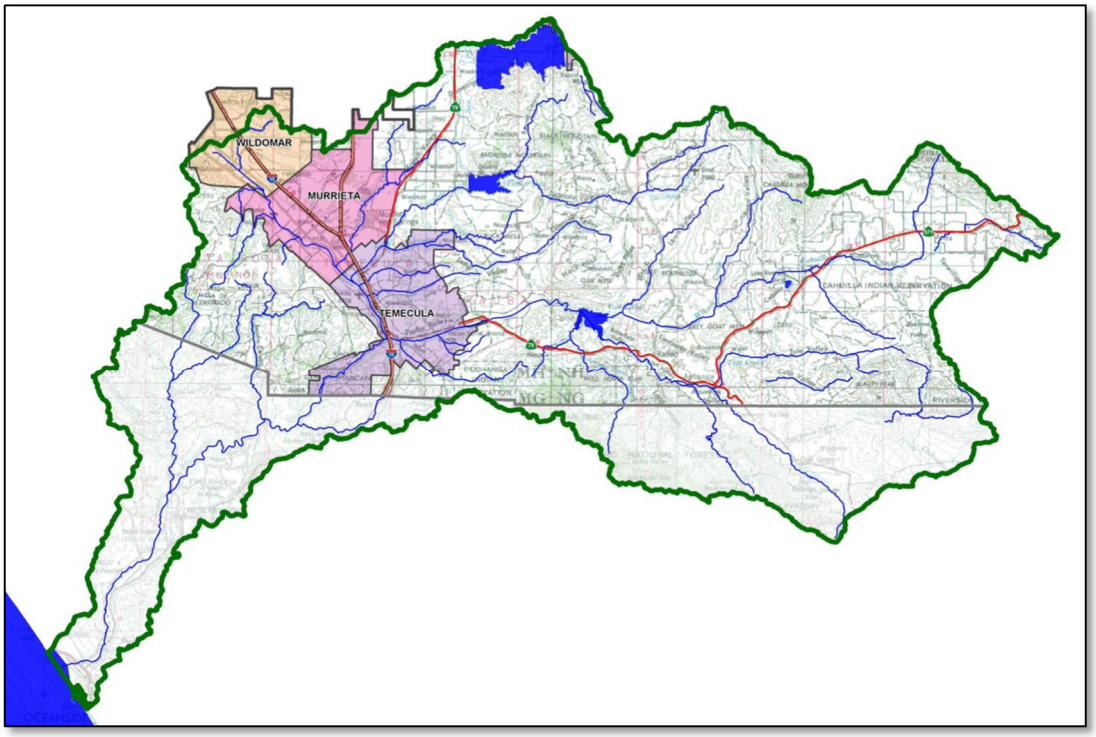
Project Specific Water Quality Management Plan

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

Project Title: Murrieta Public Library Expansion

Development No: APN 906-080-039 & 906-080-040

Design Review/Case No: G-PC-COM-2025-00034



☐ **Preliminary**
☒ **Final**

Original Date Prepared: September 17, 2024

Revision Date(s): June 7, 2025

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**

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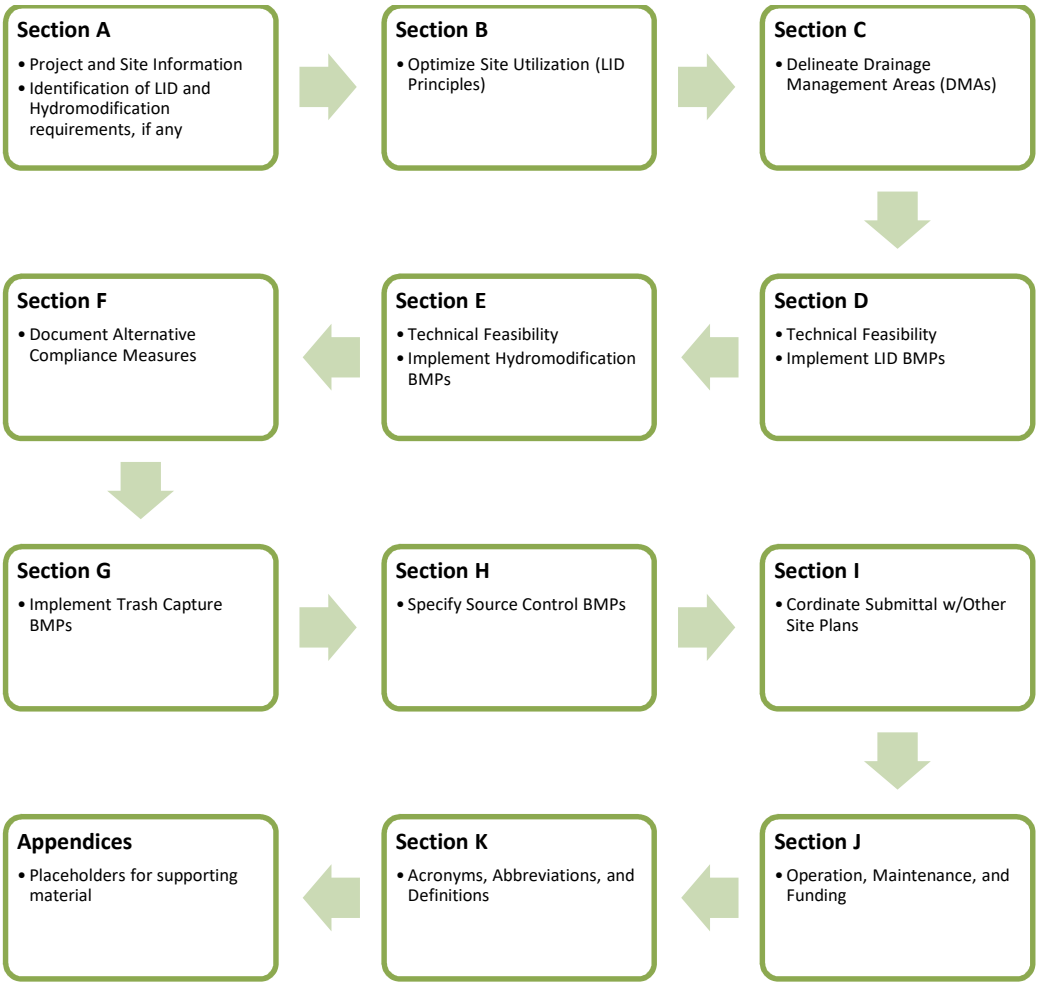
A Brief Introduction

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 (WQPM). 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.



[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.

OWNER'S CERTIFICATION

This Project-Specific WQMP has been prepared for Murrieta City by Eng'r. Virgil C. Aoanan for the Murrieta Library project.

This WQMP is intended to comply with the requirements of City of Murrieta Stormwater and Runoff Management and Discharge Controls Municipal Code Section 8.36.320, Water Quality Management Plan, 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 the City of Murrieta Stormwater and Runoff Management and Discharge Controls (Municipal Code Section 8.36).

"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	June 7, 2025 Date
Brian Crawford Owner's Printed Name	Sr. Program Manager Owner's Title/Position
bcrawford@murrietaca.gov Owner's Email Address	951-461-6047 Owner's Phone Number

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	June 7, 2025 Date
Virgil C. Aoanan Preparer's Printed Name	Principal – VCA Engineers, Inc. Preparer's Title/Position

Preparer's Licensure:

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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.

PROJECT INFORMATION		
Type of PDP:	Redevelopment	
Type of Project:	Commercial / Public Library	
Planning Area:		
Community Name:	City of Murrieta, California	
Development Name:	Murrieta Library Expansion	
PROJECT LOCATION		
Latitude & Longitude (DMS):	Latitude: 33°33'29" N and Longitude: 117°12'43" W.	
Project Watershed and Sub-Watershed:	Santa Margarita River and Sub-Watershed: Murrieta Creek	
24-Hour 85th Percentile Storm Depth (inches):	0.80"	
Is project subject to Hydromodification requirements?	☒ Y ☐ N (Select based on Section A.3)	
APN(s):	906-080-039 and 906-080-040	
Map Book and Page No.:		
PROJECT CHARACTERISTICS		
Proposed or Potential Land Use(s)	Public Library	
Proposed or Potential SIC Code(s)	8231	
Existing Impervious Area of Project Footprint (SF)	5,883 SF	
Total area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement	10,209 SF	
Total Project Area (ac)	0.53 ac	
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
Is the project exempt from Hydromodification Performance Standards?	☐ Y	☒ N
Does the project propose the use of Alternative Compliance to satisfy BMP requirements? (note, alternative compliance is not allowed for coarse sediment performance standards)	☐ 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
Are there any natural hydrologic features on the project site?	☐ Y	☒ N
Is a Geotechnical Report attached?	☒ Y	☐ N
If no Geotech. Report, list the Natural Resources Conservation Service (NRCS) soils type(s) present on the site (A, B, C and/or D)		

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

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
Murrieta Creek	Benthic Community Effects (126449), Bifenthrin (111391), Chlorpyrifos (111360), Copper (111361), Cyhalothrin, Lambda (111402), Indicator Bacteria (127907), Iron (111368), Manganese (111372), Mercury (128174), Nitrogen (132050), Oxygen, Dissolved (111375), Phosphorus (111378), Pyrethroids (111389), Toxicity (111385), Turbidity (111386)	AGR, IND, MUN, PROC, REC1, REC2, WARM, WILD	N/A
Upper Santa Margarita River	Benthic Community Effects (126468), Bifenthrin (111336), Cyhalothrin, Lambda (111348), Indicator Bacteria (128037), Iron (111312), Manganese (111316), Nitrogen (127258), Phosphorus (111323), Pyrethroids (111334), Total Dissolved Solids (125489), Toxicity (111330), Turbidity (111331)	AGR, COLD, IND, MUN, RARE, REC1, REC2, WARM, WILD	8 miles Northwest
Lower Santa Margarita River	Benthic Community Effects (126467), Chlorpyrifos (111241), Indicator Bacteria (128036), Nitrogen (127616), Phosphorus (111255), Toxicity (111259)	PROC, MUN, AGR, COLD, IND, RARE, REC1, REC2, WARM, WILD	20 miles Northeast
Santa Margarita Lagoon	Eutrophic	REC1, REC2, EST, WILD, RARE, MAR, MIGR, SPWN	

Pacific Ocean	Not Listed on Region 9 List of Impairment	IND, NAV, REC1, REC2, COMM, BIOL, WILD, RARE, MAR, AQUA, MIGR, SPWN, SHELL	

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
Murrieta Creek (North of Washington Avenue)	Natural Channel	Susceptible	☐ Y ☒ N
Murrieta Creek (South of Washington Avenue)	Natural Channel	Not Susceptible	☐ Y ☒ N
Upper Santa Margarita River	Improved Channel	Not Susceptible	☒ Y ☐ N
Lower Santa Margarita River	Natural Channel, Large River	Not Susceptible	☒ 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.			

[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.

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
Statewide Construction General Permit Coverage	☐ Y	☒ N
Statewide Industrial General Permit Coverage	☐ Y	☒ N
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	☐ Y	☒ N
Other *(please list in the space below as required)*	☐ Y	☒ N

If yes is answered to any of the questions above, the 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.

☒ 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.

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. *Yes, the natural infiltration of the property shall be preserved. However, according to the Geotechnical report performed on March 4, 2024, by Geosoils, Inc., the soil infiltration rates are very poor, ranging from 0.02 to 0.03 inches per hour. Due to this limitation, we are installing a biofiltration system without infiltration to comply with the WQMP. This system will treat stormwater runoff before discharging it into the public storm drain system located on Memorial Highway.*	
☒ 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.	

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. *Yes, the site's and roof's stormwater runoff is initially directed through a series of catch basins and underground storm drain pipes, which convey the runoff into the new biofiltration areas with no infiltration. Site service flows away from the new building and into the new bioretention areas. Stormwater ponds up to 6 inches in the biofiltration area and slowly percolates through the soil media, where it is treated and discharged via an overflow storm drain line connected to the public storm drain system on Memorial Highway. New and existing trees in the landscaped areas will help reduce runoff.*	
☒ 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.	

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 [Insert Jurisdiction], 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.

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.
Not applicable as we are using bio filtration area with no infiltration in the structural WQMP.

Section C: Delineate Drainage Management Areas (DMAs)

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
DMA–1 (BMP-1 (South))	Roof	4,541	D
	Concrete/ Concrete Pavers	1,574	
	Landscape	4,787	
DMA–2 (BMP-2(North))	Roof	1,878	D
	Concrete/ Concrete Pavers	1,653	
	Landscape	6,774	

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

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)
N/A	N/A	N/A	N/A

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	Slopes will be graded toward the center of the pervious area.
☒ Yes ☐ No ☐ N/A	Soils will be freely draining to not create vector or nuisance conditions.
☒ 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	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	Area must be designed to retain the entire Design Storm runoff without flowing offsite.

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

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

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

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:

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

(Tributary Area: Self-Retaining Area)

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
DMA-1	BMP-1 (Southern) Biofiltration Area With No Infiltration
DMA-2	BMP-2 (Northern) Biofiltration Area With No Infiltration

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 principals 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 principals 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]?		NO
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?		NO
If Yes, list affected DMAs:		
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?		
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet horizontally of a water supply well?		NO
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?		
If Yes, list affected DMAs:		
…have any DMAs been evaluated by a licensed Geotechnical Engineer, Hydrogeologist, 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?		NO
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?		
If Yes, list affected DMAs:		
Infiltration Characteristics For LID BMPs (SMR WQMP Section 2.3.3.d)		
Does the project site…	**YES**	**NO**
…have factored infiltration rates of less than 0.8 inches / hour? (Note: on a case-by-case basis, the Local Jurisdiction may allow a factor of safety as low as 1.0 to support selection of full infiltration BMPs. Therefore, measured infiltration rates could be as low as 0.8 in/hr to support full infiltration. A higher factor of safety would be required for design in accordance with the LID BMP Deign Handbook).	YES	
If Yes, list affected 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?		
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?		
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

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

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.

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		
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 to Section F to document your alternative compliance measures.

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)
Insert text here		
Insert text here		
Insert text here		
Insert text here		

Proprietary Biofiltration BMP Approval Criteria

If the project will use proprietary BMPs as biofiltration BMPs, then this section is completed to document that the proprietary BMPs are selected in accordance with Section 2.3.7 of the SMR WQMP. Proprietary Biofiltration BMPs must meet both of the following approval criteria:

1. Approval Criteria for All Proprietary BMPs, and
2. Acceptance Criteria for Proprietary Biofiltration BMPs.

When the use of proprietary biofiltration BMPs is proposed to meet the Pollutant Control performance standards, use Table D-4 to document that appropriate approval criteria have been met for the proposed BMPs. Add additional rows 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	☐ Proposed BMP has an active TAPE GULD Certification for the project pollutants of concern[4] or equivalent 3rd party demonstrated performance.	Insert text here
	☐ The BMP is used in a manner consistent with manufacturer guidelines and conditions of its third-party certification.	Insert text here
	☐ The BMP includes biological features including vegetation supported by engineered or other growing media.	Describe features here.
	☐ The BMP is designed to maximize infiltration, or supplemental infiltration is provided to achieve retention equivalent to Biofiltration with Partial Infiltration BMPs if factored infiltration rate is between 0.1 and 0.8 inches/hour.	Describe supplemental retention practices if applicable.

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

	☐ The BMP is sized using one of two Biofiltration LID sizing options in Section 2.3.2 of the SRM WQMP.	List sizing method used, resulting size (i.e. volume or flow), and provided size (for proposed unit)

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 BMP Hierarchy			No LID (Alternative Compliance)
	1. Infiltration	2. Biofiltration with Partial Infiltration	3. Biofiltration with No Infiltration	
DMA-1	☐	☐	☒	☐
DMA-2	☐	☐	☒	☐

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?	The geotechnical engineer did analyze the site for infiltration feasibility. Per their analysis, the site is infeasible for infiltration due to the infiltration rate being less than 0.8 inch/hour.
b) When in the entitlement process were other investigations conducted (e.g., groundwater quality, water rights) to evaluate infiltration feasibility?	This information can be found in the geotechnical report under Appendix A.
c) What was the scope and results of testing, if	The result of the infiltration testing was 0.03 inch per hour and 0.02 inch per hour per the Geotechnical report.

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

conducted, or rationale 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?	Infiltration is infeasible for this project as infiltration rates are lower than 0.8 inch/hour.
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?	Site is small and infiltration testing are located at low points of the site and in proposed landscaped areas with potential locations for new BMPs such as biofiltration with no infiltration.
g) What site design alternatives were considered to achieve infiltration or partial infiltration on site?	Site design alternatives are biofiltration area with no underdrain due to infiltration infeasibility.
h) What physical impairments (i.e., fire road egress, public safety considerations, utilities) and public safety concerns influenced site layout and infiltration feasibility?	No physical impairment except poor soil conditions that made infiltration not feasible for this project.
i) What LID Principles (site design BMPs) were included in the project site design?	Since infiltration is not feasible, the next BMP was biofiltration. The acceptable BMP for this project is biofiltration area with no infiltration.

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

BMP-1(Southern DMA):

DMA Type/ID	DMA (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*BMP-1 (Southern DMA)*		
	[A]		[B]	[C]	[A] x [C]			
Roof	*4,541*	*Roof*	*1*	*0.892*	*4,050.572*			
Hardscape	*1,574*	*Concrete or Asphalt*	*1*	*0.892*	*1,404.008*			
Landscape	*4,787*	*Ornamental Landscaping*	*0.4*	*0.280*	*1,338.981*			
						Design Storm Depth (in)	*DCV, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	$A_T = \Sigma[A]$	***10,902***			Σ= [D]=6,793.561	[E]=0.80	449	[G]=1435

[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.

BMP-2(Northern DMA):

DMA Type/ID	DMA (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*BMP-2 (Northern DMA)*		
	[A]		[B]	[C]	[A] x [C]			
Roof	*1,878*	*Roof*	*1*	*0.892*	*1,675.176*	*Design Storm Depth (in)*	*DCV, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Hardscape	*1,653*	*Concrete or Asphalt*	*1*	*0.892*	*1,474.476*			
Landscape	*6,774*	*Ornamental Landscaping*	*0.4*	*0.280*	*1,894.769*			
	A_T = Σ[A]	***10,305***			Σ= [D]=5,044.421	[E]=0.80	334	[G]=652

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)
BMP-1(Southern)	DMA-1	Biofiltration Area With No Infiltration	449	1435
BMP-2(Northern):	DMA-2	Biofiltration Area With No Infiltration	334	652

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

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.

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 (10% of the 2-year runoff event up to the 10-year runoff event). 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.

☒ 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.

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)
BMP-1	DMA-1	Biofiltration Area With No Infiltration	☒	0.0329	0.0166	796.12
BMP-2	DMA-2	Biofiltration Area With No Infiltration	☒	0.0150	0.0075	797.55

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 of the WQMP to determine if there are onsite Potential Critical Coarse Sediment Yield Areas or Potential Sediment Source Areas. 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. The Sediment Supply Performance Standard is met with no further action.

☐ 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 or Option 2 below.

The applicant may refer to Section 3.6.4 of the SMR WQMP for a description of the methodology to meet the Sediment Supply Performance Standard. Select the applicable compliance pathway and complete the appropriate sections to demonstrate compliance with the Sediment Supply Performance Standard if the second box is selected above:

☐ Avoid impacts related to any PDP activities to Potential Critical Coarse Sediment Yield Areas. Proceed to Section E.3.1.

☐ Complete a Site-Specific Critical Coarse Sediment Analysis. Proceed to Section E.3.2.

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 maintenance of the pre-project source(s) of Critical Coarse Sediment (i.e., Bed Sediment Supply):

1. Determine whether the site or a portion of the site is a Significant Source of Bed Sediment Supply to the Receiving Channel (i.e., an actual verified Critical Coarse Sediment Yield Area);
2. Avoid areas identified as actual verified Critical Coarse Sediment Yield Areas in the PDP design and maintain pathways for discharge of Bed Sediment Supply from these areas to receiving waters.

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* -

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

OR

☐ The project impacts transport pathways of Critical Coarse Sediment from onsite upstream drainages.

(If either of these are the case, the applicant may proceed with the subsequent steps of Section E.3).

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

Identified Channel #3 - Insert narrative description here

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 [Insert Jurisdiction]. 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]
BMP-1 (South) Bioretention Area	Bacteria, Metals, Nutrients, Sediments, Trash & Debris, Oil & Grease	80–95%
BMP-2 (North) Bioretention Area	Bacteria, Metals, Nutrients, Sediments, Trash & Debris, Oil & Grease	80–95%

[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 Local Jurisdiction may require full trash capture BMPs to be installed as part of the project. Consult with the Local Jurisdiction to determine applicability.

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-3 to determine the Trash Capture Design Storm Intensity (E).

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	*BMP-1 (SOUTHERN)*	
	[A]		[B]	[C]	[A] x [C]		
BMP-1 /Roof	*4,541*	*Roof*	*1*	*0.892*	*4,050.572*	*Trash Capture Design Storm Intensity (in)*	*Trash Capture Design Flow Rate (cubic feet or cfs)*
BMP - 1/Imp.	*1,574*	*Concrete or Asphalt*	*1*	*0.892*	*1,404.008*		
BMP - 1/Perv.	*4,787*	*Landscaping*	*0.4*	*0.280*	*1,338.981*		
	$A_T = \Sigma[A]$	10,902			$\Sigma=$ [D]=6,793.561	[E]=0.47	$[F] = \frac{[D]x[E]}{[G]}$=0.005

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

Table G-2 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	*BMP-2 (NORTHERN)*	
	[A]		[B]	[C]	[A] x [C]		
BMP-2/Roof	*1,878*	*Roof*	*1*	*0.892*	*1,675.176*	*Trash Capture Design Storm Intensity (in)*	*Trash Capture Design Flow Rate (cubic feet or cfs)*
BMP - 2/Imp.	*1,653*	*Concrete or Asphalt*	*1*	*0.892*	*1,474.476*		
BMP - 2/Perv.	*6,774*	*Landscaping*	*0.4*	*0.280*	*1,894.769*		
	$A_T = \Sigma[A]$	10,305			$\Sigma=$ [D]=5,044.421	[E]=0.47	$[F] = \frac{[D]x[E]}{[G]}$=0.004

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

Table G-3 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-4 to summarize and document the selection and sizing of Trash Capture BMPs.

Table G-4 Trash Capture BMPs

BMP Name / ID	DMA No(s)	BMP Type / Description	Required Trash Capture Flowrate (cfs)	Provided Trash Capture Flowrate (cfs)
BMP-1 (SOUTHERN)	*DMA-1*	Biofiltration Area With No Infiltration	0.073	0.005
BMP-2 (NORTHERN)	*DMA-2*	Biofiltration Area With No Infiltration	0.054	0.004

Section H: Source Control BMPs

Source Control BMPs include permanent, structural features that may be required in your Project plans, such as roofs over and berms around trash and recycling areas, and Operational BMPs, such as regular sweeping and "housekeeping," that must be implemented by the site's occupant or user. The 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	Pets 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
On-site storm drain inlets	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch basin markers may be available from the Riverside County Flood Control District and Water District 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 operation BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbook at www.cabmphandbooks.com.

On-site storm drain inlets	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch basin markers may be available from the Riverside County Flood Control District and Water District 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 operation BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbook at www.cabmphandbooks.com.
On-site storm drain inlets	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch basin markers may be available from the Riverside County Flood Control District and Water District 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 operation BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbook at www.cabmphandbooks.com.
On-site storm drain inlets	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch basin markers may be available from the Riverside County Flood Control District and Water District 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 operation BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbook at www.cabmphandbooks.com.
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On-site storm drain inlets	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch basin markers may be available from the Riverside County Flood Control District and Water District 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 operation BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbook at www.cabmphandbooks.com.
On-site storm drain inlets	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch basin markers may be available from the Riverside County Flood Control District and Water District 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 operation BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbook at www.cabmphandbooks.com.

Section I: Coordinate Submittal with Other Site Plans

Populate Table I-1 below to assist the plan checker in an expeditious review of your project. During construction and at completion, [Insert Jurisdiction] 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)
BMP-1	Bioretension Basin	Grading Sheet-C-3.0, Site Control Plan-C-2.0, Site Utility Plan-C-4.0, WQMP Plan-C-4.1, Miscellaneous Detail-C-5.1
BMP-2	Bioretension Basin	Grading Sheet-C-3.0, Site Control Plan-C-2.0, Site Utility Plan-C-4.0, WQMP Plan-C-4.1, Miscellaneous Detail-C-5.1

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)*	☐ Y	☒ N

Section J: Operation, Maintenance and Funding

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: The City of Murrieta shall be responsible for the implementation, operation and maintenance of this WQMP until proper turnover to the Owner. AA

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. 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

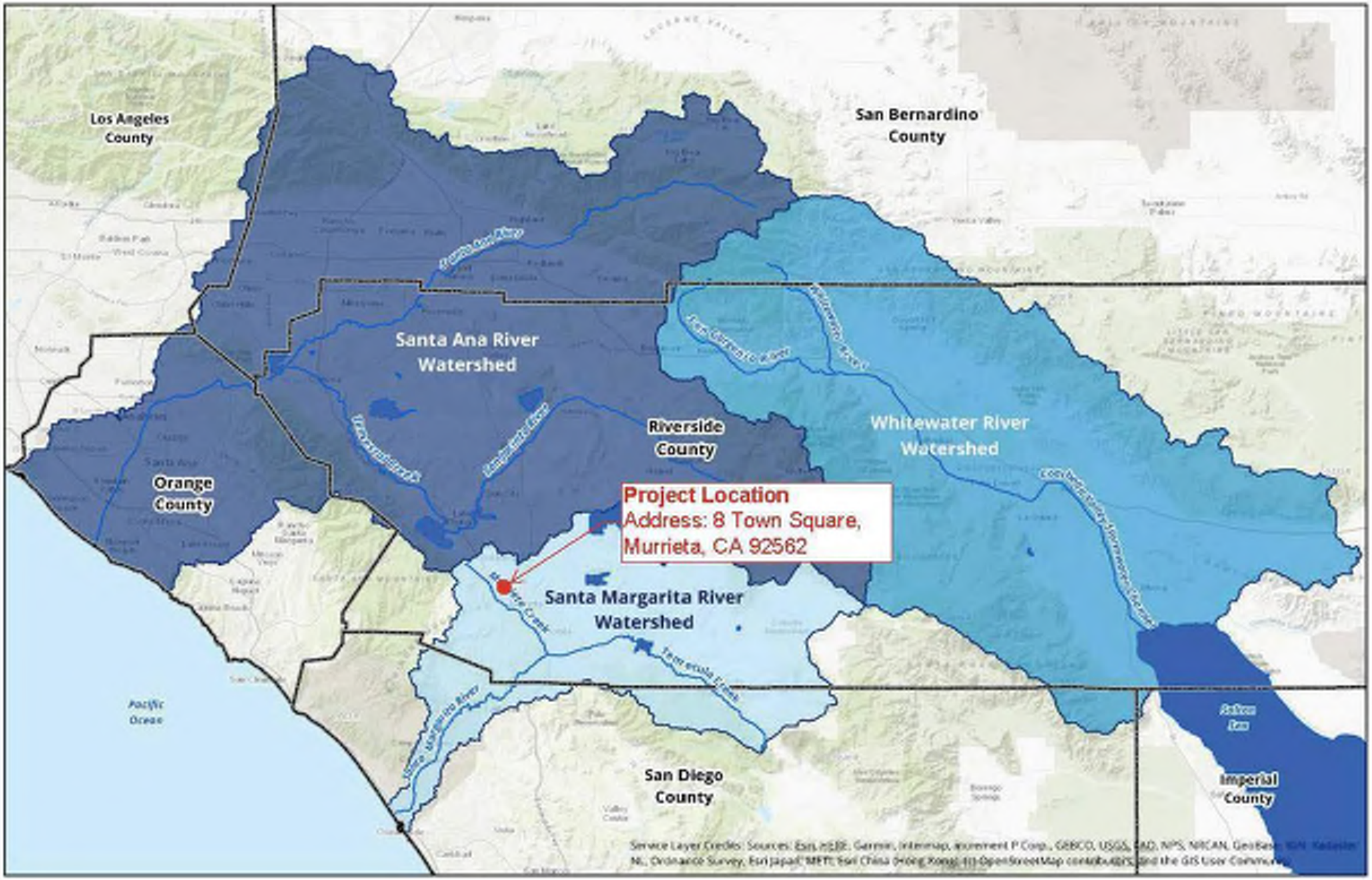
Complete the checklist below to verify all exhibits and components are included in the Project-Specific WQMP. Refer Section 4 of the SMR WQMP and Section D of this Template.

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)
☒ 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

LOCATION MAP

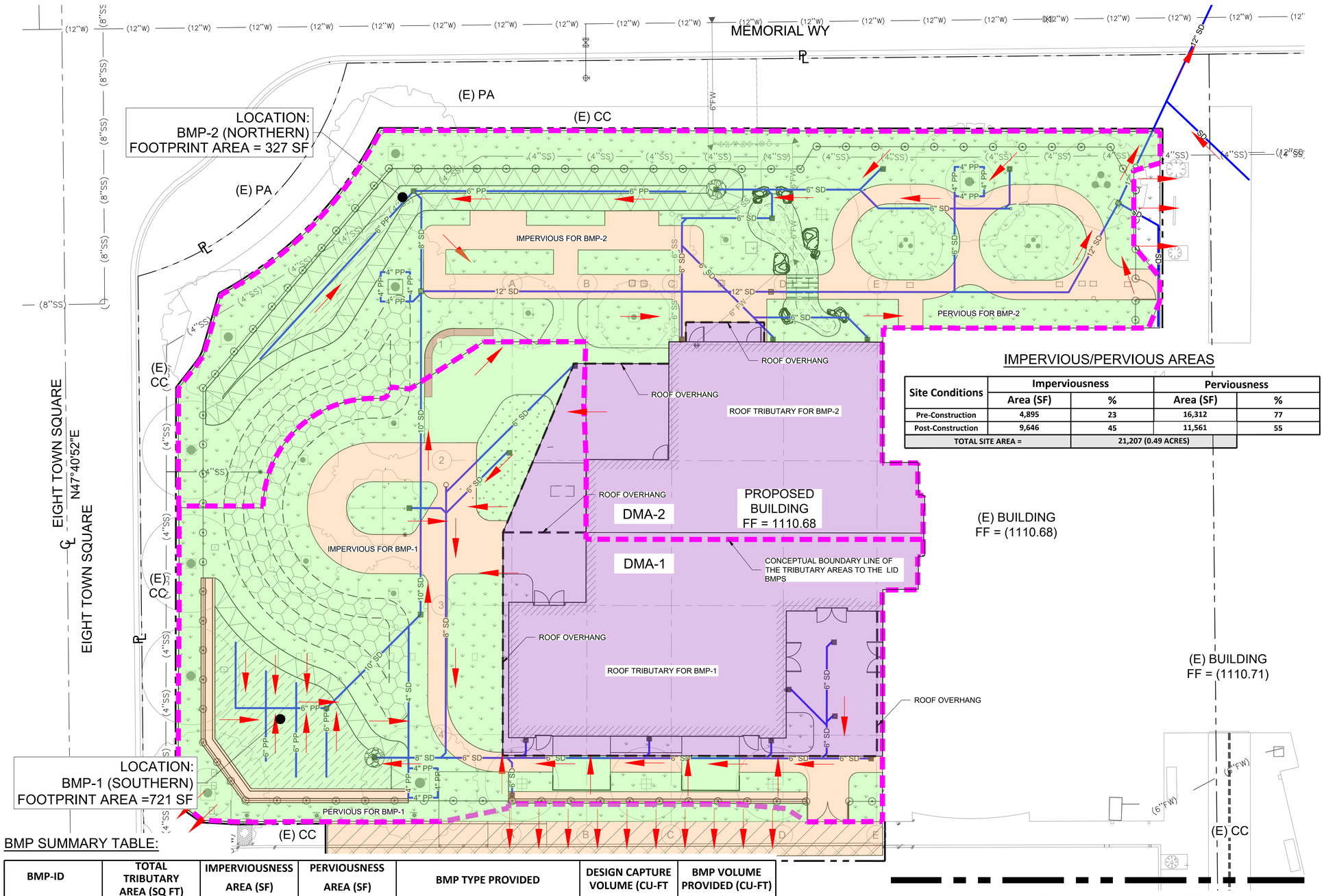
- Google Map
- Watershed Map

EXISTING SITE MAP


Los Angeles County
San Bernardino County
Santa Ana River Watershed
Riverside County
Whitewater River Watershed
Orange County
Project Location
Address: 8 Town Square, Murrieta, CA 92562
Santa Margarita River Watershed
Pacific Ocean
San Diego County
Imperial County

WQMP SITE PLAN

•Drainage Management Areas (DMAs)
•Proposed Structural Best Management Practices (BMPs)
•Drainage Paths
•Drainage Infrastructures, Inlets, Overflow
•Building, Rooflines, Downspouts
•Impervious Surfaces
•Pervious Surfaces



LEGEND:

BMP AREA	
BUILDING	6,405.45 SF
IMPERVIOUS AREA	5,242.01 SF
PLANTER AREA	11,441.71 SF
OTHER PERVIOUS AREA	60 SF
UNMITIGATED IMPERVIOUS AREA (DIMINIMUS FLOW)	1209.58 SF
SD PIPE / DRAINAGE FLOW	
CONCEPTUAL BOUNDARY LINE OF THE TRIBUTARY AREAS TO THE LID BMPS	
XX"SD PROPOSED STORM DRAIN LINE	
PROPOSED CATCH BASIN	

IMPERVIOUS/PERVIOUS AREAS

Site Conditions	Imperviousness		Perviousness	
	Area (SF)	%	Area (SF)	%
Pre-Construction	4,895	23	16,312	77
Post-Construction	9,646	45	11,561	55
TOTAL SITE AREA =		21,207 (0.49 ACRES)		

EXISTING :

TOTAL AREA: 21,207 SF = 0.49 ACRE
PERVIOUS AREA: 16,312 SF = 0.38 ACRE
IMPERVIOUS AREA: 4,895 SF = 0.11 ACRE
IMPERVIOUS RATIO : 23%

PROPOSED :

TOTAL AREA: 21,207 SF = 0.49 ACRE
PERVIOUS AREA: 11,561 SF = 0.22 ACRE
IMPERVIOUS AREA: 9,646 SF = 0.27 ACRE
IMPERVIOUS RATIO : 45%

BMP SUMMARY TABLE:

BMP-ID	TOTAL TRIBUTARY AREA (SQ FT)	IMPERVIOUSNESS AREA (SF)	PERVIOUSNESS AREA (SF)	BMP TYPE PROVIDED	DESIGN CAPTURE VOLUME (CU-FT	BMP VOLUME PROVIDED (CU-FT)
BMP-1	10,902	6,115	4,787	BIOFILTRATION AREA WITH NO INFILTRATION	449	1,435
BMP-2	10,305	3,531	6,774	BIOFILTRATION AREA WITH NO INFILTRATION	334	652

WQMP PLAN

10 5 0 10 20
GRAPHIC SCALE

BIOFILTRATION AREA WITH NO INFILTRATION
CONCEPTUAL BOUNDARY LINE OF THE TRIBUTARY AREAS TO THE LID BMPS

"AS BUILT"

THE RECEIPT OF AS-BUILT PLANS AND CITY'S ACCEPTANCE THEREOF DOES NOT ABSOLVE THE ENGINEER OF WORK OF ANY RESPONSIBILITY FOR THE PROJECT DESIGN.

ENGINEER OF WORK — DATE

RCE NO. — EXPIRATION DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER — TODD L. PITNER — No. C36079 — Exp. 6/30/26 — CIVIL — STATE OF CALIFORNIA

SCALE
HORIZONTAL
AS NOTED
VERTICAL
AS NOTED

VCA ENGINEERS INC
CIVIL ■ STRUCTURAL
631 S. Alantic Blvd.
Monterey Park, CA 91754
Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY VIRGILIO C. AOANAN — DATE 05/16/2025
ENGR. NAME TYPED VIRGILIO C. AOANAN
RCE NO. C36079 — EXP. DATE 6/30/26

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BENCH MARK
DESCRIPTION: PARCEL 8 OF PARCEL MAP NO. 29924
LOCATION: 8 TOWN SQUARE, MURRIETA, CA 92562
RECORDED: AS PER MAP RECORDED IN BOOK 204, PAGES 25 TO 26,
ELEVATION: 1094.82' DATUM: NGVD 29

APPROVED FOR SIGNATURE — DATE
TODD L. PITNER
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

DATE	INITIAL	REVISION DESCRIPTION	SHT. NO.	DATE	INITIAL
ENGINEER OF WORK				CITY APPROVAL	

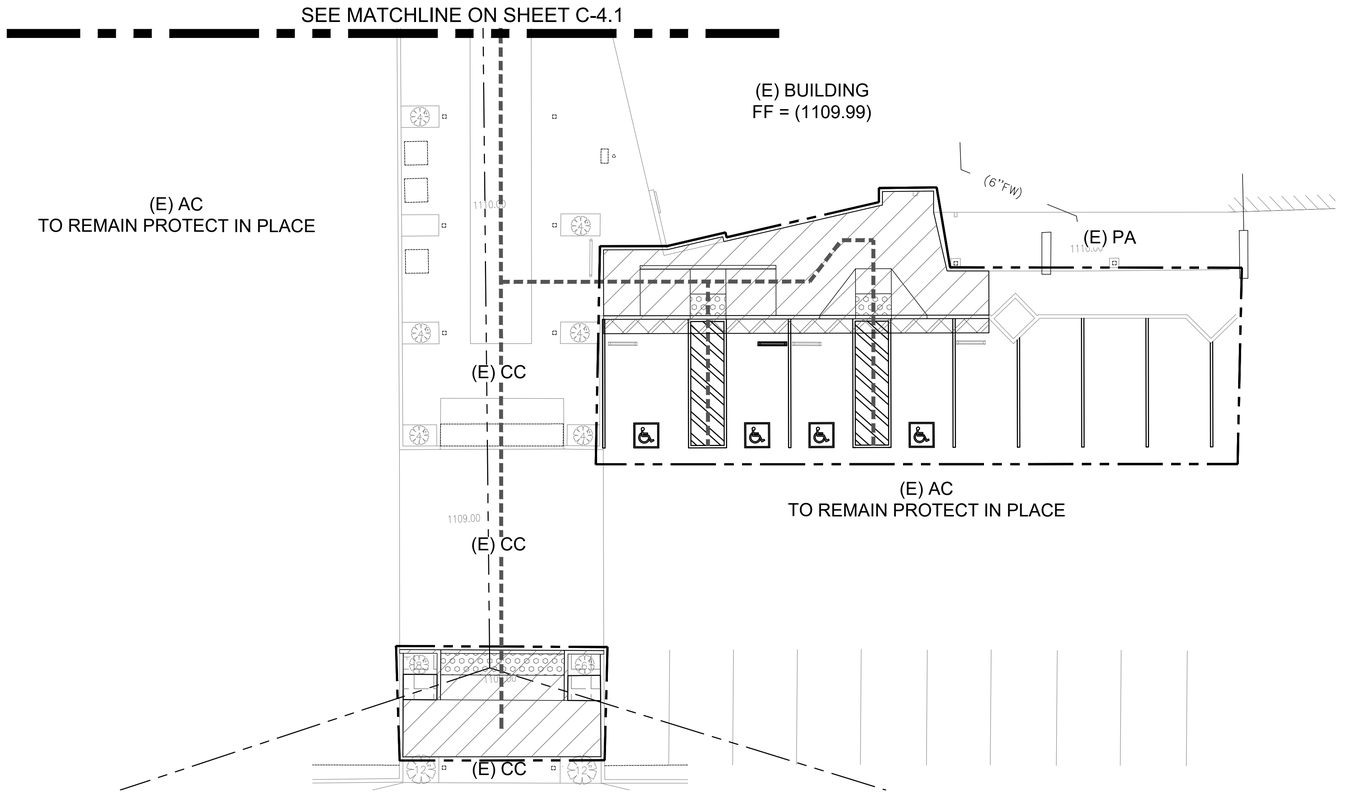
SHEET — CITY OF MURRIETA, ENGINEERING DEPARTMENT — SHEETS

WQMP PLAN
MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

APPROVED
ROBERT K. MOEHLING — DATE
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER — RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK:
PROJECT NO. G-PC-COM-2025-00034
DRAWING NO. C-4.3

murrieta title sheet.dwg



LEGEND:

	PLANTER AREA	11,441.71 SF
	OTHER PERVIOUS AREA	60 SF
	UNMITIGATED IMPERVIOUS AREA (DIMINIMUS FLOW)	1209.58 SF
XX"SD	PROPOSED STORM DRAIN LINE	

IMPERVIOUS/PERVIOUS AREAS

Site Conditions	Imperviousness		Perviousness	
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WQMP PLAN

10 5 0 10 20

GRAPHIC SCALE

"AS BUILT"

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SEAL: REGISTERED PROFESSIONAL ENGINEER — No. C36079 — Exp. 6/30/26 — CIVIL — STATE OF CALIFORNIA

SCALE

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APPROVED FOR SIGNATURE

_____ DATE _____
TODD L. PITNER
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

VCA ENGINEERS INC
CIVIL ■ STRUCTURAL
631 S. Atlantic Blvd.
Monterey Park, CA 91754
Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY VIRGILIO C. AOANAN DATE 05/16/2025

ENGR. NAME TYPED VIRGILIO C. AOANAN

RCE NO. C36079 EXP. DATE 6/30/26

DATE	INITIAL	REVISION DESCRIPTION
		ENGINEER OF WORK

SHT. NO.	DATE	INITIAL
		CITY APPROVAL

SHEET | CITY OF MURRIETA ENGINEERING DEPARTMENT | SHEETS

WQMP PLAN
MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

APPROVED
ROBERT K. MOEHLING _____ DATE _____
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK: _____

PROJECT NO. G-PC-COM-2025-00034

DRAWING NO. **C-4.4**

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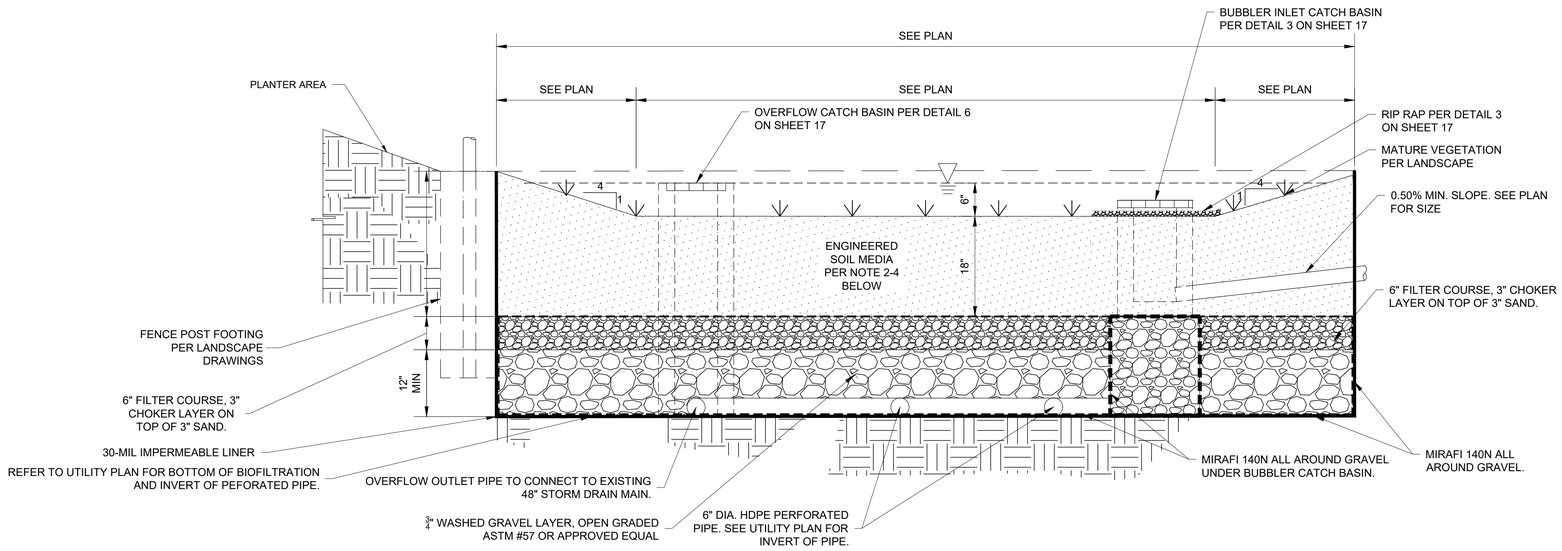
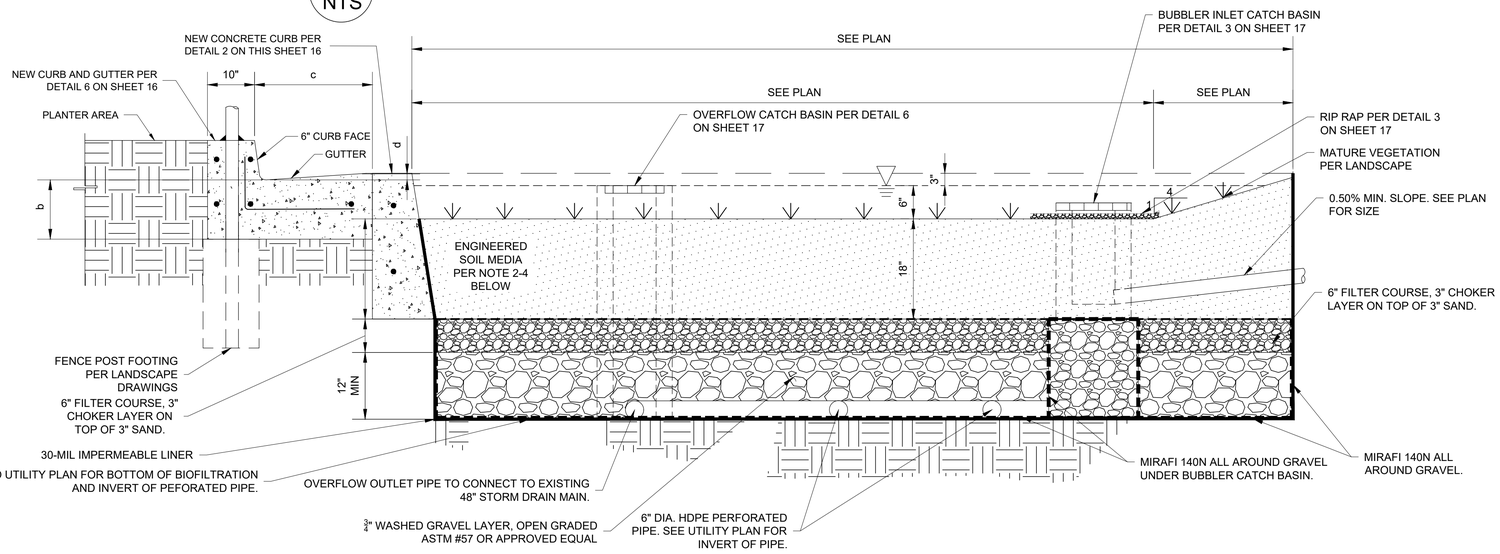


1 NTS NORTHWEST BIOFILTRATION SECTION



c	d
18"	5/7"

* "b" SHOULD BE THE MAXIMUM OF PAVEMENT & BASE THICKNESS OR 6".

2 NTS SOUTHWEST BIOFILTRATION SECTION

NOTES:

1. TO REDUCE EROSION, A COBBLESTONE PAD SHALL BE PLACED AT EACH INLET POINT. THE COBBLESTONE SHALL BE 3"-5" DIAMETER IN SIZE AND SHALL BE EMBEDDED IN 4" OF CONCRETE, 24" WIDE. THE COBBLESTONE PAD INSIDE THE BIORETENTION FACILITY SHALL BE COMPACTED AND FLUSH WITH THE FINISHED SURFACE AT THE INLET POINT AND EXTEND TO THE BOTTOM OF THE SLOPE.
2. ENGINEERED SOIL MEDIA DESIGN FILTRATION RATE OF 2.5 INCHES PER HOUR (INITIAL FILTRATION RATE SHOULD BE HIGHER).
3. ENGINEERED SOIL MEDIA SHALL BE 18" MINIMUM DEPTH FOR SOUTHERN BMP (BMP-1) AND 18" MINIMUM DEPTH FROM NORTHERN BMP (BMP-2). ENGINEERED SOIL MEDIA, / BIORETENTION SOIL MEDIA (BSM) SHALL BE COMPRISED OF 60-80% SAND, UP TO 20% TOPSOIL, AND 20% OF AN ORGANIC AMENDMENT, BY VOLUME. NUTRIENT-SENSITIVE COMPOST MAY BE USED AS THE ORGANIC AMENDMENT ACCORDING TO REQUIREMENTS IN THE "ORGANIC AMENDMENTS" SECTION OF THE SANTA MARGARITA WATERSHED BMP DESIGN MANUAL, FOR BIORETENTION BMPS.THE ORGANIC COMPONENT SHALL BE NITROGEN STABILIZED COMPOST, SUCH THAT NITROGEN DOES NOT LEACH FROM THE MEDIA. THE SOIL MEDIA SHALL MEET THE SPECIFICATIONS IN SECTION 3.8 OF THE RIVERSIDE COUNTY, SANTA MARGARITA RIVER WATERSHED REGION DESIGN HANDBOOK FOR LOW IMPACT DEVELOPMENT BEST MANAGEMENT PRACTICES, REVISED JUNE 2018. FOR SOIL MEDIA RATIO MIX, SEE TABLE BELOW.
4. FOR THIS COUNTY-MAINTAINED BMP, MULCH SHALL NOT BE USED PER RIVERSIDE COUNTY, TRANSPORTATION DEPARTMENT STANDARDS.

COMPONENT TYPE	BIORETENTION
SAND TYPE	WASHED
SAND FRACTION BY VOLUME	60% - 80%
TOPSOIL TYPE	SANDY LOAM OR LOAMY SAND
TOPSOIL FRACTION BY VOLUME	20%
ORGANIC TYPE	NUTRIENT-SENSITIVE COMPOST
ORGANIC FRACTION BY VOLUME	20%

1 BIOFILTRATION WITH NO UNDERDRAIN DETAIL

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APPROVED FOR SIGNATURE

DATE

TODD L. PITNER
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

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RCE NO. EXPIRATION DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER TODD L. PITNER No. C36079 Exp. 6/30/26 CIVIL STATE OF CALIFORNIA

SCALE
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VCA ENGINEERS INC
CIVIL ★ STRUCTURAL
631 S. Allantic Blvd.
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Fax. 323.729.6043

PREPARED BY DATE
VIRGILIO C. AOANAN 05/16/2025

ENGR. NAME TYPED VIRGILIO C. AOANAN
RCE NO. C36079 EXP. DATE 6/30/26

DATE	INITIAL	ENGINEER OF WORK

SHT. NO.	DATE	INITIAL	CITY APPROVAL

REVISION DESCRIPTION

SHEET 18 | CITY OF MURRIETA ENGINEERING DEPARTMENT | SHEETS 25

MISCELLANEOUS DETAILS
MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

APPROVED
ROBERT K. MOEHLING DATE
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK:
PROJECT NO. G-PC-COM-2025-00034
DRAWING NO.

murrieta title sheet.dwg

Appendix 2: Construction Plans

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

For Bioretention and Biofiltration facilities, the following construction notes shall be shown on the Grading and/or Drainage plans.

1) BSM and Aggregates should not be delivered or placed in frozen, wet or muddy conditions. The Contractor should protect materials from absorbing excess water and from erosion at all times. The Contractor shall not store materials unprotected during large rainfall events (>.25 inches). If water is introduced into material while it is stockpiled, the Contractor shall allow the material to drain to an acceptable level before it is placed.
2) The Engineer shall furnish to the City 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 the material is imported or if the material is mixed onsite prior to installation. Onsite mixing may only occur if sand or topsoil components are sourced from the Project site. Onsite mixing may be conducted by using loaders.
3) BSM shall be lightly compacted and placed in loose lifts of 12 inches thick. Compaction should not exceed 75% standard procter. Machinery should not be used in the BSM area to place BSM. 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.
4) The Engineer conducting the Quality Control testing shall furnish to the City a copy of the QA testing and a certification that the BSM for the project meets all of the following requirements.
    a. 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 0.005 mm: 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: Phosphorous: < 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.

