APPENDIX H: PRELIMINARY PROJECT SPECIFIC WATER QUALITY MANAGEMENT PLAN

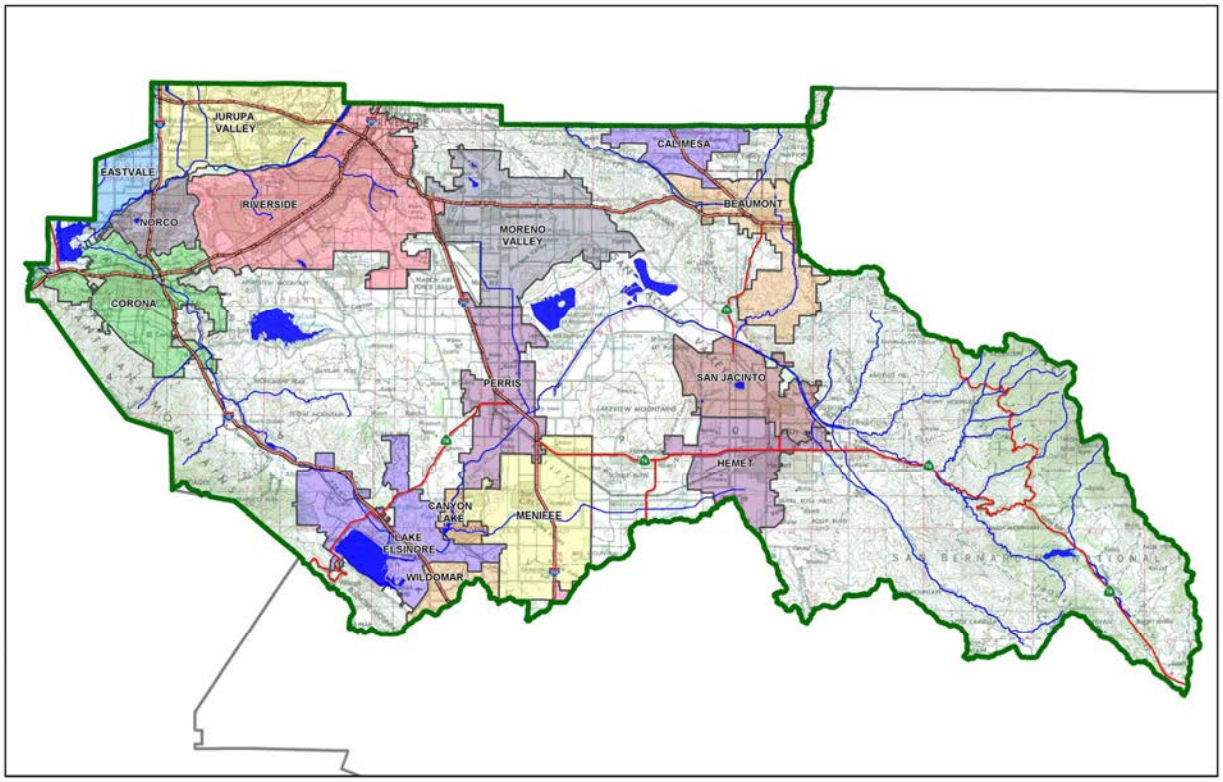
Project Specific Water Quality Management Plan

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

Project Title: Car Pros KIA Sales and Service Center

Development No: PEN19-0047

Design Review/Case No: LWQ19-008



☒ **Preliminary**
☐ **Final**

Original Date Prepared: February 2019

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Prepared for Compliance with
Regional Board Order No. **R8-2010-0033**
Template revised June 30, 2016

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OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for **Car Pros Automotive Group** by **Kimley-Horn and Associates** for the Car Pros KIA Sales and Service Center project.

This WQMP is intended to comply with the requirements 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 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."

TO BE PROVIDED ON FINAL WQMP

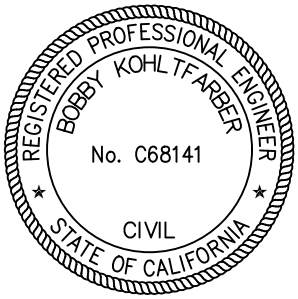
Owner's Signature	Date
Owner's Printed Name	Owner's Title/Position

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	05/17/2019 Date
Bobby Kohltfarber Preparer's Printed Name	Senior Project Manager Preparer's Title/Position

Preparer's Licensure: PE C68141



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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	**Commercial**
Planning Area:	**SP 209 C**
Community Name:	**N/A**
Development Name:	**Car Pros KIA Sales and Service Center**
PROJECT LOCATION	
Latitude & Longitude (DMS): **Lat: 33°56'0.61"N Long:117°10'28.72"W**	
Project Watershed and Sub-Watershed: **Santa Ana Watershed**	
Gross Acres: 6.19 acres APN(s): **488-390-016 & 488-390-015** Map Book and Page No.: **PM 161/16**	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	**Car Dealership**
Proposed or Potential SIC Code(s)	**5511**
Area of Impervious Project Footprint (SF)	**209,019 SF**
Total Area of proposed Impervious Surfaces within the Project Footprint (SF)/or Replacement	**209,019 SF**
Does the project consist of offsite road improvements?	☐ Y ☒ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☒ Y ☐ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the Project limits Footprint (SF)	**0 SF**
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 See Appendix 3**
What is the Water Quality Design Storm Depth for the project?	**0.669" ~ 0.67" (See Appendix 1)**

A.1 Maps and Site Plans

The site is currently undeveloped. The project is located at the northeast corner of Moreno Beach Drive and Auto Mall Drive in Moreno Valley, CA. The project is bounded by a vacant lot to the east, Pettit Street to the north, Auto Mall Drive to the west, and Moreno Beach Drive to the south. See Appendix 2, Exhibit 1, Location Map.

The proposed development consists of the construction of an approximately 24,700 square foot building and associated improvements. The associated improvements include but are not limited to the following: site grading, domestic water service, sanitary sewer service, concrete and asphalt pavement, landscaping and irrigation, underground storm drain system, and modular wetland systems. The proposed development also includes a future car wash, and sales and service facility, which will be part of a later phase and do not alter the imperviousness proposed for the site. The lot area is approximately 6.19 acres. All grading, drainage, landscape/plant palette and other pertinent construction plans are found in Appendix 2.

See Appendix 1 for WQMP Site Plan. The WQMP Site Plan includes 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
- BMP Locations (Lat/Long)

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
Moreno Master Drainage Plan – Line G STG 1	**NOT LISTED.**	**NOT LISTED.**	**N/A**
Moreno Master Drainage Plan – Line G	**NOT LISTED.**	**NOT LISTED.**	**N/A**
Quincy Street Channel	**NOT LISTED.**	**NOT LISTED.**	**N/A**
Moreno Master Drainage Plan – Line F	**NOT LISTED.**	**NOT LISTED.**	**N/A**
Moreno - Line F Bybass	**NOT LISTED.**	**NOT LISTED.**	**N/A**
Sunnymead Master Drainage Plan – Line N	**NOT LISTED.**	**NOT LISTED.**	**N/A**
KITCHING CHANNEL, PART OF AN MS4 OPERATED BY THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT (RCFCWCD).	**NOT LISTED.**	**NOT LISTED.**	**N/A**
PERRIS VALLEY STORMDRAIN, PART OF AN MS4 OPERATED BY THE RCFCWCD.	**NOT LISTED.**	**NOT LISTED.**	**N/A**
SAN JACINTO RIVER (REACH 3)	**NOT LISTED.**	**AGR, GWR, REC1, REC2, WARM, WILD**	**N/A**
CANYON LAKE (RAILROAD CORRIDOR RESERVOIR)	**NUTRIENTS, PATHOGENS**	**MUN, AGR, GWR, REC1, REC2, WARM, WILD**	**N/A**
SAN JACINTO RIVER (REACH 1)	**NOT LISTED.**	**MUN, AGR, GWR, REC1, REC2, WARM, WILD**	**N/A**
LAKE ELSINORE	**NUTRIENTS, ORGANIC ENRIGHMENT/LOW DISSOLVED OXYGEN, PCB'S, SEDIMENT TOXICITY, UNKNOWN TOXICITY**	**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** **City of Moreno Valley Building 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.

