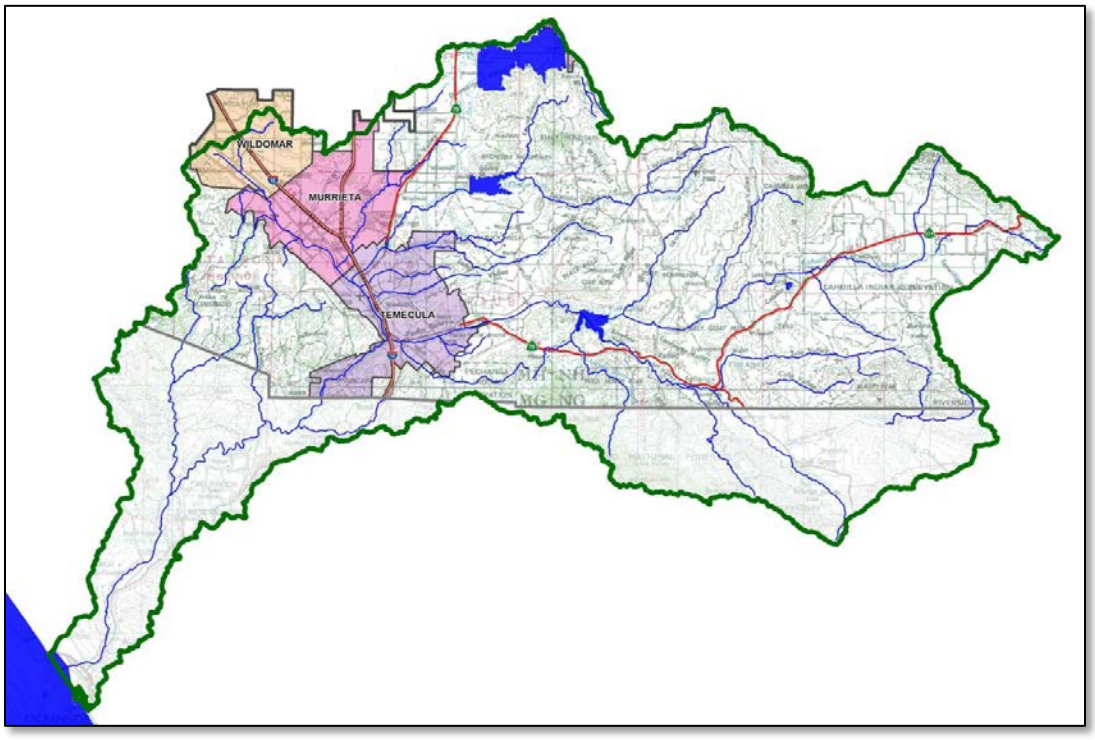
County Project Specific Water Quality Management Plan

A Template for preparing Project Specific WQMPs for Priority Development Projects only for use in the ***unincorporated portions of Riverside County*** *located within the* ***Santa Margarita Region***.

Project Title: KTM North America
Development No: PM 35212
Design Review/Case No: PPT180022
BMP$_i$ (Latitude, Longitude): 33.5691,-117.1360



☒ **Preliminary**
☐ **Final**

Original Date Prepared: August 30, 2018

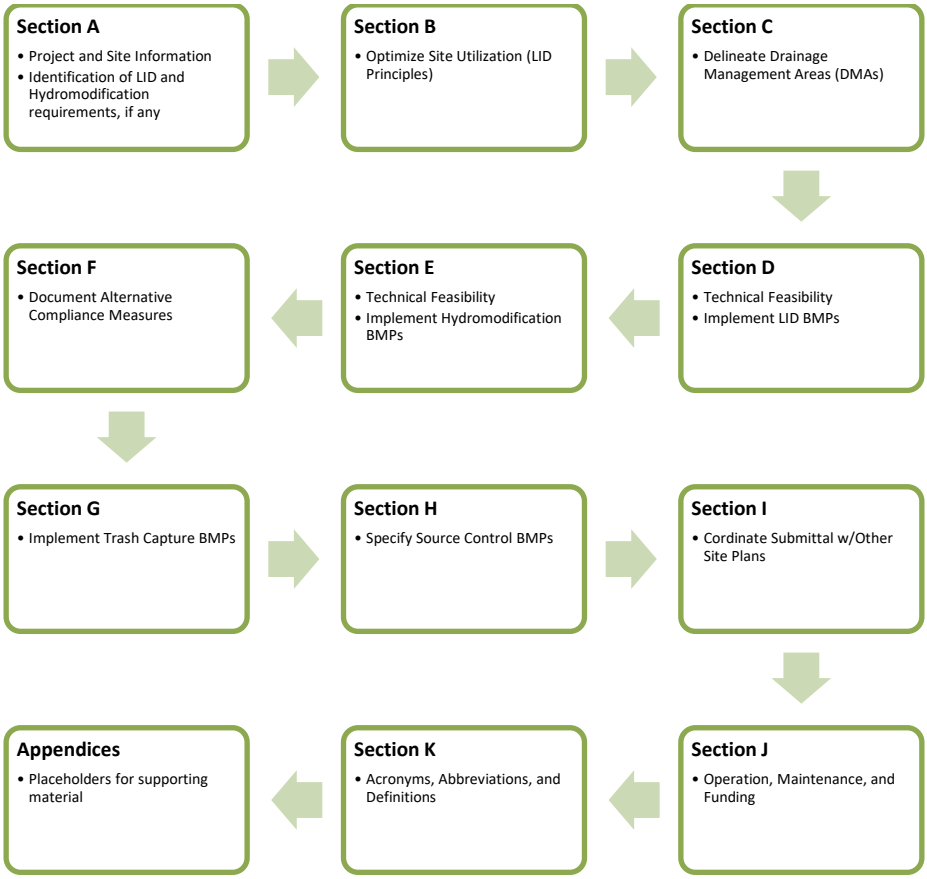
Revision Date(s): November 28, 2018, March 22, 2019, June 24, 2019

Based on 2018 WQMP, prepared for Compliance with Regional Board Order No. **R9-2013-0001** *as amended by Order No.* **R9-2015-0001** *and Order No.* **R9-2015-0100**
The County updated this template on July 24, 2018

Contact Information
Prepared for:
Pierer Immoreal North America, LLC
38429 Innovation Ct.
Murrieta, CA 92563
Robin Gangruth, Senior Legal Specialist
(951) 600-8007 x4142
Prepared by:
CASC Engineering & Consulting, Inc.
1470 E. Cooley Drive
Colton, CA 92324
Michael J. Gentile, PE, Senior Engineer
(909) 783-0101 x1610

A Brief Introduction

The Regional Municipal Separate Stormwater Sewer System (MS4) Permit[1] requires that a Project-Specific WQMP be prepared for all development projects within the Santa Margarita Region (SMR) that meet the 'Priority Development Project' categories and thresholds listed in the SMR Water Quality Management Plan (WQMP). This Project-Specific WQMP Template for Development Projects in the **Santa Margarita Region** has been prepared to help document compliance and prepare a WQMP submittal. Below is a flowchart for the layout of this Template that will provide the steps required to document compliance.



To ensure compliance with State permanent recordkeeping, the County of Riverside is no longer accepting hard copies of the **approved** Final or Preliminary WQMPs or Hydrology Reports. Electronic submittals are highly encouraged for submittal reviews, single PDF file submittal on two CD copies, to the Transportation Department (4080 Lemon Street, 8th Floor, Riverside, CA 92501) is preferred.

For Approved Final WQMPs, submit with the single file WQMP on CD:

- A wet-signed and notarized BMP maintenance agreement (See Appendix 9 for details)
- Owner's Certification signed and scanned into the PDF, or wet-signed hard copy, dated after approval.
- Print out of the WQMP site map (11x17") and Coversheet (8.5x11")
- The CD should include a Hydrology report when applicable. The County requires a hydrology report with hydraulics for the design of drainage facilities. Then provide a print out of the Pre- & Post-Hydrology map (11x17") and Report Coversheet (8.5x11")
- For tracts, submit the County EDA approved maintenance exhibit
- Signed Exhibit B.9 - WQMP O&M Cost Sheet.xlsx

[1] Order No. R9-2013-0001 as amended by Order Nos. R9-2015-0001 and R9-2015-0100, NPDES No. CAS0109266, National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the MS4s Draining the Watersheds within the San Diego Region, California Regional Water Quality Control Board, May 8, 2013.

Signed and scanned into the PDF for Final Approved WQMP, or wet-signed hard copy

OWNER'S CERTIFICATION

This Project-Specific WQMP has been prepared for Pierer Immoreal North America, LLC by CASC Engineering and Consulting, Inc. for the KTM North America (PM 35212) project.

This WQMP is intended to comply with the requirements of Riverside County for County Ordinance No. 754 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 Best Management Practices 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 Riverside County Water Quality Ordinance (No. 754).

"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 Best Management Practices in this plan meet the requirements of Regional Water Quality Control Board Order No. **R9-2013-0001** as amended by Order Nos. **R9-2015-0001 and R9-2015-0100**."

Preparer's Signature	Date
Michael J. Gentile Preparer's Printed Name	Senior Engineer Preparer's Title/Position

Preparer's Licensure: C58953, Exp. 6-30-2019

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Section A: Project and Site Information

Use the table below to compile and summarize basic site information that will be important for completing subsequent steps. Subsections A.1 through A.4 provide additional detail on documentation of additional project and site information. The Regional MS4 Permit has effectively removed the ability for a project to be grandfathered from WQMP requirements. Even if a project were able to meet all the requirements stated in Section 1.2 of the WQMP, the 2014 WQMP requirements would apply.

PROJECT INFORMATION			
Type of PDP:	New Development		
Type of Project:	Commercial Office CUP		
Planning Case Number:	PPT180022		
Rough Grade Permit No.:	N/A		
Development Name:	KTM North America (PM35212)		
PROJECT LOCATION			
Latitude & Longitude (DMS):	33°34'15"N, -117°08'03"W		
Project Watershed and Sub-Watershed:	Santa Margarita River, Warm Springs Creek		
24-Hour 85th Percentile Storm Depth (inches):	0.62		
Is project subject to Hydromodification requirements?	☒ Y ☐ N (Select based on Section A.3)		
APN(s):	963-030-002, 963-030-003		
Map Book and Page No.:	RS57/81		
PROJECT CHARACTERISTICS			
Proposed or Potential Land Use(s)		Commercial Retail	
Proposed or Potential SIC Code(s)		5571,7948	
Existing Impervious Area of Project Footprint (SF)		0	
Total area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement		TBD	
Total Project Area (ac)		26.25	
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
Has preparation of Project-Specific WQMP included coordination with other site plans?		☒ Y	☐ N
EXISTING SITE CHARACTERISTICS			
Is the project located within any Multi-Species Habitat Conservation Plan area (MSHCP Criteria Cell?)		☐ Y	☒ N
Is a Geotechnical Report attached?		☒ Y	☐ N
If no Geotech. Report, list the Natural Resources Conservation Service (NRCS) soils type(s) present on the site (A, B, C and/or D)		N/A	

Provide a brief description of the project:

The proposed land use development is located within an unincorporated community of western Riverside County called French Valley. The community consists of residential tract housing, with ancillary shops and retail establishments. The Project is specifically located east of Highway 79 (SR-79), otherwise known as Winchester Road and south of Sparkman Way. Borel Road borders the Project on a portion of the southerly boundary, and Sky Canyon Drive is located on the easterly boundary. The French Valley Airport is located further east of the Project site.

The proposed development will provide the new research and development facility, storage facility, and headquarters building to accommodate KTM North America, Inc. KTM, founded in 1953, is the second largest European motorcycle manufacturer specializing in "Ready to Race" on and off-road motorcycles.

The project site is approximately 26 acres. The project site includes the area for widening of Sky Canyon Drive, the access road between Winchester Road (SR 79) and Sky Canyon Drive, the acceleration and deceleration lanes on Winchester Road (SR 79) and the site for the proposed development (Drainage Area DA-A). Improvements on Sky Canyon Drive and Winchester Road will comply with the Santa Margarita Watershed Stormwater Permit via the Green Streets Exemption. Both areas of road improvements will incorporate vegetated swales to accept runoff, which is an applicable BMP for green streets projects per Table 3-9 of the SMR Guidance Document. The enclosed site plan shows the proposed cross-sections that incorporate this concept. No improvements to Sparkman Way are proposed.

KTM will utilize approximately 18.5 acres for the proposed development. The on-site development consists of three (3) buildings. The headquarters building at the northwest corner of the site will be two stories tall and have a footprint of 47,675 sf. In the northeast corner will be the proposed motorsport building, a single-story 60,860 sf facility. The smaller building south to the motorsport building is the proposed warehouse of 17,917 sf. The area between these two buildings is for semi-truck parking. This area also includes covered washbays for motorbikes that have been raced, and a maintenance intake area for the motorbikes. This outdoor storage area is for storage only. No maintenance of the trucks or bikes will take place within this area. There is also a loading/unloading area east of the proposed warehouse that includes a covered receiving dock. Most of the proposed facility will be closed to the public and accommodate the administrative and operational aspects of the business; however, some portions of the Project site will be open to the public and provide retail sales of equipment and merchandise. The development will provide infrastructure and public improvements, commensurate with the proposed development.

The project consists of one drainage area (DA-A) that drains to the proposed BMP (BMP1, a bioretention basin with underdrain). The proposed development mimics the existing flow patterns of the site and directs runoff through the site southwesterly towards a proposed Bioretention Basin with underdrain. labeled as BMP1 on the enclosed Site Plan. Low flow discharge from BMP1 into the nearby MS4 is via the proposed underdrains in the Bioretention Basin, and high flow (overflow) will discharge into the nearby MS4 from BMP1 via a proposed riser.

Paver and dirt roads are considered pervious for determining WQMP applicability.

A.1 Maps and Site Plans

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

- Vicinity and location maps
- Parcel Boundary and Project Footprint
- Existing and Proposed Topography
- Drainage Management Areas (DMAs)
- Proposed Structural Best Management Practices (BMPs)
- Drainage Paths
- Drainage infrastructure, inlets, overflows
- Source Control BMPs
- Site Design BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces
- Pervious Surfaces (i.e. Landscaping)
- Standard Labeling
- Cross Section and Outlet details

Use your discretion on whether or not you may need to create multiple sheets or can appropriately accommodate these features on one or two sheets. Keep in mind that the Copermittee plan reviewer must be able to easily analyze your Project utilizing this template and its associated site plans and maps. Complete the checklists in Appendix 1 to verify that all exhibits and components are included.

A.2 Identify Receiving Waters

Using Table A-1 below, list in order of upstream to downstream, the Receiving Waters that the Project site is tributary to. Continue to fill each row with the Receiving Water's 303(d) listed impairments (if any), designated Beneficial Uses, and proximity, if any, to a RARE Beneficial Use. Include a map of the Receiving Waters in Appendix 1. This map should identify the path of the stormwater discharged from the site all the way to the outlet of the Santa Margarita River to the Pacific Ocean. Use the most recent 303(d) list available from the State Water Resources Control Board Website.
(http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/)

Table A-1 Identification of Receiving Waters

Receiving Waters	USEPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Warm Springs Creek	Chlorpyrifos, E. Coli, Fecal Coliform, Iron, Manganese, Phosphorous, Total Nitrogen as N	MUN, AGR, IND, PROC, REC2, WARM, WILD	No RARE designation
Murrieta Creek	Chlorpyrifos, Copper, Iron, Manganese, Nitrogen, Phosphorous, Toxicity	MUN, AGR, IND, PROC, REC1, REC2, WARM, WILD	No RARE designation
Santa Margarita River (Upper)	Phosphorous, Total Nitrogen as N, Toxicity	MUN, AGR, IND, REC1, REC2, WARM, COLD, WILD, RARE	Approximately 7 Miles
Santa Margarita River (Lower)	Enterococcus, Fecal Coliform, Phosphorous, Total Nitrogen as N	MUN, AGR, IND, REC1, REC2, WARM, COLD, WILD, RARE	Approx.18 Miles
Santa Margarita Lagoon	Eutrophic	REC1, REC2, EST, WILD, RARE, MAR, MIGR, SPWN	Approx. 28.5 Miles
Pacific Ocean	Not listed On Region 9 List of Impairments	IND, NAV, REC1, REC2, COMM, BIOL, WILD, RARE, MAR, AQUA, MIGR, SHELL	Approx. 28.6 Miles

A.3 Drainage System Susceptibility to Hydromodification

Using Table A-2 below, list in order of the point of discharge at the project site down to the Santa Margarita River[2], each drainage system or receiving water that the project site is tributary to. Continue to fill each row with the material of the drainage system, and any exemption (if applicable). Based on the results, summarize the applicable hydromodification performance standards that will be documented in Section E. Exempted categories of receiving waters include:

- Existing storm drains that discharge directly to water storage reservoirs, lakes, or enclosed embayments, or
- Conveyance channels whose bed and bank are concrete lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.
- Other water bodies identified in an approved WMAA (See Exhibit G to the WQMP)

Include a map exhibiting each drainage system and the associated susceptibility in Appendix 1.

Table A-2 Identification of Susceptibility to Hydromodification

Drainage System	Drainage System Material	Hydromodification Exemption	Hydromodification Exempt
Warm Springs Creek	Natural Channel	NONE	☐ Y ☒ N
Murrieta Creek	Natural Channel	NONE	☐ Y ☒ N
			☐ Y ☐ N

Summary of Performance Standards

☐ **Hydromodification Exempt** – Select if "Y" is selected in the Hydromodification Exempt column above, project is exempt from hydromodification requirements.

☒ **Not Exempt**-Select if "N" is selected in any row of the Hydromodification Exempt column above. Project is subject to hydrologic control requirements and may be subject to sediment supply requirements.

A.4 Additional Permits/Approvals required for the Project:

Table A-3 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 Section 401 Water Quality Certification	☒ Y	☐ N
US Army Corps of Engineers, Clean Water Act Section 404 Permit	☒ Y	☐ N
US Fish and Wildlife, Endangered Species Act Section 7 Biological Opinion	☐ Y	☒ N

[2] Refer to Exhibit G of the WQMP for a map of exempt and potentially exempt areas. These maps are from the Draft SMR WMAA as of January 5, 2018 and will be replaced upon acceptance of the SMR WMAA.

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)* County of Riverside Grading and Building Permits	☒ Y	☐ N

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

Section B: Optimize Site Utilization (LID Principles)

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

Apply the following LID Principles to the layout of the PDP to the extent they are applicable and feasible. Putting thought upfront about how best to organize the various elements of a site can help to significantly reduce the PDP's potential impact on the environment and reduce the number and size of Structural LID BMPs that must be implemented. Integrate opportunities to accommodate the following LID Principles within the preliminary PDP site layout to maximize implementation of LID Principles.

Site Optimization

Complete checklist below to determine applicable Site Design BMPs for your site.

Project- Specific WQMP Site Design BMP Checklist

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

SITE DESIGN REQUIREMENTS

Answer the following questions below by indicating "Yes," "No," or "N/A" (Not Applicable). Justify all "No" and "N/A" answers by inserting a narrative at the end of the section. The narrative should include identification and justification of any constraints that would prevent the use of those categories of LID BMPs. Upon identifying Site Design BMP opportunities, include these on your WQMP Site plan in Appendix 1.

☒ Yes ☐ No ☐ N/A

Did you identify and preserve existing drainage patterns?

Integrating existing drainage patterns into the site plan helps to maintain the time of concentration and infiltration rates of runoff, decreasing peak flows, and may also help preserve the contribution of Critical Coarse Sediment (i.e., Bed Sediment Supply) from the PDP to the Receiving Water. Preserve existing drainage patterns by:

- Minimizing unnecessary site grading that would eliminate small depressions, where appropriate add additional "micro" storage throughout the site landscaping.
- Where possible conform the PDP site layout along natural landforms, avoid excessive grading and disturbance of vegetation and soils, preserve or replicate the sites natural drainage features and patterns.
- Set back PDP improvements from creeks, wetlands, riparian habitats and any other natural water bodies.
- Use existing and proposed site drainage patterns as a natural design element, rather than using expensive impervious conveyance systems. Use depressed landscaped areas, vegetated buffers, and bioretention areas as amenities and focal points within the site and landscape design.

Discuss how this was included or provide a discussion/justification for "No" or "N/A" answer.
The existing drainage pattern is being preserved. The existing project site had four main drainage areas that directed runoff to its respective discharge point. The proposed drainage pattern preserves these drainage areas and discharge points

☒ Yes ☐ No ☐ N/A

Did you identify and protect existing vegetation?

Identify any areas containing dense native vegetation or well-established trees, and try to avoid disturbing these areas. Soils with thick, undisturbed vegetation have a much higher capacity to store and infiltrate runoff than do disturbed soils. Reestablishment of a mature vegetative community may take decades. Sensitive areas, such as streams and floodplains should also be avoided.

- Define the development envelope and protected areas, identifying areas that are most suitable for development and areas that should be left undisturbed.
- Establish setbacks and buffer zones surrounding sensitive areas.
- Preserve significant trees and other natural vegetation where possible.

Discuss how this was included or provide a discussion/justification for "No" or "N/A" answer. *Existing vegetation will be protected within the jurisdictional boundaries per the requisite permits. The existing site had been used as a grazing area, so there is not mature vegetation to be protected on site. The northern property will be graded for future development. The southern property (south of the existing channel that divides the property) is being developed per this P-WQMP.*

Project- Specific WQMP Site Design BMP Checklist	
☒ Yes ☐ No ☐ N/A	**Did you identify and preserve natural infiltration capacity?** A key component of LID is taking advantage of a site's natural infiltration and storage capacity. A site survey and geotechnical investigation can help define areas with high potential for infiltration and surface storage. • Identify opportunities to locate LID Principles and Structural BMPs in highly pervious areas. Doing so will maximize infiltration and limit the amount of runoff generated. • Concentrate development on portions of the site with less permeable soils, and preserve areas that can promote infiltration.
Discuss how this was included or provide a discussion/justification for "No" or "N/A" answer. *Infiltration rates are not very high on site, but the infiltrative capacity of the soil, as minimal as it is, will be preserved at the proposed BMP location so that at least partial infiltration can occur. The infiltrative capacity may be enhanced somewhat by the introduction of engineered soil with high porosity and a gravel layer within the proposed bioretention BMP. This area will be staked off during construction to keep heavy equipment away and avoid compaction of the underlying soils.*	
☒ Yes ☐ No ☐ N/A	**Did you minimize impervious area?** Look for opportunities to limit impervious cover through identification of the smallest possible land area that can be practically impacted or disturbed during site development. • Limit overall coverage of paving and roofs. This can be accomplished by designing compact, taller structures, narrower and shorter streets and sidewalks, clustering buildings and sharing driveways, smaller parking lots (fewer stalls, smaller stalls, and more efficient lanes), and indoor or underground parking. • Inventory planned impervious areas on your preliminary site plan. Identify where permeable pavements, or other permeable materials, such as crushed aggregate, turf block, permeable modular blocks, pervious concrete or pervious asphalt could be substituted for impervious concrete or asphalt paving. This will help reduce the amount of Runoff that may need to be addressed through Structural BMPs. • Examine site layout and circulation patterns and identify areas where landscaping can be substituted for pavement, such as for overflow parking. • Consider green roofs. Green roofs are roofing systems that provide a layer of soil/vegetative cover over a waterproofing membrane. A green roof mimics pre-development conditions by filtering, absorbing, and evapotranspiring precipitation to help manage the effects of an otherwise impervious rooftop.
Discuss how this was included or provide a discussion/justification for "No" or "N/A" answer. *Impervious area was minimized to the extent possible. Streets and drive aisles are designed to minimum widths, and per required county standards. Landscaping features are proposed throughout the project site.*	

Project- Specific WQMP Site Design BMP Checklist	
☒ Yes ☐ No ☐ N/A	**Did you identify and disperse runoff to adjacent pervious areas or small collection areas?** Look for opportunities to direct runoff from impervious areas to adjacent landscaping, other pervious areas, or small collection areas where such runoff may be retained. This is sometimes referred to as reducing Directly Connected Impervious Areas. • Direct roof runoff into landscaped areas such as medians, parking islands, planter boxes, etc., and/or areas of pervious paving. Instead of having landscaped areas raised above the surrounding impervious areas, design them as depressed areas that can receive Runoff from adjacent impervious pavement. For example, a lawn or garden depressed 3"-4" below surrounding walkways or driveways provides a simple but quite functional landscape design element. • Detain and retain runoff throughout the site. On flatter sites, smaller Structural BMPs may be interspersed in landscaped areas among the buildings and paving. • On hillside sites, drainage from upper areas may be collected in conventional catch basins and piped to landscaped areas and LID BMPs and/or Hydrologic Control BMPs in lower areas. Low retaining walls may also be used to create terraces that can accommodate LID BMPs. Wherever possible, direct drainage from landscaped slopes offsite and not to impervious surfaces like parking lots. • Reduce curb maintenance and provide for allowances for curb cuts. • Design landscaped areas or other pervious areas to receive and infiltrate runoff from nearby impervious areas. • Use Tree Wells to intercept, infiltrate, and evapotranspire precipitation and runoff before it reaches structural BMPs. Tree wells can be used to limit the size of Drainage Management Areas that must be treated by structural BMPs. Guidelines for Tree Wells are included in the Tree Well Fact Sheet in the LID BMP Design Handbook.
Discuss how this was included or provide a discussion/justification for "No" or "N/A" answer. *On-site landscaped areas are depressed below adjacent hardscape to accept runoff from adjacent hardscape where shown on the enclosed site plan. Sky Canyon Drive and Winchester Road improvements incorporate drainage swales to qualify for Green Streets Exemption.*	
☒ Yes ☐ No ☐ N/A	**Did you utilize native or drought tolerant species in site landscaping?** Wherever possible, use native or drought tolerant species within site landscaping instead of alternatives. These plants are uniquely suited to local soils and climate and can reduce the overall demands for potable water use associated with irrigation.
Discuss how this was included or provide a discussion/justification for "No" or "N/A" answer. *The project will use drought tolerant and native species in the landscaped areas consistent with the Riverside County water conservation guidelines.*	

Project- Specific WQMP Site Design BMP Checklist

Did implement harvest and use of runoff?

Under the Regional MS4 Permit, Harvest and Use BMPs must be employed to reduce runoff on any site where they are applicable and feasible. However, Harvest and Use BMPs are effective for retention of stormwater runoff only when there is adequate demand for non-potable water during the wet season. If demand for non-potable water is not sufficiently large, the actual retention of stormwater runoff will be diminished during larger storms or during back-to-back storms.

For the purposes of planning level Harvest and Use BMP feasibility screening, Harvest and Use is only considered to be a feasible if the total average wet season demand for non-potable water is sufficiently large to use the entire DCV within 72 hours. If the average wet season demand for non-potable water is not sufficiently large to use the entire DCV within 72 hours, then Harvest and Use is not considered to be feasible and need not be considered further.

☐ Yes ☒ No ☐ N/A

The general feasibility and applicability of Harvest and Use BMPs should consider:

- Any downstream impacts related to water rights that could arise from capturing stormwater (not common).
- Conflicts with recycled water used – where the project is conditioned to use recycled water for irrigation, this should be given priority over stormwater capture as it is a year-round supply of water.
- Code Compliance - If a particular use of captured stormwater, and/or available methods for storage of captured stormwater would be contrary to building codes in effect at the time of approval of the preliminary Project-Specific WQMP, then an evaluation of harvesting and use for that use would not be required.
- Wet season demand – the applicant shall demonstrate, to the acceptance of the County of Riverside, that there is adequate demand for harvested water during the wet season to drain the system in a reasonable amount of time.

Discuss how this was included or provide a discussion/justification for "No" or "N/A" answer. *Irrigation and Toilet use anticipated demands are less than the applicable minimum values required for feasibility*.

Did you keep the runoff from sediment producing pervious area hydrologically separate from developed areas that require treatment?

☒ Yes ☐ No ☐ N/A

Pervious area that qualify as self-treating areas or off-site open space should be kept separate from drainage to structural BMPs whenever possible. This helps limit the required size of structural BMPs, helps avoid impacts to sediment supply, and helps reduce clogging risk to BMPs.

Discuss how this was included or provide a discussion/justification for "No" or "N/A" answer. *Runoff from natural areas, jurisdictional areas, and areas that will be developed later does not commingle with runoff from developed areas and proposed street improvements.*

Section C: Delineate Drainage Management Areas (DMAs) & Green Streets

This section provides streamlined guidance and documentation of the DMA delineation and categorization process, for additional information refer to the procedure in Section 3.3 of the SMR WQMP which discusses the methods of delineating and mapping your project site into individual DMAs. Complete Steps 1 to 4 to successfully delineate and categorize DMAs.

Step 1: Identify Surface Types and Drainage Pathways

Carefully delineate pervious areas and impervious areas (including roofs) throughout site and identify overland flow paths and above ground and below ground conveyances. Also identify common points (such as BMPs) that these areas drain to.

Step 2: DMA Delineation

Use the information in Step 1 to divide the entire PDP site into individual, discrete DMAs. Typically, lines delineating DMAs follow grade breaks and roof ridge lines. Where possible, establish separate DMAs for each surface type (e.g., landscaping, pervious paving, or roofs). Assign each DMA a unique code and determine its size in square feet. The total area of your site should total the sum of all of your DMAs (unless water from outside the project limits comingles with water from inside the project limits, i.e. run-on). Complete Table C-1

Table C-1 DMA Identification

DMA Name or Identification	Surface Type(s)[1]	Area (Sq. Ft.)	DMA Type
DA-A	Mixed	807,705	To be Determined in Step 3

Add Columns as Needed. Consider a separate DMA for Tree Wells or other LID principals like Self-Retaining areas are used for mitigation.

Step 3: DMA Classification

Determine how drainage from each DMA will be handled by using information from Steps 1 and 2 and by completing Steps 3.A to 3.C. Each DMA will be classified as one of the following four types:

- Type 'A': Self-Treating Areas:
- Type 'B': Self-Retaining Areas
- Type 'C': Areas Draining to Self-Retaining Areas
- Type 'D': Areas Draining to BMPs

Tree wells are considered Type 'B' areas, and their tributary areas limited to a 10:1 ratio are considered Type 'C' areas. If Tree wells are proposed, consider grading or other features to minimize the pervious runoff to the tree wells, to avoid overwhelming the trees. Type 'A', 'B', and 'C' are considered LID Principals that can be used to minimize or potentially eliminate structural LID BMPs.

If Tree wells are proposed, a landscape architect shall be consulted on the tree selection, since compliance will be determined based on the survival of the tree. The tree type should be noted on the WQMP site map.

Step 3.A – Identify Type 'A' Self-Treating Area

Indicate if the DMAs meet the following criteria by answering "Yes" or "No".

☐ Yes ☒ No	Area is undisturbed from their natural condition OR restored with Native and/or California Friendly vegetative covers.
☐ Yes ☒ No	Area is irrigated, if at all, with appropriate low water use irrigation systems to prevent irrigation runoff.
☐ Yes ☒ No	Runoff from the area will not comingle with runoff from the developed portion of the site, or across other landscaped areas that do not meet the above criteria.

If all answers indicate "Yes," complete Table C-2 to document the DMAs that are classified as Self-Treating Areas.

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

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

Step 3.B – Identify Type 'B' Self-Retaining Area and Type 'C' Areas Draining to Self-Retaining Areas

Type 'B' Self-Retaining Area: A Self-Retaining Area is shallowly depressed 'micro infiltration' areas designed to retain the Design Storm rainfall that reaches the area, without producing any Runoff.

Indicate if the DMAs meet the following criteria by answering "Yes," "No," or "N/A".

☐ Yes ☐ No ☒ N/A	Inlet elevations of area/overflow drains, if any, should be clearly specified to be three inches or more above the low point to promote ponding.
☐ Yes ☐ No ☒ N/A	Soils will be freely draining to not create vector or nuisance conditions.
☐ Yes ☐ No ☒ N/A	Pervious pavements (e.g., crushed stone, porous asphalt, pervious concrete, or permeable pavers) can be self-retaining when constructed with a gravel base course four or more inches deep below any underdrain discharge elevation.

If all answers indicate "Yes," DMAs may be categorized as Type 'B', proceed to identify Type 'C' Areas Draining to Self-Retaining Areas.

Type 'C' Areas Draining to Self-Retaining Areas: Runoff from impervious or partially pervious areas can be managed by routing it to Self-Retaining Areas consistent with the LID Principle discussed in SMR WQMP Section 3.2.5 for 'Dispersing Runoff to Adjacent Pervious Areas'.
Indicate if the DMAs meet the following criteria by answering "Yes" or "No".

☐ Yes ☒ No	The drainage from the tributary area must be directed to and dispersed within the Self-Retaining Area.

☐ Yes ☒ No The maximum ratio of Tributary Area to Self-Retaining area is (2 ÷ Impervious Fraction): 1

If all answers indicate "Yes," DMAs may be categorized as Type 'C'.

Complete Table C-3 and Table C-4 to identify Type 'B' Self-Retaining Areas and Type 'C' Areas Draining to Self-Retaining Areas.

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

Note: Tree well areas can extend well beyond the drip line. The Tree Well area for open top types would include the shallow depressed area at the soil surface. The Tree Well area for Structural Soil Tree Wells or Suspended Pavement Tree Wells includes the area with open-graded gravel or void space over the structural soil or structural cells. Please specify type in this table and WQMP site map. See LID handbook Tree Well factsheet for additional details.

$$\left(\frac{2}{Impervious\ Fraction}\right) : 1$$

(Tributary Area: Self-Retaining Area)

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

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

Note: (See Section 3.3 of SMR WQMP) Ensure that partially pervious areas draining to a Self-Retaining area do not exceed the following ratio:

Step 3.B.1 – Document the use of Green Street Exemption (see Section 3.11 of the WQMP Guidance)

The Regional MS4 Permit specifies that projects that consist of **retrofitting or redevelopment of existing paved alleys, streets, or roads** may be exempted from classification as PDPs if they are designed and constructed in accordance with USEPA Green Streets Guidance. This does not apply for interior roads for PDP projects. For projects with road frontage improvements, Green Street standards can be used in the frontage road right-of-way. The remainder of the project is subject to full WQMP and Hydromodification requirements. See excerpt from Section 3.11 of the WQMP Guidance below:

3.11.4 BMP Sizing Targets for Applicable Green Streets Projects

Applicable green street projects are not required to meet the same sizing requirements for BMPs as other projects, but should attempt to meet a sizing target to the MEP. The following steps are used to size BMPs for applicable Green Streets projects:

1. Delineate drainage areas tributary to BMP locations and compute imperviousness.
2. Determine sizing goal by referring to sizing criteria presented in Section 2.3.2 (V_{BMP}).
3. Attempt to provide the target BMP sizing according to Step 2.
4. If the target criteria cannot be achieved, document the constraints that override the application of BMPs, and provide the largest portion of the sizing criteria that can be reasonably provided given constraints.

Even if BMPs cannot be sized to meet the target sizing criteria, it is still important to design the BMP inlet, energy dissipation, and overflow capacity for the full tributary area to ensure that flooding and scour is avoided. It is strongly recommended that BMPs which are designed to less than their target design volume be designed to bypass peak flows.

Table C-4.1 – Green Streets

DMA Name or ID	Street Name	BMP Sizing Targets Calculations and documenting constraints included in Appendix 6*
	Winchester Road	☐ Yes ☒ No
	Sky Canyon Drive	☐ Yes ☒ No
		☐ Yes ☐ No
		☐ Yes ☐ No
		☐ Yes ☐ No
*WQMP shall not be approved without calculations or documenting constraints for Green Street Exemption.		

NOTE: SIZING TARGETS AND DOCUMENTING CONSTRAINTS TO BE INCLUDED IN FINAL WQMP

Step 3.C – Identify Type 'D' Areas Draining to BMPs

Areas draining to BMPs are those that could not be fully managed through LID Principles (DMA Types A through C) and will instead drain to an LID BMP and/or a Conventional Treatment BMP designed to manage water quality impacts from that area, and Hydromodification where necessary.

Complete Table C-5 to document which DMAs are classified as Areas Draining to BMPs

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

DMA Name or ID	BMP Name or ID Receiving Runoff from DMA
DA-A	BMP1

Note: More than one DMA may drain to a single LID BMP; however, one DMA may not drain to more than one BMP.

Section D: Implement LID BMPs

The Regional MS4 Permit requires the use of LID BMPs to provide retention or treatment of the DCV and includes a BMP hierarchy which requires Full Retention BMPs (Priority 1) to be considered before Biofiltration BMPs (Priority 2) and Flow-Through Treatment BMPs and Alternative Compliance BMPs (Priority 3). LID BMP selection must be based on technical feasibility and should be considered early in the site planning and design process. Use this section to document the selection of LID BMPs for each DMA. Note that feasibility is based on the DMA scale and may vary between DMAs based on site conditions.

D.1 Full Infiltration Applicability

An assessment of the feasibility of utilizing full infiltration BMPs is required for all projects, *except where it can be shown that site design LID principles fully retain the DCV (i.e., all DMAs are Type A, B, or C), or where Harvest and Use BMPs fully retain the DCV. Check the following box if applicable:*

☐ Site design LID principles or Tree Wells fully retain the DCV (i.e., all DMAs are Type A, B, or C), (Proceed to Section E).

If the above box remains unchecked, perform a site-specific evaluation of the feasibility of Infiltration BMPs using each of the applicable criteria identified in Chapter 2.3.3 of the SMR WQMP and complete the remainder of Section D.1.

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 Copermittee, at their discretion, may not require a geotechnical report for small projects as described in Chapter 2 of the SMR WQMP. 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.

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 SMR WQMP in Chapter 2.3.3. 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

Downstream Impacts (SMR WQMP Section 2.3.3.a)		
Does the project site…	**YES**	**NO**
…have any DMAs where infiltration would negatively impact downstream water rights or other Beneficial Uses[3]?		X
If Yes, list affected DMAs:		
Groundwater Protection (SMR WQMP Section 2.3.3.b)		
Does the project site…	**YES**	**NO**
…have any DMAs with industrial, and other land uses that pose a high threat to water quality, which cannot be treated by Bioretention BMPs? Or have DMAs with active industrial process areas?		X
If Yes, list affected DMAs:		
…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 horizontally of a water supply well?		X
If Yes, list affected DMAs:		
…have any DMAs that would restrict BMP locations to within a 2:1 (horizontal: vertical) influence line extending from any septic leach line?		X
If Yes, list affected DMAs:		
…have any DMAs been evaluated by a licensed Geotechnical Engineer, or Environmental Engineer, who has concluded that the soils do not have adequate physical and chemical characteristics for the protection of groundwater, and has treatment provided by amended media layers in Bioretention BMPs been considered in evaluating this factor?		X
If Yes, list affected DMAs:		
Public Safety and Offsite Improvements (SMR WQMP Section 2.3.3.c)		
Does the project site…	**YES**	**NO**
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact, such as potential seepage through fill conditions?		X
If Yes, list affected DMAs:		
Infiltration Characteristics For LID BMPs (SMR WQMP Section 2.3.3.d)		
Does the project site…	**YES**	**NO**
…have measured infiltration rates of less than 2.4 inches / hour? Riverside County may allow measure rates as low as 0.8in/hr to support infiltration BMPs, if the Engineer believes infiltration is appropriate and sustainable. Mark no, if this is the case.	X	
If Yes, list affected DMAs:	All DMAs	
Cut/Fill Conditions (SMR WQMP Section 2.3.3.e)		
Does the project site…	**YES**	**NO**
…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:		
Other Site-Specific Factors (SMR WQMP Section 2.3.3.f)		
Does the project site…	**YES**	**NO**
…have DMAs where the geotechnical investigation discovered other site-specific factors that would preclude effective and/or safe infiltration?		X
Describe here:		

If you answered "Yes" to any of the questions above for any DMA, Infiltration BMPs that rely solely on infiltration should not be used for those DMAs and you should proceed to the assessment for Biofiltration BMPs below. Biofiltration BMPs that provide partial infiltration may still be feasible and should be assessed in Section D.2. Summarize concerns identified in the Geotechnical Report, if any, that resulted in a "YES" response above in the table below.

[3] Such a condition must be substantiated by sufficient modeling to demonstrate an impact and would be subject to County of Riverside discretion. There is not a standardized method for assessing this criterion. Water rights evaluations should be site-specific.

Table D-2 Geotechnical Concerns for Onsite Infiltration

Type of Geotechnical Concern	DMAs Feasible (By Name or ID)	DMAs Infeasible (By Name or ID)
Collapsible Soil		
Expansive Soil		
Slopes		
Liquefaction		
Low Infiltration Rate	None	Full infiltration is infeasible for all DMAs
Other		

D.2 Biofiltration Applicability

This section should document the applicability of biofiltration BMPs for Type D DMAs that are not feasible for full infiltration BMPs. The key decisions to be documented in this section include:

1. Are biofiltration BMPs with partial infiltration feasible?
    a. Biofiltration BMPs must be designed to maximize incidental infiltration via a partial infiltration design unless it is demonstrated that this design is not feasible.
    b. These designs can be used at sites with low infiltration rates where other feasibility factors do not preclude incidental infiltration.

    Document summary in Table D-3.
2. If not, what are the factors that require the use of biofiltration with no infiltration? This may include:
    a. Geotechnical hazards
    b. Water rights issues
    c. Water balance issues
    d. Soil contamination or groundwater quality issues
    e. Very low infiltration rates (factored rates < 0.1 in/hr)
    f. Other factors, demonstrated to the acceptance of the local jurisdiction

    If this applies to any DMAs, then rationale must be documented in Table D-3.
3. Are biofiltration BMPs infeasible?
    a. If yes, then provide a site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5. If you plan to submit an analysis demonstrating the technical infeasibility of LID BMPs, request a pre-submittal meeting with the Copermittee with jurisdiction over the Project site to discuss this option. Proceed below.

Table D-3 Evaluation of Biofiltration BMP Feasibility

DMA ID	Is Partial/ Incidental Infiltration Allowable? (Y/N)	Basis for Infeasibility of Partial Infiltration (provide summary and include supporting basis if partial infiltration not feasible)
DA-A	Yes	

Proprietary Biofiltration BMP Approval Criteria

Does the Co-Permittee allow Proprietary BMPs as an equivalent to Biofiltration, if specific criteria is met?

☐ Yes or ☒ No, if no skip to Section F to document your alternative compliance measures.

If the project will use proprietary BMPs as biofiltration BMPs, then this section and Appendix 5 shall be completed to document that the proprietary BMPs are selected in accordance with Section 2.3.6 of the SMR WQMP and County requirements. Proprietary Biofiltration BMPs must meet both of the following approval criteria:

1. Demonstrate equivalency to Biofiltration by completing the BMP Design worksheet and Proprietary Biofiltration Criteria, which is found in Appendix 5, including all supporting documentation, and
2. Obtain Co-Permittee concurrence for the long term Operation and Maintenance Plan for the proprietary BMP. The Co-Permittee has the sole discretion to allow or reject Proprietary BMPs, especially if they will be maintained publically through a CFD, CSA, or L&LMD.

Add additional rows to Table D-4 to document approval criteria are met for each type of BMP proposed.

Table D-4 Proprietary BMP Approval Requirement Summary

Proposed Proprietary Biofiltration BMP	Approval Criteria	Notes/Comments
Insert BMP Name and Manufacturer Here	BMP Design worksheets and Proprietary Biofiltration Criteria are completed in Appendix 5	☐ Yes or ☐ No Insert text here
	Proposed BMP has an active TAPE GULD Certification for the project pollutants of concern[4] or equivalent 3rd party demonstrated performance.	☐ Yes or ☐ No Insert text here
	Is there any media or cartridge required to maintain the function of the BMP sole-sourced or proprietary in any way? If yes, obtain explicit approval by the Agency. Potentially full replacement costs to a non-proprietary BMP needs to be considered.	☐ Yes or ☐ No If yes, provide the date of concurrence from the Co-Permittee. Insert date here
	☐ The BMP includes biological features including vegetation supported by engineered or other growing media.	Describe features here.

[4] Use Table F-1, F-2, and F-3 to identify and document the pollutants of concern and include these tables in Appendix 5.

D.3 Feasibility Assessment Summaries

From the Infiltration, Biofiltration with Partial Infiltration and Biofiltration with No Infiltration Sections above, complete Table D-5 below to summarize which LID BMPs are technically feasible, and which are not, based upon the established hierarchy.

Table D-5 LID Prioritization Summary Matrix

DMA Name/ID	LID Principles or Tree Wells	LID BMP Hierarchy			No LID (Alternative Compliance)
		1. Infiltration	2. Biofiltration with Partial Infiltration*	3. Biofiltration with No Infiltration*	
DA-A	☐	☐	☒	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

*Includes Proprietary Biofiltration, if accepted by the Co-Permittee.

For those DMAs where LID BMPs are not feasible, provide a narrative in Table D-6 below summarizing why they are not feasible, include your technical infeasibility criteria in Appendix 5, and proceed to Section F below to document Alternative Compliance measures for those DMAs. Recall that each proposed DMA must pass through the LID BMP hierarchy before alternative compliance measures may be considered.

This is based on the clarification letter titled "San Diego Water Board's Expectations of Documentation to Support a Determination of Priority Development Project Infiltration Infeasibility" (April 28, 2017, Via email from San Diego Regional Water Quality Control Board to San Diego County Municipal Storm Water Copermittees[5]).

Table D-6 Summary of Infeasibility Documentation

Question	Narrative Summary (include reference to applicable appendix/attachment/report, as applicable)
a) When in the entitlement process did a geotechnical engineer analyze the site for infiltration feasibility?	N/A
b) When in the entitlement process were other investigations conducted (e.g., groundwater quality, water rights) to evaluate infiltration feasibility?	N/A
c) What was the scope and results of testing, if conducted, or rationale	N/A

[5] http://www.projectcleanwater.org/download/pdp-infiltration-infeasibility/

for why testing was not needed to reach findings?	
d) What public health and safety requirements affected infiltration locations?	N/A
e) What were the conclusions and recommendations of the geotechnical engineer and/or other professional responsible for other investigations?	N/A
f) What was the history of design discussions between the permittee and applicant for the proposed project, resulting in the final design determination related locations feasible for infiltration?	N/A
g) What site design alternatives were considered to achieve infiltration or partial infiltration on site?	N/A
h) What physical impairments (i.e., fire road egress, public safety considerations, utilities) and public safety concerns influenced site layout and infiltration feasibility?	N/A
i) What LID Principles (site design BMPs) were included in the project site design?	N/A

D.4 LID BMP Sizing

Each LID BMP must be designed to ensure that the DCV will be captured by the selected BMPs with no discharge to the storm drain or surface waters during the DCV size storm. Infiltration BMPs must at minimum be sized to capture the DCV to achieve pollutant control requirements.

