*Ornamental Landscaping*	*0.10*	*0.11*	*29985.6*			
	678664.8				393207	0.60	19660.4	25,768

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

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Table D.11 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	*Bioretention Basin I*		
	[A]		[B]	[C]	[A] x [C]			
DMA I-1	*135384.48*	*Concrete or Asphalt*	*1.0*	*0.89*	*120763*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA I-2	*90256.32*	*Ornamental Landscaping*	*0.10*	*0.11*	*9969.5*			
	225640.8				130732.5	0.60	6536.6	16,848

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

The project site is considered medium density residential, with the smallest lots being less than ¼ acre residential, which is typically considered 50% impervious, therefore the project site was analyzed as 60% impervious. This is considered conservative since this does not account for the pervious basin areas, the park areas and the open space areas.

The Riverside County Bioretention Facility – Design Procedure worksheets were utilized to size the Bioretention Basins, however, the bioretention basins are not rectangular shaped bioretention basins but are irregular shaped so the top width is the average width of the basins. All the bioretentions basins have 18" of soil media and a minimum 12" of gravel due to the vertical constraints associated with the channel elevations traversing the project. All onsite flows discharge into the RCFC&WCD channels traversing the project site.

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]
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 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]

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

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

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

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

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

If Yes, HCOC criteria do not apply.

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

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

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

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

Table F.1 Hydrologic Conditions of Concern Summary

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

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

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

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

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

The project site discharges directly into the Holland Channel, which is an engineered and maintained channel. This channel is tributary to the Lindenberger Culvert Crossing, Private Lakes, Salt Creek, and ultimately Canyon Lake, which is defined as an adequate sump. Additionally, the Riverside County Stormwater & Conservation Tracking Tool defines the area downstream of the Lindenberger Culvert Crossing as being HCOC Exempt. This definition assumes that the Holland Channel has not been constructed, so once the Holland Channel is constructed (which is required prior to the construction of this project), the project will discharge into the exempt area via an engineered and maintained channel. Therefore the project site qualifies for the HCOC Exemption.

F.2 HCOC Mitigation

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

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

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

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

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

Section G: Source Control BMPs

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

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

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

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

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

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
On-site storm drain inlets	• Mark all inlets with the words "Only Rain Down the Storm Drain" 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 optional 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."

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
Landscape/Outdoor Pesticide Use	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 to 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/. • Provide IPM information to new owners, lessees and operators.
Pools, spas, ponds, decorative fountains, and other water features	• 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/
Roofing, gutters and trim	Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	
Sidewalks		• Sweep sidewalks regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into storm drain system.
Vehicular Restrictions		• Restrict vehicular onsite power washes • Restrict vehicular onsite maintenance and repairs

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)
A	Bioretention Basin A	TBD
B	Bioretention Basin B	TBD
C	Bioretention Basin C	TBD
D	Bioretention Basin D	TBD
E	Bioretention Basin E	TBD
F	Bioretention Basin F	TBD
G	Bioretention Basin G	TBD
H	Bioretention Basin H	TBD
I	Bioretention Basin I	TBD

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: Home Owner's Association (will determined at final engineering)

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

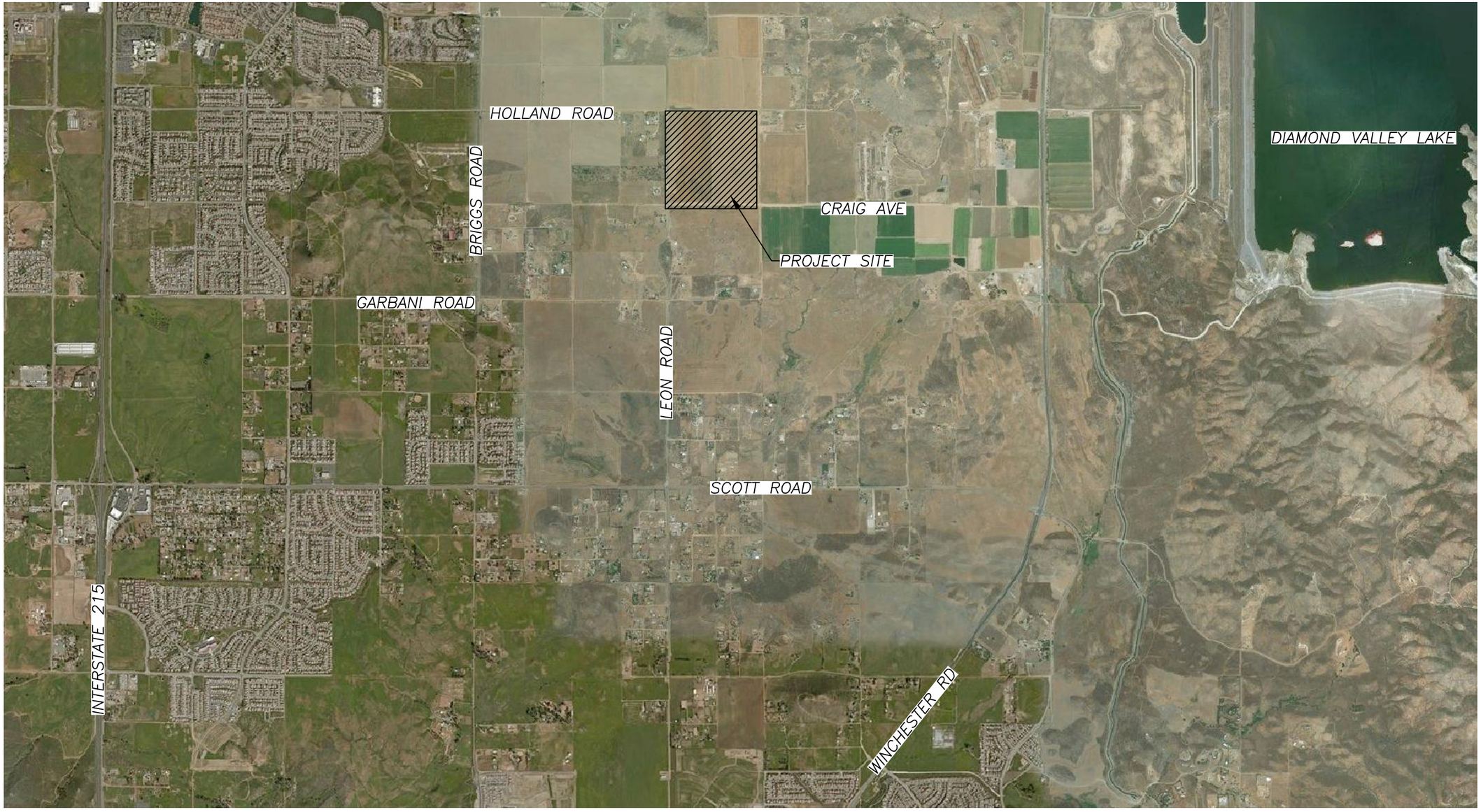
☒ Y ☐ N

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

Figure 1 – Vicinity Map



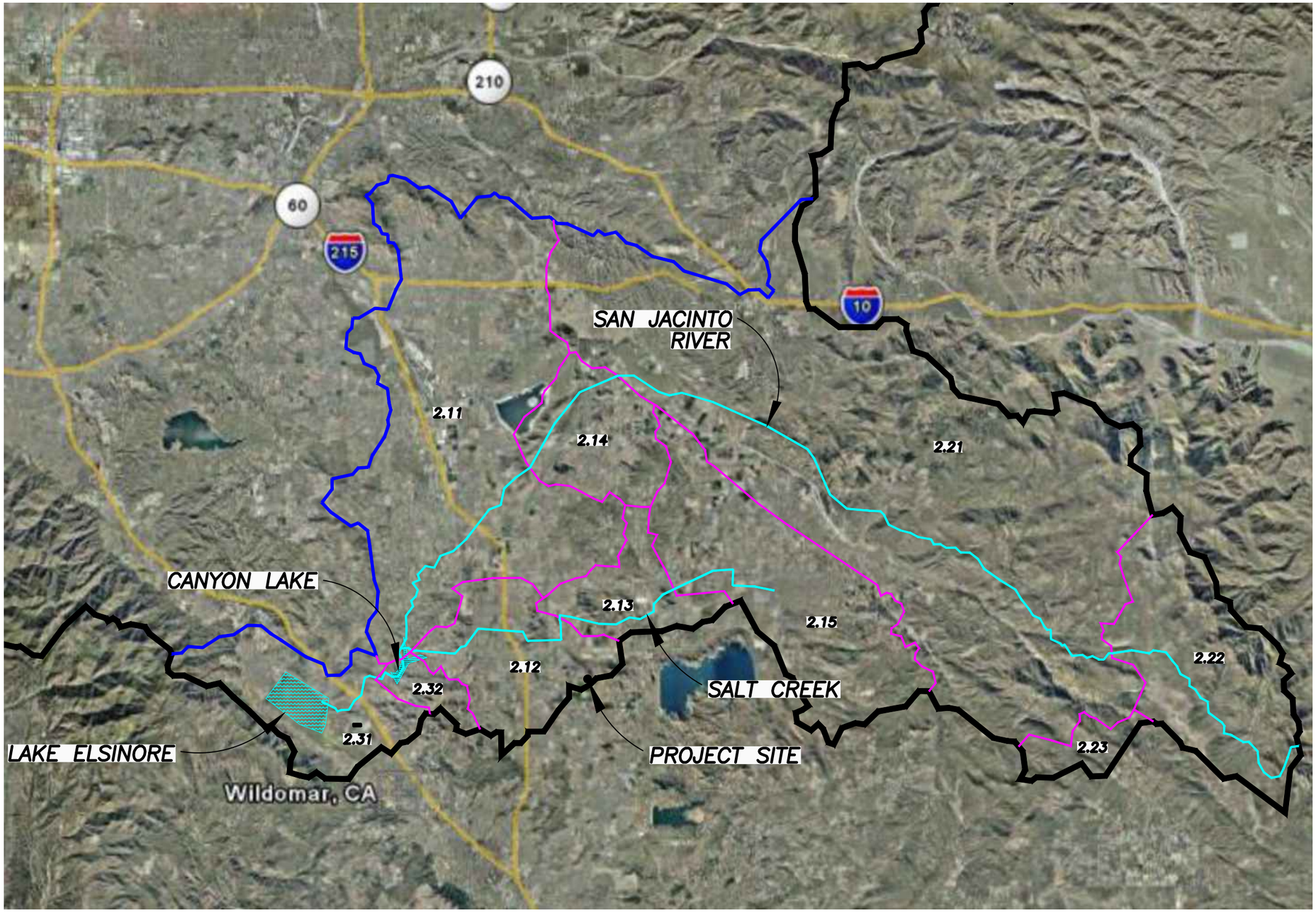
TENTATIVE TRACT MAP 37439 VICINITY MAP

N

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

FIGURE 1

Figure 2 – Receiving Waters Map



LEGEND

- Regional Boundary
- Hydrologic Unit Boundary (HU)
- Hydrologic Subarea Boundary (SA)
- FLOW PATH

TENTATIVE TRACT MAP 37439
RECEIVING WATERS MAP

N

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FIGURE 2

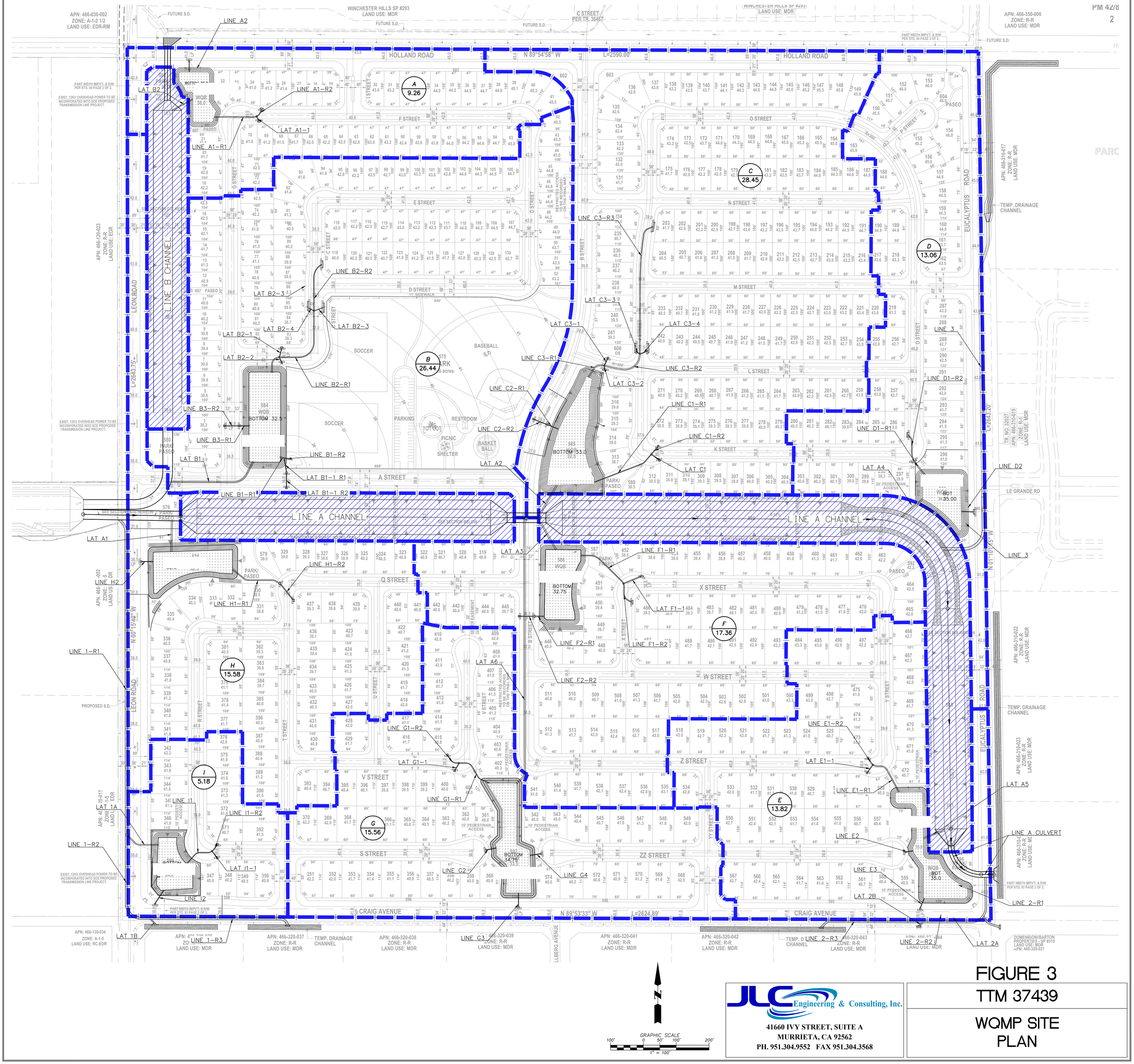
Drawing Name: O:\190.04.15\Engineering\WQMP\Appendix 1 - Maps & Site Plan\Receiving waters-San Jacinto.dwg
Last Opened: Mar 13, 2018 - 9:08am by jcarver

Figure 3 – WQMP Site Plan

TENTATIVE TRACT MAP 37439

COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

WQMP SITE PLAN



GRAPHIC SCALE
0 50' 100' 200'
1" = 100'

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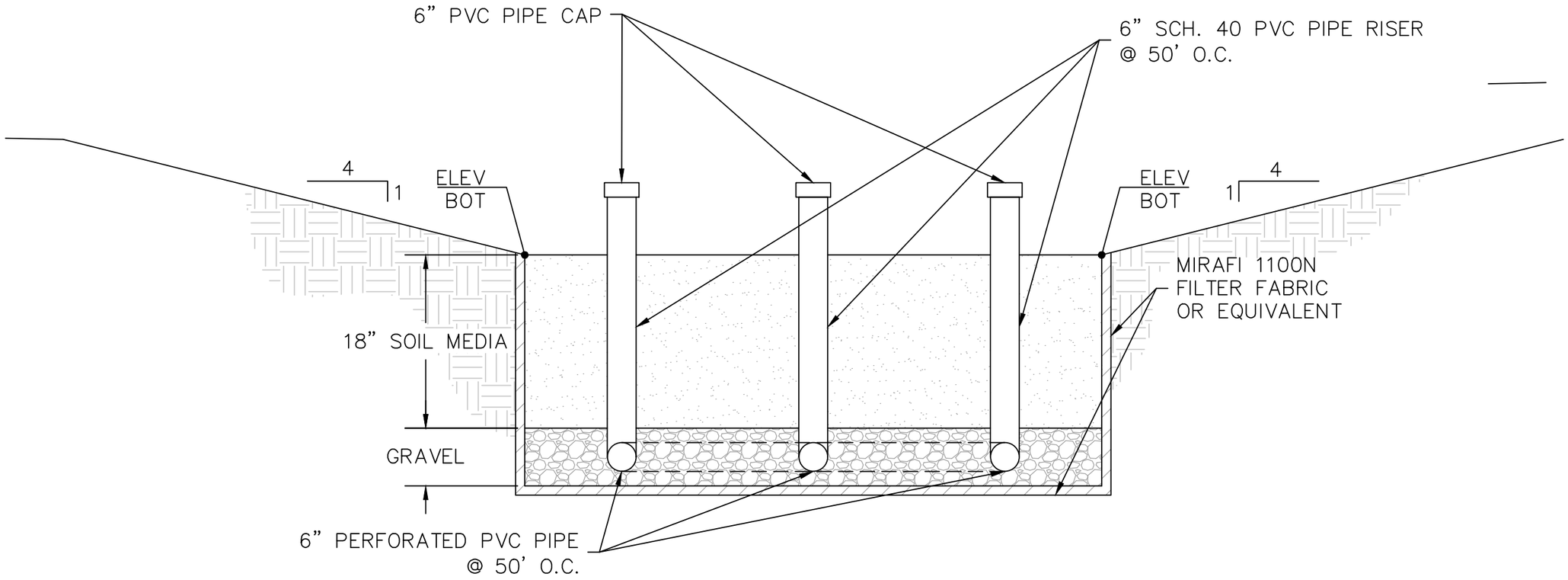
FIGURE 3
TTM 37439
WQMP SITE PLAN

TENTATIVE TRACT MAP 37439

COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

BIORETENTION BASIN DETAIL



TYPICAL BASIN SECTION

N.T.S.

THE ENGINEERED SOIL MEDIA REQUIREMENTS:

THE ENGINEERED SOIL MEDIA SHALL BE COMPRISED OF 85 PERCENT CLASS A TOPSOIL PER GREENBOOK AND 15 PERCENT ORGANIC SOIL AMENDMENT PER GREENBOOK, BY VOLUME, AND DRUM MIXED PRIOR TO PLACEMENT. THE CLASS A TOPSOIL SHALL MEET THE RANGE SPECIFIED IN TABLE 1, HEREON.

TABLE 1

% RANGE	COMPONENT
70–80	SAND
15–20	SILT
5–10	CLAY

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FIGURE 3B

TTM 37439

BIORETENTION BASIN DETAIL

Drawing Name: Q:\190.04\15\Engineering\WQMP\Appendix 1 - Maps & Site Plan\Figure 3B-Typical Bioretnetion Section.dwg
Last Opened: Mar 13, 2018 - 2:22pm by jcarver

Appendix 2: Construction Plans

Grading and Drainage Plans

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

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October 20, 2017 Project No. 17H-0307-0/01

Sun Holland, LLC
27127 Calle Arroyo, Suite 1909
San Juan Capistrano, CA 92675

Attention: Mr. Bill Lo

Subject: Geotechnical Investigation and Infiltration Testing
Tentative Tract Map 31008
Southeast of Leon Road and Holland Road
Riverside County, California

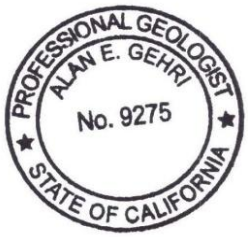
Mr. Lo:

In accordance with your request, a geotechnical investigation has been completed for the above referenced property. The results of the investigation are presented in the accompanying report, which includes a description of site conditions, results of our field exploration, field infiltration testing, laboratory testing, conclusions, and recommendations. This report has been prepared for specific application to this project, in accordance with generally accepted geotechnical engineering practice.

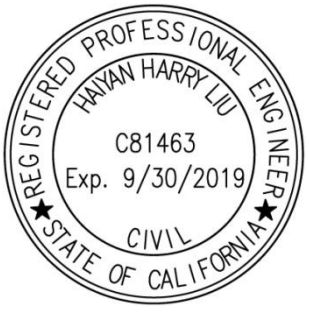
We appreciate this opportunity to be of service to you. If you have any questions regarding this report, please do not hesitate to contact us at your convenience.

Respectfully submitted,

RMA GeoScience



Alan Gehri, PG 9275
Project Geologist



Haiyan Liu, PE, C81463
Project Engineer

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GEOTECHNICAL INVESTIGATION AND INFILTRATION TESTING
TENTATIVE TRACT MAP 31008
SOUTHEAST OF LEON ROAD AND HOLLAND ROAD
RIVERSIDE COUNTY, CALIFORNIA

For

Sun Holland, LLC
27127 Calle Arroyo, Suite 1909
San Juan Capistrano, CA 92675

October 20, 2017

Project No. 17H-0307-0/01

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APPENDICES

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1.00 Introduction

1.01 Purpose

A geotechnical investigation has been completed at the subject site. The purpose of the investigation is to evaluate the geotechnical conditions at the site in relation to our understanding of the proposed development of the subject property.

1.02 Scope of the Investigation

The general scope of this investigation included the following:

- Review of published and unpublished geologic, seismic, groundwater, and geotechnical literature.
- Examination of aerial photographs and topographic maps.
- Contacting of Underground Service Alert (USA) to locate onsite utility lines.
- Logging, sampling, and backfilling of four (4) exploratory test pits excavated with a backhoe on the subject property for the residential development; and five (5) exploratory borings excavated with an 8" hollow-stem auger on the tract immediately to the west, spaced evenly along the proposed Riverside County Flood Control channel.
- Field testing for groundwater infiltration rate of underlying soils in all 4 test pits on the proposed residential development.
- Laboratory testing of representative soil samples.
- Geotechnical evaluation of the compiled data, including logs of 26 exploratory trenches and 19 exploratory borings prepared by previous consultants.
- Preparation of this report presenting our findings, conclusions, and recommendations.

Our scope of work did not include a preliminary site assessment for the potential of hazardous materials onsite.

