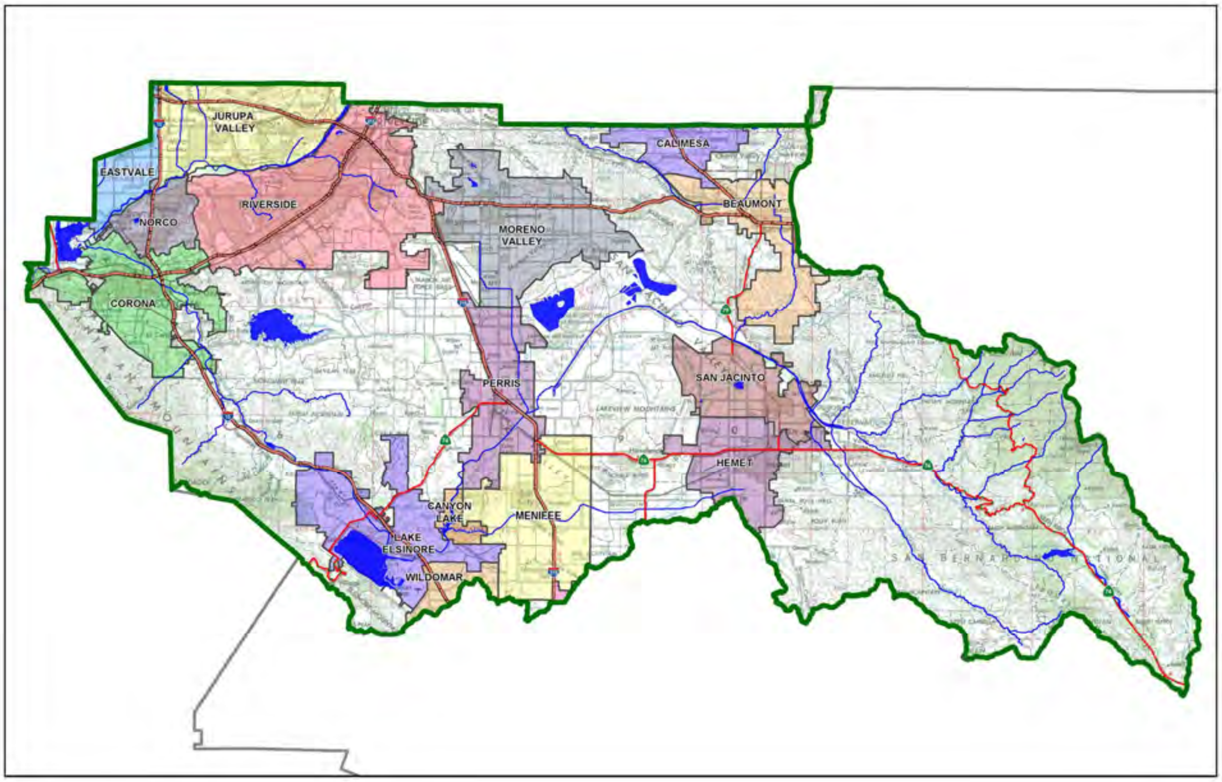
Project Specific Water Quality Management Plan

*For Projects located within the **Santa Ana Watershed** Region of Riverside County*

Project Title: Kaidence Perris

Development No:

Design Review/Case No: P22-00032



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☒ **Preliminary**
☐ **Final**

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Regional Board Order No. **R8-2010-0033**
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OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for Brookhill Corporation by ADKAN ENGINEERS for the KAIDENCE PERRIS project P22-00032.

This WQMP is intended to comply with the requirements of City of Perris for WATER QUALITY ORDINANCE 1194 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 CITY OF PERRIS Water Quality Ordinance (Municipal Code Section 1194).

"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
Michael R. Brendecke	Project Manager, P.E.
Preparer's Printed Name	Preparer's Title/Position

Preparer's Licensure:

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Section A: Project and Site Information

PROJECT INFORMATION		
Type of Project:	Residential	
Planning Area:	City of Perris General Plan	
Community Name:	General Industrial	
Development Name:	Kaidence Perris	
PROJECT LOCATION		
Latitude & Longitude (DMS): 33.829540, -117.206579		
Project Watershed and Sub-Watershed: Santa Ana Watershed, San Jacinto Watershed		
Gross Acres: 16.68 Acres APN(s): 300-090-004		
Map Book and Page No.: Record of Riverside Parcel Maps Book 176 Pages 60 through 71		
PROJECT CHARACTERISTICS		
Proposed or Potential Land Use(s)	Residential	
Proposed or Potential SIC Code(s)	1522	
Area of Impervious Project Footprint (SF)	391,136	
Total Area of proposed Impervious Surfaces within the Project Footprint (SF)/or Replacement	391,136	
Does the project consist of offsite road improvements?	☐ Y	☒ N
Does the project propose to construct unpaved roads?	☐ Y	☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y	☒ N
EXISTING SITE CHARACTERISTICS		
Total area of existing Impervious Surfaces within the Project limits Footprint (SF)	0	
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)	C	
What is the Water Quality Design Storm Depth for the project?	0.65 in	

The project is located on the corner of Rider & Evans, Perris, CA 92570 and will consist of 17 apartment buildings containing 300 total units and associated parking, drive areas, and landscaping. The site will have a total pervious area of 221,365 sf and a total impervious area of 391,136 sf. The topography of the site is mostly planar with a gentle fall to the southwest. Currently, the site is vacant and contains a moderate to a heavy growth of weeds. All onsite flows will flow to the southwest. There will be one extended detention basin sized to convey the 100-year 1-hour storm. Water during a storm event will drain via down spouts, concrete swales, and a storm drain system to the extended detention basin on site. Water will exit the extended detention basin via a storm drain piping that will ultimately be connected to an existing outlet on site which is sized to take 21.3 CFS during a 100-year storm and our outlet flows will be lower than the allowed 21.3 CFS. This is due to the fact that the geotechnical report stated that the site has inadequate infiltration rates. The site will be developed with covered trash enclosures.

A.1 Maps and Site Plans

Appendix 1 includes a map of the local vicinity and existing site. In addition, WQMP Site Plan, located in Appendix 1, includes the following:

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

A.2 Identify Receiving Waters

In order of upstream to downstream, the receiving waters that the project site is tributary to are as follows. A map of the receiving waters is included 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
Perris Valley Channel	N/A	N/A	N/A
Canyon Lake	Nutrients	WILD, REC2, WARM, GWR, MUN, REC1, AGR	N/A
Lake Elsinore	DDT, Nutrients, Organic Enrichment/Low Dissolved Oxygen, PCB's	MUN, REC1, REC2, WARM, WILD	N/A

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

Table A.2 Other Applicable Permits

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

Section B: Optimize Site Utilization (LID Principles)

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 existing site is currently vacant with developed lots to the South. Offsite drainage should not be encountered since the surrounding streets are developed with curb and gutter and the site to the South is developed with drainage routed to the local storm drainage system. The site naturally sloped from the North East to the South West and this drainage pattern will be maintained with on-site flows being directed to the proposed retention facility and ultimately transported offsite to local storm drainage.

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

No, existing vegetation is primarily comprised wild grass and is not currently overgrown.

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

No, the existing infiltration capacity of boring 1 and 2 were found to be 0.08 and 0.03 inch/hour, respectively per the geotechnical report. Natural infiltration will not be used for water quality purposes. Please refer to third page of appendix 3 where the percolation/infiltration data is provided.

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

Impervious areas have been identified on the site plan and were maximized to the furthest extent practical. The site is tightly congested to ensure minimum requirements for parking stalls, driving areas, and walkways were met.

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

Runoff will not be dispersed onto adjacent pervious areas. There is access to local storm drainage that the site can be tied into following on-site

Section C: Delineate Drainage Management Areas (DMAs)

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[12]	Area (Sq. Ft.)	DMA Type
D-5.1	Concrete & Asphalt	237,187	D
B-5.2	Landscaping	221,365	B
D-5.3	Roof	169,771	D

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]
B-5.2	LANDSCAPING	221,365	1.2	B-5.2	169771	2.4

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

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	Impervious fraction [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
D-5.1	EDB-1
B-5.2	EDB-1
D-5.3	EDB-1

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.

A Geotechnical Report is included in the report, per requirements by the County of Riverside, please see Appendix 3.

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: ALL		
…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:		

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 Co-Permittee).

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

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

Irrigation Use Feasibility

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

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

Total Area of Irrigated Landscape: 5.08 Acres

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

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

Total Area of Impervious Surfaces: 9.34 Acres

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: 1.05

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: 9.81 Acres

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

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)
9.81 Acres	5.08 Acres

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: 528

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: 9.34 Acres

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

Enter your TUTIA factor: 108

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: 1120

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)**
1120	528

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: GPD

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: Acres

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

Enter the factor from Table 2-4: GPD/Impervious Acre

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

Minimum required use: GPD

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

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
GPD	GPD

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

D.3 Bioretention and Biotreatment Assessment

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

Select one of the following:

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

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

D.4 Feasibility Assessment Summaries

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	
EDB-1	☐	☐	☐	☒	☐

D.5 LID BMP Sizing

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	*EDB-1*		
	[A]		[B]	[C]	[A] x [C]	*Design Storm Depth (in)*	*Design Capture Volume,* **V_{BMP}** *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
D-5.1	*237,187*	*Concrete or Asphalt*	*1*	*0.89*	*211,570.80*			
B-5.2	*221,365*	*Ornamental Landscaping*	*0.1*	*0.11*	*24,451.50*			
D-5.3	*169,771*	*Roofs*	*1*	*0.89*	*151435.70*			
	628,323				*387458*	*0.65*	22959.4	*37352*

[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

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 Co-Permittee). 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.

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.

The project is located within the Riverside County WAP mapping tool HCOC exemption area as approved April 20,2017.

HCOC EXEMPTION 1: The Priority Development Project disturbs less than one acre. The Co-Permittee 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

Unmitigated Area 1	**2 year – 24 hour**		
	Pre-condition	**Post-condition**	**% Difference**
Time of Concentration			
Volume (Cubic Feet)			

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

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

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

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

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

The following table identifies the potential sources of runoff pollutants for this project and specifies how they are addressed through permanent controls and operational BMPs:

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 words "Only rain Down the Strom 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. Look for faded or flaking paint as a sign to repaint. -Provide stormwater pollution prevention information to new site owners, lessees, or operators. -See applicable operational BMPs in Face Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com. -Contact Riverside County Flood Control and Water Conservation District at 951 955 1200 to check availability of Catch Basin Makers.
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. https://rcwatershed.org/wp-content/uploads/2020/09/Landscaping-and-Gardening-Guide.pdf
Landscape/Outdoor Pesticide Use	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 and detain stormwater, specify plants that are tolerant of saturated soil conditions. Consider using pest-resistant plants, especially adjacent to hardscape. To ensure 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. -Provide integrated pest management information to owners, lessees, and operators. -See applicable operational BMPs in "What you should know for…Landscaping and Gardening" at https://rcwatershed.org/wp-content/uploads/2020/09/Landscaping-and-Gardening-Guide.pdf

Refuse area	Signs will be posted on or near dumpsters with the words "Do not dump hazardous material here" or similar.	-Provide adequate number of receptacles. Inspect, 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 -See appendix 9 for frequency.
Fire sprinkler test water	Provide a means to drain fire sprinkler test water to the sanitary sewer.	-See Fact Sheet SC-41, "Building and Grounds maintenance." In the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
Condensate drain lines	Condensate drain lines may drain to landscaped areas if the flow is small enough that runoff will not occur. Do not drain to storm drain system.	
Drainage sumps	Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.	
Roofing, gutters, and trim	Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	
Plazas, sidewalks, and parking lots		-Sweep plazas, sidewalks and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect wash water containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Section H: Construction Plan Checklist

Populate Table H.1 below to assist the plan checker in an expeditious review of your project. The first two columns will contain information that was prepared in previous steps, while the last column will be populated with the corresponding plan sheets.

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)	BMP Location (Lat/Long)

TO BE COMPLETED AT TIME OF FWQMP.

Section I: Operation, Maintenance and Funding

As required by the City of Riverside, the following Operation, Maintenance, and Funding details are provided as summarized:

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.
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.
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.

See Appendix 9 for a detailed Stormwater BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the Stormwater BMPs built and an agreement assigning responsibility for maintenance and providing for inspections and certification.

Maintenance Mechanism:

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

☐ Y ☐ N

Owner shall maintain.

Operation and Maintenance Plan and Maintenance Mechanism is included in Appendix 9. Educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP are included in Appendix 10.

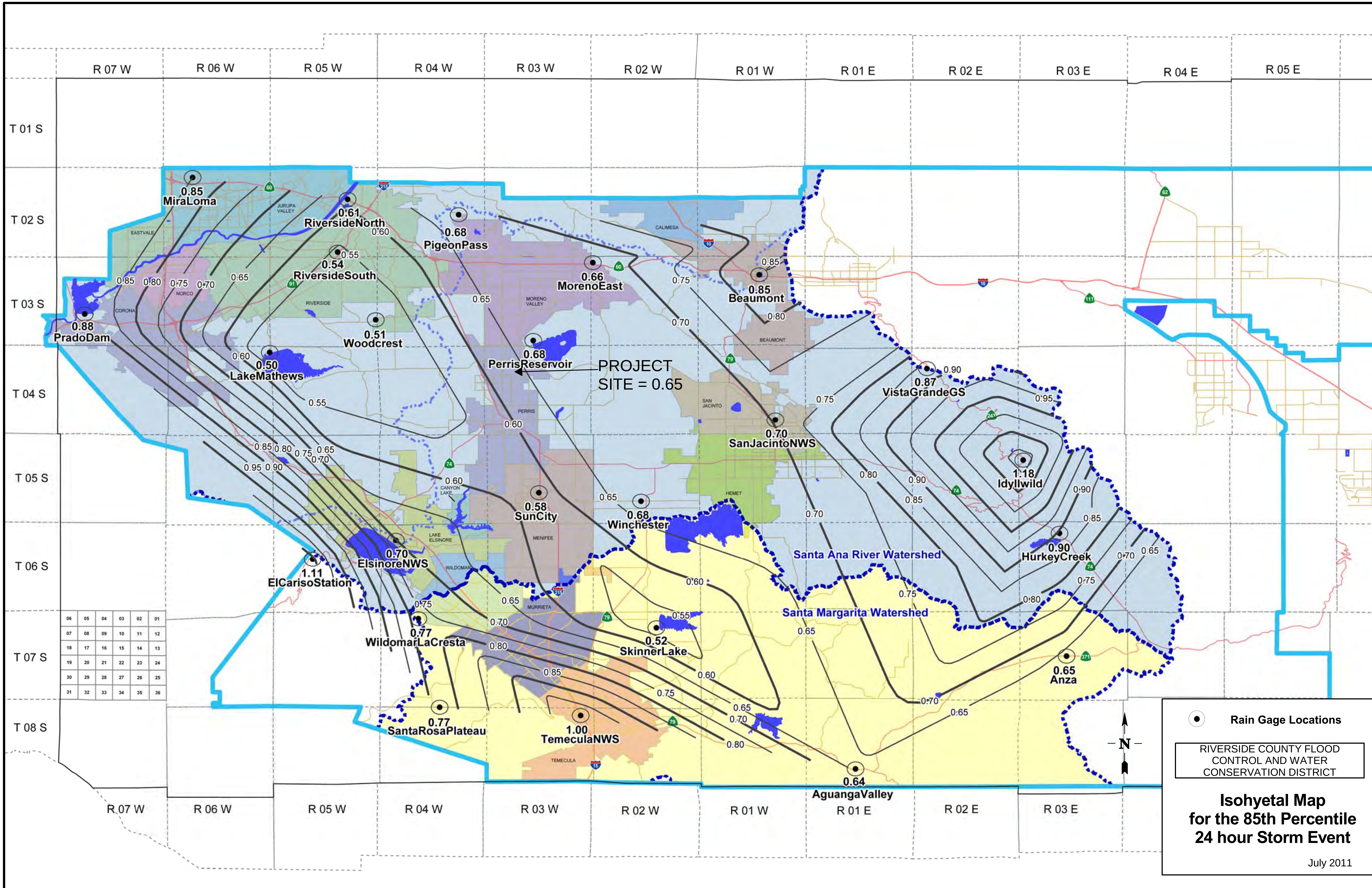
Owner/O&M Provider:

TO BE COMPLETED AT TIME OF FWQMP.

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

VICINITY MAP



R 07 W
R 06 W
R 05 W
R 04 W
R 03 W
R 02 W
R 01 W
R 01 E
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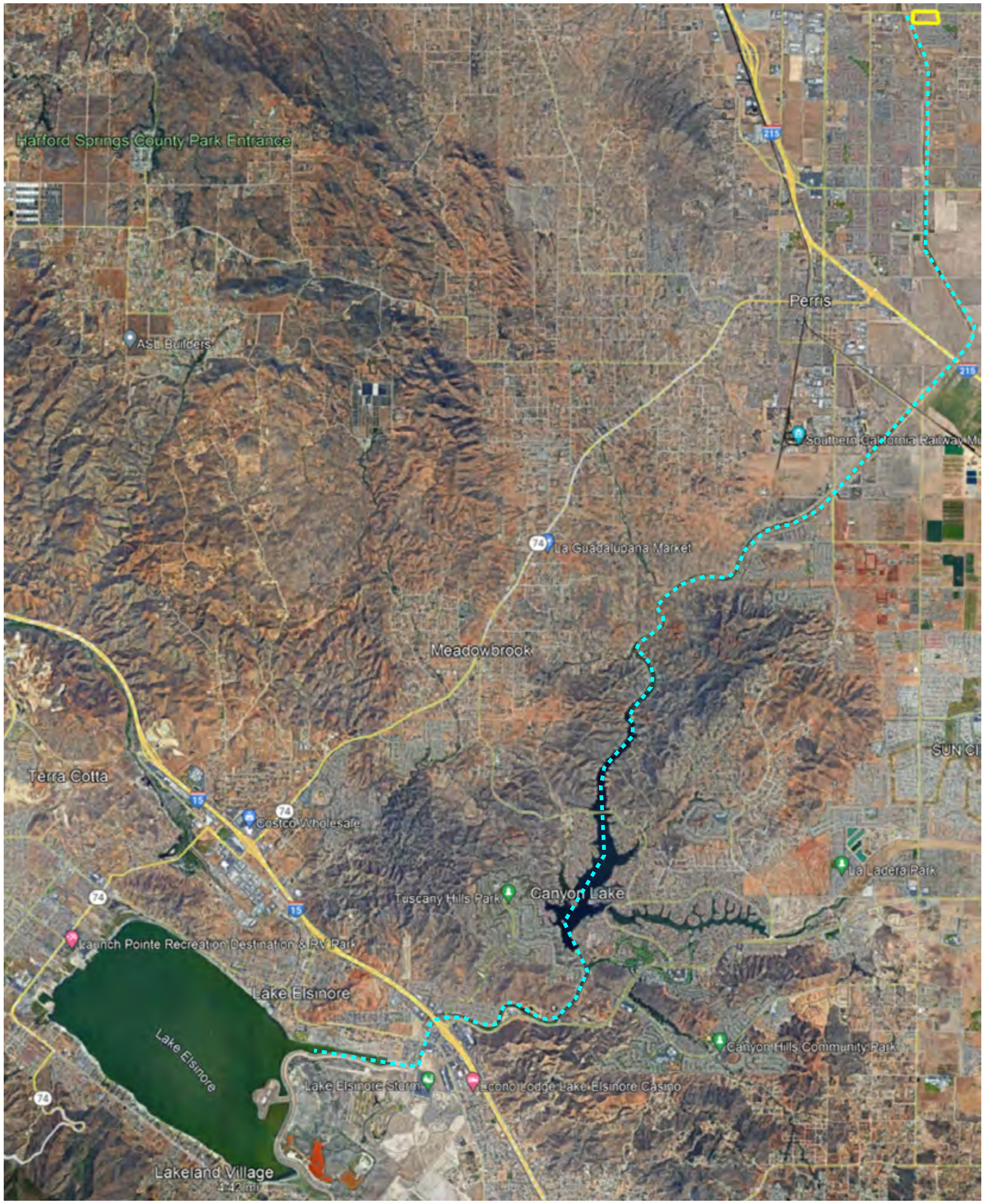
R 04 E
R 05 E
T 01 S
T 02 S
T 03 S
T 04 S
T 05 S
T 06 S
T 07 S
T 08 S
0.85 MiraLoma
0.61 RiversideNorth
0.68 PigeonPass
0.54 RiversideSouth
0.66 MorenoEast
0.85 Beaumont
0.88 PradoDam
0.51 Woodcrest
0.68 PerrisReservoir
PROJECT SITE = 0.65
0.50 LakeMathews
0.87 VistaGrandeGS
0.70 SanJacintoNWS
1.18 Idyllwild
0.58 SunCity
0.68 Winchester
0.90 HurkeyCreek
0.70 ElsinoreNWS
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
Rain Gage Locations
N
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
Isohyetal Map for the 85th Percentile 24 hour Storm Event
July 2011



VICINITY MAP / RECEIVING WATERS MAP

Brookhill Rider & Evans

FOR: Brookhill Corp

DRAWN BY: adkan ENGINEERS

DRAWING NUMBER:

PHASE OF CONSTRUCTION: WATER QUALITY MANAGEMENT PLAN MAP

AMENDED SITE MAP LOG

DATE AMENDED	DESCRIPTION	

REV	DRAWING DESCRIPTION	DWN/CKD	APPROVED	DATE

QUALIFIED SWPPP DEVELOPER

NAME: JODI MENARD
QUALIFIED SWPPP DEVELOPER
CPSWQ, QSP & QSD 00902

STAMP:

N

NOT TO SCALE

LEGEND

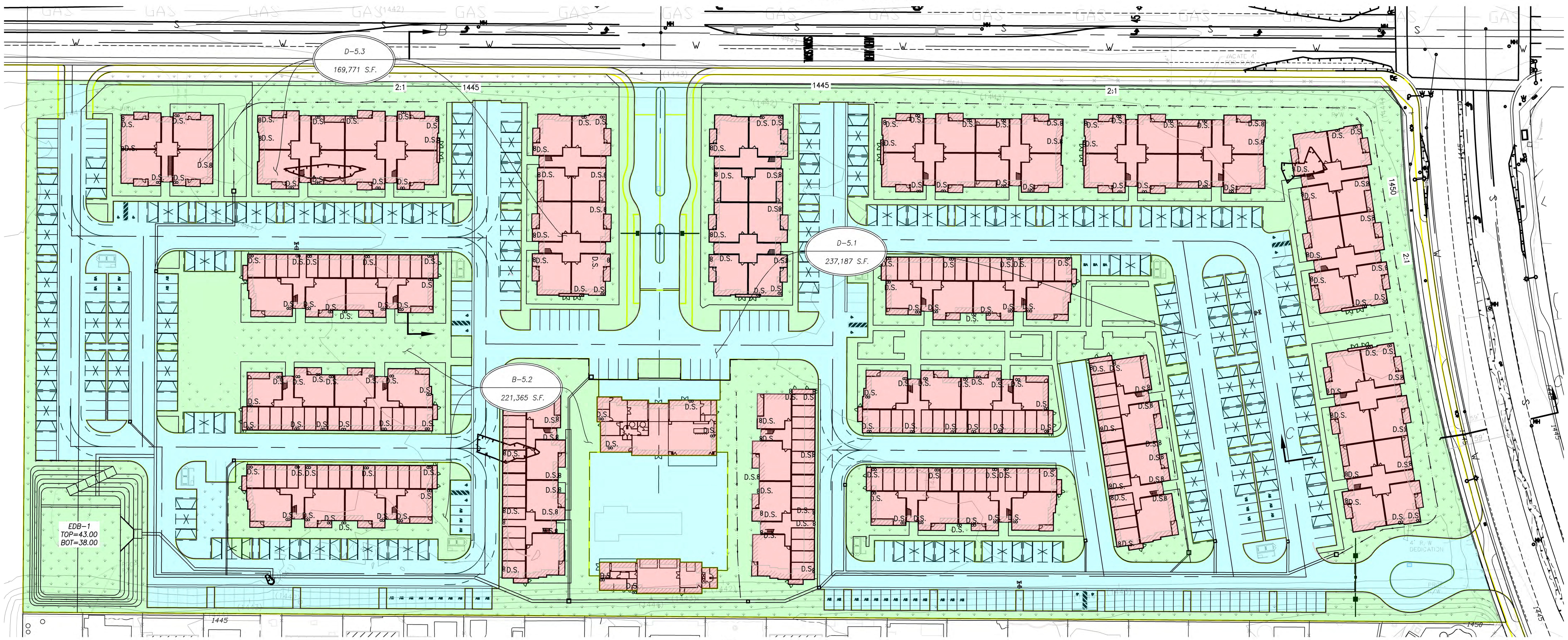
DRAINAGE PATHWAY

IN THE CITY OF PERRIS, STATE OF CALIFORNIA

DMA MAP

KAIDENCE EVANS

P22-00032



OWNER/APPLICANT

BROOKHILL CORPORATION
2716 OCEAN PARK BLVD.
SANTA MONICA, CA 90405,
TEL: (310) 314-2400 X3

ENGINEER

ADKAN ENGINEERS
6879 AIRPORT DRIVE
RIVERSIDE, CA 92504
TEL: (951) 688-0241

ASSESSOR'S PARCEL NUMBER

300-090-004

ZONING

EXISTING ZONING: MR-SP (3029)
PROPOSED ZONING: MFR-22

LAND USE

EXISTING LAND USE: COMMERCIAL
PROPOSED LAND USE: RESIDENTIAL

BENCHMARK

40 Y (PID#DX2103)
3" BRASS DISK, SET IN BOULDER, STATION IS ABOUT 4-1/2
MILES W OF LAKEVIEW, ABOUT ONE MILE W OF THE PASS THROUGH THE BERNASCONI MOUNTAINS, ABOUT 200 FEET SW
OF THE INTESECTION OF BRADLEY ROAD AND WALNUT AVENUE,
70 FEET S OF CENTERLINE OF WALNUT AVENUE, IN A LARGE
BOLDER, AND MARKED WITH A TEE. MARK IS A METROPOLOITAIN
WATER DISTRICT OF SOUTHERN CALIFORNIA STANDARD DISK STAMPED 40 Y 1931.
1988 ELEVATION: 1496.35