Biofiltration BMPs must at a minimum be sized to:

- Treat 1.5 times the DCV not reliably retained on site using a volume-base or flow-based sizing method, or
- Include static storage volume, including pore spaces and pre-filter detention volume, at least 0.75 times the portion of the DCV not reliably retained on site.

First**,** calculate the DCV for each LID BMP using the V_{BMP} worksheet in Appendix F of the LID BMP Design Handbook. Second**,** design the LID BMP to meet the required V_{BMP} using the methods included in Section 3 of the LID BMP Design Handbook. Utilize the worksheets found in the LID BMP Design Handbook or consult with the Copermittee to assist you in correctly sizing your LID BMPs. Use Table D-7 below to document the DCV each LID BMP. Provide the completed design procedure sheets for each LID BMP in Appendix 6. You may add additional rows to the table below as needed.

Table D-7 DCV Calculations for LID BMPs

DMA Type/ID	DMA (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Enter BMP Name / Identifier Here*		
	[A]		[B]	[C]	[A] x [C]			
DA-A	*807,705*	*MIXED*	*0.51*	*0.35*	*282,696.75*	*Design Storm Depth (in)*	*DCV, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	807,705				282,696.75	0.62	14,133	***52,583***

[B], [C] is obtained as described in Section 2.6.1.b of the SMR WQMP
[E] is obtained from Exhibit A in the SMR WQMP
[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6.

Complete Table D-8 below to document the Design Capture Volume and the Proposed Volume for each LID BMP. You can add rows to the table as needed. Alternatively, the Santa Margarita Hydrology Model (SMRHM) can be used to size LID BMPs to address the DCV and, if applicable, to size Hydrologic Control BMPs to meet the Hydrologic Performance Standard described in the SMR WQMP, as identified in Section E.

Table D-8 LID BMP Sizing

BMP Name / ID	DMA No.	BMP Type / Description	Design Capture Volume (ft^3)	Proposed Volume (ft^3)
BMP1	DA-A	BIORETENTION WITH UNDERDRAIN	14,133	52,583

If bioretention will include a capped underdrain, then include sizing calculations demonstrating that the BMP will meet infiltration sizing requirements with the underdrain capped and also meet biofiltration sizing requirements if the underdrain is uncapped.

Section E: Implement Hydrologic Control BMPs and Sediment Supply BMPs

See Appendix 7 for additional required information.

If a completed Table 1.2 demonstrates that the project is exempt from Hydromodification Performance Standards, specify N/A and proceed to Section G.

☐ N/A Project is Exempt from Hydromodification Performance Standards.

If a PDP is not exempt from hydromodification requirements than the PDP must satisfy the requirements of the performance standards for hydrologic control BMPs and Sediment Supply BMPs. The PDP may choose to satisfy hydrologic control requirements using onsite or offsite BMPs (i.e. Alternative Compliance). Sediment supply requirements cannot be met via alternative compliance. If N/A is not selected above, select one of the two options below and complete the applicable sections.

☒ Project is Not Hydromodification Exempt and chooses to implement Hydrologic Control and Sediment Supply BMPs Onsite (complete Section E).

☐ Project is Not Hydromodification Exempt and chooses to implement Hydrologic Control Requirements using Alternative Compliance (complete Section F). Selection of this option must be approved by the Copermittee.

E.1 Hydrologic Control BMP Selection

Capture of the DCV and achievement of the Hydrologic Performance Standard may be met by combined and/or separate structural BMPs. The user should consider the full suite of Hydrologic Control BMPs to manage runoff from the post-development condition and meet the Hydrologic Performance Standard identified in this section.

For the Preliminary WQMP, in lieu of preparing detailed routing calculations, the basin size may be estimated as the difference in volume between the pre-development and post-development hydrograph for the 10-year 24-hour storm event plus the Vbmp. This does not relieve the engineer of the responsibility for meeting the full Hydrologic Control requirements during final design.

The Hydrologic Performance Standard consists of matching or reducing the flow duration curve of post-development conditions to that of pre-existing, naturally occurring conditions, for the range of geomorphically significant flows (the low flow threshold runoff event up to the 10-year runoff event). 10% of the 2-year runoff event can be used for the low flow threshold without any justification. Higher low flow thresholds can be used with site-specific analysis, see Section 2.6.2.b of the WQMP guidance document. Select each of the hydrologic control BMP types that are applied to meet the above performance standard on the site.

☐ LID principles as defined in Section 3.2 of the SMR WQMP, including Tree Wells.

☒ Structural LID BMPs that may be modified or enlarged, if necessary, beyond the DCV.

☐ Structural Hydrologic Control BMPs that are distinct from the LID BMPs above. The LID BMP Design Handbook provides information not only on Hydrologic Control BMP design, but also on BMP design to meet the combined LID requirement and Hydrologic Performance Standard. The Handbook specifies the type of BMPs that can be used to meet the Hydrologic Performance Standard.

E.2 Hydrologic Control BMP Sizing

Hydrologic Control BMPs must be designed to ensure that the flow duration curve of the post-development DMA will not exceed that of the pre-existing, naturally occurring, DMA for the range of geomorphically significant flows. Using SMRHM, (or another acceptable continuous simulation model if approved by the Copermittee) the applicant shall demonstrate that the performance of the Hydrologic Control BMPs complies with the Hydrologic Performance Standard. Complete Table E-1 below and identify, for each DMA, the type of Hydrologic Control BMP, if the SMRHM model confirmed the management (Identified as "passed" in SMRHM), the total volume capacity of the Hydrologic Control BMP, the Hydrologic Control BMP footprint at top floor elevation, and the drawdown time of the Hydrologic Control BMP. SMRHM summary reports should be documented in Appendix 7. Refer to the SMRHM Guidance Document for additional information on SMRHM. You can add rows to the table as needed.

Note: The Riverside County Hydromodification Spreadsheet was used to calculate hydromodification volume requirements.

Table E-1 Hydrologic Control BMP Sizing

BMP Name / ID	DMA No.	BMP Type / Description	SMRHM* Passed	BMP Volume (ac-ft)	BMP Footprint (ac)	Drawdown time (hr)
BMP1	DA-A	Bioretention with partial infiltration and underdrain	☒	0.566	0.42	38.7
			☒			
			☒			
			☒			
			☒			
			☒			
			☒			
			☒			
			☒			

**Or other continuous simulation model, compliant with the WQMP and Permit. If Tree Wells are proposed for some or all of the project, check the box for Tree Wells in Section E.1 and enter each Tree Well DMA in Table E-1 above for the BMP Name/ID, DMA No. and BMP Type/Description. For Tree Wells, leave SMRHM* Passed Column and the columns to the left blank.*

If a bioretention BMP with capped underdrain is used and hydromodification requirements apply, then sizing calculations must demonstrate that the BMP meets flow duration control criteria with the underdrain capped and uncapped. Both calculations must be included.

E.3 Implement Sediment Supply BMPs

The sediment supply performance standard applies to PDPs for which hydromodification applied that have the potential to impact Potential Critical Coarse Sediment Yield Areas. Refer to Exhibit G-1 of the WQMP Guidance Document to determine if there are onsite Potential Critical Coarse Sediment Yield Areas (based on on-going WMAA analysis) or Potential Sediment Source Areas (sites added through the Regional Board review process). Select one of the two options below and include the Potential Critical Coarse Sediment Yield Area Exhibit showing your project location in Appendix 7.

☒ There are no mapped Potential Critical Coarse Sediment Yield Areas or Potential Sediment Source Areas on the site. Include a copy of Exhibit G - CCSY & PSS Areas in Appendix 7, with the project location marked. If the project is outside of the "Potential Critical Coarse Sediment Yield Areas and Potential Sediment Source Areas" then check this box. The Sediment Supply Performance Standard is met with no further action is needed.

☐ There are mapped Potential Critical Coarse Sediment Yield Areas or Potential Sediment Source Areas on the site, the Sediment Supply Performance Standard will be met through Option 1 (E.3.1) or Option 2 (E.3.2) below.

☐ E.3.1 Option 1: Avoid Potential Critical Coarse Sediment Yield Areas and Potential Sediment Source Areas

The simplest approach for complying with the Sediment Supply Performance Standard is to avoid impacts to areas identified as Potential Critical Coarse Sediment Yield Areas or Potential Sediment Supply Areas. If a portion of PDP is identified as a Potential Critical Coarse Sediment Yield Area or a Potential Sediment Source Area, that PDP may still achieve compliance with the Sediment Supply Performance Standards if Potential Critical Coarse Sediment Yield Areas and Potential Sediment Supply Areas are avoided, i.e. areas are not developed and thereby delivery of Critical Coarse Sediment to the receiving waters is not impeded by site developments.

Provide a narrative describing how the PDP has avoided impacts to Potential Critical Coarse Sediment Yield Areas and/or Potential Sediment Source Areas below.

Insert narrative description here

If it is not feasible to avoid these areas, proceed to Option 2 to complete a Site-Specific Critical Coarse Sediment Analysis.

☐ E.3.2 Option 2: Site-Specific Critical Coarse Sediment Analysis

Perform a stepwise assessment to ensure the pre-project source(s) of Critical Coarse Sediment (i.e., Bed Sediment Supply) is maintained:

Step 1: Identify if the site is an actual verified Critical Coarse Sediment Yield Area supplying Bed Sediment Supply to the receiving channel

☐ **Step 1.A** – Is the Bed Sediment of onsite streams similar to that of receiving streams?

Rate the similarity: ☐ High
☐ Medium
☐ Low

Results from the geotechnical and sieve analysis to be performed both onsite and in the receiving channel should be documented in Appendix 7. Of particular interest, the results of the sieve analysis, the soil erodibility factor, a description of the topographic relief of the project area, and the lithology of onsite soils should be reported in Appendix 7.

☐ **Step 1.B** – Are onsite streams capable of delivering Bed Sediment Supply from the site, if any, to the receiving channel?

Rate the potential: ☐ High
☐ Medium
☐ Low

Results from the analyses of the sediment delivery potential to the receiving channel should be documented in Appendix 7 and identify, at a minimum, the Sediment Source, the distance to the receiving channel, the onsite channel density, the project watershed area, the slope, length, land use, and rainfall intensity.

☐ **Step 1.C** – Will the receiving channel adversely respond to a change in Bed Sediment Load?

Rate the need for bed sediment supply:
☐ High
☐ Medium
☐ Low

Results from the in-stream analysis to be performed both onsite should be documented in Appendix 7. The analysis should, at a minimum, quantify the bank stability and the degree of incision, provide a gradation of the Bed Sediment within the receiving channel, and identify if the channel is sediment supply-limited.

☐ **Step 1.D** – Summary of Step 1

Summarize in Table E.3 the findings of Step 1 and associate a score (in parenthesis) to each step. The sum of the three individual scores determines if a stream is a significant contributor to the receiving stream.

- Sum is equal to or greater than eight - Site is a significant source of sediment bed material – all on-site streams must be preserved or by-passed within the site plan. The applicant shall proceed to Step 2 for all onsite streams.
- Sum is greater than five but lower than eight. Site is a source of sediment bed material – some of the on-site streams must be preserved (with identified streams noted). The applicant shall proceed to Step 2 for the identified streams only.

- Sum is equal to or lower than five. Site is not a significant source of sediment bed material. The applicant may advance to Section F.

Table E-2 Triad Assessment Summary

Step	Rating			Total Score
1.A	☐ High (3)	☐ Medium (2)	☐ Low (1)	
1.B	☐ High (3)	☐ Medium (2)	☐ Low (1)	
1.C	☐ High (3)	☐ Medium (2)	☐ Low (1)	
Significant Source Rating of Bed Sediment to the receiving channel(s)				

Step 2: Avoid Development of Critical Coarse Sediment Yield Areas, Potential Sediment Sources Areas, and Preserve Pathways for Transport of Bed Sediment Supply to Receiving Waters

Onsite streams identified as a actual verified Critical Coarse Sediment Yield Areas should be avoided in the site design and transport pathways for Critical Coarse Sediment should be preserved

Check those that apply:

☐ The site design does avoid all onsite channels identified as actual verified Critical Coarse Sediment Yield Areas ***AND***

☐ The drainage design bypasses flow and sediment from onsite upstream drainages identified as actual verified Critical Coarse Sediment Yield Areas to maintain Critical Coarse Sediment supply to receiving waters

(If both are yes, the applicant may disregard subsequent steps of Section E.3 and directly advance directly to Section G)

Or -

Provide in Appendix 7 a site map that identifies all onsite channels and highlights those onsite channels that were identified as a Significant Source of Bed Sediment. The site map shall demonstrate, if feasible, that the site design avoids those onsite channels identified as a Significant Source of Bed Sediment. In addition, the applicant shall describe the characteristics of each onsite channel identified as a Significant Source of Bed Sediment. If the design plan cannot avoid the onsite channels, please provide a rationale for each channel individually.

The site map shall demonstrate that the drainage design bypasses those onsite channels that supply Critical Coarse Sediment to the receiving channel(s). In addition, the applicant shall describe the characteristics of each onsite channel identified as an actual verified Critical Coarse Sediment Yield Area.

Identified Channel #1 - Insert narrative description here

Identified Channel #2 - Insert narrative description here

☐ The site design **does NOT avoid** all onsite channels identified as actual verified Critical Coarse Sediment Yield Areas

OR

☐ The project blocks the potential for Critical Coarse Sediment from migrating to receiving waters.

(If either of these are the case, the applicant shall continue completing this section).

E.3.3 Sediment Supply BMPs to Result in No Net Impact to Downstream Receiving Waters

If impacts to Critical Coarse Sediment Yield Areas cannot be avoided, sediment supply BMPs must be implemented such there is no net impact to receiving waters. Sediment supply BMPs may consist of approaches that permit flux of bed sediment supply from Critical Coarse Sediment Yield Areas within the project boundary. This approach is subject to acceptance by the County of Riverside. It may require extensive documentation and analysis by qualified professionals to support this demonstration.

Appendix H of the San Diego Model BMP Design Manual provides additional information on site-specific investigation of Critical Coarse Sediment Supply areas.

http://www.projectcleanwater.org/download/2018-model-bmp-design-manual/

If applicable, insert narrative description here

Documentation of sediment supply BMPs should be detailed in Appendix 7.

Section F: Alternative Compliance

Alternative Compliance may be used to achieve compliance with pollutant control and/or hydromodification requirements for a given PDP. Alternative Compliance may be used under two scenarios, check the applicable box if the PDP is proposing to use Alternative Compliance to satisfy all or a portion of the Pollutant Control and/or Hydrologic Control requirements (but not sediment supply requirements)

☐ If it is not feasible to fully implement Infiltration or Biofiltration BMPs at a PDP site, Flow-Through Treatment Control BMPs may be used to treat pollutants contained in the portion of DCV not reliably retained on site and Alternative Compliance measures must also be implemented to mitigate for those pollutants in the DCV that are not retained or removed on site prior to discharging to a receiving water.

☐ Alternative Compliance is selected to comply with either pollutant control or hydromodification flow control requirements even if complying with these requirements is potentially feasible on-site. If such voluntary Alternative Compliance is implemented, Flow-Through Treatment Control BMPs must still be used to treat those pollutants in the portion of the DCV not reliably retained on site prior to discharging to a receiving water.

Refer to Section 2.7 of the SMR WQMP and consult the Local Jurisdiction for currently available Alternative Compliance pathways. Coordinate with the Copermittee if electing to participate in Alternative Compliance and complete the sections below to document implementation of the Flow-Through BMP component of the program.

F.1 Identify Pollutants of Concern

The purpose of this section is to help you appropriately plan for mitigating your Pollutants of Concern in lieu of implementing LID BMPs and to document compliance and.

Utilize Table A-1 from Section A, which noted your project's Receiving Waters, to identify impairments for Receiving Waters (including downstream receiving waters) by completing Table F-1. Table F-1 includes the watersheds identified as impaired in the Approved 2010 303(d) list; check box corresponding with the PDP's receiving water. The most recent 303(d) lists are available from the State Water Resources Control Board website:
https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml).https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml.

Table F-1 Summary of Approved 2010 303(d) listed waterbodies and associated pollutants of concern for the Riverside County SMR Region and downstream waterbodies.

	Water Body	Nutrients[1]	Metals[2]	Toxicity	Bacteria and Pathogens	Pesticides and Herbicides	Sulfate	Total Dissolved Solids
☐	De Luz Creek	X	X				X	
☐	Long Canyon Creek		X		X	X		
☐	Murrieta Creek	X	X	X		X		
☐	Redhawk Channel	X	X		X	X		X
☐	Santa Gertudis Creek	X	X		X	X		
☐	Santa Margarita Estuary	X						
☐	Santa Margarita River (Lower)	X			X			
☐	Santa Margarita River (Upper)	X		X				
☐	Temecula Creek	X	X	X		X		X
☐	Warm Springs Creek	X	X		X	X		

[1] Nutrients include nitrogen, phosphorus and eutrophic conditions caused by excess nutrients.

[2] Metals includes copper, iron, and manganese.

Use Table F-2 to identify the pollutants identified with the project site. Indicate the applicable PDP Categories and/or Project Features by checking the boxes that apply. If the identified General Pollutant Categories are the same as those listed for your Receiving Waters, then these will be your Pollutants of Concern; check the appropriate box or boxes in the last row.

Table F-2 Potential Pollutants by Land Use Type

Priority Development Project Categories and/or Project Features (check those that apply)		General Pollutant Categories									
		Bacterial Indicators	Metals	Nutrients	Pesticides	Toxic Organic Compounds	Sediments	Trash & Debris	Oil & Grease	Total Dissolved Solids	Sulfate
☐	Detached Residential Development	P	N	P	P	N	P	P	P	N	N
☐	Attached Residential Development	P	N	P	P	N	P	P	P[(2)]	N	N
☐	Commercial/Industrial Development	P[(3)]	P[(7)]	P[(1)]	P[(1)]	P	P[(1)]	P	P	N	N
☐	Automotive Repair Shops	N	P	N	N	P[(4, 5)]	N	P	P	N	N
☐	Restaurants (>5,000 ft^2)	P	N	N	P[(1)]	N	N	P	P	N	N
☐	Hillside Development (>5,000 ft^2)	P	N	P	P	N	P	P	P	N	N
☐	Parking Lots (>5,000 ft^2)	P[(6)]	P[(7)]	P[(1)]	P[(1)]	P[(4)]	P	P	P	N	N
☐	Streets, Highways, and Freeways	P[(6)]	P[(7)]	P[(1)]	P[(1)]	P[(4)]	P	P	P	N	N
☐	Retail Gasoline Outlets	N	P[(7)]	N	N	P[(4)]	N	P	P	N	N
Project Priority Pollutant(s) of Concern		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

P = Potential

N = Not Potential

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

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

(3) A potential Pollutant is land use involving animal waste products; otherwise not expected

(4) Including petroleum hydrocarbons

(5) Including solvents

(6) Bacterial indicators are routinely detected in pavement runoff

(7) A potential source of metals, primarily copper and zinc. Iron, magnesium, and aluminum are commonly found in the environment and are commonly associated with soils, but are not primarily of anthropogenic stormwater origin in the municipal environment.

F.2 Treatment Control BMP Selection

Treatment Control BMPs typically provide proprietary treatment mechanisms to treat potential Pollutants in runoff, but do not sustain significant biological processes. Treatment Control BMPs must be selected to address the Project Priority Pollutants of Concern (identified above) and meet the acceptance criteria described in Section 2.3.7 of the SMR WQMP. Documentation of acceptance criteria must be included in Appendix 6. In addition, ensure that proposed Treatment Control BMPs are properly identified on the WQMP Site Plan in Appendix 1.

Table F-3 Treatment Control BMP Selection

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

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

F.3 Sizing Criteria

Utilize Table F-4 below to appropriately size flow-through BMPs to the DCV, or Design Flow Rate, as applicable. Please reference Chapter 3.5.1 of the SMR WQMP for further information.

Table F-4 Treatment Control BMP Sizing

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Enter BMP Name / Identifier Here*	
	[A]		[B]	[C]	[A] x [C]		
						Design Storm (in)	*Design Flow Rate (cfs)*
	$A_T = \Sigma[A]$				$\Sigma = [D]$	[E]	$[F] = \frac{[D]x[E]}{[G]}$

[B], [C] is obtained as described in Section 2.6.1.b from the SMR WQMP
[E] either 0.2 inches or 2 times the 85th percentile hourly rainfall intensity
[G] = 43,560,.

F.4 Hydrologic Performance Standard – Alternative Compliance Approach

Alternative compliance options are only available if the governing Copermittee has acknowledged the infeasibility of onsite Hydrologic Control BMPs and approved an alternative compliance approach. See Section 3.5 and 3.6 of the SMR WQMP.

Select the pursued alternative and describe the specifics of the alternative:

☐ Offsite Hydrologic Control Management within the same channel system

Insert narrative description here

☐ In-Stream Restoration Project

Insert narrative description here

For Offsite Hydrologic Control BMP Option

Each Hydrologic Control BMP must be designed to ensure that the flow duration curve of the post-development DMA will not exceed that of the pre-existing, naturally occurring, DMA by more than ten percent over a one-year period. Using SMRHM, the applicant shall demonstrate that the performance of each designed Hydrologic Control BMP is equivalent with the Hydrologic Performance Standard for onsite conditions. Complete Table F-5 below and identify, for each Hydrologic Control BMP, the equivalent DMA the Hydrologic Control BMP mitigates, that the SMRHM model passed, the total volume capacity of the BMP, the BMP footprint at top floor elevation, and the drawdown time of the BMP. SMRHM summary reports for the alternative approach should be documented in Appendix 7. Refer to the SMRHM Guidance Document for additional information on SMRHM. You can add rows to the table as needed.

Table F-5 Offsite Hydrologic Control BMP Sizing

BMP Name / Type	Equivalent DMA (ac)	SMRHM Passed	BMP Volume (ac-ft)	BMP Footprint (ac)	Drawdown time (hr)
		☐			
		☐			
		☐			
		☐			

For Instream Restoration Option

Attach to Appendix 7 the technical report detailing the condition of the receiving channel subject to the proposed hydrologic and sediment regimes. Provide the full design plans for the in-stream restoration project that have been approved by the Copermittee. Utilize the San Diego Regional Water Quality Equivalency Guidance Document.

Section G: Implement Trash Capture BMPs

The Santa Margarita Regional Board has required Full Trash Capture compliance thru Order No. R9-2017-007. For the Santa Margarita Watershed, the County is requiring Track 1 full trash capture compliance for projects proposing the following uses as part of their development after **December 3, 2018**.

- High-density residential: all land uses with at least ten (10) developed dwelling units/acre.
- Industrial: land uses where the primary activities on the developed parcels involve product manufacture, storage, or distribution (e.g., manufacturing businesses, warehouses, equipment storage lots, junkyards, wholesale businesses, distribution centers, or building material sales yards).
- Commercial: land uses where the primary activities on the developed parcels involve the sale or transfer of goods or services to consumers (e.g., business or professional buildings, shops, restaurants, theaters, vehicle repair shops, etc.).
- Mixed urban: land uses where high-density residential, industrial, and/or commercial land uses predominate collectively (i.e., are intermixed).
- Public transportation stations: facilities or sites where public transit agencies' vehicles load or unload passengers or goods (e.g., bus stations and stops).

Riverside County Maintenance is generally supportive of United Storm Water – Connector Pipe Screens or equivalent. Equivalent systems or alternative designs shall be on the State of California Approved Trash Capture Device List and requires approval by the Transportation Department for maintenance. Riverside County is developing Trash Capture Device Standards, which are expected to be added to the Transportation Plan Check Policies and Guidelines when available. Design calculations are not expected to be required if the project uses standard sizes per the County's Trash Capture Device Standards. Until the Trash Capture Device Standards are available and the project uses standard sizes, the project shall complete the following tables and furnish hydraulic analysis calculating the flowrate in the catch basin does not exceed the flowrate capacity of the trash capture device in a fully clogged condition.

Trash Capture BMPs may be applicable to Type 'D' DMAs, as defined in Section 2.3.4 of the SMR WQMP. Trash Capture BMPs are designed to treat Q_{TRASH}, the runoff flow rate generated during the 1-year 1-hour precipitation depth. Utilize Table G-1 to size Trash Capture BMP. Refer to Table G-2 to determine the Trash Capture Design Storm Intensity (E).

Note: Project runoff drains to a proposed bioretention / flood control basin (BMP1) prior to discharging to the MS4. Flows reach the MS4 primarily via the proposed underdrain system. Flow through the overflow riser would occur only during large storm events. Proposed BMP1, as a bioretention with partial infiltration facility, is a Certified Multi-Benefit Treatment System Complying with Trash Full Capture System Requirements per the State Water Resources Control Board, March 9, 2018. See https://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/trash_implementation/mbtscoversheet_revised_09mar18b.pdf

Therefore the requirements of Section G are satisfied and it is not necessary to complete this section.

Table G-1 Sizing Trash Capture 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	*Enter BMP Name / Identifier Here*	
	[A]		[B]	[C]	[A] x [C]		
						Trash Capture Design Storm Intensity (in)	*Trash Capture Design Flow Rate (cubic feet or cfs)*
	$A_T = \Sigma[A]$				$\Sigma = [D]$	[E]	$[F] = \frac{[D]x[E]}{[G]}$

[B], [C] is obtained as described in Section 2.6.1.b from the SMR WQMP
[G] = 43,560

Table G-2 Approximate precipitation depth/intensity values for calculation of the Trash Capture Design Storm

City	1-year 1-hour Precipitation Depth/Intensity (inches/hr)
Murrieta	0.47
Temecula	0.50
Wildomar	0.37

Use Table G-3 to summarize and document the selection and sizing of Trash Capture BMPs.

Table G-3 Trash Capture BMPs

BMP Name / ID	DMA No(s)	BMP Type / Description	Required Trash Capture Flowrate (cfs)	Provided Trash Capture Flowrate (cfs)[1]

[1] For connector pipe screens, the Trash Capture Flowrate shall be based on a fully clogged condition for the screen, where the water level is at the top of the screen. Then determined the Flowrate based on weir equation (Qweir = C x L x H^(2/3), where C = 3.4). The height used to calculate the weir flow rate shall maintain a 6" freeboard to the invert of the catch basin opening at the road. This analysis is meant to replicate the hydraulic analysis used in the County's Full Trash Capture Device Standards.

Section H: Source Control BMPs

Section H need only be completed at the Preliminary WQMP phase if source control is critical to the project successfully handling the anticipated pollutants.

Source Control BMPs include permanent, structural features that may be required in your Project plans, such as roofs over and berms around trash and recycling areas, and Operational BMPs, such as regular sweeping and "housekeeping," that must be implemented by the site's occupant or user. The Maximum Extent Practicable (MEP) standard typically requires both types of BMPs. In general, Operational Source Control BMPs cannot be substituted for a feasible and effective Structural Source Control BMP. Complete checklist below to determine applicable Source Control BMPs for your site.

Project-Specific WQMP Source Control BMP Checklist

All development projects must implement Source Control BMPs. Source Control BMPs are used to minimize pollutants that may discharge to the MS4. Refer to Chapter 3 (Section 3.8) of the SMR WQMP for additional information. Complete Steps 1 and 2 below to identify Source Control BMPs for the project site.

Step 1: Identify Pollutant Sources

Review project site plans and identify the applicable pollutant sources. "Yes" indicates that the pollutant source is applicable to project site. "No" indicates that the pollutant source is not applicable to project site.

☒ Yes ☐ No	Storm Drain Inlets		☐ Yes ☒ No	Outdoor storage areas	
☒ Yes ☐ No	Floor Drains		☐ Yes ☒ No	Material storage areas	
☐ Yes ☒ No	Sump Pumps		☐ Yes ☒ No	Fueling areas	
☒ Yes ☐ No	Pest Control/Herbicide Application		☐ Yes ☒ No	Loading Docks	
☐ Yes ☒ No	Food Service Areas		☐ Yes ☒ No	Fire Sprinkler Test/Maintenance water	
☒ Yes ☐ No	Trash Storage Areas		☒ Yes ☐ No	Plazas, Sidewalks and Parking Lots	
☐ Yes ☒ No	Industrial Processes		☐ Yes ☒ No	Pools, Spas, Fountains and other water features	
☒ Yes ☐ No	Vehicle and Equipment Cleaning and Maintenance/Repair Areas				

Step 2: Required Source Control BMPs

List each Pollutant source identified above in column 1 and fill in the corresponding Structural Source Control BMPs and Operational Control BMPs by referring to the Stormwater Pollutant Sources/Source Control Checklist included in Appendix 8. The resulting list of structural and operational source control BMPs must be implemented as long as the associated sources are present on the project site. Add additional rows as needed.

Pollutant Source	Structural Source Control BMP	Operational Source Control BMP
Storm Drain Inlets	Stencil or signage at all inlets.	Maintain and periodically repaint or replace inlet markings. Provide stormwater pollution prevention information to new employees. Clean out catch basin sumps before they are 40% full

Interior Floor Drains	Interior floor drains will be plumbed to the sanitary sewer.	Inspect and maintain drains to prevent blockages and overflow.
Pest Control/Herbicide Application	There are no native trees or areas of shrubs or groundcover to be undisturbed and retained within the project boundary. Landscape design will minimize irrigation and runoff, promote surface infiltration where appropriate, and minimize the use of fertilizers and pesticides. Proposed basin and landscaped swales will be planted with species that are tolerant of saturated soil conditions. Selected plants are appropriate to site soils, climate, environment, and restrictions due to proximity to French Valley Airport.	Maintain landscaping using minimum or no pesticides.
Trash Storage Areas	Covered Trash Storage Area will be covered and designed to prevent off-site run-on. Refuse to be collected from storage area per local requirements. Signs will be posted on or near dumpsters with the words “Do not dump hazardous materials here” or similar wording acceptable to the County of Riverside.	Clean up trash and debris weekly and as needed. Receptacles shall be inspected regularly and repaired immediately. Receptacles shall be covered at all times. Spills shall be cleaned up immediately. Spill control materials shall be available on-site at convenient locations, clearly marked. Personnel shall be trained in spill prevention and cleanup.
Vehicle and Equipment Cleaning and Maintenance	Cleaning of motorbikes will take place in covered washbays. Washbays walled off so are protected from run-on from adjacent areas by. Drains will be plumbed to the sanitary sewer. Maintenance and tear-down of motorbikes will take place in the indoor research and development facility.	Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system.
Condensate drain lines	Condensate drain lines may discharge to landscape areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system.	

Roofing, gutters, and trim	Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	
Plazas, Sidewalks, Parking Lots		Vacuum sweep on a monthly basis. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer.

Section I: Coordinate Submittal with Other Site Plans

For Final WQMPs, populate Table I-1 below to assist the plan checker in an expeditious review of your project. During construction and at completion, County of Riverside inspectors will verify the installation of BMPs against the approved plans. The first two columns will contain information that was prepared in previous steps, while the last column will be populated with the corresponding plan sheets. This table is to be completed with the submittal of your final Project-Specific WQMP.

Table I-1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)
BMP1	BMP1 – Bioretention with Partial Infiltration	Conceptual Grading Plan
Insert text here	Insert text here	Insert text here
Insert text here	Insert text here	Insert text here
Insert text here	Insert text here	Insert text here
Insert text here	Insert text here	Insert text here

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

Use Table I-2 to identify other applicable permits that may impact design of the site. If yes is answered to any of the items below, the Copermittee may require proof of approval/coverage from those agencies as applicable including documentation of any associated requirements that may affect this Project-Specific WQMP.

Table I-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 Section 401 Water Quality Certification	☒ Y	☐ N
US Army Corps of Engineers, Clean Water Act 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)*County of Riverside Grading and Building Permits	☒ Y	☐ N

Section J: Operation, Maintenance and Funding

Applicant is required to state the intended responsible party for BMP Operation, Maintenance and Funding at the Preliminary WQMP phase. The remaining requirements as outlined above are required for Final WQMP only.

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

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

The Copermittee with jurisdiction over the Project site will also require that you prepare and submit a detailed BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the BMPs built on your site. An agreement assigning responsibility for maintenance and providing for inspections and certification may also be required.

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

Maintenance Mechanism: Maintenance of BMPs is the responsibility of Pierer Immoreal North America, LLC. The cost of maintaining the BMPs is budgeted as part of normal business operations.

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

☐ Y ☒ N

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

Section K: Acronyms, Abbreviations and Definitions

Regional MS4 Permit	Order No. R9-2013-0001 as amended by Order No. R9-2015-0001 and Order No. R9-2015-0100 an NPDES Permit issued by the San Diego Regional Water Quality Control Board.
Applicant	Public or private entity seeking the discretionary approval of new or replaced improvements from the Copermittee with jurisdiction over the project site. The Applicant has overall responsibility for the implementation and the approval of a Priority Development Project. The WQMP uses consistently the term "user" to refer to the applicant such as developer or project proponent. The WQMP employs also the designation "user" to identify the Registered Professional Civil Engineer responsible for submitting the Project-Specific WQMP, and designing the required BMPs.
Best Management Practice (BMP)	Defined in 40 CFR 122.2 as schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States. BMPs also include treatment requirements, operating procedures and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. In the case of municipal storm water permits, BMPs are typically used in place of numeric effluent limits.
BMP Fact Sheets	BMP Fact Sheets are available in the LID BMP Design Handbook. Individual BMP Fact Sheets include sitting considerations, and design and sizing guidelines for seven types of structural BMPs (infiltration basin, infiltration trench, permeable pavement, harvest-and-use, bioretention, extended detention basin, and sand filter).
California Stormwater Quality Association (CASQA)	Publisher of the California Stormwater Best Management Practices Handbooks, available at www.cabmphandbooks.com.
Conventional Treatment Control BMP	A type of BMP that provides treatment of stormwater runoff. Conventional treatment control BMPs, while designed to treat particular Pollutants, typically do not provide the same level of volume reduction as LID BMPs, and commonly require more specialized maintenance than LID BMPs. As such, the Regional MS4 Permit and this WQMP require the use of LID BMPs wherever feasible, before Conventional Treatment BMPs can be considered or implemented.
Copermittees	The Regional MS4 Permit identifies the Cities of Murrieta, Temecula, and Wildomar, the County, and the District, as Copermittees for the SMR.

County	The abbreviation refers to the County of Riverside in this document.
CEQA	California Environmental Quality Act - a statute that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible.
CIMIS	California Irrigation Management Information System - an integrated network of 118 automated active weather stations all over California managed by the California Department of Water Resources.
CWA	Clean Water Act - is the primary federal law governing water pollution. Passed in 1972, the CWA established the goals of eliminating releases of high amounts of toxic substances into water, eliminating additional water pollution by 1985, and ensuring that surface waters would meet standards necessary for human sports and recreation by 1983. CWA Section 402(p) is the federal statute requiring NPDES permits for discharges from MS4s.
CWA Section 303(d) Waterbody	Impaired water in which water quality does not meet applicable water quality standards and/or is not expected to meet water quality standards, even after the application of technology based pollution controls required by the CWA. The discharge of urban runoff to these water bodies by the Copermittees is significant because these discharges can cause or contribute to violations of applicable water quality standards.
Design Storm	The Regional MS4 Permit has established the 85th percentile, 24-hour storm event as the "Design Storm". The applicant may refer to Exhibit A to identify the applicable Design Storm Depth (D85) to the project.
DCV	Design Capture Volume (DCV) is the volume of runoff produced from the Design Storm to be mitigated through LID Retention BMPs, Other LID BMPs and Volume Based Conventional Treatment BMPs, as appropriate.
Design Flow Rate	The design flow rate represents the minimum flow rate capacity that flow-based conventional treatment control BMPs should treat to the MEP, when considered.
DCIA	Directly Connected Impervious Areas - those impervious areas that are hydraulically connected to the MS4 (i.e. street curbs, catch basins, storm drains, etc.) and thence to the structural BMP without flowing over pervious areas.
Discretionary Approval	A decision in which a Copermittee uses its judgment in deciding whether and how to carry out or approve a project.
District	Riverside County Flood Control and Water Conservation District.

DMA	A Drainage Management Area - a delineated portion of a project site that is hydraulically connected to a common structural BMP or conveyance point. The Applicant may refer to Section 3.3 for further guidelines on how to delineate DMAs.
Drawdown Time	Refers to the amount of time the design volume takes to pass through the BMP. The specified or incorporated drawdown times are to ensure that adequate contact or detention time has occurred for treatment, while not creating vector or other nuisance issues. It is important to abide by the drawdown time requirements stated in the fact sheet for each specific BMP.
Effective Area	Area which 1) is suitable for a BMP (for example, if infiltration is potentially feasible for the site based on infeasibility criteria, infiltration must be allowed over this area) and 2) receives runoff from impervious areas.
ESA	An Environmental Sensitive Area (ESA) designates an area "in which plants or animals life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which would be easily disturbed or degraded by human activities and developments". (Reference: California Public Resources Code § 30107.5).
ET	Evapotranspiration (ET) is the loss of water to the atmosphere by the combined processes of evaporation (from soil and plant surfaces) and transpiration (from plant tissues). It is also an indicator of how much water crops, lawn, garden, and trees need for healthy growth and productivity
FAR	The Floor Area Ratio (FAR) is the total square feet of a building divided by the total square feet of the lot the building is located on.
Flow-Based BMP	Flow-based BMPs are conventional treatment control BMPs that are sized to treat the design flow rate.
FPPP	Facility Pollution Prevention Plan
HCOC	Hydrologic Condition of Concern - Exists when the alteration of a site's hydrologic regime caused by development would cause significant impacts on downstream channels and aquatic habitats, alone or in conjunction with impacts of other projects.
HMP	Hydromodification Management Plan – Plan defining Performance Standards for PDPs to manage increases in runoff discharge rates and durations.
Hydrologic Control BMP	BMP to mitigate the increases in runoff discharge rates and durations and meet the Performance Standards set forth in the HMP.
HSG	Hydrologic Soil Groups – soil classification to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. The HSGs are A (very low runoff potential/high infiltration rate), B, C, and D (high runoff potential/very low infiltration rate)

Hydromodification	The Regional MS4 Permit identifies that increased volume, velocity, frequency and discharge duration of storm water runoff from developed areas has the potential to greatly accelerate downstream erosion, impair stream habitat in natural drainages, and negatively impact beneficial uses.
JRMP	A separate Jurisdictional Runoff Management Plan (JRMP) has been developed by each Copermittee and identifies the local programs and activities that the Copermittee is implementing to meet the Regional MS4 Permit requirements.
LID	Low Impact Development (LID) is a site design strategy with a goal of maintaining or replicating the pre-development hydrologic regime through the use of design techniques. LID site design BMPs help preserve and restore the natural hydrologic cycle of the site, allowing for filtration and infiltration which can greatly reduce the volume, peak flow rate, velocity, and pollutant loads of storm water runoff.
LID BMP	A type of stormwater BMP that is based upon Low Impact Development concepts. LID BMPs not only provide highly effective treatment of stormwater runoff, but also yield potentially significant reductions in runoff volume – helping to mimic the pre-project hydrologic regime, and also require less ongoing maintenance than Treatment Control BMPs. The applicant may refer to Chapter 2.
LID BMP Design Handbook	The LID BMP Design Handbook was developed by the Copermittees to provide guidance for the planning, design and maintenance of LID BMPs which may be used to mitigate the water quality impacts of PDPs within the County.
LID Bioretention BMP	LID Bioretention BMPs are bioretention areas are vegetated (i.e., landscaped) shallow depressions that provide storage, infiltration, and evapotranspiration, and provide for pollutant removal (e.g., filtration, adsorption, nutrient uptake) by filtering stormwater through the vegetation and soils. In bioretention areas, pore spaces and organic material in the soils help to retain water in the form of soil moisture and to promote the adsorption of pollutants (e.g., dissolved metals and petroleum hydrocarbons) into the soil matrix. Plants use soil moisture and promote the drying of the soil through transpiration. The Regional MS4 Permit defines "retain" as to keep or hold in a particular place, condition, or position without discharge to surface waters.
LID Biofiltration BMP	BMPs that reduce stormwater pollutant discharges by intercepting rainfall on vegetative canopy, and through incidental infiltration and/or evapotranspiration, and filtration, and other biological and chemical processes. As stormwater passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded, and sequestered by the soil and plants, and collected through an underdrain.

LID Harvest and Reuse BMP	BMPs used to facilitate capturing Stormwater Runoff for later use without negatively impacting downstream water rights or other Beneficial Uses.
LID Infiltration BMP	BMPs to reduce stormwater runoff by capturing and infiltrating the runoff into in-situ soils or amended onsite soils. Typical LID Infiltration BMPs include infiltration basins, infiltration trenches and pervious pavements.
LID Retention BMP	BMPs to ensure full onsite retention without runoff of the DCV such as infiltration basins, bioretention, chambers, trenches, permeable pavement and pavers, harvest and reuse.
LID Principles	Site design concepts that prevent or minimize the causes (or drivers) of post-construction impacts, and help mimic the pre-development hydrologic regime.
MEP	Maximum Extent Practicable - standard established by the 1987 amendments to the CWA for the reduction of Pollutant discharges from MS4s. Refer to Attachment C of the Regional MS4 Permit for a complete definition of MEP.
MF	Multi-family – zoning classification for parcels having 2 or more living residential units.
MS4	Municipal Separate Storm Sewer System (MS4) is a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or designated and approved management agency under section 208 of the CWA that discharges to waters of the United States; (ii) Designated or used for collecting or conveying storm water; (iii) Which is not a combined sewer; (iv) Which is not part of the Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.26.
New Development Project	Defined by the Regional MS4 Permit as 'Priority Development Projects' if the project, or a component of the project meets the categories and thresholds described in Section 1.1.1.
NPDES	National Pollution Discharge Elimination System - Federal program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 318, 402, and 405 of the CWA.
NRCS	Natural Resources Conservation Service

PDP	Priority Development Project - Includes New Development and Redevelopment project categories listed in Provision E.3.b of the Regional MS4 Permit.
Priority Pollutants of Concern	Pollutants expected to be present on the project site and for which a downstream water body is also listed as Impaired under the CWA Section 303(d) list or by a TMDL.
Project-Specific WQMP	A plan specifying and documenting permanent LID Principles and Stormwater BMPs to control post-construction Pollutants and stormwater runoff for the life of the PDP, and the plans for operation and maintenance of those BMPs for the life of the project.
Receiving Waters	Waters of the United States.
Redevelopment Project	The creation, addition, and or replacement of impervious surface on an already developed site. Examples include the expansion of a building footprint, road widening, the addition to or replacement of a structure, and creation or addition of impervious surfaces. Replacement of impervious surfaces includes any activity that is not part of a routine maintenance activity where impervious material(s) are removed, exposing underlying soil during construction. Redevelopment does not include trenching and resurfacing associated with utility work; resurfacing existing roadways; new sidewalk construction, pedestrian ramps, or bike lane on existing roads; and routine replacement of damaged pavement, such as pothole repair. Project that meets the criteria described in Section 1.
Runoff Fund	Runoff Funds have not been established by the Copermittees and are not available to the Applicant. If established, a Runoff Fund will develop regional mitigation projects where PDPs will be able to buy mitigation credits if it is determined that implementing onsite controls is infeasible.
San Diego Regional Board	San Diego Regional Water Quality Control Board - The term "Regional Board", as defined in Water Code section 13050(b), is intended to refer to the California Regional Water Quality Control Board for the San Diego Region as specified in Water Code Section 13200. State agency responsible for managing and regulating water quality in the SMR.
SCCWRP	Southern California Coastal Water Research Project
Site Design BMP	Site design BMPs prevent or minimize the causes (or drivers) of post-construction impacts, and help mimic the pre-development hydrologic regime.
SF	Parcels with a zoning classification for a single residential unit.
SMC	Southern California Stormwater Monitoring Coalition
SMR	The Santa Margarita Region (SMR) represents the portion of the Santa Margarita Watershed that is included within the County of Riverside.

Source Control BMP	Source Control BMPs land use or site planning practices, or structural or nonstructural measures that aim to prevent runoff pollution by reducing the potential for contamination at the source of pollution. Source control BMPs minimize the contact between Pollutants and runoff.
Structural BMP	Structures designed to remove pollutants from stormwater runoff and mitigate hydromodification impacts.
SWPPP	Storm Water Pollution Prevention Plan
Tentative Tract Map	Tentative Tract Maps are required for all subdivision creating five (5) or more parcels, five (5) or more condominiums as defined in Section 783 of the California Civil Code, a community apartment project containing five (5) or more parcels, or for the conversion of a dwelling to a stock cooperative containing five (5) or more dwelling units.
TMDL	Total Maximum Daily Load - the maximum amount of a Pollutant that can be discharged into a waterbody from all sources (point and non-point) and still maintain Water Quality Standards. Under CWA Section 303(d), TMDLs must be developed for all waterbodies that do not meet Water Quality Standards after application of technology-based controls.
USEPA	United States Environmental Protection Agency
Volume-Based BMP	Volume-Based BMPs applies to BMPs where the primary mode of pollutant removal depends upon the volumetric capacity such as detention, retention, and infiltration systems.
WQMP	Water Quality Management Plan
Wet Season	The Regional MS4 Permit defines the wet season from October 1 through April 30.

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

Complete the checklist below to verify all exhibits and components are included in the Project-Specific WQMP. Refer Section 4 of the SMR WQMP and Section D of this Template.

