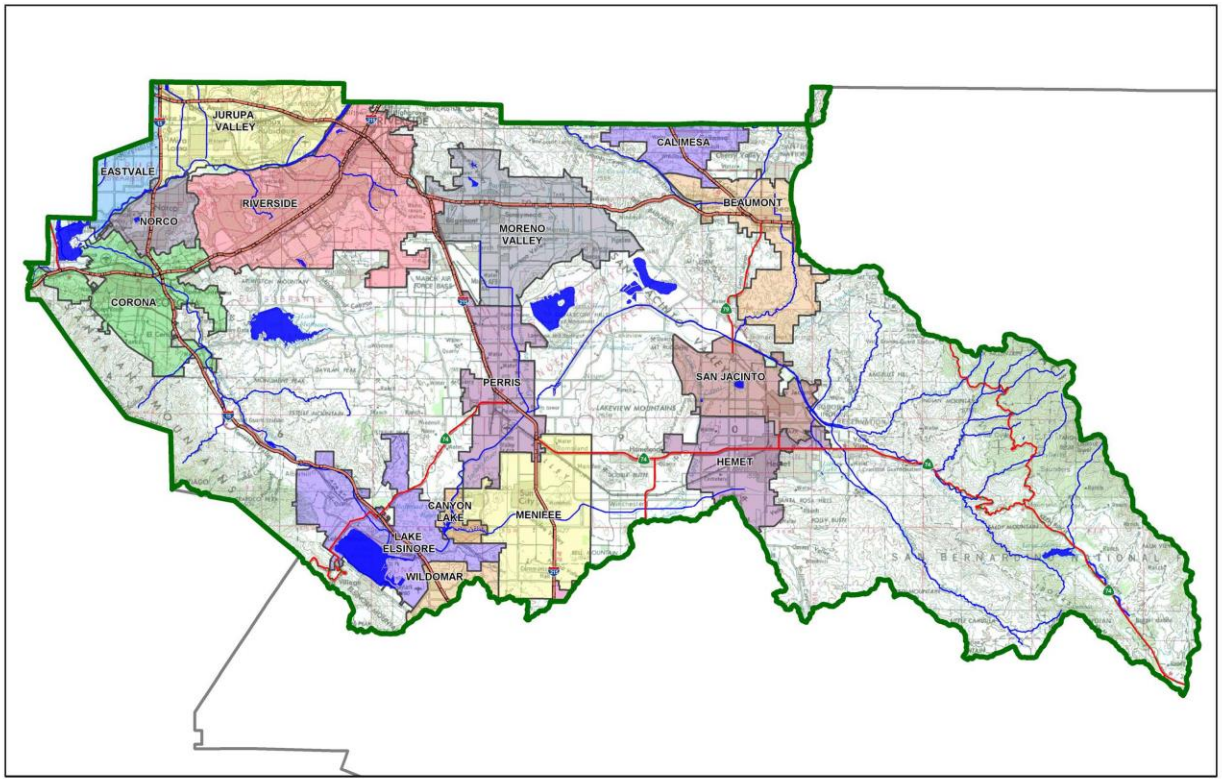
Project Specific Water Quality Management Plan

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

Project Title: Tentative Tract Map 38421, Town Center at Moreno Valley Specific Plan

Development No: Insert text here

Design Review/Case No: LWQ22-0026



☒ **Preliminary**
☐ **Final**

Original Date Prepared: 6/13/2022

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9/30/2022

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

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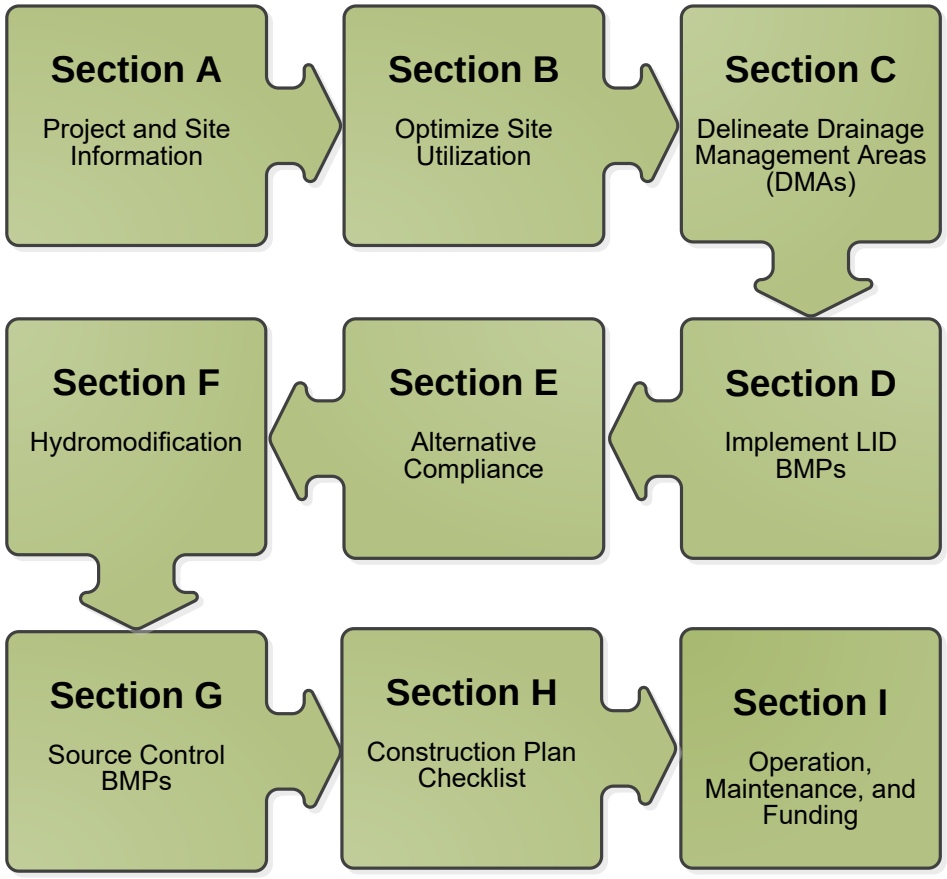
A Brief Introduction

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



OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for

Lewis Management Corp. by Samuel J. Jacoby, PE, QSD, Cannon Corporation for the Tentative Tract Map 38421, Town Center at Moreno Valley Specific Plan project.

This WQMP is intended to comply with the requirements of City of Moreno Valley for Ordinance 827 which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under City of Moreno Valley Water Quality Ordinance (Municipal Code Section 8.10).

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

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

PREPARER'S CERTIFICATION

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

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

Preparer's Licensure:

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Mixed Use, residential, commercial
Planning Area:	N/A
Community Name:	City of Moreno Valley
Development Name:	Tentative Tract Map 38421, Town Center at Moreno Valley Specific Plan
PROJECT LOCATION	
Latitude & Longitude (DMS): 33.92d N, 117.19d W	
Project Watershed and Sub-Watershed: Lake Elsinore, San Jacinto River	
APN(s): 487-470-030, 031,	
Map Book and Page No.: 11/10	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Residential, Commercial
Proposed or Potential SIC Code(s)	8811,5999
Area of Impervious Project Footprint (SF)	0 SF (existing)
Total Area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement	1,752,028± SF (prop'd)
Does the project consist of offsite road improvements?	☒ Y ☐ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the project limits (SF)	0
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	N/A
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☒ Y ☐ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	N/A

Existing and Proposed Site Description

(Section added at request of Plan reviewer)

As described in Section B, the site exists in an undeveloped condition. There exists a single parcel between Bay Avenue and Cottonwood Avenue, and a second parcel between Cottonwood and Alessandro Boulevard. there are several minor pieces of each parcel that have been conveyed as right of way easements on the adjacent streets including Nason Street. The project proposes to vacate Bay Avenue and re-dedicate a narrower right of way; dedicate a new, north-south "A" street; create two park parcels and create 6 developable parcels. The proposed lot-specific development plans have not yet been determined. As part of this initial phase of work (mass grading, constructing temporary sedimentation basins, and common infrastructure), the project aims to identify significant restrictions or opportunities for lot-specific water quality. As each lot develops, an expected condition of approval will

be that each lot will be required to submit an independent Water Quality Management Plan, complete with lot-specific infiltration testing. Please note that the BMPs identified herein are conceptual in nature, and are not intended for construction during the mapping/initial work, but instead will guide future development-specific BMPs.

Per plan checker for Tentative Map stage, ultimate BMPs are not sited or determined on the BMP exhibits resulting from these factors. Additionally, considerations should be taken by Engineer of Record on future phases to document actual location of sedimentation basins (in place prior to work) and take appropriate measures when siting ultimate BMPs, such as avoiding these areas, or performing additional testing.

What is the Water Quality Design Storm Depth for the project?	0.65

A.1 Maps and Site Plans

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

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

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

A.2 Identify Receiving Waters

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

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Perris Valley Storm Drain Channel	None	N/A	N/A
san jacinto river - reaches 1,2,3	None	INTERMITTENT - MUN, AGR, GWR, REC1, REC2, WARM, WILD	N/A
Canyon Lake	Nutrients	MUN, AGR, GWR, REC1, REC2, WARM, WILD	N/A
Lake Elsinore	PCBs (Polychlorinated biphenyls) (68444), Organic Enrichment/Low Dissolved Oxygen (68808), Nutrients (69206), Toxicity (76493), DDT (Dichlorodiphenyltrichloroethane) (94768)	REC1, REC2, WARM, WILD	N/A
Temescal Creek, Reach 6	None	INTERMITTENT - GWR, REC1, REC2, WARM, WILD	N/A
Temescal Creek, Reach 5	None	AGR, GWR, REC1, REC2, WARM, WILD, RARE	N/A
Temescal Creek, Reach 4	None	RARE, INTERMITTENT - AGR, GWR, REC1, REC2, WARM, WILD	N/A
Temescal Creek, Reach 3	None	N/A	N/A
Temescal Creek, Reach 2	None	INTERMITTENT - AGR, IND, GWR, REC1, REC2, LWARM, WILD	N/A
Temescal Creek, Reach 1	None	REC1, REC2, WARM, WILD	N/A
Santa Ana River, Reach 2	None	AGR, GWR, REC1, REC2, WARM, WILD, RARE, SPWN	48 Mi.
Santa Ana River, Reach 1	None	REC1, REC2, WARM, WILD	N/A

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

Table A.2 Other Applicable Permits

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

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

Section B: Optimize Site Utilization (LID Principles)

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

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

Site Optimization

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

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

The existing site has a subtle topographic, and hydrologic, north-south aligned ridge on the eastern half of the site, that separates drainage southeast to Nason St. from flow directed southwest towards Alessandro, Bay and ultimately Morrison St. This ridge is separate from the existing soil stockpile at the southeast corner of the site. The project has 'tabled' existing and built-out hydrology from the proposed parcels according to the divide, and the water quality design follows accordingly.

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

Native vegetation is not preserved. The site currently exists in an undeveloped condition, and will be mass-graded to accommodate the development

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

Yes, infiltration testing has occurred, and will be maintained through limited sub-surface interaction, and limited the 'cut' in the earthwork. Infiltration is proposed for BMPs

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

The project proposes impervious areas by zone and by tentatively mapped parcel. The project proposes immediate imperviousness solely along the project's roadways - the roadway imperviousness is

mandated by the City of Moreno Valley. Future phases will identify and minimize imperviousness as practicable.

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

The project proposes immediate imperviousness solely along the project's roadways - the roadway imperviousness is mandated by the City of Moreno Valley. Future phases will identify and minimize imperviousness as practicable.

PLEASE NOTE:

This WQMP is being prepared to support a non-development-specific tentative tract map. While the infrastructure for the development is proposed, such as roads water, sewer, improvements to adjacent rights of way, the project proposes to subdivide the land from two parcels to 8 proposed lots (inclusive of parks). The lot-specific development plans have not been prepared. Once said lot plans are developed, the developer would, consistent with City guidance, prepare lot-specific WQMP plans. Based on the findings contained herein, infiltration appears to be feasible, and latter WQMPs are anticipated to be consistent within this overall WQMP's findings and recommendations.

Section C: Delineate Drainage Management Areas (DMAs)

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

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1]	Area (Sq. Ft.)	DMA Type
DMA 1	Residential impervious landscape	210,700 90,300 301,000	Type D-Bioinfiltratoin Type D-Bioinfiltratoin
DMA 2	Residential impervious landscape	262,536 112,515 375,052	Type D-Bioinfiltratoin Type D-Bioinfiltratoin
DMA 3a	Residential impervious landscape	71,961 30,840 102,802	Type D-Bioinfiltratoin Type D-Bioinfiltratoin
DMA 3b	Residential impervious landscape	103,063 44,170 147,233	Type D-Bioinfiltratoin Type D-Bioinfiltratoin
DMA 4a	Park impervious landscape	15,072 60,287 75,359	Type D-Bioinfiltratoin Type D-Bioinfiltratoin
DMA 4b	Park impervious landscape	15,420 90,779 106,199	Type D-Bioinfiltratoin Type D-Bioinfiltratoin
DMA 5	Residential impervious landscape	227,165 97,357 324,522	Type D-Bioinfiltratoin Type D-Bioinfiltratoin
DMA 6	Residential impervious landscape	239,057 102,453 341,510	Type D-Bioinfiltratoin Type D-Bioinfiltratoin
DMA 7a	commercial impervious landscape	176,614 31,167 207,781	Type D-Bioinfiltratoin Type D-Bioinfiltratoin
DMA 7b	commercial impervious landscape	412,470 72,789 485,258	Type D-Bioinfiltratoin Type D-Bioinfiltratoin
DMA 8	Residential impervious landscape	11,935 47,742 59,677	Type D-Bioinfiltratoin Type D-Bioinfiltratoin

(CONTINUED, NEXT PAGE)

DMA Name or ID	Surface Type(s)[1]	Area (Sq. Ft.)	DMA Type
DMA ROW SOUTH	Street,Sidewalk landscape	110,120 27,530 137,650	None None
DMA ROW NORTH	Street,Sidewalk landscape	140,786 35,196 175,982	None None
DMA ROW EAST	Street,Sidewalk landscape	177,376 44,344 221,720	None None

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

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

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

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

Note by engineer: Consistent with City comments during preliminary WQMP review, the infiltration BMPs will account for the volume of self-retaining landscape areas. While the areas may, in fact, self-retain, the City requires the infiltration BMPs to be sized in the event that self-retaining fails, or otherwise is non-functional.

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]
TBD (DEFERRED UNTIL SITE-SPECIFIC WQMPs)*				TBD (DEFERRED UNTIL SITE-SPECIFIC WQMPs)*		

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

*Tables left blank resulting from direction of plan checker during tentative map stage.

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

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

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

DMA Name or ID	BMP Name or ID
DMA 1	BMP 1, TBD
DMA 2	BMP 2, TBD
DMA 3a	BMP 3a, TBD
DMA 3b	BMP 3b, TBD
DMA 4a	BMP 4a, TBD
DMA 4b	BMP 4b, TBD
DMA 5	BMP 5, TBD
DMA 6	BMP 6, TBD
DMA 7a	BMP 7a, TBD
DMA 7b	BMP 7b, TBD
DMA 8	BMP 8, TBD
DMA ROW(all)	N/A

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

Section D: Implement LID BMPs

D.1 Infiltration Applicability

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

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

Geotechnical Report

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

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

Infiltration Feasibility

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

Table D.1 Infiltration Feasibility

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

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

Note by engineer: Consistent with City comments during preliminary WQMP review, wile the geotechnical report did indicated infiltration feasibility during the Tentative Map stage, each lot-

specific WQMP will be required to submit Lot-Specific geotechnical analysis and infiltration testing. The lot-specific WQMP shall be based on the subsequent test results.

D.2 Harvest and Use Assessment

Please check what applies*:*

☐ Reclaimed water will be used for the non-potable water demands for the project.

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

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

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

Irrigation Use Feasibility

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

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

Total Area of Irrigated Landscape: N/A, infiltration and/or bioretention proposed

Type of Landscaping (Conservation Design or Active Turf): N/A, infiltration and/or bioretention proposed

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

Total Area of Impervious Surfaces: N/A, infiltration and/or bioretention proposed

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

Enter your EIATIA factor: N/A, infiltration and/or bioretention proposed

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

Minimum required irrigated area: N/A, infiltration and/or bioretention proposed

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

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)
N/A, infiltration and/or bioretention proposed	**N/A, infiltration and/or bioretention proposed**

Toilet Use Feasibility

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

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

Projected Number of Daily Toilet Users: N/A, infiltration and/or bioretention proposed

Project Type: N/A, infiltration and/or bioretention proposed

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

Total Area of Impervious Surfaces: N/A, infiltration and/or bioretention proposed

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

Enter your TUTIA factor: N/A, infiltration and/or bioretention proposed

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

Minimum number of toilet users: N/A, infiltration and/or bioretention proposed

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

Minimum required Toilet Users (Step 4)	Projected number of toilet users (Step 1)
N/A, infiltration and/or bioretention proposed	N/A, infiltration and/or bioretention proposed

Other Non-Potable Use Feasibility

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

N/A, infiltration and/or bioretention proposed

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

Average Daily Demand: N/A, infiltration and/or bioretention proposed

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

Total Area of Impervious Surfaces: N/A, infiltration and/or bioretention proposed

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

Enter the factor from Table 2-3: N/A, infiltration and/or bioretention proposed

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

Minimum required use: N/A, infiltration and/or bioretention proposed

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

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
N/A, infiltration and/or bioretention proposed	N/A, infiltration and/or bioretention proposed

If Irrigation, Toilet and Other Use feasibility anticipated demands are less than the applicable minimum values, Harvest and Use BMPs are not required and you should proceed to utilize LID Bioretention and Biotreatment, unless a site-specific analysis has been completed that demonstrates technical infeasibility as noted in D.3 below.

D.3 Bioretention and Biotreatment Assessment

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

Select one of the following:

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

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

D.4 Feasibility Assessment Summaries

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

Table D.2 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
DMA 1	☒	☐	☐	☐	☐
DMA 2	☒	☐	☐	☐	☐
DMA 3a	☒	☐	☐	☐	☐
DMA 3b	☒	☐	☐	☐	☐
DMA 4a	☒	☐	☐	☐	☐
DMA 4b	☒	☐	☐	☐	☐
DMA 5	☒	☐	☐	☐	☐
DMA 6	☒	☐	☐	☐	☐
DMA 7a	☒	☐	☐	☐	☐
DMA 7b	☒	☐	☐	☐	☐
DMA 8	☒	☐	☐	☐	☐
DMA ROW	☐	☐	☐	☐	☒

Note by engineer: The conceptual "Bio-Infiltration" is an alias to Infiltration Basins, per the Riverside County BMP Manual, and is not intended to be interpreted as "Bioretention" which does allow for piped discharge of treated flow.

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

The right of way has not been identified as containing, nor draining to, a BMP.

D.5 LID BMP Sizing

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

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet) [A]	Post-Project Surface Type	Effective Impervious Fraction, I_f [B]	DMA Runoff Factor [C]	DMA Areas x Runoff Factor [A] x [C]	*Enter BMP Name / Identifier Here*		
DMA 1	***301,000***	***Residential***	***0.7***	0.493894	***148,661.90***	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	AT Σ=300999.6				Σ=148662	0.66	8,176.4	

DMA Type/ID	DMA Area (square feet) [A]	Post-Project Surface Type	Effective Impervious Fraction, I_f [B]	DMA Runoff Factor [C]	DMA Areas x Runoff Factor [A] x [C]	*Enter BMP Name / Identifier Here*		
DMA 2	***375,052***	***Residential***	***0.7***	0.493894	***185,235.73***	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	AT Σ=375051.6				Σ=185236	0.66	10,188.0	

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]	
DMA 3a	***102,802***	***Residential***	***0.7***	0.493894	***50,773.09***	*Design Storm Depth (in)* / *Design Capture Volume, V_{BMP} (cubic feet)* / *Proposed Volume on Plans (cubic feet)*
	AT Σ=102801.6				Σ=50773	0.66 / 2,792.5

DMA Type/ID	**DMA Area (square feet)** [A]	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f** [B]	**DMA Runoff Factor** [C]	**DMA Areas x Runoff Factor** [A] x [C]	***Enter BMP Name / Identifier Here***
DMA 3b	***147,233***	***Residential***	***0.7***	0.493894	***72,717.40***	*Design Storm Depth (in)* / *Design Capture Volume, V_{BMP} (cubic feet)* / *Proposed Volume on Plans (cubic feet)*
	AT Σ=147232.8				Σ=72717	0.66 / 3,999.5

DMA Type/ID	**DMA Area (square feet)** [A]	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f** [B]	**DMA Runoff Factor** [C]	**DMA Areas x Runoff Factor** [A] x [C]	***Enter BMP Name / Identifier Here***
DMA 4a	***75,359***	***Residential***	***0.2***	0.170464	***12,845.96***	*Design Storm Depth (in)* / *Design Capture Volume, V_{BMP} (cubic feet)* / *Proposed Volume on Plans (cubic feet)*
	AT Σ=75358.8				Σ=12846	0.66 / 706.5

DMA Type/ID	**DMA Area (square feet)** [A]	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f** [B]	**DMA Runoff Factor** [C]	**DMA Areas x Runoff Factor** [A] x [C]	***Enter BMP Name / Identifier Here***
DMA 4b		***Residential***	***0.2***	0.170464		*Design* *Design* *Proposed*

	77,101				***13,142.98***	*Storm Depth (in)*	*Capture Volume, $\mathbf{V_{BMP}}$ (cubic feet)*	*Volume on Plans (cubic feet)*
	AT Σ=77101.2				Σ=13143	0.66	722.9	

DMA Type/ID	**DMA Area (square feet)** [A]	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f** [B]	**DMA Runoff Factor** [C]	**DMA Areas x Runoff Factor** [A] x [C]	***Enter BMP Name / Identifier Here***		
DMA 5	***324,522***	***Residential***	***0.7***	0.493894	***160,279.47***	*Design Storm Depth (in)*	*Design Capture Volume, $\mathbf{V_{BMP}}$ (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	AT Σ=324522				Σ=160279	0.66	8,815.4	

DMA Type/ID	**DMA Area (square feet)** [A]	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f** [B]	**DMA Runoff Factor** [C]	**DMA Areas x Runoff Factor** [A] x [C]	***Enter BMP Name / Identifier Here***		
DMA 6	***341,510***	***Residential***	***0.7***	0.493894	***168,669.94***	*Design Storm Depth (in)*	*Design Capture Volume, $\mathbf{V_{BMP}}$ (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	AT Σ=341510.4				Σ=168670	0.66	9,276.8	

DMA Type/ID	**DMA Area (square feet)** [A]	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f** [B]	**DMA Runoff Factor** [C]	**DMA Areas x Runoff Factor** [A] x [C]	***Enter BMP Name / Identifier Here***		
DMA 7a	***207,781***	***Residential***	***0.85***	0.66126925	***137,399.32***	*Design Storm Depth*	*Design Capture Volume,*	*Proposed Volume on Plans*

						(in)	V_{BMP} *(cubic feet)*	*(cubic feet)*
	AT Σ=207781.2				Σ=137399	0.66	7,557.0	

DMA Type/ID	**DMA Area (square feet)** [A]	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f** [B]	**DMA Runoff Factor** [C]	**DMA Areas x Runoff Factor** [A] x [C]	***Enter BMP Name / Identifier Here***		
DMA 8	***59,677***	***Commercial***	***0.2***	0.170464	***10,172.81***	*Design Storm Depth (in)*	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	AT Σ=59677.2				Σ=10173	0.66	559.5	

DMA Type/ID	**DMA Area (square feet)** [A]	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f** [B]	**DMA Runoff Factor** [C]	**DMA Areas x Runoff Factor** [A] x [C]	***Enter BMP Name / Identifier Here***		
DMA ROW SOUTH	***137,650***	***Right of Way***	***0.7***	0.493894	***67,984.31***	*Design Storm Depth (in)*	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	AT Σ=137649.6				Σ=67984	0.66	3,739.1	

DMA Type/ID	**DMA Area (square feet)** [A]	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f** [B]	**DMA Runoff Factor** [C]	**DMA Areas x Runoff Factor** [A] x [C]	***Enter BMP Name / Identifier Here***		
DMA ROW NORTH	***175,982***	***Right of Way***	***0.7***	0.493894	***86,916.65***	*Design Storm Depth (in)*	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*

	AT Σ=175982.4				Σ=86917	0.66	4,780.4	

DMA Type/ID	DMA Area (square feet) [A]	Post-Project Surface Type	Effective Impervious Fraction, I_f [B]	DMA Runoff Factor [C]	DMA Areas x Runoff Factor [A] x [C]	*Enter BMP Name / Identifier Here*		
DMA ROW EAST	***221,720***	***Right of Way***	***0.7***	0.493894	***109,506.38***	*Design Storm Depth (in)*	*Design Capture Volume,* $\mathbf{V_{BMP}}$ *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	AT Σ=221720.4				Σ=109506	0.66	6,022.9	

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

Section E: Alternative Compliance (LID Waiver Program)

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

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

- *Or* -

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

The right of way does not drain to a BMP.

E.1 Identify Pollutants of Concern

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

Table E.1 Potential Pollutants by Land Use Type

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

P = Potential

N = Not Potential

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

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

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

(4) Specifically petroleum hydrocarbons

(5) Specifically solvents

(6) Bacterial indicators are routinely detected in pavement runoff

E.2 Stormwater Credits

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

Table E.2 Water Quality Credits

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

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

E.3 Sizing Criteria

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

Table E.3 Treatment Control BMP Sizing

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

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

E.4 Treatment Control BMP Selection

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

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

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

Table E.4 Treatment Control BMP Selection

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

[1] Treatment Control BMPs must not be constructed within Receiving Waters. In addition, a proposed Treatment Control BMP may be listed more than once if they possess more than one qualifying pollutant removal efficiency.

[2] Cross Reference Table E.1 above to populate this column.

[3] As documented in a Co-Permittee Approved Study and provided in Appendix 6.

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

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

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

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

If Yes, HCOC criteria do not apply.

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

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

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

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

Table F.1 Hydrologic Conditions of Concern Summary

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

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

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

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

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

The western portion of the site is exempt from hydromodification per the 2012 Hydromodification Applicability Map. The eastern portion of the site was not exempt per the 2012 map, but the Current MDP map indicates that the eastern portion drains to an improved line "F:

F.2 HCOC Mitigation

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

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

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

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

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

Section G: Source Control BMPs

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

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

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

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

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

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
Trash & Debris/ Sedimentation		Trash Inlet Filters
Trash & Debris/ Sedimentation		Street Sweeping
Trash & Debris/ Sedimentation		Storm Drain Stenciling
Trash & Debris/ Sedimentation		Restrict outdoor storage
Trash & Debris/ Sedimentation		Maintain trash and debris storage areas
Runoff Reduction		Efficient Irrigation
Trash & Debris/ Sedimentation		Maintain Dock Aras

Section H: Construction Plan Checklist

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

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)
BMP 1	Infiltration and/or bioretention	To be designed with site-development-specific WQMP
BMP 2	Infiltration and/or bioretention	To be designed with site-development-specific WQMP
BMP 3a	Infiltration and/or bioretention	To be designed with site-development-specific WQMP
BMP 3b	Infiltration and/or bioretention	To be designed with site-development-specific WQMP
BMP 4a	Infiltration and/or bioretention	To be designed with site-development-specific WQMP
BMP 4b	Infiltration and/or bioretention	To be designed with site-development-specific WQMP
BMP 5	Infiltration and/or bioretention	To be designed with site-development-specific WQMP
BMP 6	Infiltration and/or bioretention	To be designed with site-development-specific WQMP
BMP 7a	Infiltration and/or bioretention	To be designed with site-development-specific WQMP
BMP 7b	Infiltration and/or bioretention	To be designed with site-development-specific WQMP
BMP 8	Infiltration and/or bioretention	To be designed with site-development-specific WQMP

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

Section I: Operation, Maintenance and Funding

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

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

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

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

Maintenance Mechanism: Insert text here.

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

☒ Y ☐ N

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

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

WQ DMA ROW EAST
5.09 ACRES

WQ DMA ROW NORTH
4.04 ACRES

WQ DMA ROW SOUTH
3.16 ACRES

WQ DMA 1
6.91 ACRES

WQ DMA 2
8.61 ACRES

WQ DMA 3A
2.36 ACRES

WQ DMA 3B
3.38 ACRES

WQ DMA 4A
1.73 ACRES

WQ DMA 4B
1.77 ACRES

WQ DMA 5
7.45 ACRES

WQ DMA 6
7.84 ACRES

WQ DMA 7A
4.77 ACRES

WQ DMA 7B
11.14 ACRES

WQ DMA 8
1.37 ACRES

PARCEL 1
27.351 ACRES (GROSS)
26.347 ACRES (NET)

PARCEL 2
36.145 ACRES (GROSS)
34.4 ACRES (NET)

INTERIM SEDIMENTATION BASIN, LOCATIOIN OF FUTURE BMP SIZE, TYPE DETERMINED)

INTERIM SEDIMENTATION BASIN LOCATIOIN OF FUTURE BMP (SIZE, TYPE UNDETERMINED)

INTERIM SEDIMENTATION BASIN, LOCATION OF FUTURE BMP SIZE, TYPE DETERMINED)

INTERIM SEDIMENTATION BASIN LOCATIOIN OF FUTURE BMP (SIZE, TYPE UNDETERMINED)

INTERIM SEDIMENTATION BASIN LOCATIOIN OF FUTURE BMP (SIZE, TYPE UNDETERMINED)

INTERIM SEDIMENTATION BASIN LOCATIOIN OF FUTURE BMP (SIZE, TYPE UNDETERMINED)

INTERIM SEDIMENTATION BASIN LOCATIOIN OF FUTURE BMP (SIZE, TYPE UNDETERMINED)

BAY AVENUE

0 100 200
1 INCH = 100 FEET

PLAN PREPARED BY:
Cannon

PLAN PREPARED FOR:
LEWIS MANAGEMENT CORP.
1156 NORTH MOUNTAIN AVENUE
UPLAND, CALIFORNIA 91785-0670
TEL: (909) 985-0971

TRACT 38421 PRELIMINARY WATER QUALITY EXHIBIT

CITY OF MORENO VALLEY
CALIFORNIA

DATE 9/21/2022
JOB NO. 211203
CPN: PEN22-077
TTM: 38421
SHEET
WQ1

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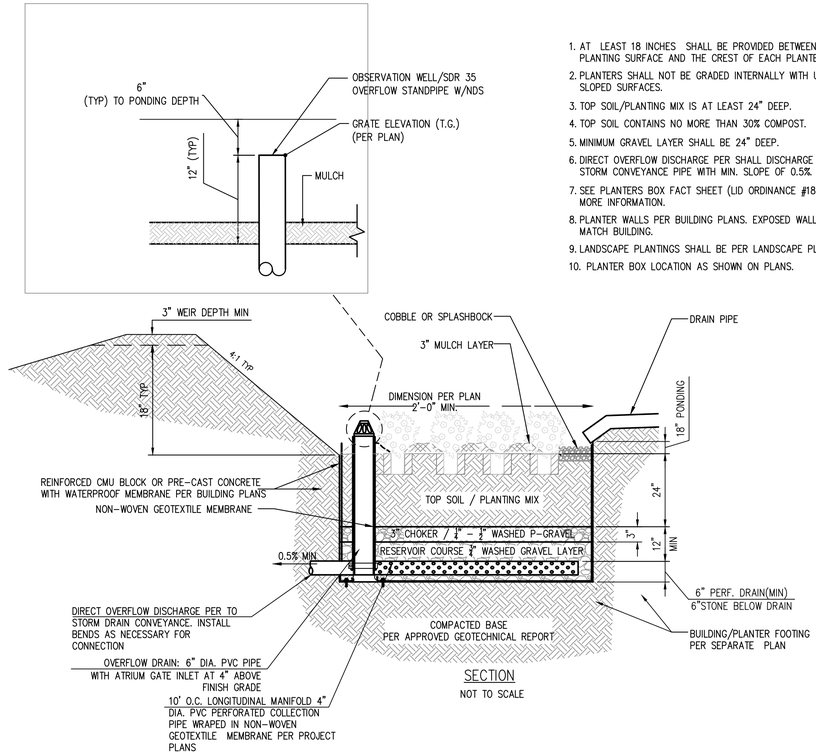


SECTION

NOT TO SCALE

1. AT LEAST 18 INCHES SHALL BE PROVIDED BETWEEN THE PLANTING SURFACE AND THE CREST OF EACH PLANTER
2. PLANTERS SHALL NOT BE GRADED INTERNALLY WITH UNEVEN OR SLOPED SURFACES.
3. TOP SOIL/PLANTING MIX IS AT LEAST 24" DEEP.
4. TOP SOIL CONTAINS NO MORE THAN 30% COMPOST.
5. MINIMUM GRAVEL LAYER SHALL BE 24" DEEP.
6. DIRECT OVERFLOW DISCHARGE PER SHALL DISCHARGE TO THE STORM CONVEYANCE PIPE WITH MIN. SLOPE OF 0.5%
7. SEE PLANTERS BOX FACT SHEET (LID ORDINANCE #181899) FOR MORE INFORMATION.
8. PLANTER WALLS PER BUILDING PLANS. EXPOSED WALLS TO MATCH BUILDING.
9. LANDSCAPE PLANTINGS SHALL BE PER LANDSCAPE PLANS.
10. PLANTER BOX LOCATION AS SHOWN ON PLANS.