Consideration of "highest and best use" of the discharge should also be considered. For example, Lake Elsinore is evaporating faster than runoff from natural precipitation can recharge it. Requiring infiltration of 85% of runoff events for projects tributary to Lake Elsinore would only exacerbate current water quality problems associated with Pollutant concentration due to lake water evaporation. In cases where rainfall events have low potential to recharge Lake Elsinore (i.e. no hydraulic connection between groundwater to Lake Elsinore, or other factors), requiring infiltration of Urban Runoff from projects is counterproductive to the overall watershed goals. Project proponents, in these cases, would be allowed to discharge Urban Runoff, provided they used equally effective filtration-based BMPs.

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 site is currently undeveloped. The existing site has varying topography. Approximately half of the site currently drains west and is captured by a 96" RCP along Pettit Street, while the other half drains east and is captured by an existing 18" RCP that discharges through an existing headwall at the south-east corner of the site. Under both scenarios, storm water continues east via surface flow until it eventually reaches the Quincy Street Channel.

The proposed development includes the construction of a car sales and service facility accompanied by asphalt pavement, concrete hardscape, and landscaping. The proposed site grading intends to maintain the existing natural flow pattern by having about half of the site drain into the existing 96" RCP, while the other half drains to the existing headwall at the south-east corner. Appendix 1 includes an exhibit for reference.

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

The proposed project site is currently 100% pervious. All existing vegetation will be removed. The proposed landscape will enhance the project site.

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

Per Riverside County Stormwater and Water Conservation Tracking Tool, the site consists of Type A and B soil which has a low potential for runoff and a high infiltration capacity. (See Appendix 3) However, based on the Geotechnical Investigation and Percolation Test Results Report prepared by Geocon West, Inc on January 18, 2019 it was concluded that infiltration is between the ranges of 0.01 to 0.31 in/hr. Due to the low infiltration rates infiltration is infeasible. (See Appendix 3) Onsite soils will be classified as D for all calculations.

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

The preliminary site plan was done with the intent of maximizing the pervious area on the site. This was accomplished by using landscape planters throughout the site and perimeter planter areas.

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

Yes, where feasible.

Section C: Delineate Drainage Management Areas (DMAs)

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

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1][2]	Area (Sq. Ft.)	DMA Type
DMA-1	**Concrete / Asphalt / Landscape Areas**	**27,742**	**Type "D" – Area that drains to BMP**
DMA-2	**Concrete / Asphalt / Landscape Areas**	**61,584**	**Type "D" – Area that drains to BMP**
DMA -3	**Mixed Surface Type**	**158,355**	**Type "D" – Area that drains to BMP**

[1]Reference Table 2-1 in the WQMP Guidance Document to populate this column
[2]If multi-surface provide back-up

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

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)
DA A	**39,629**	**Proposed Landscaping**	**Drip Irrigation**
DA B	**12,157**	**Proposed Landscaping**	**Drip Irrigation**

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

Self-Retaining Area				**Type 'C' DMAs that are draining to the Self-Retaining Area**		
DMA Name/ ID	Post-project surface type	Area (square feet) [A]	Storm Depth (inches) [B]	DMA Name / ID	[C] from Table C.4 = [C]	Required Retention Depth (inches) [D]
N/A						

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

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

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

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

DMA Name or ID	BMP Name or ID
DMA-1	**Modular Wetland**
DMA-2	**Modular Wetland**
DMA-3	**Modular Wetland**

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; proceed to section D.3

If no, continue working through this section to implement your LID BMPs. It is recommended that you contact your Co-Permittee to verify whether or not your project discharges to an approved downstream 'Highest and Best Use' feature.

Geotechnical Report

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

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

Infiltration Feasibility

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

Table D.1 Infiltration Feasibility

Does the project site…	YES	NO
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?		X
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		X
If Yes, list affected DMAs:		
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?		X
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?	X	
If Yes, list affected DMAs: (Based on the Geotechnical Investigation and Percolation Test Results Report prepared by Geocon West, Inc on January 18, 2019 it was concluded that infiltration is between the ranges of 0.01 to 0.31 in/hr)	All DMA's	
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?		X
If Yes, list affected DMAs:		
…geotechnical report identifies other site-specific factors that would preclude effective and safe infiltration?		X
Describe here:		

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

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 none of the above criteria applies, follow the steps below to assess the feasibility of irrigation use, toilet use and other non-potable uses (e.g., industrial use).

Irrigation Use Feasibility

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

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

Total Area of Irrigated Landscape: **60,680 Square feet (1.39 ac)**

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

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

Total Area of Impervious Surfaces: **209,019 Square Feet (4.80 ac)**

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

Enter your EIATIA factor: **1.16 ac/ac**

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: **242,462 Square Feet (5.57 ac)**

Step 5: Determine if harvesting storm water 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)
5.57 ac	**1.39 ac**

Therefore, harvesting storm water runoff for irrigation is not feasible for the project site.

Toilet Use Feasibility

Complete the following steps to determine the feasibility of harvesting storm water 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: ***less than 100 users a day***

Project Type: **Commercial**

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: **209,019 Square Feet (4.80 ac)**

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

Enter your TUTIA factor: ***145 tu/ac***

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: ***696 toilet users***

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)
696 toilet users	**Less than 100 toilet users a day**

Therefore, harvesting storm water runoff for toilet flushing use is not feasible for the project site.

Other Non-Potable Use Feasibility

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

N/A

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

Average Daily Demand: **N/A**

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

Total Area of Impervious Surfaces: **N/A**

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

Enter the factor from Table 2-4: **N/A**

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

Minimum required use: **N/A**

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

Minimum required non-potable use (Step 4)	Projected average daily use (Step 1)
N/A	**N/A**

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

In conclusion irrigation, toilet and other non-potable use is less than the applicable minimum values, harvest and use BMPs are not required for this project site.

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-3	☐	☐	☐	☒	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

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.

N/A

D.5 LID BMP Sizing

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

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*BMP-1 (MWS-L-4-8)*		
	[A]		[B]	[C]	[A] x [C]			
DMA-1	**27,742**	***Concrete, Asphalt, & Landscape***	***1.0***	***0.89***	***24,746***	*Design Rainfall Intensity (in/hr)*	*Design Flowrate, Q_{BMP} (cubic feet/sec)*	*Proposed Flowrate (cubic feet/sec)*
	A_T=**27,742**				***Σ= 24,746***	***0.2***	***0.1***	***0.115***

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*BMP-2 (MWS-L-8-12)*		
	[A]		[B]	[C]	[A] x [C]			
DMA-2	**61,584**	***Concrete, Asphalt, & Landscape***	***1.0***	***0.89***	***54,933***	*Design Rainfall Intensity (in/hr)*	*Design Flowrate, Q_{BMP} (cubic feet/sec)*	*Proposed Flowrate (cubic feet/sec)*
	A_T=**61,584**				***Σ= 54,933***	***0.2***	***0.3***	***0.346***

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*BMP-3 (MWS-L-8-20)*		
	[A]		[B]	[C]	[A] x [C]			
DMA-3A	**126,015**	***Concrete, Asphalt, & Landscape***	***1.0***	***0.89***	***112,405***	*Design Rainfall Intensity (in/hr)*	*Design Flowrate, Q_{BMP} (cubic feet/sec)*	*Proposed Flowrate (cubic feet/sec)*
DMA-3B	**32,340**	***Ornamental Landscaping***	***0.1***	***0.11***	***3,572***			
	A_T=**158,355**				***Σ= 115,978***	***0.2***	***0.5***	***0.577***

[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.