Map and Site Plan Checklist
Indicate all Maps and Site Plans are included in your Project-Specific WQMP by checking the boxes below.
☒ Vicinity and Location Map
☒ Existing Site Map (unless exiting conditions are included in WQMP Site Plan)
☒ WQMP Site Plan
☒ Parcel Boundary and Project Footprint
☒ Existing and Proposed Topography & Drainage Management Areas (DMAs)
☒ Proposed Structural Best Management Practices (BMPs), with cross sections
☒ Drainage Paths
☒ Drainage infrastructure, inlets, overflows
☒ Source Control & Site Design BMPs (notes can be used for BMPs that can't be depicted)
☒ Buildings, Roof Lines, Downspouts
☒ Impervious Surfaces
☒ Pervious Surfaces (i.e. Landscaping)
☒ Standardized Labeling
☐ Use Riverside County Flood Control CB-110 for outlet structure with block outs for a trash screen out the outside, and an orifice/weir plate(s) on the inside of the structure or other design that is as easy to maintain. The screen should be as large as possible to minimize clogging.
☐ If BMPs are in the road R/W (only with CFD/CSA maintenance or LID Principals) add "BMP" paddle markers at the start and end of each BMPs and LID principals
☒ When underdrain are proposed, gravel shall be clean washed gravel, AASHTO #57 stone preferred. Underdrains shall be Schedule 40 PVC, with a minimum slope of 0.005, with cleanouts equal in diameter of the subdrain that extends 6 inches above the media with a lockable screw cap, spaced every 50 feet, at the collector drain line connection, and at any bends.
☒ When BSM is proposed, BSM shall consist of 60-80% clean sand, up to 20% clean topsoil, and 20% of a nutrient-stabilized organic amendment. BSM shall be placed on top of 3-inches of Choker Sand placed on top of 3-inches of ASTM No. 8 stone (1/4 to 1/2-inch pea gravel), and placed on top of 12 to 24-inches of a clean, open-graded drain rock layer.
☐ For Tracts, the Regional Board requires fully functioning WQMP BMPs for opening model home complexes, sales offices, or use of roads (i.e. prior to occupancy or intended use of any portion of the project). The County encourages phasing post-construction BMPs, small structural BMPs (e.g. specifically for sales offices), or self-retaining areas. This phasing can be shown on the WQMP site map and sequencing shall be included on the Grading plans, so that a fully functioning WQMP BMP is addressing any portion of the project that has been granted occupancy or granted the intended use.

KTM NORTH AMERICA - WQMP SITE PLAN

NEC OF WINCHESTER ROAD AND BOREL ROAD, CA

NOTES:
THIS SITE MAP REPRESENTS DRAINAGE AREAS AND BMP LOCATIONS FOR THE PROPOSED DEVELOPMENT. THE CALCULATIONS FOR DCV AND FOR HYDROMODIFICATION ARE BASED ON THE IMPERVIOUS AREA PERCENTAGE RESULTING FROM THE CURRENT DEVELOPMENT.

RUNOFF FROM DA-A WILL DISCHARGE TO PROPOSED BMP1.

NOTE:
THERE ARE NO SUITABILITY/FEASIBILITY CONSTRAINTS.

DESIGN CAPTURE VOLUME

DA-A:

[A] NET AREA 18.54 AC (807,705 SF)

[B] PERCENT IMPERVIOUS: 51%

[C] RUNOFF FACTOR: 0.35

[D] STORM DEPTH (INCHES): 0.62

[E] Vu = [C] X [D] = 0.21

DESIGN CAPTURE VOLUME: 1/12 X [A] X [E] X 43,560 = 14,133 CF

NON-STRUCTURAL SOURCE CONTROL BMPS (SEE SHEET 2 FOR LOCATIONS)

1. EDUCATION OF PROPERTY OWNERS, TENANTS AND OCCUPANTS ON STORMWATER BMPS
2. LANDSCAPE MANAGEMENT BMPS
3. BMP MAINTENANCE
4. LOCAL WATER QUALITY ORDINANCES
5. EMPLOYEE TRAINING
6. CATCH BASIN INSPECTION PROGRAM
7. VACUUM SWEEPING OF PRIVATE STREETS AND PARKING LOTS

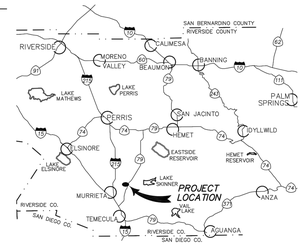
STRUCTURAL SOURCE CONTROL BMPS (SEE SHEET 2 FOR LOCATIONS)

8. STORM DRAIN SYSTEM STENCILING AND SIGNAGE (SD-13)
9. EFFICIENT IRRIGATION SYSTEMS (SD-12)

LID PARTIAL INFILTRATION BMPS

① BIORETENTION BASIN WITH UNDERDRAIN

VICINITY MAP
FOR KTM
IN THE COUNTY OF RIVERSIDE



PROJECT AREA

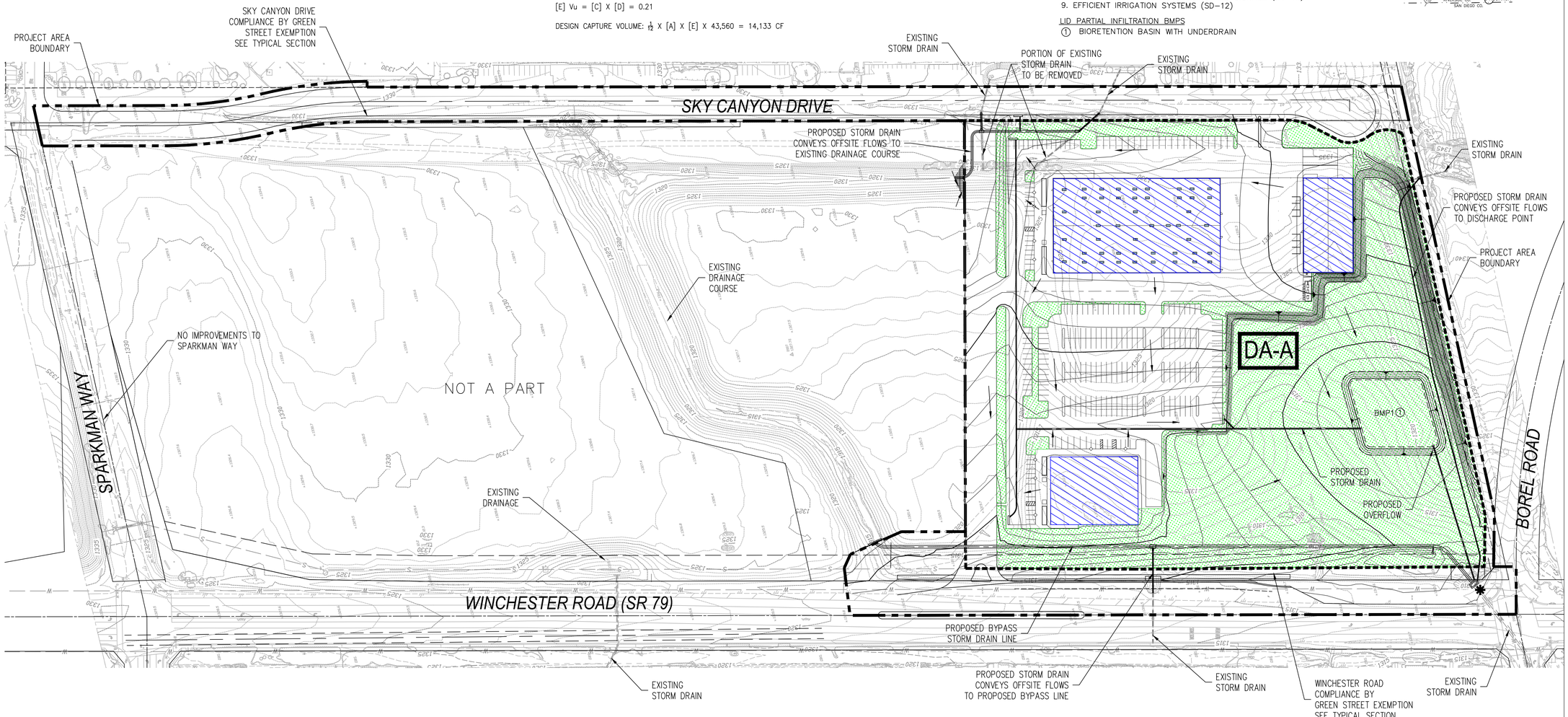
TOTAL PROJECT AREA: 26.25 AC (1,143,556 SF)

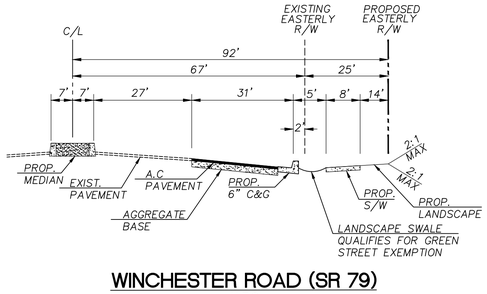
DRAINAGE AREAS

DA-A: 18.54 AC (807,705 SF)

LEGEND

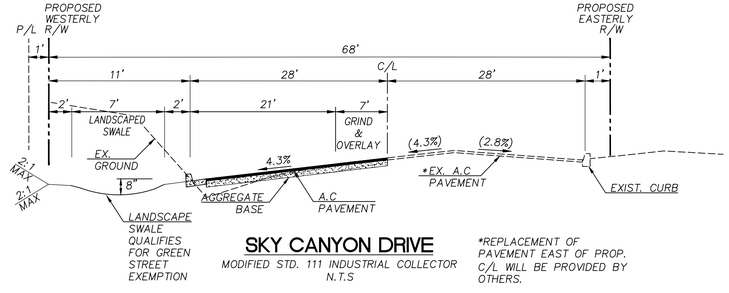
- PROJECT AREA BOUNDARY
- DRAINAGE AREA (DA) BOUNDARY
- ULTIMATE DISCHARGE LOCATION
- LANDSCAPING AREA/ NATURAL OPEN SPACE
- BUILDING AREA
- FLOW DIRECTION
- DA-A — DRAINAGE AREA LABEL





WINCHESTER ROAD (SR 79)
N.T.S

N.T.S



SKY CANYON DRIVE
MODIFIED STD. 111 INDUSTRIAL COLLECTOR
N.T.S

*REPLACEMENT OF PAVEMENT EAST OF PROP. C/L WILL BE PROVIDED BY OTHERS.

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

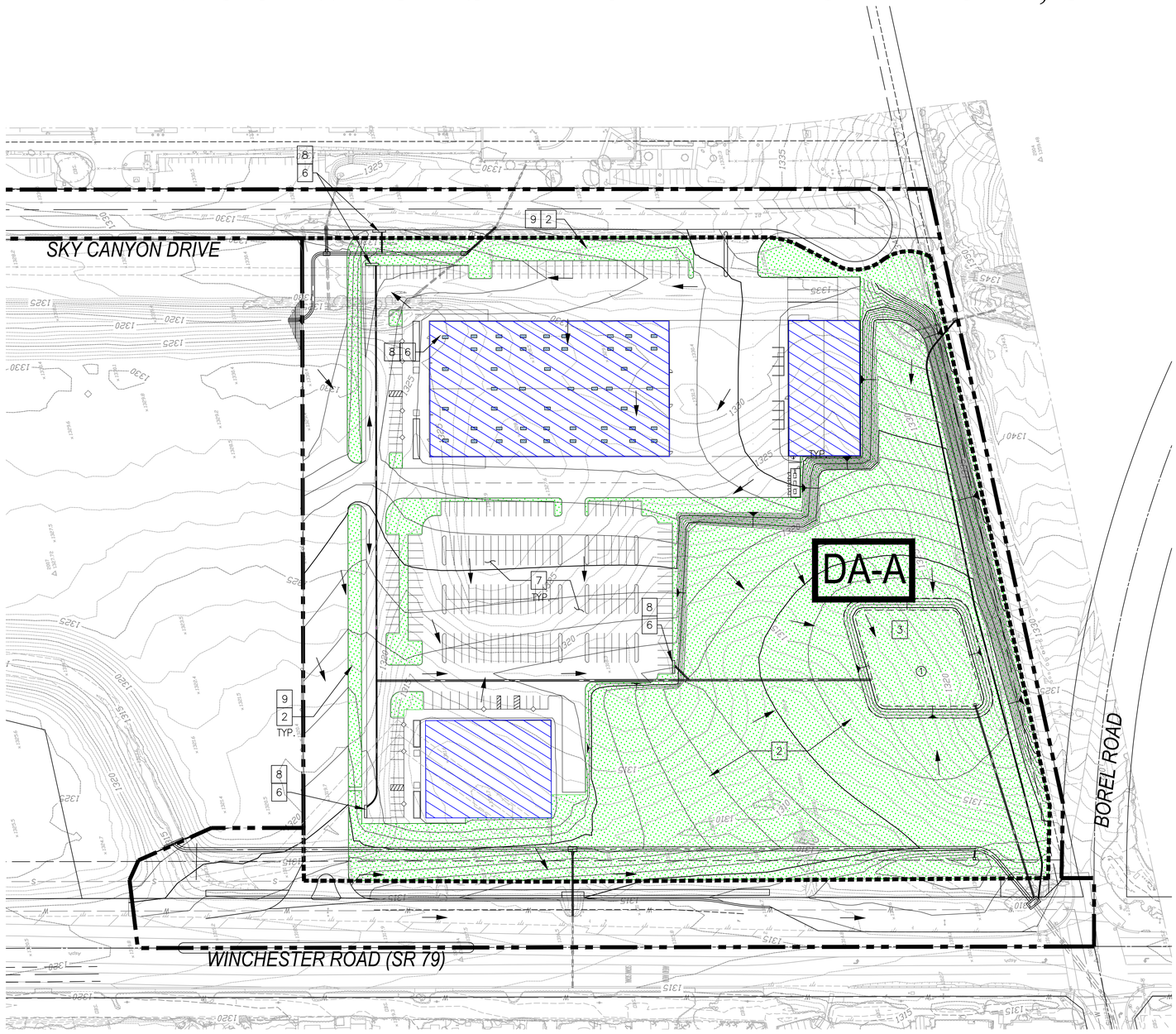
CASC
Engineering and Consulting
1470 EAST COOLEY DRIVE, COLTON, CA 92324
PH. (909) 783-0101 FAX (909) 783-0108
www.cascinc.com

KTM NORTH AMERICA - WQMP SITE PLAN

NEC OF WINCHESTER ROAD AND BOREL ROAD, CA

NOTE:
THIS SITE MAP REPRESENTS DRAINAGE AREAS AND BMP LOCATIONS FOR THE ON-SITE PORTION OF THE PROPOSED DEVELOPMENT.

NOTE:
THERE ARE NO SUITABILITY/FEASIBILITY CONSTRAINTS.



☐ SOURCE CONTROL BMPS

NON-STRUCTURAL SOURCE CONTROL BMPS

1. EDUCATION OF PROPERTY OWNERS, TENANTS, AND OCCUPANTS ON STORMWATER BMPS
2. LANDSCAPE MANAGEMENT BMPS
3. BMP MAINTENANCE
4. LOCAL WATER QUALITY ORDINANCES
5. EMPLOYEE TRAINING
6. CATCH BASIN INSPECTION PROGRAM
7. VACUUM SWEEPING OF PRIVATE STREETS AND PARKING LOTS

STRUCTURAL SOURCE CONTROL BMPS

8. STORM DRAIN SYSTEM STENCILING AND SIGNAGE (SD-13)
9. EFFICIENT IRRIGATION SYSTEMS (SD-12)

LID BMPS

LID BIOFILTRATION WITH PARTIAL INFILTRATION BMPS

① BIORETENTION BASIN WITH UNDERDRAIN

LEGEND

- PROJECT AREA BOUNDARY
- DRAINAGE AREA (DA) BOUNDARY
- ULTIMATE DISCHARGE LOCATION
- LANDSCAPING AREA/ NATURAL OPEN SPACE
- BUILDING AREA
- FLOW DIRECTION
- DA-A — DRAINAGE AREA LABEL

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GRAPHIC SCALE
80 0 40 80 160
1" = 80'

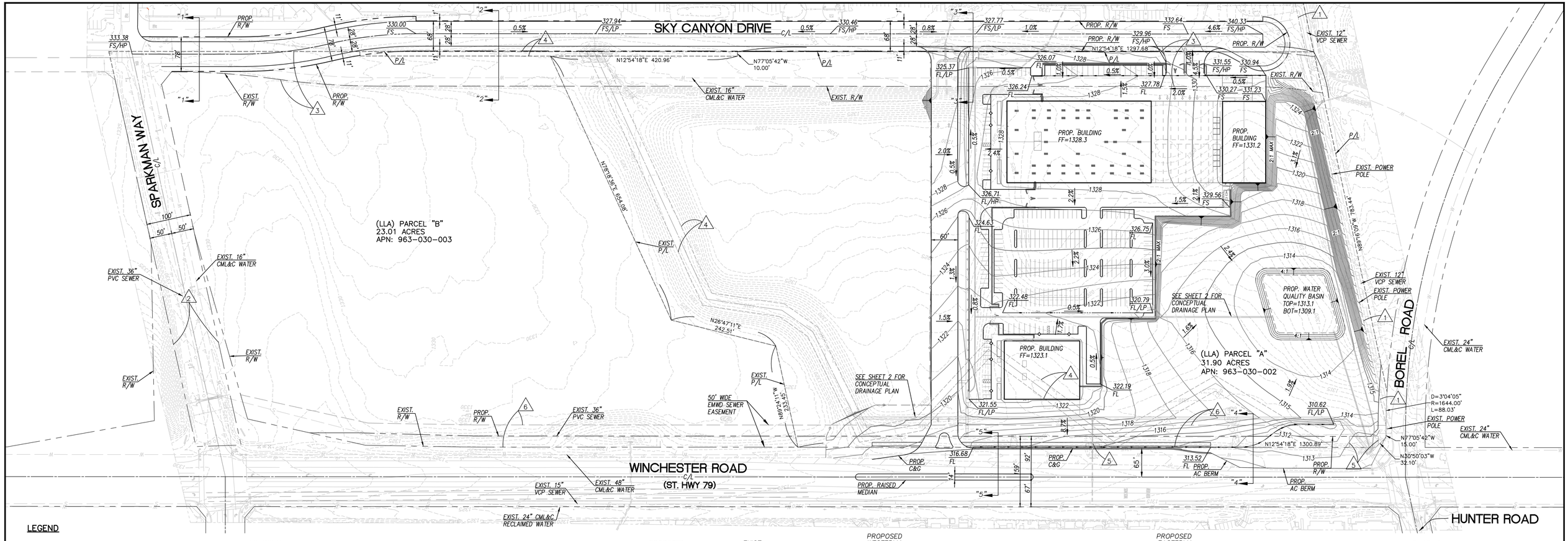
Appendix 2: Construction Plans

*The latest set of Grading, Drainage Plans, and Street Improvement plans **shall be included***

Bioretention/Biofiltration BMPs construction notes (Santa Margarita Region only). For Bioretention and Biofiltration facilities, the **following construction notes shall be shown on the Grading and/or Drainage plans:**

1. *The Engineer shall furnish to the County a copy of the source testing and a signed certification that the fully blended Bioretention/Biofiltration Soil Media (BSM) material meets all of the WQMP requirements before material is imported or if the material is mixed onsite prior to installation.*
2. *As BSM material is being installed, Quality Assurance (QA) tests shall be conducted or for every 1,200 tons or 800 cubic yards mixed on-site from a completely mixed stockpile or windrow, with a minimum of three tests. For imported material from a supplier with a quality control program the QA tests shall be conducted 2,400 tons or 1,600 cubic yards from the supplier.*
3. *The Engineer conducting the Quality Control testing shall furnish to the County copy of the QA testing and a certification that the BSM for the project meets all of the following requirements. Certified mitigation plans can be used for exceedances, as long as all requirements are designed to be met.*
    a. *BSM shall not be compacted. BSM shall consist of 60-80% clean sand, up to 20% clean topsoil, and 20% of a nutrient-stabilized organic amendment. The initial infiltration rate shall be greater than 8 inches per hour per laboratory test.*
    b. *pH: 6.0 – 8.5; Salinity: 0.5 to 3.0 mmho/cm as electrical conductivity; Sodium absorption ratio: < 6.0; Chloride: < 800 ppm in saturated extract; Cation Exchange Capacity (CEC): > 10 meq/100 g; Organic Matter: 2 to 5-percent on a dry weight basis; Carbon: Nitrogen Ratio: 12 to 40, preferably 15 to 40; Gravel larger than 2mm: 0 to 25-percent of the total sample; Clay smaller than 0.005mm: 0 to 5 percent of the non-gravel fraction.*
    c. *BSM shall be tested to limit the leaching of potential inherent pollutants. BSM used in Biofiltration BMPs shall conform to the following limits for pollutant concentrations in saturated extract: Phosphorus: < 1 mg/L; Nitrate < 3 mg/L, Copper < 0.025 mg/L. These pollutant limits are for the amount that is leached from the sample, not from the soil sample itself. Testing may be performed after laboratory rinsing of media with up to 15 pore volumes of water. Equivalent test results will be accepted if certified by a laboratory or appropriate testing facility.*
    d. *Low nutrient compost used in BSM shall be sourced from a facility permitted through CalRecycle, preferably through USCC STA program. Compost shall conform to the following requirements: Physical contaminants <1% by dry weight; Carbon:Nitrogen ratio: 12:1 to 40:1; Maturity/Stability shall conform to either: Solvita Maturity Index: ≥ 5.5, CO2 Evolution: < 2.5 mg CO2-C per g compost organic matter per day, or < 5 mg CO2-C per g compost C per day; Select Pathogens and Trace metals shall pass US EPA Class A Standard. Testing shall be no more than 6 months old and representative of current stockpiles.*
    e. *Coconut coir pith used in BSM shall be thoroughly rinsed with freshwater and screened to remove coarse fibers as part of production and aged > 6 months. Peat used in BSM shall be sphagnum peat.*

Please notify the County if additional sources and laboratories can be added to this list. The Potential Sources and Laboratories are not part of the construction note - **Potential BSM sources may include**: Gail Materials (Temescal Valley), Agriservice (Oceanside), and Greatsoils (Escondido). Earthworks (Riverside); **Potential Laboratories may include**: Fruit Growers Laboratory, Inc. (Santa Paula, http://www.fglinc.com/) Wallace Laboratories (El Segundo, http://us.wlabs.com/). Control Labs (Watsonville, http://www.controllabs.com) and A&L Western Laboratories (Modesto, http://www.al-labs-west.com/).

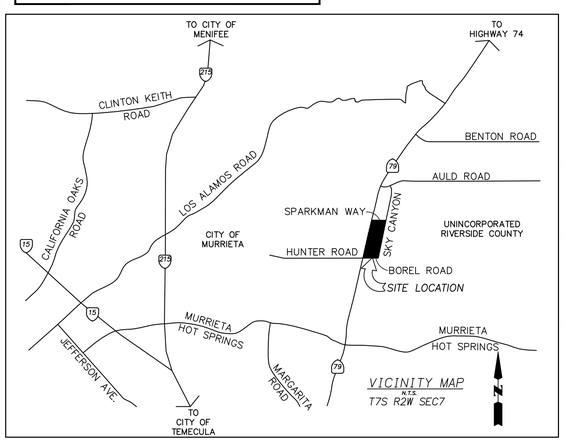


LEGEND

- 1320 PROPOSED CONTOUR
- 1320 EXISTING CONTOUR
- LIMITS OF GRADING
- FLOWLINE
- GRADE BREAK
- SLOPE
- C/L CENTERLINE
- G/B GRADE BREAK
- LP LOW POINT
- FL FLOWLINE
- FS FINISHED SURFACE
- HP HIGH POINT
- P/L PROPERTY LINE
- R/W RIGHT OF WAY

RAW EARTHWORK QUANTITIES

CUT VOLUME (ADJUSTED)	52,200	CU. YD.
FILL VOLUME (ADJUSTED)	67,064	CU. YD.
NET VOLUME (ADJUSTED)	14,864	CU. YD. <FILL>



PROJECT AREA:

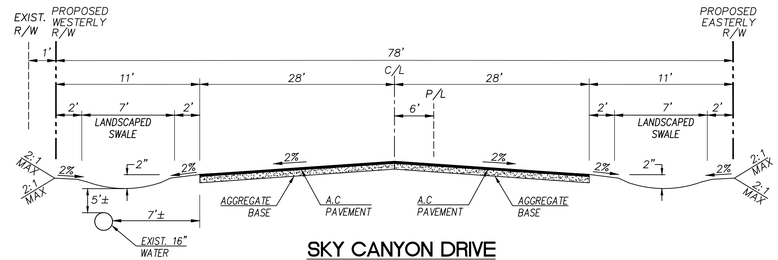
ASSESSOR'S PARCEL NUMBER: 963-030-003 AND 963-030-002
NET AREA = 46.22 ACRES, GROSS AREA = 54.91 ACRES

EASEMENT NOTES

1. EASEMENT GRANTED TO CALIFORNIA ELECTRIC POWER COMPANY PURPOSE PUBLIC UTILITIES RECORDED SEPTEMBER 05, 1947 IN BOOK 847, PAGE 403 OFFICIAL RECORDS.
2. EASEMENT GRANTED TO COUNTY OF RIVERSIDE PURPOSE PUBLIC ROAD AND DRAINAGE PURPOSES, INCLUDING PUBLIC UTILITIES AND PUBLIC SERVICE PURPOSES RECORDING DATE JULY 02, 1986 RECORDING NO. 154436 OFFICIAL RECORDS.
3. EASEMENT GRANTED TO COUNTY OF RIVERSIDE PURPOSE PUBLIC ROAD AND DRAINAGE PURPOSES, INCLUDING PUBLIC UTILITIES AND PUBLIC SERVICE PURPOSES RECORDED JANUARY 29, 1992 RECORDING NO. 31490 OFFICIAL RECORDS.
4. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO AS CONDEMNED BY AN INSTRUMENT, ENTITLED: FINAL ORDER OF CONDEMNATION CASE NO. 196063 IN FAVOR OF COUNTY OF RIVERSIDE PURPOSE SLOPE AND DRAINAGE PURPOSES RECORDED DECEMBER 20, 1993 RECORDING NO: 503849 OFFICIAL RECORDS.
5. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT: GRANTED TO COUNTY OF RIVERSIDE PURPOSE PUBLIC ROAD AND DRAINAGE PURPOSES, INCLUDING PUBLIC UTILITIES AND PUBLIC SERVICE PURPOSES RECORDED AUGUST 11, 1994 RECORDING NO: 315142 OFFICIAL RECORDS.
6. GRANT OF EASEMENT IN FAVOR OF EASTERN MUNICIPAL WATER DISTRICT RECORDED JUNE 28, 2005 RECORDING NO: 2005-0512435 OFFICIAL RECORDS REFERENCE IS HEREBY MADE TO SAID DOCUMENT FOR FULL PARTICULARS.

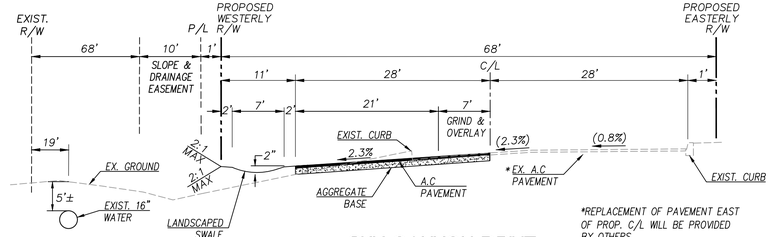
LEGAL DESCRIPTION

BEING A PORTION OF GOVERNMENT LOT 2 OF THE SOUTHWEST ONE-QUARTER OF SECTION 7, TOWNSHIP 7 SOUTH, RANGE 2 WEST, SAN BERNARDINO BASE AND MERIDIAN, IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA.



SKY CANYON DRIVE

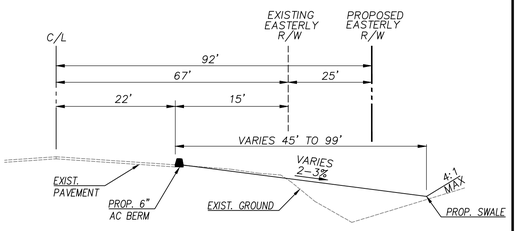
SECTION "1"
MODIFIED STD. 111 INDUSTRIAL COLLECTOR
N.T.S



SKY CANYON DRIVE

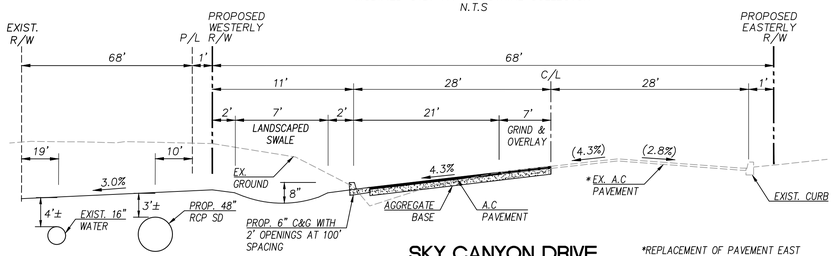
SECTION "2"
MODIFIED STD. 111 INDUSTRIAL COLLECTOR
N.T.S

*REPLACEMENT OF PAVEMENT EAST OF PROP. C/L WILL BE PROVIDED BY OTHERS.



WINCHESTER ROAD (SR 79)

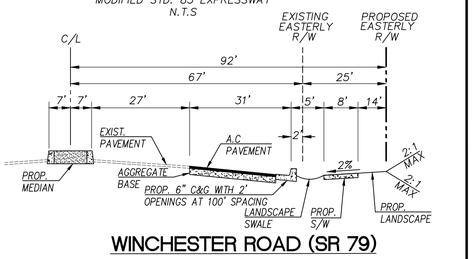
SECTION "4"
MODIFIED STD. 83 EXPRESSWAY
N.T.S



SKY CANYON DRIVE

SECTION "3"
MODIFIED STD. 111 INDUSTRIAL COLLECTOR
N.T.S

*REPLACEMENT OF PAVEMENT EAST OF PROP. C/L WILL BE PROVIDED BY OTHERS.



WINCHESTER ROAD (SR 79)

SECTION "5"
MODIFIED STD. 83 EXPRESSWAY
N.T.S

SHEET 1 OF 2

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

CONCEPTUAL GRADING PLAN
KTM DEVELOPMENT
RIVERSIDE COUNTY, CA

CASC
Engineering and Consulting
1470 EAST COOLEY DRIVE, COLTON, CA 92324
PH. (909) 783-0101 FAX (909) 783-0108
www.cascinc.com

SKY CANYON DRIVE
C/L
SPARKMAN WAY
C/L
BOREL ROAD
C/L
WINCHESTER ROAD
C/L
(ST. HWY 79)
HUNTER ROAD
C/L
PROP. R/W
EXIST. R/W
P/L
EXIST. FL
EXIST. P/L
333.38 FS/HP
330.00 FS
0.5%
327.94 FS/LP
330.46 FS/HP
0.5%
0.8%
327.77 FS/LP
1.0%
332.64 FS
4.6%
340.33 FS/HP
EXIST. 16" CML&C WATER
EXIST. 36" PVC SEWER
EXIST. 66" CMP SD (REPLACE WITH 66" RCP)
EXIST. SD OUTLET (1316.7) INV. Q100=138.9 CFS
EXIST. 36" CMP SD (REPLACE WITH 36" RCP)
Q100=46.0 CFS
1321.0 INV.
PROP. 48" RCP
PROP. SD OUTLET 1320.00 INV. Q100=76.0 CFS
PROP. SD INLET 1326.00 FL 1321.50 INV Q100=5.4 CFS
1321.5 INV.
1321.0 INV.
JOIN EXIST. 24" CMP
Q100=28.0 CFS
1322.20 INV.
EXIST. 24" CMP SD (REPLACE WITH 24" RCP)
PROP. 18" RCP
PROP. 18" RCP SD
PROP. SD INLET 1325.44 FL 1320.25" INV Q100=6.5" CFS
EXIST. 12" VCP SEWER
1336.08 INV Q100=5.8 CFS
EXIST. 18" CMP
JOIN EXIST. 18" CMP
PROP. 18" RCP
PROP. 24" RCP SD
315.60 INV.
313.06 INV.
PROP. 30" RCP SD
PROP. SD INLET 1321.07 FL 1315.07 INV. Q100=18.6 CFS
PROP. SD OUTLET 1309.70 INV./FL Q100=28.6 CFS
PROP. WATER QUALITY BASIN TOP=1313.1 BOT=1309.1
PROP. SD INLET 1309.10 FL 1305.06 INV. Q100=48.0 CFS
PROP. RCP SD
1304.58 INV
PROP. 18" RCP SD
EXIST. 24" CML&C WATER
PROP. SD INLET 1321.63 FL 1316.63 INV. Q100=6.5 CFS
PROP. 18" RCP SD
50' WIDE EMWD SEWER EASEMENT
PROP. SD INLET 1313.60 INV./FL Q100=241.6 CFS
PROP. 60" RCP SD
1309.10 INV
PROP. 60" RCP SD
PROP. 24" RCP SD
1310.53 INV.
JOIN EXIST. 24" RCP
EXIST. 24" RCP
EXIST. R/W
PROP. R/W
PROP. SD INLET 1310.62 TG 1307.0 INV. Q100=10.8 CFS
JOIN EXIST. 78" RCP (1303.70) INV Q100=304.0 CFS
EXIST. 78" RCP SD
EXIST. 24" CML&C WATER
EXIST. 12" SEWER
EXIST. 48" CML&C WATER
EXIST. 15" VCP SEWER
EXIST. 24" CML&C RECLAIMED WATER
EXIST. 36" RCP

LEGEND

— — — —	PROJECT BOUNDARY
13XX	PROPOSED CONTOUR
13XX	EXISTING CONTOUR
— — ○ — —	DAYLIGHT
— — — —	GRADE BREAK
	SLOPE
C/L	CENTERLINE
EXIST.	EXISTING
PROP.	PROPOSED
P/L	PROPERTY LINE
FL	FLOWLINE
INV.	INVERT
SD	STORM DRAIN

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

CONCEPTUAL DRAINAGE PLAN
KTM DEVELOPMENT
RIVERSIDE COUNTY, CA

CASC
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www.cascinc.com

Appendix 3: Soils Information

Geotechnical Study, Other Infiltration Testing Data, and/or Other Documentation

Examples of material to provide in Appendix 3 may include but are not limited to the following:

- Geotechnical Study/Report prepared for the project,
- Additional soils testing data (if not included in the Geotechnical Study),
- Exhibits/Maps/Other Documentation of the Hydrologic Soils Groups (HSG)s at the project site.

This information should support the Full Infiltration Applicability, and Biofiltration Applicability sections of this Template. Refer to Section 2.3 of the SMR WQMP and Sections A and D of this Template.

The County will accept explicit recommendations from the Geotechnical Engineer, such as specifying a design infiltration rate (unfactored) when infiltration rates vary, recommendations for impermeable liners due to concerns about seepage in fill areas/near gas tanks, or other site specific recommendations based on physical conditions.

UPDATED GEOTECHNICAL INVESTIGATION

KTM DEVELOPMENT
NEC OF HWY 79 AND BOREL ROAD
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

GEOCON
WEST, INC.

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

KTM NORTH AMERICA, INC.
MURRIETA, CALIFORNIA

AUGUST 18, 2017
PROJECT NO. T2788-22-01

Project No. T2788-22-01
August 18, 2017

KTM North America, Inc.
38429 Innovation Court
Murrieta, California 92563

Attention: Ms. Cheryl Webb

Subject: UPDATED GEOTECHNICAL INVESTIGATION
KTM DEVELOPMENT
NEC HWY 79 AND BOREL ROAD
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

Dear Ms. Webb:

In accordance with your authorization of Proposal IE-1910 dated April 26, 2017, Geocon West, Inc. (Geocon) herein submits the results of our updated geotechnical investigation for the proposed KTM development to be located on approximately 53 acres immediately west of the French Valley Airport northeast of the intersection of Borel Road and Highway 79 in the French Valley area of Riverside County, California. The accompanying report presents our findings, conclusions and recommendations pertaining to the geotechnical aspects of the proposed development. Based on the results of our investigation, it is our opinion that the site can be developed as proposed, provided the recommendations of this report are followed and implemented during design and construction.

Should you have any questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON WEST, INC.

PROFESSIONAL GEOLOGIST
LISA A. BATTIATO
No. 2316
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Lisa A. Battiato
CEG 2316

REGISTERED PROFESSIONAL ENGINEER
CHET E. ROBINSON
No. 2890
GEOTECHNICAL
STATE OF CALIFORNIA

Chet E. Robinson
GE 2890

LAB:CER:hd

(email) Addressee

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

UPDATED GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of our updated geotechnical investigation for the proposed KTM development proposed for approximately 53 acres immediately northeast of Borel Road and Highway 79 in the French Valley area of Riverside County, California (see *Vicinity Map*, Figure 1). The purpose of the updated investigation was to evaluate subsurface soil and geologic conditions underlying the area of proposed construction and, based on conditions encountered, to provide preliminary conclusions and recommendations pertaining to the geotechnical aspects of design and construction.

Geocon performed a geotechnical investigation on the site in 2007 which included the excavation of 13 test pits, four seismic refraction traverses, and laboratory testing. At that time, a light industrial/commercial development was being considered for the site. The locations of the field work, geotechnical logs, seismic refraction report, and laboratory test results are included herein for ease of reference. The previous geotechnical work is depicted on the *Geotechnical Map* (see Figure 2).

The scope of our recent work included a site reconnaissance, aerial photograph review, literature review, infiltration testing, laboratory testing, engineering analyses, and the preparation of this report. The approximate locations of the infiltration tests (IT) are presented on the *Geotechnical Map* (see Figure 2). *Appendix A* presents a discussion of the field investigation and logs of the excavations. The pertinent logs from the previous investigation and the results of the seismic refraction survey are also included in *Appendix A*.

Laboratory tests were performed on selected soil samples obtained during the investigation to determine pertinent physical and chemical soil properties. *Appendix B* presents a summary of the laboratory test results. The pertinent laboratory testing from the previous investigation is also included in *Appendix B.*

The recommendations presented herein are based on analysis of the data obtained during the investigation and our experience with similar soil and geologic conditions. References reviewed to prepare this report are provided in the *List of References* section.

If project details vary significantly from those described above, Geocon should be contacted to determine the necessity for review and possible revision of this report.

2. SITE AND PROJECT DESCRIPTION

The approximately 53-acre site is located immediately northeast of Borel Road and Highway 79 (Winchester Road) in the French Valley area of Riverside County, California. The site is bounded on the south by Borel Road, the west by Highway 79, the east by French Valley Airport, and the north by Sparkman Way. The site descends to the south and west with a high elevation of approximately 1335 in the northern area to 1320 along the southern boundary and 1315 within a drainage at the southwestern area of the site. Fill has been placed within the central portion of the site resulting in two level pads. The site is currently undeveloped and is utilized for agriculture.

Based on the aerial photograph review, the site was undeveloped and plowed prior to 1995. The fill was placed on the site between 1995 and 1997 and appears to have been derived from the French Valley Airport north of Sparkman Way. Since 1997 the site has remained similar to today's conditions with two areas of undocumented fill north and south of a central channel with natural topography in the far northern and southern portions of the site.

Grading plans were not available at the time of this report. Based upon current site topography and surrounding grades we anticipate site grades to be changed from 5 to 15 feet to provide level building pads for the proposed development. We anticipate that grading will incorporate a bedrock cut slope up to approximately 15 feet in height descending to the site from the southern boundary. Fill slopes may also be created during grading and are anticipated to be 15 feet or less in height.

The details of site development are not known at this time; however, we understand that a KTM headquarters building will be constructed on a portion of the site. We anticipate that additional commercial or light industrial development and possibly a moto-cross track will also be constructed.

We anticipate that the buildings at the site will consist of one or more concrete tilt-up structures with spread footing foundations and concrete slab-on-grade floors. We anticipate the future buildings would be single-story, approximately 20-foot-high structures with metal roofs. It is anticipated that column loads for these structures will be up to 100 kips and wall loads will be up to 8 kips per linear foot. Preliminary geotechnical recommendations for design of these structures are provided herein. This report and preliminary recommendations should be reviewed once plans for the industrial development are available and additional geotechnical work may be necessary at that time.

If project details differ significantly from those described, Geocon should be contacted for review and possible revision to this report.

3. GEOLOGIC SETTING

The site is located within the Perris Block of the Peninsular Ranges Geomorphic Province. The Perris Block is characterized by granitic highlands which display three elevated erosional surfaces surrounded by alluviated valleys. The Peninsular Ranges are bound by the Transverse Ranges (San Gabrielle and San Bernardino Mountains) to the north and the Colorado Desert Geomorphic Province to the east. The Province extends westward into the Pacific Ocean and southward to the tip of Baja California. Overall the Province is characterized by Cretaceous-age granitic rock and a lesser amount of Mesozoic-age metamorphic rock overlain by terrestrial and marine sediments. Faulting within the province is typically northwest trending and includes the San Andreas, San Jacinto, Elsinore, and Newport-Inglewood faults. Locally, the site is within the northern portion of the Temecula Valley, north of the intersection of the Wildomar and Murrieta Hot Springs faults. Localized faulting is mapped as separating the Cretaceous-age granitic rocks on the northeast from the Quaternary-age Pauba fanglomerate on the southwest. Undocumented fill, alluvium, colluvium and older alluvium overlie granitic bedrock in the vicinity of the site. The regional geology is depicted on Figure 3, *Regional Geologic Map*.

4. GEOLOGIC MATERIALS

4.1 General

Site geologic materials encountered consist of undocumented artificial fill, younger alluvium, colluvium and older alluvium over Cretaceous-age gabbroic bedrock (Kennedy & Morton, 2003). The descriptions of the soil and geologic conditions are shown on the excavation logs located in *Appendix A* and described herein in order of increasing age.

4.2 Undocumented Artificial Fill (afu)

Undocumented artificial fill is located within a majority of the site with exception of approximately the southern 25 percent of the property. Based on Google images, the fill was placed prior to 1997 and appears to have been derived from the airport northeast of Sparkman Way. No geotechnical documentation was provided that would indicate this fill was placed under observation and testing by a geotechnical firm, therefore, it is considered undocumented. The fill soils consist of layers of silty to clayey sands, clays, and silts which were generally brown, loose to dense, dry to moist, and contained some porosity. We found fill depths north of the channel to be 5 to 14 feet and south of the channel to be 5 to 12 feet.

4.3 Younger Alluvium (Qal)

Younger alluvium was encountered within a drainage in the southwestern portion of the site to depths of 5.5 feet. The soil consists of soft to loose clays and silty sands which were wet during our field exploration in 2007.

4.4 Colluvium (Qcol)

Colluvium was encountered above the bedrock in approximately the southern 25 percent of the site. The soil consists of brown clayey sand to clay which were medium dense to stiff and slightly moist in 2007. Depths of colluvium were found to be 3 to 5.5 feet.

4.5 Older Alluvium (Qova)

Older alluvium is mapped across the site (Kennedy & Morton, 2003) and was encountered beneath the undocumented fill in the central and northern portions of the site. The soil consisted of red-brown silty sand and grey clay which was moist, well indurated and difficult to dig. Carbonate was observed on ped facies indicating a pre-Holocene age for the unit.

4.6 Cretaceous-age Gabbroic Bedrock (Kgb)

Cretaceous-age gabbroic bedrock underlies the site at depth and is present within 3 to 5.5 feet of the surface in approximately the southern 25 percent of the site. The unit was excavatable with a backhoe during Geocon's 2007 investigation. Seismic refraction traverses indicate the unit is rippable to depths of 20 feet below existing ground surface.

5. GEOLOGIC STRUCTURE

The geologic structure consists of generally massive granitic bedrock underlying the site with horizontal to gently dipping colluvial and alluvial soils. No jointing or foliation attitudes are depicted on the regional geologic maps in the vicinity of the site.

6. GROUNDWATER

Groundwater was not encountered during this or the previous investigation in 2007 in our explorations conducted to a maximum depth of 15 feet below grade. California Department of Water Resources well data indicates groundwater has been measured at depths of about 45 feet below the ground surface at elevation 1280 to 1285 in wells less than ¼ mile northwest of the site (Wells 07S03W12H001S and 07S03W12J002S), and groundwater was measured at a depth of 8 feet below the ground surface in a well at the elevation of 1288 approximately ½ mile east of the site near the California Aqueduct in 1968 (Well 07S02W07J001S). During the rainy season, localized perched water conditions may develop above less permeable units that may require special consideration during grading operations. Further, groundwater will likely travel along bedrock joints and could reach the surface in an artesian condition within and adjacent to the site. Groundwater elevations are dependent on seasonal precipitation, irrigation, and land use, among other factors, and vary thus.

7. GEOLOGIC HAZARDS

7.1 Surface Fault Rupture

The numerous faults in southern California include active, potentially active, and inactive faults. The criteria for these major groups are based on criteria developed by the California Geological Survey (CGS, formerly known as CDMG) for the Alquist-Priolo Earthquake Fault Zone Program (Bryant and Hart, 2007). By definition, an active fault is one that has had surface displacement within Holocene time (about the last 11,000 years). A potentially active fault has demonstrated surface displacement during Quaternary time (approximately the last 1.6 million years), but has had no known Holocene movement. Faults that have not moved in the last 1.6 million years are considered inactive.

The site is not within a currently established State of California Alquist-Priolo Earthquake Fault Zone (CA DC, 2017a; RCIT, 2017) or a Riverside County Fault Hazard Zone for surface fault rupture hazards. No active or potentially active faults with the potential for surface fault rupture are known to pass directly beneath the site (Morton & Kennedy, 2003).

The closest active fault to the site is the Elsinore fault located approximately 3.8 miles southwest of the site. Faults within a 50-mile radius of the site are listed in Table 7.1.1. Historic earthquakes in southern California of magnitude 6.0 and greater, their magnitude, distance, and direction from the site are listed in Table 7.1.2.