CONCEPTUAL BMP (1)

SEE NOTE BELOW NTS

BIORETENTION BMP CONCEPTUAL IN NATURE. FINAL SIZE, LOCATION, AND BMP TYPE (FILTRATION, RETENTION, SUB SURFACE INFILTRATION) IS DEPENDANT ON LOT-SPECIFIC BMPs AS WELL AS LOT-SPECIFIC INFILTRATION FEASIBILITY ANALYSIS

PLAN PREPARED BY:
Cannon
16842 Von Karman Avenue, Suite #150
Irvine, CA 92606
949.668.1683

PLAN PREPARED FOR:
LEWIS MANAGEMENT CORP.
1156 NORTH MOUNTAIN AVENUE
UPLAND, CALIFORNIA 91785-0670
TEL: (909) 985-0971

TOWN CENTER AT MORENO VALLEY
TRACT 38421
WATER QUALITY DETAILS

CITY OF MORENO VALLEY
CALIFORNIA

DATE: 7/6/22
JOB NO. 211203
CPN: PEN22-077
TTM: 38421
SHEET
WQ2

Appendix 2: Construction Plans

Grading and Drainage Plans

PRELIMINARY GRADING PLAN FOR TENTATIVE TRACT MAP NO. 38421

LEGAL DESCRIPTION:

THE LAND IS SITUATED IN THE CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

PARCEL A: APN 487-470-31
21.94 ACRES M/L IN POR LOTS 2 & 8 BLK 93 AND LOT 7 BLK 93 MB 011/010 SB BEAR VALLEY & ALESSANDRO DEVELOPMENT CO LOT 2 BLOCK 93 SUBDIVISIONNAME BEAR VALLEY & ALESSANDRO DEVELOPMENT CO ACRES 021.94 M/L LOT TYPE LOT REC MAP TYPE MAP BOOK RECORDED CO CODE SB MAP PLAT B 011 MAP PLAT P 010 PORTION LOT PORTION LOT 7 LOT TYPE LOT PORTION LOT PORTION LOT 8 LOT TYPE LOT

PARCEL B: APN 487-470-30
34.48 ACRES M/L IN POR LOTS 1 & 8 BLK 104 AND LOTS 2 & 7 BLK 104 MB 011/010 SB BEAR VALLEY & ALESSANDRO DEVELOPMENT CO LOT 1 BLOCK 104 SUBDIVISION NAME BEAR VALLEY & ALESSANDRO DEVELOPMENT CO ACRES 034.48 M/L LOT TYPE LOT REC MAP TYPE MAP BOOK RECORDED CO CODE SB MAP PLAT B 011 MAP PLAT P 010 PORTION LOT PORTION LOT 2 LOT TYPE LOT PORTION LOT PORTION LOT 7 LOT TYPE LOT LOT 8 LOT TYPE LOT

FLOOD ZONE:

ZONE X – AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOOD PLAIN

GENERAL PLAN LAND USE DESIGNATION:

EXISTING: SITE: VACANT
NORTH: RESIDENTIAL
SOUTH: VACANT, RESIDENTIAL
NORTHWEST: RESIDENTIAL
SOUTHWEST: VACANT
EAST: RESIDENTIAL, CIVIC, COMMERCIAL
PROPOSED: LOTS 1,2,3,5,6: RESIDENTAL
LOT 7: COMMERCIAL
LOTS 4 AND 8: PARK / OPEN SPACE

ZONING DESIGNATION:

EXISTING: SITE: DC-DOWNTOWN CENTER
NORTH: DC-DOWNTOWN CENTER
SOUTH: DC-DOWNTOWN CENTER
NORTHWEST: DC-DOWNTOWN CENTER
SOUTHWEST: DC-DOWNTOWN CENTER
EAST: DC-DOWNTOWN CENTER
PROPOSED: SITE: SPECIFIC PLAN 222 OVERLAY, TO BE ADDED TO DC-DOWNTOWN CENTER

APN:

487-470-031 & 487-470-030

PROJECT AREA:

GROSS: 63.50 ACRES
NET: 57.34 ACRES
*INCLUDES AREAS OF EXISING PARCELS (PRIOR TO BAY VACATION) AS GROSS, MINUS ONSITE RIGHT OF WAY EASEMENTS FOR NET.

EARTHWORK:

95,92,378 CY CUT
82,480 CY FILL
9,898 CY SHRINKAGE
0 CY IMPORT/EXPORT (BALANCE)

LEGEND AND ABBREVIATIONS

	EXISTING	PROPOSED
PROPERTY LINE		
RIGHT-OF-WAY		
EASEMENT/SETBACK		
STREET CENTERLINE		
CURB		
CURB & GUTTER		
WATER MAIN	X"W	
SANITARY SEWER LINE	X"S	
STORM DRAIN LINE	SD	
GAS LINE	X"G	
EDISON	SCE	
TELEPHONE	T	
OIL	OIL	
CITY OF MORENO VALLEY	MVU	
TV	TV	

ACRE	AC
SQUARE FEET	SF
CENTERLINE	CL / ℄
CURB	CB
EXISTING	(E)
FLOW LINE	FL / ℄
MEDIAN	MED
OPEN SPACE	OS
PUBLIC FACILITY	PF
PRIVATE ACCESS EASEMENT	PAE
PROPERTY LINE	PL / ℄
RIGHT OF WAY	R/W or RW
STORM DRAIN	SD
SANITARY SEWER	SS
TOP OF CURB	TC
TOP OF GRATE	TG
BOTTOM OF WALL	BW
TOP OF WALL	TW
UNLESS NOTED OTHERWISE	U.N.O.
NOT A PART OF THIS PLAN	NAP

CITY PEN NUMBERS:

(PEN22-0077)

THOMAS BROS PAGE:

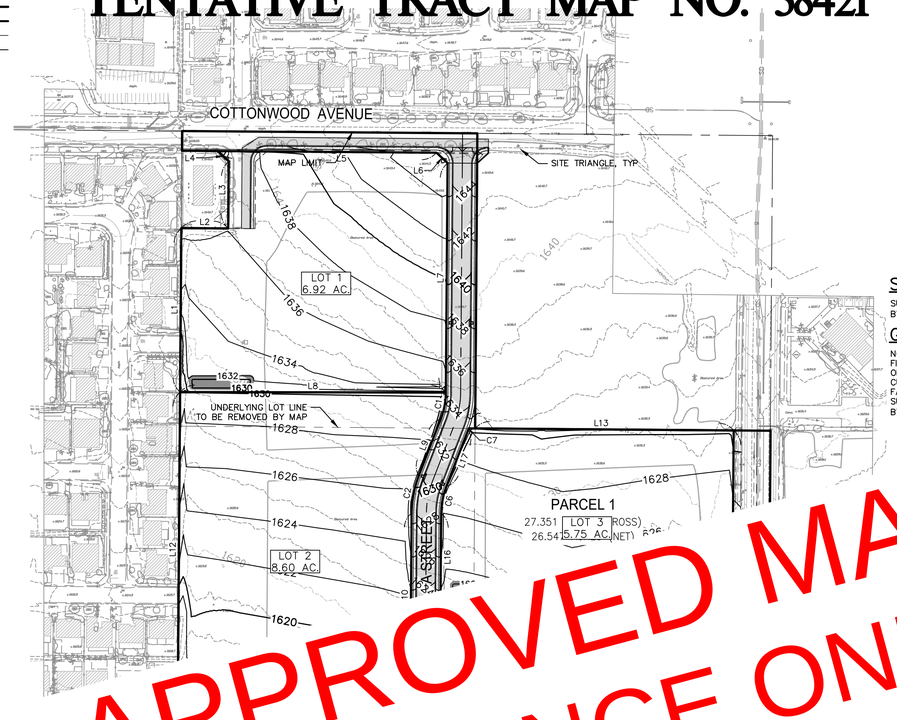
PAGE: 718, GRID: A4
PAGE: 718, GRID: A5
PAGE: 718, GRID: B4
PAGE: 718, GRID: B5

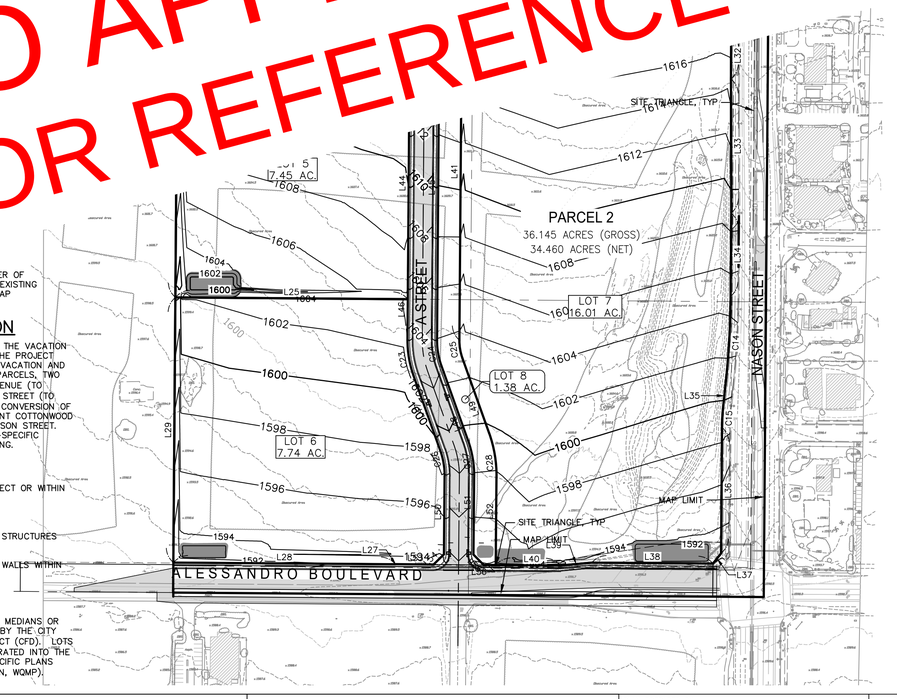
OWNER:

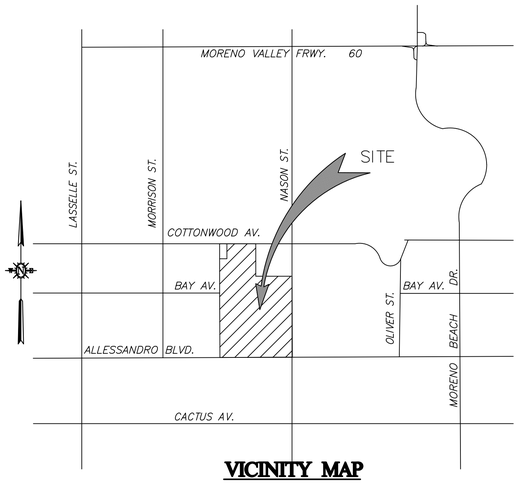
CITY MORENO VALLEY
14177 FREDERICK ST.,
MORENO VALLEY, CA 92553

DEVELOPER:

LEWIS MANAGEMENT
ATTENTION:
[illegible]







VICINITY MAP

NOT TO SCALE

SURVEY NOTE

SURVEY PROVIDED BY DEVELOPER, AND SUPPLEMENTED BY CANNON CORP., FIELD DATA 3/18/22

GEO NOTE

NO INDICATIONS OF FAULTING OR FAULT RELATED FISSURING OR FRACTURING IS KNOWN TO EXIST OR OBSERVED ONSITE. THIS SITE IS NOT LOCATED WITHIN A CURRENTLY DESIGNATED ALQUIST-PRIOLO EARTHQUAKE FAULT ZONE OR COUNTY OF RIVERSIDE FAULT ZONE. SURVEY PROVIDED BY DEVELOPER, AND SUPPLEMENTED BY CANNON CORP., FIELD DATA 3/18/22

SHEET INDEX

LOT AREAS

LOT		EXISTING R/W OR LOT	EXISTING EASEMENT	DEDICATION/ SUBDIVISION (AC)	COMMENTS
COTTONWOOD AVENUE	D	0.61	0.0610	0.7080	(RE)DEDICATE
NASON STREET	E	1.4340	2.3190	3.9390	(RE)DEDICATE
ALLESANDRO AVENUE	F	1.6620	0.1100	1.9070	(RE)DEDICATE
BAY AVENUE	A	2.4260		1.8460	VACATE
"A" STREET	B,C			3.880	
EMWD			0.251*		
LOT 1	1	26.292			
LOT 2	2				
LOT 3	3				
LOT 4	4				
LOT 5	5				
LOT 6	6				
LOT 7	7				
LOT 8	8				
SUM AREAS		66			
TOTAL AREAS		69.6 (E			

PORTIONS OF BAY, ALESSANDRO, AND NASO[illegible] BE RE-DEL[illegible] WAY AND WILL

EASEMENT TABLE

AFFECTS	PURPOSE	DOC/LOC	BENEFICIARY	PR. DISPOSITION	COMMENT
EXISTING					
1	PUBLIC UTILITIES & INCIDENTAL PURPOSE	DOC #1977-43349 OF OFFICIAL RECORDS	SCEC	QUITCLAIM	
2	BOUNDARY	BOOK 80, PAGE 53 OF RECORDS OF SURVEY	COUNTY OF RIVERSIDE	QUITCLAIM	
3	ROAD & UTILITIES	DOC #1993-211297 OF OFFICIAL RECORDS	CITY OF MORENO VALLEY	CONVERT TO RIGHT OF WAY	
4	PIPELINE	DOC #2012-0177957 OF OFFICIAL RECORDS	EMWD	QUITCLAIM	
5	ROAD & UTILITIES	DOC #2013-463248 OF OFFICIAL RECORDS	CITY OF MORENO VALLEY	CONVERT TO RIGHT OF WAY	
6	DRAINAGEDO	DOC #2013-484376 OF OFFICIAL RECORDS	CITY OF MORENO VALLEY	MAINTAIN	
PROPOSED					
AA	DRAINAGE EASEMENT	DEDICATED WITH MAP		PROPOSED	
BB	MUV ELECTRIC	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	
CC	EMWD	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	

[illegible]IFIED HEREIN, IS FEE OWNER OF [illegible]TO LOTS NORTH AND SOUTH OF THE EXISTING [illegible]AVENUE AT THE TIME OF THE TENTATIVE MAP PREPARATION.

PROJECT DESCRIPTION

THE PROJECT, AS PROPOSED, INCLUDES THE VACATION OF THE EXISTING BAY AVENUE WITHIN THE PROJECT LIMITS, SUBDIVISION OF THE RESULTING VACATION AND ADJACENT TWO LOTS TO 6 BUILDABLE PARCELS, TWO PARK PARCELS, DEDICATION OF BAY AVENUE (TO DEMINSION SHOWN), DEDICATION OF "A" STREET (TO DIMENSION SHOWN), REDEDICATION AND CONVERSION OF RIGHT OF WAY EASEMENTS FOR ADJACENT COTTONWOOD AVENUE, ALESSANDRO AVENUE, AND NASON STREET. THE PROJECT DOES NOT PROPOSE LOT-SPECIFIC DEVELOPMENT CONCURRENT WITH MAPPING.

WELL NOTE

THERE ARE NO WELLS WITHIN THE PROJECT OR WITHIN 200' OF THE PROJECT

STRUCTURE NOTE

THERE ARE NO EXISTING OR PROPOSED STRUCTURES WITHIN THE PROJECT SITE.

THERE ARE NO EXISTING OR PROPOSED WALLS WITHIN THE PROJECT SITE.

LANDSCAPE NOTE

LANDSCAPING WITHIN THE ROUNDABOUT, MEDIANS OR PROPOSED PARKS MAY BE MAINTAINED BY THE CITY THORUGH A COMMUNITY FACILITY DISTRICT (CFD). LOTS A AND B (PARK LOTS) TO BE INCORPORATED INTO THE CFD FOLLOWING APPROVAL OF LOT-SPECIFIC PLANS (SEPARATE GRADING/DEVELOPMENT PLAN, WQMP).

Parcel Line and Curve Table			
Line #/Curve #	Length	Bearing/Delta	Radius
C1	60.43'	20.73	167.00'
C2	84.31'	20.73	233.00'
C3	25.49'	58.42	25.00'
C4	40.39'	26.91	86.00'
C5	25.52'	58.50	25.00'
C6	60.42'	20.73	167.00'
C7	2.65'	0.65	233.00'
C8	25.52'	58.50	25.00'
C9	40.65'	27.08	86.00'
C10	25.56'	58.58	25.00'
C14	204.76'	5.92	1983.00'
C15	53.38'	5.92	517.00'
C16	25.52'	58.50	25.00'
C17	40.41'	26.92	86.00'
C18	25.49'	58.42	25.00'
C19	25.56'	58.58	25.00'
C20	40.63'	27.07	86.00'
C21	13.27'	30.42	25.00'
C22	12.25'	28.08	25.00'
C23	81.56'	20.06	233.00'
C24	58.46'	20.06	167.00'
C25	40.95'	20.06	117.00'
C26	58.67'	20.13	167.00'
C27	81.85'	20.13	233.00'
C28	99.42'	20.13	283.00'
L1	367.00	N0°25'56"E	
L2	104.82	S89°34'04"E	
L3	150.00	N0°25'56"E	
L4	33.96	N46°57'58"W	
L5	489.33	S89°33'23"E	
L6	33.99	S46°57'52"E	
L7	512.95	S0°25'53"W	
L8	594.20	S89°56'48"E	
L9	137.28	S21°09'53"W	
L10	375.39	S0°26'03"W	
L11	458.16	N89°33'38"W	
L12	702.95	N0°25'56"E	
L13	578.19	S89°33'27"E	
L14	390.92	S0°25'50"W	

Parcel Line and Curve Table			
Line #/Curve #	Length	Bearing/Delta	Radius
L15	652.71	N89°33'40"W	
L16	200.95	N0°26'01"E	
L17	137.28	N21°09'53"E	
L18	212.00	S0°25'50"W	
L19	31.24	S40°14'39"W	
L20	570.94	N89°33'38"W	
L21	174.27	N0°26'01"E	
L22	627.06	N0°26'22"E	
L25	519.73	N89°33'48"W	
L27	0.21	S45°26'02"W	
L28	496.79	N89°33'57"W	
L29	593.06	N0°26'21"E	
L31	31.25	S39°23'41"E	
L32	104.88	S0°25'50"W	
L33	300.10	S0°08'32"E	
L34	186.30	S0°25'50"W	
L35	35.75	S6°20'48"W	
L36	281.51	S0°25'50"W	
L37	29.21	S38°28'45"W	
L38	271.02	N89°33'57"W	
L39	70.35	S84°43'25"W	
L40	144.72	N89°33'57"W	
L41	715.00	N0°26'01"E	
L42	458.15	N89°33'38"W	
L43	570.94	S89°33'38"E	
L44	565.48	N0°26'01"E	
L45	656.23	N0°26'01"E	
L46	90.91	N0°26'01"E	
L47	177.99	N19°37'20"W	
L48	177.99	N19°37'20"W	
L49	177.99	N19°37'20"W	
L50	174.40	N0°30'22"E	
L51	174.40	N0°30'22"E	
L52	197.19	N0°30'22"E	
L53	84.77	S89°29'38"E	
L54	32.53	N45°30'22"E	
L55	32.53	N44°29'38"W	
L56	27.00	N89°29'38"W	

GEOTECHNICAL REVIEW

THIS PLAN HAS BEEN REVIEWED AND CONFORMS TO RECOMMENDATIONS OF THE SOILS ENGINEERING/GEOLOGIC REPORT DATED _____.

SIGNATURE _____ DATE _____

PREPARED BY:

I HEREBY CERTIFY THAT:
1. THESE PLANS HAVE BEEN PREPARED UNDER MY SUPERVISION:
2. THE GRADING SHOWN HEREON WILL NOT DIVERT DRAINAGE FROM ITS NATURAL DOWNSTREAM COURSE OR OBSTRUCT THE DRAINAGE OF ADJACENT PROPERTIES:

REGISTERED PROFESSIONAL ENGINEER WILHELM JOHN MAUL NO. 42549 EXP. 03/31/2024 CIVIL STATE OF CALIFORNIA

ENGINEER _____ 8/1/2022
WILHELM J. MAUL EXP. DATE

PROFESSIONAL LAND SURVEYOR AARON P. TILLMANNS NO. 9584 STATE OF CALIFORNIA

_____ 8/1/2022
AARON P. TILLMANNS EXP. DATE

PLAN PREPARED BY:
Cannon
16842 Von Karman Avenue, Suite #150
Irvine, CA 92606
949.668.1683

PLAN PREPARED FOR:
LEWIS MANAGEMENT CORP.
1156 NORTH MOUNTAIN AVENUE
UPLAND, CALIFORNIA 91785-0670
TEL: (909) 985-0971

TOWN CENTER AT MORENO VALLEY
TENTATIVE TRACT MAP 38421
PRELIMINARY GRADING PLAN
CITY OF MORENO VALLEY
CALIFORNIA

DATE: 7/6/22
JOB NO. 211203
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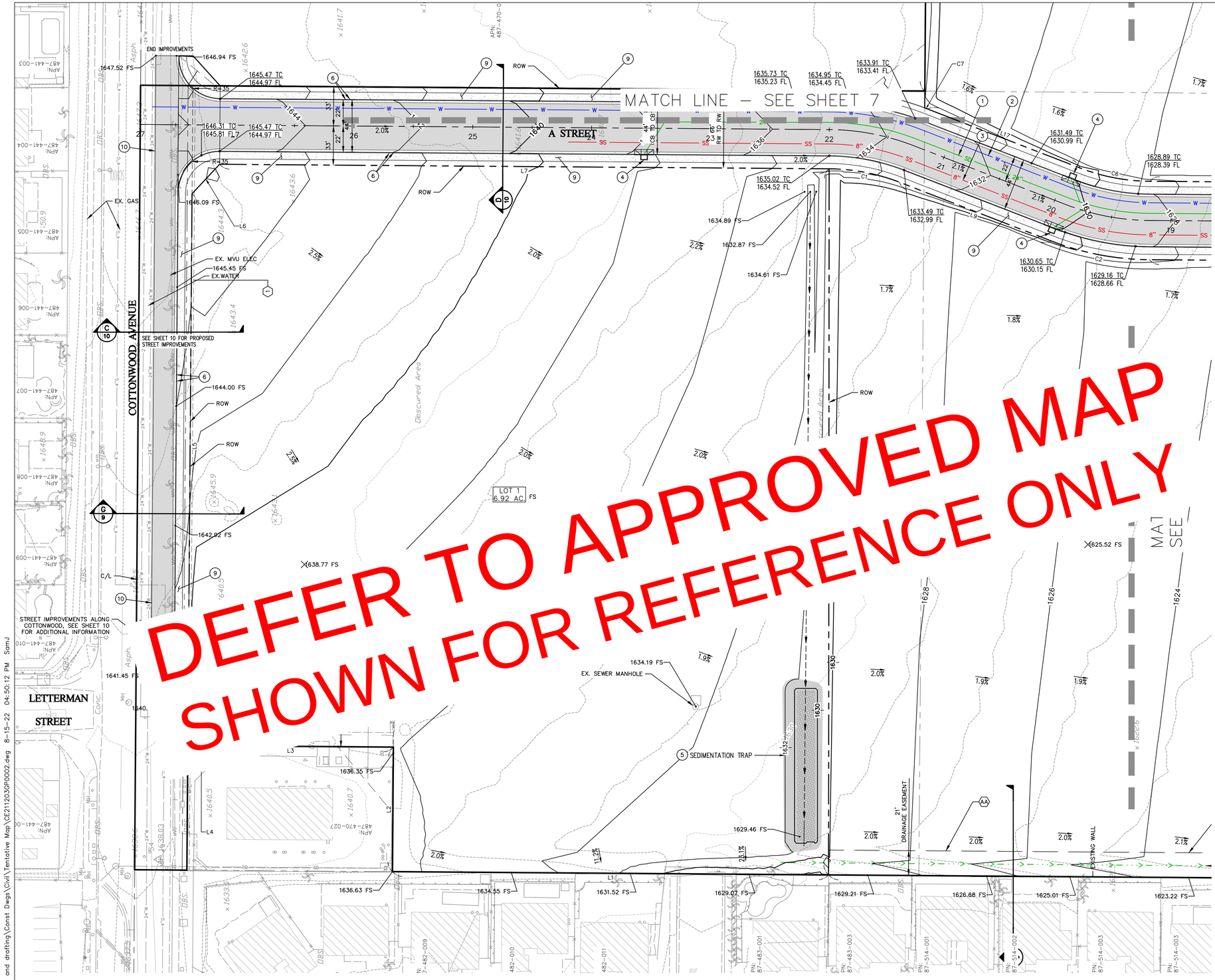

Parcel Line and Curve Table			
Line #/Curve #	Length	Bearing/Delta	Radius
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C2	84.31'	20.73	233.00'
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C7	2.65'	0.65	233.00'
L1	367.00	N0°25'56"E	
L2	104.82	S89°34'04"E	
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EASEMENT TABLE

AFFECTS	PURPOSE	REFERENCE DOC/LOC	BENEFICIARY	PR. DISPOSITION	COMMENT
EXISTING					
1	PUBLIC UTILITIES & INCIDENTAL PURPOSE	DOC #1977-43349 OF OFFICIAL RECORDS	SCEC	QUITCLAIM	
3	ROAD & UTILITIES	DOC #1993-211297 OF OFFICIAL RECORDS	CITY OF MORENO VALLEY	CONVERT TO RIGHT OF WAY	
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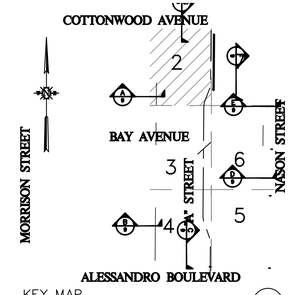
PROPOSED					
AA	DRAINAGE EASEMENT	DEDICATED WITH MAP		PROPOSED	
BB	MUV ELECTRIC	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	
CC	EMWD	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	

CONSTRUCTION NOTES

1. PROPOSED STORM DRAIN
2. PROPOSED EMWD WATER MAIN
3. PROPOSED EMWD SEWER MAIN
4. PROPOSED INLET
5. PROPOSED SEDIMENTATION BASIN
6. PROPOSED CURB
9. PROPOSED SIDEWALK
10. PROPOSED EDGE OF PAVEMENT
11. PROPOSED DRAINAGE SWALE



GEOTECHNICAL REVIEW

THIS PLAN HAS BEEN REVIEWED AND CONFORMS TO RECOMMENDATIONS OF THE SOILS ENGINEERING/GEOLOGIC REPORT DATED _____.

SIGNATURE _____ DATE _____

PREPARED BY:

I HEREBY CERTIFY THAT:
1. THESE PLANS HAVE BEEN PREPARED UNDER MY SUPERVISION:
2. THE GRADING SHOWN HEREON WILL NOT DIVERT DRAINAGE FROM ITS NATURAL DOWNSTREAM COURSE OR OBSTRUCT THE DRAINAGE OF ADJACENT PROPERTIES:

REGISTERED PROFESSIONAL ENGINEER – WILHELM JOHN MAUL – NO. 42549 – EXP. 03/31/2024 – CIVIL – STATE OF CALIFORNIA

ENGINEER _____ 8/1/2022
WILHELM J. MAUL EXP. DATE

LEGEND

	EXISTING	PROPOSED
WATER MAIN	X"W	X"W
SANITARY SEWER LINE	X"S	X"SS
STORM DRAIN LINE	SD	SD
EASEMENT. SEE SHEET 1 SWALE LINEWORK.		
ROAD PAVEMENT		
INLET		
STORMWATER BMP SEDIMENT TRAP		SIDESLOPE, BOTTOM

PLAN PREPARED BY:
Cannon
16842 Von Karman Avenue, Suite #150
Irvine, CA 92606
949.668.1683

PLAN PREPARED FOR:
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TOWN CENTER AT MORENO VALLEY
TENTATIVE TRACT MAP 38421
PRELIMINARY GRADING PLAN

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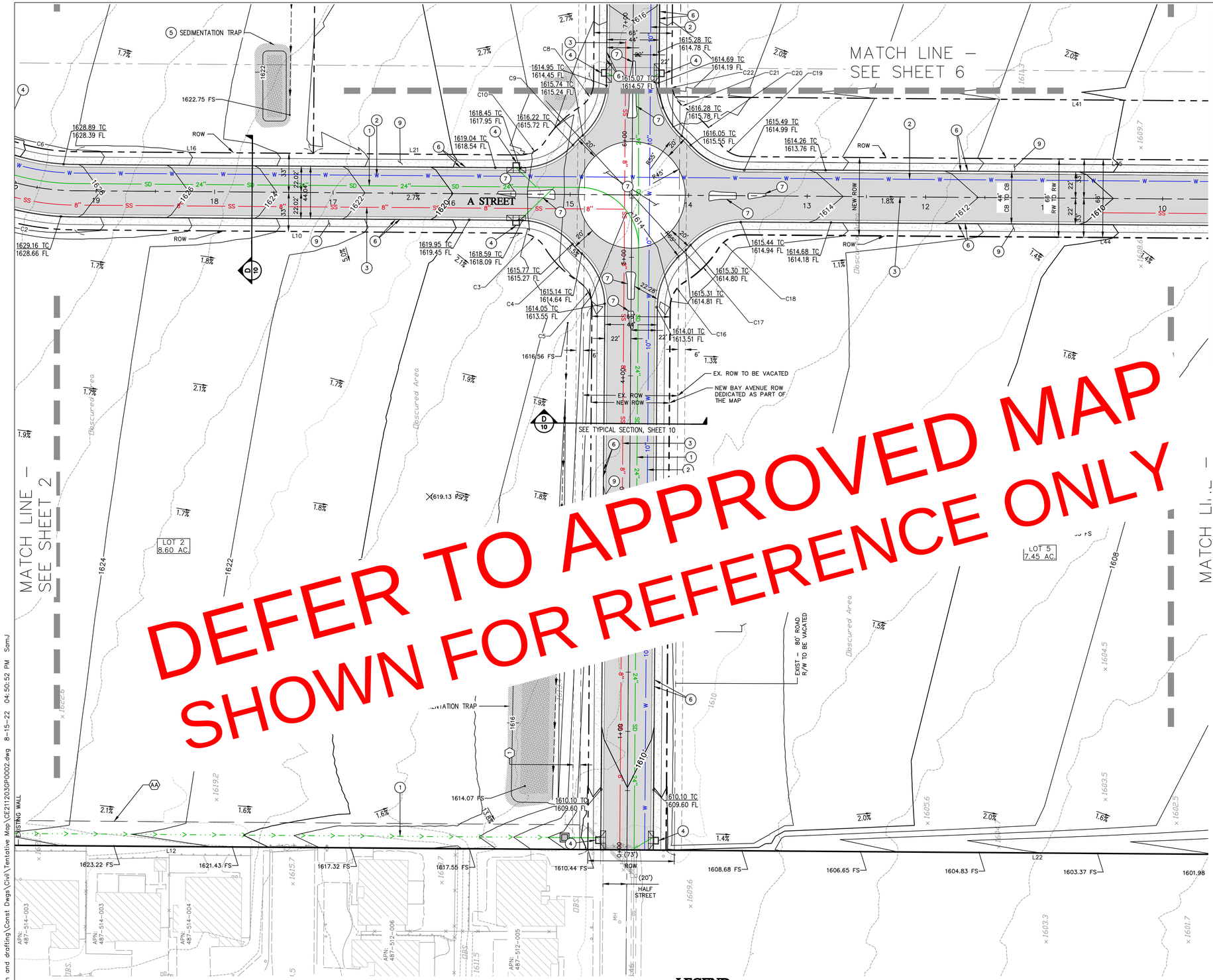

Parcel Line and Curve Table			
Line #/Curve #	Length	Bearing/Delta	Radius
C2	84.31'	20.73	233.00'
C3	25.49'	58.42	25.00'
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C6	60.42'	20.73	167.00'
C8	25.52'	58.50	25.00'
C9	40.65'	27.08	86.00'
C10	25.56'	58.58	25.00'
C16	25.52'	58.50	25.00'
C17	40.41'	26.92	86.00'
C18	25.49'	58.42	25.00'
C19	25.56'	58.58	25.00'
C20	40.63'	27.07	86.00'
C21	13.27'	30.42	25.00'
C22	12.25'	28.08	25.00'
L10	375.39	S0°26'03"W	
L11	458.16	N89°33'38"W	
L12	702.95	N0°25'56"E	
L16	200.95	N0°26'01"E	
L21	174.27	N0°26'01"E	

Parcel Line and Curve Table			
Line #/Curve #	Length	Bearing/Delta	Radius
L22	627.06	N0°26'22"E	
L41	715.00	N0°26'01"E	
L42	458.15	N89°33'38"W	

EASEMENT TABLE

AFFECTS	PURPOSE	REFERENCE DOC/LOC	BENEFICIARY	PR. DISPOSITION	COMMENT
EXISTING					
1	PUBLIC UTILITIES & INCIDENTAL PURPOSE	DOC #1977-43349 OF OFFICIAL RECORDS	SCEC	QUITCLAIM	
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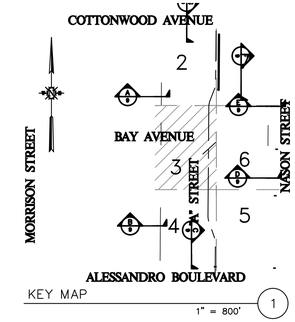
AA	DRAINAGE EASEMENT	DEDICATED WITH MAP		PROPOSED	
BB	MUV ELECTRIC	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	
CC	EMWD	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	

CONSTRUCTION NOTES

1. PROPOSED STORM DRAIN
2. PROPOSED EMWD WATER MAIN
3. PROPOSED EMWD SEWER MAIN
4. PROPOSED INLET
5. PROPOSED SEDIMENTATION BASIN
6. PROPOSED CURB
7. PROPOSED MEDIAN LANDSCAPING
8. PROPOSED SIGNALIZED INTERSECTION
9. PROPOSED SIDEWALK



GEOTECHNICAL REVIEW

THIS PLAN HAS BEEN REVIEWED AND CONFORMS TO RECOMMENDATIONS OF THE SOILS ENGINEERING/GEOLOGIC REPORT DATED _____.