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	**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)**	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f**	**DMA Runoff Factor**	**DMA Area x Runoff Factor**		***Enter BMP Name / Identifier Here***		
	[A]		[B]	[C]	[A] x [C]				
See Table D.3						*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 for Flow-Based Treatment Control BMPs [E] = .2, for Volume-Based Control Treatment BMPs, [E] 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]
BMP-1: Modular Wetland		80% of TSS and 90% hydrocarbons
BMP-2: Modular Wetland		80% of TSS and 90% hydrocarbons
BMP-3: Modular Wetland		80% of TSS and 90% hydrocarbons

[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**
DMA-1 & 2 Time of Concentration (min)	11.35	9.35	17.6
DMA-3 Time of Concentration (min)	7.85	14.57	85.6
DMA-1 & 2 Volume (Cubic Feet)	11,709	8,107	30.8
DMA-2 Volume (Cubic Feet)	12,776	14,397	12.7
DMA-1 & 2 Flowrate (cfs)	2.52	2.75	9.1
DMA-2 Flowrate (cfs)	3.46	3.66	5.8

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

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

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

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

N/A

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.

Hydromodification will be mitigated limiting the discharge from the site to a flow rate no greater than 110% of the pre-development 2-year peak flow. Summary of peak flowrates are shown on Table F.1. See Appendix 7 for all calculations.

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
Modular Wetlands	Mark all modular wetlands with the words "Only Rain Down the Storm Drain" or similar. Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify stenciling. **(CASQQ BMP SD-13, "Storm Drain Signage")**	Maintain and periodically repaint or replace stencil markings; Provide stormwater pollution prevention information to new site owners, lessees, or operators; See applicable operational BMPs in Fact Sheet SC-74 "Drainage System Maintenance" provided in Appendix 8 of this report.
Landscape/ Outdoor pesticide use	Final landscape plans will accomplish all 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 storm water pollution. Where landscaped areas are used to retain or detain storm water, 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. (CASQA BMP SD-10, "Site Design and Landscape Planning" and SD-12, "Efficient Irrigation")	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/Downloads/LandscapeGardenBrochure.pdf. Provide IPM information to new owners, lessees and operators. Applicable operational BMPS in "What you should know for…. Landscape and Gardening": • Never apply pesticides or fertilizers when rain is predicted within the next 48 hours. • Do not overwater. Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through city's program.
Plazas, sidewalks, and parking lots.	None	Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect wash water containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Section H: Construction Plan Checklist

Populate Table H.1 below to assist the plan checker in an expeditious review of your project. The first two columns will contain information that was prepared in previous steps, while the last column will be populated with the corresponding plan sheets. 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 Location (Lat/Long)
To be submitted with Final 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: Car Pros Automotive Group shall be responsible for maintenance.

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.

BMP Name and BMP Implementation, Maintenance, and Inspection Procedures	*Implementation, Maintenance, and Inspection Frequency and Schedule*	*Inspection / Maintenance Activities Required*	*Person or Entity with Operation & Maintenance Responsibility*	*BMP Start-up Schedule*
Non-Structural Source Control BMPs				
Education for Property Owners, Tenants and Occupants	Within 30 days of tenant occupancy and annually thereafter.	Educational material shall be provided to all employees and tenants.	Car Pros Automotive Group	At conclusion of construction. Date to be determined after final engineering is complete.
Activity Restriction	Ongoing; Yearly for all employees and within 30 days of hire date for new employees.	The owner shall develop activity restrictions to minimize the threat of hazardous waste or contamination into the storm drainage system. Car washing is not allowed on-site at any time.	Car Pros Automotive Group	At conclusion of construction. Date to be determined after final engineering is complete.

BMP Name and BMP Implementation, Maintenance, and Inspection Procedures	***Implementation, Maintenance, and Inspection Frequency and Schedule***	***Inspection / Maintenance Activities Required***	***Person or Entity with Operation & Maintenance Responsibility***	***BMP Start-up Schedule***
Common Area Landscape Management	Weekly	Training on landscape management consistent with County Water Conservation Resolution or City equivalent, plus Management Guidelines for Fertilizers (DAMP Section 5.5) shall be conducted for all new field landscape maintenance personnel.	Car Pros Automotive Group	At conclusion of construction. Date to be determined after final engineering is complete.
BMP Maintenance	Weekly	Maintenance of BMPs implemented at the project site shall be performed at the frequency prescribed in this WQMP.	Car Pros Automotive Group	At conclusion of construction. Date to be determined after final engineering is complete.
Common Area Litter Control	Weekly	Litter patrol, violations investigation, reporting and other litter control activities shall be performed in conjunction with maintenance activities.	Car Pros Automotive Group	At conclusion of construction. Date to be determined after final engineering is complete.

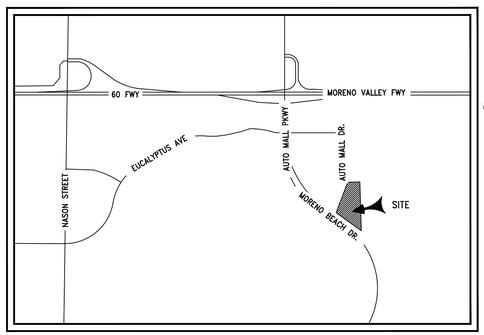
BMP Name and BMP Implementation, Maintenance, and Inspection Procedures	*Implementation, Maintenance, and Inspection Frequency and Schedule*	*Inspection / Maintenance Activities Required*	*Person or Entity with Operation & Maintenance Responsibility*	*BMP Start-up Schedule*
Training	Ongoing; Yearly for all employees and within 30 days of hire date for new employees.	Education programs shall be implemented as they apply to future employees and training of current employees.	Car Pros Automotive Group	At conclusion of construction. Date to be determined after final engineering is complete.
Common Area Catch Basin Inspection	Twice a month to remove debris and after every major storm event	Litter and debris removal, illicit discharge violations investigation and reporting shall be performed in conjunction with maintenance activities.	Car Pros Automotive Group	At conclusion of construction. Date to be determined after final engineering is complete.
Street Sweeping Private Streets and Parking Lots	Monthly	Private streets and parking area within the project shall be swept at a minimum frequency of once a month.	Car Pros Automotive Group	At conclusion of construction. Date to be determined after final engineering is complete.
Structural Source Control BMPs				

BMP Name and BMP Implementation, Maintenance, and Inspection Procedures	*Implementation, Maintenance, and Inspection Frequency and Schedule*	*Inspection / Maintenance Activities Required*	*Person or Entity with Operation & Maintenance Responsibility*	*BMP Start-up Schedule*
Provide Storm Drain System Stenciling and Signage	Yearly	All proposed inlets shall be marked with the appropriate "No Dumping. Drains to Ocean." Stencil. The stencils must be repainted when they become illegible, but at a minimum once every five years.	Car Pros Automotive Group	At conclusion of construction. Date to be determined after final engineering is complete.
Use Efficient Irrigation Systems & Landscape Design	Monthly	Verify that landscape design continues to function properly by correctly adjusting to eliminate overspray to hardscape areas, and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, and day or night time temperatures.	Car Pros Automotive Group	At conclusion of construction. Date to be determined after final engineering is complete.
Low Impact Development (LID) and Treatment Control BMPs				

BMP Name and BMP Implementation, Maintenance, and Inspection Procedures	***Implementation, Maintenance, and Inspection Frequency and Schedule***	***Inspection / Maintenance Activities Required***	***Person or Entity with Operation & Maintenance Responsibility***	***BMP Start-up Schedule***
Catch Basins and Modular Wetland (See Appendix 10)	Bi- annual	Inspect and remove trash and debris from chamber twice a year.	Car Pros Automotive Group	At conclusion of construction. Date to be determined after final engineering is complete.