ZONING

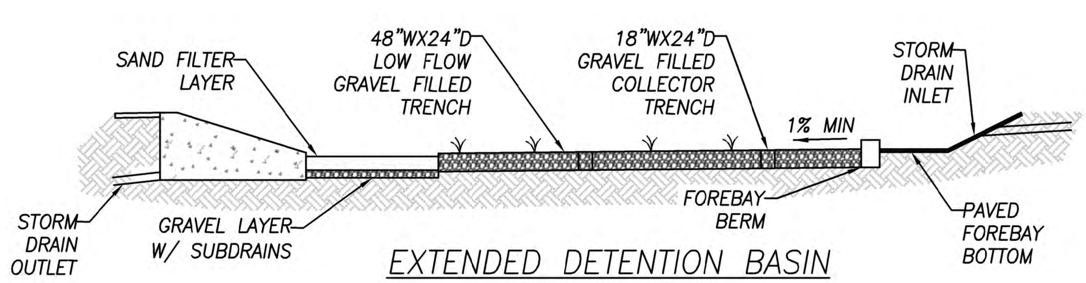
EXISTING ZONING: MR-SP (3029)
PROPOSED ZONING: MFR-22

LAND USE

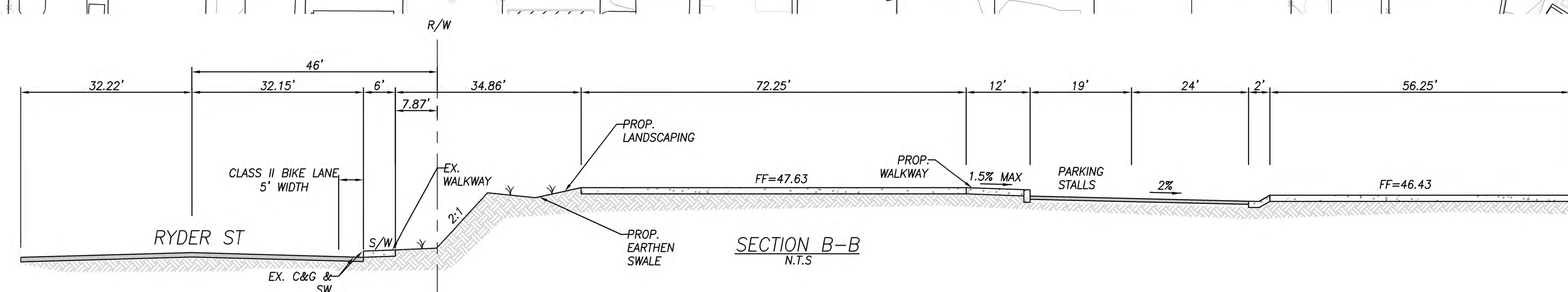
EXISTING LAND USE: COMMERCIAL
PROPOSED LAND USE: RESIDENTIAL

UTILITY PERVEYORS

WATER: EMWD
SEWER: EMWD



EXTENDED DETENTION BASIN BMP SECTION
N.T.S



SECTION B-B
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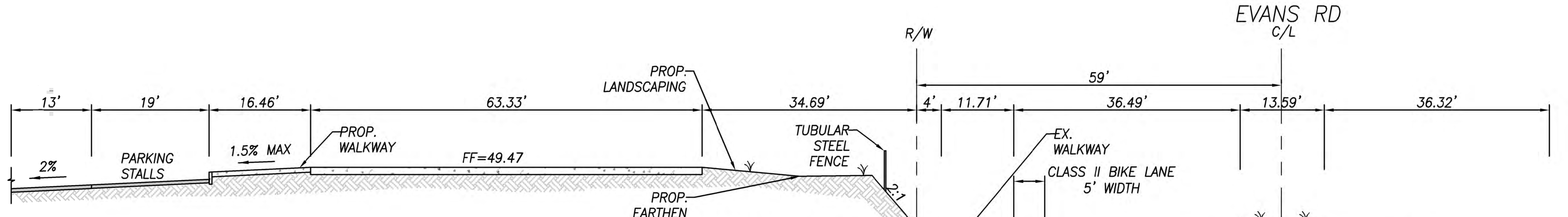


SECTION C-C
N.T.S

LEGEND

DMA	DMA TYPE	AREA (S.F.)		BMP	BMP TYPE
D-5.1	CONCRETE & ASPHALT	237,187		EDB-1	EXTENDED DETENTION BASIN
B-5.2	LANDSCAPING	221,365			
D-5.3	ROOF	169,771			

TOTAL TREATED AREA 640,332

DMA BOUNDARY — — — —

0 25 50 100 150 200

SCALE: 1" = 50'

PLANS PREPARED BY:

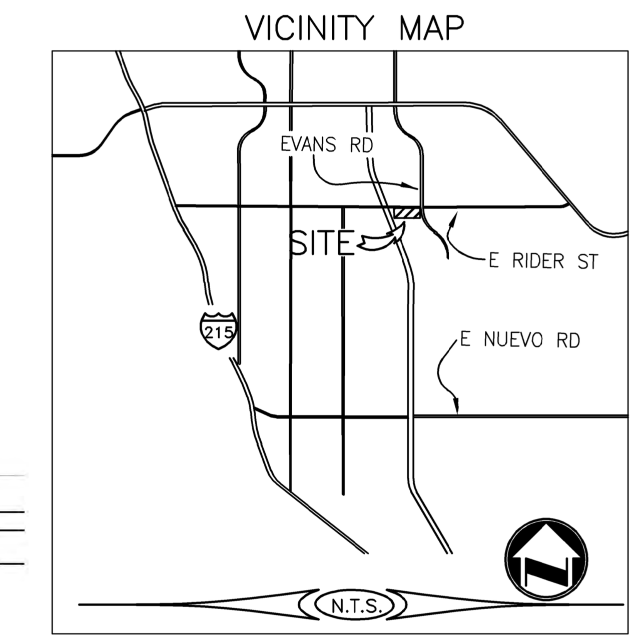
adkan ENGINEERS
Civil Engineering · Surveying · Planning
6879 Airport Drive, Riverside, CA 92504
Tel:(951) 688-0241 · Fax:(951) 688-0599

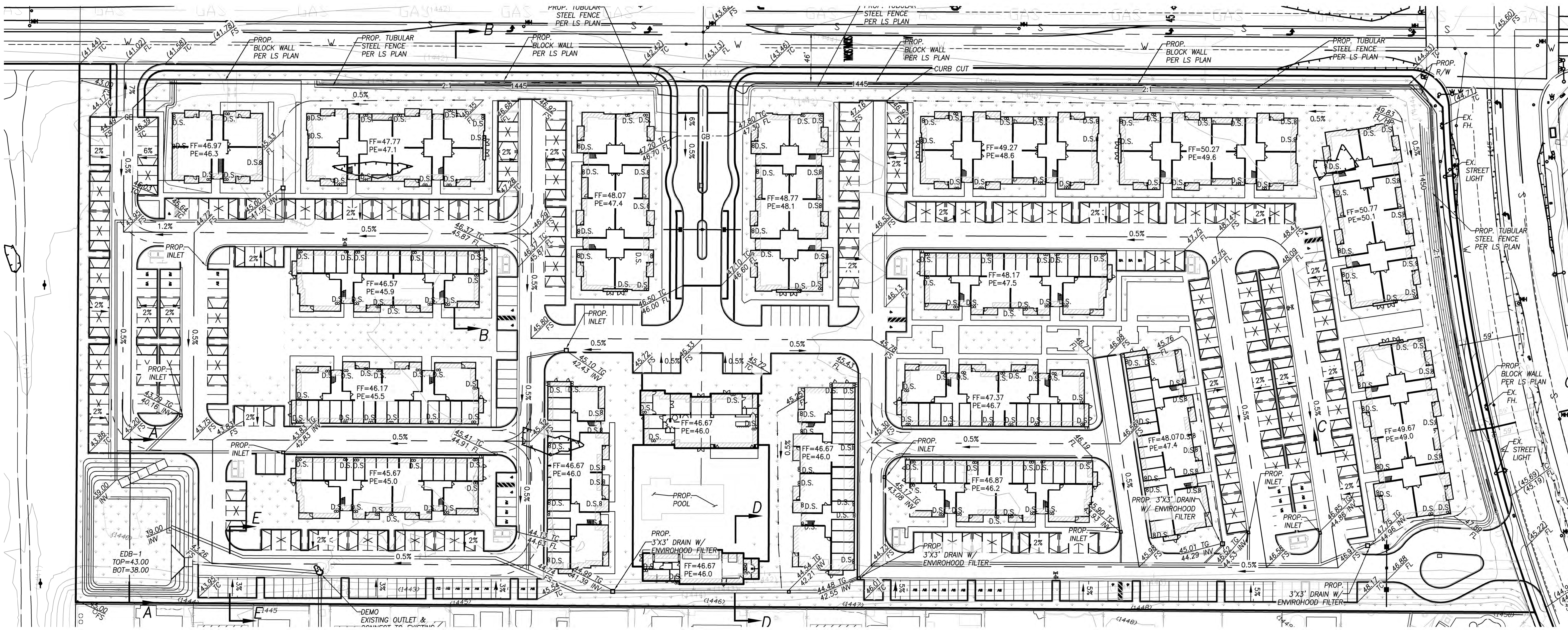
Plot Date: 3/6/2023

U:\Projects\Brook Hill Corporation\10001\Engineering\PWQMP\10001-BMP DMA.Maps.dwg 3:23 PM

IN THE CITY OF PERRIS, STATE OF CALIFORNIA

POST-CONSTRUCTION BMP SITE PLAN
KAIDENCE PERRIS, EVANS ROAD
(P22-00032)





OWNER/APPLICANT
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ENGINEER
ADKAN ENGINEERS
6879 AIRPORT DRIVE
RIVERSIDE, CA 92504
TEL: (951) 688-0241

ASSESSOR'S PARCEL NUMBER
300-090-004

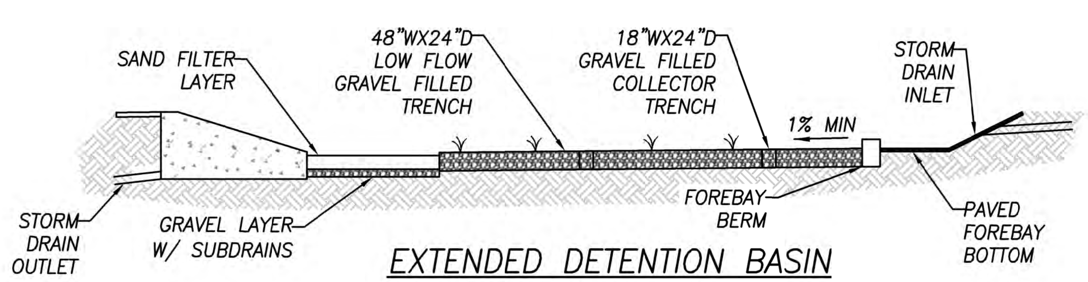
PROJECT AREA
TOTAL: 636,412 SF 14.61 ACRES

ZONING
EXISTING ZONING: MR-SP (3029)
PROPOSED ZONING: MFR-22

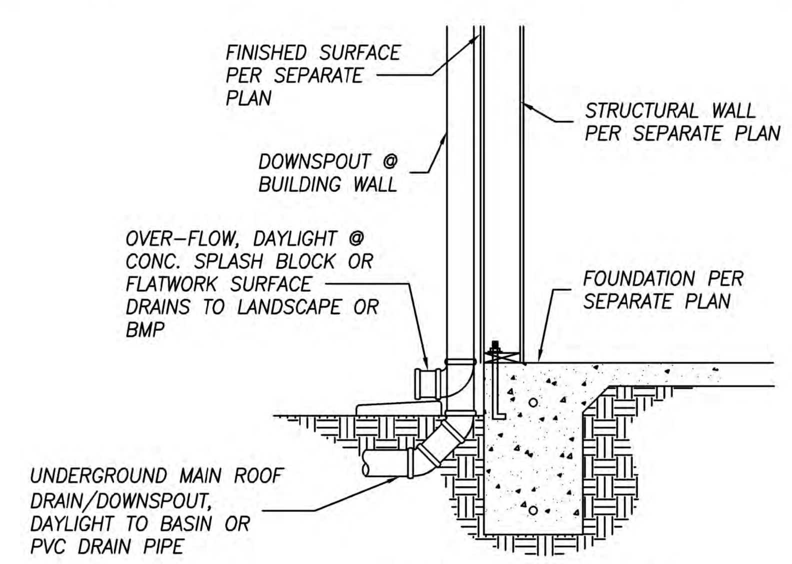
LAND USE
EXISTING LAND USE: COMMERCIAL
PROPOSED LAND USE: RESIDENTIAL

BENCHMARK
40 Y (PID#DX2103)
3" BRASS DISK, SET IN BOULDER, STATION IS ABOUT 4-1/2
MILES W OF LAKEVIEW, ABOUT ONE MILE W OF THE PASS THROUGH THE BERNASCONI MOUNTAINS, ABOUT 200 FEET SW
OF THE INTESECTION OF BRADLEY ROAD AND WALNUT AVENUE,
70 FEET S OF CENTERLINE OF WALNUT AVENUE, IN A LARGE
BOLDER, AND MARKED WITH A TEE. MARK IS A METROPOLOITAIN
WATER DISTRICT OF SOUTHERN CALIFORNIA STANDARD DISK
STAMPED 40 Y 1931.
1988 ELEVATION: 1496.35

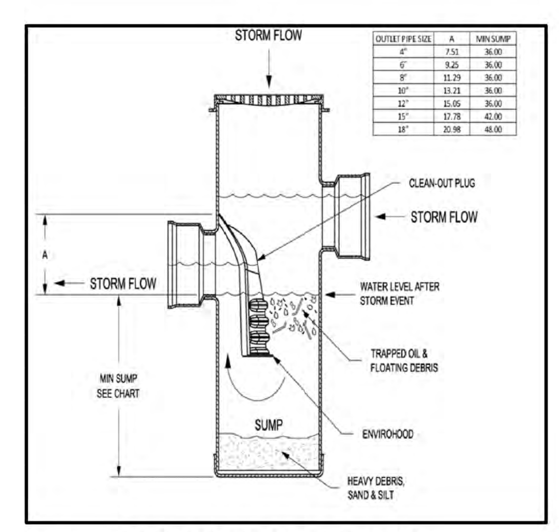
LEGAL DESCRIPTION
LOT 1 AS SHOWN ON LOT LINE ADJUSTMENT NO. 00-0033
RECORDED APRIL 13, 2000 AS INSTRUMENT NO. 2000-136848
OF OFFICIAL RECORDS OF OF RIVERSIDE, CALIFORNIA, BEING A PORTION OF PARCEL 17 OF PARCEL MAP NO. 25943
ON FILE IN BOOK 176 PAGES 60 THROUGH 71 OF PARCEL MAPS, RECORDS OF RIVERSIDE COUNTY, CALIFORNIA IN SECTION
16, TOWNSHIP 4 SOUTH, RANGE 3 WEST, RANCHO SAN JACINTO
NUEVO.



EXTENDED DETENTION BASIN BMP SECTION
N.T.S



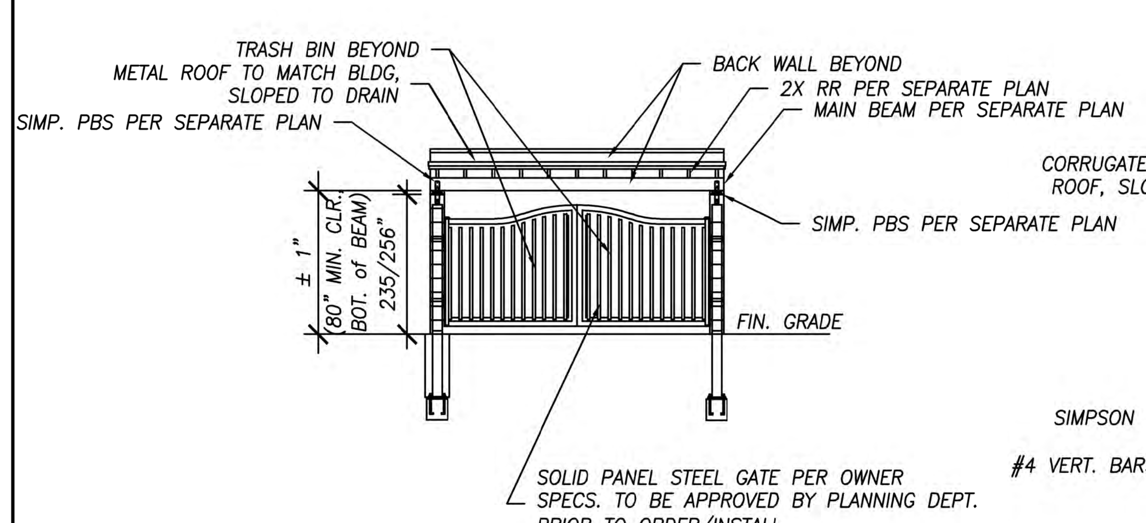
DOWN SPOUT DETAIL
N.T.S.

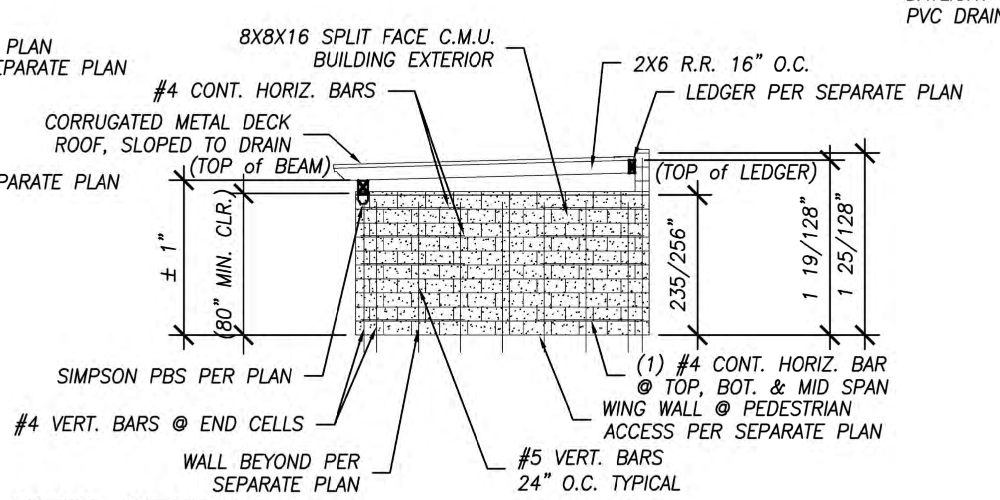


ENVIROHOOD FILTER
N.T.S.

*"ONLY RAIN DOWN THE STORM DRAIN" STENCIL FROM BERNTSEN DESIGN "ORD-ONLY RAIN-DOWN THE STORM DRAIN" OR SIMILAR TO BE PAINTED ON INLET GRATES.

ORD - Only Rain - Down the Storm Drain





TRASH ENCLOSURE CROSS SECTION
N.T.S.

SCALE: 1" = 50'

PLANS PREPARED BY:
adkan ENGINEERS
Civil Engineering · Surveying · Planning
6879 Airport Drive, Riverside, CA 92504
Tel:(951) 688-0241 · Fax:(951) 688-0599

Plot Date: 3/9/2023

Appendix 2: Construction Plans

Grading and Drainage Plans

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

GEOTECHNICAL • ENVIRONMENTAL • GEOLOGY • MATERIALS TESTING & INSPECTION • FORENSIC • LABORATORY

SALEM engineering group, inc.

GEOTECHNICAL ENGINEERING INVESTIGATION

PROPOSED MULTI-FAMILY DEVELOPMENT
EVANS ROAD AND RIDER STREET
PERRIS, CALIFORNIA

SALEM PROJECT NO. 3-221-0432
MAY 25, 2021

PREPARED FOR:

MR. KEITH GEIGER
BROOKHILL CORP.
2716 OCEAN PARK BLVD., SUITE 1055
SANTA MONICA, CA 90405

PREPARED BY:

SALEM ENGINEERING GROUP, INC.
8711 MONROE COURT, SUITE A
RANCHO CUCAMONGA, CA 91730
P: (909) 980-6455
F: (909) 980-6435
www.salem.net

8711 Monroe Court, Suite A
Rancho Cucamonga, CA 91730
Phone (909) 980-6455
Fax (909) 980-6435

May 25, 2021

Project No. 3-221-0432

Mr. Keith Geiger
Brookhill Corp.
2716 Ocean Park Blvd., Suite 1055
Santa Monica, CA 90405

**SUBJECT: GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED MULTI-FAMILY DEVELOPMENT
EVANS ROAD AND RIDER STREET
PERRIS, CALIFORNIA**

Dear Mr. Geiger:

At your request and authorization, SALEM Engineering Group, Inc. (SALEM) has prepared this Geotechnical Engineering Investigation report for the Proposed Multi-Family Development to be located at the subject site.

The accompanying report presents our findings, conclusions, and recommendations regarding the geotechnical aspects of designing and constructing the project as presently proposed. In our opinion, the proposed project is feasible from a geotechnical viewpoint provided our recommendations are incorporated into the design and construction of the project.

We appreciate the opportunity to assist you with this project. Should you have questions regarding this report or need additional information, please contact the undersigned at (909) 980-6455.

Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

Ibrahim Foud Ibrahim, PE
Senior Managing Engineer
RCE 86724

Clarence Jiang, GE
Senior Geotechnical Engineer
RGE 2477

TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

8711 Monroe Court, Suite A
Rancho Cucamonga, CA 91730
Phone (909) 980-6455
Fax (909) 980-6435

GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED MULTI-FAMILY DEVELOPMENT
EVANS ROAD AND RIDER STREET
PERRIS, CALIFORNIA

1. PURPOSE AND SCOPE

This report presents the results of our Geotechnical Engineering Investigation for the proposed Multi-Family Development to be located at the southwest corner of the intersection of Evans Road and Rider Street in the City of Perris, California (see Figure 1, Vicinity Map).

The purpose of our geotechnical engineering investigation was to observe and sample the subsurface conditions encountered at the site, and provide conclusions and recommendations relative to the geotechnical aspects of constructing the project as presently proposed.

The scope of this investigation included a field exploration, percolation testing, laboratory testing, engineering analysis and the preparation of this report. Our field exploration was performed on May 10 and 12, 2021 and included drilling of twelve (12) small-diameter soil borings to a maximum depth of 28 feet at the site. Additionally, two (2) percolation tests were performed at depths of approximately 5 and 10 feet below existing grade to determine infiltration rate. The locations of the soil borings and percolation tests are depicted on Figure 2, Site Plan. A detailed discussion of our field investigation and exploratory boring logs are presented in Appendix A.

Laboratory tests were performed on selected soil samples obtained during the investigation to evaluate pertinent physical properties for engineering analyses. Appendix B presents the laboratory test results in tabular and graphic format. The recommendations presented herein are based on analysis of the data obtained during the investigation and our experience with similar soil and geologic conditions. If project details vary significantly from those described herein, SALEM should be contacted to determine the necessity for review and possible revision of this report. Earthwork and Pavement Specifications are presented in Appendix C. If text of the report conflict with the specifications in Appendix C, the recommendations in the text of the report have precedence.

2. PROJECT DESCRIPTION

Based on the information provided to us, we understand that the proposed development of the site will include construction of a 324-unit apartment complex. The Proposed Multi-Family Development will include (4) 8 Unit 2-Story Buildings, (6) 12 Units 2-Story Buildings, (5) 16 Units 3-Story Buildings, (3) 18 Units 3-Story Buildings, (4) 24 Unit 3-Story Buildings, 3,500 square-foot Clubhouse, 2,500 square-foot Recreation Room, Pool, and associated parking and landscaping. Maximum wall load is expected to be on the order of 5 kips per linear foot. Maximum column load is expected to be on the order of 100 kips. Floor slab soil bearing pressure is expected to be on the order of 150 psf.

A grading plan was not available at the time of preparation of this report. As the site area is relatively flat, we anticipate that cuts and fills during the earthwork will be minimal and limited to providing a level building pad and positive site drainage. In the event that changes occur in the nature or design of the project, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and the conclusions of our report are modified. The site configuration and locations of proposed improvements are shown on the Site Plan, Figure 2.

3. SITE LOCATION AND DESCRIPTION

The subject site is nearly rectangular in shape and encompasses approximately 14.7 acres. The site is located at the southwest corner of the intersection of Evans Road and Rider Street in the City of Perris, California (see Vicinity Plan, Figure 1).