SIGNATURE _____ DATE _____

PREPARED BY:

I HEREBY CERTIFY THAT:
1. THESE PLANS HAVE BEEN PREPARED UNDER MY SUPERVISION:
2. THE GRADING SHOWN HEREON WILL NOT DIVERT DRAINAGE FROM ITS NATURAL DOWNSTREAM COURSE OR OBSTRUCT THE DRAINAGE OF ADJACENT PROPERTIES:

REGISTERED PROFESSIONAL ENGINEER – WILHELM JOHN MAUL – NO. 42549 – EXP. 03/31/2024 – CIVIL – STATE OF CALIFORNIA

ENGINEER _____ 8/1/2022
WILHELM J. MAUL EXP. DATE

LEGEND

	EXISTING	PROPOSED
WATER MAIN	X"W	X"W
SANITARY SEWER LINE	X"S	X"SS
STORM DRAIN LINE	SD	SD
EASEMENT. SEE SHEET 1 SWALE LINEWORK.		
ROAD PAVEMENT		
INLET		
STORMWATER BMP SEDIMENT TRAP		SIDESLOPE / BOTTOM

PLAN PREPARED BY:
Cannon
16842 Von Karman Avenue, Suite #150
Irvine, CA 92606
949.668.1683

PLAN PREPARED FOR:
LEWIS MANAGEMENT CORP.
1156 NORTH MOUNTAIN AVENUE
UPLAND, CALIFORNIA 91785-0670
TEL: (909) 985-0971

TOWN CENTER AT MORENO VALLEY
TENTATIVE TRACT MAP 38421
PRELIMINARY GRADING PLAN

CITY OF MORENO VALLEY
CALIFORNIA

DATE: 7/6/22
JOB NO. 211203
CPN: PEN22-077
TTM: 38421
SHEET 3 OF 11

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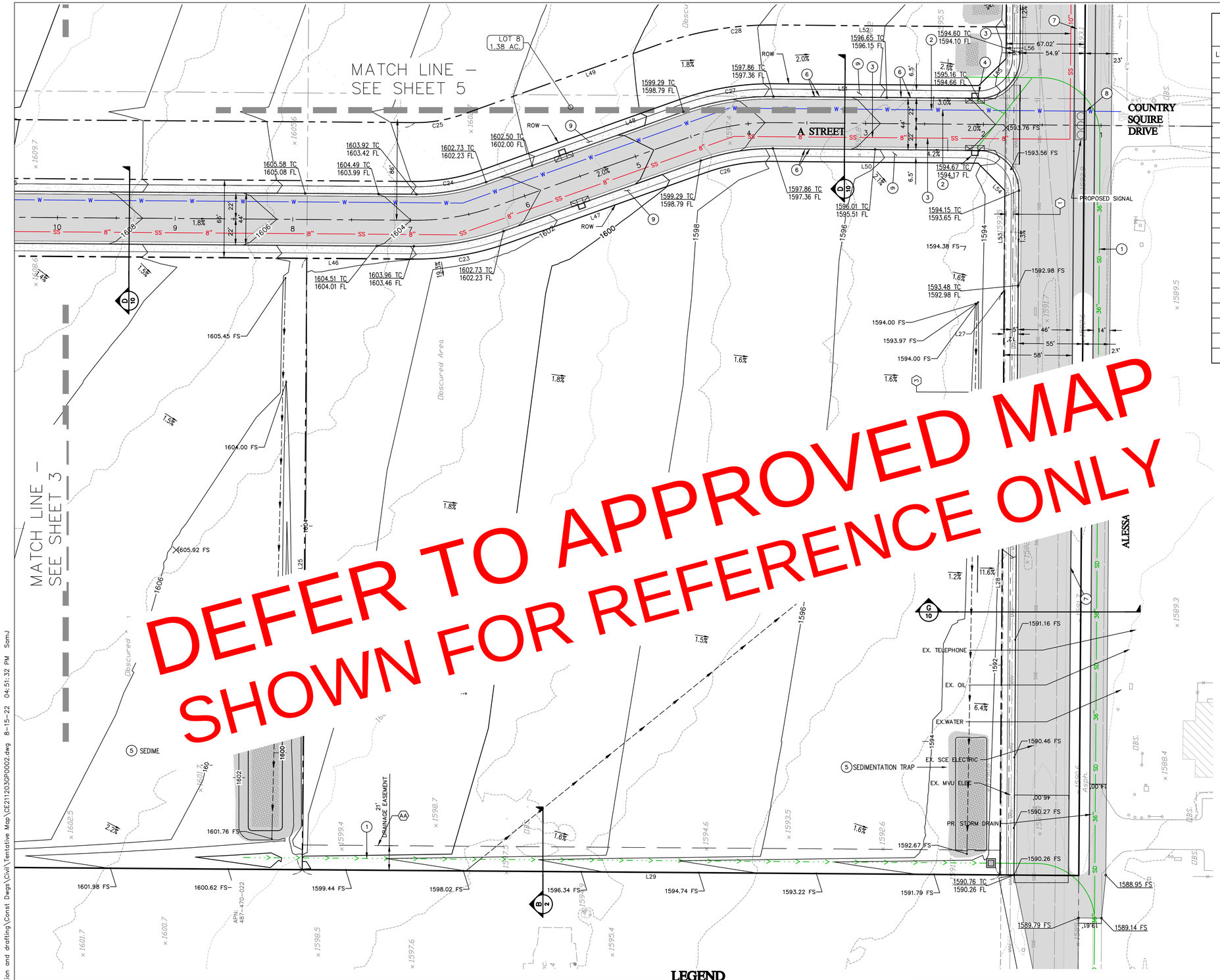


Parcel Line and Curve Table			
Line #/Curve #	Length	Bearing/Delta	Radius
C23	81.56'	20.06	233.00'
C24	58.46'	20.06	167.00'
C25	40.95'	20.06	117.00'
C26	58.67'	20.13	167.00'
C27	81.85'	20.13	233.00'
C28	99.42'	20.13	283.00'
L25	519.73	N89°33'48"W	
L27	0.21	S45°26'02"W	
L28	496.79	N89°33'57"W	
L29	593.06	N0°26'21"E	
L46	90.91	N0°26'01"E	
L47	177.99	N19°37'20"W	
L48	177.99	N19°37'20"W	
L49	177.99	N19°37'20"W	
L50	174.40	N0°30'22"E	
L51	174.40	N0°30'22"E	
L52	197.19	N0°30'22"E	
L53	84.77	S89°29'38"E	
L54	32.53	N45°30'22"E	
L55	32.53	N44°29'38"W	

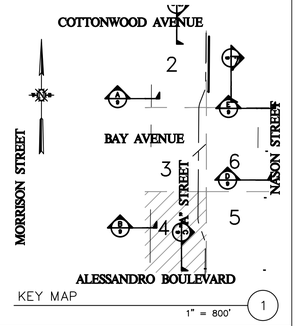
Parcel Line and Curve Table			
Line #/Curve #	Length	Bearing/Delta	Radius
L56	27.00	N89°29'38"W	

EASEMENT TABLE

AFFECTS	PURPOSE	REFERENCE DOC/LOC	BENEFICIARY	PR. DISPOSITION	COMMENT
EXISTING					
1	PUBLIC UTILITIES & INCIDENTAL PURPOSE	DOC #1977-43349 OF OFFICIAL RECORDS	SCEC	QUITCLAIM	
3	ROAD & UTILITIES	DOC #1993-211297 OF OFFICIAL RECORDS	CITY OF MORENO VALLEY	CONVERT TO RIGHT OF WAY	
5	ROAD & UTILITIES	DOC #2013-463248 OF OFFICIAL RECORDS	CITY OF MORENO VALLEY	CONVERT TO RIGHT OF WAY	
PROPOSED					
AA	DRAINAGE EASEMENT	DEDICATED WITH MAP		PROPOSED	
BB	MUV ELECTRIC	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	
CC	EMWD	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	

CONSTRUCTION NOTES

1. PROPOSED STORM DRAIN
2. PROPOSED EMWD WATER MAIN
3. PROPOSED EMWD SEWER MAIN
4. PROPOSED INLET
5. PROPOSED SEDIMENTATION BASIN
6. PROPOSED CURB
7. PROPOSED MEDIAN LANDSCAPING
9. PROPOSED SIDEWALK
11. PROPOSED DRAINAGE SWALE



KEY MAP 1" = 800'

GEOTECHNICAL REVIEW

THIS PLAN HAS BEEN REVIEWED AND CONFORMS TO RECOMMENDATIONS OF THE SOILS ENGINEERING/GEOLOGIC REPORT DATED _____.

SIGNATURE _____ DATE _____

PREPARED BY:

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ENGINEER _____ 8/1/2022
WILHELM J. MAUL EXP. DATE

REGISTERED PROFESSIONAL ENGINEER
WILHELM JOHN MAUL
NO. 42549
EXP. 03/31/2024
CIVIL
STATE OF CALIFORNIA

LEGEND

	EXISTING	PROPOSED
WATER MAIN	X"W"	X"W"
SANITARY SEWER LINE	X"S"	X"SS"
STORM DRAIN LINE	SD	SD
EASEMENT, SEE SHEET 1		
SWALE LINEWORK		
ROAD PAVEMENT		
INLET		
STORMWATER BMP SEDIMENT TRAP		

PLAN PREPARED BY:
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TOWN CENTER AT MORENO VALLEY
TENTATIVE TRACT MAP 38421
PRELIMINARY GRADING PLAN

CITY OF MORENO VALLEY
CALIFORNIA

DATE: 7/6/22
JOB NO. 211203
CPN: PEN22-077
TTM: 38421
SHEET
4 OF 11

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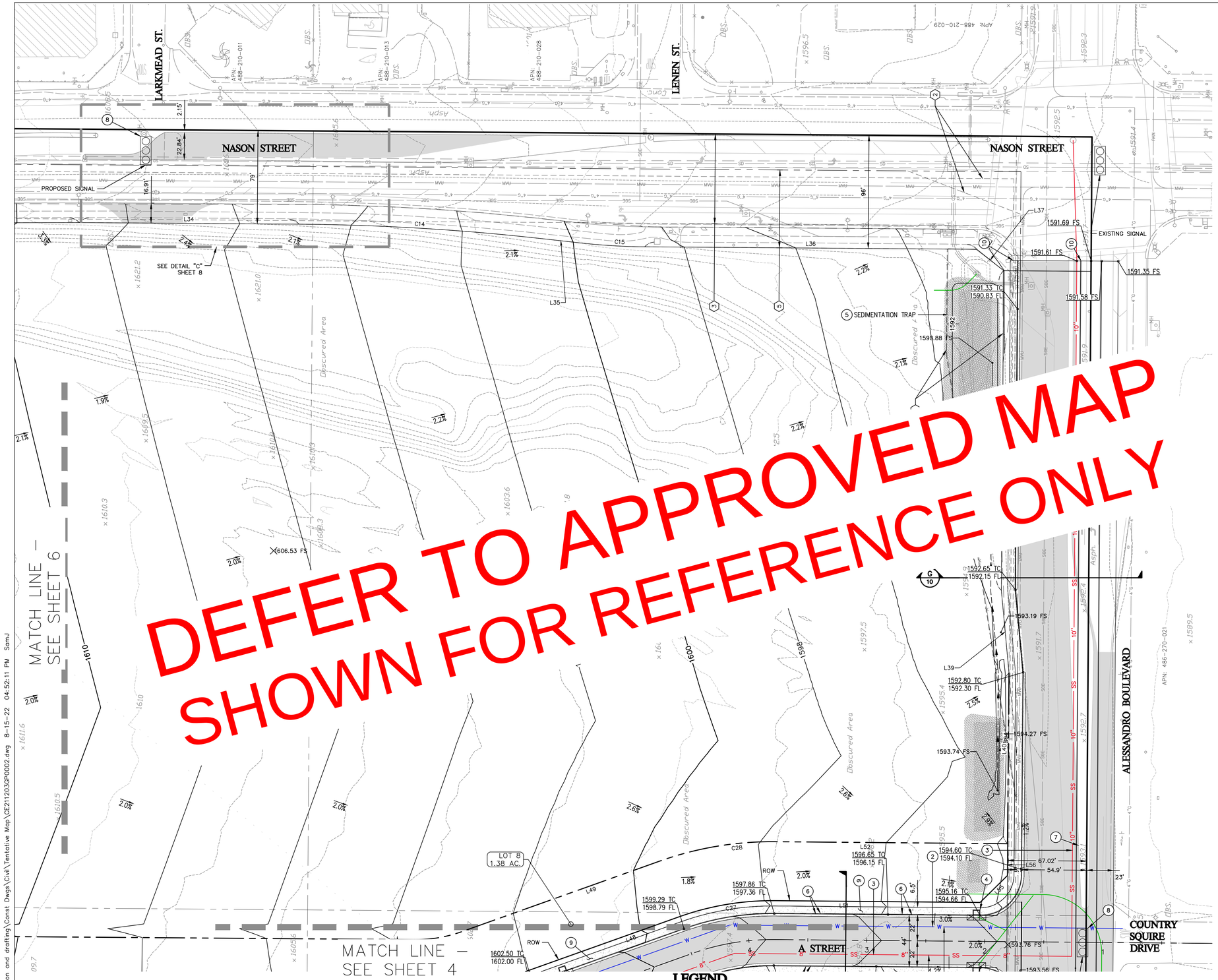


Parcel Line and Curve Table

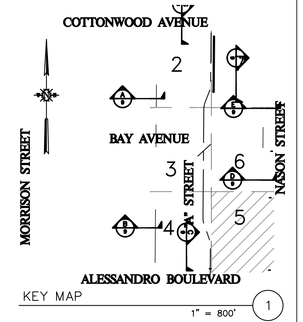
Line #/Curve #	Length	Bearing/Delta	Radius
C14	204.76'	5.92	1983.00'
C15	53.38'	5.92	517.00'
C25	40.95'	20.06	117.00'
C27	81.85'	20.13	233.00'
C28	99.42'	20.13	283.00'
L34	186.30	S0°25'50"W	
L35	35.75	S6°20'48"W	
L36	281.51	S0°25'50"W	
L37	29.21	S38°28'45"W	
L38	271.02	N89°33'57"W	
L39	70.35	S84°43'25"W	
L40	144.72	N89°33'57"W	
L48	177.99	N19°37'20"W	
L49	177.99	N19°37'20"W	
L51	174.40	N0°30'22"E	
L52	197.19	N0°30'22"E	
L55	32.53	N44°29'38"W	
L56	27.00	N89°29'38"W	

EASEMENT TABLE

AFFECTS	PURPOSE	REFERENCE DOC/LOC	BENEFICIARY	PR. DISPOSITION	COMMENT
EXISTING					
2	BOUNDARY	BOOK 80, PAGE 53 OF RECORDS OF SURVEY	COUNTY OF RIVERSIDE	QUITCLAIM	
3	ROAD & UTILITIES	DOC #1993-211297 OF OFFICIAL RECORDS	CITY OF MORENO VALLEY	CONVERT TO RIGHT OF WAY	
5	ROAD & UTILITIES	DOC #2013-463248 OF OFFICIAL RECORDS	CITY OF MORENO VALLEY	CONVERT TO RIGHT OF WAY	
6	DRAINAGEDO	DOC #2013-484376 OF OFFICIAL RECORDS	CITY OF MORENO VALLEY	VACATE	
PROPOSED					
AA	DRAINAGE EASEMENT	DEDICATED WITH MAP		PROPOSED	
BB	MUV ELECTRIC	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	
CC	EMWD	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	

CONSTRUCTION NOTES

(2) PROPOSED EMWD WATER MAIN
(3) PROPOSED EMWD SEWER MAIN
(4) PROPOSED INLET
(5) PROPOSED SEDIMENTATION BASIN
(6) PROPOSED CURB
(8) PROPOSED SIGNALIZED INTERSECTION
(9) PROPOSED SIDEWALK



1 INCH = 40 FEET

GEOTECHNICAL REVIEW

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SIGNATURE _____ DATE _____

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REGISTERED PROFESSIONAL ENGINEER
WILHELM JOHN MAUL
NO. 42549
EXP. 03/31/2024
CIVIL
STATE OF CALIFORNIA

ENGINEER _____ 8/1/2022
WILHELM J. MAUL EXP. DATE

LEGEND

	EXISTING	PROPOSED
WATER MAIN	X"W	X"W
SANITARY SEWER LINE	X"S	X"SS
STORM DRAIN LINE	SD	SD
EASEMENT, SEE SHEET 1		
SWALE LINEWORK.		
ROAD PAVEMENT		
INLET		
STORMWATER BMP SEDIMENT TRAP		SIDE SLOPE / BOTTOM

PLAN PREPARED BY:
Cannon
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Irvine, CA 92606
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PLAN PREPARED FOR:
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UPLAND, CALIFORNIA 91785-0670
TEL: (909) 985-0971

TOWN CENTER AT MORENO VALLEY
TENTATIVE TRACT MAP 38421
PRELIMINARY GRADING PLAN

CITY OF MORENO VALLEY
CALIFORNIA

DATE: 7/6/22
JOB NO. 211203
CPN: PEN22-077
TTM: 38421
SHEET 5 OF 11

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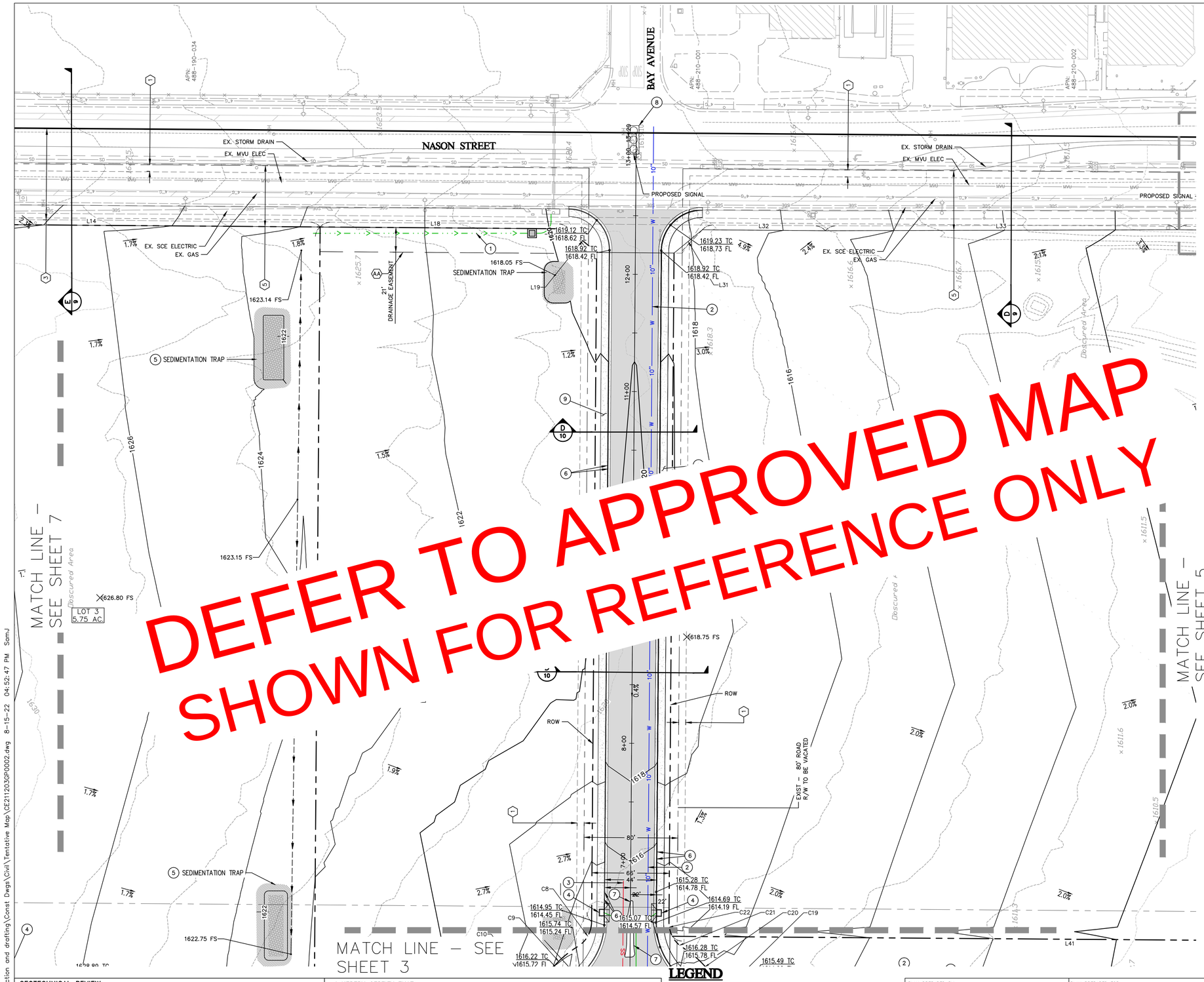


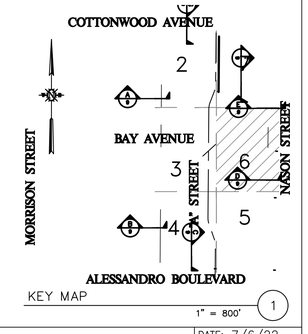
Parcel Line and Curve Table			
Line #/Curve #	Length	Bearing/Delta	Radius
C8	25.52'	58.50	25.00'
C9	40.65'	27.08	86.00'
C10	25.56'	58.58	25.00'
C22	12.25'	28.08	25.00'
L14	390.92	S0°25'50"W	
L15	652.71	N89°33'40"W	
L18	212.00	S0°25'50"W	
L19	31.24	S40°14'39"W	
L20	570.94	N89°33'38"W	
L31	31.25	S39°23'41"E	
L32	104.88	S0°25'50"W	
L33	300.10	S0°08'32"E	
L41	715.00	N0°26'01"E	
L43	570.94	S89°33'38"E	

EASEMENT TABLE

AFFECTS	PURPOSE	REFERENCE DOC/LOC	BENEFICIARY	PR. DISPOSITION	COMMENT
EXISTING					
1	PUBLIC UTILITIES & INCIDENTAL PURPOSE	DOC #1977-43349 OF OFFICIAL RECORDS	SCEC	QUITCLAIM	
3	ROAD & UTILITIES	DOC #1993-211297 OF OFFICIAL RECORDS	CITY OF MORENO VALLEY	CONVERT TO RIGHT OF WAY	
5	ROAD & UTILITIES	DOC #2013-463248 OF OFFICIAL RECORDS	CITY OF MORENO VALLEY	CONVERT TO RIGHT OF WAY	
PROPOSED					
AA	DRAINAGE EASEMENT	DEDICATED WITH MAP		PROPOSED	
BB	MUV ELECTRIC	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	
CC	EMWD	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	

CONSTRUCTION NOTES

(2) PROPOSED EMWD WATER MAIN
(4) PROPOSED INLET
(5) PROPOSED SEDIMENTATION BASIN
(6) PROPOSED CURB
(7) PROPOSED MEDIAN LANDSCAPING
(8) PROPOSED SIGNALIZED INTERSECTION
(9) PROPOSED SIDEWALK
11 PROPOSED DRAINAGE SWALE



GEOTECHNICAL REVIEW

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WILHELM J. MAUL EXP. DATE

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WILHELM JOHN MAUL
NO. 42549
EXP. 03/31/2024
CIVIL
STATE OF CALIFORNIA

LEGEND

WATER MAIN
SANITARY SEWER LINE
STORM DRAIN LINE
EASEMENT, SEE SHEET 1
SWALE LINEWORK
ROAD PAVEMENT
INLET
STORMWATER BMP SEDIMENT TRAP

EXISTING / PROPOSED
X"W" / X"W"
X"S" / X"SS"
SD / SD
SIDE SLOPE
BOTTOM

PLAN PREPARED BY:
Cannon
16842 Von Karman Avenue, Suite #150
Irvine, CA 92606
949.668.1683

PLAN PREPARED FOR:
LEWIS MANAGEMENT CORP.
1156 NORTH MOUNTAIN AVENUE
UPLAND, CALIFORNIA 91785-0670
TEL: (909) 985-0971

TOWN CENTER AT MORENO VALLEY
TENTATIVE TRACT MAP 38421
PRELIMINARY GRADING PLAN

CITY OF MORENO VALLEY
CALIFORNIA

DATE: 7/6/22
JOB NO. 211203
CPN: PEN22-077
TTM: 38421
SHEET
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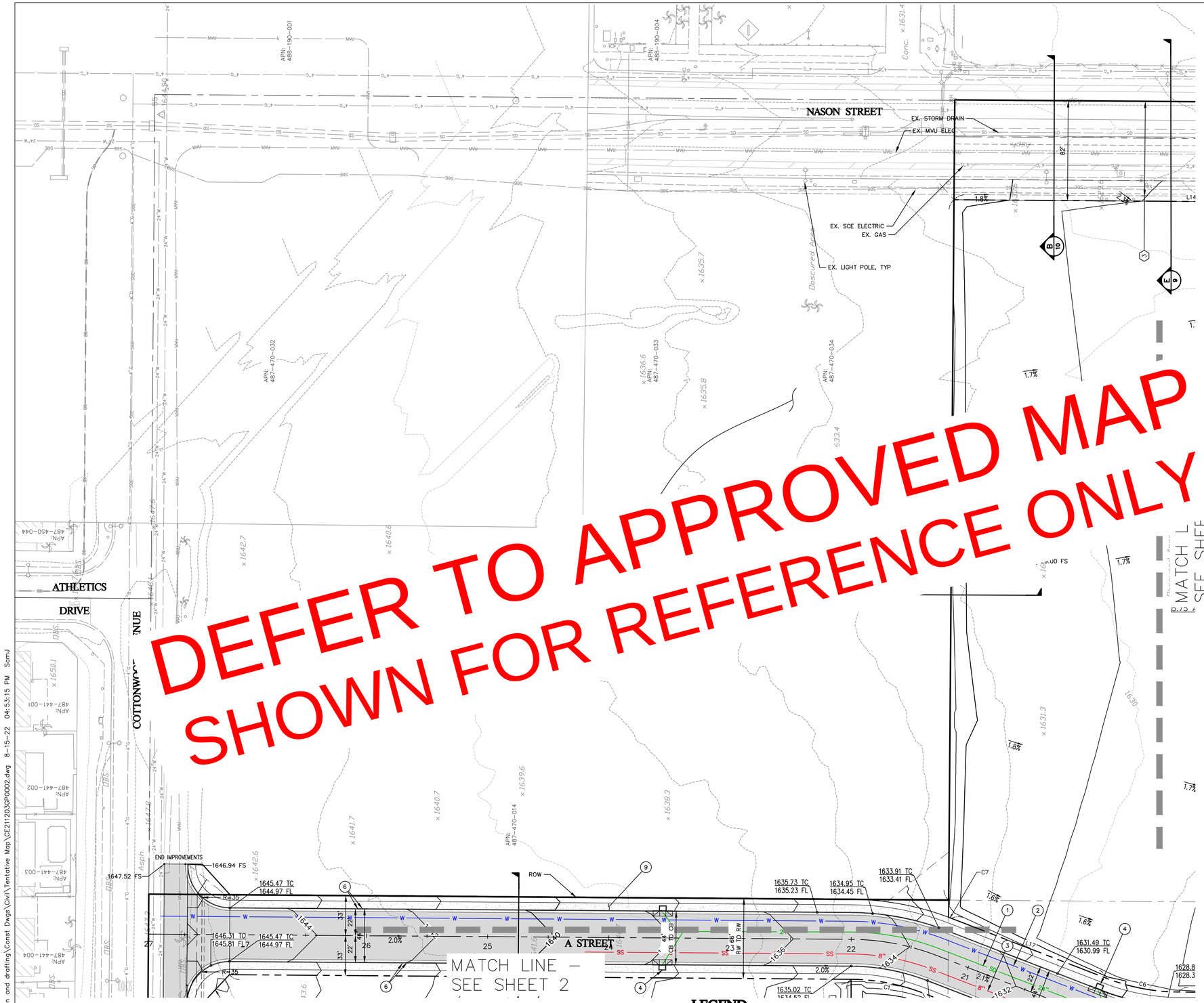

Parcel Line and Curve Table			
Line #/Curve #	Length	Bearing/Delta	Radius
C1	60.43'	20.73	167.00'
C6	60.42'	20.73	167.00'
C7	2.65'	0.65	233.00'
L7	512.95	S0°25'53"W	
L13	578.19	S89°33'27"E	
L14	390.92	S0°25'50"W	
L17	137.28	N21°09'53"E	

EASEMENT TABLE

AFFECTS	PURPOSE	REFERENCE DOC/LOC	BENEFICIARY	PR. DISPOSITION	COMMENT
EXISTING					
3	ROAD & UTILITIES	DOC #1993-211297 OF OFFICIAL RECORDS	CITY OF MORENO VALLEY	CONVERT TO RIGHT OF WAY	
PROPOSED					
BB	MUV ELECTRIC	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	
CC	EMWD	DEDICATED PER SEPARATE DOCUMENT		PROPOSED	

CONSTRUCTION NOTES

1. PROPOSED STORM DRAIN
2. PROPOSED EMWD WATER MAIN
3. PROPOSED EMWD SEWER MAIN
4. PROPOSED INLET
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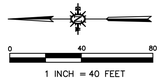

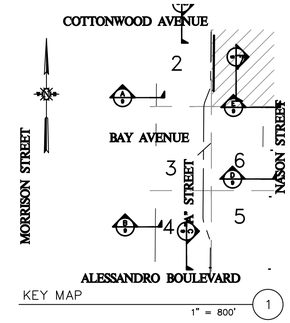

KEY MAP 1

1" = 800'

GEOTECHNICAL REVIEW

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CIVIL
STATE OF CALIFORNIA

ENGINEER _____ 8/1/2022
WILHELM J. MAUL EXP. DATE

LEGEND

	EXISTING	PROPOSED
WATER MAIN	X"W	X"W
SANITARY SEWER LINE	X"S	X"SS
STORM DRAIN LINE	SD	SD
EASEMENT. SEE SHEET 1 SWALE LINEWORK.		
ROAD PAVEMENT		
INLET		
STORMWATER BMP SEDIMENT TRAP		

SIDES/OPE BOTTOM

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TOWN CENTER AT MORENO VALLEY
TENTATIVE TRACT MAP 38421
PRELIMINARY GRADING PLAN

CITY OF MORENO VALLEY
CALIFORNIA

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SHEET 7 OF 11

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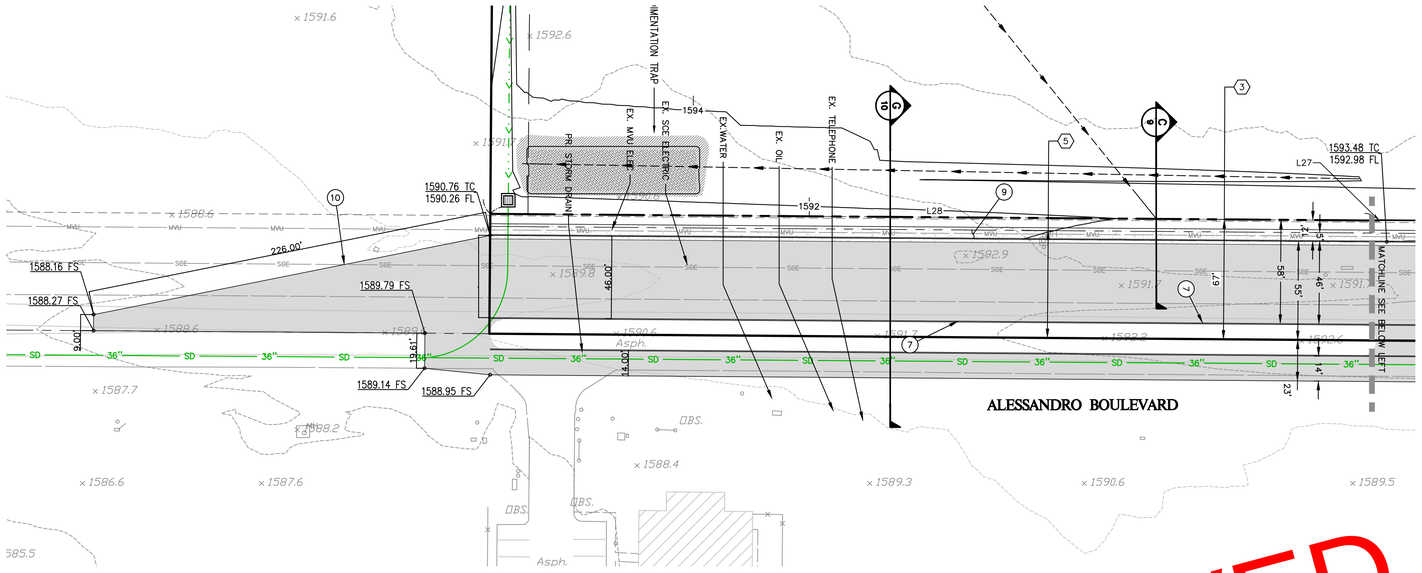
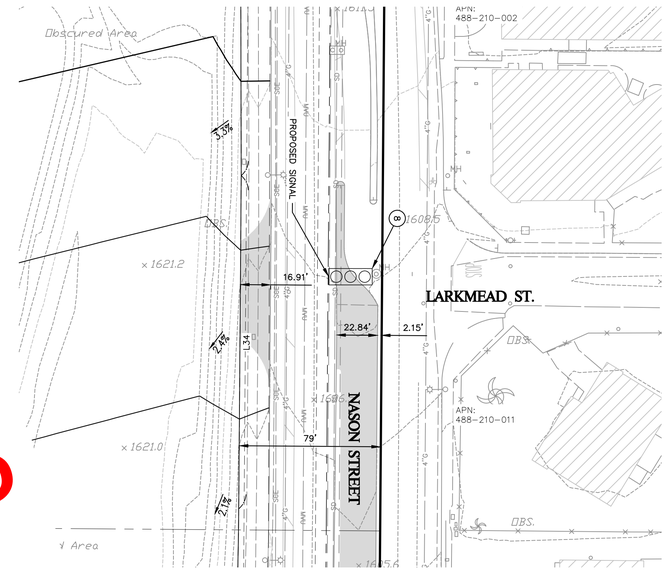
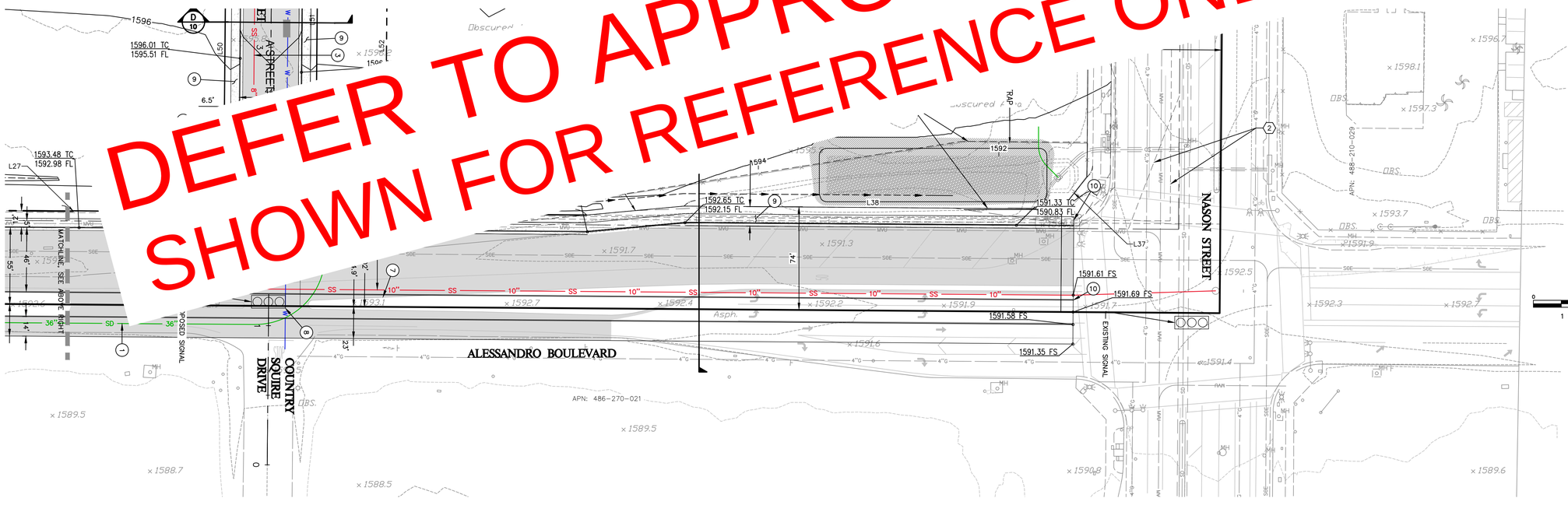