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map



VICINITY MAP
NTS

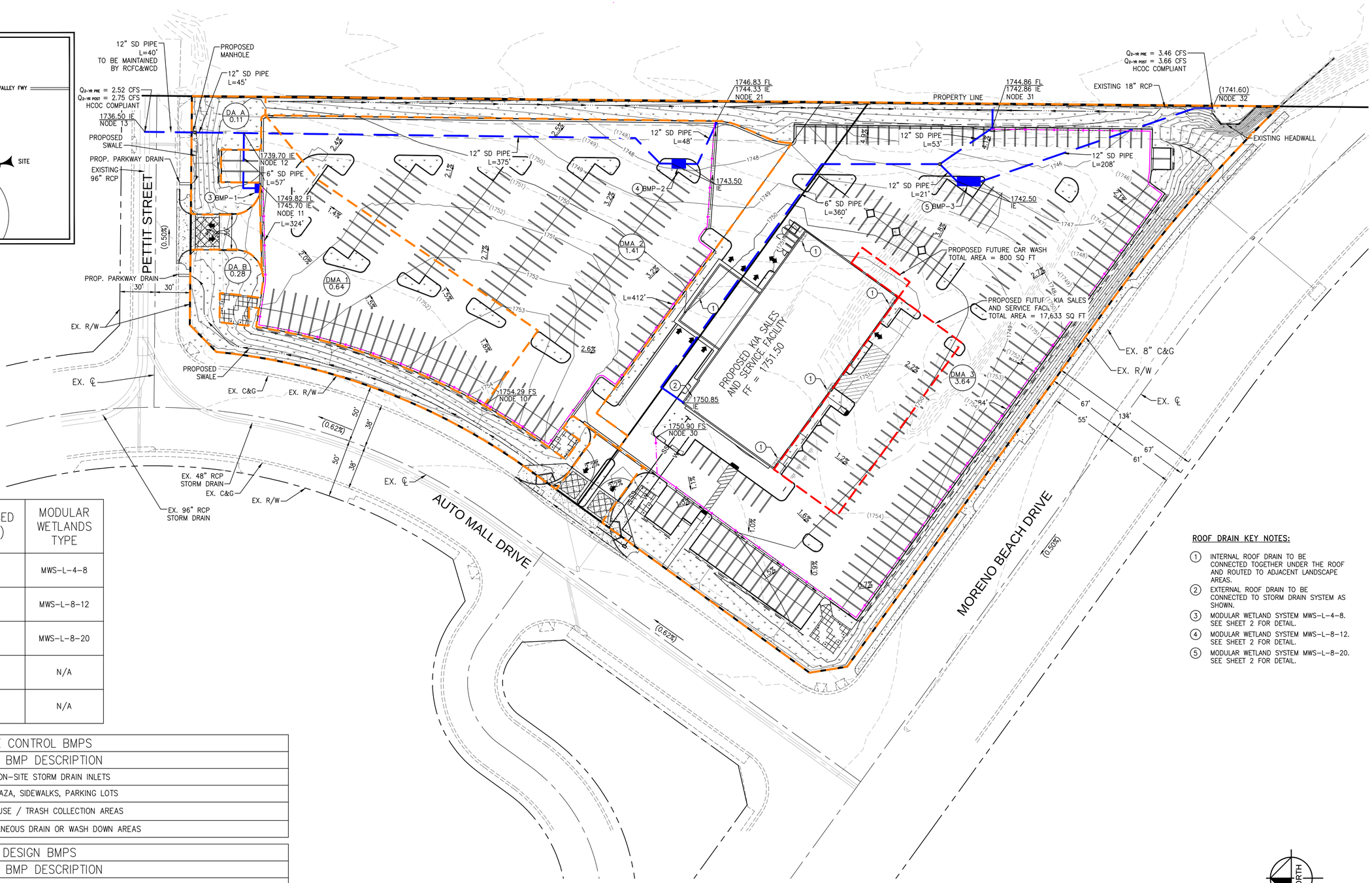
LEGEND

- PROPOSED CONTOUR (575)
- EXISTING CONTOUR ((575))
- PROPERTY LINE
- DMA BOUNDARY
- FUTURE EXPANSION AREAS
- PROPOSED STORM DRAIN
- FLOW PATH
- DMA NAME (X)
- DMA AREA (IN ACRES) (XX)
- RIGHT OF WAY
- PROPOSED LANDSCAPE

DMA	AREA (AC)	BMP ID	MINIMUM QBMP(CFS)	PROPOSED Q(CFS)	MODULAR WETLANDS TYPE
DMA-1	0.64	BMP-1	0.1	0.115	MWS-L-4-8
DMA-2	1.41	BMP-2	0.3	0.346	MWS-L-8-12
DMA-3	3.64	BMP-3	0.5	0.577	MWS-L-8-20
DA-A	0.11	SELF TREATING	N/A	N/A	N/A
DA-B	0.28	SELF TREATING	N/A	N/A	N/A

SOURCE CONTROL BMPS	
BMP ID	BMP DESCRIPTION
SC-74	ON-SITE STORM DRAIN INLETS
SC-41	PLAZA, SIDEWALKS, PARKING LOTS
SC-34	REFUSE / TRASH COLLECTION AREAS
SC-10	MISCELLANEOUS DRAIN OR WASH DOWN AREAS

SITE DESIGN BMPS	
BMP ID	BMP DESCRIPTION
SD-10, SD-12	LANDSCAPE / OUTDOOR PESTICIDE USE
SD-11	ROOF RUNOFF
SD-13	STORM DRAIN STENCILING AND SIGNAGE → ALL SD GRATED INLETS, CURB CUTS (TYP.)
SD-32	REFUSE / TRASH COLLECTION AREAS



ROOF DRAIN KEY NOTES:

1. INTERNAL ROOF DRAIN TO BE CONNECTED TOGETHER UNDER THE ROOF AND ROUTED TO ADJACENT LANDSCAPE AREAS.
2. EXTERNAL ROOF DRAIN TO BE CONNECTED TO STORM DRAIN SYSTEM AS SHOWN.
3. MODULAR WETLAND SYSTEM MWS-L-4-8. SEE SHEET 2 FOR DETAIL.
4. MODULAR WETLAND SYSTEM MWS-L-8-12. SEE SHEET 2 FOR DETAIL.
5. MODULAR WETLAND SYSTEM MWS-L-8-20. SEE SHEET 2 FOR DETAIL.

NORTH

GRAPHIC SCALE IN FEET
0 20 40 80
SCALE 1" = 40'