The site is currently a vacant land with dry weeds. The property is mainly surrounded by single family residences. Perris Valley Storm Drain is located on average at approximately 200 feet west of the site. The site is relatively flat with no major changes in grade. The average ground elevation of the site is approximately 1,440 feet above mean sea level based on Google Earth imagery.

4. FIELD EXPLORATION

Our field exploration consisted of site surface reconnaissance and subsurface exploration. The exploratory test borings (B-1 through B-12) were drilled on May 10 and 12, 2021 at the locations shown on the Site Plan, Figure 2. The test borings were advanced with 6½-inch diameter hollow stem augers rotated by a truck-mounted CME 45C drill rig. The test borings were extended to a maximum depth of 28 feet below existing grade. The depth of our exploration was limited due to auger refusal on dense/hard soil conditions.

The materials encountered in the test borings were visually classified in the field, and logs were recorded by a field engineer and stratification lines were approximated on the basis of observations made at the time of drilling. Visual classification of the materials encountered in the test borings were generally made in accordance with the Unified Soil Classification System (ASTM D2488).

A soil classification chart and key to sampling is presented on the Unified Soil Classification Chart, in Appendix "A." The logs of the test borings are presented in Appendix "A." The Boring Logs include the soil type, color, moisture content, dry density, and the applicable Unified Soil Classification System symbol. The location of the test borings were determined by measuring from features shown on the Site Plan, provided to us. Hence, accuracy can be implied only to the degree that this method warrants.

The actual boundaries between different soil types may be gradual and soil conditions may vary. For a more detailed description of the materials encountered, the Boring Logs in Appendix "A" should be consulted. Soil samples were obtained from the test borings at the depths shown on the logs of borings. The MCS samples were recovered and capped at both ends to preserve the samples at their natural moisture content; SPT samples were recovered and placed in a sealed bag to preserve their natural moisture content. The borings were backfilled with soil cuttings after completion of the drilling.

5. LABORATORY TESTING

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory-testing program was formulated with emphasis on the evaluation of natural moisture, density, shear strength, consolidation potential, maximum density and optimum moisture determination, and gradation of the materials encountered.

In addition, chemical tests were performed to evaluate the corrosivity of the soils to buried concrete and metal. Details of the laboratory test program and the results of laboratory test are summarized in Appendix "B." This information, along with the field observations, was used to prepare the final boring logs in Appendix "A."

6. GEOLOGIC SETTING

The subject site is located within the Peninsular Range Geomorphic Province, an area characterized by active northeast trending strike slip faults, including the San Jacinto to the northwest, and the Elsinore to the southwest. The project site is situated between the Santa Rosa Mountains and the San Jacinto Mountains to the east; and Santa Ana Mountains to the west and south. The near-surface deposits in the vicinity of the subject site are comprised of recent alluvium consisting of unconsolidated sands, silt, and clays derived from erosion of local mountain ranges. Deposits encountered on the subject site during exploratory drilling are discussed in detail in this report.

7. GEOLOGIC HAZARDS

7.1 Faulting and Seismicity

Based on the proximity of several dominant active faults and seismogenic structures, as well as the historic seismic record, the area of the subject site is considered subject to relatively high seismicity. The seismic hazard most likely to impact the site is ground-shaking due to a large earthquake on one of the major active regional faults. Moderate to large earthquakes have affected the area of the subject site within historic time.

There are no known active fault traces in the project vicinity. The project area is not within an Alquist-Priolo Earthquake Fault (Special Studies) Zone and will not require a special site investigation by an Engineering Geologist. Soils on site are classified as Site Class D in accordance with Chapter 16 of the California Building Code. The proposed structures are determined to be in Seismic Design Category D.

To determine the distance of known active faults within 100 miles of the site, we used the United States Geological Survey (USGS) web-based application *2008 National Seismic Hazard Maps - Fault Parameters*. Site latitude is 33.8294° North; site longitude is 117.2067° West. The ten closest active faults are summarized below in Table 7.1.

TABLE 7.1
REGIONAL FAULT SUMMARY

Fault Name	Distance to Site (miles)	Maximum Earthquake Magnitude, M_w
San Jacinto; A+CC+B+SM	7.0	7.6
San Jacinto; SBV+SJV+A+CC+B+SM	8.3	7.9
San Jacinto; SBV	13.1	7.1
Elsinore; W+GI	13.7	7.3
Elsinore; W+GI+T+J+CM	13.8	7.8
Elsinore; T+J_CM	15.0	7.5
S. San Andreas; PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	19.8	8.2
Chino, alt 2	20.7	6.8
Elsinore; W	22.1	7.0
Chino, alt 1	22.6	6.7

The faults tabulated above and numerous other faults in the region are sources of potential ground motion. However, earthquakes that might occur on other faults throughout California are also potential generators of significant ground motion and could subject the site to intense ground shaking.

7.2 Surface Fault Rupture

The site is not within a currently established State of California Earthquake Fault Zone for surface fault rupture hazards. No active faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low.

7.3 Ground Shaking

Seismic coefficients and spectral response acceleration values were developed based on the 2019 California Building Code (CBC). The CBC methodology for determining design ground motion values is based on the Office of Statewide Health Planning and Development (OSHPD) Seismic Design Maps, which incorporate both probabilistic and deterministic seismic ground motion.

Based on the 2019 CBC, a Site Class D represents the on-site soil conditions. A table providing the recommended design acceleration parameters for the project site, based on a Site Class D designation, is included in Section 9.2.1 of this report.

Based on the Office of Statewide Health Planning and Development (OSHPD) Seismic Design Maps, the estimated design peak ground acceleration adjusted for site class effects (PGA_M) was determined to be 0.554g (based on both probabilistic and deterministic seismic ground motion).

7.4 Liquefaction

Soil liquefaction is a state of soil particles suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs under saturated conditions in soils such as sand in which the strength is purely frictional. Primary factors that trigger liquefaction are: moderate to strong ground shaking (seismic source), relatively clean, loose granular soils (primarily poorly graded sands and silty sands), and saturated soil conditions (shallow groundwater). Due to the increasing overburden pressure with depth, liquefaction of granular soils is generally limited to the upper 50 feet of a soil profile. However, liquefaction has occurred in soils other than clean sand.

The soils encountered within the depth of 28 feet on the project site consisted predominately of stiff to hard silty sand/sandy silt, sandy silt, and loose to very dense silty sand with various amounts of gravel and clay. Groundwater was not encountered during this investigation. The historically highest groundwater is estimated to be at a depth of 20 feet below ground surface based on the County of Riverside Geologic Hazards Map (2004) and regional groundwater data. The Riverside County Office of Information Technology GIS website shows the subject site to be in a very high liquefaction potential area.

Low to very low cohesion strength is commonly associated with the sandy soil profile at the site. A seismic hazard, which could cause damage to the proposed development during seismic shaking, is the post-liquefaction settlement of liquefied sands.

The potential for soil liquefaction during a seismic event was evaluated using LiqIT computer program (version 4.7.5) developed by GeoLogismiki of Greece. For the analysis, a maximum earthquake magnitude of 7.9 M_w, a peak horizontal ground surface acceleration of 0.554g (PGA_M) and a groundwater depth of 20 feet were considered appropriate for the liquefaction analysis. The analysis indicated that the on-site soils had a moderate potential for liquefaction and that the total liquefaction-induced settlement was calculated to be 1.33 inches. Differential settlement is estimated to be 0.67 inches over a horizontal distance of 40 feet. The liquefaction analysis is included in Appendix A.

7.5 Lateral Spreading

Lateral spreading is a phenomenon in which soils move laterally during seismic shaking and is often associated with liquefaction. The amount of movement depends on the soil strength, duration and intensity of seismic shaking, topography, and free face geometry. Due to relatively flat site topography, we judge the likelihood of lateral spreading to be low.

7.6 Landslides

There are no known landslides at the site, nor is the site in the path of any known or potential landslides. We do not consider the potential for a landslide to be a hazard to this project.

7.7 Tsunamis and Seiches

The site is not located within a coastal area. Therefore, tsunamis (seismic sea waves) are not considered a significant hazard at the site. Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No major water-retaining structures are located immediately up gradient from the project site. Flooding from a seismically-induced seiche is considered unlikely.

8. SOIL AND GROUNDWATER CONDITIONS

8.1 Subsurface Conditions

The subsurface conditions encountered appear typical of those found in the geologic region of the site. In general, the soils within the depth of exploration consisted predominately of stiff to hard silty sand/sandy silt, sandy silt, and loose to very dense silty sand with various amounts of gravel and clay.

Fill soils may be present on site between our test boring locations. Verification of the extent of fill should be determined during site grading. Undocumented fill material are not suitable to support any future structures and should be replaced with Engineered Fill. The extent and consistency of the fills should be verified during site construction. Prior to fill placement, Salem Engineering Group, Inc. should inspect the bottom of the excavation to verify the fill condition.

The soils were classified in the field during the drilling and sampling operations. The stratification lines were approximated by the field engineer on the basis of observations made at the time of drilling. The actual boundaries between different soil types may be gradual and soil conditions may vary. For a more detailed description of the materials encountered, the Boring Logs in Appendix "A" should be consulted.

The Boring Logs include the soil type, color, moisture content, dry density, and the applicable Unified Soil Classification System symbol. The locations of the test borings were determined by measuring from feature shown on the Site Plan, provided to us. Hence, accuracy can be implied only to the degree that this method warrants.

8.2 Groundwater

The test boring locations were checked for the presence of groundwater during and after the drilling operations. Free groundwater was not encountered during this investigation. The historically highest groundwater is estimated to be at a depth of 20 feet below ground surface based on the County of Riverside Geologic Hazards Map (2004) and regional groundwater data

It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, localized pumping, and climatic conditions as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

8.3 Soil Corrosion Screening

Excessive sulfate in either the soil or native water may result in an adverse reaction between the cement in concrete and the soil. The 2014 Edition of ACI 318 (ACI 318) has established criteria for evaluation of sulfate and chloride levels and how they relate to cement reactivity with soil and/or water.

A soil sample was obtained from the project site and was tested for the evaluation of the potential for concrete deterioration or steel corrosion due to attack by soil-borne soluble salts and soluble chloride.

The water-soluble sulfate concentration in the saturation extract from the soil sample was detected to be 130 mg/kg. ACI 318 Tables 19.3.1.1 and 19.3.2.1 outline exposure categories, classes, and concrete requirements by exposure class. ACI 318 requirements for site concrete based upon soluble sulfate are summarized in Table 8.3 below.

TABLE 8.3
WATER SOLUBLE SULFATE EXPOSURE REQUIREMENTS

Water Soluble Sulfate (SO_4) in Soil, % by Weight	Exposure Severity	Exposure Class	Maximum w/cm Ratio	Minimum Concrete Compressive Strength	Cementations Materials Type
0.0130	Not Severe	S0	N/A	2,500 psi	No Restriction

The water-soluble chloride concentration detected in saturation extract from the soil samples was 53 mg/kg. This level of chloride concentration is considered to be mildly corrosive.

It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, applicable manufacturer's recommendations for corrosion protection of buried metal pipe be closely followed.

8.4 Percolation Testing

Two percolation tests (P-1 and P-2) were performed within assumed infiltration areas and were conducted in accordance with the guidelines established by the County of Riverside. Results of the falling head tests are presented in the attachments to this report. The approximate locations of the percolation tests are shown on the attached Site Plan, Figure 2.

The boreholes were advanced to the depths shown on the percolation test worksheets. The holes were pre-saturated before percolation testing commenced. Percolation rates were measured by filling the test holes with clean water and measuring the water drops at a certain time interval. The difference in the percolation rates are reflected by the varied type of soil materials at the bottom of the test holes. The test results are shown on the table below.

TABLE 8.4
PERCOLATION TEST RESULTS

Test No.	Depth (feet)	Measured Percolation Rate (min/inch)	Infiltration Rate* (inch/hour)	Soil Type**
P-1	10	83.3	**0.08**	Sandy SILT (ML)
P-2	5	250.0	**0.03**	Sandy SILT (ML)

*** Tested infiltration Rate = (ΔH 60 r) / (Δt(r + 2H_{avg}))**
****At bottom of test hole.**

<u>Based on the soil condition and percolation test results, the site is considered to be technically **infeasible** to attain an infiltration rate necessary to achieve reliable performance of infiltration or bioretention BMPs in retaining the stormwater quality design volume (SWQDv) on site.</u>

The soil infiltration or percolation rates are based on tests conducted with clear water. The infiltration/percolation rates may vary with time as a result of soil clogging from water impurities. The infiltration/percolation rates will deteriorate over time due to the soil conditions and an appropriate factor of safety (FS) shall be applied to the tested infiltration rate for the final design infiltration rate.

The scope of our services did not include a groundwater study and was limited to the performance of percolation testing and soil profile description, and the submitted data only. Our services did not include those associated with septic system design. Neither did services include an Environmental Site Assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater, or atmosphere; or the presence of wetlands. Any statements, or absence of statements, in this report or on any boring logs regarding odors, unusual or suspicious items, or conditions observed, are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessment.

The geotechnical engineering information presented herein is based upon professional interpretation utilizing standard engineering practices. The work conducted through the course of this investigation, including the preparation of this report, has been performed in accordance with the generally accepted standards of geotechnical engineering practice, which existed in the geographic area at the time the report was written. No other warranty, express or implied, is made.

Please be advised that when performing percolation testing services in relatively small diameter borings, that the testing may not fully model the actual full scale long term performance of a given site. This is particularly true where percolation test data is to be used in the design of large infiltration system such as may be proposed for the site. The measured percolation rate includes dispersion of the water at the sidewalls of the boring as well as into the underlying soils. Subsurface conditions, including percolation rates, can change over time as fine-grained soils migrate. It is not warranted that such information and interpretation cannot be superseded by future geotechnical engineering developments. We emphasize that this report is valid for the project outlined above and should not be used for any other sites.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 General

9.1.1 Based upon the data collected during this investigation, and from a geotechnical engineering standpoint, it is our opinion that the site is suitable for the proposed construction of improvements at the site as planned, provided the recommendations contained in this report are incorporated into the project design and construction. Conclusions and recommendations provided in this report are based on our review of available literature, analysis of data obtained from our field exploration and laboratory testing program, and our understanding of the proposed development at this time.

9.1.2 The primary geotechnical constraints identified in our investigation is the presence of potentially compressible material at the site. Recommendations to mitigate the effects of these soils are provided in this report.

9.1.3 No significant fill soils were encountered in our borings. Undocumented fill soils may be present on site between our test boring locations. Undocumented/uncertified fill materials are not suitable to support any future structures and should be excavated and recompacted in accordance with section 9.5 of this report. The extent and consistency of the fills should be verified during site construction. Prior to fill placement, Salem Engineering Group, Inc. should inspect the bottom of the excavation to verify the fill condition.

9.1.4 Site demolition activities shall include removal of all surface obstructions not intended to be incorporated into final site design. In addition, underground buried structures and/or utility lines encountered during demolition and construction should be properly removed and the resulting excavations backfilled with Engineered Fill. It is suspected that possible demolition activities of the existing structures may disturb the upper soils. After demolition activities, it is recommended that disturbed soils be removed and/or recompacted.

9.1.5 Surface vegetation consisting of grasses and other similar vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. The upper 4 to 6 inches of the soils containing vegetation, roots, and other objectionable organic matter encountered at the time of grading should be stripped and removed from the surface. Deeper stripping may be required in localized areas. The stripped vegetation will not be suitable for use as Engineered Fill or within 5 feet of building pads or within pavement areas. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas or exported from the site.

9.1.6 The near-surface onsite soils are moisture-sensitive and are moderately compressible under saturated conditions. Proposed structures may experience excessive post-construction settlement, when the foundation soil become near saturated. The compressible or weak soils should be removed and re-compacted according to the recommendations in the Grading section of this report (Section 9.5).

9.1.7 Based on the subsurface conditions at the site and the anticipated structural loading, we anticipate that the proposed buildings may be supported using conventional shallow foundations provided that the recommendations presented herein are incorporated in the design and construction of the project.

9.1.8 SALEM shall review the project grading and foundation plans prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required. If SALEM is not provided plans and specifications for review, we cannot assume any responsibility for the future performance of the project.

9.1.9 SALEM shall be present at the site during site demolition and preparation to observe site clearing/demolition, preparation of exposed surfaces after clearing, and placement, treatment and compaction of fill material.

9.1.10 SALEM's observations should be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. Moisture content of footings and slab subgrade should be tested immediately prior to concrete placement. SALEM should observe foundation excavations prior to placement of reinforcing steel or concrete to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report.

9.2 Seismic Design Criteria

9.2.1 For seismic design of the structures, and in accordance with the seismic provisions of the 2019 CBC, our recommended parameters are shown below. These parameters were determined using California's Office of Statewide Health Planning and Development (OSHPD) Seismic Design Map Tool Website (https://seismicmaps.org/) in accordance with the 2019 CBC. The Site Class was determined based on the soils encountered during our field exploration.

TABLE 9.2.1
SEISMIC DESIGN PARAMETERS

Seismic Item	Symbol	Value	ASCE 7-16 or 2019 CBC Reference
Site Coordinates (Datum = NAD 83)		33.8294 Lat -117.2067 Lon	
Site Class	--	D	ASCE 7 Table 20.3-1
Soil Profile Name	--	Stiff Soil	ASCE 7 Table 20.3-1
Risk Category	--	II	Table 1604.5
Site Coefficient for PGA	F_{PGA}	1.1	ASCE 7 Table 11.8-1
Peak Ground Acceleration (adjusted for Site Class effects)	PGA_M	0.554g	ASCE 7 Equation 11.8-1
Seismic Design Category	SDC	D	Table 1613.2.5
Mapped Spectral Acceleration (Short period - 0.2 sec)	S_S	1.5 g	Figure 1613.2.1(1-8)
Mapped Spectral Acceleration (1.0 sec. period)	S_1	0.579 g	Figure 1613.2.1(1-8)
Site Class Modified Site Coefficient	F_a	1	Table 1613.2.3(1)
Site Class Modified Site Coefficient	F_v	1.721*	Table 1613.2.3(2)
MCE Spectral Response Acceleration (Short period - 0.2 sec) $S_{MS} = F_a S_S$	S_{MS}	1.5 g	Equation 16-36
MCE Spectral Response Acceleration (1.0 sec. period) $S_{M1} = F_v S_1$	S_{M1}	0.996 g*	Equation 16-37
Design Spectral Response Acceleration $S_{DS}=⅔S_{MS}$ (short period - 0.2 sec)	S_{DS}	1 g	Equation 16-38
Design Spectral Response Acceleration $S_{D1}=⅔S_{M1}$ (1.0 sec. period)	S_{D1}	0.664 g*	Equation 16-39
Short Term Transition Period (S_{D1}/S_{DS}), Seconds	T_S	0.664	ASCE 7-16, Section 11.4.6
Long Period Transition Period (seconds)	T_L	8	ASCE 7-16, Figure 22-14

*** Determined per ASCE Table 11.4-2 for use in calculating T_S only.**

9.2.2 Site Specific Ground Motion Analysis was not included in the scope of this investigation. Per ASCE 11.4.8, structures on Site Class D with S_1 greater than or equal to 0.2 may require Site Specific Ground Motion Analysis. However, a site specific motion analysis may not be required based on Exceptions listed in ASCE 11.4.8. The Structural Engineer should verify whether

Exception No. 2 of ASCE 7-16, Section 11.4.8, is valid for the site. In the event that a site specific ground motion analysis is required, SALEM should be contacted for these services.

9.2.3 Conformance to the criteria in the above table for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

9.3 Soil and Excavation Characteristics

9.3.1 Based on the soil conditions encountered in our soil borings, the onsite soils can be excavated with moderate to elaborate effort using conventional heavy-duty earthmoving equipment. Large earthmoving equipment may be required for deeper excavation.

9.3.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable Occupational Safety and Health Administration (OSHA) rules and regulations to maintain safety and maintain the stability of adjacent existing improvements.

9.3.3 The near surface soils identified as part of our investigation are, generally, dry to moist due to the absorption characteristics of the soil. Earthwork operations may encounter very moist unstable soils which may require removal to a stable bottom. Exposed native soils exposed as part of site grading operations shall not be allowed to dry out and should be kept continuously moist prior to placement of subsequent fill.

9.4 Materials for Fill

9.4.1 Excavated soils generated from cut operations at the site are suitable for use as general Engineered Fill in structural areas, provided they do not have an Expansion Index greater than 20 (EI≤20) and do not contain deleterious matter, organic material, or rock material larger than 3 inches in maximum dimension.

9.4.2 The preferred materials specified for Engineered Fill are suitable for most applications with the exception of exposure to erosion. Project site winterization and protection of exposed soils during the construction phase should be the sole responsibility of the Contractor, since they have complete control of the project site.

9.4.3 Environmental characteristics and corrosion potential of import soil materials should also be considered.

9.4.4 Proposed import materials should be sampled, tested, and approved by SALEM prior to its transportation to the site.

9.4.5 Import soil shall be well-graded, slightly cohesive silty fine sand or sandy silt, with relatively impervious characteristics when compacted. A clean sand or very sandy soil is not acceptable for this purpose. This material should be approved by the Engineer prior to use and should typically possess the soil characteristics summarized below in Table 9.4.5.

TABLE 9.4.5
IMPORT FILL REQUIREMENTS

Minimum Percent Passing No. 200 Sieve	20
Maximum Percent Passing No. 200 Sieve	50
Minimum Percent Passing No. 4 Sieve	70
Maximum Particle Size	3"
Maximum Plasticity Index	12
Maximum CBC Expansion Index	20

9.5 Grading

9.5.1 A representative of our firm should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material. The Geotechnical Engineer may reject any material that does not meet compaction and stability requirements. Further recommendations of this report are predicated upon the assumption that earthwork construction will conform to recommendations set forth in this section as well as other portions of this report.

9.5.2 A preconstruction conference should be held at the site prior to the beginning of grading operations with the owner, contractor, civil engineer and geotechnical engineer in attendance.

9.5.3 Site preparation should begin with removal of existing surface/subsurface structures, underground utilities and storage tanks, any existing uncertified fill, and debris. Excavations or depressions resulting from site clearing operations, or other existing excavations or depressions, should be restored with Engineered Fill in accordance with the recommendations of this report.

9.5.4 Surface vegetation consisting of grasses and other similar vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. The upper 2 to 4 inches of the soils containing, vegetation, roots and other objectionable organic matter encountered at the time of grading should be stripped and removed from the surface. Deeper stripping may be required in localized areas. In addition, existing concrete and asphalt materials shall be removed from areas of proposed improvements and stockpiled separately from excavated soil material. The stripped vegetation, asphalt and concrete materials will not be suitable for use as Engineered Fill or within 5 feet of building pads or within pavement areas. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas or exported from the site.

9.5.5 Tree root systems in proposed improvement areas should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots greater than ½ inch in diameter. Tree roots removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill of tree root excavations is not permitted until all exposed surfaces have been inspected and the Soils Engineer is present for the proper control of backfill placement and compaction. Burning in areas which are to receive fill materials shall not be permitted.

9.5.6 Any undocumented and uncertified fill materials encountered during grading should be removed and replaced with engineered fill. The actual depth of the overexcavation and recompaction should be determined by our field representative during construction.

9.5.7 Structural building pad areas should be considered as areas extending a minimum of 5 feet horizontally beyond the outside dimensions of building, including footings and non-cantilevered overhangs carrying structural loads.

9.5.8 To minimize post-construction soil movement and provide uniform support for the proposed buildings, overexcavation and recompaction within the proposed building areas should be performed to a minimum depth of **two (2) feet** below existing grade or **two (2) feet** below proposed footing bottom, whichever is deeper. The overexcavation and recompaction should also extend laterally to a minimum of 5 feet beyond the outer edges of the proposed footings.

9.5.9 Within pavement areas, overexcavation and recompaction should be performed to a minimum depth of **two (2) feet** below existing grade or **two (2) feet** below proposed grade, whichever is deeper. The overexcavation and recompaction should also extend laterally to a minimum of 2 feet beyond the pavement.

9.5.10 Prior to placement of fill soils, the upper 10 to 12 inches of native subgrade soils should be scarified, moisture-conditioned to no less than optimum moisture content and recompacted to a minimum of 95% of the maximum dry density based on ASTM D1557 Test Method.

9.5.11 All Engineered Fill (including scarified ground surfaces and backfill) should be placed in thin lifts to allow for adequate bonding and compaction (typically 6 to 8 inches in loose thickness).

9.5.12 Engineered Fill soils should be placed, moisture conditioned to near optimum moisture content, and compacted to at least 95% relative compaction.

9.5.13 Final pavement subgrade should be finished to a smooth, unyielding surface. We further recommend proof-rolling the subgrade with a loaded water truck (or similar equipment with high contact pressure) to verify the stability of the subgrade prior to placing aggregate base.

9.5.14 An integral part of satisfactory fill placement is the stability of the placed lift of soil. If placed materials exhibit excessive instability as determined by a SALEM field representative, the lift will be considered unacceptable and shall be remedied prior to placement of additional fill material. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

9.5.15 The most effective site preparation alternatives will depend on site conditions prior to grading. We should evaluate site conditions and provide supplemental recommendations immediately prior to grading, if necessary.

9.5.16 We do not anticipate groundwater or seepage to adversely affect construction if conducted during the drier months of the year (typically summer and fall). However, groundwater and soil moisture conditions could be significantly different during the wet season (typically winter and spring) as surface soil becomes wet; perched groundwater conditions may develop. Grading during this time period will likely encounter wet materials resulting in possible excavation and fill placement difficulties.