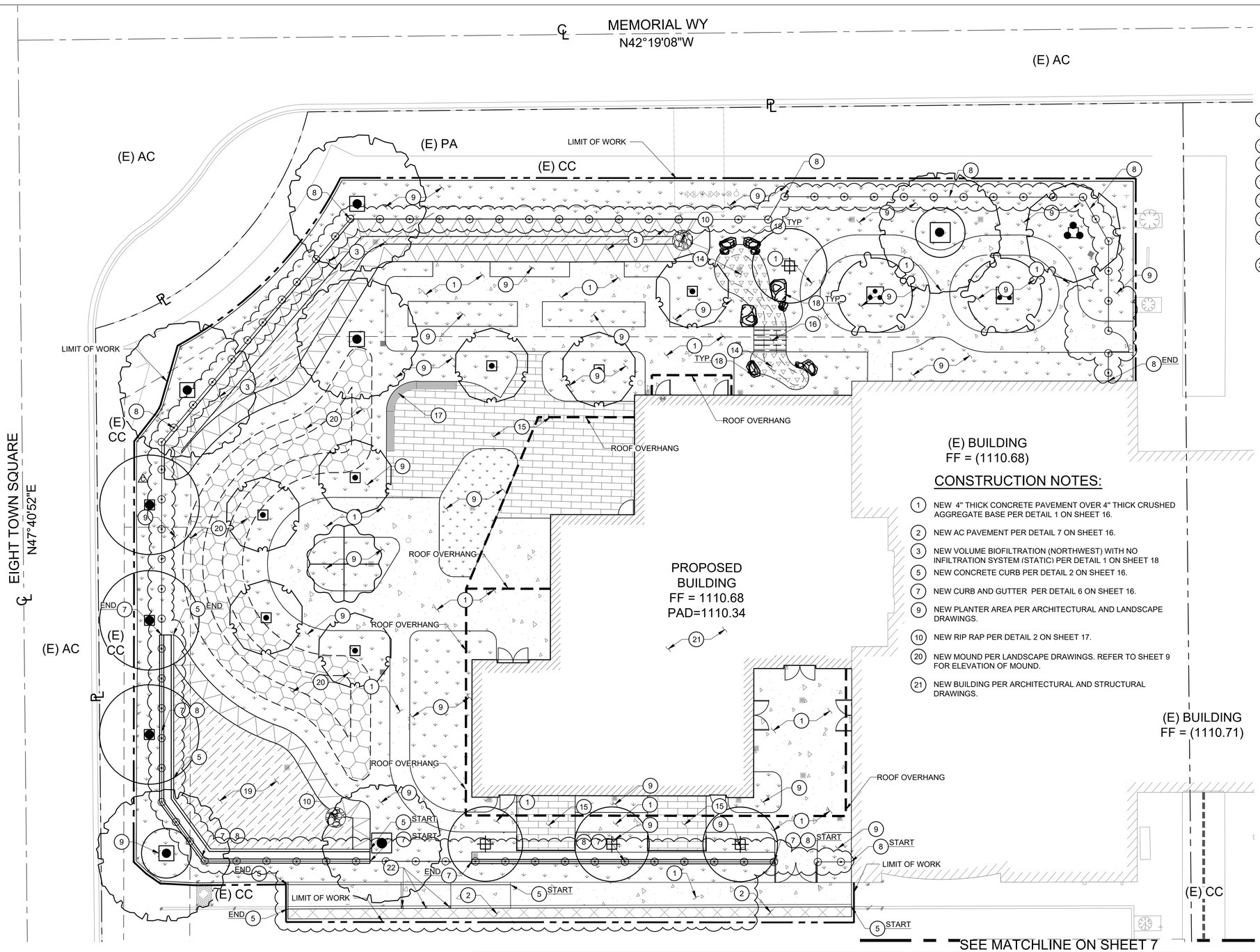
d. Low nutrient compost used in BSM shall be sourced from a facility permitted through CalRecyle, preferably through USCC STA program. Compost shall conform to the following requirements: Physical contaminants <1% by dry weight; Carbon:Nitrogen ratio: 12:1 to 40:1, Maturity/Stability shall conform to either: Solvita Maturity Index: ≥ 5.5, CO2 Evolution: < 2.5 mg CO2-C per g compost organic matter per day, or < 5 mg CO2 – shall be 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.

Potential BSM sources may include (not part of construction note): Gail Materials (Temescal Valley), Agriservice (Oceanside), Greatsoils (Escondido), and Earthworks (Riverside).

Potential Laboratories may include (not part of construction note): Fruit Growers Laboratory, Inc. (Santa Paula, http://www.fglinc.com/), Wallace Laboratories (El Segundo, http://us.wlabs.com/), Control Labs (Watsonville, http://controllabs.com) and A&L Western Laboratories (Modesto, http://www.al-labs-west.com/)

GRADING PLAN

- SITE PLAN
- GRADING 1& 2
- DRAINAGE PLAN
- STORM DRAIN UTILITY PROFILE



CONSTRUCTION NOTES (FOR REFERENCE ONLY):

8 NEW FENCE, FENCE POST, AND POST FOOTING PER LANDSCAPE DRAWING.

14 NEW COBBLE PER LANDSCAPE DRAWINGS.

15 NEW CONCRETE PAVERS PER LANDSCAPE DRAWINGS.

16 NEW BRIDGE PER LANDSCAPE DRAWINGS.

17 NEW BENCH PER LANDSCAPE DRAWINGS.

18 NEW BOULDERS PER LANDSCAPE DRAWINGS.

19 NEW BIOFILTRATION (SOUTHWEST) WITH NO INFILTRATION SYSTEM (STATIC) PER DETAIL 2 ON SHEET 18.

20 NEW MOUND PER LANDSCAPE DRAWINGS. REFER TO SHEET 9 FOR ELEVATION OF MOUND.

LEGEND:

NEW 4" THICK CONCRETE PAVEMENT OVER 4" THICK CRUSHED AGGREGATE BASE PER DETAIL 1 ON SHEET 16.

NEW AC PAVEMENT PER DETAIL 7 ON SHEET 16.

NEW VOLUME BIOFILTRATION WITH NO INFILTRATION SYSTEM (STATIC) PER DETAIL 1 ON SHEET 18.

NEW RIP RAP PER DETAIL 2 ON SHEET 17.

4:1 SLOPE

LIMIT OF WORK

PATH OF TRAVEL

CONSTRUCTION NOTES:

1 NEW 4" THICK CONCRETE PAVEMENT OVER 4" THICK CRUSHED AGGREGATE BASE PER DETAIL 1 ON SHEET 16.

2 NEW AC PAVEMENT PER DETAIL 7 ON SHEET 16.

3 NEW VOLUME BIOFILTRATION (NORTHWEST) WITH NO INFILTRATION SYSTEM (STATIC) PER DETAIL 1 ON SHEET 18

5 NEW CONCRETE CURB PER DETAIL 2 ON SHEET 16.

7 NEW CURB AND GUTTER PER DETAIL 6 ON SHEET 16.

9 NEW PLANTER AREA PER ARCHITECTURAL AND LANDSCAPE DRAWINGS.

10 NEW RIP RAP PER DETAIL 2 ON SHEET 17.

20 NEW MOUND PER LANDSCAPE DRAWINGS. REFER TO SHEET 9 FOR ELEVATION OF MOUND.

21 NEW BUILDING PER ARCHITECTURAL AND STRUCTURAL DRAWINGS.

LEGEND (FOR REFERENCE ONLY):

NEW CONCRETE PAVERS PER LANDSCAPE DRAWINGS.

NEW PLANTER AREA PER LANDSCAPE DRAWINGS.

NEW COBBLE PER LANDSCAPE DRAWINGS.

NEW FENCE AND POST PER LANDSCAPE DRAWINGS.

NEW ROOF OVERHANG PER ARCHITECTURAL DRAWING.

10 5 0 10 20

GRAPHIC SCALE
SCALE 1" = 10'

SHEET NOTES:

1. FOR GENERAL NOTES, LEGEND AND ABBREVIATIONS, SEE SHEETS 1 AND 2.
2. REFER TO ARCHITECTURAL AND LANDSCAPE DRAWINGS FOR OTHER SITE DIMENSIONS AND IMPROVEMENTS NOT SHOWN ON THIS DRAWING.

"AS BUILT"

THE RECEIPT OF AS-BUILT PLANS AND CITY'S ACCEPTANCE THEREOF DOES NOT ABSOLVE THE ENGINEER OF WORK OF ANY RESPONSIBILITY FOR THE PROJECT DESIGN.

ENGINEER OF WORK _____ DATE _____

RCE NO. _____ EXPIRATION DATE _____

SEAL: REGISTERED PROFESSIONAL ENGINEER VIRGILIO C. AOANAN No. C36079 Exp. 6/30/26 CIVIL STATE OF CALIFORNIA

SCALE

HORIZONTAL

AS NOTED

VERTICAL

AS NOTED

VCA ENGINEERS INC
CIVIL ★ STRUCTURAL
631 S. Alemlo Blvd.
Monterey Park, CA 91754
Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY VIRGILIO C. AOANAN DATE 05/16/2025

ENGR. NAME TYPED VIRGILIO C. AOANAN

RCE NO. C36079 EXP. DATE 6/30/26

DATE	INITIAL	ENGINEER OF WORK
06/13/2025	2	BID ISSUE SET

REVISION DESCRIPTION

SHT. NO.	DATE	INITIAL	CITY APPROVAL

Underground Service Alert
Call: TOLL FREE
1-800
422-4133
TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
DESCRIPTON: PARCEL 8 OF PARCEL MAP NO. 29924
LOCATION: 8 TOWN SQUARE, MURRIETA, CA 92562
RECORDED: AS PER MAP RECORDED IN BOOK 204, PAGES 25 TO 26,
ELEVATION: 1094.82' DATUM: NGVD 29

APPROVED FOR SIGNATURE

_____ DATE _____

SHEET 6 | CITY OF MURRIETA ENGINEERING DEPARTMENT | SHEETS 25

SITE PLAN 1
(FOR REFERENCE ONLY)
MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

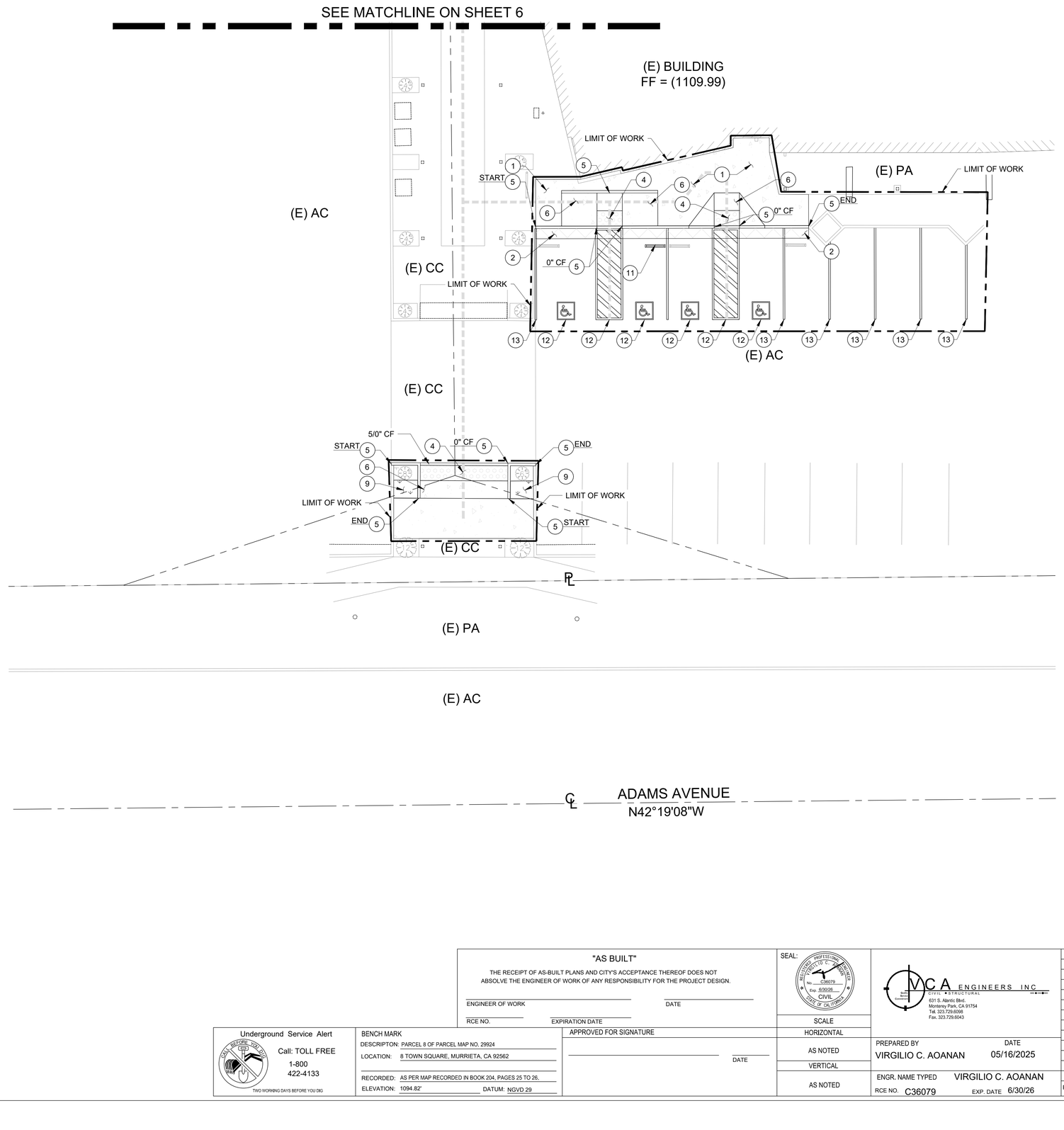
APPROVED
ROBERT K. MOEHLING _____ DATE _____
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK: _____

PROJECT NO. G-PC-COM-2025-00034

DRAWING NO.

murrieta title sheet.dwg



CONSTRUCTION NOTES:

1. NEW 4" THICK CONCRETE PAVEMENT OVER 4" THICK CRUSHED AGGREGATE BASE PER DETAIL 1 ON SHEET 16.
2. NEW AC PAVEMENT PER DETAIL 7 ON SHEET 16.
4. NEW TRUNCATED DOMES PER DETAIL 5 ON SHEET 16.
5. NEW CONCRETE CURB PER DETAIL 2 ON SHEET 16.
6. NEW CONCRETE CURB RAMP PER DETAIL 8 ON SHEET 16.
9. NEW PLANTER AREA PER ARCHITECTURAL AND LANDSCAPE DRAWINGS.
11. NEW CONCRETE WHEEL STOPPER PER ARCHITECTURAL DRAWINGS.
12. NEW ADA STRIPING PER ARCHITECTURAL DRAWINGS.
13. NEW STRIPING PER ARCHITECTURAL DRAWINGS.

LEGEND:

- NEW 4" THICK CONCRETE PAVEMENT OVER 4" THICK CRUSHED AGGREGATE BASE PER DETAIL 1 ON SHEET 16.
- NEW AC PAVEMENT PER DETAIL 7 ON SHEET 16.
- NEW TRUNCATED DOMES PER DETAIL 5 ON SHEET 16.
- NEW PLANTER AREA PER LANDSCAPE DRAWINGS.
- INSTALL NEW STRIPING PER ARCHITECTURAL DRAWINGS.
- LIMIT OF WORK
- PATH OF TRAVEL

10 5 0 10 20

GRAPHIC SCALE
SCALE 1" = 10'

"AS BUILT"

THE RECEIPT OF AS-BUILT PLANS AND CITY'S ACCEPTANCE THEREOF DOES NOT ABSOLVE THE ENGINEER OF WORK OF ANY RESPONSIBILITY FOR THE PROJECT DESIGN.

ENGINEER OF WORK _____ DATE _____

RCE NO. _____ EXPIRATION DATE _____

SEAL: REGISTERED PROFESSIONAL ENGINEER — VIRGILIO C. AOANAN — No. C36079 — Exp. 6/30/26 — CIVIL — STATE OF CALIFORNIA

SCALE

HORIZONTAL

AS NOTED

VERTICAL

AS NOTED

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631 S. Alantic Blvd.
Monterey Park, CA 91754
Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY VIRGILIO C. AOANAN DATE 05/16/2025

ENGR. NAME TYPED VIRGILIO C. AOANAN

RCE NO. C36079 EXP. DATE 6/30/26

DATE	INITIAL	REVISION DESCRIPTION	SHT. NO.	DATE	INITIAL
ENGINEER OF WORK				CITY APPROVAL	

Underground Service Alert
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TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
DESCRIPTON: PARCEL 8 OF PARCEL MAP NO. 29924
LOCATION: 8 TOWN SQUARE, MURRIETA, CA 92562
RECORDED: AS PER MAP RECORDED IN BOOK 204, PAGES 25 TO 26,
ELEVATION: 1094.82' DATUM: NGVD 29

APPROVED FOR SIGNATURE _____ DATE _____

SHEET 7 — CITY OF MURRIETA, ENGINEERING DEPARTMENT — SHEETS 25

SITE PLAN 2
(FOR REFERENCE ONLY)
MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

APPROVED
ROBERT K. MOEHLING _____ DATE _____
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK: _____
PROJECT NO. G-PC-COM-2025-00034
DRAWING NO.

murrieta title sheet.dwg

MEMORIAL WY
N42°19'08"W

EIGHT TOWN SQUARE
N47°40'52"E

(E) AC

(E) PA

(E) CC

(E) AC

(E) CC

(E) CC

PROPOSED BUILDING
FF = 1110.68
PAD=1110.34

(E) BUILDING
FF = (1110.68)

(E) BUILDING
FF = (1110.71)

BIOFILTRATION AREA 2

BIOFILTRATION AREA 1

ROOF OVERHANG

SEE MATCHLINE ON SHEET 10

LEGEND:

- IMPERVIOUS AREA
- PERVIOUS AREA
- 4:1 SLOPE
- GRADE BREAK
- FLOW LINE
- ROOF OVERHANG

GRAPHIC SCALE
SCALE 1" = 10'

SHEET NOTES:

1. FOR GENERAL NOTES, LEGEND AND ABBREVIATIONS, SEE SHEETS C-1.0 AND C-1.1.
2. REFER TO ARCHITECTURAL AND LANDSCAPE DRAWINGS FOR OTHER SITE DIMENSIONS AND IMPROVEMENTS NOT SHOWN ON THIS DRAWING.

"AS BUILT"

THE RECEIPT OF AS-BUILT PLANS AND CITY'S ACCEPTANCE THEREOF DOES NOT ABSOLVE THE ENGINEER OF WORK OF ANY RESPONSIBILITY FOR THE PROJECT DESIGN.

ENGINEER OF WORK _____ DATE _____

RCE NO. _____ EXPIRATION DATE _____

SEAL: REGISTERED PROFESSIONAL ENGINEER — TODD L. PITNER — No. C36079 — Exp. 6/30/26 — CIVIL — STATE OF CALIFORNIA

SCALE
HORIZONTAL
AS NOTED
VERTICAL
AS NOTED

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422-4133
TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
DESCRIPTION: PARCEL 8 OF PARCEL MAP NO. 29924
LOCATION: 8 TOWN SQUARE, MURRIETA, CA 92562
RECORDED: AS PER MAP RECORDED IN BOOK 204, PAGES 25 TO 26,
ELEVATION: 1094.82' DATUM: NGVD 29

APPROVED FOR SIGNATURE

_____ DATE _____
TODD L. PITNER
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

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Monterey Park, CA 91754
Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY VIRGILIO C. AOANAN DATE 05/16/2025
ENGR. NAME TYPED VIRGILIO C. AOANAN
RCE NO. C36079 EXP. DATE 6/30/26

DATE	INITIAL	REVISION DESCRIPTION
06/13/2025	A	BID ISSUE SET
ENGINEER OF WORK		

SHT. NO.	DATE	INITIAL
CITY APPROVAL		

SHEET 9 — CITY OF MURRIETA, ENGINEERING DEPARTMENT — SHEETS 25

SITE GRADING PLAN 1

MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

APPROVED
ROBERT K. MOEHLING _____ DATE _____
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER RCE 63056

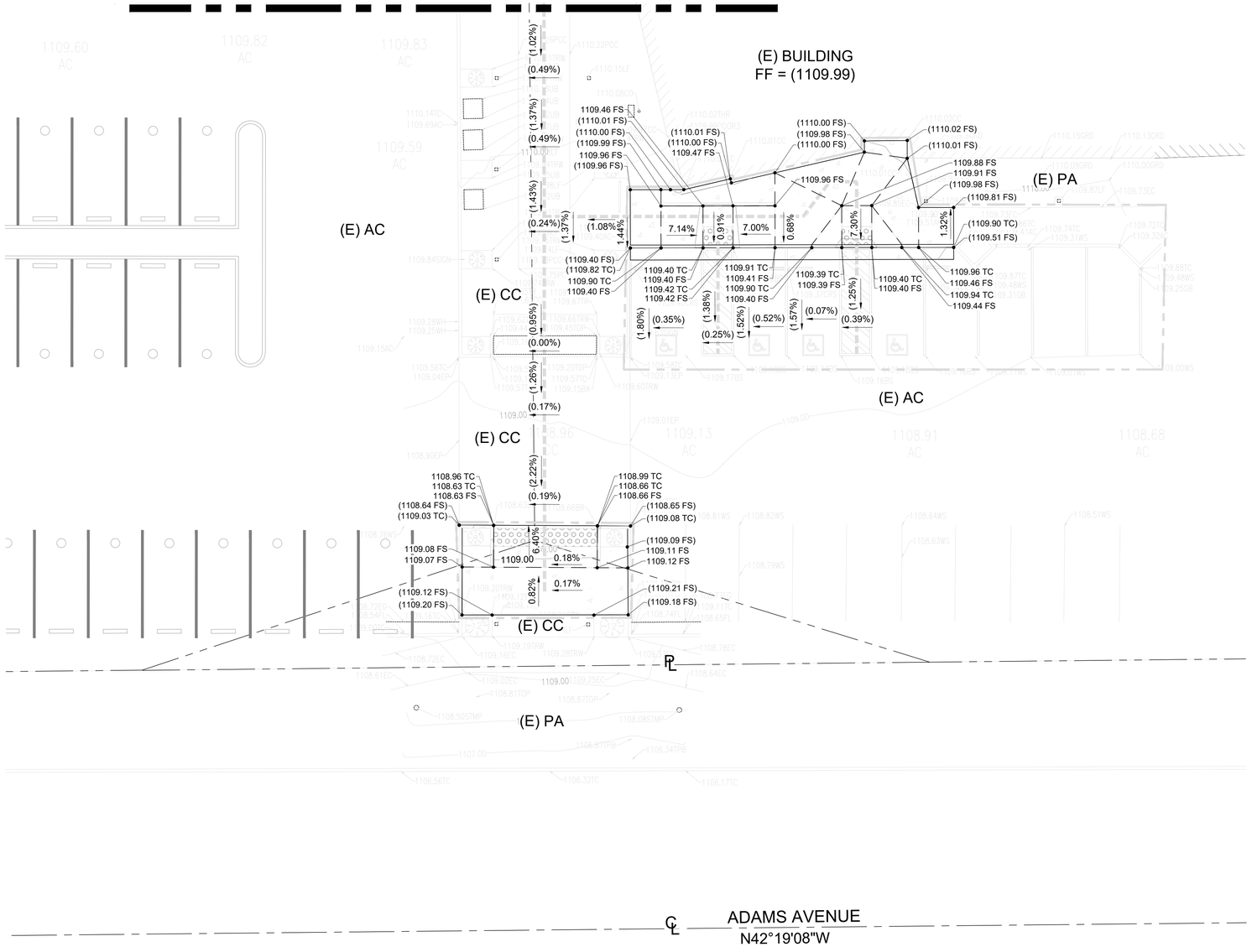
DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK: _____

PROJECT NO. G-PC-COM-2025-00034

DRAWING NO.

murrieta title sheet.dwg

SEE MATCHLINE ON SHEET 9



LEGEND:

- IMPERVIOUS AREA
- PERVIOUS AREA
- 4:1 SLOPE
- GRADE BREAK
- FLOW LINE
- ROOF OVERHANG

10 5 0 10 20

GRAPHIC SCALE
SCALE 1" = 10'

SHEET NOTES:

1. FOR GENERAL NOTES, LEGEND AND ABBREVIATIONS, SEE SHEETS 1 AND 2.
2. REFER TO ARCHITECTURAL AND LANDSCAPE DRAWINGS FOR OTHER SITE DIMENSIONS AND IMPROVEMENTS NOT SHOWN ON THIS DRAWING.

"AS BUILT"

THE RECEIPT OF AS-BUILT PLANS AND CITY'S ACCEPTANCE THEREOF DOES NOT ABSOLVE THE ENGINEER OF WORK OF ANY RESPONSIBILITY FOR THE PROJECT DESIGN.

ENGINEER OF WORK _____ DATE _____

RCE NO. _____ EXPIRATION DATE _____

SEAL: REGISTERED PROFESSIONAL ENGINEER — VIRGILIO C. AOANAN — No. C36079 — Exp. 6/30/26 — CIVIL — STATE OF CALIFORNIA

SCALE
HORIZONTAL AS NOTED
VERTICAL AS NOTED

MCA ENGINEERS INC
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631 S. Alantic Blvd.
Monterey Park, CA 91754
Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY VIRGILIO C. AOANAN DATE 05/16/2025

ENGR. NAME TYPED VIRGILIO C. AOANAN
RCE NO. C36079 EXP. DATE 6/30/26

DATE	INITIAL	REVISION DESCRIPTION	SHT. NO.	DATE	INITIAL
ENGINEER OF WORK				CITY APPROVAL	

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BENCH MARK
DESCRIPTION: PARCEL 8 OF PARCEL MAP NO. 29924
LOCATION: 8 TOWN SQUARE, MURRIETA, CA 92562
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ELEVATION: 1094.82' DATUM: NGVD 29

APPROVED FOR SIGNATURE
_____ DATE _____
TODD L. PITNER
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

SHEET 10 — CITY OF MURRIETA, ENGINEERING DEPARTMENT — SHEETS 25

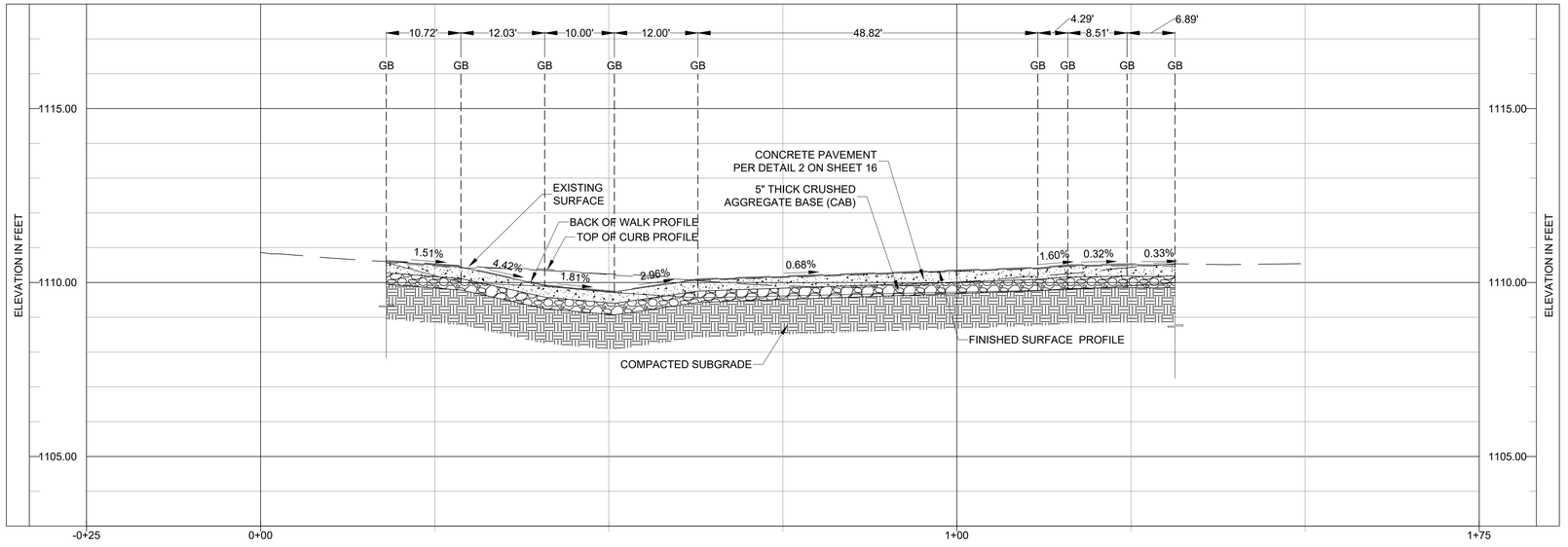
SITE GRADING PLAN 2

MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

APPROVED
ROBERT K. MOEHLING _____ DATE _____
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK: _____
PROJECT NO. G-PC-COM-2025-00034
DRAWING NO.

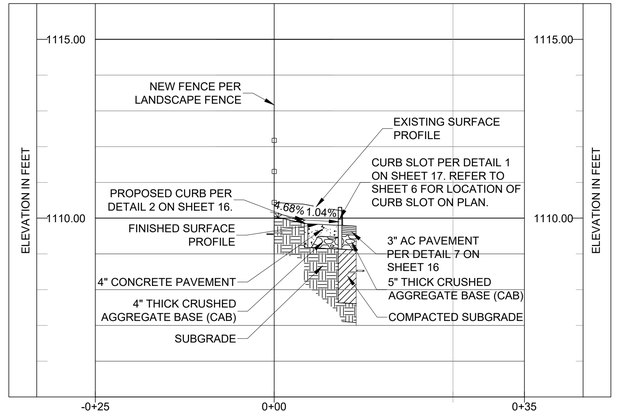
murrieta title sheet.dwg



GRADING SECTION PROFILE - 1

SCALE HOR 1"=10' VER 1"=2'

1 / 9



GRADING SECTION PROFILE - 2

SCALE HOR 1"=10' VER 1"=2'

2 / 9

"AS BUILT"

THE RECEIPT OF AS-BUILT PLANS AND CITY'S ACCEPTANCE THEREOF DOES NOT ABSOLVE THE ENGINEER OF WORK OF ANY RESPONSIBILITY FOR THE PROJECT DESIGN.

ENGINEER OF WORK — DATE

RCE NO. — EXPIRATION DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER — ROBERT K. MOEHLING — No. C36079 — Exp. 6/30/26 — CIVIL — STATE OF CALIFORNIA

SCALE

HORIZONTAL: AS NOTED

VERTICAL: AS NOTED

VCA ENGINEERS INC
CIVIL • STRUCTURAL
631 S. Allantic Blvd.
Monterey Park, CA 91754
Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY: VIRGILIO C. AOANAN — DATE: 05/16/2025

ENGR. NAME TYPED: VIRGILIO C. AOANAN

RCE NO. C36079 — EXP. DATE 6/30/26

DATE	INITIAL	REVISION DESCRIPTION

ENGINEER OF WORK

SHT. NO. — DATE — INITIAL — CITY APPROVAL

Underground Service Alert
Call: TOLL FREE
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TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK

DESCRIPTION: PARCEL 8 OF PARCEL MAP NO. 29924

LOCATION: 8 TOWN SQUARE, MURRIETA, CA 92562

RECORDED: AS PER MAP RECORDED IN BOOK 204, PAGES 25 TO 26,

ELEVATION: 1094.82' DATUM: NGVD 29

APPROVED FOR SIGNATURE

TODD L. PITNER — DATE
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

SHEET 11 — SHEETS 25

CITY OF MURRIETA
ENGINEERING DEPARTMENT

GRADING SECTION

MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

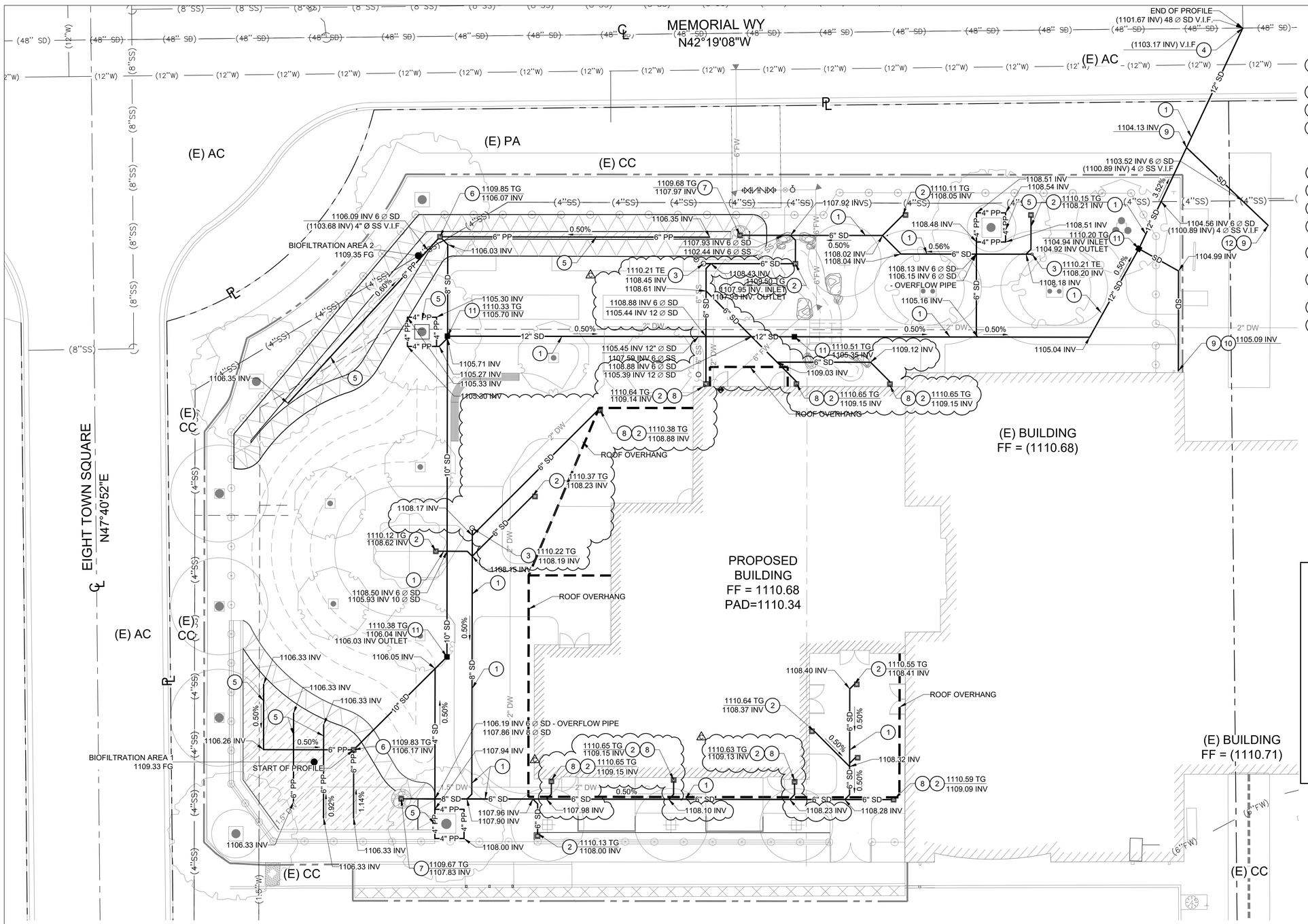
APPROVED
ROBERT K. MOEHLING — DATE
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER — RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK:

PROJECT NO. G-PC-COM-2025-00034

DRAWING NO.

murrieta title sheet.dwg



CONSTRUCTION NOTES:

STORM DRAIN:

1. PROPOSED NEW DUAL WALL HDPE STORM DRAIN LINE PER DETAIL 4 ON SHEET 17. SEE PLAN FOR SIZES.
2. 12" X 12" CATCH BASIN PER DETAIL 5 ON SHEET 17.
3. CLEANOUT PER DETAIL 3 ON SHEET 17.
4. CONNECT TO EXISTING STORM DRAIN MAIN. CONTRACTOR TO VERIFY IN FIELD LOCATION, SIZE, AND INVERT OF EXISTING STORM DRAIN LATERAL PRIOR TO INSTALLATION OF NEW STORM DRAIN LINE. COORDINATE WITH CITY OF MURRIETA PRIOR TO INSTALLATION.
5. NEW DUAL WALL HDPE PERFORATED PIPE. SEE PLANS FOR SIZES.
6. 24" X 24" OVERFLOW CATCH BASIN PER DETAIL 5 ON SHEET 17.
7. NEW BUBBLER CATCH BASIN INLET PER DETAIL 2 ON SHEET 17.
8. NEW BUILDING DOWNSPOUT TO SPLASH PER TO GRADE PER PLUMBING DRAWINGS. FOR CONTINUATION, REFER TO PLUMBING DRAWINGS.
9. DUAL WALL HDPE STORM DRAIN LINE PER DETAIL 4 ON SHEET 17. MATCH EXISTING PIPE SIZE.
10. CONNECT TO EXISTING DOWNSPOUT. VERIFY IN FIELD LOCATION AND INVERT PRIOR TO INSTALLATION OF NEW STORMDRAIN LINE.
11. 24"X24" CATCH BASIN WITH SOLID GRATE PER DETAIL 5 ON SHEET 17.
12. CONNECT TO ON-SITE EXISTING STORM DRAIN LINE. VERIFY IN FIELD LOCATION, SIZE, AND INVERT PRIOR TO INSTALLTION OF NEW STORM DRAIN LINE.

LEGEND:

- NEW BIOFILTRATION WITH NO INFILTRATION SYSTEM (STATIC) PER DETAIL 1 ON SHEET 18.
- NEW RIP RAP PER DETAIL 2 ON SHEET 17.
- 4:1 SLOPE
- ROOF OVERHANG

SHEET NOTES:

1. FOR GENERAL NOTES, LEGENDS AND ABBREVIATIONS, SEE SHEET 1 AND 2.
2. SEE ARCHITECTURAL DRAWINGS FOR OTHER SITE RELATED DIMENSIONS NOT SHOWN ON THIS DRAWING.
3. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL SURFACE AND/OR UNDERGROUND UTILITIES IN CONFLICT WITH THE PROPOSED DEMOLITION AND DESIGN ITEMS. CONTRACTOR SHALL REPORT ANY DISCREPANCIES AND/OR CONSTRUCTION RELATED ISSUES TO THE OWNER OR DESIGN TEAM PRIOR TO THE COMMENCEMENT OF WORK.
4. CONTRACTOR TO VERIFY IN FIELD THE JOINING TO EXISTING ELEVATION AND THE CURRENT SITE CONDITION WITH THE DESIGN GRADES. CONTRACTOR SHALL REPORT ANY DISCREPANCIES TO THE OWNER OR DESIGN TEAM PRIOR TO THE COMMENCEMENT OF WORK.
5. THE EXISTING UNDERGROUND UTILITIES THAT ARE SHOWN ON HEREIN WERE TAKEN FROM EXISTING AS-BUILT DRAWINGS. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VISIT THE JOB SITE AND VERIFY THE EXISTING CONDITIONS BEFORE STARTING WORK. ANY DISCREPANCY SHALL BE REPORTED TO THE DESIGN TEAM PRIOR TO COMMENCEMENT OF WORK.

10 5 0 10 20

GRAPHIC SCALE
SCALE 1" = 10'

"AS BUILT"

THE RECEIPT OF AS-BUILT PLANS AND CITY'S ACCEPTANCE THEREOF DOES NOT ABSOLVE THE ENGINEER OF WORK OF ANY RESPONSIBILITY FOR THE PROJECT DESIGN.

ENGINEER OF WORK — DATE

RCE NO. — EXPIRATION DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER — VIRGILIO C. AOANAN — No. C36079 — Exp. 6/30/26 — CIVIL — STATE OF CALIFORNIA

SCALE
HORIZONTAL: AS NOTED
VERTICAL: AS NOTED

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422-4133
TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
DESCRIPTION: PARCEL 8 OF PARCEL MAP NO. 29924
LOCATION: 8 TOWN SQUARE, MURRIETA, CA 92562
RECORDED: AS PER MAP RECORDED IN BOOK 204, PAGES 25 TO 26,
ELEVATION: 1094.82' DATUM: NGVD 29

APPROVED FOR SIGNATURE

TODD L. PITNER — DATE
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

VCA ENGINEERS INC
CIVIL ★ STRUCTURAL
631 S. Allantic Blvd.
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Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY — DATE
VIRGILIO C. AOANAN — 05/16/2025

ENGR. NAME TYPED: VIRGILIO C. AOANAN
RCE NO. C36079 EXP. DATE 6/30/26

DATE	INITIAL	ENGINEER OF WORK

DATE		BID ISSUE SET
06/13/2025	1	

SHT. NO.	DATE	INITIAL	REVISION DESCRIPTION
			CITY APPROVAL

SHEET 12 — CITY OF MURRIETA — ENGINEERING DEPARTMENT — SHEETS 25

DRAINAGE PLAN

MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

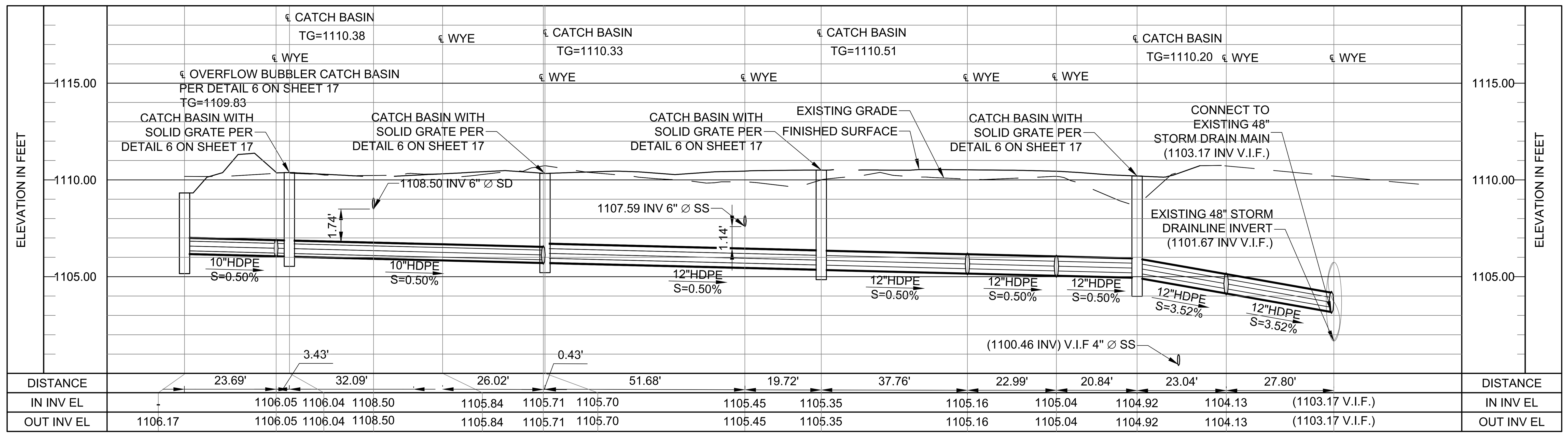
APPROVED
ROBERT K. MOEHLING — DATE
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER — RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK:

PROJECT NO. G-PC-COM-2025-00034

DRAWING NO.

murrieta title sheet.dwg



STORM DRAIN PROFILE - 1 (1/10)

SCALE HOR 1"=20' VER 1"=4'

"AS BUILT"

THE RECEIPT OF AS-BUILT PLANS AND CITY'S ACCEPTANCE THEREOF DOES NOT ABSOLVE THE ENGINEER OF WORK OF ANY RESPONSIBILITY FOR THE PROJECT DESIGN.

ENGINEER OF WORK ______ DATE ______

RCE NO. ______ EXPIRATION DATE ______

SEAL: REGISTERED PROFESSIONAL ENGINEER — VIRGILIO C. AOANAN — No. C36079 — Exp. 6/30/26 — CIVIL — STATE OF CALIFORNIA

SCALE
HORIZONTAL
AS NOTED
VERTICAL
AS NOTED

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631 S. Alantic Blvd.
Monterey Park, CA 91754
Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY: VIRGILIO C. AOANAN — DATE: 05/16/2025

ENGR. NAME TYPED: VIRGILIO C. AOANAN
RCE NO. C36079 — EXP. DATE 6/30/26

Underground Service Alert
Call: TOLL FREE
1-800
422-4133
TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
DESCRIPTION: PARCEL 8 OF PARCEL MAP NO. 29924
LOCATION: 8 TOWN SQUARE, MURRIETA, CA 92562
RECORDED: AS PER MAP RECORDED IN BOOK 204, PAGES 25 TO 26.
ELEVATION: 1094.82' — DATUM: NGVD 29

APPROVED FOR SIGNATURE
TODD L. PITNER — DATE ______
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

DATE	INITIAL	REVISION DESCRIPTION	SHT. NO.	DATE	INITIAL
ENGINEER OF WORK				CITY APPROVAL	

SHEET 13 — SHEETS 25

CITY OF MURRIETA
ENGINEERING DEPARTMENT

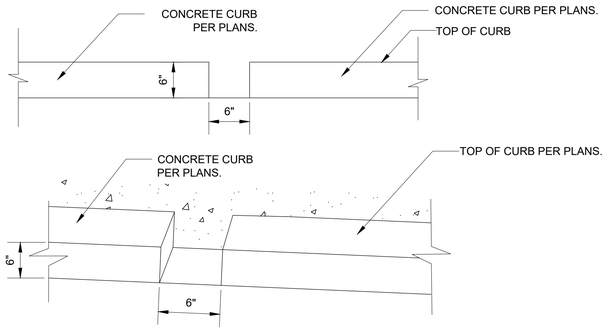
STORM DRAIN UTILITY PROFILE
MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

APPROVED
ROBERT K. MOEHLING ______ DATE ______
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER — RCE 63056

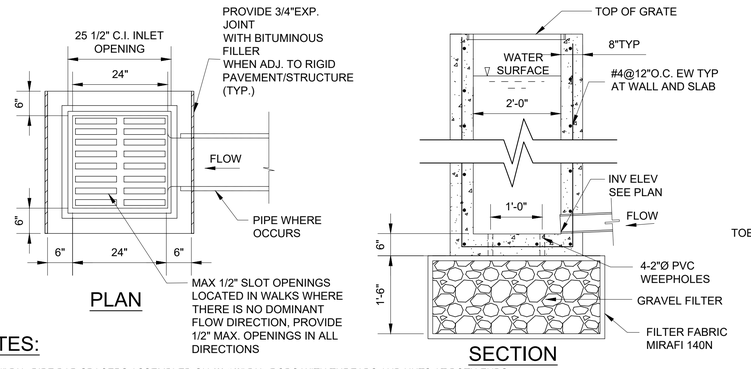
DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK: ______

PROJECT NO.: G-PC-COM-2025-00034
DRAWING NO.

murrieta title sheet.dwg

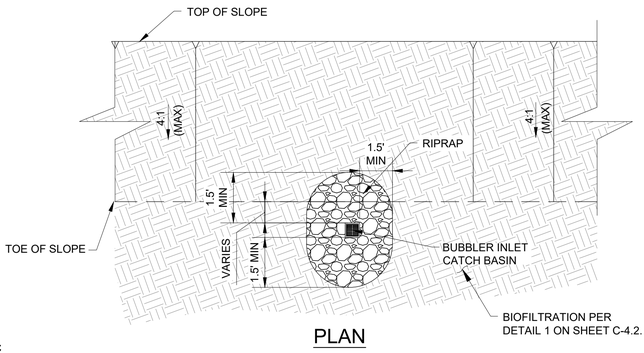


1 CURB SLOT DETAIL
NOT TO SCALE



PLAN

SECTION



PLAN

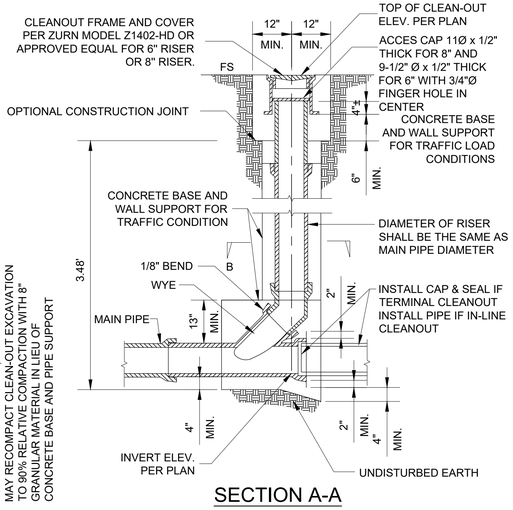
NOTES:

1. USE 3/4" DIA. PIPE BAR SPACERS ASSEMBLED ON (2) 1/2" DIA. RODS WITH THREADS AND NUTS AT BOTH ENDS.
2. ALL METAL PARTS SHALL BE GALVANIZED AFTER FABRICATION AND WELDING, AND BEFORE ASSEMBLING.
3. FRAME AND GRATE SHALL BE SIMILAR TO ALHAMBRA FOUNDRY CO. LTD. SERIES MODEL NO. 1581, OR APPROVED EQUAL.
4. GRATES SHALL BE VANDAL-RESISTANT CONSTRUCTION WITH 1/2" MAX OPENINGS.
5. CONCRETE, fc' = 3,000 PSI @ 28 DAYS PER SSPWC.
6. REBAR, FY = 60,000 PSI, ASTM A615
7. GRATE MUST COMPLY WITH ADA REQUIREMENTS.
8. PROVIDE 1/2" MAX GRID/OPENING IN GRATING IN THE DIRECTION OF TRAFFIC FLOW.

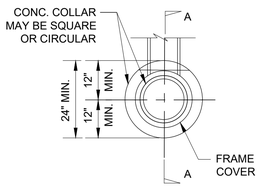
RIP RAP NOTES:

1. TO REDUCE EROSION, A COBBLESTONE PAD SHALL BE PLACED AT EACH INLET POINT. THE COBBLESTONE SHALL BE 3"-5" DIAMETER IN SIZE AND SHALL BE EMBEDDED IN 4" OF CONCRETE. THE COBBLESTONE PAD INSIDE THE BIORETENTION FACILITY SHALL BE COMPACTED.

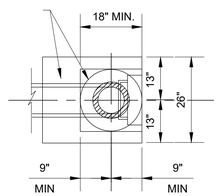
2 24"X24" BUBBLER CATCH BASIN AND RIP RAP DETAIL
NOT TO SCALE



SECTION A-A

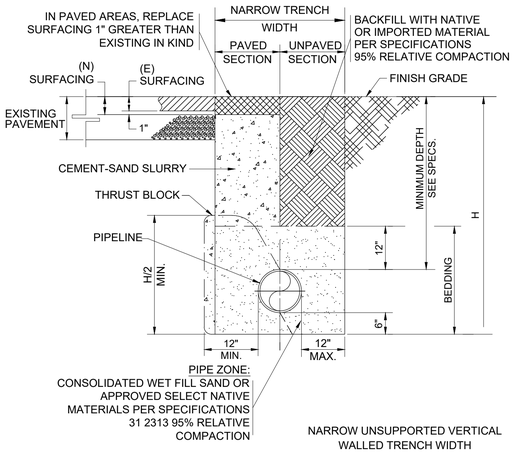


PLAN



SECTION B-B

3 CLEANOUT DETAIL
NOT TO SCALE



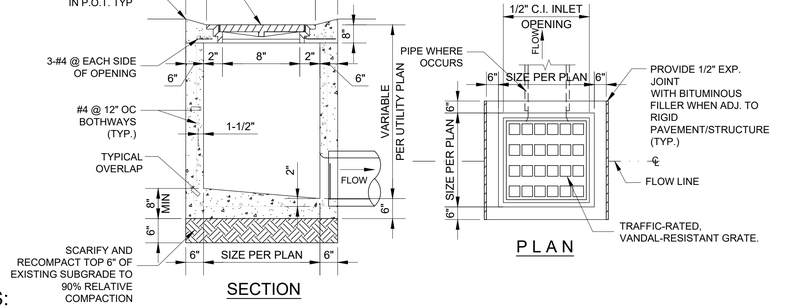
NOTE:

1. PAVEMENT FINISH SURFACE SHALL BE A SMOOTH CONTINUATION OF ADJOINING PAVED SURFACE.

NARROW UNSUPPORTED VERTICAL WALLED TRENCH WIDTH

NOMINAL PIPE DIAMETER (INCHES)	NARROW TRENCH WIDTH MIN. (INCHES)
6	18
8	18
10	18
12	18

4 TRENCH DETAIL
NOT TO SCALE



SECTION

PLAN

NOTES:

1. USE 3/4" DIA. PIPE BAR SPACERS ASSEMBLED ON (2) 1/2" DIA. RODS WITH THREADS AND NUTS AT BOTH ENDS.
2. ALL METAL PARTS SHALL BE GALVANIZED AFTER FABRICATION AND WELDING, AND BEFORE ASSEMBLING.
3. FRAME AND GRATE SHALL BE SIMILAR TO EISEL ENTERPRISES INC. ALHAMBRA FOUNDRY CO. LTD. SERIES MODEL NO. A-2012 OR BROOKS PRODUCTS, INC. OR APPROVED EQUAL.
4. GRATES MUST COMPLY WITH ALL ADA REQUIREMENTS.
5. PROVIDE 1/2" MAX GRID/OPENINGS IN GRATING IN THE DIRECTION OF TRAFFIC FLOW
6. GRATES SHALL BE OF VANDAL-RESISTANT CONSTRUCTION .
7. FRAME AND GRATE SHALL BE TRAFFIC-RATED.
8. REBAR, FY = 60,000 PSI, ASTM A615, GRADE 60.
9. CONCRETE, F'C = 3,000 PSI @ 28 DAYS PER SSPWC, TYPE II CEMENT.
10. THE CONTRACTOR SHALL BE ABLE TO INSTALL AN APPROVED EQUAL PREFABRICATED CATCH BASIN.
11. CONTRACTOR TO INSTALL NEW SOLID GRATE AT LOCATION WHERE DRAINAGE PLAN CALLS OUT.

5 CATCH BASIN DETAIL
NOT TO SCALE

"AS BUILT"

THE RECEIPT OF AS-BUILT PLANS AND CITY'S ACCEPTANCE THEREOF DOES NOT ABSOLVE THE ENGINEER OF WORK OF ANY RESPONSIBILITY FOR THE PROJECT DESIGN.