PEN 19-0047/LST19-0008

Kimley»Horn

PRELIMINARY WQMP EXHIBIT DETAILS
CAR PROS KIA SALES AND SERVICE FACILITY
SHEET 1 OF 2 5/17/2019

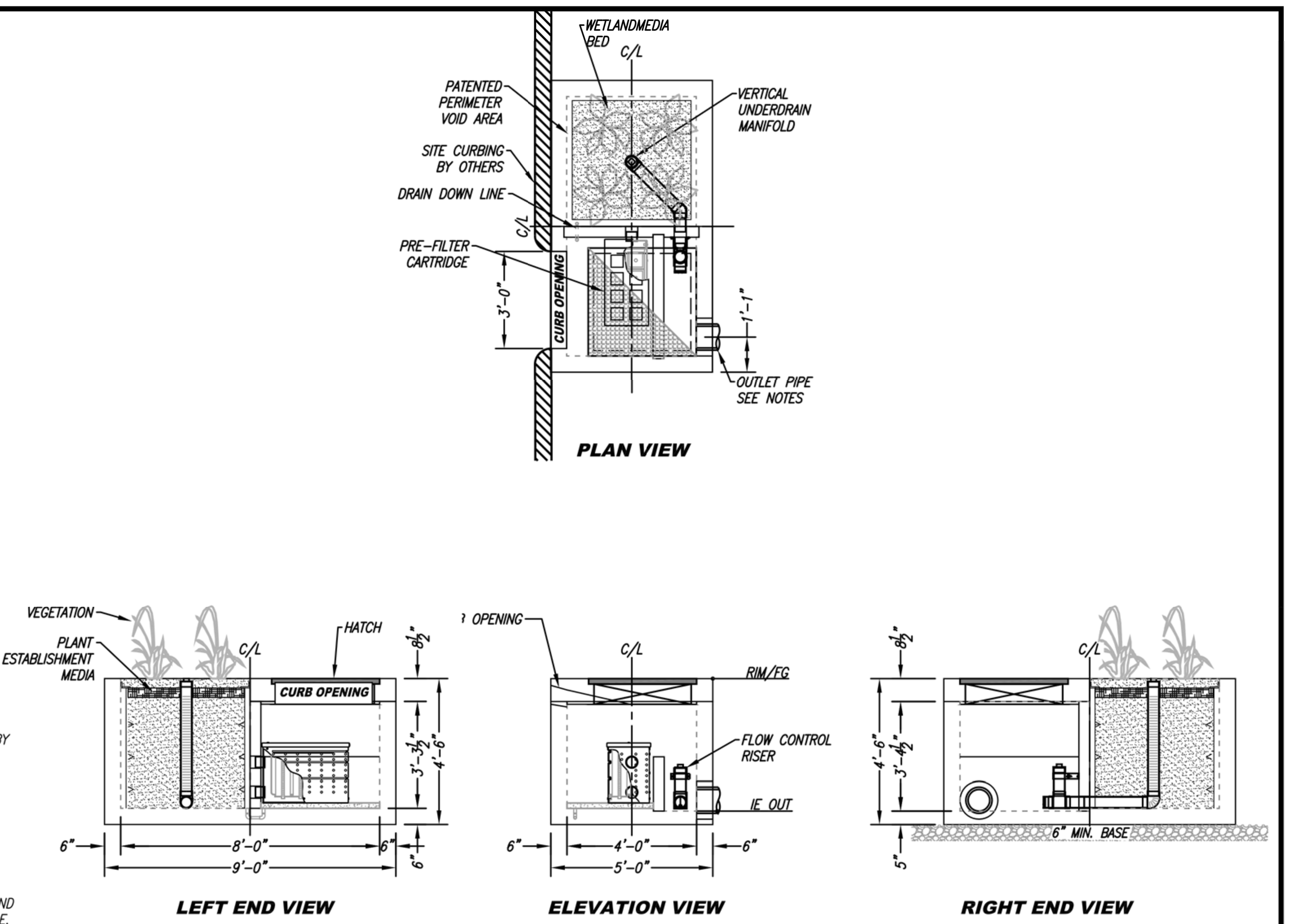
SITE SPECIFIC DATA			
PROJECT NUMBER	194117001		
ORDER NUMBER			
PROJECT NAME	CAR PROS KIA		
PROJECT LOCATION	MORENO VALLEY		
STRUCTURE ID	BMP-1		
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.1	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			1.97
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	1745.7	HDPE	6"
INLET PIPE 2			
OUTLET PIPE	1745.7	HDPE	6"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	1749.8	1749.8	1749.8
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	36" X 36"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			TBD
ORIFICE SIZE (DIA. INCHES)			TBD
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.			

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.



TREATMENT FLOW (CFS)	0.115
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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Bio Clean — A Forterra Company

MWS-L-4-8-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

BMP-1
N.T.S.
(3)

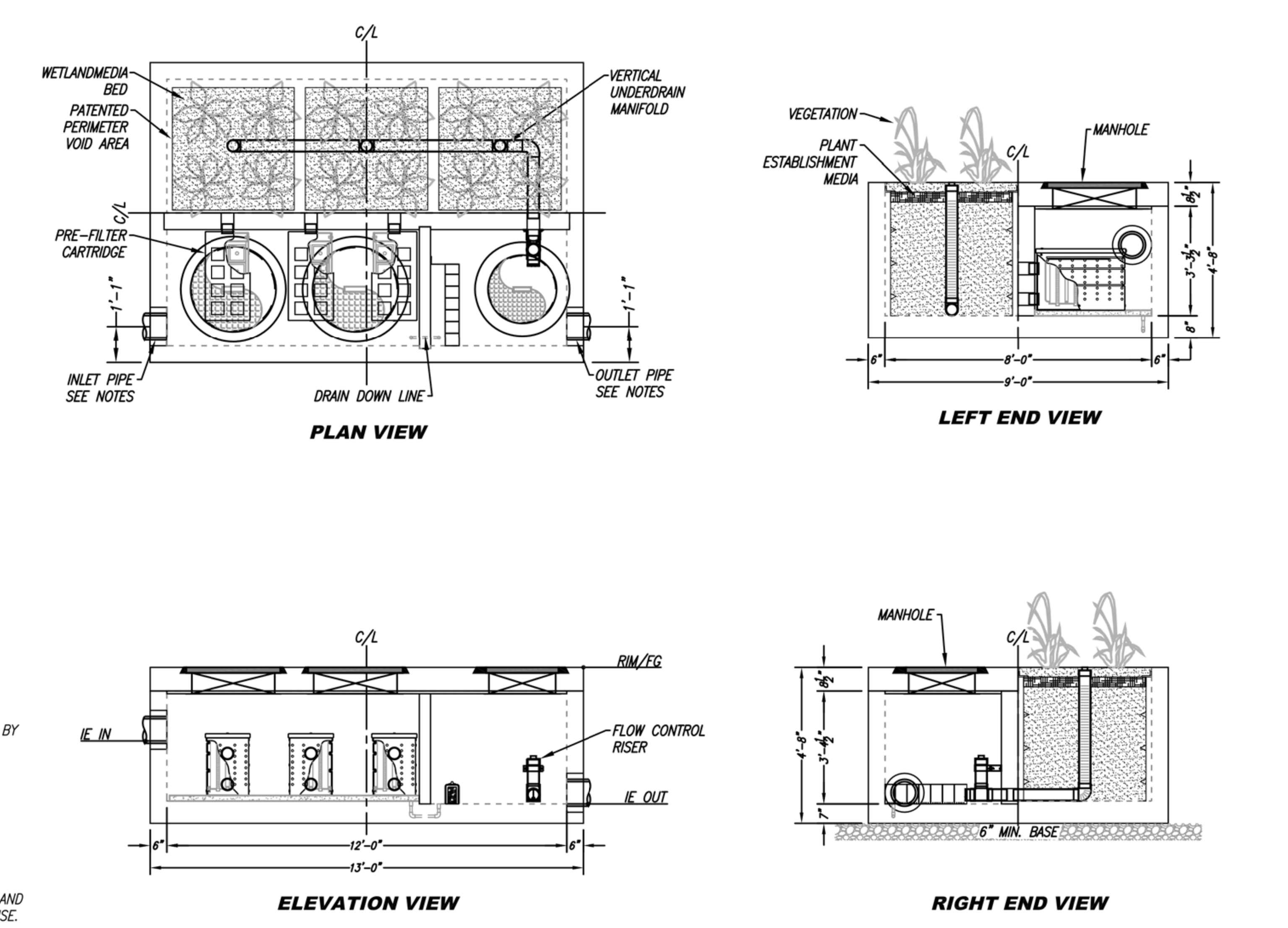
SITE SPECIFIC DATA			
PROJECT NUMBER	194117001		
ORDER NUMBER			
PROJECT NAME	CAR PROS KIA		
PROJECT LOCATION	MORENO VALLEY		
STRUCTURE ID	BMP-2		
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.3	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			4.26
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	1743.5	HDPE	12"
INLET PIPE 2			
OUTLET PIPE	1743.5	HDPE	12"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	1747.6	1747.6	1747.6
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	2EA ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			TBD
ORIFICE SIZE (DIA. INCHES)			TBD
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.			