1.03 Site Location and Description

The site of the proposed residential development is located at the southeast corner of Leon Road and Holland Road in the Winchester area of Riverside County, California. It is bounded to the north by Holland Road, to the east by Eucalyptus Road, to the south by Craig Avenue, to the west by Leon Road, and surrounded on all sides by flat ungraded properties with minimal improvements other than several farmhouses located at least 250 feet to the west and a cluster of greenhouses located immediately to the east. The property consists of 160 acres of relatively flat, tilled agricultural land with a total relief of approximately 9 feet, sloping gently to the southwest. Two small granite outcrops are visible in the southwest corner of the property, which showed significant resistance to digging by a backhoe.

The site of the proposed Riverside County Flood Control channel lies immediately to the west of the proposed residential development, and is also composed of flat agricultural land that is being used primarily growing crops, but contains several farmhouses and a dairy farm in the eastern portion.

The site is located in an area that has not been evaluated by the California Geological Survey for seismic hazards such as liquefaction and landslide hazards. It is not located in an Alquist-Priolo Fault Zone or a Riverside County Fault Zone (Riverside County General Plan Safety Element, 2015). Its central geographic position is 33.6671° north latitude and -117.1151° west longitude.

1.04 Site Land Use and History

Based on aerial photographs dating back to 1938 that were reviewed for this study, the property has always been vacant land used for agricultural purposes, with no onsite improvements or structures.

1.05 Planned Development

According to the tentative tract map and flood control plans provided to us, it is our understanding that a new residential development is planned for tract 31008, and a Riverside County Flood Control channel is planned for the tract immediately to the west.

Preliminary site plans for the residential development show 537 homes with associated street improvements, flood control channels along the perimeter and through the center of the site with box culverts to allow water passage under proposed streets, and a 5-acre park in the center. No retaining walls are currently planned onsite. The approximate limits of the planned development are shown on the Boring and Test Pit Location Map 1, Plate 1.

Plans for the flood control channels show an approximately 150 feet wide graded earthen channel with 4H:1V slopes on both sides leading up to 15 feet wide unpaved access roads and 10 feet wide concrete channels.

The conclusions and recommendations contained in this report are based on our understanding of the currently proposed utilization of the project site, as derived from site plans and verbal information supplied to us.

1.06 Investigation Methods

Our investigation consisted of office research, field exploration, field infiltration testing, laboratory testing, review of the compiled data, and preparation of this report. It has been performed in a manner consistent with generally accepted engineering and geologic principles and practices, and has incorporated applicable requirements of California Building Code. Definitions of technical terms and symbols used in this report include those of the ASTM International, the California Building Code, and commonly used geologic nomenclature.

Technical supporting data are presented in the attached appendices. Appendix A presents a description of the methods and equipment used in performing the field exploration, test data for our field infiltration testing, and logs of our subsurface exploration. Appendix B presents a description of our laboratory testing and the test results. General Earthwork and Grading Specifications are presented in Appendix C. Appendix D presents referenced test pit/boring logs from other company. References are presented in Appendix E.

2.00 Findings

2.01 Geologic Setting

The site is located within the Perris Block of the Southern California Batholith, a large block of granitic bedrock that was formed during Cretaceous time, approximately 90 to 100 million years ago. While internally unfaulted and considered structurally stable, the Perris Block is bounded on the west by the Elsinore Fault zone and on the east by the San Jacinto Fault zone. Rocks in the region of the site consist of Cretaceous-age Quartz Diorite, as mapped by Dibblee (2003). Small outcrops of the granitic bedrock are visible on the site, and larger outcrops are visible in the hills to the northeast.

Locally, the site is located between the Menifee Valley to the west and Domenigoni Valley to the east, which are characterized by stratified sequences of moderately consolidated alluvial sand, silt and clay.

The subject site is underlain by well-consolidated clayey sand alluvium, which is underlain at depth by quartz diorite bedrock. Outcrops of the bedrock that have been weathered to low relief are exposed in the southwest corner of the property. The earth materials encountered in our investigation are described below.

2.02 Earth Materials

Topsoil/Disturbed Native Soil (Af)

Tilled agricultural topsoil was exposed in all borings and test pits to a depth of approximately 2-3 feet below existing ground surface. The topsoil consists of light brown, silty fine sand that contains small quantities of organics from fertilization. The maximum depth of topsoil/fill encountered onsite was 3 feet.

Native Alluvial Soil (Qal)

Native soil, exposed in all 4 test pits and 5 exploratory borings excavated by RMA Geoscience, as well as the 26 test pits and 19 borings excavated by previous consultants, consists of reddish brown to dark brown, clayey fine to medium sand that is in a moist to damp and dense to very dense condition, and grades to coarser material at depth. Minor porosity was observed in more clayey materials. Maximum depth of soil encountered during our investigation was 21 feet, and maximum depth documented in reports by previous consultants is 50 feet.

Quartz Diorite (Kdvg)

Bedrock was not encountered in our test pits or borings, but is exposed at the surface in the southwest corner of the site, and highly weathered bedrock is documented at a depth of 35 feet in boring B-5 by EcoTech (2004). The bedrock consists of light gray to whitish gray, medium-grained quartz diorite. The rock is mostly massive with some minor fracturing on the exposed face, and was slowly excavated by a backhoe with considerable difficulty. Removal of the bedrock will likely require heavy construction equipment.

The earth materials encountered in the exploratory test pits excavated at the site are described in greater detail on the logs contained in Appendix A.

2.03 Expansive Soils

Based on our laboratory data the earth materials exposed in the exploratory borings have a very low expansion potential, however some medium expansion (EI>50) soils may be encountered at completion of grading. We recommended that as grading progresses, each building pad be evaluated for its expansive potential. We should re-evaluate the foundation design parameters thereafter.

2.04 Surface and Groundwater Conditions

No groundwater was encountered in any of the test pits that were excavated at the site to a maximum depth of 9 feet below existing grade or the borings that were excavated to 21 feet below existing grade. No groundwater was encountered by previous consultants in borings excavated to 50 feet below existing grade (2004). No springs or seeps were observed on site at the time of our investigation.

2.05 Faults

The proposed site is not located within an Alquist-Priolo Earthquake Fault Zone, and there are no known active faults that traverse the property. However, there are faults in close enough proximity to the site to cause moderate to intense ground shaking during the lifetime of the proposed development. Additionally, the site has experienced earthquake-induced ground shaking in the past and can be expected to experience further shaking in the future. Regional faults in the vicinity of the site that are capable of producing a moment magnitude exceeding 6.0 are listed in the following table.

Fault Name	Approximate Distance (km)	Source Type (A,B,C)	Maximum Magnitude (Mw)	Slip Rate (mm/yr)	Fault Type (SS, DS, BT)
Elsinore-Temecula	16.9	B	6.8	5.00	SS
San Jacinto -San Jacinto Valley	18.8	B	6.9	12.00	SS
San Jacinto-Anza	20.0	A	7.2	12.00	SS
Elsinore-Glen Ivy	21.7	B	6.8	5.00	SS
Elsinore-Julian	33.7	A	7.1	5.00	SS
San Jacinto -San Bernardino	40.4	B	6.7	12.00	SS
San Andreas	44.2	A	7.4	24.00	SS

2.06 Flooding Potential

According to Federal Emergency Management Agency (Flood Insurance Rate Map #06065C2090G), the site is located in an area of Flood Zone X, which is an area where the likelihood of flood hazards is considered minimal.

2.07 Liquefaction

The site is located in an area that has not been evaluated by the California Geological Survey for liquefaction hazard. Due to the dense, cohesive soils underlying the site and lack of groundwater encountered to at least 50 feet below ground surface, liquefaction potential is considered minimal.

2.08 Landslides

The site is located in an area that has not been evaluated by the California Geological Survey for landslide hazards. Evidence of landsliding was not encountered during our subsurface investigation. Due to the flat relief of the site, the potential for landsliding is considered minimal.

2.09 Infiltration Testing

Four (4) field soil infiltration tests were performed in the test pits excavated at the four corners of the proposed residential development, using the Double-Ring Infiltrometer method (ASTM Test Method D 3385). The locations of the field infiltration tests are shown on Plate 1.

The infiltrometer equipment consisted of two graduated plastic cylinders, two aluminum rings, Mariotte tubes, shutoff values, and plastic tubing to connect the cylinders and aluminum rings. The cylinders were connected to special supports to prevent tipping and to maintain proper height. The aluminum rings were 12 and 24 inches in diameter and 20 inches high. The Mariotte tubes were used to maintain a constant water level in the aluminum rings. Infiltration rate of water during the test was determined by monitoring volume changes in the calibrated cylinders. Testing was continued until a relatively uniform infiltration rate was obtained.

The infiltration tests were conducted in alluvial soils at a depth of approximately 8-9 feet below the existing ground surface. Soils at test locations consisted very dense, clayey to silty sand.

The testing yielded the following final infiltration rates:

Location	Infiltration Rate (inches/hour)
TP-1	0.03
TP-2	0.04
TP-3	0.03
TP-4	0.04

Field infiltration test result sheets are included in Appendix A.

3.00 Conclusions and Recommendations

3.01 General Conclusion

Based on specific data and information contained in this report, our understanding of the project and our general experience in engineering geology and geotechnical engineering, it is our professional judgment that the proposed development is geologically and geotechnically feasible. This is provided that the recommendations presented below are fully implemented during design, grading and construction.

The undisturbed native soil described in section 2.02 is suitable for support of structural fill, provided that all topsoil and disturbed native soils are removed to at least one foot into the undisturbed native soil prior to placement of compacted fill, or a minimum of two feet below planned footings, whichever is greater.

3.02 General Earthwork and Grading

All earthwork and grading should be performed in accordance with Section 3.03 of this report, County of Riverside requirements, and all applicable governmental agency requirements. It should be noted that all references to maximum dry density, optimum moisture content, and relative compaction are based on ASTM D 1557 laboratory test procedures. Recommendations contained in Appendix C are general specifications for typical grading projects and may not be entirely applicable to this project.

3.03 Removal Recommendations

In areas where grading is planned all topsoil and disturbed native soil should be removed, as well as the upper one (1) foot of undisturbed native soil, or to two (2) feet below the bottom of planned footings, whichever is greater. Based on the information obtained during our investigation, these removals can be expected to extend to approximately four (4) feet below existing grade. Overexcavation should extend a minimum of five (5) feet outside the limits of proposed foundations. Materials that are removed are suitable for reuse as compacted fill as long as they are processed in accordance with the grading guidelines present in this report.

All vegetation, trash and debris should be cleared from the grading area and removed from the site. Tree stumps, branches and roots will need to be hauled from the site and may not be placed in fills. In addition, any other soils indentified to contain chemical contamination should not be used for compacted fill unless such use is approved by environmental studies.

Following the over-excavation indicated above, a designated representative for the Project Geotechnical Engineer must review the exposed ground surface and determine if any additional over-excavation is required. The over-excavated ground surface in all areas determined to be satisfactory for the support of fills must be scarified to a minimum depth of 12 inches. The moisture content of the scarified zone shall be adjusted to within 2% of the optimum moisture content. The scarified zone must then be uniformly compacted to at least 90% relative compaction. Removed and/or over-excavated soils may be moisture-conditioned and re-compacted as engineered fill. Fill material should be placed in nearly horizontal layers, uniformly moisture conditioned to within 2% of optimum moisture content, and then compacted in layers that do not exceed approximately 6 inches in thickness.

All concrete flatwork and paved areas shall be underlain by a minimum of 12 inches of soil compacted to a minimum of 90% relative compaction (ASTM: D1557). The exposed soils beneath all over-excavations should be scarified an additional 12 inches, moisture conditioned and compacted to a minimum of 90% relative compaction (ASTM: D1557).

3.04 Slopes

All fill and cut slopes should be constructed at inclinations of 2 horizontal to 1 vertical or flatter.

3.05 Seismic Design Parameters

Seismic design parameters have been developed in accordance with Section 1613 of the 2016 California Building Code (CBC) using the online U.S. Geological Survey Seismic Design Maps Calculator (Version 3.1.0, ASCE 7-10 Standard) and a site location based on latitude and longitude. The calculator generates probabilistic and deterministic maximum considered earthquake spectral parameters represented by a 5-percent damped acceleration response spectrum having a 2-percent probability of exceedance in 50 years. The deterministic

response accelerations are calculated as 150 percent of the largest median 5-percent damped spectral response acceleration computed on active faults within a region, where the deterministic values govern. The calculator does not, however, produce separate probabilistic and deterministic results. The parameters generated for the subject site are presented as follows:

2016 California Building Code (CBC) Seismic Parameters

Parameter	Value
Site Location	Latitude = 33.6671 degrees Longitude = -117.1151 degrees
Site Class	Site Class = D Soil Profile Name: Stiff Alluvial Soil
Mapped Spectral Accelerations (Site Class B)	S_s (0.2- second period) = 1.500g S_1 (1-second period) = 0.600g
Site Coefficients (Site Class D)	F_a = 1.0 F_v = 1.5
Maximum Considered Earthquake Spectral Accelerations (Site Class D)	S_{MS} (0.2- second period) = 1.500g S_{M1} (1-second period) = 0.900g
Design Earthquake Spectral Accelerations (Site Class D)	S_{DS} (0.2- second period) = 1.000g S_{D1} (1-second period) = 0.600g

The above table shows that the mapped spectral response acceleration parameter for a 1-second period (S_1) is less than 0.75g. Therefore, for Occupancy Category II the Seismic Design Category is D (CBC Table 1604.5 and Section 1613.5.6). Consequently, as required for Seismic Design Categories C through F by CBC Section 1803.5.11, slope instability, liquefaction, total and differential settlement and surface displacement due to faulting or seismically induced flooding have been evaluated (see Section 3.10).

Peak earthquake ground acceleration adjusted for site class effects (PGA_M) has been determine in accordance with ASCE 7-10 Section 11.8.3 as follows: $PGA_M = F_{PGA} \times PGA = 1.0 \times 0.500 = 0.5g$.

3.06 Liquefaction and Secondary Earthquake Hazards

Potential secondary seismic hazards that can affect land development project include liquefaction, tsunamis, seiches, seismically induced settlement, seismically induced flooding and seismically induced landsliding.

Liquefaction

Liquefaction is a phenomenon where earthquake-induced ground vibrations increase the pore pressure in saturated, granular soils until it is equal to the confining, overburden pressure. When this occurs, the soil can completely lose its shear strength and enter a liquefied state. In order for liquefaction to occur, three criteria must be met: underlying loose, coarse-grained (sandy) soils, a groundwater depth of less than about 50 feet, and a potential for seismic shaking from nearby large-magnitude earthquake. The site is underlain by dense to very dense, cohesive alluvial soils with groundwater depth greater than 50 feet below ground surface; therefore, the risk of liquefaction occurring during a design seismic event is considered very low.

Tsunamis and Seiches

Tsunamis are sea waves that are generated in response to large-magnitude earthquakes. When these waves reach shorelines, they sometimes produce coastal flooding. Seiches are the oscillation of large bodies of standing water, such as lakes, that can occur in response to ground shaking. Tsunamis do not pose hazards due to the inland location of the site. According to the County of Riverside Safety Element of the General Plan the site is not located in a special flood hazard area, therefore seiches do not pose a hazard to the subject site.

Seismically Induced Settlement

Seismically induced settlement occurs most frequently in areas underlain by loose, granular sediments. Damage as a result of seismically induced settlement is most dramatic when differential settlement occurs in areas with large variations in the thickness of underlying sediments. Settlement caused by ground shaking is often non-uniformly distributed, which can result in differential settlement. Since the site is underlain by dense, cohesive alluvial soils, seismically induced settlement is considered a minimal design concern during a design seismic event.

Seismically Induced Flooding

According to the Safety Element of the County of Riverside General Plan, the site lies within a dam hazard zone due to its proximity to Diamond Valley Lake. Consequently seismically induced flooding at the site is considered a potential hazard.

Seismically Induced Landsliding

Based on the fact that there are no existing slopes on or near the site, and the site is underlain by dense, cohesive alluvial soil, seismically induced landsliding is not considered a concern with respect to the subject site.

3.07 Foundations

Isolated spread footings and/or continuous wall footings are recommended to support the proposed single-family residences. If the planned footings are established in engineered fill with low expansion index (EI<50), footings may be designed using the following allowable soil bearing values:

- Continuous Footings:

  Footings having a minimum width of 12 inches and 15 inches for one- and two-stories, respectively, and a minimum depth of 15 inches and 18 inches for one- and two-stories, respectively, below the lowest adjacent grades have an allowable bearing capacity of 2,000 pounds per square foot (psf) for engineered fill.

- Isolated Spread Footings:

  Footings having a minimum width of 24 inches and a minimum depth of 18 inches below the lowest adjacent grade have an allowable bearing capacity of 2,000 pounds per square foot (psf) for engineered fill.

- Retaining Wall Footings:

  Footings for retaining walls should be founded in compacted fill or dense alluvial soils at a minimum depth of 15 inches and have a minimum width of 12 inches. Footings may be designed using the allowable bearing capacity and lateral resistance values recommended for continuous footings. However, when calculating passive resistance, the upper 6 inches of the footings should be ignored in areas where the footings will not

be covered with concrete flatwork or asphalt pavement.

The above bearing capacities represent an allowable net increase in soil pressure over existing soil pressure and may be increased by one-third for short-term wind or seismic loads. The maximum expected settlement of footings designed with the recommended allowable bearing capacity is expected to be on the order of ½ inch with differential settlement on the order of ¼ inch across a 30 foot span.

Soils at the site are generally granular with a very low expansion potential. Therefore, reinforcement of footings for expansive soil is not required. However, in view of the seismic setting, a nominal reinforcement consisting of one #4 bar placed within 3 inches of the top of footings and another placed within 3 inches of the bottom of footings is recommended. The structural engineer may require heavier reinforcement.

All footing excavations should be observed by the geotechnical consultant to verify that they have been excavated into competent soils. The foundation excavations should be observed prior to the placement of forms, reinforcement steel, or concrete. These excavations should be evenly trimmed and level. Prior to concrete placement, any loose or soft soils should be removed. Excavated soils should not be placed in slab or footing areas unless properly compacted.

Footings may experience an overall loss in bearing capacity or an increased potential to settle where located in close proximity to existing or future utility trenches. Furthermore, stresses imposed by the footings on the utility lines may cause cracking, collapse and/or a loss of serviceability. To reduce this risk, footings should extend below a 1:1 plane projected upward from the closest bottom corner of the trench.

3.08 Lateral Load Resistance

Lateral loads may be resisted by soil friction and the passive resistance of the soil. The following parameters are recommended.

- Allowable Passive Earth Pressure = 250 pcf (equivalent fluid weight).
- Allowable Coefficient of Friction (soil to footing) = 0.3
- Retaining structures should be designed to resist the following lateral active earth pressures:

Surface Slope of Retained Materials (Horizontal:Vertical)	Equivalent Fluid Weight (pcf)
Level	37
5:1	39
4:1	40
3:1	42
2:1	52

These active earth pressures are only applicable if the retained earth is allowed to strain sufficiently to achieve the active state. The required minimum horizontal strain to achieve the active state is approximately 0.0025H. Retaining

structures should be designed to resist an at-rest lateral earth pressure if this horizontal strain cannot be achieved.

- At-rest Lateral Earth Pressure for level backfill = 58 pcf (equivalent fluid weight)

The Mononobe-Okabe method is commonly utilized for determining seismically induced active and passive lateral earth pressures and is based on the limit equilibrium Coulomb theory for static stress conditions. This method entails three fundamental assumptions (e.g., Seed and Whitman, 1970): Wall movement is sufficient to ensure either active or passive conditions, the driving soil wedge inducing the lateral earth pressures is formed by a planar failure surface starting at the heel of the wall and extending to the free surface of the backfill, and the driving soil wedge and the retaining structure act as rigid bodies, and therefore, experiences uniform accelerations throughout the respective bodies (U.S. Army Corps of Engineers, 2003, Engineering and Design - Stability Analysis of Concrete Structures).

- Seismic Lateral Earth Pressure for level backfill = 20 pcf (equivalent fluid weight).

The seismic lateral earth pressure given above is an inverted triangle, and the resultant of this pressure is an increment of force which should be applied to the back of the wall at 2/3 of the wall height and also applied as a reduction of force to the front of the wall in the upper 1/3 of the footing depth. Per CBC Section 1803.5.12 dynamic seismic lateral earth pressures shall be applied to foundation walls and retaining walls supporting more than 6 feet of backfill. Dynamic seismic lateral earth pressures may also be applied to shorter walls at the discretion of the structural engineer. The dynamic seismic lateral earth pressure will act in addition to the static active earth pressure given above.

3.09 Interior Slabs on Grade

We recommend the use of non-structural slab-on-grade floors for structures supported on properly compacted fill placed in accordance with the recommendations contained in this report. These floor slabs should have a minimum thickness of 4 inches and should be divided into squares or rectangles using weakened plane joints (contraction joints), each with maximum dimensions not exceeding 15 feet. Contraction joints should be made in accordance with American Concrete Institute (ACI) guidelines. Slab-on-grade floors should be reinforced with at least the reinforcement required to control cracking due to shrinkage and temperature stresses or with a minimum of 6x6-10/10 welded wire fabric placed at mid- height of the slab. Due to the difficulty of installing and maintaining welded wire fabric in the middle of concrete slabs-on- grade during construction, consideration should be given to using steel reinforcement consisting of steel rebar (i.e. No. 3 bars) placed 24 inches on-center in both directions in lieu of welded wire fabric.

Special care should be taken on floors slabs to be covered with thin-set tile or other inflexible coverings. Alternatively, inflexible flooring may be installed with unbonded fabric or liners to prevent reflection of slab cracks through the flooring.

A moisture vapor retarder/barrier is recommended beneath all slab-on-grade floors that will be covered by moisture- sensitive flooring materials such as vinyl, linoleum, wood, carpet, rubber, rubber-backed carpet, tile, impermeable floor coatings, adhesives, or where moisture-sensitive equipment, products, or environments will exist. We recommend that design and construction of the vapor retarder or barrier conform to the 2016 California Building Code (CBC) and pertinent sections of American Concrete Institute (ACI) guidance documents 302.1R-04, 302.2R-06 and 360R-10.

The moisture vapor retarder/barrier should be designed by the Project Architect or Structural Engineer, but at a minimum should consist of a 10 mils thick polyethylene with a maximum perm rating of 0.3 in accordance with

ASTM E 1745. Seams in the moisture vapor retarder/barrier should be overlapped no less than 6 inches or in accordance with the manufacturer's recommendations. Joints and penetrations should be sealed with the manufacturer's recommended adhesives, pressure-sensitive tape, or both. The contractor must avoid damaging or puncturing the vapor retarder/barrier and repair any punctures with additional polyethylene properly lapped and sealed.