ENGINEER OF WORK — DATE

RCE NO. — EXPIRATION DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER — No. C36079 — Exp. 6/30/26 — CIVIL — STATE OF CALIFORNIA

SCALE

HORIZONTAL: AS NOTED

VERTICAL: AS NOTED

VCA ENGINEERS INC — CIVIL + STRUCTURAL
631 S. Alantic Blvd,
Monterey Park, CA 91754
Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY: VIRGILIO C. AOANAN — DATE: 05/16/2025

ENGR. NAME TYPED: VIRGILIO C. AOANAN

RCE NO. C36079 — EXP. DATE 6/30/26

Underground Service Alert
Call: TOLL FREE
1-800
422-4133
TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
DESCRIPTION: PARCEL 8 OF PARCEL MAP NO. 29924
LOCATION: 8 TOWN SQUARE, MURRIETA, CA 92562
RECORDED: AS PER MAP RECORDED IN BOOK 204, PAGES 25 TO 26.
ELEVATION: 1094.82' DATUM: NGVD 29

APPROVED FOR SIGNATURE

TODD L. PITNER — DATE
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

DATE	INITIAL	REVISION DESCRIPTION	SHT. NO.	DATE	INITIAL
ENGINEER OF WORK				CITY APPROVAL	

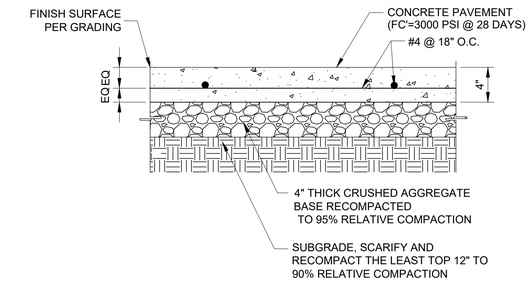
SHEET 17 — CITY OF MURRIETA, ENGINEERING DEPARTMENT — SHEETS 25

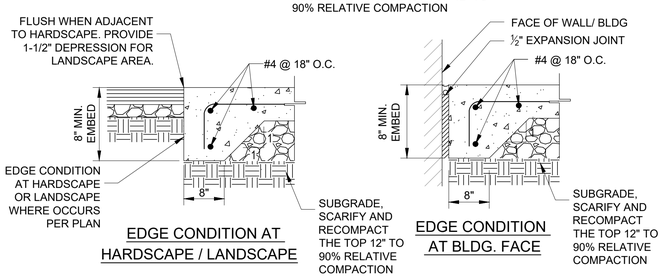
MISCELLANEOUS DETAILS
MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

APPROVED
ROBERT K. MOEHLING — DATE
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER — RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK:
PROJECT NO. G-PC-COM-2025-00034
DRAWING NO.

murrieta title sheet.dwg

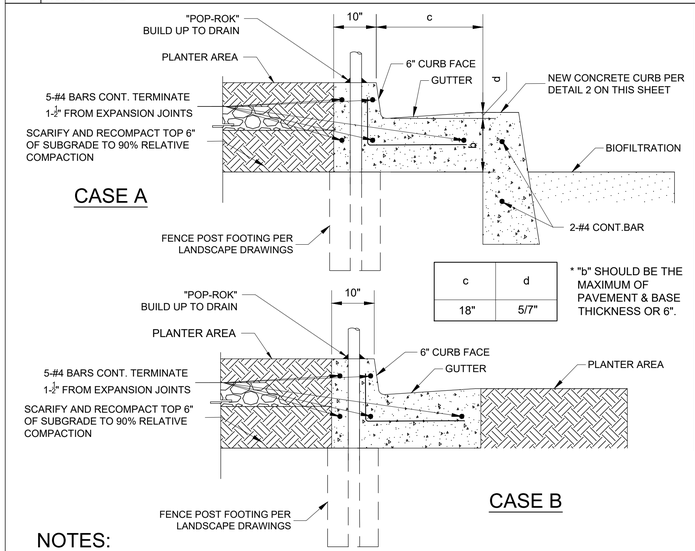




NOTES:

1. CONCRETE, F'C = 3,000 PSI @ 28 DAYS, TYPE I CEMENT
2. REBARS, FY=60,000 PSI ASTM A615.
3. FOR WPJ CONSTRUCTION JOINTS AND PATTERN, REFER TO ARCHITECTURAL AND LANDSCAPE DRAWINGS AND SPECIFICATIONS.
4. CRACK CONTROL JOINTS SHOULD BE SPACED @ INTERVALS NOT GREATER THAN 10' USING SAWCUTS AND EXTEND MINIMUM OF 1/4 THE SLAB THICKNESS.
5. FOR FINISH SURFACES, COLOR INTEGRATION, EXPANSION JOINTS AND OTHER PAVEMENT SURFACE FEATURES, SEE ARCHITECTURAL & LANDSCAPE DRAWINGS.
6. FOR PAVEMENT TRANSITIONAL AND JOINT DETAILS REFER TO DETAIL 3 AND 4 ON THIS SHEET.
7. PROVIDE THICKENED EDGE FOR ALL EDGE CONDITIONS.

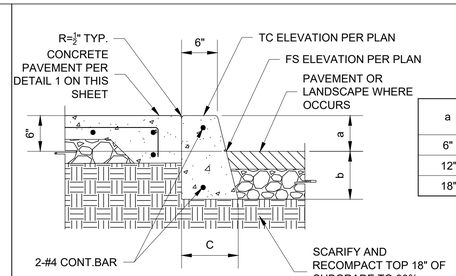
1 CONCRETE PAVEMENT SECTION
NOT TO SCALE



NOTES:

1. WHEN OVERALL HEIGHT OF WALL IS LESS THAN 22", STANDARD FENCE POST FOOTING SHALL BE CONSTRUCTED & WALL POURED ON TOP.
2. PROVIDE EXPANSION JOINTS AT 30'-0" O.C MAX.

6 GRAVITY CURB AND GUTTER
NOT TO SCALE

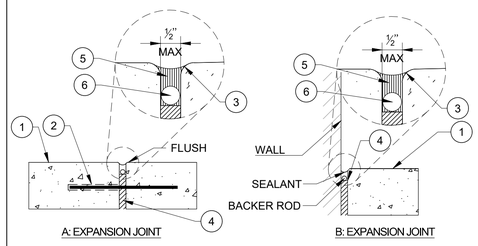


a	b	c
6"	8"	9-1/2"
12"	12"	12"
18"	12"	13-1/2"

NOTES:

1. PROVIDE 1/4" SELF SEALING EXPANSION JOINT WITH PREFORMED JOINT FILLER AT ALL ANGLE POINTS AND THE BEGINNING AND END OF ALL CURVES.
2. PROVIDE CONTRACTION JOINTS CONSISTING OF ONE INCH DEEP CUT SCORES AT 20' O.C. MAX UNLESS OTHERWISE NOTED BY SIDEWALK OR PAVEMENT JOINT PATTERN.
3. WHERE A WALK IS ADJACENT TO THE CURB, ALL JOINTS IN THE CURB SHALL LINE WITH ALL JOINTS IN THE WALK.
4. CONCRETE, FC'=3,500 PSI @ 28 DAYS PER SSPWC.

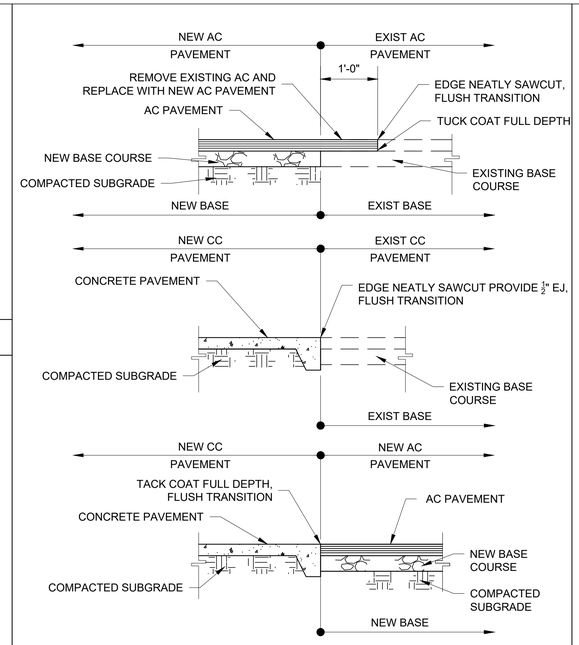
2 CONCRETE CURB DETAIL
NOT TO SCALE



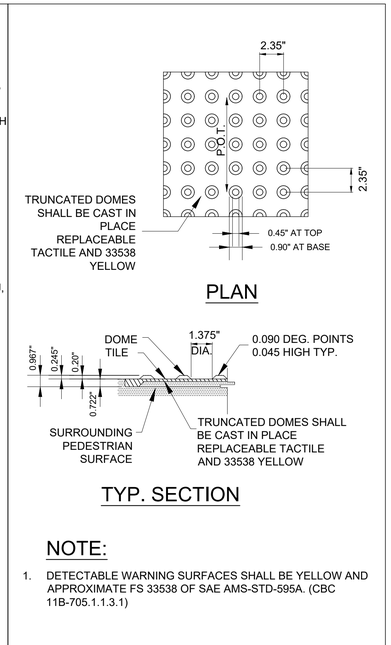
LEGEND:

1. PAVING FINISH SURFACE.
2. 18" #4 REBAR W/ 'SMOOTH DOWEL' @ 36" OC, CENTER IN CONC. AT COLD JOINTS & EVERY EXPANSION JOINTS 20' OC MAX.
3. 1/4" R. @ EDGES. TYP.
4. PREMOLDED E.J. FILLER.
5. JOINT SEALANT. COLOR TO BE SELECTED BY ARCHITECT. SUBMIT COLOR SAMPLES PRIOR TO INSTALLATION.
6. BACKER ROD.

3 JOINT DETAIL
NOT TO SCALE



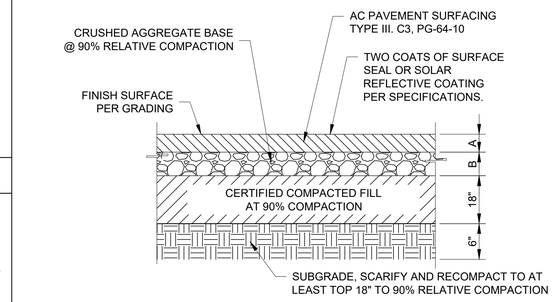
4 PAVEMENT TRANSITION DETAIL
NOT TO SCALE



NOTE:

1. DETECTABLE WARNING SURFACES SHALL BE YELLOW AND APPROXIMATE FS 33538 OF SAE AMS-STD-595A. (CBC 11B-705.1.1.3.1)

5 CAST-IN-PLACE TRUNCATED DOME DETAIL
NOT TO SCALE



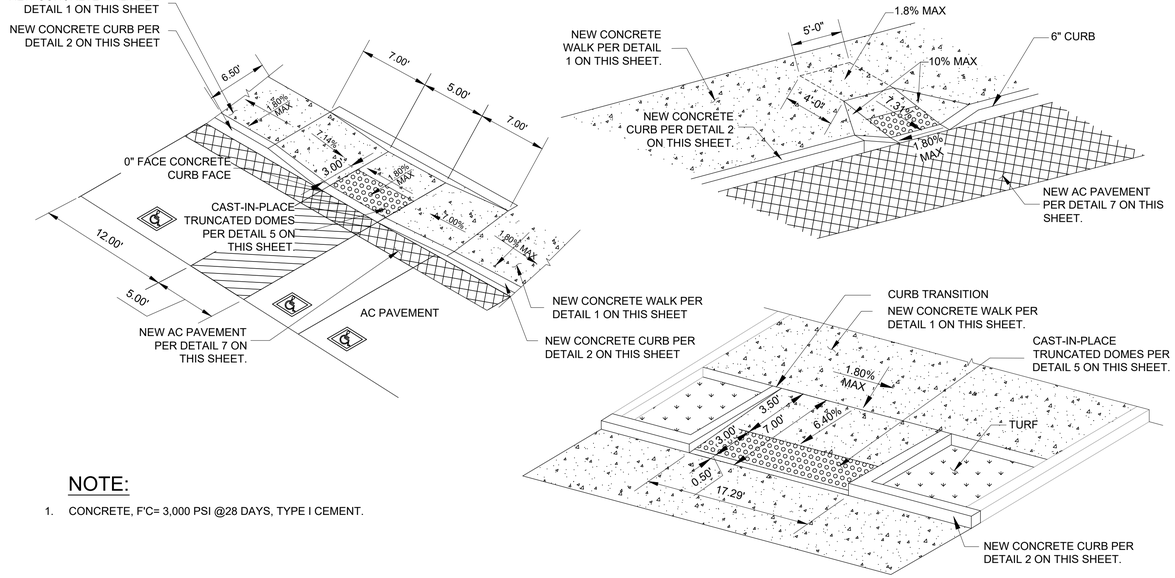
3" THICK OR LESS AC PAVEMENT

LOCATION	A C		BASE COURSE		
	THICKNESS "A"	CLASS	THICKNESS "B"	TYPE	GRADE
PARKING LOT	3"	C2	5"	CAB	FINE

NOTES:

1. FOR PAVEMENT TRANSITION REFER TO DETAIL 4 ON THIS SHEET.

7 AC PAVEMENT SECTION
NOT TO SCALE



NOTE:

1. CONCRETE, F'C= 3,000 PSI @28 DAYS, TYPE I CEMENT.

8 CONCRETE CURB RAMP DETAIL
NOT TO SCALE

"AS BUILT"

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ENGINEER OF WORK — DATE

RCE NO. — EXPIRATION DATE

Underground Service Alert
Call: TOLL FREE 1-800 422-4133
TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
DESCRIPTION: PARCEL 8 OF PARCEL MAP NO. 29924
LOCATION: 8 TOWN SQUARE, MURRIETA, CA 92562
RECORDED: AS PER MAP RECORDED IN BOOK 204, PAGES 25 TO 26,
ELEVATION: 1094.82' DATUM: NGVD 29

APPROVED FOR SIGNATURE
DATE
TODD L. PITNER
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

SEAL: REGISTERED PROFESSIONAL ENGINEER No. C36079 Exp. 6/30/26 CIVIL STATE OF CALIFORNIA

SCALE
HORIZONTAL
AS NOTED
VERTICAL
AS NOTED

MCA ENGINEERS INC
CIVIL • STRUCTURAL
631 S. Alantic Blvd.
Monterey Park, CA 91754
Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY VIRGILIO C. AOANAN — DATE 05/16/2025
ENGR. NAME TYPED VIRGILIO C. AOANAN
RCE NO. C36079 EXP. DATE 6/30/26

DATE	INITIAL	REVISION DESCRIPTION	SHT. NO.	DATE	INITIAL
ENGINEER OF WORK				CITY APPROVAL	

SHEET 16 — CITY OF MURRIETA, ENGINEERING DEPARTMENT — SHEETS 25

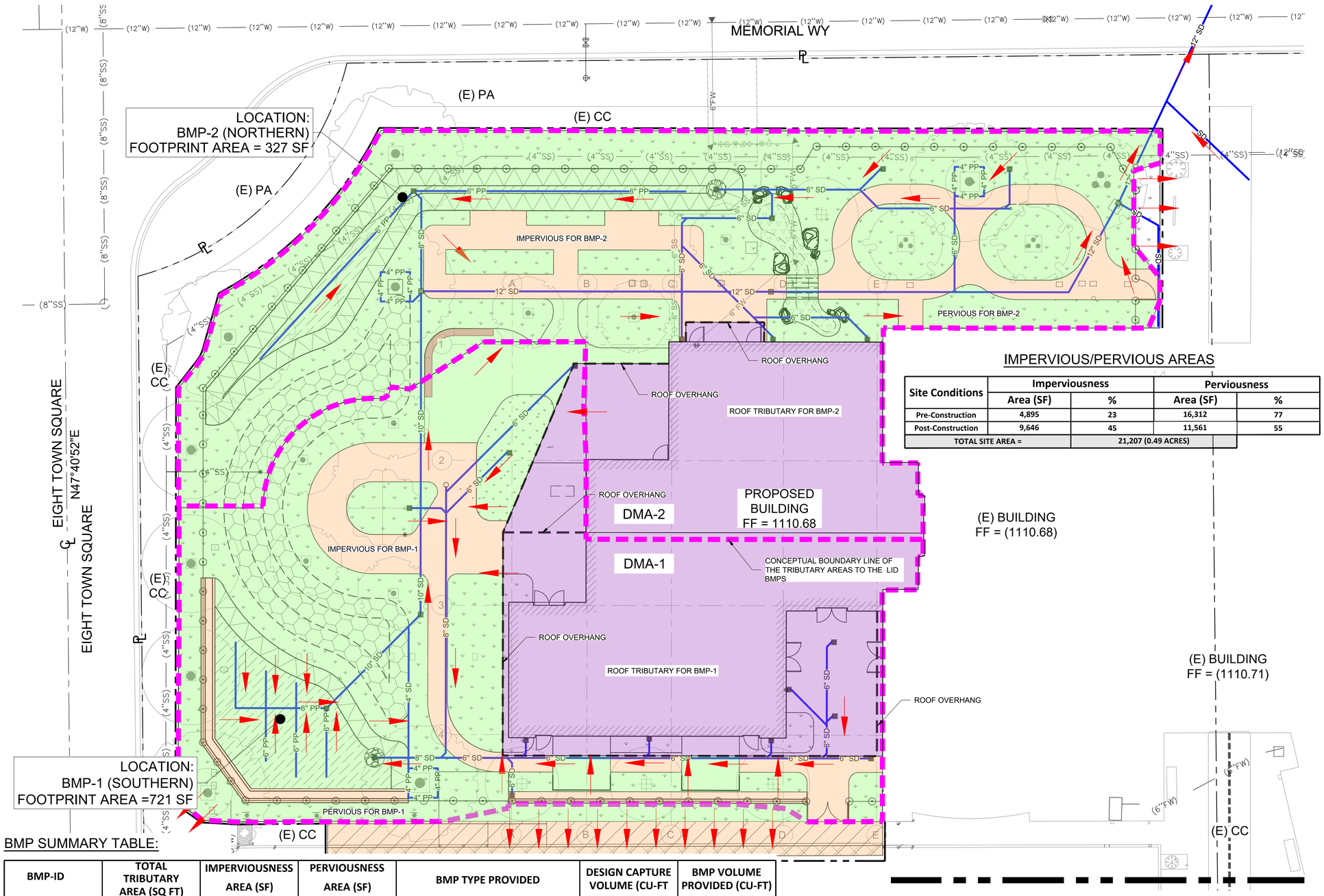
MISCELLANEOUS DETAILS
MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

APPROVED
ROBERT K. MOEHLING — DATE
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER — RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK:
PROJECT NO. G-PC-COM-2025-00034
DRAWING NO.

murrieta title sheet.dwg

WQMP PLAN



LEGEND:

BMP AREA	
BUILDING	6,405.45 SF
IMPERVIOUS AREA	5,242.01 SF
PLANTER AREA	11,441.71 SF
OTHER PERVIOUS AREA	60 SF
UNMITIGATED IMPERVIOUS AREA (DIMINIMUS FLOW)	1209.58 SF
SD PIPE / DRAINAGE FLOW	
CONCEPTUAL BOUNDARY LINE OF THE TRIBUTARY AREAS TO THE LID BMPS	
XX"SD PROPOSED STORM DRAIN LINE	
PROPOSED CATCH BASIN	

IMPERVIOUS/PERVIOUS AREAS

Site Conditions	Imperviousness		Perviousness	
	Area (SF)	%	Area (SF)	%
Pre-Construction	4,895	23	16,312	77
Post-Construction	9,646	45	11,561	55
TOTAL SITE AREA =		21,207 (0.49 ACRES)		

EXISTING :

TOTAL AREA: 21,207 SF = 0.49 ACRE
PERVIOUS AREA: 16,312 SF = 0.38 ACRE
IMPERVIOUS AREA: 4,895 SF = 0.11 ACRE
IMPERVIOUS RATIO : 23%

PROPOSED :

TOTAL AREA: 21,207 SF = 0.49 ACRE
PERVIOUS AREA: 11,561 SF = 0.22 ACRE
IMPERVIOUS AREA: 9,646 SF = 0.27 ACRE
IMPERVIOUS RATIO : 45%

BMP SUMMARY TABLE:

BMP-ID	TOTAL TRIBUTARY AREA (SQ FT)	IMPERVIOUSNESS AREA (SF)	PERVIOUSNESS AREA (SF)	BMP TYPE PROVIDED	DESIGN CAPTURE VOLUME (CU-FT	BMP VOLUME PROVIDED (CU-FT)
BMP-1	10,902	6,115	4,787	BIOFILTRATION AREA WITH NO INFILTRATION	449	1,435
BMP-2	10,305	3,531	6,774	BIOFILTRATION AREA WITH NO INFILTRATION	334	652

WQMP PLAN

10 5 0 10 20
GRAPHIC SCALE

BIOFILTRATION AREA WITH NO INFILTRATION
CONCEPTUAL BOUNDARY LINE OF THE TRIBUTARY AREAS TO THE LID BMPS

"AS BUILT"

THE RECEIPT OF AS-BUILT PLANS AND CITY'S ACCEPTANCE THEREOF DOES NOT ABSOLVE THE ENGINEER OF WORK OF ANY RESPONSIBILITY FOR THE PROJECT DESIGN.

ENGINEER OF WORK — DATE

RCE NO. — EXPIRATION DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER — TODD L. PITNER — No. C36079 — Exp. 6/30/26 — CIVIL — STATE OF CALIFORNIA

SCALE
HORIZONTAL
AS NOTED
VERTICAL
AS NOTED

VCA ENGINEERS INC
CIVIL ■ STRUCTURAL
631 S. Alantic Blvd.
Monterey Park, CA 91754
Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY VIRGILIO C. AOANAN — DATE 05/16/2025
ENGR. NAME TYPED VIRGILIO C. AOANAN
RCE NO. C36079 — EXP. DATE 6/30/26

Underground Service Alert
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1-800
422-4133
TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
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RECORDED: AS PER MAP RECORDED IN BOOK 204, PAGES 25 TO 26,
ELEVATION: 1094.82' DATUM: NGVD 29

APPROVED FOR SIGNATURE — DATE
TODD L. PITNER
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

DATE	INITIAL	REVISION DESCRIPTION	SHT. NO.	DATE	INITIAL
ENGINEER OF WORK				CITY APPROVAL	

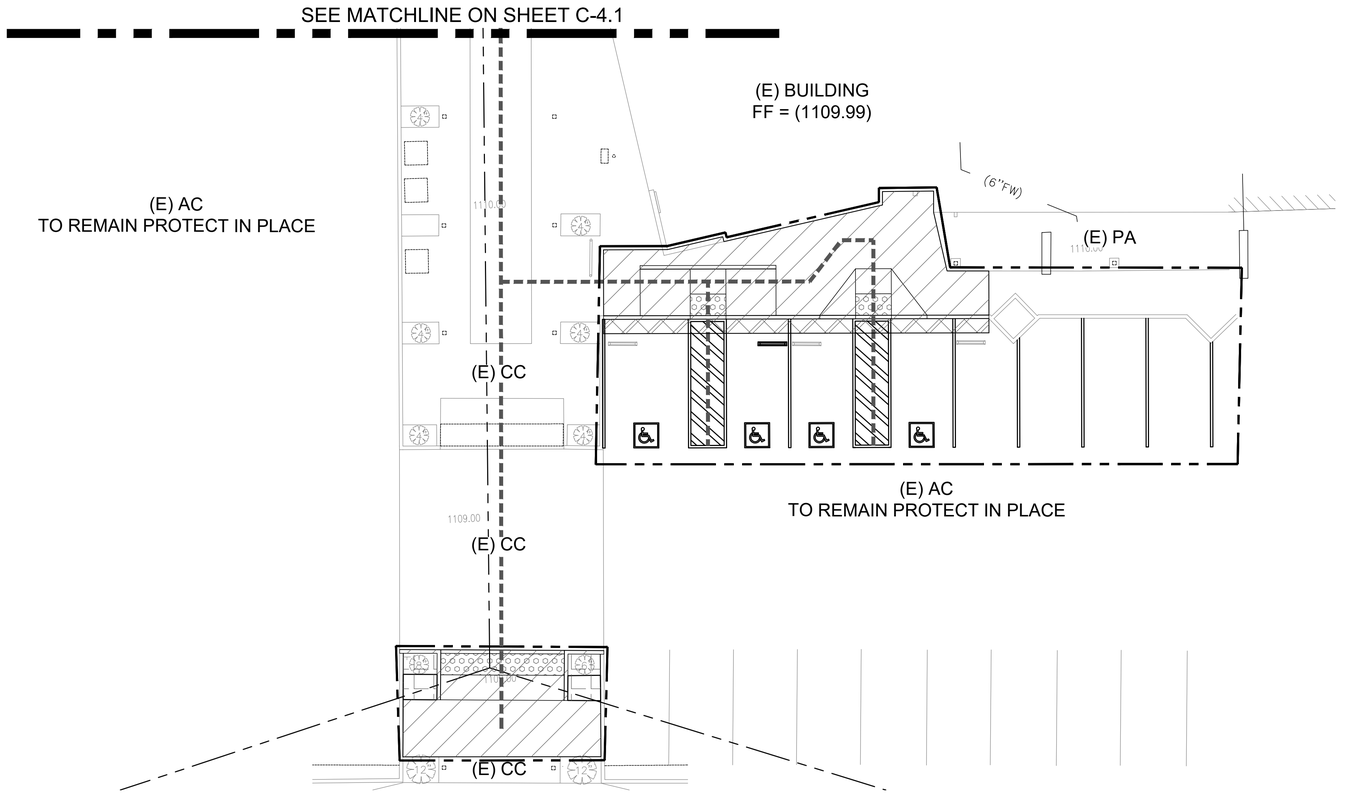
SHEET — CITY OF MURRIETA, ENGINEERING DEPARTMENT — SHEETS

WQMP PLAN
MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

APPROVED
ROBERT K. MOEHLING — DATE
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER — RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK:
PROJECT NO. G-PC-COM-2025-00034
DRAWING NO. C-4.3

murrieta title sheet.dwg



LEGEND:

	PLANTER AREA	11,441.71 SF
	OTHER PERVIOUS AREA	60 SF
	UNMITIGATED IMPERVIOUS AREA (DIMINIMUS FLOW)	1209.58 SF
XX"SD	PROPOSED STORM DRAIN LINE	

IMPERVIOUS/PERVIOUS AREAS

Site Conditions	Imperviousness		Perviousness	
	Area (SF)	%	Area (SF)	%
Pre-Construction	4,895	23	16,312	77
Post-Construction	9,646	45	11,561	55
TOTAL SITE AREA =		21,207 (0.49 ACRES)		

EXISTING :

TOTAL AREA: 21,207 SF = 0.49 ACRE
PERVIOUS AREA: 16,312 SF = 0.38 ACRE
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PROPOSED :

TOTAL AREA: 21,207 SF = 0.49 ACRE
PERVIOUS AREA: 11,561 SF = 0.22 ACRE
IMPERVIOUS AREA: 9,646 SF = 0.27 ACRE
IMPERVIOUS RATIO : 45%

WQMP PLAN

10 5 0 10 20

GRAPHIC SCALE

"AS BUILT"

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ENGINEER OF WORK _____ DATE _____

RCE NO. _____ EXPIRATION DATE _____

SEAL: REGISTERED PROFESSIONAL ENGINEER — No. C36079 — Exp. 6/30/26 — CIVIL — STATE OF CALIFORNIA

SCALE

HORIZONTAL: AS NOTED

VERTICAL: AS NOTED

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_____ DATE _____
TODD L. PITNER
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

VCA ENGINEERS INC
CIVIL ■ STRUCTURAL
631 S. Atlantic Blvd.
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PREPARED BY VIRGILIO C. AOANAN DATE 05/16/2025

ENGR. NAME TYPED VIRGILIO C. AOANAN

RCE NO. C36079 EXP. DATE 6/30/26

DATE	INITIAL	REVISION DESCRIPTION
		ENGINEER OF WORK

SHT. NO.	DATE	INITIAL
		CITY APPROVAL

SHEET | CITY OF MURRIETA ENGINEERING DEPARTMENT | SHEETS

WQMP PLAN
MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

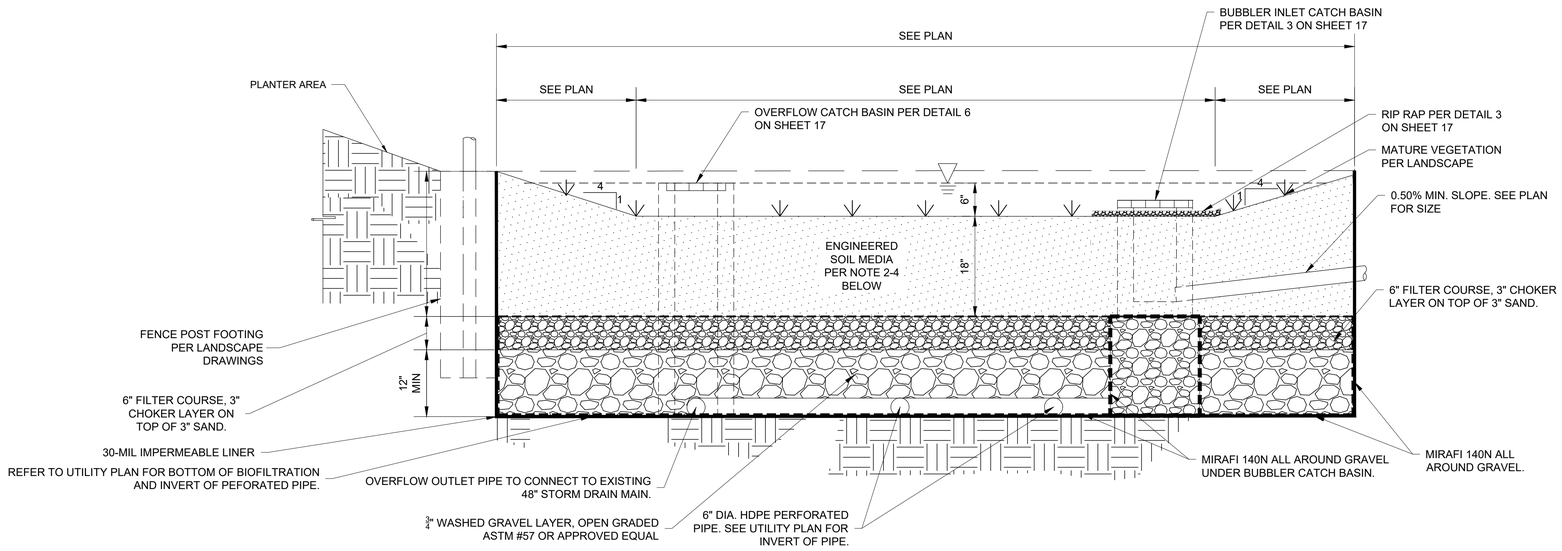
APPROVED
ROBERT K. MOEHLING _____ DATE _____
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK: _____

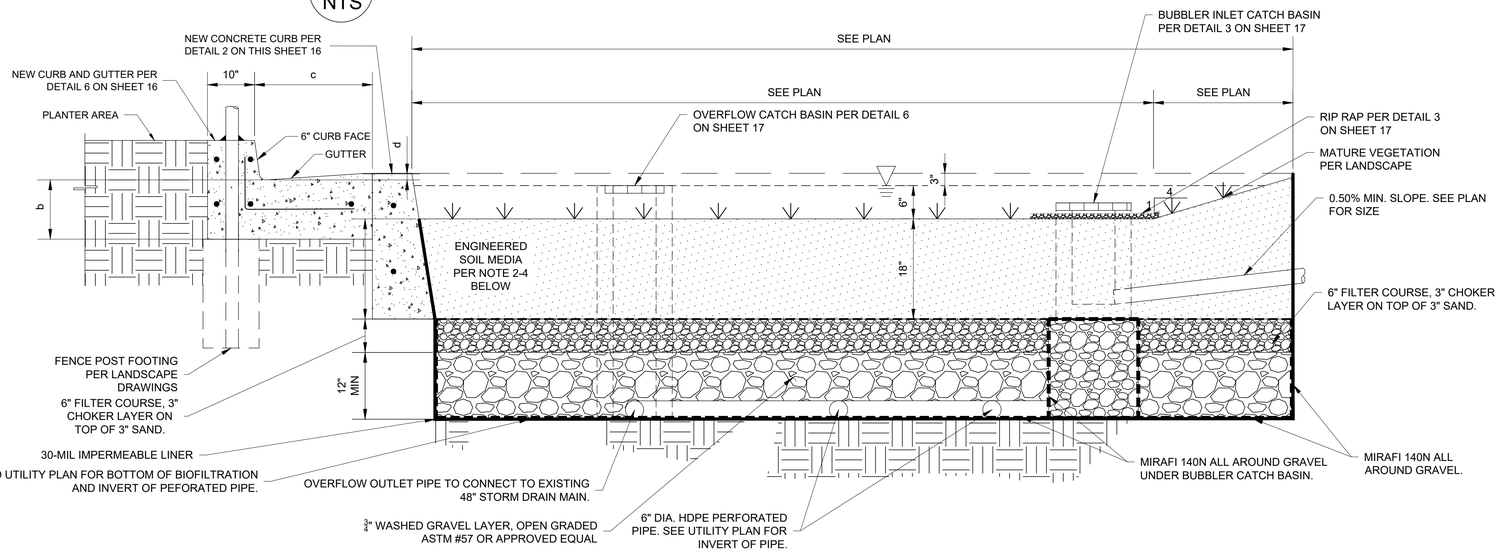
PROJECT NO. G-PC-COM-2025-00034

DRAWING NO. **C-4.4**

murrieta title sheet.dwg



1 NTS NORTHWEST BIOFILTRATION SECTION



c	d
18"	5/7"

* "b" SHOULD BE THE MAXIMUM OF PAVEMENT & BASE THICKNESS OR 6".

2 NTS SOUTHWEST BIOFILTRATION SECTION

NOTES:

1. TO REDUCE EROSION, A COBBLESTONE PAD SHALL BE PLACED AT EACH INLET POINT. THE COBBLESTONE SHALL BE 3"-5" DIAMETER IN SIZE AND SHALL BE EMBEDDED IN 4" OF CONCRETE, 24" WIDE. THE COBBLESTONE PAD INSIDE THE BIORETENTION FACILITY SHALL BE COMPACTED AND FLUSH WITH THE FINISHED SURFACE AT THE INLET POINT AND EXTEND TO THE BOTTOM OF THE SLOPE.
2. ENGINEERED SOIL MEDIA DESIGN FILTRATION RATE OF 2.5 INCHES PER HOUR (INITIAL FILTRATION RATE SHOULD BE HIGHER).
3. ENGINEERED SOIL MEDIA SHALL BE 18" MINIMUM DEPTH FOR SOUTHERN BMP (BMP-1) AND 18" MINIMUM DEPTH FROM NORTHERN BMP (BMP-2). ENGINEERED SOIL MEDIA, / BIORETENTION SOIL MEDIA (BSM) SHALL BE COMPRISED OF 60-80% SAND, UP TO 20% TOPSOIL, AND 20% OF AN ORGANIC AMENDMENT, BY VOLUME. NUTRIENT-SENSITIVE COMPOST MAY BE USED AS THE ORGANIC AMENDMENT ACCORDING TO REQUIREMENTS IN THE "ORGANIC AMENDMENTS" SECTION OF THE SANTA MARGARITA WATERSHED BMP DESIGN MANUAL, FOR BIORETENTION BMPS.THE ORGANIC COMPONENT SHALL BE NITROGEN STABILIZED COMPOST, SUCH THAT NITROGEN DOES NOT LEACH FROM THE MEDIA. THE SOIL MEDIA SHALL MEET THE SPECIFICATIONS IN SECTION 3.8 OF THE RIVERSIDE COUNTY, SANTA MARGARITA RIVER WATERSHED REGION DESIGN HANDBOOK FOR LOW IMPACT DEVELOPMENT BEST MANAGEMENT PRACTICES, REVISED JUNE 2018. FOR SOIL MEDIA RATIO MIX, SEE TABLE BELOW.
4. FOR THIS COUNTY-MAINTAINED BMP, MULCH SHALL NOT BE USED PER RIVERSIDE COUNTY, TRANSPORTATION DEPARTMENT STANDARDS.

COMPONENT TYPE	BIORETENTION
SAND TYPE	WASHED
SAND FRACTION BY VOLUME	60% - 80%
TOPSOIL TYPE	SANDY LOAM OR LOAMY SAND
TOPSOIL FRACTION BY VOLUME	20%
ORGANIC TYPE	NUTRIENT-SENSITIVE COMPOST
ORGANIC FRACTION BY VOLUME	20%

1 BIOFILTRATION WITH NO UNDERDRAIN DETAIL

NOT TO SCALE

Underground Service Alert
Call: TOLL FREE
1-800
422-4133
TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
DESCRIPTION: PARCEL 8 OF PARCEL MAP NO. 29924
LOCATION: 8 TOWN SQUARE, MURRIETA, CA 92562
RECORDED: AS PER MAP RECORDED IN BOOK 204, PAGES 25 TO 26,
ELEVATION: 1094.82' DATUM: NGVD 29

APPROVED FOR SIGNATURE

DATE

TODD L. PITNER
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

"AS BUILT"

THE RECEIPT OF AS-BUILT PLANS AND CITY'S ACCEPTANCE THEREOF DOES NOT ABSOLVE THE ENGINEER OF WORK OF ANY RESPONSIBILITY FOR THE PROJECT DESIGN.

ENGINEER OF WORK DATE

RCE NO. EXPIRATION DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER TODD L. PITNER No. C36079 Exp. 6/30/26 CIVIL STATE OF CALIFORNIA

SCALE
HORIZONTAL
AS NOTED
VERTICAL
AS NOTED

VCA ENGINEERS INC
CIVIL ★ STRUCTURAL
631 S. Allantic Blvd.
Monterey Park, CA 91754
Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY DATE
VIRGILIO C. AOANAN 05/16/2025

ENGR. NAME TYPED VIRGILIO C. AOANAN
RCE NO. C36079 EXP. DATE 6/30/26

DATE	INITIAL	ENGINEER OF WORK

SHT. NO.	DATE	INITIAL	CITY APPROVAL

REVISION DESCRIPTION

SHEET 18 | CITY OF MURRIETA ENGINEERING DEPARTMENT | SHEETS 25

MISCELLANEOUS DETAILS
MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

APPROVED
ROBERT K. MOEHLING DATE
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK:
PROJECT NO. G-PC-COM-2025-00034
DRAWING NO.

murrieta title sheet.dwg

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.

SOIL REPORT

Geosoils, Inc.

April 20, 2023

GEOTECHNICAL UPDATE REPORT FOR THE PUBLIC LIBRARY EXPANSION PROJECT TOWN SQUARE PARK PARCELS 7 AND 8 OF PARCEL MAP NO. 29924 CITY OF MURRIETA, RIVERSIDE COUNTY CALIFORNIA (APNS 906-080-039 AND -040)

FOR

CITY OF MURRIETA
COMMUNITY SERVICES DEPARTMENT
1 TOWN SQUARE
MURRIETA, CALIFORNIA 92562

W.O. 8582-A-SC APRIL 21, 2023

GeoSoils, Inc.

Geotechnical • Geologic • Coastal • Environmental

18451 Collier Avenue, Suite A • Lake Elsinore, California 92530 • (951) 471-0700 • FAX (951) 471-0702 • www.geosoilsinc.com

April 21, 2023

W.O. 8582-A-SC

City of Murrieta
Community Services Department
1 Town Square
Murrieta, California 92562

Attention: Mr. Brian Crawford

Subject: Geotechnical Update Report for the Public Library Expansion Project, Town Square Park, Parcels 7 and 8 of Parcel Map No. 29924, City of Murrieta, Riverside County, California (APNs 906-080-039 and -040)

Dear Mr. Crawford:

In accordance with your request and authorization, GeoSoils, Inc. (GSI) is providing this geotechnical update report for the Town Square Park public library expansion project in the City of Murrieta, Riverside County, California. It is our understanding that site-specific design criteria from the 2022 California Building Code ([2022, CBC], California Building Standards Commission [CBSC], 2022), are to be used for foundation designs within the project. Based on the relative age of the referenced geotechnical reports, updated seismic and foundation design parameters are provided herein, per current code standards. The scope of our services has included a review of available background geologic, geotechnical, and grading data for the Town Square project site (see Appendix A), a site reconnaissance and geologic field mapping, the advancement of four (4) hand-auger borings onsite and soil sample collection, appropriate laboratory testing, evaluation of data obtained, and preparation of this summary update report and accompaniments.

BACKGROUND AND SITE CONDITIONS

The site was previously geotechnically investigated by Highland Geotechnical Consultants, Inc. (HGCI, 1988) and GSI (2000c), as referenced in Appendix A. These early studies concluded that a majority of the site is located within an Alquist-Priolo Earthquake Fault Zone (APEFZ), and that an active strand of the Elsinore fault exists onsite. The previous detailed fault finding study by GSI (2000c) located an active fault splay onsite and previously established structural setback zones for development of the overall Town Square Park project. These early studies also included the advancement of subsurface cone penetration test (CPT) soundings. After these early studies, original rough grading of Town Square Park was completed under the geotechnical observation and testing services of GSI (2000a and 2000b). Shortly after original rough grading of the Town Square Park, Geotechnics Incorporated (GI, 2002) prepared a geotechnical investigation

for the proposed development of the Library, Senior Center, Amphitheater, and City Hall Complex onsite. This study by GI (2002) included the advancement of subsurface borings and additional cone penetration test (CPT) soundings within the proposed areas of development onsite. Additional precise grading was conducted within the site under the observation and testing services of GI (2005). After these early geotechnical studies and previous episodes of rough and precise grading, the library, senior center, original amphitheater, police station, and City hall complexes were constructed onsite. More recently, GSI (2018b) prepared updated seismic and foundation design parameters and a compaction report of grading (GSI, 2020), for the new Town Square Park Amphitheater project. After rough grading, and issuance of the grading report (GSI, 2020) the new amphitheater complex was constructed across Memorial Way from the existing public library building.

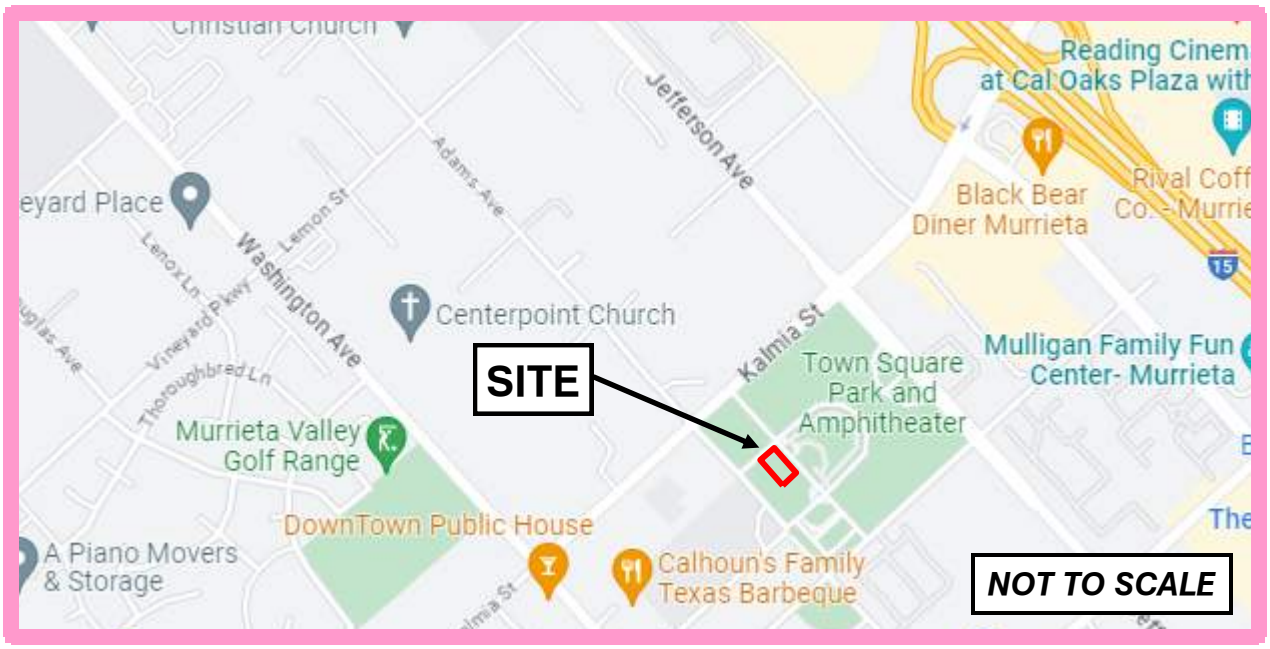
PROPOSED DEVELOPMENT

It is our understanding that continued development within the Murrieta Town Square Park would consist of the expansion of the existing public library, along with the installation of underground utilities, associated concrete flatwork improvements, and potentially perimeter block wall improvements. The public library expansion is proposed to be constructed in the existing garden area of the library complex. We further understand that the public building is proposed as a one-story structure, with slab-on-grade/continuous footings, using typical wood-, block-, or steel-frame and stucco type construction. Building loads are assumed to be typical for this type of relatively light structure. Additional sewage disposal (if proposed) is to be accommodated by tying into the regional system.

SITE LOCATION AND CURRENT SITE CONDITIONS

The subject property (Parcels 7 and 8) is located at 8 Town Square, in the City of Murrieta, Riverside County, California (see Figure 1, Site Location Map). Based on our review, the site is currently developed with the Murrieta Public Library building with associated concrete flatwork and landscape improvements. Topographically, the property consists of flat-lying terrain that varies in elevation from approximately 1,115 feet MSL (Mean Sea Level) near the southern corner of the site to approximately 1,118 feet MSL near the northern corner of the property. Therefore, overall relief is on the order of 3 feet. Based on our review, the project site is mantled by compacted artificial fill placed during original, and following site grading activities (GSI, 2000a and 2000b, and GI, 2005), that is in-turn underlain by Quaternary-age younger alluvium and sedimentary bedrock of the Pauba Formation, at varying depths. A review of the Riverside County Information Technology website (RCIT, 2023) indicates the site is located within in an area designated as having a “Moderate” potential for liquefaction during a seismic event, and was located within an “Active” zone of subsidence.

Base Map: TOPO! Copyright 2003 National Geographic, USGS Murrieta Quadrangle, California -- Riverside Co., 7.5 Minute, dated 1979.



Base Map: Google Maps, Copyright 2023, Map Data Copyright 2023 Google

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GeoSoils, Inc.

W.O.

8582-A-SC

SITE LOCATION MAP

Figure 1

FIELD STUDIES

As indicated above, field studies conducted during our evaluation of the property for this investigation consisted of geologic reconnaissance mapping and the advancement of four (4) hand-auger borings onsite for the evaluation of near-surface soil and geologic conditions, soil sample collection, and associated laboratory testing. Field exploration was performed on March 31, 2023. The hand-auger borings were observed and logged by an engineering geologist from our firm who also collected representative soil samples for appropriate laboratory testing. The logs of the hand-auger borings are presented in Appendix B. The approximate locations of the exploratory hand-auger borings conducted for this study are presented on Figure 2 (Geotechnical Map).

ENGINEERING GEOLOGY

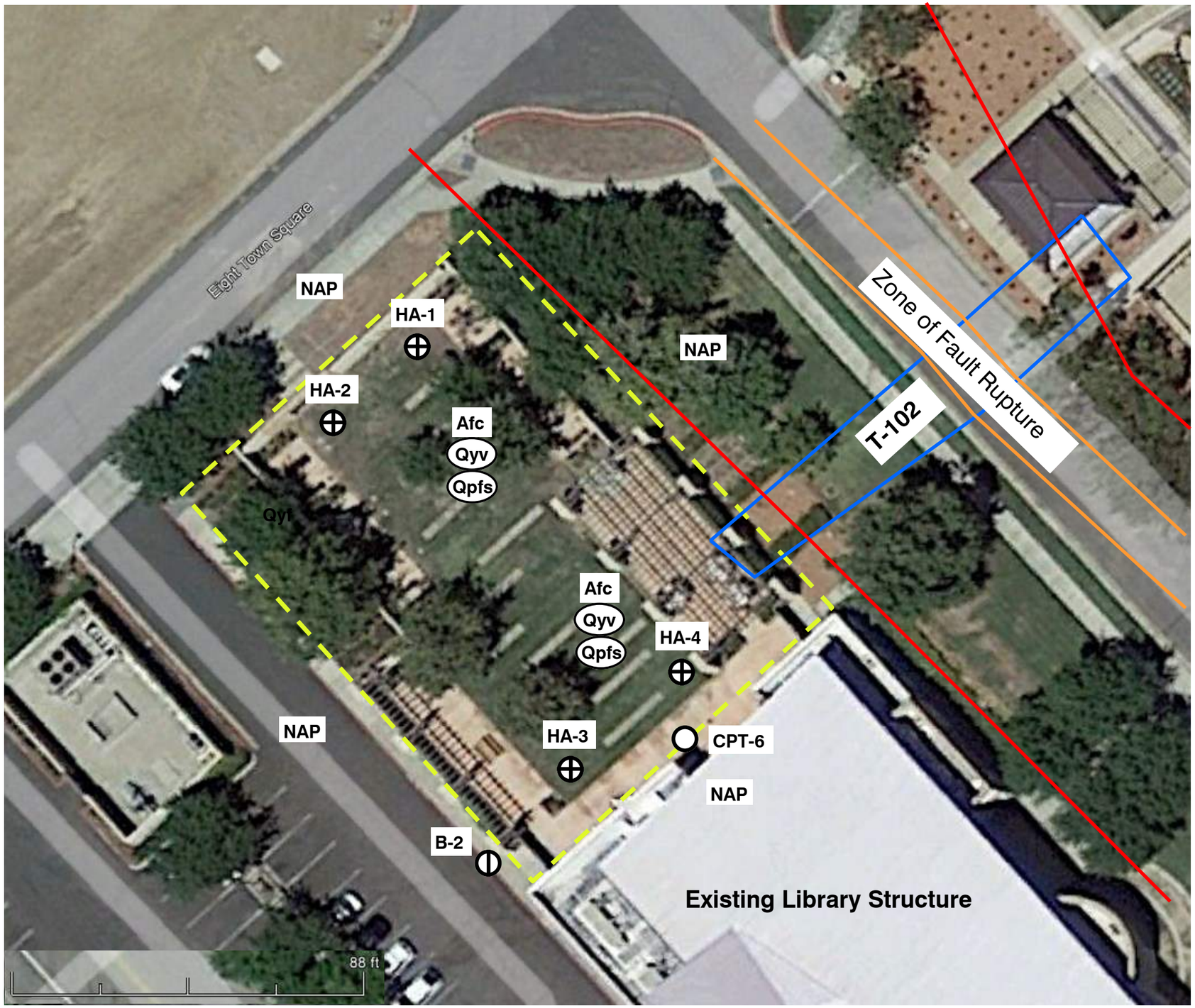
Based on our review, and the subsurface investigation conducted for this study, the project site is mantled by compacted artificial fill placed during original site grading (GSI; 2000a, and GI, 2005), which is in-turn underlain by Quaternary-age young alluvial valley deposits and sedimentary bedrock of the Pauba Formation, at varying depths. A splay of the active Elsinore fault zone transects the Town Square Park property and structural setbacks have been previously recommended (GSI, 2000a and 2000c), and recently updated (GSI, 2018a). Typical cut and fill grading techniques were used to attain the desired graded configurations. Based on our review (GSI, 2000a and GI, 2005), maximum compacted fill thicknesses across the areas of the existing library building were generally on the order of approximately 5 feet.

Site Earth Materials

As discussed above, the earth materials encountered during our subsurface investigation, or during our review, include compacted artificial fill (Afc), Holocene- to late Pleistocene-age young alluvial valley deposits (Qyv), and Pleistocene-age sedimentary bedrock assigned to the sandstone member of the Quaternary Pauba Formation ([Qpfs] Kennedy and Morton, 2003). Mappable geologic units are shown on Figure 2 (Geotechnical Map), and these units are described as follows, from youngest to oldest:

Artificial Fill, Compacted (Afc)

Compacted artificial fill was encountered throughout the garden area of the existing public library. The compacted artificial fill ranged in composition but was generally dark brown to pale reddish brown, silty to clayey sands. The compacted fill materials are anticipated to have a low expansion potential based on the laboratory testing conducted. The near-surface compacted fill materials are weathered and locally disturbed in their existing state, and therefore, the upper 1 to 2 feet of near-surface soils, or depth of removed trellis or perimeter wall footings, should be removed and recompacted during precise grading for the proposed library expansion.



GSI LEGEND

Afc	Artificial Fill, Compacted.
Qyv	Quaternary Young Alluvial Valley Deposits, Circled where Buried.
Qpfs	Quaternary Pauba Formation, Sandstone Member, Circled where Buried.
HA-4	Approximate Location of Exploratory Hand Auger Boring, this Study.
B-2	Approximate Location of Exploratory Boring, HGC, 1988.
CPT-6	Approximate Location of Cone Penetration Test, GSI, 2000c.
T-102	Approximate Location of Fault Finding Trench, GSI 2000c.
	Location of Updated Fault Setback Zone, GSI, 2018a.
	Approximate Boundary of Area Under the Purview of this Report.
NAP	Not A Part of this Study.