ALESSANDRO ROAD (WEST)
SCALE: 1"=40' B



NASON @ LARKMEAD
SCALE: 1"=40' A

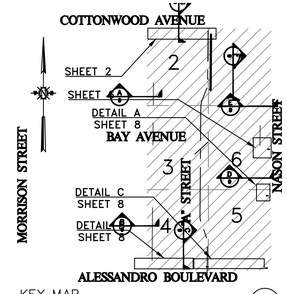


ALESSANDRO ROAD (EAST)
SCALE: 1"=40' C

CONSTRUCTION NOTES

1. PROPOSED STORM DRAIN
2. PROPOSED EMWD WATER MAIN
3. PROPOSED EMWD SEWER MAIN
4. PROPOSED INLET
5. PROPOSED SEDIMENTATION BASIN
6. PROPOSED CURB
7. PROPOSED MEDIAN LANDSCAPING
8. PROPOSED SIGNALIZED INTERSECTION
9. PROPOSED SIDEWALK
10. PROPOSED EDGE OF PAVEMENT

0 40 80
1 INCH = 40 FEET



KEY MAP
1" = 800' 1

GEOTECHNICAL REVIEW

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WILHELM JOHN MAUL
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EXP. 03/31/2024
CIVIL
STATE OF CALIFORNIA

LEGEND

	EXISTING	PROPOSED
WATER MAIN	X"W	X"W
SANITARY SEWER LINE	X"S	X"SS
STORM DRAIN LINE	SD	SD
EASEMENT. SEE SHEET 1		
SWALE LINEWORK.		
ROAD PAVEMENT		
INLET		
STORMWATER BMP SEDIMENT TRAP		

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TOWN CENTER AT MORENO VALLEY
TENTATIVE TRACT MAP 38421
OFFSITE SITE PLAN
CITY OF MORENO VALLEY
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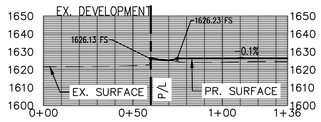
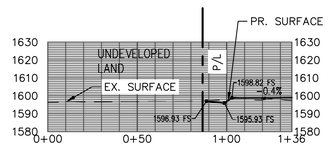


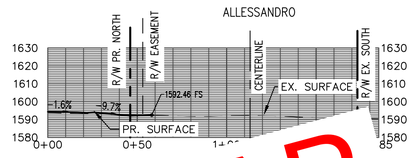
A–A – PROFILE VIEW

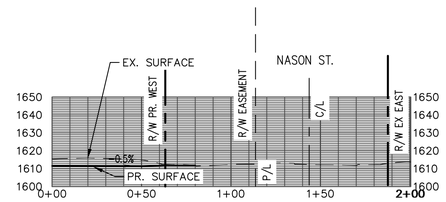
SCALE: HORIZ. 1" = 40'; VERT. 1" = 40'



B–B – PROFILE VIEW

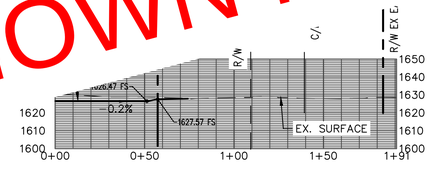
SCALE: HORIZ. 1" = 40'; VERT. 1" = 40'





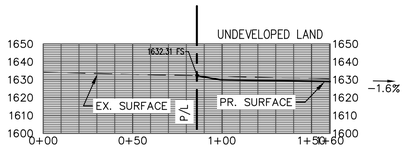
D–D – PROFILE VIEW

SCALE: HORIZ. 1" = 40'; VERT. 1" = 40'



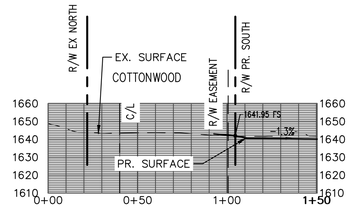
E–E – PROFILE VIEW

SCALE: HORIZ. 1" = 40'; VERT. 1" = 40'



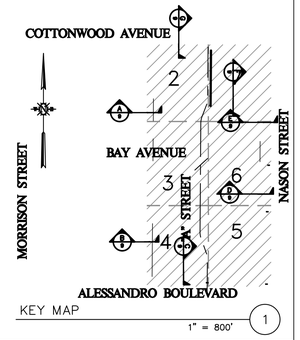
F–F – PROFILE VIEW

SCALE: HORIZ. 1" = 40'; VERT. 1" = 40'



G–G – PROFILE VIEW

SCALE: HORIZ. 1" = 40'; VERT. 1" = 40'



KEY MAP 1" = 800' (1)

GEOTECHNICAL REVIEW

THIS PLAN HAS BEEN REVIEWED AND CONFORMS TO RECOMMENDATIONS OF THE SOILS ENGINEERING/GEOLOGIC REPORT DATED _____.

SIGNATURE _____ DATE _____

PREPARED BY:

I HEREBY CERTIFY THAT:
1. THESE PLANS HAVE BEEN PREPARED UNDER MY SUPERVISION:
2. THE GRADING SHOWN HEREON WILL NOT DIVERT DRAINAGE FROM ITS NATURAL DOWNSTREAM COURSE OR OBSTRUCT THE DRAINAGE OF ADJACENT PROPERTIES:

REGISTERED PROFESSIONAL ENGINEER — WILHELM JOHN MAUL — NO. 42549 — EXP. 03/31/2024 — CIVIL — STATE OF CALIFORNIA

ENGINEER _____ 8/1/2022
WILHELM J. MAUL EXP. DATE

PLAN PREPARED BY:

Cannon
16842 Von Karman Avenue, Suite #150
Irvine, CA 92606
949.668.1683

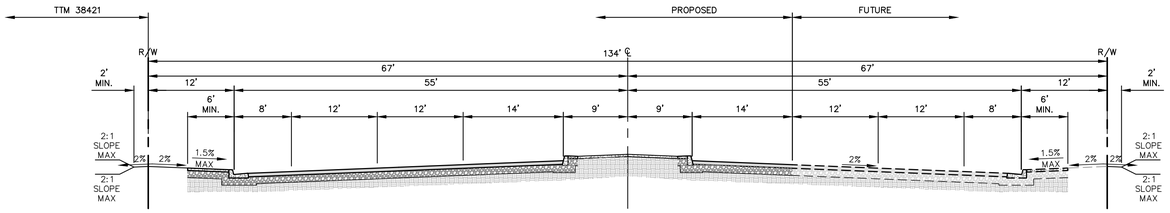
PLAN PREPARED FOR:

LEWIS MANAGEMENT CORP.
1156 NORTH MOUNTAIN AVENUE
UPLAND, CALIFORNIA 91785-0670
TEL: (909) 985-0971

TOWN CENTER AT MORENO VALLEY
TENTATIVE TRACT MAP 38421
BOUNDARY SECTIONS

CITY OF MORENO VALLEY
CALIFORNIA

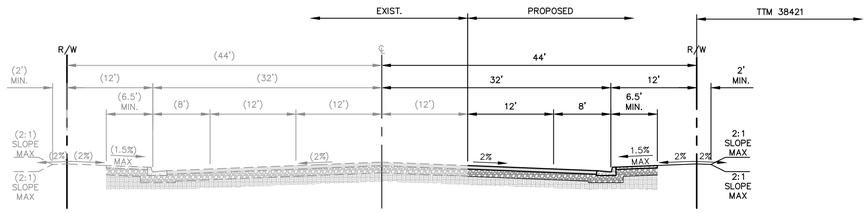
DATE: 7/6/22
JOB NO. 211203
CPN: PEN22-077
TTM: 38421
SHEET
9 11
OF



CLASS 5 DIVIDED ARTERIAL (ALESSANDRO BLVD) (A)

TYPICAL SECTION N.T.S.

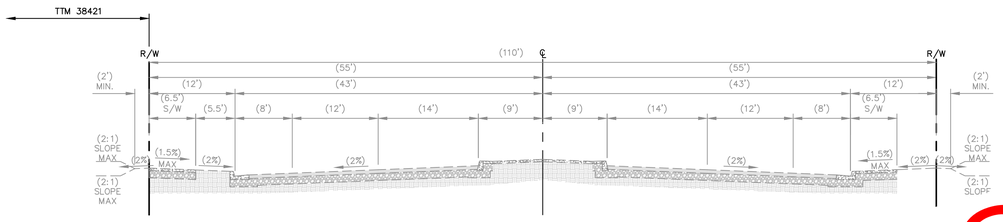
MVSI-101A-1



MINOR ARTERIAL (COTTONWOOD AVE) (C)

TYPICAL SECTION N.T.S.

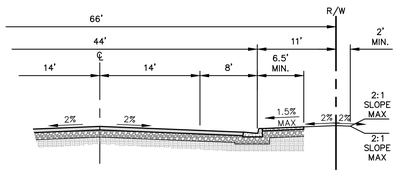
MVSI-105A-2



4 LANE DIVIDED ARTERIAL (NASON ST) – EXISTING (B)

TYPICAL SECTION N.T.S

MVSI-103A-1



JAY AVE. & A ST.) – PROPOSED (D)

N.T.S.

GEOTECHNICAL REVIEW

THIS PLAN HAS BEEN REVIEWED AND CONFORMS TO RECOMMENDATIONS OF THE SOILS ENGINEERING/GEOLOGIC REPORT DATED _____.

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PREPARED BY:

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REGISTERED PROFESSIONAL ENGINEER
WILHELM JOHN MAUL
NO. 42549
EXP. 03/31/2024
CIVIL
STATE OF CALIFORNIA

ENGINEER _____ 8/1/2022
WILHELM J. MAUL EXP. DATE

PLAN PREPARED BY:

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949.668.1683

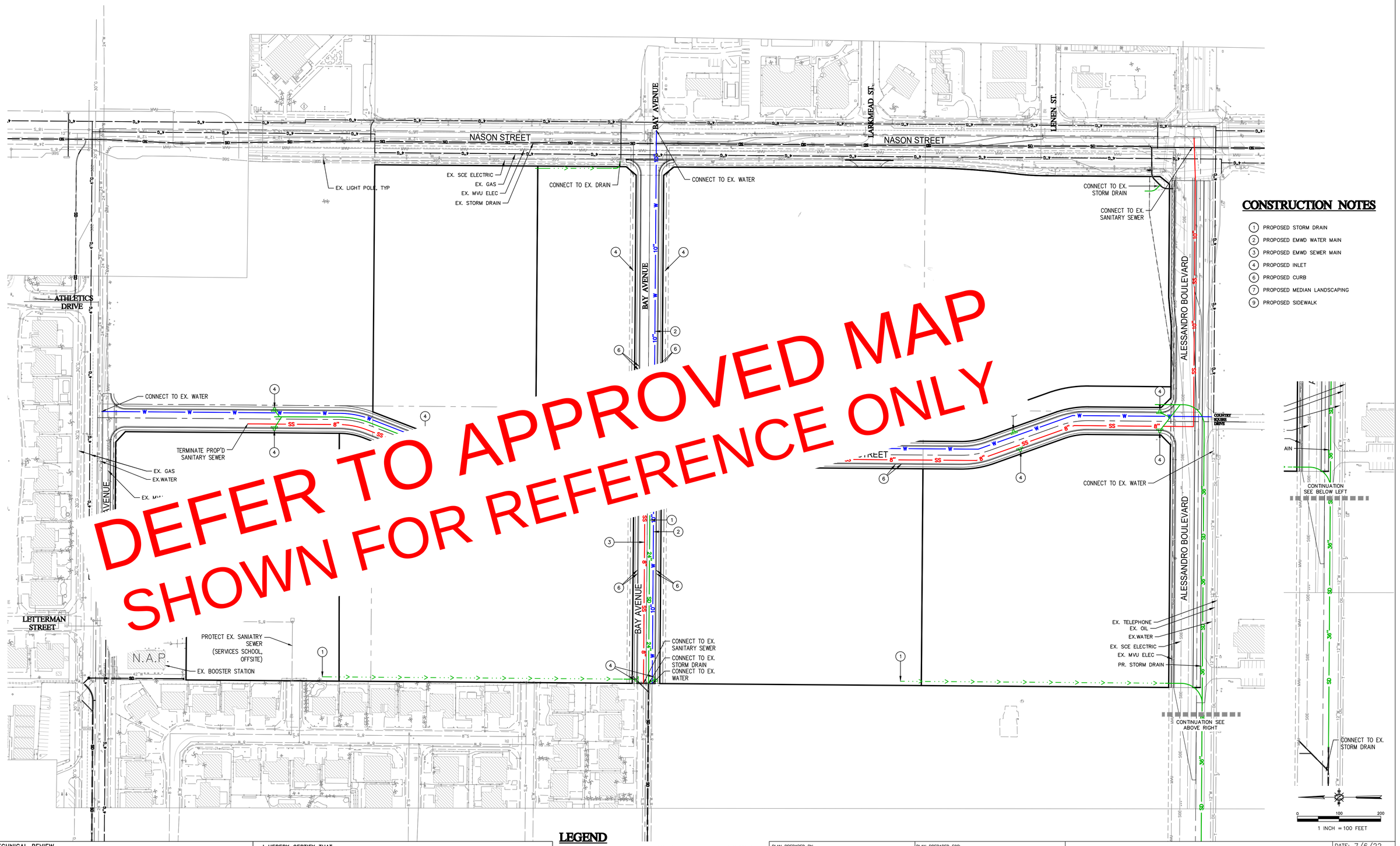
PLAN PREPARED FOR:

LEWIS MANAGEMENT CORP.
1156 NORTH MOUNTAIN AVENUE
UPLAND, CALIFORNIA 91785-0670
TEL: (909) 985-0971

TOWN CENTER AT MORENO VALLEY
TENTATIVE TRACT MAP 38421
ROAD CROSS SECTIONS

CITY OF MORENO VALLEY
CALIFORNIA

DATE: 7/6/22
JOB NO. 211203
CPN: PEN22-077
TTM: 38421
SHEET
10 OF 11



CONSTRUCTION NOTES

1. PROPOSED STORM DRAIN
2. PROPOSED EMWD WATER MAIN
3. PROPOSED EMWD SEWER MAIN
4. PROPOSED INLET
6. PROPOSED CURB
7. PROPOSED MEDIAN LANDSCAPING
9. PROPOSED SIDEWALK

GEOTECHNICAL REVIEW

THIS PLAN HAS BEEN REVIEWED AND CONFORMS TO RECOMMENDATIONS OF THE SOILS ENGINEERING/GEOLOGIC REPORT DATED _____.

SIGNATURE _____ DATE _____

PREPARED BY:

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REGISTERED PROFESSIONAL ENGINEER
WILHELM JOHN MAUL
NO. 42549
EXP. 03/31/2024
CIVIL
STATE OF CALIFORNIA

ENGINEER _____ 8/1/2022
WILHELM J. MAUL EXP. DATE

LEGEND

	EXISTING	PROPOSED
WATER MAIN	X"W	X"W
SANITARY SEWER LINE	X"S	X"SS
STORM DRAIN LINE	SD	SD
EASEMENT. SEE SHEET 1 SWALE LINEWORK.		
ROAD PAVEMENT		
INLET		
STORMWATER BMP SEDIMENT TRAP		SIDESLOPE, BOTTOM

PLAN PREPARED BY:
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Irvine, CA 92606
949.668.1683

PLAN PREPARED FOR:
LEWIS MANAGEMENT CORP.
1156 NORTH MOUNTAIN AVENUE
UPLAND, CALIFORNIA 91785-0670
TEL: (909) 985-0971

TOWN CENTER AT MORENO VALLEY
TENTATIVE TRACT MAP 38421
CONCEPT UTILITY PLAN

CITY OF MORENO VALLEY
CALIFORNIA

DATE: 7/6/22
JOB NO. 211203
CPN: PEN22-077
TTM: 38421
SHEET 11 OF 11

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Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

GEOTECHNICAL EXPLORATION
MORENO VALLEY TOWN CENTER
NORTHWEST CORNER OF ALESSANDRO BLVD AND NASON STREET
MORENO VALLEY, CALIFORNIA

Prepared for

LEWIS LAND DEVELOPERS, LLC

1156 North Mountain Avenue
Upland, California 91786

Project No. 13177.002

July 23, 2021

July 23, 2021

Project No. 13177.002

Lewis Land Developers, LLC
1156 North Mountain Avenue
Upland, California 91786

Attention: Mr. Bill Hoover, Vice President-Development Feasibility

Subject: Geotechnical Exploration
Moreno Valley Town Center
Northwest Corner of Alessandro Blvd and Nason Street
Moreno Valley, California

In accordance with your request, we are pleased to present this geotechnical exploration report for the subject project. This report presents our findings, conclusions and recommendations pertaining to the geotechnical aspects of the proposed development. It is our opinion that the overall site appears suitable for the intended use provided our recommendations included herein are properly incorporated during design and construction phases of development.

If you have any questions regarding this report, please do not hesitate to contact the undersigned. We appreciate this opportunity to be of service on this project.

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

Simon I. Saiid, GE 2641
Principal Engineer

Robert F. Riha, CEG 1921
Sr. VP / Sr. Principal Geologist

Distribution: (1) Addressee (PDF copy)

TABLE OF CONTENTS

Section Page

Accompanying Tables, Figures, Plates and Appendices

Tables

Figures

Appendices

1.0 INTRODUCTION

1.1 Purpose and Scope

This geotechnical exploration report is for the Moreno Valley Town Center residential project located at the Northwest Corner of Alessandro Blvd and Nason Street, in Moreno Valley, California (see Figure 1). Our scope of services for this geotechnical exploration included the following:

- Review of available site-specific reports and published data, including various geologic publications listed in the references at the end of this report.
- A review of the provided site plan.
- Site reconnaissance and visual observations of surface conditions to evaluate any potential localized settlement or other surface distresses.
- Excavation of eight (8) geotechnical borings and four (4) percolation-infiltration tests to explore the subsurface soil conditions within the site. Approximate locations of these explorations are depicted on Figure 2. The logs of borings and percolation tests are included in Appendix A.
- Laboratory testing was performed on representative samples and results are included in Appendix B.
- Geotechnical engineering analyses performed or as directed by a California registered Geotechnical Engineer (GE). A California Certified Engineering Geologist (CEG) performed engineering geology review of site geologic hazards.
- Preparation of this update report, which presents the results of our geotechnical exploration and preliminary recommendation for site development.

This report is not intended to be used as an environmental assessment (Phase I or other), and foundation and/or a rough grading plan review.

1.2 Site Location and Description

Based on information provided, the approximately 59-acre site is tentatively planned to be developed into a mixed residential (37 acres in the north) and non-residential (16 acres in the south), with a park and library (in the center portion). The overall property consists of the following APNs: 487-470-030 (21.94 acres), 487-470-031 (34.48 acres), and future Bay Ave ROW vacated (2.19 acres). The site is currently undeveloped with a large stockpile of fill in the southeastern corner. Small vegetation growth including weeds and seasonal grasses cover most of the site. The site topography slopes gently into southwesterly direction. Site elevations vary from approximately 1590 feet MSL (Mean Sea Level) in the

southwest corner to a maximum elevation of approximately 1640 feet MSL in the northeast corner of the site.

1.3 Proposed Development

No specific plans were provided to our office regarding proposed site development. However, based on personal communications, we understand that the residential development will host typical one- or two-story single-family residential homes consisting of wood-frame structures with conventional slab-on-grade foundations. The foundation loads are not expected to exceed 2,500 pounds per lineal foot (plf) for continuous footings. We also expect the loading and foundation requirements for the non-residential portion of the site to be substantially similar. We anticipate site grading will require maximum cuts and fills on the order of ±10 feet. If site development differs significantly from the assumptions stated herein, our recommendations should be subject to further reviews and evaluations.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Our field exploration consisted of the excavation of eight (8) borings and four (4) percolation/infiltration tests within accessible areas of the site. During excavation, bulk samples and relatively "undisturbed" Ring samples were collected from the exploration borings for further laboratory testing and evaluation. Approximate locations of the borings and percolation/infiltration tests are depicted on the *Boring Location Plan* (Figure 2). Sampling was conducted by a staff engineer from our firm. After logging and sampling, the excavations were loosely backfilled with spoils generated during excavation.

The exploration logs included within Appendix A and related information depicts subsurface conditions only at the locations indicated and at the particular date designated on the logs. Subsurface conditions at other locations may differ from conditions occurring at these borings locations. The passage of time may result in altered subsurface conditions due to environmental changes. In addition, any stratification lines on the logs represent the approximate boundary between soil types and the transition may be gradual.

2.2 Laboratory Testing

Laboratory tests were performed on representative bulk samples to provide a basis for development of remedial earthwork and geotechnical design parameters. Selected samples were tested to determine the following parameters: maximum dry density and optimum moisture, expansion index, soluble sulfate content, gradation and collapse potential. The results of our laboratory testing are presented in Appendix B.

3.0 GEOTECHNICAL AND GEOLOGIC FINDINGS

3.1 Regional Geology

The site is located within a prominent natural geomorphic province in southwestern California known as the Peninsular Ranges. It is characterized by steep, elongated ranges and valleys that trend northwestward. More specifically, the site is situated within the Perris Block, an eroded mass of Cretaceous and older crystalline rock.

The Perris Block, approximately 20 miles by 50 miles in extent, is bounded by the San Jacinto Fault Zone to the northeast, the Elsinore Fault Zone to the southwest, the Cucamonga Fault Zone to the northwest, and the Temecula Basin to the southeast. The southeast boundary of the Perris block is poorly defined. The Perris Block has had a complex tectonic history, apparently undergoing relative vertical land movements of several thousand feet in response to movement on the Elsinore and San Jacinto Fault Zones. Thin sedimentary and volcanic materials locally mantle the crystalline bedrock. Alluvial and colluvial deposits fill the lower valley areas. Based on published geologic maps (see Figure 3), the site is underlain by young and very old fan deposits.

3.2 Site Specific Geology

The geologic units encountered are discussed in the following sections in order of increasing age and further described on the logs of borings in Appendix A.

3.2.1 Artificial Fill (Stockpile)

A large stockpile of artificial fill is located at the southeastern corner of the site. The source of these materials is not known to us, however the soils appear to substantially similar to the soils explored in the borings. Additionally, artificial fill was encountered in some of our borings in the upper 12 to 24 inches of site soils, which appear to be the result of previous site grading or agricultural activities. The suitability of the stockpile soils to be used as fill materials during grading should be further evaluated during grading.

3.2.2 Alluvial Deposits

The alluvial fan deposits were observed throughout the site to the depths explored of 51 feet below ground surface. As encountered, these soils typically consisted of brown to reddish brown, medium dense to very dense, moist silty sand (SM) and well-graded sand with variable amounts of silt (SW-SM) and interbedded low-plasticity sandy silt (ML) layers. This alluvium is expected to generally possess a very low expansion potential (EI<21). Our laboratory testing indicates the upper 5 to 10 feet of alluvium has a slight to moderate collapse potential (<6%).

3.3 Landslide/Debris Flow and Rock Fall

No evidence of on-site landslides/debris flow or rock fall was observed during our field investigation and review of referenced reports. Elevated topography and thick deposits of surficial soils typically associated with landsliding or debris flows are not present. Due to the lack of nearby rock outcrop and the gentle natural slope of adjacent hillside areas, the debris flow and rock fall hazard is considered very low.

3.4 Rippability

Based on the results of our geotechnical borings, previous experience in this area, we do not anticipate that bedrock be encountered during site work within the upper 50 feet below ground surface (BGS)

3.5 Groundwater and Surface Water

Groundwater was not encountered during this exploration to the depths explored (51.5 feet). Recent groundwater level was measured in March 2021 at approximately 1470 feet MSL (approximately 40 feet BGS) at well EMWD25695 (339025N1171928W001), which is approximately one-mile south of the site. Thus, we do not anticipate significant groundwater related problems during grading or future development. However, locally perched water conditions can occur and may fluctuate seasonally, depending on rainfall. No surface water was observed.

3.6 Faulting

No indications of faulting or fault related fissuring or fracturing is known to exist or observed onsite. This site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone or County of Riverside Fault Zone.

3.7 Ground Shaking

Strong ground shaking can be expected at the site during moderate to severe earthquakes in this general region. This is common to virtually all of Southern California. Intensity of ground shaking at a given location depends primarily upon earthquake magnitude, site distance from the source, and site response (soil type) characteristics. The site-specific seismic coefficients provided in this section are based on an interactive tools/programs currently available on USGS website and OSHPD seismic maps. Based on ASCE 7-16 and our site-specific ground motion analysis for this Class D site, the seismic coefficients for this site are as listed in Table 1 below:

Table 1. CBC Site-Specific Seismic Coefficients

CBC Categorization/Coefficient		Value (g)
Site Longitude (decimal degrees)	-117.1940	
Site Latitude (decimal degrees)	33.9208	
Site Class Definition	**D**	
Mapped Spectral Response Acceleration at 0.2s Period, S_s		**1.87**
Mapped Spectral Response Acceleration at 1s Period, S_1		**0.74**
Short Period Site Coefficient at 0.2s Period, F_a		**1.0**
Long Period Site Coefficient at 1s Period, F_v		**1.7**
Adjusted Spectral Response Acceleration at 0.2s Period, S_{MS}		**1.87**
Adjusted Spectral Response Acceleration at 1s Period, S_{M1}		**1.25**
Design Spectral Response Acceleration at 0.2s Period, S_{DS}		***1.25***
Design Spectral Response Acceleration at 1s Period, S_{D1}		***0.83***
Site-Specific Modified Peak Ground Acceleration, PGA_m		***0.87***
Note: The seismic coefficients for Site Class D follows Exception (2) in Section 11.4.8 of ASCE 7-16 that assumes a fundamental period of vibration less than 0.5s for the proposed structures. The project structural engineer should confirm such assumption or else a site–specific ground motion analysis will be required		

3.8 Dynamic Settlement (Liquefaction and Dry Settlement)

Ground movements generated during a seismic event can produce settlements in sands or granular earth materials both above and below the water table. The earth materials onsite may experience seismically induced settlement during the design seismic event. The potential for such seismic densification to manifest at the graded surface and impact the development site is low to moderate.

If remedial grading is performed as recommended, total dynamic densification settlement is estimated to be less than 2 inches globally with anticipated differential settlement of 1-inch in 40 feet.

3.9 Expansive Soils

Limited laboratory testing indicated that near surface soils generally possess a very low expansion potential.

3.10 Slope Stability

It is anticipated that slopes constructed within the site are to be less than 15 feet in height. If constructed at 2:1 gradient using onsite soils, these slopes should be grossly stable under short- and long-term conditions (including seismic loading).

3.11 Percolation/Infiltration Testing

Percolation tests and associated test borings were performed in the vicinity of the proposed basins on the center-right and lower-right sections of the site (see Figure 2). Testing was performed in general accordance with the procedures of the Riverside County Flood Control and Water Conservation District (RCFC&WCD) Design Handbook (RCFC, 2011). The percolation tests (P-1 through P-4) were performed to depths of approximately 5 to 7 feet BGS. Adjacent deeper borings indicate the presence of silty sands to well-graded sands with silts to depths of at least 12 feet BGS. The results of the percolation testing are presented below. A factor of safety has not been applied to these rates.

Table 2. Summary of Percolation/Infiltration Test Results

Test Hole #	Location	Depth BGS (ft)	Percolation Rate (min/in)	Infiltration Rate (in/hr)	Soil Description
P-1	See Fig 2	7	1.0	2.9	Silty Sand (SM)
P-2	See Fig 2	5	0.7	4.1	Silty Sand (SM)
P-3	See Fig 2	5	1.5	1.5	Silty Sand (SM)
P-4	See Fig 2	5	0.7	3.5	Silty Sand (SM)

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 General

Development of the site appears feasible from a geotechnical viewpoint provided that the following recommendations are incorporated into the design and construction phases of development.

4.2 Earthwork

Earthwork should be performed in accordance with the following recommendations and the *Earthwork and Grading Specifications* Appendix C. The recommendations contained in Appendix C, are general grading specifications provided for typical grading projects and some of the recommendations may not be strictly applicable to this project. The specific recommendations contained in the text of this report supersede the general recommendations in Appendix C. The contract between the developer and earthwork contractor should be worded such that it is the responsibility of the contractor to place the fill properly in accordance with the recommendations of this report, the specifications in Appendix C, applicable City Grading Ordinances, notwithstanding the testing and observation of the geotechnical consultant.

4.2.1 Site Preparation and Remedial Grading

Prior to grading, the proposed structural improvement areas (i.e. all structural fill areas, pavement areas, buildings, etc.) of the site should be cleared of surface and subsurface obstructions, heavy vegetation, and/or deleterious materials. Roots and debris should be disposed of offsite. Septic tanks or seepage pits, if encountered, should be abandoned in accordance with the County of Riverside Department of Health Services guidelines.

Compressible materials including; undocumented fill, surficial topsoil, and near surface alluvial deposits are potentially compressible in their present state and may settle under the surcharge of fills or foundation loading. As such, these materials should be removed and re-compacted to a minimum of 90 percent relative compaction (based on ASTM D1557). For preliminary planning purposes, the anticipated removal depth is expected to extend to a depth of 6 feet BGS in the northern portion of the site (or north of LB-3), 8 feet in the middle portion of the site (or between LB-4 and LB-5) and 10 feet south of LB-6. The removal limit should be established by a 1:1 (H:V) projection from the edge of fill soils supporting settlement-sensitive structures downward and outward to competent material identified by the geotechnical consultant. Cut slopes exposing alluvial soils greater than 3 feet in height should be removed and replaced as compacted fill slopes in accordance with Appendix C. Removals will also include benching into competent

material as the fills rise. Areas adjacent to existing structures, property boundary and roadways, may require special monitoring. Temporary cuts in these areas should be no steeper than 1:1 slopes. Deeper removal may be required in localized areas depending on recommendations by the geotechnical consultant.

4.2.2 Suitability of Site Soils for Fills

The onsite soils are generally suitable for re-use as compacted fill, provided they are free of debris and organic matter. Fills placed within 10 feet of finish pad grades or slope faces should contain no rocks over 12 inches in maximum dimension. If encountered, clayey soils layers (EI>51) should be placed at depth greater than 5 feet below finished grades where feasible. All structural fill should be compacted throughout to 90 percent of the ASTM D 1557 laboratory maximum density, at or slightly above optimum moisture.

Fill soils should be placed at a minimum of 90 percent relative compaction (based on ASTM D1557) and near or above optimum moisture content. Placement and compaction of fill should be performed in accordance with local grading ordinances under the observation and testing of the geotechnical consultant. The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in thickness.