ACI guidelines allow for the placement of the moisture vapor retarder/barrier either directly beneath floor slabs or below an intermediate granular soil layer. Placing the moisture retarder/barrier directly beneath the floor slab will eliminate potential problems caused by water being trapped in a granular fill layer. Concrete slabs poured directly on a vapor retarder/barrier, however, can experience increased shrinkage cracking and curling due to differential rates of curing through the thickness of the slab. Therefore, for concrete placed directly on the vapor retarder, we recommend a maximum water cement ratio of 0.45 and the use of water-reducing admixtures to increase workability and decrease bleeding. Full depth construction joints and control joints should be provided to control cracking and slab thickness and reinforcement as recommended by the Structural Engineer to resist the effects of curling.

If granular soil is placed over the vapor retarder/barrier, we recommend that the layer be at least 2 inches thick in accordance with traditional practice in southern California. Granular fill should consist of clean fine graded materials with 10 to 30% passing the No. 100 sieve and free from clay or silt. The granular layer should be uniformly compacted and trimmed to provide the full design thickness of the proposed slab. The granular fill layer should not be left exposed to rain or other sources of water such as wet-grinding, power washing, pipe leaks or other processes, and should be dry at the time of concrete placement. Granular fill layers that become saturated should be removed and replaced prior to concrete placement.

An additional layer of sand may be placed beneath the vapor retarder/barrier at the developer's discretion to minimize the potential of the retarder/barrier being punctured by underlying soils.

Prior to the placement of the moisture barrier and sand, the subgrade soils underlying the slab should be observed by the geotechnical consultant to verify that all under-slab utility trenches have been properly backfilled and compacted, that no loose or soft soils are present, and that the slab subgrade has been properly compacted to a minimum of 90 percent relative compaction within the upper 12 inches.

3.10 Miscellaneous Concrete Flatwork

Miscellaneous concrete flatwork and walkways should be designed with a minimum thickness of 4 inches. Large slabs should be reinforced with a minimum of #4 rebar placed 24 inches on-center in both directions. The reinforcement must be placed at mid-height in the slab. Control joints should be constructed to create squares or rectangles with a maximum spacing of 12 feet. Walkways should be separated from foundations with a thick expansion joint filler. Control joints should be constructed into non-reinforced walkways at a maximum of 5 feet spacing. The Project Civil Engineer should provide design details and specifications for all exterior concrete flatwork including the thickness of slabs, required reinforcement, and joint spacing.

Concrete driveways and any other concrete flatwork that will be subject to vehicular traffic, should be at least 5 inches thick and reinforced with at least #4 rebar placed 18" on-center in both directions in the middle of the slab. These slabs should be underlain by at least 8 inches of Class 2 Aggregate Base compacted to a relative compaction of at least 95 percent. The location and spacing of construction and contraction joints should also be determined by the Project Civil Engineer.

The subgrade soils beneath all miscellaneous concrete flatwork should be moisture conditioned and compacted in accordance with Section 3.3 of this report.

3.11 Cement Type and Corrosion Potential

Soluble sulfate tests indicate the on-site soils have a sulfate in water concentration of 0.02% by weight. These results indicate that concrete at the subject site will have a negligible exposure to water-soluble sulfate in the soil. Our preliminary recommendations for concrete exposed to sulfate-containing soils are presented in the table below.

RECOMMENDATIONS FOR CONCRETE EXPOSED TO SULFATE-CONTAINING SOILS

Sulfate Exposure	Water Soluble Sulfate (SO_4) in Soil (% by Weight)	Sulfate (SO_4) in Water (ppm)	Cement Type (ASTM C150)	Maximum Water-Cement Ratio (by Weight)	Minimum Compressive Strength (psi)
Negligible	0.00 - 0.10	0-150	--	--	2,500
Moderate	0.10 - 0.20	150-1,500	II	0.50	4,000
Severe	0.20 - 2.00	1,500-10,000	V	0.45	4,500
Very Severe	Over 2.00	Over 10,000	V plus pozzolan or slag	0.45	4,500

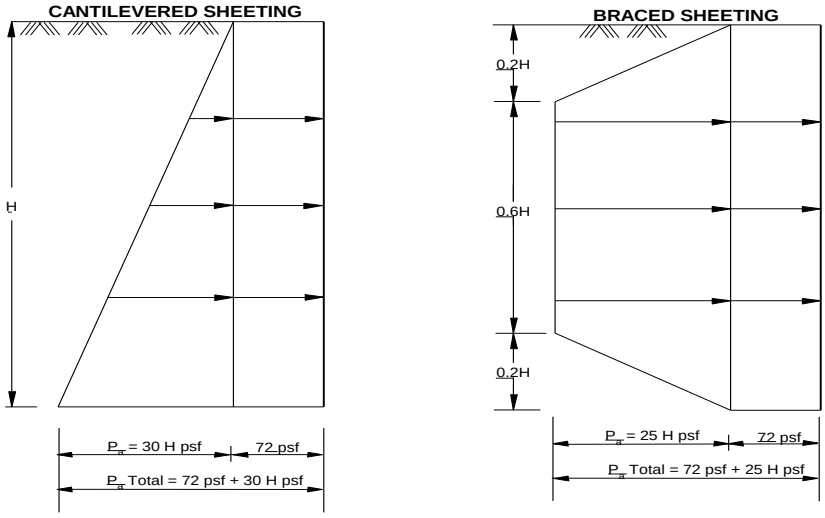
Use of alternate combinations of cementitious materials may be permitted if the combinations meet design recommendations contained in American Concrete Institute guideline ACI 318-11.

The soils were also tested for soil reactivity (pH). The test results indicate that the on-site soils have a soil reactivity (pH) of 7.7 and an electrical resistivity of 1,386 ohm-cm. A neutral or non-corrosive soil has a pH value ranging from 5.5 to 8.4. Generally, soils that could be considered moderately corrosive to ferrous metals have resistivity values of about 3,000 ohm-cm to 10,000 ohm-cm. Soils with resistivity values less than 3,000 ohm-cm can be considered corrosive and soils with resistivity values less than 1,000 ohm-cm can be considered extremely corrosive.

Based on our analysis, it appears that the underlying onsite soils are corrosive to ferrous metals. We recommend that a corrosion design consultant, experienced in the field of corrosion design, provide solutions to mitigate potential for damage to buried metal or ferrous materials that come in contact with the onsite soils.

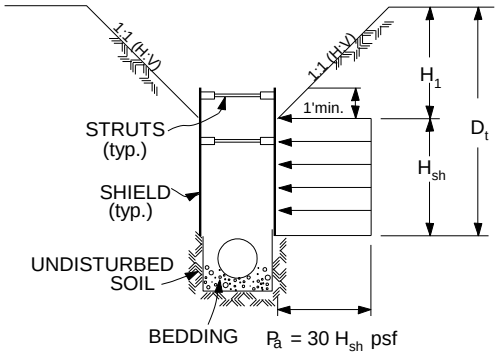
3.12 Temporary Slopes

Excavation of utility trenches will require either temporary sloped excavations or shoring. Sloping and shoring requirements should conform to Cal/OSHA standards for sandy soils. Our recommendations for lateral earth pressures to be used in the design of cantilevered and/or braced shoring are presented below. These values incorporate a uniform lateral pressure of 72 psf to provide for the normal construction loads imposed by vehicles, equipment, materials, and workmen on the surface adjacent to the trench excavation. However, if vehicles, equipment, materials, etc., are kept a minimum distance equal to the height of the excavation away from the edge of the excavation, this surcharge load need not be applied.



SHORING DESIGN: LATERAL SHORING PRESSURES

Design of the shield struts should be based on a value of 0.65 times the indicated pressure, Pa, for the approximate trench depth. The wales and sheeting can be designed for a value of 2/3 the design strut value.



HEIGHT OF SHIELD, H_{sh} = DEPTH OF TRENCH, D_t , MINUS DEPTH OF SLOPE, H_1

TYPICAL SHORING
DETAIL

Placement of the shield may be made after the excavation is completed or driven down as the material is excavated from inside of the shield. If placed after the excavation, some overexcavation may be required to allow for the shield width and advancement of the shield. The shield may be placed at either the top or the bottom of the pipe zone. Due to the anticipated thinness of the shield walls, removal of the shield after construction should have negligible effects on the load factor of pipes. Shields may be successively placed with conventional trenching equipment.

Vehicles, equipment, materials, etc. should be set back away from the edge of temporary excavations a minimum distance of 15 feet from the top edge of the excavation. Surface waters should be diverted away from temporary excavations and prevented from draining over the top of the excavation and down the slope face. During periods of heavy rain, the slope face should be protected with sandbags to prevent drainage over the edge of the slope, and a visqueen liner placed on the slope face to prevent erosion of the slope face.

Periodic observations of the excavations should be made by the geotechnical consultant to verify that the soil conditions have not varied from those anticipated and to monitor the overall condition of the temporary excavations over time. If at any time during construction conditions are encountered which differ from those anticipated, the geotechnical consultant should be contacted and allowed to analyze the field conditions prior to commencing work within the excavation.

Cal/OSHA construction safety orders should be observed during all underground work.

3.13 Utility Trench Backfill

The onsite fill soils will not be suitable for use as pipe bedding for buried utilities. All pipes should be bedded in a sand, gravel or crushed aggregate imported material complying with the requirements of the Standard Specifications for Public Works Construction (Greenbook) Section 306-1.2.1. Crushed rock products that do not contain appreciable fines should not be utilized as pipe bedding and/or backfill. Bedding materials should be densified to at least 90% relative compaction (ASTM D1557). The geotechnical consultant should review and approve of proposed bedding materials prior to use.

The on-site soils are expected to be suitable as trench backfill provided they are screened of organic matter, boulders and cobbles over 6 inches in diameter. Trench backfill should be densified to at least 90% relative compaction (ASTM D1557). On-site granular soils with a sand equivalent value of 15 or greater may be water densified initially per Greenbook Specifications. Supplemental mechanical compaction methods will be required to attain the required 90% relative compaction.

All utility trench backfill within street right of way, utility easements, under or adjacent to sidewalks, driveways, or building pads should be observed and tested by the geotechnical consultant to verify proper compaction. Trenches excavated adjacent to foundations should not extend within the footing influence zone defined as the area within a line projected at a 1:1 drawn from the bottom edge of the footing. Trenches crossing perpendicular to foundations should be excavated and backfilled prior to the construction of the foundations. The excavations should be backfilled in the presence of the geotechnical engineer and tested to verify adequate compaction beneath the proposed footing. Cal/OSHA construction safety orders should be observed during all underground work.

3.14 Preliminary Pavement Sections

Based on the soil encountered during our geotechnical exploration, we estimate that the R-value is 30. Structural sections were designed using the procedures outlined in Chapter 630 of the California Highway Design Manual (Caltrans, 2008). This procedure uses the principle that the pavement structural section must be of adequate thickness to distribute the load from the design Traffic Index (TI) to the subgrade soils in such a manner that the stresses from the applied loads do not exceed the strength of the soil (R- value). : Recommended structural sections are as follows:

- Local Streets/Cul-De-Sac (TI=4.0, R-Value=30):
  3 inches of asphaltic concrete over
  4 inches of crushed aggregate or miscellaneous base*

- Residential Streets (TI=5.0, R-Value=30):
  3 inches of asphaltic concrete over
  6 inches of crushed aggregate or miscellaneous base*

- Residential Collector (TI=6.0, R-Value=30):
  4 inches of asphaltic concrete over
  7 inches of crushed aggregate or miscellaneous base*

- Minor Arterial Streets (TI=8.0, R-Value=30):
  5 inches of asphaltic concrete over
  11 inches of crushed aggregate or miscellaneous base*

*Recommended minimum thickness of aggregate or miscellaneous base.

Portland cement concrete (PCC) pavements for areas which are not subject to traffic loads may be designed with a minimum thickness of 4.0 inches of Portland cement concrete on compacted native soils. If traffic loads are anticipated, PCC pavements should be designed for a minimum thickness of 6.0 inches of Portland cement concrete on 4.0 inches of crushed aggregate or miscellaneous base.

Prior to paving, the subgrade should be prepared in accordance with this report. At a minimum, the upper 12 inches of subgrade soils should be at or above optimum moisture content and compacted to a minimum of 95% relative compaction. All aggregate base courses should also be moisture conditioned to within 2% of optimum moisture content and compacted to a minimum of 95% relative compaction.

R-value tests should be performed at the completion of grading and final pavement section design developed at that time.

3.15 Drainage and Moisture Proofing

Surface drainage should be directed away from the proposed structures into suitable drainage devices. Neither excess irrigation nor rainwater should be allowed to collect or pond against building foundations. Surface waters should be diverted away from the tops of slopes and prevented from draining over the top of slopes and down the slope face.

Retaining structures should be drained to prevent the accumulation of subsurface water behind the walls. Backdrains should be installed behind all retaining walls exceeding 3 feet in height. All backdrains should outlet to suitable drainage devices. Retaining wall less than 3 feet in height should be provided with backdrains or weep holes. Dampproofing and/or waterproofing should also be provided on all retaining walls.

3.16 Geotechnical Observations

All footing excavations should be observed by the geotechnical consultant to verify that they have been excavated into competent earth materials. The foundation excavations should be observed prior to the placement of forms, reinforcement steel, or concrete. These excavations should be evenly trimmed and level. Prior to concrete placement, any loose or soft soils should be removed. Excavated soils should not be placed on slab or footing areas unless properly compacted.

Prior to the placement of the moisture barrier and sand, the subgrade soils underlying the slab should be observed by the geotechnical consultant to verify that all under-slab utility trenches have been properly backfilled and compacted, that no loose or soft soils are present, and that the slab subgrade has been properly compacted to a minimum of 90 percent relative compaction within the upper 12 inches.

Footings may experience an overall loss in bearing capacity or an increased potential to settle where located in close proximity to existing or future utility trenches. Furthermore, stresses imposed by the footings on the utility lines may cause cracking, collapse and/or a loss of serviceability. To reduce this risk, footings should extend below a 1:1 plane projected upward from the closest bottom of the trench.

Slabs on grade and walkways should be brought to a minimum of 2% and a maximum of 6% above their optimum moisture content for a depth of 18 inches prior to the placement of concrete. The geotechnical consultant should perform insitu moisture tests to verify that the appropriate moisture content has been achieved a maximum of 24 hours prior to the placement of concrete or moisture barriers.

Placement of planned retaining wall backdrains should be observed prior to backfilling.

3.17 Plan Review

Once formal foundation plans are prepared for the subject property, this office should review the plans from a geotechnical viewpoint, comment on changes from the plan used during preparation of this report and revise the recommendations of this report where necessary.

3.18 Onsite Stormwater Disposal

Due to the very low rate of infiltration, it is our opinion that onsite stormwater disposal is not a feasible option at the planned depths. We recommend use of a soil infiltration rate of 0.03 cm/hr (0.01 in/hr) for design of the storm water system, which includes the minimum factor of safety correction required by the Riverside County Flood Control and Water Conservation District.

Design Infiltration Rate $I_D = I_M/(CF) = (0.03 \text{ in/hr})/(3) = 0.01 \text{ in/hr}$

The purpose of the factor of safety is to account for degradation of soil conditions by fine grained materials carried by runoff and other similar conditions that can occur during storms or between periods of maintenance. As a minimum, the factor of safety and design of the infiltration system should follow procedures in the current Riverside County Design Handbook for Low Impact Development Best Management Practices. Homeowners and the Homeowner's Association (HOA) should be notified of all required maintenance procedures for the pretreatment system in order to minimize the possibility of siltation and reduced infiltration rate.

Compaction of soil below the proposed storm water infiltration system could significantly lower infiltration rates and could make the tested rate inapplicable. Compaction of soil below the infiltration system could destroy soil structure and thus seriously impact the infiltration system's performance. Proper oversight is needed during construction to ensure that natural soils at the bottom of the infiltration system are not compacted and that the stormwater system excavation does not deviate from the proposed design depth. If the bottom of the stormwater system excavation is deeper than the design depth, the geotechnical engineer should be immediately contacted to provide additional recommendations. Loose fill soil should not be placed above naturally occurring soils at the bottom of the storm water system excavation, as saturation of such soils could result in settlement that might adversely impact the storm water system and overlying improvements.

It should be noted that intentional discharge of storm water into the soil underlying a development can lead to a variety of geotechnical distress issues. Saturation of the underlying soils can lead to loss of structural support, causing movement of foundations and other improvements due to settlement, collapse, internal erosion, expansion, or any other potential processes.

4.00 Closure

The findings, conclusions and recommendations in this report were prepared in accordance with generally accepted engineering and geologic principles and practices. No other warranty, either expressed or implied, is made. This report has been prepared for Sun Holland, LLC to be used solely for design purposes. Anyone using this report for any other purpose must draw their own conclusions regarding required construction procedures and subsurface conditions.

The geotechnical and geologic consultant should be retained during the earthwork and foundation phases of construction to monitor compliance with the design concepts and recommendations and to provide additional recommendations as needed. Should subsurface conditions be encountered during construction that are different from those described in this report, this office should be notified immediately so that our recommendations may be re-evaluated.

FIGURES

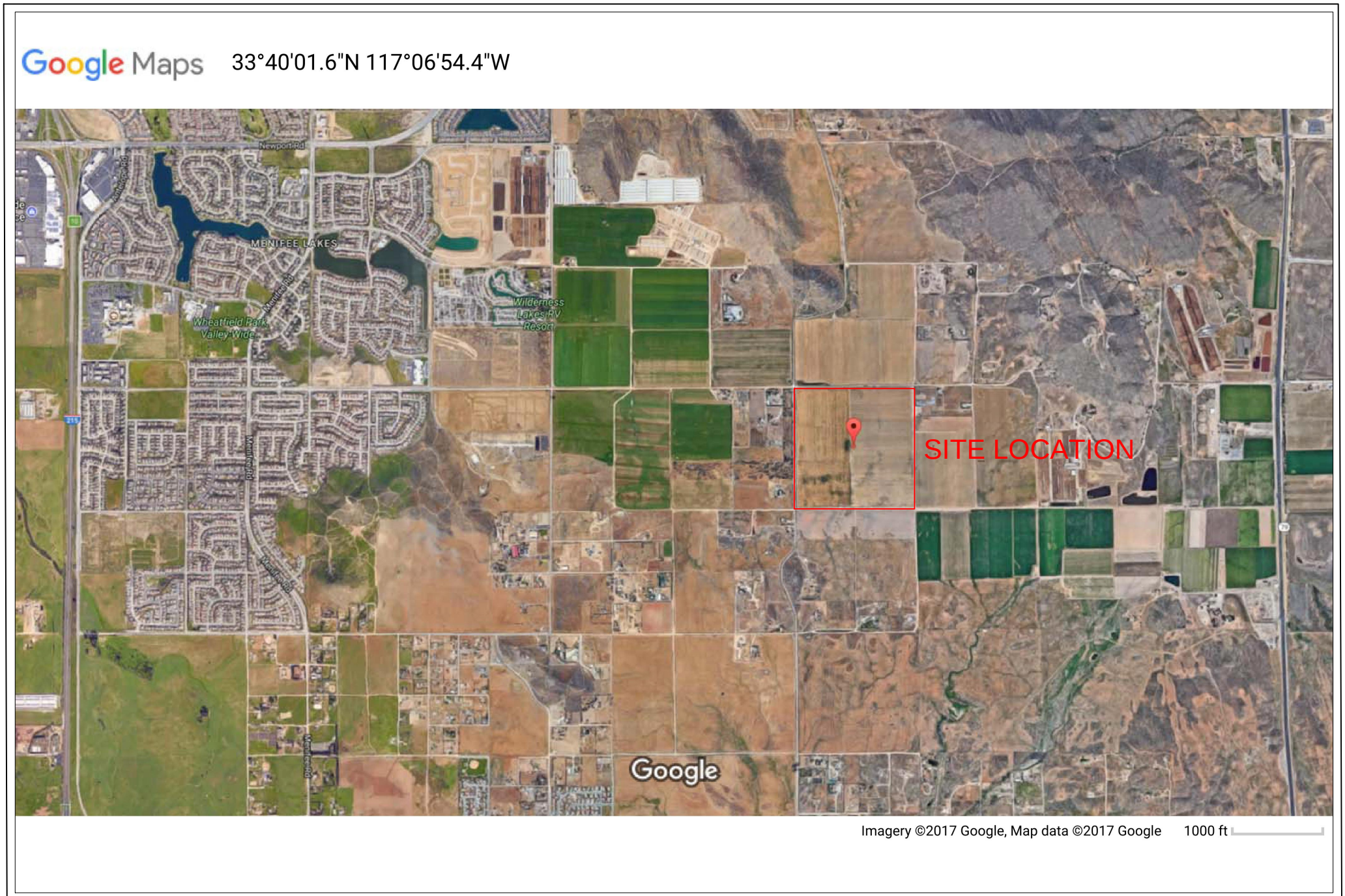


Figure 1

Site Location Map

Tentative Tract 31008

RMA GeoScience

RMA Job No:	17H-0307-0
Date:	Oct, 2017
Prepared By:	AEG

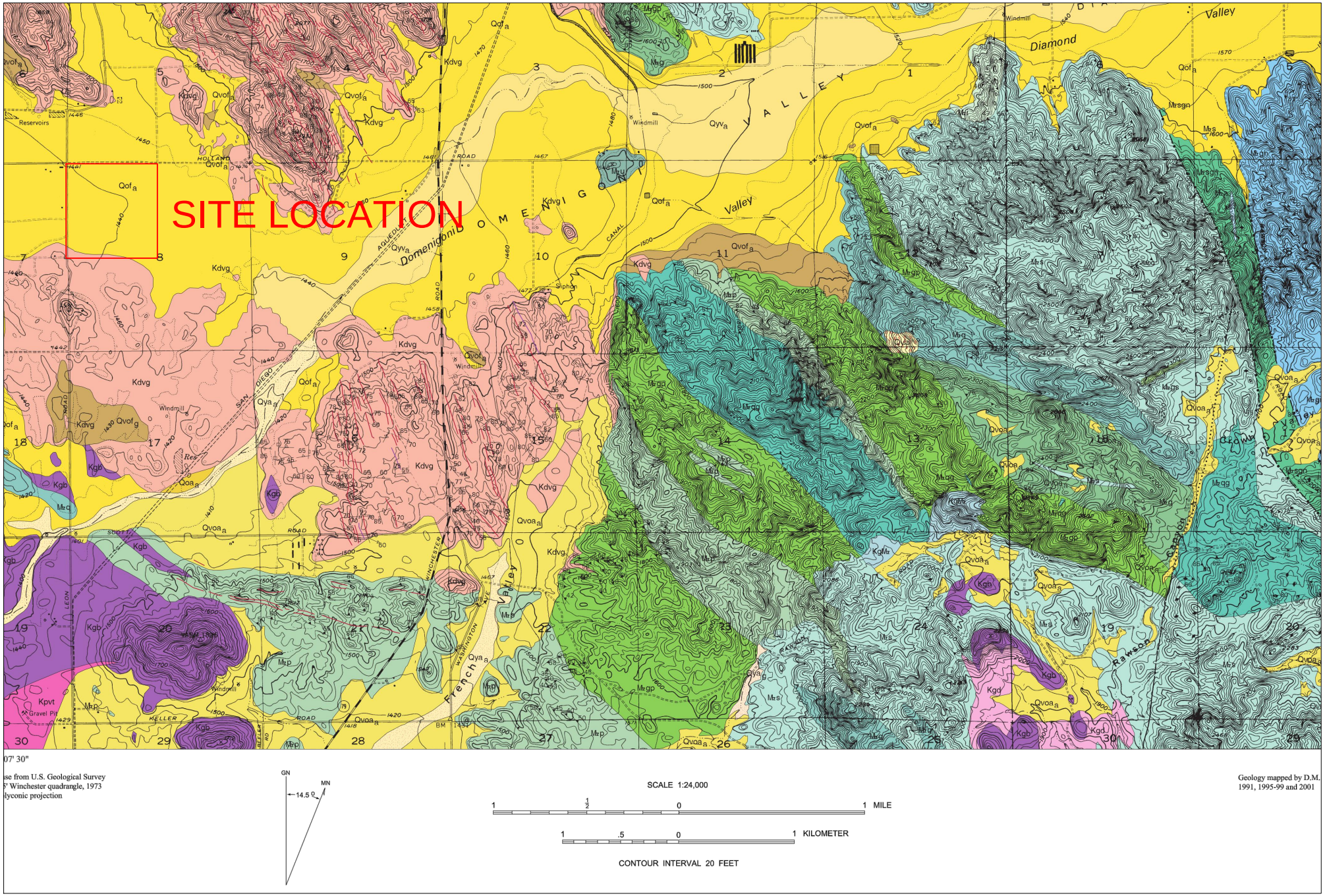


Figure 2

Regional Geologic Map

Tentative Tract 31008

RMA Job No:	17H-0307-0
Date:	Oct, 2017
Prepared By:	AEG

APPENDIX A

FIELD INVESTIGATION

RMA GeoScience

APPENDIX A

FIELD INVESTIGATION

A-1.00 FIELD EXPLORATION

A-1.01 Number of Test Pits

Our subsurface investigation consisted of the excavation of four (4) backhoe-excavated test pits, and five (5) hollow-stem auger borings.