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.



TREATMENT FLOW (CFS)	0.346
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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Bio Clean — A Forterra Company

MWS-L-8-12-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

BMP-2
N.T.S.
(4)

SITE SPECIFIC DATA			
PROJECT NAME	CAR PROS KIA		
PROJECT LOCATION	MORENO VALLEY		
STRUCTURE ID	BMP-3		
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.5	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			8.13
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	1742.5	HDPE	12"
INLET PIPE 2			
OUTLET PIPE	1742.5	HDPE	12"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	1746.6	1746.6	1746.6
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			11.85
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø2.43"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			

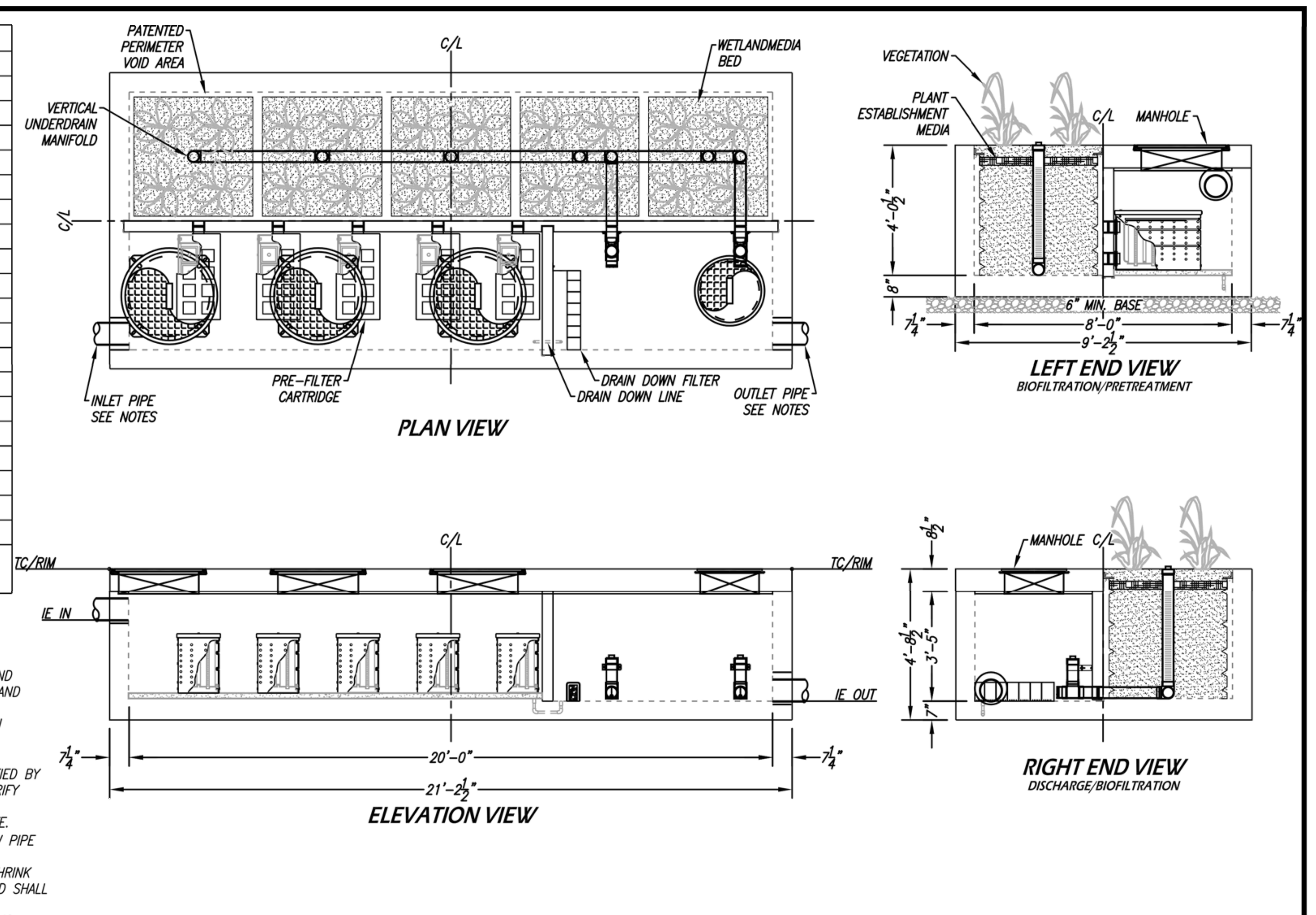
INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

6/2/15/OHN



TREATMENT FLOW (CFS)	0.577
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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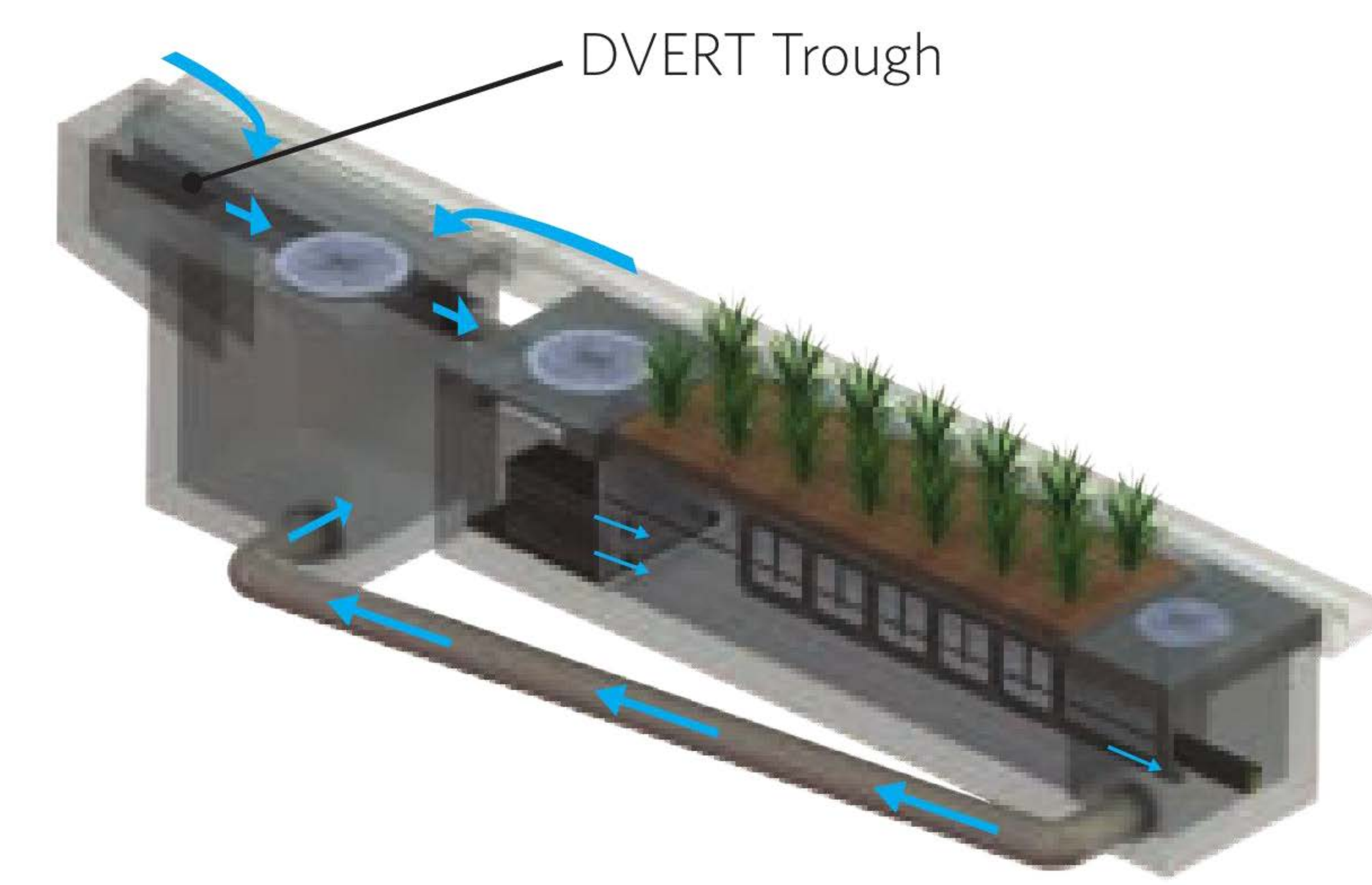
MODULAR WETLANDS — www.ModularWetlands.com | (855) 5MOD-WET

MWS-L-8-20-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

BMP-3
N.T.S.
(5)

DVERT LOW FLOW DIVERSION



MODULAR WETLAND BYPASS SYSTEM
N.T.S.