TABLE 7.1.1
ACTIVE FAULTS WITHIN 50 MILES OF THE SITE

Fault Name	Maximum Magnitude (Mw)	Geometry (Slip Character)	Slip Rate (mm/yr)	Information Source	Distance from Site (mi)	Direction from Site
San Jacinto (San Jacinto Valley)	6.9	RL-SS	12.0	a	N	19
Elsinore (Glen Ivy)	6.8	RL-SS	5.0	a	NW	21
San Jacinto (Anza)	7.2	RL-SS	12.0	a	SE	50
Elsinore (Temecula)	6.8	RL-SS	5.0	a	SW	4
San Jacinto (San Bernardino)	6.7	RL-SS	12.0	a	N	35
San Andreas Fault (San Bernardino Segment)	7.5	RL-SS	24.0	a	N	37
Chino Fault	6.7	RL-R-O	1.0	a	NW	38
Whittier Fault	6.8	RL-R-O	2.5	a	NW	50
Pinto Mountain Fault	7.2	LL-SS	2.5	a	NE	39
San Jacinto (Coyote Creek)	6.8	RL-SS	4.0	a	SE	45
Cucamonga Fault	6.9	R	5.0	a	NW	50
Newport-Inglewood (Offshore)	7.1	RL-SS	1.5	a	SW	37
Elsinore (Julian)	7.1	RL-SS	5.0	a	SE	47

Geometry: BT = blind thrust, LL = left lateral, N = normal, O = oblique, R = reverse, RL = right lateral, SS = strike slip.

Information Sources: a = Cao, T., Bryant, W.A., Rowshandel, B., Branum, D., and Wills, C.J., 2003, The Revised 2002 California Probabilistic Seismic Hazard Maps, including Appendices A, B, and C, dated June; b = online Fault Activity Map of California website, maps.conservation.ca.gov/cgs/fam/, as of 1/2017.

n/a = data not available

TABLE 7.1.2
HISTORIC EARTHQUAKE EVENTS WITH RESPECT TO THE SITE

Earthquake (Oldest to Youngest)	Date of Earthquake	Magnitude	Distance to Epicenter (Miles)	Direction to Epicenter
San Jacinto	April 21, 1918	6.8	14	NE
Loma Linda Area	July 22, 1923	6.3	30	NNW
Long Beach	March 10, 1933	6.4	48	W
Buck Ridge	March 25, 1937	6.0	52	ESE
Imperial Valley	May 18, 1940	6.9	59	NE
Desert Hot Springs	December 4, 1948	6.0	50	ENE
Arroyo Salada	March 19, 1954	6.4	63	ESE
Borrego Mountain	April 8, 1968	6.5	69	ESE
San Fernando	February 9, 1971	6.6	98	NW
Joshua Tree	April 22, 1992	6.1	58	ENE
Landers	June 28, 1992	7.3	62	NE
Big Bear	June 28, 1992	6.4	48	NNE
Northridge	January 17, 1994	6.7	98	WNW
Hector Mine	October 16, 1999	7.1	89	NE

7.2 Seismic Design Criteria

The following table summarizes summarizes site-specific design criteria obtained from the 2016 California Building Code (CBC; Based on the 2015 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The data was calculated using the computer program *U.S. Seismic Design Maps*, provided by the USGS. The short spectral response uses a period of 0.2 second. We evaluated the Site Class based on the discussion in Section 1613.3.2 of the 2016 CBC and Table 20.3-1 of ASCE 7-10. The values presented below are for the risk-targeted maximum considered earthquake (MCE_R).

2016 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2016 CBC Reference
Site Class	D	Section 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	1.800g	Figure 1613.3.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.706g	Figure 1613.3.1(2)
Site Coefficient, F_A	1.000	Table 1613.3.3(1)
Site Coefficient, F_V	1.500	Table 1613.3.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	1.800g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE_R Spectral Response Acceleration – (1 sec), S_{M1}	1.059g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	1.200g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.706g	Section 1613.3.4 (Eqn 16-40)

The table below presents the mapped maximum considered geometric mean (MCE_G) seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10.

ASCE 7-10 PEAK GROUND ACCELERATION

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.680g	Figure 22-7
Site Coefficient, F_{PGA}	1.000	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.68g	Section 11.8.3 (Eqn 11.8-1)

Conformance to the criteria in the above tables 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.

7.3 Liquefaction Potential

Liquefaction is a phenomenon in which loose, saturated, relatively cohesionless soil deposits lose shear strength during strong ground motions. Primary factors controlling liquefaction include intensity and duration of ground motion, gradation characteristics of the subsurface soils, in-situ stress conditions, and the depth to groundwater. Liquefaction is typified by a loss of shear strength in the liquefied layers due to rapid increases in pore water pressure generated by earthquake accelerations.

The current standard of practice, as outlined in the "Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California" and "Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California" requires liquefaction analysis to a depth of 50 feet below the lowest portion of the proposed structure. Liquefaction typically occurs in areas where the soils below the water table are composed of poorly consolidated, fine to medium-grained, primarily sandy soil. In addition to the requisite soil conditions, the ground acceleration and duration of the earthquake must also be of a sufficient level to induce liquefaction.

Based on the lack of shallow groundwater, the dense consistency of the soils, and granitic bedrock underlying the site, the potential for liquefaction and associated ground deformations beneath the site is nil.

7.4 Collapsible Soils

Hydroconsolidation is the tendency of unsaturated soil structure to collapse upon saturation resulting in the overall settlement of the effected soil and overlying foundations or improvements supported thereon. Potentially compressible soils underlying the site are typically removed and recompacted during remedial site grading. However, if compressible soil is left in-place, a potential for settlement due to hydroconsolidation of the soil exists.

Fill and alluvial soils obtained during our 2007 investigation were tested for consolidation and hydrocollapse potential. The undocumented artificial fill soils exhibited a collapse potential of 1.3% while the older alluvial soils exhibited a collapse potential of 0.3% when loaded to the anticipated post-grading pressures. The test results indicate that the undocumented artificial fill and older alluvial soils are classified as have a slight (0.1 to 2.0%) degree of specimen collapse in accordance with ASTM D5333.

7.5 Landslides

There are no steep slopes on or adjacent to the site. Therefore, landslides are not a design consideration for the site.

7.6 Rock Fall Hazards

Rock falls are not a design consideration for the site.

7.7 Slope Stability

Grading along the southern boundary of the site will likely result in a bedrock cut slope inclined as steep as 2:1 (h:v) and as high as 15 feet. Fill slopes may also result from grading and are anticipated to be inclined as steep as 2:1 (h:v) and 15 feet or less in height. In general, it is our opinion that cut slopes into the bedrock or fill slopes constructed to a maximum height of 15 feet and with an inclination of 2:1 (h:v) or less will possess Factors of Safety of 1.5 or greater under static loading and 1.1 or greater under seismic loading (see Figures 4 and 5). Specific slope stability analyses should be performed if graded fill slopes over 15 feet or steeper than 2:1 (h:v) are planned at the site. Fill keys should be constructed in accordance with the standard grading specifications in *Appendix C*. Grading of fill slopes should be designed in accordance with the requirements of the local building codes of Riverside County and the 2016 California Building Code (CBC).

7.8 Tsunamis and Seiches

A tsunami is a series of long period waves generated in the ocean by a sudden displacement of large volumes of water. Causes of tsunamis include underwater earthquakes, volcanic eruptions, or offshore slope failures. The first order driving force for locally generated tsunamis offshore southern California is expected to be tectonic deformation from large earthquakes (Legg, *et al.*, 2003). The site is located approximately 40 miles from the nearest coastline; therefore, the negligible risk associated with tsunamis is not a design consideration.

A seiche is a run-up of water within a lake or embayment triggered by fault- or landslide-induced ground displacement. The site is located approximately 3.5 miles west of Lake Skinner. The site is not located within the flood plain for either lake, therefore a seiche emanating from either reservoir is not a design consideration.

7.9 Dam Inundation

Dam inundation is the flooding of an area downstream of a dam as the result of dam failure. Causes of inundation include earthquakes or over filling of a dam. Lake Skinner dam is located 3.5 miles east of the site. The site is not located within a Lake Skinner inundation area (Metropolitan Water District of Southern California, 1992). Therefore, inundation due to dam failure is not a design consideration.

8. SITE INFILTRATION

The infiltration tests were performed to assist in design of the site stormwater best management practices (BMPs) to be used for the project. The test locations were determined by Mr. Mike Gentile of CASC Engineering.

Geocon excavated three test pits to a depth of approximately 5 feet below existing grades. Infiltration testing was performed on August 3, 4, and 7, 2017, in general conformance with the applicable test methods presented in Appendix A of the *Riverside County – Low Impact Development BMP Design Handbook* (Handbook), Section 2.2.2 for double-ring infiltrometers. The test locations are depicted on the *Geotechnical Map*, Figure 2. Site soils consisted of fill above older alluvium (IT-2 and IT-3) and alluvium over granitic bedrock (IT-1). We did not encounter groundwater during our infiltration test or during our previous geotechnical exploration in 2007 conducted to depths of 15 feet.

The double-ring infiltrometer testing was conducted using graduated mariotte tubes to maintain a constant head within the tests apparatus and measure the water volume. Results of the infiltration testing are presented in Table 1 below. The infiltration test readings and a plot of the test results are included in Appendix A. The recommended infiltration rate in Table 1 was evaluated using the inner ring flow.

TABLE 8.1
INFILTRATION TEST RATES

Test ID	IT-1	IT-2	IT-3
Depth to Infiltration Test, ft	5.0	5.0	5.0
Soil Type	Kgb	SC-SM	CL
Infiltration Rate (in/hr):	0.28	0.022	0.006

It is likely the project area contains soils with varying infiltration rates. Please note that the Handbook requires that a factor of safety of 3 be applied to the infiltration rate based on these testing methods.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 General

9.1.1 It is our opinion that soil or geologic conditions were not encountered during the investigation that would preclude the proposed development of the project provided the recommendations presented herein are followed and implemented during design and construction.

9.1.2 Potential geologic hazards at the site include seismic shaking, potentially compressible undocumented artificial fill, young alluvium, and colluvium, and moderately expansive soils. Based on our investigation and available geologic information, active, potentially active, or inactive faults are not present underlying or trending toward the site.

9.1.3 The undocumented artificial fill, young alluvium, and colluvium are considered unsuitable for the support of compacted fill or settlement-sensitive improvements. Remedial grading of the upper soils will be required as discussed herein. Newly placed engineered fill is considered suitable to support additional fill, proposed structures, and improvements.

9.1.4 The site fill, alluvium, and colluvial soils are underlain by older alluvium and granitic bedrock. We did not encountered refusal during excavations and seismic refraction data indicates removals should be attainable with grading equipment in good working order to depths of approximately 20 feet.

9.1.5 Oversize material (greater than six-inches) was observed during our subsurface investigation. If oversize material is encountered it should be disposed of in accordance with *Appendix C*.

9.1.6 Moisture contents are expected to vary based on the season and amount of precipitation. Special handling of the soil should be anticipated, particularly if grading occurs during the rainy season, as drying back of the existing materials may be necessary prior to their use as fill.

9.1.7 Groundwater was not encountered during our exploration on the site to depths of 15 feet. Groundwater is not anticipated within the depths of the planned excavations; however, it is possible that perched water will be encountered during grading during the rainy seasons, and may require special considerations during grading.

9.1.8 Although the majority of on-site soils consist of silty or clayey sands, some granular material, having little to no cohesion and subject to caving in un-shored excavations, should be anticipated at the site. It is the responsibility of the contractor to ensure that excavations and trenches are properly shored and maintained in accordance with OSHA rules and regulations to maintain the stability of adjacent existing improvements.

9.1.9 Proper drainage should be maintained to preserve the design properties of the fill in the graded areas. Recommendations for site drainage are provided herein.

9.1.10 Once grading plans become available, they should be reviewed by this office to determine the necessity for review and possible revision of this report.

9.1.11 Fill slopes and cut slopes are not expected to exceed 15 feet in height and should be constructed at a gradient of 2:1 or flatter. If slope heights or inclinations greater than those assumed herein are incorporated into the project, Geocon should be provided the opportunity to review the slopes for stability.

9.1.12 Changes in the design, location or elevation of improvements, as outlined in this report, should be reviewed by this office. Once grading plans become available, they should be reviewed by this office to determine the necessity for review and possible revision of this report.

9.1.13 Recommended grading specifications are provided in *Appendix C*.

9.2 Soil Characteristics

9.2.1 Based on the material classifications and laboratory testing by Geocon, site soils generally possess a medium expansion potential (expansion index [EI] of 51 to 90), and are considered "expansive" as defined by 2016 California Building Code (CBC) Section 1803.5.3. Table 9.2.1 presents soil classifications based on the EI.

TABLE 9.2.1
SOIL CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	Expansion Classification	2016 CBC Expansion Classification
0 – 20	Very Low	Non-Expansive
21 – 50	Low	Expansive
51 – 90	**Medium**	
91 – 130	High	
Greater Than 130	Very High	

9.2.2 Due to the variability of the materials classifications of the site soils, we anticipate that materials with a "low" to "high" expansion potential will be encountered during earthwork. Site grading should include the placement of soils with an expansion index of 60 or less within the upper 4 feet of building pad areas. Soils with an expansion index greater than 60 should not be placed within 4 feet of the proposed foundations, flatwork or paving improvements. Additional testing for expansion potential should be performed during grading and once final grades are achieved.

9.2.3 Laboratory tests were completed on a sample of the site materials to evaluate the percentage of water-soluble sulfate content. Results from the laboratory water-soluble sulfate content tests indicate that the on-site materials at the location tested possess a sulfate content of 0.003% equating to an exposure class of S0 (Not Applicable) to concrete structures as defined by 2016 CBC Section 1904.3 and ACI 318. Table 9.2.3 presents a summary of concrete requirements set forth by 2016 CBC Section 1904.3 and ACI 318. The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

TABLE 9.2.3
REQUIREMENTS FOR CONCRETE
EXPOSED TO SULFATE-CONTAINING SOLUTIONS

Sulfate Exposure	Exposure Class	Water-Soluble Sulfate Percent by Weight	Cement Type	Maximum Water to Cement Ratio by Weight	Minimum Compressive Strength (psi)
Negligible	**S0**	**0.00-0.10**	**--**	**--**	**2,500**
Moderate	S1	0.10-0.20	II	0.50	4,000
Severe	S2	0.20-2.00	V	0.45	4,500
Very Severe	S3	> 2.00	V+ Pozzolan or Slag	0.45	4,500

9.2.4 Laboratory testing indicates the site soils have a minimum electrical resistivity of 3,000 ohm-cm, possess 50 parts per million chloride, 0.003% sulfate (30 parts per million), and have a pH of 7.6. Based on the laboratory test results, the site would not be classified as "corrosive" in accordance with the Caltrans Corrosion Guidelines (Caltrans, 2012).

TABLE 9.2.4
CALTRANS CORROSION GUIDELINES

Corrosion Exposure	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)	pH
Corrosive	<1,000	500 or greater	2,000 or greater	5.5 or less

9.2.5 Geocon does not practice in the field of corrosion engineering. Therefore, further evaluation by a corrosion engineer should be performed if improvements that could be susceptible to corrosion are planned.

9.3 Grading

9.3.1 Grading should be performed in accordance with the *Recommended Grading Specifications* contained in *Appendix C* and the Grading Ordinances of Riverside County.

9.3.2 Prior to commencing grading, a preconstruction conference should be held at the site with the county inspector, owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

9.3.3 Site preparation should begin with the removal of deleterious material, debris, buried trash, and vegetation. The depth of removal should be such that material exposed in cut areas or soil to be used as fill is relatively free of organic matter. Material generated during stripping and/or site demolition should be exported from the site.

9.3.4 Undocumented artificial fill, young alluvium, and colluvium within the limits of grading should be removed to expose competent older alluvium or bedrock. The depth of removals is generally anticipated to be 3 to 14 feet in depth below existing ground surface based on the subsurface excavation logs. Anticipated removal depths are depicted on the *Geotechnical Map* (see Figure 2). The actual depth of removal should be evaluated by the engineering geologist during grading operations. In general, removals should extend to a depth at which moderately dense older alluvial soils with no visible porosity or bedrock are encountered. For the purposes of this project, moderately dense soils are defined as in-situ, natural soils which have a dry density of at least 85 percent of maximum density based on ASTM D1557. Where over excavation and compaction is to be conducted within building areas, the

excavations should be extended at least 2 feet below the bottom of the planned foundations and laterally a minimum distance of 5 feet beyond the building footprint or for a distance equal to the depth of removal, whichever is greater. Where the lateral over-excavation is not possible, structural setbacks or deepened footings may be required.

9.3.5 Removals in pavement and sidewalk areas should extend at least 2 feet beneath the pavement or flatwork subgrade elevation. The bottom of the excavations should be scarified to a depth of at least 1 foot, moisture conditioned as necessary, and properly compacted.

9.3.6 The cut portion in cut/fill transition areas within proposed structural areas should be over excavated to remove the differential support conditions. Over excavations should extend to a minimum depth of H/3 where H is the deepest fill in the building area. The over excavation should extend 5 feet horizontally from the outside edge of the structural area.

9.3.7 Geocon should observe the removal bottoms to check the competency at the bottom of the removal. Deeper excavations may be required if dry, loose, soft, or porous materials are present at the base of the removals.

9.3.8 The fill placed within 4 feet of proposed foundations should possess an expansion index (EI) of 60 or less.

9.3.9 If perched groundwater or saturated materials are encountered during remedial grading, extensive drying and mixing with drier soil will be required. The excavated materials should then be moisture conditioned as necessary prior to placement as compacted fill.

9.3.10 The site should be brought to finish grade elevations with fill compacted in layers. Layers of fill should be no thicker than will allow for adequate bonding and compaction. Fill, including backfill and scarified ground surfaces, should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density at approximately 2 percent above optimum moisture content as determined by ASTM D 1557. Fill materials placed below optimum moisture content may require additional moisture conditioning prior to placing additional fill.

9.3.11 Import fill (if necessary) should consist of granular materials with an expansion index (EI) of 50 or less, non-corrosive, generally free of deleterious material and contain rock fragments no larger than 6 inches. Geocon should be notified of the import soil source and should perform laboratory testing of import soil prior to its arrival at the site to evaluate its suitability as fill material.

9.3.12 Trench and foundation excavation bottoms must be observed and approved in writing by the Geotechnical Engineer, prior to placing bedding materials, fill, steel, gravel or concrete.

9.4 Graded Slopes

9.4.1 If constructed, fill slopes should be overbuilt at least 2 feet and cut back to grade. The slopes should be track-walked at the completion of each slope such that the fill is compacted to a dry density of at least 90 percent of the laboratory maximum dry density at 2 percent above optimum moisture content. Rocks greater than 6 inches in maximum dimension should not be placed within 15 feet of slope face.

9.4.2 Finished slopes should be landscaped with drought-tolerant vegetation having variable root depths and requiring minimal landscape irrigation. Some of the site soils are granular and have little to no cohesion, so the slope surfaces may be susceptible to erosion. Therefore, the slopes should be drained and properly maintained to reduce the potential for surface erosion. Water should not be allowed to flow down slopes. Construction of earth berms, lined v-ditches or similar are recommended.

9.4.3 Proposed slopes are anticipated to be grossly stable; however, natural factors may result in slope creep and/or lateral fill extension over time. Slope creep is due to alternate wetting and drying of fill soils resulting in downslope movement. Slope creep occurs throughout the life of the slope and may affect improvements within about 10 feet of the top of slope, depending on the slope height. Slope creep can result in differential settlement of the structures supported by the slope. Lateral fill extension (LFE) occurs when expansive soils within the slope experience deep wetting due to rainfall or irrigation. LFE is mitigated as much as practical during grading by placing expansive soils at slightly greater than optimum moisture content.

9.4.4 Landscaping activities should avoid over steepening of slopes or grade changes along slopes. Backfill of irrigation lines should be compacted to 90 percent of the maximum dry density as evaluated by ASTM D1557. Vegetation should be light weight with variable root depth.

9.4.5 Excessive watering should be avoided, and only enough irrigation to support vegetation suitable to the prevailing climate should be applied. Irrigation of natural, ungraded slopes should not be performed. Drainage or irrigation from adjacent improvements should not be directed to the tops of slopes. Drainage should be directed toward streets and approved drainage devices. Areas of seepage may develop after periods of heavy rainfall or irrigation.

9.5 Earthwork Grading Factors

9.5.1 Estimates of shrinkage factors are based on empirical judgments comparing the material in its existing or natural state as encountered in the exploratory excavations to a compacted state. Variations in natural soil density and in compacted fill density render shrinkage value estimates very approximate. As an example, the contractor can compact the fill to a dry density of 90 percent or higher of the laboratory maximum dry density. Thus, the contractor has an approximately 10 percent range of control over the fill volume. Based on our experience and the densities measured during our investigation, the shrinkage of onsite undocumented fill is anticipated to be on the order of 5 to 10 percent, young alluvium is anticipated to shrink 10 to 15 percent, and colluvium is anticipated to shrink 5 to 10 percent when compacted to at least 90 percent of the laboratory maximum dry density. Shrinkage of older alluvium at the site is anticipated to be on the order of 0 to 5 percent when compacted to at least 90 percent of the laboratory maximum dry density. Bedrock is anticipated to bulk from 0 to 5 percent. Please note that this estimate is for preliminary quantity estimates only. Due to the variations in the actual shrinkage/bulking factors, a balance area should be provided to accommodate variations.

9.6 Utility Trench Backfill

9.6.1 Utility trenches should be properly backfilled in accordance with the requirements of the County of Riverside and the latest edition of the *Standard Specifications for Public Works Construction* (Greenbook). The pipes should be bedded with well graded crushed rock or clean sands (Sand Equivalent greater than 30) to a depth of at least one foot over the pipe. The bedding material must be inspected and approved in writing by the Geotechnical Engineer (a representative of Geocon). We recommend that jetting only be performed if trench wall soils have an SE of 15 or greater. The use of well graded crushed rock is only acceptable if used in conjunction with filter fabric to prevent the gravel from having direct contact with soil. The remainder of the trench backfill may be derived from onsite soil or approved import soil, compacted as necessary, until the required compaction is obtained. The use of 2-sack slurry and controlled low strength material (CLSM) are also acceptable as backfill. However, consideration should be given to the possibility of differential settlement where the slurry ends and earthen backfill begins. These transitions should be minimized and additional stabilization should be considered at these transitions.

9.6.2 In accordance with Eastern Municipal Water District (EMWD) requirements, utility excavation bottoms must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon), prior to placing bedding materials, fill, gravel, concrete, or geogrid.

9.7 Foundation and Concrete Slabs-On-Grade Recommendations

9.7.1 The foundation recommendations presented herein are for the proposed building subsequent to the recommended grading. It is our understanding that planned buildings will be supported on conventional shallow foundations with a concrete slab-on-grade deriving support in at least 2 feet of newly placed engineered fill.

9.7.2 Foundations for the structures may consist of either continuous strip footings and/or isolated spread footings. Conventionally reinforced continuous footings should be at least 18 inches wide and extend at least 24 inches below lowest adjacent pad grade. Isolated spread footings should have a minimum width of 24 inches and should extend at least 24 inches below lowest adjacent pad grade. Figure 5 presents a wall/column footing dimension detail depicting lowest adjacent pad grade.

9.7.3 Following remedial grading, foundations for the buildings may be designed for an allowable soil bearing pressure of 2,000 psf (dead plus live load). This soil bearing pressure may be increased by 150 psf and 250 psf for each additional foot of foundation width and depth, respectively, up to a maximum allowable bearing value of 3,000 psf. The allowable bearing pressure may be increased by one-third for transient loads due to wind or seismic forces.

9.7.4 The maximum expected static settlement for the planned structure supported on conventional foundation systems with the above allowable bearing pressure, and deriving support in engineered fill is estimated to be 1 inch and to occur below the heaviest loaded structural element.

9.7.5 Settlement of the foundation system is expected to occur on initial application of loading. Differential settlement is not expected to exceed ½ inch over a horizontal distance of 40 feet.

9.7.6 Once the design and foundation loading configuration proceeds to a more finalized plan, the estimated settlements within this report should be reviewed and revised, if necessary.

9.7.7 Steel reinforcement for continuous footings should consist of at least four No. 4 steel reinforcing bars placed horizontally in the footings, two near the top and two near the bottom. Steel reinforcement for the spread footings should be designed by the project structural engineer.

9.7.8 Foundations near slopes should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.

9.7.9 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisture conditioned, as necessary, to maintain a moist condition as would be expected in such concrete placement.

9.7.10 Building slabs-on-grade deriving support in newly placed engineered fill, not subject to vehicle loading, should be a minimum of 4 inches thick and should be reinforced with a minimum of No. 3 steel reinforcing bars placed 24 inches on center in both horizontal directions. Steel reinforcing should be positioned vertically near the slab midpoint.

9.7.11 Slabs-on-grade that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder placed directly beneath the slab. The vapor retarder and acceptable permeance should be specified by the project architect or developer based on the type of floor covering that will be installed. The vapor retarder design should be consistent with the guidelines presented in Section 9.3 of the American Concrete Institute's (ACI) Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials (ACI 302.2R-06) and should be installed in general conformance with ASTM E1643 (latest edition) and the manufacturer's recommendations. A minimum thickness of 15 mils extruded polyolefin plastic is recommended; vapor retarders which contain recycled content or woven materials are not recommended. The vapor retarder should have a permeance of less than 0.01 perms demonstrated by testing before and after mandatory conditioning. The vapor retarder should be installed in direct contact with the concrete slab with proper perimeter seal. If the California Green Building Code requirements apply to this project, the vapor retarder should be underlain by 4 inches of clean aggregate. It is important that the vapor retarder be puncture resistant since it will be in direct contact with angular gravel. As an alternative to the clean aggregate suggested in the Green Building Code, it is our opinion that the concrete slab-on-grade may be underlain by a vapor retarder over 4 inches of clean sand (sand equivalent greater than 30), since the sand will serve as a capillary break and will minimize the potential for punctures and damage to the vapor barrier.

9.7.12 The bedding sand thickness should be determined by the project foundation engineer, architect, and/or developer. However, we should be contacted to provide recommendations if the bedding sand is thicker than 4 inches. Placement of 3 inches and 4 inches of sand is common practice in southern California for 5-inch and 4-inch thick slabs, respectively. The foundation engineer should provide appropriate concrete mix design criteria and curing measures that may be utilized to assure proper curing of the slab to reduce the potential for rapid moisture loss and subsequent cracking and/or slab curl.

9.7.13 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil (if present), differential settlement of existing soil or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. 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.

9.7.14 Geocon should be consulted to provide additional design parameters as required by the structural engineer.

9.8 Exterior Concrete Flatwork

9.8.1 Exterior concrete flatwork not subject to vehicular traffic should be constructed in accordance with the recommendations herein assuming the subgrade materials possess an Expansion Index of 60 or less. Subgrade soils should be compacted to 90 percent relative compaction at 2 percent above optimum moisture. Slab panels should be a minimum of 4 inches thick and when in excess of 8 feet square should be reinforced with No. 3 reinforcing bars spaced 18 inches center-to-center in both directions to reduce the potential for cracking. In addition, concrete flatwork should be provided with crack control joints to reduce and/or control shrinkage cracking. Crack control spacing should be determined by the project structural engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing. Subgrade soil for exterior slabs not subjected to vehicle loads should be compacted in accordance with criteria presented in the grading section prior to concrete placement. Subgrade soil should be properly compacted and the moisture content of subgrade soil should be verified prior to placing concrete. Base materials will not be required below concrete improvements.

9.8.2 Even with the incorporation of the recommendations of this report, the exterior concrete flatwork has a potential to experience some uplift due to expansive soil beneath grade or differential settlement. The steel reinforcement should overlap continuously in flatwork to reduce the potential for vertical offsets within flatwork.

9.8.3 Where exterior flatwork abuts the structure at entrant or exit points, the exterior slab should be dowelled into the structure's foundation stem wall. This recommendation is intended to reduce the potential for differential elevations that could result from differential settlement or

minor heave of the flatwork. Dowelling details should be designed by the project structural engineer.

9.8.4 The recommendations presented herein are intended to reduce the potential for cracking of exterior slabs as a result of differential movement. However, even with the incorporation of the recommendations presented herein, slabs-on-grade will still crack. The occurrence of concrete shrinkage cracks is independent of the soil supporting characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, the use of crack control joints and proper concrete placement and curing. Crack control joints should be spaced at intervals no greater than 12 feet. Literature provided by the Portland Concrete Association (PCA) and American Concrete Institute (ACI) present recommendations for proper concrete mix, construction, and curing practices, and should be incorporated into project construction.

9.9 Conventional Retaining Walls

9.9.1 The recommendations presented herein are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 10 feet. If walls higher than 10 feet or other types of walls are planned, Geocon should be consulted for additional recommendations.

9.9.2 Retaining wall foundations may be designed in accordance with the recommendations provided in the *Foundation and Concrete Slabs-On-Grade Recommendations* section of this report.

9.9.3 Retaining walls with a level backfill surface that are not restrained at the top should be designed utilizing a triangular distribution of pressure (active pressure) of 35 pcf. Restrained walls are those that are not allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall in feet) at the top of the wall. Where walls are restrained from movement at the top and are retaining a level soil backfill, walls may be designed utilizing a triangular distribution of pressure (at-rest pressure) of 55 pcf. If restrained walls which retain sloping backfill are planned, Geocon should be contacted for additional recommendations.

9.9.4 The wall pressures provided above assume that the proposed retaining walls will support relatively undisturbed older alluvium soils, granitic bedrock, or engineered fill derived from selectively graded onsite soils with an EI of 60 or less. If import soil will be used to backfill proposed retaining walls, revised earth pressures may be required to account for the geotechnical properties of the import soil used as engineered fill. This should be evaluated

once the use of import soil is established. Imported fill should be observed, tested, and approved by Geocon West, Inc. prior to bringing soil to the site.

9.9.5 In addition to the recommended earth pressure, retaining walls adjacent to the street or driveway areas should be designed to resist a uniform lateral pressure of 100 psf, acting as a result of an assumed 300 psf surcharge behind the wall due to normal street traffic. If the traffic is kept back at least 10 feet from the walls, the traffic surcharge may be neglected.

9.9.6 Additional active pressure should be added for a surcharge condition due to sloping ground, vehicular traffic, or adjacent structures. Once the design becomes more finalized, an addendum letter can be prepared revising recommendations and addressing specific surcharge conditions throughout the project, if necessary.

9.9.7 The structural engineer should determine the seismic design category for the project in accordance with Section 1613 of the CBC. If the project possesses a seismic design category of D, E, or F, proposed retaining walls in excess of 6 feet in height should be designed with seismic lateral pressure (Section 1803.5.12 of the 2016 CBC).

9.9.8 A seismic load of 10 pcf should be used for design of walls that support more than 6 feet of backfill in accordance with Section 1803.5.12 of the 2016 CBC. The seismic load is applied as an equivalent fluid pressure along the height of the wall and the calculated loads result in a maximum load exerted at the base of the wall and zero at the top of the wall. This seismic load should be applied in addition to the active earth pressure. The earth pressure is based on half of two-thirds of PGA_M calculated from ASCE 7-10 Section 11.8.3.

9.9.9 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The retaining walls and improvements above the retaining walls should be designed to incorporate an appropriate amount of lateral deflection as determined by the structural engineer.

9.9.10 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and waterproofed as required by the project architect. The soil immediately adjacent to the backfilled retaining wall should be composed of free draining material completely wrapped in Mirafi 140N (or equivalent) filter fabric for a lateral distance of 1 foot for the bottom two-thirds of the height of the retaining wall. The upper one-third should be backfilled with less permeable compacted fill to reduce water infiltration. Alternatively, a drainage panel, such as a Miradrain 6000 or equivalent, can be placed along the back of the wall. The options are shown on Figure 10. The use of drainage

openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The recommendations herein assume a properly compacted backfill (EI of 50 or less) with no hydrostatic forces or imposed surcharge load. If conditions different than those described are expected or if specific drainage details are desired, Geocon should be contacted for additional recommendations.

9.9.11 Wall foundations should be designed in accordance with the above foundation recommendations.

9.10 Lateral Design

9.10.1 To resist lateral loads, a passive pressure exerted by an equivalent fluid weight of 200 pounds per cubic foot (pcf) should be used for the design of footings or shear keys poured neat against newly compacted fill. The allowable passive pressure assumes a horizontal surface extending at least 5 feet, or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in design for passive resistance.

9.10.2 If friction is to be used to resist lateral loads, an allowable coefficient of friction between newly compacted fill soil and concrete of 0.25 should be used for design.

9.11 Preliminary Pavement Recommendations

9.11.1 The final pavement sections for roadways should be based on the R-Value of the subgrade soils encountered at final subgrade elevation. Streets should be designed in accordance with the County of Riverside requirements, when final Traffic Indices and R-Value test results of subgrade soil are completed. Based on our experience with similar soils we have estimated an R-value of 15 for the site. Preliminary flexible pavement sections are presented in Table 9.11.1. We have provided pavement thicknesses for typical roadway classifications. The civil engineer should select the appropriate roadway classification and traffic index based on the anticipated traffic. Geocon should be contacted for additional recommendations if other traffic indices are appropriate for the site roadways.

TABLE 9.11.1
PRELIMINARY FLEXIBLE PAVEMENT SECTIONS

Roadway Classification	Assumed Traffic Index	Assumed Subgrade R-Value	Asphalt Concrete (inches)	Crushed Aggregate Base (inches)
Roadways Servicing Light-Duty Vehicles Local Streets	5.5	15	4.0	7.5
Roadways Servicing Heavy Truck Vehicles Collector Streets	7.0	15	4.0	13.0

9.11.2 The upper 12 inches of the subgrade soil should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 2 percent above optimum moisture content beneath pavement sections.

9.11.3 The crushed aggregated base and asphalt concrete materials should conform to Section 200-2.2 and Section 203-6, respectively, of the *Standard Specifications for Public Works Construction* (Greenbook) and the latest edition of the City of Menifee/Riverside County *Design Standards*. Base materials should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at optimum moisture content. Asphalt concrete should be compacted to a density of 95 percent of the laboratory Hveem density in accordance with ASTM D 1561.

9.11.4 A rigid Portland cement concrete (PCC) pavement section should be placed in driveway aprons and cross gutters and where desired to support heavy vehicle loads. We calculated the rigid pavement section in general conformance with the procedure recommended by the American Concrete Institute report ACI 330R, *Guide for Design and Construction of Concrete Parking Lots* using the parameters presented in Table 8.11.7.

TABLE 9.11.4
RIGID PAVEMENT DESIGN PARAMETERS

Design Parameter	Design Value
Modulus of subgrade reaction, k	75 pci
Modulus of rupture for concrete, M_R	550 psi
Traffic Category, TC	C and D
Average daily truck traffic, ADTT	100 and 700

9.11.5 Based on the criteria presented herein, the PCC pavement sections should have a minimum thickness as presented in Table 8.11.8.

TABLE 9.11.5
RIGID PAVEMENT RECOMMENDATIONS

Roadway Classification	Portland Cement Concrete (inches)
Roadways (TC=C)	7.0
Truck Areas (TC=D)	8.5

9.11.6 The PCC pavement should be placed over subgrade soil that is compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 2 percent above optimum moisture content. This pavement section is based on a minimum concrete compressive strength of approximately 3,500 psi (pounds per square inch). Base material will not be required beneath concrete improvements.

9.11.7 A thickened edge or integral curb should be constructed on the outside of concrete slabs subjected to wheel loads. The thickened edge should be 1.2 times the slab thickness or a minimum thickness of 2 inches, whichever results in a thicker edge, and taper back to the recommended slab thickness 4 feet behind the face of the slab (e.g., a 9-inch-thick slab would have an 11-inch-thick edge). Reinforcing steel will not be necessary within the concrete for geotechnical purposes with the possible exception of dowels at construction joints as discussed herein.

9.11.8 In order to control the location and spread of concrete shrinkage cracks, crack-control joints (weakened plane joints) should be included in the design of the concrete pavement slab in accordance with the referenced ACI report.

9.11.9 Performance of the pavements is highly dependent on providing positive surface drainage away from the edge of the pavement. Ponding of water on or adjacent to the pavement surfaces will likely result in pavement distress and subgrade failure. Drainage from landscaped areas should be directed to controlled drainage structures. Landscape areas adjacent to the edge of asphalt pavements are not recommended due to the potential for surface or irrigation water to infiltrate the underlying permeable aggregate base and cause distress. Where such a condition cannot be avoided, consideration should be given to incorporating measures that will significantly reduce the potential for subsurface water migration into the aggregate base. If planter islands are planned, the perimeter curb should extend at least 6 inches below the level of the base materials.

9.12 Temporary Excavations

9.12.1 It is the responsibility of the contractor to ensure that excavations and trenches are properly shored and maintained in accordance with applicable OSHA rules and regulations to maintain safety and maintain the stability of adjacent existing improvements.

9.12.2 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. Penetrations below this 1:1 projection will require special excavation measures such as sloping or shoring.

9.12.3 Excavations on the order of 5 to 10 feet in vertical height may be required during grading operations and utility installation. The contractor's competent person should evaluate the necessity for layback of vertical cut areas. Vertical excavations up to 5 feet may be attempted where loose soils or caving sands are not present, and where not surcharged by existing structures or vehicle/construction equipment loads.

9.12.4 Vertical excavations greater than 5 feet may require sloping or slot-cutting measures in order to provide a stable excavation. It is anticipated that sufficient space is available to complete the majority of the required earthwork for this project using sloping measures. If necessary, shoring recommendations will be provided in an addendum.

9.12.5 Where sufficient space is available, temporary unsurcharged embankments may be sloped back at a uniform 1.5:1 (h:v) slope gradient or flatter for heights up to 20 feet. A uniform slope does not have a vertical portion.

9.12.6 Where sloped embankments are utilized, the top of the slope should be barricaded to prevent vehicles and storage loads at the top of the slope within a horizontal distance equal to the height of the slope. If the temporary construction embankments are to be maintained during the rainy season, berms are suggested along the tops of the slopes where necessary to prevent runoff water from entering the excavation and eroding the slope faces. The contractor's personnel should inspect the soil exposed in the cut slopes during excavation so that modifications of the slopes can be made if variations in the soil conditions occur. Excavations should be stabilized within 30 days of initial excavation.

9.13 Site Drainage and Moisture Protection

9.13.1 Proper site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2016 CBC 1804.4 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

9.13.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

9.13.3 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. We recommend that area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes be used. In addition, where landscaping is planned adjacent to the pavement, we recommend construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material.

9.13.4 If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to infiltration areas. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeology study at the site. Down-gradient and adjacent structures may be subjected to seeps, movement of foundations and slabs, or other impacts as a result of water infiltration.

9.14 Plan Review

9.14.1 Geocon should review the grading, structural, and foundation plans for the project prior to final submittal to verify that the plans have been prepared in substantial conformance with the recommendations of this report. Additional analyses may be required after review of the project plans.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous materials was not part of the scope of services provided by Geocon.

2. This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

3. The findings of this report are valid as of the date of this report. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

4. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

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3. Bryant, W. A. and Hart, E. W., 2007, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zone Maps, California Division of Mines and Geology Special Publication 42, interim revision.

4. California Building Standards Commission, 2016, *California Building Code (CBC)*, California Code of Regulations Title 24, Part 2.

5. California Division of Oil, Gas and Geothermal Resources, 2016, Online Well Finder, http://maps.conservation.ca.gov/doggr/wellfinder/#close. Accessed April 5, 2017.

6. California Department of Transportation (Caltrans), Division of Engineering Services, Materials Engineering and Testing Services, *Corrosion Guidelines, Version 2.0*, dated November, 2012.

7. California Department of Water Resources, Water Data Library www.water.ca.gov/waterdatalibrary/

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14. CASC Engineering, *APN 963-030-002 Constraints Map*, undated.

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4/19/99	C136-42 102 & 103	2000
10/15/97	C117-42 75&76	2000
10/4/95	CAP 155 & 156	2000
5/14/93	C91-7 9&10	2000
5/4/90	90116 9, 10, 11	3000
1/13/89	89019 22, 23, 24	4000
11/30/89	89264 2 & 3	4000
9/21/89	89203 3	4000
7/30/86	86184 155 & 156	2000
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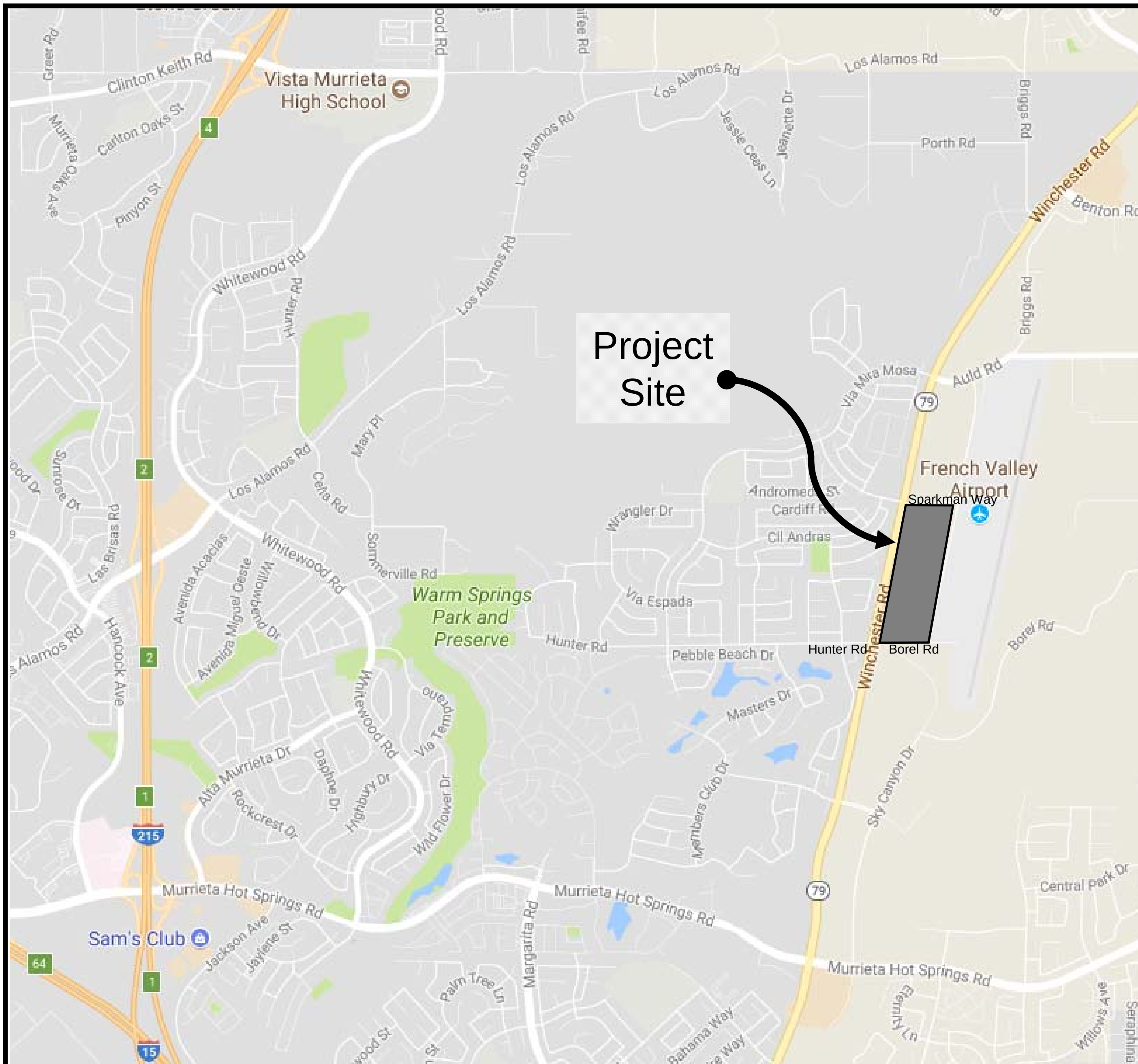

SOURCE: Google Maps, 2017

NOT TO SCALE

N

VICINITY MAP

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41571 CORNING PLACE, SUITE 101, MURRIETA, CA 92562-7065
PHONE 951-304-2300 FAX 951-304-2392

KTM DEVELOPMENT
NE CORNER OF HWY 79 AND BOREL ROAD
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

AMO			AUGUST, 2017	PROJECT NO. T2788-22-01	FIG. 1

GEOCON LEGEND

Locations are approximate

- ..... PROJECT BOUNDARY
- IT-3 ..... INFILTRATION TEST LOCATION
- T-13 ..... TEST PIT LOCATION, 2007
- S-4 ..... SEISMIC REFRACTION TRAVERSE
- 5 ..... ANTICIPATED REMOVAL DEPTH, IN FEET
- afu ..... UNDOCUMENTED ARTIFICIAL FILL
- Qal ..... YOUNG ALLUVIUM
- Qcol ..... COLLUVIUM
- Qvoa ..... OLDER ALLUVIUM
- Kgr ..... GRANITIC BEDROCK
- ..... GEOLOGIC CONTACT

0 215 430

SCALE 1" = 215'

N

Source: CASC Engineering and Consulting, *APN 963-030-002 Constraints Map – Draft* (undated).