ALL LOCATIONS ARE APPROXIMATE

This document or e-file is not part of the Construction Documents and should not be relied upon as being an accurate depiction of design.

GeoSoils, Inc.

Figure 2

GEOTECHNICAL MAP

W.O. 8582-A-SC	DATE: 04/23	SCALE: See Bar Scale

Quaternary - Young Alluvial Valley Deposits (Map Symbol - Qyv)

Although not encountered during our subsurface investigation, young alluvial valley deposits were previously encountered onsite (GSI, 2000c) and generally consisted of medium to dark brown to olive brown, fine- to coarse-grained silty to clayey sands, and sandy silts. These sediments were described as loose to medium dense with depth, and dry to wet and locally saturated. The loose near-surface young alluvial valley deposits were mitigated during site grading activities (GSI, 2000a). The underlying alluvial materials are not anticipated to be encountered during site grading and improvements construction.

Quaternary Pauba Formation - Sandstone Member (Map Symbol - Qpfs)

Underlying the surficial units at depth, Pleistocene-age sedimentary bedrock assigned to the sandstone member of the Quaternary Pauba Formation (Qpfs) was discontinuously encountered (GSI, 2000c). The Pauba Formation generally consists of siltstones, sandstones, and claystones, with localized conglomerates and fanglomerates (Kennedy and Morton, 2003). The underlying sedimentary bedrock materials are not anticipated to be encountered during site grading and improvements construction.

FAULTING AND REGIONAL SEISMICITY

Local and Regional Faults

A majority of the Town Square Park is located within an Alquist-Priolo Earthquake Fault Zone (California Geological Survey [CGS], 2018). As discussed previously, a splay of the active Elsinore fault zone transects the Town Square Park property, and lies in close proximity to the existing public library building (see Figure 2, Geotechnical Map). As such, structural setbacks have been previously recommended (GSI, 2000a and 2000c), and recently updated (GSI, 2018a). In addition, the site is situated in a region subject to strong earthquakes occurring along these active faults. These faults include, but are not limited to; the local Elsinore fault systems; the San Jacinto Fault; and the San Andreas Fault.

General

In the event of an upper bound (maximum probable) or credible earthquake occurring on any of the nearby major faults, strong ground shaking would occur in the subject site's general area. Potential damage to any structure(s) would likely be greatest from the vibrations and impelling force caused by the inertia of a structure's mass than from those induced by the hazards listed herein. This potential would be no greater than that for other existing structures and improvements in the immediate vicinity.

Seismic Shaking Parameters

The following table summarizes the reevaluated site-specific design criteria obtained from the 2022 CBC, Chapter 16 Structural Design, Section 1613, Earthquake Loads. The computer program Seismic Design Maps, provided by the California Office of Statewide Health Planning and Development (OSHPD, 2023) has been used to aid in design (https://seismicmaps.org). The short spectral response uses a period of 0.2 seconds.

2022 CBC SEISMIC DESIGN PARAMETERS		
PARAMETER	**SITE-SPECIFIC DESIGN VALUE PER ASCE 7-16**	**2022 CBC or REFERENCE**
Risk Category[1]	I, II, or III	Table 1604.5
Site Class	D	Section 1613.2.2/Chap. 20 ASCE 7-16 (p. 203-204)
Spectral Response - (0.2 sec), S_s	1.137 g	Section 1613.2.1, Figure 1613.2.1(1)
Spectral Response - (1 sec), S_1	1.038 g	Section 1613.2.1, Figure 1613.2.1(2)
Site Coefficient, F_a	1.0[2]	Table 1613.2.3(1)
Site Coefficient, F_v	2.5[3] (Section 21.3)	Table 1613.2.3(2)
Maximum Considered Earthquake Spectral Response Acceleration (0.2 sec), S_{MS}	1.818 g[4] (Section 21.4)	Section 1613.2.3 (Eqn 16-36)
Maximum Considered Earthquake Spectral Response Acceleration (1 sec),S_{M1}	1.833 g[5] (Section 21.4)	Section 1613.2.3 (Eqn 16-37)
5% Damped Design Spectral Response Acceleration (0.2 sec), S_{DS}	1.212 g[6]	Section 1613.2.4 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	1.222 g[7] (Section 21.4)	Section 1613.2.4 (Eqn 16-39)
PGA_M - Probabilistic Vertical Ground Acceleration may be assumed as about 50% of these values.	0.773 g	ASCE 7-16 (Eqn 11.8.1)
Seismic Design Category	D[8] (Section 11.6)	Section 1613.2.5/ASCE 7-16 (p. 85: Table 11.6-1 or 11.6-2)

1. Risk Category to be confirmed by the Project Architect or Structural Engineer.
2. Per Table 11.4-1 of ASCE 7-16
3. Per Section 21.3 of ASCE 7-16, if $S_1 \geq 0.2$ then F_v is taken as 2.5.
4. Per Section 21.4 of ASCE 7-16, $S_{MS} = (1.5)(S_{DS}) = (1.5)(1.212\ g) = 1.818$ g
5. Per Section 21.4 of ASCE 7-16, $S_{M1} = (1.5)(S_{D1}) = (1.5)(1.222\ g) = 1.833$ g
6. Per Section 21.4 of ASCE 7-16, S_{DS} shall be taken as 90 percent of the maximum spectral acceleration (S_a) obtained from the site-specific spectrum at any period within the range from 0.2 to 5 seconds, inclusive.
7. Per Section 21.4 of ASCE 7-16, S_{D1} shall be taken as the maximum value of the product TS_a obtained from the site-specific spectrum from the period within the range of 1 to 5 seconds, inclusive.
8. Per Tables 11.6-1 and 11.6-2 of ASCE 7-16, Mapped S_1 (0.597 g) $\leq$ 0.75. Thus, the seismic design category is "D".

GENERAL SEISMIC PARAMETERS	
PARAMETER	**VALUE**
Distance to Seismic Source Elsinore (Temecula) Fault	0.0 mi (0.0 km)[1]
Upper Bound Earthquake Elsinore (Temecula) Fault	$M_W = 6.8$[2]

[1] - Blake (2000a)
[2] - Cao, et al. (2003)

Conformance to the criteria above for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur in the event of a large earthquake. The primary goal of seismic design is to protect life, not to eliminate all damage, since such design may be economically prohibitive. Cumulative effects of seismic events are not addressed in the 2022 CBC (CBSC, 2022a) and regular maintenance and repair following locally significant seismic events (i.e., M_w5.5) will likely be necessary, as is the case in all of Southern California.

SECONDARY SEISMIC HAZARDS

The following list includes other geologic/seismic related hazards that have been considered during our evaluation of the site. The hazards listed are considered negligible or mitigated as a result of site location, soil characteristics, recommended remedial site grading, foundation designs, and typical site development procedures:

- Liquefaction
- Lateral Spreading
- Subsidence
- Ground Lurching or Shallow Ground Rupture
- Seiche

A review of the Riverside County Information Technology (RCIT, 2023), or "Map My County" website, indicates that the site is also located within a County of Riverside fault zone. In addition, the site is located within a zone of "moderate" liquefaction potential, and is characterized as being within an "active" zone of subsidence (RCIT, 2021). However, our general liquefaction screening evaluation (pursuant to Special Publication 117 [CGS, 2008 SP117]) indicates that the potential for liquefaction and associated adverse effects within the site is considered low to perhaps moderate, based on the medium dense to dense young alluvial valley deposits and the dense to hard sedimentary bedrock deposits which underlie the site at depth, and removal of near-surface potentially compressible soils during previous site grading activities.

The effects of areal subsidence generally occur at the transition or boundaries between low-lying areas and adjacent hillside terrain, where materials of substantially different engineering properties (i.e., thick alluvium vs. bedrock) are present, or in areas of overdraft owing to groundwater withdrawal, usually where bounded by Neogene faults. Our review of available data, as well as stereoscopic aerial photographs (USDA, 1980), showed no features generally associated with areal subsidence (i.e., radially-directed drainages flowing into a depression(s), linearity of depressions associated with mountain fronts, etc.), directly on the project site. In view of the nature of the underlying young alluvial valley deposits, and sedimentary bedrock deposits which underlie the site at depth, the potential for this phenomena to affect the site is considered low.

LABORATORY TESTING

Maximum Density Testing

The laboratory maximum dry density and optimum moisture content for the major soil type encountered was evaluated in general accordance with test method ASTM D 1557. The following table presents the maximum density testing used for our evaluation:

LOCATION	SOIL TYPE	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)
HA-1 @ 0-2'	Dark Brown, Clayey SAND	125.8	8.8

Expansion Potential

Expansion Index (E.I.) testing was performed on a representative sample of the onsite soils encountered during our subsurface investigation. Based on the test results obtained, the expansive potential of the onsite soils may be classified as low expansive (i.e., E.I. between 21 to 50). Based on the above, foundation recommendations for low expansive soils are provided herein.

Plasticity Index

Plasticity index (P.I.) testing was performed where Expansion Index testing indicated an E.I. greater than 20. Testing was performed to evaluate the liquid limit, plastic limit and plasticity index in general accordance with ASTM D 4318. These tests results were used to evaluate the soil classification in accordance with the Unified Soil Classification System. The test results and classification from the sample obtained onsite are presented in the following table and in Appendix C:

LOCATION	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
HA-1 @ 0-2'	33	15	18

Soluble Sulfates/Corrosivity

A representative sample of site soil was analyzed for soluble sulfates, chloride, pH, and resistivity. The soluble sulfate and corrosion potential results are presented in the following Table and in Appendix C:

LOCATION AND DEPTH (FT.)	SOLUBLE SULFATES (PERCENTAGE BY WEIGHT)	CHLORIDE (PPM)	pH	RESISTIVITY (OHMS-CM)
HA-1 @ 0-2'	0.007	11	8.3	2,100

For foundation planning purposes, and based upon the soluble sulfate test results and the latest edition of the 2022 CBC (CBSC, 2022), the soluble sulfate content is considered Class “S0” per the ACI 318-14 (0.00 to 0.10 soil percentage by weight is considered Class “S0”). As such, the use of Type V sulfate resistant concrete is currently not anticipated. Based on the results of the pH and resistivity testing, the onsite soils are generally considered moderately alkaline (a pH of 7.9 to 8.4 is considered moderately alkaline), and are considered moderately corrosive to ferrous metals in a saturated state (2,000 to 10,000 ohm-cm is considered moderately corrosive). Chlorides are generally low. Based on the laboratory testing conducted, reinforced concrete mix design should conform to Exposure Classes “S0", “W0", and “C1” in Table 19.3.2.1 of ACI 318R-14, as the foundations would likely be exposed to moisture.

Although the site soils are categorized as being moderately corrosive toward ferrous metals, it is our understanding that ferrous metals embedded in properly poured and formed concrete with the proper mix should be adequately protected from these conditions. As stated above, the soluble sulfate content is considered Class “S0.” Based upon the laboratory test results obtained, a consulting corrosion engineer may be retained to provide specific recommendations for foundations, utility piping, etc, as warranted.

CONCLUSIONS AND RECOMMENDATIONS

Based on our review of the available data (see Appendix A), our subsurface investigation and laboratory testing conducted, and geologic and engineering analysis, the proposed development of the subject site appears feasible from a geotechnical viewpoint, provided the conclusions and recommendations presented herein are properly incorporated into the design and construction of the project. The fault setback zone (see Figure 2, Geotechnical Map) should be plotted on any grading and the architectural plans. Per Code, structures proposed for human occupancy (> 2,000 person-hours/year) should not be considered within the fault setback zone. All other findings, conclusions and recommendations in previous referenced reports by GSI and GI (see Appendix A) remain pertinent and applicable except as specifically superceded herein. The recommendations are presented below.

RECOMMENDATIONS FOR PRECISE GRADING

General

1. All grading should be performed in accordance with the 2022 CBC, City of Murrieta and Riverside County guidelines.

2. Geotechnical observations and compaction testing services should be provided during precise grading to aid the contractor during recommended removals and in his effort to moisture-condition and recompact the near-surface fills. If necessary, based on our observations, and the planned removal of trellis or perimeter wall footings, additional remedial recommendations may be warranted.

3. At the completion of grading and earthwork, and after the geotechnical consultant has finished observations and testing of the work completed, a final as-graded compaction report should be prepared, and may be subject to review by the controlling governmental agencies.

4. General Earthwork and Grading Guidelines are provided at the end of this report as Appendix D. Specific recommendations are provided below.

Grubbing and Demolition

1. All concrete structures/improvements, underground utilities, vegetation and trees (including roots), and other deleterious debris should be removed from the areas of proposed grading/earthwork.

2. The project geotechnical consultant should be notified of any previous foundation, irrigation lines, storm drain lines, or other subsurface structures that are uncovered during the recommended removals, so that appropriate remedial recommendations can be provided.

3. Existing utilities, where present (i.e., area drains, irrigation, electric lines, etc.), should removed, capped, and clearly marked at or near the future connection point.

Treatment of Existing Ground

1. Approximate depths of remedial removals are outlined herein. Due to the span of time since original site grading (GSI, 2000a; and GI, 2005), the existing onsite landscape improvements, and for preliminary planning purposes, removal depths are estimated to be on the order of approximately 1 to 2 feet across the majority of the site, with the possibility of localized deeper removals in the areas of planned trellis or perimeter wall footing removals. Near-surface weathered and disturbed soils should be removed to competent fill materials (i.e., greater than or equal to

90 percent relative compaction), if not removed by proposed excavation within areas proposed for settlement-sensitive improvements. A minimum of 2 feet of compacted fill should underlie all proposed footings/foundations and settlement-sensitive improvements. Variations from these thicknesses should be anticipated. Actual depths of removals will be evaluated in the field during site grading by the geotechnical consultant.

2. After the above removals, the upper 6 inches of the exposed subsoils should be scarified, brought to at least optimum moisture content, and recompacted to a minimum relative compaction of 90 percent of the laboratory standard.

3. Removals should be provided below the bottom of settlement-sensitive improvements and foundation systems, to 5 feet horizontally outside the perimeter of any settlement-sensitive improvements, or a 1:1 (horizontal:vertical [h:v]) projection from the bottom outside edge of footings, whichever is greater.

4. Onsite materials may be reused as compacted fill provided that major concentrations of vegetation and debris are removed, and they are properly moisture conditioned prior to fill placement and compaction.

5. Fill materials should be brought to at least optimum moisture content, and then recompacted to a minimum relative compaction of 90 percent of the laboratory standard (ASTM D 1557). This may be achieved by shallow removals, stockpiling, and replacement and recompaction of reprocessed soils. Reprocessing as described above, should also be conducted within the influence of all settlement-sensitive improvements (i.e., isolated footings, flatwork, retaining walls, etc.).

6. Localized deeper removals may be necessary due to dry weathered materials, previously installed footings, or utilities. The project geotechnical consultant should observe all removal areas during the grading and earthwork.

Fill Placement

1. Fill materials should be brought to at least optimum moisture content, placed in thin 6- to 8-inch lifts and mechanically compacted to obtain a minimum relative compaction of 90 percent of the laboratory standard (ASTM D 1557).

2. Fill materials should be cleansed of major vegetation and debris prior to fill placement.

3. Although not currently anticipated, any import materials should be evaluated and deemed suitable by the geotechnical consultant prior to importation or placement on the site. Foundation designs may be altered if import materials have a greater expansion or sulfate/corrosion value than the onsite materials tested.

PRELIMINARY FOUNDATION RECOMMENDATIONS

The proposed foundation systems should be designed and constructed in accordance with current standards of practice, the guidelines contained within the 2022 CBC, the ACI (2015 and 2014a), and the differential settlement and expansion potential values provided herein. The onsite soils expansion potentials have been evaluated to be low expansive (E.I. of 21 to 50). As such, foundation systems constructed within the influence of detrimentally expansive soils (i.e., E.I. > 20 and P.I. $\geq$ 15) will require specific design to resist expansive soil effects per Sections 1808.6.1 or 1808.6.2 of the 2022 CBC, and should be reviewed by the project structural engineer. Based on the above, GSI is providing preliminary design and construction recommendations for post-tensioned and mat foundation systems for low expansive soil conditions (E.I. = 21 to 50).

For the purpose of our geotechnical review and analyses, GSI has assumed that the foundations and slab design loads are typical for these types of relatively light structures. Therefore, wall loads for one- and two-story structures are anticipated to be 1 to 2 kips per lineal foot of wall and 20 to 30 psf of concrete floor load. Isolated column loads are anticipated to be in the range of 10 to 50 kips. All footings are recommended to embed into compacted fill, as indicated in this report.

This section presents criteria for the preliminary design of foundations, concrete slabs, and other elements possibly applicable to the project. These criteria should not be considered as substitutes for actual designs by the structural engineer. Recommendations by the project's design-structural engineer or architect, which may exceed the geotechnical consultant's recommendations, should take precedence over the following requirements. The foundation systems recommended herein may be used to support the proposed structures provided they are entirely founded in engineered fill tested and approved by GSI that overlies dense formational earth materials. If the information concerning the proposed development plans is not correct, or any changes in the design, location or loading conditions of the proposed structures are made, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report are modified or approved in writing by this office. Upon request, GSI could provide additional input/consultation regarding soil parameters, as they relate to foundation design.

General recommendations for foundation systems are provided in the following sections, and are not intended to preclude the transmission of water or water vapor through the foundations or slabs. Further discussion and recommendations are provided within the soil moisture transmission considerations section of this report. Unless specifically superceded in this report, all findings, conclusions and recommendations in referenced reports by GSI and GI remain pertinent and applicable, and should be incorporated into project plans and construction.

General Foundation Design

1. The foundation systems should be designed and constructed in accordance with guidelines presented in the 2022 CBC.

2. An allowable bearing value of 2,000 psf may be used for the design of footings that maintain a minimum width of 12 inches and a minimum depth of 12 inches (below the lowest adjacent grade) and are founded entirely into properly engineered fill. This value may be increased by 20 percent for each additional 12 inches in footing embedment to a maximum value of 2,500 psf. These values may be increased by one-third when considering short duration seismic or wind loads. Isolated pad footings should have a minimum dimension of at least 24 inches square and a minimum embedment of 24 inches below the lowest adjacent grade into properly engineered fill. Foundation embedment excludes any landscaped zones, concrete slabs-on-grade, or slab underlayment.

3. Passive earth pressure in properly compacted silty or clayey sand fill may be computed as an equivalent fluid having a density of 250 pcf, with a maximum earth pressure of 2,500 psf for footings founded into properly engineered fill. Lateral passive pressures for shallow foundations within the influence of retaining walls should be reduced following review by the civil engineer, proper surcharge loading shall be considered.

4. For lateral sliding resistance, a 0.35 coefficient of friction may be used for a concrete to soil contact when multiplied by the dead load.

5. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

6. All footing setbacks from slopes should comply with Figure 1808.7.1 of the 2022 CBC. GSI recommends a minimum horizontal setback distance of 7 feet as measured from the bottom (i.e., bearing elevation), outboard edge of the footing to the slope face.

7. Footings for structures adjacent to retaining walls should be deepened so as to extend below a 1:1 projection from the heel of the wall should this condition occur. Alternatively, walls may be designed to accommodate structural loads from buildings or appurtenances as described in the “Preliminary Wall Design Parameters” section of this report.

8. All interior and exterior column footings should be tied to the perimeter wall footings in at least two directions. The base of the reinforced grade beam should be at the same elevation as the adjoining footings.

9. The project structural engineer should consider the use of transverse and longitudinal control joints to help control slab cracking due to concrete shrinkage or expansion. Two of the best ways to control this movement are: 1) add a sufficient amount of reinforcing steel to increase the tensile strength of the slab; and 2) provide an adequate amount of control or expansion joints to accommodate anticipated concrete shrinkage and expansion. Transverse and longitudinal crack control joints should be spaced no more than 13 feet on center and constructed to a minimum depth of T/4, where "T" equals the slab thickness in inches. Per Portland Cement Association (PCA) and ACI guidelines, joints are commonly spaced at distances equal to 24 to 30 times the slab thickness. Joint spacing that is greater than 15 feet requires the use of load transfer devices (dowels or diamond plates).

10. Provided the recommendations in this report are properly followed, foundation systems should be designed to accommodate a total settlement of 1½ inches and a differential settlement of at least 1 inch in a 40-foot horizontal span (angular distortion= 1/480). This estimated settlement should be re-evaluated once the final foundation layouts, loads, and final grading configuration become available. These preliminary settlement values do not apply to improvements constructed within 2022 CBC setbacks or within the influence of unmitigated soils. In addition, these values do not take seismic effects from strong ground motion into account.

PRELIMINARY FOUNDATION CONSTRUCTION RECOMMENDATIONS

Post-Tension Foundation Systems

On a preliminary basis, post-tension or mat foundation systems will likely be recommended where the E.I. > 20 and P.I. $\geq$ 15, and may also be used to mitigate the damaging effects of differential or seismic settlements on the proposed building foundations and slab-on-grade floors. The post-tension foundation designer may elect to exceed the minimal recommendations, provided herein, to increase slab stiffness performance. Post-tension (PT) design may be either ribbed or mat-type. The latter is also referred to as uniform thickness foundation (UTF). The use of a UTF is an alternative to the traditional ribbed-type. The UTF offers a reduction in grade beams. That is to say a UTF typically uses a single perimeter grade beam and “shovel” footings, but has a thicker slab than the ribbed-type. UTF perimeter footings may use an allowable vertical bearing value of 1,500 psf, if founded into approved engineered fill overlying dense formational materials.

The information and recommendations presented in this section are not meant to supercede design by a registered structural engineer or civil engineer qualified to perform post-tensioned design. Post-tension foundations should be designed using sound engineering practice and be in accordance with local and 2022 CBC requirements and Post Tensioning Institute (PTI) methodologies (PTI; 2004, 2008, 2012, 2013, and 2014). Upon request, GSI can provide additional data/consultation regarding soil parameters as related to post-tension foundation design.

From a soil expansion/shrinkage standpoint, a common contributing factor to distress of structures using post-tensioned slabs is a “dishing” or “arching” of the slabs. This is caused by the fluctuation of moisture content in the soils below the perimeter of the slab primarily due to onsite and offsite irrigation practices, climatic and seasonal changes, and the presence of expansive soils. When the soil environment surrounding the exterior of the slab has a higher moisture content than the area beneath the slab, moisture tends to migrate inward, underneath the slab edges to a distance beyond the slab edges referred to as the moisture variation distance. When this migration of water occurs, the volume of the soils beneath the slab edges expands and causes the slab edges to lift in response. This is referred to as an edge-lift condition. Conversely, when the outside soil environment is drier, the moisture transmission regime is reversed and the soils underneath the slab edges lose their moisture and shrink. This process leads to dropping of the slab at the edges, which leads to what is commonly referred to as the center lift condition. A well-designed, post-tensioned slab having sufficient stiffness and rigidity provides a resistance to excessive bending that results from non-uniform swelling and shrinking slab subgrade soils, particularly within the moisture variation distance, near the slab edges. Other mitigation techniques typically used in conjunction with post-tensioned slabs consist of a combination of specific soil pre-saturation and the construction of a perimeter "cut-off" wall grade beam. Soil pre-saturation consists of moisture-conditioning the slab subgrade soils prior to the post-tension slab construction. This effectively reduces soil moisture migration from the area located outside the building toward the soils underlying the post-tension slab. Perimeter cut-off walls are thickened edges of the concrete slab that impedes both outward and inward soil moisture migration.

Slab Subgrade Pre-Soaking

Pre-moistening of the slab subgrade soil is recommended owing to potential expansive soil conditions at the site. The moisture content of the subgrade soils should be equal to or greater than optimum moisture to a depth equivalent to the depth of anticipated footings.

Pre-moistening or pre-soaking should be evaluated by the soils engineer 72 hours prior to concrete placement. In summary:

EXPANSION INDEX	PAD SOIL MOISTURE	CONSTRUCTION METHOD	SOIL MOISTURE RETENTION
Low (E.I. 21-50)	Upper 12 inches of pad soil moisture 2 percent over optimum (or 1.2 times)	Wetting or reprocessing	Periodically wet or cover with plastic after trenching. Evaluation 72 hours prior to placement of concrete.

Perimeter Cut-Off Walls

Perimeter cut-off walls should be at least 12 inches deep for low expansive soil conditions. The cut-off walls may be integrated into the slab design or independent of the slab. The

bottom of the perimeter cut-off wall should be designed to resist tension, using cable or reinforcement per the structural engineer.

Post-Tension Foundation Design

The following recommendations for design of post-tensioned slabs have been prepared in general compliance with the requirements of the recent Post Tensioning Institute's (PTI's) publication titled "Design of Post-Tensioned Slabs on Ground, Third Edition" (PTI, 2004), together with its addendums and errata (PTI; 2008, 2012, 2013, and 2014).

Post-Tension Foundation Soil Support Parameters

The recommendations for soil support parameters have been provided based on the typical soil index properties for soils that are low to very high in expansion potential. The soil index properties are typically the upper bound values based on our experience and practice in the southern California area. Additional testing is recommended either during or following grading, and prior to foundation construction to further evaluate the soil conditions within the upper 7 to 15 feet of pad grade. The following table presents suggested minimum coefficients to be used in the Post-Tensioning Institute design method.

Thornthwaite Moisture Index	-20 inches/year
Correction Factor for Irrigation	20 inches/year
Depth to Constant Soil Suction	7 feet or overexcavation depth to bedrock
Constant soil Suction (pf)	3.6
Moisture Velocity	0.7 inches/month
Effective Plasticity Index (P.I.)*	< 15-50
* - The weighted plasticity index should be evaluated for the upper 13 feet of foundation soils either during or following grading.	

Based on the above, the recommended post-tension soil support parameters are tabulated below:

TABLE 1 - POST-TENSION FOUNDATION DESIGN

DESIGN PARAMETER[4]	VERY LOW TO LOW EXPANSION[5] (E.I. = 0-50)
e_m center lift	9.0 feet
e_m edge lift	5.2 feet
y_m center lift	0.4 inches

TABLE 1 - POST-TENSION FOUNDATION DESIGN	
DESIGN PARAMETER[4]	**VERY LOW TO LOW EXPANSION[5] (E.I. = 0-50)**
y_m edge lift	0.7 inch
Bearing Value [1]	1,500 psf [1]
Lateral Pressure	250 psf
Subgrade Modulus (k)	100 pci/inch
Minimum Perimeter Footing Embedment [2]	12 inches

[1] Internal bearing values within the perimeter of the post-tension slab for very low to low expansive soil conditions may be increased to 2,000 psf for a minimum embedment of 12 inches, then by 20 percent for each additional foot of embedment to a maximum of 2,500 psf.
[2] For medium to very high expansive soil conditions, internal bearing values within the perimeter of the post-tension slab may be increased to 1,500 psf for a minimum embedment of 12 inches, then by 20 percent for each additional foot of embedment to a maximum of 2,000 psf.
[3] As measured below the lowest adjacent compacted subgrade surface (not including slab underlayment layer thickness).
[4] Post-tension slab design should also be evaluated with respect to the potential differential settlements provided in this report.
[5] Category Criteria: Category I Expansion Index < 50 (very low to low), or Max fill less than 35 feet thick, or fill differential less than 10 feet.

The parameters are considered minimums and may not be adequate to represent all expansive soils and site conditions such as adverse drainage or improper landscaping and maintenance. The above parameters are applicable provided the grades around the structure provide positive drainage that is maintained away from the building foundation. In addition, no trees with significant root systems are to be planted within 15 feet of the perimeter of foundations. Therefore, it is important that information regarding drainage, site maintenance, trees, settlements, and effects of expansive soils be passed on to all interested/affected parties. The values tabulated above may not be appropriate to account for possible differential settlement of the slab due to other factors, such as excessive settlements. If a stiffer slab is desired, alternative Post-Tensioning Institute ([PTI] third edition) parameters may be recommended. All exterior columns not supported by the post-tensioned foundation should be supported by 24 square-inch isolated footings extending at least 24 inches into approved engineered fill. Exterior column footings should be tied to the post-tensioned foundation with 12 square-inch, reinforced grade beams in at least two directions for low expansive soils.

Mat Foundations

In lieu of using a post-tensioned foundation to resist expansive soil effects, the Client may consider a mat foundation which uses steel bar reinforcement instead of post-tensioned cables. The structural engineer may supersede the following recommendations based on the planned building loads and use. WRI (Wire reinforcement institute) methodologies for design may be used.

Mat Foundation Design

The design of mat foundations should incorporate the vertical modulus of subgrade reaction. This value is a unit value for a 1-foot square footing and should be reduced in

accordance with the following equation when used with the design of larger foundations. This is assumes that the bearing soils will consist of engineered fills with an average relative compaction of 90 percent of the laboratory (ASTM D 1557), overlying dense formational earth materials.

$$K_R = K_S \left[\frac{B+1}{2B} \right]^2$$

where: K_S = unit subgrade modulus
K_R = reduced subgrade modulus
B = foundation width (in feet)

The modulus of subgrade reaction (K_S) and effective plasticity index (PI) to be used in mat foundation design for the expansive soil conditions encountered are presented in the following table:

LOW EXPANSION (E.I. = 21-50)
K_S = 100 pci/inch, PI = 18

Reinforcement bar sizing and spacing for mat slab foundations should be provided by the structural engineer. Mat slabs may be uniform thickness foundations (UTF) or may incorporate the use of edge footings for moisture cut-off barriers as recommended herein for post-tension foundations. Edge footings should be a minimum of 6 inches wide. The bottom of the edge footing should be designed to resist tension, using reinforcement per the structural engineer. The need and arrangement of interior grade beams (stiffening beams) will be in accordance with the structural consultant's recommendations. The recommendations for a mat type of foundation assume that the soils below the slab are compacted fill overlying dense, unweathered formational earth materials. The parameters herein are to mitigate the effects of expansive soils and should be modified to mitigate the effects of the total and differential settlements reported earlier in this report.

Specific pre-moistening/pre-soaking and moisture testing of the slab subgrade are recommended for expansive soil conditions (E.I. > 20 and P.I. of 15 or greater), as previously provided in this report. Slab subgrade moisture conditioning/pre-soaking should conform to the recommendations previously provided for post-tension foundation systems.

Confirmation Testing for Final Foundation Design

Following the completion of site grading, the expansion index, plasticity index, subgrade modulus, corrosion potential of soils exposed near finish grade should be re-evaluated. Although not anticipated, the results of the recommended testing may require amendments to these preliminary recommendations.

Alternative Foundations

Based on the available information, the site pads and foundations may be altered to provide a more cost-effective grading solution and use drilled pier-supported improvements. Should these alternative grading solutions be requested, GSI will provide additional recommendations with regard to drilled pier design and construction, and alternative recommendations for grading.

SOIL MOISTURE TRANSMISSION CONSIDERATIONS

GSI has evaluated the potential for vapor or water transmission through the concrete floor slab, in light of typical floor coverings and improvements. Please note that slab moisture emission rates range from about 2 to 27 lbs/24 hours/1,000 square feet from a typical slab (Kanare, 2005), while floor covering manufacturers generally recommend about 3 lbs/24 hours as an upper limit. The recommendations in this section are not intended to preclude the transmission of water or vapor through the foundation or slabs. Foundation systems and slabs shall not allow water or water vapor to enter into the structure so as to cause damage to another building component or to limit the installation of the type of flooring materials typically used for the particular application (State of California, 2023). These recommendations may be exceeded or supplemented by a water "proofing" specialist, project architect, or structural consultant. Thus, the client will need to evaluate the following in light of a cost versus benefit analysis (owner expectations and repairs/replacement), along with disclosure to all interested/affected parties.

Vapor transmission will occur in new slab-on-grade floors as a result of chemical reactions taking place within the curing concrete. Vapor transmission through concrete floor slabs as a result of concrete curing has the potential to adversely affect sensitive floor coverings depending on the thickness of the concrete floor slab and the duration of time between the placement of concrete and the floor covering. It is possible that a slab moisture sealant may be needed prior to the placement of sensitive floor coverings if a thick slab-on-grade floor is used and the time frame between concrete and floor covering placement is relatively short.

Considering the E.I. test results presented herein, and known soil conditions in the region, the anticipated typical water vapor transmission rates, floor coverings, and improvements (to be chosen by the Client or project architect) that can tolerate vapor transmission rates without significant distress, the following alternatives are provided:

- Concrete slabs should be increased in thickness.

- Concrete slab underlayment should consist of a 15-mil vapor retarder, or equivalent, with all laps sealed per the 2022 CBC and the manufacturer's recommendation. The vapor retarder should comply with the ASTM E 1745 - Class A criteria, and be installed in accordance with ACI 302.1R-04 and ASTM E 1643.

- The 15-mil vapor retarder (ASTM E 1745 - Class A) should be installed per the recommendations of the manufacturer, including all penetrations (i.e., pipe, ducting, rebar, etc.).

- Concrete slabs, including the garage areas, should be underlain by 2 inches of clean sand (SE $\geq$ 30) above a 15-mil vapor retarder (ASTM E-1745 - Class A, per Engineering Bulletin 119 [Kanare, 2005]) installed per the recommendations of the manufacturer, including all penetrations (i.e., pipe, ducting, rebar, etc.). The manufacturer shall provide instructions for lap sealing, including minimum width of lap, method of sealing, and either supply or specify suitable products for lap sealing (ASTM E 1745), and per Code.

- ACI 302.1R-04 (2004) states "If a cushion or sand layer is desired between the vapor retarder and the slab, care must be taken to protect the sand layer from taking on additional water from a source such as rain, curing, cutting, or cleaning. Wet cushion or sand layer has been directly linked in the past to significant lengthening of time required for a slab to reach an acceptable level of dryness for floor covering applications." Therefore, additional observation or testing will be necessary for the cushion or sand layer for moisture content, and relatively uniform thicknesses, prior to the placement of concrete.

- The vapor retarder shall be underlain by 2 inches of clean sand (SE $\geq$ 30) placed directly on the prepared, moisture conditioned, subgrade and should be sealed to provide a continuous retarder under the entire slab, as discussed above.

- Concrete should have a maximum water/cement ratio of 0.50. This does not supercede Table 19.3.2.1 of ACI (2014a) for corrosion or other corrosive requirements. Additional concrete mix design recommendations should be provided by the structural consultant or waterproofing specialist. Concrete finishing and workability should be addressed by the structural consultant and a waterproofing specialist.

- Where slab water/cement ratios are as indicated herein, or admixtures used, the structural consultant should also make changes to the concrete in the grade beams and footings in kind, so that the concrete used in the foundation and slabs are designed or treated for more uniform moisture protection.

- The owner(s) should be specifically advised which areas are suitable for tile flooring, vinyl flooring, or other types of water/vapor-sensitive flooring and which are not suitable. In all planned floor areas, flooring shall be installed per the manufactures recommendations.

- Additional recommendations regarding water or vapor transmission should be provided by the architect/structural engineer/slab or foundation designer and should be consistent with the specified floor coverings indicated by the architect.

Regardless of the mitigation, some limited moisture/moisture vapor transmission through the slab should be anticipated. Construction crews may require special training for installation of certain product(s), as well as concrete finishing techniques. The use of specialized product(s) should be approved by the slab designer and water-proofing consultant.

PRELIMINARY WALL DESIGN PARAMETERS

General

Recommendations for specialty walls (i.e., crib, earthstone, geogrid, etc.) can be provided upon request, and would be based on site specific conditions. Conventional retaining walls should be designed for the differential settlements (seismic and static) provided previously, and the recommendations presented below.

Conventional Retaining Walls

The design parameters provided below assume that either very low expansive soils (typically Class 2 permeable filter material or Class 3 aggregate base) or native onsite materials with an expansion index up to 50 are used to backfill any retaining wall. The type of backfill (i.e., select or native), should be specified by the wall designer, and clearly shown on the plans. Building walls, below grade, should be water-proofed. Waterproofing should also be provided for site retaining walls in order to reduce the potential for efflorescence staining.

Preliminary Retaining Wall Foundation Design

Preliminary foundation design for retaining walls should incorporate the following recommendations:

Minimum Footing Embedment - 18 inches below the lowest adjacent grade (excluding landscape layer [upper 6 inches]).

Minimum Footing Width - 24 inches.

Allowable Bearing Pressure - An allowable bearing pressure of 2,500 pcf may be used in the preliminary design of retaining wall foundations provided that the footing maintains a minimum width of 24 inches and extends at least 18 inches into approved engineered fill overlying dense formational materials. This pressure may be increased by one-third for short-term wind or seismic loads.

Passive Earth Pressure - A passive earth pressure of 250 pcf with a maximum earth pressure of 2,500 psf may be used in the preliminary design of retaining wall foundations provided the foundation is embedded into properly compacted silty to clayey sand fill.

Lateral Sliding Resistance - A 0.35 coefficient of friction may be used for a concrete to soil contact when multiplied by the dead load. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

Backfill Soil Density - Soil densities ranging between 125 pcf and 135 pcf may be used in the design of retaining wall foundations. This assumes an average engineered fill compaction of at least 90 percent of the laboratory standard (ASTM D 1557).

Any retaining wall footings near the perimeter of the site (i.e., un-mitigated soils) will likely need to be deepened into unweathered compacted fills for adequate vertical and lateral bearing support. All retaining wall footing setbacks from slopes should comply with Figure 1808.7.1 of the 2022 CBC. GSI recommends a minimum horizontal setback distance of 7 feet as measured from the bottom, outboard edge of the footing to the slope face.

Restrained Walls

Any retaining walls that will be restrained prior to placing and compacting backfill material or that have re-entrant or male corners, should be designed for an at-rest equivalent fluid pressure (EFP) of 55 pcf and 65 pcf for select and very low to low expansive native backfill, respectively. The design should include any applicable surcharge loading. For areas of male or re-entrant corners, the restrained wall design should extend a minimum distance of twice the height of the wall (2H) laterally from the corner.

Cantilevered Walls

The recommendations presented below are for cantilevered retaining walls up to 10 feet high. Design parameters for walls less than 3 feet in height may be superceded by City of Murrieta or County of Riverside regional standard design. Active earth pressure may be used for retaining wall design, provided the top of the wall is not restrained from minor deflections. An equivalent fluid pressure approach may be used to compute the

horizontal pressure against the wall. Appropriate fluid unit weights are given below for specific slope gradients of the retained material. These do not include other superimposed loading conditions due to traffic, structures, seismic events or adverse geologic conditions. When wall configurations are finalized, the appropriate loading conditions for superimposed loads can be provided upon request.

For preliminary planning purposes, the structural consultant/wall designer should incorporate the surcharge of traffic on the back of retaining walls where vehicular traffic could occur within horizontal distance "H" from the back of the retaining wall (where "H" equals the wall height). The traffic surcharge may be taken as 100 psf/ft in the upper 5 feet of backfill for light truck and cars traffic. This does not include the surcharge of parked vehicles which should be evaluated at a higher surcharge to account for the effects of seismic loading. Equivalent fluid pressures for the design of cantilevered retaining walls are provided in the following table:

SURFACE SLOPE OF RETAINED MATERIAL (HORIZONTAL:VERTICAL)	EQUIVALENT FLUID WEIGHT P.C.F. (SELECT BACKFILL)[2]	EQUIVALENT FLUID WEIGHT P.C.F. (NATIVE BACKFILL)[3]
Level[1]	38	50
2 to 1	55	65

[1] Level backfill behind a retaining wall is defined as compacted earth materials, properly drained, without a slope for a distance of 2H behind the wall, where H is the height of the wall.
[2] SE $\geq$ 30, P.I. < 15, E.I. < 21, and $\leq$ 10% passing No. 200 sieve.
[3] E.I. = 0 to 50, SE $\geq$ 30, P.I. < 15, E.I. < 21, and $\leq$ 15% passing No. 200 sieve.

Seismic Surcharge

For engineered retaining walls with more than 6 feet of retained materials, as measured vertically from the bottom of the wall footing at the heel to daylight , GSI recommends that the walls be evaluated for a seismic surcharge (in general accordance with 2022 CBC requirements). The site walls in this category should maintain an overturning Factor-of-Safety (FOS) of approximately 1.25 when the seismic surcharge (increment), is applied. For restrained walls, the seismic surcharge should be applied as a uniform surcharge load from the bottom of the footing (excluding shear keys) to the top of the backfill at the heel of the wall footing. This seismic surcharge pressure (seismic increment) may be taken as 18H where "H" for retained walls is the dimension previously noted as the height of the backfill to the bottom of the footing. The resultant force should be applied at a distance 0.6 H up from the bottom of the footing. For the evaluation of the seismic surcharge, the bearing pressure may exceed the static value by one-third, considering the transient nature of this surcharge. For cantilevered walls, the pressure should be applied as an inverted triangular distribution using 18H. For restrained walls, the pressure should be applied as a rectangular distribution. Please note this is for local wall stability only.

The 18H is derived from a Mononobe-Okabe solution for both restrained cantilever walls. This accounts for the increased lateral pressure due to shakedown or movement of the sand fill soil in the zone of influence from the wall or roughly a 45° - ϕ/2 plane away from the back of the wall. The 18H seismic surcharge is derived from the formula:

$P_h = ⅜ \bullet a_h \bullet \gamma_t H$

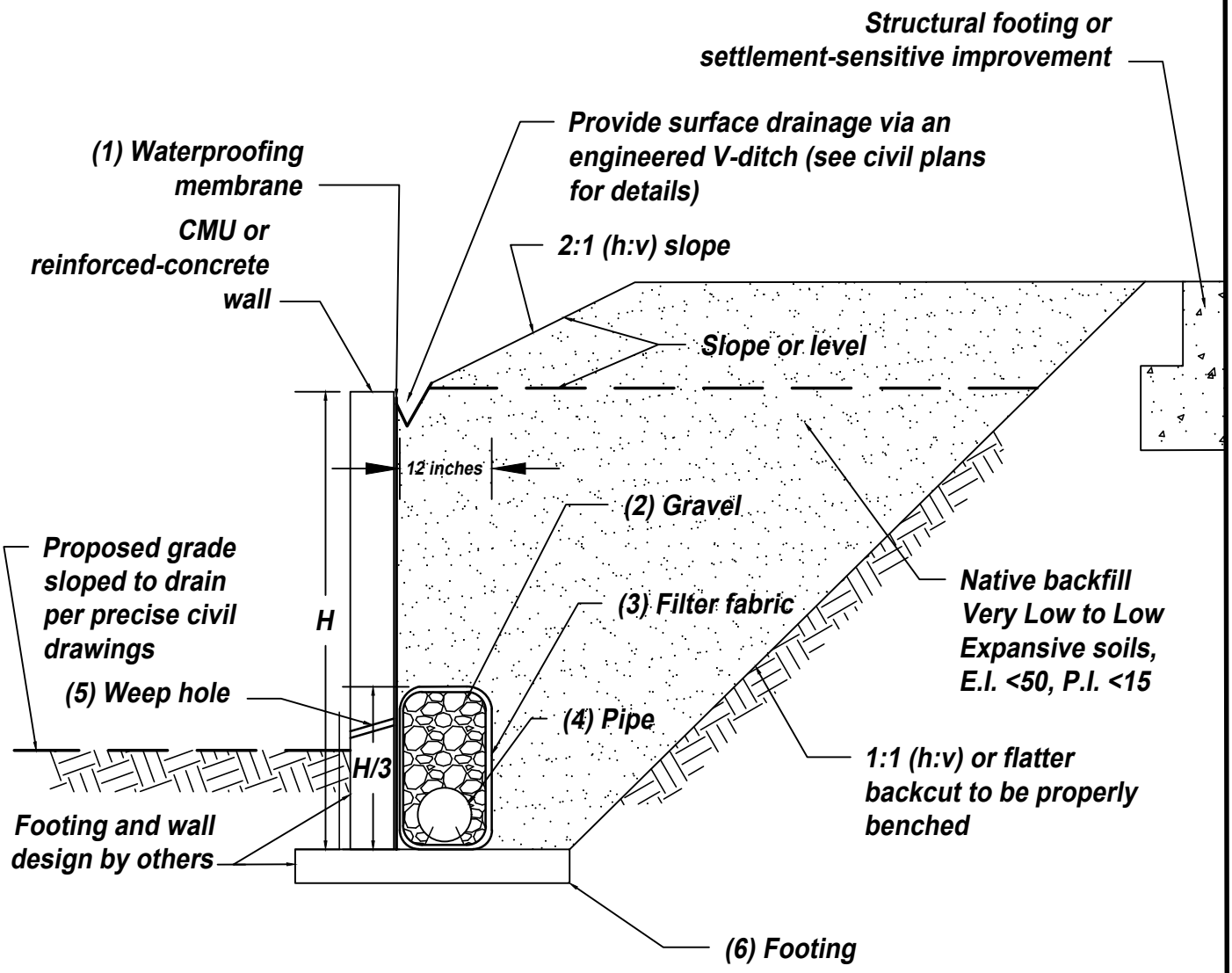
Where:

P_h	=	Seismic increment.
a_h	=	Probabilistic horizontal site acceleration with a percentage of "g".
γ_t	=	total unit weight (120 to 125 pcf for site soils @ 90% relative compaction).
H	=	Height of the wall from the bottom of the footing or point of pile fixity.

Retaining Wall Backfill and Drainage

Positive drainage must be provided behind all retaining walls in the form of gravel wrapped in geofabric and outlets. A backdrain system is considered necessary for retaining walls that are 2 feet or greater in height. Details 1, 2, and 3, present the backdrainage options discussed below. Backdrains should consist of a 4-inch diameter perforated PVC or ABS pipe encased in either Class 2 permeable filter material or ¾-inch to 1½-inch gravel wrapped in approved filter fabric (Mirafi 140 or equivalent). For select backfill, the filter material should extend a minimum of 1 horizontal foot behind the base of the walls and upward at least 1 foot. For native backfill that has up to E.I. = 20, continuous Class 2 permeable drain materials should be used behind the wall. This material should be continuous (i.e., full height) behind the wall, and it should be constructed in accordance with the enclosed Detail 1 (Typical Retaining Wall Backfill and Drainage Detail). For limited access and confined areas, (panel) drainage behind the wall may be constructed in accordance with Detail 2 (Retaining Wall Backfill and Subdrain Detail Geotextile Drain). Materials with an expansion index (E.I.) potential of greater than 20 should not be used as backfill for retaining walls. Retaining wall backfill materials should be moisture conditioned and mixed to achieve the soil's optimum moisture content, placed in relatively thin lifts (6 to 10 inches), and compacted to at least 90 percent relative compaction. For more onerous expansive situations, backfill and drainage behind the retaining wall should conform with Detail 3 (Retaining Wall And Subdrain Detail Clean Sand Backfill).

Outlets should consist of a 4-inch diameter solid PVC or ABS pipe spaced no greater than about 100 feet apart, with a minimum of two outlets, one on each end. The use of weep holes, only, in walls higher than 2 feet, is not recommended. The surface of the backfill should be sealed by pavement or the top 18 inches compacted with native soil (E.I. ≤ 50). Proper surface drainage should also be provided. For additional mitigation, consideration should be given to applying a water-proof membrane to the back of all retaining structures. The use of a waterstop should be considered for all concrete and masonry joints.



(1) Waterproofing membrane.

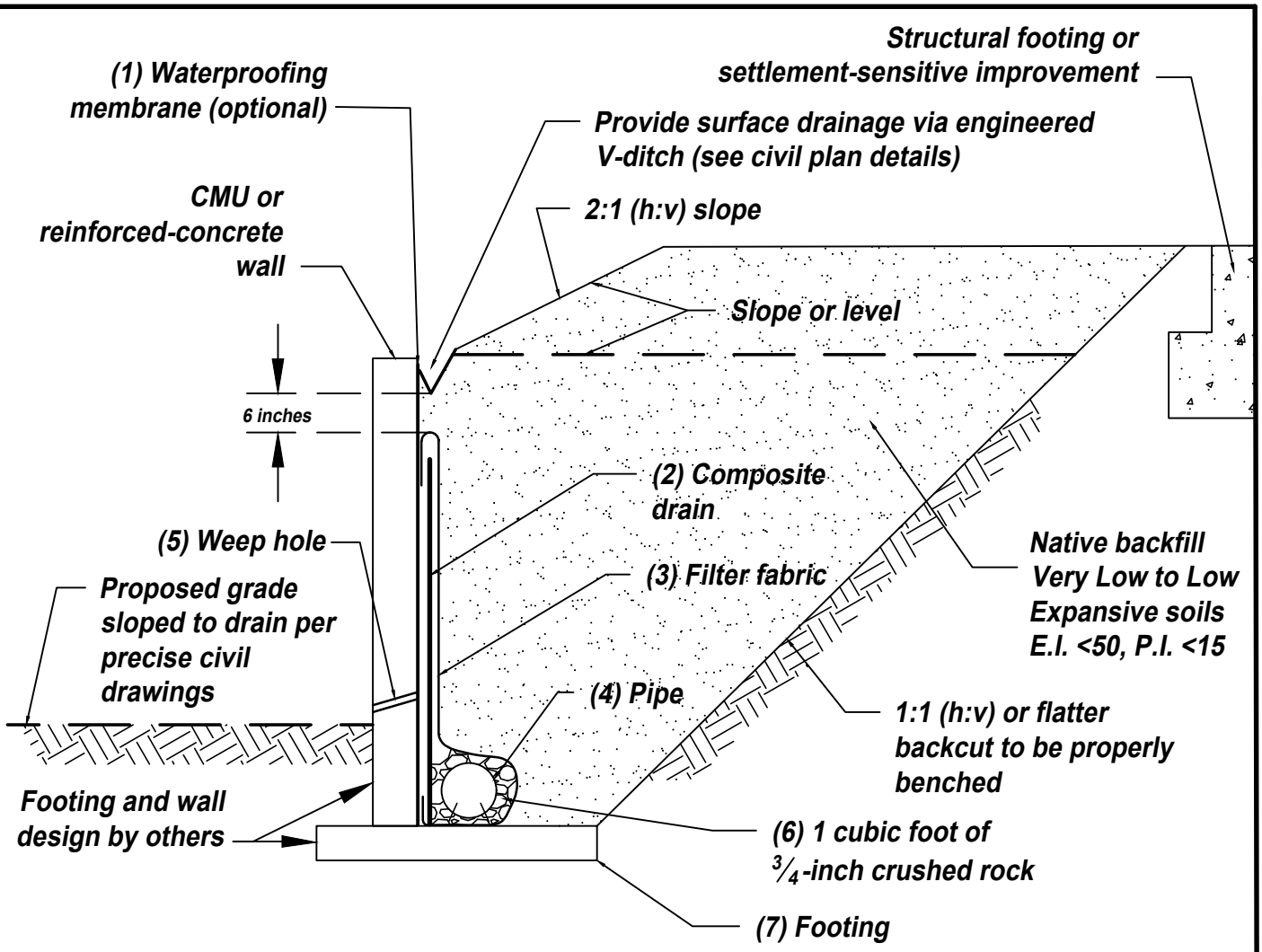
(2) Gravel: Clean, crushed, ¾ to 1½ inch.

(3) Filter fabric: Mirafi 140N or approved equivalent.

(4) Pipe: 4-inch-diameter perforated PVC, Schedule 40, or approved alternative with minimum of 1 percent gradient sloped to suitable, approved outlet point (perforations down).

(5) Weep holes: For CMU walls, Omit grout every other block, at or slightly above finished surface. For reinforced concrete walls, minimum 2-inch diameter weep holesspaced at 20 foot centers along the wall and placed 3 inches above finished surface. Design civil engineer to provide drainage at toe of wall. No weep holes for below-grade walls.

(6) Footing: If bench is created behind the footing greater than the footing width using level fill or cut natural earth materials, an additional "heel" drain will likely be required by geotechnical consultant.



(1) Waterproofing membrane (optional): Liquid boot or approved mastic equivalent.

(2) Drain: Miradrain 6000 or J-drain 200 or equivalent for non-waterproofed walls; Miradrain 6200 or J-drain 200 or equivalent for waterproofed walls (all perforations down).