A-1.02 Location of Test Pits

The approximate locations of the Test Pits and Exploratory borings are presented as Plate 1 and Plate 2, Boring and Test Pit Location Map 1 and 2.

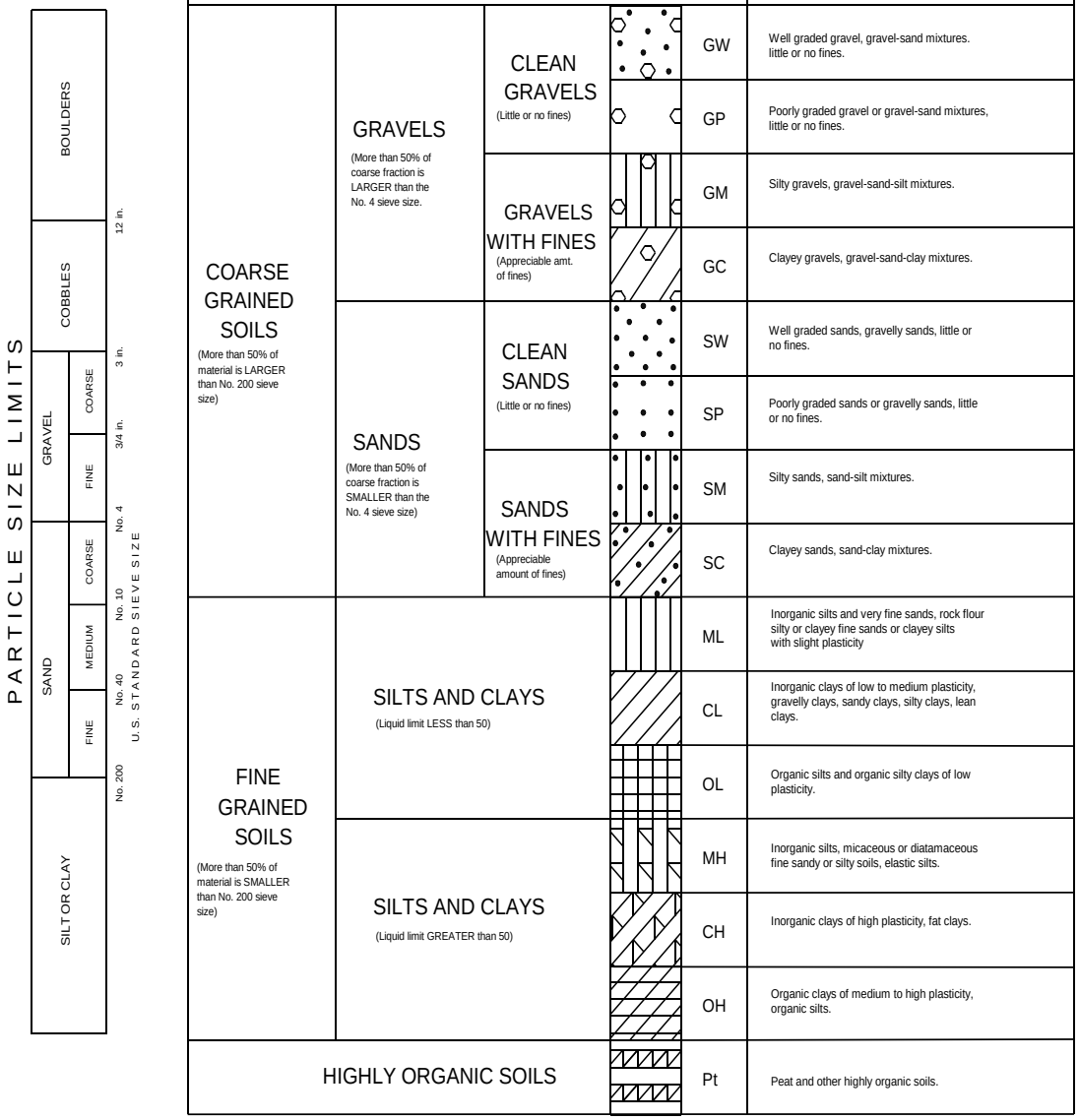
A-1.03 Test Pit Logging

Logs of test pits were prepared by one of our staff and are attached in this appendix. The logs contain factual information and interpretation of subsurface conditions between samples. The strata indicated on these logs represent the approximate boundary between earth units and the transition may be gradual. The logs show subsurface conditions at the dates and locations indicated, and may not be representative of subsurface conditions at other locations and times.

Identification of the soils encountered during the subsurface exploration was made using the field identification procedure of the Unified Soils Classification System (ASTM D2488). A legend indicating the symbols and definitions used in this classification system and a legend defining the terms used in describing the relative compaction, consistency or firmness of the soil are attached in this appendix. Bag samples of the major earth units were obtained for laboratory inspection and testing, and the in-place density of the various strata encountered in the exploration was determined.

A-1.04 Field Infiltration Testing

Four (4) field soil infiltration tests were performed in the test pits excavated at the four corners of the proposed residential development, using the Double-Ring Infiltrometer method (ASTM Test Method D 3385). The results of our infiltration testing are included in this appendix. The locations of the field infiltration tests are shown on Plate 1.



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

UNIFIED SOIL CLASSIFICATION SYSTEM

I. SOIL STRENGTH/DENSITY

BASED ON STANDARD PENETRATION TESTS

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

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

BASED ON RELATIVE COMPACTION

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

II. SOIL MOISTURE

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

BORING AND TEST PIT LOGS

BORING NUMBER B-1

RMA GeoScience
9854 □leno□□s □l□d., Sun V□lle□, CA 91352

CLIENT: Sun Holland, LLC
PROJECT NAME: Canterwood
PROJECT NUMBER: 17H-0307-0/01
PROJECT LOCATION: Tract 31008, Riverside County, CA
DATE STARTED: 9-27-17 COMPLETED: 9-27-17
GROUND ELEVATION: _____ BORING DIAMETER: 8"
EXCAVATION METHOD: 8" Hollow-stem Auger
GROUND WATER LEVELS: _____
DRILLING CONTRACTOR: RMA Geoscience
LOGGED BY: AEG CHECKED BY: MAS

DEPTH (ft)	DRIVE SAMPLPE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D50	Classification
0										Topsoil (Af) 0-3' Brown, silty fine SAND (damp, soft)			
5	☒	28/32/14	☒	5.5	113.7	120.0				Alluvium (Qal) @5' Brown, silty fine to medium SAND (moist, dense to very dense)	34%		SM
10	☒	27/18/17	☒	13.6	120.5	136.9				@10' Reddish brown clayey fine SAND (moist to damp, medium dense to dense)			SC
15	☒	2/6/15		12.3	111.7	125.5				@15' Reddish brown clayey fine SAND (moist to damp, medium dense)			SC
20	☒	3/12/19		16.7	112.3	131.1				@20' Reddish brown, silty fine SAND (moist, medium dense)			SM
25										Total Depth = 21' No Water No Caving Backfilled with Cuttings			
30													

☒ 2.5" Ring Sample ◫ Standard Split Spoon Sample

BORING NUMBER B-2

RMA GeoScience
9854 □leno□□s □l□d., Sun V□lle□, CA 91352

CLIENT: Sun Holland, LLC
PROJECT NAME: Canterwood
PROJECT NUMBER: 17H-0307-0/01
PROJECT LOCATION: Tract 31008, Riverside County, CA
DATE STARTED: 9-27-17 COMPLETED: 9-27-17
GROUND ELEVATION: _____ BORING DIAMETER: 8"
EXCAVATION METHOD: 8" Hollow-stem Auger
GROUND WATER LEVELS: _____
DRILLING CONTRACTOR: RMA Geoscience
LOGGED BY: AEG CHECKED BY: MAS

DEPTH (ft)	DRIVE SAMPLPE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D50	Classification
0										Topsoil (Af) 0-3' Brown, silty fine SAND (damp, soft)			SM
5	☒	4/18/26		14.6	114.0	130.7				Alluvium (Qal) @4' Reddish brown, clayey to silty fine SAND (moist to damp, medium dense to dense)	44%		SM
10	☒	7/14/16		11.3	120.8	134.5				@8' Reddish brown, clayey fine SAND (moist, medium dense to dense)			SC
15	☒	2/11/13		13.1	116.9	132.2				@13' Reddish brown, clayey fine SAND (moist, medium dense)			SC
20										Total Depth = 15' No Water No Caving Backfilled with Cuttings			
25													
30													

☒ 2.5" Ring Sample ◫ Standard Split Spoon Sample

BORING NUMBER B-3

RMA GeoScience
9854 □leno□□s □l□d., Sun V□lle□, CA 91352

CLIENT: Sun Holland, LLC
PROJECT NAME: Canterwood
PROJECT NUMBER: 17H-0307-0/01
PROJECT LOCATION: Tract 31008, Riverside County, CA
DATE STARTED: 9-27-17 COMPLETED: 9-27-17
GROUND ELEVATION: _____ BORING DIAMETER: 8"
EXCAVATION METHOD: 8" Hollow-stem Auger
GROUND WATER LEVELS: _____
DRILLING CONTRACTOR: RMA Geoscience
LOGGED BY: AEG CHECKED BY: MAS

DEPTH (ft)	DRIVE SAMPLPE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D_{50}	Classification
0										Topsoil (Af) 0-3' Light brown, silty fine SAND (slightly moist, soft to medium dense)			SM
5	☒	7/13/19		12.2	115.8	129.9				Alluvium (Qal) @5' Reddish brown, clayey fine SAND (moist, medium dense to dense)			SC
10	☒	4/12/20	☒	10.9	112.8	125.1				@10' Reddish brown, clayey fine SAND (moist, medium dense to dense)			SC
15	☒	1/7/20		12.2	115.5	129.6				@15' Reddish brown, silty fine to medium SAND with clay (slightly moist, medium dense)			SM
20										Total Depth = 16' No Water No Caving Backfilled with Cuttings			
25													
30													

☒ 2.5" Ring Sample
◫ Standard Split Spoon Sample

BORING NUMBER B-4

RMA GeoScience
9854 □leno□□s □l□d., Sun V□lle□, CA 91352

CLIENT: Sun Holland, LLC
PROJECT NAME: Canterwood
PROJECT NUMBER: 17H-0307-0/01
PROJECT LOCATION: Tract 31008, Riverside County, CA
DATE STARTED: 9-27-17 COMPLETED: 9-27-17
GROUND ELEVATION: _____ BORING DIAMETER: 8"
EXCAVATION METHOD: 8" Hollow-stem Auger
GROUND WATER LEVELS: _____
DRILLING CONTRACTOR: RMA Geoscience
LOGGED BY: AEG CHECKED BY: MAS

DEPTH (ft)	DRIVE SAMPLPE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
0										Topsoil (Af)			
	☒	16/40/31		9.6	122.6	134.3				0-2' Light brown, silty fine SAND (slightly moist, soft to medium dense)			SM
										Alluvium (Qal)			
5										@2' Reddish brown, clayey fine to medium SAND (moist, very dense)	48%		SC
	☒	3/17/20		9.3	121.0	132.3				@7' Reddish brown, silty fine SAND with clay (moist, dense)			SC
10													
	☒	10/20/29		13.6	117.3	133.3				@12' Dark reddish brown, clayey fine SAND (moist, dense to very dense)			SC
15										Total Depth = 15' No Water No Caving Backfilled with Cuttings			
20													
25													
30													

☒ 2.5" Ring Sample ◫ Standard Split Spoon Sample

BORING NUMBER B-5

RMA GeoScience
9854 □leno□□s □l□d., Sun V□lle□, CA 91352

CLIENT: Sun Holland, LLC
PROJECT NAME: Canterwood
PROJECT NUMBER: 17H-0307-0/01
PROJECT LOCATION: Tract 31008, Riverside County, CA
DATE STARTED: 9-27-17 COMPLETED: 9-27-17
GROUND ELEVATION: _____ BORING DIAMETER: 8"
EXCAVATION METHOD: 8" Hollow-stem Auger
GROUND WATER LEVELS: _____
DRILLING CONTRACTOR: RMA Geoscience
LOGGED BY: AEG CHECKED BY: MAS

DEPTH (ft)	DRIVE SAMPLPE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D_{50}	Classification
0										☒ 2.5" Ring Sample ◫ Standard Split Spoon Sample			
										Topsoil (Af)			
										0-3' Brown, silty fine SAND with clay (slightly moist to moist, medium dense)			SM
										Alluvium (Qal)			
5	☒	3/12/20		14.7	112.2	128.7				@5' Reddish brown, clayey fine SAND (moist, medium dense)			SC
10	☒	12/50=6"		10.1	108.4	119.4				@10' Reddish brown, clayey fine SAND (moist, very dense)			SC
15	☒	3/19/23		13.2	116.5	131.9				@15' Reddish brown, clayey fine to medium SAND (moist, dense)			SC
										Total Depth = 16' No Water No Caving Backfilled with Cuttings			
20													
25													
30													

TEST PIT NUMBER TP-1

RMA GeoScience
9854 □leno□□s □l□d., Sun V□lle□, CA 91352

CLIENT: Sun Holland, LLC
PROJECT NAME: Canterwood
PROJECT NUMBER: 17H-0307-0/01
PROJECT LOCATION: Tract 31008, Riverside County, CA
DATE STARTED: 9-28-17 COMPLETED: 9-28-17
GROUND ELEVATION: _____ BORING DIAMETER: _____
EXCAVATION METHOD: Backhoe
GROUND WATER LEVELS: _____
DRILLING CONTRACTOR: Williams Backhoe
LOGGED BY: AEG CHECKED BY: MAS

DEPTH (ft)	DRIVE SAMPLPE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D50	Classification
0			☒							Topsoil (Af) 0-3' Light brown, silty fine SAND (slightly moist, soft, tilled)			SM
5			☒							Alluvium (Qal) 3-9' Reddish brown, clayey medium SAND (moist, very dense)	51%		SC
10										Total Depth = 9' No Water No Caving Backfilled			
15													
20													
25													
30													

☒ 2.5" Ring Sample ◫ Standard Split Spoon Sample

TEST PIT NUMBER TP-2

RMA GeoScience
9854 □leno□□s □l□d., Sun V□lle□, CA 91352

CLIENT: Sun Holland, LLC
PROJECT NAME: Canterwood
PROJECT NUMBER: 17H-0307-0/01
PROJECT LOCATION: Tract 31008, Riverside County, CA
DATE STARTED: 9-28-17 COMPLETED: 9-28-17
GROUND ELEVATION: _____ BORING DIAMETER: _____
EXCAVATION METHOD: Backhoe
GROUND WATER LEVELS: _____
DRILLING CONTRACTOR: Williams Backhoe
LOGGED BY: AEG CHECKED BY: MAS

DEPTH (ft)	DRIVE SAMPLPE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
0										☒ 2.5" Ring Sample ◫ Standard Split Spoon Sample			
										Artificial Fill (Af) 0-3' Light brown, silty fine SAND (slightly moist, soft, tilled)			SM
5										Alluvium (Qal) 3-8' Reddish brown, clayey fine to medium SAND (moist, very dense)			SC
10										Total Depth = 8' No Water No Caving Backfilled			
15													
20													
25													
30													

TEST PIT NUMBER TP-3

RMA GeoScience
9854 □leno□□s □l□d., Sun V□lle□, CA 91352

CLIENT: Sun Holland, LLC
PROJECT NAME: Canterwood
PROJECT NUMBER: 17H-0307-0/01
PROJECT LOCATION: Tract 31008, Riverside County, CA
DATE STARTED: 9-28-17 COMPLETED: 9-28-17
GROUND ELEVATION: BORING DIAMETER:
EXCAVATION METHOD: Backhoe
GROUND WATER LEVELS:
DRILLING CONTRACTOR: Williams Backhoe
LOGGED BY: AEG CHECKED BY: MAS

DEPTH (ft)	DRIVE SAMPLPE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D50	Classification
0										☒ 2.5" Ring Sample ◫ Standard Split Spoon Sample			
			☒							Artificial Fill (Af) 0-3' Light brown, silty fine SAND (slightly moist, soft, tilled)			SM
5			☒							Alluvium (Qal) 3-9' Reddish brown, clayey fine to medium SAND (moist, very dense)	24%		SC
10										Total Depth = 9' No Water No Caving Backfilled			
15													
20													
25													
30													

TEST PIT NUMBER TP-4

RMA GeoScience
9854 □leno□□s □l□d., Sun V□lle□, CA 91352

CLIENT: Sun Holland, LLC
PROJECT NAME: Canterwood
PROJECT NUMBER: 17H-0307-0/01
PROJECT LOCATION: Tract 31008, Riverside County, CA
DATE STARTED: 9-28-17 COMPLETED: 9-28-17
GROUND ELEVATION: _____ BORING DIAMETER: _____
EXCAVATION METHOD: Backhoe
GROUND WATER LEVELS: _____
DRILLING CONTRACTOR: Williams Backhoe
LOGGED BY: AEG CHECKED BY: MAS

DEPTH (ft)	DRIVE SAMPLPE	BLOW COUNT (N VALUE)	BULK SAMPLE	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	WET UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	MATERIAL DESCRIPTION	<200	D 50	Classification
0										☒ 2.5" Ring Sample ◫ Standard Split Spoon Sample			
										Artificial Fill (Af) 0-3' Light brown, silty fine SAND (slightly moist, soft, tilled)			SM
5										Alluvium (Qal) 3-8' Reddish brown, clayey to silty, fine to medium SAND (moist, dense to very dense)			SC
10										Total Depth = 8' No Water No Caving Backfilled			
15													
20													
25													
30													

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Infiltration Test Results

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GEOTECHNICAL CONSULTANTS

INFILTRATION TEST RESULTS

Project ID	17H-0307-0
Test Location	TP-1 @ 9'
Tested By	AEG
Date	9/28/17
Tube Set	1

Constants	Area (cm^2)	Depth of Liq (cm)
Inner Ring	707	10.16
Anlr. Space	2106	10.16

Test No.	Start or End	Date M/D/Y	Time Hr:Min	Interval Elapsed (min)	Flow Readings				Incr. Infiltration Rate		Incr. Infiltration Rate		Remarks
					Inner Ring		Annular Space						
					Reading (mm)	Flow (cm^3)	Reading (mm)	Flow (cm^3)	Inner (cm/hr)	Annular (cm/hr)	Inner (in/hr)	Annular (in/hr)	
1	Start	9/28/17	10:00	30	420	31	465	550	0.09	0.52	0.03	0.21	
	End	9/28/17	10:30	30	415		435						
2	Start	9/28/17	10:30	30	415	31	435	459	0.09	0.44	0.03	0.17	
	End	9/28/17	11:00	60	410		410						
3	Start	9/28/17	11:00	30	410	31	410	367	0.09	0.35	0.03	0.14	
	End	9/28/17	11:30	90	405		390						
4	Start	9/28/17	11:30	30	405	31	390	275	0.09	0.26	0.03	0.10	
	End	9/28/17	12:00	120	400		375						
5	Start	9/28/17	12:00	30	400	31	375	275	0.09	0.26	0.03	0.10	
	End	9/28/17	12:30	150	395		360						
6	Start	9/28/17	12:30	30	395	31	360	183	0.09	0.17	0.03	0.07	
	End	9/28/17	13:00	180	390		350						
7	Start	9/28/17	13:00	30	390	31	350	183	0.09	0.17	0.03	0.07	
	End	9/28/17	13:30	210	385		340						
8	Start	9/28/17	13:30	30	385	31	340	183	0.09	0.17	0.03	0.07	
	End	9/28/17	14:00	240	380		330						