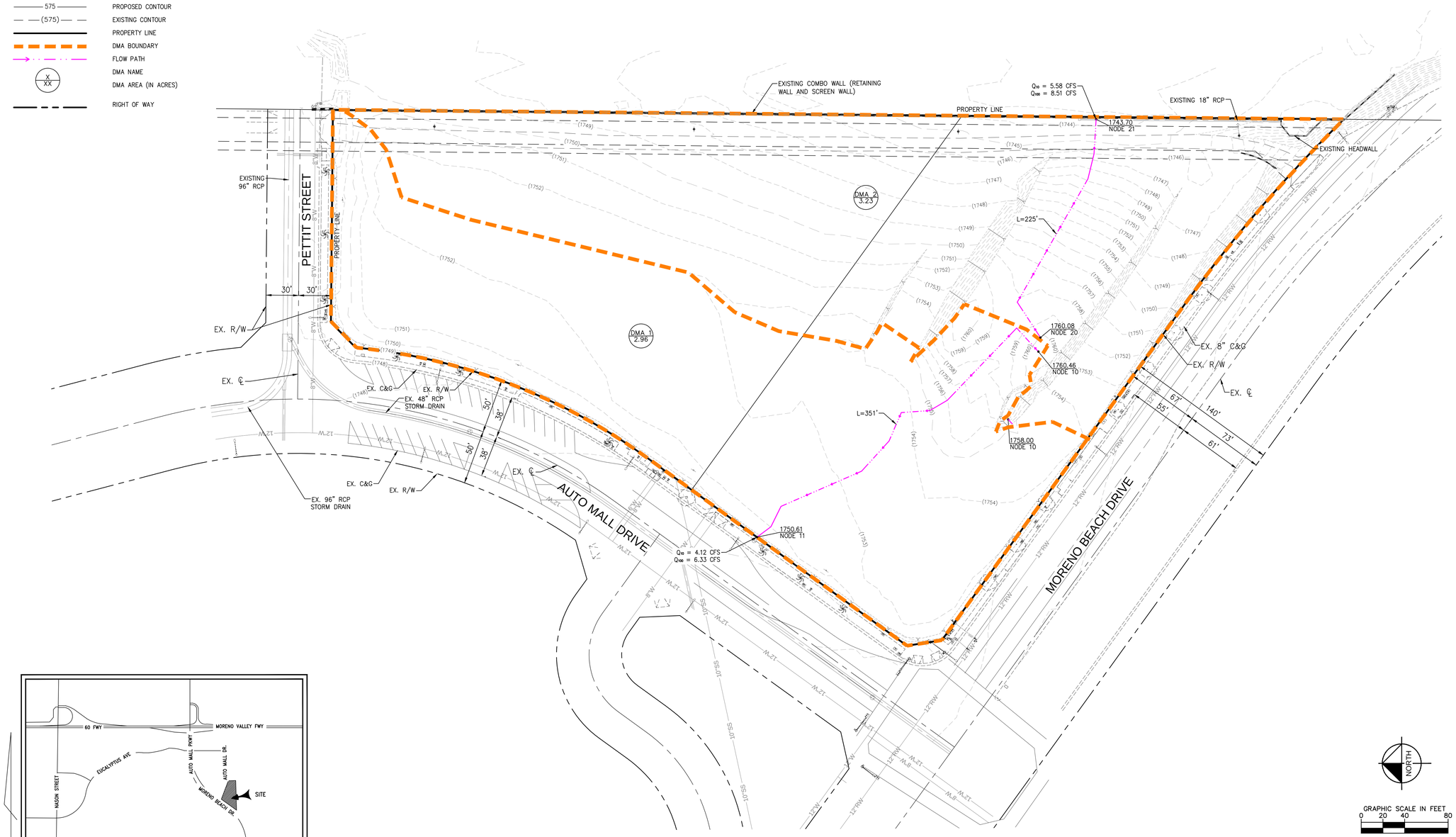
PEN 19-0047/LST19-0008

Kimley»Horn

PRELIMINARY WQMP EXHIBIT DETAILS
CAR PROS KIA SALES AND SERVICE FACILITY
SHEET 2 OF 2 5/17/2019

LEGEND

- 575 — PROPOSED CONTOUR
- (575) — EXISTING CONTOUR
- PROPERTY LINE
- DMA BOUNDARY
- FLOW PATH
- X / XX — DMA NAME / DMA AREA (IN ACRES)
- RIGHT OF WAY



VICINITY MAP
NTS

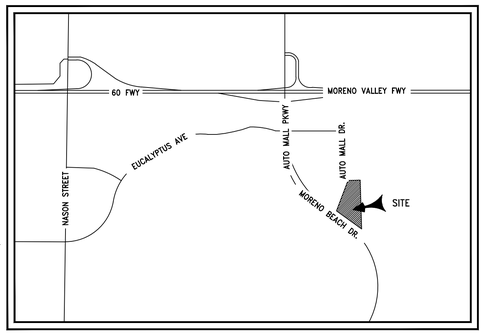
NORTH

GRAPHIC SCALE IN FEET
0 20 40 80
SCALE 1" = 40'