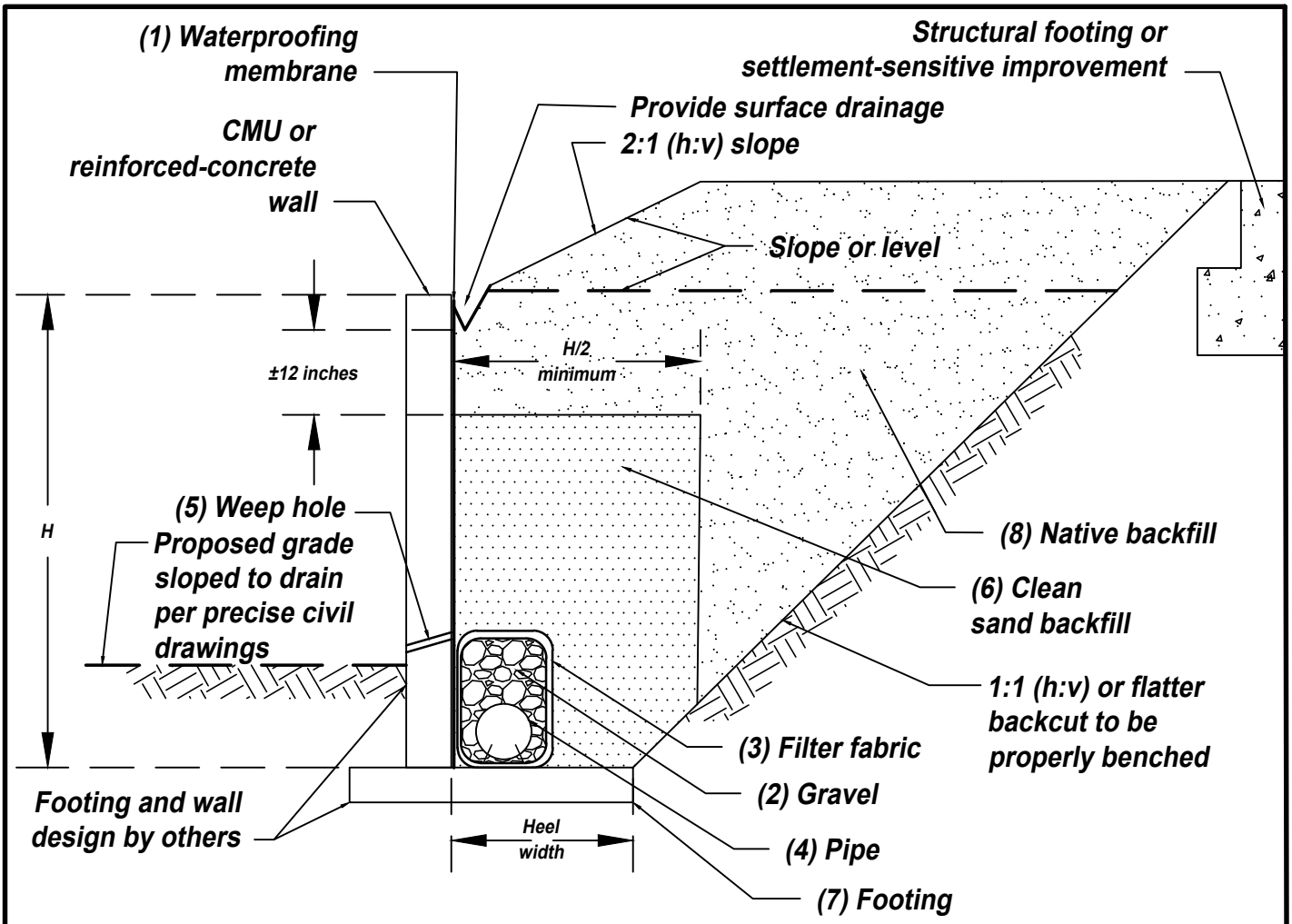
(3) Filter fabric: Mirafi 140N or approved equivalent; place fabric flap behind core.

(4) Pipe: 4-inch-diameter perforated PVC, Schedule 40, or approved alternative with minimum of 1 percent gradient to proper outlet point (perforations down).

(5) Weep holes: For CMU walls, Omit grout every other block, at or slightly above finished surface. For reinforced concrete walls, minimum 2-inch diameter weep holesspaced at 20 foot centers along the wall and placed 3 inches above finished surface. Design civil engineer to provide drainage at toe of wall. No weep holes for below-grade walls.

(6) Gravel: Clean, crushed, ¾ to 1½ inch.

(7) Footing: If bench is created behind the footing greater than the footing width using level fill or cut natural earth materials, an additional "heel" drain will likely be required by geotechnical consultant.



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(6) Clean sand backfill: Must have sand equivalent value (S.E.) of 35 or greater; can be densified by water jetting upon approval by geotechnical engineer.

(7) Footing: If bench is created behind the footing greater than the footing width using level fill or cut natural earth materials, an additional "heel" drain will likely be required by geotechnical consultant.

(8) Native backfill: If E.I. <21 and S.E. ≥35 then all sand requirements also may not be required and will be reviewed by the geotechnical consultant.

Wall/Retaining Wall Footing Transitions

Site walls are anticipated to be founded on footings designed in accordance with the recommendations in this report. Should wall footings transition from cut to fill, the structural consultant/wall designer may specify either:

a) A minimum of a 2-foot overexcavation and recompaction of cut materials for a distance of 2H, from the point of transition.

b) Increase of the amount of reinforcing steel and wall detailing (i.e., expansion joints or crack control joints) such that a angular distortion of 1/360 for a distance of 2H on either side of the transition may be accommodated. Expansion joints should be placed no greater than 20 feet on-center, in accordance with the structural engineer's/wall designer's recommendations, regardless of whether or not transition conditions exist. Expansion joints should be sealed with a flexible, non-shrink grout.

c) Embed the footings entirely into native formational material (i.e., deepened footings).

If transitions from cut to fill transect the wall footing alignment at an angle of less than 45 degrees (plan view), then the designer should follow recommendation "a" (above) and until such transition is between 45 and 90 degrees to the wall alignment.

Slope Setback Considerations for Footings

Footings should maintain a horizontal distance, X, between any adjacent descending slope face and the bottom outer edge of the footing, and comply with the guidelines depicted on Figure 1808.7.1 of the 2022 CBC. The horizontal distance, X, may be calculated by using $X = h/3$, where h is the height of the slope. X should not be less than 7 feet, nor need not be greater than 40 feet. X may be maintained by deepening the footings.

DRIVEWAY, CONCRETE APRONS, FLATWORK, AND OTHER IMPROVEMENTS

The soil materials on site may be expansive. The effects of expansive soils are cumulative, and typically occur over the lifetime of any improvements. On relatively level areas, when the soils are allowed to dry, the dessication and swelling process tends to cause heaving and distress to flatwork and other improvements. The resulting potential for distress to improvements may be reduced, but not totally eliminated. To that end, it is recommended that the developer should notify any owners or interested/affected parties of this long-term potential for distress. To reduce the likelihood of distress, the following recommendations are presented for all exterior flatwork:

1. The subgrade area for concrete slabs should be compacted to achieve a minimum 90 percent relative compaction, and then be presoaked to 2 to 3 percentage points above (or 125 percent of) the soils' optimum moisture content, to a depth of 18 inches below subgrade elevation. If very low expansive soils are present, only optimum moisture content, or greater, is required and specific presoaking is not warranted. The moisture content of the subgrade should be proof tested within 72 hours prior to concrete placement.

2. Exterior concrete slabs should be cast over a non-yielding surface, consisting of a 4-inch layer of Class 2 base, crushed rock, gravel, or clean sand (or City minimum), that should be compacted and level prior to placement of concrete. If very low expansive soils are present, the base, rock, gravel, or sand may be deleted. The layer or subgrade should be wet-down completely prior to placement of concrete, to minimize loss of concrete moisture to the surrounding earth materials.

3. Exterior slabs should be a minimum of 4 inches thick. Driveway slabs and approaches should additionally have a thickened edge (12 inches) adjacent to all landscape areas, to help impede infiltration of landscape water under the slab. Trash disposal (dumpster) area aprons should be a minimum of 6 inches thick and meet minimum City/County standards, as necessary.

4. The use of transverse and longitudinal control joints are recommended to help control slab cracking due to concrete shrinkage or expansion. Two ways to mitigate such cracking are: a) add a sufficient amount of reinforcing steel, increasing tensile strength of the slab; and, b) provide an adequate amount of control or expansion joints to accommodate anticipated concrete shrinkage and expansion.

   In order to reduce the potential for unsightly cracks, slabs should be reinforced at mid-height with a minimum of No. 3 bars placed at 18 inches on center, in each direction. If subgrade soils within the top 7 feet from finish grade are very low expansive soils (i.e., E.I. $\leq$ 20), then 6x6-W1.4xW1.4 welded-wire mesh may be substituted for the rebar, provided the reinforcement is placed on chairs, at slab mid-height. The exterior slabs should be scored or saw cut, ½ to ⅜ inches deep, often enough so that no section is greater than 10 feet by 10 feet. For sidewalks or narrow slabs, control joints should be provided at intervals of every 6 feet. The slabs should be separated from the foundations and sidewalks with expansion joint filler material.

5. No traffic should be allowed upon the newly placed concrete slabs until they have been properly cured to within 75 percent of design strength. Concrete compression strength should be a minimum of 2,500 psi.

6. Driveways, sidewalks, and patio slabs adjacent to the structure should be separated from the structure with thick expansion joint filler material. In areas directly adjacent to a continuous source of moisture (i.e., irrigation, planters, etc.), all joints should be additionally sealed with flexible mastic.

7. Planters and walls (sound walls or retaining walls) should not be tied to the structure.

8. Overhang structures should be supported on the slabs, or structurally designed with continuous footings tied in at least two directions. If very low expansion soils are present, footings need only be tied in one direction.

9. Any masonry landscape or sound walls that are to be constructed throughout the property should be grouted and articulated in segments no more than 20 feet long. These segments should be keyed or doweled together.

10. If settlement concerns or expansive soils are present, utilities may be enclosed within a closed utilidor (vault) or designed with flexible connections to accommodate differential settlement and expansive soil conditions.

11. Positive site drainage should be maintained at all times. Finish grade on the building pad should provide a minimum of 1 to 2 percent fall to an approved outlet, as indicated herein. Drainage reversals could occur, including post-construction settlement, if relatively flat drainage gradients are not periodically maintained by the owner or interested/affected parties.

12. Air conditioning (A/C) units should be supported by slabs that are incorporated into the building foundation or constructed on a rigid slab with flexible couplings for plumbing and electrical lines. A/C waste water lines should be drained to a suitable non-erosive outlet.

13. Shrinkage cracks could become excessive if proper finishing and curing practices are not followed. Finishing and curing practices should be performed per the Portland Cement Association (PCA) guidelines. Mix design should incorporate rate of curing for climate and time of year, sulfate content of soils, corrosion potential of soils, and fertilizers used on site.

DEVELOPMENT CRITERIA

Slope Maintenance and Planting

Water has been shown to weaken the inherent strength of all earth materials. Slope stability is significantly reduced by overly wet conditions. Positive surface drainage away

from slopes should be maintained and only the amount of irrigation necessary to sustain plant life should be provided for planted slopes. Over-watering should be avoided as it adversely affects site improvements, and causes perched groundwater conditions. Graded slopes constructed utilizing onsite materials would be erosive. Eroded debris may be minimized and surficial slope stability enhanced by establishing and maintaining a suitable vegetation cover soon after construction. Compaction to the face of fill slopes would tend to minimize short-term erosion until vegetation is established. Plants selected for landscaping should be light weight, deep rooted types that require little water and are capable of surviving the prevailing climate. Jute-type matting or other fibrous covers may aid in allowing the establishment of a sparse plant cover. Using plants other than those recommended above will increase the potential for perched water, staining, mold, etc., to develop. A rodent control program to prevent burrowing should be implemented. Irrigation of natural (ungraded) slope areas is generally not recommended. Over-steepening of slopes should be avoided during building construction activities and landscaping.

Drainage

Adequate surface drainage is a very important factor in reducing the likelihood of adverse performance of foundations, hardscape, and slopes. Surface drainage should be sufficient to prevent ponding of water anywhere on a lot, and especially near structures and tops of slopes. Surface drainage should be carefully taken into consideration during fine grading, landscaping, and building construction. Therefore, care should be taken that future landscaping or construction activities do not create adverse drainage conditions. Positive site drainage should be provided and maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground. In general, the area within 5 feet around a structure should slope away from the structure. We recommend that unpaved lawn and landscape areas have a minimum gradient of 1 percent sloping away from structures, and whenever possible, should be above adjacent paved areas. Consideration should be given to avoiding construction of planters adjacent to structures. Pad drainage should be directed toward the street or other approved area(s). Downspouts, or drainage devices should outlet a minimum of 5 feet from structures or into a subsurface drainage system. Areas of seepage may develop due to irrigation or heavy rainfall, and should be anticipated. Minimizing irrigation will lessen this potential. If areas of seepage develop, recommendations for minimizing this effect could be provided upon request.

Erosion Control

Cut and fill slopes will be subject to surficial erosion during and after grading. Onsite earth materials have a moderate to high erosion potential. Consideration should be given to providing hay bales and silt fences for the temporary control of surface water, from a geotechnical viewpoint.

Landscape Maintenance and Planter Design

Only the amount of irrigation necessary to sustain plant life should be provided. Over-watering the landscape areas will adversely affect proposed site improvements. We would recommend that any proposed open-bottom planters adjacent to proposed structures be eliminated for a minimum distance of 10 feet. As an alternative, closed-bottom type planters could be used. An outlet placed in the bottom of the planter, could be installed to direct drainage away from structures or any exterior concrete flatwork. If planters are constructed adjacent to structures, the sides and bottom of the planter should be provided with a moisture barrier to prevent penetration of irrigation water into the subgrade. Provisions should be made to drain the excess irrigation water from the planters without saturating the subgrade below or adjacent to the planters. Graded slope areas should be planted with drought resistant vegetation. Consideration should be given to the type of vegetation chosen and their potential effect upon surface improvements (i.e., some trees will have an effect on concrete flatwork with their extensive root systems). From a geotechnical standpoint leaching is not recommended for establishing landscaping. If the surface soils are processed for the purpose of adding amendments, they should be recompacted to 90 percent minimum relative compaction.

Subsurface and Surface Water

Subsurface and surface water are not anticipated to affect site development, provided that the recommendations contained in this report are incorporated into final design and construction and that prudent surface and subsurface drainage practices are incorporated into the construction plans. Perched groundwater conditions along zones of contrasting permeabilities may not be precluded from occurring in the future due to site irrigation, poor drainage conditions, or damaged utilities, and should be anticipated. Should perched groundwater conditions develop, this office could assess the affected area(s) and provide the appropriate recommendations to mitigate the observed groundwater conditions. Groundwater conditions may change with the introduction of irrigation, rainfall, or other factors.

Site Improvements

If any additional improvements (e.g., structures, walls, etc.) are planned for the site, recommendations concerning the geological or geotechnical aspects of design and construction of said improvements could be provided upon request. This office should be notified in advance of any fill placement, grading of the site, or trench backfilling after rough grading has been completed. This includes any grading, utility trench and retaining wall backfills, flatwork, etc.

Additional Grading

This office should be notified in advance of any fill placement, supplemental regrading of the site, or trench backfilling after rough grading has been completed. This includes completion of grading in the amphitheater areas, utility trench, and retaining wall backfills.

Footing Trench Excavation

All footing excavations should be observed by a representative of this firm after trenching and prior to concrete form and reinforcement placement. The purpose of the observations is to evaluate that the excavations have been made into the recommended bearing material and to the minimum widths and depths recommended for construction. If loose or compressible materials are exposed within the footing excavation, a deeper footing or removal and recompaction of the subgrade materials would be recommended at that time. Footing trench spoil and any excess soils generated from utility trench excavations should be compacted to a minimum relative compaction of 90 percent, if not removed from the site.

Trenching/Temporary Construction Backcuts

Considering the nature of the onsite earth materials, caving or sloughing could be a factor in subsurface excavations and trenching. Shoring or excavating the trench walls/backcuts at the angle of repose (typically 25 to 45 degrees [except as specifically superceded within the text of this report]), should be anticipated. All excavations should be observed by an engineering geologist or soil engineer from GSI, prior to workers entering the excavation or trench, and conform to CAL-OSHA, state, and local safety codes. Should adverse conditions exist, appropriate recommendations would be offered at that time. The above recommendations should be provided to any contractors or subcontractors, etc., that may perform such work.

Utility Trench Backfill

1. All interior utility trench backfill should be brought to at least 2 percent above optimum moisture content and then compacted to obtain a minimum relative compaction of 90 percent of the laboratory standard. As an alternative for shallow (12-inch to 18-inch) under-slab trenches, sand having a sand equivalent value of 30 or greater may be used and jetted or flooded into place. Observation, probing and testing should be provided to evaluate the desired results.

2. Exterior trenches adjacent to, and within areas extending below a 1:1 plane projected from the outside bottom edge of the footing, and all trenches beneath hardscape features and in slopes, should be compacted to at least 90 percent of the laboratory standard. Sand backfill, unless excavated from the trench, should not be used in these backfill areas. Compaction testing and observations, along with probing, should be accomplished to evaluate the desired results.

3. All trench excavations should conform to CAL-OSHA, state, and local safety codes.

4. Utilities crossing grade beams, perimeter beams, or footings should either pass below the footing or grade beam utilizing a hardened collar or foam spacer, or pass through the footing or grade beam in accordance with the recommendations of the structural engineer.

SUMMARY OF RECOMMENDATIONS REGARDING GEOTECHNICAL OBSERVATION AND TESTING

We recommend that observation or testing be performed by GSI at each of the following construction stages:

- During grading/recertification.
- During excavation.
- During placement of subdrains, toe drains, or other subdrainage devices, prior to placing fill or backfill.
- After excavation of building footings, retaining wall footings, and free standing walls footings, prior to the placement of reinforcing steel or concrete.
- Prior to pouring any slabs or flatwork, after presoaking/presaturation of building pads and other flatwork subgrade, before the placement of concrete, reinforcing steel, capillary break (i.e., sand, pea-gravel, etc.), or vapor retarders.
- During retaining wall subdrain installation, prior to backfill placement.
- During placement of backfill for area drains, interior plumbing, utility line trenches, and retaining wall backfill.
- During slope construction/repair.
- When any unusual soil conditions are encountered during any construction operations, after to the issuance of this report.
- When any developer or owner improvements, such as flatwork, foundations, walls, etc., are proposed, prior to construction. GSI should review and approve such plans, prior to construction
- A report of geotechnical observation and testing should be provided at the conclusion of each of the above stages, in order to provide concise and clear documentation of site work, or to comply with code requirements.

OTHER DESIGN PROFESSIONALS/CONSULTANTS

The design civil engineer, structural engineer, foundation designer, architect, landscape architect, wall designer, etc., should review the recommendations provided herein, incorporate those recommendations into all their respective plans, and by explicit reference, make this report part of their project plans.

This report presents minimum design criteria for the design of slabs, foundations and other elements possibly applicable to the project. These criteria should not be considered as substitutes for actual designs by the structural engineer/designer. Please note that the recommendations contained herein are not intended to preclude the transmission of water or vapor through the slab or foundation. The structural engineer/foundation or slab designer should provide recommendations to not allow water or vapor to enter into the structure so as to cause damage to another building component, or so as to limit the installation of the type of flooring materials typically used for the particular application, per the State of California (2018).

The structural engineer/designer should analyze actual soil-structure interaction and consider, as needed, bearing, expansive soil influence, and strength, stiffness and deflections in the various slab, foundation, and other elements in order to develop appropriate, design-specific details. As conditions dictate, it is possible that other influences will also have to be considered. If analyses by the structural engineer/designer result in less critical details than are provided herein as minimums, the minimums presented herein should be adopted. It is considered likely that some, more restrictive details will be required.

If the structural engineer/designer has any questions or requires further assistance, they should not hesitate to call or otherwise transmit their requests to GSI. In order to mitigate potential distress, the foundation or improvement's designer should confirm to GSI and the governing agency, in writing, that the proposed foundations or improvements can tolerate the amount of differential settlement or expansion characteristics and other design criteria specified herein.

PLAN REVIEW

Final project plans (foundation, block wall, landscaping, etc.), should be reviewed by this office prior to construction, so that construction is in accordance with the conclusions and recommendations of this report. Based on our review, supplemental recommendations or further geotechnical studies may be warranted.

LIMITATIONS

The materials encountered on the project site and used for our analysis are believed representative of the area; however, soil and bedrock materials vary in character between excavations and natural outcrops or conditions exposed during mass grading. Site conditions may vary due to seasonal changes or other factors.

Inasmuch as our study is based upon our review and engineering analyses and laboratory data, the conclusions and recommendations are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty, either express or implied, is given. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, or their inaction; or work performed when GSI is not requested to be onsite, to evaluate if our recommendations have been properly implemented. Use of this report constitutes an agreement and consent by the user to all the limitations outlined above, notwithstanding any other agreements that may be in place. In addition, this report may be subject to review by the controlling authorities. Thus, this report brings to completion our scope of services for this portion of the project.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,

GeoSoils, Inc.

Todd A. Greer
Engineering Geologist, CEG 2377

Stephen J. Coover
Geotechnical Engineer, GE 2057

TAG/JPF/SJC/sh

Enclosures: Appendix A - References
Appendix B - Hand-Auger Boring Logs
Appendix C - Laboratory Test Results
Appendix D - General Earthwork and Grading Guidelines

Distribution: (1) Addressee (PDF via email)

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

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APPENDIX B

HAND-AUGER BORING LOGS

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions			Group Symbols	Typical Names
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravel with	GM	Silty gravels gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands more than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils 50% or more passes No. 200 sieve	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, mucic, and other highly organic soils

CONSISTENCY OR RELATIVE DENSITY

CRITERIA

Standard Penetration Test

Penetration Resistance N (blows/ft)	Relative Density
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium
30 - 50	Dense
> 50	Very dense

Standard Penetration Test

Penetration Resistance N (blows/ft)	Consistency	Unconfined Compressive Strength (tons/ft^2)
<2	Very Soft	<0.25
2 - 4	Soft	0.25 - .050
4 - 8	Medium	0.50 - 1.00
8 - 15	Stiff	1.00 - 2.00
15 - 30	Very Stiff	2.00 - 4.00
>30	Hard	>4.00

3" 3/4" #4 #10 #40 #200 U.S. Standard Sieve

Unified Soil Classification	Cobbles	Gravel		Sand			Silt or Clay
		coarse	fine	coarse	medium	fine	

MOISTURE CONDITIONS

Dry	Absence of moisture: dusty, dry to the touch
Slightly Moist	Below optimum moisture content for compaction
Moist	Near optimum moisture content
Very Moist	Above optimum moisture content
Wet	Visible free water; below water table

MATERIAL QUANTITY

trace	0 - 5 %
few	5 - 10 %
little	10 - 25 %
some	25 - 45 %

OTHER SYMBOLS

C Core Sample
S SPT Sample
B Bulk Sample
__ Groundwater
Qp Pocket Penetrometer

BASIC LOG FORMAT:
Group name, Group symbol, (grain size), color, moisture, consistency or relative density. Additional comments: odor, presence of roots, mica, gypsum, coarse grained particles, etc.

EXAMPLE:
Sand (SP), fine to medium grained, brown, moist, loose, trace silt, little fine gravel, few cobbles up to 4" in size, some hair roots and rootlets.

File:Mgr: c;\SoilClassif.wpd

PLATE B-1

GeoSoils, Inc.

W.O. 8582-A-SC
City of Murrieta - Community Services Department
Public Library Addition Project, City of Murrieta
Logged By: TAG
3-31-2023

LOG OF EXPLORATORY HAND AUGER BORINGS

TEST PIT NO.	ELEV. (ft.)	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
HA-1	1,119'	0'-1'	SM/SC	Nuke @ 0' BULK @ 0'-2'	14.8	99.2	**ARTIFICIAL FILL - COMPACTED (Afc)**: Sod Lawn followed by; SILTY to CLAYEY SAND, dark brown, wet, loose; abundant roots and rootlets, weathered landscape layer.
		1'-2'	SC	Nuke @ 1'	18.2	91.7	CLAYEY SAND, dark brown, wet, loose to medium dense with depth; very fine to coarse grained sands.
		2'-4'	SM/SC	Nuke @ 2'	20.3	120.2	SILTY to CLAYEY SAND, pale reddish brown, moist to wet, medium dense; very fine to coarse grained sands, firm and unyielding.
							Total Depth = 4' No Groundwater/Seepage Encountered/No Caving. Backfilled 3-31-23.
HA-2	1,118'	0'-2'	SM/SC				**ARTIFICIAL FILL - COMPACTED (Afc)**: Sod Lawn followed by; SILTY to CLAYEY SAND, dark brown, wet, loose to medium dense with depth; some roots and rootlets, weathered landscape layer.
		2'-3'	SC				CLAYEY SAND, dark brown, wet to saturated (recent heavy rains), medium dense.
							Total Depth = 3' No Groundwater/Seepage Encountered/No Caving. Backfilled 3-31-23.

GeoSoils, Inc.

W.O. 8582-A-SC
City of Murrieta - Community Services Department
Public Library Addition Project, City of Murrieta
Logged By: TAG
3-31-2023

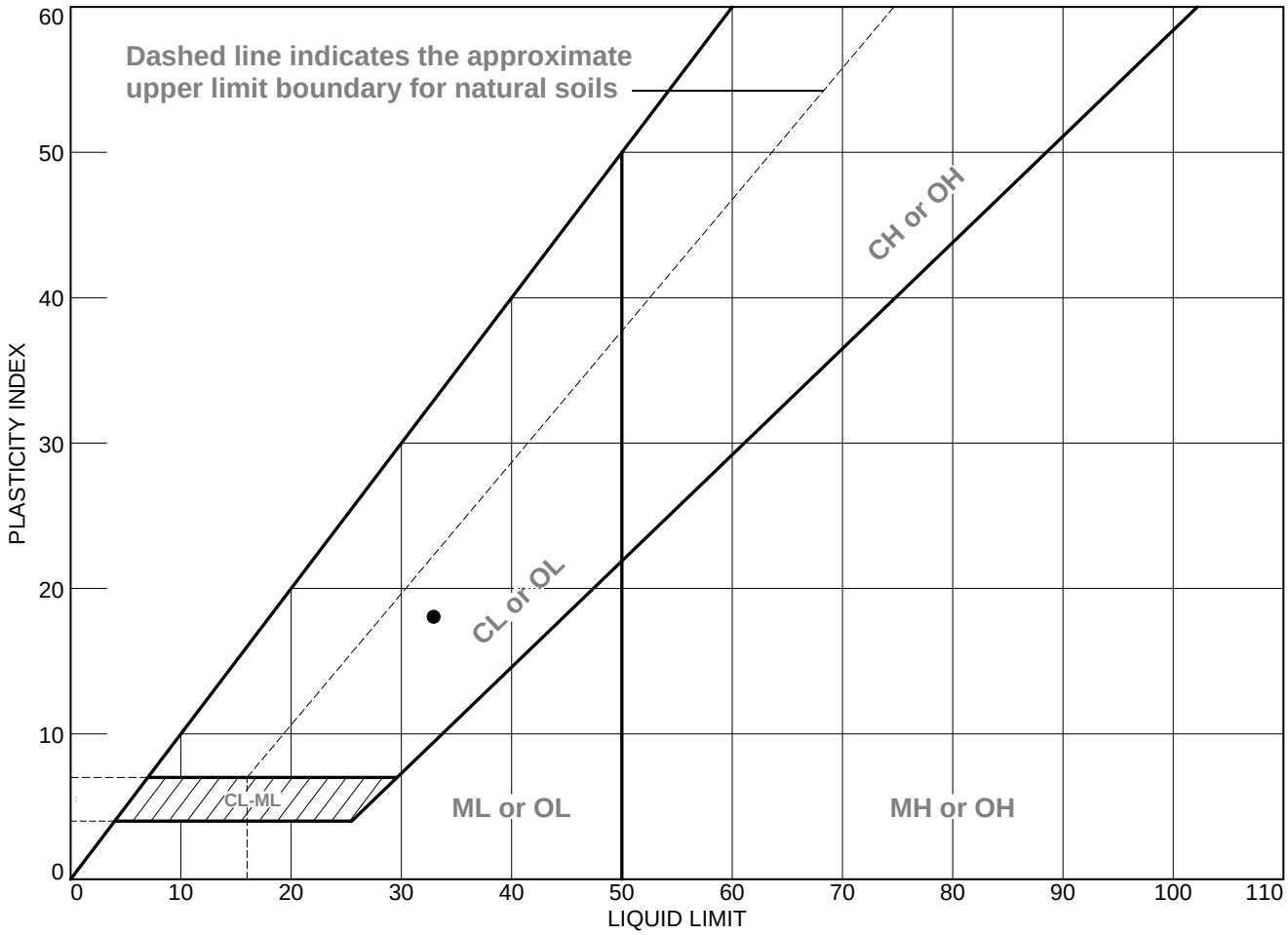
LOG OF EXPLORATORY HAND AUGER BORINGS

TEST PIT NO.	ELEV. (ft.)	DEPTH (ft.)	GROUP SYMBOL	SAMPLE DEPTH (ft.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DESCRIPTION
HA-3	1,117'	0'-1'	SM				**ARTIFICIAL FILL - COMPACTED (Afc)**: Sod Lawn followed by; SILTY SAND, grayish brown, moist, loose; fine to coarse grained sands, weathered landscape layer.
		1'-2'	SM				SILTY SAND, grayish brown to pale reddish brown, moist, medium dense, firm and unyielding @ 2'.
							Total Depth = 2' No Groundwater/Seepage Encountered/No Caving. Backfilled 3-31-23.
HA-4	1,117'	0'-0.5'	SC				**ARTIFICIAL FILL - COMPACTED (Afc)**: Sod Lawn followed by; CLAYEY SAND, dark brown, saturated (recent heavy rains), loose; weathered landscape layer.
		0.5'-3.5'	SM				SILTY SAND, grayish brown, wet, loose to medium dense with depth; fine to coarse grained sands, firm and unyielding @ 2.5'.
		3.5'-4'	SC				CLAYEY SAND, dark brown, wet, medium dense; very fine to coarse grained sands.
							Total Depth = 4' No Groundwater/Seepage Encountered/No Caving. Backfilled 3-31-23.

APPENDIX C

LABORATORY TEST RESULTS

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	HA-1	HA-1	0-2	-	15	33	18	SC

GeoSoils, Inc.

Client: City of Murrieta
Project: Library Addition

Project No.: 8582-A-SC **Figure**

Tested By: TR **Checked By:** TR

GeoSoils, Inc.
5741 Palmer Way, Carlsbad CA 92010
Phone (760) 438-3155

CORROSION REPORT SUMMARY

Project No: **8582-A-SC**
Project Name: **City of Murrieta**
Report Date: **April 14, 2023**

SAMPLE ID	pH (H+)	Minimum Resistivity (ohm/cm)	Sulfate Content (wt%)	Chloride Content (mg/kg)
HA-1, 0-2ft	8.3	2100	0.007	11

Sample testing in accordance with: pH - CTM 643, Resistivity - CTM 643
Sulfate - CTM 417, Chloride - CTM 422

Remarks: _____

APPENDIX D

GENERAL EARTHWORK AND GRADING GUIDELINES

GENERAL EARTHWORK AND GRADING GUIDELINES

General

These guidelines present general procedures and requirements for earthwork and grading as shown on the approved grading plans, including preparation of areas to be filled, placement of fill, installation of subdrains, excavations, and appurtenant structures or flatwork. The recommendations contained in the geotechnical report are part of these earthwork and grading guidelines and would supercede the provisions contained hereafter in the case of conflict. Evaluations performed by the consultant during the course of grading may result in new or revised recommendations which could supercede these guidelines or the recommendations contained in the geotechnical report. Generalized details follow this text.

The contractor is responsible for the satisfactory completion of all earthwork in accordance with provisions of the project plans and specifications and latest adopted Code. In the case of conflict, the most onerous provisions shall prevail. The project geotechnical engineer and engineering geologist (geotechnical consultant), and/or their representatives, should provide observation and testing services, and geotechnical consultation during the duration of the project.

EARTHWORK OBSERVATIONS AND TESTING

Geotechnical Consultant

Prior to the commencement of grading, a qualified geotechnical consultant (soil engineer and engineering geologist) should be employed for the purpose of observing earthwork procedures and testing the fills for general conformance with the recommendations of the geotechnical report(s), the approved grading plans, and applicable grading codes and ordinances.

The geotechnical consultant should provide testing and observation so that an evaluation may be made that the work is being accomplished as specified. It is the responsibility of the contractor to assist the consultants and keep them apprised of anticipated work schedules and changes, so that they may schedule their personnel accordingly.

All remedial removals, clean-outs, prepared ground to receive fill, key excavations, and subdrain installation should be observed and documented by the geotechnical consultant prior to placing any fill. It is the contractor's responsibility to notify the geotechnical consultant when such areas are ready for observation.

Laboratory and Field Tests

Maximum dry density tests to determine the degree of compaction should be performed in accordance with American Standard Testing Materials test method ASTM designation D 1557. Random or representative field compaction tests should be performed in accordance with test methods ASTM designation D 1556, D 2937 or D 2922, and D 3017, at intervals of approximately ±2 feet of fill height or approximately every 1,000 cubic yards

placed. These criteria would vary depending on the soil conditions and the size of the project. The location and frequency of testing would be at the discretion of the geotechnical consultant.

Contractor's Responsibility

All clearing, site preparation, and earthwork performed on the project should be conducted by the contractor, with observation by a geotechnical consultant, and staged approval by the governing agencies, as applicable. It is the contractor's responsibility to prepare the ground surface to receive the fill, to the satisfaction of the geotechnical consultant, and to place, spread, moisture condition, mix, and compact the fill in accordance with the recommendations of the geotechnical consultant. The contractor should also remove all non-earth material considered unsatisfactory by the geotechnical consultant.

Notwithstanding the services provided by the geotechnical consultant, it is the sole responsibility of the contractor to provide adequate equipment and methods to accomplish the earthwork in strict accordance with applicable grading guidelines, latest adopted Codes or agency ordinances, geotechnical report(s), and approved grading plans. Sufficient watering apparatus and compaction equipment should be provided by the contractor with due consideration for the fill material, rate of placement, and climatic conditions. If, in the opinion of the geotechnical consultant, unsatisfactory conditions such as questionable weather, excessive oversized rock or deleterious material, insufficient support equipment, etc., are resulting in a quality of work that is not acceptable, the consultant will inform the contractor, and the contractor is expected to rectify the conditions, and if necessary, stop work until conditions are satisfactory.

During construction, the contractor shall properly grade all surfaces to maintain good drainage and prevent ponding of water. The contractor shall take remedial measures to control surface water and to prevent erosion of graded areas until such time as permanent drainage and erosion control measures have been installed.

SITE PREPARATION

All major vegetation, including brush, trees, thick grasses, organic debris, and other deleterious material, should be removed and disposed of off-site. These removals must be concluded prior to placing fill. In-place existing fill, soil, alluvium, colluvium, or rock materials, as evaluated by the geotechnical consultant as being unsuitable, should be removed prior to any fill placement. Depending upon the soil conditions, these materials may be reused as compacted fills. Any materials incorporated as part of the compacted fills should be approved by the geotechnical consultant.

Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines, or other structures not located prior to grading, are to be removed or treated in a manner recommended by the geotechnical consultant. Soft, dry, spongy, highly fractured, or otherwise unsuitable ground, extending to such a depth that surface processing cannot adequately improve the condition, should be overexcavated down to

firm ground and approved by the geotechnical consultant before compaction and filling operations continue. Overexcavated and processed soils, which have been properly mixed and moisture conditioned, should be re-compacted to the minimum relative compaction as specified in these guidelines.

Existing ground, which is determined to be satisfactory for support of the fills, should be scarified (ripped) to a minimum depth of 6 to 8 inches, or as directed by the geotechnical consultant. After the scarified ground is brought to optimum moisture content, or greater and mixed, the materials should be compacted as specified herein. If the scarified zone is greater than 6 to 8 inches in depth, it may be necessary to remove the excess and place the material in lifts restricted to about 6 to 8 inches in compacted thickness.

Existing ground which is not satisfactory to support compacted fill should be overexcavated as required in the geotechnical report, or by the on-site geotechnical consultant. Scarification, disc harrowing, or other acceptable forms of mixing should continue until the soils are broken down and free of large lumps or clods, until the working surface is reasonably uniform and free from ruts, hollows, hummocks, mounds, or other uneven features, which would inhibit compaction as described previously.

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical [h:v]), the ground should be stepped or benched. The lowest bench, which will act as a key, should be a minimum of 15 feet wide and should be at least 2 feet deep into firm material, and approved by the geotechnical consultant. In fill-over-cut slope conditions, the recommended minimum width of the lowest bench or key is also 15 feet, with the key founded on firm material, as designated by the geotechnical consultant. As a general rule, unless specifically recommended otherwise by the geotechnical consultant, the minimum width of fill keys should be equal to ½ the height of the slope.

Standard benching is generally 4 feet (minimum) vertically, exposing firm, acceptable material. Benching may be used to remove unsuitable materials, although it is understood that the vertical height of the bench may exceed 4 feet. Pre-stripping may be considered for unsuitable materials in excess of 4 feet in thickness.

All areas to receive fill, including processed areas, removal areas, and the toes of fill benches, should be observed and approved by the geotechnical consultant prior to placement of fill. Fills may then be properly placed and compacted until design grades (elevations) are attained.

COMPACTED FILLS

Any earth materials imported or excavated on the property may be utilized in the fill provided that each material has been evaluated to be suitable by the geotechnical consultant. These materials should be free of roots, tree branches, other organic matter, or other deleterious materials. All unsuitable materials should be removed from the fill as directed by the geotechnical consultant. Soils of poor gradation, undesirable expansion

potential, or substandard strength characteristics may be designated by the consultant as unsuitable and may require blending with other soils to serve as a satisfactory fill material.

Fill materials derived from benching operations should be dispersed throughout the fill area and blended with other approved material. Benching operations should not result in the benched material being placed only within a single equipment width away from the fill/bedrock contact.

Oversized materials defined as rock, or other irreducible materials, with a maximum dimension greater than 12 inches, should not be buried or placed in fills unless the location of materials and disposal methods are specifically approved by the geotechnical consultant. Oversized material should be taken offsite, or placed in accordance with recommendations of the geotechnical consultant in areas designated as suitable for rock disposal. GSI anticipates that soils to be utilized as fill material for the subject project may contain some rock. Appropriately, the need for rock disposal may be necessary during grading operations on the site. From a geotechnical standpoint, the depth of any rocks, rock fills, or rock blankets, should be a sufficient distance from finish grade. This depth is generally the same as any overexcavation due to cut-fill transitions in hard rock areas, and generally facilitates the excavation of structural footings and substructures. Should deeper excavations be proposed (i.e., deepened footings, utility trenching, swimming pools, spas, etc.), the developer may consider increasing the hold-down depth of any rocky fills to be placed, as appropriate. In addition, some agencies/jurisdictions mandate a specific hold-down depth for oversize materials placed in fills. The hold-down depth, and potential to encounter oversize rock, both within fills, and occurring in cut or natural areas, would need to be disclosed to all interested/affected parties. Once approved by the governing agency, the hold-down depth for oversized rock (i.e., greater than 12 inches) in fills on this project is provided as 10 feet, unless specified differently in the text of this report. The governing agency may require that these materials need to be deeper, crushed, or reduced to less than 12 inches in maximum dimension, at their discretion.

To facilitate future trenching, rock (or oversized material), should not be placed within the hold-down depth feet from finish grade, the range of foundation excavations, future utilities, or underground construction unless specifically approved by the governing agency, the geotechnical consultant, and/or the developer's representative.

If import material is required for grading, representative samples of the materials to be utilized as compacted fill should be analyzed in the laboratory by the geotechnical consultant to evaluate it's physical properties and suitability for use onsite. Such testing should be performed three (3) days prior to importation. If any material other than that previously tested is encountered during grading, an appropriate analysis of this material should be conducted by the geotechnical consultant as soon as possible.

Approved fill material should be placed in areas prepared to receive fill in near horizontal layers, that when compacted, should not exceed about 6 to 8 inches in thickness. The geotechnical consultant may approve thick lifts if testing indicates the grading procedures are such that adequate compaction is being achieved with lifts of greater thickness. Each

layer should be spread evenly and blended to attain uniformity of material and moisture suitable for compaction.

Fill layers at a moisture content less than optimum should be watered and mixed, and wet fill layers should be aerated by scarification, or should be blended with drier material. Moisture conditioning, blending, and mixing of the fill layer should continue until the fill materials have a uniform moisture content at, or above, optimum moisture.

After each layer has been evenly spread, moisture conditioned, and mixed, it should be uniformly compacted to a minimum of 90 percent of the maximum density as evaluated by ASTM test designation D 1557, or as otherwise recommended by the geotechnical consultant. Compaction equipment should be adequately sized and should be specifically designed for soil compaction, or of proven reliability to efficiently achieve the specified degree of compaction.

Where tests indicate that the density of any layer of fill, or portion thereof, is below the required relative compaction, or improper moisture is in evidence, the particular layer or portion shall be re-worked until the required density and/or moisture content has been attained. No additional fill shall be placed in an area until the last placed lift of fill has been tested and found to meet the density and moisture requirements, and is approved by the geotechnical consultant.

In general, per the latest adopted Code, fill slopes should be designed and constructed at a gradient of 2:1 (h:v), or flatter. Compaction of slopes should be accomplished by over-building a minimum of 3 feet horizontally, and subsequently trimming back to the design slope configuration. Testing shall be performed as the fill is elevated to evaluate compaction as the fill core is being developed. Special efforts may be necessary to attain the specified compaction in the fill slope zone. Final slope shaping should be performed by trimming and removing loose materials with appropriate equipment. A final evaluation of fill slope compaction should be based on observation and/or testing of the finished slope face. Where compacted fill slopes are designed steeper than 2:1 (h:v), prior approval from the governing agency, specific material types, a higher minimum relative compaction, special reinforcement, and special grading procedures will be recommended.

If an alternative to over-building and cutting back the compacted fill slopes is selected, then special effort should be made to achieve the required compaction in the outer 10 feet of each lift of fill by undertaking the following:

1. An extra piece of equipment consisting of a heavy, short-shanked sheepsfoot should be used to roll (horizontal) parallel to the slopes continuously as fill is placed. The sheepsfoot roller should also be used to roll perpendicular to the slopes, and extend out over the slope to provide adequate compaction to the face of the slope.

2. Loose fill should not be spilled out over the face of the slope as each lift is compacted. Any loose fill spilled over a previously completed slope face should be trimmed off or be subject to re-rolling.

3. Field compaction tests will be made in the outer (horizontal) ±2 to ±8 feet of the slope at appropriate vertical intervals, subsequent to compaction operations.

4. After completion of the slope, the slope face should be shaped with a small tractor and then re-rolled with a sheepsfoot to achieve compaction to near the slope face. Subsequent to testing to evaluate compaction, the slopes should be grid-rolled to achieve compaction to the slope face. Final testing should be used to evaluate compaction after grid rolling.

5. Where testing indicates less than adequate compaction, the contractor will be responsible to rip, water, mix, and recompact the slope material as necessary to achieve compaction. Additional testing should be performed to evaluate compaction.

SUBDRAIN INSTALLATION

Subdrains should be installed in approved ground in accordance with the approximate alignment and details indicated by the geotechnical consultant. Subdrain locations or materials should not be changed or modified without approval of the geotechnical consultant. The geotechnical consultant may recommend and direct changes in subdrain line, grade, and drain material in the field, pending exposed conditions. The location of constructed subdrains, especially the outlets, should be recorded/surveyed by the project civil engineer. Drainage at the subdrain outlets should be provided by the project civil engineer.

EXCAVATIONS

Excavations and cut slopes should be examined during grading by the geotechnical consultant. If directed by the geotechnical consultant, further excavations or overexcavation and refilling of cut areas should be performed, and/or remedial grading of cut slopes should be performed. When fill-over-cut slopes are to be graded, unless otherwise approved, the cut portion of the slope should be observed by the geotechnical consultant prior to placement of materials for construction of the fill portion of the slope. The geotechnical consultant should observe all cut slopes, and should be notified by the contractor when excavation of cut slopes commence.

If, during the course of grading, unforeseen adverse or potentially adverse geologic conditions are encountered, the geotechnical consultant should investigate, evaluate, and make appropriate recommendations for mitigation of these conditions. The need for cut slope buttressing or stabilizing should be based on in-grading evaluation by the geotechnical consultant, whether anticipated or not.

Unless otherwise specified in geotechnical and geological report(s), no cut slopes should be excavated higher or steeper than that allowed by the ordinances of controlling

governmental agencies. Additionally, short-term stability of temporary cut slopes is the contractor's responsibility.

Erosion control and drainage devices should be designed by the project civil engineer and should be constructed in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the geotechnical consultant.

COMPLETION

Observation, testing, and consultation by the geotechnical consultant should be conducted during the grading operations in order to state an opinion that all cut and fill areas are graded in accordance with the approved project specifications. After completion of grading, and after the geotechnical consultant has finished observations of the work, final reports should be submitted, and may be subject to review by the controlling governmental agencies. No further excavation or filling should be undertaken without prior notification of the geotechnical consultant or approved plans.

All finished cut and fill slopes should be protected from erosion and/or be planted in accordance with the project specifications and/or as recommended by a landscape architect. Such protection and/or planning should be undertaken as soon as practical after completion of grading.

JOB SAFETY

General

At GSI, getting the job done safely is of primary concern. The following is the company's safety considerations for use by all employees on multi-employer construction sites. On-ground personnel are at highest risk of injury, and possible fatality, on grading and construction projects. GSI recognizes that construction activities will vary on each site, and that site safety is the prime responsibility of the contractor; however, everyone must be safety conscious and responsible at all times. To achieve our goal of avoiding accidents, cooperation between the client, the contractor, and GSI personnel must be maintained.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of field personnel on grading and construction projects:

Safety Meetings: GSI field personnel are directed to attend contractor's regularly scheduled and documented safety meetings.

Safety Vests: Safety vests are provided for, and are to be worn by GSI personnel, at all times, when they are working in the field.

Safety Flags: Two safety flags are provided to GSI field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

Flashing Lights: All vehicles stationary in the grading area shall use rotating or flashing amber beacons, or strobe lights, on the vehicle during all field testing. While operating a vehicle in the grading area, the emergency flasher on the vehicle shall be activated.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

Test Pits Location, Orientation, and Clearance

The technician is responsible for selecting test pit locations. A primary concern should be the technician's safety. Efforts will be made to coordinate locations with the grading contractor's authorized representative, and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractor's authorized representative (supervisor, grade checker, dump man, operator, etc.) should direct excavation of the pit and safety during the test period. Of paramount concern should be the soil technician's safety, and obtaining enough tests to represent the fill.

Test pits should be excavated so that the spoil pile is placed away from oncoming traffic, whenever possible. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates the fill be maintained in a driveable condition. Alternatively, the contractor may wish to park a piece of equipment in front of the test holes, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits. No grading equipment should enter this zone during the testing procedure. The zone should extend approximately 50 feet outward from the center of the test pit. This zone is established for safety and to avoid excessive ground vibration, which typically decreases test results.

When taking slope tests, the technician should park the vehicle directly above or below the test location. If this is not possible, a prominent flag should be placed at the top of the slope. The contractor's representative should effectively keep all equipment at a safe operational distance (e.g., 50 feet) away from the slope during this testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location, well away from the equipment traffic pattern. The contractor should inform our personnel of all changes to haul roads, cut and fill areas or other factors that may affect site access and site safety.

In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is required, by company

policy, to immediately withdraw and notify his/her supervisor. The grading contractor's representative will be contacted in an effort to affect a solution. However, in the interim, no further testing will be performed until the situation is rectified. Any fill placed can be considered unacceptable and subject to reprocessing, recompaction, or removal.

In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to the technician's attention and notify this office. Effective communication and coordination between the contractor's representative and the soil technician is strongly encouraged in order to implement the above safety plan.

Trench and Vertical Excavation

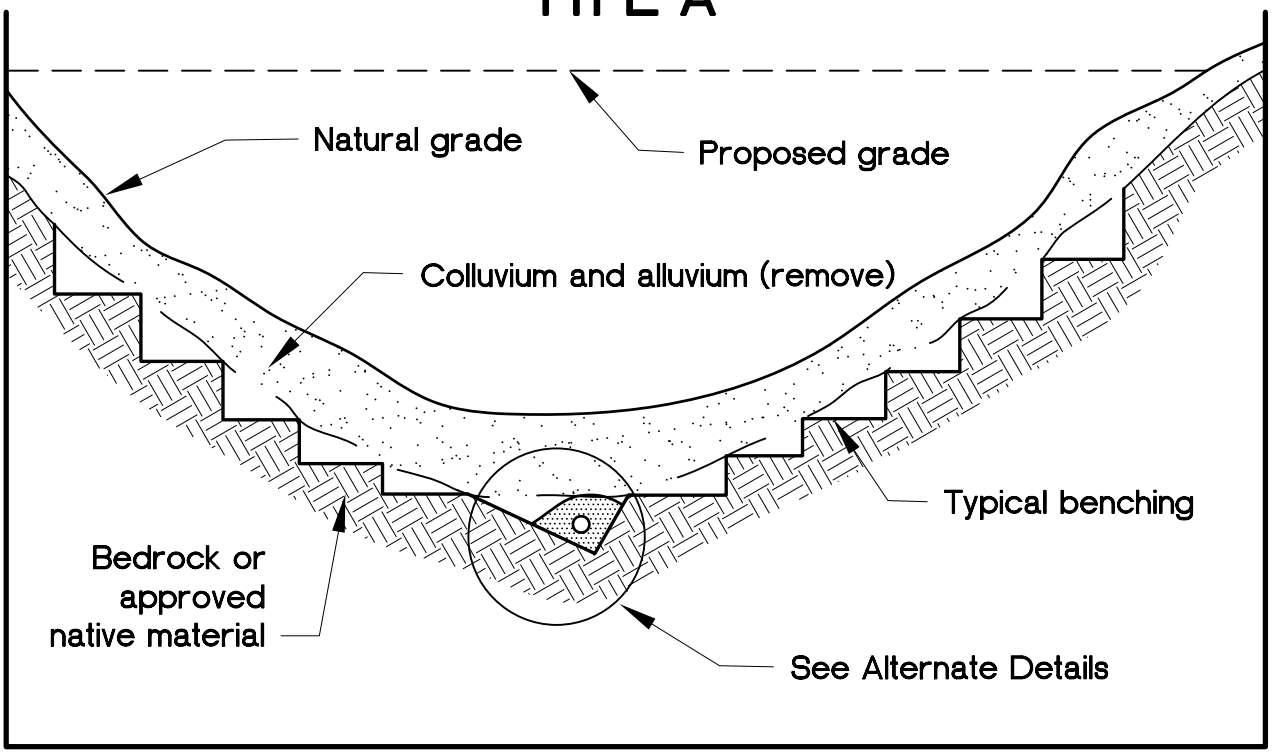
It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Our personnel are directed not to enter any excavation or vertical cut which: 1) is 5 feet or deeper unless shored or laid back; 2) displays any evidence of instability, has any loose rock or other debris which could fall into the trench; or 3) displays any other evidence of any unsafe conditions regardless of depth.

All trench excavations or vertical cuts in excess of 5 feet deep, which any person enters, should be shored or laid back. Trench access should be provided in accordance with Cal/OSHA and/or state and local standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

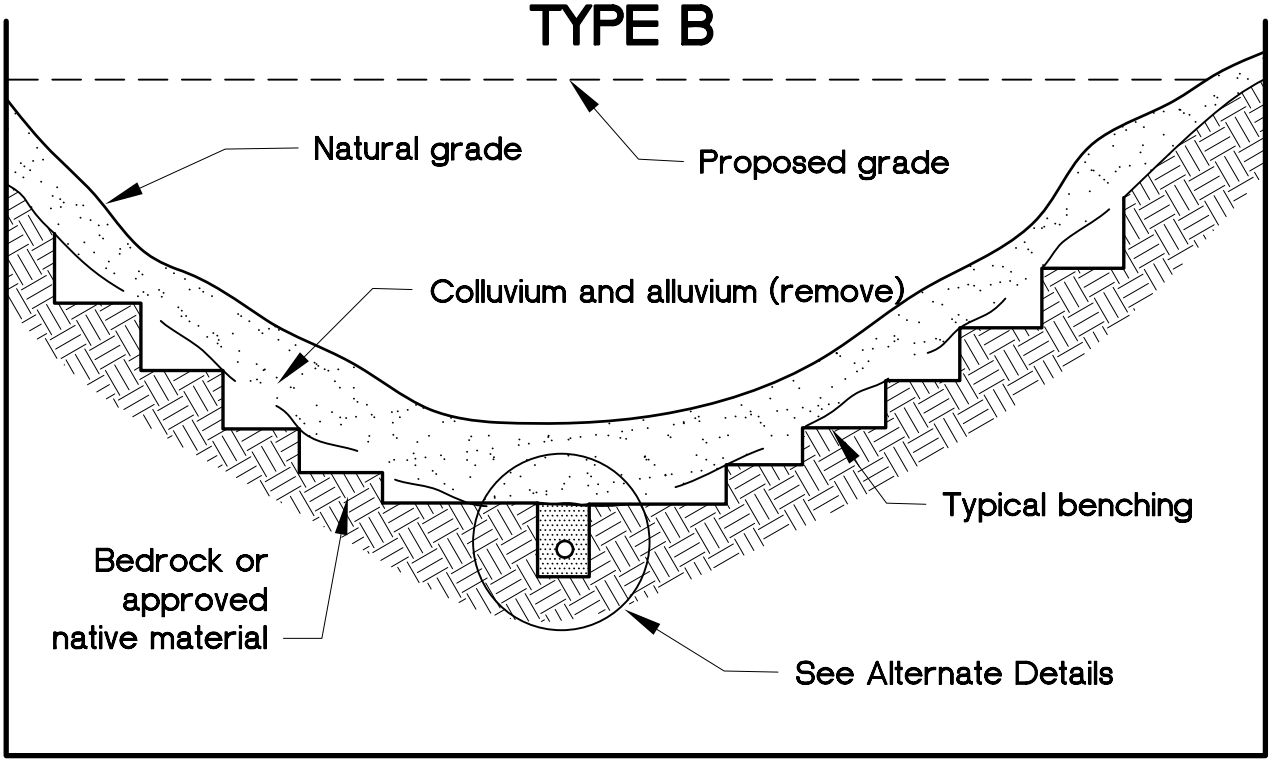
If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraw and notify his/her supervisor. The contractor's representative will be contacted in an effort to affect a solution. All backfill not tested due to safety concerns or other reasons could be subject to reprocessing and/or removal.