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GEOTECHNICAL MAP

KTM DEVELOPMENT
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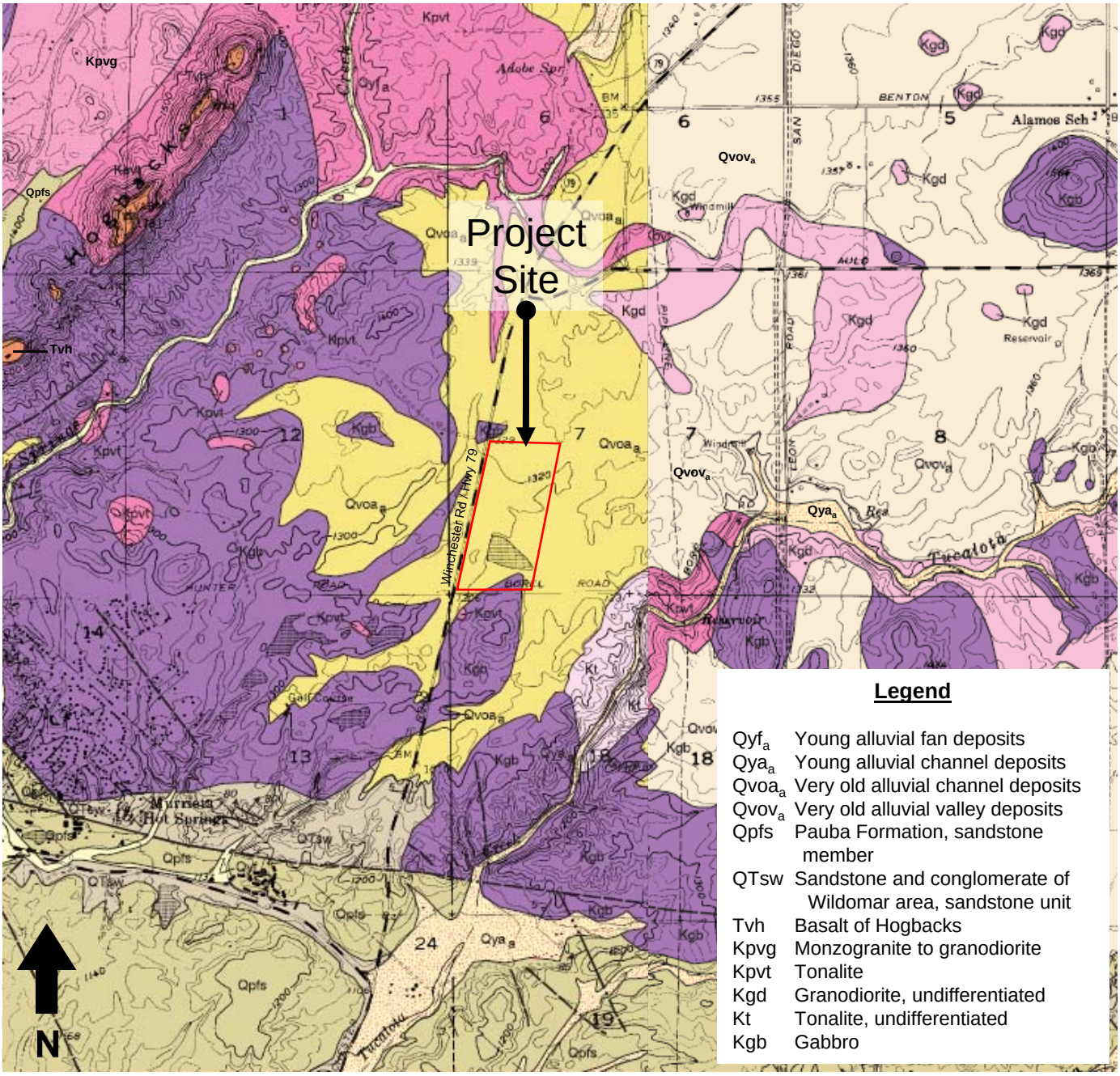
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

AMO			AUGUST, 2017	PROJECT NO. T2788-22-01	FIG. 2



SOURCE: Kennedy, M.P., and D.M. Morton, 2003, Preliminary Geologic Map of the Murrieta 7.5' Quadrangle, Riverside County, California, v. 1.0, USGS OFR 03-189; and Morton, D.M., and M.P. Kennedy, 2003, Geologic Map of the Bachelor Mountain 7.5' Quadrangle, Riverside County, California, v. 1.0, USGS OFR 03-103.

REGIONAL GEOLOGIC MAP

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KTM DEVELOPMENT
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FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

AMO			AUGUST, 2017	PROJECT NO. T2788-22-01	FIG. 3

ASSUMED CONDITIONS:

SLOPE HEIGHT	H	=	15 feet
SLOPE INCLINATION	2.0 : 1.0 (Horizontal : Vertical)		
TOTAL UNIT WEIGHT OF SOIL	γ_t	=	125 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	=	22 degrees
APPARENT COHESION	C	=	235 pounds per square foot
NO SEEPAGE FORCES			

ANALYSIS:

$\lambda_{c\phi} = \frac{\gamma H \tan\phi}{C}$ EQUATION (3-3), REFERENCE 1

$FS = \frac{N_{cf} C}{\gamma H}$ EQUATION (3-2), REFERENCE 1

$\lambda_{c\phi}$ = 3.2 CALCULATED USING EQ. (3-3)

Ncf = 16 DETERMINED USING FIGURE 10, REFERENCE 2

FS = 2.0 FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES:

1……Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics Series No. 46,1954

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41571 CORNING PLACE SUITE 101 MURRIETA, CA 92562-7065
PHONE 951-304-2300 FAX 951-304-2392

CER		

SLOPE STABILITY ANALYSIS

KTM DEVELOPMENT
NE CORNER OF HWY 79 AND BOREL ROAD
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

AUGUST, 2017	PROJECT NO. T2788-22-01	FIG. 4

ASSUMED CONDITIONS:

SLOPE HEIGHT	H	= 15 feet
SLOPE INCLINATION		2.0 : 1.0 (Horizontal : Vertical)
TOTAL UNIT WEIGHT OF SOIL	γ_t	= 125 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	= 22 degrees
APPARENT COHESION	C	= 235 pounds per square foot
PSEUDOSTATIC COEFFICIENT	k_h	= 0.15
PSEUDOSTATIC INCLINATION		1.4 : 1.0 (Horizontal : Vertical)
PSEUDOSTATIC UNIT WEIGHT	γ_{ps}	= 126 pounds per cubic foot

NO SEEPAGE FORCES

ANALYSIS:

$\lambda_{c\phi} = \frac{\gamma H \tan\phi}{C}$ EQUATION (3-3), REFERENCE 1

$FS = \frac{N_{cf} C}{\gamma H}$ EQUATION (3-2), REFERENCE 1

$\lambda_{c\phi}$ = 3.3 CALCULATED USING EQ. (3-3)

Ncf = 14 DETERMINED USING FIGURE 10, REFERENCE 2

FS = 1.7 FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES:

1……Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics Series No. 46,1954

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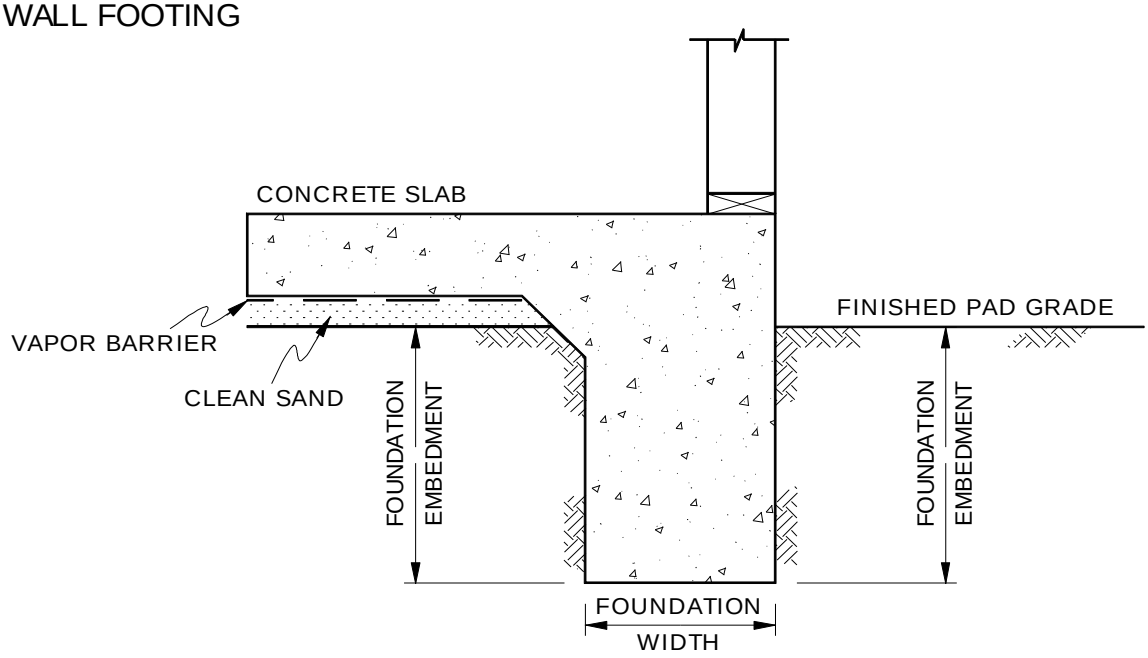
CER		

SLOPE STABILITY ANALYSIS - WITH SEISMIC

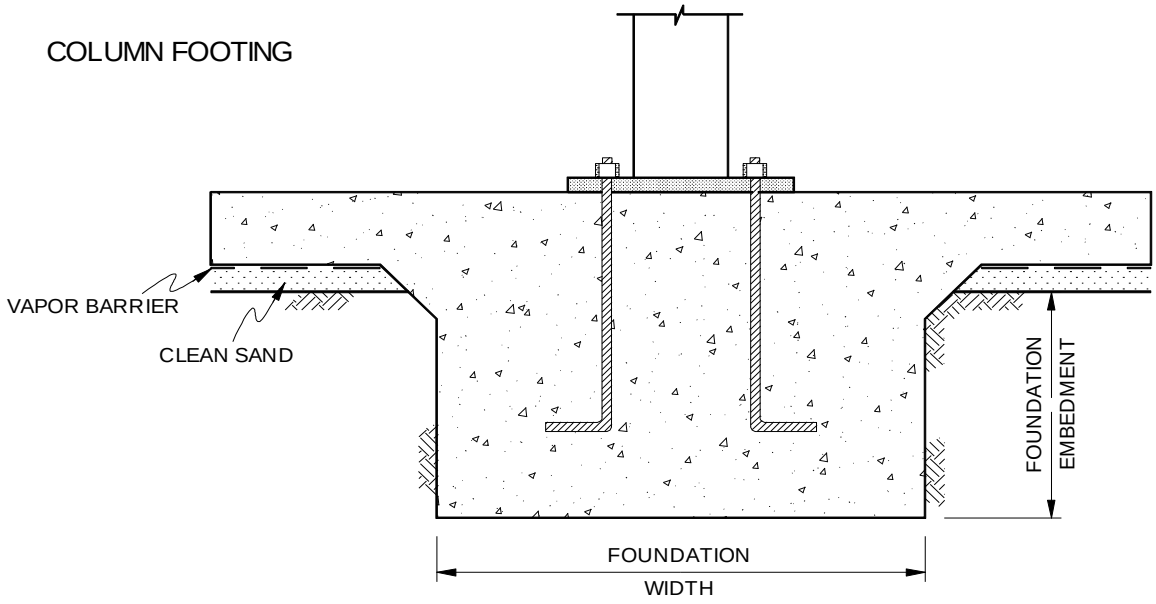
KTM DEVELOPMENT
NE CORNER OF HWY 79 AND BOREL ROAD
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

AUGUST, 2017	PROJECT NO. T2788-22-01	FIG. 5

WALL FOOTING



COLUMN FOOTING



NOTE: SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

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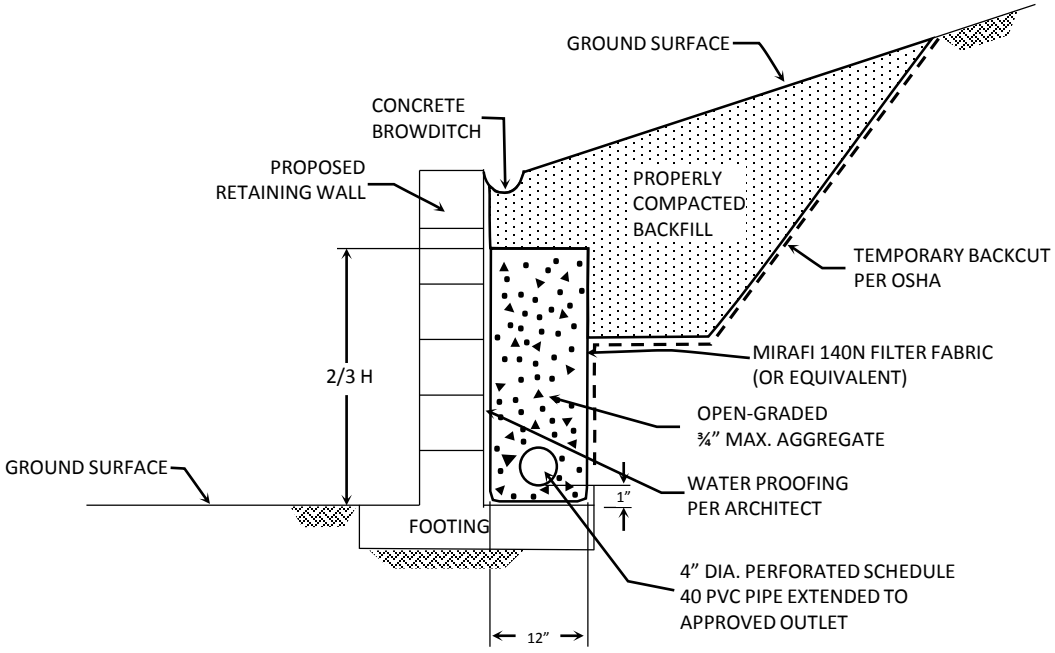
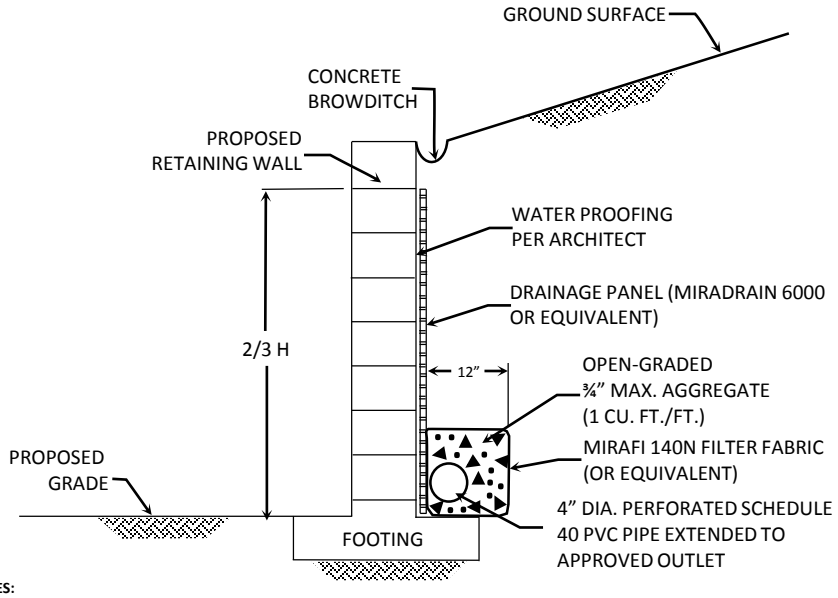
WALL / COLUMN FOOTING DETAIL

KTM DEVELOPMENT
NE CORNER OF HWY 79 AND BOREL ROAD
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

AUGUST, 2017	PROJECT NO. T2788-22-01	FIG. 6





NOTES:

DRAIN SHOULD BE UNFORMLY SLOPED TO GRAVITY OUTLET
OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPIMG

CONCRETE BROW DITCH RECOMMENDED FOR SLOPE HEIGHTS
GREATER THAN 6 FEET

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

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KTM DEVELOPMENT
NE CORNER OF HWY 79 AND BOREL ROAD
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

AUGUST, 2017	PROJECT NO. T2788-22-01	FIG. 7

APPENDIX A

APPENDIX A

EXPLORATORY EXCAVATIONS

We performed the double ring infiltration testing on August 3, 4, and 7, 2017. Our field work consisted of excavating three infiltration test pits at approximately 5 feet below existing grades and performing double ring infiltrometer testing in accordance with Riverside County LIB BMP Handbook. Upon completion, the infiltration test pits were loosely backfilled with native soils.

PROJECT NO. T2788-22-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH IT-1 ELEV. (MSL.) 1309.5 DATE COMPLETED 08/02/2017 EQUIPMENT BACKHOE BUCKET BY: A. ORTON	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0	IT-1 @ 0-1			SC-SM	**YOUNG ALLUVIUM (Qal)** Silty Clayey SAND, medium dense, slightly moist, dark brown; fine sand; trace medium to coarse sand; trace gravel; some clay; trace roots; visible porosity; upper 1' disked			
				CL	Sandy CLAY, stiff to hard, moist, dark brown; some fine sand			
2	IT-1 @ 2-3							
4	IT-1 @ 4-5				**GRANITIC BEDROCK (Kgr)** Medium dense, moist, olive gray; highly weathered Excavates as SC-SM, Silty Clayey SAND; fine to medium sand; some slightly indurated chunks; trace carbonate stringers			
					Total depth 5 feet No groundwater encountered; no caving Prepared for double-ring infiltrometer testing			

Figure A-1,
Log of Trench IT-1, Page 1 of 1

T2788-22-01 TEST PIT LOGS.GPJ

SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. T2788-22-01

TRENCH IT-2

ELEV. (MSL.) **1326.5** DATE COMPLETED **08/02/2017**

EQUIPMENT **BACKHOE BUCKET** BY: **A. ORTON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED ARTIFICIAL FILL (afu)** Silty SAND, medium dense, slightly moist, brown; fine to medium sand; trace coarse sand; trace gravel; trace clay; roots near surface; upper 1' disked			
					- @1', becomes dense; trace porosity; trace cobbles, small boulders			
2								
	IT-2 @ 3-4			SC-SM	Silty Clayey SAND, dense, moist, dark brown; fine to coarse sand			
4								
					Total depth 5 feet No groundwater encountered; no caving Prepared for double-ring infiltrometer testing			

Figure A-2,
Log of Trench IT-2, Page 1 of 1

T2788-22-01 TEST PIT LOGS.GPJ

SAMPLE SYMBOLS

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

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

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PROJECT NO. T2788-22-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH IT-3 ELEV. (MSL.) **1329.5** DATE COMPLETED **08/02/2017** EQUIPMENT **BACKHOE BUCKET** BY: **A. ORTON** MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED ARTIFICIAL FILL (afu)** Silty SAND, medium dense, slightly moist, brown; fine to medium sand; trace coarse sand; trace gravel; trace clay; roots near surface; trace porosity; upper 1' disked			
2				SC	Clayey SAND, medium dense, slightly moist, dark brown; fine sand			
				SM	Silty SAND, medium dense, slightly moist, light brown; fine sand; trace gravel, cobbles, and boulders; trace porosity			
4	IT-3 @ 4-5			CL	Sandy CLAY, hard, moist, dark brown; fine to medium sand			
					Total depth 5 feet No groundwater encountered; no caving Prepared for double-ring infiltrometer testing			

Figure A-3,
Log of Trench IT-3, Page 1 of 1

T2788-22-01 TEST PIT LOGS.GPJ

SAMPLE SYMBOLS

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

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

GEOCON

DOUBLE RING INFILTROMETER TEST DATA

Project Name:	KTM Industrial	Constants	Ring Data		Marriotte Tubes	
Project No.:	T2788-22-01		Area, A_r (in^2)	Depth of Liquid (in.)	ID	Vol., V_r (in^3/in)
Test No.:	IT-1					
Test Location:	Winchester Rd.	Inner Ring:	113	11.25	Small	3,000 ml
Test By: AMO	USCS Class: SC-SM	Annular Ring:	339	9.15	Large	60 cm
Water Table Depth:	Penetration of Rings into Soil (in.)		Inner:	1	Outer:	1.25
Date of Test: 08/07/2017	Liquid Used: Water	pH:	Ground Temp (◦F):		at Depth:	

Liquid level maintained by using small Marriotte tube for inner ring; large Marriotte tube for annular ring.

Additional Comments: Air temperature 67°F at 7:30 am; foggy.

Time Interval	Time (hr.:min.)	Δt min. / total	Small Marriotte		Large Marriotte		Ambient Air Temp (◦F)†	Infiltration Rate, I**		Remarks
			Volume (V, cm^3)	ΔV (test & total)	Height (H, cm)	ΔH (test & total)		Inner (in./hr.)	Outer (in./hr.)	
1 - Start	7:50 AM	10	3000	1790	56.8	9.5	67	5.8	1.8	Light breeze; foggy
End	8:00 AM	10	1210	1790	47.3	9.5	70			
2 - Start	8:00 AM	10	1210	690	47.3	9.0	70	2.2	1.7	
End	8:10 AM	20	520	2480	38.3	18.5	70			
3 - Start	8:10 AM	10	520	380	38.3	8.2	70	1.2	1.6	
End	8:20 AM	30	140	2860	30.1	26.7	70			
4 - Start	8:20 AM	10	1450	370	30.1	8.5	70	1.2	1.6	Partially filled small tube
End	8:30 AM	40	1080	3230	21.6	35.2	71			
5 - Start	8:30 AM	10	1080	270	21.6	6.4	71	0.9	1.2	Cloudy; fog lifting
End	8:40 AM	50	810	3500	15.2	41.6	74			
6 - Start	8:40 AM	20	810	460	35.5	12.5	74	0.7	1.2	Part. filled large tube; sunny
End	9:00 AM	70	350	3960	23.0	54.1	72			
7 - Start	9:00 AM	20	2490	330	23.0	12.4	72	0.53	1.2	Partially filled small tube
End	9:20 AM	90	2160	4290	10.6	66.5	76			
8 - Start	9:20 AM	20	2160	370	40.3	10.3	76	0.60	1.0	Partially filled large tube
End	9:40 AM	110	1790	4660	30.0	76.8	77			
9 - Start	9:40 AM	20	1790	340	30.0	10.6	77	0.55	1.0	
End	10:00 AM	130	1450	5000	19.4	87.4	80			
10 - Start	10:00 AM	60	2940	1030	46.9	28.1	80	0.56	0.90	Filled both tubes
End	11:00 AM	190	1910	6030	18.8	115.5	84			
11 - Start	11:00 AM	60	2800	620	44.8	24.7	84	0.33	0.80	Mod. breeze; filled both tubes
End	12:00 PM	250	2180	6650	20.1	140.2	89			
12 - Start	12:00 PM	60	2180	660	40.9	22.3	89	0.36	0.72	Partially filled large tube
End	1:00 PM	310	1520	7310	18.6	162.5	92			
13 - Start	1:00 PM	60	1520	600	48.9	22.5	92	0.32	0.72	Partially filled large tube
End	2:00 PM	370	920	7910	26.4	185.0	95			
14 - Start	2:00 PM	60	2670	380	42.9	19.1	95	0.21	0.61	Filled both tubes
End	3:00 PM	430	2290	8290	23.8	204.1	95			
15 - Start	3:00 PM	60	2290	510	44.3	20.5	95	0.28	0.66	Filled large tube
End	4:00 PM	490	1780	8800	23.8	224.6	95			

*Flow, $Q_f = \Delta H \times V_r$ **Infiltration Rate, $I = (Q_f/A_r)/\Delta t$ † Proxy for Liquid Temperature

GEOCON WEST, INC.
GEOTECHNICAL ENVIRONMENTAL MATERIALS
41571 CORNING PLACE, SUITE 101, MURRIETA, CA 92562-7065
PHONE 951-304-2300 FAX 951-304-2392

AMO

INFILTRATION DATA

KTM DEVELOPMENT
NE CORNER OF HWY 79 AND BOREL ROAD
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

AUGUST, 2017 | PROJECT NO. T2788-22-01 | FIG A-4

DOUBLE RING INFILTROMETER TEST DATA

Project Name:	KTM Industrial		Constants	Ring Data		Marriotte Tubes	
Project No.:	T2788-22-01			Area, A_r (in^2)	Depth of Liquid (in.)	ID	Vol., V_r (in^3/in)
Test No.:	IT-2						
Test Location:	Winchester Rd.		Inner Ring:	113	11.5	Small	3,000 ml
Test By: AMO	USCS Class: SC/CL		Annular Ring:	339	11.5	Large	60 cm
Water Table Depth:	Penetration of Rings into Soil (in.)			Inner:	1.5	Outer:	1.75
Date of Test: 08/04/2017	Liquid Used: Water	pH:		Ground Temp (◦F):		at Depth:	

Liquid level maintained by using small Marriotte tube for inner ring; large Marriotte tube for annular ring.

Additional Comments: Sunny

Time Interval	Time (hr.:min.)	Δt min. / total	Small Marriotte		Large Marriotte		Ambient Air Temp (◦F)†	Infiltration Rate, I**		Remarks
			Volume (V, cm^3)	ΔV (test & total)	Height (H, cm)	ΔH (test & total)		Inner (in./hr.)	Outer (in./hr.)	
1 - Start	7:30 AM	5	1750	1420	31.1	4.5	73	9.2	1.7	Sunny; still
End	7:35 AM	5	330	1420	26.6	4.5	73			
2 - Start	7:35 AM	9	3000	3000	44.6	20.2	73	10.8	4.3	Filled both tubes
End	7:44 AM	14	0	4420	24.4	24.7	73			
3 - Start	7:44 AM	11	2900	1550	37.8	15.1	73	4.6	2.7	Slight breeze; filled both tubes
End	7:55 AM	25	1350	5970	22.7	39.8	73			
4 - Start	7:55 AM	10	1350	180	22.7	11.1	73	0.58	2.1	
End	8:05 AM	35	1170	6150	11.6	50.9	76			
5 - Start	8:05 AM	30	1170	10	43.9	15.9	76	0.011	1.0	Filled large tube
End	8:35 AM	65	1160	6160	28.0	66.8	78			
6 - Start	8:35 AM	30	1160	10	28.0	4.5	78	0.011	0.29	
End	9:05 AM	95	1150	6170	23.5	71.3	80			
7 - Start	9:05 AM	30	1150	10	23.5	1.2	80	0.011	0.077	
End	9:35 AM	125	1140	6180	22.3	72.5	84			
8 - Start	9:35 AM	30	1140	30	22.3	1.3	84	0.032	0.084	
End	10:05 AM	155	1110	6210	21.0	73.8	86			
9 - Start	10:05 AM	30	1110	40	21.0	1.3	86	0.043	0.084	
End	10:35 AM	185	1070	6250	19.7	75.1	88			
10 - Start	10:35 AM	30	1070	30	19.7	1.2	88	0.032	0.077	
End	11:05 AM	215	1040	6280	18.5	76.3	89			
11 - Start	11:05 AM	30	1040	20	18.5	1.2	89	0.022	0.077	Moderate breeze
End	11:35 AM	245	1020	6300	17.3	77.5	92			
12 - Start	11:35 AM	30	1020	20	17.3	1.2	92	0.022	0.077	
End	12:05 PM	275	1000	6320	16.1	78.7	93			
13 - Start	12:05 PM	30	1000	20	16.1	1.2	93	0.022	0.077	
End	12:35 PM	305	980	6340	14.9	79.9	93			
14 - Start										
End										
15 - Start										
End										

*Flow, $Q_f = \Delta H \times V_r$ **Infiltration Rate, $I = (Q_f/A_r)/\Delta t$ † Proxy for Liquid Temperature

GEOCON WEST, INC.
GEOTECHNICAL ENVIRONMENTAL MATERIALS
41571 CORNING PLACE, SUITE 101, MURRIETA, CA 92562-7065
PHONE 951-304-2300 FAX 951-304-2392

AMO		

INFILTRATION DATA

KTM DEVELOPMENT
NE CORNER OF HWY 79 AND BOREL ROAD
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

AUGUST, 2017	PROJECT NO. T2788-22-01	FIG A-5

DOUBLE RING INFILTROMETER TEST DATA

Project Name:	KTM Industrial		Constants	Ring Data		Marriotte Tubes	
Project No.:	T2788-22-01			Area, A_r (in^2)	Depth of Liquid (in.)	ID	Vol., V_r (in^3/in)
Test No.:	IT-3						
Test Location:	Winchester Rd.		Inner Ring:	113	12.25	Small	3,000 ml
Test By: AMO	USCS Class: SC/CL		Annular Ring:	339	12.25	Large	60 cm
Water Table Depth:	Penetration of Rings into Soil (in.)		Inner:	1.5		Outer:	1.25
Date of Test: 08/03/2017	Liquid Used: Water	pH:	Ground Temp (◦F):			at Depth:	

Liquid level maintained by using small Marriotte tube for inner ring; large Marriotte tube for annular ring.

Additional Comments: Air temp 78°F at 7:23 am. It was very warm overnight.

Time Interval	Time (hr.:min.)	Δt min. / total	Small Marriotte		Large Marriotte		Ambient Air Temp (◦F)†	Infiltration Rate, I**		Remarks
			Volume (V, cm^3)	ΔV (test & total)	Height (H, cm)	ΔH (test & total)		Inner (in./hr.)	Outer (in./hr.)	
1 - Start	8:46 AM	8	350	300	42.1	3.8	84	1.2	0.9	Slightly overcast; still
End	8:54 AM	8	50	300	38.3	3.8	84			
2 - Start	8:55 AM	10	3000	90	38.2	3.0	84	0.29	0.58	Filled small tube
End	9:05 AM	18	2910	390	35.2	6.8	86			
3 - Start	9:05 AM	10	2910	50	35.2	1.8	86	0.16	0.35	Sunny; slight breeze
End	9:15 AM	28	2860	440	33.4	8.6	86			
4 - Start	9:15 AM	10	2860	4	33.4	1.2	86	0.013	0.23	
End	9:25 AM	38	2856	444	32.2	9.8	86			
5 - Start	9:25 AM	10	2856	3	32.2	0.5	86	0.010	0.097	
End	9:35 AM	48	2853	447	31.7	10.3	86			
6 - Start	9:35 AM	30	2853	13	31.7	1.4	86	0.014	0.090	
End	10:05 AM	78	2840	460	30.3	11.7	89			
7 - Start	10:05 AM	30	2840	5	30.3	1.1	89	0.005	0.071	
End	10:35 AM	108	2835	465	29.2	12.8	92			
8 - Start	10:35 AM	30	2835	5	29.2	1.5	92	0.005	0.097	
End	11:05 AM	138	2830	470	27.7	14.3	94			
9 - Start	11:05 AM	30	2830	10	27.7	1.1	94	0.011	0.071	
End	11:35 AM	168	2820	480	26.6	15.4	95			
10 - Start	11:35 AM	60	2820	10	26.6	2.3	95	0.005	0.074	Light to mod. Gusty winds
End	12:35 PM	228	2810	490	24.3	17.7	97			
11 - Start	12:35 PM	60	2810	15	24.3	2.5	97	0.008	0.080	
End	1:35 PM	288	2795	505	21.8	20.2	99			
12 - Start	1:35 PM	60	2795	13	21.8	2.4	99	0.007	0.077	Moderate breeze
End	2:35 PM	348	2782	518	19.4	22.6	100			
13 - Start	2:35 PM	60	2782	12	19.4	2.6	100	0.006	0.084	
End	3:35 PM	408	2770	530	16.8	25.2	98			
14 - Start										
End										
15 - Start										
End										

*Flow, $Q_f = \Delta H \times V_r$ **Infiltration Rate, $I = (Q_f/A_r)/\Delta t$ † Proxy for Liquid Temperature

GEOCON WEST, INC.
GEOTECHNICAL ENVIRONMENTAL MATERIALS
41571 CORNING PLACE, SUITE 101, MURRIETA, CA 92562-7065
PHONE 951-304-2300 FAX 951-304-2392

AMO

INFILTRATION DATA

KTM DEVELOPMENT
NE CORNER OF HWY 79 AND BOREL ROAD
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

AUGUST, 2017 | PROJECT NO. T2788-22-01 | FIG A-6

PROJECT NO. 07178-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 1 ELEV. (MSL.)_____ DATE COMPLETED 07-20-2007 EQUIPMENT JD 510 BACKHOE WITH 24" BUCKET BY: P. THERIAULT	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM SC ML	**UNDOCUMENTED FILL-** *afu* Layered light and dark brown, loose to dense, damp to moist, Silty, fine to medium SAND to Clayey SAND to Sandy SILT; roothairs, upper 2" spread out 3/4" base; trace gravel; upper 1' disturbed			
2	T1-1							
4	T1-2			CL	Becomes stiff, medium brown, moist, fine to medium, Sandy CLAY	100/6"		
6	T1-3			SM	**OLDER ALLUVIUM-** *Qoal* Dense, brownish red, moist, Silty, fine to medium SAND			
					TRENCH TERMINATED AT 6½ FEET No groundwater encountered Removal to 5 feet			

Figure A-1,
Log of Trench T 1, Page 1 of 1

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

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

GEOCON

PROJECT NO. 07178-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 2 ELEV. (MSL.) _____ DATE COMPLETED 07-20-2007 EQUIPMENT JD 510 BACKHOE WITH 24" BUCKET BY: P. THERIAULT	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM ML	**UNDOCUMENTED FILL**- *afu* Medium dense, to stiff, mottled light brown and gray-brown, slightly moist, Silty, fine to medium sand, to fine to medium Sandy SILT; trace gravel, upper 1' disturbed			
2								
4	T2-1					52/3"		
6				ML	**OLDER ALLUVIUM**- *Qoal* Very dense, moist, gray, fine, Sandy SILT; difficult digging			
					TRENCH TERMINATED AT 6½ FEET No groundwater encountered Removal to 5½ feet			

Figure A-2,
Log of Trench T 2, Page 1 of 1

07178-42-01.GPJ

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

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

GEOCON

PROJECT NO. 07178-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 3 ELEV. (MSL.)_____ DATE COMPLETED 07-20-2007 EQUIPMENT JD 610 BACKHOE WITH 24" BUCKET BY: P. THERIAULT	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM ML	**UNDOCUMENTED FILL**- *afu* Medium dense, layered brown and light brown, slightly moist, Silty, fine to medium SAND and Sandy SILT; upper 1' disturbed			
2								
4	T3-1					37/3"		
6					-Becomes mostly sandy silt			
				SM	Silty SAND; some cobble			
8				CL	Gray CLAY			
				SM	Silty SAND			
10				SM	**OLDER ALLUVIUM**- *Qoal* Dense, medium brown, moist, Silty, fine SAND, some medium , some clay; difficult digging			
12								
					GRANITIC BEDROCK- *Kgr* Weathered, soft, moist, gray/white; excavates as fine to coarse sand with gravel, difficult digging			
					TRENCH TERMINATED AT 13½ FEET No groundwater encountered			

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Figure A-3,
Log of Trench T 3, Page 1 of 1

SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. 07178-42-01

TRENCH T 4

ELEV. (MSL.)____ DATE COMPLETED 07-20-2007

EQUIPMENT JD 510 BACKHOE WITH 24" BUCKET BY: P. THERIAULT

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
2	T4-1			SM ML CL	**UNDOCUMENTED FILL**- *afu* Medium dense to stiff, slightly moist, layered light brown to dark brown, Silty, fine to medium SAND to Sandy SILT and Sandy CLAY; some gravel; upper 1' disturbed	37/3"		
4								
6								
8								
10				CL	Stiff, moist, fine to coarse, Sandy CLAY			
12								
14					**GRANITIC BEDROCK**- *Kgr* Fine grained, yellow-brown, soft (weathered), friable; difficult digging at 13½'			

TRENCH TERMINATED AT 14 FEET
No groundwater encountered
Removal to 13 feet

07178-42-01.GPJ

Figure A-4,
Log of Trench T 4, Page 1 of 1

SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. 07178-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 5 ELEV. (MSL.)_____ DATE COMPLETED 07-20-2007 EQUIPMENT JD 510 BACKHOE WITH 24" BUCKET BY: P. THERIAULT	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM CL	**UNDOCUMENTED FILL-** *afu* Medium dense to stiff, slightly moist, layered light brown and dark brown, Silty fine to medium SAND to Sandy CLAY; some gray clay			
2								
4	T5-1					43/3"		
6								
8								
10								
12								
14	T5-2			SM	**OLDER ALLUVIUM-** *Qoal* Dense, moist, mottled gray and yellowish brown, Silty, Gravelly, fine to medium, SAND; some coarse sand; well indurated			
					TRENCH TERMINATED AT 15 FEET No groundwater encountered Removal to 14 feet			

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Figure A-5,
Log of Trench T 5, Page 1 of 1

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

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

GEOCON

PROJECT NO. 07178-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 6 ELEV. (MSL.) _____ DATE COMPLETED 07-20-2007 EQUIPMENT JD 510 BACKHOE WITH 24" BUCKET BY: P. THERIAULT	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM CL	**UNDOCUMENTED FILL-** *afu* Medium dense, slightly moist, layered brown, light brown and gray, Silty, fine to medium SAND with lesser amounts of Sandy CLAY			
2								
4	T6-1					40/3"		
6								
8								
10				SM	**OLDER ALLUVIUM-** *Qoal* Very dense, moist, reddish yellowish brown, Silty, fine to medium SAND; well indurated; difficult digging; some carbonate stringers on ped surfaces TRENCH TERMINATED AT 10 FEET No groundwater encountered Removal to 9½ feet			

Figure A-6,
Log of Trench T 6, Page 1 of 1

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SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. 07178-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 7 ELEV. (MSL.) _____ DATE COMPLETED 07-20-2007 EQUIPMENT JD 510 BACKHOE WITH 24" BUCKET BY: P. THERIAULT	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM CL	**UNDOCUMENTED FILL**- *afu* Medium dense to stiff, slightly moist, layered brown, light brown and gray, Silty, fine to medium SAND to Sandy CLAY; upper 1' disturbed			
2								
4	T7-1					50/4"		
6								
8								
10				SM	**OLDER ALLUVIUM**- *Qoal* Very dense, moist, reddish yellowish brown, Silty, fine to medium SAND; difficult digging; well indurated; some carbonate stringers on ped surfaces TRENCH TERMINATED AT 10½ FEET No groundwater encountered Removal to 9½ feet			

Figure A-7,
Log of Trench T 7, Page 1 of 1

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SAMPLE SYMBOLS

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

▩ ... DISTURBED OR BAG SAMPLE ◪ ... CHUNK SAMPLE ▼ ... WATER TABLE OR SEEPAGE

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

GEOCON

PROJECT NO. 07178-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 8 ELEV. (MSL.)_____ DATE COMPLETED 07-20-2007 EQUIPMENT JD 610 BACKHOE WITH 24" BUCKET BY: P. THERIAULT	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM CL	**UNDOCUMENTED FILL**- *afu* Medium dense, slightly moist, layered light brown, dark brown and gray, Silty, fine to medium SAND to Sandy CLAY; roothairs near surface; upper 1' disturbed			
2								
4	T8-1					32/3"		
6								
8								
10								
12					**GRANITIC BEDROCK**- *Kgr* Moderately hard, moist, brownish yellow; excavates as a silty, sandy gravel; difficult digging TRENCH TERMINATED AT 6½ FEET No groundwater encountered Removal to 5 feet			

Figure A-8,
Log of Trench T 8, Page 1 of 1

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SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. 07178-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 9 ELEV. (MSL.) _____ DATE COMPLETED 07-20-2007 EQUIPMENT JD 510 BACKHOE WITH 24" BUCKET BY: P. THERIAULT	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SC	**COLLUVIUM**- *Qcol* Medium dense, slightly moist, brownish red, Clayey, fine to coarse SAND, with gravel; trace cobble; upper 1' disturbed			
2								
4					**GRANITIC BEDROCK**- *Kgr* Weathered, soft, moist, gray; excavates as a gravelly, fine to coarse sand with some silt -Becomes moderately hard; difficult digging at 5'			
6					TRENCH TERMINATED AT 6½ FEET No groundwater encountered Removal to 5 feet			

Figure A-9,
Log of Trench T 9, Page 1 of 1

07178-42-01.GPJ

SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. 07178-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 10 ELEV. (MSL.)_____ DATE COMPLETED 07-20-2007 EQUIPMENT JD 510 BACKHOE WITH 24" BUCKET BY: P. THERIAULT	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SC	**COLLUVIUM**- *Qcol* Medium dense, slightly moist, brown, Clayey, fine to medium SAND, some coarse sand; upper 1' disturbed			
2								
4					**GRANITIC BEDROCK**- *Kgr* Weathered, soft, yellow, friable; excavates as sandy cobble -Difficult digging at 3½'			
					TRENCH TERMINATED AT 4½ FEET No groundwater encountered Removal to 3½ feet			

Figure A-10,
Log of Trench T 10, Page 1 of 1

07178-42-01.GPJ

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

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

GEOCON

PROJECT NO. 07178-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 11 ELEV. (MSL.)____ DATE COMPLETED 07-20-2007 EQUIPMENT JD 510 BACKHOE WITH 24" BUCKET BY: P. THERIAULT	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**COLLUVIUM**- *Qcol* Stiff, slightly moist, brown, fine to medium, Sandy CLAY; trace cobble			
2					-Moist; some cobble at 3'			
4					**GRANITIC BEDROCK**- *Kgr* Weathered, moist, gray, fine-grained; excavates as a gravelly sand, with cobbles -Difficult digging at 5'			
					TRENCH TERMINATED AT 5½ FEET No groundwater encountered Removal to 4 feet			

Figure A-11,
Log of Trench T 11, Page 1 of 1

07178-42-01.GPJ

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

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

GEOCON

PROJECT NO. 07178-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 12 ELEV. (MSL.)_____ DATE COMPLETED 07-20-2007 EQUIPMENT JD 510 BACKHOE WITH 24" BUCKET BY: P. THERIAULT	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	ALLUVIUM - *Qal* Soft, wet, brown, fine to medium, Sandy CLAY; upper 1' disturbed			
				SM	-Boulder (30") at 1'			
2	T12-1			CL	Whitish, fine to medium, Silty SAND Fine to medium, Sandy CLAY			
4								
6	T12-2				GRANITIC BEDROCK- *Kgr* Weathered, soft, moist, black and white with orange staining; excavates as a sandy cobble; difficult excavation			
					TRENCH TERMINATED AT 6½ FEET No groundwater encountered Removal to 5½ feet			

Figure A-12,
Log of Trench T 12, Page 1 of 1

07178-42-01.GPJ

SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. 07178-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 13 ELEV. (MSL.)_____ DATE COMPLETED 07-20-2007 EQUIPMENT JD 510 BACKHOE WITH 24" BUCKET BY: P. THERIAULT	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SC	**COLLUVIUM**- *Qcol* Medium dense, slightly moist, brown, Clayey, fine to medium SAND, some coarse sand; upper 1' disturbed			
2				CL	Stiff, moist, dark brown, Sandy CLAY			
4								
6					**GRANITIC BEDROCK**- *Kgr* Weathered, gray and orange, fine-grained, moist, friable -Difficult digging at 6'			
					TRENCH TERMINATED AT 6½ FEET No groundwater encountered Removal to 5½ feet			

Figure A-13,
Log of Trench T 13, Page 1 of 1

07178-42-01.GPJ

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

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

GEOCON

TERRA GEOSCIENCES

SEISMIC REFRACTION SURVEY

FLEMMING PROPERTY

CITY OF MURRIETA, CALIFORNIA

Project No. 272232-1

July 20, 2007

Prepared for:

GEOCON, Inc.
41571 Corning Place
Suite 101
Murrieta, CA 92562-7065

Consulting Engineering Geology & Geophysics

P.O. Box 1099, Loma Linda, CA 92354 • 909-796-4667

GEOCON, Inc.
41571 Corning Place
Suite 101
Murrieta, CA 92562-7065

Attention: Mr. Paul Theriault, Project Geologist

Regarding: Seismic Refraction Survey
Flemming Property
City of Murrieta, California
GEOCON Project Number 07871-42-01

INTRODUCTION

As requested, this firm has performed a geophysical survey using the seismic refraction method for the above-referenced site along four selected areas as delineated by you. The purpose of this investigation was to assess the general seismic velocity characteristics of the underlying earth materials and to aid in evaluating whether high velocity earth materials (non-rippable) are present along local areas which could possibly indicate areas of potential excavation difficulties.

The bedrock materials underlying the site at depth have been mapped by Kennedy and Morton (2003) to consist of Cretaceous age granitic rock classified as brown-weathering, medium- to very coarse-grained hornblende gabbro, which is locally mantled across portions of the site by Pleistocene age older alluvial channel deposits generally consisting of moderately indurated, dissected gravel, sand, silt, and clay. We understand that this report will be included as a technical appendix to your report, therefore as requested, the locations of our geophysical survey lines were transferred onto your field map for inclusion onto your final map.

As authorized by you, the following services were performed during this study:

- **Review of available published and unpublished geologic/geophysical data in our files pertinent to the site.**
- **Performing a seismic refraction survey by a State of California Professional Geophysicist, to include four traverses along selected portions of the subject site.**
- **Preparation of this report, presenting the results of our findings and conclusions with respect to the velocity characteristics and the expected rippability potentials of the subsurface earth materials.**

Accompanying Appendices

Appendix A - Layer Velocity Profiles
Appendix B - Tomographic Models
Appendix C - Excavation Considerations
Appendix D - References

SEISMIC REFRACTION SURVEY

Methodology

The seismic refraction method consists of measuring (at known points along the surface of the ground) the travel times of compressional waves generated by an impulsive energy source and can be used to estimate the layering, structure, and seismic acoustic velocities of subsurface horizons. Seismic waves travel down and through the soils and rocks, and when the wave encounters a contact between two earth materials having different velocities, some of the wave's energy travels along the contact at the velocity of the lower layer. The fundamental assumption is that each successively deeper layer has a velocity greater than the layer immediately above it. As the wave travels along the contact, some of the wave's energy is refracted toward the surface where it is detected by a series of motion-sensitive transducers (geophones). The arrival time of the seismic wave at the geophone locations can be related to the relative seismic velocities of the subsurface layers in feet per second (fps), which can then be used to aid in interpreting both the depth and type of materials encountered.

Field Procedures

Four seismic refraction survey lines were performed each being 130-feet in length, with a target depth of around 30±-feet. A 16-pound sledge-hammer was used as an energy source to produce the seismic waves and twelve, 14-Hz geophones (with 70% damping), were spaced at 12-foot intervals along the traverse lines to detect both the direct and refracted waves. The seismic wave arrivals were digitally recorded in SEG-2 format on a Geometrics StrataVisor™ NX model signal enhancement refraction seismograph. Seven shot points were utilized along each seismic line spread using forward, reverse, and intermediate locations, in order to obtain sufficient data for velocity analysis and depth modeling purposes. The data was acquired using a sampling rate of 0.25 millisecorids with a record length of 0.08 seconds. No acquisition filters were used. Each geophone and shot location was surveyed using a hand level and ruler for relative topographic correction. During acquisition, the seismograph provides both a hard copy and screen display of the seismic wave arrivals, of which are digitally recorded on the in-board seismograph computer.