INFILTRATION TEST RESULTS

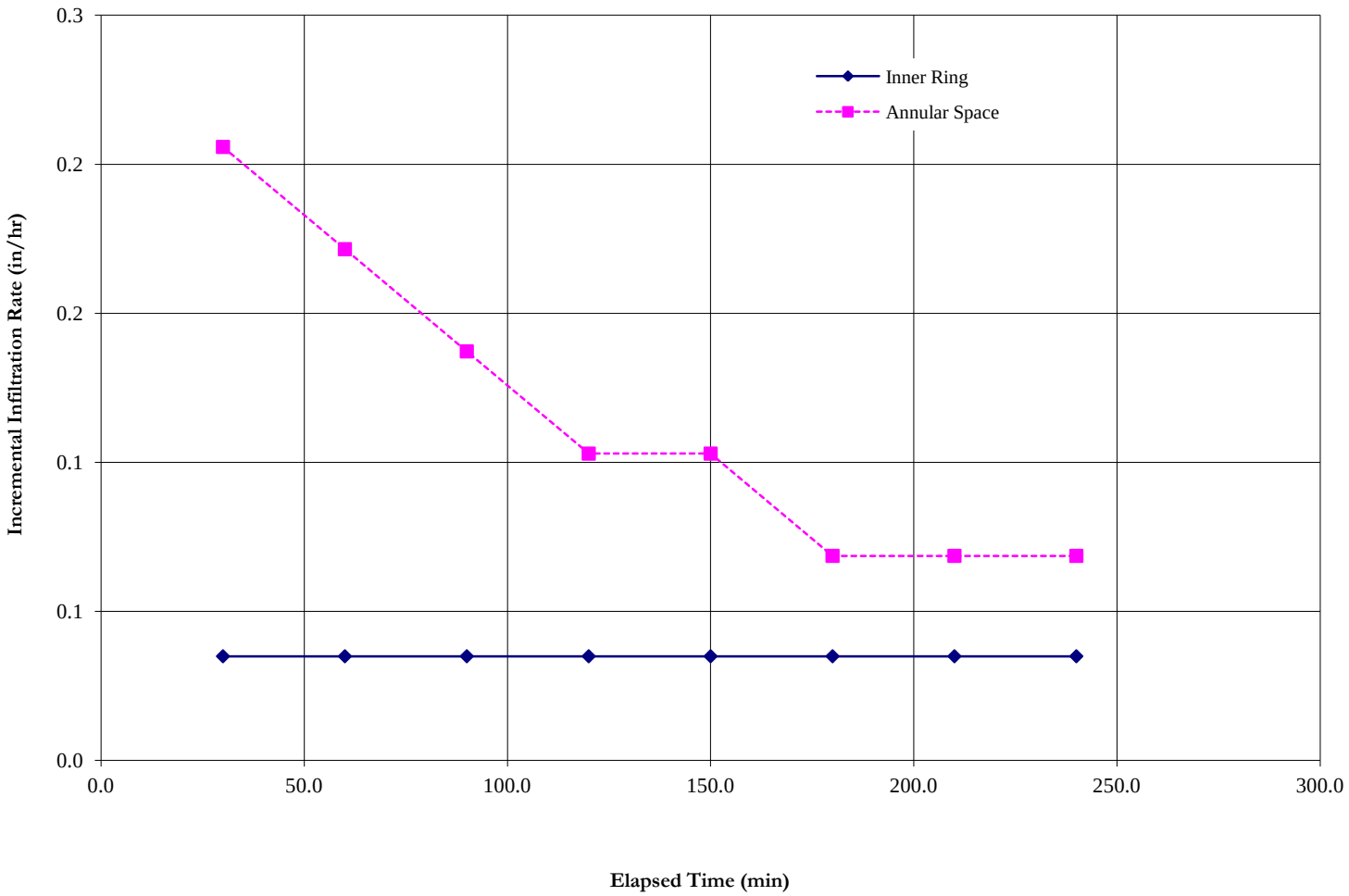
Project ID 17H-0307-0

Tested By AEG

Test Location TP-1 @ 9'

Date of Test 9/28/17

INFILTRATION TEST



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GEOTECHNICAL CONSULTANTS

INFILTRATION TEST RESULTS

Project ID	17H-0307-0
Test Location	TP-2 @ 8'
Tested By	AEG
Date	9/28/17
Tube Set	2

Constants	Area (cm^2)	Depth of Liq (cm)
Inner Ring	707	10.16
Anlr. Space	2106	10.16

Test No.	Start or End	Date M/D/Y	Time Hr:Min	Interval Elapsed (min)	Flow Readings				Incr. Infiltration Rate		Incr. Infiltration Rate		Remarks
					Inner Ring		Annular Space						
					Reading (mm)	Flow (cm^3)	Reading (mm)	Flow (cm^3)	Inner (cm/hr)	Annular (cm/hr)	Inner (in/hr)	Annular (in/hr)	
1	Start	9/28/17	10:45	30	435	32	490	276	0.09	0.26	0.04	0.10	
	End	9/28/17	11:15	30	430		475						
2	Start	9/28/17	11:15	30	430	32	475	276	0.09	0.26	0.04	0.10	
	End	9/28/17	11:45	60	425		460						
3	Start	9/28/17	11:45	30	425	32	460	276	0.09	0.26	0.04	0.10	
	End	9/28/17	12:15	90	420		445						
4	Start	9/28/17	12:15	30	420	32	445	276	0.09	0.26	0.04	0.10	
	End	9/28/17	12:45	120	415		430						
5	Start	9/28/17	12:45	30	415	32	430	276	0.09	0.26	0.04	0.10	
	End	9/28/17	13:15	150	410		415						
6	Start	9/28/17	13:15	30	410	32	415	184	0.09	0.17	0.04	0.07	
	End	9/28/17	13:45	180	405		405						
7	Start	9/28/17	13:45	30	405	32	405	184	0.09	0.17	0.04	0.07	
	End	9/28/17	14:15	210	400		395						
8	Start	9/28/17	14:15	30	400	32	395	184	0.09	0.17	0.04	0.07	
	End	9/28/17	14:45	240	395		385						

INFILTRATION TEST RESULTS

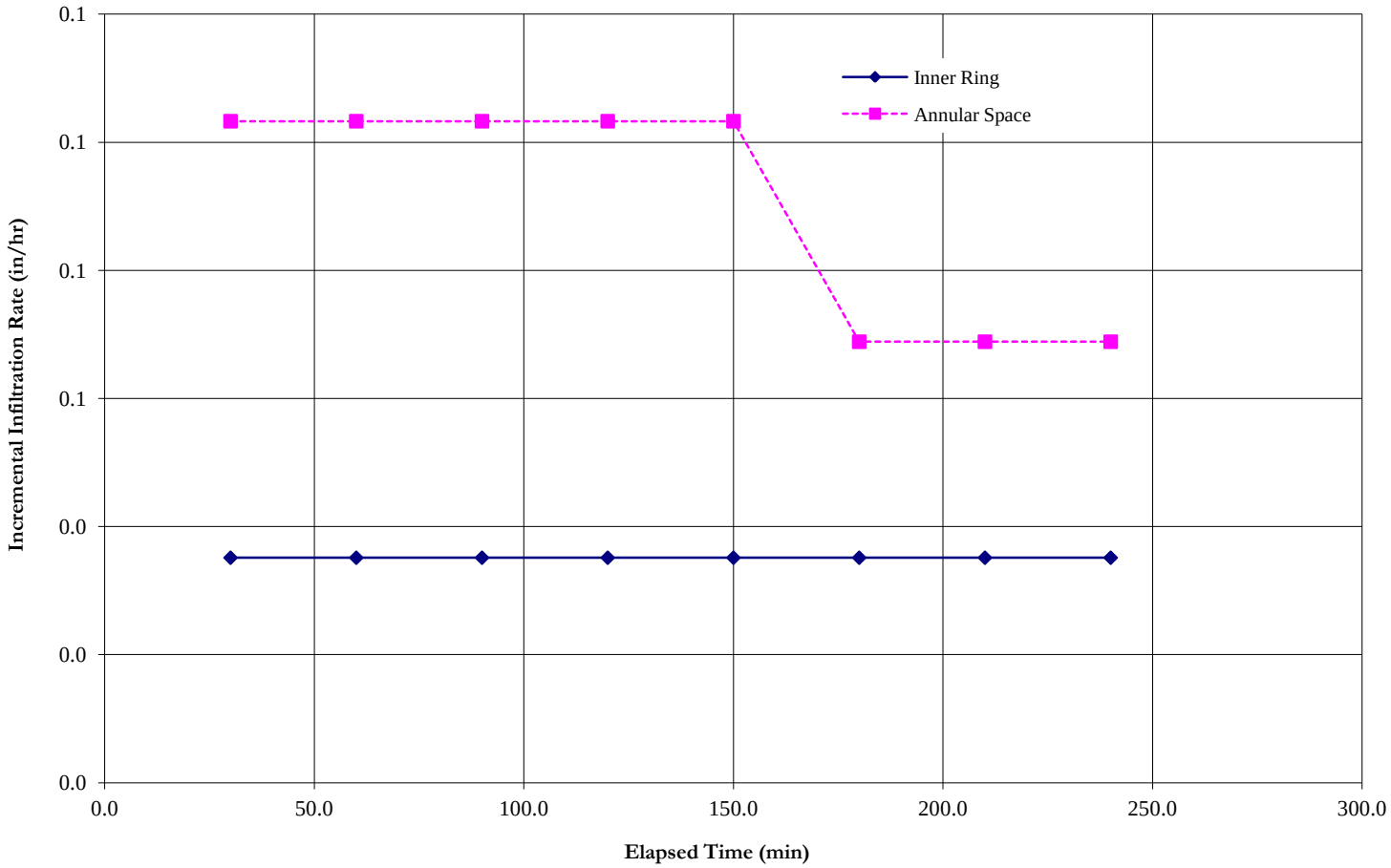
Project ID 17H-0307-0

Tested By AEG

Test Location TP-2 @ 8'

Date of Test 9/28/17

INFILTRATION TEST



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GEOTECHNICAL CONSULTANTS

INFILTRATION TEST RESULTS

Project ID	17H-0307-0
Test Location	TP-3 @ 9'
Tested By	AEG
Date	9/28/17
Tube Set	1

Constants	Area (cm^2)	Depth of Liq (cm)
Inner Ring	707	10.16
Anlr. Space	2106	10.16

Test No.	Start or End	Date M/D/Y	Time Hr:Min	Interval Elapsed (min)	Flow Readings				Incr. Infiltration Rate		Incr. Infiltration Rate		Remarks
					Inner Ring		Annular Space						
					Reading (mm)	Flow (cm^3)	Reading (mm)	Flow (cm^3)	Inner (cm/hr)	Annular (cm/hr)	Inner (in/hr)	Annular (in/hr)	
1	Start	9/28/17	11:30	30	410	31	475	275	0.09	0.26	0.03	0.10	
	End	9/28/17	12:00	30	405		460						
2	Start	9/28/17	12:00	30	405	31	460	275	0.09	0.26	0.03	0.10	
	End	9/28/17	12:30	60	400		445						
3	Start	9/28/17	12:30	30	400	31	445	275	0.09	0.26	0.03	0.10	
	End	9/28/17	13:00	90	395		430						
4	Start	9/28/17	13:00	30	395	31	430	183	0.09	0.17	0.03	0.07	
	End	9/28/17	13:30	120	390		420						
5	Start	9/28/17	13:30	30	390	31	420	183	0.09	0.17	0.03	0.07	
	End	9/28/17	14:00	150	385		410						
6	Start	9/28/17	14:00	30	385	31	410	183	0.09	0.17	0.03	0.07	
	End	9/28/17	14:30	180	380		400						
7	Start	9/28/17	14:30	30	380	31	400	183	0.09	0.17	0.03	0.07	
	End	9/28/17	15:00	210	375		390						
8	Start	9/28/17	15:00	30	375	31	390	183	0.09	0.17	0.03	0.07	
	End	9/28/17	15:30	240	370		380						

INFILTRATION TEST RESULTS

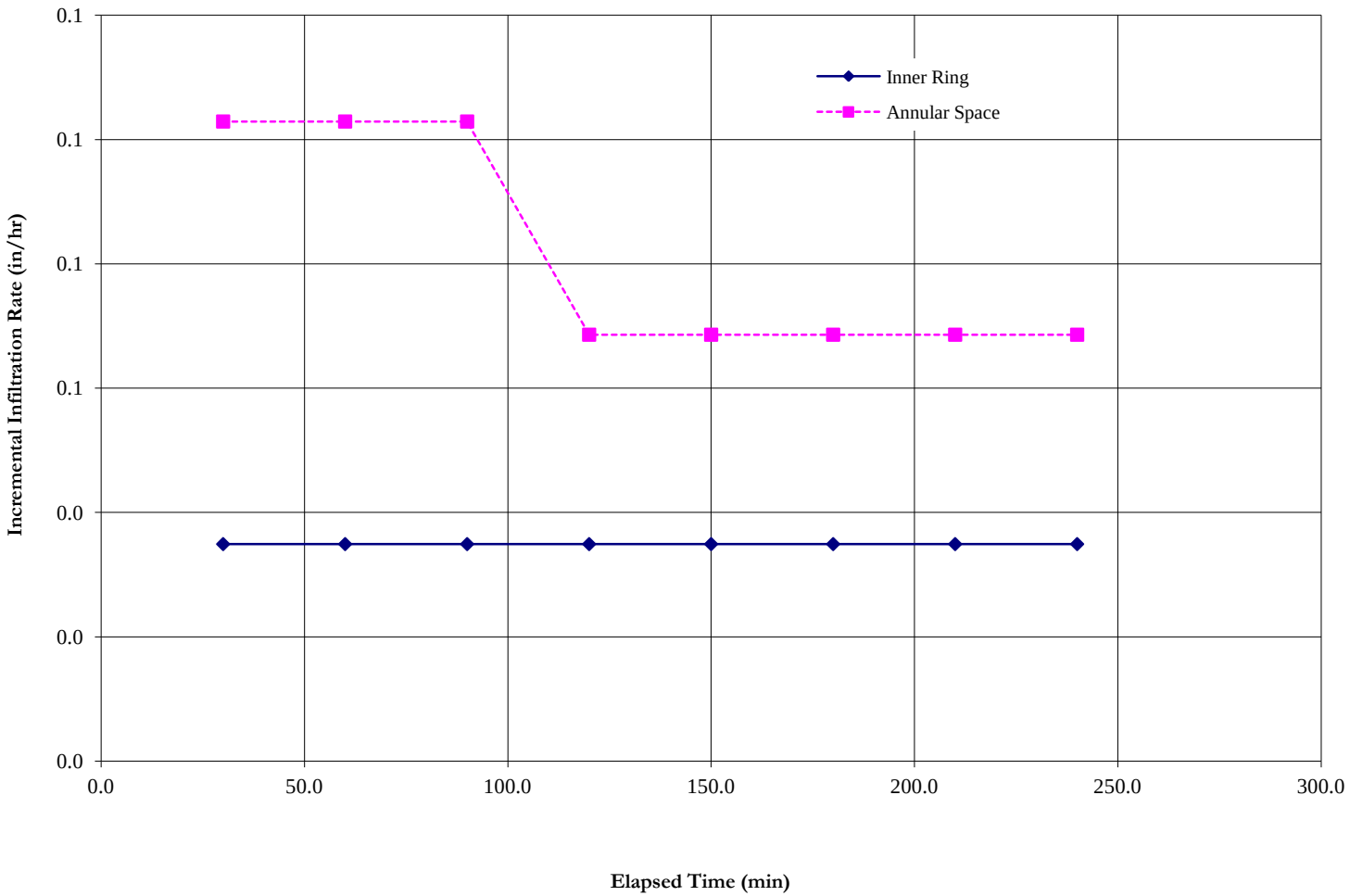
Project ID 17H-0307-0

Tested By AEG

Test Location TP-3 @ 9'

Date of Test 9/28/17

INFILTRATION TEST



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GEOTECHNICAL CONSULTANTS

INFILTRATION TEST RESULTS

Project ID	17H-0307-0
Test Location	TP-4 @ 8'
Tested By	AEG
Date	9/28/17
Tube Set	2

Constants	Area (cm^2)	Depth of Liq (cm)
Inner Ring	707	10.16
Anlr. Space	2106	10.16

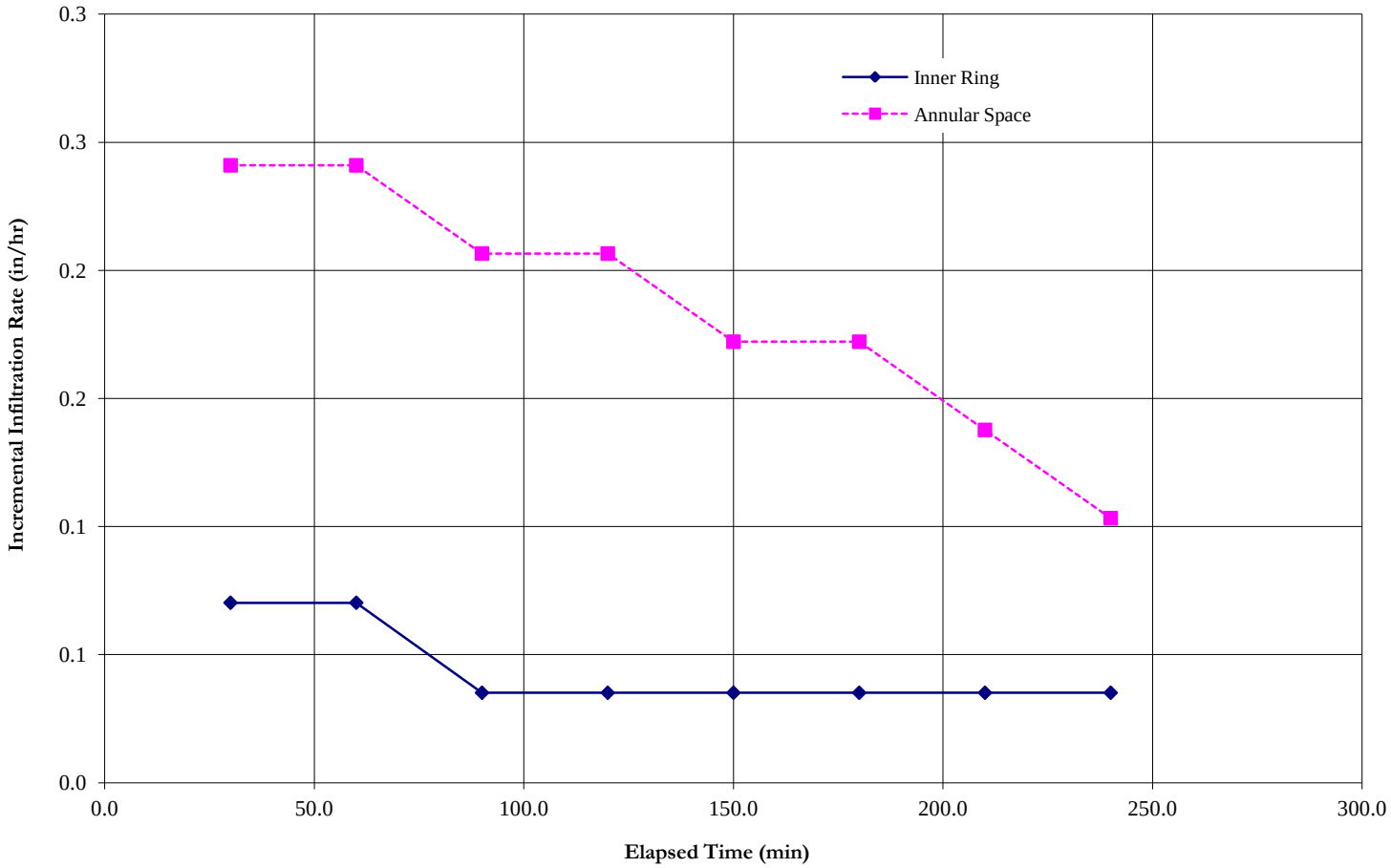
Test No.	Start or End	Date M/D/Y	Time Hr:Min	Interval Elapsed (min)	Flow Readings				Incr. Infiltration Rate		Incr. Infiltration Rate		Remarks
					Inner Ring		Annular Space						
					Reading (mm)	Flow (cm^3)	Reading (mm)	Flow (cm^3)	Inner (cm/hr)	Annular (cm/hr)	Inner (in/hr)	Annular (in/hr)	
1	Start	9/28/17	11:45	30	455	63	480	645	0.18	0.61	0.07	0.24	
	End	9/28/17	12:15	30	445		445						
2	Start	9/28/17	12:15	30	445	63	445	645	0.18	0.61	0.07	0.24	
	End	9/28/17	12:45	60	435		410						
3	Start	9/28/17	12:45	30	435	32	410	552	0.09	0.52	0.04	0.21	
	End	9/28/17	13:15	90	430		380						
4	Start	9/28/17	13:15	30	430	32	380	552	0.09	0.52	0.04	0.21	
	End	9/28/17	13:45	120	425		350						
5	Start	9/28/17	13:45	30	425	32	350	460	0.09	0.44	0.04	0.17	
	End	9/28/17	14:15	150	420		325						
6	Start	9/28/17	14:15	30	420	32	325	460	0.09	0.44	0.04	0.17	
	End	9/28/17	14:45	180	415		300						
7	Start	9/28/17	14:45	30	415	32	300	368	0.09	0.35	0.04	0.14	
	End	9/28/17	15:15	210	410		280						
8	Start	9/28/17	14:45	30	415	32	280	276	0.09	0.26	0.04	0.10	
	End	9/28/17	15:15	240	410		265						

INFILTRATION TEST RESULTS

Project ID 17H-0307-0 | Tested By AEG

Test Location TP-4 @ 8' | Date of Test 9/28/17

INFILTRATION TEST



APPENDIX B

LABORATORY TESTS

APPENDIX B

LABORATORY TESTS

B-1.00 LABORATORY TESTS

B-1.01 Sieve Analysis (% finer than #200)

Two soil samples obtained from the test borings were tested in accordance with ASTM D1140 to determine the percent passing the #200 sieve. This represents the amount of silt and clay that is present in the soil.

B-1.02 Soluble Sulfates

Tests were performed in accordance with California Test Methods 417 and 422 on a near-surface soil sample obtained during the field exploration. These tests were performed by AP Engineering and Testing located in Pomona, California. Test results are included in this section.

B-1.03 Soil Reactivity (pH) and Electrical Conductivity (Ec)

Representative soil sample was tested for soil reactivity (pH) and electrical conductivity (Ec) using California Test Method 643. The pH measurement determines the degree of acidity or alkalinity in the soils. The Ec is a measure of the electrical resistivity and is expressed as the reciprocal of the resistivity. These tests were performed by AP Engineering and Testing located in Pomona, California. Test results are included in this section.