Fill slope keyways will be necessary at the toe of all fill slopes and at fill-over-cut contacts. Keyway schematics, including dimensions and subdrain recommendations are provided in Appendix C. All keyways should be excavated into dense bedrock or dense older alluvium as determined by the geotechnical engineer.

Fills placed on slopes steeper than 5:1 (horizontal:vertical) should be benched into dense soils (see Appendix C for benching detail). Benching should be of sufficient depth to remove all loose material. A minimum bench height of 2 feet into approved material should be maintained at all times.

4.2.3 Shrinkage

The volume change of excavated onsite soils upon recompaction is expected to vary with materials, density, insitu moisture content, and location and compaction effort. The in-place and compacted densities of soil materials vary and accurate overall determination of shrinkage and bulking cannot be made. Therefore, we recommend site grading include, if possible, a balance area or ability to adjust grades slightly to accommodate some variation. Based on our review, we expect recompaction shrinkage (when recompacted to an average 93 percent of ASTM D1557) of 8- to 14-percent by volume for alluvial soils and 10 to 20 percent for any surficial topsoil/undocumented fill.

4.2.4 Import Soils

Import soils and/or borrow sites, if needed, should be evaluated by us prior to import. Import soils should be uncontaminated, granular in nature, free of organic material (loss on ignition less-than 2 percent), have low expansion potential (with an Expansion Index less than 21) and have a low corrosion impact to the proposed improvements.

4.2.5 Utility Trenches

Utility trenches should be backfilled with compacted fill in accordance with the *Standard Specifications for Public Works Construction,* ("Greenbook"), 2021 Edition. Fill material above the pipe zone should be placed in lifts not exceeding 8 inches in uncompacted thickness and should be compacted to at least 90 percent relative compaction (ASTM D 1557) by mechanical means only. Site soils may generally be suitable as trench backfill provided these soils are screened of rocks over 1½ inches in diameter and organic matter. The upper 6 inches of backfill in all pavement areas should be compacted to at least 95 percent relative compaction.

Excavation of utility trenches should be performed in accordance with the project plans, specifications and the *"Greenbook"*. The contractor should be responsible for providing a "competent person" as defined in Article 6 of the *California Construction Safety Orders*. Contractors should be advised that sandy soils (such as fills generated from the onsite alluvium) could make excavations particularly unsafe if all safety precautions are not properly implemented. In addition, excavations at or near the toe of slopes and/or parallel to slopes may be highly unstable due to the increased driving force and load on the trench wall. Spoil piles from the excavation(s) and construction equipment should be kept away from the sides of the trenches. Leighton does not consult in the area of safety engineering.

4.2.6 Drainage

All drainage should be directed away from structures a minimum of 1% by means of approved permanent/temporary drainage devices. Adequate storm drainage of any proposed pad should be provided to avoid wetting of foundation soils. Irrigation adjacent to buildings should be avoided when possible. As an option, sealed-bottom planter boxes and/or drought resistant vegetation should be used within 5-feet of buildings.

4.2.7 Slope Construction

Compacted fill up to 25 feet in height at 2:1 (horizontal:vertical) are considered grossly stable for static and pseudostatic conditions. Higher or steeper slopes should be subject to further review and evaluation. Any new 2:1 slopes using the onsite soils compacted to minimum 90 percent should also be stable under short and long term conditions. The outer portion of new fill slopes should be either

overbuilt by 2 feet (minimum) and trimmed back to the finished slope configuration or compacted in vertical increments of 5 feet (maximum) by a weighted sheepsfoot roller as the fill is placed. The slope face should then be track-walked by dozers of appropriate weight to achieve the final slope configuration and compaction to the slope face.

New fill slopes should be provided a toe of slope keyways as depicted in Appendix C. Any new fill slopes placed along existing fill slope, the minimum new fill width should be 8 feet. If fill is placed against existing cut slope (exposing older alluvium), the minimum fill width should be 15 feet per Appendix C. All cut slopes should be observed and mapped by a Leighton geologist to confirm the exposed conditions are stable and no minor fill width is left in place. In this case, when cutting an existing fill slope back into the fill core, a minimum remaining fill width of 15 feet is recommended. Any existing cut or fill slopes to remain in the current condition should be minimally scarified to remove minor erosion rills or vermin burrow, moisture conditioned thoroughly and compacted by track walking large dozer to achieve a compacted slope face.

Slope faces are inherently subject to erosion, particularly if exposed to rainfall and irrigation. Landscaping and slope maintenance should be conducted as soon as possible in order to increase long-term surficial stability. Berms should be provided at the top of fill slopes. Drainage should be directed such that surface runoff on the slope face is minimized

4.3 Foundation Design

4.3.1 Bearing and Lateral Pressures

Based on our analysis, single-family residential structures or light commercial structures may be founded on conventional or post-tensioned slab-on-grade systems based on prevailing finish pad soils conditions after grading. The compacted fill is anticipated to possess very low expansion potential. As such, we recommend that the structural consultant and/or foundation engineer presents foundation design categories (i.e. conventional or stiffened slab-on-grade design) based on actual expansion potential of subgrade soils of each pad at completion of grading. Foundation footings may be designed with the following geotechnical design parameters:

Allowable Bearing Capacity:	2,000 psf at a minimum depth of embedment of 12 inches (min. width of 12 inches). This bearing capacity may be increased by ⅓ for short-term loading conditions (e.g., wind, seismic).
Sliding Coefficient:	0.35
Total Settlement:	2.0 inches
Differential Settlement:	1.0 inch in 40 feet

The slab/foundation reinforcement should comply with the recommendations included in table below and the structural engineer's requirements.

Table 3. Conventional Foundation Requirements

Conventional Foundation	Minimum Requirements
Minimum Footing Reinforcement	No. 4 rebar one (1) on top and one (1) on bottom.
Minimum Slab Thickness	4 inches (actual)
Minimum Slab Reinforcement	No. 3 rebar spaced 18 inches on center each way.
Minimum Slab Subgrade Moisture	110% optimum moisture to 12" depth prior to placing concrete.

4.4 Retaining Walls

Retaining wall earth pressures are a function of the amount of wall yielding horizontally under load. If the wall can yield enough to mobilize full shear strength of backfill soils, then the wall can be designed for "active" pressure. If the wall cannot yield under the applied load, the shear strength of the soil cannot be mobilized and the earth pressure will be higher. Such walls should be designed for "at rest" conditions. If a structure moves toward the soils, the resulting resistance developed by the soil is the "passive" resistance. Retaining walls backfilled with non-expansive soils should be designed using the following equivalent fluid pressures:

Table 4. Retaining Wall Design Earth Pressures (Static, Drained)

Loading Conditions	Equivalent Fluid Density (pcf)	
	Level Backfill	**2:1 Backfill**
Active	36	50
At-Rest	55	85
Passive*	300	150 (2:1, sloping down)

* This assumes level condition in front of the wall will remain for the duration of the project, not to exceed 3,500 psf at depth. If sloping down (2:1) grades exist in front of walls, then they should be designed using passive values reduced to ½ of level backfill passive resistance values.

Unrestrained (yielding) cantilever walls should be designed for the active equivalent-fluid weight value provided above for very low to low expansive soils that are free draining. In the design of walls restrained from movement at the top (non-yielding) such as basement or elevator pit/utility vaults, the at-rest equivalent fluid weight value should be used. Total depth of retained earth for design of cantilever walls should be measured as the vertical distance below the ground surface measured at the wall face for stem design, or measured at the heel of the footing for overturning and sliding calculations. Should a sloping backfill other than a 2:1 (horizontal:vertical) be constructed above the wall (or a

backfill is loaded by an adjacent surcharge load), the equivalent fluid weight values provided above should be re-evaluated on an individual case basis by us. Non-standard wall designs should also be reviewed by us prior to construction to check that the proper soil parameters have been incorporated into the wall design.

All retaining walls should be provided with appropriate drainage. The outlet pipe should be sloped to drain to a suitable outlet. Typical wall drainage design is illustrated in Appendix C, *Retaining Wall Backfill and Subdrain Detail*. Wall backfill should be non-expansive (EI $\leq$ 21) sands compacted by mechanical methods to a minimum of 90 percent relative compaction (ASTM D 1557). Clayey site soils should not be used as wall backfill. Walls should not be backfilled until wall concrete attains the 28-day compressive strength and/or as determined by the Structural Engineer that the wall is structurally capable of supporting backfill. Lightweight compaction equipment should be used, unless otherwise approved by the Structural Engineer.

4.5 Foundation Setback from Slopes

We recommend a minimum horizontal setback distance from the face of slopes for all structural footings (retaining and decorative walls, flatwork, building footings, pools, etc.). This distance is measured from the outside bottom edge of the footing horizontally to the slope face (or the face of a retaining wall) and should be a minimum of H/2, where H is the slope height (in feet).

Table 5. Footing Setbacks

Slope Height	Recommended Footing Setback
<5 feet	5 feet minimum
5 to 15 feet	7 feet minimum
>15 feet	H/2, where H is the slope height, not to exceed 10 feet to 2:1 slope face

The soils within the structural setback area generally possess poor lateral stability and improvements (such as retaining walls, pools, sidewalks, fences, pavements, decorative flatwork, etc.) constructed within this setback area will be subject to lateral movement and/or differential settlement. Potential distress to such improvements may be mitigated by providing a deepened footing or a pier and grade-beam foundation system to support the improvement. The deepened footing should meet the setback described above. Modifications of slope inclinations near foundations may increase the setback and should be reviewed by the design team prior to completion of design or implementation.

4.6 Sulfate Attack

The results of limited laboratory testing indicated negligible sulfate exposure to concrete per ACI 318. Further testing should be performed during site grading to confirm soluble-sulfate content of near finish subgrade soils. Additional testing for general corrosion potential to ferrous materials should also be performed during grading.

4.7 Concrete Flatwork

Sidewalk/Flatwork should conform to applicable City and County standards. A representative of Leighton should verify subgrade soil expansion, moisture conditions and compaction prior to formwork and reinforcement placement. If subgrade soils possess expansion index greater than 21, we recommend a minimum 8-inch deepened edge be constructed for all flatwork to reduce moisture variation in subgrade soils along concrete edges adjacent to open (unfinished) or irrigated landscape areas.

Concrete flatwork should be constructed of uniformly cured, low-slump concrete and should contain sufficient control/contraction joints. Additional provisions such as ascending/descending slope conditions, perched (irrigation) water, special surcharge loading conditions, potential expansive soil pressure and differential settlement/heave should be incorporated into the design of exterior improvements. Additional exterior slab details are suggested in the American Concrete Institute (ACI) guidelines. Homeowners (HOA) should be advised of their maintenance responsibilities as well as geotechnical issues that could affect performance of site improvements.

4.8 Preliminary Pavement Design

The preliminary pavement design provided below is based on the locally accepted Caltrans Highway Design Manual and a preliminary R-value of 65 based on our laboratory testing on a representative soil sample. For planning and estimating purposes, the pavement sections are calculated based on assumed Traffic Indexes (TI).

Table 6. Asphalt Pavement Sections

General Traffic Condition*	Traffic Index (TI)**	Asphalt Concrete* (inches)	Aggregate Base* (inches)
Local (Private) Street	6.0	3.0	6.0
Collector Street	7.0	3.0	6.0

*Per City minimum or as calculated

Actual R-value of the subgrade soils will need to be verified after completion of site grading to finalize the pavement design. Pavement design and minimum sections should conform to applicable City standards, where applicable.

For rigid pavement design, we recommend that a minimum of 6 inches of PCC pavement be used, in high impact load areas or if to be subjected to truck traffic. The PCC pavement should be placed on a minimum 6-inch aggregate base. The PCC pavement may be placed directly on a compacted subgrade with an R-Value of 40 or higher. The PCC pavement should have a minimum of 28-day compressive strength of 3,250 psi. Aggregate base should conform to the Standard Specifications for Public Works Construction (Green Book), 2021 Edition. Placement of concrete materials should follow applicable ACI and County standards.

The upper 6 inches of the subgrade soils should be moisture-conditioned to near optimum moisture content, compacted to at least 95 percent relative compaction (ASTM D1557) and kept in this condition until the pavement section is constructed. Minimum relative compaction requirements for aggregate base should be 95 percent of the maximum laboratory density as determined by ASTM D1557. If applicable, aggregate base should conform to the “Standard Specifications for Public Works Construction” (Greenbook) current edition or Caltrans Class 2 aggregate base and applicable City standards

If pavement areas are adjacent to watered landscape areas, some deterioration of the subgrade load bearing capacity may result. Moisture control measures such as deepened curbs or other moisture barrier materials may be used to prevent the subgrade soils from becoming saturated. The use of concrete cutoff or edge barriers should be considered when pavement is planned adjacent to either open (unfinished) or irrigated landscaped areas.

5.0 GEOTECHNICAL CONSTRUCTION SERVICES

Geotechnical review is of paramount importance in engineering practice. Poor performances of many foundation and earthwork projects have been attributed to inadequate construction review. We recommend that Leighton be provided the opportunity to review the grading plan and foundation plan(s) prior to bid.

Reasonably-continuous construction observation and review during site grading and foundation installation allows for evaluation of the actual soil conditions and the ability to provide appropriate revisions where required during construction. Geotechnical conclusions and preliminary recommendations should be reviewed and verified by Leighton during construction, and revised accordingly if geotechnical conditions encountered vary from our findings and interpretations. Geotechnical observation and testing should be provided:

- After completion of site clearing,
- During preparation and overexcavation of surface soils as described herein,
- During compaction of all fill materials,
- Testing of slab subgrade moisture content, prior to placement of vapor retarder,
- After excavation of all footings, and prior to placement of concrete,
- During utility trench backfilling and compaction, and
- When any unusual conditions are encountered.

Additional geotechnical exploration and analysis may be required based on final development plans, for reasons such as significant changes in proposed structure locations/footprints. We should review grading (civil) and foundation (structural) plans, and comment further on geotechnical aspects of this project.

6.0 LIMITATIONS

This report was necessarily based in part upon data obtained from a limited number of observances, site visits, soil samples, tests, analyses, histories of occurrences, spaced subsurface explorations and limited information on historical events and observations. Such information is necessarily incomplete. The nature of many sites is such that differing characteristics can be experienced within small distances and under various climatic conditions. Changes in subsurface conditions can and do occur over time. This investigation was performed with the understanding that the subject site is proposed for residential and commercial development. The client is referred to Appendix D regarding important information provided by the GBA (Geoprofessional Business Association) on geotechnical engineering studies and reports and their applicability.

This report was prepared for Lewis Land Developers, LLC based on Lewis Land Developers, LLC needs, directions, and requirements at the time of our investigation. This report is not authorized for use by, and is not to be relied upon by any party except Lewis Land Developers, LLC, and its successors and assigns as owner of the property, with whom Leighton and Associates, Inc. has contracted for the work. Use of or reliance on this report by any other party is at that party's risk. Unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify Leighton and Associates, Inc. from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of Leighton and Associates, Inc.

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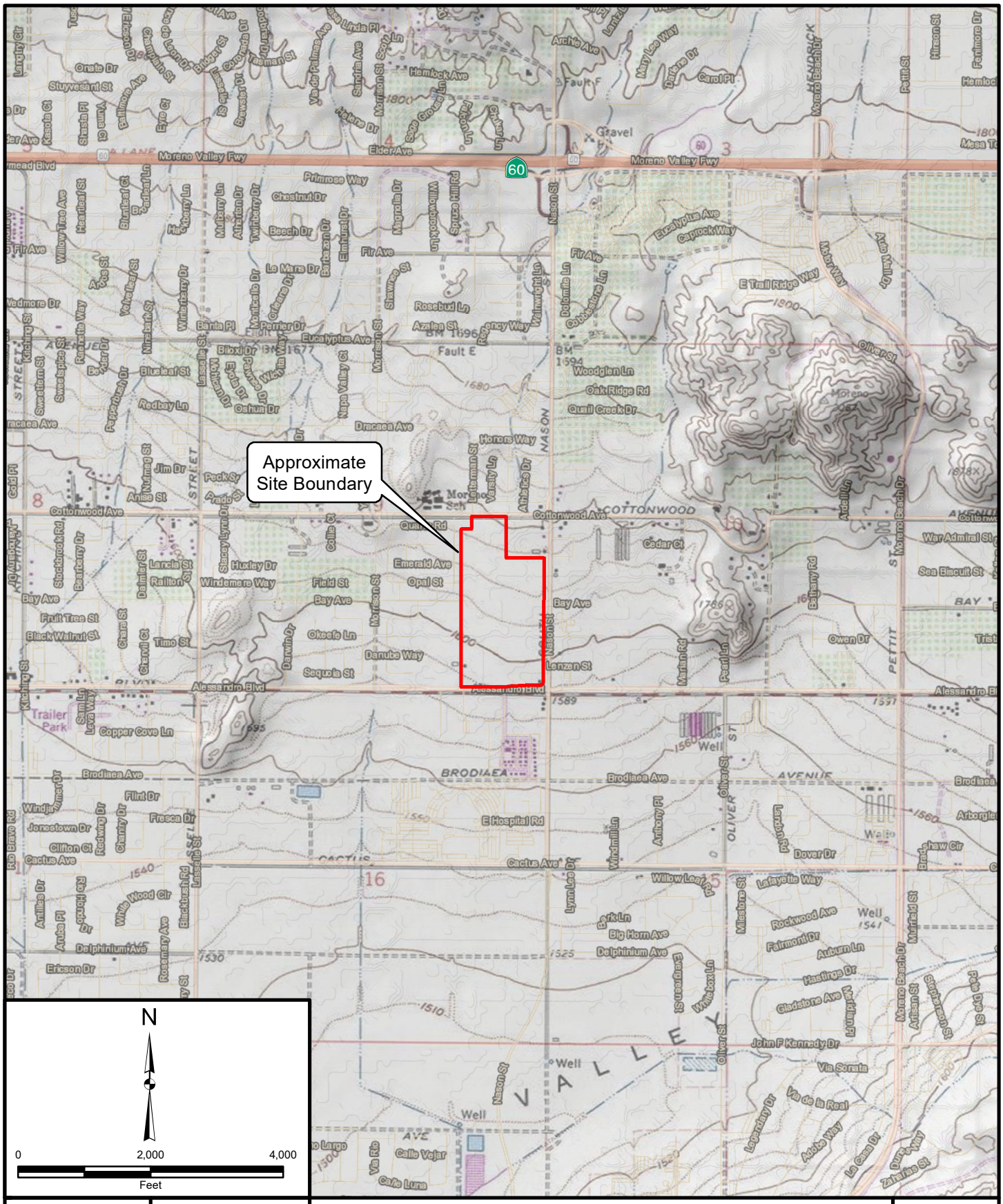

Project: 13177.002	Eng/Geol: RIR
Scale: 1 " = 2,000 '	Date: July 2021
Base Map: ESRI ArcGIS Online 2021 Author: Leighton Geomatics (kmanchikanti)	

SITE LOCATION MAP

Lewis Moreno Valley Town Center
NW Corner of Alessandro Boulevard and Nason Street
Moreno Valley, County of Riverside, California

Figure 1

Leighton

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Legend

LB-18 T.D 15' — Approximate Location of Soil Boring showing Total Depth in feet below ground surface

P4 — Approximate Location of Percolation Hole

Polygon Site Features

Approximate Site Boundary

EMWD Leherman Booster Station
26711 Cottonwood Avenue

Soil Stockpile

LB1 T.D.25'

LB2 T.D.50'

LB3 T.D.20'

P1

P2

LB4 T.D.20'

LB5 T.D.15'

LB6 T.D.25'

Soil Stockpile

Soil Stockpile

LB7 T.D.20'

P3

P4

LB8 T.D.15'

N

0 300 600

Feet

Project: 13177.001	Eng/Geol: RBH
Scale: 1 " = 300 '	Date: July 2021
Base Map: ESRI ArcGIS Online 2021 Author: (kmanchikanti)	

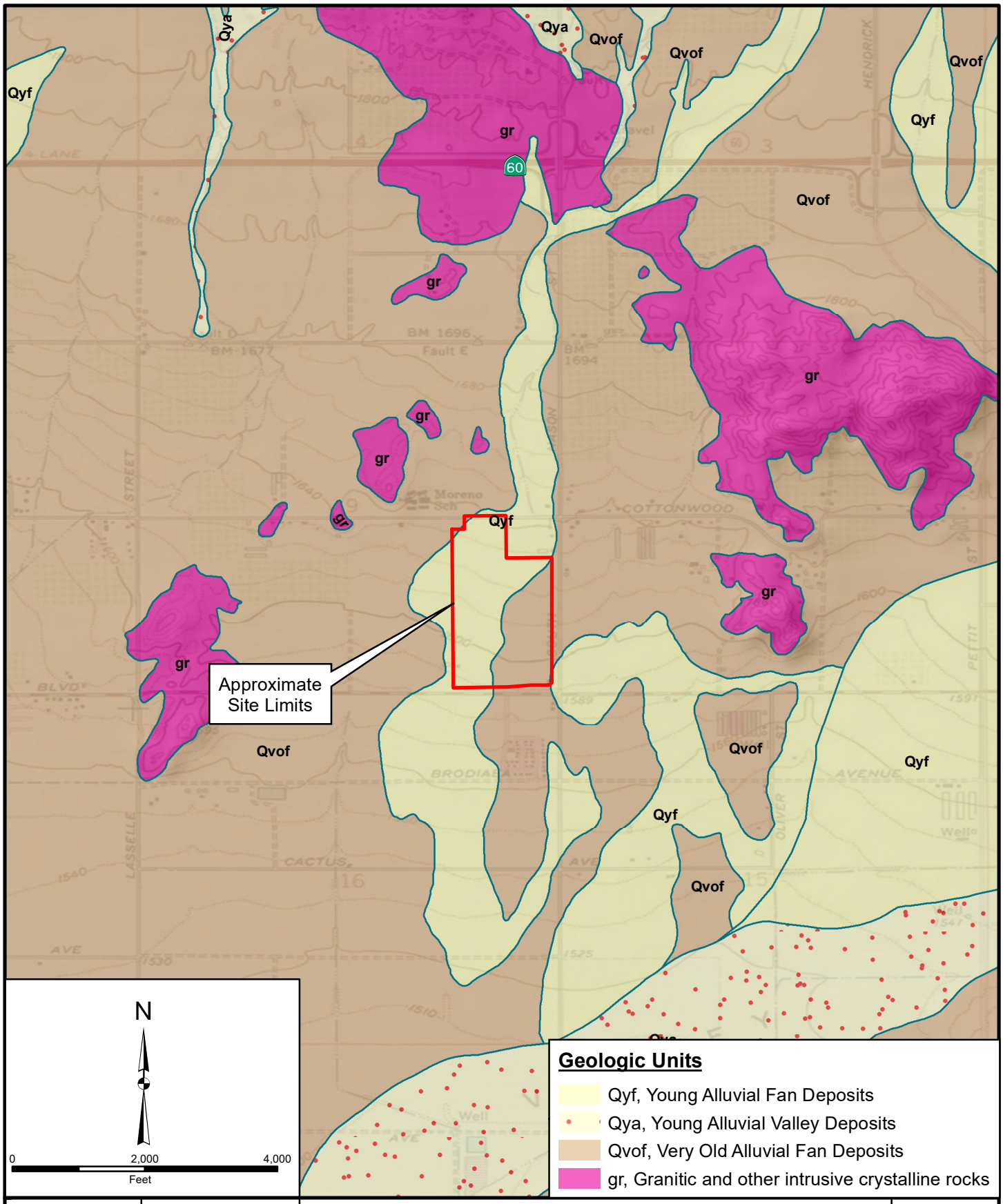
BORING LOCATION MAP

Lewis Moreno Valley Town Center
NW Corner of Alessandro Boulevard and Nason Street
Moreno Valley, County of Riverside, California

Figure 2

Leighton

Map Saved as V:\Drafting\13177\002\Maps\13177-002_F02_BLM_2021-07-14.mxd on 7/20/2021 4:18:42 PM



Project: 13177.002	Eng/Geol: RIR
Scale:1 " = 2,000 '	Date: July 2021

Base Map: USGS Topo Map Service from Esri, 2021
Reference: Socal Preliminary Geology, CGS 2010

REGIONAL GEOLOGY MAP

Lewis Moreno Valley Town Center
NW Corner of Alessandro Boulevard and Nason Street
Moreno Valley, County of Riverside, California

Figure 3

Leighton

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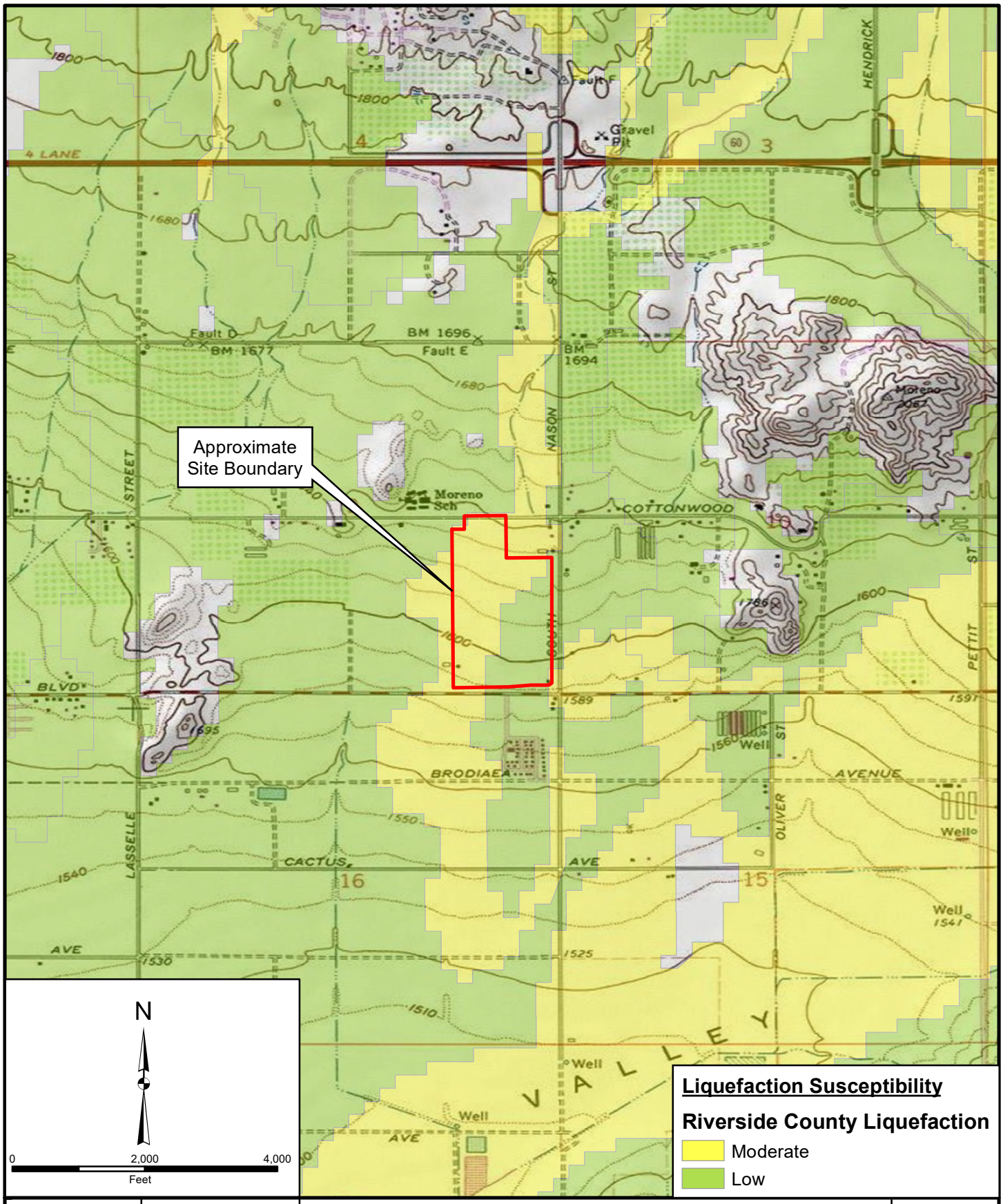

Project: 13177.002	Eng/Geol: RIR
Scale:1 " = 2,000 '	Date: July 2021
Base Map: USGS Topo Map Service from Esri, 2021 Reference: Riverside County GIS	

LIQUEFACTION HAZARD MAP

Lewis Moreno Valley Town Center
NW Corner of Alessandro Boulevard and Nason Street
Moreno Valley, County of Riverside, California

Figure 4

Leighton

Document Path: V:\Drafting\13177\002\Maps\13177-002_F04_LHM_2021-07-15.mxd Author: (kmanchikanti)

APPENDIX A

FIELD EXPLORATION / LOGS OF BORINGS

GEOTECHNICAL BORING LOG LB-01

Project No.	13177.002	**Date Drilled**	7-1-21
Project	Lewis MV Town Center	**Logged By**	DP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	DP

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1				SM	SILTY SAND, dense, pale brown to strong brown, slightly moist, Maximum Density = 134.5 pcf at Moisture = 7.9%, R-Value = 65, Fines = 24%, Sand = 70%, Gravel = 6%	MD, RV, SA
				R-1	13 20 25	117	3		SILTY SAND, medium dense, strong brown, moist	
	5			R-2	13 14 15				SILTY SAND, medium dense, strong brown, moist	
				S-1	6 7 9				SILTY SAND, medium dense, strong brown, moist	
	10			R-3	13 14 17	123	5		SILTY SAND, medium dense, strong brown, moist, Collapse = 1.14%	CO
	15			R-4	14 19 26			SW-SM	Well-graded SAND with silt, medium dense, yellowish brown, moist	
	20			S-2	8 9 12				Well-graded SAND with silt, medium dense, yellowish brown, moist	
	25			R-5	18 26 31				Well-graded SAND with silt, dense, yellowish brown, moist	
									Boring Terminated at 26.5 Feet No Groundwater Encountered Backfilled with Soil Cuttings	
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-02

Project No.	13177.002	**Date Drilled**	7-1-21
Project	Lewis MV Town Center	**Logged By**	DP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	DP

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	SILTY SAND, dense, pale brown to strong brown, slightly moist	
	5			R-1	9 11 15	120	2		SILTY SAND, medium dense, strong brown, moist	
	10			R-2	19 32 47	120	5		SILTY SAND, medium dense, strong brown, moist	
	15			S-1	9 11 10			SM	SILTY SAND, medium dense, light brown to yellowish brown, moist, note: cleaner than Silty Sand above	
	20			R-3	9 15 20	117	6		SILTY SAND, medium dense, light brown to yellowish brown, moist, FINES = 18%	-200
	25			S-2	9 10 13				SILTY SAND, dense, light brown to yellowish brown, moist	
	30									

The Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-02

Project No.	13177.002	**Date Drilled**	7-1-21
Project	Lewis MV Town Center	**Logged By**	DP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	DP

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30			R-4	21 22 28	119	3		SILTY SAND, dense, light brown to yellowish brown, moist	
	35			S-3	13 16 12			SM	SILTY SAND with clay, medium dense, brown, moist, FINES = 24%, with some thin interbedded clayier layers and cleaner layers	-200
	40			R-5	20 34 40				SILTY SAND, dense, light brown to yellowish brown, slightly moist, Note: less fines than above, bordering on SW-SM	
	45			S-4	7 11 16				SILTY SAND with clay, medium dense to dense, reddish brown, moist	
	50			S-5	8 12 12				SILTY SAND with clay, medium dense, reddish brown, moist	
	55								Boring Terminated at 51.5 Feet No Groundwater Encountered Backfilled with Soil Cuttings	
	60									

SOIL DESCRIPTION: This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
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- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
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- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-03

Project No.	13177.002	**Date Drilled**	7-1-21
Project	Lewis MV Town Center	**Logged By**	DP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	DP

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	SILTY SAND, loose, pale brown to strong brown, slightly moist, Maximum Density = 133.6 pcf at Moisture = 7.5%, Fines = 27%, Sand = 69%, Gravel = 4%	MD, SA
				R-1	5 7 10	110	4		SILTY SAND, medium dense, strong brown, moist	
	5			R-2	8 9 10	114	2		SILTY SAND, medium dense, strong brown, moist, Collapse = 2.79%	CO
				R-3	5 6 10			SW-SM	Well-graded SAND with silt and gravel, medium dense, light brown to yellowish brown, moist	
	10			R-4	10 15 26	122	6			
								SM	SILTY SAND, medium dense, brown to strong brown, moist	
	15			R-5	8 12 14				SILTY SAND, medium dense, brown to strong brown, moist	
	20			R-6	10 14 27			SW-SM	Well-graded SAND with silt and gravel, medium dense, light brown to yellowish brown, moist	
	25								Boring Terminated at 21.5 Feet No Groundwater Encountered Backfilled with Soil Cuttings	
	30									

SOIL DESCRIPTION: This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
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- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-04

Project No.	13177.002	**Date Drilled**	7-1-21
Project	Lewis MV Town Center	**Logged By**	DP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	DP

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
	0							SM	SILTY SAND with gravel, loose, pale brown to strong brown, slightly moist	
				R-1	10 17 24	120	2		SILTY SAND with gravel, medium dense, strong brown, moist	
	5			S-1	15 33 30				SILTY SAND with gravel, medium dense, strong brown, moist	
				R-2	16 22 29				SILTY SAND with gravel, medium dense, strong brown, moist	
	10			R-3	20 18 30	117	2	SW-SM	Well-graded SAND with silt, medium dense, brown to yellowish brown, moist	
	15			S-2	5 8 7				Well-graded SAND with silt, medium dense, yellowish brown, slightly moist	
	20			R-4	19 18 27			SM	SILTY SAND, medium dense, brown to strong brown, moist, fine sand	
	25								Boring Terminated at 21.5 Feet No Groundwater Encountered Backfilled with Soil Cuttings	
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG LB-05