If GSI personnel become aware of anyone working beneath an unsafe trench wall or vertical excavation, we have a legal obligation to put the contractor and owner/developer on notice to immediately correct the situation. If corrective steps are not taken, GSI then has an obligation to notify Cal/OSHA and/or the proper controlling authorities.

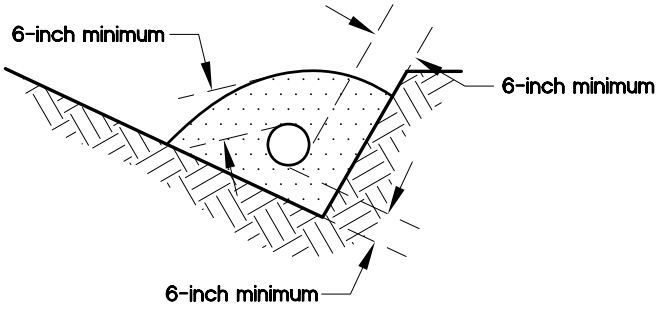
TYPE A



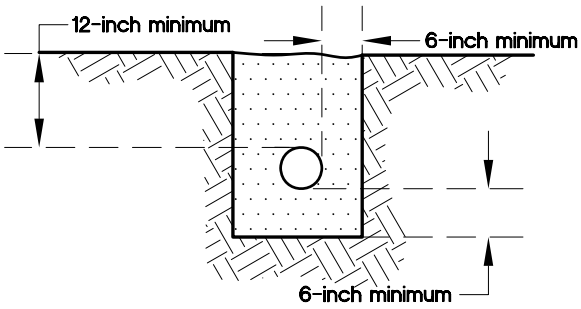
TYPE B



Selection of alternate subdrain details, location, and extent of subdrains should be evaluated by the geotechnical consultant during grading.



A-1



B-1

Filter material: Minimum volume of 9 cubic feet per lineal foot of pipe.

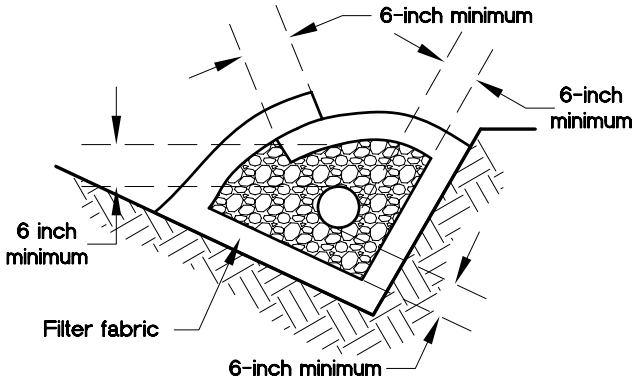
Perforated pipe: 6-inch-diameter ABS or PVC pipe or approved substitute with minimum 8 perforations (¼-inch diameter) per lineal foot in bottom half of pipe (ASTM D-2751, SDR-35, or ASTM D-1527, Schd. 40).

For continuous run in excess of 500 feet, use 8-inch-diameter pipe (ASTM D-3034, SDR-35, or ASTM D-1785, Schd. 40).

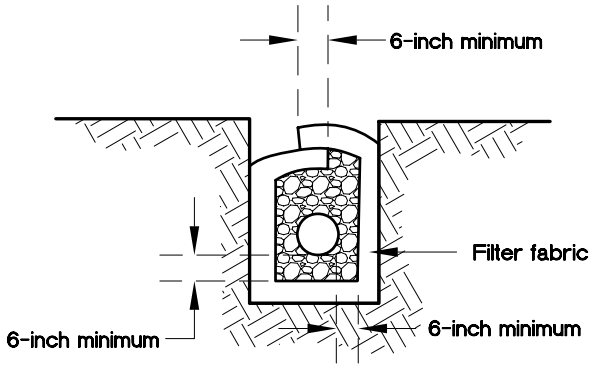
FILTER MATERIAL

Sieve Size	Percent Passing
1 inch	100
¾ inch	90-100
⅜ inch	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

ALTERNATE 1: PERFORATED PIPE AND FILTER MATERIAL



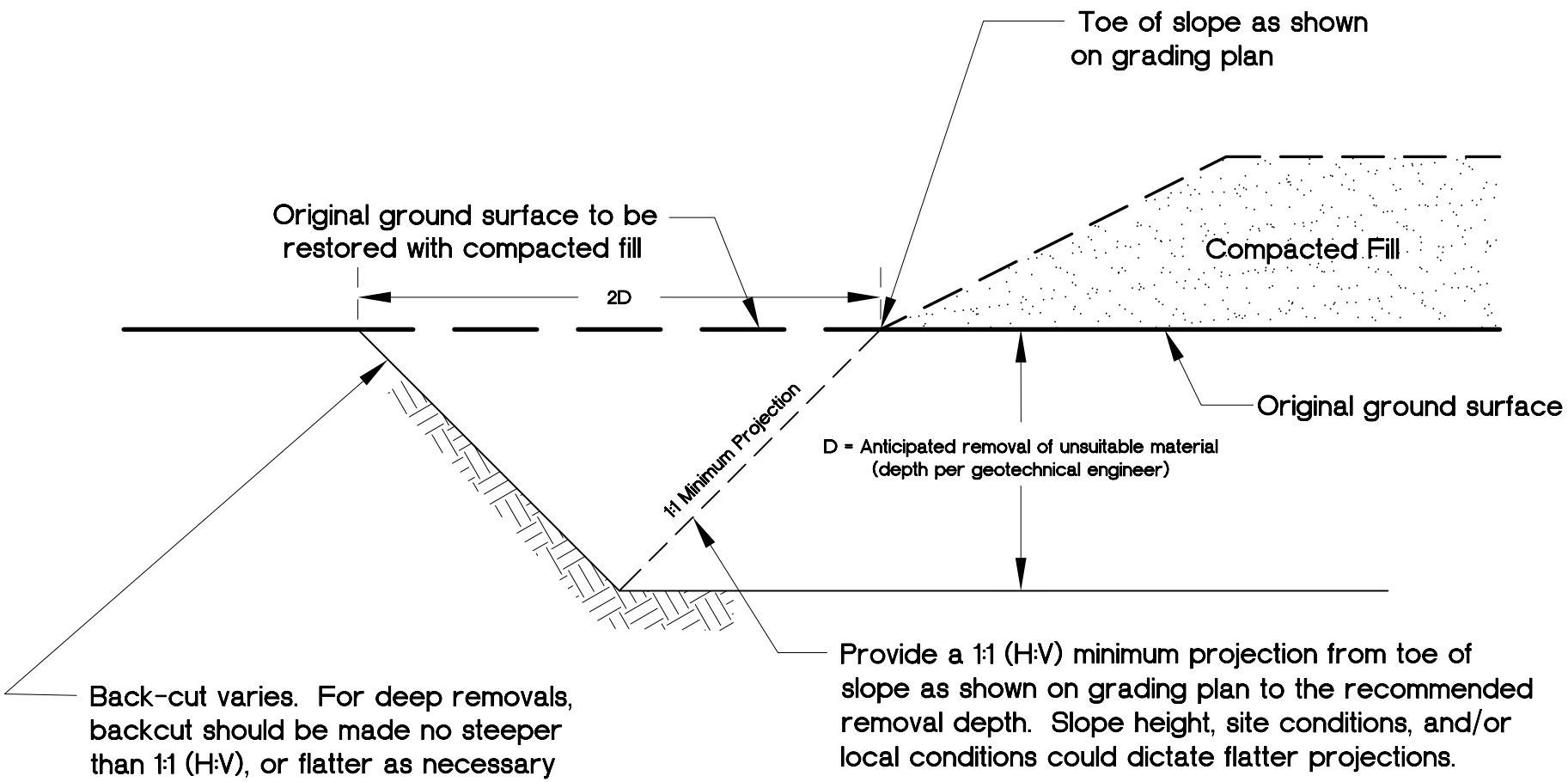
A-2



B-2

Gravel Material: 9 cubic feet per lineal foot.
Perforated Pipe: See Alternate 1
Gravel: Clean ¾-inch rock or approved substitute.
Filter Fabric: Mirafi 140 or approved substitute.

ALTERNATE 2: PERFORATED PIPE, GRAVEL, AND FILTER FABRIC



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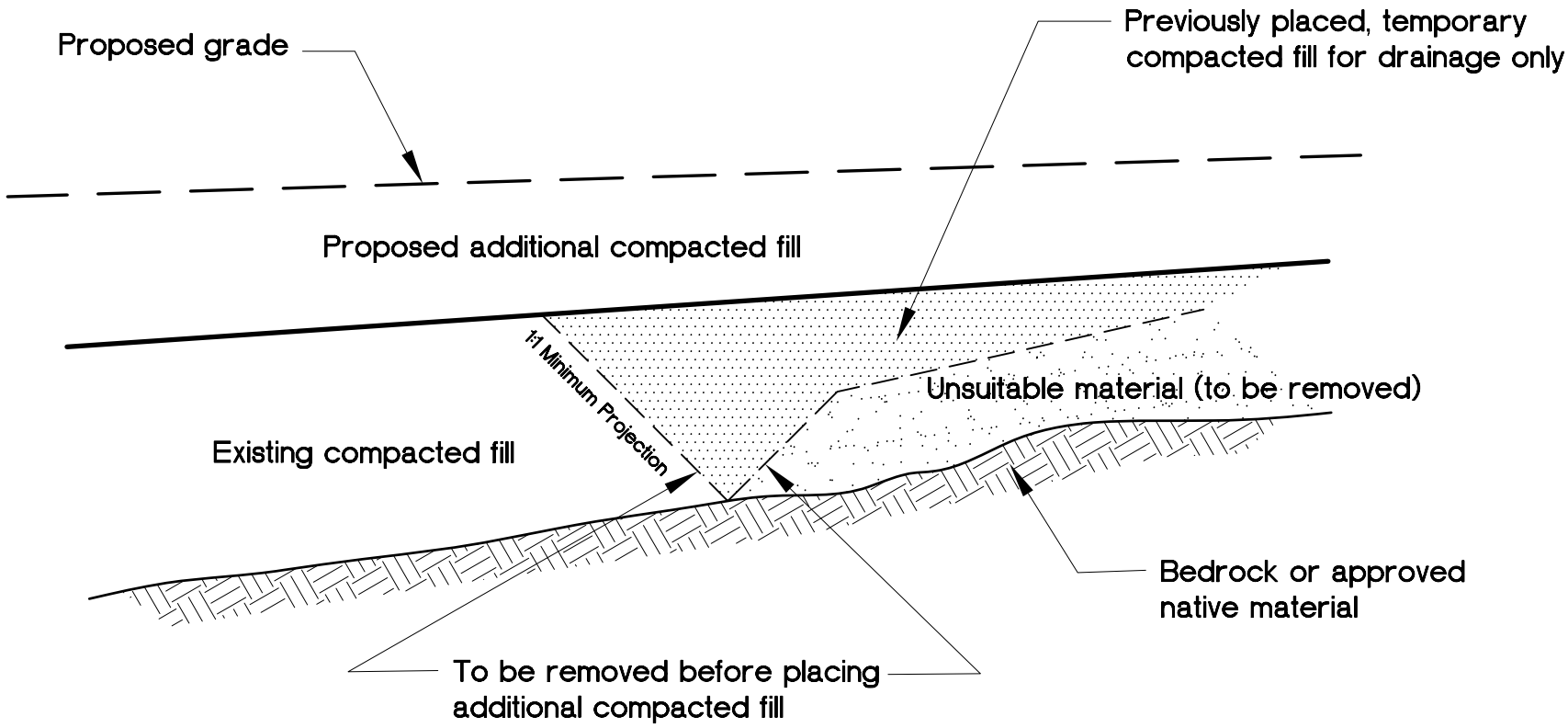
FILL SLOPE TOEING OUT ON FLAT ALLUVIATED CANYON DETAIL

Plate D-3



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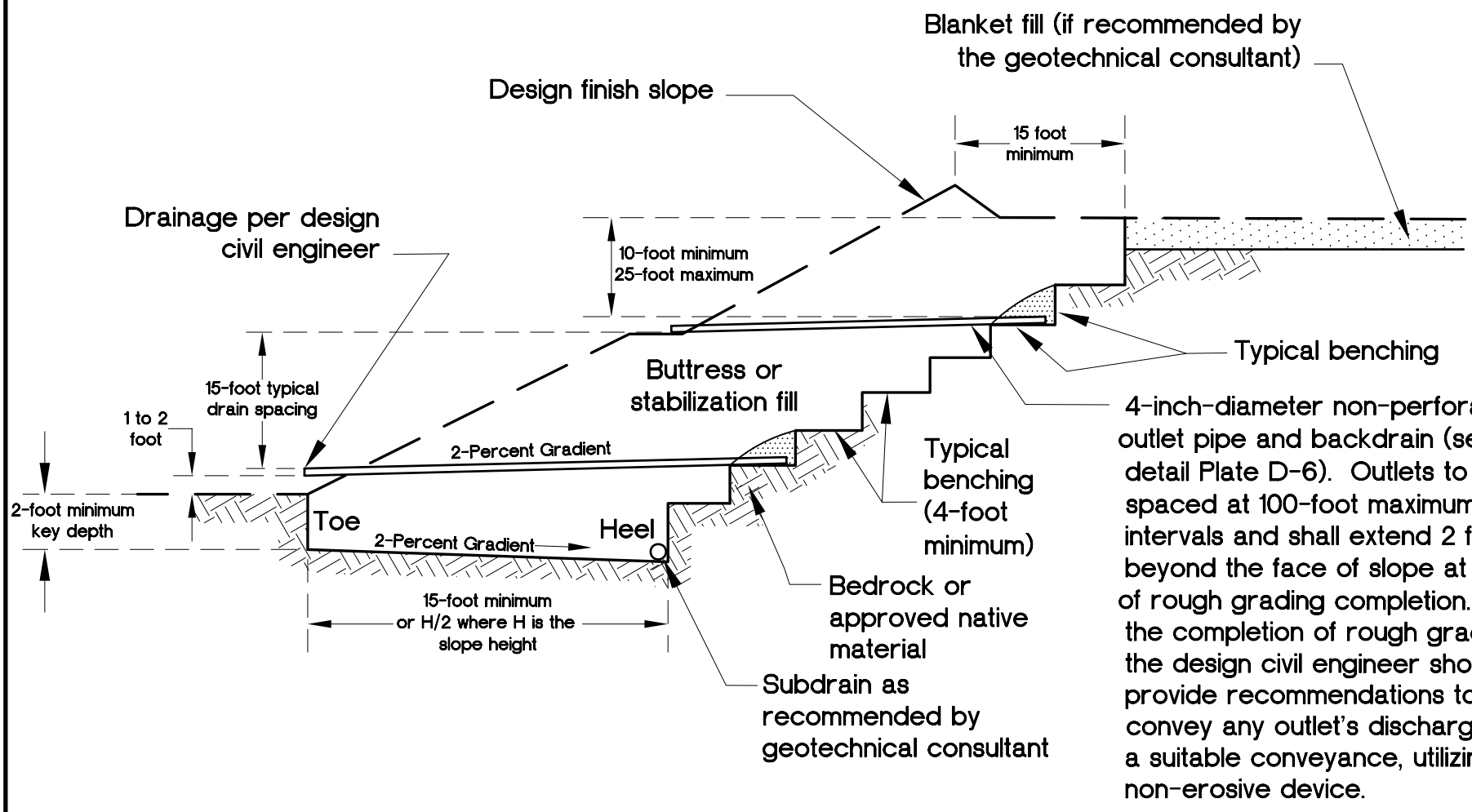
REMOVAL ADJACENT TO EXISTING FILL ADJOINING CANYON FILL DETAIL

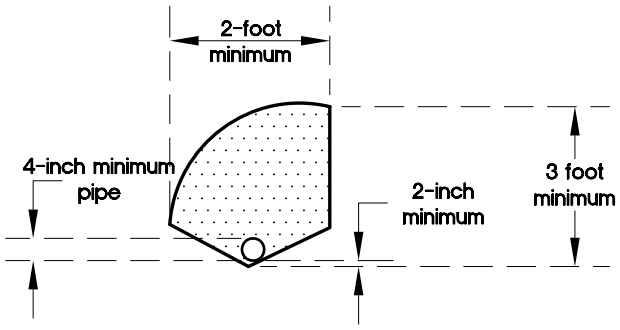
Plate D-4

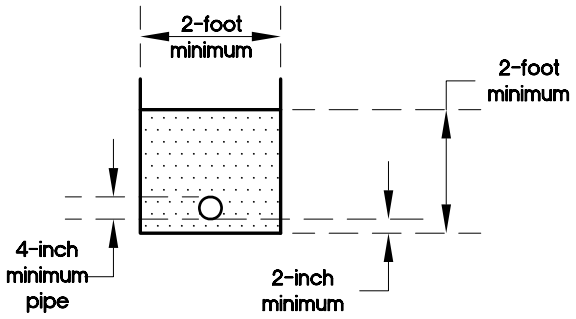


GeoSoils, Inc.

TYPICAL STABILIZATION / BUTTRESS FILL DETAIL

Plate D-5





Filter Material: Minimum of 5 cubic feet per lineal foot of pipe or 4 cubic feet per lineal feet of pipe when placed in square cut trench.

Alternative in Lieu of Filter Material: Gravel may be encased in approved filter fabric. Filter fabric shall be Mirafi 140 or equivalent. Filter fabric shall be lapped a minimum of 12 inches in all joints.

Minimum 4-Inch-Diameter Pipe: ABS-ASTM D-2751, SDR 35; or ASTM D-1527 Schedule 40, PVC-ASTM D-3034, SDR 35; or ASTM D-1785 Schedule 40 with a crushing strength of 1,000 pounds minimum, and a minimum of 8 uniformly-spaced perforations per foot of pipe. Must be installed with perforations down at bottom of pipe. Provide cap at upstream end of pipe. Slope at 2 percent to outlet pipe. Outlet pipe to be connected to subdrain pipe with tee or elbow.

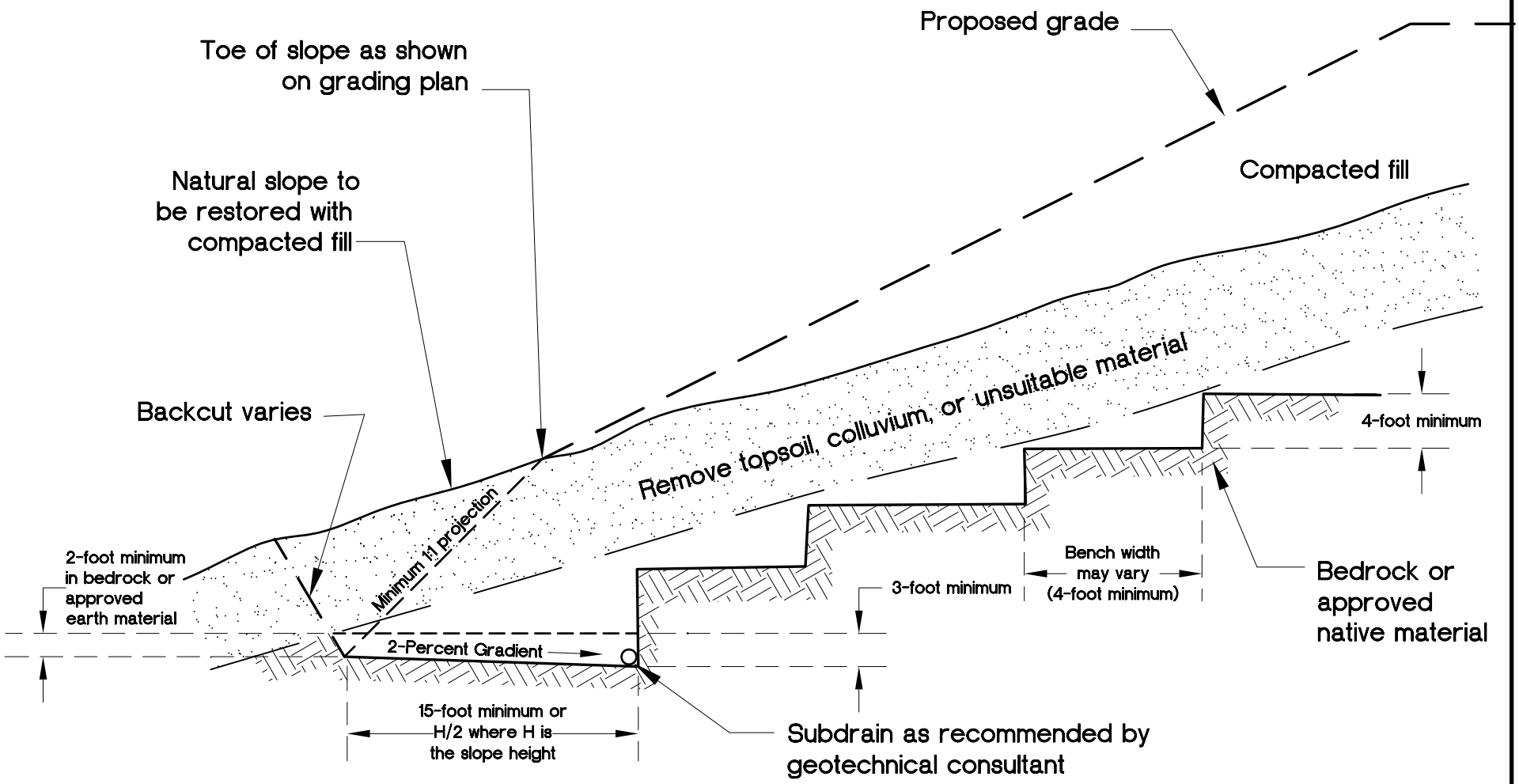
Notes:
1. Trench for outlet pipes to be backfilled and compacted with onsite soil.
2. Backdrains and lateral drains shall be located at elevation of every bench drain. First drain located at elevation just above lower lot grade. Additional drains may be required at the discretion of the geotechnical consultant.

Filter Material shall be of the following specification or an approved equivalent.

Sieve Size	Percent Passing
1 inch	100
¾ inch	90-100
⅜ inch	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

Gravel shall be of the following specification or an approved equivalent.

Sieve Size	Percent Passing
1½ inch	100
No. 4	50
No. 200	8

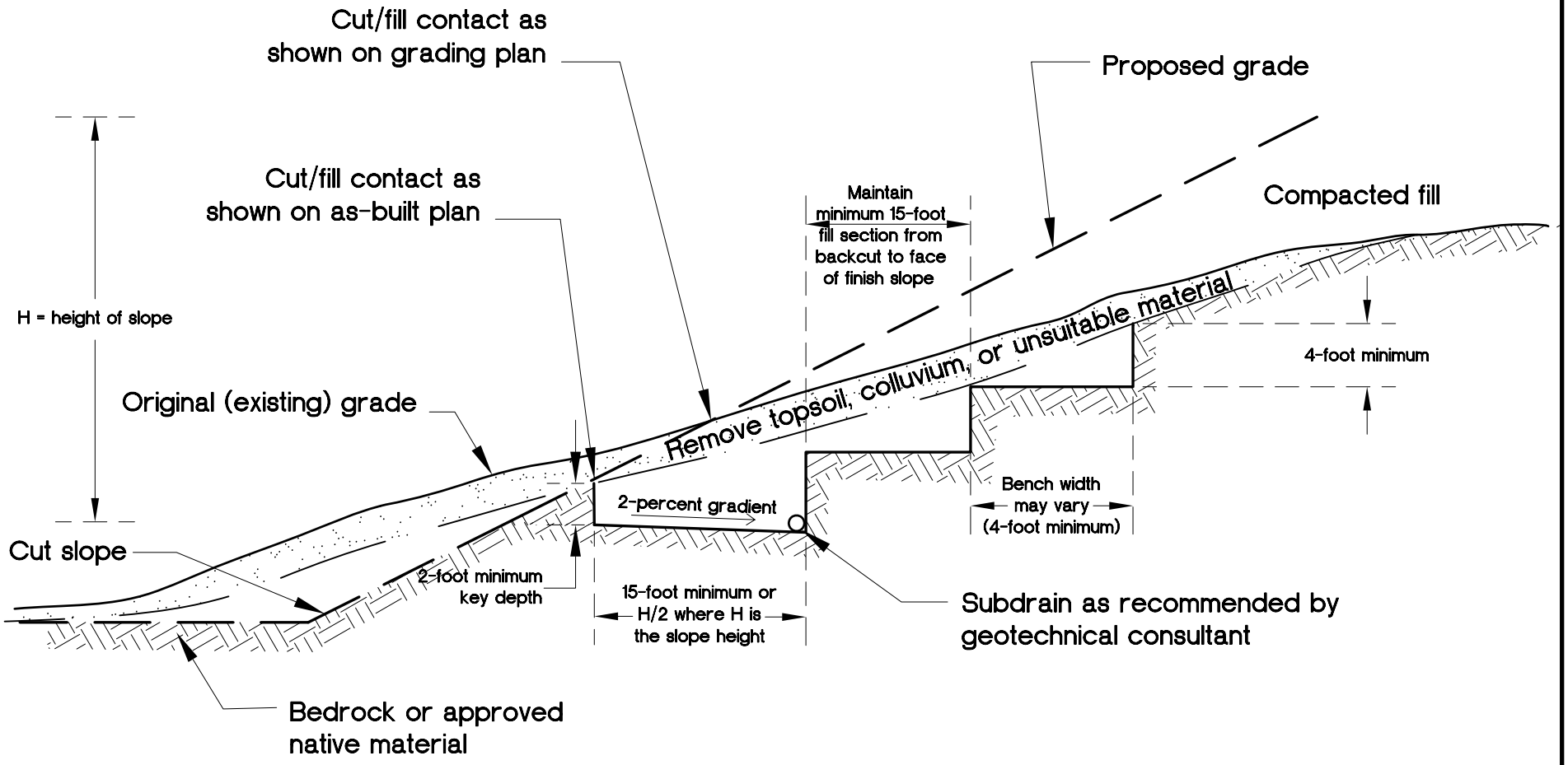


NOTES:

1. Where the natural slope approaches or exceeds the design slope ratio, special recommendations would be provided by the geotechnical consultant.

2. The need for and disposition of drains should be evaluated by the geotechnical consultant, based upon exposed conditions.

GeoSoils, Inc.	FILL OVER NATURAL (SIDEHILL FILL) DETAIL	Plate D-7

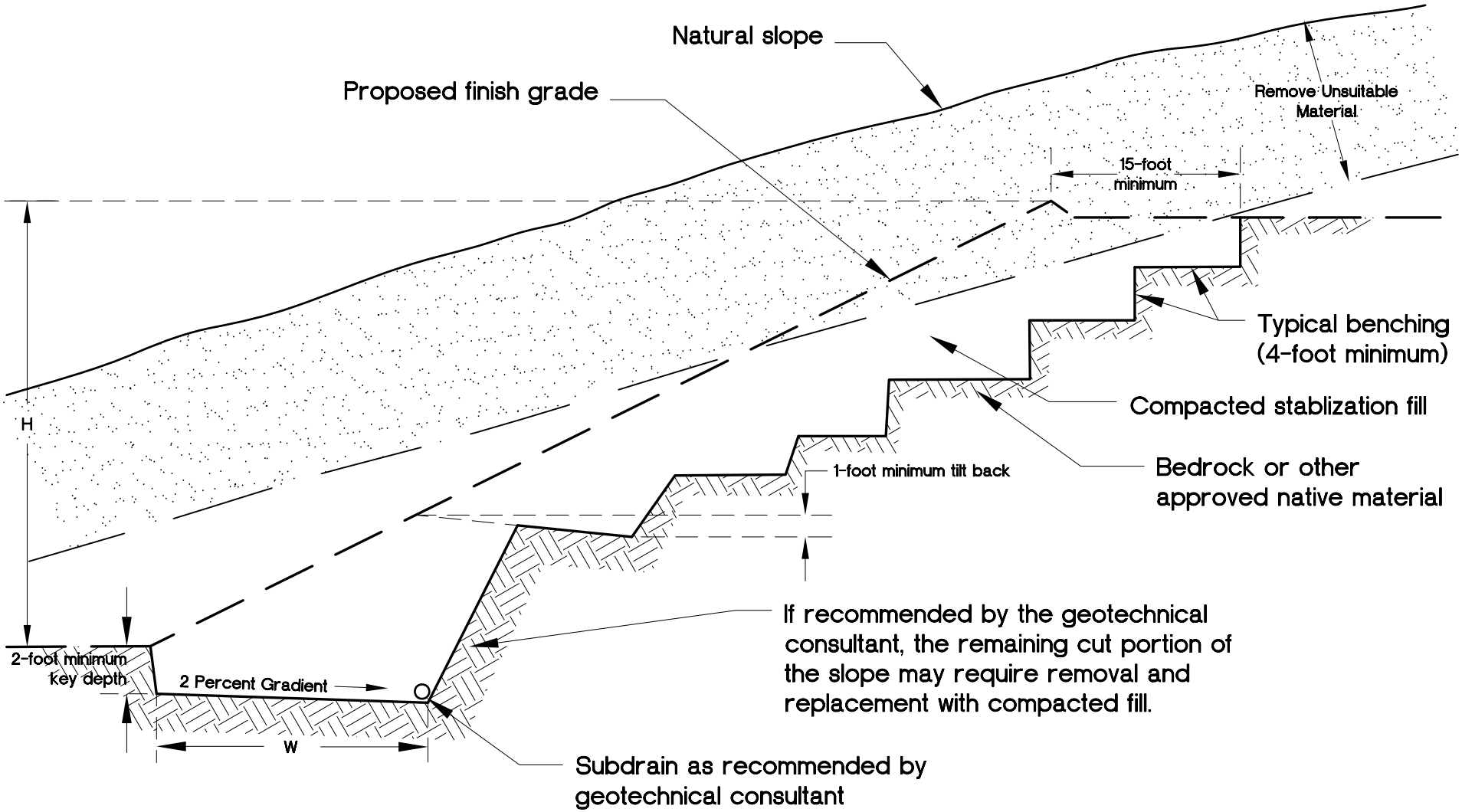


NOTE: The cut portion of the slope should be excavated and evaluated by the geotechnical consultant prior to construction of the fill portion.

GeoSoils, Inc.

FILL OVER CUT DETAIL

Plate D-8

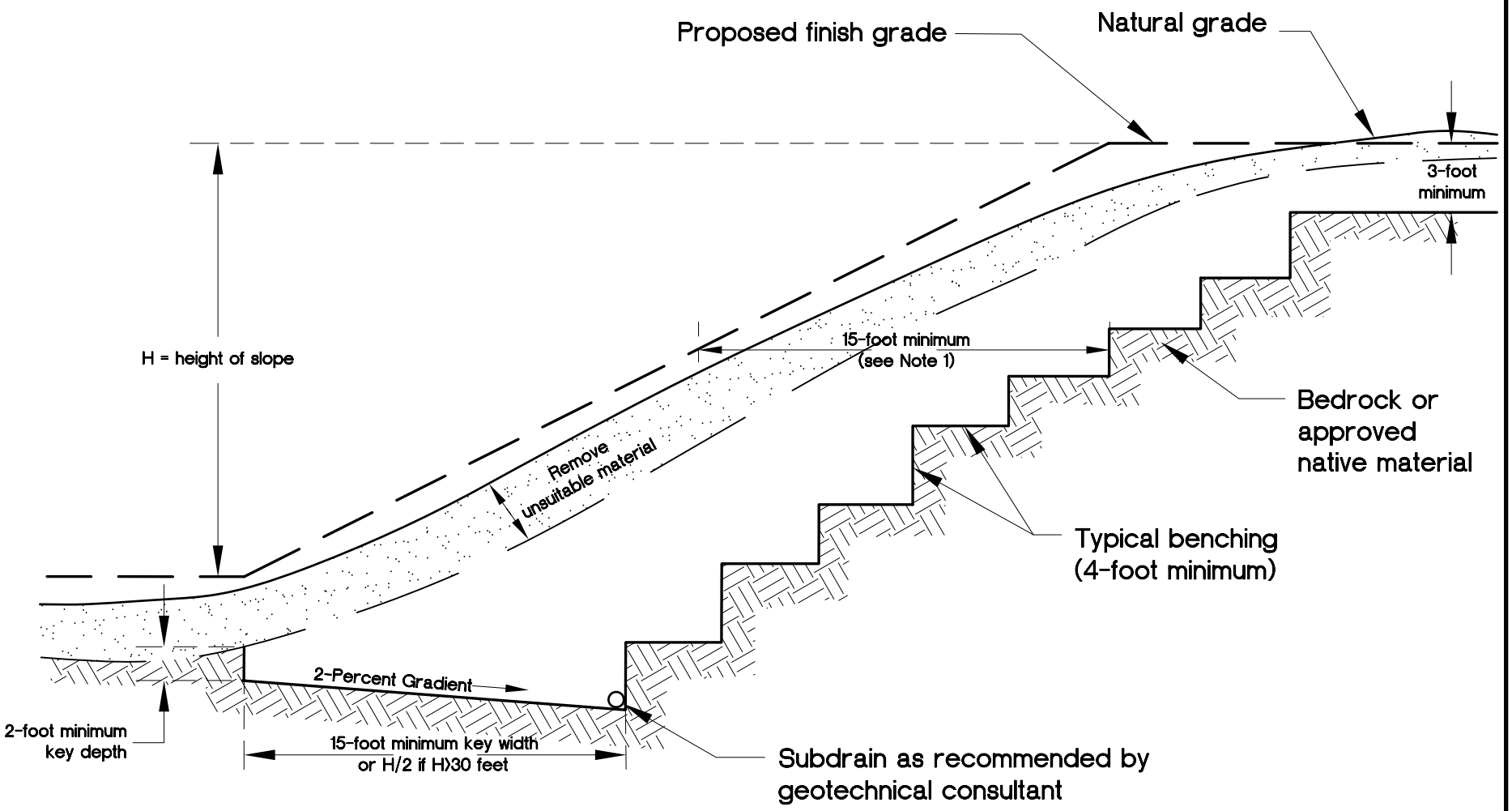


NOTES:

1. Subdrains may be required as specified by the geotechnical consultant.

2. W shall be equipment width (15 feet) for slope heights less than 25 feet. For slopes greater than 25 feet, W shall be evaluated by the geotechnical consultant. At no time, shall W be less than H/2, where H is the height of the slope.

GeoSoils, Inc.	STABLIZATION FILL FOR UNSTABLE MATERIAL EXPOSED IN CUT SLOPE DETAIL	Plate D-9



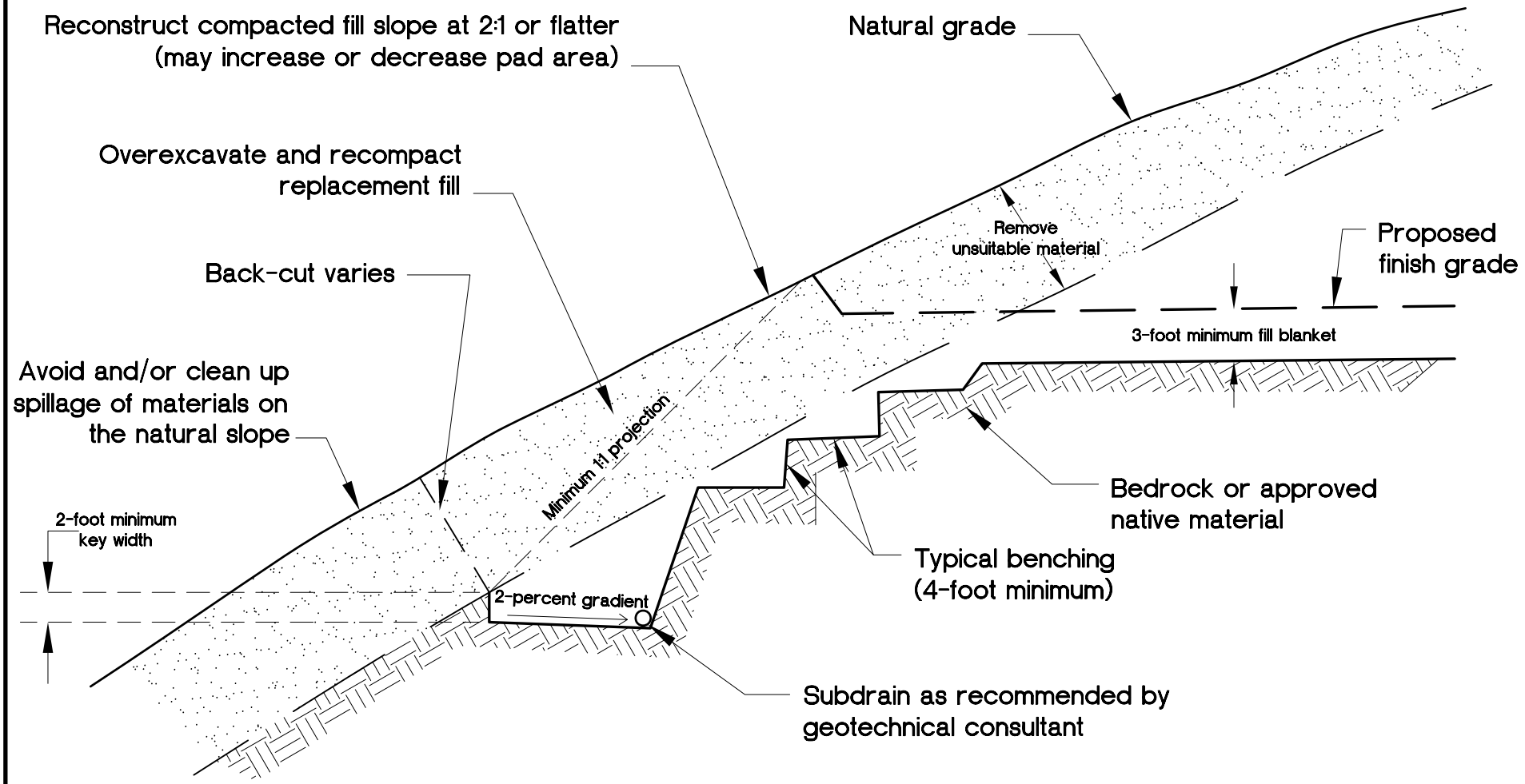
NOTES:

1. 15-foot minimum to be maintained from proposed finish slope face to backcut.
2. The need and disposition of drains will be evaluated by the geotechnical consultant based on field conditions.
3. Pad overexcavation and recompaction should be performed if evaluated to be necessary by the geotechnical consultant.

GeoSoils, Inc.

SKIN FILL OF NATURAL GROUND DETAIL

Plate D–10



NOTES:

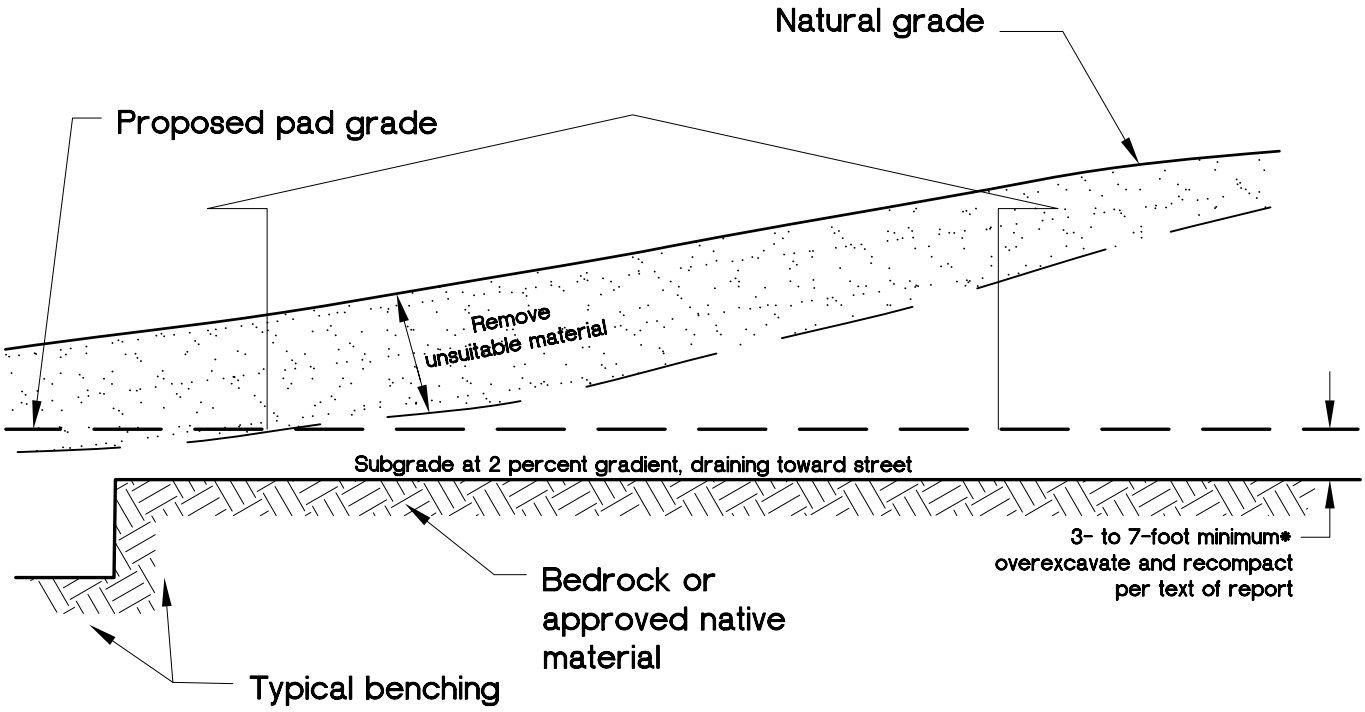
1. Subdrain and key width requirements will be evaluated based on exposed subsurface conditions and thickness of overburden.

2. Pad overexcavation and recompaction should be performed if evaluated necessary by the geotechnical consultant.

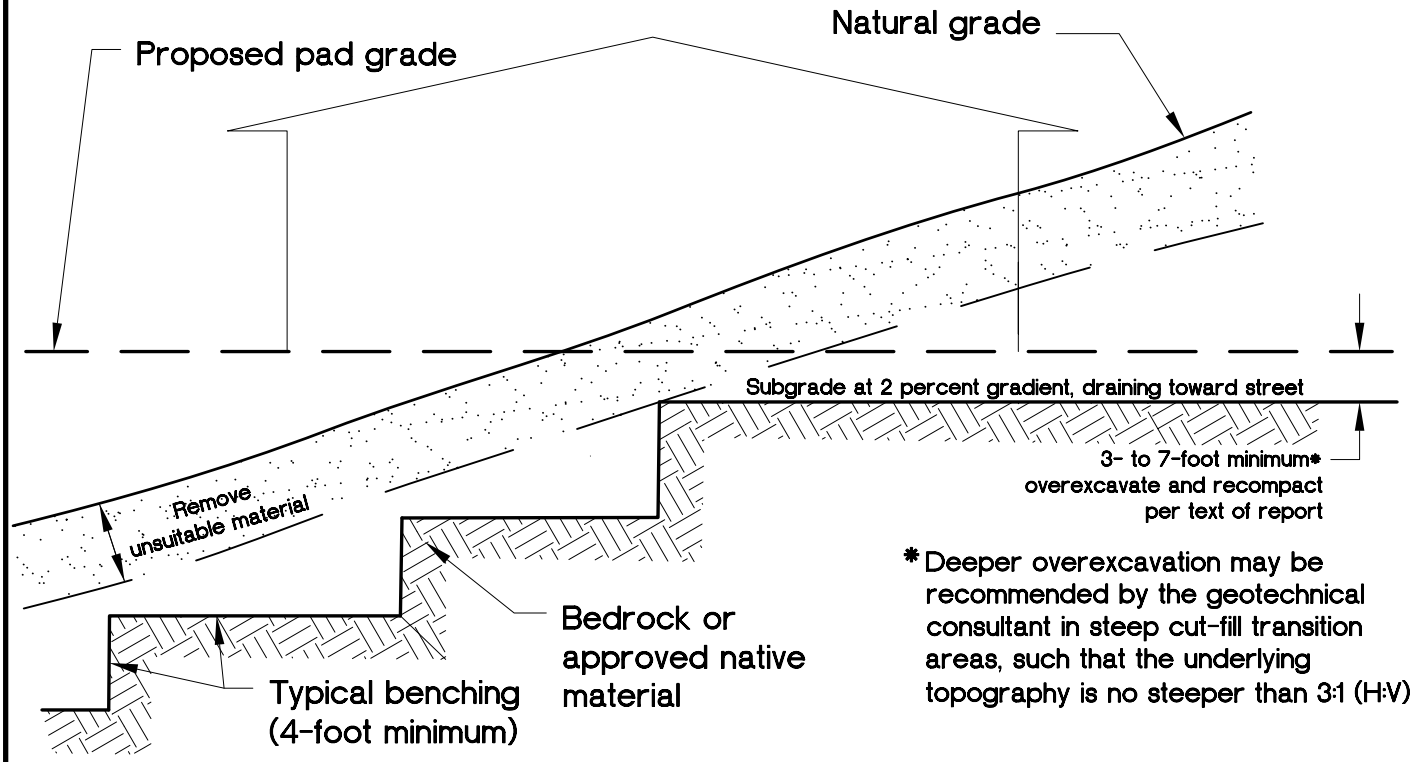
GeoSoils, Inc.

DAYLIGHT CUT LOT DETAIL

Plate D-11



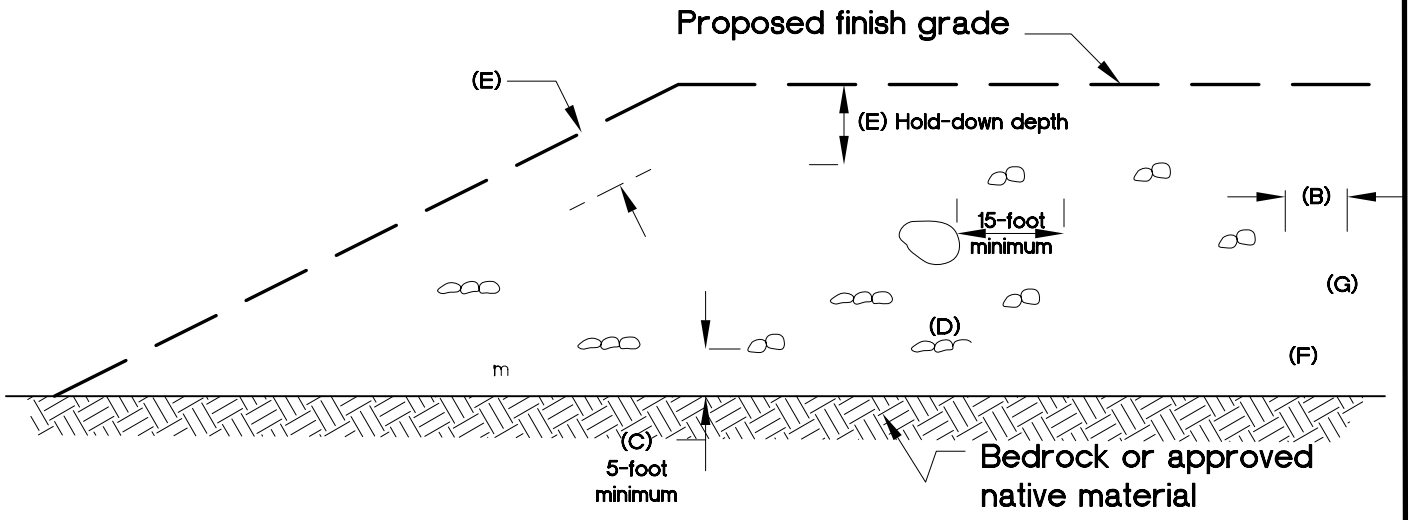
CUT LOT OR MATERIAL-TYPE TRANSITION



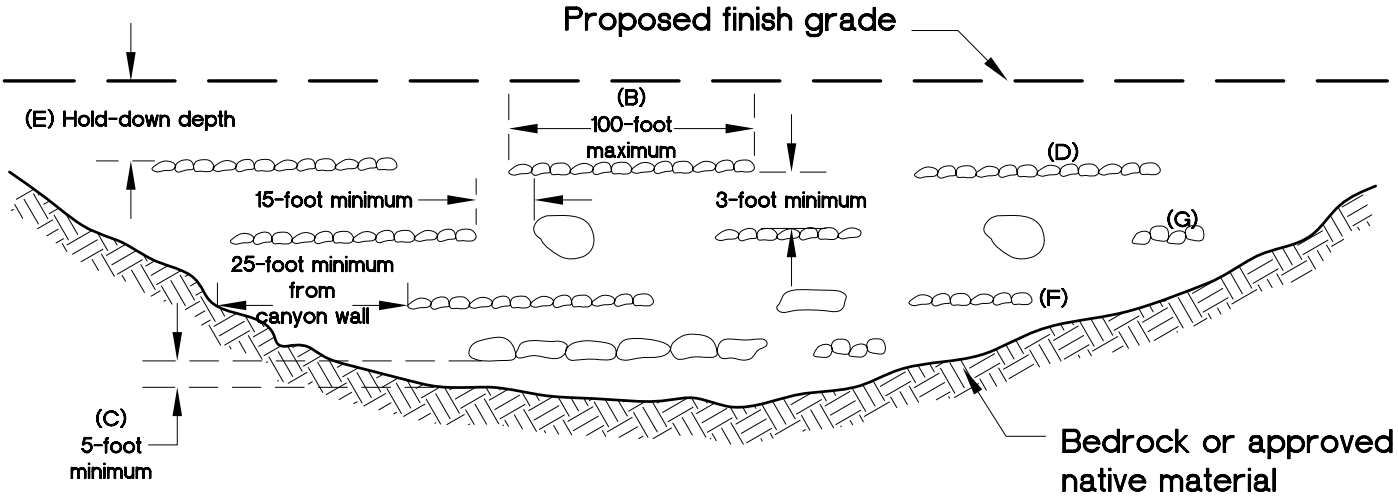
CUT-FILL LOT (DAYLIGHT TRANSITION)

GeoSoils, Inc.	TRANSITION LOT DETAILS	Plate D-12

VIEW NORMAL TO SLOPE FACE



VIEW PARALLEL TO SLOPE FACE



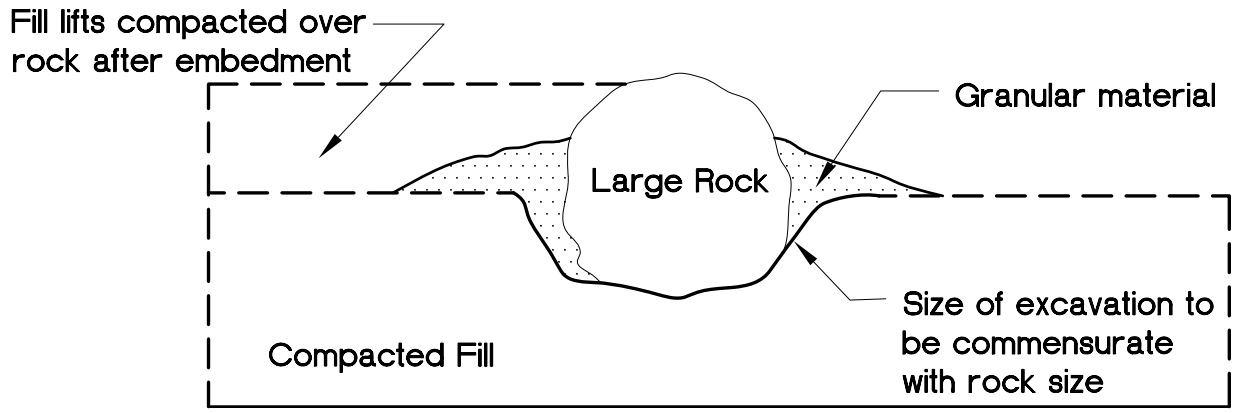
NOTES:

A. One equipment width or a minimum of 15 feet between rows (or windrows).
B. Height and width may vary depending on rock size and type of equipment. Length of windrow shall be no greater than 100 feet.
C. If approved by the geotechnical consultant, windrows may be placed directly on competent material or bedrock, provided adequate space is available for compaction.
D. Orientation of windrows may vary but should be as recommended by the geotechnical engineer and/or engineering geologist. Staggering of windrows is not necessary unless recommended.
E. Clear area for utility trenches, foundations, and swimming pools; Hold-down depth as specified in text of report, subject to governing agency approval.
F. All fill over and around rock windrow shall be compacted to at least 90 percent relative compaction or as recommended.
G. After fill between windrows is placed and compacted, with the lift of fill covering windrow, windrow should be proof rolled with a D-9 dozer or equivalent.