Data Reduction

The data on the paper record and/or display screen were used to analyze the arrival time of the primary seismic "P"-waves at each geophone station, in the form of a wiggle trace, or wave travel-time curve, for quality control purposes in the field. All of the recorded data was subsequently transferred to our office computer for further processing, analyzing, and printing purposes, using the computer programs **SIP** (**S**eismic refraction **I**nterpretation **P**rogram) developed by Rimrock Geophysics, Inc. (1995), and **Rayfract™** (Intelligent Resources, Inc., 1996-2007). **SIP** is a ray-trace modeling program that evaluates the subsurface using layer assignments based on time-distance curves and is better suited for layered media, using the "Seismic Refraction Modeling by Computer" method (Scott, 1973). In addition, **Rayfract™** was also used for comparative purposes. **Rayfract™** is seismic refraction tomography software that models subsurface refraction, transmission, and diffraction of acoustic waves. Both computer programs perform their analysis using exactly the same input data, which includes first-arrival P-waves and line geometry.

SUMMARY OF GEOPHYSICAL INTERPRETATION

To begin our discussion, it should be understood that the velocity data obtained during this survey represents an average of seismic velocities within any given layer. For example, high seismic velocity boulders/dikes or local lithologic inconsistencies, may be isolated within a low velocity matrix, thus yielding an average medium velocity for that layer. Therefore, in any given layer, a range of velocities could be anticipated, which can also result in a wide range of excavation characteristics.

It is also important to consider that the seismic velocities obtained within bedrock materials are influenced by the nature and character of the localized major structural discontinuities (foliation, fracturing, etc.). Generally, it is expected that higher (truer) velocities will be obtained when the seismic waves propagate along direction (strike) of the dominant structure, with a damping effect when the seismic waves travel in a perpendicular direction. Therefore, the seismic velocities obtained during our field study and as discussed below, should be considered minimum velocities at this time, as the structure of the bedrock locally is not known.

In general, the site where locally surveyed, was noted to be characterized by three major subsurface layers with respect to seismic velocities. The following velocity layer summaries have been prepared using the **SIP** analysis, with the representative Layer Velocity Profiles for each seismic survey line presented within Appendix A. These profiles generally indicate the respective "weighted average" subsurface velocities in generalized layers.

- **Velocity Layer V1**:

  This uppermost velocity layer (V1) is most likely comprised of topsoil, colluvium, fill materials, and/or older alluvial deposits, such as mapped by Kennedy and Morton (2003). This layer has an average weighted velocity ranging from 1,418 to 1,605 fps, which is typical for these types of surficial-mantling materials.

- **Velocity Layer V2**:

  The second velocity layer (V2) yielded a wide range of 2,037 to 3,397 fps, indicating high degrees of weathering and fracturing of the underlying granitic bedrock where present, moderately indurated older alluvial deposits, or possible localized artificial fill. The higher-end seismic velocities in this layer are typical for both moderately indurated sediments, and for the near surface weathered zone commonly found in granitic rocks within the southern California region, with fill materials possibly represented by the lower-end velocities (i.e., 2,037 fps).

- **Velocity Layer V3**:

  The third layer (V3) indicates relatively a wide range of weathered granitic bedrock, with average weighted velocities of 4,348 to 7,806 fps. This range of seismic velocities indicates the likelihood of scattered buried fresh large boulders and/or dikes within a moderately decomposed matrix or possibly a moderate to slightly weathered intact rock matrix with wide-spaced fracturing.

Using **Rayfract™**, a tomographic model for each seismic line was also prepared and analyzed for comparative purposes, as presented in Appendix B, which generally indicates the relative structure and velocity distribution. The models were prepared to display the same relative color intensities for the respective velocities so that they may be comparable across the site. Although no discrete velocity layers or boundaries are created, these models generally resemble the **SIP** analysis. **Rayfract™** allows imaging of subsurface velocity using first break energy propagation modeling. It can be seen in these tomographic models that the seismic velocity (which generally relates to hardness) of the bedrock and/or older alluvial deposits gradually increases with depth which is most likely the representative condition of the subsurface materials, along with some lateral variations suggestive of buried corestones and/or dikes. It was also noted that for the most part, the seismic velocities on the Layer Velocity Profiles (Appendix A) appears to generally correlate with the average of the velocity gradients as shown on the Tomographic Models (Appendix B).

GENERALIZED RIPPABILITY CHARACTERISTICS OF GRANITIC BEDROCK

A summary of the generalized rippability characteristics of granitic bedrock based on rippability performance charts prepared by Caterpillar, Inc. (2000 and 2004) has been provided to aid in evaluating potential excavation difficulties with respect to the seismic velocities obtained along the local areas surveyed. The velocity ranges described below are approximate and assume typical, good-working, heavy excavation equipment, such as single shank or D9R dozer, such as described by Caterpillar, Inc. (2000 and 2004); however, different excavating equipment (i.e., trenching equipment) may not correlate well with these velocity ranges. Trenching operations within granitic bedrock materials with seismic velocities generally greater than 3,500 to 4,000±-fps, typically encounter very difficult to non-productable conditions. A summary of excavation considerations has been included in Appendix C in order to provide the client with a better understanding of the complexities of excavation in granitic bedrock materials. These concepts should be understood so that proper planning and excavation techniques can be employed by the selected grading contractor.

- ***Rippable Condition (0 - 4,000 ft/sec)***:

  This velocity range indicates rippable materials which may consist of alluvial-type deposits and decomposed granitics, with random hardrock floaters. These materials will break down into slightly silty, well-graded sand, whereas floaters will require special disposal. Some areas containing numerous hardrock floaters may present utility trench problems. Large floaters exposed at or near finished grade may present problems for footing or infrastructure trenching.

- **Marginally Rippable Condition (4,000 - 8,000 ft/sec)**:

  This range of velocities indicates materials which may consist of slightly- to moderately-weathered granitics or large areas of fresh granitics separated by weathered fractured zones. These materials are generally rippable with difficulty by a Caterpillar D9R or equivalent. Excavations may produce material that will partially break down into a coarse, slightly silty to clean sand, with a high percentage of very coarse sand to pebble-sized material. Less fractured or weathered materials will probably require blasting to facilitate removal.

- **Non-Rippable Condition (8,000 ft/sec or greater)**:

  This velocity range includes non-rippable material consisting primarily of moderately fractured granitics at lower velocities and only slightly fractured or unfractured rock at higher velocities. Materials in this velocity range may be marginally rippable, depending upon the degree of fracturing and the skill and experience of the operator. Tooth penetration is often the key to ripping success, regardless of seismic velocity. If the fractures and joints do not allow tooth penetration, the material may not be ripped effectively; however, pre-blasting or "popping" may induce sufficient fracturing to permit tooth entry. In their natural state, materials with these velocities are generally not desirable for building pad grade, due to difficulty in footing and utility trench excavation. Blasting will most likely produce oversized material, requiring special disposal.

SUMMARY OF FINDINGS AND CONCLUSIONS

The raw field data was considered to be of moderately good quality which had only minor amounts of ambient "noise" that was introduced during our survey from distant vehicular traffic and periodic wind sources. Analysis of the data and picking of the primary "P"-wave arrivals was performed with little difficulty and occasional interpolation of data was necessary. Based on the results of our comparative seismic analyses of both **SIP** and **Rayfract™** (of which both software programs use exactly the same input data), the seismic refraction survey lines appear to generally coincide with one another, with some minor variances due to the methods that these programs process and integrate the input data. The anticipated excavation potentials of the velocity layers encountered locally during our survey are as follows:

- **Velocity Layer V1**:

  No major excavating difficulties are expected to be encountered within the uppermost, low-velocity layer V1 (velocity range of 1,418 to 1,605 fps). This layer is expected to be comprised of topsoil, colluvium, fill, and/or older alluvial deposits.

- **Velocity Layer V2**:

  The second layer V2 is most likely consists of highly- to moderately-weathered granitic bedrock and/or moderately indurated older alluvial deposits (velocity range of 2,037 to 3,397 fps), along with localized fill materials, of which we understand are present locally within the subject property. These materials are expected to excavate with only slight difficulty assuming appropriate good-working equipment for the proposed type of excavation. Isolated floaters (i.e., boulders, corestones, etc.) could be present within weathered granitic bedrock based on surficial exposures in the local region and could produce difficult conditions locally. Placement of infrastructures in this material may also be difficult. Although not anticipated, localized blasting in the bedrock materials due to the presence of buried boulders and dikes cannot be completely ruled out.

- **Velocity Layer V3**:

  Some excavation difficulties within the lower V3 velocity layer (velocity range of 4,348 to 7,806 fps) are anticipated, where slightly- to moderately-weathered granitic

bedrock is encountered approaching the higher-end velocities. Hard excavating areas consisting of localized boulders, dikes, and/or fresher bedrock with relatively wide-spaced jointing/fracturing could be encountered during both remedial grading and placement of infrastructures, which may require some blasting to achieve desired grade. Excavations performed within the older alluvial deposits, if present, are not expected to encounter difficult conditions which would require blasting.

Based on the Tomographic Models (Appendix B) and typical excavation characteristics that have observed within granitic bedrock materials of the southern California region, anticipation of gradual increasing hardness with depth along with localized lateral variations, with respect to excavation characteristics, should be anticipated across the site. It may be expected that when ground velocities on the order of 6,000± fps or greater are encountered, increasing difficulties in excavation conditions and rippability will occur with respect to grading production. These increases may result in slower production rates from the cut excavation with an increase in the generation of oversized rock materials. This is also dependent upon the type and operating condition of the excavation equipment used, how hard the contractor is willing to work the equipment, and the structural discontinuities of the rock fabric. The decision for blasting of the rock for excavatability is sometimes made based upon economic production reasons and not solely on the rippability (velocity/hardness) characteristics of the bedrock.

CLOSURE

This survey was performed using "state of the art" geophysical techniques, computer processing, and equipment, in the localized areas delineated by you. We make no warranty, either expressed or implied. It should be noted that our data was obtained along four specific areas; therefore, other local areas within the site beyond the limits of our seismic lines may contain different velocity layers and depths not encountered during our field survey. Estimates of layer velocity boundaries are generally considered to be within 10±-percent of the depth of the contact. It should be understood that when using these theoretical geophysical principles and techniques, sources of error are possible in both the data obtained and in the interpretation. In summary, the results of this survey are to be considered as an aid to assessing the rippability potentials of the bedrock locally. This information should be carefully reviewed by the grading contractor and representative "test" excavations should be considered, so that they may be correlated with the data presented within this report.

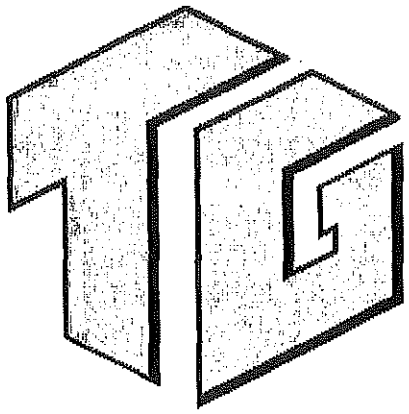
If you should have any questions regarding this report or do not understand the limitations of this survey, please do not hesitate to contact our office.

Respectfully submitted,
TERRA GEOSCIENCES

Donn C. Schwartzkopf
Principal Geophysicist
PGP 1002

APPENDIX A

LAYER VELOCITY PROFILES

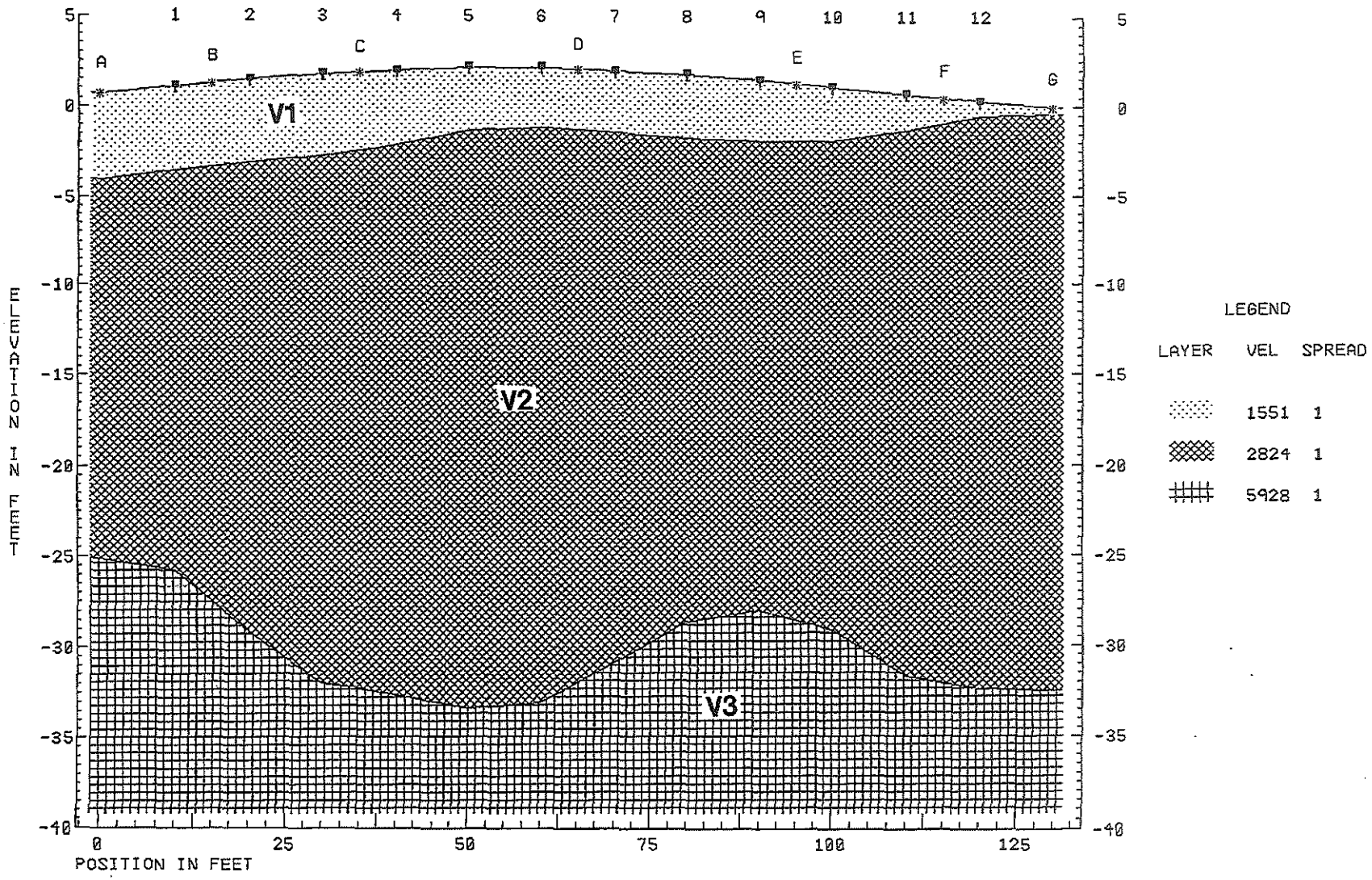


LAYER VELOCITY PROFILE S-1

← North - South →

FILE 2232.SIP
SEISMIC LINE S-1

SPREAD 1

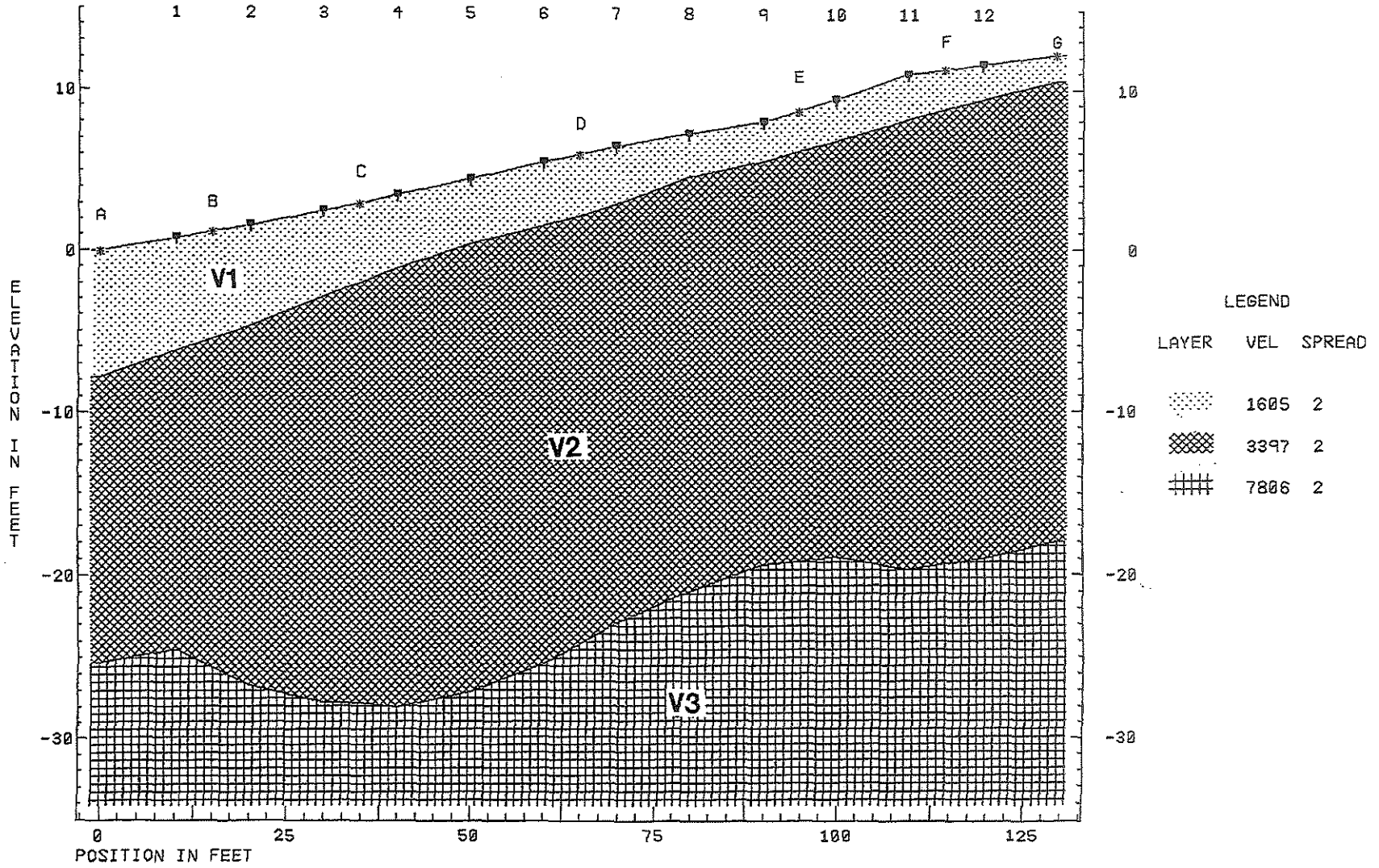


LAYER VELOCITY PROFILE S-2

← North - South →

FILE 2232-2.SIP
SEISMIC LINE S-2

SPREAD 2

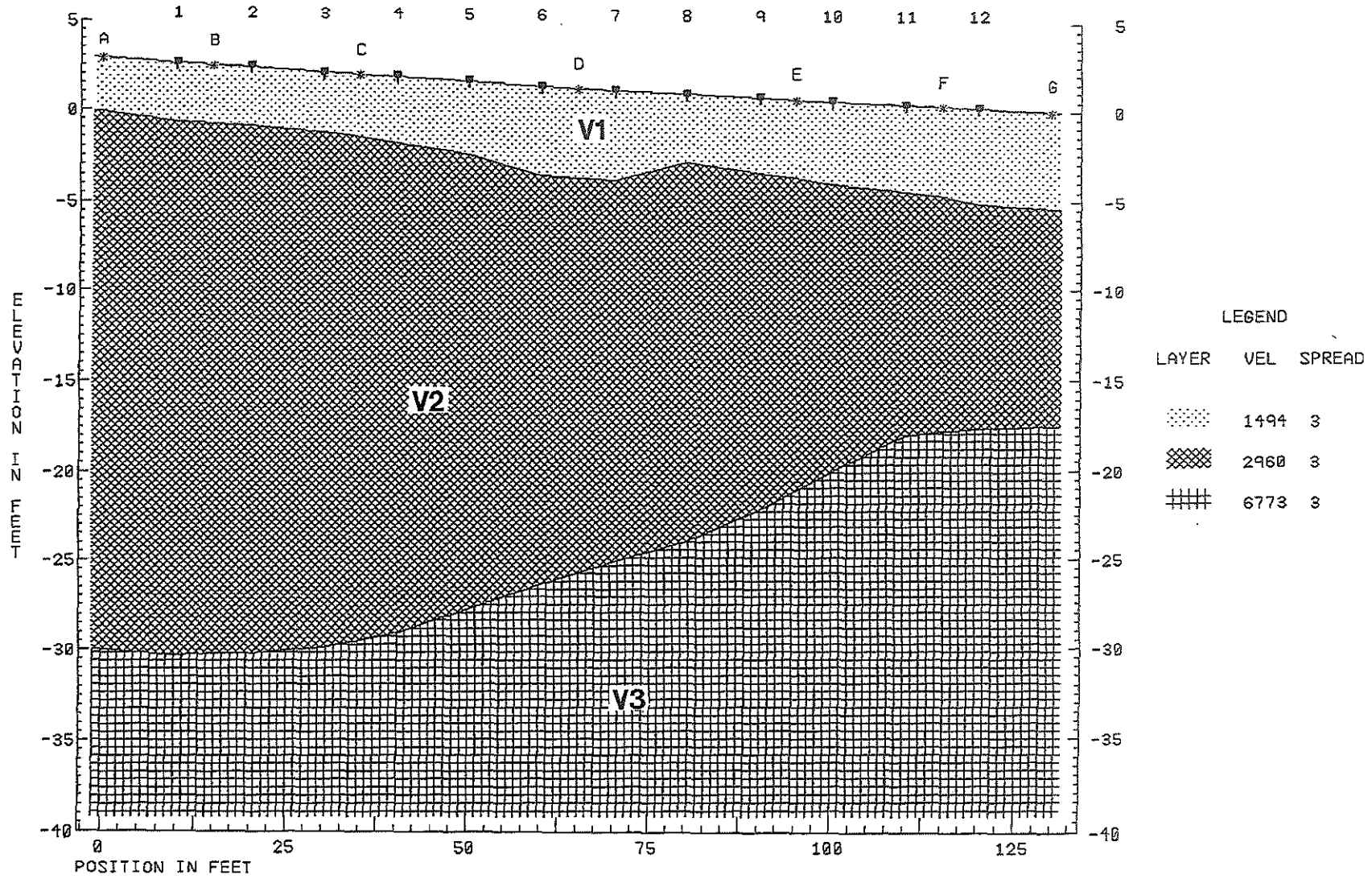


LAYER VELOCITY PROFILE S-3

← East - West →

FILE 2232-3.SIP
SEISMIC LINE S-3

SPREAD 3

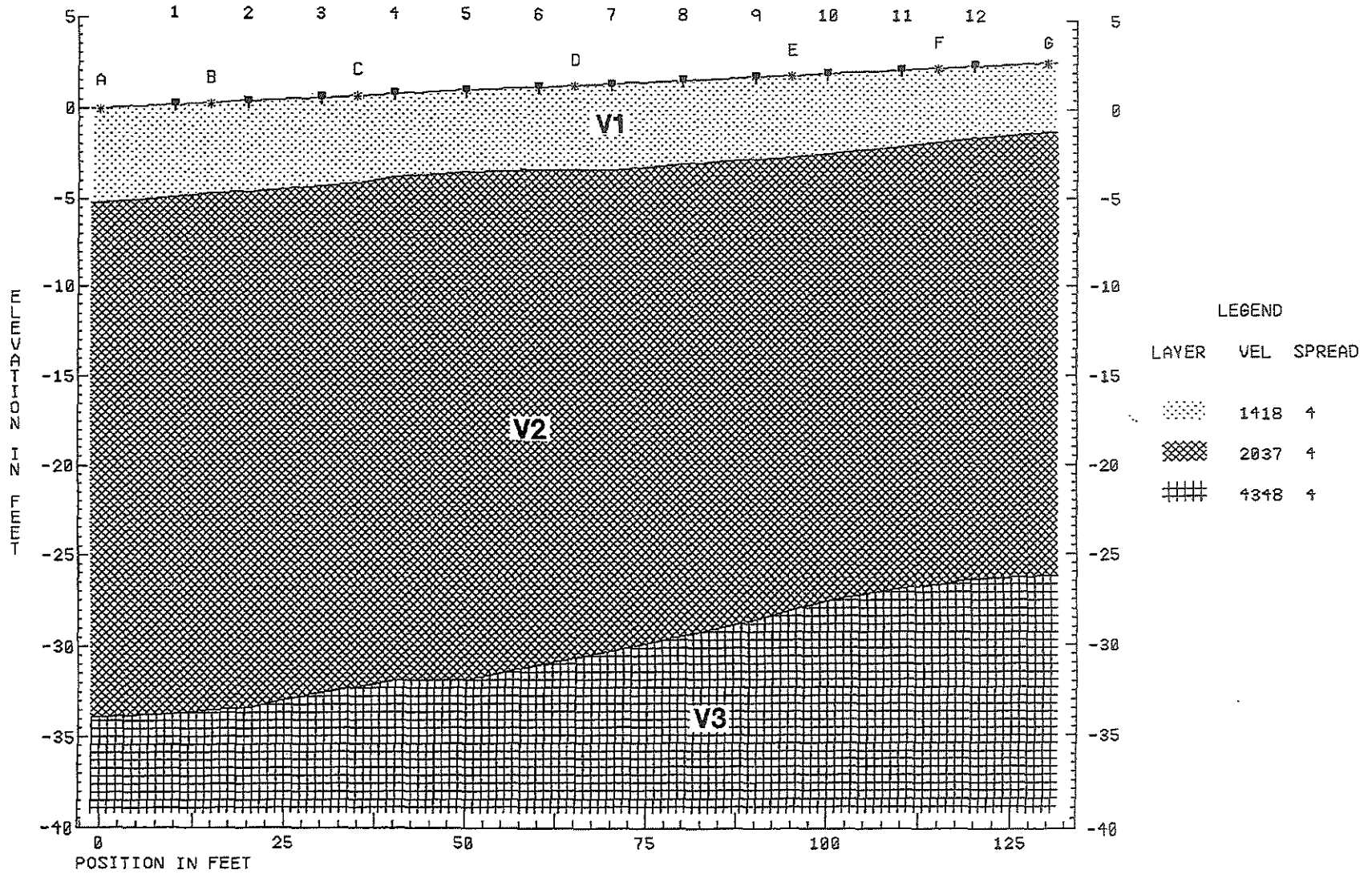


LAYER VELOCITY PROFILE S-4

← West - East →

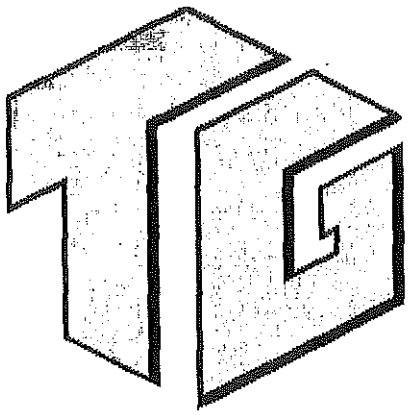
FILE 2232-4.SIP
SEISMIC LINE S-4

SPREAD 4



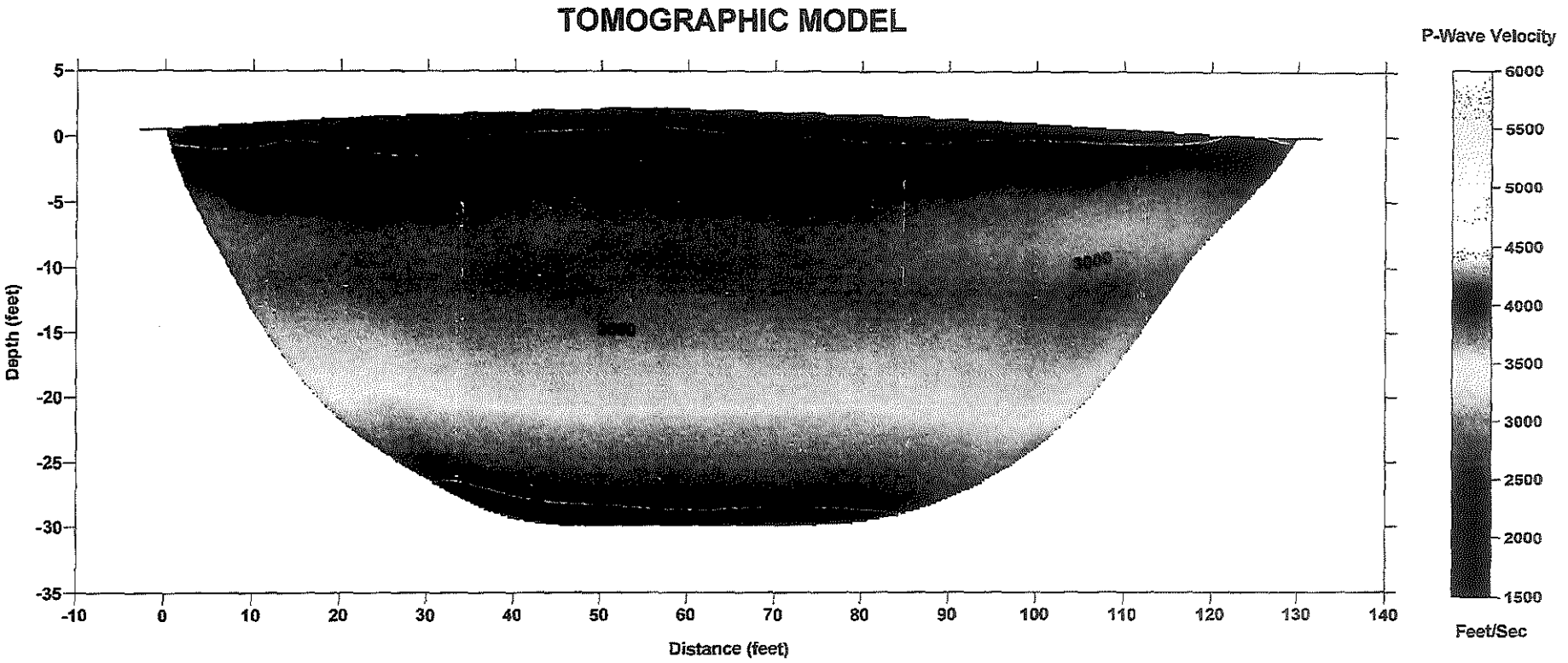
APPENDIX B

TOMOGRAPHIC MODELS



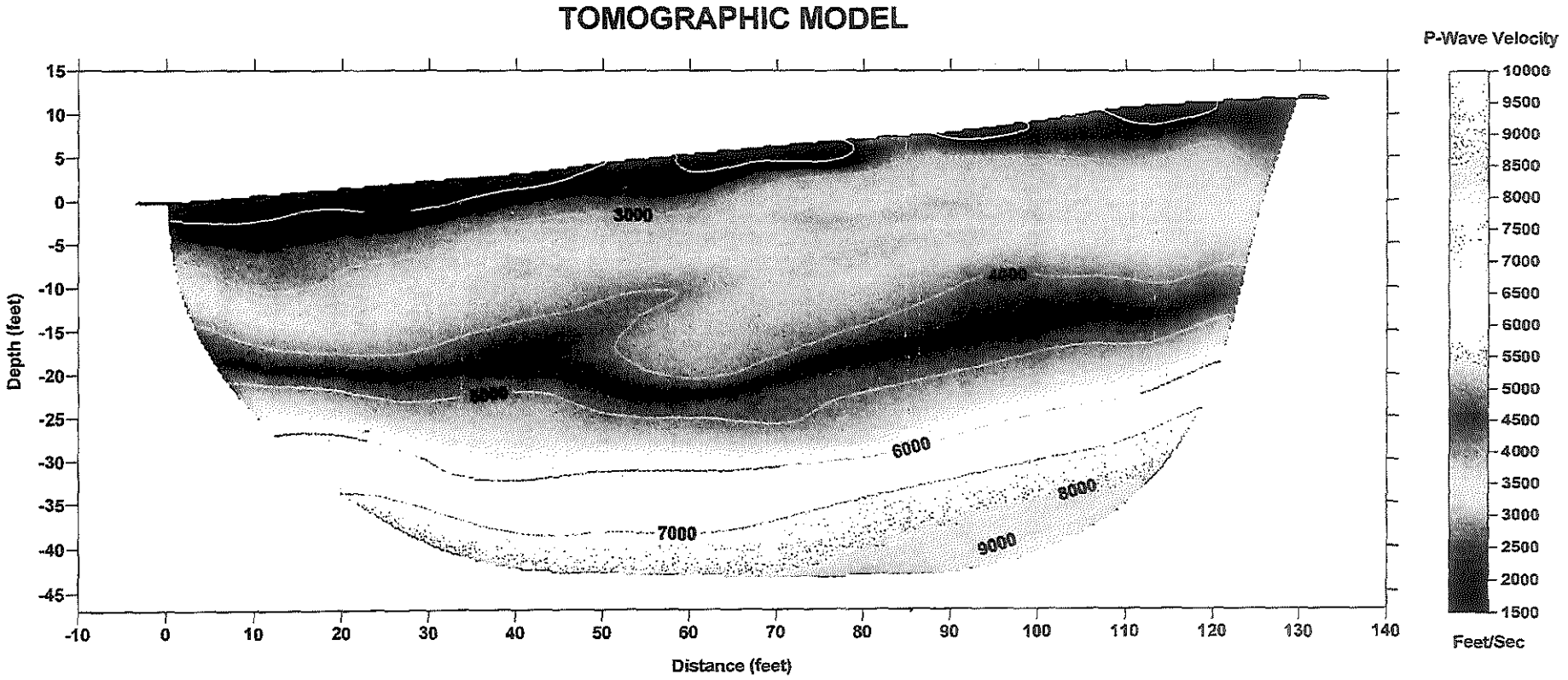
SEISMIC LINE S-1

← North - South →



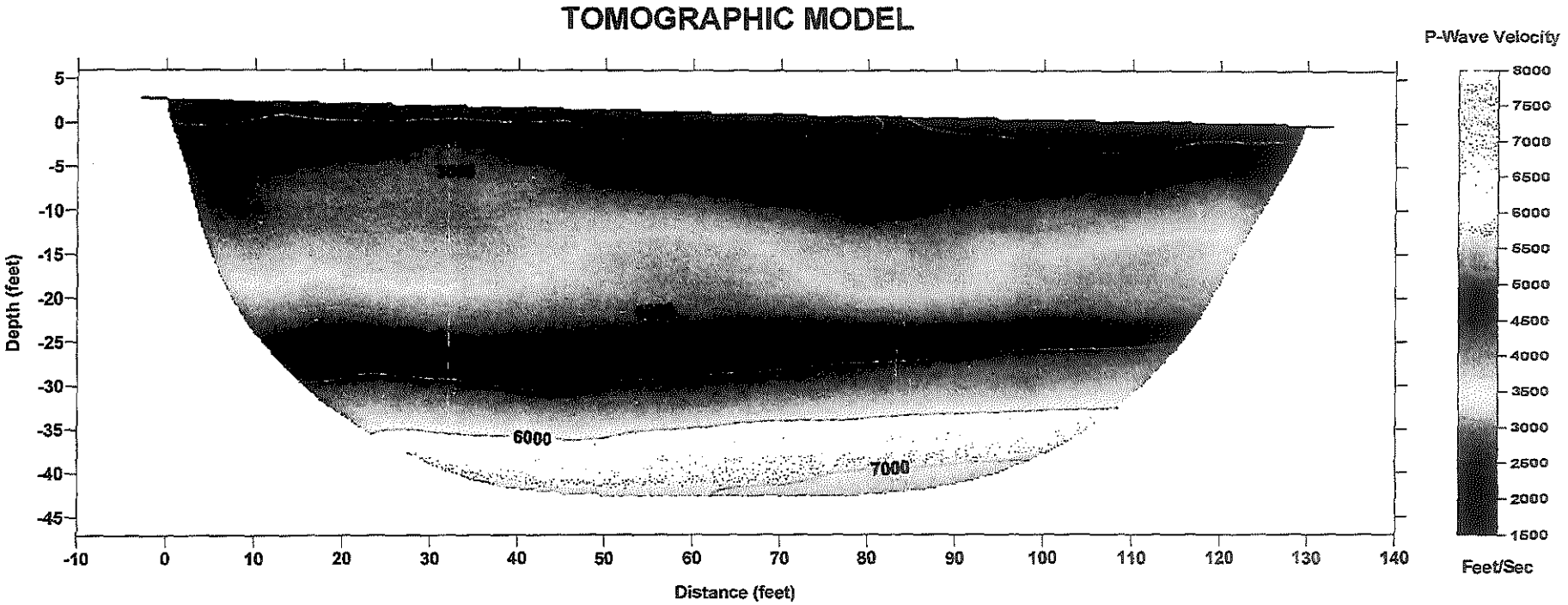
SEISMIC LINE S-2

← North - South →



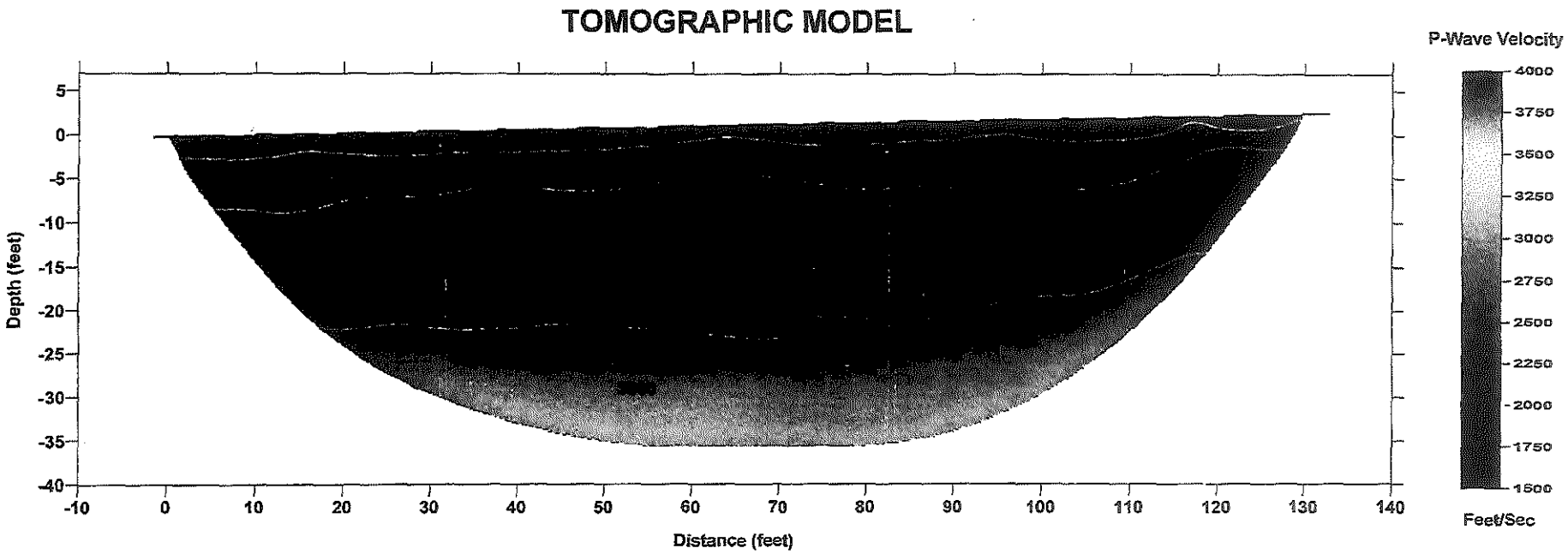
SEISMIC LINE S-3

← East - West →



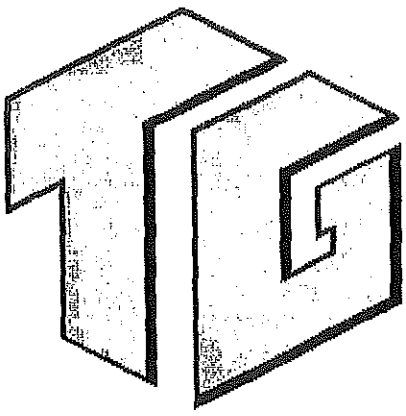
SEISMIC LINE S-4

← West - East →



APPENDIX C

EXCAVATION CONSIDERATIONS



EXCAVATION CONSIDERATIONS

These excavation considerations have been included to provide the client with a brief overall summary of the general complexity of hard bedrock excavation. It is considered the clients responsibility to insure that the grading contractor they select is both properly licensed and qualified, with experience in hard-bedrock ripping processes. To evaluate whether a particular bedrock material can be ripped, this geophysical survey should be used in conjunction with the geologic or geotechnical report prepared for the project which describes the physical properties of the bedrock. The physical characteristics of bedrock materials that favor ripping generally include the presence of fractures, faults and other structural discontinuities, weathering effects, brittleness or crystalline structure, stratification of lamination, large grain size, moisture permeated clay, and low compressive strength. Unfavorable conditions can include such characteristics as massive and homogeneous formations, non-crystalline structure, absence of planes of weakness, fine-grained materials, and formations of clay origin where moisture makes the material plastic.

When assessing the potential rippability of the underlying bedrock of a given site, the above geologic characteristics along with the estimated seismic velocities can then be used to evaluate what type of equipment may be appropriate for the proposed grading. When selecting the proper ripping equipment there are three primary factors to consider, which are:

- **Down Pressure available at the tip, which determines the ripper penetration that can be attained and maintained,**
- **Tractor flywheel horsepower, which determines whether the tractor can advance the tip, and,**
- **Tractor gross-weight, which determines whether the tractor will have sufficient traction to use the horsepower.**

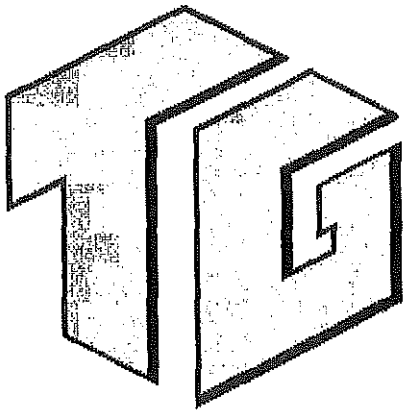
In addition to selecting the appropriate tractor, selection of the proper ripper design is also important. There are basically three designs, being radial, parallelogram, and adjustable parallelogram, of which the contractor should be aware of when selecting the appropriate design to be used for the project. The penetration depth will depend upon the down-pressure and penetration angle, as well as the length of the shank tips (short, intermediate, and long).

Also important in the excavation process is the ripping technique used as well as the skill of the individual tractor operator. These techniques include the use of one or more ripping teeth, up- and down-hill ripping, and the direction of ripping with respect to the geologic structure of the bedrock locally. The use of two tractors (one to push the first tractor-ripper) can extend the range of materials that can be ripped. The second tractor can also be used to supply additional down-pressure on the ripper. Consideration of light blasting can also facilitate the ripper penetration and reduce the cost of moving highly consolidated rock formations.

All of the combined factors above should be considered by both the client and the grading contractor, to insure that the proper selection of equipment and ripping techniques are used for the proposed grading.

APPENDIX D

REFERENCES



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APPENDIX B

APPENDIX B

LABORATORY TESTING

We performed laboratory tests in accordance with current generally accepted test methods of ASTM International (ASTM) or other suggested procedures. The results of the laboratory tests are presented in *Appendix B.*

SUMMARY OF CORROSIVITY TEST RESULTS

Sample No.	Chloride Content (ppm)	Sulfate Content (%)	pH	Resistivity (ohm-centimeter)
IT-1 @ 0-1’	50	--	7.6	3,000

Chloride content determined by California Test 422.
Water-soluble sulfate determined by California Test 417.
Resistivity and pH determined by Caltrans Test 643.