Project No.	13177.002	**Date Drilled**	7-1-21
Project	Lewis MV Town Center	**Logged By**	DP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	DP

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	SILTY SAND with gravel, loose, pale brown to strong brown, slightly moist	
				R-1	5 9 12	117	3		SILTY SAND with gravel, medium dense, strong brown, moist	
	5			B-1 R-2	24 50/6"	118	4		SILTY SAND with gravel, medium dense, strong brown, moist, EI = 1 (Very Low)	EI
				S-1	10 8 8				SILTY SAND with gravel, medium dense, strong brown, moist	
	10			R-3	16 16					
					20			SW-SM	Well-graded SAND with silt, medium dense, brown to yellowish brown, moist, with interbedded poorly-graded sand layers	
	15			R-4	7 12 18				Well-graded SAND with silt, medium dense, yellowish brown, slightly moist	
									Boring Terminated at 16.5 Feet No Groundwater Encountered Backfilled with Soil Cuttings	
	20									
	25									
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-06

Project No.	13177.002	**Date Drilled**	7-1-21
Project	Lewis MV Town Center	**Logged By**	DP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	DP

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	SILTY SAND with gravel, dense, pale brown to strong brown, slightly moist	
				R-1	5 8 10	114	3		SILTY SAND with gravel, medium dense, strong brown, moist	
	5			R-2	7 6 8	108	2		SILTY SAND with gravel, medium dense, strong brown, moist, Collapse = 3.67%	CO
				R-3	7 10 10	117	2	SW-SM	Well-graded SAND with silt, medium dense, yellowish brown to light brown, moist	
	10			S-1	3 5 6			SM	SILTY SAND, loose, brown, moist	
	15			R-4	18 26 32				SILTY SAND, dense, brown, moist	
	20			S-2	5 8 13			SW-SM	Well-graded SAND with silt, medium dense, brown, moist, with interbeds of Silty Sand	
	25			R-5	12 37 50/6"				Well-graded SAND with silt, dense, brown, moist	
	30								Boring Terminated at 26.5 Feet No Groundwater Encountered Backfilled with Soil Cuttings	

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG LB-07

Project No.	13177.002	**Date Drilled**	7-1-21
Project	Lewis MV Town Center	**Logged By**	DP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	DP

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	SILTY SAND with gravel, loose, pale brown to strong brown, slightly moist	
				R-1	6 5 12	116	3		SILTY SAND with gravel, medium dense, strong brown, moist	
	5			R-2	9 12 14	118	3		SILTY SAND with gravel, medium dense, strong brown, moist	
				S-1	5 7 8				SILTY SAND, medium dense, strong brown, moist	
	10			R-3	10 11 13	112	5		SILTY SAND, medium dense, strong brown, moist, Collapse = 4.73%	CO
	15			S-2	15 19 18			ML	SANDY SILT or SILTY SAND, dense, dark reddish brown, moist	
	20			R-4	9 15 21			SW-SM	Well-graded SAND with silt and clay, medium dense, brown, moist	
	25								Boring Terminated at 21.5 Feet No Groundwater Encountered Backfilled with Soil Cuttings	
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG LB-08

Project No.	13177.002	**Date Drilled**	7-1-21
Project	Lewis MV Town Center	**Logged By**	DP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	DP

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1				SM	SILTY SAND with gravel, loose, pale brown to strong brown, slightly moist	
				R-1	4 5 7	105	6		SILTY SAND with gravel, loose, strong brown, moist	
	5			R-2	3 5 7	112	5		SILTY SAND with gravel, loose, strong brown, moist, Collapse = 5.60%	CO
				R-3	4 5 9	113	5		SILTY SAND with gravel, loose, strong brown, moist	
	10			R-4	5 6 9	113	5		SILTY SAND, loose, strong brown, moist, Collapse = 4.77%	CO
	15			R-5	16 26 36			ML	SANDY SILT or SILTY SAND, dense, dark reddish brown, slightly moist	
									Boring Terminated at 16.5 Feet No Groundwater Encountered Backfilled with Soil Cuttings	
	20									
	25									
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG P-01

Project No.	13177.002	**Date Drilled**	7-1-21
Project	Lewis MV Town Center	**Logged By**	DP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	DP

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0	N S						SM	Silty SAND with Gravel, medium dense, brown, slightly moist	
	5									
	10								Boring Terminated at 7 Feet No Groundwater Encountered Backfilled with Soil Cuttings After Percolation Test	
	15									
	20									
	25									
	30									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG P-02

Project No.	13177.002	**Date Drilled**	7-1-21
Project	Lewis MV Town Center	**Logged By**	DP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	DP

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
	0							SM	Silty SAND with Gravel, medium dense, brown, slightly moist	
	5								Boring Terminated at 5 Feet No Groundwater Encountered Backfilled with Soil Cuttings After Percolation Test	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG P-03

Project No.	13177.002	**Date Drilled**	7-1-21
Project	Lewis MV Town Center	**Logged By**	DP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	DP

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
	0							SM	Silty SAND, loose, pale brown, slightly moist, fine sand	
	5								Boring Terminated at 5 Feet No Groundwater Encountered Backfilled with Soil Cuttings After Percolation Test	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG P-04

Project No.	13177.002	**Date Drilled**	7-1-21
Project	Lewis MV Town Center	**Logged By**	DP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	DP

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
	0							SM	Silty SAND, loose, pale brown, slightly moist, fine sand, FINES = 42%	
				R1	6 10 13					-200
	5								Boring Terminated at 5 Feet No Groundwater Encountered Backfilled with Soil Cuttings After Percolation Test	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

APPENDIX B

GEOTECHNICAL LABORATORY TEST RESULTS

One-Dimensional Swell or Settlement Potential of Cohesive Soils

(ASTM D 4546) -- Method 'B'

Leighton

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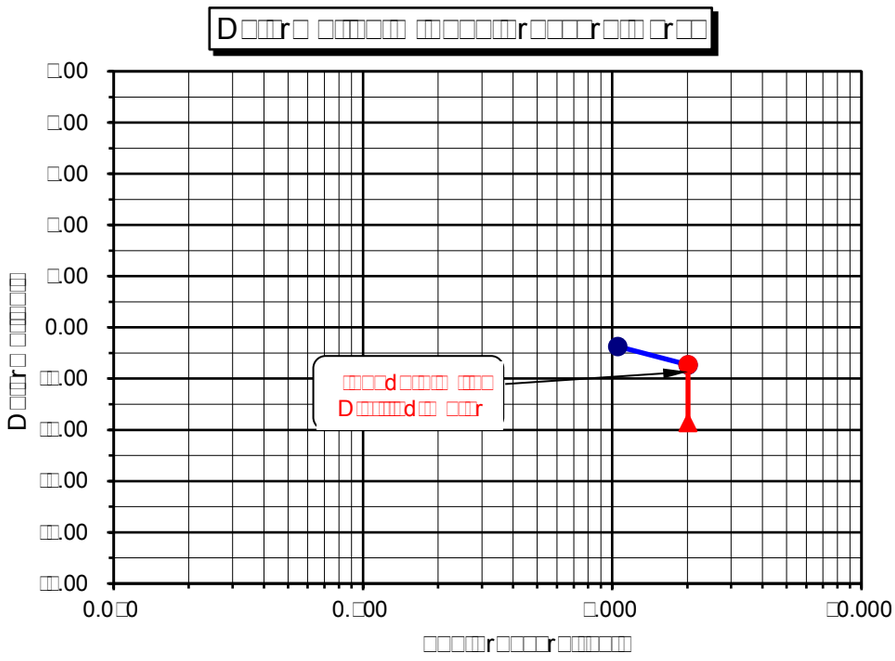
Percent Swell / Settlement After Inundation = -1.14



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One-Dimensional Swell or Settlement Potential of Cohesive Soils

(ASTM D 4546) -- Method 'B'

Leighton

Project Name:	[illegible]	Date Sampled:	[illegible]
Project No.:	[illegible]	Date Tested:	[illegible]
Boring No.:	LB-3	Tested By:	[illegible]
Sample No.:	R-2	Checked By:	
Soil Description:	[illegible]		

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[illegible]	[illegible]
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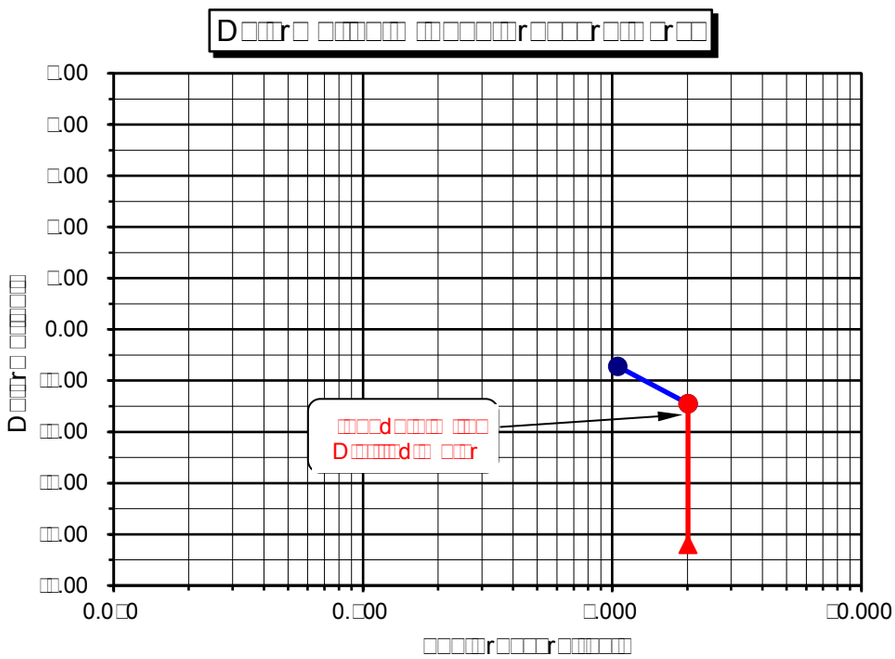
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Percent Swell / Settlement After Inundation = -2.79



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One-Dimensional Swell or Settlement Potential of Cohesive Soils

(ASTM D 4546) -- Method 'B'

Leighton

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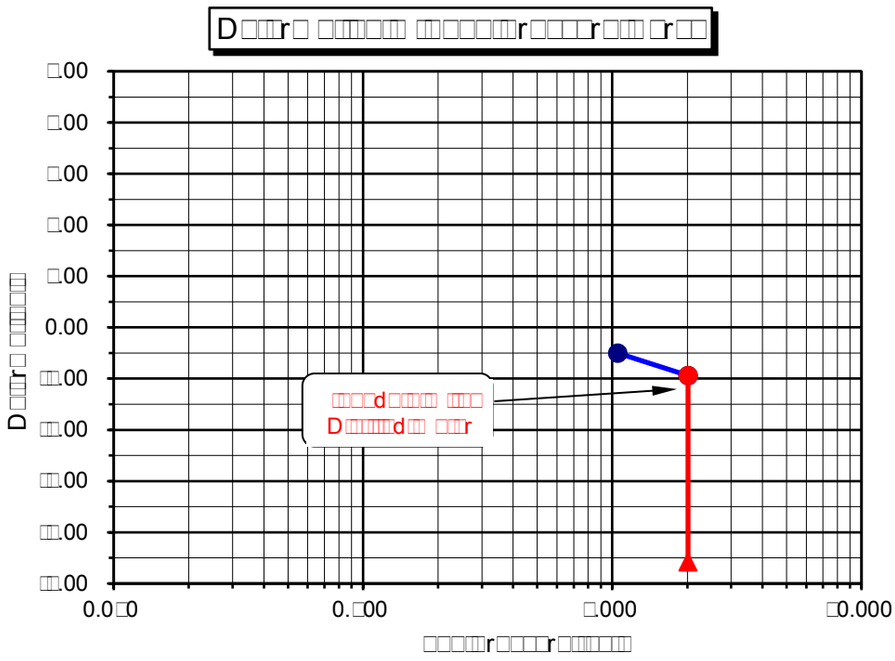
Percent Swell / Settlement After Inundation = -3.67



R□□.0□□0

One-Dimensional Swell or Settlement Potential of Cohesive Soils

(ASTM D 4546) -- Method 'B'

Leighton

Project Name and No.	[illegible]	Date Sampled	[illegible]
Project No.	[illegible]	Date Tested	[illegible]
Boring No.	LB-7	Tested By	[illegible]
Sample No.	R-3	Checked By	[illegible]
Soil Description	[illegible]		

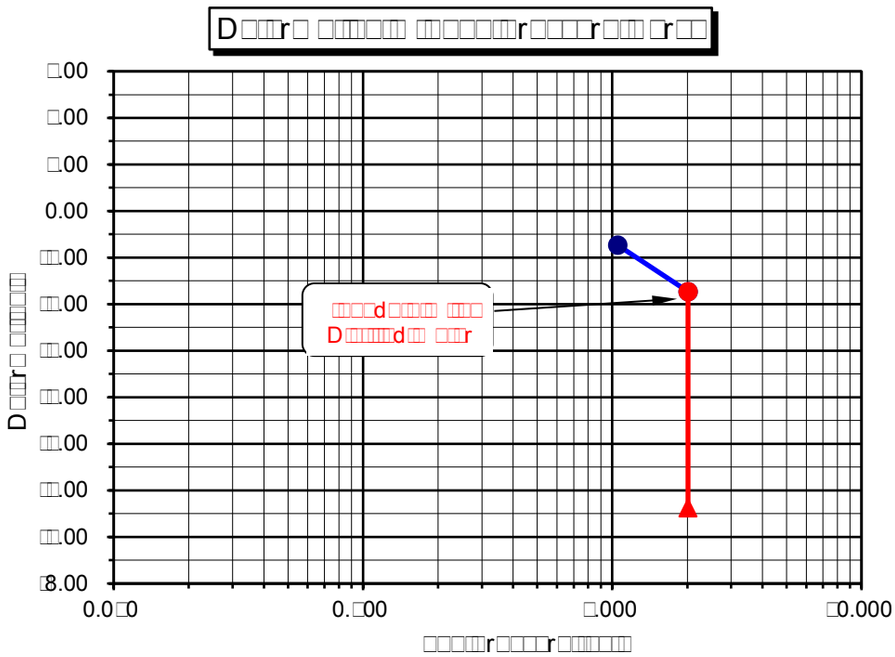
Remarks: [illegible]

Initial Dry Density, pcf	0.0
Initial Moisture, %	0.0
Initial Void Ratio	0.0000
Final Void Ratio	0.0000
Specific Gravity, Assumed	0.00

Initial Dry Density, pcf	[illegible]
Initial Moisture, %	[illegible]
Initial Saturation, %	0.0
Swell Pressure, psf	0.00
Final Dry Density, pcf	[illegible]

Load, psf	Final Reading	Change in Thickness, in.	Thickness, in.	Void Ratio	Saturation, %	Dry Density, pcf
0.00	0.0000	0.0000	0.00	0.00	0.0	0.0
0.00	0.0000	0.0000	0.00	[illegible]	0.0	[illegible]
[illegible]	0.0000	0.0000	0.00	[illegible]	0.0	[illegible]

Percent Swell / Settlement After Inundation = -4.73



R 0.0

One-Dimensional Swell or Settlement Potential of Cohesive Soils

(ASTM D 4546) -- Method 'B'

Leighton

Project Name and No.	[illegible]	Tested By	[illegible]
Project No.	[illegible].00	Tested By	[illegible]
Boring No.	LB-8		
Sample No.	R-2	Depth, ft.	[illegible].0

Description of Material [illegible]

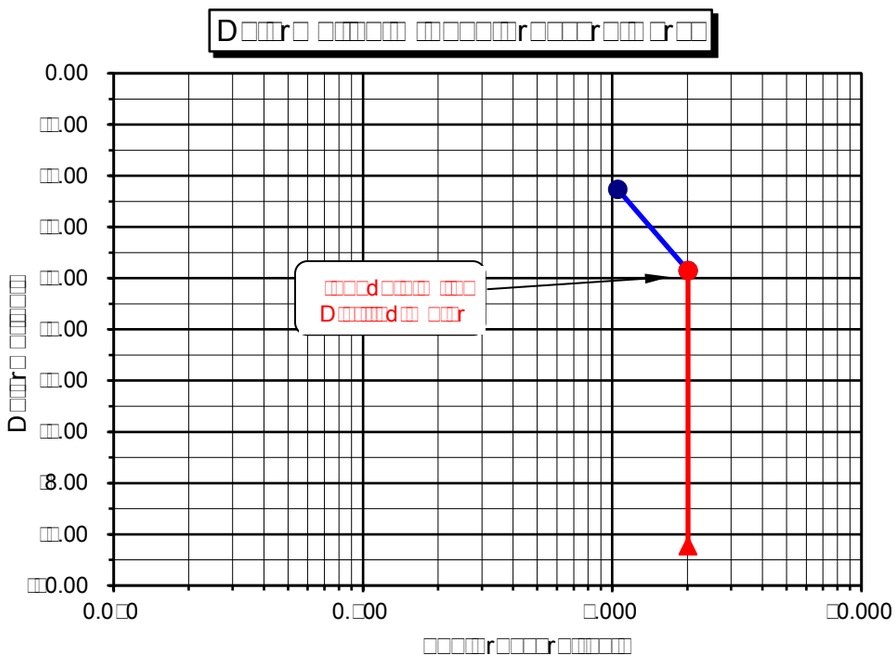
Remarks [illegible]

Initial Dry Density, pcf	[illegible]00.[illegible]
Initial Moisture Content, %	[illegible].[illegible]
Initial Void Ratio	[illegible].0000
Percent Saturation, %	0.0000
Height of Specimen, in.	[illegible].[illegible]000

Final Dry Density, pcf	[illegible]0.[illegible]
Final Moisture Content, %	[illegible].[illegible]
Load Increment	0.[illegible]000
Swell Pressure, psf	[illegible].[illegible]0
Height of Specimen, in.	[illegible].8

Load Increment	Pressure, psf	Dial Reading	Change in Specimen Height, in.	Corrected Change in Specimen Height, in.	Percent Change in Specimen Height	Percent Swell / Settlement
[illegible].0[illegible]0	0.0[illegible]	0.[illegible]	0.00	[illegible].[illegible]	0.[illegible]	[illegible].[illegible]
[illegible].0[illegible]	0.0[illegible]8[illegible]	0.[illegible]	0.00	[illegible].8[illegible]	0.[illegible]0[illegible]	[illegible].8[illegible]
[illegible]	0.0[illegible]	0.[illegible]0[illegible]	0.00	[illegible].[illegible]	0.[illegible]	[illegible].[illegible]

Percent Swell / Settlement After Inundation = -5.60



One-Dimensional Swell or Settlement Potential of Cohesive Soils

(ASTM D 4546) -- Method 'B'

Leighton

Project Name and No.	[illegible]	Tested By	[illegible]
Project No.	[illegible].00	Checked By	[illegible]
Boring No.	LB-8		
Sample No.	R-4		
Soil Description	[illegible]		

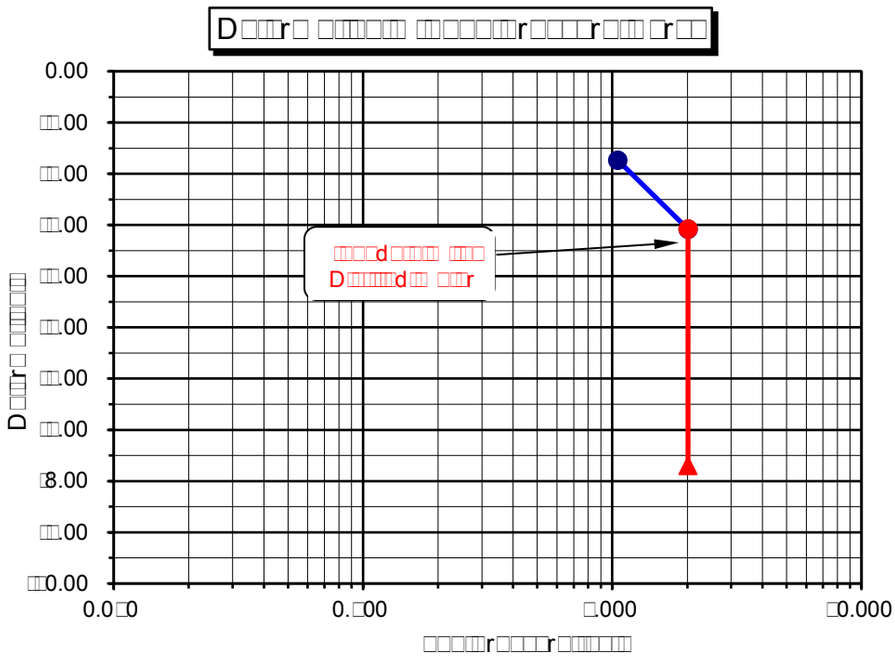
Remarks: [illegible]

Initial Dry Density, pcf	0[illegible]
Initial Moisture, %	[illegible]
Initial Void Ratio	[illegible].0000
Initial Degree of Saturation, %	0.0000
Height of Ring, in	[illegible].[illegible]

Final Dry Density, pcf	[illegible]
Final Moisture, %	[illegible]
Specific Gravity, Assumed	8.0
Diameter of Ring, in	0.[illegible]8[illegible]
Area of Ring, sq ft	[illegible].[illegible]0
Volume of Ring, cu ft	[illegible].08

Load, psf	Corrected Height, in	Change in Height, in	Average Height, in	Void Ratio	Degree of Saturation, %	Dry Density, pcf
[illegible].0[illegible]0	0.0[illegible]	0.[illegible]8[illegible]	0.00	[illegible].[illegible]	0.[illegible]0[illegible]	[illegible].[illegible]
[illegible].0[illegible]	0.0[illegible]08	0.[illegible]	0.00	[illegible].08	0.[illegible]880	[illegible].08
[illegible]	0.0[illegible]0	0.[illegible]0	0.00	[illegible].[illegible]0	0.[illegible]	[illegible].[illegible]0

Percent Swell / Settlement After Inundation = -4.77



R[illegible].[illegible]0[illegible]0

Leighton

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D 6913

Project Name: Lewis/MV Town Center/Geo
Tested By: MRV Date: 07/15/21
Project No.: 13177.002
Checked By: MRV Date: 07/16/21
Boring No.: LB-1
Depth (feet): 0.0
Sample No.: B-1
Soil Identification: Silty Sand (SM), Dark Yellowish Brown.

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	M	M	Wt. of Air-Dry Soil + Cont.(g)	2029.2	991.3
Wt. Air-Dried Soil + Cont.(g)	2029.2	991.3	Wt. of Dry Soil + Cont. (g)	2004.3	991.3
Wt. of Container (g)	666.4	666.4	Wt. of Container No._____(g)	666.4	666.4
Dry Wt. of Soil (g)	1337.4	324.9	Moisture Content (%)	1.9	0.0

Passing #4 Material After Wet Sieve		
	Container No.	M
	Wt. of Dry Soil + Container (g)	909.4
	Wt. of Container (g)	666.4
	Dry Wt. of Soil Retained on # 200 Sieve (g)	243.0

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained (g)		Percent Passing (%)
	(mm.)	Whole Sample	Sample Passing #4	
1 1/2"	37.500			100.0
1"	25.000			100.0
3/4"	19.000	0.0		100.0
1/2"	12.500	20.1		98.5
3/8"	9.500	45.3		96.6
#4	4.750	75.4		94.4
#8	2.360		28.0	86.3
#16	1.180		67.3	74.8
#30	0.600		112.8	61.6
#50	0.300		160.7	47.7
#100	0.150		207.4	34.1
#200	0.075		243.1	23.8
PAN				

GRAVEL: **6 %**
SAND: **70 %**
FINES: **24 %**
GROUP SYMBOL: **SM**

Cu = D60/D10 = N/A
Cc = $(D30)^2/(D60*D10)$ = N/A

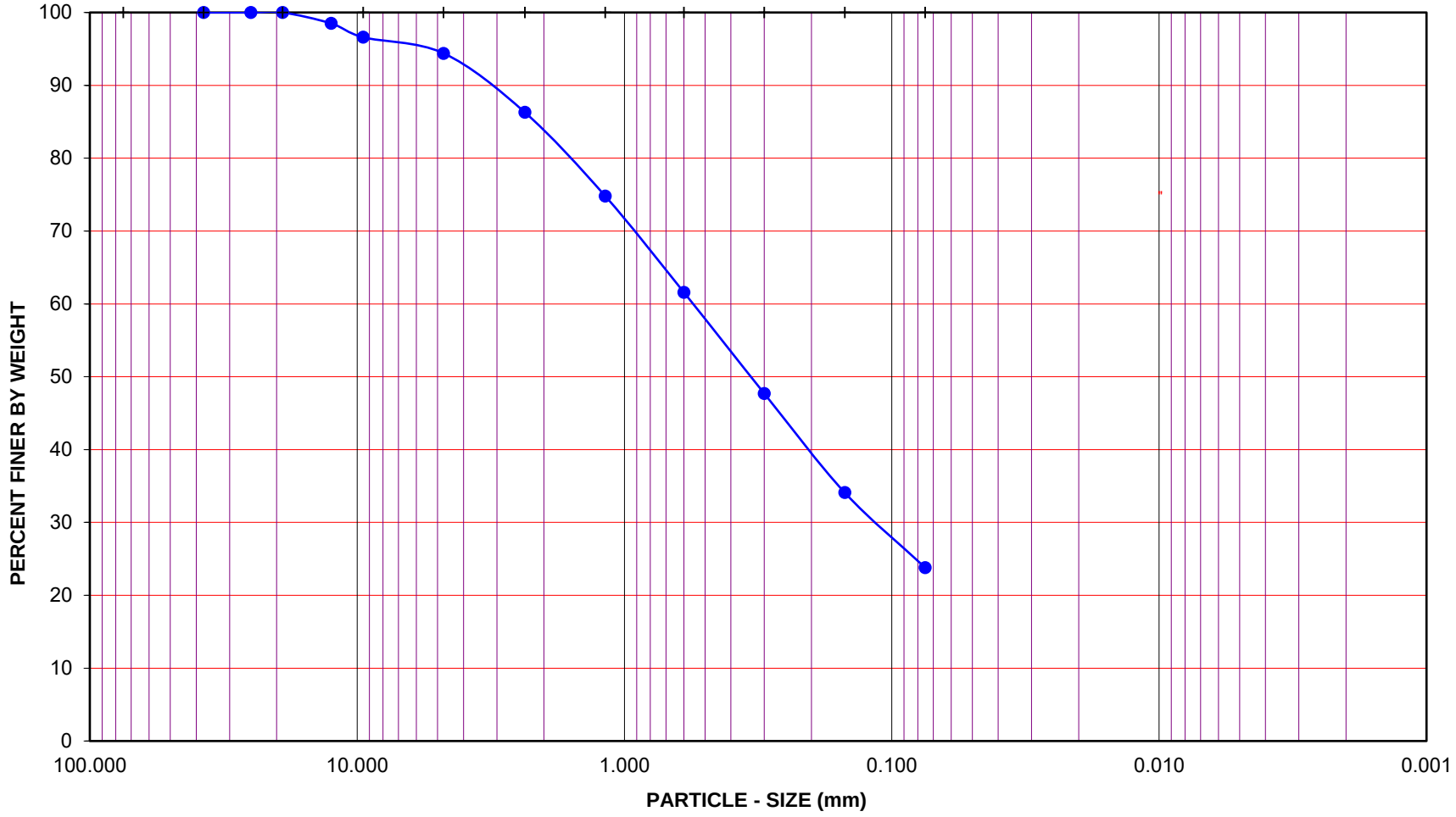
Remarks:

GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

U.S. STANDARD SIEVE OPENING: 3.0" 1 1/2" 3/4" 3/8"

U.S. STANDARD SIEVE NUMBER: #4 #8 #16 #30 #50 #100 #200

HYDROMETER



Project Name: Lewis/MV Town Center/Geo

Project No.: 13177.002

Boring No.: LB-1 Sample No.: B-1

Depth (feet): 0.0 Soil Type : SM

Soil Identification: Silty Sand (SM), Dark Yellowish Brown.

GR:SA:FI : (%) 6 : 70 : 24

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

Jul-21

Leighton

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D 6913

Project Name: Lewis/MV Town Center/Geo
Tested By: MRV Date: 07/15/21
Project No.: 13177.002
Checked By: MRV Date: 07/16/21
Boring No.: LB-3
Depth (feet): 0.0
Sample No.: B-1
Soil Identification: Silty Sand (SM), Dark Yellowish Brown.

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	B	B	Wt. of Air-Dry Soil + Cont.(g)	2024.7	990.3
Wt. Air-Dried Soil + Cont.(g)	2024.7	990.3	Wt. of Dry Soil + Cont. (g)	1995.4	990.3
Wt. of Container (g)	673.2	673.2	Wt. of Container No._____(g)	673.2	673.2
Dry Wt. of Soil (g)	1322.4	317.1	Moisture Content (%)	2.2	0.0

Passing #4 Material After Wet Sieve		
	Container No.	B
	Wt. of Dry Soil + Container (g)	903.2
	Wt. of Container (g)	673.2
	Dry Wt. of Soil Retained on # 200 Sieve (g)	230.0

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained (g)		Percent Passing (%)
	(mm.)	Whole Sample	Sample Passing #4	
1 1/2"	37.500			100.0
1"	25.000			100.0
3/4"	19.000	0.0		100.0
1/2"	12.500	10.6		99.2
3/8"	9.500	25.2		98.1
#4	4.750	48.0		96.4
#8	2.360		19.0	90.6
#16	1.180		48.2	81.7
#30	0.600		78.2	72.6
#50	0.300		123.5	58.9
#100	0.150		179.6	41.8
#200	0.075		226.9	27.4
PAN				

GRAVEL: **4 %**
SAND: **69 %**
FINES: **27 %**
GROUP SYMBOL: **SM**

Cu = D60/D10 = N/A
Cc = $(D30)^2/(D60*D10)$ = N/A

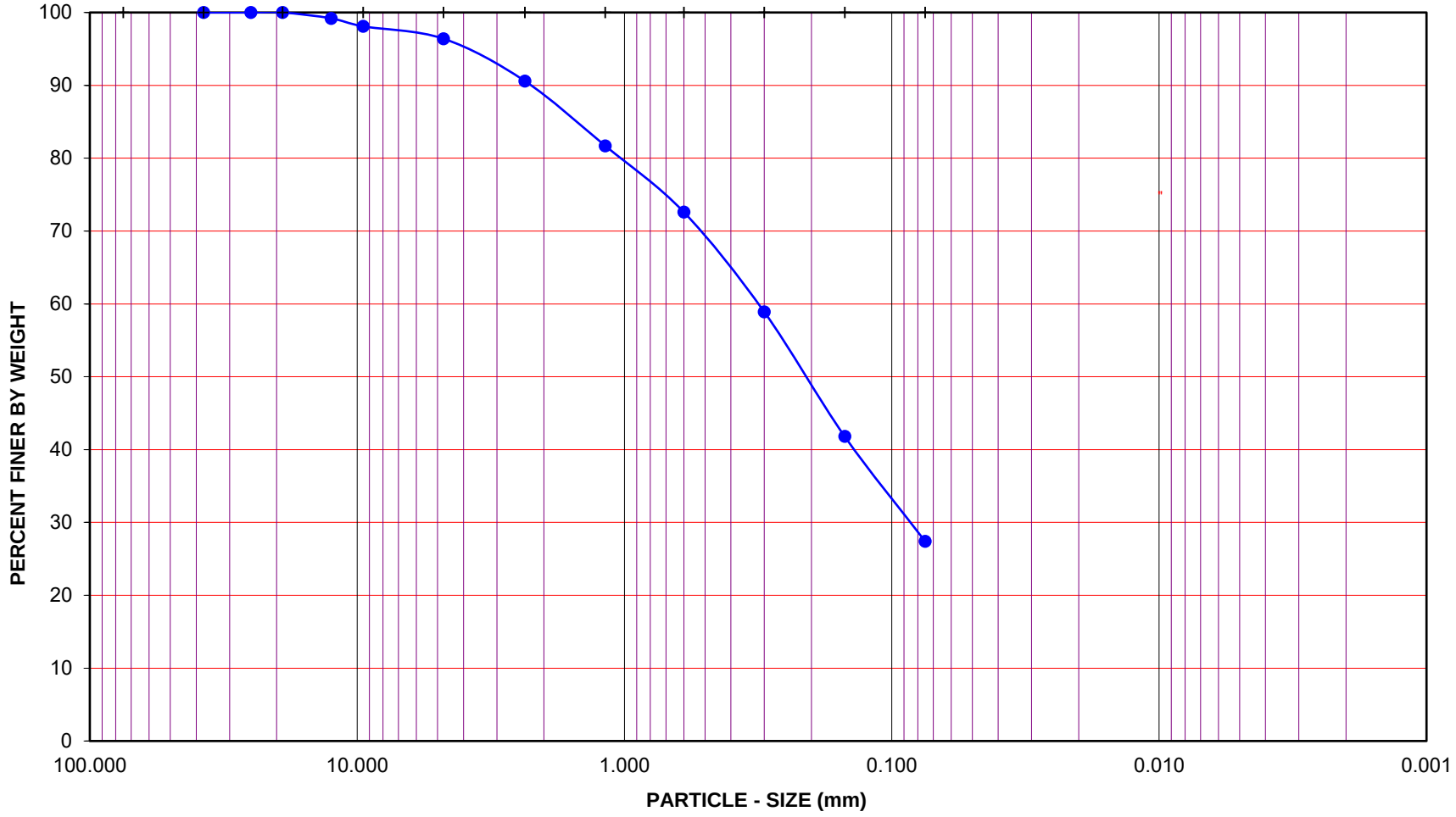
Remarks:

GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

U.S. STANDARD SIEVE OPENING: 3.0" 1 1/2" 3/4" 3/8"

U.S. STANDARD SIEVE NUMBER: #4 #8 #16 #30 #50 #100 #200

HYDROMETER



Project Name: Lewis/MV Town Center/Geo

Project No.: 13177.002

Boring No.: LB-3 Sample No.: B-1

Depth (feet): 0.0 Soil Type : SM

Soil Identification: Silty Sand (SM), Dark Yellowish Brown.