Project site winterization consisting of placement of aggregate base and protecting exposed soils during construction should be performed. If the construction schedule requires grading operations during the wet season, we can provide additional recommendations as conditions warrant.

9.5.17 Wet soils may become non conducive to site grading as the upper soils yield under the weight of the construction equipment. Therefore, mitigation measures should be performed for stabilization. Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with dryer materials; removing and replacing the soil with an approved fill material or placement of slurry, crushed rocks or aggregate base material; or mixing the soil with an approved lime or cement product. The most common remedial measure of stabilizing the bottom of the excavation due to wet soil condition is to reduce the moisture of the soil to near the optimum moisture content by having the subgrade soils scarified and aerated or mixed with drier soils prior to compacting. However, the drying process may require an extended period of time and delay the construction operation.

To expedite the stabilizing process, slurry or crushed rock may be utilized for stabilization provided this method is approved by the owner for the cost purpose. If the use of slurry, crushed rock is considered, it is recommended that the upper soft and wet soils be replaced by 6 to 24 inches of 2-sack slurry or ¾-inch to 1-inch crushed rocks. The thickness of the slurry or rock layer depends on the severity of the soil instability. The recommended 6 to 24 inches of crushed rock material will provide a stable platform.

It is further recommended that lighter compaction equipment be utilized for compacting the crushed rock. A layer of geofabric is recommended to be placed on top of the compacted crushed rock to minimize migration of soil particles into the voids of the crushed rock, resulting in soil movement. Although it is not required, the use of geogrid (e.g. Tensar TX7) below the slurry or crushed rock will enhance stability and reduce the required thickness of crushed rock necessary for stabilization. Our firm should be consulted prior to implementing remedial measures to provide appropriate recommendations.

9.6 Shallow Foundations

9.6.1 The site is suitable for use of conventional shallow foundations consisting of continuous footings and isolated pad footings bearing in properly compacted Engineered Fill.

9.6.2 The bearing wall footings considered for the structure should be continuous with a minimum width of 15 inches and extend to a minimum depth of 18 inches below the lowest adjacent grade. Isolated column footings should have a minimum width of 24 inches and extend a minimum depth of 18 inches below the lowest adjacent grade.

9.6.3 The bottom of footing excavations should be maintained free of loose and disturbed soil. Footing concrete should be placed into a neat excavation.

9.6.4 Footings proportioned as recommended above may be designed for the maximum allowable soil bearing pressures shown in the table below.

Loading Condition	Allowable Bearing
Dead Load Only	2,000 psf
Dead-Plus-Live Load	2,500 psf
Total Load, Including Wind or Seismic Loads	3,325 psf

9.6.5 For design purposes, total settlement due to static and seismic loadings on the order of 2 inches may be assumed for shallow footings. Differential settlement due to static and seismic loadings, along a 40-foot exterior wall footing or between adjoining column footings, should be 1 inch, producing an angular distortion of 0.002. Most of the settlement is expected to occur during construction as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. The footing excavations should not be allowed to dry out any time prior to pouring concrete.

9.6.6 Resistance to lateral footing displacement can be computed using an allowable coefficient of friction factor of 0.35 acting between the base of foundations and the supporting subgrade.

9.6.7 Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 300 pounds per cubic foot acting against the appropriate vertical native footing faces. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance. An increase of one-third is permitted when using the alternate load combination that includes wind or earthquake loads.

9.6.8 Underground utilities running parallel to footings should not be constructed in the zone of influence of footings. The zone of influence may be taken to be the area beneath the footing and within a 1:1 plane extending out and down from the bottom edge of the footing.

9.6.9 The foundation subgrade should be sprinkled as necessary to maintain a moist condition without significant shrinkage cracks as would be expected in any concrete placement. Prior to placing rebar reinforcement, foundation excavations should be evaluated by a representative of SALEM for appropriate support characteristics and moisture content. Moisture conditioning may be required for the materials exposed at footing bottom, particularly if foundation excavations are left open for an extended period.

9.7 Concrete Slabs-on-Grade

9.7.1 Slab thickness and reinforcement should be determined by the structural engineer based on the anticipated loading. We recommend that non-structural slabs-on-grade be at least 4 inches thick and underlain by six (6) inches of compacted clean granular aggregate subbase material compacted to at least 95% relative compaction.

9.7.2 Granular aggregate subbase material shall conform to ASTM D-2940, Latest Edition (Table 1, bases) with at least 95 percent passing a 1½-inch sieve and not more than 8% passing a No. 200

sieve or clean Crushed Aggregate Base (CAB) to prevent capillary moisture rise. Crushed Miscellaneous Base (CMB) containing recycled materials should not be used as granular aggregate subbase within the building areas.

9.7.3 We recommend reinforcing slabs, at a minimum, with No. 3 reinforcing bars placed 18 inches on center, each way.

9.7.4 Slabs subject to structural loading may be designed utilizing a modulus of subgrade reaction K of 140 pounds per square inch per inch. The K value was approximated based on inter-relationship of soil classification and bearing values (Portland Cement Association, Rocky Mountain Northwest).

9.7.5 The spacing of crack control joints should be designed by the project structural engineer. In order to regulate cracking of the slabs, we recommend that construction joints or control joints be provided at a maximum spacing of 15 feet in each direction for 5-inch thick slabs and 12 feet for 4-inch thick slabs.

9.7.6 Crack control joints should extend a minimum depth of one-fourth the slab thickness and should be constructed using saw-cuts or other methods as soon as practical after concrete placement. The exterior floors should be poured separately in order to act independently of the walls and foundation system.

9.7.7 It is recommended that the utility trenches within the structure be compacted, as specified in our report, to minimize the transmission of moisture through the utility trench backfill. Special attention to the immediate drainage and irrigation around the structures is recommended.

9.7.8 Moisture within the structure may be derived from water vapors, which were transformed from the moisture within the soils. This moisture vapor penetration can affect floor coverings and produce mold and mildew in the structure. To minimize moisture vapor intrusion, it is recommended that a vapor retarder be installed in accordance with manufacturer's recommendations and/or ASTM guidelines, whichever is more stringent. In addition, ventilation of the structure is recommended to reduce the accumulation of interior moisture.

9.7.9 In areas where it is desired to reduce floor dampness where moisture-sensitive coverings are anticipated, construction should have a suitable waterproof vapor retarder (a minimum of 15 mils thick polyethylene vapor retarder sheeting, Raven Industries "VaporBlock 15, Stego Industries 15 mil "StegoWrap" or W.R. Meadows Sealtight 15 mil "Perminator") incorporated into the floor slab design. The water vapor retarder should be decay resistant material complying with ASTM E96 not exceeding 0.04 perms, ASTM E154 and ASTM E1745 Class A. The vapor barrier should be placed between the concrete slab and the compacted granular aggregate subbase material. The water vapor retarder (vapor barrier) should be installed in accordance with ASTM Specification E 1643-94.

9.7.10 The concrete maybe placed directly on vapor retarder. The vapor retarder should be inspected prior to concrete placement. Cut or punctured retarder should be repaired using vapor retarder material lapped 6 inches beyond damaged areas and taped.

9.7.11 The recommendations of this report are intended to reduce the potential for cracking of slabs due to soil movement. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade may exhibit some cracking due to soil movement. This is common for project areas that contain expansive soils since designing to eliminate potential soil movement is cost prohibitive. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

9.7.12 Proper finishing and curing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

9.8 Lateral Earth Pressures and Frictional Resistance

9.8.1 Active, at-rest and passive unit lateral earth pressures against footings and walls are summarized in the table below:

Lateral Pressure Level Backfill and Drained Conditions	**Equivalent Fluid Pressure, pcf**
Active Pressure	42
At-Rest Pressure	62
Passive Pressure	300
Related Parameters	
Allowable Coefficient of Friction	0.35
In-Place Soil Density (lbs/ft^3)	120

9.8.2 Active pressure applies to walls, which are free to rotate. At-rest pressure applies to walls, which are restrained against rotation. The preceding lateral earth pressures assume sufficient drainage behind retaining walls to prevent the build-up of hydrostatic pressure.

9.8.3 The top one-foot of adjacent subgrade should be deleted from the passive pressure computation.

9.8.4 The foregoing values of lateral earth pressures represent allowable soil values and a safety factor consistent with the design conditions should be included in their usage.

9.8.5 For stability against lateral sliding, which is resisted solely by the passive pressure, we recommend a minimum safety factor of 1.5.

9.8.6 For stability against lateral sliding, which is resisted by the combined passive and frictional resistance, a minimum safety factor of 2.0 is recommended.

9.8.7 For lateral stability against seismic loading conditions, we recommend a minimum safety factor of 1.1.

9.8.8 For dynamic seismic lateral loading the following equation shall be used:

Dynamic Seismic Lateral Loading Equation
Dynamic Seismic Lateral Load = $\frac{3}{8}\gamma K_h H^2$
Where: γ = In-Place Soil Density
K_h = Horizontal Acceleration = $\frac{2}{3}PGA_M$
H = Wall Height

9.9 Retaining Walls

9.9.1 Retaining and/or below grade walls should be drained with either perforated pipe encased in free-draining gravel or a prefabricated drainage system. The gravel zone should have a minimum width of 12 inches wide and should extend upward to within 12 inches of the top of the wall. The upper 12 inches of backfill should consist of native soils, concrete, asphaltic-concrete or other suitable backfill to minimize surface drainage into the wall drain system. The gravel should conform to Class II permeable materials graded in accordance with the current CalTrans Standard Specifications.

9.9.2 Prefabricated drainage systems, such as Miradrain®, Enkadrain®, or an equivalent substitute, are acceptable alternatives in lieu of gravel provided they are installed in accordance with the manufacturer's recommendations. If a prefabricated drainage system is proposed, our firm should review the system for final acceptance prior to installation.

9.9.3 Drainage pipes should be placed with perforations down and should discharge in a non-erosive manner away from foundations and other improvements. The top of the perforated pipe should be placed at or below the bottom of the adjacent floor slab or pavements. The pipe should be placed in the center line of the drainage blanket and should have a minimum diameter of 4 inches. Slots should be no wider than 1/8-inch in diameter, while perforations should be no more than ¼-inch in diameter.

9.9.4 If retaining walls are less than 5 feet in height, the perforated pipe may be omitted in lieu of weep holes on 4 feet maximum spacing. The weep holes should consist of 2-inch minimum diameter holes (concrete walls) or unmortared head joints (masonry walls) and placed no higher than 18 inches above the lowest adjacent grade. Two 8-inch square overlapping patches of geotextile fabric (conforming to the CalTrans Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.

9.9.5 During grading and backfilling operations adjacent to any walls, heavy equipment should not be allowed to operate within a lateral distance of 5 feet from the wall, or within a lateral distance equal to the wall height, whichever is greater, to avoid developing excessive lateral pressures. Within this zone, only hand operated equipment ("whackers," vibratory plates, or pneumatic compactors) should be used to compact the backfill soils.

9.10 Temporary Excavations

9.10.1 We anticipate that the majority of the sandy site soils will be classified as Cal-OSHA "Type C" soil when encountered in excavations during site development and construction. Excavation sloping, benching, the use of trench shields, and the placement of trench spoils should conform to the latest applicable Cal-OSHA standards. The contractor should have a Cal-OSHA-approved "competent person" onsite during excavation to evaluate trench conditions and make appropriate recommendations where necessary.

9.10.2 It is the contractor's responsibility to provide sufficient and safe excavation support as well as protecting nearby utilities, structures, and other improvements which may be damaged by earth movements. All onsite excavations must be conducted in such a manner that potential surcharges from existing structures, construction equipment, and vehicle loads are resisted. The surcharge area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load.

9.10.3 Temporary excavations and slope faces should be protected from rainfall and erosion. Surface runoff should be directed away from excavations and slopes.

9.10.4 Open, unbraced excavations in undisturbed soils should be made according to the slopes presented in the following table:

RECOMMENDED EXCAVATION SLOPES

Depth of Excavation (ft)	Slope (Horizontal : Vertical)
0-5	1:1
5-10	2:1

9.10.5 If, due to space limitation, excavations near property lines or existing structures are performed in a vertical position, slot cuts, braced shorings or shields may be used for supporting vertical excavations. Therefore, in order to comply with the local and state safety regulations, a properly designed and installed shoring system would be required to accomplish planned excavations and installation. A Specialty Shoring Contractor should be responsible for the design and installation of such a shoring system during construction.

9.10.6 Braced shorings should be designed for a maximum pressure distribution of 30H, (where H is the depth of the excavation in feet). The foregoing does not include excess hydrostatic pressure or surcharge loading. Fifty percent of any surcharge load, such as construction equipment weight, should be added to the lateral load given herein. Equipment traffic should concurrently be limited to an area at least 3 feet from the shoring face or edge of the slope.

9.10.7 The excavation and shoring recommendations provided herein are based on soil characteristics derived from the borings within the area. Variations in soil conditions will likely be encountered during the excavations. SALEM Engineering Group, Inc. should be afforded the opportunity to provide field review to evaluate the actual conditions and account for field condition variations not otherwise anticipated in the preparation of this recommendation. Slope height, slope inclination, or excavation depth should in no case exceed those specified in local, state, or federal safety regulation, (e.g. OSHA) standards for excavations, 29 CFR part 1926, or Assessor's regulations.

9.11 Underground Utilities

9.11.1 Underground utility trenches should be backfilled with properly compacted material. The material excavated from the trenches should be adequate for use as backfill provided it does not contain deleterious matter, vegetation or rock larger than 3 inches in maximum dimension. Trench backfill should be placed in loose lifts not exceeding 8 inches and compacted to at least 95% relative compaction at slightly above the optimum moisture content.

9.11.2 Bedding and pipe zone backfill typically extends from the bottom of the trench excavations to approximately 6 to 12 inches above the crown of the pipe. Pipe bedding and backfill material should conform to the requirements of the governing utility agency.

9.11.3 It is suggested that underground utilities crossing beneath new or existing structures be plugged at entry and exit locations to the buildings or structures to prevent water migration. Trench plugs can consist of on-site clay soils, if available, or sand cement slurry. The trench plugs should extend 2 feet beyond each side of individual perimeter foundations.

9.11.4 The contractor is responsible for removing all water-sensitive soils from the trench regardless of the backfill location and compaction requirements. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

9.12 Surface Drainage

9.12.1 Proper surface drainage is critical to the future performance of the project. Uncontrolled infiltration of irrigation excess and storm runoff into the soils can adversely affect the performance of the planned improvements. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change to important engineering properties. Proper drainage should be maintained at all times.

9.12.2 The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than 5 percent for a minimum distance of 10 feet.

9.12.3 Impervious surfaces within 10 feet of the building foundation shall be sloped a minimum of 2 percent away from the building and drainage gradients maintained to carry all surface water to collection facilities and off site. These grades should be maintained for the life of the project. Ponding of water should not be allowed adjacent to the structure. Over-irrigation within landscaped areas adjacent to the structure should not be performed.

9.12.4 Roof drains should be installed with appropriate downspout extensions out-falling on splash blocks so as to direct water a minimum of 5 feet away from the structures or be connected to the storm drain system for the development.

9.13 Pavement Design

9.13.1 Based on site soil conditions, an R-value of 25 was used for the preliminary flexible asphaltic concrete pavement design. The R-value may be verified during grading of the pavement areas.

9.13.2 The asphaltic concrete (flexible pavement is based on a 20-year pavement life for traffic indexes of 5.0 and 6.0. If higher traffic loading is anticipated, SALEM should be contacted to provide revised pavement thickness recommendations.

TABLE 9.13.2
ASPHALT CONCRETE PAVEMENT

Traffic Index	Asphaltic Concrete	Clean Class II Aggregate Base*	Compacted Subgrade*
5.0 (Vehicle Parking and Drive Areas)	3.0"	6.0"	12.0"
6.0 (Heavy Truck Areas)	3.0"	9.5"	12.0"

95% compaction based on ASTM D1557 Test Method

9.13.3 The following recommendations are for light-duty and heavy-duty Portland Cement Concrete pavement sections.

TABLE 9.13.3
PORTLAND CEMENT CONCRETE PAVEMENT

Traffic Index	Portland Cement Concrete*	Clean Class II Aggregate Base**	Compacted Subgrade**
5.0 (Light Duty)	5.0"	4.0"	12.0"
6.0 (Heavy Duty)	6.5"	6.0"	12.0"

**** Min Compressive Strength of 4,000 psi; Min Reinforcement of #4 bars at 18" O.C., E.W.***
***** 95% compaction based on ASTM D1557 Test Method***

10. PLAN REVIEW, CONSTRUCTION OBSERVATION AND TESTING

10.1 Plan and Specification Review

10.1.1 SALEM should review the project plans and specifications prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required.

10.2 Construction Observation and Testing Services

10.2.1 The recommendations provided in this report are based on the assumption that we will continue as Geotechnical Engineer of Record throughout the construction phase. It is important to maintain continuity of geotechnical interpretation and confirm that field conditions encountered are similar to those anticipated during design. If we are not retained for these services, we cannot assume any responsibility for others interpretation of our recommendations, and therefore the future performance of the project.

10.2.2 SALEM should be present at the site during site preparation to observe site clearing, preparation of exposed surfaces after clearing, and placement, treatment and compaction of fill material.

10.2.3 SALEM's observations should be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. Moisture content of footings and slab subgrade should be tested immediately prior to concrete placement. SALEM should observe foundation excavations prior to placement of reinforcing steel or concrete to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report.

11. LIMITATIONS AND CHANGED CONDITIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the test borings drilled at the approximate locations shown on the Site Plan, Figure 2. The report does not reflect variations which may occur between boring locations. The nature and extent of such variations may not become evident until construction is initiated. If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing on-site observations during the excavation period and noting the characteristics of such variations. The findings and recommendations presented in this report are valid as of the present and for the proposed construction.

If site conditions change due to natural processes or human intervention on the property or adjacent to the site, or changes occur in the nature or design of the project, or if there is a substantial time lapse between the submission of this report and the start of the work at the site, the conclusions and recommendations contained in our report will not be considered valid unless the changes are reviewed by SALEM and the conclusions of our report are modified or verified in writing. The validity of the recommendations contained in this report is also dependent upon an adequate testing and observations program during the construction phase.

Our firm assumes no responsibility for construction compliance with the design concepts or recommendations unless we have been retained to perform the on-site testing and review during construction. SALEM has prepared this report for the exclusive use of the owner and project design consultants.

SALEM does not practice in the field of corrosion engineering. It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, that manufacturer's recommendations for corrosion protection be closely followed. Further, a corrosion engineer may be needed to incorporate the necessary precautions to avoid premature corrosion of concrete slabs and foundations in direct contact with native soil.

The importation of soil and or aggregate materials to the site should be screened to determine the potential for corrosion to concrete and buried metal piping. The report has been prepared in accordance with generally accepted geotechnical engineering practices in the area. No other warranties, either express or implied, are made as to the professional advice provided under the terms of our agreement and included in this report.

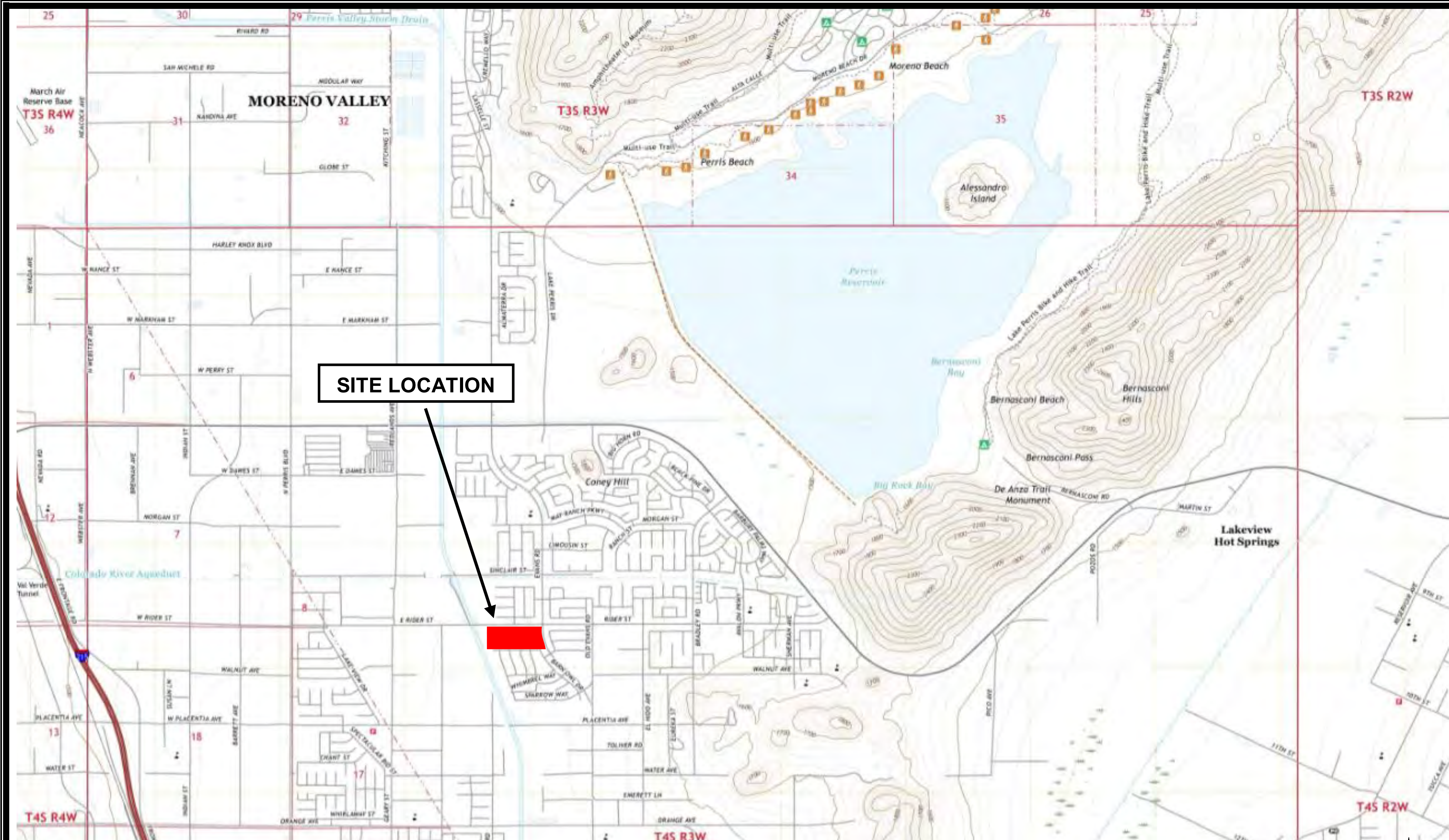
If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (909) 980-6455.

Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

Ibrahim Foud Ibrahim, PE
Senior Managing Engineer
RCE 86724

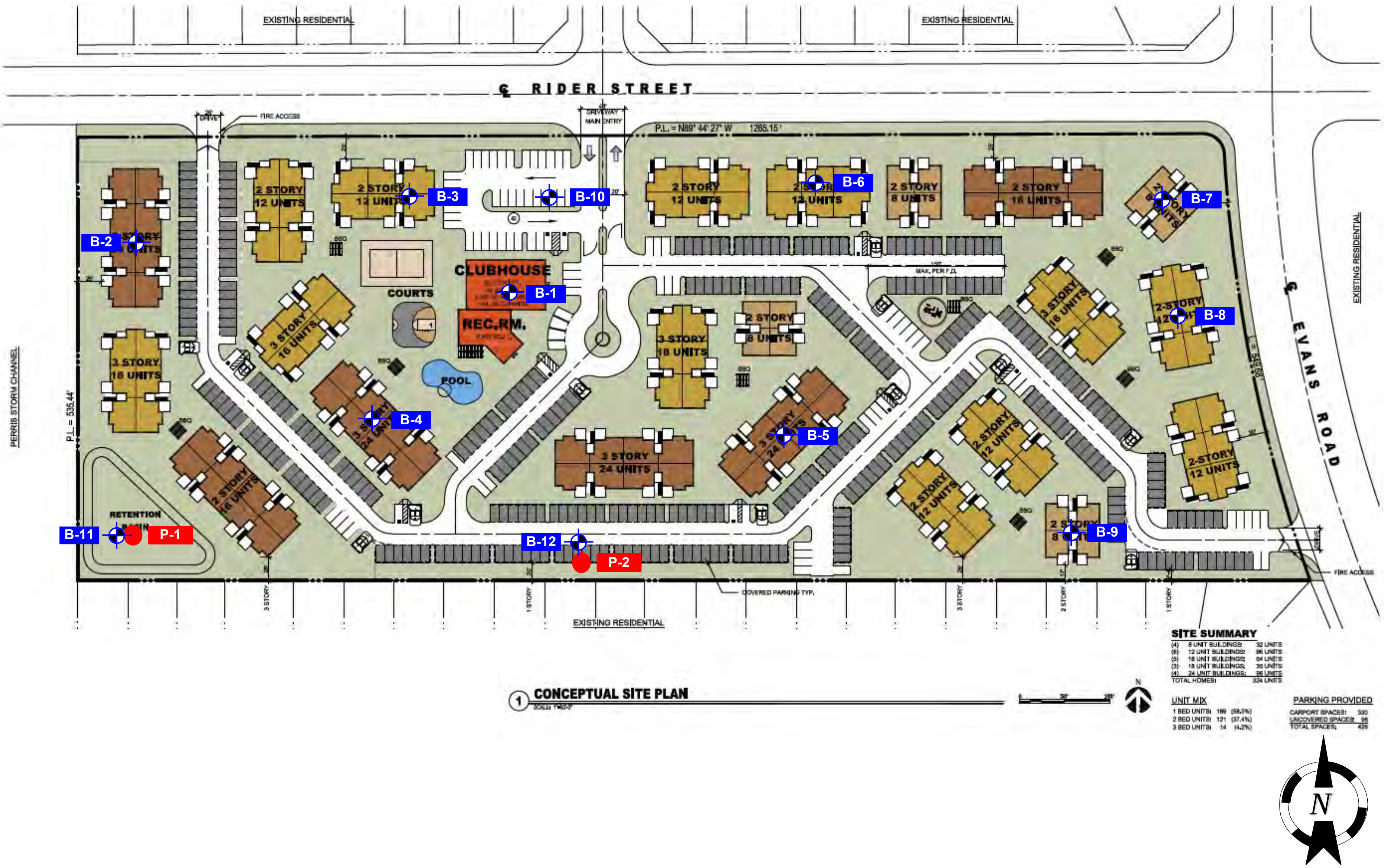
Clarence Jiang, GE
Senior Geotechnical Engineer
RGE 2477



Source Image: U.S. Geological Survey, Perris, California, https://ngmdb.usgs.gov/topoview (2018)

VICINITY MAP **GEOTECHNICAL ENGINEERING INVESTIGATION** **Proposed Multi-Family Development** **SWC Evans Road & Rider Street** **Perris, California**	SCALE: NOT TO SCALE	DATE: 05/2021
	DRAWN BY: II	APPROVED BY: CJ
	PROJECT NO. 3-221-0432	FIGURE NO. 1

SALEM engineering group, inc.