B-1.04 Moisture Determination

Moisture content of the soil samples was performed in accordance to standard method for determination of water content of soil by drying oven, ASTM D2216. The mass of material remaining after oven drying is used as the mass of the solid particles. The results of our laboratory tests are presented on Boring Logs RMA-B1 through RMA-B5 presented in Appendix A.

B-1.05 Density of Split-Barrel Samples

The density of tube samples, which were obtained using a split-barrel sampler, were determined in accordance with ASTM D2937. The results of these tests are provided on the Boring Logs RMA-B1 through RMA-B5 presented in Appendix A.

B-1.06 Maximum Density

Maximum density - optimum moisture relationship for the major soil types encountered during the field exploration were determined in the laboratory using the standard procedures of ASTM D1557.

B-1.07 Expansion Index

Expansion index testing was performed on representative samples of the major soil type to be placed as engineered structural fill, by the test methods outlined in ASTM D4829.

B-1.08 Test Results

Results for laboratory tests performed on representative samples obtained during the field investigation are presented in this appendix and on Boring Logs RMA-B1 through RMA-B5 presented in Appendix A.

MAXIMUM DENSITY - OPTIMUM MOISTURE

(Test Method: ASTM D1557)

Sample Location	Optimum Moisture (Percent)	Maximum Density (lbs/ft^3)
TP-1 @ 3-9 feet	7.1	136.1
TP-1 @ 0-3 feet	9.1	127.4

SOLUBLE SULFATES

(California Test Method 417)

Sample Location	Soluble Sulfate (ppm)
TP-1 @ 0-3 feet	167

SOIL REACTIVITY (pH) AND ELECTRICAL CONDUCTIVITY

(California Test Method 643)

Sample Location	pH	Resistivity (Ohm-cm)
TP-1 @ 0-3 feet	7.7	1386

EXPANSION TEST

(Test Method: ASTM D4829)

Sample Location	Expansion Index	Expansion Classification
TP-1 @ 0-3 feet	0	Very Low
TP-3 @ 0-3 feet	0	Very Low
TP-1 @ 3-9 feet	9	Very Low
TP-3 @ 3-9 feet	13	Very Low

APPENDIX C

GENERAL EARTHWORK
AND
GRADING SPECIFICATIONS

RMA GeoScience

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

C-1.00 GENERAL DESCRIPTION

C-1.01 Introduction

These specifications present our general recommendations for earthwork and grading as shown on the approved grading plans for the subject project. These specifications shall cover all clearing and grubbing, removal of existing structures, preparation of land to be filled, filling of the land, spreading, compaction and control of the fill, and all subsidiary work necessary to complete the grading of the filled areas to conform with the lines, grades and slopes as shown on the approved plans.

The recommendations contained in the geotechnical report of which these general specifications are a part of shall supersede the provisions contained hereinafter in case of conflict.

C-1.02 Laboratory Standard and Field Test Methods

The laboratory standard used to establish the maximum density and optimum moisture shall be ASTM D1557.

The insitu density of earth materials (field compaction tests) shall be determined by the sand cone method (ASTM D1556), direct transmission nuclear method (ASTM D2922) or other test methods as considered appropriate by the geotechnical consultant.

Relative compaction is defined, for purposes of these specifications, as the ratio of the in-place density to the maximum density as determined in the previously mentioned laboratory standard.

C-2.00 Clearing

C-2.01 Surface Clearing

All structures marked for removal, timber, logs, trees, brush and other rubbish shall be removed and disposed of off the site. Any trees to be removed shall be pulled in such a manner so as to remove as much of the root system as possible.

C-2.02 Subsurface Removals

A thorough search should be made for possible underground storage tanks and/or septic tanks and cesspools. If found, tanks should be removed and cesspools pumped dry.

Any concrete irrigation lines shall be crushed in place and all metal underground lines shall be removed from the site.

C-2.03 Backfill of Cavities

All cavities created or exposed during clearing and grubbing operations or by previous use of the site shall be cleared of deleterious material and backfilled with native soils or other materials approved by the soil engineer. Said backfill shall be compacted to a minimum of 90% relative compaction.

C-3.00 ORIGINAL GROUND PREPARATION

C-3.01 Stripping of Vegetation

After the site has been properly cleared, all vegetation and topsoil containing the root systems of former vegetation shall be stripped from areas to be graded. Materials removed in this stripping process may be used as fill in areas designated by the soil engineer, provided the vegetation is mixed with a sufficient amount of soil to assure that no appreciable settlement or other detriment will occur due to decaying of the organic matter. Soil materials containing more than 3% organics shall not be used as structural fill.

C-3.02 Removals of Non-Engineered Fills

Any non-engineered fills encountered during grading shall be completely removed and the underlying ground shall be prepared in accordance to the recommendations for original ground preparation contained in this section. After cleansing of any organic matter the fill material may be used for engineered fill.

C-3.03 Overexcavation of Fill Areas

The existing ground in all areas determined to be satisfactory for the support of fills shall be scarified to a minimum depth of 6 inches. Scarification shall continue until the soils are broken down and free from lumps or clods and until the scarified zone is uniform. The moisture content of the scarified zone shall be adjusted to within 2% of optimum moisture. The scarified zone shall then be uniformly compacted to 90% relative compaction.

Where fill material is to be placed on ground with slopes steeper than 5:1 (H:V) the sloping ground shall be benched. The lowermost bench shall be a minimum of 15 feet wide, shall be a minimum of 2 feet deep, and shall expose firm material as determined by the geotechnical consultant. Other benches shall be excavated to firm material as determined by the geotechnical consultant and shall have a minimum width of 4 feet.

Existing ground that is determined to be unsatisfactory for the support of fills shall be overexcavated in accordance to the recommendations contained in the geotechnical report of which these general specifications are a part.

C-4.00 FILL MATERIALS

C-4.01 General

Materials for the fill shall be free from vegetable matter and other deleterious substances, shall not contain rocks or lumps of a greater dimension than is recommended by the geotechnical consultant, and shall be approved by the geotechnical consultant. Soils of poor gradation, expansion, or strength properties shall be placed in areas designated by the geotechnical consultant or shall be mixed with other soils providing satisfactory fill material.

C-4.02 Oversize Material

Oversize material, rock or other irreducible material with a maximum dimension greater than 12 inches, shall not be placed in fills, unless the location, materials, and disposal methods are specifically approved by the geotechnical consultant. Oversize material shall be placed in such a manner that nesting of oversize material does not occur and in such a manner that the oversize material is completely surrounded by fill material compacted to a minimum of 90% relative compaction. Oversize material shall not be placed within 10 feet of finished grade without the approval of the geotechnical consultant.

C-4.03 Import

Material imported to the site shall conform to the requirements of Section 4.01 of these specifications. Potential import material shall be approved by the geotechnical consultant prior to importation to the subject site.

C-5.00 PLACING AND SPREADING OF FILL

C-5.01 Fill Lifts

The selected fill material shall be placed in nearly horizontal layers which will not exceed approximately 6 inches in thickness when compacted. Thicker lifts may be placed if testing indicates the compaction procedures are such that the required compaction is being achieved and the geotechnical consultant approves their use.
Each layer shall be spread evenly and shall be thoroughly blade mixed during the spreading to insure uniformity of material in each layer.

C-5.02 Fill Moisture

When the moisture content of the fill material is below that recommended by the soils engineer, water shall then be added until the moisture content is as specified to assure thorough bonding during the compaction process.

When the moisture content of the fill material is above that recommended by the soils engineer, the fill material shall be aerated by blading or other satisfactory methods until the moisture content is as specified.

C-5.03 Fill Compaction

After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted to not less than 90% relative compaction. Compaction shall be by sheepsfoot rollers, multiple-wheel pneumatic tired rollers, or other types approved by the soil engineer.

Rolling shall be accomplished while the fill material is at the specified moisture content. Rolling of each layer shall be continuous over its entire area, and the roller shall make sufficient trips to insure that the desired density has been obtained.

C-5.04 Fill Slopes

Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compacting of the slopes may be done progressively in increments of 3 to 4 feet in fill height. At the completion of grading, the slope face shall be compacted to a minimum of 93% relative compaction. This may require track rolling or rolling with a grid roller attached to a tractor mounted side-boom.

Slopes may be over filled and cut back in such a manner that the exposed slope faces are compacted to a minimum of 93% relative compaction.

The fill operation shall be continued in six inch (6") compacted layers, or as specified above, until the fill has been brought to the finished slopes and grades as shown on the accepted plans.

C-5.05 Compaction Testing

Field density tests shall be made by the geotechnical consultant to determine the compaction of each layer of fill. Density tests shall be made at locations and elevations selected by the geotechnical consultant.

Frequency of field density tests shall be not less than one test for each 2.0 feet of fill height and at least every one thousand cubic yards of fill. Where fill slopes exceed four feet in height their finished faces shall be tested at a frequency of one test for each 1000 square feet of slope face.

Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density reading shall be taken in the compacted material below the disturbed surface. When these readings indicate that the density of any layer of fill or portion thereof is below the required density, the particular layer or portion shall be reworked until the required density has been obtained.

C-6.00 SUBDRAINS

C-6.01 Subdrain Material

Subdrains shall be constructed of a minimum 4-inch diameter pipe encased in a suitable filter material. The subdrain pipe shall be Schedule 40 Acrylonitrile Butadiene Styrene (ABS) or Schedule 40 Polyvinyl Chloride Plastic (PVC) pipe or approved equivalent. Subdrain pipe shall be installed with perforations down. Filter material shall consist of 3/4" to 1 1/2" clean gravel wrapped in an envelope of filter fabric consisting of Mirafi 140N or approved equivalent.

C-6.02 Subdrain Installation

Subdrain systems, if required, shall be installed in approved ground to conform the approximate alignment and details shown on the plans or herein. The subdrain locations shall not be changed or modified without the approval of the geotechnical consultant. The geotechnical consultant may recommend and direct changes in the subdrain line, grade or material upon approval by the design civil engineer and the appropriate governmental agencies.

C-7.00 EXCAVATIONS

C-7.01 General

Excavations and cut slopes shall be examined by the geotechnical consultant. If determined necessary by the geotechnical consultant, further excavation or overexcavation and refilling of overexcavated areas shall be performed, and/or remedial grading of cut slopes shall be performed.

C-7.02 Fill-Over-Cut Slopes

Where fill-over-cut slopes are to be graded the cut portion of the slope shall be made and approved by the geotechnical consultant prior to placement of materials for construction of the fill portion of the slope.

C-8.00 TRENCH BACKFILL

C-8.01 General

Trench backfill within street right of ways shall be mechanically compacted to 90% relative compaction as determined by the ASTM D1557 test method.

C-9.00 SEASONAL LIMITS

C-9.01 General

No fill material shall be placed, spread or rolled while it is frozen or thawing or during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by the soils engineer indicate that the moisture content and density of the fill are as previously specified.

C-10.00 SUPERVISION

C-10.01 Prior to Grading

The site shall be observed by the geotechnical consultant upon completion of clearing and grubbing, prior to the preparation of any original ground for preparation of fill.

The supervisor of the grading contractor, the field representative of the geotechnical consultant, and the grading inspector for the local jurisdiction shall have a meeting and discuss the geotechnical aspects of the earthwork prior to commencement of grading.

C-10.02 During Grading

Site preparation of all areas to receive fill shall be tested and approved by the geotechnical consultant prior to the placement of any fill.

The geotechnical consultant or his representative shall observe the fill and compaction operations so that he can provide an opinion regarding the conformance of the work to the recommendations of the soil report.

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APPENDIX D

REFERENCED TEST PIT/BORING LOGS BY OTHER COMPANY

Test Pit Logs by EcoTech

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1436 Feet TRENCH NO. T-1

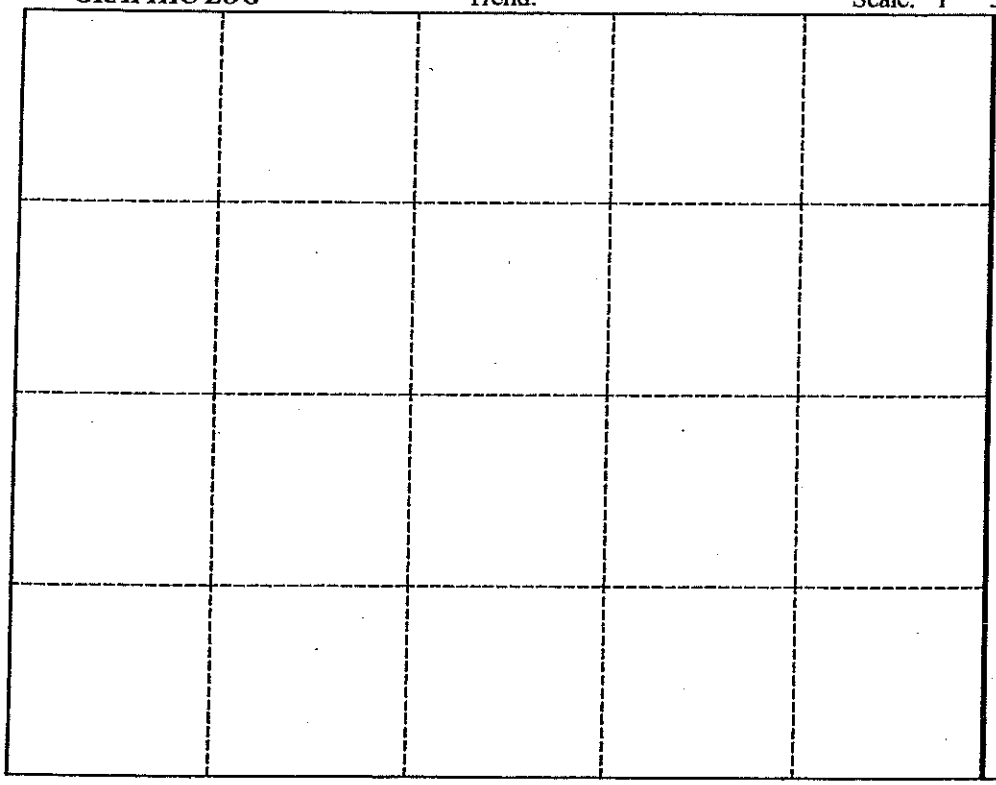
PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
					SC		**Older Alluvium (Qoa)** CLAYEY SAND: Red brown, fine to coarse grained , moist, dense, cohesive
5							
10							
							Total Depth at 12 Feet No Groundwater Trench Backfilled
15							

LOGGED BY Christopher Krall DATE 03-13-02

SAMPLED BY Christopher Krall

GRAPHIC LOG Trend: Scale: 1" = 5'



*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1435 Feet TRENCH NO. T-2

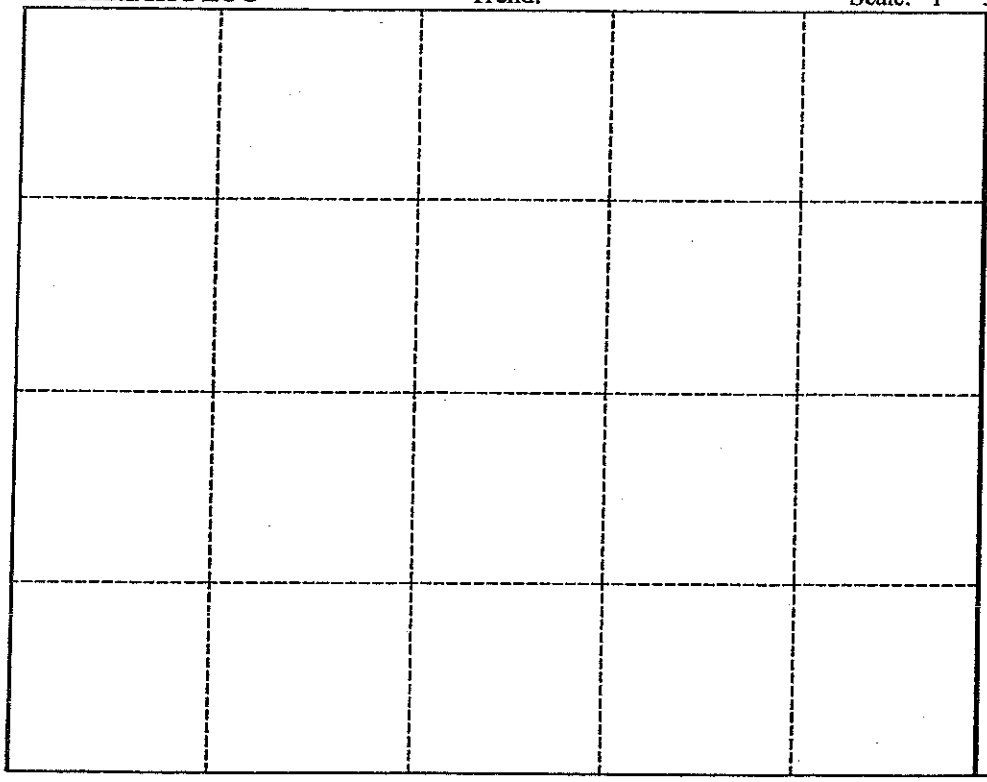
PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
	BULK MD				SC		**Older Alluvium (Qoa)** CLAYEY SAND: Red brown, fine to coarse grained , moist, dense, cohesive, maximum dry density = 119.0 pcf optimum moisture = 13% Difficult Excavation below 7 Feet
5							
10							Total Depth 10 Feet No Groundwater Trench Backfilled
15							

LOGGED BY Christopher Krall DATE 03-13-02

SAMPLED BY Christopher Krall

GRAPHIC LOG Trend: Scale: 1" = 5'



*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1437 Feet TRENCH NO. T-3

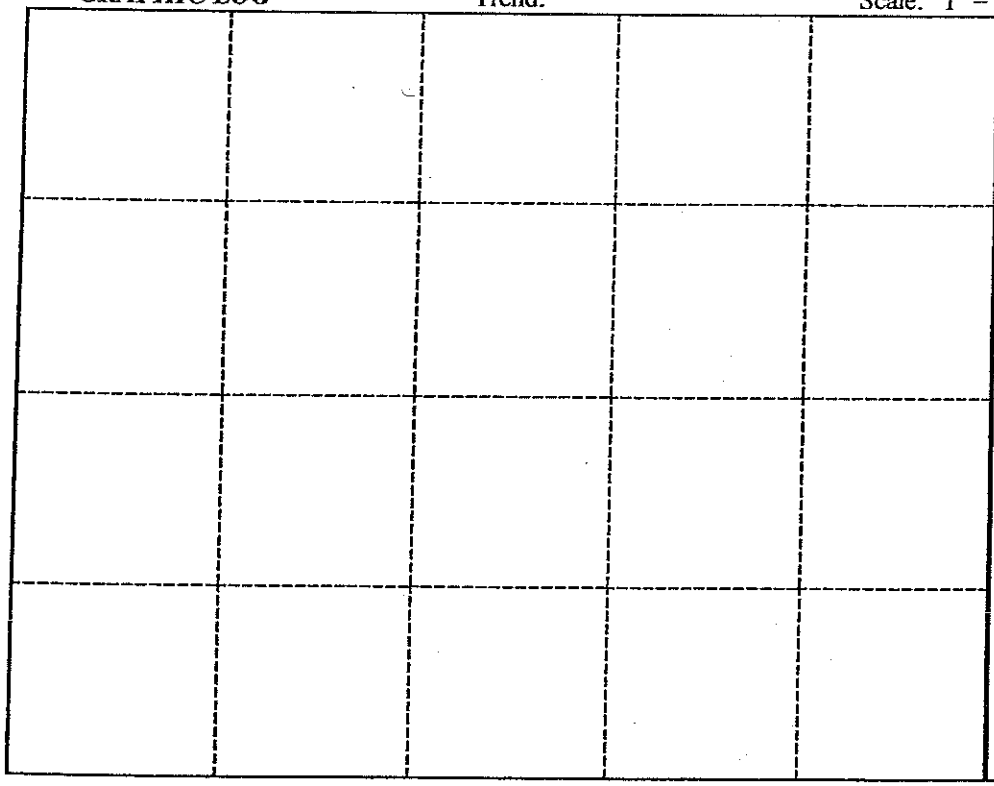
PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
5					SC / SM		**Older Alluvium (Qoa)** CLAYEY SILTY SAND: Red brown, fine to coarse grained, very dense, hard, indurated, minor pores from 3 to 5 Feet. Difficult Excavation below 7 Feet
10							Total Depth 10 Feet No Groundwater Trench Backfilled
15							

LOGGED BY Christopher Krall DATE 03-13-02

SAMPLED BY Christopher Krall

GRAPHIC LOG Trend: Scale: 1" = 5'



*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1437 Feet TRENCH NO. T-4

PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
							LOGGED BY Christopher Krall DATE 03-13-02
							SAMPLED BY Christopher Krall
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
5					SC / SM		**Older Alluvium (Qoa)** CLAYEY SILTY SAND: Red brown, fine to coarse, grained, very dense, hard, indurated, minor pores from 3 to 5 Feet. Difficult Excavation below 4 Feet
10							Total Depth 10 Feet No Groundwater Trech Backfilled
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1438 Feet TRENCH NO. T-5

PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
					SC / SM		**Older Alluvium (Qoa)** CLAYEY SILTY SAND: Red brown, fine to coarse, grained, very dense, hard, indurated, minor pores from 3 to 5 Feet.
5							
10							Total Depth 10 Feet No Groundwater Trecnch Backfilled
15							

LOGGED BY Christopher Krall **DATE** 03-13-02

SAMPLED BY Christopher Krall

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1440 Feet TRENCH NO. T- 6

PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
5					SC		**Older Alluvium (Qoa)** CLAYEY SAND: Dark yellow brown, fine to coarse grained, moist, dense, well graded, very hard, indurated, minor pores.
10							Total Depth 10 Feet No Groundwater Trench Backfilled
15							

LOGGED BY Christopher Krall **DATE** 03-13-02

SAMPLED BY Christopher Krall

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1440 Feet TRENCH NO. T-7

PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
							LOGGED BY Christopher Krall DATE 03-13-02
							SAMPLED BY Christopher Krall
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
					SC	Qoa	**Older Alluvium (Qoa)** CLAYEY SAND: Dark yellow brown, fine to coarse grained, moist, dense, well graded, very hard, indurated, minor pores.
5							
10							Total Depth 10 Feet No Groundwater Trench Backfilled
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1441 Feet TRENCH NO. T-8

PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
							LOGGED BY Christopher Krall DATE 03-13-02
							SAMPLED BY Christopher Krall
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
5					SC	Qoa	**Older Alluvium (Qoa)** CLAYEY SAND: Red brown, fine to coarse grained , moist, dense, cohesive Very difficult excavation below 8 Feet
10							Total Depth 12 Feet No Groundwater Trench Backfilled
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1439 Feet TRENCH NO. T-9

PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION LOGGED BY Christopher Krall DATE 03-13-01 SAMPLED BY Christopher Krall
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
5					SC	Qoa	**Older Alluvium (Qoa)** CLAYEY SAND: Red brown, fine to coarse grained , moist, dense, cohesive
10	BULK MD				SC	Qoa	CLAYEY SAND: Dark Red brown, fine to coarse grained, moist, dense, hard, indurated blocky soil structure Maximum Dry Density = 118.9 pcf Optimum Moisture = 13 %
15							Total Depth 12 Feet No Groundwater Trench Backfilled

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1441 Feet TRENCH NO. T-10

PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
							LOGGED BY Christopher Krall **DATE** 03-13-02
							SAMPLED BY Christopher Krall
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
					SC	Qoa	**Older Alluvium (Qoa)** CLAYEY SAND: Dark yellow brown, fine to coarse grained, moist, dense, well graded, very hard, indurated, minor pores.
5							Coarse grained below 8 Feet
10							Total Depth 10 Feet No Groundwater Trench Backfilled
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1443 Feet TRENCH NO. T-11

PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION LOGGED BY Christopher Krall DATE 03-13-02 SAMPLED BY Christopher Krall
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
5					SC	Qoa	**Older Alluvium (Qoa)** CLAYEY SAND: Dark yellow brown, fine to coarse grained, moist, dense, well graded, very hard, indurated, minor pores. Pores to 1/8 " diameter below 8 Feet (7 % to 8 %)
10							Total Depth 9 Feet No Groundwater Trench Backfilled
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1438 Feet TRENCH NO. T-12

PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION LOGGED BY Christopher Krall DATE 03-13-02 SAMPLED BY Christopher Krall
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
5					SC	Qoa	**Older Alluvium (Qoa)** CLAYEY SAND: Dark yellow brown, fine to coarse grained, moist, dense, well graded, very hard, indurated, minor pores.
10							Total Depth 10 Feet No Groundwater Trench Backfilled
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1438 Feet TRENCH NO. T-13

PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
							LOGGED BY Christopher Krall **DATE** 03-13-02
							SAMPLED BY Christopher Krall
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
					SC	Qoa	**Older Alluvium (Qoa)** CLAYEY SAND: Dark yellow brown, fine to coarse grained, moist, dense, well graded, very hard, indurated, minor pores.
5							Very Difficult Excavation
10							Total Depth 9 Feet No Groundwater Trench Backfilled
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1440 Feet TRENCH NO. T-14

PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
							LOGGED BY Christopher Krall **DATE** 03-13-02
							SAMPLED BY Christopher Krall
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
5	BULK GS				SC	Qoa	**Older Alluvium (Qoa)** CLAYEY SAND: Dark yellow brown, fine to coarse grained, moist, dense, well graded, very hard, indurated, minor pores. Expansion Index - 13
10							Total Depth 10 Feet No Groundwater Trench Backfilled
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1437 Feet TRENCH NO. T-15

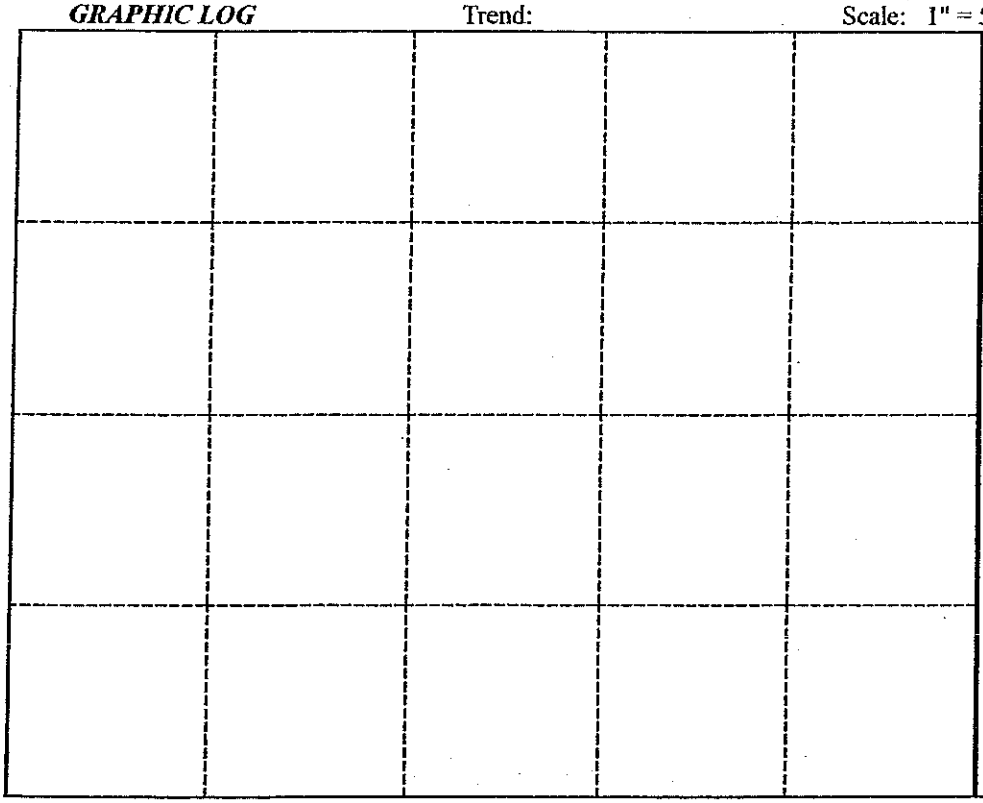
PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
5					SC	Qoa	**Older Alluvium (Qoa)** CLAYEY SAND: Dark yellow brown, fine to coarse grained, moist, dense, well graded, very hard, indurated, minor pores.
10							Total Depth 10 Feet No Groundwater Trench Backfilled
15							

LOGGED BY Christopher Krall DATE 03-13-02

SAMPLED BY Christopher Krall

GRAPHIC LOG Trend: Scale: 1" = 5'



*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME EcoTech, Inc. ELEVATION 1436 Feet TRENCH NO. T-16

PROJECT No. 621-01 EQUIPMENT CAT 420 D

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION LOGGED BY Christopher Krall DATE 03-13-02 SAMPLED BY Christopher Krall
0					SM		**Top Soil:** SILTY SAND: Gray brown, fine to coarse grained, moist, loose.
5	Bulk GS				SC	Qoa	**Older Alluvium (Qoa)** CLAYEY SAND: Dark yellow brown, fine to coarse grained, moist, dense, well graded, very hard, indurated, minor pores. Expansion Index = 0
10							Total Depth 8 Feet No Groundwater Trench Backfilled
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME **Canterwood** ELEVATION TRENCH NO. **T18**

PROJECT No. **621-01** EQUIPMENT **CAT 420d**

GEOTECHNICAL DESCRIPTION

LOGGED BY **Steve Pyle** **DATE** **03/10/04**

SAMPLED BY **Steve Pyle**

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	
	NG		105.5	14.2	SM		**Top Soil:** Silty sand fine/organic moist & loose
					SC		**Older Alluvium (Qoa):** Red brown sandy clay, very hard moist and dense
5	B						
							Dark red brown moist and dense
10							
							Total 12ft depth Dark red brown **No ground water**
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME **Canterwood** ELEVATION TRENCH NO. **T19**

PROJECT No. **621-01** EQUIPMENT **CAT 420d**

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
					SM		**Top Soil:** Silty sand fine grained moist & loose
5	NG		104.5	11.5	SC		**Older Alluvium (Qoa):** Red brown sandy clay, very difficult to excavate below 7ft moist and dense
10							**Total 9ft depth red brown** **No ground water**
15							

LOGGED BY **Steve Pyle** **DATE** **03/10/04**

SAMPLED BY **Steve Pyle**

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME **Canterwood** ELEVATION TRENCH NO. **T20**

PROJECT No. **621-01** EQUIPMENT **CAT 420d**

GEOTECHNICAL DESCRIPTION

LOGGED BY **Steve Pyle** **DATE** **03/10/04**

SAMPLED BY **Steve Pyle**

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	
	NG		104.1	17.2	SM		**Top Soil:** Lt brown sandy fine grained dry and dense primiter road
5	B				SC		**Older Alluvium (Qoa):** Yellowish brown sandy clay, moist and dense, minor pores @ 6-7ft. Very hard to 10ft less hard 10-12ft
10							
15							**Total 12ft depth yellowish brown** **No ground water**

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME **Canterwood** ELEVATION TRENCH NO. **T21**

PROJECT No. **621-01** EQUIPMENT **CAT 420d**

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
					SM		**Top Soil:** Gray silty sand fine moist and loose
5	NG		107.4	12.4	SC		**Older Alluvium (Qoa):** Yellowish brown very hard, difficult to excavate below 5ft , could not excavate below 8ft.
10							**Total 8ft depth yellowish brown** **No ground water**
15							

LOGGED BY **Steve Pyle** **DATE** **03/10/04**

SAMPLED BY **Steve Pyle**

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME **Canterwood** ELEVATION TRENCH NO. **T22**

PROJECT No. **621-01** EQUIPMENT **CAT 420d**

GEOTECHNICAL DESCRIPTION

LOGGED BY **Steve Pyle** **DATE** **03/10/04**

SAMPLED BY **Steve Pyle**

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	
					SM		**Top Soil:** Silty sand fine to coarse moist and loose
	B						
	NG		110.1	15.3	SC		**Older Alluvium (Qoa):** Yellowish brown very hard, well grained.
5							
10							**Total 9ft depth yellowish brown** **No ground water Trench backfill**
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME **Canterwood** ELEVATION TRENCH NO. **T23**

PROJECT No. **621-01** EQUIPMENT **CAT 420d**

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
							LOGGED BY Steve Pyle **DATE** 03/10/04
							SAMPLED BY Steve Pyle
					SM		**Top Soil:** Silty sand gray brown fine to coarse
5	NG		101.9	14.1	SC		**Older Alluvium (Qoa):** Clay sand dark yellow brown moist and dense
10	B						**Total 10ft depth Dark yellow brown** **No ground water** **Trench backfill**
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME **Canterwood** ELEVATION TRENCH NO. **T24**

PROJECT No. **621-01** EQUIPMENT **CAT 420d**

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
							LOGGED BY Steve Pyle **DATE** 03/10/04 **SAMPLED BY** Steve Pyle
	NG		105.3	12.6	SM		**Top Soil:** Silty sand lt brown fine to coarse grained moist & loose
					SC		**Older Alluvium (Qoa):** Clayey sand dark yellow brown moist and dense
5							
							Total 8ft depth No ground water **Trench backfill**
10							
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME **Canterwood** ELEVATION TRENCH NO. **T25**

PROJECT No. **621-01** EQUIPMENT **CAT 420d**

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
							LOGGED BY Steve Pyle **DATE** 03/10/04
							SAMPLED BY Steve Pyle
					SM		**Top Soil:** Silty sand gray brown fine to coarse grained moist & loose
	NG		108.6	13.6	SC		**Older Alluvium (Qoa):** Dark yellow brown sand coarse moist and dense Extremely hard to excavate
5							**Total 4ft depth No ground water** **Refusal at 4ft DG** **Trench backfill**
10							
15							

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

EXPLORATORY TRENCH LOG

PROJECT NAME **Canterwood** ELEVATION TRENCH NO. **T26**

PROJECT No. **621-01** EQUIPMENT **CAT 420d**

DEPTH (FEET)	TYPE OF TEST*	SAMPLE DEPTH	DRY DENSITY (PCF)	MOISTURE CONTENT %	(USCS) SOIL CLASSIFICATION	EARTH MATERIAL	GEOTECHNICAL DESCRIPTION
							LOGGED BY Steve Pyle **DATE** 03/10/04
							SAMPLED BY Steve Pyle
					SM		**Top Soil:** Silty sand gray brown fine to coarse grained moist & loose
5	NG		110.3	14.9	SC		**Older Alluvium (Qoa):** Red brown sand coarse grained moist and dense
10							
15							**Total 15ft depth DG No ground water Trench backfill**

GRAPHIC LOG Trend: Scale: 1" = 5'

*TEST SYMBOLS

B - BULK SAMPLE
R - RING SAMPLE
SC - SANDCONE
MD - MAXIMUM DENSITY
GS - GRAIN SIZE
SE - SAND EQUIVALENT
NG - NUCLEAR GAUGE
(90) - RELATIVE COMPACTION

RGS Engineering Geology

Boring Logs by GeoCon

PROJECT NO. T2304-12-01

BORING B 1

ELEV. (MSL.) 1440'± DATE COMPLETED 03-28-2005

EQUIPMENT CME 75

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0		SM	**TOPSOIL** Loose, medium dense, moist, Silty, fine to medium SAND			
2			**OLDER ALLUVIUM** Dense, very moist, orange-brown, Silty SAND, trace clay, trace coarse sand, trace carbonate			
4	B1-1			63	114.7	16.2
6	B1-2		-Very dense, very moist, orange brown, Silty, fine to medium SAND, trace carbonate at 6 feet	85/11"	116.0	16.6
8			-Soil becomes less moist at 8 feet			
10	B1-3	SM	-Very dense, damp, orange brown, Silty, fine to coarse SAND, little clay, manganese staining at 9 feet -Driller reports gravel at 11 feet	81/10"		
12	B1-4		-Contains large (3mm) biotite	92/9"		
14						
16	B1-5		-Becomes moist	76		
			BORING TERMINATED AT 16 FEET No groundwater encountered Backfilled			

T2304-12-01.GPJ

Figure A-1,
Log of Boring B 1, Page 1 of 1

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL ◧ ... STANDARD PENETRATION TEST ■ ... DRIVE SAMPLE (UNDISTURBED)

▨ ... DISTURBED OR BAG SAMPLE ◣ ... CHUNK SAMPLE ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2304-12-01

BORING B 2

ELEV. (MSL.) 1439'± DATE COMPLETED 03-28-2005

EQUIPMENT CME 75

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B2-1			SM	**TOPSOIL** Loose, moist, brown, Silty, fine to medium SAND			
2					**ALLUVIUM** Dense, moist, orange brown, Clayey Silty SAND			
	B2-2			SM/SC		56	125.0	12.2
4					Very dense, moist, orange brown, Silty, fine to coarse SAND with manganese staining			
6	B2-3					95/11"		
	B2-4							
8	B2-6							
	B2-5			SM		50/5"		
10								
12								
14								
	B2-7				-Becomes sandier and micaceous	78		
16								
18								
20	B2-8					50/6"		
					BORING TERMINATED AT 20½ FEET No groundwater encountered Backfilled			

T2304-12-01.GPJ

Figure A-2,
Log of Boring B 2, Page 1 of 1

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2304-12-01

BORING B 3

ELEV. (MSL.) 1440'± DATE COMPLETED 03-28-2005

EQUIPMENT CME 75

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				SM	**TOPSOIL** Loose, moist, brown, Silty, fine to medium SAND			
2					**OLDER ALLUVIUM** Very dense, moist, orange brown, Silty SAND with trace clay, manganese staining			
4	B3-1					76	124.4	12.6
6	B3-2				-Trace pinhole porosity	50/6"	125.1	12.4
8								
10	B3-3					50/5"		
12								
14								
16	B3-4			SM	-Becomes bright orange and siltier	50/4"		
18								
20	B3-5				-Becomes orange brown and micaceous with large (3-5mm) biotite grains	50/4"		
22								
24					-Driller added water to hole to facilitate drilling			
26	B3-6				-Little clay	82		
28								

T2304-12-01.GPJ

Figure A-3,
Log of Boring B 3, Page 1 of 2

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2304-12-01

BORING B 3

ELEV. (MSL.) 1440'± DATE COMPLETED 03-28-2005

EQUIPMENT CME 75

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B3-7			SM	-Sand is fine, soil is less cemented	50/4½"		
32								
34					-Becomes light brown			
36	B3-8					78/11"		
38								
40	B3-9			SP	Very dense, damp, yellow, fine to medium sand, friable	50/6"		
42								
44								
46	B3-10			SP	Very dense, moist, light yellow brown, Silty, fine to medium SAND, friable - sample disturbed	50/6"		
48				SP/SW	Very dense, damp, light yellow, fine to coarse SAND, friable			
50	B3-11					50/5"		
					BORING TERMINATED AT 50½ FEET No groundwater encountered Backfilled			

Figure A-3,
Log of Boring B 3, Page 2 of 2

T2304-12-01.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2304-12-01

BORING B 4

ELEV. (MSL.) 1441'± DATE COMPLETED 03-28-2005

EQUIPMENT CME 75

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**TOPSOIL** Loose, moist, brown, Silty, fine SAND			
2					**OLDER ALLUVIUM** Very dense, moist, orange brown, Silty, coarse SAND with little clay, trace to some pinhole porosity			
4	B4-1					89	126.9	11.5
6	B4-2			SM	-No pinhole porosity, trace clay, very moist	77	120.4	14.2
8								
10	B4-3				-Becomes dense with manganese staining	47		
12								
14				SM	Very dense, moist, orange, Silty, fine SAND, manganese staining			
16	B4-4					32		
					BORING TERMINATED AT 16 FEET No groundwater encountered Backfilled			

T2304-12-01.GPJ

Figure A-4,
Log of Boring B 4, Page 1 of 1

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ▮ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2304-12-01

BORING B 5

ELEV. (MSL.) 1442'± DATE COMPLETED 03-28-2005

EQUIPMENT CME 75

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**TOPSOIL** Loose, moist, brown, Silty SAND			
2					**OLDER ALLUVIUM** Very dense, moist, orange brown, Silty SAND with little clay			
4	B5-1					80/10"	123.3	11.6
6	B5-2			SM	-Little pinhole porosity, manganese staining	92/11"	130.8	9.9
8								
10	B5-3					83/11"		
12								
14								
16	B5-4				Medium dense, moist, yellow brown, Silty, fine SAND trace coarse sand	39		
					BORING TERMINATED AT 16 FEET No groundwater encountered Backfilled			

T2304-12-01.GPJ

Figure A-5,
Log of Boring B 5, Page 1 of 1

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2304-12-01

BORING B 6

ELEV. (MSL.) 1441'± DATE COMPLETED 03-28-2005

EQUIPMENT CME 75

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B6-1	SM	**TOPSOIL** Loose, moist, brown, Silty SAND			
2			**OLDER ALLUVIUM** Very dense, moist, orange brown, Silty, fine to coarse SAND, trace clay			
4	B6-2			81	130.2	9.9
6	B6-3	SM	-Less clay at 6 feet	50/5"	125.5	12.0
8						
10	B6-4			50/4"		
12						
14			Very dense, moist, yellow brown, fine to medium SAND with trace silt and mica			
16	B6-5	SP		76		
18		SM	Very dense, moist, orange brown, Silty, fine SAND			
20	B6-6			50/6"		
			BORING TERMINATED AT 20½ FEET No groundwater encountered Backfilled			

T2304-12-01.GPJ

Figure A-6,
Log of Boring B 6, Page 1 of 1

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2304-12-01

BORING B 7

ELEV. (MSL.) 1441'± DATE COMPLETED 03-28-2005

EQUIPMENT CME 75

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**TOPSOIL** Loose, moist, brown, Silty SAND			
2					**OLDER ALLUVIUM** Very dense, moist, orange brown, Silty SAND			
4	B7-1					93	129.9	10.3
6	B7-2			SM	-Becomes dense with manganese staining	54	125.1	12.0
8								
10	B7-3				-Very dense, moist, orange, fine to medium SAND with silt, non-cemented	80		
12								
14								
16	B7-4					91/10½"		
					BORING TERMINATED AT 16 FEET No groundwater encountered Backfilled			

Figure A-7,
Log of Boring B 7, Page 1 of 1

T2304-12-01.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2304-12-01

BORING B 8

ELEV. (MSL.) 1440'± DATE COMPLETED 03-28-2005

EQUIPMENT CME 75

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**TOPSOIL** Loose, moist,brown, Silty SAND			
2					**OLDER ALLUVIUM** Very dense, very moist, orange brown, Silty SAND, with little clay			
4	B8-1					96/11"	120.9	15.3
6	B8-2					50/6"	122.9	11.6
8								
10	B8-3			SM	-Driller added water to hole to facilitate drilling	50/6"		
12								
14								
16	B8-4				-Becomes dense, very moist, clay content increases, contains large biotite	53		
18								
20	B8-5				-Becomes very dense	81		
					BORING TERMINATED AT 21 FEET No groundwater encountered Backfilled			

Figure A-8,
Log of Boring B 8, Page 1 of 1

T2304-12-01.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2304-12-01

BORING B 9

ELEV. (MSL.) 1439'± DATE COMPLETED 03-28-2005

EQUIPMENT CME 75

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**TOPSOIL** Loose, moist, brown, Silty SAND			
2					**ALLUVIUM** Dense, moist, orange, Silty SAND with little clay and manganese staining			
4	B9-1			SM		46	128.0	11.2
6	B9-2				-Becomes yellow brown and clayey	47		
8					Dense, moist, orange, Clayey SAND			
10	B9-3			SC		68		
12								
14				SC/SM	Medium dense, very moist, orange brown, Silty SAND with some clay			
16	B3-4					36		
					BORING TERMINATED AT 16 FEET No groundwater encountered Backfilled			

T2304-12-01.GPJ

Figure A-9,
Log of Boring B 9, Page 1 of 1

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◹ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Boring Logs by EcoTech

EXPLORATORY BORING LOG

Date: 04-10-02	Drill Method: HSA	Logged By: Chris Krall	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1437 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B-1*
0						SM	**Older Alluvium (Qoa)** SILTY SAND : Yellow brown, fine to coarse grained, damp, medium dense
5						SC	CLAYEY SAND: Red Brown, fine to coarse grained, moist, dense cohesive, well indurated, hard
10						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.

EXPLORATORY BORING LOG

Date: 04-10-02	Drill Method: HSA	Logged By: Chris Krall	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1437 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B-1 (Con't)*
30						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.
35							
40							
							Total Depth 50 Feet No Groundwater Hole Backfilled to 40 Feet for Percolation Testing

EXPLORATORY BORING LOG

Date: 04-10-02	Drill Method: HSA	Logged By: Pete Ratbun	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1438 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B-2*
0						SM	**Older Alluvium (Qoa)** SILTY SAND : Yellow brown, fine to coarse grained, damp, medium dense
5						SC	CLAYEY SAND: Red Brown, fine to coarse grained, moist, dense cohesive, well indurated, hard
10						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.