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GEOTECHNICAL ENVIRONMENTAL MATERIALS
41571 CORNING PLACE, SUITE 101, MURRIETA, CA 92562-7065
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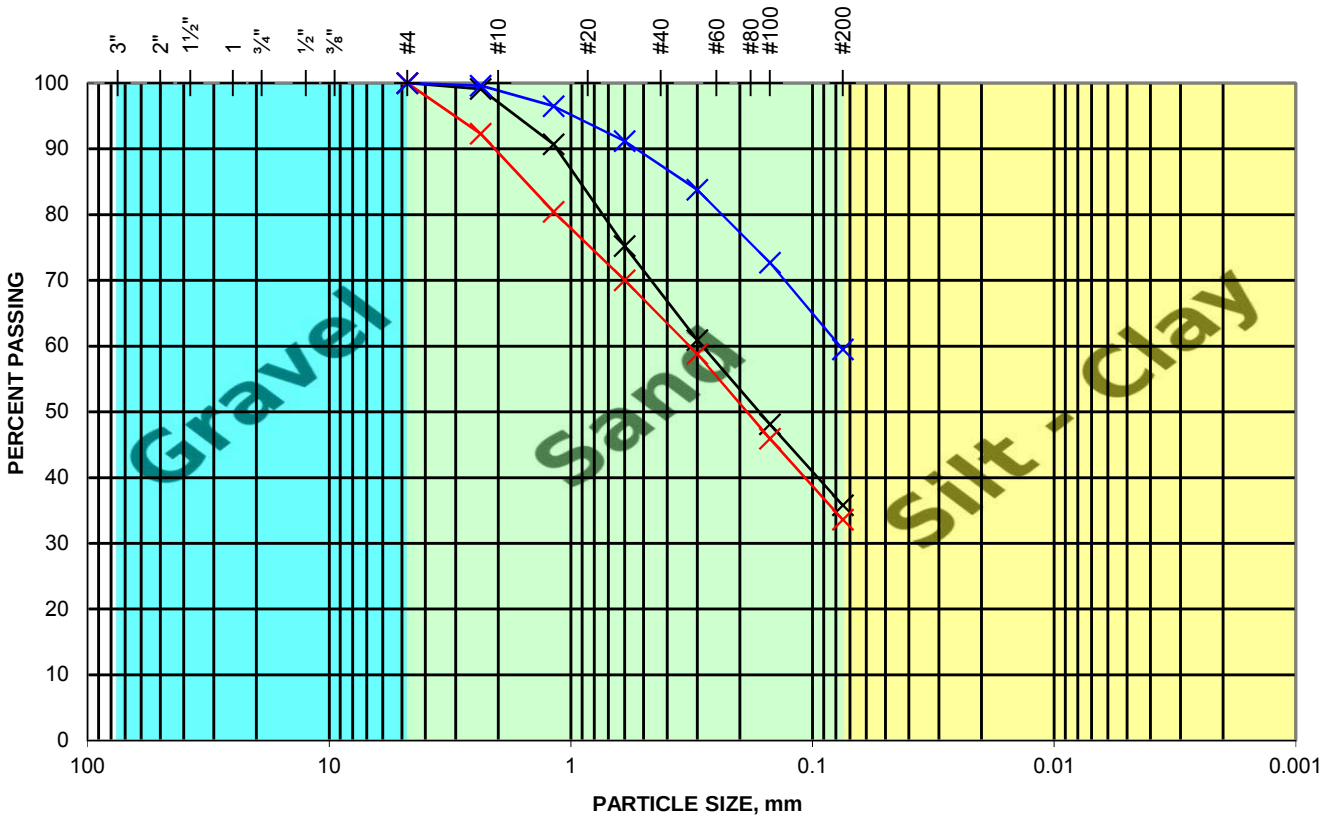
LABORATORY TEST RESULTS

KTM DEVELOPMENT
NE CORNER OF HWY 79 AND BOREL ROAD
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

AUGUST, 2017 | PROJECT NO. T2788-22-01 | FIG B-1



SAMPLE ID	SAMPLE DESCRIPTION
IT-1 @ 4-5'	SC-SM - Silty Clayey SAND
IT-2 @ 3-4'	SC-SM - Silty Clayey SAND
IT-3 @ 4-5'	CL - Sandy CLAY

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GRAIN SIZE DISTRIBUTION

KTM DEVELOPMENT
NE CORNER OF HWY 79 AND BOREL ROAD
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

AUGUST, 2017	PROJECT NO. T2788-22-01	FIG B-2

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected ring samples were tested to determine their in-place density and moisture content. Disturbed bulk samples were tested to determine compaction (maximum dry density and optimum moisture content), remolded direct shear strength, expansion characteristics, and water soluble sulfate content. The results of laboratory tests performed are summarized in tabular and graphical form herewith.

TABLE B-I
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS
ASTM D 1557-02

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
T1-1	Brown, fine to medium sandy Clay	121.7	12.9
T5-1	Brown, silty Clay with little sand	111.3	17.1
T12-1	Grayish brown, clayey, fine to medium Sand	127.7	11.2
T12-2	Gray, sandy, fine to coarse Gravel with trace clay	121.7	13.6

TABLE B-II
SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS
ASTM D 3080-03

Sample No.	Dry Density (pcf)	Moisture Content (%)	Unit Cohesion (psf)	Angle of Shear Resistance (degrees)
T1-1	109.1	13.3	235	22

Sample remolded to approximately 90 percent maximum dry density near optimum moisture content

TABLE B-III
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D 4829-88

Sample No.	Moisture Content		Dry Density (pcf)	Expansion Index
	Before Test (%)	After Test (%)		
T1-1	10.6	24.9*	110.0	60
T12-1	10.7	27.1	108.1	61

TABLE B-IV
SUMMARY OF LABORATORY WATER-SOLUBLE SULFATE TEST RESULTS
CALIFORNIA TEST 417

Sample No.	Water Soluble Sulfate (%)
T1-1	0.003

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MOISTURE DENSITY& MOISTURE CONTENT

PROJECT NAME	FLEMMING PROPERTY
PROJECT NUMBER	7178-42-01
DATE	7/26/2007
TECHNICIAN	JD

SAMPLE	T2-1	T3-1	T4-1	T5-2	T7-1			
HT. OF SAMPLE	2	1	1	1	1			
GROSS WET WT	363.5	192.2	177.2	199.6	184.0			
TARE	88.5	44.7	44.0	44.0	43.7			
RING DIAMETER	2.420	2.420	2.420	2.420	2.420	2.375	2.375	2.375
WET DENSITY	113.9	122.2	110.3	128.9	116.2			
WET WEIGHT	100.0	100.0	100.0	100.0	100.0			
DRY WEIGHT	82.3	82.1	83.9	87.0	87.9			
% MOISTURE	21.5	21.8	19.2	14.9	13.8			
DRY DENSITY	93.7	100.3	92.6	112.1	102.1			
	ML- DARK YELLOWISH BROWN CLAYEY SILT WITH TRACE FINE SAND	CL- DARK BROWN SILTY CLAY WITH TRACE FINE SAND	CL- DARK BROWN SILTY CLAY WITH TRACE FINE SAND	CL- DARK BROWN SILTY CLAY WITH TRACE FINE SAND	CL- DARK BROWN SILTY CLAY WITH TRACE FINE SAND			

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INCORPORATED

DIRECT SHEAR TEST REPORT

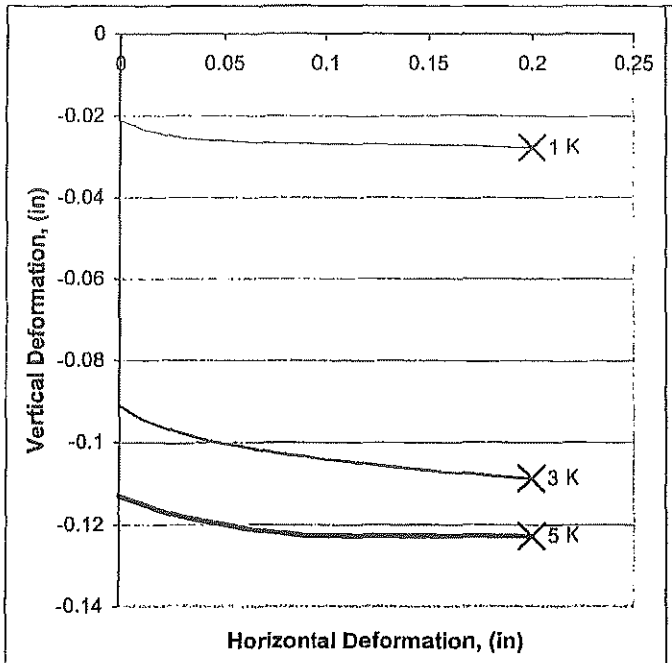
FLEMMING PROPERTY

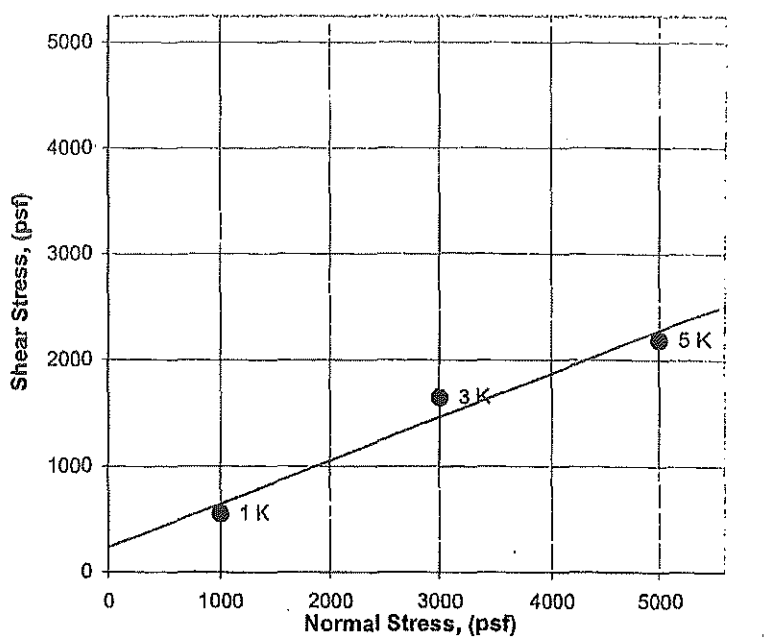
7178-42-01 **Date:** Thursday, July 26, 2007 **By:** JD

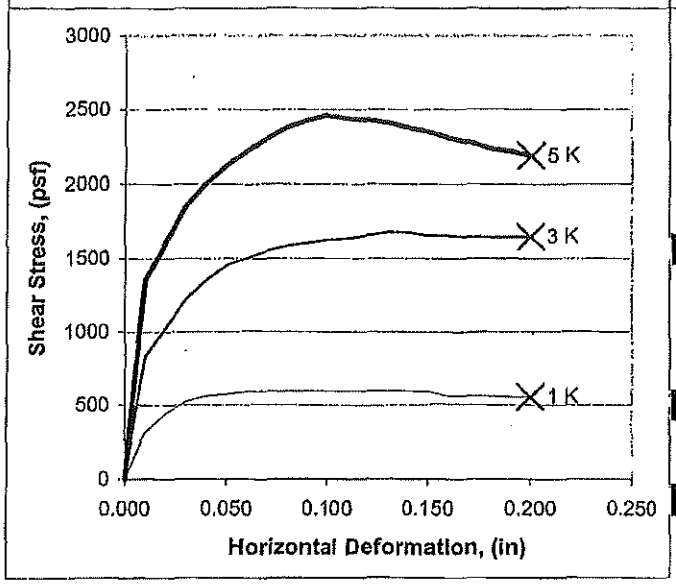
Sample No.: T1-1 **Natural or Remold:** Remolded

Description: CL- brown (f-m) sandy clay

Remarks:







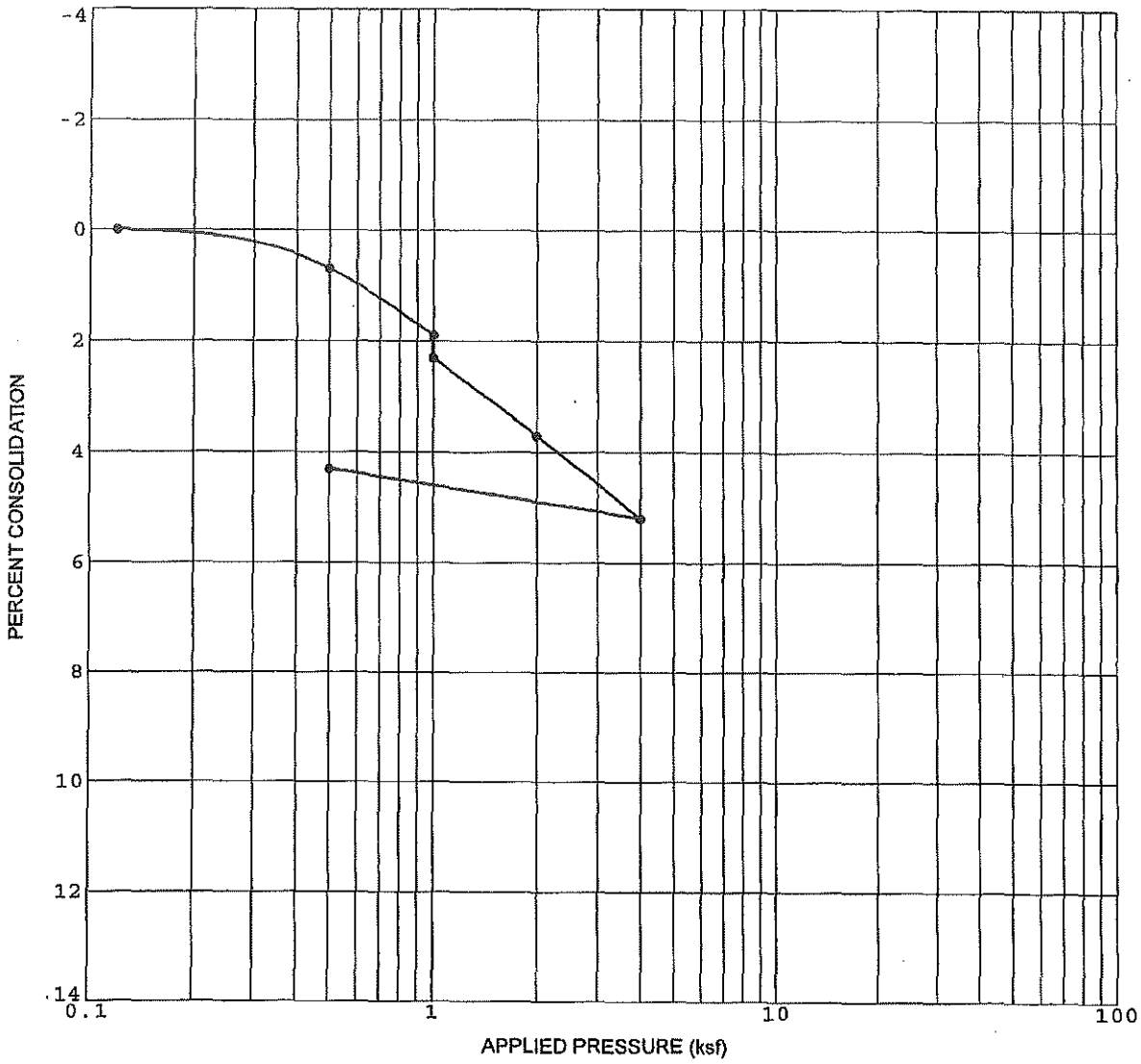
ϕ (Degrees)	22.2
c (psf)	235
Tan ϕ	0.409
Method	Calc

Load	1 K	3 K	5 K
INITIAL			
Water Content	12.5%	13.3%	13.9%
Dry Density (pcf)	109.9	109.1	108.5
Saturation*	65.7%	68.4%	70.5%
Height (inches)	1.00	1.00	1.00
AFTER TEST			
Water Content	22.9%	24.3%	24.9%
Dry Density (pcf)	113.0	122.4	123.7
FAILURE			
Normal Stress (psf)	1000	3000	5000
Failure Stress (psf)	552	1645	2187
Failure Deffinition	User	User	User
Displacement (in)	0.20	0.20	0.20
Rate (in/min)	0.0150	0.0150	0.0150

* Degree of saturation calculated with a specific gravity of 2.65

PROJECT NO. 07178-42-01

SAMPLE NO. T1-3



Initial Dry Density (pcf)	105.6	Initial Saturation (%)	88.6
Initial Water Content (%)	17.9	Sample Saturated at (ksf)	1.0

CONSOLIDATION CURVE

FLEMMING PROPERTY

RIVERSIDE COUNTY, CALIFORNIA

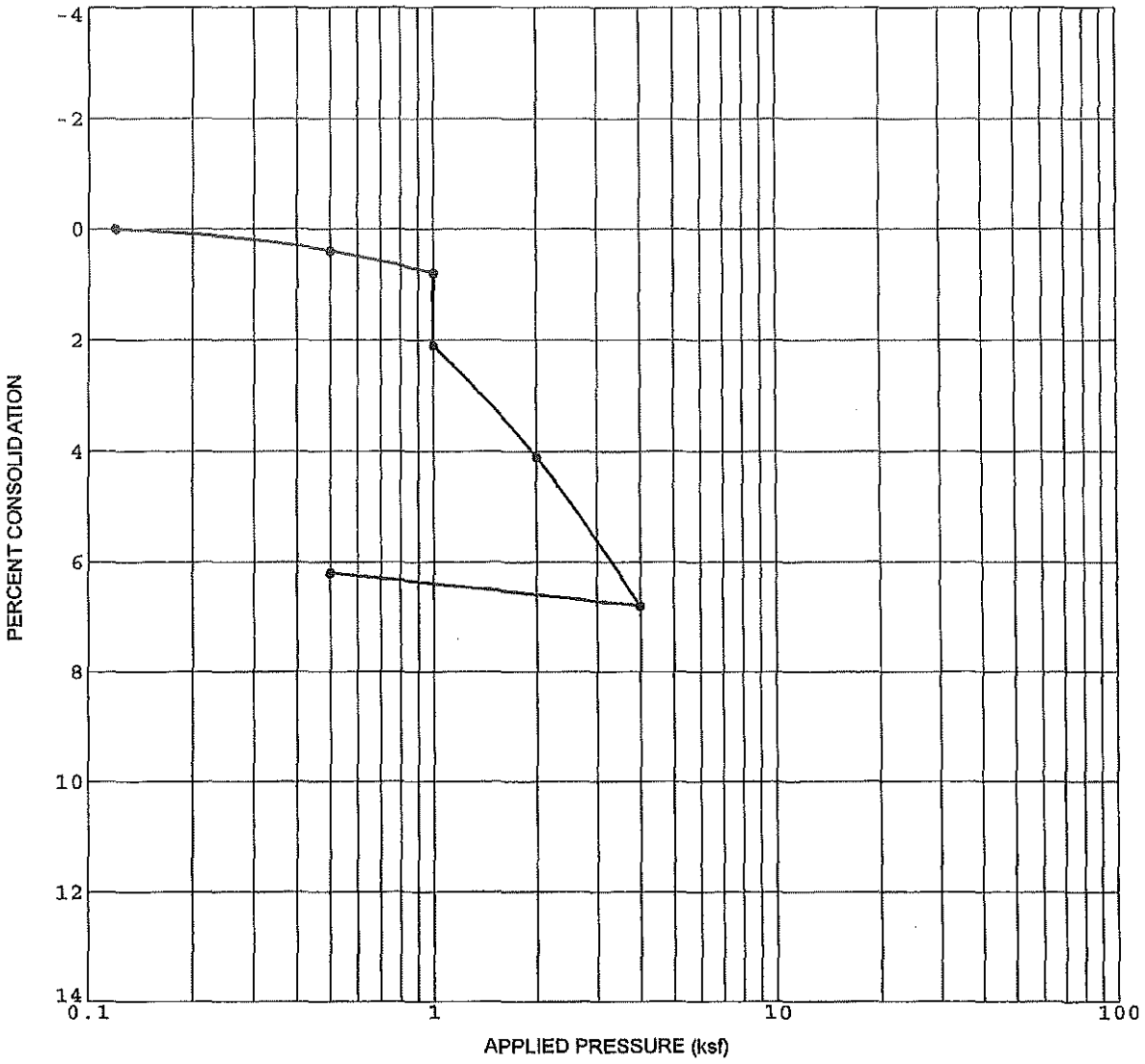
07178-42-01.GPJ

Figure B-1

GEOCON

PROJECT NO. 07178-42-01

SAMPLE NO. T6-1



Initial Dry Density (pcf)	111.2	Initial Saturation (%)	72.1
Initial Water Content (%)	12.4	Sample Saturated at (ksf)	1.0

CONSOLIDATION CURVE

FLEMMING PROPERTY

RIVERSIDE COUNTY, CALIFORNIA

07178-42-01.GPJ

Figure B-2

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APPENDIX C

APPENDIX C

RECOMMENDED GRADING SPECIFICATIONS

FOR

KTM DEVELOPMENT
NEC BOREL ROAD AND HIGHWAY 79
FRENCH VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

PROJECT NO. T2788-22-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9

and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition

4. CLEARING AND PREPARING AREAS TO BE FILLED

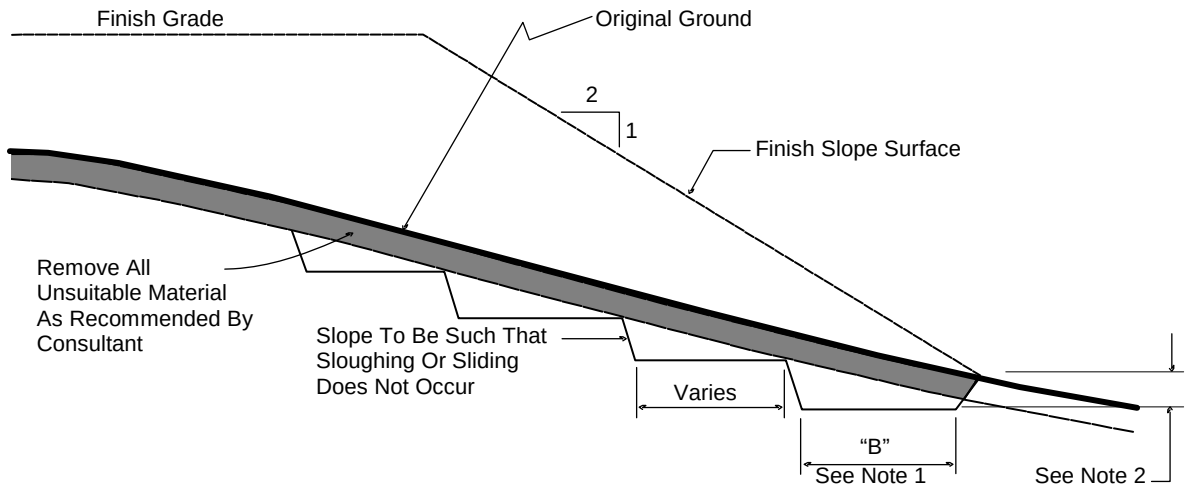
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



No Scale

DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection

variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of "passes" have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

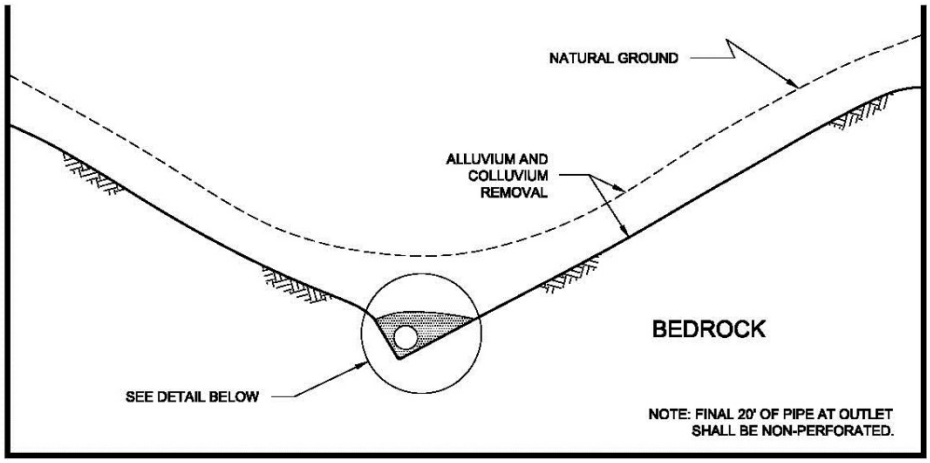
6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

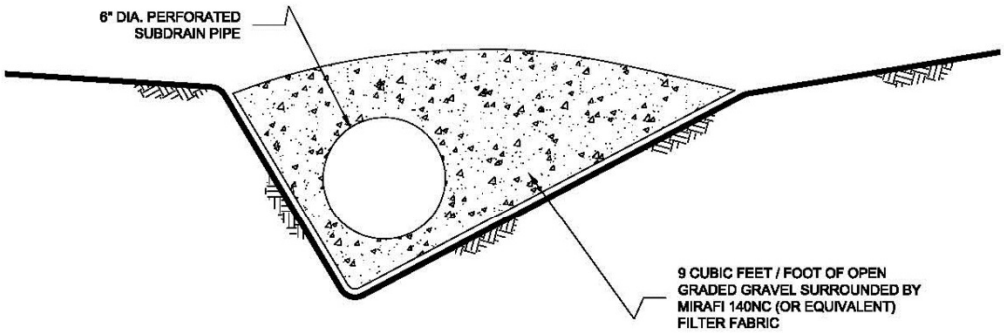
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

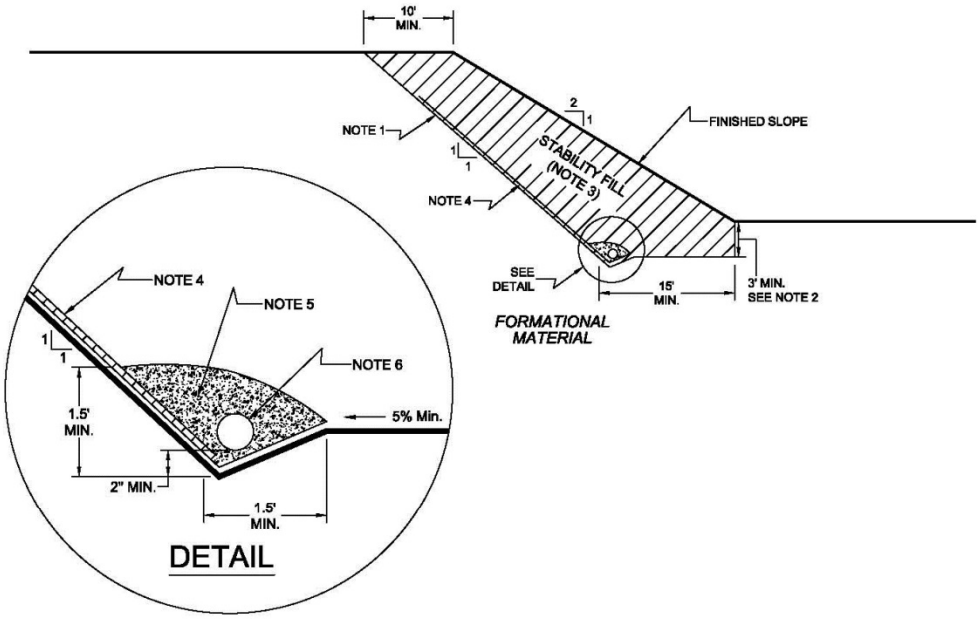
1.....6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS
IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2.....6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS
LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or lager) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1.....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2.....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4.....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5.....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

NO SCALE

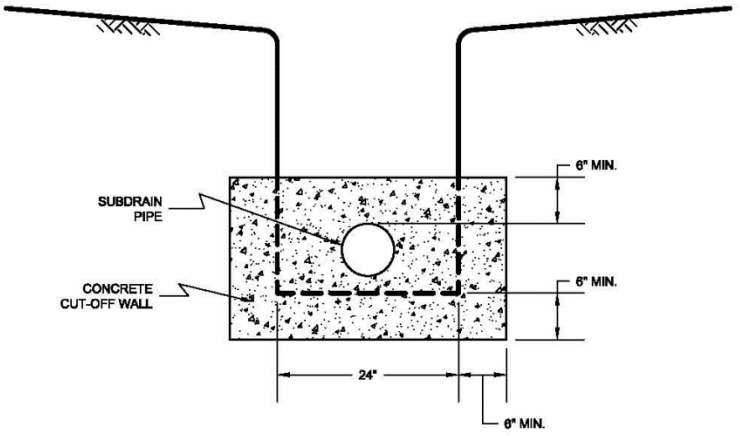
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

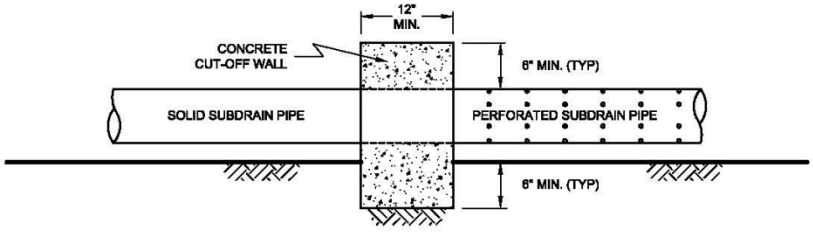
TYPICAL CUT OFF WALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW

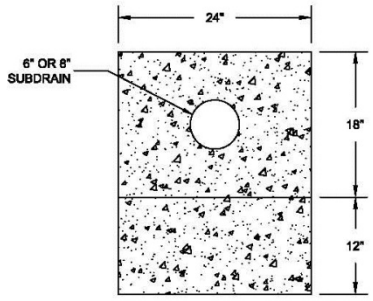


NO SCALE

7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

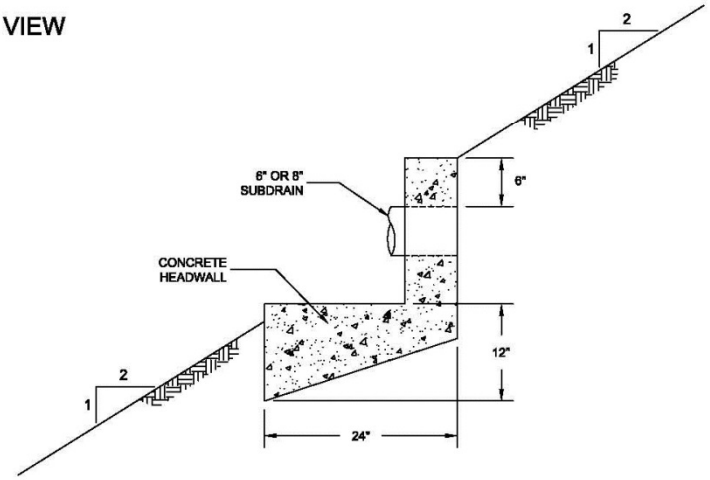
TYPICAL HEADWALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW



NOTE: HEADWALL SHOULD OUTLET AT TOE OF FILL SLOPE
OR INTO CONTROLLED SURFACE DRAINAGE

NO SCALE

7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an “as-built” map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

Appendix 4: Historical Site Conditions

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

Examples of material to provide in Appendix 4 may include but are not limited to the following:

- Environmental Site Assessments conducted for the project,
- Other information on Past Site Use that impacts the feasibility of LID BMP implementation on the site.

This information should support the Full Infiltration Applicability, and Biofiltration Applicability sections of this Template. Refer to Section 2.3 of the SMR WQMP and Sections D of this Template.

Appendix 5: LID Feasibility Supplemental Information

Information that supports or supplements the determination of LID technical feasibility documented in Section D

Examples of material to provide in Appendix 5 may include but are not limited to the following:

- Technical feasibility criteria for DMAs
- Site specific analysis of technical infeasibility of all LID BMPs (if Alternative Compliance is needed)
- Documentation of Approval criteria for Proprietary Biofiltration BMPs

This information should support the Full Infiltration Applicability, and Biofiltration Applicability sections of this Template. Refer to Section 2.3 of the SMR WQMP and Sections D of this Template.

Proprietary Biofiltration Criteria

The applicant shall provide documentation of compliance with each criterion in this checklist as part of the project submittal. Proprietary Biofiltration BMPs shall not be proposed if the BMP will accept undeveloped off-site tributary flows, where potential silt/sediment could clog or otherwise negatively impact the BMP.

1	**All BMPs must be sited/designed with the max. feasible infiltration/evapotranspiration[6].**	
	Requirement	Response
1a	What was the development status of the site prior to project application (i.e. raw ungraded land, or redevelopment with existing graded conditions)? – There will be more expectations to infiltrate if the project is a new development.	
1b	History of design discussions/coordination for the site proposed project, resulting in the final design determination (i.e. infiltration vs. flow-thru):	
1c	The consideration of site design alternatives to achieve infiltration or partial infiltration on site;	
1d	The physical impairments (i.e., fire road egress, public safety considerations, sewer lines, etc.) and public safety concerns (impermeable liners only to avoid geotech or contamination issues);	
1e	The extent low impact development BMP requirements were included in the project site design (site design worksheets can be attached).	
1f	When in the development process (e.g. entitlement or plan check, with dates of geotechnical work and development approval dates) did a geotechnical engineer analyze the site for infiltration feasibility?	
1g	What was the scope of the geotechnical testing?	
1h	What are Public Health and Safety requirements that affect infiltration locations?	
1i	What are the conclusions and recommendations from the geotechnical engineer, in regards to infiltrating/retaining on-site or allowing some or all of the flows to flow-thru as a proprietary BMP?	
1j	How will the proposed proprietary biofiltration BMPs achieve maximum feasible retention	

[6] To address San Diego Regional Board letter dated April 28, 2017 regarding documentation to support infeasibility to retain or infiltrate storm water on-site. This document will be used to meet the Regional Board requirements for documentation. As such, not apply or non-responses will not be accepted.

	(evapotranspiration and infiltration) of the water quality volume, as required by MS4 Permits?	

2	**Proprietary Biofiltration BMP sizing (all proprietary/compact BMPs require TAPE approval)[7]**	
	Requirement	Response
2a	Use Table F-1 and F-2 of the WQMP template to identify and list all the pollutants of concern.	
2b	Attached Active Technology Acceptance Protocol-Ecology (TAPE) certification, with General Use Level Designation (GULD) for all of applicable pollutants of concern	Yes _____ or No_____
2c	The most restrictive loading rates outlined in TAPE GULD approval[8] for all of the pollutants of concern.	
2d	Attach calculations, and all relevant steps to show that the sizing of the proprietary BMP is based on the flowrate (or volume) used to obtain TAPE/GULD approval (the most restrictive rate).	Yes _____ or No_____
2e	Are the infiltration rates are outlet controlled (e.g., via an underdrain and orifice/weir) or controlled by the infiltration rate of the media? Faster infiltration rates thru the media tend to reduce O&M issues.	Is the design infiltration rate controlled by the outlet? Yes _____ or No_____ If No, provide the rates for the outlet and the media and explain why outlet control is not practicable.
2f	Does the water surface drains to at least 12 inches below the media surface within 24 hours from the end of storm event flow to preserve plant health and promote healthy soil structure?	Yes _____ or No_____

3	**Biofiltration BMPs must be designed to promote appropriate biological activity to support and maintain treatment processes.**	
	Requirement	Response
3a	Plants tolerant of project climate, design ponding depths and the treatment media composition.	Provide documentation justifying plant selection.[9]

[7] Full scale field testing data that has been verified by Washington Department of Ecology and General Use Level Designation is required. https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies. Otherwise, the County has no obligation to accept the use of any other proprietary flow-thru BMP. Additional guidance can be found at the end of this checklist from the San Diego BMPDM Appendix F.1 for other verified third-party, field scale testing performance criteria that does not meet the Washington Department of Ecology standards.

[8] E.g. if the BMP was certified/verified with 100 gallons per minute treatment rate, the BMP shall be sized with no more than the equivalent rate).

[9] See Appendix E.20 of the San Deigo BMPDM for initial plan list for consideration for Riverside County.

3b	Plants that minimize irrigation requirements.	Provide documentation describing irrigation requirements for establishment and long term operation.
3c	Plant location and growth will not impede expected long-term media filtration rates and will enhance long-term infiltration rates to the extent possible.	Provide documentation justifying plant selection.[4]
3d	If plants are not applicable to the biofiltration design, other biological processes are supported as needed to sustain treatment processes (e.g., biofilm in a subsurface flow wetland). TAPE GULD approval that identifies approval with and without plants can be submitted for approval.	For biofiltration designs without plants, describe the biological processes that will support effective treatment and how they will be sustained.

4	**Biofiltration BMPs must be designed with a hydraulic loading rate to prevent erosion, scour, and channeling within the BMP. Erosion, scour, and/or channeling can disrupt treatment processes and reduce effectiveness.**	
	Requirement	Response
4a	What pre-treatment devices (e.g. vegetated buffers, catch basin inserts) and designs (e.g. forebay berms with cutouts) are proposed?	
4b	Adequate scour protection has been provided for both sheet flow and pipe inflows to the BMP.	
4c	Where scour protection has not been provided, flows into and within the BMP are kept to non-erosive velocities.	What are the maximum velocities for sheet flow and pipe inflows into the BMP?
4d	The BMP is used in a manner consistent with manufacturer guidelines and conditions of its third-party certification (e.g. maximum tributary area, maximum inflow velocities, etc.).	Manufacturer Requirements vs. the Design
4e	To preserve permeability, the media should have substantial void ratios and avoidance of choking layers.	Provide media gradation calculations and (if proposed) geotextile selection calculations if the geotextile could affect hydraulic loading rate.

5	**Biofiltration BMP must include operation and maintenance design features and planning considerations for continued effectiveness of pollutant removal and flow control functions. Biofiltration BMPs require regular maintenance in order provide ongoing function as intended. Additionally, it is not possible to foresee and avoid potential issues as part of design; therefore, plans must be in place to correct issues if they arise.**	
	Requirement	Response

5a	Is there any media or cartridge required to maintain the function of the BMP sole-sourced or proprietary in any way? If yes, obtain explicit approval by the Agency. Potentially full replacement costs to a non-proprietary BMP needs to be considered.	Yes _____ or No_____, explain:
5b	The maintenance plan specific for the proprietary BMP specific inspection activities, regular/periodic maintenance activities and specific corrective actions relating to scour, erosion, channeling, media clogging, vegetation health, and inflow and outflow structures.	This is in addition to the O&M Plan described in the WQMP guidance document, Section 5.
5c	Adequate site area and features have been provided for BMP inspection and maintenance access.	Illustrate maintenance access routes, setbacks, maintenance features as needed on project water quality plans
5d	For proprietary biofiltration BMPs, the BMP maintenance plan is consistent with manufacturer guidelines and conditions of its third-party certification (i.e., maintenance activities, frequencies).	Yes _____ or No_____
5e	Describe all portions of the BMP that may potentially clog or present an O&M issue.	
5f	Describe design features to address each of the potential clogging or O&M issues.	

By signing below, the preparer certifies all the information provided with this submittal and submittals related to proprietary BMPs for the project is accurate, and relevant information to assess the long term operation and maintenance of this proprietary BMP was not omitted with this submittal.

Prepared by: _____

Title: _____

Signature: _____

Date: _____

Alternative Pollutant Treatment Performance Standard

County staff may allow the applicant to submit alternative third-party documentation that the pollutant treatment performance of the system is consistent with Technology Acceptance Protocol-Ecology certifications. Table F.1-1 describes the required levels of certification and Table F.1-2 describes the pollutant treatment performance levels associated with each level of certification. Acceptance of this approach is at the sole discretion of County staff, preference would be given to:

a. Verified third-party, field-scale testing performance under the Technology Acceptance Reciprocity Partnership Tier II Protocol. This protocol is no longer operated, however this is considered to be a valid protocol and historic verifications are considered to be representative provided that product models being proposed are consistent with those that were tested. Technology Acceptance Reciprocity Partnership verifications were conducted under New Jersey Corporation for Advance Testing and are archived at the website linked below. Note that Technology Acceptance Reciprocity Partnership verifications must be matched to pollutant treatment standards in Table F.1-2 then matched to an equivalent Technology Acceptance Protocol-Ecology certification in Table F.1-1.

b. Verified third-party, field-scale testing performance under the New Jersey Corporation for Advance Testing protocol. Note that New Jersey Corporation for Advance Testing verifications must be matched to pollutant treatment standards in Table F.1-2 then matched to an equivalent Technology Acceptance Protocol- Ecology certification in Table F.1-1. A list of field-scale verified technologies under Technology Acceptance Reciprocity Partnership Tier II and New Jersey Corporation for Advance Testing can be accessed at: http://www.njcat.org/verification-process/technology-verification-database.html (refer to: field verified technologies only).

Table F.1-1: Required Technology Acceptance Protocol-Ecology Certifications for Polltuants of Concern for Biofiltration Performance Standard

Project Pollutant of Concern	Required Technology Acceptance Protocol-Ecology Certification for Biofiltration Performance Standard
Trash	Basic Treatment OR Phosphorus Treatment OR Enhanced Treatment
Sediments	Basic Treatment OR Phosphorus Treatment OR Enhanced Treatment
Oil and Grease	Basic Treatment OR Phosphorus Treatment OR Enhanced Treatment
Nutrients	Phosphorus Treatment[1]
Metals	Enhanced Treatment
Pesticides	Basic Treatment (including filtration)[2] OR Phosphorus Treatment OR Enhanced Treatment
Organics	Basic Treatment (including filtration)[2] OR Phosphorus Treatment OR Enhanced Treatment
Bacteria and Viruses	Basic Treatment (including bacteria removal processes)[3] OR Phosphorus Treatment OR Enhanced Treatment

1 – There is no Technology Acceptance Protocol-Ecology equivalent for nitrogen compounds; however systems that are designed to retain phosphorus (as well as meet basic treatment designation), generally also provide treatment of nitrogen compounds. Where nitrogen is a pollutant of concern, relative performance of available certified systems for nitrogen removal should be considered in BMP selection.
2 – Pesticides, organics, and oxygen demanding substances are typically addressed by particle filtration consistent with the level of treatment required to achieve Basic treatment certification; if a system with Basic treatment certification does not provide filtration, it is not acceptable for pesticides, organics or oxygen demanding substances.
3 – There is no Technology Acceptance Protocol-Ecology equivalent for pathogens (viruses and bacteria), and testing data are limited because of typical sample hold times. Systems with Technology Acceptance Protocol-Ecology Basic Treatment must be include one or more significant bacteria removal process such as media filtration, physical sorption, predation, reduced redox conditions, and/or solar inactivation. Where design options are available to enhance pathogen removal (i.e., pathogen-specific media mix offered by vendor), this design variation should be used.

Table F.1-2: Performance Standards for Technology Acceptance Protocol-Ecology Certification

Performance Goal	Influent Range	Criteria
Basic Treatment	20 – 100 mg/L TSS	Effluent goal ≤ 20 mg/L TSS
	100 – 200 mg/L TSS	≥ 80% TSS removal
	>200 mg/L TSS	> 80% TSS removal
Enhanced (Dissolved Metals) Treatment	Dissolved copper 0.005 – 0.02 mg/L	Must meet basic treatment goal and better than basic treatment currently defined as >30% dissolved copper removal
	Dissolved zinc 0.02 – 0.3 mg/L	Must meet basic treatment goal and better than basic treatment currently defined as >60% dissolved zinc removal
Phosphorous Treatment	Total phosphorous 0.1 – 0.5 mg/L	Must meet basic treatment goal and exhibit ≥50% total phosphorous removal
Oil Treatment	Total petroleum hydrocarbon > 10 mg/L	No ongoing or recurring visible sheen in effluent Daily average effluent Total petroleum hydrocarbon concentration < 10 mg/L Maximum effluent Total petroleum hydrocarbon concentration for a 15 mg/L for a discrete (grab) sample
Pretreatment	50 – 100 mg/L TSS	≤ 50 mg/L TSS
	≥ 200 mg/L TSS	≥ 50% TSS removal

Appendix 6: LID BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation to supplement Section D

Examples of material to provide in Appendix 6 may include but are not limited to the following:

- DCV calculations,
- LID BMP sizing calculations from Exhibit C of the SMR WQMP
- Design details/drawings from manufacturers for proprietary BMPs

This information should support the Full Infiltration Applicability, and Biofiltration Applicability sections of this Template. Refer to Section 3.4 of the SMR WQMP and Sections D.4 of this Template.

WQMP Project Report

County of Riverside Stormwater Program

Santa Ana River Watershed Geodatabase

Wednesday, October 24, 2018

Note: The information provided in this report and on the Stormwater Geodatabase for the County of Riverside Stormwater Program is intended to provide basic guidance in the preparation of the applicant's Water Quality Management Plan (WQMP) and should not be relied upon without independent verification.

Project Site Parcel Number(s):	963030002, 963030010, 963030003, RW, RW
Latitude/Longitude:	33.5725, -117.134
Thomas Brothers Page:	
Project Site Acreage:	52.08
Watershed(s):	SANTA MARGARITA
This Project Site Resides in the following Hydrologic Unit(s) (HUC):	**HUC Name** - HUC Number **Warm Springs Creek** - 180703020401
The HUCs Contribute stormwater to the following 303d listed water bodies and TMDLs which may include drainage from your proposed Project Site:	**WBID Name** - WBID Number **Santa Margarita River (Lower)** - CAR902110001998091116134 6 **Santa Margarita River (Upper)** - CAR902220002001100114105 0 **Murrieta Creek** - CAR902320002001092415213 6 **Warm Springs Creek (Riverside County)** - CAR902330002008082500593 3
These 303d listed Water bodies and TMDLs have the following Pollutants of Concern (POC):	**Bacterial Indicators** - Enterococcus, Escherichia coli (E. coli), Fecal Coliform **Metals/Metalloids** - Copper, Iron, Manganese **Nutrients** - Nitrogen, Phosphorus, Total Nitrogen as N **Pesticides** - Chlorpyrifos **Toxicity** - Toxicity
Is the Site subject to Hydromodification:	Yes
Limitations on Infiltration:	**Project Site Onsite Soils Group(s)** - C, D **Known Groundwater Contamination Plumes within 1000'** - No **Adjacent Water Supply Wells(s)** - No information available please contact your local water agency for more information. Your local contact agency is EASTERN MUNICIPAL W.D.. Your local wholesaler contact agency is METROPOLITAN WATER DISTRICT. None

Environmentally Sensitive Areas within 200'(Fish and Wildlife Habitat/Species):	
Environmentally Sensitive Areas within 200'(CVMSHCP):	None
Environmentally Sensitive Areas within 200'(WRMSHCP):	Burrowing Owl Survey Required Area,Narrow Endemic Plants Survey Req. - Area 4,Criteria Area Survey Req. - Area 4,Narrow Endemic Plants Survey Req. - NAP
Groundwater elevation from Mean Sea Level:	No Data
85th Percentile Design Storm Depth (in):	0.616
Groundwater Basin:	No Data
MSHCP/CVMSHCP Criteria Cell (s):	Click here for detailed MSHCP report
Retention Ordinance Information:	No Data
Studies and Reports Related to Project Site:	IBI Scores - Southern Cal bulletin118_4-sc water_fact_3_7.11 Murrieta Creek Santa Margarita River Watershed Annual Watermaster Murrieta Creek/Murrieta Valley ADP Map 1 Murrieta Creek/Murrieta Valley ADP Map 2 Murrieta Creek/Murrieta Valley ADP Report SMR Annual Report 2009-10

Santa Margarita Watershed

BMP Design Volume, V_{BMP} (Rev. 03-2012)

Legend: Required Entries / Calculated Cells

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

Company Name	CASC	Date	6/21/2019
Designed by	MJG	County/City Case No	PPT180022
Company Project Number/Name	KTM		
Drainage Area Number/Name	DA-A		

Enter the Area Tributary to this Feature A_T = 18.54 acres

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

Site Location

Township: 7S

Range: 2W

Section: 7

Enter the 85th Percentile, 24-hour Rainfall Depth D_{85} = 0.62

Determine the Effective Impervious Fraction

Type of post-development surface cover (use pull down menu): Mixed Surface Types

Effective Impervious Fraction I_f = 0.51

Calculate the composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$

C = 0.35

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 85% Unit Storage Volume $V_U = D_{85} \times C$

V_u = 0.21 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}.