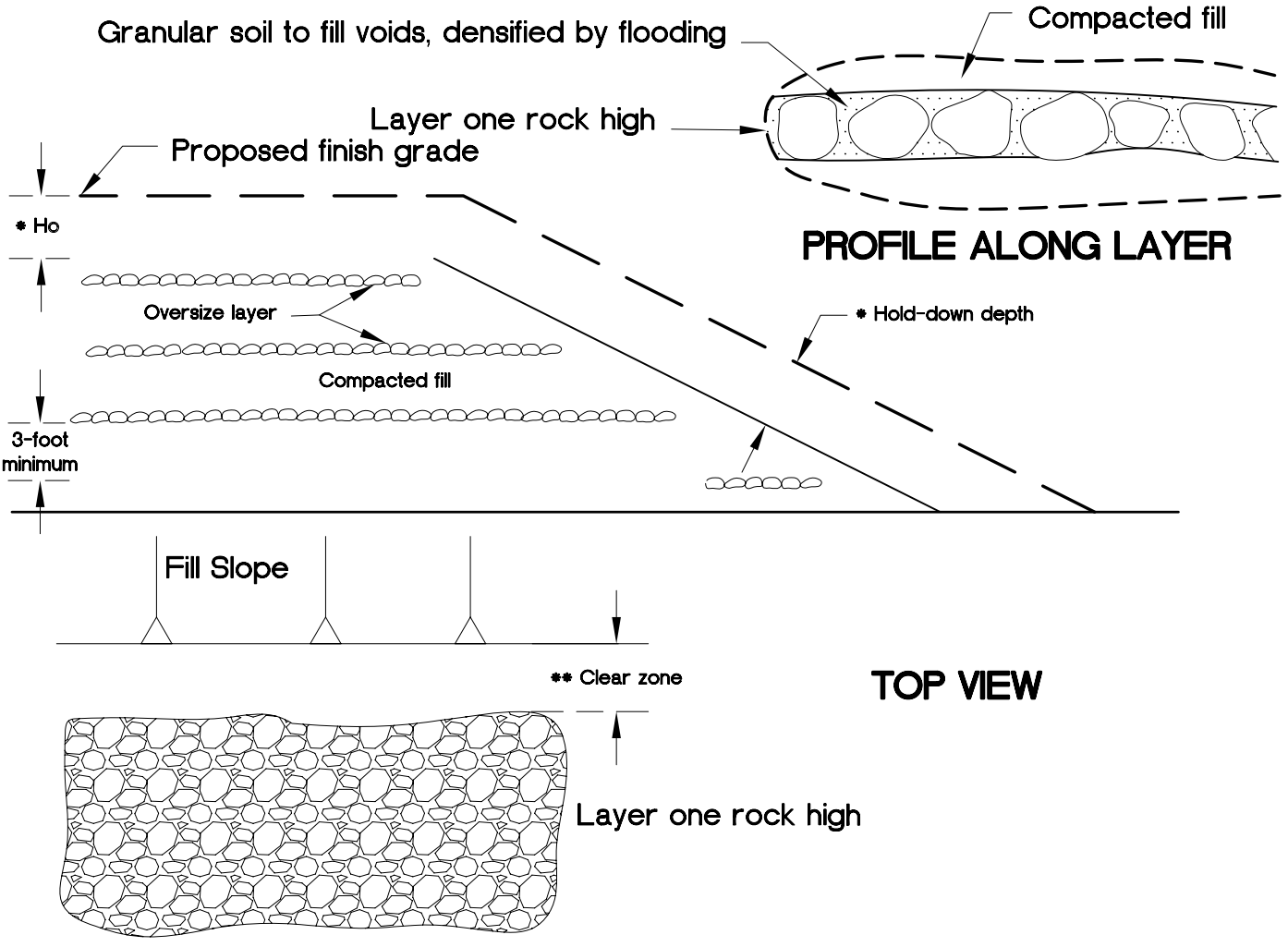
VIEWS ARE DIAGRAMMATIC ONLY AND MAY BE SUPERSEDED BY REPORT RECOMMENDATIONS OR CODE
ROCK SHOULD NOT TOUCH AND VOIDS SHOULD BE COMPLETELY FILLED

GeoSoils, Inc.	OVERSIZE ROCK DISPOSAL DETAIL	Plate D-13

ROCK DISPOSAL PITS



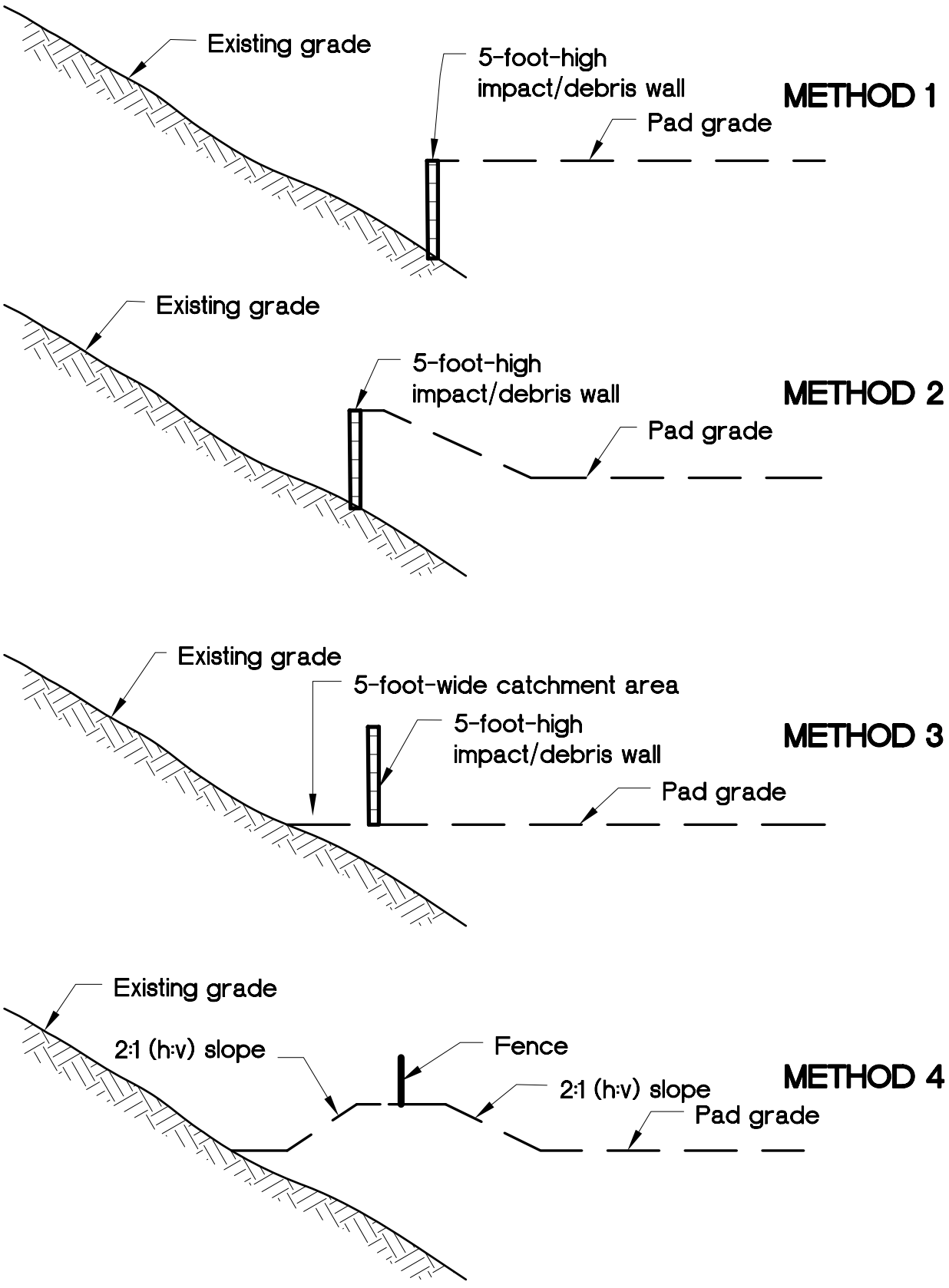
ROCK DISPOSAL LAYERS



* Hold-down depth or below lowest utility as specified in text of report, subject to governing agency approval.

** Clear zone for utility trenches, foundations, and swimming pools, as specified in text of report.

VIEWS ARE DIAGRAMMATIC ONLY AND MAY BE SUPERSEDED BY REPORT RECOMMENDATIONS OR CODE ROCK SHOULD NOT TOUCH AND VOIDS SHOULD BE COMPLETELY FILLED IN

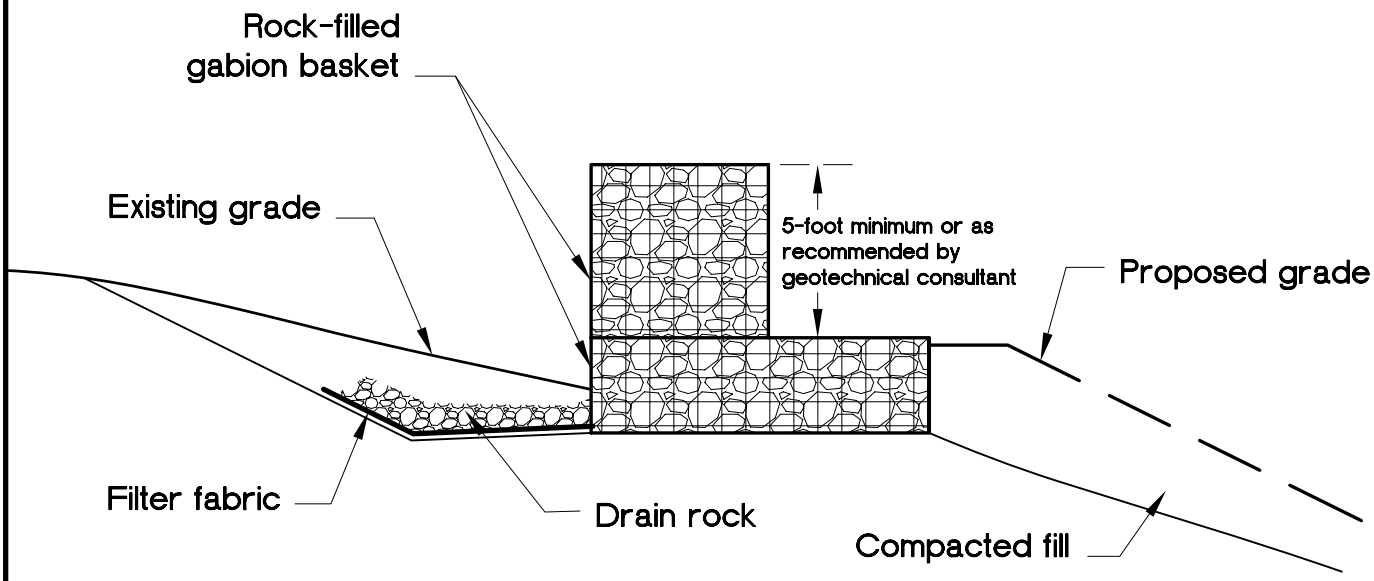


NOT TO SCALE

GeoSoils, Inc.

DEBRIS DEVICE CONTROL METHODS DETAIL

Plate D–15



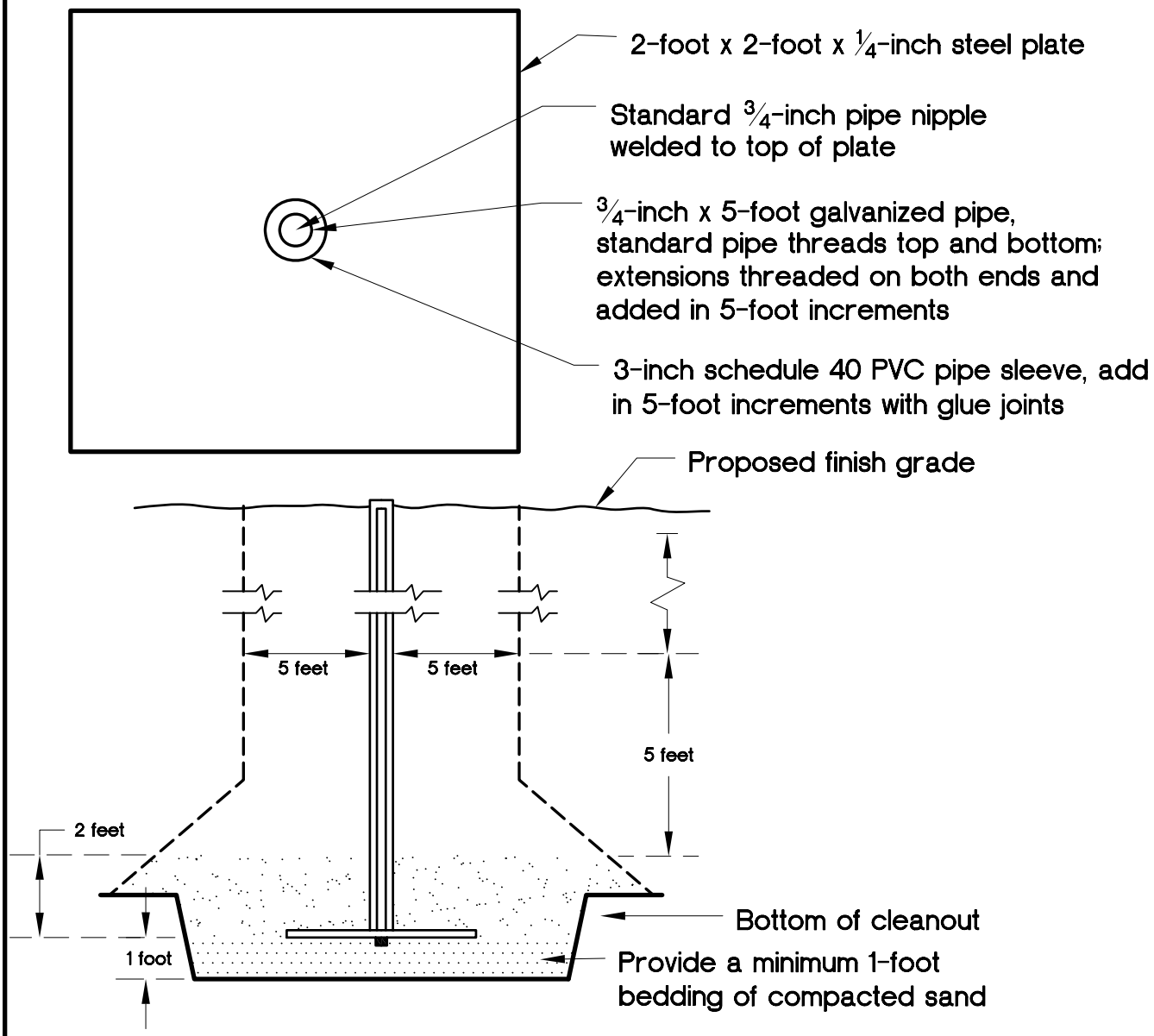
Gabion impact or diversion wall should be constructed at the base of the ascending slope subject to rock fall. Walls need to be constructed with high segments that sustain impact and mitigate potential for overtopping, and low segment that provides channelization of sediments and debris to desired depositional area for subsequent clean-out. Additional subdrain may be recommended by geotechnical consultant.

From GSA, 1987

GeoSoils, Inc.

ROCK FALL MITIGATION DETAIL

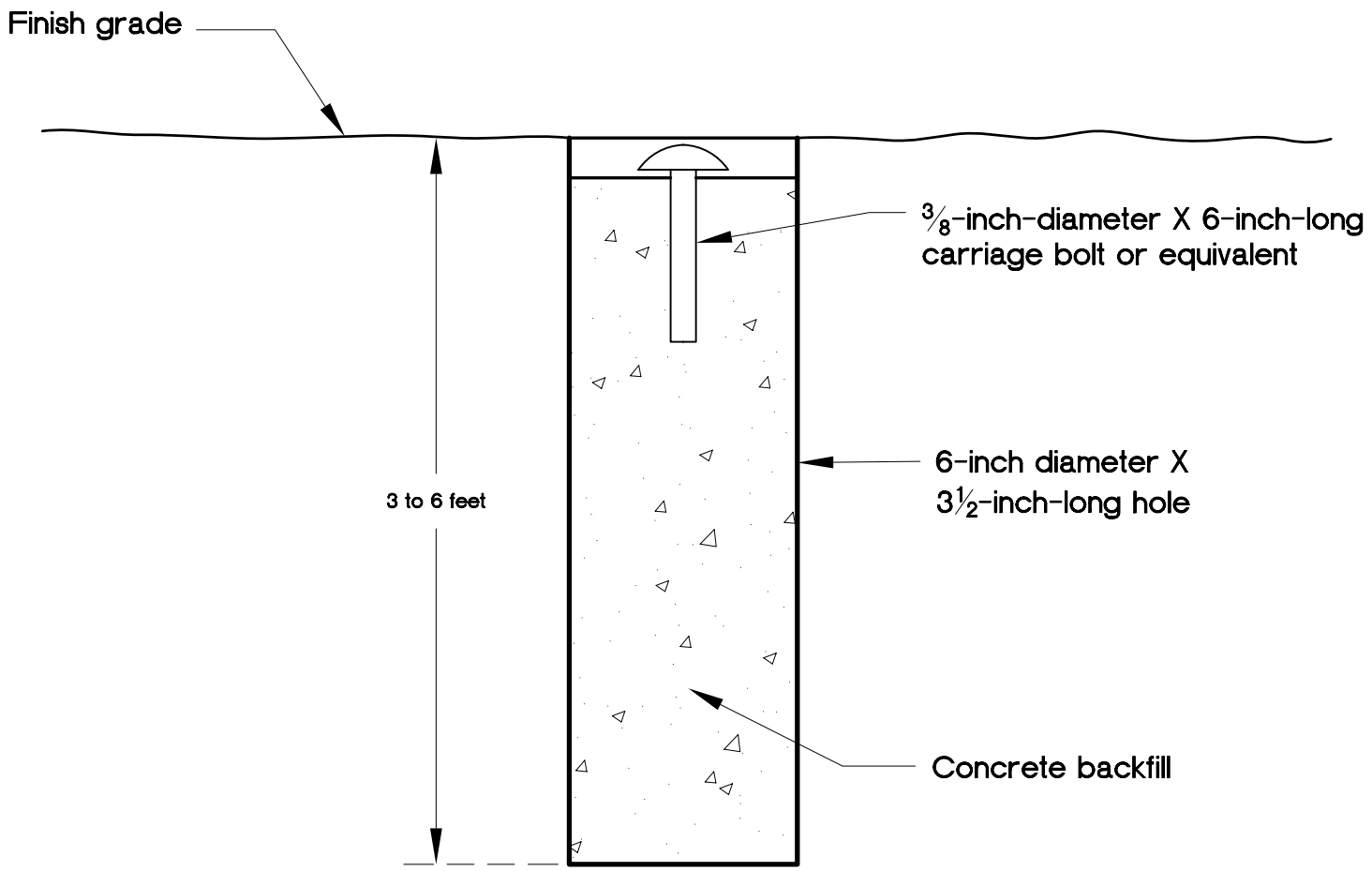
Plate D-16



NOTES:

1. Locations of settlement plates should be clearly marked and readily visible (red flagged) to equipment operators.
2. Contractor should maintain clearance of a 5-foot radius of plate base and withiin 5 feet (vertical) for heavy equipment. Fill within clearance area should be hand compacted to project specifications or compacted by alternative approved method by the geotechnical consultant (in writing, prior to construction).
3. After 5 feet (vertical) of fill is in place, contractor should maintain a 5-foot radius equipment clearance from riser.
4. Place and mechanically hand compact initial 2 feet of fill prior to establishing the initial reading.
5. In the event of damage to the settlement plate or extension resulting from equipment operating within the specified clearance area, contractor should immediately notify the geotechnical consultant and should be responsible for restoring the settlement plates to working order.
6. An alternate design and method of installation may be provided at the discretion of the geotechnical consultant.

GeoSoils, Inc.	SETTLEMENT PLATE AND RISER DETAIL	Plate D–18



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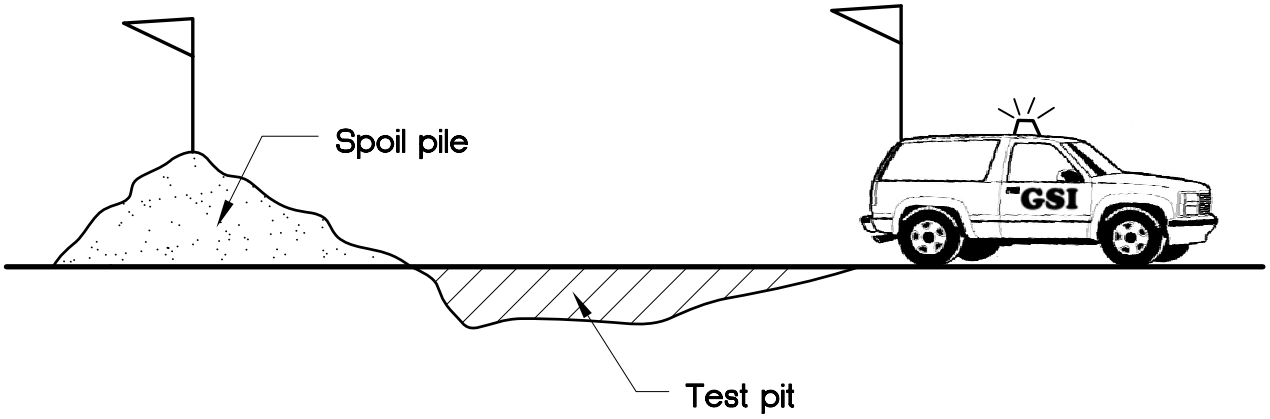
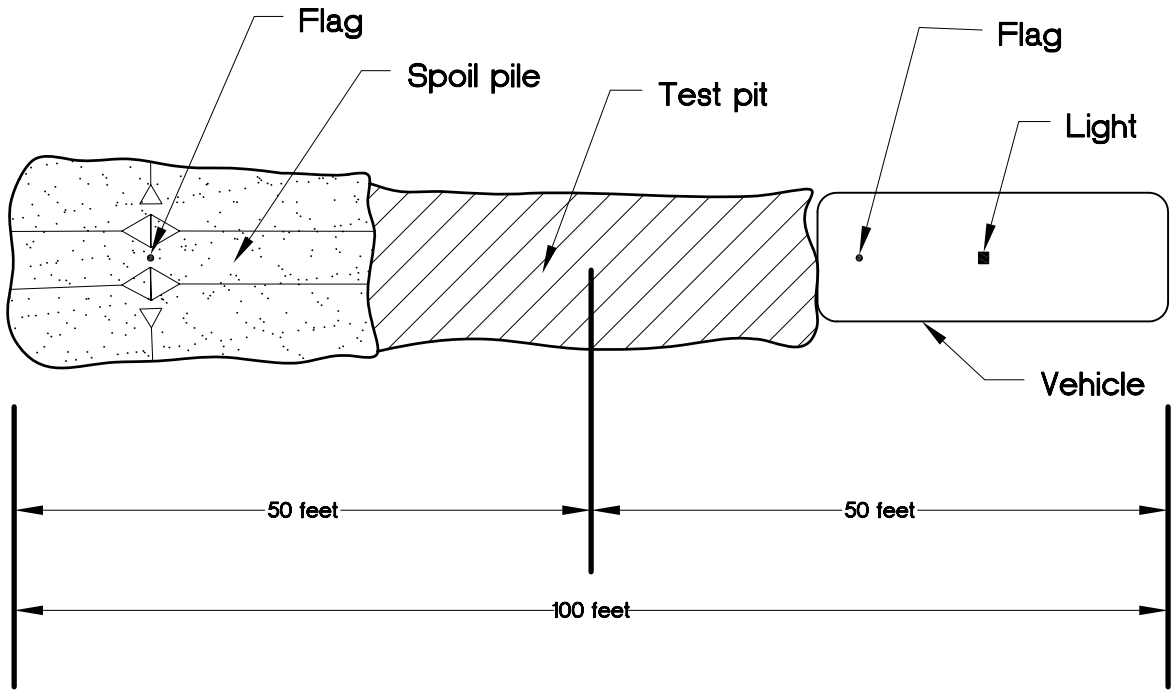
TYPICAL SURFACE SETTLEMENT MONUMENT

Plate D–19

SIDE VIEW



TOP VIEW



GeoSoils, Inc.	TEST PIT SAFETY DIAGRAM	Plate D-20

INFILTRATION REPORT

Geosoils, Inc.

March 4, 2024

SUPPLEMENTAL INFILTRATION FEASIBILITY TESTING FOR
THE PUBLIC LIBRARY EXPANSION PROJECT
TOWN SQUARE PARK
PARCELS 7 AND 8 OF PARCEL MAP NO. 29924
CITY OF MURRIETA, RIVERSIDE COUNTY
CALIFORNIA (APNS 906-080-039 AND -040)

FOR

CITY OF MURRIETA
COMMUNITY SERVICES DEPARTMENT
1 TOWN SQUARE
MURRIETA, CALIFORNIA 92562

W.O. 8582-A1-SC **MARCH 4, 2024**

GeoSoils, Inc.

Geotechnical • Geologic • Coastal • Environmental
18451 Collier Avenue, Suite A, Lake Elsinore, California 92530
TEL: (951) 471-0700 - FAX: (951) 471-0702
www.geosoilsinc.com

March 4, 2024

W.O. 8582-A1-SC

City of Murrieta
Community Services Department
1 Town Square
Murrieta, California 92562

Attention: Mr. Brian Crawford

Subject: Supplemental Infiltration Feasibility Testing for the Public Library Expansion Project, Town Square Park, Parcels 7 and 8 of Parcel Map No. 29924, City of Murrieta, Riverside County, California (APNs 906-080-039 and -040)

Dear Mr. Crawford:

In accordance with your request and authorization, GeoSoils, Inc. (GSI) is providing the results of our supplemental infiltration feasibility testing for the Town Square Park public library expansion project in the City of Murrieta, Riverside County, California. The scope of our services has included a review of the referenced reports and documents (see the Appendix), the advancement of two (2) exploratory borings onsite, which were excavated to depths of approximately 5 and 10 feet below the existing surface (bgs), geologic logging, supplemental field infiltration testing, analysis of field test data obtained, and preparation of this summary infiltration feasibility testing report.

SITE LOCATION AND CURRENT SITE CONDITIONS

The subject property (Parcels 7 and 8) is located at 8 Town Square, in the City of Murrieta, Riverside County, California). Based on our review, the site is currently developed with the Murrieta Public Library building with associated concrete flatwork and landscape improvements. Topographically, the property consists of flat-lying terrain that varies in elevation from approximately 1,115 feet MSL (Mean Sea Level) near the southern corner of the site to approximately 1,118 feet MSL near the northern corner of the property. Therefore, overall relief is on the order of 3 feet. Based on our review, the project site is mantled by compacted artificial fill placed during original and following site grading activities (GSI, 2000a and 2000b, and GI, 2005), that is in-turn underlain at shallow depths by Quaternary-age younger alluvium and sedimentary bedrock of the Pauba Formation.

PROPOSED DEVELOPMENT AND BACKGROUND

It is our understanding that continued development within the Murrieta Town Square Park would consist of the expansion of the existing public library, along with the installation of underground utilities, stormwater BMP systems, associated concrete flatwork improvements, and potentially perimeter block wall improvements. The public library expansion is proposed to be constructed in the existing garden area of the library complex. We further understand that the library expansion is proposed as a one- to two-story structure, with slab-on-grade and continuous footings, using typical wood-, block-, or steel-frame and stucco type construction. Building loads are assumed to be typical for this type of relatively light structure.

SITE GEOLOGY

Based on our previous subsurface investigation (GSI, 2023) and published geologic mapping by Kennedy and Morton (2003), the project site is mantled by compacted artificial fill placed during original site grading (GSI, 2000a and GI, 2005), which is in-turn underlain at shallow depths by Quaternary-age young alluvial valley deposits and sedimentary bedrock of the Pauba Formation. Compacted artificial fill was encountered in approximately the upper five (5) feet. The compacted artificial fill ranged in composition but was generally dark brown to brown, silty to clayey sands. Sedimentary bedrock was encountered at depth during our field investigation for this study, and is assigned to the Quaternary Pauba Formation (Qpfs). The sandstone deposits underlying the compacted fill generally consisted of pale brown to reddish brown clayey sands to sandy clays, that were generally wet and hard to very stiff with depth.

GROUNDWATER

Seeps, springs, or other indications of a high groundwater level were not noted on the subject property during the time of our field investigation, as groundwater was not encountered within any of the subsurface borings advanced during our previous field work (GSI, 2000c). Based on our review of the California Department of Water Resources, (CDWR) Water Data Library (2023), the historic depth to groundwater in a well east of the property was measured at approximately 27 feet below the ground surface (Well No. 339586N1175535W001) in 1994. The current depth to groundwater in a well just southwest of the property was measured as approximately 61.5 feet below the ground surface (Well No. 339566N1175810W001) in March of 2023. In general, and based upon the available data to date, the regional groundwater gradient is to the southwest, and is not expected to be a factor in the development if the site. However, these observations reflect site conditions at the time of our field work and do not prevent future changes in local groundwater conditions from excessive irrigation, precipitation, or that were not evident at the time of our investigation, including perched water conditions.

SUPPLEMENTAL INFILTRATION TESTING

In general accordance with guidelines of the Riverside County Flood Control (RCFC, 2011) Design Handbook for Low Impact Development Best Management Practices, two (2) infiltration tests were conducted within the proposed stormwater BMP system locations onsite. As requested by the design engineer, the infiltration testing was conducted at depths of 5 feet and 10 feet, in the designated area provided. The approximate locations of the infiltration tests for this study are provided on Figure 1 (Boring Location Map). The supplemental infiltration testing was performed to further evaluate site conditions with respect to the proposed BMP systems that would retain and filter onsite storm water. The infiltration testing was performed in general conformance with the RCFC (2011 and 2016) and CASQA (2003) design handbooks for such testing. The infiltration testing was performed by a staff geologist from our firm. Logs of the borings advanced for this study are presented in Appendix B, and the Field Infiltration Data Sheets are presented in Appendix C. Procedures for testing are outlined briefly below:

Percolation Test Procedures

Test Borings:

1. Drill rig excavated to depths of approximately 5 feet and 10 feet.
2. Diameter - 8 inches.
3. After the removal of loose materials, 2 inches of gravel were placed on the bottom of each test boring.
4. A perforated pipe with silt-sock was then installed within each test boring to facilitate accurate field measurements and prevent caving during the pre-soak period and infiltration testing.

Pre-Soaking: After the installation of the perforated pipes, the 5-foot boring was filled with clear water several times. The 10-foot boring was filled with a column of clear water to four (4) feet below existing grades (i.e., at least five (5) times the borings radius [RCFC, 2011]). The pre-soak continued overnight for a period of at least 24 hours, as the water did not seep away while the tester was present.

Sandy Soil Test: Following the pre-soak period, sandy soil criteria testing was conducted. Two (2) consecutive measurements were made at each test location at intervals of approximately 25 minutes. Less than 6 inches of water seeped away during each of the two (2) test measurements within the percolation test locations, therefore a 30 minute test period was selected for standard (percolation) testing (RCFC, 2011).

GSI LEGEND

Afc Artificial Fill, Compacted.

Qpfs Quaternary Pauba Formation, Sandstone Member, Circled where Buried.

IT-2 Approximate Location of Infiltration Test Boring.

Approximate Boundary of Area Under the Purview of this Report.

NAP Not A Part of this Study.

ALL LOCATIONS ARE APPROXIMATE

This document or e-file is not part of the Construction Documents and should not be relied upon as being an accurate depiction of design.

GeoSoils, Inc.

Figure 1

BORING LOCATION MAP

W.O. 8582-A1-SC	DATE: 03/24	SCALE: NTS

Testing: After required pre-soak period and sandy soil test periods, infiltration testing started at all locations. A column of clear water was re-established within each of the test locations to a depth of at least five (5) times the boring radius for the shallow testing, and of four (4) feet below the existing grade for the deep testing. The drop in water level was measured from a fixed reference point, refilling after each test measurement. Within all percolation test locations, a series of test measurements were taken for a minimum period of six (6) hours, at time intervals of 30 minutes.

Accuracy: All test measurements were read to the nearest ¼-inch.

Test Results: Calculations from our field testing indicate percolation rates of 120 minutes/inch in both locations. Per the RCFC (2011) guidelines, the percolation rates obtained were then converted to infiltration rates using the "Porchet Method," to be used by the design engineer for appropriate sizing of the BMP systems (RCFC, 2011). The converted infiltration rates obtained varied between 0.03 inches/hour at a depth of 5 feet, and 0.02 inches/hour, at a depth of 10 feet. Typically, the lowest infiltration rate obtained is applied to the design; therefore, an unfactored (i.e., no factor of safety) infiltration rate (UIR) of 0.02 inches/hour was obtained. The converted infiltration rates, along with the formulas used are presented in Figure 2 (Percolation Rate to Infiltration Rate Conversion).

USDA Site Soil Group, Soil Units, and Ksat Values

Our review of the United States Department of Agriculture (USDA, 2024) Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm), indicates that only one (1) major soil unit underlies the portion of the site where the proposed library expansion is proposed. The Ramona very fine sandy loam (ReC2) is shown underlying the proposed BMP system locations with a generalized Hydrologic Soil Group of "C," and a capacity of the most limiting soil layer to transmit water (Ksat) of "Moderately High" (i.e., 0.20 to 0.57 in/hr), which is significantly higher than tested average.

Infiltration Siting Requirements

Our review of the general infiltration siting requirements and limitations (CASQA, 2003), indicates sites characterized as belonging to Hydrologic Soil Group "A," "B," and "C" may be suitable for infiltration, requiring a minimum soil infiltration rate of 0.5 inches/hour (CASQA, 2003). Based on our review of historic regional groundwater levels and previous onsite subsurface investigation, a minimum 10-foot vertical separation from the bottom of the BMP system to the top of historic high groundwater levels will be maintained.

Percolation Rate to Infiltration Rate Conversion

* Infiltration Rate (I_t) = $\dfrac{\Delta H\ \pi r^2\ 60}{\Delta t(\pi r^2 + 2\pi r H_{avg})} = \dfrac{\Delta H\ 60\ r}{\Delta t(r+2H_{avg})}$

Where:
- I_t = tested infiltration rate, inches/hour
- ΔH = change in head over the time interval, inches
- Δt = time interval, minutes
- r = effective radius of test hole
- H_{avg} = average head over the time interval, inches

		Δt	Init Level	Fnl Level	ΔH	H_{avg}	I_t	
Infiltration Test Numbers	IT-1 @ 5 ft.	30	34	33 3/4	1/4	33 7/8	0.03	
	IT-2 @ 10 ft.	30	48	47 3/4	1/4	47 7/8	0.02	
								Low = 0.02
								Average = 0.25
								**UIR= 0.02

* Conversion per the "Porchet Method" (RCFC, 2011)

** UIR = Unfactored Infiltration Rate

W.O. 8582-A1-SC

Figure 2

The design engineer will need to review basin siting requirements by CASQA (2003) and the converted infiltration rates obtained during this study with respect to the proposed water quality BMP systems. An appropriate factor of safety (FOS), per the RCFC (2011) BMP design handbook, should be applied by the design engineer, as warranted. Due to the lower infiltration rates obtained (below 0.50 in/hr), filtration/detention systems, bio-retention facilities, extended detention basins, sand filter/media treatment areas, vegetated swales, etc., may need to be incorporated onsite, and should be considered for supplemental planning purposes. The design infiltration rates, general BMP design parameters, and recommendations proved herein are based on our experience with earth materials within the City of Murrieta, RCFC (2011) and State criteria (CASQA, 2003), and our experience on adjacent sites with similar geologic conditions.

CONCLUSIONS AND RECOMMENDATIONS

Based on the onsite infiltration testing conducted, it is our opinion that the proposed continued site development is feasible from a geologic and geotechnical viewpoint, provided the recommendations presented herein, and within the previous report by GSI (2023) are properly implemented during project planning, design, and construction, as warranted. General recommendations for storm water quality BMP systems are presented below.

Onsite Storm Water Quality Best Management Practice (BMP) Systems

Should onsite infiltration-runoff retention systems (OIRRS) be planned for Best Management Practices (BMP's) or Low Impact Development (LID) principles for the project, some guidelines should/must be followed in the planning, design, and construction of such systems. Such facilities, if improperly designed or implemented without consideration of the geotechnical aspects of site conditions, can contribute to flooding, saturation of bearing materials beneath site improvements, slope instability, and possible concentration and contribution of pollutants into the groundwater or storm drain and/or utility trench systems.

A key factor in these systems is the infiltration rate (often referred to as the percolation rate) which can be ascribed to, or determined for, the earth materials within which these systems are installed. Additionally, the infiltration rate of the designed system (which may include gravel, sand, mulch/topsoil, or other amendments, etc.) will need to be considered. The project infiltration testing is very site specific, any changes to the location of the proposed OIRRS and/or estimated size of the OIRRS, may require additional infiltration testing. Locally, relatively impermeable formations include: terrace deposits, claystone, siltstone, cemented sandstone, igneous and metamorphic bedrock, as well as expansive fill soils.

Some of the methods which are used for onsite infiltration include percolation basins, dry wells, bio-swale/bio-retention, permeable pavers/pavement, infiltration trenches, filter boxes and subsurface infiltration galleries/chambers. Some of these systems are

constructed using native and import soils, perforated piping, and filter fabrics while others employ structural components such as stormwater infiltration chambers and filters/separators. Every site will have characteristics which should lend themselves to one or more of these methods; but, not every site is suitable for OIRRS. In practice, OIRRS are usually initially designed by the project design civil engineer. Selection of methods should include (but should not be limited to) review by licensed professionals including the geotechnical engineer, hydrogeologist, engineering geologist, project civil engineer, landscape architect, environmental professional, and industrial hygienist. Applicable governing agency requirements should be reviewed and included in design considerations.

The following geotechnical guidelines should be considered when designing onsite infiltration-runoff retention systems:

- It is not good engineering practice to allow water to saturate soils, especially near slopes or improvements; however, the controlling agency/authority is now requiring this for OIRRS purposes on many projects.

- Where possible, infiltration system design should be based on actual infiltration testing results/data to determine the infiltration rate of the earth materials being contemplated for infiltration.

- Impermeable liners used in conjunction with basins should consist of a 30-mil polyvinyl chloride (PVC) membrane that is covered by a minimum of 12-inches of clean soil, free from rocks and debris, at a maximum inclination of 4:1 (h:v), and meets the following minimum specifications:

  Specific Gravity (ASTM D792): 1.2 (g/cc [min.]); Tensile (ASTM D882): 73 (lb/in-width [min.]); Elongation at Break (ASTM D882): 380 (% [min.]); Modulus (ASTM D882): 30 (lb/in-width [min.]); and Tear Strength (ASTM D1004): 8 (lbs [min.]); Seam Shear Strength (ASTM D882) 58.4 (lb/in [min.]); Seam Peel Strength (ASTM D882) 15 (lb/in [min]).

- Wherever possible, infiltrations systems should not be placed within a distance of H/2 from the toes of slopes (where H equals the height of slope).

- The landscape architect should be notified of the location of the proposed OIRRS. If landscaping is proposed within the OIRRS, consideration should be given to the type of vegetation chosen and their potential effect upon subsurface improvements (i.e., some trees/shrubs will have an effect on subsurface improvements with their extensive root systems). Over-watering landscape areas above, or adjacent to, the proposed OIRRS could adversely affect performance of the system.

- Areas adjacent to, or within, the OIRRS that are subject to inundation should be properly protected against scouring, undermining, and erosion, in accordance with the recommendations of the design engineer.

- If subsurface infiltration galleries/chambers are proposed, the appropriate size, depth interval, and ultimate placement of the detention/infiltration system should be evaluated by the design engineer, and be of sufficient width/depth to achieve optimum performance, based on the infiltration rates provided. In addition, proper debris filter systems will need to be used for the infiltration galleries/chambers. Debris filter systems will need to be self cleaning and periodically and regularly maintained on a regular basis. Provisions for the regular and periodic maintenance of any debris filter system are recommended and this condition should be disclosed to all interested/affected parties.

- Infiltrations systems should not be installed within 8 feet of building foundations utility trenches, and walls, or a 1:1 (horizontal to vertical [h:v]) slope (down and away) from the bottom elements of these improvements. Alternatively, deepened foundations and/or pile/pier supported improvements may be used.

- Infiltration systems should not be installed adjacent to pavement or hardscape improvements. Alternatively, deepened/thickened edges and curbs and/or impermeable liners may be used in areas adjoining the OIRRS.

- As with any OIRRS, localized ponding and groundwater seepage should be anticipated. The potential for seepage and/or perched groundwater to occur after site development should be disclosed to all interested/affected parties.

- Installation of infiltrations systems should avoid expansive soils (Expansion Index [E.I.] $\geq$51) or soils with a relatively high plasticity index (P.I. > 20).

- Infiltration systems should not be installed where the vertical separation of the groundwater level is less than 10 feet from the base of the system.

- Infiltration systems should be designed using a suitable factor of safety (FOS) to account for uncertainties in the known infiltration rates (as generally required by the controlling authorities), and reduction in performance over time.

- As with any OIRRS, proper care will need to provided. Best management practices should be followed at all times, especially during inclement weather. Provisions for the management of any siltation, debris within the OIRRS, or overgrown vegetation (including root systems) should be considered. An appropriate inspection schedule will need to adopted and provided to all interested/affected parties.

- Any designed system will require regular and periodic maintenance, which may include rehabilitation and/or complete replacement of the filter media (e.g., sand, gravel, filter fabrics, topsoils, mulch, etc.) or other components used in construction, so that the design life exceeds 15 years. Due to the potential for piping and adverse seepage conditions, a burrowing rodent control program should also be implemented onsite.

- Newly established vegetation/landscaping (including phreatophytes) may have root systems that will influence the performance of the OIRRS or nearby LID systems.

- The potential for surface flooding, in the case of system blockage, should be evaluated by the design engineer.

- Any proposed utility backfill materials (i.e., inlet/outlet piping and/or other subsurface utilities) located within or near the proposed area of the OIRRS may become saturated. This is due to the potential for piping, water migration, and/or seepage along the utility trench line backfill. If utility trenches cross and/or are proposed near the OIRRS, cut-off walls or other water barriers will need to be installed to mitigate the potential for piping and excess water entering the utility backfill materials. Planned or existing utilities may also be subject to piping of fines into open-graded gravel backfill layers unless separated from overlying or adjoining OIRRS by geotextiles and/or slurry backfill.

- The use of OIRRS above existing utilities that might degrade/corrode with the introduction of water/seepage should be avoided.

LIMITATIONS

The materials encountered on the project site and used for our analysis are believed representative of the area; however, soil and bedrock materials vary in character between excavations and natural outcrops or conditions exposed during mass grading. Site conditions may vary due to seasonal changes or other factors.

Inasmuch as our study is based upon our review and engineering analyses and field test data, the conclusions and recommendations are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty, either express or implied, is given. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, or their inaction; or work performed when GSI is not requested to be onsite, to evaluate if our recommendations have been properly implemented. Use of this report constitutes an agreement and consent by the user to all the limitations outlined above, notwithstanding any other agreements that may be in place. In addition, this report may be subject to review by the controlling authorities. Thus, this report brings to completion our scope of services for this portion of the project.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,

GeoSoils, Inc.

Todd A. Greer
Engineering Geologist, CEG 2377

Stephen J. Coover
Geotechnical Engineer, GE 2057

MAM/TAG/JPF/SJC/sh

Enclosures: Appendix A - References
Appendix B - Boring Logs
Appendix C - Field Infiltration Data Sheets

Distribution: (1) Addressee (PDF via email)

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

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APPENDIX B

BORING LOGS

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions			Group Symbols	Typical Names
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravel with	GM	Silty gravels gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands more than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils 50% or more passes No. 200 sieve	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, mucic, and other highly organic soils

CONSISTENCY OR RELATIVE DENSITY

CRITERIA

Standard Penetration Test

Penetration Resistance N (blows/ft)	Relative Density
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium
30 - 50	Dense
> 50	Very dense

Standard Penetration Test

Penetration Resistance N (blows/ft)	Consistency	Unconfined Compressive Strength (tons/ft^2)
<2	Very Soft	<0.25
2 - 4	Soft	0.25 - .050
4 - 8	Medium	0.50 - 1.00
8 - 15	Stiff	1.00 - 2.00
15 - 30	Very Stiff	2.00 - 4.00
>30	Hard	>4.00

3" 3/4" #4 #10 #40 #200 U.S. Standard Sieve

Unified Soil Classification	Cobbles	Gravel		Sand			Silt or Clay
		coarse	fine	coarse	medium	fine	

MOISTURE CONDITIONS

Dry	Absence of moisture: dusty, dry to the touch
Slightly Moist	Below optimum moisture content for compaction
Moist	Near optimum moisture content
Very Moist	Above optimum moisture content
Wet	Visible free water; below water table

MATERIAL QUANTITY

trace	0 - 5 %
few	5 - 10 %
little	10 - 25 %
some	25 - 45 %

OTHER SYMBOLS

C Core Sample
S SPT Sample
B Bulk Sample
__ Groundwater
Qp Pocket Penetrometer

BASIC LOG FORMAT:
Group name, Group symbol, (grain size), color, moisture, consistency or relative density. Additional comments: odor, presence of roots, mica, gypsum, coarse grained particles, etc.

EXAMPLE:
Sand (SP), fine to medium grained, brown, moist, loose, trace silt, little fine gravel, few cobbles up to 4" in size, some hair roots and rootlets.

File:Mgr: c;\SoilClassif.wpd

PLATE B-1

GeoSoils, Inc.

BORING LOG

PROJECT: CITY OF MURRIETA LIBRARY EXPANSION

W.O. 8582-A1-SC *BORING* I-1 *SHEET* 1 *OF* 1

DATE EXCAVATED 2-13-24 *LOGGED BY:* MAM *APPROX. ELEV.:* 1,118 MSL

SAMPLE METHOD: 8" Hollow Stem Auger (no sampling)

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Sample: Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Material Description
0				SM SC				**ARTIFICIAL FILL, COMPACTED (Afc):** @ 0', SILTY SAND, dark brown, wet, loose; abundant organics and root materials at surface, planter soil. @ 0.5', CLAYEY SAND, gray, wet, medium stiff.
5				SC				@ 4', As per 0.5', brown. Total Depth = 5'. No groundwater or caving encountered. Presoaked at 8:25 am. Backfilled 2-14-24.
10								
15								
20								
25								
30								

▼ *Standard Penetration Test*
⌶ *Undisturbed, Ring Sample*
▽ *Groundwater*
♀ *Seepage*

GeoSoils, Inc.

PLATE B-2

GeoSoils, Inc.

BORING LOG

PROJECT: CITY OF MURRIETA LIBRARY EXPANSION

W.O. 8582-A1-SC *BORING* I-2 *SHEET* 1 *OF* 1

DATE EXCAVATED 2-13-24 *LOGGED BY:* MAM *APPROX. ELEV.:* 1,117 MSL

SAMPLE METHOD: 8" HSA, 140lb @ 30" Drop, Cal Sampler Only

Depth (ft.)	Sample: Bulk	Sample: Undisturbed	Blows/Ft.	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	Saturation (%)	Material Description
0			14	SC/ SM				**ARTIFICIAL FILL, COMPACTED (Afc):** @ 0', SILTY CLAYEY SAND, brown, wet, loose; organics at surface, planter soil at surface.
			18	SC				@ 1', As per 0, medium dense. @ 3', CLAYEY SAND, brown, wet, medium dense; trace organics.
5			43	SC/CL				@ 5', As per 3'; no organics.
			54	CL				**QUATERNARY PAUBA FORMATION (Qpfs):** @ 5.5', SANDY CLAY, pale brown to medium brown, wet, hard; trace roots.
10			33	CL				@ 10', CLAYEY SAND, medium brown to reddish brown, wet, very stiff.
15								Total Depth = 11.5'. No groundwater or caving encountered. Presoaked at 9:43. Backfilled 2-14-23.
20								
25								
30								

▼ *Standard Penetration Test*

⌶ *Undisturbed, Ring Sample*

▽ *Groundwater*

♀ *Seepage*

GeoSoils, Inc.

PLATE B-3

APPENDIX C

FIELD INFILTRATION DATA SHEETS

Leach Line Percolation Data Sheet

Project: 8582-A1-SC	City of Murrieta	W.O. Number: Murrieta Library Expansion	
Test Hole No.: T-1		Date Excavated: 2/13/2024	
Depth of Test Hole: 5'		Soil Classification: SC	
Check for Sandy Soil Criteria Tested by: MAM		Date: 2/13/2024	Presoak: @8:25A
Actual Percolation Tested by: MAM		Date: 2/14/2024	

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (Min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ in Water Level (Inches)
1	9:35 10:00	25	30	28	2.0
2	10:03 10:28	25	31	29.5	1.5

Use: Normal Sandy (Circle One) Soil Criteria

	Time	Time Interval (min)	Total Elapsed Time (Min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ in Water Level (Inches)	Percolation Rate (min/inch)
First Hour	10:30 11:00	30	30	30.5	29	1.5	
	11:01 11:31	30	60	30	29.875	0.125	240
Second Hour	11:32 12:02	30	90	33	32.5	0.5	60
	12:04 12:34	30	120	33	32.75	0.25	120
Third Hour	12:35 1:05	30	150	33	32.75	0.25	120
	1:05 1:35	30	180	33	32.75	0.25	120
Fourth Hour	1:37 2:07	30	210	33.25	33	0.25	120
	2:09 2:39	30	240	33.5	33.25	0.25	120
Fifth Hour	2:41 3:11	30	270	33.5	33.25	0.25	120
	3:12 3:42	30	300	33.75	33.5	0.25	120
Sixth Hour	3:43 4:13	30	330	34	33.75	0.25	120
	4:13 4:43	30	360	34	33.75	0.25	120

Leach Line Percolation Data Sheet

Project: 8582-A1-SC	W.O. Number: Murrieta Library Expansion
Test Hole No.: I-2	Date Excavated: 2/13/2024
Depth of Test Hole: 11	Soil Classification: SC
Check for Sandy Soil Criteria Tested by: MAM	Date: 2/13/2024 Presoak: @ 9:43
Actual Percolation Tested by: MAM	Date: 2/14/2024

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (Min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ in Water Level (Inches)
1	9:45 10:10	25	48	45.25	2.75
2	10:12 10:37	25	48	47	1.0

Use: Normal Sandy (Circle One) Soil Criteria

	Time	Time Interval (min)	Total Elapsed Time (Min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ in Water Level (Inches)	Percolation Rate (min/inch)
First Hour	10:39 11:09	30	30	48	47.5	0.5	60
	11:13 11:43	30	60	48	47.5	0.5	60
Second Hour	11:44 12:14	30	90	48	47.5	0.5	60
	12:16 12:46	30	120	48	47.5	0.5	60
Third Hour	12:48 1:28	30	150	48	47.5	0.5	60
	1:29 1:59	30	180	48	47.5	0.5	60
Fourth Hour	2:00 2:30	30	210	48	47.75	0.25	120
	2:32 3:02	30	240	48	47.5	0.5	60
Fifth Hour	3:04 3:34	30	270	48	47.5	0.5	60
	3:35 4:05	30	300	48	47.75	0.25	120
Sixth Hour	4:05 4:35	30	330	48	47.75	0.25	120
	4:36 5:06	30	360	48	47.75	0.25	120

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.

(ASK IF APPLICABLE TO THIS PROJECT)

Based on the review of available historical site data and prior assessments, no significant historical conditions or past land uses affecting LID BMP implementation have been identified for the Murrieta Public Library site

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.

(ASK IF APPLICABLE TO THIS PROJECT)

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.