GR:SA:FI : (%) 4 : 69 : 27

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

Jul-21

EXPANSION INDEX of SOILS
ASTM D 4829

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[illegible] 0 [illegible]	**1**

R-VALUE TEST RESULTS

ASTM D 2844

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TEST SPECIMEN	A	B	C
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DR[illegible]D[illegible]	[illegible].8	[illegible]	[illegible]0.[illegible]
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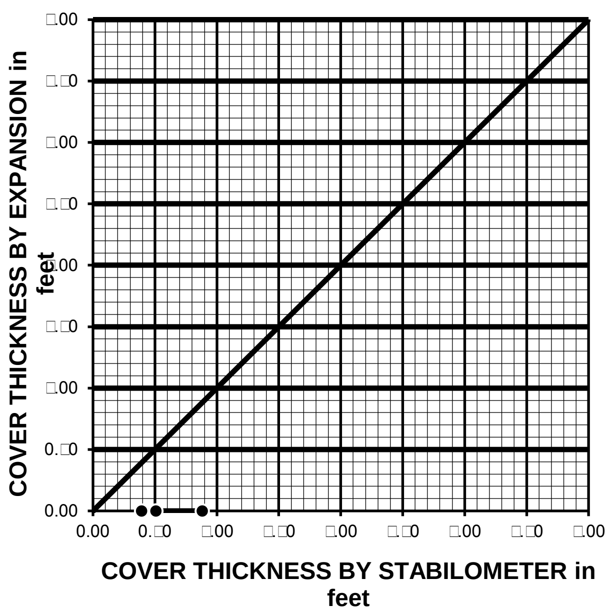

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Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: Lewis/MV Town Center/Geo Tested By : M. Vinet Date: 07/16/21

Project No. : 13177.002 Data Input By: M. Vinet Date: 07/16/21

Boring No.	LB-3			
Sample No.	B-1			
Sample Depth (ft)	0.0			
Soil Identification:	Silty Sand (SM)			
Wet Weight of Soil + Container (g)	100.00			
Dry Weight of Soil + Container (g)	100.00			
Weight of Container (g)	0.00			
Moisture Content (%)	0.00			
Weight of Soaked Soil (g)	100.00			

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	1			
Crucible No.	1			
Furnace Temperature (°C)	850			
Time In / Time Out	Timer			
Duration of Combustion (min)	45			
Wt. of Crucible + Residue (g)	25.1158			
Wt. of Crucible (g)	25.1099			
Wt. of Residue (g) (A)	0.0059			
PPM of Sulfate (A) x 41150	242.79			
PPM of Sulfate, Dry Weight Basis	**243**			

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)	30			
ml of AgNO3 Soln. Used in Titration (C)	0.8			
PPM of Chloride (C -0.2) * 100 * 30 / B	60			
PPM of Chloride, Dry Wt. Basis	**60**			

pH TEST, DOT California Test 643

pH Value	**7.20**			
Temperature °C	21.0			

Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 643

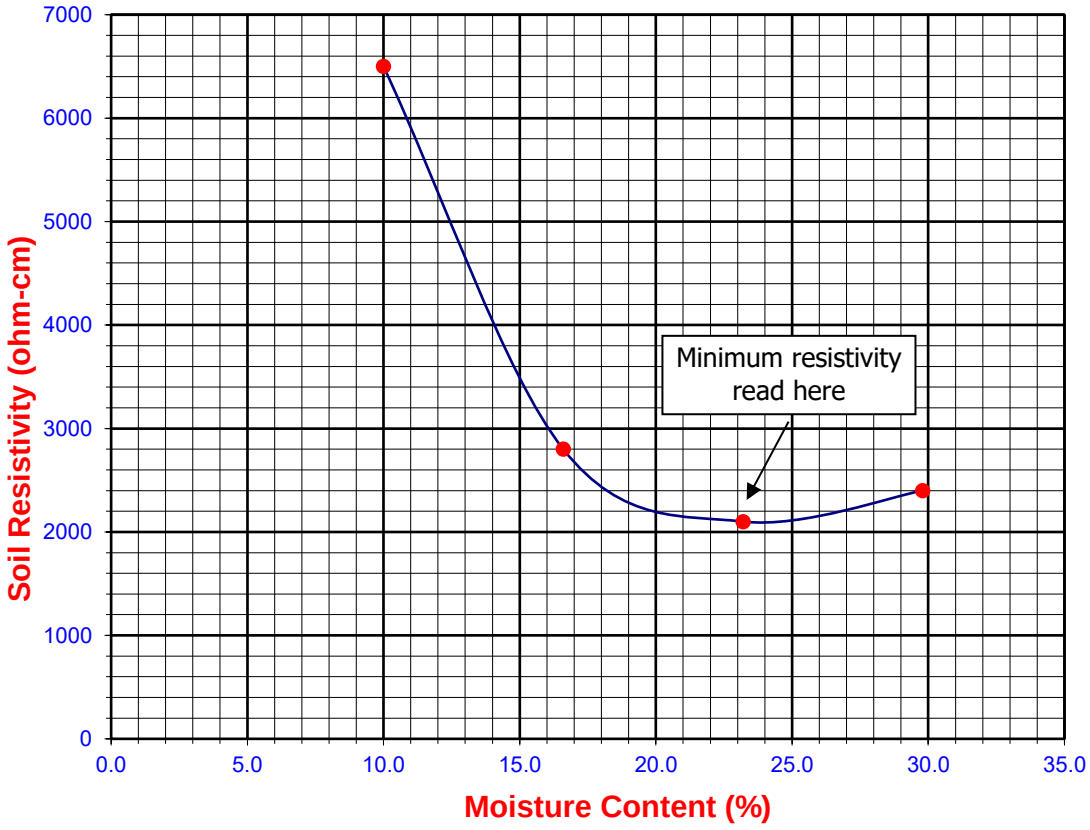
Project Name:	Lewis/MV Town Center/Geo		Tested By :	M. Vinet	Date: 07/16/21
Project No. :	13177.002		Data Input By:	M. Vinet	Date: 07/16/21
Boring No.:	LB-3		Depth (ft.) :	0.0	
Sample No. :	B-1				
Soil Identification:*	Silty Sand (SM)				

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	50	10.00	6500	6500
2	83	16.60	2800	2800
3	116	23.20	2100	2100
4	149	29.80	2400	2400
5				

Moisture Content (%) (MCi)	0.00
Wet Wt. of Soil + Cont. (g)	100.00
Dry Wt. of Soil + Cont. (g)	100.00
Wt. of Container (g)	0.00
Container No.	A
Initial Soil Wt. (g) (Wt)	500.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
2100	**23.2**	**243**	**60**	**7.20**	**21.0**



APPENDIX C

EARTHWORK AND GRADING SPECIFICATIONS

APPENDIX D

GBA IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT

Appendix 4: Historical Site Conditions

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

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Santa Ana 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 Ana 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 Ana 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 Ana Watershed

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

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	Cannon Corp	Date	8/15/2022
Designed by	Samuel J. Jacoby, PE, QSD	Case No	
Company Project Number/Name	Moreno Valley Town Center, for Lewis Management		

BMP Identification

BMP NAME / ID: Lot/BMP #1

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85} = 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
1	*300,999.60*	*Mixed Surface Types*	*0.7*	*0.49*	*148661.9*			
	300999.6		*Total*		148661.9	0.66	*8176.4*	

Proposed Volume must be greater than the Design Capture Volume

Notes:

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

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: Cannon Corp | Date: 5/20/2022

Designed by: Samuel J. Jacoby, PE, QSD | Case No:

Company Project Number/Name: Moreno Valley Town Center, for Lewis Management

BMP Identification

BMP NAME / ID: Lot/BMP #2

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E — D_{85}= 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
2	*375,051.60*	*Mixed Surface Types*	*0.7*	*0.49*	*185235.7*			
	375051.6	**Total**			**185235.7**	**0.66**	**10188**	

Proposed Volume must be greater than the Design Capture Volume

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}	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: Cannon Corp — Date: 5/20/2022
Designed by: Samuel J. Jacoby, PE, QSD — Case No:
Company Project Number/Name: Moreno Valley Town Center, for Lewis Management

BMP Identification

BMP NAME / ID: Lot/BMP #3a

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85}= 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
3a	*102,801.60*	*Mixed Surface Types*	*0.7*	*0.49*	*50773.1*			
	102801.6	***Total***			**50773.1**	**0.66**	**2792.5**	

Proposed Volume must be greater than the Design Capture Volume

Notes:

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

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	Cannon Corp	Date	8/15/2022
Designed by	Samuel J. Jacoby, PE, QSD	Case No	
Company Project Number/Name	Moreno Valley Town Center, for Lewis Management		

BMP Identification

BMP NAME / ID: Lot/BMP #3b

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85} = 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
3b	*147,232.80*	*Mixed Surface Types*	*0.7*	*0.49*	*72717.4*			
	147232.8		***Total***		**72717.4**	**0.66**	**3999.5**	

Proposed Volume must be greater than the Design Capture Volume

Notes:

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

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: Cannon Corp — Date: 8/15/2022
Designed by: Samuel J. Jacoby, PE, QSD — Case No:
Company Project Number/Name: Moreno Valley Town Center, for Lewis Management

BMP Identification

BMP NAME / ID: Lot/BMP #4a

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E — D_{85}= 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
4a	*75,358.80*	*Mixed Surface Types*	*0.2*	*0.17*	*12846*			
	75358.8	**Total**			**12846**	**0.66**	**706.5**	

Proposed Volume must be greater than the Design Capture Volume

Notes:

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

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	Cannon Corp	Date	8/15/2022
Designed by	Samuel J. Jacoby, PE, QSD	Case No	
Company Project Number/Name	Moreno Valley Town Center, for Lewis Management		

BMP Identification

BMP NAME / ID: Lot/BMP #4b

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85}= 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
4b	*77,101.20*	*Mixed Surface Types*	*0.2*	*0.17*	*13143*			
	77101.2	***Total***			**13143**	**0.66**	***722.9***	

Proposed Volume must be greater than the Design Capture Volume

Notes:

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

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: Cannon Corp
Date: 8/15/2022
Designed by: Samuel J. Jacoby, PE, QSD
Case No:
Company Project Number/Name: Moreno Valley Town Center, for Lewis Management

BMP Identification

BMP NAME / ID: Lot/BMP #5

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85}= 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
5	*324,522.00*	*Mixed Surface Types*	*0.7*	*0.49*	*160279.5*			
	324522	***Total***			160279.5	0.66	*8815.4*	

Proposed Volume must be greater than the Design Capture Volume

Notes:

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

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: Cannon Corp | Date: 8/15/2022
Designed by: Samuel J. Jacoby, PE, QSD | Case No:
Company Project Number/Name: Moreno Valley Town Center, for Lewis Management

BMP Identification

BMP NAME / ID: Lot/BMP #6

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E — D_{85}= 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
6	*341,510.40*	*Mixed Surface Types*	*0.7*	*0.49*	*168669.9*			
	341510.4	***Total***			**168669.9**	**0.66**	**9276.8**	

Proposed Volume must be greater than the Design Capture Volume

Notes:

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

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: Cannon Corp | Date: 8/15/2022

Designed by: Samuel J. Jacoby, PE, QSD | Case No:

Company Project Number/Name: Moreno Valley Town Center, for Lewis Management

BMP Identification

BMP NAME / ID: Lot/BMP #7a

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85}= 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
7a	*207,781.20*	*Mixed Surface Types*	*0.85*	*0.66*	*137399.3*			
	207781.2	***Total***			**137399.3**	**0.66**	**7557**	

Proposed Volume must be greater than the Design Capture Volume

Notes:

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

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: Cannon Corp — Date: 8/15/2022
Designed by: Samuel J. Jacoby, PE, QSD — Case No:
Company Project Number/Name: Moreno Valley Town Center, for Lewis Management

BMP Identification

BMP NAME / ID: Lot/BMP #7b

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85}= 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
7b	*485,258.40*	*Mixed Surface Types*	*0.85*	*0.66*	*320886.5*			
	485258.4	***Total***			**320886.5**	**0.66**	***17648.8***	

Proposed Volume must be greater than the Design Capture Volume

Notes:

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

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: Cannon Corp — Date: 8/15/2022
Designed by: Samuel J. Jacoby, PE, QSD — Case No:
Company Project Number/Name: Moreno Valley Town Center, for Lewis Management

BMP Identification

BMP NAME / ID: Lot/BMP #8

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E — D_{85}= 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
8	*59,677.20*	*Mixed Surface Types*	*0.2*	*0.17*	*10172.8*			
	59677.2	***Total***			**10172.8**	**0.66**	***559.5***	

Proposed Volume must be greater than the Design Capture Volume

Notes:

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

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	Cannon Corp	Date	8/15/2022
Designed by	Samuel J. Jacoby, PE, QSD	Case No	
Company Project Number/Name	Moreno Valley Town Center, for Lewis Management		

BMP Identification

BMP NAME / ID: Lot/BMP ROW South

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85} = 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
ROW South	*137,649.60*	*Mixed Surface Types*	*0.7*	*0.49*	*67984.3*			
	137649.6	***Total***			***67984.3***	***0.66***	***3739.1***	

Proposed Volume must be greater than the Design Capture Volume

Notes:

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

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: Cannon Corp — Date: 8/15/2022
Designed by: Samuel J. Jacoby, PE, QSD — Case No:
Company Project Number/Name: Moreno Valley Town Center, for Lewis Management

BMP Identification

BMP NAME / ID: Lot/BMP ROW North

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E — D_{85}= 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
ROW North	*175,982.40*	*Mixed Surface Types*	*0.7*	*0.49*	*86916.7*			
	175982.4	***Total***			**86916.7**	**0.66**	**4780.4**	

Proposed Volume must be greater than the Design Capture Volume

Notes:

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

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	Cannon Corp	Date	8/15/2022
Designed by	Samuel J. Jacoby, PE, QSD	Case No	
Company Project Number/Name	Moreno Valley Town Center, for Lewis Management		

BMP Identification

BMP NAME / ID: Lot/BMP ROW East

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85}= 0.66 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
ROW East	*221,720.40*	*Mixed Surface Types*	*0.7*	*0.49*	*109506.4*			
	221720.4	***Total***			**109506.4**	**0.66**	***6022.9***	

Proposed Volume must be greater than the Design Capture Volume

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

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 | Date
Designed by | Case No
Company Project Number/Name

BMP Identification

BMP NAME / ID

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity I = 0.20 in/hr

Drainage Management Area Tabulation

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

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs									
		0	*Total*			0	0.20		

Notes:

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

Company Name: Cannon Corp | Date: 8/15/2022

Designed by: reno Valley Town Center, for Lewis Managem | County/City Case No.:

Design Volume

Enter the area tributary to this feature — A_T = 6.9 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 8,176 ft^3

Type of Bioretention Facility Design

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

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

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer — d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb — w_T = 30.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ — d_E = 1.33 ft

Minimum Surface Area, A_m

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

A_M = 6,164 ft^2

Proposed Surface Area — A= 7,560 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 2 %

6" Check Dam Spacing — 25 feet

Describe Vegetation:

Notes: 30 ft x 252 ft

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

Company Name: Cannon Corp — Date: 8/15/2022

Designed by: reno Valley Town Center, for Lewis Managem — County/City Case No.:

Design Volume

Enter the area tributary to this feature	A_T=	8.61	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	10,188	ft^3

Type of Bioretention Facility Design

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

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

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	1.5	ft
Top Width of Bioretention Facility, excluding curb	w_T =	46.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.33	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	7,633	ft^2
Proposed Surface Area	A=	10,120	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		2	%
6" Check Dam Spacing		25	feet
Describe Vegetation:			

Notes: 46 ft x 220 ft

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

Company Name: Cannon Corp Date: 8/15/2022

Designed by: reno Valley Town Center, for Lewis Managem County/City Case No.:

Design Volume

Enter the area tributary to this feature A_T= 2.36 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 2,793 ft^3

Type of Bioretention Facility Design

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

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

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb w_T = 25.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ d_E = 1.32 ft

Minimum Surface Area, A_m

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

A_M = 2,113 ft^2

Proposed Surface Area A= 2,600 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = 4 :1

Diameter of Underdrain 6 inches

Longitudinal Slope of Site (3% maximum) 2 %

6" Check Dam Spacing 25 feet

Describe Vegetation:

Notes: 25 ft x 104 ft

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

Company Name: Cannon Corp | Date: 8/15/2022

Designed by: reno Valley Town Center, for Lewis Managem | County/City Case No.:

Design Volume

Enter the area tributary to this feature	A_T=	3.38	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	4,000	ft^3

Type of Bioretention Facility Design

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

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

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	1.5	ft
Top Width of Bioretention Facility, excluding curb	w_T =	30.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.33	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	3,015	ft^2
Proposed Surface Area	A=	3,150	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		2	%
6" Check Dam Spacing		25	feet
Describe Vegetation:			

Notes: 30 ft x 105 ft

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

Company Name: Cannon Corp Date: 8/15/2022

Designed by: reno Valley Town Center, for Lewis Managem County/City Case No.:

Design Volume

Enter the area tributary to this feature A_T= 1.73 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 707 ft^3

Type of Bioretention Facility Design

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

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

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb w_T = 26.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ d_E = 1.32 ft

Minimum Surface Area, A_m

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

A_M = 534 ft^2

Proposed Surface Area A= 1,040 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = 4 :1

Diameter of Underdrain 6 inches

Longitudinal Slope of Site (3% maximum) 2 %

6" Check Dam Spacing 25 feet

Describe Vegetation:

Notes: 26 ft x 40 ft

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

Company Name: Cannon Corp Date: 8/15/2022

Designed by: reno Valley Town Center, for Lewis Managem County/City Case No.:

Design Volume

Enter the area tributary to this feature — A_T = 1.77 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 723 ft^3

Type of Bioretention Facility Design

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

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

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer — d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb — w_T = 20.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ — d_E = 1.32 ft

Minimum Surface Area, A_m

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

A_M = 550 ft^2

Proposed Surface Area — A= 800 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 2 %

6" Check Dam Spacing — 25 feet

Describe Vegetation:

Notes: 20 ft x 40 ft

Bioretention Facility - Design Procedure	BMP ID 5	Legend:	Required Entries / Calculated Cells

Company Name: Cannon Corp Date: 8/15/2022

Designed by: reno Valley Town Center, for Lewis Managem County/City Case No.:

Design Volume

Enter the area tributary to this feature A_T = 7.45 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP} = 8,815 ft^3

Type of Bioretention Facility Design

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

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

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb w_T = 45.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ d_E = 1.33 ft

Minimum Surface Area, A_m

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

A_M = 6,607 ft^2

Proposed Surface Area A= 8,100 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = 4 :1

Diameter of Underdrain 6 inches

Longitudinal Slope of Site (3% maximum) 2 %

6" Check Dam Spacing 25 feet

Describe Vegetation:

Notes: 45 ft x 180 ft

Bioretention Facility - Design Procedure	BMP ID 6	Legend:	Required Entries / Calculated Cells

Company Name: Cannon Corp — Date: 8/15/2022

Designed by: reno Valley Town Center, for Lewis Managem — County/City Case No.:

Design Volume

Enter the area tributary to this feature	A_T=	7.84	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	9,277	ft^3

Type of Bioretention Facility Design

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

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

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	1.5	ft
Top Width of Bioretention Facility, excluding curb	w_T =	45.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.33	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	6,952	ft^2
Proposed Surface Area	A=	8,325	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		2	%
6" Check Dam Spacing		25	feet
Describe Vegetation:			

Notes: 45 ft x 185 ft

Bioretention Facility - Design Procedure	BMP ID 7a	Legend:	Required Entries / Calculated Cells

Company Name: Cannon Corp Date: 8/15/2022

Designed by: reno Valley Town Center, for Lewis Managem County/City Case No.:

Design Volume

Enter the area tributary to this feature A_T= 4.77 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 7,557 ft^3

Type of Bioretention Facility Design

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

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

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb w_T = 40.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ d_E = 1.33 ft

Minimum Surface Area, A_m

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

A_M = 5,672 ft^2

Proposed Surface Area A= 7,000 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = 4 :1

Diameter of Underdrain 6 inches

Longitudinal Slope of Site (3% maximum) 2 %

6" Check Dam Spacing 25 feet

Describe Vegetation:

Notes: 40 ft x 175 ft

Bioretention Facility - Design Procedure	BMP ID 7b	Legend:	Required Entries / Calculated Cells

Company Name: Cannon Corp — Date: 8/15/2022

Designed by: reno Valley Town Center, for Lewis Managem — County/City Case No.:

Design Volume

Enter the area tributary to this feature — A_T = 11.14 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 17,649 ft^3

Type of Bioretention Facility Design

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

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

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer — d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb — w_T = 55.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ — d_E = 1.34 ft

Minimum Surface Area, A_m

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

A_M = 13,198 ft^2

Proposed Surface Area — A= 16,775 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 2 %

6" Check Dam Spacing — 25 feet

Describe Vegetation:

Notes: 55 ft x 305 ft

Bioretention Facility - Design Procedure	BMP ID 8	Legend:	Required Entries / Calculated Cells

Company Name: Cannon Corp — Date: 8/15/2022

Designed by: reno Valley Town Center, for Lewis Managem — County/City Case No.:

Design Volume

Enter the area tributary to this feature — A_T = 1.37 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 560 ft^3

Type of Bioretention Facility Design

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

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

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer — d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb — w_T = 40.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ — d_E = 1.33 ft

Minimum Surface Area, A_m

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

A_M = 420 ft^2

Proposed Surface Area — A= 1,760 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 2 %

6" Check Dam Spacing — 25 feet

Describe Vegetation:

Notes: 40 ft x 44 ft

Effective Impervious Fraction

Developed Cover Types	Effective Impervious Fraction
Roofs	1.00
Concrete or Asphalt	1.00
Grouted or Gapless Paving Blocks	1.00
Compacted Soil (e.g. unpaved parking)	0.40
Decomposed Granite	0.40
Permeable Paving Blocks w/ Sand Filled Gap	0.25
Class 2 Base	0.30
Gravel or Class 2 Permeable Base	0.10
Pervious Concrete / Porous Asphalt	0.10
Open and Porous Pavers	0.10
Turf block	0.10
Ornamental Landscaping	0.10
Natural (A Soil)	0.03
Natural (B Soil)	0.15
Natural (C Soil)	0.30
Natural (D Soil)	0.40

Mixed Surface Types

Use this table to determine the effective impervious fraction for the V_{BMP} and Q_{BMP} calculation sheets

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

JURUPA VALLEY
EASTVALE
NORCO
PRADO DAM
CORONA
RIVERSIDE
ZONE 1
SITE
LAKE MATHEWS
ZONE 2
MORENO VALLEY
CALIMESA
BEAUMONT
BANNING
ZONE 5
MYSTIC LAKE
SAN JACINTO
ZONE 4
PERRIS
HEMET
MENIFEE
CANYON LAKE
LAKE ELSINORE
ZONE 3
WILDOMAR
MURRIETA
ZONE 7

Legend

Stream Type
- Not Susceptible Stream Channels
- Potentially Susceptible Stream Channels
- Large River (Not Susceptible)
- Santa Ana River
- Adequate Sump

Watershed Areas
- Not Applicable Area
- Applicable Area
- Applicable Area Watershed Boundaries

- Flood Control and Water Conservation District Boundary
- Study Area
- County Boundary

RBF CONSULTING
GIS

0 1 2 3 4 Miles

Map Document: (M:\Models\10c\BDP\CP\HCO_HydromodModule_Large_5000.mxd mxd - RH) - 10/2/12

HCOC Applicability Map

Hydromodification Susceptibility Documentation Report and Mapping
Riverside County Flood Control and Water Conservation District

Map 2

SITE

Unlined Channel, Since Lined

PROPOSED LINE F-2 TO REPLACE EXISTING LINE F-2

CACTUS BASIN
Qin = 3020 cfs
Qout = 2115 cfs
STORAGE = 100 ac. ft.
R/W = 21.7 ac.

LEGEND

- DRAINAGE BOUNDARY
- PROPOSED STORM DRAIN
- PROPOSED OPEN CHANNEL
- EXISTING FACILITY
- Q=10 — 10 YEAR FLOW IN CFS
- Q=100 — 100 YEAR FLOW IN CFS

SCALE 1"=800'

-1200 -800 -400 0 400 800 1200

NOTES

1. ADOPTED IN OCTOBER 1980
2. REVISION #1 IN APRIL 1991
3. REVISION #2 IN PROGRESS

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

MORENO

MASTER DRAINAGE PLAN

ADOPTED OCTOBER 1980

REVISION NO. 2 APRIL 2015

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

1. ☐ Review Column 1 and identify which of these potential sources of stormwater pollutants apply to your site. Check each box that applies.

2. ☐ Review Column 2 and incorporate all of the corresponding applicable BMPs in your WQMP Exhibit.

3. ☐ Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in your WQMP. Use the format shown in Table G.1on page 23 of this WQMP Template. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternative BMPs for those shown here.

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

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

TO BE PROVIDED WITH FINAL WQMP

Appendix 10: Educational Materials

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

3.5 Bioretention Facility

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

Description

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

Siting Considerations

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

- ✓ Parking islands
- ✓ Medians
- ✓ Site entrances

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

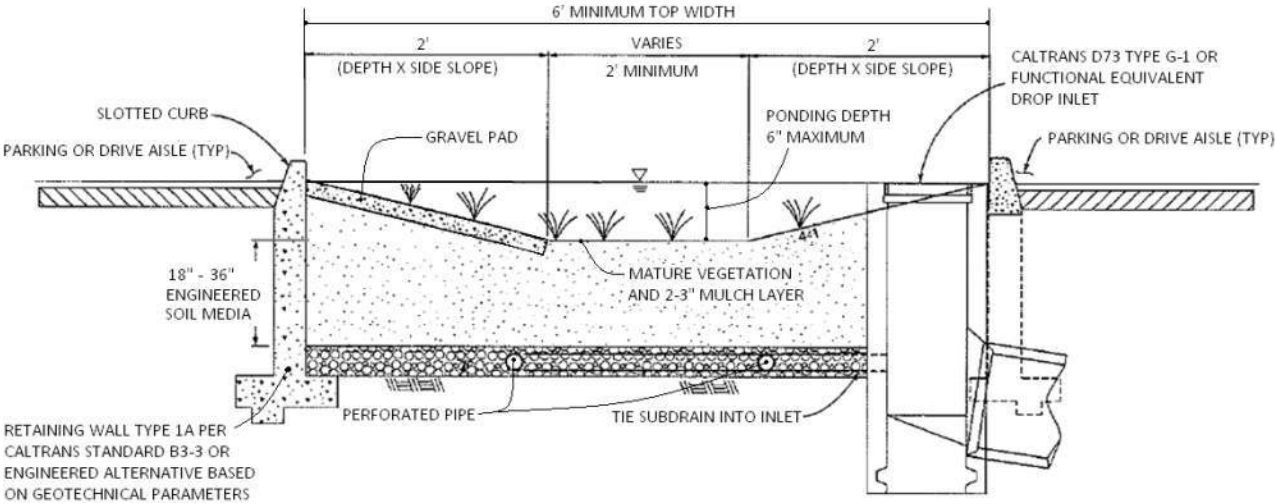
- *Depressing* landscaped areas below adjacent impervious surfaces, rather than elevating those areas
- Grading the site to direct runoff from those impervious surfaces *into* the Bioretention Facility, rather than away from the landscaping
- Sizing and designing the depressed landscaped area as a Bioretention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

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

Design and Sizing Criteria

The recommended cross section necessary for a Bioretention Facility includes:

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



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

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

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

Figure 1: Standard Layout for a Bioretention Facility

Engineered Soil Media Requirements

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

Table 1: Mineral Component Range Requirements

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

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

Vegetation Requirements

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

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

Curb Cuts

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

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

Figure 2: Curb Cut located in a Bioretention Facility

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

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

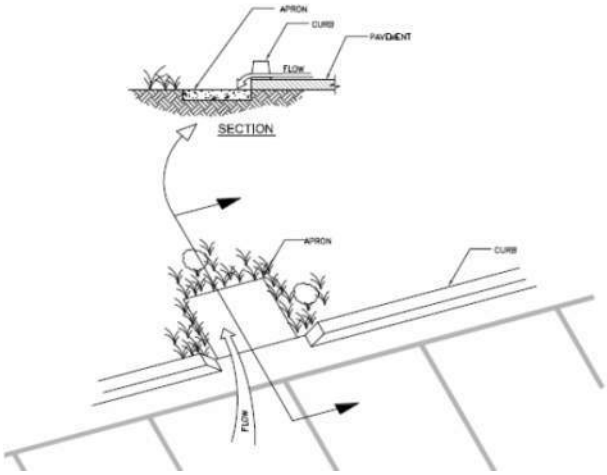


Figure 3: Apron located in a Bioretention Facility

Terracing the Landscaped Filter Basin

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

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

Table 2: Check Dam Spacing

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

Roof Runoff

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

Retaining Walls

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

Side Slope Requirements

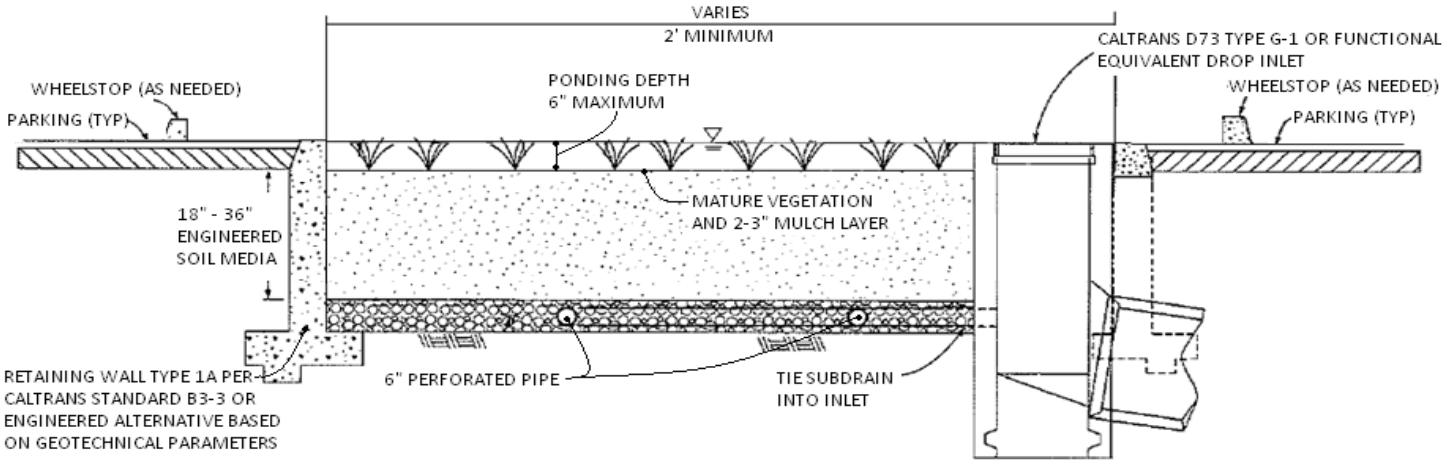
Bioretention Facilities Requiring Side Slopes

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

Bioretention Facilities Not Requiring Side Slopes

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

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



Planter Boxes

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

Figure 5: Planter Box
Source: LA Team Effort

Overflow

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

Underdrain Gravel and Pipes

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

Figure 6: Incorrect Placement of an Overflow Inlet.

Inspection and Maintenance Schedule

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

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

Bioretention Facility Design Procedure

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

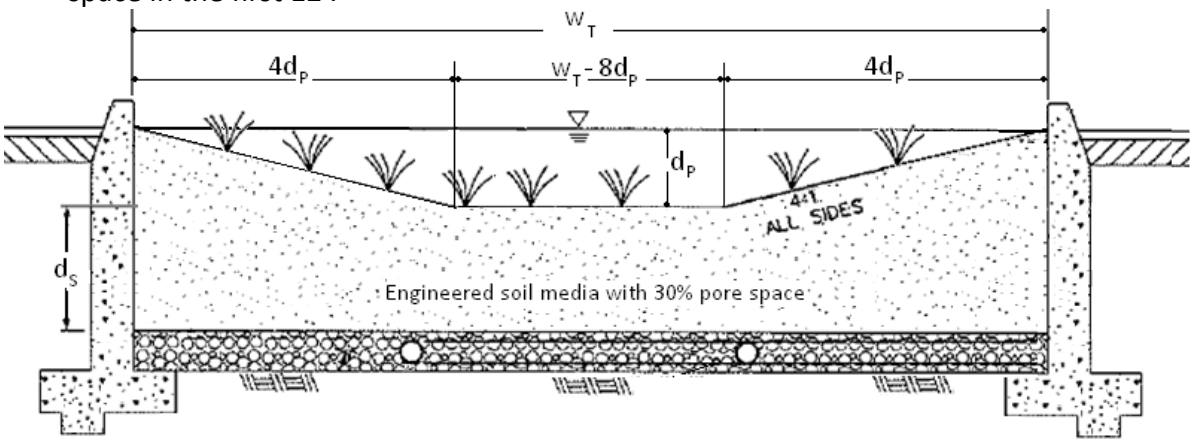
2) Enter the Design Volume, $V_{BMP,}$ determined from Section 2.1 of this Handbook.