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12\ (in/ft)}$$

V_{BMP} = 14,133 ft^3

Notes:

Biofiltration with Partial Infiltration Facility - Design Procedure	BMP ID 1	Legend:	Required Entries / Calculated Cells
Company Name:	CASC	Date:	6/21/2019
Designed by:	MJG	County/City Case No.:	PPT180022

Design Volume

Enter the area tributary to this feature — A_T = 18.54 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 14,133 ft^3

Enter initial estimate of footprint of BMP, $Area_{BMP}$ (Guidance: A reasonable starting point is 3% of the tributary impervious area) — $Area_{BMP}$ = 18,200 ft^2

Note: This area shall be measured at the mid-ponding depth of the BMP. For systems with side-slopes, this should be the contour that is midway between the floor of the basin and the maximum water quality ponding elevation of the basin. The underlying gravel layer (infiltration storage layer) should extend to this contour. For systems with vertical walls, the effective area is the full footprint.

Portion of DCV Reliably Retained

Depth of Gravel Infiltration Storage Layer (18" minimum; 30" maximum) — dg = 18.0 inches

Portion of V_{BMP} Reliably Retained via Infiltration Storage in Gravel Layer

$V_{retained} = d_g\,(in) \times 0.4 \times Area_{BMP}\,(ft^2) \times 1/12$ — $V_{Retained}$ = 10920.0 ft^3

Portion of V_{BMP} not Reliably Retained

$V_{Not\ Reliably\ Retained} = V_{BMP} - V_{Retained}$ — $V_{Not\ Reliably\ Retained}$ = 3213.0 ft^3

Biofiltration with Partial Retention Facility Surface Area

Depth of Surface Ponding Layer (6" minimum, 12" maximum) — d_P = 6.0 inches

Depth of Engineered Soil Media (24" to 36"; 18" if vertically constrained) — d_S = 24.0 inches

Design Media Filtration Rate (2.5 in/hr) — I_{design} = 2.5 in/hr

Allowable Routing Period, $T_{routing}$ (5 hrs) — $T_{routing}$ = 5.0 hr

Effective Biofiltration Depth, d_{E_bio}

$d_{E\_bio}\,(ft) = (d_P + (0.3 \times d_S) + (I_{design} * T_{routing}))\,(ft)$ — d_{E_bio} = 2.1 ft

Effective Static Depth, $d_{E\_bio\_static}$

$d_{E\_bio\_static} = (d_P + (0.3 * d_S))\,(ft)$ — $d_{E\_bio\_static}$ = 1.1 ft

$V_{biofiltered} = d_{E\_bio} * Area_{BMP}$ — $V_{biofiltered}$ = 38978.3 ft^3

$V_{biofiltered\_static} = d_{E\_bio\_static} * Area_{BMP}$ — $V_{biofiltered\_static}$ = 20020.0 ft^3

Sizing Option 1 Result		
Criteria 1:	$V_{biofiltered\ (with\ routing)} > 150\%$ of $V_{not\ reliably\ retained}$	Results: PASS

Sizing Option 2 Result		
Criteria 2:	$V_{biofiltered\_static} > 0.75 \times V_{Not\ Reliably\ Retained}$	Results: PASS

Note

If neither of these criteria are met, then increase retention depth, increase footprint, or both, and rerun calculations. This calculation is inherently iterative.

Biofiltration with Partial Retention Facility Properties

Side Slopes in Partial Retention with Biofiltration Facility	z = 4	:1
Diameter of Underdrain	6	inches
Longitudinal Slope of Site (3% maximum)	0.5	%
Check Dam Spacing	0	feet
Describe Vegetation:	Natural Grasses	

Notes: Basin will be hydroseeded with a Native Seed Mix per Landscape Plans

Appendix 7:
Hydromodification & Critical Coarse Sediment

Supporting Detail for Hydromodification compliance & Exhibit G - CCSY & PSS Areas with the project location.

The preparer shall include the following in this Appendix (Refer to Section 2.4 and 3.6 of the SMR WQMP and Sections E of this Template):

- Hydromodification Exemption Exhibit (if the project is in an area exempt from Hydromod)
- Potential Critical Coarse Sediment Yield Area Mapping (to show if the site is out of a CCSYA)
- Hydromodification BMP sizing calculations (i.e. County Hydromod Spreadsheet – Hydromod, and BMP Design tabs, SMRHM report files, or other acceptable Hydromod calculations)
- Site-Specific Critical Coarse Sediment Analysis (if a project impacts a CCSYA)
- Design details/drawings from manufacturers for proprietary BMPs (if proprietary BMPs are proposed)

In addition, the project shall comply with drainage law and good practices:

- Protect the Site and Roads from Q100yr, without impacting adjacent property owners.
- Pad elevations must be above the Q100yr water surface at all locations.

I. Identify Offsite Hydrology

A. If the project intends to allow the flows to pass through the project uninterrupted, the flows must remain along its natural flow-path and natural condition. The project must also:
   (1) Ensure that the existing stream is stable. If not, the design must include stabilization.
   (2) Does the 100 year flow path affect proposed project elements, such as streets and fill slopes? If so, the project must properly design for impingements, provide revetment, etc. If the water surface changes due to impingements on neighbor's properties, Permission to pond letters must be provided.

B. If the project intends to collect and convey the offsite flows, see the next section:

II. Hydraulics

A. Project must provide collection inlets that can be accessed for maintenance. If located outside of the project boundary, the project must provide a Permission Letter or drainage easement. If the inlet creates new ponding on private property, the project must provide a Permission to Pond letter or easement.

B. The project should not divert watershed areas over 1 acre. If so, Permission Letter to accept project's diversion and drainage concept must be received by the project.

C. The project should have an adequate outlet. If not, include Permission Letters and implement Increased Runoff criteria (2, 5,10 year storm events and the 1, 3, 6 and 24 hour durations). 100 year storm routing is not to be used. Runoff from the offsite plus onsite must be returned to its natural (existing) condition of velocity, peak flow-rate, flow-width and location/right of way, if permission letters have not been obtained.

D. The project must adequately convey the 100 year storm between the combination of street flow and pipe flow per County Ordinance.

E. The project should use the downstream connection as the Q100yr water surface control elevation, to ensure 6 inches minimum of freeboard in proposed drainage system.

III. Basin Layout

A. Implement Basin Guidelines as best as possible from Appendix C, Design Handbook for LID BMPs.

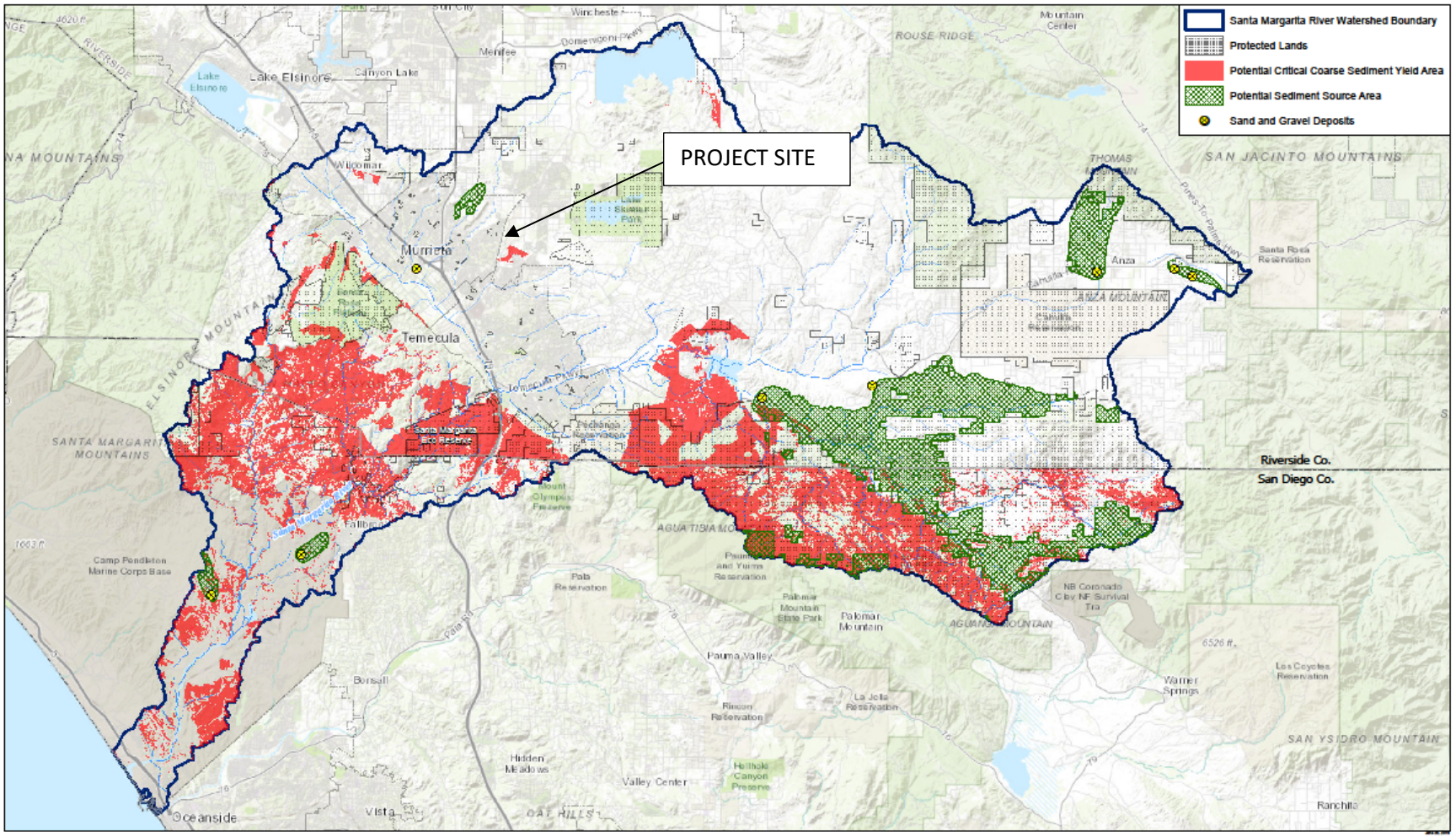


Exhibit G-1

SANTA MARGARITA RIVER WATERSHED
POTENTIAL CRITICAL COARSE SEDIMENT YIELD AREAS AND POTENTIAL SEDIMENT SOURCE AREAS

Santa Margarita Region - County HydroMod Iterative Spreadsheet Model

Only for use the unincorporated portions of Riverside County, unless otherwise approved by the Co-Permittee

Development Project Number(s):	PM 35212	Rain Gauge	Eastern Slopes
Latitude (decimal format):	33.5691	BMP Type (per WQMP):	Bioretention with Underdrain
Longitude (decimal format):	-117.136	BMP Number (Sequential):	1

Pre-Development - Hydrology Information

DRAINAGE AREA (ACRES) - 10 acre max[1]	18.54	2-YEAR, 1-HOUR INTENSITY (IN/HR) - Plate D-4.3	0.586
LONGEST WATERCOURSE (FT) - 1,000' max[1]	1690	10-YEAR, 1-HOUR INTENSITY (IN/HR) - Plate D-4.1 or D-4.5	0.88
UPSTREAM ELEVATION OF WATERCOURSE (FT)	1334	SLOPE OF THE INTENSITY DURATION - Plate D-4.6	0.55
DOWNSTREAM ELEV. OF WATERCOURSE (FT)	1309	CLOSEST IMPERVIOUS PERCENTAGE (%)	0% Undeveloped - Fair Cover
EXISTING IMPERVIOUS PERCENTAGE (%)	0		
Use 10% of Q2 to avoid Field Screening requirements	Yes		

Pre-Development - Soils Information

Cover Type #	Subarea Acreage	Cover Type	Vegetative Cover	Soil A %	Soil B %	Soil C %	Soil D %	RI Index AMC I	RI Index AMC II	RI Index AMC III
8	18.54 Ac.	Grass	Fair Cover				100	68	**84**	93
								0	**0**	0
								0	**0**	0
	18.54 Ac.						**Weighted Average RI Numbers =**	**68.0**	**84.0**	**93.0**

Per Dr. Luis Parra, the AMC condition is based on the rainfall record. Applying NEH-4 (1964) for the non-freezing conditions in Riverside County the AMC conditions are:
AMC-I for less than 0.5" of rain the previous 5 days; AMC-II for between 0.5" to 1.1" of rain the previous 5 days; or AMC-III for more than 1.1" for the previous 5 days.

Pre-Development - Calculated Range of Flow Rates analyzed for Hydromod (Suceptible Range of Flows)

Calculated Upper Flow-rate limit	Calculated Lower Flow-rate limit
Ex. 10-year Flowrate[1] = **18.900** cfs	Ex. 10% of the 2-year Flowrate[1] = **0.876** cfs
(Co-Permitte Approval is required) User-Defined Discharge Values with accompanying Hydrology Study[1]	
Ex. 10-year Flowrate (Attach Study) = 18.9 cfs	Ex. 2-year Flowrate (Attach Study) = 8.76 cfs

[1]The equations used to determine the 10-year and 10% of the 2-yr are limited to 10-acres and 1,000'. Flowrates from a separate study can be used to over-ride the calculated values so that larger areas (up to 20 acres) and longer watercourse lengths can be used. All values still need to be filled out, even when there is a user-defined discharge value entered.

Post-Project - Hydrograph Information

DRAINAGE AREA (ACRES)	18.54
LONGEST WATERCOURSE (FT)	1740
DIFFERENCE IN ELEV (FT) - along watercourse	21
PROPOSED IMPERVIOUS PERCENTAGE (%)	51

Go to "BMP Design" tab to design your BMP, then check results below.
Print both this "HydroMod" Sheet and the "BMP Design" sheet for your submittal.

Post-Project - Soils Information

Cover Type #	Subarea Acreage	Cover Type	Vegetative Cover	Soil A %	Soil B %	Soil C %	Soil D %	RI Index AMC I	RI Index AMC II	RI Index AMC III
22	18.54 Ac.	Urban Landscaping	Good Cover				100	57	**75**	88
								0	**0**	0
								0	**0**	0
	18.54 Ac.						**Weighted Average RI Numbers =**	**57.0**	**75.0**	**88.0**

Per Dr. Luis Parra, the AMC condition is based on the rainfall record. Applying NEH-4 (1964) for the non-freezing conditions in Riverside County the AMC conditions are:
AMC-I for less than 0.5" of rain the previous 5 days; AMC-II for between 0.5" to 1.1" of rain the previous 5 days; or AMC-III for more than 1.1" for the previous 5 days.

Results

		First result out of compliance in the rainfall record				See below for the Height in the Basin (Stage) that is causing a non-compliant result	
Hydromod Ponded depth	**1.30 feet**	Requirement		Proposed			
Hydromod Drain Time (unclogged)	38.74 hours						
Is the HydroMod BMP properly sized?	**Yes, this is acceptable**	---	---	---	---		
Mitigated Q < 110% of Pre-Dev. Q?	**Yes, this is acceptable**	---	---	---	---	Issue @ Stage =	---
Mitigated Duration < 110% of Pre-Dev?*	**Yes, this is acceptable**	---	---	---	---	Issue @ Stage =	---

Responsible-in-charge: _____ Date: _____

Signature: _____ Spreadsheet Developed by: Benjie Cho, P.E.

BMP Design

Fill in **blue** shaded areas

BMP Geometry & Detention Calculations

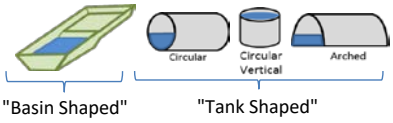
0.1	feet, Stage Intervals

Larger Stage Intervals may incr. the Q at the bottom stg.

PROPOSED BMP DIMENSIONS

STEP1: Size the BMP, so that the Total Volume > Max HydroMod Vol. (Deeper is ok, it will be refined in the Design Geometry)

Is the BMP a Tank shape? 2 1 for yes; 2 for no.

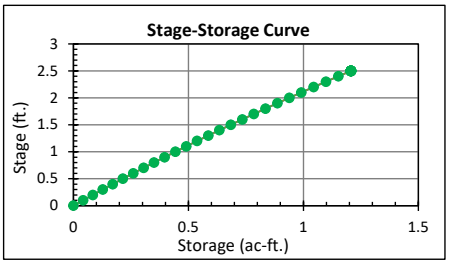


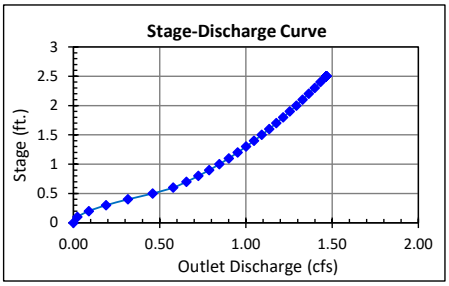
Basin Shaped BMP (Bottom Stage 1st)

Bottom Stage H= 2.5' SS= 4 :1

	Top Area		Bottom Area	
Width	150	Width	130	FT
Length	160	Length	140	FT
area =	24000	area =	18200	

Top Stage H=





Prop. Top Stg. Vol. =	-	FT3
Prop Bottom Stg Vol =	52,583	FT3
Total Prop. Volume[1] =	52,583	FT3
Max HydroMod Volume =	24,639	FT3
Total Surface Area[2] =	24,000	FT2
BMP % of Site =	2.97%	
Max HydroMod Depth[3] =	1.30	FT

[1]Does not include forebay, or low flow trench
[2]Does not account for freeboard or access roads
[3]Does not consider Increased Runoff

MINIMUM DESIGN GEOMETRY

STEP2: Delete outlets, then propose the largest lowest orifice that does not, exceed the ex. Q or Duration. If the Q is acceptable, but the duration is exceeded, try decreasing orifice, then adding a weir slightly below the stage that has an issue.

OUTLETS (for Stage-Discharge)

Orifice Outlets			Weir Outlets		
Invert Height (ft)	Diameter (inches)	No. of Orifices	Crest Height (ft)	Crest Width (ft)	No. of Weirs
0	6.00	1			

Hydromod Depth = 1.30 FT
+ 1' Freeboard = 2.30 FT
Resize with Hydromod Depth +1' Freeboard

Top Surface Area
Based on HydroMod Depth +1' of Freeboard

Bottom Stage		
Width	148.4	FT
Length	158.4	FT

Stage-Storage-Discharge*

Stage (FT)	Storage (AC-FT)	Storage (FT3)	Q (CFS)
0	0	0	0
0.10	0.042	1831	0.02
0.20	0.085	3683	0.09
0.30	0.128	5558	0.19
0.40	0.171	7454	0.32
0.50	0.215	9373	0.46
0.60	0.260	11313	0.58
0.70	0.305	13277	0.66
0.80	0.350	15262	0.72
0.90	0.396	17270	0.79
1.00	0.443	19301	0.85
1.10	0.490	21355	0.90
1.20	0.538	23432	0.95
1.30	0.586	25532	1.00
1.40	0.635	27655	1.05
1.50	0.684	29802	1.09
1.60	0.734	31972	1.14
1.70	0.784	34166	1.18
1.80	0.835	36384	1.22
1.90	0.887	38625	1.25
2.00	0.939	40891	1.29
2.10	0.991	43180	1.33
2.20	1.044	45494	1.36
2.30	1.098	47833	1.40
2.40	*1.152*	*50196*	*1.43*
2.50	*1.207*	*52583*	*1.47*
2.50	1.207	52,583	

STEP3: Complete an increased runoff analysis, if the project can impact downstream properties. Incorporate these designs into the WQMP site plan. Add emergency overflow weir, for flows that exceed the Hydromod volumes, sized to the 100-year peak flow rate. Add access roads (< 10% longitudnal slope) with enough width & turn around access for equipment that would be needed to scarify the bottom or remove Bioretention soil media.

Add Infiltration

Enter information from actual infiltration tests or design BSM rate

No	Consider Infiltration, Bioretention, or Biofiltration (Yes or No)?	-	FT3/sec, Unfactored Infiltration (over entire bottom)
2.5	Infiltration/Biofiltration rate thru the finish surface of the BMP (in/hr)[3]	-	**FT3/sec, Infiltration / Factor of Safety**
3	Factor of Safety[3]	-	FT3, Vol. Infiltrated, over representative time
300	mins, Time represented by Infil. Tests or Biofiltraton Routing Time[4]	-	FT3/sec, Low-Loss after representative time

[3]Measured Infiltration Rate per the LID Manual, Appendix A for Infiltration/BioRetention. For BioFiltration use a rate thru the media of 2.5 in/hr (long term design rate).
[4]Time that infiltration rate is being applied for Hydromod analysis for Infiltration/BioRention. Use 300 minutes (5hrs) for BioFiltration. Pore space is not accounted for at this time.

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1

Rational Hydrology Study Date: 06/21/19 File:ktm2exist.out

KTM North America
2-year storm, existing conditions
for hydromod

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6268

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 2.00 Antecedent Moisture Condition = 1

Standard intensity-duration curves data (Plate D-4.1)
For the [Murrieta,Tmc,Rnch CaNorco] area used.
10 year storm 10 minute intensity = 2.360(In/Hr)
10 year storm 60 minute intensity = 0.880(In/Hr)
100 year storm 10 minute intensity = 3.480(In/Hr)
100 year storm 60 minute intensity = 1.300(In/Hr)

Storm event year = 2.0
Calculated rainfall intensity data:
1 hour intensity = 0.586(In/Hr)
Slope of intensity duration curve = 0.5500

++

Process from Point/Station 10.000 to Point/Station 11.000

**** INITIAL AREA EVALUATION ****

Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 1334.000(Ft.)
Bottom (of initial area) elevation = 1312.000(Ft.)
Difference in elevation = 22.000(Ft.)
Slope = 0.02200 s(percent)= 2.20
TC = k(0.710)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 24.142 min.
Rainfall intensity = 0.968(In/Hr) for a 2.0 year storm
UNDEVELOPED (fair cover) subarea
Runoff Coefficient = 0.552
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1) = 68.60
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 3.930(CFS)
Total initial stream area = 7.360(Ac.)
Pervious area fraction = 1.000

++

Process from Point/Station 11.000 to Point/Station 12.000

**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1312.000(Ft.)
End of natural channel elevation = 1309.000(Ft.)
Length of natural channel = 690.000(Ft.)
Estimated mean flow rate at midpoint of channel = 6.915(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow = 1.50(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0043
Corrected/adjusted channel slope = 0.0043
Travel time = 7.65 min. TC = 31.79 min.

Adding area flow to channel
UNDEVELOPED (fair cover) subarea

Runoff Coefficient = 0.519
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1) = 68.60
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 0.832(In/Hr) for a 2.0 year storm
Subarea runoff = 4.826(CFS) for 11.180(Ac.)
Total runoff = 8.756(CFS) Total area = 18.540(Ac.)
End of computations, total study area = 18.54 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number = 84.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1

Rational Hydrology Study Date: 06/21/19
File:ktm10exist.out

KTM North America
10-year storm, existing condition
For Hydromodification Analysis

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6268

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Murrieta,Tmc,Rnch CaNorco] area used.
10 year storm 10 minute intensity = 2.360(In/Hr)
10 year storm 60 minute intensity = 0.880(In/Hr)
100 year storm 10 minute intensity = 3.480(In/Hr)
100 year storm 60 minute intensity = 1.300(In/Hr)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.880(In/Hr)
Slope of intensity duration curve = 0.5500

++
Process from Point/Station 10.000 to Point/Station 11.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 1334.000(Ft.)
Bottom (of initial area) elevation = 1312.000(Ft.)
Difference in elevation = 22.000(Ft.)
Slope = 0.02200 s(percent)= 2.20
TC = k(0.710)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 24.142 min.
Rainfall intensity = 1.452(In/Hr) for a 10.0 year storm
UNDEVELOPED (fair cover) subarea
Runoff Coefficient = 0.766
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 84.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 8.186(CFS)
Total initial stream area = 7.360(Ac.)
Pervious area fraction = 1.000

++
Process from Point/Station 11.000 to Point/Station 12.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation = 1312.000(Ft.)
End of natural channel elevation = 1309.000(Ft.)
Length of natural channel = 690.000(Ft.)
Estimated mean flow rate at midpoint of channel = 14.403(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow = 1.81(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
Normal channel slope = 0.0043
Corrected/adjusted channel slope = 0.0043
Travel time = 6.35 min. TC = 30.49 min.

Adding area flow to channel
UNDEVELOPED (fair cover) subarea

Runoff Coefficient = 0.751
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2) = 84.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Rainfall intensity = 1.277(In/Hr) for a 10.0 year storm
Subarea runoff = 10.716(CFS) for 11.180(Ac.)
Total runoff = 18.902(CFS) Total area = 18.540(Ac.)
End of computations, total study area = 18.54 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number = 84.0

KTM NORTH AMERICA - HCOC HYDROLOGY MAP - PRE-PROJECT CONDITION

NEC OF WINCHESTER ROAD AND BOREL ROAD, CA

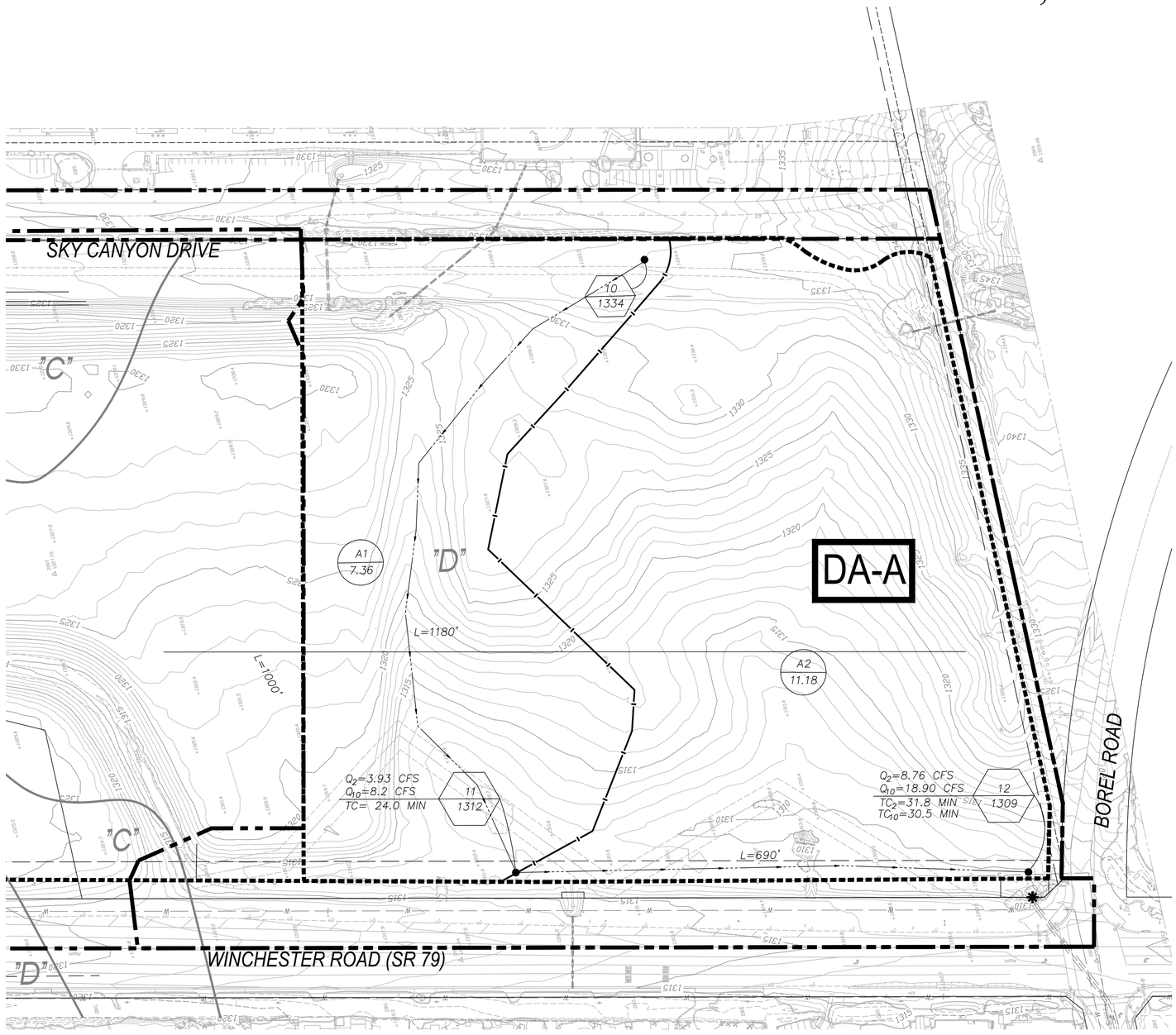
NOTES:
1. THIS HYDROLOGY MAP SHOWS THE EXISTING DRAINAGE PATTERN WITHIN THE BOUNDARIES OF THE PROPOSED DEVELOPMENT.
2. IN ORDER TO COMPARE PRE-DEVELOPMENT AND POST-DEVELOPMENT CONDITIONS FOR HYDROLOGIC CONDITIONS OF CONCERN (HCOC), THE ACREAGES ARE IDENTICAL FOR BOTH CONDITIONS.
3. DRAINAGE AREA (ACREAGE) IS BASED ON THE NET ACREAGE FOR DA-A, POST-DEVELOPMENT. SEE WQMP SITE MAP FOR DETAILS.

HYDROLOGY DATA

SOIL TYPE = D
COVER TYPE: GRASS, ANNUAL OR PERENNIAL, FAIR COVER
RUNOFF INDEX (AMC II) = 84

STANDARD INTENSITY DURATION CURVE: MURRIETA – TEMECULA, & RANCHO CALIFORNIA (PLATE D-4.1)
- 2-YEAR, 1-HOUR INTENSITY: 0.586 INCHES/HOUR
- 10-YEAR, 1-HOUR INTENSITY: 0.88 INCHES/HOUR
- 100-YEAR, 1-HOUR INTENSITY: 1.30 INCHES/HOUR
- SLOPE OF INTENSITY DURATION CURVE: 0.550

2-YEAR STORM: AMC I
10-YEAR STORM: AMC II



LEGEND

- PROJECT AREA BOUNDARY
- DRAINAGE AREA (DA) BOUNDARY
- FLOW PATH
- SUBAREA BOUNDARY
- * ULTIMATE DISCHARGE LOCATION
- DA-A DRAINAGE AREA LABEL FROM WQMP
- XXX / XX.X NODE/CONCENTRATION POINT ELEVATION
- XX / X.X SUBAREA ACRES
- L=XXX' MAIN FLOW PATH
- "C" / "D" HYDROLOGIC SOIL GROUP BOUNDARY

GRAPHIC SCALE
80 0 40 80 160
1" = 80'

CASC
Engineering and Consulting
1470 EAST COOLEY DRIVE, COLTON, CA 92324
PH. (909) 783-0101 FAX (909) 783-0108
www.cascinc.com

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

For Final WQMP, include a copy of the completed Pollutant Sources/Source Control Checklist in the subsequent pages and summarize Source Control BMPs in Section H of this Template.

Appendix 8
STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

How to use this worksheet (also see instructions in Section H of the 2018 SMR WQMP Template):

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

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

Appendix 8
STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Show on WQMP Drawings**	3 **Permanent Controls—List in WQMP Table and Narrative**	4 **Operational BMPs—Include in WQMP Table and Narrative**
☐ **D1.** Need for future indoor & structural pest control		☐ Note building design features that discourage entry of pests.	☐ Provide Integrated Pest Management information to owners, lessees, and operators.
☒ **D2.** Landscape/ Outdoor Pesticide Use	☐ Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained. ☐ Show self-retaining landscape areas, if any. ☐ Show stormwater treatment and hydrograph modification management BMPs.	State that final landscape plans will accomplish all of the following. ☐ Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. ☒ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. ☒ Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. ☒ Consider using pest-resistant plants, especially adjacent to hardscape. To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	☒ Maintain landscaping using minimum or no pesticides. ☐ See applicable operational BMPs in "What you should know for.....Landscape and Gardening" at: http://www.rcwatershed.org/about/materials-library/#1450469138395-bb76dd39-d810 ☐ Provide IPM information to new owners, lessees and operators.

Appendix 8
STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☐ **E.** Pools, spas, ponds, decorative fountains, and other water features.	☐ Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)	If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	☐ See applicable operational BMPs in "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at: http://www.rcwatershed.org/about/materials-library/#1450469201433-f5f358c9-6008
☐ **F.** Food service	☐ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ☐ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	☐ Describe the location and features of the designated cleaning area. ☐ Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.	☐ See the brochure, "The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries" at http://www.rcwatershed.org/about/materials-library/#1450389926766-61e8af0b-53a9 Provide this brochure to new site owners, lessees, and operators.
☒ **G.** Refuse areas	☐ Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ☐ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area. ☐ Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	☐ State how site refuse will be handled and provide supporting detail to what is shown on plans. ☐ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	☐ State how the following will be implemented: Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

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1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ **H.** Industrial processes.	❑ Show process area.	❑ If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."	❑ See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com See the brochure "Industrial & Commercial Facilities Best Management Practices for: Industrial, Commercial Facilities" at: http://www.rcwatershed.org/about/materials-library/#1450389926766-61e8af0b-53a9
❑ **I.** Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)	❑ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area. ❑ Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults. ❑ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	❑ Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for: ▪ Hazardous Waste Generation ▪ Hazardous Materials Release Response and Inventory ▪ California Accidental Release (CalARP) ▪ Aboveground Storage Tank ▪ Uniform Fire Code Article 80 Section 103(b) & (c) 1991 ▪ Underground Storage Tank www.cchealth.org/groups/hazmat/	❑ See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ **J.** Vehicle and Equipment Cleaning	☐ Show on drawings as appropriate: (1) Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	☐ If a car wash area is not provided, describe any measures taken to discourage on-site car washing and explain how these will be enforced.	Describe operational measures to implement the following (if applicable): ☒ Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at: http://www.rcwatershed.org/about/materials-library/#1450389926766-61e8af0b-53a9 ☐ Car dealerships and similar may rinse cars with water only.

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☒ **K.** Vehicle/Equipment Repair and Maintenance	❑ Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater. ❑ Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas. ❑ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.	☒ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ❑ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ❑ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the Stormwater Control Plan, note that all of the following restrictions apply to use the site: ❑ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains. ❑ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately. ❑ No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment. Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations; "Outdoor Cleaning Activities;" and "Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants. Brochures can be found at: http://www.rcwatershed.org/about/materials-library/#1450389926766-61e8af0b-53a9

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STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

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

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❑ **M.** Loading Docks	❑ Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer. ❑ Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. ❑ Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.		❑ Move loaded and unloaded items indoors as soon as possible. ❑ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

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

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☒ **P.** Plazas, sidewalks, and parking lots.			☒ Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Appendix 9: O&M

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

For the Final WQMP the following information shall be provided:

1. Maintenance Plan per Section 5.3.5 of the WQMP Guidance Document. County will regularly inspect BMPs, so BMPs without access (e.g. backyards, etc) will be rejected. Due to liability, the County does not allow for overlapping private maintenance in the public right-of-way.
2. For all projects, include one wet-signed and notarized hardcopy of the BMP Maintenance agreement. Please note, references to Exhibit A and B on Page 1can be struck out if the entire parcel is mentioned in the "Legal Description" on Page 1 of the agreement. Otherwise see below for Exhibit A and B standards. For BMP agreement, ensure that the name on the agreement matches throughout and the notary sheet, Notary shall be the latest California format, the date of the agreement is the date of the notary, all text does not exceed the margins, then the County will sign, attest & record
3. For Tracts, contact County EDA regarding maintenance determinations/formations. Include a completed Exhibit B.9 - WQMP O&M Cost Sheet.xlsx that is signed by both the preparer (to ensure quantities are correct) and the owner (to understand the maintenance obligations in perpetuity) & an Approved Maintenance Exhibit from EDA.
4. For Tracts or any project , written documentation from the maintenance entity that they are willing to maintain (e.g. CFD, CSA, L&LMD, etc.)

BMP EXHIBIT "A" STANDARDS

1. Use the legal description of the parcel as shown on the tentative exhibit. If not available, use the one in the most current title report.
2. As a backup, if the project is a map the description of the future lot may be included for reference

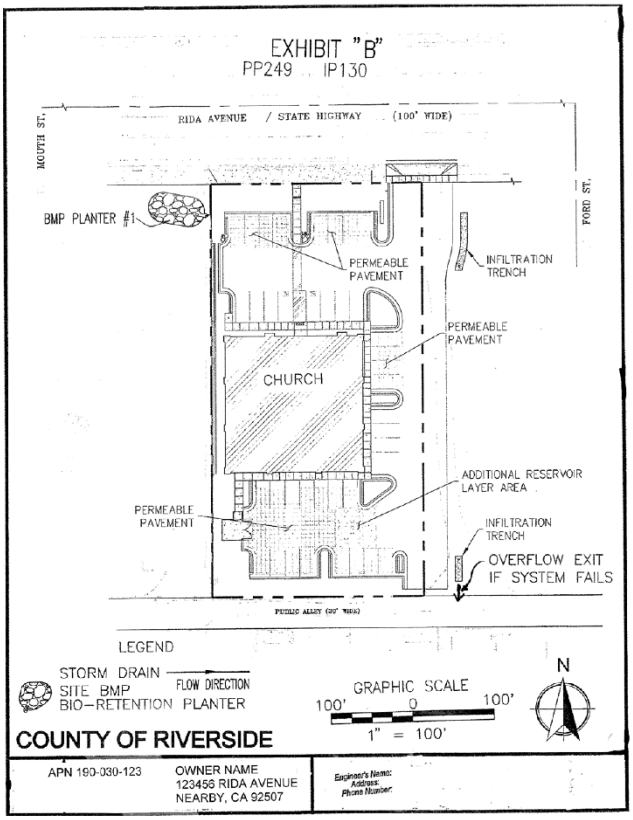
BMP EXHIBIT "B" STANDARDS

1. 0.12" minimum lettering
2. Sheet size must be 8.5" x 11"
3. Show Street names, north arrow
4. Indicate point of flow exit into street if basin system fails
5. Indicate Q100 of flow exit into street
6. Indicate direction of flow exit into street
7. Indicate by notation and/or show nearest downstream drainage facility (catch basin, culvert, riser, etc)
8. Show "Exhibit A", IP and project number (TR, PM, PUP, PP etc)
9. Title block, signature block, engineer seals, USA note is not necessary on Exhibit
10. Show scale used for drawing, provide 4" graphic scale

MAINTENANCE EXHIBIT "B" STANDARDS

1. 0.12" minimum lettering
2. Sheet size must be 8.5" x 11"
3. Show street names, north arrow
4. Show "Exhibit A", IP and project number (TR, PM, PUP, PP etc)
5. Title block, signature block, engineer seals, USA note is not necessary on Exhibit
6. Show scale used for drawing, provide 4" graphic scale

BMP EXHIBIT B EXAMPLE



Recorded at the request of:
COUNTY OF RIVERSIDE
TRANSPORTATION DEPARTMENT

THIS INSTRUMENT IS FOR THE BENEFIT
OF THE COUNTY OF RIVERSIDE AND
ENTITLED TO BE RECORDED WITHOUT
FEE.(GOV. CODE 6103)

RETURN TO:
RIVERSIDE COUNTY TRANSPORTATION
DEPARTMENT. **STOP NO. 1080**
4080 LEMON STREET
RIVERSIDE, CA 92501

COVENANT AND AGREEMENT REGARDING WATER QUALITY MANAGEMENT PLAN BMP, CONSENT TO INSPECT, MAINTENANCE AND INDEMNIFICATION

APN:_____ **PROJECT No.**_____ **IP No.**_____

OWNER(S):_____

PROPERTY ADDRESS:_____

LEGAL DESCRIPTION:_____
_____
_____

THIS AGREEMENT is made and entered into in Riverside County, California, this _____ day of _____ Year_____, by and between_____, (hereinafter referred to as "Covenantor" or "Owner") and the COUNTY OF RIVERSIDE via its Department of Transportation, a political subdivision of the State of California (hereinafter referred to as "County").

RECITALS

WHEREAS, the Covenantor owns real property ("Property") in the County of Riverside, State of California, more specifically described in Exhibit "A" and depicted in Exhibit "B", each of these exhibits is attached, and incorporated herein by this reference;

WHEREAS, the County is the owner of interests in that certain real property within the unincorporated area of the County of Riverside, State of California, containing storm drains, pipelines, and related appurtenances constituting the County's municipal separate storm sewer system (the County's "MS4");

WHEREAS, Covenantor intends to develop, improve, and/or use the Property is such a way that approval by the County for such development, improvement, and/or use is required pursuant to applicable laws;

WHEREAS, As a condition for said approval by the County, County required Covenantor, and Covenantor desires to, restrict the use of the Property according to the conditions, covenants, equitable servitudes, and restrictions contained herein for the express benefit of the County's MS4, which include requirements that the Property incorporate post construction on-site stormwater quality control measures;

WHEREAS, the Covenantor/Owner has chosen to install one or more _____, hereinafter referred to as "Device", as the on-site control measure to minimize pollutants in urban runoff;

WHEREAS, said Device has been installed in accordance with plans and specifications accepted by the County;

WHEREAS, said Device, with installation on private property and draining only private property, is a private facility with all maintenance or replacement, therefore, the sole responsibility of the Covenantor/Owner in accordance with the terms of this Agreement;

WHEREAS, the Covenantor/Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of Device and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining; to confined space and waste disposal methods, in effect at the time such maintenance occurs;

NOW THEREFORE, incorporating the foregoing Recitals and in consideration of the covenants and conditions contained herein, and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, and expressly for the benefit of, and to bind, their sucessors in interest, the parties hereto agree as follows:

1. Covenantor/Owner hereby provides the County or County's designee complete access to the Device and its immediate vicinity and such access onto the property to permit access to the devise at any time, upon twenty-four *(24)* hour advance notice in writing, of any duration for the purpose of inspection, sampling and testing of the Device. County shall make every effort at all times to minimize or avoid interference with Owner's use of the Property.

2. Covenantor/Owner shall use its best efforts diligently to maintain the Device in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of material(s) from the Device and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested

from time to time by the County / Regional Water Quality Control Board (RWQCB), the Owner shall provide the RWQCB with documentation identifying the material(s) removed, the quantity, and disposal destination.

3. In the event Covenantor/Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) days of being given written notice by the County, the County is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense to the Owner or Owner's successors or assigns, including administrative costs and interest thereon at the maximum rate authorized by the Civil Code from the date of notice of expense until paid in full.

4. The County may require the Covenantor/Owner to post security in a form and for a time period satisfactory to the County to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under this Agreement, the County may, in the case of a cash deposit, certificate of deposit or letter of credit, act for the Owner using the proceeds from it, or in the case of a surety bond, require the sureties to perform the obligations of the Agreement.

5. The County may, but shall not be obligated to, enforce this Agreement by a proceeding at law or in equity against any person or persons violating or attempting to violate any condition, covenant, equitable servitude, or restriction provided for herein, either to restrain such violation or to recover damages.

6. This Agreement constitutes the entire agreement and understanding between the parties with respect to the subject matter of this Agreement and supersedes all prior or contemporaneous agreements and understandings with respect to the subject matter hereof, whether oral or written.

7. If any part of this Agreement is declared by a final decision of a court of competent jurisdiction to be invalid for any reason, such shall not affect the validity of the rest of the Agreement. The other parts of this Agreement shall remain in effect as if this Agreement had been executed without the invalid parts(s). The parties declare that they intend and desire that the remaining parts of this Agreement continue to be effective without any part(s) that have been declared invalid.

8. This Agreement may be executed in counterparts, each of which so executed shall, irrespective of the date of its execution and delivery, be deemed an orginal, and all such counterparts together shall constitute one and the same instrument.

9. This Agreement shall be recorded in the Office of the Recorder of Riverside County, California and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth.

10. In the event of legal action occasioned by any default or action of the Covenantor/Owner, or its successors or assigns, then the Covenantor/Owner and its

successors or assigns agree(s) to pay all costs incurred by the County in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

11. Covenantor/Owner agrees to indemnify, defend, and hold harmless the County, its elected officers, employees, agents, and contractors from and against any and all liability, expense, including costs and reasonable legal fees, and claims of damage of any nature whatsoever including, but not limited to, death, bodily injury, personal injury, or property damage arising from or connected with the County inspection of the Property except where such liability, expense, or claim for damage results from the sole negligence or willful misconduct of the County.

12. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien thereon against.

13. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto and any other present or future interest holders or estate holders in the property. The term "Owner" shall include not only the present Owner, but also its heirs, successors in interest and in title to the property, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of this Agreement. Owner shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the County at the same time such notice is provided to the successor.

14. Time is of the essence in the performance of this Agreement.

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15. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two *(72)* hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

COVENANTOR/OWNER NAME:

COUNTY:

Riverside County Department of Transportation
Attn: Transportation Director
4080 Lemon Street
Riverside, CA

COUNTY OF RIVERSIDE
TRANSPORTATION DEPARTMENT

Patricia Romo, P.E.
Director of Transportation

Date

(Attest)

Date

COVENANTOR/OWNER

Signature of Covenantor/Owner

(Print Name)

(Print Title)

Attach Notary

Appendix 10: Educational Materials

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

For the Final WQMP, examples of material to provide in Appendix 10 may include but are not limited to the following:

- BMP Fact Sheets for proposed BMPs form Exhibit C: LID BMP Design Handbook of the SMR WQMP,
- Source control information and training material for site owners and operators,
- O&M training material,
- Other educational/training material related to site drainage and BMPs.