ISOHYETAL MAP FOR THE 85TH. PERCENTILE 24-HOUR STORM EVENT

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

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

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

Santa Ana River Watershed
Santa Margarita Watershed

Project Location
Address: 8 Town Square,
Murrieta, CA 92562

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

N

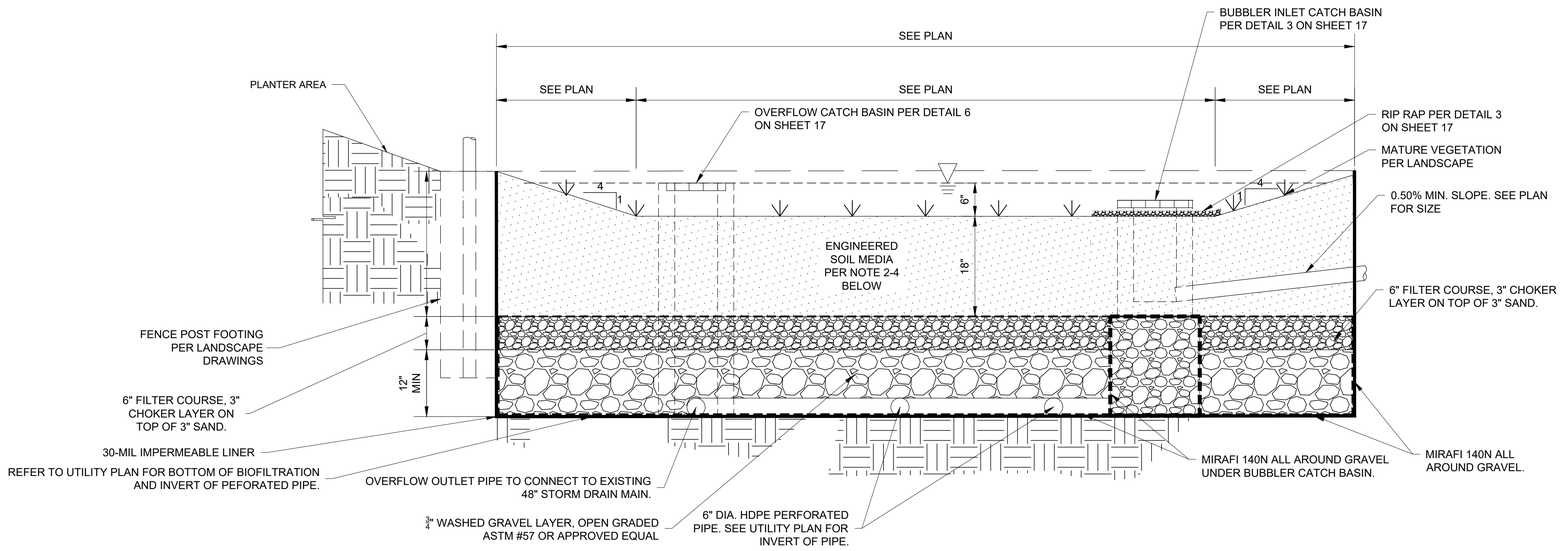
Rain Gage Locations

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

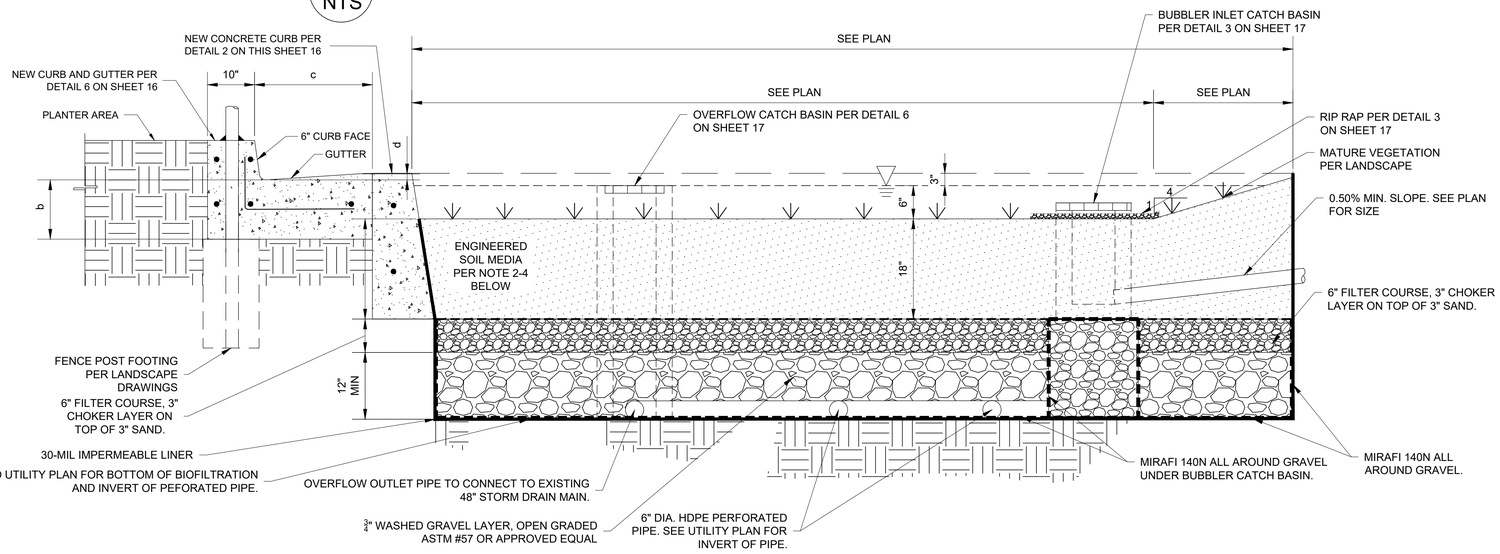
Isohyetal Map for the 85th Percentile 24 hour Storm Event

July 2011

BIOFILTRATION AREA WITH NO INFILTRATION DETAIL



1 NTS NORTHWEST BIOFILTRATION SECTION



c	d
18"	5/7"

* "b" SHOULD BE THE MAXIMUM OF PAVEMENT & BASE THICKNESS OR 6".

2 NTS SOUTHWEST BIOFILTRATION SECTION

NOTES:

1. TO REDUCE EROSION, A COBBLESTONE PAD SHALL BE PLACED AT EACH INLET POINT. THE COBBLESTONE SHALL BE 3"-5" DIAMETER IN SIZE AND SHALL BE EMBEDDED IN 4" OF CONCRETE, 24" WIDE. THE COBBLESTONE PAD INSIDE THE BIORETENTION FACILITY SHALL BE COMPACTED AND FLUSH WITH THE FINISHED SURFACE AT THE INLET POINT AND EXTEND TO THE BOTTOM OF THE SLOPE.
2. ENGINEERED SOIL MEDIA DESIGN FILTRATION RATE OF 2.5 INCHES PER HOUR (INITIAL FILTRATION RATE SHOULD BE HIGHER).
3. ENGINEERED SOIL MEDIA SHALL BE 18" MINIMUM DEPTH FOR SOUTHERN BMP (BMP-1) AND 18" MINIMUM DEPTH FROM NORTHERN BMP (BMP-2). ENGINEERED SOIL MEDIA, / BIORETENTION SOIL MEDIA (BSM) SHALL BE COMPRISED OF 60-80% SAND, UP TO 20% TOPSOIL, AND 20% OF AN ORGANIC AMENDMENT, BY VOLUME. NUTRIENT-SENSITIVE COMPOST MAY BE USED AS THE ORGANIC AMENDMENT ACCORDING TO REQUIREMENTS IN THE "ORGANIC AMENDMENTS" SECTION OF THE SANTA MARGARITA WATERSHED BMP DESIGN MANUAL, FOR BIORETENTION BMPS.THE ORGANIC COMPONENT SHALL BE NITROGEN STABILIZED COMPOST, SUCH THAT NITROGEN DOES NOT LEACH FROM THE MEDIA. THE SOIL MEDIA SHALL MEET THE SPECIFICATIONS IN SECTION 3.8 OF THE RIVERSIDE COUNTY, SANTA MARGARITA RIVER WATERSHED REGION DESIGN HANDBOOK FOR LOW IMPACT DEVELOPMENT BEST MANAGEMENT PRACTICES, REVISED JUNE 2018. FOR SOIL MEDIA RATIO MIX, SEE TABLE BELOW.
4. FOR THIS COUNTY-MAINTAINED BMP, MULCH SHALL NOT BE USED PER RIVERSIDE COUNTY, TRANSPORTATION DEPARTMENT STANDARDS.

COMPONENT TYPE	BIORETENTION
SAND TYPE	WASHED
SAND FRACTION BY VOLUME	60% - 80%
TOPSOIL TYPE	SANDY LOAM OR LOAMY SAND
TOPSOIL FRACTION BY VOLUME	20%
ORGANIC TYPE	NUTRIENT-SENSITIVE COMPOST
ORGANIC FRACTION BY VOLUME	20%

1 BIOFILTRATION WITH NO UNDERDRAIN DETAIL

NOT TO SCALE

Underground Service Alert
Call: TOLL FREE
1-800
422-4133
TWO WORKING DAYS BEFORE YOU DIG

BENCH MARK
DESCRIPTION: PARCEL 8 OF PARCEL MAP NO. 29924
LOCATION: 8 TOWN SQUARE, MURRIETA, CA 92562
RECORDED: AS PER MAP RECORDED IN BOOK 204, PAGES 25 TO 26,
ELEVATION: 1094.82' DATUM: NGVD 29

APPROVED FOR SIGNATURE

DATE

TODD L. PITNER
MICHAEL BAKER INTERNATIONAL
PLAN CHECK FIRM
RCE NO.58606

"AS BUILT"

THE RECEIPT OF AS-BUILT PLANS AND CITY'S ACCEPTANCE THEREOF DOES NOT ABSOLVE THE ENGINEER OF WORK OF ANY RESPONSIBILITY FOR THE PROJECT DESIGN.

ENGINEER OF WORK DATE

RCE NO. EXPIRATION DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER TODD L. PITNER No. C36079 Exp. 6/30/26 CIVIL STATE OF CALIFORNIA

SCALE
HORIZONTAL
AS NOTED
VERTICAL
AS NOTED

VCA ENGINEERS INC
CIVIL ★ STRUCTURAL
631 S. Allantic Blvd.
Monterey Park, CA 91754
Tel. 323.729.6098
Fax. 323.729.6043

PREPARED BY DATE
VIRGILIO C. AOANAN 05/16/2025

ENGR. NAME TYPED VIRGILIO C. AOANAN
RCE NO. C36079 EXP. DATE 6/30/26

DATE	INITIAL	ENGINEER OF WORK

SHT. NO.	DATE	INITIAL	CITY APPROVAL

REVISION DESCRIPTION

SHEET 18 | CITY OF MURRIETA ENGINEERING DEPARTMENT | SHEETS 25

MISCELLANEOUS DETAILS
MURRIETA PUBLIC LIBRARY EXPANSION
8 TOWN SQUARE, MURRIETA, CA 92562

APPROVED
ROBERT K. MOEHLING DATE
DIRECTOR OF PUBLIC WORKS / CITY ENGINEER RCE 63056

DWN BY: DENNIS PHAM
CHKD BY: TONY DANG
FIELD BK:
PROJECT NO. G-PC-COM-2025-00034
DRAWING NO.

murrieta title sheet.dwg

SANTA MARGARITA WATERSHED
V BMP & Q BMP WORKSHEETS

Santa Margarita Watershed

V_{BMP} and Q_{BMP} worksheets

These worksheets are to be used to determine the required

Design Capture Volume (V_{BMP})
or the
Design Flow Rate (Q_{BMP})

for BMPs in the Santa Margarita Watershed

To verify which watershed your project is located within, visit

www.rcflood.org/npdes

and use the 'Locate my Watershed' tool

If your project is not located in the Santa Margarita Watershed,

Do not use these worksheets! Instead visit

www.rcflood.org/npdes/developers.aspx

To access worksheets applicable to your watershed

Use the tabs across the bottom
to access the worksheets for the Santa Margarita Watershed

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	VCA Engineer, Inc	Date	6/6/2025
Designed by		County/City Case No	Riverside
Company Project Number/Name	Murrieta Public Library		
Drainage Area Number/Name	BMP-1 (Southern)-IMPERVIOUS		

Enter the Area Tributary to this Feature A_T = 0.14 acres

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

Site Location

Township: 7 South

Range: 3 West

Section: 0

Enter the 85th Percentile, 24-hour Rainfall Depth D_{85} = 0.80

Determine the Effective Impervious Fraction

Type of post-development surface cover (use pull down menu): Concrete or Asphalt

Effective Impervious Fraction I_f = 1.00

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 = 0.89

Determine Design Storage Volume, V_{BMP}

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

V_u = 0.71 (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} = 361 ft^3

Notes:

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	VCA Engineer, Inc	Date	6/6/2025
Designed by		County/City Case No	Riverside
Company Project Number/Name	Murrieta Public Library		
Drainage Area Number/Name	BMP-1 (Southern)-PERVIOUS		

Enter the Area Tributary to this Feature A_T = 0.11 acres

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

Site Location

Township: 7 South

Range: 3 West

Section: 0

Enter the 85th Percentile, 24-hour Rainfall Depth D_{85} = 0.80

Determine the Effective Impervious Fraction

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

Effective Impervious Fraction I_f = 0.40

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 = 0.28

Determine Design Storage Volume, V_{BMP}

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

V_u = 0.22 (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} = 88 ft^3

Notes:

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	VCA Engineer, Inc	Date	6/6/2025
Designed by		County/City Case No	Riverside
Company Project Number/Name	Murrieta Public Library		
Drainage Area Number/Name	BMP-2 (Northern)-IMPERVIOUS		

Enter the Area Tributary to this Feature A_T = 0.081 acres

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

Site Location

Township: 7 South

Range: 3 West

Section: 0

Enter the 85th Percentile, 24-hour Rainfall Depth D_{85} = 0.80

Determine the Effective Impervious Fraction

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

Effective Impervious Fraction I_f = 1.00

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 = 0.89

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 85% Unit Storage Volume $V_U = D_{85} \times C$ V_u = 0.71 (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} = 209 ft^3

Notes:

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	VCA Engineer, Inc	Date	6/6/2025
Designed by		County/City Case No	Riverside
Company Project Number/Name	Murrieta Public Library		
Drainage Area Number/Name	BMP-2 (Northern)-PERVIOUS		

Enter the Area Tributary to this Feature A_T = 0.156 acres

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

Site Location

Township: 7 South

Range: 3 West

Section: 0

Enter the 85th Percentile, 24-hour Rainfall Depth D_{85} = 0.80

Determine the Effective Impervious Fraction

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

Effective Impervious Fraction I_f = 0.40

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 = 0.28

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 85% Unit Storage Volume $V_U = D_{85} \times C$ V_u = 0.22 (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} = 125 ft^3

Notes:

ACTUAL DESIGN OVERALL VOLUME BIOFILTRATION FACILITY NO INFILTRATION SPREADSHEET

Biofiltration with No Infiltration Facility - Design Procedure	BMP ID	Legend:	Required Entries
			Calculated Cells

Company Name: Date:

Designed by: County/City Case No.:

Design Volume

Enter the area tributary to this feature	A_T=	0.531	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	783	ft^3
Estimated footprint of BMP, $Area_{BMP}$ (available space or 3% imp. area)	$Area_{BMP}$=	1,048	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 for drain pipes should extend to this contour. For systems with vertical walls, the effective area is the full footprint.

Biofiltration with No Infiltration 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 =	18.0	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 x d_S) + (I_{design} * $T_{routing}$)) (ft)	d_{E_bio} =	2.0	ft
Effective Static Depth, $d_{E\_bio\_static}$ $d_{E\_bio\_static}$ = (d_P + (0.3 * d_S)) (ft)	$d_{E\_bio\_static}$ =	1.0	ft
$V_{biofiltered}$ = d_{E_bio} * $Area_{BMP}$	$V_{biofiltered}$ =	2087.3	ft^3
$V_{biofiltered\_static}$ = $d_{E\_bio\_static}$ * $Area_{BMP}$	$V_{biofiltered\_static}$ =	995.6	ft^3

Sizing Option 1 Result

Criteria 1: $V_{biofiltered\ (with\ routing)} \geq 150\%$ of V_{BMP} Results: PASS

Sizing Option 2 Result

Criteria 2: $V_{biofiltered\_static} \geq 0.75$ x V_{BMP} Results: PASS

Note

If neither of these criteria are met increase the footprint and rerun calculations. This calculation is inherently iterative.

Biofiltration with No Retention Facility Properties

Side Slopes in Partial Retention with Biofiltration Facility	z =	2	:1

Message: ERROR, side slopes too steep for Facility design

Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		4	%
Check Dam Spacing		Error	feet

Describe Vegetation:

Notes:

ACTUAL DESIGN BMP-1 SOUTHERN VOLUME BIOFILTRATION FACILITY NO INFILTRATION SPREADSHEET

Biofiltration with No Infiltration Facility - Design Procedure	BMP ID: BMP-1 (Southern)	Legend:	Required Entries / Calculated Cells
Company Name:	VCA Engineer Inc.	Date:	6/6/25
Designed by:	VCA Engineer Inc.	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T =	0.293	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP} =	449	ft^3
Estimated footprint of BMP, $Area_{BMP}$ (available space or 3% imp. area)	$Area_{BMP}$ =	721	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 for drain pipes should extend to this contour. For systems with vertical walls, the effective area is the full footprint.

Biofiltration with No Infiltration 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 =	18.0	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 x d_S) + (I_{design} * $T_{routing}$)) (ft)	d_{E_bio} =	2.0	ft
Effective Static Depth, $d_{E\_bio\_static}$ $d_{E\_bio\_static}$ = (d_P + (0.3 * d_S)) (ft)	$d_{E\_bio\_static}$ =	1.0	ft
$V_{biofiltered}$ = d_{E_bio} * $Area_{BMP}$	$V_{biofiltered}$ =	1435.7	ft^3
$V_{biofiltered\_static}$ = $d_{E\_bio\_static}$ * $Area_{BMP}$	$V_{biofiltered\_static}$ =	684.8	ft^3

Sizing Option 1 Result

Criteria 1: $V_{biofiltered\ (with\ routing)} \geq 150\%$ of V_{BMP} — Results: PASS

Sizing Option 2 Result

Criteria 2: $V_{biofiltered\_static} \geq 0.75$ x V_{BMP} — Results: PASS

Note

If neither of these criteria are met increase the footprint and rerun calculations. This calculation is inherently iterative.

Biofiltration with No 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)		3	%
Check Dam Spacing		10	feet
Describe Vegetation:			

Notes:

ACTUAL DESIGN BMP-2 NORTHERN VOLUME BIOFILTRATION FACILITY NO INFILTRATION SPREADSHEET

Biofiltration with No Infiltration Facility - Design Procedure	BMP ID: BMP-2 (Northern)	Legend: Required Entries / Calculated Cells
Company Name: VCA Engineer Inc.		Date: 6/6/25
Designed by: VCA Engineer Inc.		County/City Case No.:

Design Volume

Enter the area tributary to this feature	A_T =	0.237	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP} =	334	ft^3
Estimated footprint of BMP, $Area_{BMP}$ (available space or 3% imp. area)	$Area_{BMP}$ =	327	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 for drain pipes should extend to this contour. For systems with vertical walls, the effective area is the full footprint.

Biofiltration with No Infiltration 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 =	18.0	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 x d_S) + (I_{design} * $T_{routing}$)) (ft)	d_{E_bio} =	2.0	ft
Effective Static Depth, $d_{E\_bio\_static}$ $d_{E\_bio\_static}$ = (d_P + (0.3 * d_S)) (ft)	$d_{E\_bio\_static}$ =	1.0	ft
$V_{biofiltered}$ = d_{E_bio} * $Area_{BMP}$	$V_{biofiltered}$ =	651.7	ft^3
$V_{biofiltered\_static}$ = $d_{E\_bio\_static}$ * $Area_{BMP}$	$V_{biofiltered\_static}$ =	310.8	ft^3

Sizing Option 1 Result

Criteria 1: $V_{biofiltered\ (with\ routing)} \geq 150\%$ of V_{BMP} — Results: PASS

Sizing Option 2 Result

Criteria 2: $V_{biofiltered\_static} \geq 0.75$ x V_{BMP} — Results: PASS

Note

If neither of these criteria are met increase the footprint and rerun calculations. This calculation is inherently iterative.

Biofiltration with No 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)		3	%
Check Dam Spacing		10	feet
Describe Vegetation:			

Notes:

BMPs FACILITY & FACT SHEET

3.5 Bioretention Facility

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

Description

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

Siting Considerations

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

- ✓ Parking islands
- ✓ Medians
- ✓ Site entrances

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

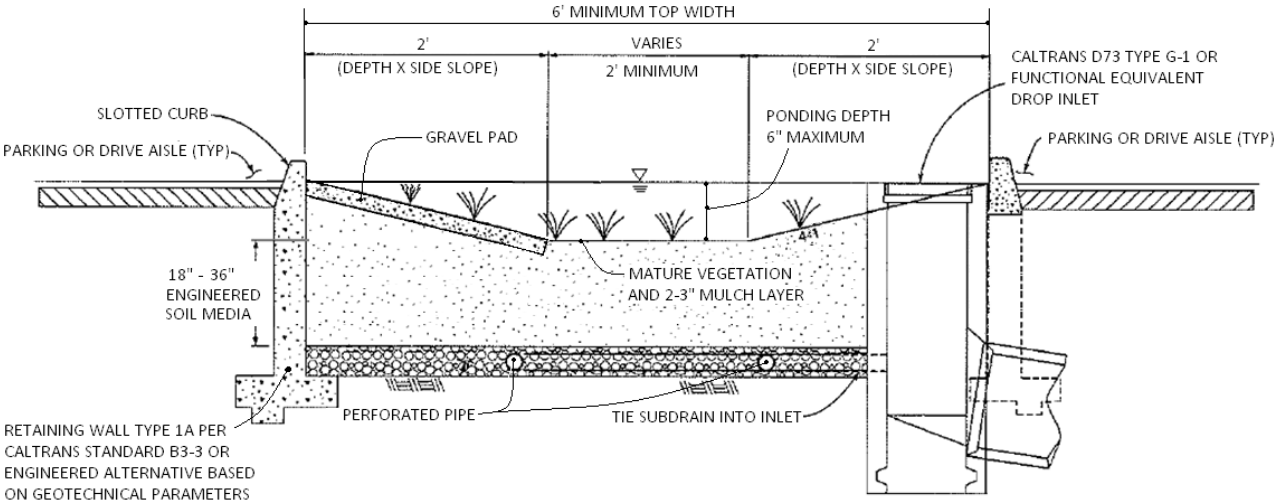
- *Depressing* landscaped areas below adjacent impervious surfaces, rather than elevating those areas
- Grading the site to direct runoff from those impervious surfaces *into* the Bioretention Facility, rather than away from the landscaping
- Sizing and designing the depressed landscaped area as a Bioretention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

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

Design and Sizing Criteria

The recommended cross section necessary for a Bioretention Facility includes:

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



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

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

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

Figure 1: Standard Layout for a Bioretention Facility

Engineered Soil Media Requirements

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

Table 1: Mineral Component Range Requirements

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

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

Vegetation Requirements

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

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

Curb Cuts

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

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

Figure 2: Curb Cut located in a Bioretention Facility

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

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

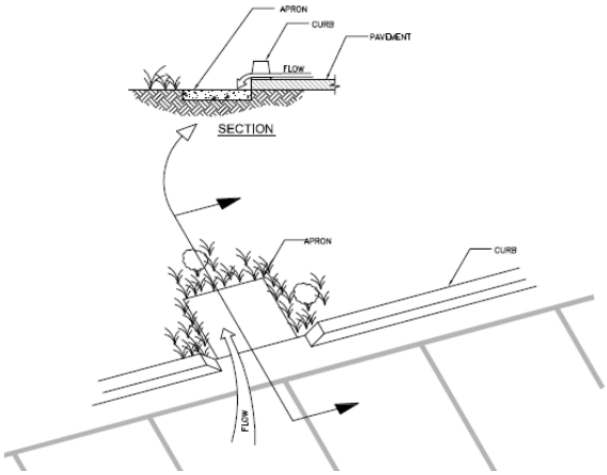


Figure 3: Apron located in a Bioretention Facility

Terracing the Landscaped Filter Basin

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

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

Table 2: Check Dam Spacing

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

Roof Runoff

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

Retaining Walls

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

Side Slope Requirements

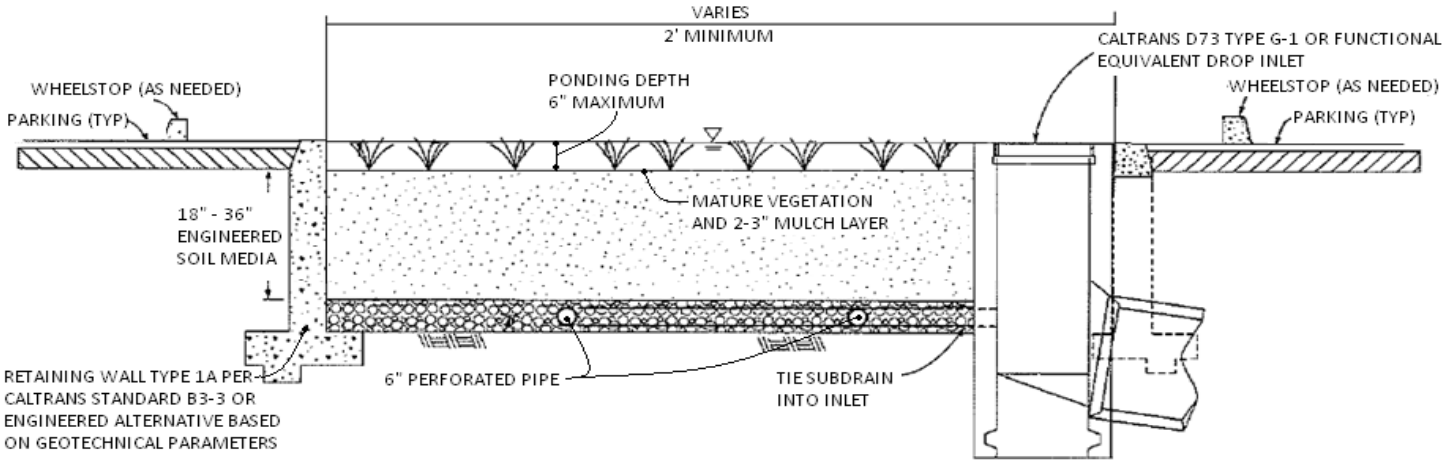
Bioretention Facilities Requiring Side Slopes

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

Bioretention Facilities Not Requiring Side Slopes

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

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



Planter Boxes

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

Figure 5: Planter Box
Source: LA Team Effort

Overflow

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

Underdrain Gravel and Pipes

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

Figure 6: Incorrect Placement of an Overflow Inlet.

Inspection and Maintenance Schedule

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

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

Bioretention Facility Design Procedure

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

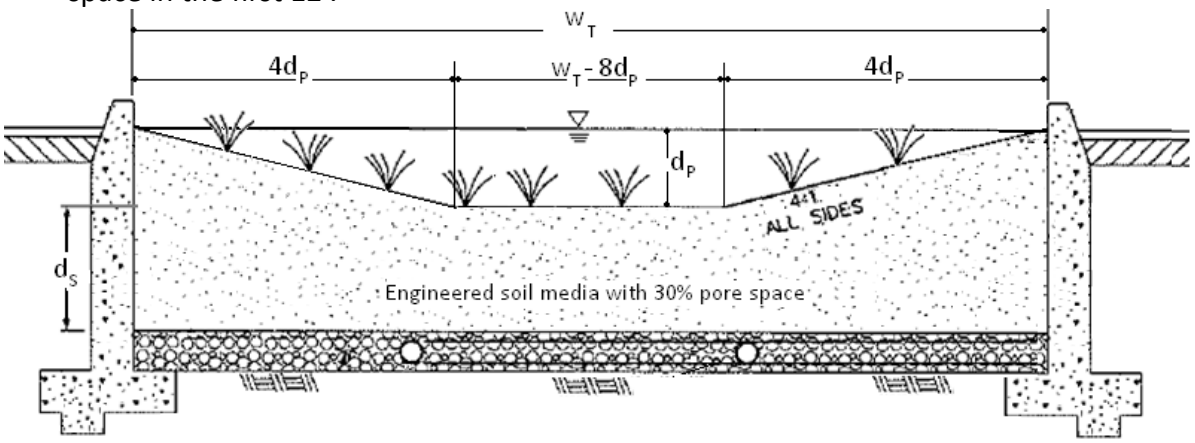
2) Enter the Design Volume, $V_{BMP,}$ determined from Section 2.1 of this Handbook.

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

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

5) Enter the top width of the Bioretention Facility.

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

13) Describe the vegetation used within the Bioretention Facility.

References Used to Develop this Fact Sheet

Anderson, Dale V. "Landscaped Filter Basin Soil Requirements." Riverside, May 2010.

California Department of Transportation. CalTrans Standard Plans. 15 September 2005. May 2010 <http://www.dot.ca.gov/hq/esc/oe/project_plans/HTM/stdplns-met-new99.htm>.

Camp Dresser and McKee Inc.; Larry Walker Associates. California Stormwater Best Management Practice Handbook for New Development and Redevelopment. California Stormwater Quality Association (CASQA), 2004.

Contra Costa Clean Water Program. Stormwater Quality Requirements for Development Applications. 3rd Edition. Contra Costa, 2006.

County of Los Angeles Public Works. Stormwater Best Management Practice Design and Maintenance Manual. Los Angeles, 2009.

Kim, Hunho, Eric A. Seagren and Allen P. Davis. "Engineered Bioretention for Removal of Nitrate from Stormwater Runoff." Water Environment Research 75.4 (2003): 355-366.

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Montgomery County Maryland Department of Permitting Services Water Resources Section. Biofiltration (BF). Montgomery County, 2005.

Program, Ventura Countywide Stormwater Quality Management. Technical Guidance Manual for Stormwater Quality Control Measures. Ventura, 2002.

United States Environmental Protection Agency. Storm Water Technology Fact Sheet Bioretention. Washington D.C, 1999.

Urban Drainage and Flood Control District. Urban Storm Drainage Criteria Manual Volume 3 - Best Management Practices. Vol. 3. Denver, 2008. 3 vols.

Urbonas, Ben R. Stormwater Sand Filter Sizing and Design: A Unit Operations Approach. Denver: Urban Drainage and Flood Control District, 2002.

Appendix 7: Hydromodification

Supporting Detail Relating to compliance with the Hydromodification Performance Standards

Examples of material to provide in Appendix 7 may include but are not limited to the following:

- Hydromodification Exemption Exhibit,
- Potential Critical Coarse Sediment Yield Area Mapping
- Hydromodification BMP sizing calculations,
- SMRHM report files,
- Site-Specific Critical Coarse Sediment Analysis,
- Design details/drawings from manufacturers for proprietary BMPs

This information should support the hydromodification exemption (if applicable) and hydrologic control BMP and Sediment Supply BMP sections of this Template. Refer to Section 2.4 and 3.6 of the SMR WQMP and Sections E of this Template.

Proposed Biofiltration Area:

The proposed biofiltration area with no infiltration volume has a static value of 1005 CF, which is greater than the required hydromodification volume of 753 CF. Therefore, our proposed BMP and site meet the hydromodification requirements.

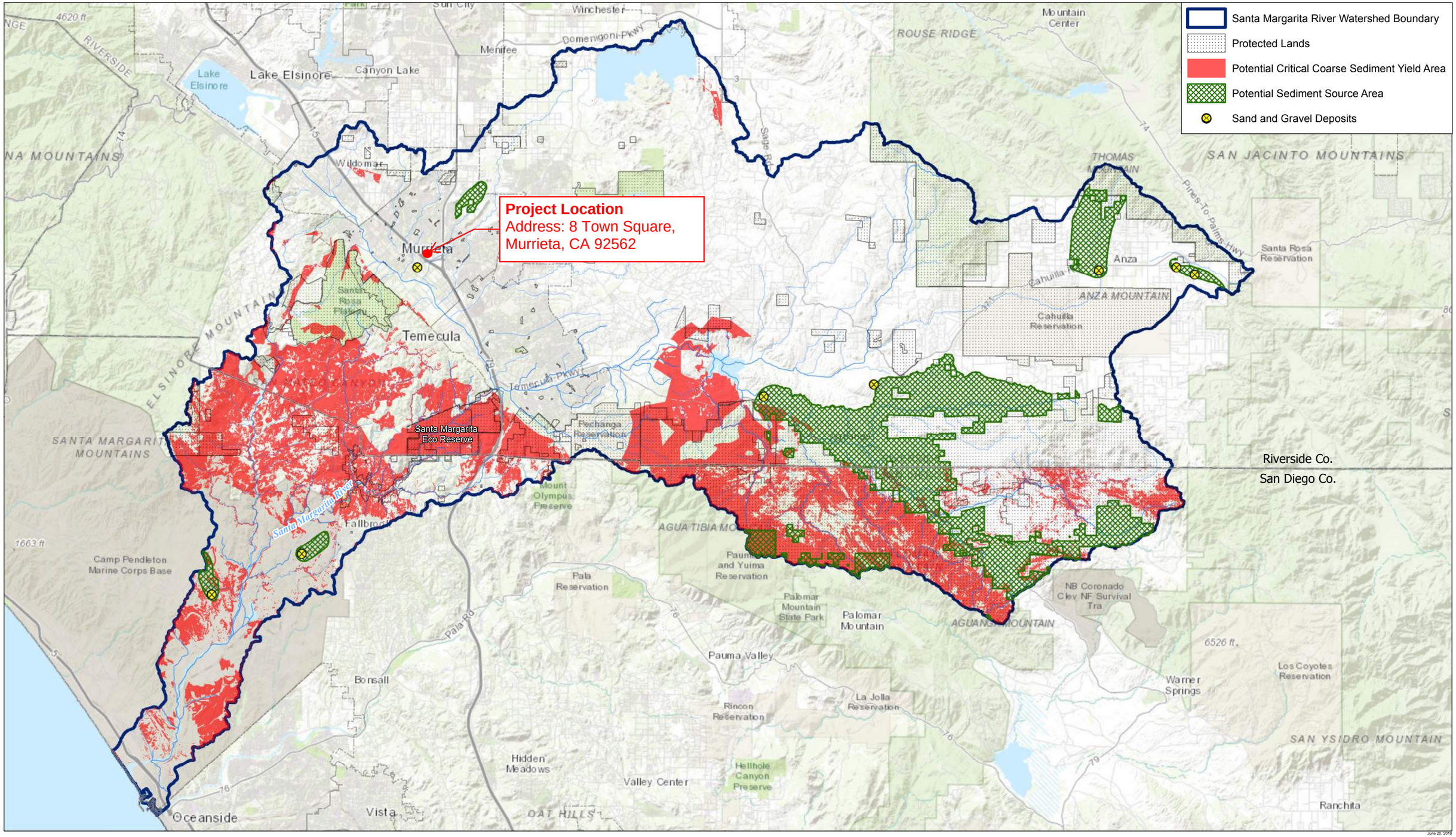


Exhibit G-1

SANTA MARGARITA RIVER WATERSHED

POTENTIAL CRITICAL COARSE SEDIMENT YIELD AREAS AND POTENTIAL SEDIMENT SOURCE AREAS

HYDROMOD SPREADSHEET
TEMECULA

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):		Rain Gauge	Temecula Valley
Latitude (decimal format):	33.558257	BMP Type (per WQMP):	Biofiltration Area With No Infiltration
Longitude (decimal format):	-117.21328	BMP Number (Sequential):	BMP-1 (Southern)

Pre-Development

Pre-Development - Hydrology Information			
DRAINAGE AREA (ACRES) - 10 acre max[1]	0.25	2-YEAR, 1-HOUR INTENSITY (IN/HR) - Plate D-4.3	0.55
LONGEST WATERCOURSE (FT) - 1,000' max[1]	85	10-YEAR, 1-HOUR INTENSITY (IN/HR) - Plate D-4.1	0.88
UPSTREAM ELEVATION OF WATERCOURSE (FT)	1110.58	SLOPE OF THE INTENSITY DURATION - Plate D-4.6	0.55
DOWNSTREAM ELEV. OF WATERCOURSE (FT)	1108.77	CLOSEST IMPERVIOUS PERCENTAGE (%)	0% Undeveloped - Good Cover
EXISTING IMPERVIOUS PERCENTAGE (%)	0		
Use 10% of Q2 to avoid Field Screening requirements	Yes		

Pre-Development

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
5	0.25 Ac.	Chaparral, Narrowleaf	Poor Cover			100		75	**88**	95
								0	**0**	0
								0	**0**	0
	0.25 Ac.						**Weighted Average RI Numbers =**	**75.0**	**88.0**	**95.0**

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

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] = **0.182** cfs	Ex. 10% of the 2-year Flowrate[1] = **0.026** cfs
(Co-Permitte Approval is required) User-Defined Discharge Values with accompanying Hydrology Study[1]	
Ex. 10-year Flowrate (Attach Study) = cfs	Ex. 2-year Flowrate (Attach Study) = 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

Post-Project - Hydrograph Information		
DRAINAGE AREA (ACRES)	0.25	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.
LONGEST WATERCOURSE (FT)	98.5	
DIFFERENCE IN ELEV (FT) - along watercourse	0.54	
PROPOSED IMPERVIOUS PERCENTAGE (%)	34.27	

Post-Project

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	0.25 Ac.	Urban Landscaping	Good Cover		100			36	**56**	75
								0	**0**	0
								0	**0**	0
	0.25 Ac.						**Weighted Average RI Numbers =**	**36.0**	**56.0**	**75.0**

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	
		Requirement		Proposed			
Hydromod Ponded depth	**0.40 feet**						
Hydromod Drain Time (unclogged)	**#DIV/0!**						
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

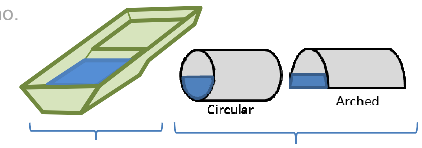
0.1 **feet, Stage Intervals**

Larger 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" "Tank Shaped"

Basin Shaped BMP (Bottom Stage 1st)

Bottom Stage H= **0.7'** SS= 4 :1

	Top Area		Bottom Area	
Width	25.6	Width	20	FT
Length	41.65	Length	36.05	FT
area =	1066.24	area =	721	

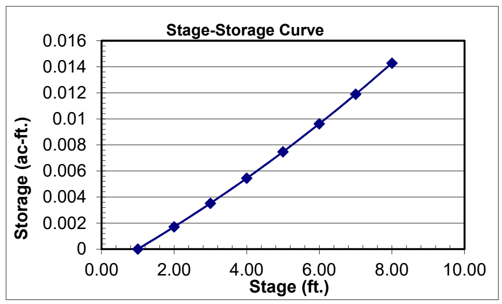
Top Stage H= **0.0'**

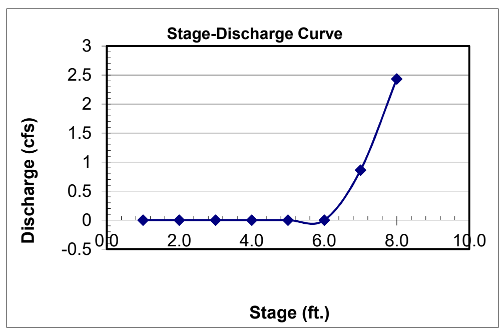
Prop. Top Stg. Vol. =	-	FT3
Prop Bottom Stg Vol =	622	FT3
Total Prop. Volume[1] =	622	FT3
Max HydroMod Volume =	301	FT3
Total Acreage[2] =	1,066	FT2
BMP % of Site =	9.79%	
Max HydroMod Depth[3] =	0.40	FT

[1]Does not include forebay, or low flow trench

[2]Does not account for freeboard or access roads

[3]Does not consider Increased Runoff





Stage-Storage-Discharge*

Stage (FT)	Storage (AC-FT)	Storage (FT3)	Q (CFS)
0	0	0	0
0.10	0.002	74	0.00
0.20	0.004	153	0.00
0.30	0.005	237	0.00
0.40	0.007	326	0.00
0.50	0.010	419	0.00
0.60	0.012	518	0.86
0.70	0.014	622	2.43
	0.014	622	

MINIMUM DESIGN GEOMETRY

STEP3: 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			0.50	8	1

Hydromod Depth =	0.40 FT
+ 1' Freeboard =	1.40 FT

Top Surface Area

Based on HydroMod Depth +1' of Freeboard

Bottom Stage		
Width	25.6	FT
Length	41.65	FT

STEP4: 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

Yes	**Consider Infiltration (Yes or No)?**
2.5	Infiltration rate (in/hr) [3]
3	Factor of Safety (3 or greater) [3]
300	mins, Max. Time represented by tests

0.0417	ft3/sec, Infiltration (over entire bottom)
0.0139	ft3/sec, Infiltration / Factor of Safety

Only if allowed by the Co-Permittee, these infiltration inputs can be used to simulate Bioretention/Biofiltration rates with Backup Calcs and Data.

[3]Per the RC LID Manual, Appendix A.

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):		Rain Gauge	Temecula Valley
Latitude (decimal format):	33.558257	BMP Type (per WQMP):	Biofiltration Area With No Infiltration
Longitude (decimal format):	-117.21328	BMP Number (Sequential):	BMP-2 (Northern)

Pre-Development

Pre-Development - Hydrology Information			
DRAINAGE AREA (ACRES) - 10 acre max[1]	0.244	2-YEAR, 1-HOUR INTENSITY (IN/HR) - Plate D-4.3	0.55
LONGEST WATERCOURSE (FT) - 1,000' max[1]	85	10-YEAR, 1-HOUR INTENSITY (IN/HR) - Plate D-4.1	0.88
UPSTREAM ELEVATION OF WATERCOURSE (FT)	1110.58	SLOPE OF THE INTENSITY DURATION - Plate D-4.6	0.55
DOWNSTREAM ELEV. OF WATERCOURSE (FT)	1108.77	CLOSEST IMPERVIOUS PERCENTAGE (%)	0% Undeveloped - Good Cover
EXISTING IMPERVIOUS PERCENTAGE (%)	0		
Use 10% of Q2 to avoid Field Screening requirements	Yes		

Pre-Development

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
5	0.244 Ac.	Chaparral, Narrowleaf	Poor Cover			100		75	**88**	95
								0	**0**	0
								0	**0**	0
	0.24 Ac.						**Weighted Average RI Numbers =**	**75.0**	**88.0**	**95.0**

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

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] = **0.178** cfs	Ex. 10% of the 2-year Flowrate[1] = **0.026** cfs
(Co-Permitte Approval is required) User-Defined Discharge Values with accompanying Hydrology Study[1]	
Ex. 10-year Flowrate (Attach Study) = cfs	Ex. 2-year Flowrate (Attach Study) = 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

Post-Project - Hydrograph Information		
DRAINAGE AREA (ACRES)	0.244	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.
LONGEST WATERCOURSE (FT)	98.5	
DIFFERENCE IN ELEV (FT) - along watercourse	0.54	
PROPOSED IMPERVIOUS PERCENTAGE (%)	32.72	

Post-Project

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	0.244 Ac.	Urban Landscaping	Good Cover		100			36	**56**	75
								0	**0**	0
								0	**0**	0
	0.24 Ac.						**Weighted Average RI Numbers =**	**36.0**	**56.0**	**75.0**

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	
		Requirement		Proposed			
Hydromod Ponded depth	**0.70 feet**						
Hydromod Drain Time (unclogged)	**27.14 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

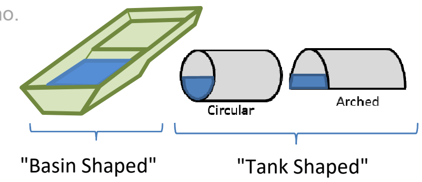
0.1 feet, Stage Intervals

Larger 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.

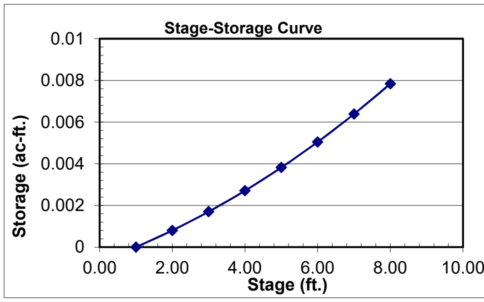


Basin Shaped BMP (Bottom Stage 1st)

Bottom Stage H= 0.7' SS= 4 :1

	Top Area		Bottom Area	
Width	12.6	Width	7	FT
Length	52.32	Length	46.72	FT
area =	659.232	area =	327	

Top Stage H= 0.0'

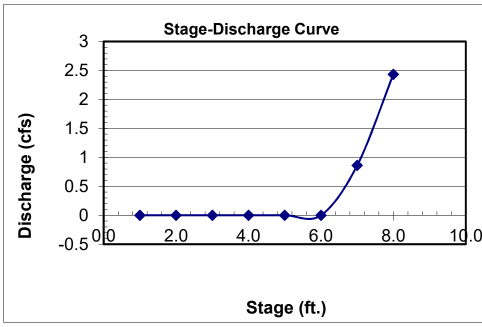


Prop. Top Stg. Vol. =	-	FT3
Prop Bottom Stg Vol =	338	FT3
Total Prop. Volume[1] =	338	FT3
Max HydroMod Volume =	291	FT3
Total Acreage[2] =	659	FT2
BMP % of Site =	6.20%	
Max HydroMod Depth[3] =	0.70	FT

[1]Does not include forebay, or low flow trench

[2]Does not account for freeboard or access roads

[3]Does not consider Increased Runoff



Stage-Storage-Discharge*

Stage (FT)	Storage (AC-FT)	Storage (FT3)	Q (CFS)
0	0	0	0
0.10	0.001	35	0.00
0.20	0.002	74	0.00
0.30	0.003	118	0.00
0.40	0.004	167	0.00
0.50	0.005	220	0.00
0.60	0.006	278	0.86
0.70	0.008	341	2.43
	0.008	341	

MINIMUM DESIGN GEOMETRY

STEP3: 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			0.50	8	1

Hydromod Depth = 0.70 FT

+ 1' Freeboard = 1.70 FT

Top Surface Area

Based on HydroMod Depth +1' of Freeboard

Bottom Stage		
Width	12.6	FT
Length	52.32	FT

STEP4: 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

Yes	**Consider Infiltration (Yes or No)?**
2.5	Infiltration rate (in/hr) [3]
3	Factor of Safety (3 or greater) [3]
300	mins, Max. Time represented by tests

0.0189 ft3/sec, Infiltration (over entire bottom)

0.0063 ft3/sec, Infiltration / Factor of Safety

Only if allowed by the Co-Permittee, these infiltration inputs can be used to simulate Bioretention/Biofiltration rates with Backup Calcs and Data.

[3]Per the RC LID Manual, Appendix A.

EXHIBIT G-1
POTENTIAL CRITICAL COARSE SEDIMENT YIELD MAP

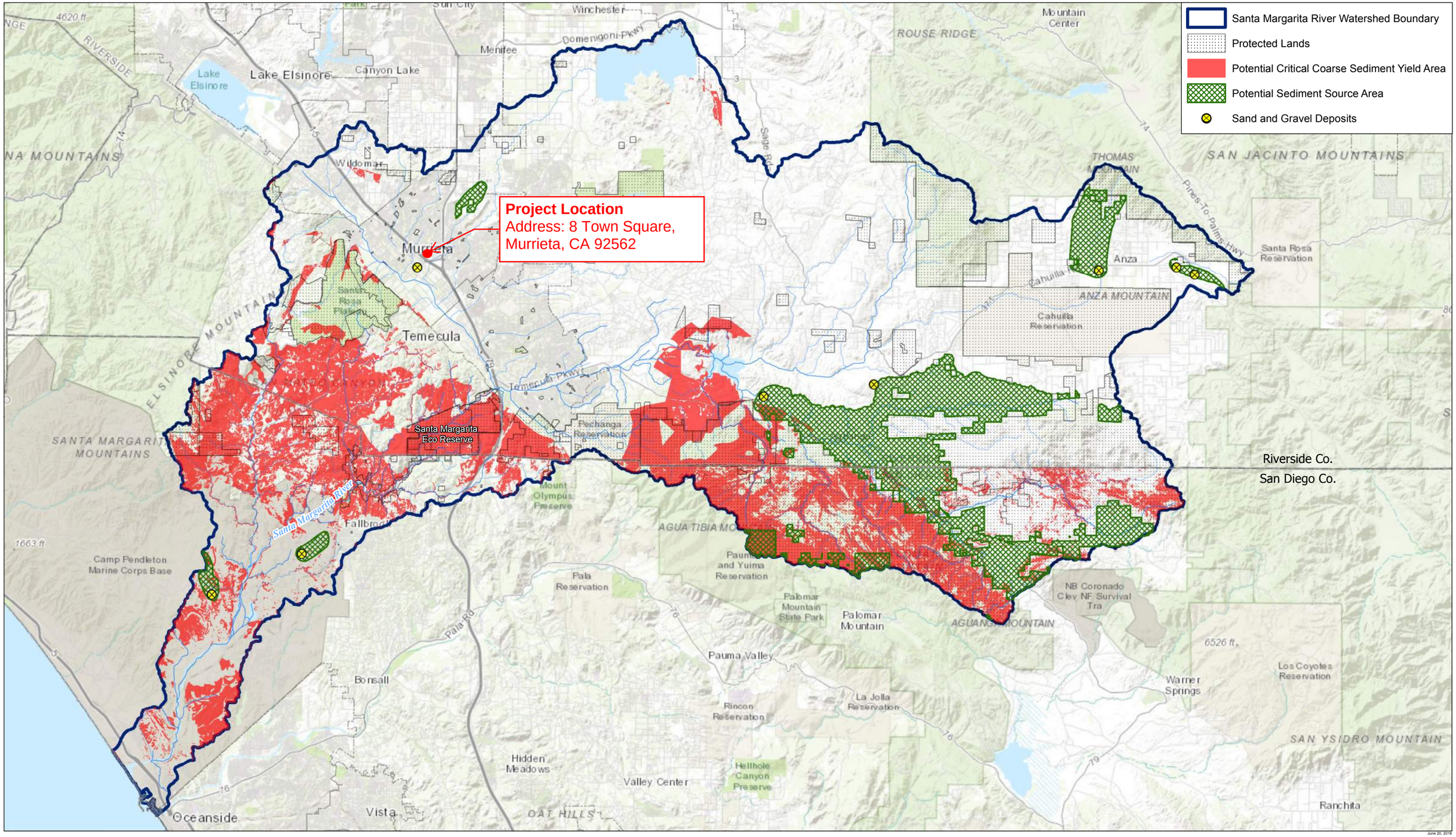


Exhibit G-1

SANTA MARGARITA RIVER WATERSHED

POTENTIAL CRITICAL COARSE SEDIMENT YIELD AREAS AND POTENTIAL SEDIMENT SOURCE AREAS

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

Include a copy of the completed Pollutant Sources/Source Control Checklist used to document Source Control BMPs in Section H of this Template.

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

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

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

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

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

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

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

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

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

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

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

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

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ N. **Fire Sprinkler Test Water**		❑ **Provide a means to drain fire sprinkler test water to the sanitary sewer.**	❑ **See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**
O. **Miscellaneous Drain or Wash Water or Other Sources** ❑ **Boiler drain lines** ❑ **Condensate drain lines** ❑ **Rooftop equipment** ❑ **Drainage sumps** ❑ **Roofing, gutters, and trim.** ❑ **Other sources**		❑ **Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.** ❑ **Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system.** ❑ **Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment.** ❑ **Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.** ❑ **Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.** **Include controls for other sources as specified by local reviewer.**	

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☑ P. **Plazas, sidewalks, and parking lots.**			☑ **Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.**

Appendix 9: O&M

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

Include the completed Operation and Maintenance Plan in this Appendix along with additional documentation of Finance and Maintenance Recording Mechanisms for the site. Refer to Sections 3.10 and 5 of the SMR WQMP and Section J of this Template.

Maintenance Requirements

Maintenance and regular inspections are important for proper function of biofiltration areas. Biofiltration areas require annual plant, soil, and mulch layer maintenance to ensure optimal infiltration, storage, and pollutant removal capabilities. In general, biofiltration maintenance requirements are typical landscape care procedures and include:

- Irrigate plants as needed during prolonged dry periods. In general, plants should be selected to be drought-tolerant and not require irrigation after establishment (two to three years).

- Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred. Properly-designed facilities with appropriate flow velocities should not cause erosion except potentially during in extreme events. If erosion occurs, the flow velocities and gradients within the biofiltration area and flow dissipation and erosion protection strategies in the pretreatment area and flow entrance should be reassessed. If sediment is deposited in the biofiltration area, identify the source of the sediment within the tributary area, stabilize the source, and remove excess surface deposits.

- Prune and remove dead plant material as needed. Replace all dead plants, and if specific plants have a high mortality rate, assess the cause and, if necessary, replace with more appropriate species.

- Remove weeds as needed until plants are established. Weed removal should become less frequent if the appropriate plant species are used and planting density is attained.

- Select the proper soil mix and plants for optimal fertility, plant establishment, and growth to preclude the use of nutrient and pesticide supplements. By design, biofiltration facilities are located in areas where phosphorous and nitrogen levels are often elevated such that these should not be limiting nutrients. Addition of nutrients and pesticides may contribute pollutant loads to receiving waters.

- In areas where heavy metals deposition is likely (i.e., tributary areas to industrial, vehicle dealerships/repair, parking lots, roads), replace mulch annually. In areas where metals deposition is less likely (i.e., residential lots), replace or add mulch as needed to maintain a two to three inch depth at least once every two years.

- Analyze soil for fertility and pollutant levels if necessary. Biofiltration soil media are designed to maintain long-term fertility and pollutant processing capability.

- Eliminate standing water to prevent vector breeding.

- Inspect overflow devices for obstructions or debris, which should be removed immediately. Repair or replace damaged pipes upon discovery.

- Inspect, and clean if necessary, the underdrain.

A summary of potential problems that need to be addressed by maintenance activities is presented in Table E-13.

The County requires execution of a maintenance agreement to be recorded by the property owner for the on-going maintenance of any privately-maintained stormwater quality control measures. The property owner is responsible for compliance with the maintenance agreement. A sample maintenance agreement is presented in Appendix H.

Table E-13. Biofiltration Troubleshooting Summary

Problem	Conditions When Maintenance Is Needed	Maintenance Required
Vegetation	Overgrown vegetation	Mow and prune vegetation as appropriate.
	Presence of invasive, poisonous, nuisance, or noxious vegetation or weeds	Remove this vegetation and plant native species as needed.
Trash and Debris	Trash, plant litter, and dead leaves present	Remove and properly dispose of trash and debris.
Irrigation (if applicable)	Not functioning correctly	Check irrigation system for clogs or broken lines and repair as needed.
Inlet/Overflow	Inlet/overflow areas clogged with sediment and/or debris	Remove material.
	Overflow pipe blocked or broken	Repair as needed.
Erosion/Sediment Accumulation	Splash pads or spreader incorrectly placed Presence of erosion or sediment accumulation	Check inlet structure to ensure proper function. Repair, or replace if necessary, the inlet device. Repair eroded areas with gravel as needed. Re-grade the biofiltration area as needed.
Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Remove any evidence of visual contamination from floatables such as oil and grease.
Standing water	Standing water observed more than 96 hours after storm event	Inspect, and clean as needed, the underdrain to ensure proper function. Clear clogs as needed. Remove and replace planter media (sand, gravel, topsoil, mulch) and vegetation.

Appendix 10: Educational Materials

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

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.