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

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

5) Enter the top width of the Bioretention Facility.

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

13) Describe the vegetation used within the Bioretention Facility.

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Non-Stormwater Discharges SC-10

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, air conditioner condensate, etc. However there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains. They can generally be detected through a combination of detection and elimination. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of pollutants on streets and into the storm drain system and creeks.

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Approach

Initially the industry must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is in the elimination of non-stormwater discharges.

CASQA California Stormwater Quality Association

Pollution Prevention

- Ensure that used oil, used antifreeze, and hazardous chemical recycling programs are being implemented. Encourage litter control.

Suggested Protocols

Recommended Complaint Investigation Equipment

- Field Screening Analysis
  - pH paper or meter
  - Commercial stormwater pollutant screening kit that can detect for reactive phosphorus, nitrate nitrogen, ammonium nitrogen, specific conductance, and turbidity
  - Sample jars
  - Sample collection pole
  - A tool to remove access hole covers
- Laboratory Analysis
  - Sample cooler
  - Ice
  - Sample jars and labels
  - Chain of custody forms
- Documentation
  - Camera
  - Notebook
  - Pens
  - Notice of Violation forms
  - Educational materials

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.
- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled or demarcated next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

- See SC44 Stormwater Drainage System Maintenance for additional information.

Illicit Connections

- Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- Isolate problem areas and plug illicit discharge points.
- Locate and evaluate all discharges to the industrial storm drain system.

Visual Inspection and Inventory

- Inventory and inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system.
- Inspect the path of floor drains in older buildings.

Smoke Testing

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.
- During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

Dye Testing

- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

TV Inspection of Drainage System

- TV Cameras can be employed to visually identify illicit connections to the industrial storm drainage system.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Once a site has been cleaned:

- Post "No Dumping" signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC11 Spill Prevention, Control, and Cleanup.

Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.
- Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.

Reporting

- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.
- Document and report annually the results of the program.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

Training

- Training of technical staff in identifying and documenting illegal dumping incidents is required.
- Consider posting the quick reference table near storm drains to reinforce training.
- Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.
- Conduct spill response drills annually (if no events occurred to evaluate your plan) in cooperation with other industries.
- When a responsible party is identified, educate the party on the impacts of his or her actions.

Spill Response and Prevention

- See SC11 Spill Prevention Control and Cleanup.

Other Considerations

- Many facilities do not have accurate, up-to-date schematic drawings.

Requirements

Costs (including capital and operation & maintenance)

- The primary cost is for staff time and depends on how aggressively a program is implemented.
- Cost for containment and disposal is borne by the discharger.
- Illicit connections can be difficult to locate especially if there is groundwater infiltration.
- Indoor floor drains may require re-plumbing if cross-connections to storm drains are detected.

Maintenance (including administrative and staffing)

- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Further Detail of the BMP

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. All of these wastes cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots

- Types and quantities (in some cases) of wastes
- Patterns in time of occurrence (time of day/night, month, or year)
- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
- Responsible parties

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

What constitutes a "non-stormwater" discharge?

- Non-stormwater discharges to the stormwater collection system may include any water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

- Facilities subject to stormwater permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The State's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Performance Evaluation

- Review annually internal investigation results; assess whether goals were met and what changes or improvements are necessary.
- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Spill Prevention, Control & Cleanup SC-11

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Objectives

- ■□Cover
- ■□Contain
- ■□Educate
- ■□Reduce/Minimize
- ■□Product Substitution

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental or illegal spills. Preparation for accidental or illegal spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify potential spill areas, specify material handling procedures, describe spill response procedures, and provide spill clean-up equipment. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills.

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Approach

Pollution Prevention

- ■□ Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- ■□ Develop a Spill Prevention Control and Countermeasure (SPCC) Plan. The plan should include:

- Description of the facility, owner and address, activities and chemicals present
- Facility map
- Notification and evacuation procedures
- Cleanup instructions
- Identification of responsible departments
- Identify key spill response personnel

■ Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.

Suggested Protocols (including equipment needs)

Spill Prevention

■ Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

■ If consistent illegal dumping is observed at the facility:

- Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
- Landscaping and beautification efforts may also discourage illegal dumping.
- Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.

■ Store and contain liquid materials in such a manner that if the tank is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.

■ If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.

■ Routine maintenance:

- Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
- Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
- Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*

- Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

- Label all containers according to their contents (e.g., solvent, gasoline).

- Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).

- Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).

- Identify key spill response personnel.

Spill Control and Cleanup Activities

- Follow the Spill Prevention Control and Countermeasure Plan.

- Clean up leaks and spills immediately.

- Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).

- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use of brooms, shovels, sweepers, or plows.

- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.

- Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.

- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board.

- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).

- Report spills to local agencies, such as the fire department; they can assist in cleanup.

- Establish a system for tracking incidents. The system should be designed to identify the following:

  - Types and quantities (in some cases) of wastes

  - Patterns in time of occurrence (time of day/night, month, or year)

- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
- Responsible parties

Training

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
  - The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.
  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.
- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

- A Spill Prevention Control and Countermeasure Plan (SPCC) is required for facilities that are subject to the oil pollution regulations specified in Part 112 of Title 40 of the Code of Federal Regulations or if they have a storage capacity of 10,000 gallons or more of petroleum. (Health and Safety Code 6.67)
- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.
- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.
- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- Date corrective action was taken

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from

tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- Installation problems
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves)
- External corrosion and structural failure
- Spills and overfills due to operator error
- Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanger, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.

- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently relocate accumulated stormwater during the wet season.
- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Immediately drain all fluids from wrecked vehicles.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use adsorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.

- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:
  - Cover fueling area if possible.
  - Use a perimeter drain or slope pavement inward with drainage to a sump.
  - Pave fueling area with concrete rather than asphalt.
- If dead-end sump is not used to collect spills, install an oil/water separator.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Discourage "topping-off' of fuel tanks.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Use adsorbent materials on small spills and general cleaning rather than hosing down the area. Remove the adsorbent materials promptly.
- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities. The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department)
- Develop procedures to prevent/mitigate spills to storm drain systems
- Identify responsible departments
- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures
- Address spills at municipal facilities, as well as public areas

- Provide training concerning spill prevention, response and cleanup to all appropriate personnel

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Stormwater Managers Resource Center http://www.stormwatercenter.net/

Safer Alternative Products SC-35

Description

Promote the use of less harmful products and products that contain little or no TMDL pollutants. Alternatives exist for most product classes including chemical fertilizers, pesticides, cleaning solutions, janitorial chemicals, automotive and paint products, and consumables (batteries, fluorescent lamps).

Approach

Pattern a new program after the many established programs around the state and country. Integrate this best management practice as much as possible with existing programs at your facility.

Develop a comprehensive program based on:

- The "Precautionary Principle," which is an alternative to the "Risk Assessment" model that says it's acceptable to use a potentially harmful product until physical evidence of its harmful effects are established and deemed too costly from an environmental or public health perspective. For instance, a risk assessment approach might say it's acceptable to use a pesticide until there is direct proof of an environmental impact. The Precautionary Principle approach is used to evaluate whether a given product is safe, whether it is really necessary, and whether alternative products would perform just as well.
- Environmentally Preferable Purchasing Program to minimize the purchase of products containing hazardous ingredients used in the facility's custodial services, fleet maintenance, and facility maintenance in favor of using alternate products that pose less risk to employees and to the environment.
- Integrated Pest Management (IPM) or Less-Toxic Pesticide Program, which uses a pest management approach that minimizes the use of toxic chemicals and gets rid of pests by methods that pose a lower risk to employees, the public, and the environment.
- Energy Efficiency Program including no-cost and low-cost energy conservation and efficiency actions that can reduce both energy consumption and electricity bills, along with long-term energy efficiency investments.

Consider the following mechanisms for developing and implementing a comprehensive program:

- Policies

Objectives

- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

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- Procedures
  - Standard operating procedures (SOPs)
  - Purchasing guidelines and procedures
  - Bid packages (services and supplies)
- Materials
  - Preferred or approved product and supplier lists
  - Product and supplier evaluation criteria
  - Training sessions and manuals
  - Fact sheets for employees

Implement this BMP in conjunction with the Vehicle and Equipment Management fact sheets (SC20 – SC22) and SC41, Building and Grounds Maintenance.

Training

- Employees who handle potentially harmful materials in the use of safer alternatives.
- Purchasing departments should be encouraged to procure less hazardous materials and products that contain little or no harmful substances or TMDL pollutants.

Regulations

This BMP has no regulatory requirements. Existing regulations already encourage facilities to reduce the use of hazardous materials through incentives such as reduced:

- Specialized equipment storage and handling requirements,
- Storm water runoff sampling requirements,
- Training and licensing requirements, and
- Record keeping and reporting requirements.

Equipment

- There are no major equipment requirements to this BMP.

Limitations

- Alternative products may not be available, suitable, or effective in every case.

Requirements

Cost Considerations

- The primary cost is for staff time to: 1) develop new policies and procedures and 2) educate purchasing departments and employees who handle potentially harmful materials about the availability, procurement, and use of safer alternatives.

- Some alternative products may be slightly more expensive than conventional products.

Supplemental Information

Employees and contractors / service providers can both be educated about safer alternatives by using information developed by a number of organizations including the references and resources listed below.

The following discussion provides some general information on safer alternatives. More specific information on particular hazardous materials and the available alternatives may be found in the references and resources listed below.

- Automotive products – Less toxic alternatives are not available for many automotive products, especially engine fluids. But there are alternatives to grease lubricants, car polishes, degreasers, and windshield washer solution. Rerefined motor oil is also available.
- Vehicle/Trailer lubrication – Fifth wheel bearings on trucks require routine lubrication. Adhesive lubricants are available to replace typical chassis grease.
- Cleaners – Vegetables-based or citrus-based soaps are available to replace petroleum-based soaps/detergents.
- Paint products – Water-based paints, wood preservatives, stains, and finishes are available.
- Pesticides – Specific alternative products or methods exist to control most insects, fungi, and weeds.
- Chemical Fertilizers – Compost and soil amendments are natural alternatives.
- Consumables – Manufacturers have either reduced or are in the process of reducing the amount of heavy metals in consumables such as batteries and fluorescent lamps. All fluorescent lamps contain mercury, however low-mercury containing lamps are now available from most hardware and lighting stores. Fluorescent lamps are also more energy efficient than the average incandescent lamp.
- Janitorial chemicals – Even biodegradable soap can harm fish and wildlife before it biodegrades. Biodegradable does not mean non-toxic. Safer products and procedures are available for floor stripping and cleaning, as well as carpet, glass, metal, and restroom cleaning and disinfecting.

Examples

There are a number of business and trade associations, and communities with effective programs. Some of the more prominent are listed below in the references and resources section.

References and Resources

Note: Many of these references provide alternative products for materials that typically are used inside and disposed to the sanitary sewer as well as alternatives to products that usually end up in the storm drain.

General Sustainable Practices and Pollution Prevention Including Pollutant-Specific Information

California Department of Toxic Substances Control (www.dtsc.ca.gov)

California Integrated Waste Management Board (www.ciwmb.ca.gov)

City of Santa Monica (www.santa-monica.org/environment)

City of Palo Alto (www.city.palo-alto.ca.us/cleanbay)

City and County of San Francisco, Department of the Environment (www.ci.sf.ca.us/sfenvironment)

Earth 911 (www.earth911.org/master.asp)

Environmental Finance Center Region IX (www.greenstart.org/efc9)

Flex Your Power (www.flexyourpower.ca.gov)

GreenBiz.com (www.greenbiz.com)

Green Business Program (www.abag.org/bayarea/enviro/gbus/gb.html)

Pacific Industrial and Business Association (www.piba.org)

Sacramento Clean Water Business Partners (www.sacstormwater.org)

USEPA BMP fact sheet – Alternative products (http://cfpub.epa.gov/npdes/stormwater/menuofbmps/poll_2.cfm)

USEPA Region IX Pollution Prevention Program (www.epa.gov/region09/p2)

Western Regional Pollution Prevention Network (www.westp2net.org)

Metals (mercury, copper)

National Electrical Manufacturers Association - Environment, Health and Safety (www.nema.org)

Sustainable Conservation (www.suscon.org)

Auto Recycling Project

Brake Pad Partnership

Pesticides and Chemical Fertilizers

Bio-Integral Resource Center (www.birc.org)

California Department of Pesticide Regulation (www.cdpr.ca.gov)

University of California Statewide IPM Program (www.ipm.ucdavis.edu/default.html)

Dioxins

Bay Area Dioxins Project (http://dioxin.abag.ca.gov/)

Building & Grounds Maintenance SC-41

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	
Organics	

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

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- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Training

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- Clean up spills immediately.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.
- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

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Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Parking/Storage Area Maintenance SC-43

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

CASQA California Stormwater Quality Association

SC-43 Parking/Storage Area Maintenance

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

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Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Drainage System Maintenance SC-44

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	
Bacteria	✓
Oil and Grease	
Organics	

Approach

Pollution Prevention

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Suggested Protocols

Catch Basins/Inlet Structures

- Staff should regularly inspect facilities to ensure compliance with the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- Conduct routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS.

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
  - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?
- Record locations of apparent illegal discharges/illicit connections?
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Eliminate the discharge once the origin of flow is established.

- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- Have staff involved in detection and removal of illicit connections trained in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:
  - Purchase and installation of signs.
  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.
  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.
  - Purchase of landfill space to dispose of illegally-dumped items and material.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

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http://www.epa.gov/npdes/menuofbmps/poll_16.htm

S-1: Storm Drain Message and Signage

Purpose

Waste material dumped into storm drain inlets can adversely impact surface and ground waters. In fact, any material discharged into the storm drain system has the potential to significantly impact downstream receiving waters. Storm drain messages have become a popular method of alerting and reminding the public about the effects of and the prohibitions against waste disposal into the storm drain system. The signs are typically stenciled or affixed near the storm drain inlet or catch basin. The message simply informs the public that dumping of wastes into storm drain inlets is prohibited and/or that the drain ultimately discharges into receiving waters.

General Guidance

- The signs must be placed so they are easily visible to the public.
- Be aware that signs placed on sidewalk will be worn by foot traffic.

Design Specifications

- Signs with language and/or graphical icons that prohibit illegal dumping, must be posted at designated public access points along channels and streams within the project area. Consult with Los Angeles County Department of Public Works (LACDPW) staff to determine specific signage requirements for channels and streams.
- Storm drain message markers, placards, concrete stamps, or stenciled language/icons (e.g., "No Dumping – Drains to the Ocean") are required at all storm drain inlets and catch basins within the project area to discourage illegal or inadvertent dumping. Signs should be placed in clear sight facing anyone approaching the storm drain inlet or catch basin from either side (see Figure D-1 and Figure D-2). LACDPW staff should be contacted to determine specific requirements for types of signs and methods of application. A stencil can be purchased for a nominal fee from LACDPW Building and Safety Office by calling (626) 458-3171. All storm drain inlet and catch basin locations must be identified on the project site map.

Maintenance Requirements

Legibility and visibility of markers and signs should be maintained (e.g., signs should be repainted or replaced as necessary). If required by LACDPW, the owner/operator or homeowner's association shall enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards and signs.

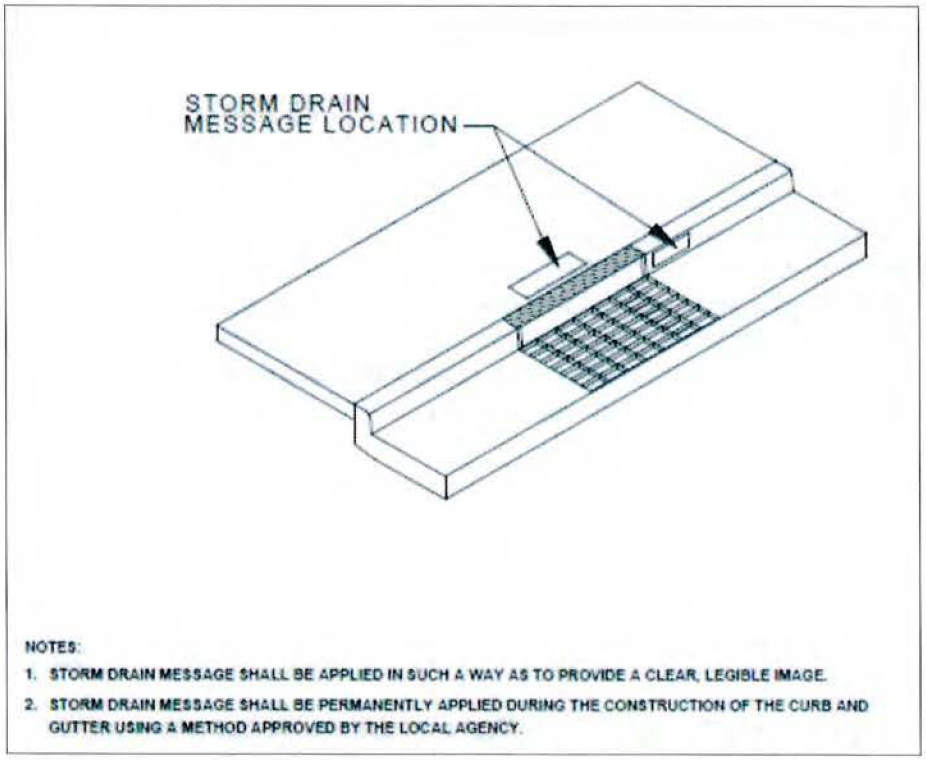

Figure D-1. Storm Drain Message Location – Curb Type Inlet

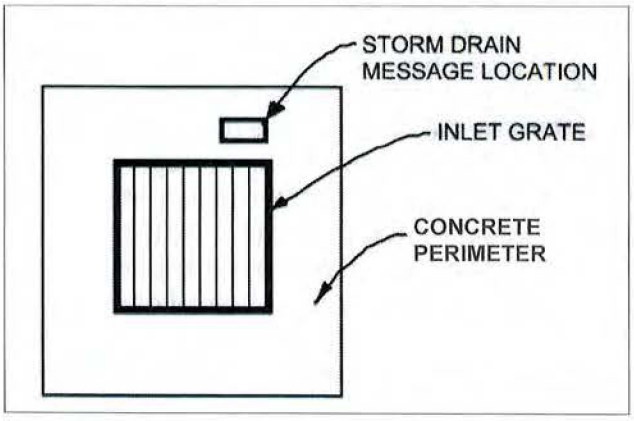

Figure D-2. Storm Drain Message Location – Catch Basin/Area Type Inlet

S-4: Outdoor Loading/Unloading Dock Area

Purpose

Materials spilled, leaked, or lost during loading or unloading may collect on impervious surfaces or in the soil and be carried away by stormwater runoff or when the area is cleaned. Precipitation may also wash pollutants from machinery used to load or unload materials. In particular, loading docks have the potential to contribute heavy metals, nutrients, suspended solids, oils, and grease to stormwater runoff due to the heavy truck traffic and loading and unloading activities. Depressed loading docks (e.g., truck wells) are contained areas that can also accumulate water.

Design Specifications

Design specifications for outdoor loading/unloading dock areas are regulated by local building and fire codes and by current County ordinances and zoning requirements. Additionally, individual businesses may have their own design or access requirements for loading docks. Design specifications presented in this fact sheet are intended to enhance and be consistent with these code and ordinance requirements while addressing stormwater runoff concerns. The design specifications presented in Table D-4 are not intended to conflict with requirements established by individual businesses, but should be followed to the maximum extent practicable.

Accumulated Water

Stormwater runoff, non-stormwater runoff, and spills will accumulate in containment areas and sumps with impervious surfaces, such as depressed loading docks. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without appropriate permitting. Contact LACDPW (1-888-CLEAN-LA) for information regarding discharge of contaminated accumulated water.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., covers, signs) must be maintained by the owner/operator as required by local codes and ordinances. If a water quality inlet or infiltration system is installed, it must be maintained as indicated by the manufacturer or installer. Outdoor loading/unloading dock areas must be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

Table D-4. Design Specifications for Outdoor Loading/Unloading Dock Area

Design Feature	Design Specifications
Surfacing	• Construct/pave outdoor loading/unloading dock areas with Portland cement concrete or an equivalent impervious surface. Ensure that the surfacing material is chemically-resistant to materials being handled in the loading/unloading dock area.
Covers	• Cover outdoor loading/unloading dock areas to a distance of at least 10 feet beyond the loading dock or building face if there is no raised dock. If the cover or roof structure does not include sidewalls, then the roof overhang must extend beyond the grade break. The overhang must extend a minimum of 20 percent of the roof height. • For interior transfer bays, provide a minimum 10-foot "No Obstruction Zone" to allow trucks or trailers to extend at least 5 feet inside the building. Identify "No Obstruction Zone" clearly on site plans and paint zone with high visibility floor paint. • If covers or interior transfer bays are not feasible, install a seal or door skirt and provide a cover to shield all material transfers between trailers and building. • LACDPW may grant waivers for covers on a case-by-case basis.
Hydraulic Isolation/Drainage	• For outdoor loading/unloading dock areas, hydraulically-isolate the first six feet of paved area measured from the building or dock face with grading, berms, or drains to prevent stormwater run-on from surrounding areas or roof drains. Direct stormwater runoff (e.g., from downspouts/roofs) and drainage from surrounding areas away from hydraulically-isolated areas to a stormwater runoff discharge point that meets all applicable LID Standards Manual requirements. • For interior transfer bays or bay doors, prevent stormwater runoff from surrounding areas from entering the building with grading or drains. Do not install interior floor drains in the "No Obstruction Zone". Hydraulically-isolate the "No Obstruction Zone" from any interior floor drains. • Do not install direct connections to storm drains from depressed loading docks. Connect drains or direct drainage from hydraulically-isolated loading/unloading dock area to an approved sediment/oil/water separator system connected a discharge location as determined by LACDPW. Provide a manual emergency spill diversion valve upstream of separator system to direct flow, in the event of a spill, to an approved spill containment vault sized to contain a volume equal to 125% of largest container handled at the facility. Provide additional emergency means, such as drain plugs or drain covers, to prevent spills or contaminated stormwater runoff from entering the storm drain system.

S-8: Landscape Irrigation Practices

Purpose

Irrigation runoff provides a pathway for pollutants (i.e., nutrients, bacteria, organics, sediment) to enter the storm drain system. By effectively irrigating, less runoff is produced resulting in less potential for pollutants to enter the storm drain system.

General Guidance

- Do not allow irrigation runoff from the landscaped area to drain directly to storm drain system.
- Minimize use of fertilizer, pesticides, and herbicides on landscaped areas.
- Plan sites with sufficient landscaped area and dispersal capacity (e.g., ability to receive irrigation water without generating runoff).
- Consult a landscape professional regarding appropriate plants, fertilizer, mulching applications, and irrigation requirements (if any) to ensure healthy vegetation growth.

Design Specifications

- Choose plants that minimize the need for fertilizer and pesticides.
- Group plants with similar water requirements and water accordingly.
- Use mulch to minimize evaporation and erosion.
- Include a vegetative boundary around project site to act as a filter.
- Design the irrigation system to only water areas that need it.
- Install an approved subsurface drip, pop-up, or other irrigation system.[1] The irrigation system should employ effective energy dissipation and uniform flow spreading methods to prevent erosion and facilitate efficient dispersion.
- Install rain sensors to shut off the irrigation system during and after storm events.
- Include pressure sensors to shut off flow-through system in case of sudden pressure drop. A sudden pressure drop may indicate a broken irrigation head or water line.
- If the hydraulic conductivity in the soil is not sufficient for the necessary water application rate, implement soil amendments to avoid potential geotechnical hazards (i.e., liquefaction, landslide, collapsible soils, and expansive soils).

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[1] If alternative distribution systems (e.g., spray irrigation) are approved, the County will establish guidelines to implement these new systems.

- For sites located on or within 50 feet of a steep slope (15% or greater), do not irrigate landscape within three days of a storm event to avoid potential geotechnical instability.[2]
- Implement Integrated Pest Management practices.

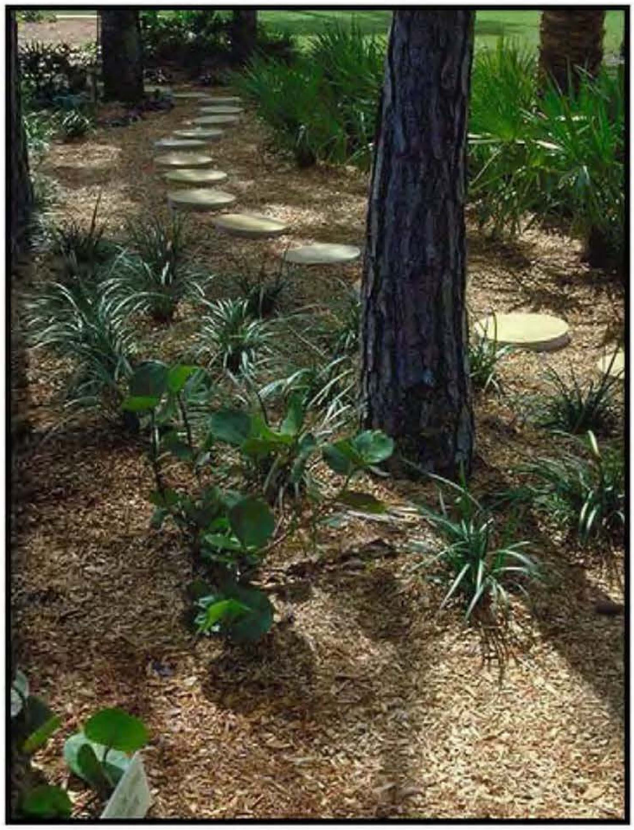
For additional guidelines and requirements, refer to the Los Angeles County Department of Health Services.

Maintenance Requirements

Maintain irrigation areas to remove trash and debris and loose vegetation. Rehabilitate areas of bare soil. If a rain or pressure sensor is installed, it should be checked periodically to ensure proper function. Inspect and maintain irrigation equipment and components to ensure proper functionality. Clean equipment as necessary to prevent algae growth and vector breeding. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

[2] As determined by the City of Los Angeles, Building and Safety Division

Site Design & Landscape Planning SD-10



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

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SD-10 Site Design & Landscape Planning

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Efficient Irrigation SD-12

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.
- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

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Media Filter TC-40

Maintenance Concerns, Objectives, and Goals

- Pollutant Breakthrough
- Clogged of Sand Media
- Trash and Debris Accumulation

General Description

Stormwater media filters are usually two-chambered including a pretreatment settling basin and a filter bed filled with sand or other absorptive filtering media. As stormwater flows into the first chamber, large particles settle out, and then finer particles and other pollutants are removed as stormwater flows through the filtering media in the second chamber. There are a number of design variations including the Austin sand filter, Delaware sand filter, and multi-chambered treatment train (MCTT).

Targeted Constituents

✓	Sediment	■
✓	Nutrients	●
✓	Trash	■
✓	Metals	■
✓	Bacteria	▲
✓	Oil and Grease	■
✓	Organics	■

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

Inspection/Maintenance Considerations

Media filters may exhibit decreased effectiveness after a few years of operation, depending on the activities occurring in the drainage area. Media filters clog easily when subjected to high sediment loads. Sediment reducing pretreatment practices, such as vegetated buffer strips or vegetated swales, placed upstream of the filter should be maintained properly to reduce sediment loads into filter. Media filters can become a nuisance due to mosquito or midge breeding if not properly designed and maintained. Installations should dewater completely (recommended 72 hour or less residence time) to prevent creating mosquito and other vector habitats. Maintenance efforts will need to focus on basic housekeeping practices such as removal of debris accumulations and vegetation management (in filter media) to prevent clogs and/or pods of standing water. To minimize the potential for clogging, frequent maintenance and inspection practices are required. Waste sand, gravel, filter cloth, or filter media must be disposed of properly and in accordance with all applicable laws.

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Inspection Activities	Suggested Frequency
■ During the first year of operation, inspect chambers quarterly to ensure that the system is functioning properly. ■ Inspect sand filters after every major storm in the first few months after construction to ensure that the system is functioning properly.	Post construction
■ Ensure that filter surface, inlets, and outlets are clear of debris. ■ Ensure that the contributing area is stabilized and mowed, with clippings removed. ■ Check to ensure that the filter surface is not clogging. ■ Ensure that activities in the drainage area minimize oil/grease and sediment entry to the system. ■ Inspect the facility once during the wet season after a large rain event to determine whether the facility is draining completely within 72 hr.	Quarterly, and after major storms
■ Inspect for standing water, sediment, trash and debris, structural damage, and to identify potential problems.	Semi-annual
■ Check to see that the filter bed is clean of sediments and the sediment chamber contains no more than six inches of sediment. ■ Make sure that there is no evidence of deterioration of concrete structures. ■ Inspect grates (if used). ■ Inspect inlets, outlets, and overflow spillway to ensure good condition and no evidence of erosion. ■ Ensure that flow is not bypassing the facility. ■ Ensure that no noticeable odors are detected outside the facility.	Annual
Maintenance Activities	**Suggested Frequency**
■ Remove trash and debris from the sedimentation basin (Austin design), the riser pipe, and the filter bed as needed. ■ Prevent grass clippings from washing into the filter. ■ Remove trash from inlet grates to maintain the inflow capacity of the media filter. ■ Upstream vegetation should be maintained as needed.	Frequently (as needed)
■ Clean filter surface semiannually; or more often if watershed is excessively erosive. ■ Replace sorbent pillows (Multi-Chamber Treatment Train only).	Semi-annual
■ Repair or replace any damaged structural parts. ■ Stabilize any eroded areas.	Annual
■ Remove accumulated sediment in the sedimentation chamber every 10 years or when the sediment occupies 10-20% of the basin volume or accumulates to a depth of six inches, whichever is less. ■ Remove top 2 in. of media filter and landfill if facility drain time exceeds 72 hr. Restore media depth to 18 in. when overall media depth drops to 12 in.).	As needed

Inspection Activities	Suggested Frequency
■ During the first year of operation, inspect chambers quarterly to ensure that the system is functioning properly. ■ Inspect sand filters after every major storm in the first few months after construction to ensure that the system is functioning properly.	Post construction
■ Ensure that filter surface, inlets, and outlets are clear of debris. ■ Ensure that the contributing area is stabilized and mowed, with clippings removed. ■ Check to ensure that the filter surface is not clogging. ■ Ensure that activities in the drainage area minimize oil/grease and sediment entry to the system. ■ Inspect the facility once during the wet season after a large rain event to determine whether the facility is draining completely within 72 hr.	Quarterly, and after major storms
■ Inspect for standing water, sediment, trash and debris, structural damage, and to identify potential problems.	Semi-annual
■ Check to see that the filter bed is clean of sediments and the sediment chamber contains no more than six inches of sediment. ■ Make sure that there is no evidence of deterioration of concrete structures. ■ Inspect grates (if used). ■ Inspect inlets, outlets, and overflow spillway to ensure good condition and no evidence of erosion. ■ Ensure that flow is not bypassing the facility. ■ Ensure that no noticeable odors are detected outside the facility.	Annual
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■ Clean filter surface semiannually; or more often if watershed is excessively erosive. ■ Replace sorbent pillows (Multi-Chamber Treatment Train only).	Semi-annual
■ Repair or replace any damaged structural parts. ■ Stabilize any eroded areas.	Annual
■ Remove accumulated sediment in the sedimentation chamber every 10 years or when the sediment occupies 10-20% of the basin volume or accumulates to a depth of six inches, whichever is less. ■ Remove top 2 in. of media filter and landfill if facility drain time exceeds 72 hr. Restore media depth to 18 in. when overall media depth drops to 12 in.).	As needed

Water Quality Inlet TC-50

General Description

Water quality inlets (WQIs), also commonly called trapping catch basins, oil/grit separators or oil/water separators, consist of one or more chambers that promote sedimentation of coarse materials and separation of free oil (as opposed to emulsified or dissolved oil) from stormwater. Some WQIs also contain screens to help retain larger or floating debris, and many of the newer designs also include a coalescing unit that helps promote oil/water separation.

These devices are appropriate for capturing hydrocarbon spills, but provide very marginal sediment removal and are not very effective for treatment of stormwater runoff. WQIs typically capture only the first portion of runoff for treatment and are generally used for pretreatment before discharging to other best management practices (BMPs).

Inspection/Maintenance Considerations

High sediment loads can interfere with the ability of the WQI to effectively separate oil and grease from the runoff. During periods of high flow, sediment can be resuspended and released from the WQI into surface waters. Maintenance of WQIs can be easily neglected because they are underground. Establishment of a maintenance schedule is helpful for ensuring proper maintenance occurs. The required maintenance effort will be site-specific due to variations in sediment and hydrocarbon loading. Since WQI residuals contain hydrocarbon by-products, they may require disposal as hazardous waste. Many WQI owners coordinate with waste haulers to collect and dispose of these residuals.

Maintenance Concerns, Objectives, and Goals

- ■ High Sediment Loads
- ■ Hazardous Waste
- ■ Vector Control

Targeted Constituents

✓	Sediment	●
✓	Nutrients	●
✓	Trash	▲
✓	Metals	●
✓	Bacteria	●
✓	Oil and Grease	▲
✓	Organics	●

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

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Inspection Activities	Suggested Frequency
■ Inspect after every storm event to determine if maintenance is required.	Monthly during the wet season, or after significant rain events

Maintenance Activities	Suggested Frequency
■ Clean out and dispose of accumulated oil, grease, and sediments. Remove accumulated trash and debris. The clean out and disposal techniques should be environmentally acceptable and in accordance with local regulations.	Annual, before the wet season, or more frequent as needed

Additional Information

Since WQIs can be relatively deep, they may be designated as confined spaces. Caution should be exercised to comply with confined space entry safety regulations if it is required.

References

http://www.co.pierce.wa.us/pc/services/home/environ/water/swm/sppman/bmpt1.htm