EXPLORATORY BORING LOG

Date: 04-10-02	Drill Method: HSA	Logged By: Pete Ratbun	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1438 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B- 2 (Con't)*
0						SP /SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.
55							
							Total Depth 50 Feet No Groundwater Hole Backfilled to 40 Feet for Percolation Testing

EXPLORATORY BORING LOG

Date: 04/10/02	Drill Method: HSA	Logged By: Pete Ratbun	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1439 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B- 3*
5						SM	**Older Alluvium (Qoa)** SILTY SAND : Yellow brown, fine to coarse grained, damp, medium dense
10						SC	CLAYEY SAND: Red Brown, fine to coarse grained, moist, dense cohesive, well indurated, hard
						SM	SILTY SAND WITH CLAY: Brown, fine to coarse grained, damp dense
						SP / SW	SAND: Medium light brown, fine to coarse grained, damp, dense.

EXPLORATORY BORING LOG

Date: 04/10/02	Drill Method: HSA	Logged By: Pete Ratbun	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1439 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B- 3 (Con't)*
30						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.
35							
40							
5							
5							Total depth 50 Feet No Groundwater Hole Backfilled to 40 Feet for Percolation Testing

EXPLORATORY BORING LOG

Date: 04/11/02	Drill Method: HSA	Logged By: Pete Ratbun	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1440 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B-4*
						SM	**Older Alluvium (Qoa)** SILTY SAND : Yellow brown, fine to coarse grained, damp, medium dense
5						SC	CLAYEY SAND: Red Brown, fine to coarse grained, moist, dense cohesive, well indurated, hard
						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.

EXPLORATORY BORING LOG

Date: 04/11/02	Drill Method: HSA	Logged By: Pete Ratbun	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1440 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B-4 (Con't)*
30						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.
35							
40							
5							
0							
							Total depth 50 Feet No Groundwater Hole Backfilled to 40 Feet for Percolation Testing
5							

EXPLORATORY BORING LOG

Date: 04/10/02	Drill Method: HSA	Logged By: Pete Ratbun	Location: See plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1436 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	**Lithologic Description** ***Boring B-5***
						SM	**Older Alluvium (Qoa)** SILTY SAND : Yellow brown, fine to coarse grained, damp, medium dense
						SC	CLAYED SAND: Light orange / red brown, fine to coarse grained with clay, very dense damp
						SP / SW	SAND: Medium to light brown, very dense, fine to coarse, grained damp, well graded, non-cohesive

EXPLORATORY BORING LOG

Date: 04/10/02	Drill Method: HSA	Logged By: Pete Ratbun	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1436 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B- 5 (Con't)*
30						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.
35							DECOMPOSED GRANITE: Variegated Yellow - Brown , fine to coarse grained, dense, hard, well decomposed and weathered
40							Total depth 50 Feet No Groundwater Hole Backfilled to 40 Feet for Percolation Testing

EXPLORATORY BORING LOG

Date: 04/11/02	Drill Method: HSA	Logged By: Chris Krall	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1435 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B-6*
						SM	**Older Alluvium (Qoa)** SILTY SAND : Yellow brown, fine to coarse grained, damp, medium dense
						SC	CLAYEY SAND: Red Brown, fine to coarse grained, moist, dense cohesive, well indurated, hard
						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.

EXPLORATORY BORING LOG

Date: 04/11/02	Drill Method: HSA	Logged By: Chris Krall	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1435 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B- 6 (Con't)*
30						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.
35							
							Total depth 50 Feet No Groundwater Hole Backfilled to 40 Feet for Percolation Testing

EXPLORATORY BORING LOG

Date: 04/11/02	Drill Method: HSA	Logged By: Chris Krall	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1438 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B- 7*
						SM	**Older Alluvium (Qoa)** SILTY SAND : Yellow brown, fine to coarse grained, damp, medium dense
						SC	CLAYEY SAND: Red Brown, fine to coarse grained, moist, dense cohesive, well indurated, hard
						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.

EXPLORATORY BORING LOG

Date: 04/11/02	Drill Method: HSA	Logged By: Chris Krall	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1438 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B- 7 (Con't)*
0						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.
5							
0							
							Total Depth 50 Feet No Groundwater Hole Backfilled to 40 Feet for Percolation Testing

EXPLORATORY BORING LOG

Date: 04/11/02	Drill Method: HSA	Logged By: Chris Krall	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1440 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B- 8*
						SM	**Older Alluvium (Qoa)** SILTY SAND : Yellow brown, fine to coarse grained, damp, medium dense
5						SC	CLAYEY SAND: Red Brown, fine to coarse grained, moist, dense cohesive, well indurated, hard
						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.

EXPLORATORY BORING LOG

Date: 04/11/02	Drill Method: HSA	Logged By: Chris Krall	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1440 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B- 8 (Con't)*
50						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.
55							Total Depth 50 Feet No Groundwater Hole Backfilled to 40 Feet for Percolation Testing

EXPLORATORY BORING LOG

Date: 04/11/02	Drill Method: HSA	Logged By: Chris Krall	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1438 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B- 9*
0						SM	**Older Alluvium (Qoa)** SILTY SAND : Yellow brown, fine to coarse grained, damp, medium dense
5						SC	CLAYEY SAND: Red Brown, fine to coarse grained, moist, dense cohesive, well indurated, hard
0						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.
5							
0							
5							

EXPLORATORY BORING LOG

Date: 04/11/02	Drill Method: HSA	Logged By: Chris Krall	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1438 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B- 9 (Con't)*
0						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.
5							
							Total Depth 50 Feet No Groundwater Hole Backfilled to 40 Feet for Percolation Testing

EXPLORATORY BORING LOG

Date: 04/11/02	Drill Method: HSA	Logged By: Chris Krall	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1442 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B- 10*
0						SM	**Older Alluvium (Qoa)** SILTY SAND : Yellow brown, fine to coarse grained, damp, medium dense
5						SC	CLAYEY SAND: Red Brown, fine to coarse grained, moist, dense cohesive, well indurated, hard
10							
15						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.
25							

EXPLORATORY BORING LOG

Date: 04/11/02	Drill Method: HSA	Logged By: Chris Krall	Location: See Plan
Drive Weight: 140 Lbs	Drop: 30 Inches	Elevation: 1442 Feet	Hole Diameter: 8" - 12"

Depth (ft)	Blows per Foot	Soil Sample	PID (ppm)	Moisture Content (%)	Graphic Log	USCS	Lithologic Description *Boring B- 10 (Con't)*
30						SP / SW	SAND: Yellow brown, fine to coarse grained, moist, medium dense, moderately well graded, non-cohesive.
35							
							Total Depth 50 Feet No Groundwater Hole Backfilled to 40 Feet for Percolation Testing

APPENDIX E

REFERENCES

RMA GeoScience
Every Project Matters | www.rmacompanies.com

REFERENCES

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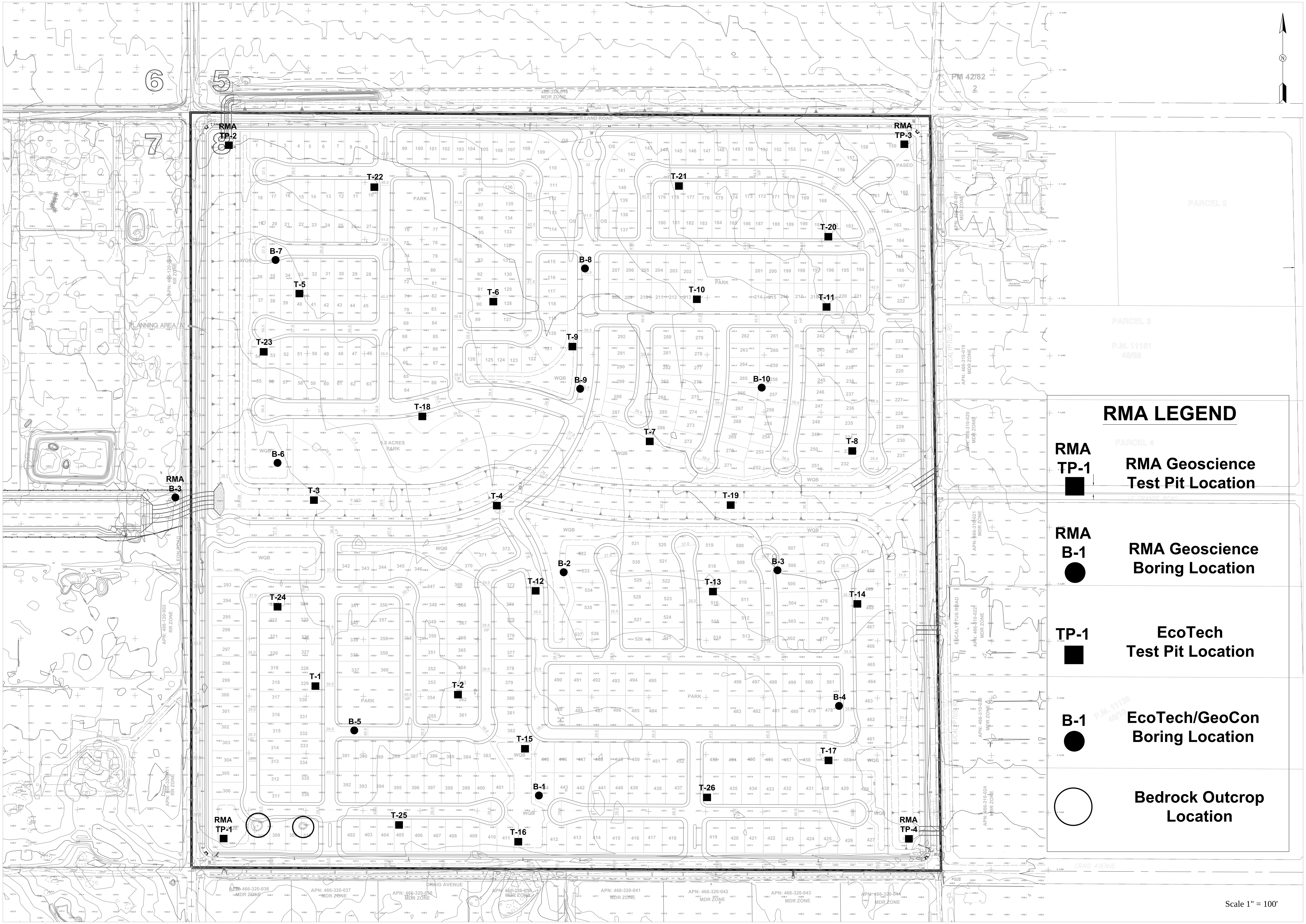
5. Morton, D.M., 2003, Preliminary Geologic Map of the Winchester 7.5' Quadrangle, Riverside County, California, USGS Open-File Report 03-188, Scale 1:24,000.

6. Riverside County Flood Control and Water Conservation District, Design Handbook for Low Impact Development Best Management Practices, 2011.

7. Historic Aerials by NETR, Aerial Photographs from 1938 to 2012, Topographic Maps from 1943 to 1986: http://www.historicaerials.com/

8. Google Earth, Aerial Photographs, 1996-2016



BORING AND TRENCH LOCATION MAP 1

Plate 1

PROJECT NO.	17H-0307-0
DATE	10-30-17
PREPARED BY	AEG
APPROVED BY	MAS

RMA B-5

RMA B-4

RMA B-1

RMA B-2

RMA LEGEND

RMA B-1

RMA Geoscience Boring Location

Scale 1" = 100'

BORING AND TRENCH LOCATION MAP 2

RMA GeoScience

Plate 2

PROJECT NO.	17H-0307-0
DATE	10-30-17
PREPARED BY	AEG
APPROVED BY	MAS

Appendix 4: Historical Site Conditions

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

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Isohyetal Map for the 85th Percentile 24-hour Storm Event

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

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

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

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

Santa Ana River Watershed
Santa Margarita Watershed

EASTVALE | JURUPA VALLEY | NORCO | CORONA | RIVERSIDE | MORENO VALLEY | CALIMESA | BEAUMONT | SAN JACINTO | PERRIS | CANYON LAKE | LAKE ELSINORE | WILDOMAR | MENIFEE | MURRIETA | TEMECULA | HEMET

N

Rain Gage Locations

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

Isohyetal Map for the 85th Percentile 24 hour Storm Event

July 2011

Santa Ana Watershed – BMP Design Volume Spreadsheets

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

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	JLC Engineering and Consulting, Inc.	Date	2/9/2018
Designed by	Jilleen Ferris	Case No	TR 37449
Company Project Number/Name	TRACT 37449		

BMP Identification

BMP NAME / ID: DMA A

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.60 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
A-1	*242019.36*	*Roofs*	*1*	*0.89*	*215881.3*			
A-2	*161346.24*	*Ornamental Landscaping*	*0.1*	*0.11*	*17822*			
	403365.6	***Total***			**233703.3**	**0.60**	***11685.2***	***14721.68***

Notes:

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

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	JLC Engineering and Consulting, Inc.	Date	2/9/2018
Designed by	Jilleen Ferris	Case No	TR 37439
Company Project Number/Name	TRACT 37439		

BMP Identification

BMP NAME / ID: DMA B

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.60 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
B-1	*691035.84*	*Roofs*	*1*	*0.89*	*616404*			
B-2	*460690.56*	*Ornamental Landscaping*	*0.1*	*0.11*	*50887*			
	1151726.4		***Total***		**667291**	**0.60**	***33364.6***	***35566.63***

Notes:

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

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: JLC Engineering and Consulting, Inc. — Date: 2/9/2018

Designed by: Jilleen Ferris — Case No: TR 37439

Company Project Number/Name: TRACT 37439

BMP Identification

BMP NAME / ID: DMA C

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.60 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
C-1	*743569.2*	*Roofs*	*1*	*0.89*	*663263.7*			
C-2	*495712.8*	*Ornamental Landscaping*	*0.1*	*0.11*	*54755.4*			
	1239282	***Total***			**718019.1**	**0.60**	***35901***	***47223***

Notes:

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

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: JLC Engineering and Consulting, Inc. — Date: 2/9/2018
Designed by: Jilleen Ferris — Case No: TR 37439
Company Project Number/Name: TRACT 37439

BMP Identification

BMP NAME / ID: DMA D

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.60 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
D-1	*341336.16*	*Roofs*	*1*	*0.89*	*304471.9*			
D-2	*227557.44*	*Ornamental Landscaping*	*0.1*	*0.11*	*25135.5*			
	568893.6	***Total***			**329607.4**	**0.60**	***16480.4***	***18227.24***

Notes:

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

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: JLC Engineering and Consulting, Inc. — Date: 2/9/2018

Designed by: Jilleen Ferris — Case No: TR 37439

Company Project Number/Name: TRACT 37439

BMP Identification

BMP NAME / ID: DMA E

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E — D_{85}= 0.60 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
E-1	*361199.52*	*Roofs*	*1*	*0.89*	*322190*			
E-2	*240799.68*	*Ornamental Landscaping*	*0.1*	*0.11*	*26598.3*			
	601999.2	***Total***			**348788.3**	**0.60**	***17439.4***	***25243.7***

Notes:

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

(Rev. 10-2011)

Legend: Required Entries | Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: JLC Engineering and Consulting, Inc. Date: 2/9/2018
Designed by: Jilleen Ferris Case No: TR 37439
Company Project Number/Name: TRACT 37439

BMP Identification

BMP NAME / ID: DMA F

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.60 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
F-1	*453720.96*	*Roofs*	*1*	*0.89*	*404719.1*			
F-2	*302480.64*	*Ornamental Landscaping*	*0.1*	*0.11*	*33411.4*			
	756201.6	***Total***			**438130.5**	**0.60**	***21906.5***	***34221***

Notes:

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

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: JLC Engineering and Consulting, Inc.

Date: 2/9/2018

Designed by: Jilleen Ferris

Case No: TR 37439

Company Project Number/Name: TRACT 37439

BMP Identification

BMP NAME / ID: DMA G

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.60 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
G-1	*406676.16*	*Roofs*	*1*	*0.89*	*362755.1*			
G-2	*271117.44*	*Ornamental Landscaping*	*0.1*	*0.11*	*29947.1*			
	677793.6	***Total***			392702.2	0.60	*19635.1*	*32472*

Notes:

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

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	JLC Engineering and Consulting, Inc.	Date	2/9/2018
Designed by	Jilleen Ferris	Case No	TR 37439
Company Project Number/Name	TRACT 37439		

BMP Identification

BMP NAME / ID: DMA H

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.60 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
H-1	*407198.88*	*Roofs*	*1*	*0.89*	*363221.4*			
H-2	*271465.92*	*Ornamental Landscaping*	*0.1*	*0.11*	*29985.6*			
	678664.8		*Total*		393207	0.60	*19660.4*	*34357*

Notes:

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

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	JLC Engineering and Consulting, Inc.	Date	2/9/2018
Designed by	Jilleen Ferris	Case No	TR 37439
Company Project Number/Name	TRACT 37439		

BMP Identification

BMP NAME / ID: DMA I

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.60 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
I-1	*135384.48*	*Roofs*	*1*	*0.89*	*120763*			
I-2	*90256.32*	*Ornamental Landscaping*	*0.1*	*0.11*	*9969.5*			
	225640.8	***Total***			**130732.5**	**0.60**	***6536.6***	***22463***

Notes:

Bioretention Facility – Design Procedure Spreadsheets

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

Company Name:	JLC Engineering & Consulting, Inc.	Date:	2/12/2018
Designed by:	Jilleen Ferris	County/City Case No.:	TR 37439

Design Volume

Enter the area tributary to this feature — A_T = 9.26 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 11,685 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 = 75.0 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 = 1.34 ft

Minimum Surface Area, A_m

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

A_M = 8,716 ft^2

Proposed Surface Area — A= 10,905 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 0.5 %

6" Check Dam Spacing — 0 feet

Describe Vegetation:

Notes:

Bioretention Facility - Design Procedure	BMP ID: B	Legend:	Required Entries / Calculated Cells
Company Name:	JLC Engineering & Consulting, Inc.	Date:	2/12/2018
Designed by:	Jilleen Ferris	County/City Case No.:	TR 37439

Design Volume

Enter the area tributary to this feature	A_T=	26.44	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	33,365	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 =	153.0	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 =	24,715	ft^2
Proposed Surface Area	A=	26,346	ft^2
Minimum Required Length of Bioretention Facility, L	L =	161.5	ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0.5	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes:

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

Company Name:	JLC Engineering & Consulting, Inc.	Date:	2/12/2018
Designed by:	Jilleen Ferris	County/City Case No.:	TR 37439

Design Volume

Enter the area tributary to this feature	A_T=	28.45	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	35,901	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 =	140.0	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 =	1.35	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	26,693	ft^2
Proposed Surface Area	A=	27,932	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0.5	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes:

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

Company Name:	JLC Engineering & Consulting, Inc.	Date:	2/12/2018
Designed by:	Jilleen Ferris	County/City Case No.:	TR 37439

Design Volume

Enter the area tributary to this feature — A_T = 13.06 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 16,480 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 = 118.0 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 = 1.34 ft

Minimum Surface Area, A_m

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

A_M = 12,262 ft^2

Proposed Surface Area — A= 13,502 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 0.5 %

6" Check Dam Spacing — 0 feet

Describe Vegetation:

Notes:

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

Company Name:	JLC Engineering & Consulting, Inc.	Date:	2/12/2018
Designed by:	Jilleen Ferris	County/City Case No.:	TR 37439

Design Volume

Enter the area tributary to this feature — A_T = 13.82 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 17,439 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 = 54.0 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 = 1.34 ft

Minimum Surface Area, A_m

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

A_M = 13,044 ft^2

Proposed Surface Area — A= 18,699 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 0.5 %

6" Check Dam Spacing — 0 feet

Describe Vegetation:

Notes:

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

Company Name:	JLC Engineering & Consulting, Inc.	Date:	2/12/2018
Designed by:	Jilleen Ferris	County/City Case No.:	TR 37439

Design Volume

Enter the area tributary to this feature	A_T=	17.36	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	21,907	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 =	54.0	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 =	1.34	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	16,385	ft^2
Proposed Surface Area	A=	19,636	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0.5	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes:

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

Company Name:	JLC Engineering & Consulting, Inc.	Date:	2/12/2018
Designed by:	Jilleen Ferris	County/City Case No.:	TR 37439

Design Volume

Enter the area tributary to this feature — A_T = 15.56 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 19,635 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 = 70.0 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 = 1.34 ft

Minimum Surface Area, A_m

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

A_M = 14,654 ft^2

Proposed Surface Area — A= 22,438 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 0.5 %

6" Check Dam Spacing — 0 feet

Describe Vegetation:

Notes:

Bioretention Facility - Design Procedure	BMP ID: H	Legend:	Required Entries / Calculated Cells
Company Name:	JLC Engineering & Consulting, Inc.	Date:	2/12/2018
Designed by:	Jilleen Ferris	County/City Case No.:	TR 37439

Design Volume

Enter the area tributary to this feature	A_T =	15.58	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP} =	19,660	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 =	113.0	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 =	1.34	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	14,631	ft^2
Proposed Surface Area	A=	19,087	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0.5	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes:

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

Company Name: JLC Engineering & Consulting, Inc. Date: 2/12/2018

Designed by: Jilleen Ferris County/City Case No.: TR 37439

Design Volume

Enter the area tributary to this feature A_T = 5.18 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP} = 6,537 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 = 132.0 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 = 1.34 ft

Minimum Surface Area, A_m

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

A_M = 4,862 ft^2

Proposed Surface Area A= 12,480 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = 4 :1

Diameter of Underdrain 6 inches

Longitudinal Slope of Site (3% maximum) 0.5 %

6" Check Dam Spacing 0 feet

Describe Vegetation:

Notes:

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

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

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

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.**

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**

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

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

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

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ K. **Vehicle/Equipment Repair and Maintenance**	❑ **Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater.** ❑ **Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas.** ❑ **Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.**	☒ **State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area.** ❑ **State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.** ❑ **State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.**	**In the Stormwater Control Plan, note that all of the following restrictions apply to use the site:** ❑ **No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains.** ❑ **No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately.** ❑ **No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.** Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations". Brochure can be found at http://rcflood.org/stormwater/ Refer to Outdoor Cleaning Activities and Professional Mobile Service Providers for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ L. **Fuel Dispensing Areas**	❑ **Fueling areas[6] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable.** ❑ **Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.**		❑ **The property owner shall dry sweep the fueling area routinely.** ❑ **See the Fact Sheet SD-30 , "Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

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

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

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ 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

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
☒ 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

WILL BE PROVIDED AT FINAL ENGINEERING

Appendix 10: Educational Materials

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

WILL BE PROVIDED AT FINAL ENGINEERING