SITE PLAN

GEOTECHNICAL ENGINEERING INVESTIGATION
Proposed Multi-Family Development
SWC Evans Road & Rider Street
Perris, California

SCALE:	DATE:
NOT TO SCALE	05/2021
DRAWN BY: II	APPROVED BY: CJ
PROJECT NO. 3-221-0432	FIGURE NO. 2

LEGEND:

- B-1 Soil Boring Locations
- P-1 Percolation Locations

All Locations Approximate

SALEM engineering group, inc.

APPENDIX

A

APPENDIX A
FIELD EXPLORATION

Fieldwork for our investigation (drilling) was conducted on May 10 and 12, 2021 and included a site visit, subsurface exploration, and soil sampling. Percolation testing was performed on May 11, 2021. The locations of the exploratory borings and percolation tests are shown on the Site Plan, Figure 2. Boring logs for our exploration are presented in figures following the text in this appendix. Borings were located in the field using existing reference points. Therefore, actual boring locations may deviate slightly.

In general, our borings were performed using a truck-mounted CME 45C drill rig equipped with 6½-inch diameter hollow stem augers. Sampling in the borings was accomplished using a hydraulic 140-pound hammer with a 30-inch drop. Samples were obtained with a 3-inch outside-diameter (OD), split spoon (California Modified) sampler, and a 2-inch OD, Standard Penetration Test (SPT) sampler. The number of blows required to drive the sampler the last 12 inches (or fraction thereof) of the 18-inch sampling interval were recorded on the boring logs. The blow counts shown on the boring logs should not be interpreted as standard SPT "N" values; corrections have not been applied. Upon completion, borings were backfilled with drill cuttings.

Subsurface conditions encountered in the exploratory borings were visually examined, classified and logged in general accordance with the American Society for Testing and Materials (ASTM) Practice for Description and Identification of Soils (Visual-Manual Procedure D2488). This system uses the Unified Soil Classification System (USCS) for soil designations. The logs depict soil and geologic conditions encountered and depths at which samples were obtained. The logs also include our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, drill rig penetration rates, excavation characteristics and other factors. The transition between materials may be abrupt or gradual. Where applicable, the field logs were revised based on subsequent laboratory testing.

SALEM engineering group, inc.

Test Boring: B-1 **Page** 1 **Of:** 2

Project Number: 3-221-0432

Date: 05/12/2021

Client: Brookhill Corp.

Project: Proposed Multi-Family Development

Location: SWC of Evans Road & Rider Street, Perris, California

Drilled By: SALEM **Logged By:** JC

Drill Type: CME 45C **Elevation:** 1,440'

Auger Type: 6.5 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
1440 / 0		SM-ML	Silty SAND/Sandy SILT Stiff; moist; brown; fine to medium grain sand.				
	7/6 6/6 11/6			17	8.3	112.1	
1435 / 5	11/6 50/5 -		Grades as above; dense/hard.	50/5"	7.5	110.0	
1430 / 10	10/6 13/6 6/6		Grades as above; medium dense.	19	6.2	117.7	
		SM	Silty SAND medium dense; moist; light brown; fine to medium grain sand; with gravel.				
1425 / 15	7/6 7/6 8/6			15	11.0	-	
		ML	Sandy SILT Stiff; moist; brown; fine to medium grain sand.				Harder drilling at 18 feet BSG.
		SM	Silty SAND Loose; moist; grayish brown; fine to coarse grain sand.				
1420 / 20	4/6 5/6 5/6			10	6.7	-	*Water added during drilling after 20' sample.
1415 / 25	16/6 27/6 35/6		Grades as above; very dense; brown; fine to medium grain sand.	62	10.1	-	
				51	14.6	-	

Notes:

Figure Number A-1

SALEM engineering group, inc.

Project Number: 3-221-0432
Date: 05/12/2021
Test Boring: B-1

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
	10/6 18/6 33/6	ML	Sandy SILT Very dense; moist; brown; fine grain sand; trace clay.				
1410 — 30			Auger refusal at 28 feet due to hard soils.				
1405 — 35							
1400 — 40							
1395 — 45							
1390 — 50							
1385 — 55							
1380 — 60							

Notes:

Test Boring: B-2 **Page** 1 **Of:** 1

SALEM engineering group, inc.

Project Number: 3-221-0432

Date: 05/10/2021

Client: Brookhill Corp.

Project: Proposed Multi-Family Development

Location: SWC of Evans Road & Rider Street, Perris, California

Drilled By: SALEM **Logged By:** JC

Drill Type: CME 45C **Elevation:** 1,440'

Auger Type: 4 in. Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
1440 – 0		ML	Sandy SILT Very stiff; dry; very light brown/ white; fine grain sand; with roots.				
	8/6 13/6 27/6			40	6.8	107.0	
1435 – 5	18/6 50/1 -		Grades as above; hard; slightly moist; light brown; more sand.	50/1"	7.8	116.1	
1430 – 10	14/6 50/3 -		Grades as above.	50/3"	6.6	119.3	
1425 – 15	5/6 9/6 11/6		Grades as above; very stiff; moist; brown.	20	10.8	-	
		SM	Silty SAND Medium dense; slightly moist; brown; fine to coarse grain sand.				
1420 – 20	14/6 12/6 11/6			23	5.2	-	
			End of boring at 21.5 feet BSG.				
1415 – 25							

Notes: *Water added during drilling.*

Figure Number A-2

SALEM engineering group, inc.

Test Boring: B-3 **Page** 1 **Of:** 1

Project Number: 3-221-0432

Date: 05/10/2021

Client: Brookhill Corp.

Project: Proposed Multi-Family Development

Location: SWC of Evans Road & Rider Street, Perris, California

Drilled By: SALEM **Logged By:** JC

Drill Type: CME 45C **Elevation:** 1,440'

Auger Type: 6.5 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
1440 / 0		ML	Sandy SILT Firm; dry; light brown; fine grain sand.				
	5/6 4/6 5/6			9	8.1	102.3	
1435 / 5	35/6 50/2 -		Grades as above; hard.	50/2"	9.3	95.9	
1430 / 10	11/6 15/6 13/6		Grades as above; very stiff; more sand.	28	8.2	-	
1425 / 15	16/6 15/6 27/6		Grades as above; hard; slightly moist.	42	13.1	-	
			End of boring at 16.5 feet BSG.				
1420 / 20							
1415 / 25							

Notes: *Water added during drilling.*

Figure Number A-3

SALEM engineering group, inc.

Test Boring: B-4 **Page** 1 **Of:** 1

Project Number: 3-221-0432

Date: 05/10/2021

Client: Brookhill Corp.

Project: Proposed Multi-Family Development

Location: SWC of Evans Road & Rider Street, Perris, California

Drilled By: SALEM **Logged By:** JC

Drill Type: CME 45C **Elevation:** 1,440'

Auger Type: 4 in. Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
1440 / 0		SM-ML	Silty SAND/Sandy SILT Hard; dry; light brown; fine grain sand.				
	4/6, 16/6, 35/6			51	5.3	123.7	
1435 / 5	28/6, 50/1, -		Grades as above; slightly moist; less sand.	50/1"	7.6	120.4	
1430 / 10	11/6, 8/6, 10/6		Grades as above; very stiff; more sand.	18	7.6	-	
1425 / 15	16/6, 17/6, 18/6		Grades as above; hard.	35	12.2	-	
		SM	Silty SAND Medium dense; slightly moist; grayish brown; fine to medium grain sand.				
1420 / 20	12/6, 13/6, 15/6			28	9.9	-	
			End of boring at 21.5 feet BSG.				
1415 / 25							

Notes: *Water added during drilling.*

Figure Number A-4

SALEM engineering group, inc.

Test Boring: B-5 **Page** 1 **Of:** 1

Project Number: 3-221-0432

Date: 05/10/2021

Client: Brookhill Corp.

Project: Proposed Multi-Family Development

Location: SWC of Evans Road & Rider Street, Perris, California

Drilled By: SALEM **Logged By:** JC

Drill Type: CME 45C **Elevation:** 1,440'

Auger Type: 4 in. Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
1440 / 0		SM-ML	Silty SAND/Sandy SILT Very stiff; slightly moist; light brown; fine to medium grain sand.				
	12/6 9/6 11/6			20	8.5	-	
1435 / 5	25/6 37/6 50/1	SM	Silty SAND Very dense; moist; light brown; fine to medium grain sand; light cementation.	87/7"	6.3	124.1	
1430 / 10	14/6 26/6 42/6		Grades as above; brown; fine to coarse grain sand.	68	10.5	125.2	
1425 / 15	13/6 19/6 26/6		Grades as above; dense; fine to medium grain sand.	45			
			End of boring at 16.5 feet BSG.				
1420 / 20							
1415 / 25							

Notes: *Water added during drilling.*

Figure Number A-5

Test Boring: B-6 **Page** 1 **Of:** 1

Project Number: 3-221-0432

Date: 05/10/2021

Client: Brookhill Corp.

SALEM engineering group, inc.

Project: Proposed Multi-Family Development

Location: SWC of Evans Road & Rider Street, Perris, California

Drilled By: SALEM **Logged By:** JC

Drill Type: CME 45C **Elevation:** 1,440'

Auger Type: 4 in. Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
1440 – 0		SM	Silty SAND Very dense; moist; light brown; fine to coarse grain sand.				
	42/6 45/6 50/2			95/8"	7.9	121.1	
1435 – 5	41/6 50/3 -		Grades as above; less silt.	50/3"	6.4	124.3	
1430 – 10		ML	Sandy SILT Hard; moist; brown; fine grain sand.				
	14/6 17/6 21/6			38	10.8	-	
1425 – 15	12/6 20/6 22/6		Grades as above; fine to medium grain sand; more sand.	42	9.1	-	
1420 – 20	10/6 14/6 15/6		Grades as above; medium dense; slightly moist.	29	5.7	-	
			End of boring at 21.5 feet BSG.				
1415 – 25							

Notes: *Water added during drilling.*

Figure Number A-6

Test Boring: B-7 **Page** 1 **Of:** 1

SALEM engineering group, inc.

Project Number: 3-221-0432

Date: 05/10/2021

Client: Brookhill Corp.

Project: Proposed Multi-Family Development

Location: SWC of Evans Road & Rider Street, Perris, California

Drilled By: SALEM **Logged By:** JC

Drill Type: CME 45C **Elevation:** 1,440'

Auger Type: 4 in. Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
1440 — 0	16/6 24/6 50/2	ML	Sandy SILT Hard; slightly moist; light brown; fine to medium grain sand.	74/8"	6.8	117.6	
1435 — 5	33/6 35/6 50/3	SM	Silty SAND Very dense; light brown; slightly moist; fine to medium grain sand.	85/9"	6.4	124.3	
1430 — 10	12/6 20/6 28/6		Grades as above; dense; more silt.	48	10.8	-	
1425 — 15	10/6 10/6 12/6	ML	SILT Very stiff; moist; light reddish brown.	22	12.8	-	
1420 — 20	19/6 21/6 21/6	SM	Silty SAND Dense; moist; reddish brown; fine to coarse grain sand.	42	9.2	-	
			End of boring at 21.5 feet BSG.				
1415 — 25							

Notes: *Water added during drilling.*

Figure Number A-7

SALEM engineering group, inc.

Test Boring: B-8 **Page** 1 **Of:** 1

Project Number: 3-221-0432

Date: 05/10/2021

Client: Brookhill Corp.

Project: Proposed Multi-Family Development

Location: SWC of Evans Road & Rider Street, Perris, California

Drilled By: SALEM **Logged By:** JC

Drill Type: CME 45C **Elevation:** 1,440'

Auger Type: 4 in. Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
1440 — 0		SM	Silty SAND Dense; slightly moist; light brown; fine to coarse grain sand.				
	5/6 8/6 35/6			43	6.6	109.7	
1435 — 5	38/6 50/1 -	ML	Sandy SILT Hard; moist; brown; fine grain sand.	50/1"	10.6	123.3	
1430 — 10	10/6 11/6 17/6		Grades as above; very stiff.	28	7.9	-	
		SM	Silty SAND Medium dense; slightly moist; brown; fine to coarse grain sand.				
1425 — 15	14/6 12/6 15/6			27	4.0	-	
			End of boring at 16.5 feet BSG.				
1420 — 20							
1415 — 25							

Notes: *Water added during drilling.*

Figure Number A-8

SALEM engineering group, inc.

Test Boring: B-9 **Page** 1 **Of:** 1

Project Number: 3-221-0432

Date: 05/10/2021

Client: Brookhill Corp.

Project: Proposed Multi-Family Development

Location: SWC of Evans Road & Rider Street, Perris, California

Drilled By: SALEM **Logged By:** JC

Drill Type: CME 45C **Elevation:** 1,440'

Auger Type: 4 in. Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
1440 — 0	17/6 13/6 14/6	SM	Silty SAND Medium dense; moist; dark brown; fine to medium grain sand; trace clay.	27	8.5	132.6	
1435 — 5	21/6 43/6 50/1	ML	Sandy SILT Hard; moist; brown; fine grain sand.	93/7"	11.3	128.9	
1430 — 10	15/6 11/6 14/6	SM	Silty SAND Medium dense; moist; brown; fine to medium grain sand.	25	10.4	120.9	
1425 — 15	12/6 15/6 20/6	ML	Sandy SILT Hard; moist; yellowish brown; fine grain sand.	35	16.1	-	
1420 — 20	20/6 28/6 50/1	SM	Silty SAND Very dense; moist; reddish brown; fine to medium grain sand; trace clay.	78/7"	11.1	-	
			End of boring at 21.5 feet BSG.				
1415 — 25							

Notes: *Water added during drilling.*

Figure Number A-9

SALEM engineering group, inc.

Test Boring: B-10 **Page** 1 **Of:** 1

Project Number: 3-221-0432

Date: 05/10/2021

Client: Brookhill Corp.

Project: Proposed Multi-Family Development

Location: SWC of Evans Road & Rider Street, Perris, California

Drilled By: SALEM **Logged By:** JC

Drill Type: CME 45C **Elevation:** 1,440'

Auger Type: 4 in. Solid Flight Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
1440 — 0		ML	Sandy SILT Hard; slightly moist; light brown; fine grain sand.				
	15/6 50/2 -			50/2"	7.4	111.4	
1435 — 5	15/6 19/6 22/6		Grades as above; moist.	41	11.9	-	
			End of boring at 6.5 feet BSG.				
1430 — 10							
1425 — 15							
1420 — 20							
1415 — 25							

Notes: *Water added during drilling.*

Figure Number A-10

SALEM engineering group, inc.

Test Boring: B-11 **Page** 1 **Of:** 1

Project Number: 3-221-0432

Date: 05/10/2021

Client: Brookhill Corp.

Project: Proposed Multi-Family Development

Location: SWC of Evans Road & Rider Street, Perris, California

Drilled By: SALEM **Logged By:** JC

Drill Type: CME 45C **Elevation:** 1,440'

Auger Type: 6.5 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
1440 — 0		ML	Sandy SILT Hard; slightly moist; light brown; fine grain sand.				
	9/6 19/6 50/6			69	6.8	-	
1435 — 5	11/6 17/6 24/6		Grades as above; moist; brown; more sand.	41	11.1	-	
	8/6 11/6 20/6		Grades as above.	31	10.9	-	
1430 — 10			End of boring at 10 feet BSG.				
1425 — 15							
1420 — 20							
1415 — 25							

Notes:

Figure Number A-11

SALEM engineering group, inc.

Test Boring: B-12 **Page** 1 **Of:** 1

Project Number: 3-221-0432

Date: 05/10/2021

Client: Brookhill Corp.

Project: Proposed Multi-Family Development

Location: SWC of Evans Road & Rider Street, Perris, California

Drilled By: SALEM **Logged By:** JC

Drill Type: CME 45C **Elevation:** 1,440'

Auger Type: 6.5 in. Hollow Stem Auger **Initial Depth to Groundwater:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Final Depth to Groundwater:** N/A

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
1440 / 0	13/6 15/6 14/6	SM	Silty SAND Medium dense; slightly moist; brown; fine to coarse grain sand.	29	3.9	128.2	
	10/6 17/6 28/6	ML	Sandy SILT Hard; moist; brown; fine to medium grain sand.	45	11.4	-	
1435 / 5			End of boring at 5 feet BSG.				
1430 / 10							
1425 / 15							
1420 / 20							
1415 / 25							

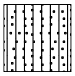
Notes:

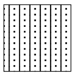
Figure Number A-12

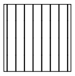
KEY TO SYMBOLS

Symbol Description

Strata symbols

 **Silty Sand/Sandy Silt**

 **Silty sand**

 **Silt**

Misc. Symbols

 **Drill rejection**

 **Boring continues**

Soil Samplers

 **California sampler**

 **Standard penetration test**

Notes:

Granular Soils
Blows Per Foot (Uncorrected)

	MCS	SPT
Very loose	<5	<4
Loose	5-15	4-10
Medium dense	16-40	11-30
Dense	41-65	31-50
Very dense	>65	>50

Cohesive Soils
Blows Per Foot (Uncorrected)

	MCS	SPT
Very soft	<3	<2
Soft	3-5	2-4
Firm	6-10	5-8
Stiff	11-20	9-15
Very Stiff	21-40	16-30
Hard	>40	>30

MCS = Modified California Sampler
SPT = Standard Penetration Test Sampler

Percolation Test Worksheet

Project: Proposed Multi-Family Development
Evans Rd and Rider St
Perris, California

Job No.: 3-221-0432
Date Drilled: 5/10/2021
Soil Classification: Sandy SILT (ML)

Hole Radius: 4 in.
Pipe Dia.: 3 in.
Total Depth of Hole: 120 in.

Test Hole No.: **P-1**
Tested by: JC
Drilled Hole Depth: 10 ft.

Presoaking Date: 5/10/2021
Test Date: 5/11/2021

Pipe Stick up: 0 ft.

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Meas. Perc Rate (min/in)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate, It (in/hr)
10:40	11:10	10.00	Y	0:30	8.19	8.29	1.20	30	25.0	21.7	20.5	21.1	0.21
11:10	11:40	10.00	N	0:30	8.29	8.38	1.08	30	27.8	20.5	19.4	20.0	0.20
11:40	12:10	10.00	N	0:30	8.38	8.46	0.96	30	31.3	19.4	18.5	19.0	0.18
12:10	12:40	10.00	N	0:30	8.46	8.52	0.72	30	41.7	18.5	17.8	18.1	0.14
12:40	13:10	10.00	N	0:30	8.52	8.57	0.60	30	50.0	17.8	17.2	17.5	0.12
13:10	13:40	10.00	N	0:30	8.57	8.61	0.48	30	62.5	17.2	16.7	16.9	0.10
13:40	14:10	10.00	N	0:30	8.61	8.64	0.36	30	83.3	16.7	16.3	16.5	0.08
14:10	14:40	10.00	N	0:30	8.64	8.67	0.36	30	83.3	16.3	16.0	16.1	0.08
14:40	15:10	10.00	N	0:30	8.67	8.70	0.36	30	83.3	16.0	15.6	15.8	0.08
15:10	15:40	10.00	N	0:30	8.70	8.73	0.36	30	83.3	15.6	15.2	15.4	0.08
15:40	16:10	10.00	N	0:30	8.73	8.76	0.36	30	83.3	15.2	14.9	15.1	0.08
16:10	16:40	10.00	N	0:30	8.76	8.79	0.36	30	83.3	14.9	14.5	14.7	0.09
Recommended for Design:										**Infiltration Rate**			**0.08**

SALEM engineering group, inc.

Percolation Test Worksheet

Project: **Proposed Multi-Family Development**
Evans Rd and Rider St
Perris, California

Job No.: **3-221-0432**
Date Drilled: **5/10/2021**
Soil Classification: **Sandy SILT (ML)**

Hole Radius: 4 in.
Pipe Dia.: 3 in.
Total Depth of Hole: 60 in.

Test Hole No.: **P-2**
Tested by: **JC**
Drilled Hole Depth: **5.0** ft.

Presoaking Date: **5/10/2021**
Test Date: **5/11/2021**

Pipe Stick up: 1.25 ft.

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Meas. Perc Rate (min/in)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate, It (in/hr)
10:50	11:20	6.25	Y	0:30	4.51	4.69	2.16	30	13.9	20.9	18.7	19.8	0.40
11:20	11:50	6.25	N	0:30	4.69	4.77	0.96	30	31.3	18.7	17.8	18.2	0.19
11:50	12:20	6.25	N	0:30	4.77	4.80	0.36	30	83.3	17.8	17.4	17.6	0.07
12:20	12:50	6.25	N	0:30	4.80	4.82	0.24	30	125.0	17.4	17.2	17.3	0.05
12:50	13:20	6.25	N	0:30	4.82	4.84	0.24	30	125.0	17.2	16.9	17.0	0.05
13:20	13:50	6.25	N	0:30	4.84	4.86	0.24	30	125.0	16.9	16.7	16.8	0.05
13:50	14:20	6.25	N	0:30	4.86	4.87	0.12	30	250.0	16.7	16.6	16.6	0.03
14:20	14:50	6.25	N	0:30	4.87	4.88	0.12	30	250.0	16.6	16.4	16.5	0.03
14:50	15:20	6.25	N	0:30	4.88	4.89	0.12	30	250.0	16.4	16.3	16.4	0.03
15:20	15:50	6.25	N	0:30	4.89	4.90	0.12	30	250.0	16.3	16.2	16.3	0.03
15:50	16:20	6.25	N	0:30	4.90	4.91	0.12	30	250.0	16.2	16.1	16.1	0.03
16:20	16:50	6.25	N	0:30	4.91	4.92	0.12	30	250.0	16.1	16.0	16.0	0.03
Recommended for Design:										**Infiltration Rate**			**0.03**

SALEM engineering group, inc.

Salem Engineering Group, Inc.
8711 Monroe Court, Suite A
Rancho Cucamonga, CA 91730
(909) 980-6455

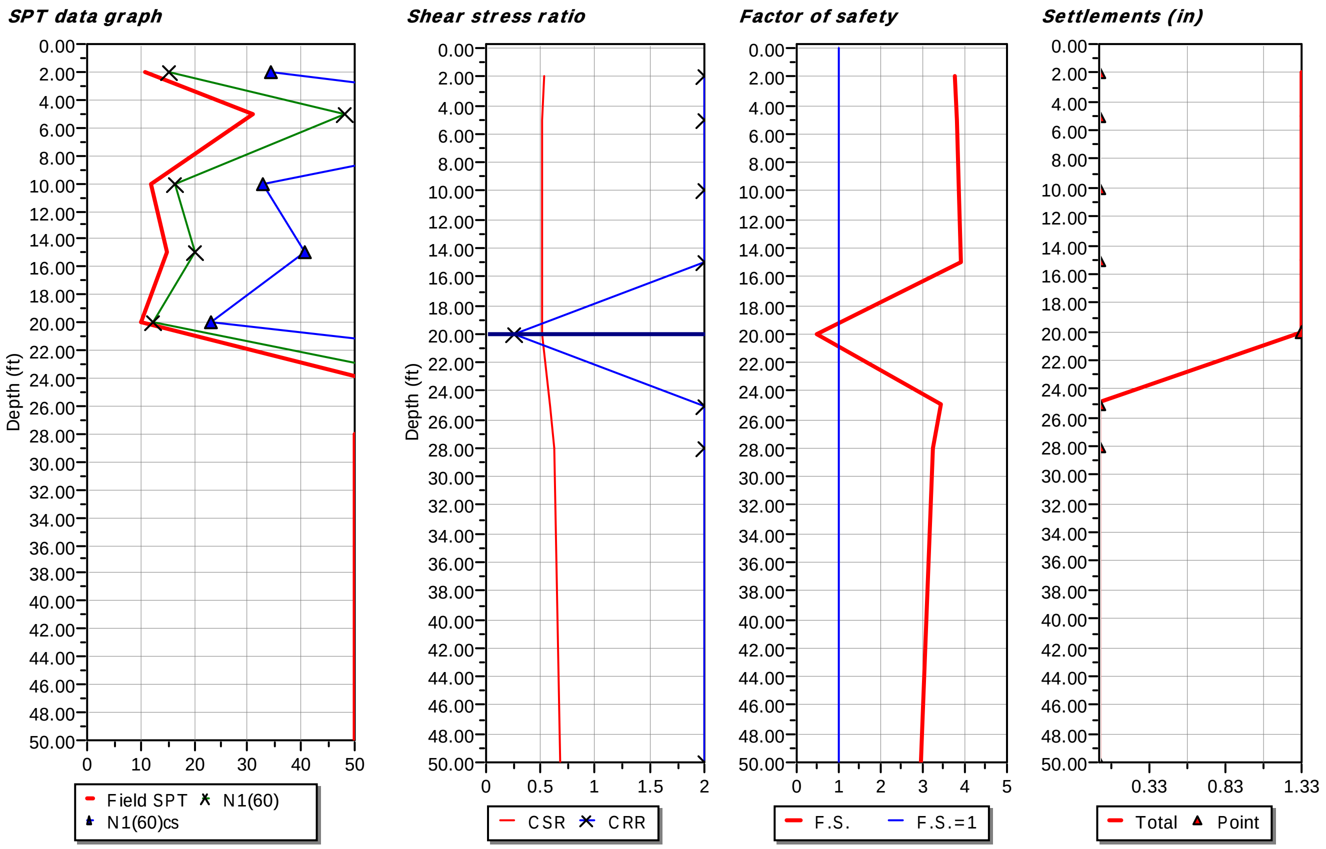
LIQUEFACTION ANALYSIS REPORT

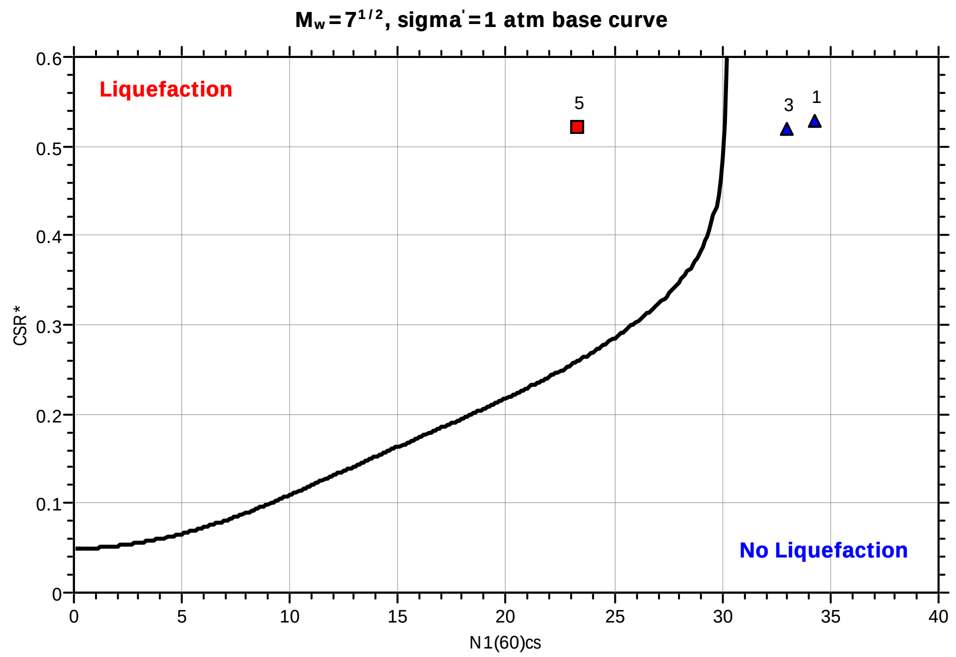
Project title : 3-221-0432

Project subtitle : Perris

Input parameters and analysis data

In-situ data type:	Standard Penetration Test	Depth to water table:	20.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	7.90
Analysis method:	NCEER 1998	Peak ground accelaration:	0.55 g
Fines correction method:	Robertson & Wride	User defined F.S.:	1.30





:: Field input data ::

Point ID	Depth (ft)	Field N_{SPT} (blows/feet)	Unit weight (pcf)	Fines content (%)
1	2.00	11.00	120.00	55.00
2	5.00	31.00	120.00	47.00
3	10.00	12.00	120.00	45.00
4	15.00	15.00	120.00	46.00
5	20.00	10.00	120.00	40.00
6	25.00	62.00	120.00	37.00
7	28.00	50.00	120.00	50.00
8	50.00	50.00	120.00	50.00

Depth : Depth from free surface, at which SPT was performed (ft)
Field SPT : SPT blows measured at field (blows/feet)
Unit weight : Bulk unit weight of soil at test depth (pcf)
Fines content : Percentage of fines in soil (%)

:: Cyclic Stress Ratio calculation (CSR fully adjusted and normalized) ::

Point ID	Depth (ft)	Sigma (tsf)	u (tsf)	Sigma' (tsf)	r_d	CSR	MSF	$CSR_{eq,M=7.5}$	K_{sigma}	CSR^*
1	2.00	0.12	0.00	0.12	1.00	0.36	0.88	0.41	1.00	0.41
2	5.00	0.30	0.00	0.30	0.99	0.35	0.88	0.40	1.00	0.40
3	10.00	0.60	0.00	0.60	0.98	0.35	0.88	0.40	1.00	0.40
4	15.00	0.90	0.00	0.90	0.97	0.34	0.88	0.39	1.00	0.39
5	20.00	1.20	0.00	1.20	0.95	0.34	0.88	0.39	0.97	0.40
6	25.00	1.50	0.16	1.34	0.94	0.38	0.88	0.43	0.95	0.45
7	28.00	1.68	0.25	1.43	0.93	0.39	0.88	0.45	0.94	0.48
8	50.00	3.00	0.94	2.06	0.77	0.40	0.88	0.46	0.87	0.52

Depth : Depth from free surface, at which SPT was performed (ft)
Sigma : Total overburden pressure at test point, during earthquake (tsf)
u : Water pressure at test point, during earthquake (tsf)
Sigma' : Effective overburden pressure, during earthquake (tsf)
r_d : Nonlinear shear mass factor
CSR : Cyclic Stress Ratio
MSF : Magnitude Scaling Factor
$CSR_{eq,M=7.5}$ CSR adjusted for M=7.5
K_{sigma} Effective overburden stress factor
CSR^* CSR fully adjusted

:: Cyclic Resistance Ratio calculation $CRR_{7.5}$ ::

Point ID	Field SPT	C_n	C_e	C_b	C_r	C_s	$N_{1(60)}$	DeltaN	$N_{1(60)cs}$	$CRR_{7.5}$
1	11.00	1.70	0.86	1.05	0.75	1.20	15.22	19.02	34.24	2.00
2	31.00	1.70	0.90	1.05	0.80	1.20	47.95	50.35	98.29	2.00
3	12.00	1.32	0.97	1.05	0.85	1.20	16.48	16.48	32.96	2.00
4	15.00	1.08	1.04	1.05	0.95	1.20	20.14	20.64	40.77	2.00
5	10.00	0.93	1.11	1.05	0.95	1.20	12.40	10.85	23.25	0.26
6	62.00	0.88	1.18	1.05	0.95	1.20	77.17	61.74	138.91	2.00
7	50.00	0.85	1.22	1.05	1.00	1.20	65.74	73.96	139.70	2.00
8	50.00	0.71	1.33	1.05	1.00	1.20	59.76	67.23	126.98	2.00

C_n : Overburden corretion factor
C_e : Energy correction factor
C_b : Borehole diameter correction factor
C_r : Rod length correction factor
C_s : Liner correction factor
$N_{1(60)}$: Corrected N_{SPT}
DeltaN : Addition to corrected N_{SPT} value due to the presence of fines
$N_{1(60)cs}$: Corected $N_{1(60)}$ value for fines
$CRR_{7.5)}$: Cyclic resistance ratio for M=7.5

:: Settlements calculation for saturated sands ::

Point ID	$N_{1(60)}$	N_1	FS_L	e_v (%)	Settle. (in)
1	34.24	28.53	3.78	0.00	0.00
2	98.29	81.91	3.81	0.00	0.00
3	32.96	27.46	3.86	0.00	0.00
4	40.77	33.98	3.90	0.00	0.00
5	23.25	19.37	0.50	2.22	1.33
6	138.91	115.76	3.41	0.00	0.00
7	139.70	116.42	3.22	0.00	0.00
8	126.98	105.82	2.94	0.00	0.00

Total settlement : 1.33

$N_{1,(60)}$: Stress normalized and corrected SPT blow count
N_1: Japanese equivalent corrected value
FS_L: Calculated factor of safety
e_v: Post-liquefaction volumentric strain (%)
Settle.: Calculated settlement (in)

:: Liquefaction potential according to Iwasaki ::

Point ID	F	w_z	I_L
1	0.00	9.70	0.00
2	0.00	9.24	0.00
3	0.00	8.48	0.00
4	0.00	7.71	0.00
5	0.50	6.95	5.34
6	0.00	6.19	0.00
7	0.00	5.73	0.00
8	0.00	2.38	0.00

Overall potential I_L : 5.34

I_L = 0.00 - No liquefaction
I_L between 0.00 and 5 - Liquefaction not probable
I_L between 5 and 15 - Liquefaction probable
I_L > 15 - Liquefaction certain

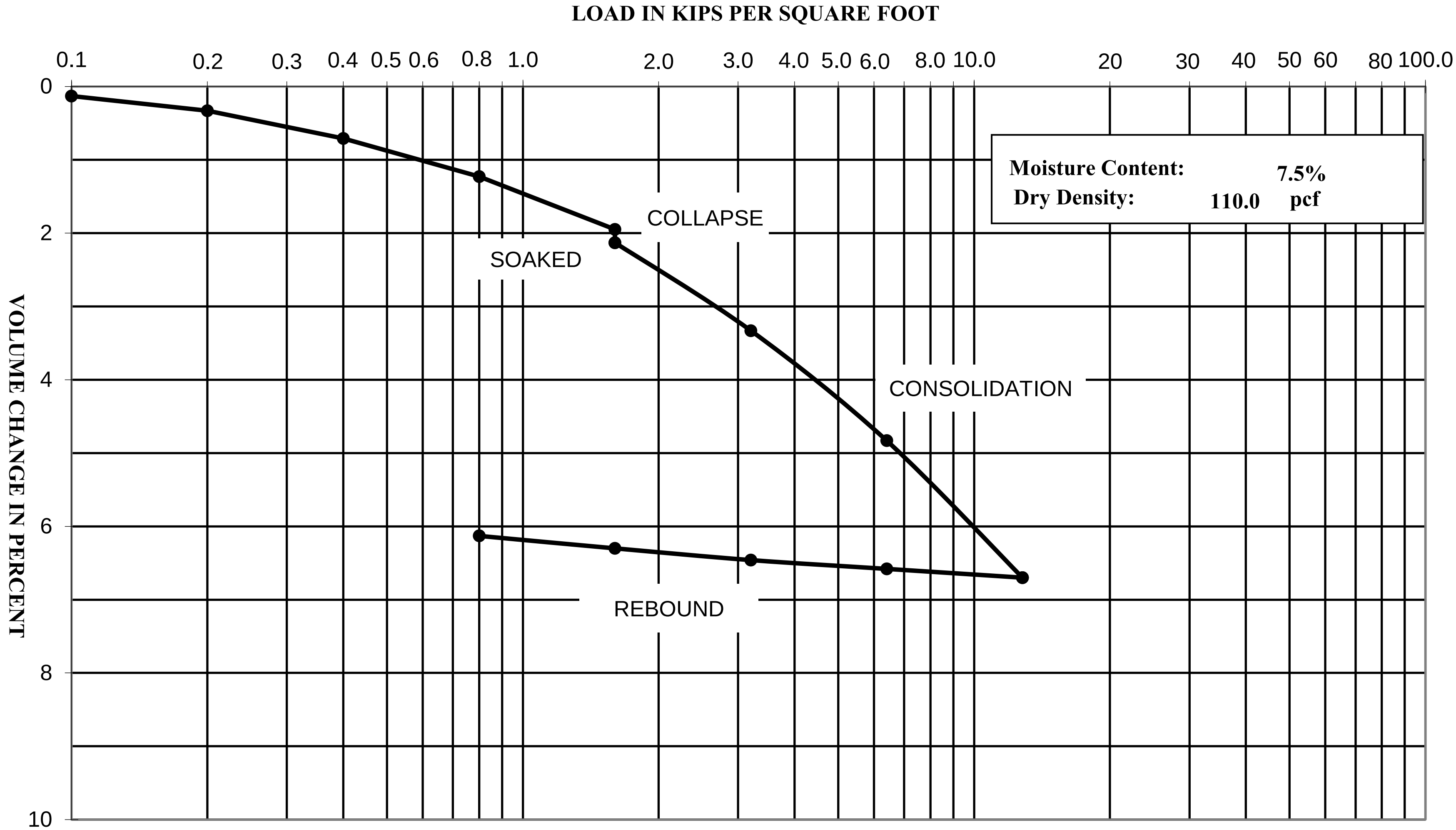
APPENDIX

B

APPENDIX B
LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM), Caltrans, or other suggested procedures. Selected samples were tested for in-situ dry density and moisture content, corrosivity, consolidation, shear strength, maximum density and optimum moisture content, and grain size distribution. The results of the laboratory tests are summarized in the following figures.

CONSOLIDATION - PRESSURE TEST DATA
ASTM D2435



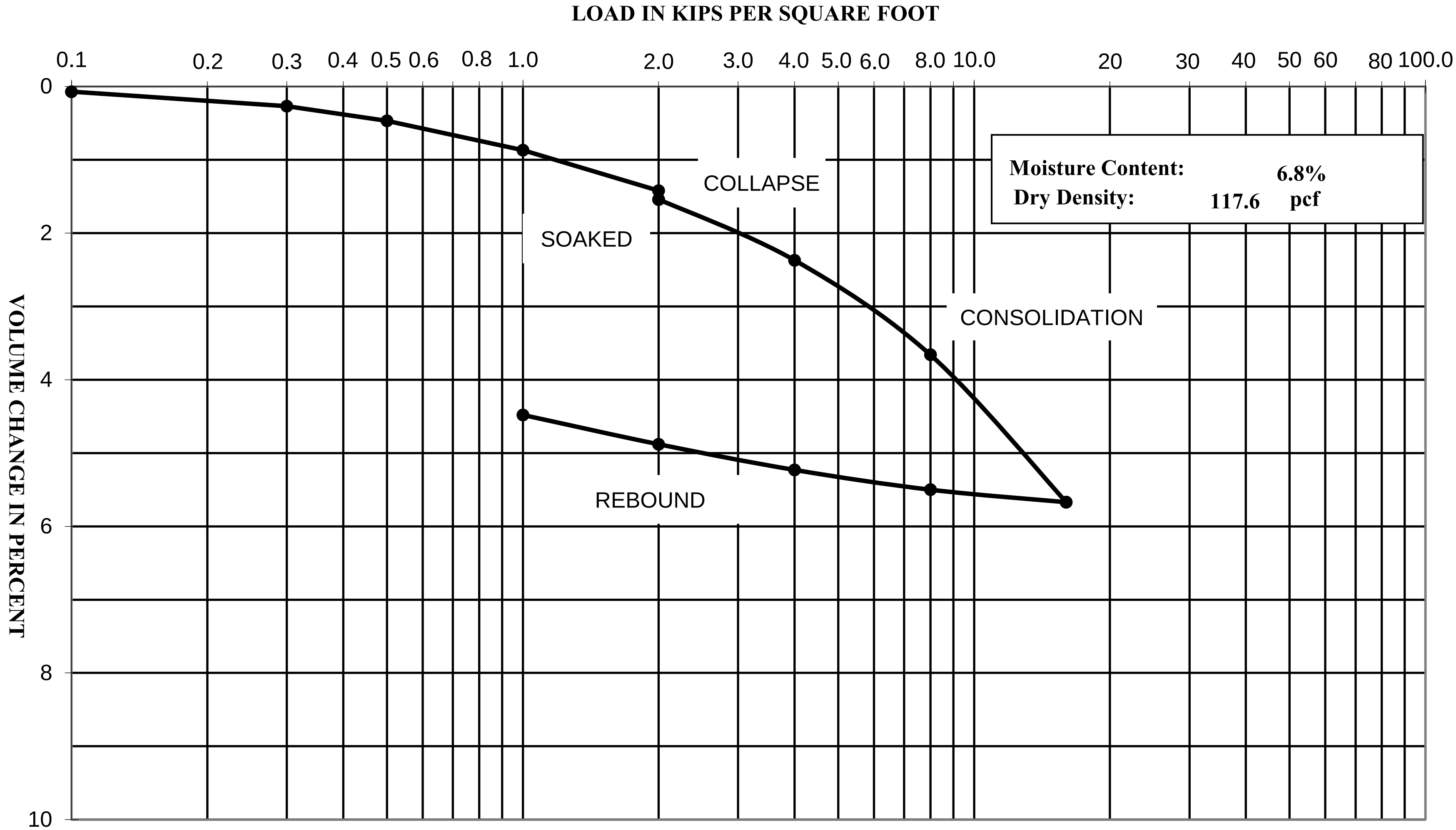
Project Name: Proposed Multi-Family Development- Perris

Project Number: 3-221-0432

Boring: B-1 @ 5'

SALEM engineering group, inc.

CONSOLIDATION - PRESSURE TEST DATA
ASTM D2435



Project Name: Proposed Multi-Family Development- Perris

Project Number: 3-221-0432

Boring: B-7 @ 2'

SALEM engineering group, inc.

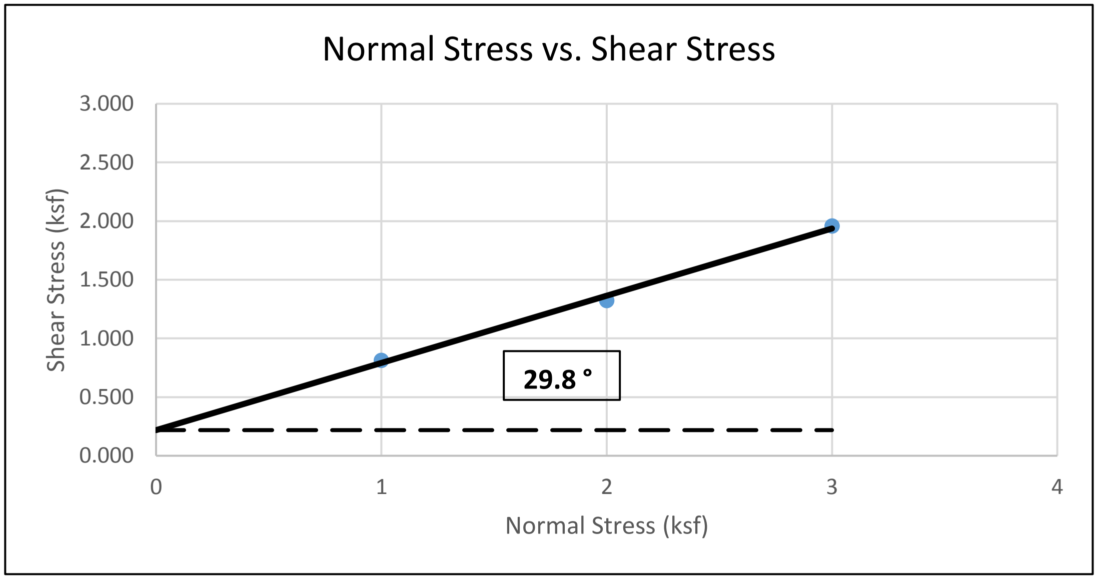
Direct Shear Test (ASTM D3080)

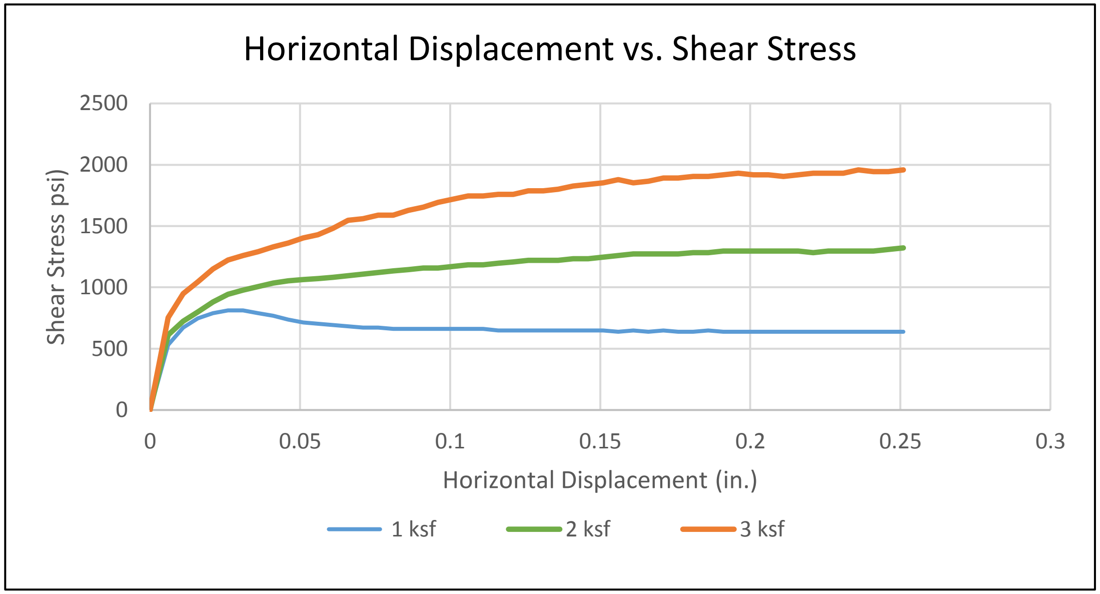
Project Name:	Proposed Multi-Family Development- Perris
Project Number:	3-221-0432
Client:	0.00
Sample Location:	B-1 @ 2'
Sample Type:	Undisturbed Ring
Soil Classification:	SM/ML
Tested By:	M. Noorzay
Reviewed By:	CJ
Date:	5/20/2021
Equipment Used:	Geomatic Direct Shear Machine

	Sample 1	Sample 2	Sample 3
Normal Stress (ksf)	1.000	2.000	3.000
Shear Rate (in/min)	0.004		
Peak Shear Stress (ksf)	0.812	1.322	1.958
Residual Shear Stress (ksf)	0.000	0.000	0.000

Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in.)	1	1	1
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	8.0		
Final Moisture Content (%)	16.0	15.5	15.4
Dry Density (pcf)	116.2	113.5	114.7

Peak Shear Strength Values	
Slope	0.57
Friction Angle	29.8
Cohesion (psf)	218





SALEM engineering group, inc.

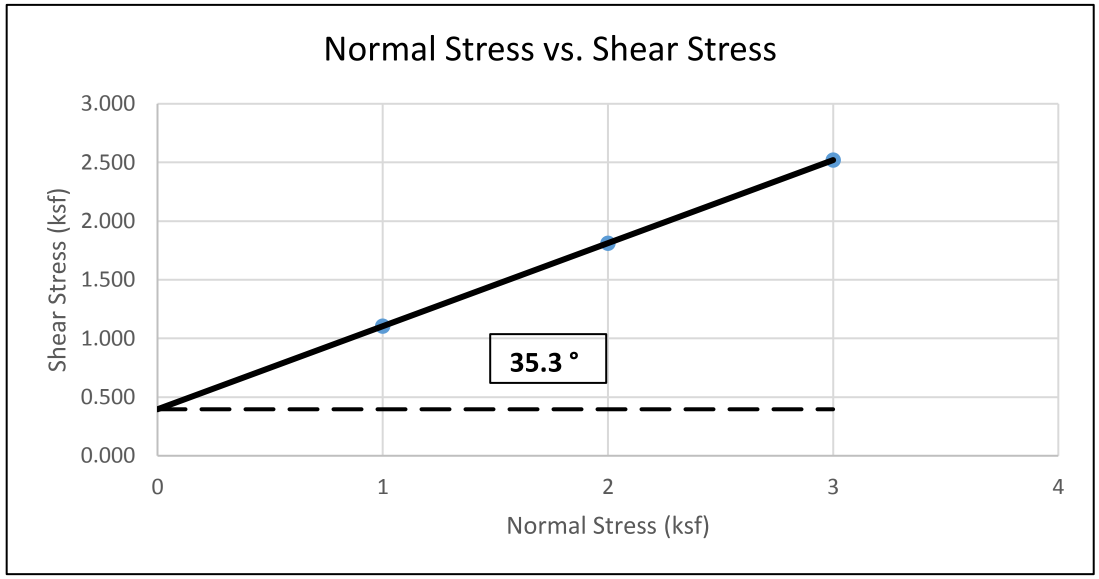
Direct Shear Test (ASTM D3080)

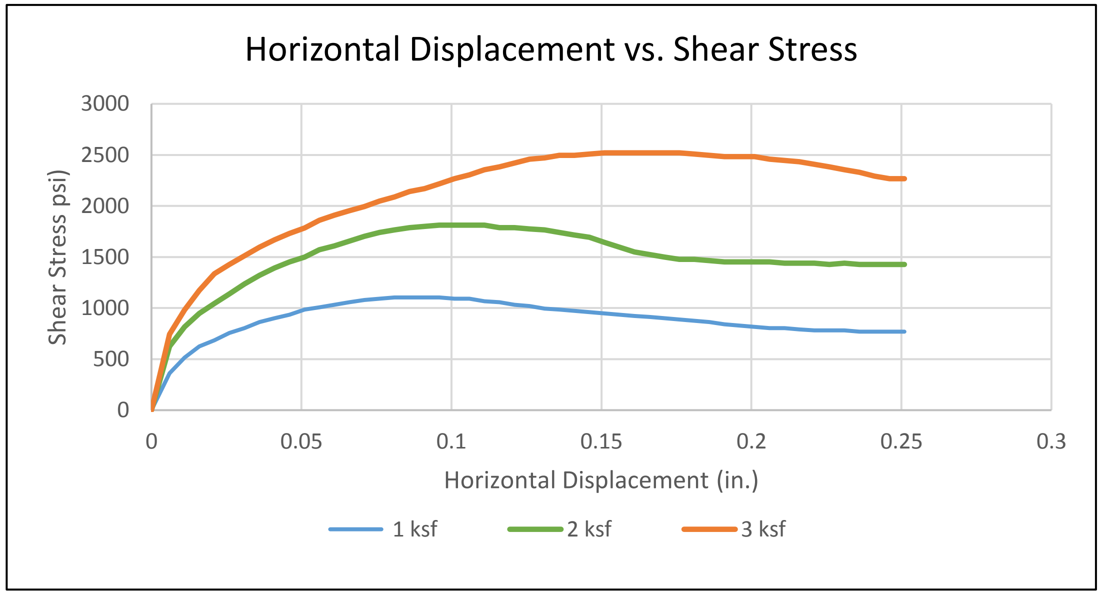
Project Name:	Proposed Multi-Family Development- Perris
Project Number:	3-221-0432
Client:	0.00
Sample Location:	B-7 @ 5'
Sample Type:	Undisturbed Ring
Soil Classification:	SM
Tested By:	M. Noorzay
Reviewed By:	CJ
Date:	5/21/2021
Equipment Used:	Geomatic Direct Shear Machine

	Sample 1	Sample 2	Sample 3
Normal Stress (ksf)	1.000	2.000	3.000
Shear Rate (in/min)	0.004		
Peak Shear Stress (ksf)	1.104	1.812	2.520
Residual Shear Stress (ksf)	0.000	0.000	0.000

Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in.)	1	1	1
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	6.2		
Final Moisture Content (%)	13.9	13.3	13.4
Dry Density (pcf)	122.6	123.1	119.6

Peak Shear Strength Values	
Slope	0.71
Friction Angle	35.3
Cohesion (psf)	396





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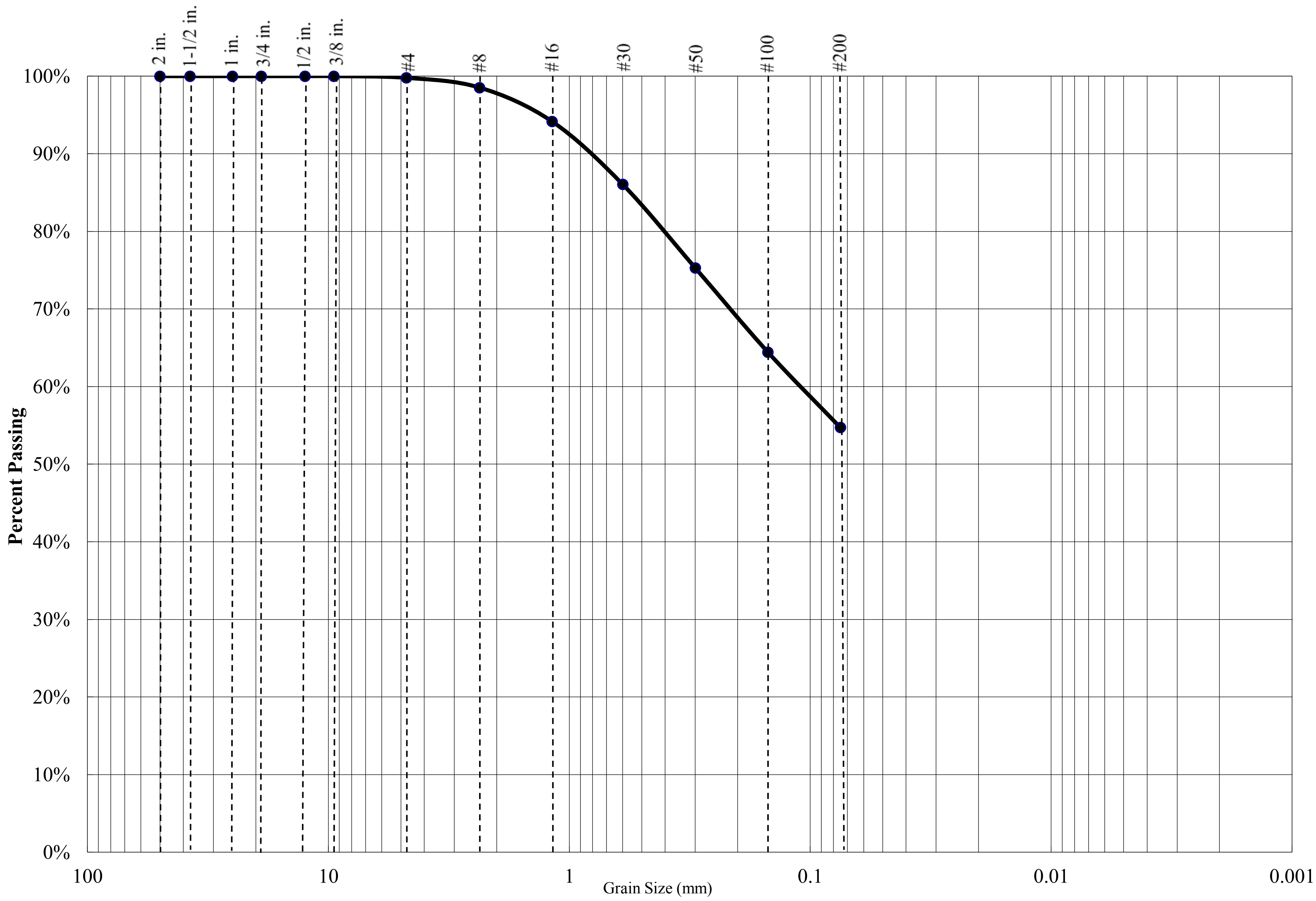
PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	45%	55%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	99.8%
#8	98.5%
#16	94.2%
#30	86.0%
#50	75.3%
#100	64.4%
#200	54.7%

Atterberg Limits		
PL=	LL=	PI=

Coefficients		
D_{85}=	D_{60}=	D_{50}=
D_{30}=	D_{15}=	D_{10}=
C_u= N/A	C_c= N/A	

USCS CLASSIFICATION

Project Name: Proposed Multi-Family Development- Perris

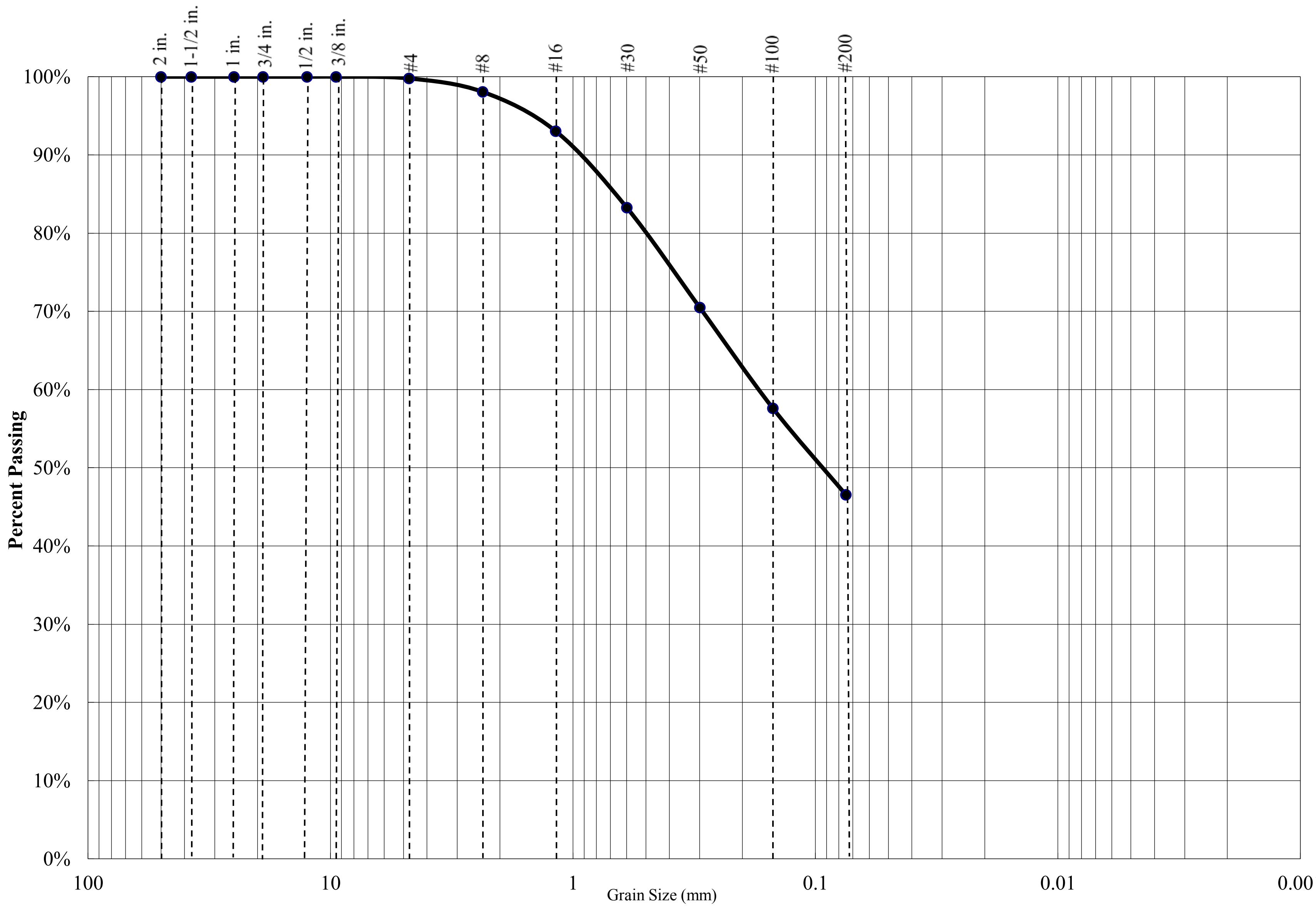
Project Number: 3-221-0432

Boring: B-1 @ 2'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	53%	47%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	99.8%
#8	98.1%
#16	93.1%
#30	83.3%
#50	70.5%
#100	57.6%
#200	46.6%

Atterberg Limits		
PL=	LL=	PI=

Coefficients				
D_{85}=		D_{60}=		D_{50}=
D_{30}=		D_{15}=		D_{10}=
C_u=	N/A	C_c=	N/A	

USCS CLASSIFICATION
-

Project Name: Proposed Multi-Family Development- Perris

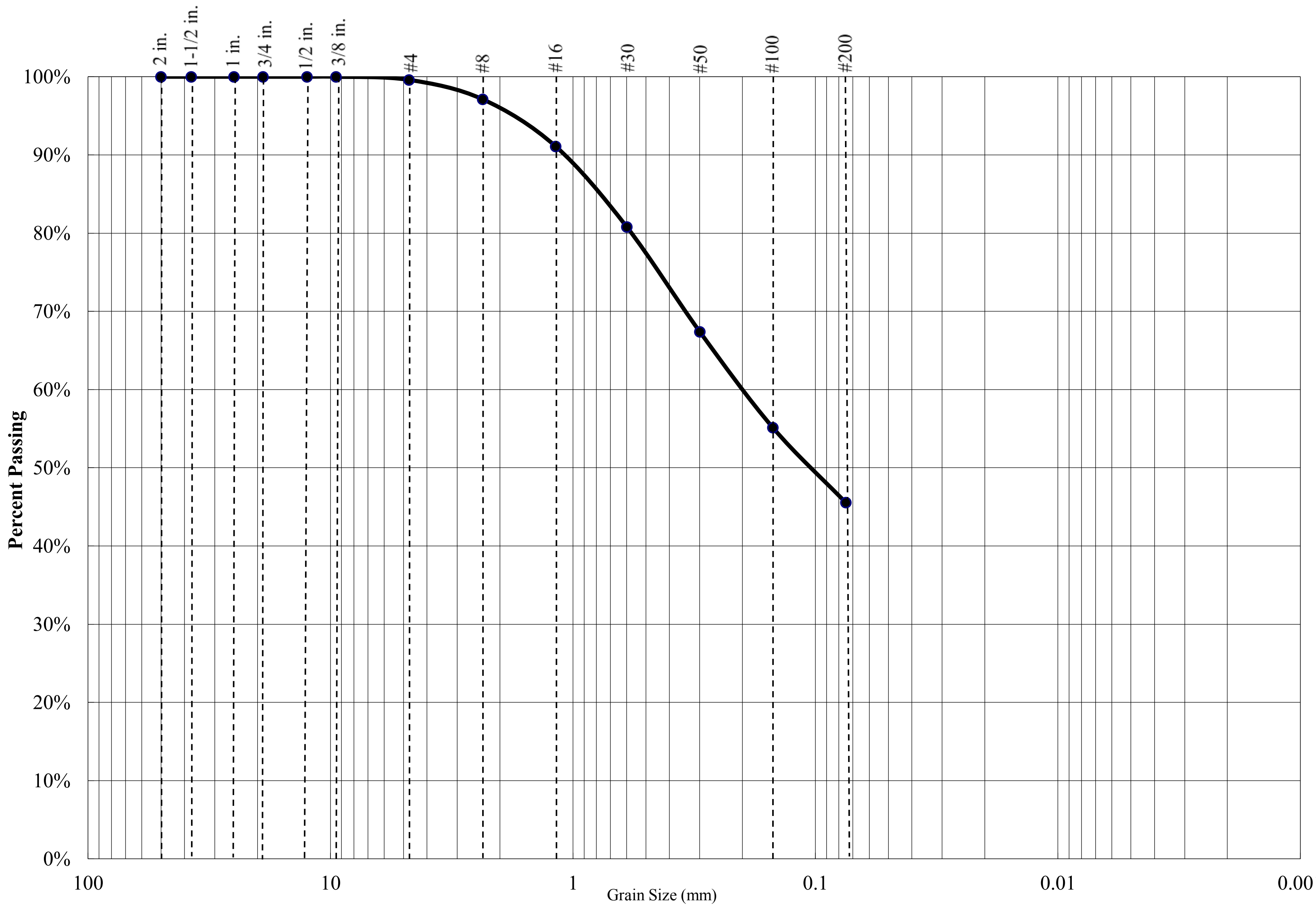
Project Number: 3-221-0432

Boring: B-1 @ 5'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	54%	46%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	99.6%
#8	97.1%
#16	91.1%
#30	80.8%
#50	67.4%
#100	55.2%
#200	45.6%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
-

Project Name: Proposed Multi-Family Development- Perris

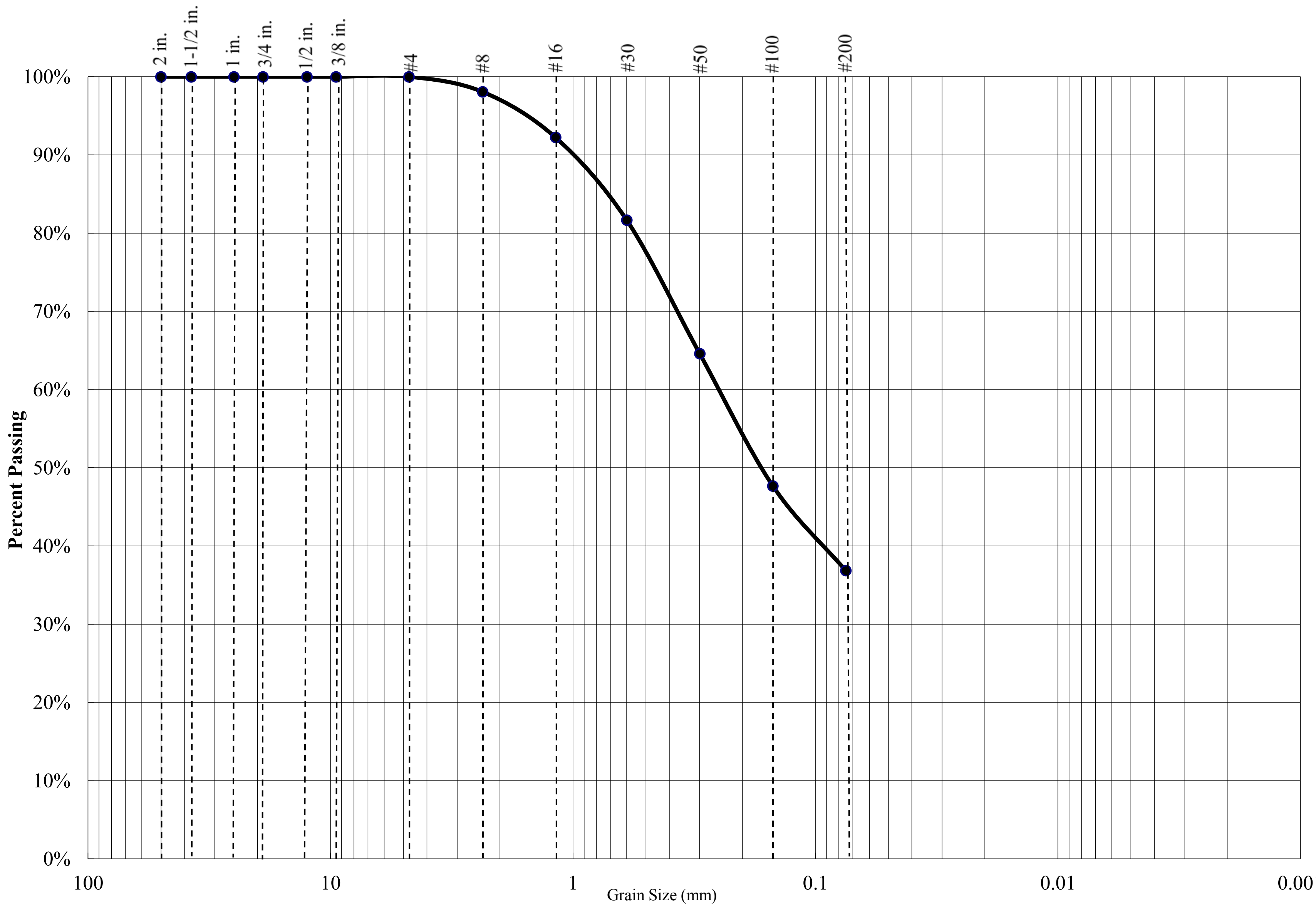
Project Number: 3-221-0432

Boring: B-1 @ 15'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	63%	37%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	98.1%
#16	92.2%
#30	81.7%
#50	64.6%
#100	47.7%
#200	36.9%

Atterberg Limits		
PL=	LL=	PI=

Coefficients				
D85=		D60=		D50=
D30=		D15=		D10=
C_u=	N/A	C_c=	N/A	

USCS CLASSIFICATION
-

Project Name: Proposed Multi-Family Development- Perris

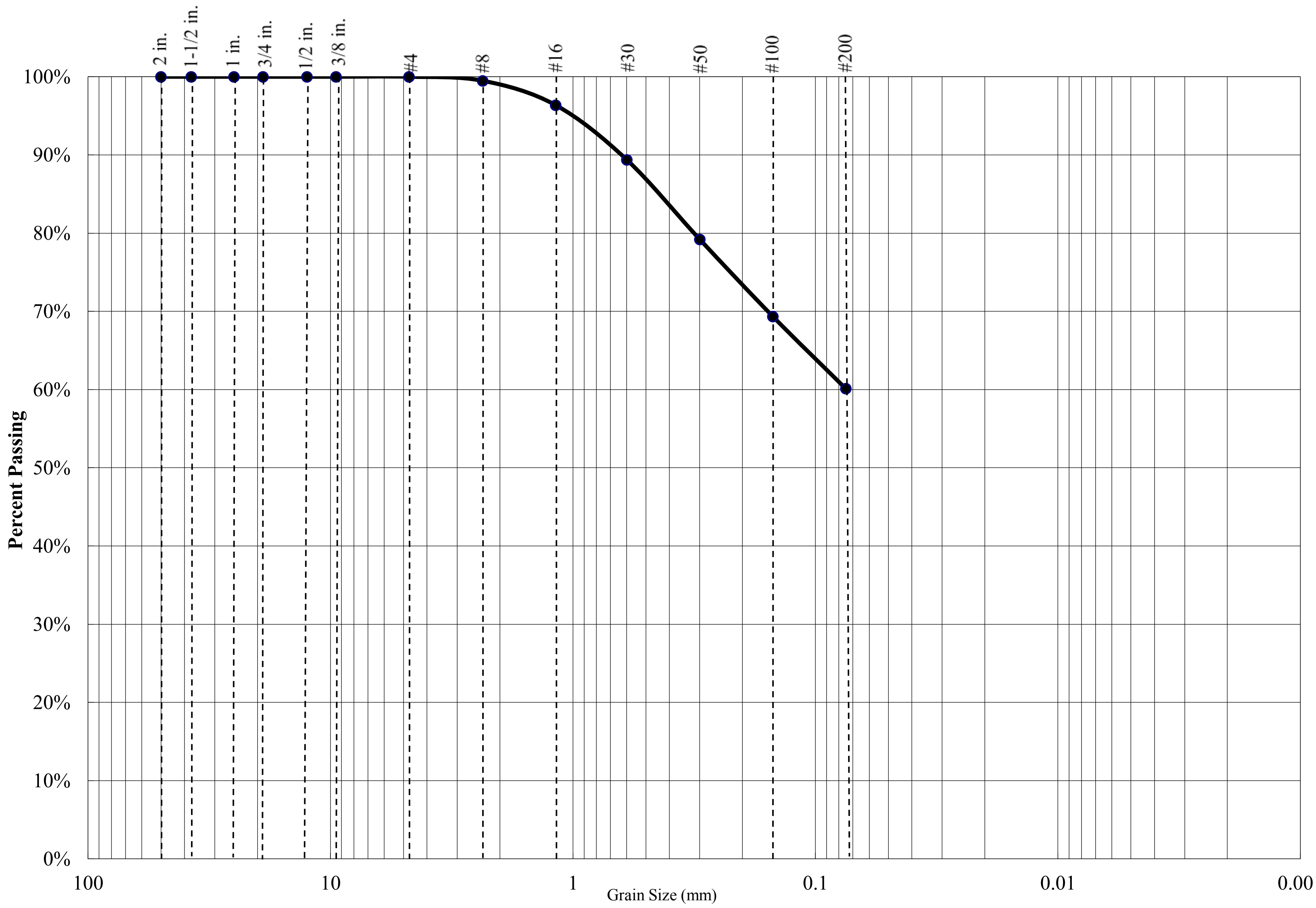
Project Number: 3-221-0432

Boring: B-1 @ 25'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	40%	60%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	99.5%
#16	96.4%
#30	89.4%
#50	79.2%
#100	69.4%
#200	60.1%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
-

Project Name: Proposed Multi-Family Development- Perris

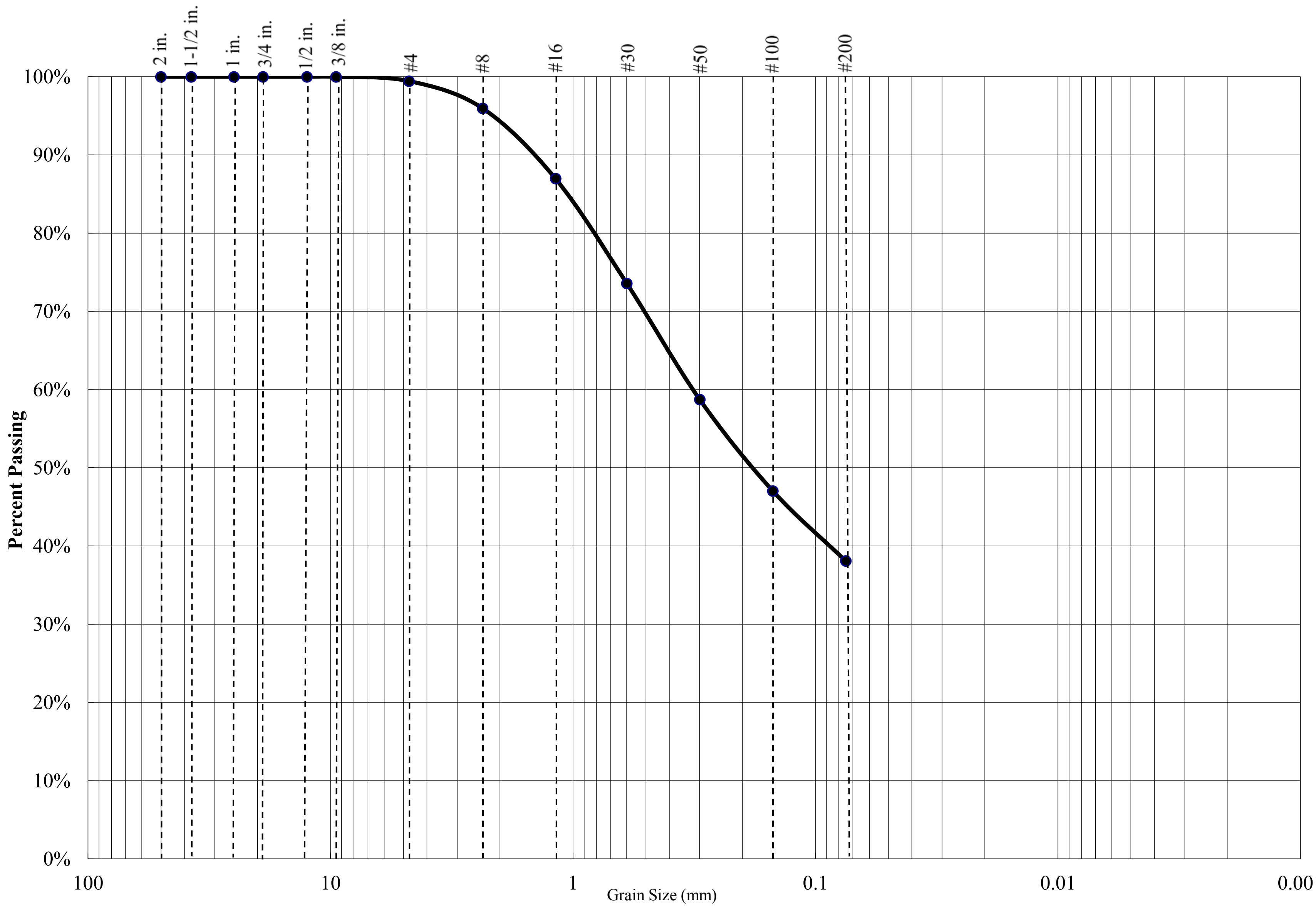
Project Number: 3-221-0432

Boring: B-7 @ 2'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
1%	61%	38%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	99.4%
#8	96.0%
#16	87.0%
#30	73.6%
#50	58.7%
#100	47.0%
#200	38.1%

Atterberg Limits		
PL=	LL=	PI=

Coefficients				
D85=		D60=		D50=
D30=		D15=		D10=
C_u=	N/A	C_c=	N/A	

USCS CLASSIFICATION
-

Project Name: Proposed Multi-Family Development- Perris

Project Number: 3-221-0432

Boring: B-7 @ 5'

SALEM engineering group, inc.

CHEMICAL ANALYSIS

SO_4 - Modified CTM 417 & Cl - Modified CTM 417/422

Project Name: Proposed Multi-Family Development- Perris
Project Number: 3-221-0432
Date Sampled: 5/10/21- 5/12/21 Date Tested: 5/21/21
Sampled By: JC Tested By: Mobin Noorzay
Soil Description: Silty Sand (SM)

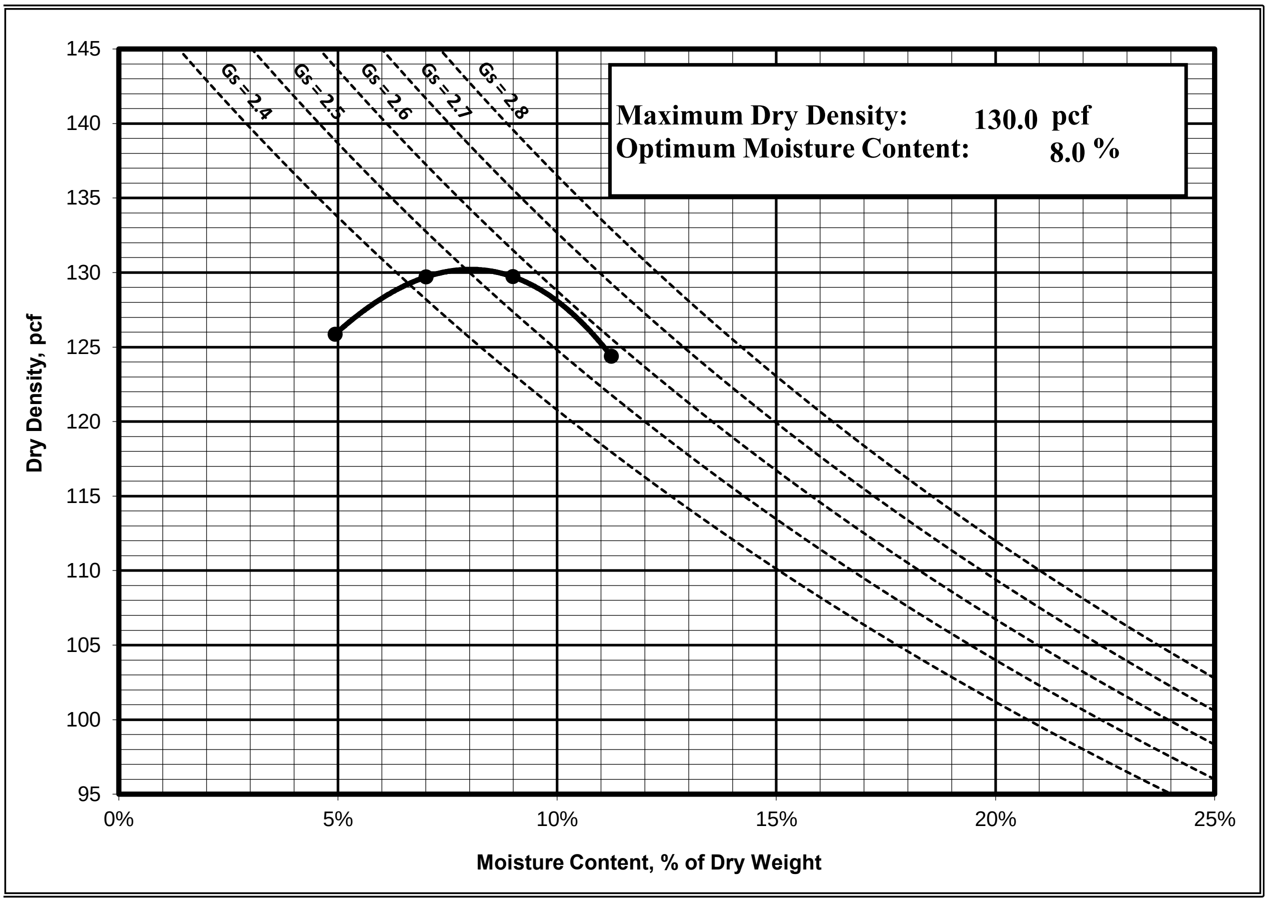
Sample Number	Sample Location	Soluble Sulfate SO_4-S	Soluble Chloride Cl	pH
1a.	B-1 @ 0 - 4'	130 mg/kg	53 mg/kg	7.6
1b.	B-1 @ 0 - 4'	130 mg/kg	53 mg/kg	7.6
1c.	B-1 @ 0 - 4'	130 mg/kg	53 mg/kg	7.6
Average:		**130 mg/kg**	**53 mg/kg**	**7.6**

SALEM engineering group, inc.

Laboratory Compaction Curve
ASTM D1557

Project Name: Proposed Multi-Family Development - Perris, CA
Project Number: 3-221-0432
Date Sampled: 5/10/2021- 5/12/2021 Date Tested: 5/18/2021
Sampled By: JC Tested By: Mobin Noorzay
Sample Location: B-1 @ 0'-4'
Soil Description: Brown Silty SAND/Sandy SILT (SM/ML)
Test Method: Method B

	1	2	3	4
Weight of Moist Specimen & Mold, (g)	6287.7	6389.5	6428.6	6382.9
Weight of Compaction Mold, (g)	4290.9	4290.9	4290.9	4290.9
Weight of Moist Specimen, (g)	1996.8	2098.6	2137.7	2092.0
Volume of Mold, (ft^3)	0.0333	0.0333	0.0333	0.0333
Wet Density, (pcf)	132.1	138.8	141.4	138.4
Weight of Wet (Moisture) Sample, (g)	200.0	200.0	200.0	200.0
Weight of Dry (Moisture) Sample, (g)	190.6	186.9	183.5	179.8
Moisture Content, (%)	4.9%	7.0%	9.0%	11.2%
Dry Density, (pcf)	125.9	129.7	129.7	124.4



SALEM
engineering group, inc.

APPENDIX

C

APPENDIX C
GENERAL EARTHWORK AND PAVEMENT SPECIFICATIONS

When the text of the report conflicts with the general specifications in this appendix, the recommendations in the report have precedence.

1.0 SCOPE OF WORK: These specifications and applicable plans pertain to and include all earthwork associated with the site rough grading, including, but not limited to, the furnishing of all labor, tools and equipment necessary for site clearing and grubbing, stripping, preparation of foundation materials for receiving fill, excavation, processing, placement and compaction of fill and backfill materials to the lines and grades shown on the project grading plans and disposal of excess materials.

2.0 PERFORMANCE: The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications. This work shall be inspected and tested by a representative of SALEM Engineering Group, Incorporated, hereinafter referred to as the Soils Engineer and/or Testing Agency. Attainment of design grades, when achieved, shall be certified by the project Civil Engineer. Both the Soils Engineer and the Civil Engineer are the Owner's representatives. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary adjustments until all work is deemed satisfactory as determined by both the Soils Engineer and the Civil Engineer. No deviation from these specifications shall be made except upon written approval of the Soils Engineer, Civil Engineer, or project Architect. No earthwork shall be performed without the physical presence or approval of the Soils Engineer. The Contractor shall notify the Soils Engineer at least 2 working days prior to the commencement of any aspect of the site earthwork.

The Contractor shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner and the Engineers harmless from any and all liability, real or alleged, in connection with the performance of work on this project, except for liability arising from the sole negligence of the Owner or the Engineers.

3.0 TECHNICAL REQUIREMENTS: All compacted materials shall be densified to no less that 95 percent of relative compaction (90% for silty or clayey soil) based on ASTM D1557 Test Method (latest edition), UBC or CAL-216, or as specified in the technical portion of the Soil Engineer's report. The location and frequency of field density tests shall be determined by the Soils Engineer. The results of these tests and compliance with these specifications shall be the basis upon which satisfactory completion of work will be judged by the Soils Engineer.

4.0 SOILS AND FOUNDATION CONDITIONS: The Contractor is presumed to have visited the site and to have familiarized himself with existing site conditions and the contents of the data presented in the Geotechnical Engineering Report. The Contractor shall make his own interpretation of the data contained in the Geotechnical Engineering Report and the Contractor shall not be relieved of liability for any loss sustained as a result of any variance between conditions indicated by or deduced from said report and the actual conditions encountered during the progress of the work.

5.0 DUST CONTROL: The work includes dust control as required for the alleviation or prevention of any dust nuisance on or about the site or the borrow area, or off-site if caused by the Contractor's operation either during the performance of the earthwork or resulting from the conditions in which the Contractor leaves the site. The Contractor shall assume all liability, including court costs of codefendants, for all claims related to dust or wind-blown materials attributable to his work. Site preparation shall consist of site clearing and grubbing and preparation of foundation materials for receiving fill.

6.0 CLEARING AND GRUBBING: The Contractor shall accept the site in this present condition and shall demolish and/or remove from the area of designated project earthwork all structures, both surface and subsurface, trees, brush, roots, debris, organic matter and all other matter determined by the Soils Engineer to be deleterious. Such materials shall become the property of the Contractor and shall be removed from the site.

Tree root systems in proposed improvement areas should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots greater than 1 inch in diameter. Tree roots removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill of tree root excavations is not permitted until all exposed surfaces have been inspected and the Soils Engineer is present for the proper control of backfill placement and compaction. Burning in areas which are to receive fill materials shall not be permitted.

7.0 SUBGRADE PREPARATION: Surfaces to receive Engineered Fill and/or building or slab loads shall be prepared as outlined above, scarified to a minimum of 12 inches, moisture-conditioned as necessary, and recompacted to 95 percent relative compaction (90% for silty or clayey soil).

Loose soil areas and/or areas of disturbed soil shall be moisture-conditioned as necessary and recompacted to 95 percent relative compaction (90% for silty or clayey soil). All ruts, hummocks, or other uneven surface features shall be removed by surface grading prior to placement of any fill materials. All areas which are to receive fill materials shall be approved by the Soils Engineer prior to the placement of any fill material.

8.0 EXCAVATION: All excavation shall be accomplished to the tolerance normally defined by the Civil Engineer as shown on the project grading plans. All over-excavation below the grades specified shall be backfilled at the Contractor's expense and shall be compacted in accordance with the applicable technical requirements.

9.0 FILL AND BACKFILL MATERIAL: No material shall be moved or compacted without the presence or approval of the Soils Engineer. Material from the required site excavation may be utilized for construction site fills, provided prior approval is given by the Soils Engineer. All materials utilized for constructing site fills shall be free from vegetation or other deleterious matter as determined by the Soils Engineer.

10.0 PLACEMENT, SPREADING AND COMPACTION: The placement and spreading of approved fill materials and the processing and compaction of approved fill and native materials shall be the responsibility of the Contractor. Compaction of fill materials by flooding, ponding, or jetting shall not be permitted unless specifically approved by local code, as well as the Soils Engineer. Both cut and fill shall be surface-compacted to the satisfaction of the Soils Engineer prior to final acceptance.

11.0 SEASONAL LIMITS: No fill material shall be placed, spread, or rolled while it is frozen or thawing, or during unfavorable wet weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until the Soils Engineer indicates that the moisture content and density of previously placed fill is as specified.

12.0 DEFINITIONS - The term "pavement" shall include asphaltic concrete surfacing, untreated aggregate base, and aggregate subbase. The term "subgrade" is that portion of the area on which surfacing, base, or subbase is to be placed. The term "Standard Specifications": hereinafter referred to, is the most recent edition of the Standard Specifications of the State of California, Department of Transportation. The term "relative compaction" refers to the field density expressed as a percentage of the maximum laboratory density as determined by ASTM D1557 Test Method (latest edition) or California Test Method 216 (CAL-216), as applicable.

13.0 PREPARATION OF THE SUBGRADE - The Contractor shall prepare the surface of the various subgrades receiving subsequent pavement courses to the lines, grades, and dimensions given on the plans. The upper 12 inches of the soil subgrade beneath the pavement section shall be compacted to a minimum relative compaction of 95 percent (90% for silty or clayey soil) based upon ASTM D1557. The finished subgrades shall be tested and approved by the Soils Engineer prior to the placement of additional pavement courses.

14.0 AGGREGATE BASE - The aggregate base material shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate base material shall conform to the requirements of Section 26 of the Standard Specifications for Class II material, ¾-inch or 1½-inches maximum size. The aggregate base material shall be compacted to a minimum relative compaction of 95 percent based upon CAL-216. The aggregate base material shall be spread in layers not exceeding 6 inches and each layer of aggregate material course shall be tested and approved by the Soils Engineer prior to the placement of successive layers.

15.0 AGGREGATE SUBBASE - The aggregate subbase shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate subbase material shall conform to the requirements of Section 25 of the Standard Specifications for Class II Subbase material. The aggregate subbase material shall be compacted to a minimum relative compaction of 95 percent based upon CAL-216, and it shall be spread and compacted in accordance with the Standard Specifications. Each layer of aggregate subbase shall be tested and approved by the Soils Engineer prior to the placement of successive layers.

16.0 ASPHALTIC CONCRETE SURFACING - Asphaltic concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant and spread and compacted on a prepared base in conformity with the lines, grades, and dimensions shown on the plans. The viscosity grade of the asphalt shall be PG 64-10, unless otherwise stipulated or local conditions warrant more stringent grade. The mineral aggregate shall be Type A or B, ½ inch maximum size, medium grading, and shall conform to the requirements set forth in Section 39 of the Standard Specifications. The drying, proportioning, and mixing of the materials shall conform to Section 39. The prime coat, spreading and compacting equipment, and spreading and compacting the mixture shall conform to the applicable chapters of Section 39, with the exception that no surface course shall be placed when the atmospheric temperature is below 50 degrees F. The surfacing shall be rolled with a combination steel-wheel and pneumatic rollers, as described in the Standard Specifications. The surface course shall be placed with an approved self-propelled mechanical spreading and finishing machine.

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

Basin Size and Flow Calculations

Extended Detention Basin Size and Flow Calculations

	BASIN PARAMETERS				OUTLET									
Basin Elevation	Depth	Area S.F.	Volume C.F.	Volume AC-FT	Q_1 Orrifice Plate (cfs)	Q_2 Orrifice Plate (cfs)	Q_3 Orrifice Plate (cfs)	Q_4 Orrifice Plate (cfs)	Q_5Orrifice Plate (cfs)	Q6Orrifice Plate (cfs)	Q7 Orrifice Plate (cfs)	Q8Orrifice Plate (cfs)	Q Weir 1 (cfs)	Q Total (cfs)
1438.00	0.00	7,046.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1438.33	0.33	7,375.00	2,379.46	0.055	0.032	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.032
1438.67	0.67	7,704.00	4,941.25	0.113	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.061
1439.00	1.00	8,033.00	7,539.50	0.173	0.080	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080
1439.33	1.33	8,396.33	10,269.15	0.236	0.095	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.095
1439.67	1.67	8,759.67	13,197.73	0.303	0.108	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.108
1440.00	2.00	9,123.00	16,169.00	0.371	0.120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.120
1440.33	2.33	9,520.67	19,300.17	0.443	0.131	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.131
1440.67	2.67	9,918.33	22,647.39	0.520	0.141	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.141
1441.00	3.00	10,316.00	26,043.00	0.598	0.150	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.150
1441.33	3.33	10,754.00	29,637.00	0.680	0.158	2.390	2.390	2.390	2.390	1.830	0.000	0.000	0.000	11.546
1441.67	3.67	11,192.00	33,466.73	0.768	0.167	3.405	3.405	3.405	3.405	2.607	0.000	0.000	0.000	16.394
1442.00	4.00	11,630.00	37,352.00	0.857	0.174	4.160	4.160	4.160	4.160	3.185	0.000	0.000	0.000	19.999
1442.33	4.33	12,092.00	41,433.77	0.951	0.182	4.797	4.797	4.797	4.797	3.673	0.000	0.000	2.110	25.154
1442.67	4.67	12,554.00	45,766.00	1.051	0.189	5.376	5.376	5.376	5.376	4.116	0.000	0.000	25.379	51.187
1443.00	5.00	13,016.00	50,155.00	1.151	0.196	5.883	5.883	5.883	5.883	4.504	0.000	0.000	60.561	88.793

SUPPORTING DESIGN PARAMETERS

Orifice Coefficient	0.66	1.7600	12.00	12.00	12.00	12.00	10.50			0.00	
Gravimetric Constant	32.2 ft/s^2	0.1467	1.0000	1.0000	1.0000	1.0000	0.8750	0.0000	0.0000	0.0000	
Number of Rows	1	0.0169	0.7854	0.7854	0.7854	0.7854	0.6013	0.0000	0.0000	0.0000	
Minimum Orrifice Plate Height		1	1	1	1	1	1	1	1	1	
Minimum Orrifice Plate Width		1438.2	1441	1441	1441	1441	1441	1441		0	

. Weir

Sharp Crest Weir Coefficient	3.33
Length of Weir	28.00
Elev. at Crest of Weir	1442.25

Orifice Equation

Q=Cd(1/4πD2)√2gh

Weir Equation

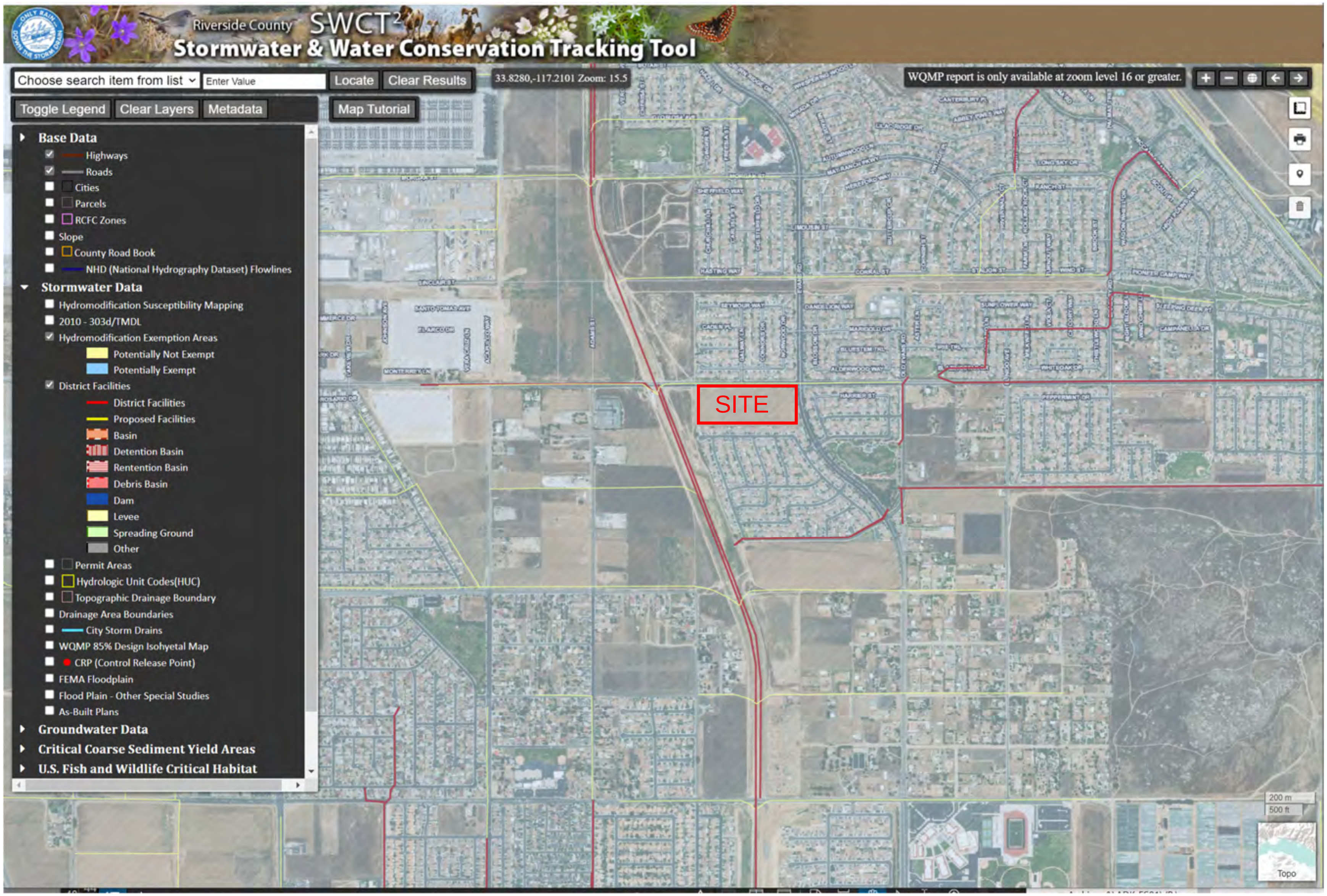
(Q/(Weir Length* Weir Coefficent))^(2/3)

Q100 Elevation Weir Calc		
Box Inlet Weir Calc		
Crest Wier Elev.	1442.25	
Q100	32.95	cfs
Weir Length	28	
Weir Coeff.	3.33	
H Weir	0.499845097	
Q100 Elevation	**1442.75**	

Basin Storm Event Summary							
Storm Event	Existing		Proposed		Routed		
	Volume (ac.ft.)	cfs	Volume (ac.ft.)	cfs	Volume (ac.ft.)	cfs	Depth (ft)
100yr1hr	1.4000	37.744	1.3328	36.740	0.877	21.079	4.07
100yr3hr	2.0104	21.611	1.8907	21.492	0.789	17.246	3.75
100yr6hr	2.6826	19.109	2.5855	19.856	0.768	16.369	3.67
100yr24hr	3.5414	7.320	3.9950	6.685	0.645	6.647	3.19

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern



Riverside County SWCT²
Stormwater & Water Conservation Tracking Tool
Choose search item from list
Enter Value
Locate
Clear Results
33.8280,-117.2101 Zoom: 15.5
WQMP report is only available at zoom level 16 or greater.
Toggle Legend
Clear Layers
Metadata
Map Tutorial
Base Data
Highways
Roads
Cities
Parcels
RCFC Zones
Slope
County Road Book
NHD (National Hydrography Dataset) Flowlines
Stormwater Data
Hydromodification Susceptibility Mapping
2010 - 303d/TMDL
Hydromodification Exemption Areas
Potentially Not Exempt
Potentially Exempt
District Facilities
District Facilities
Proposed Facilities
Basin
Detention Basin
Rentention Basin
Debris Basin
Dam
Levee
Spreading Ground
Other
Permit Areas
Hydrologic Unit Codes(HUC)
Topographic Drainage Boundary
Drainage Area Boundaries
City Storm Drains
WQMP 85% Design Isohyetal Map
CRP (Control Release Point)
FEMA Floodplain
Flood Plain - Other Special Studies
As-Built Plans
Groundwater Data
Critical Coarse Sediment Yield Areas
U.S. Fish and Wildlife Critical Habitat
SITE
200 m
500 ft
Topo