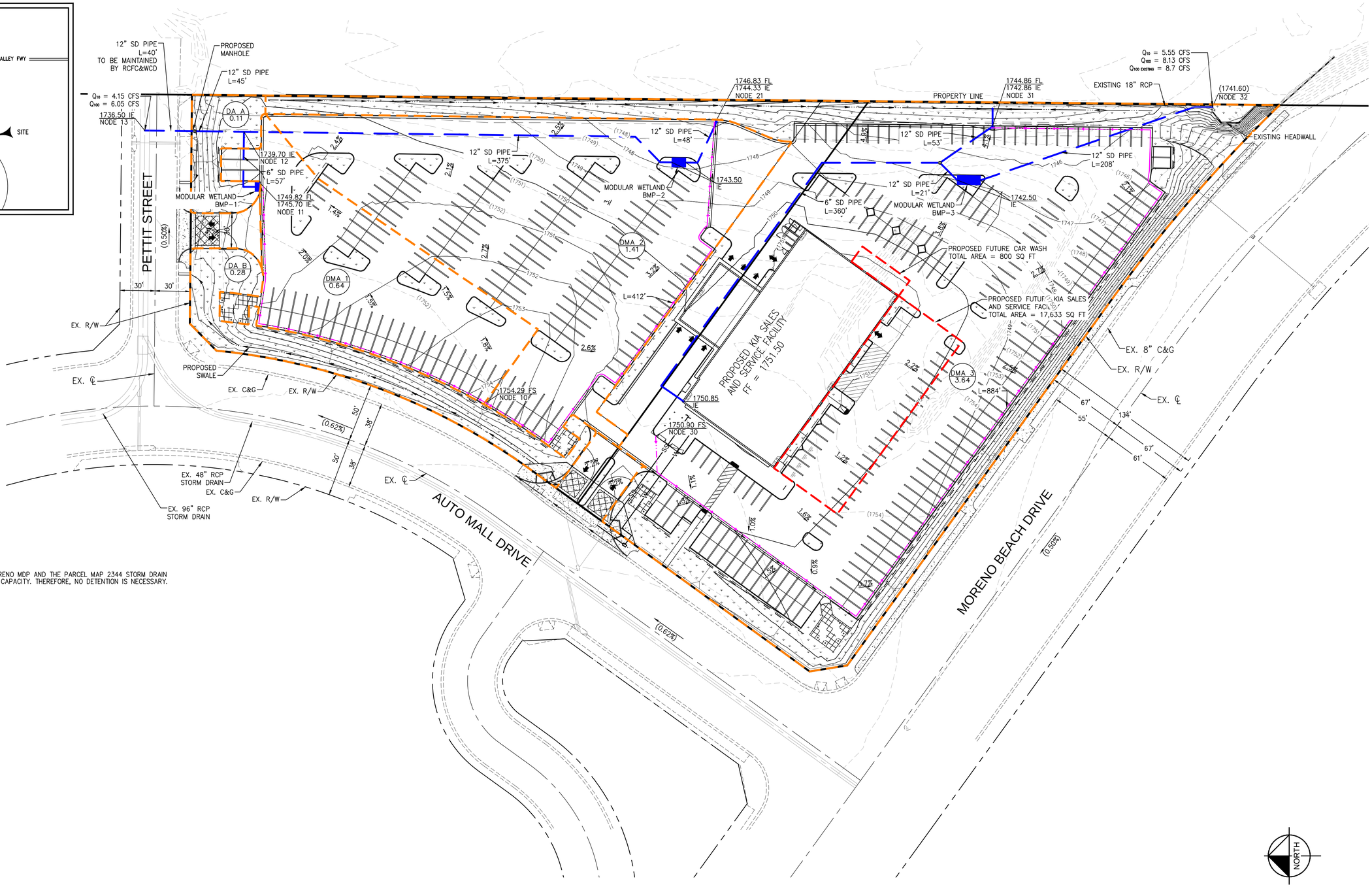
PEN 19-0047/LST19-0008

Kimley»Horn

EXISTING DRAINAGE MAP
CAR PROS KIA SALES AND SERVICE FACILITY
5/17/2019



VICINITY MAP
NTS



LEGEND

- 575 — PROPOSED CONTOUR
- (575) — EXISTING CONTOUR
- PROPERTY LINE
- DMA BOUNDARY
- FUTURE EXPANSION AREAS
- PROPOSED STORM DRAIN
- FLOW PATH
- X / XX — DMA NAME / DMA AREA (IN ACRES)
- RIGHT OF WAY
- PROPOSED LANDSCAPE

NOTE: RECEIVING STORM DRAINS HAVE A SPECIFIED CAPACITY PER THE MORENO MDP AND THE PARCEL MAP 2344 STORM DRAIN PLANS. UNMITIGATED RUNOFF FROM THE PROJECT SITE IS LESS THAN THE CAPACITY. THEREFORE, NO DETENTION IS NECESSARY.

NORTH

GRAPHIC SCALE IN FEET
0 20 40 80
SCALE 1" = 40'

PEN 19-0047/LST19-0008

Kimley»Horn

PROPOSED DRAINAGE MAP
CAR PROS KIA SALES AND SERVICE FACILITY
5/17/2019

Car Pros KIA Sales and Service Center

Potential Ultimate Discharge

ZONE 1

ZONE 2

ZONE 3

ZONE 4

ZONE 5

ZONE 7

Legend

Stream Type

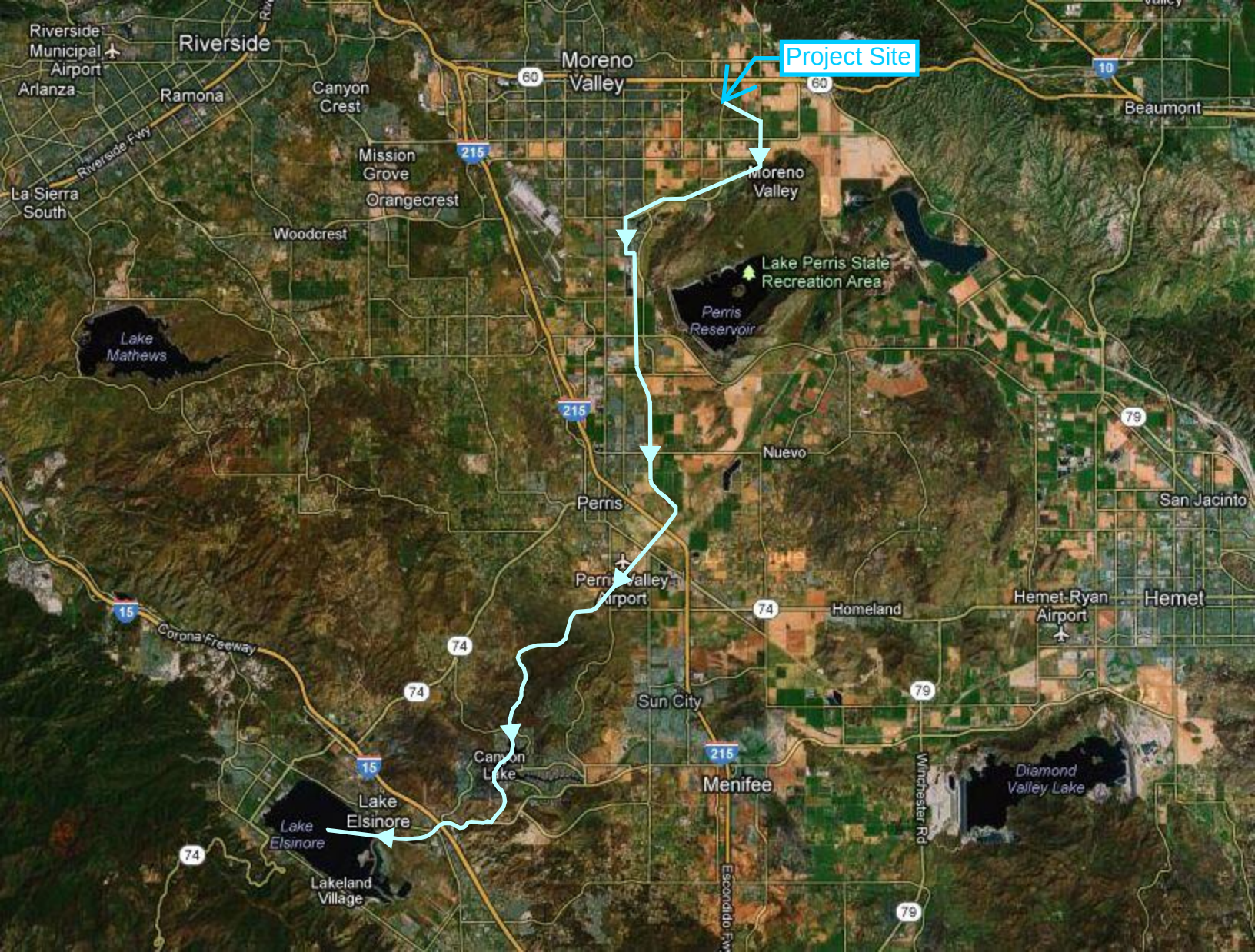
- Engineered, Fully Hardened, and Maintained (EFHM)
- Engineered, Partially Hardened, and Maintained (EPHM)
- Engineered, Earthen, and Maintained (EEM)
- Not Engineered and Earthen (NEE)
- Natural (NAT)
- Santa Ana River (SAR)
- Flood Control and Water Conservation District Boundary
- Study Area
- County Boundary

0 1 2 3 4 Miles

Existing Stream Channel Delineation Map

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

Map 1


Project Site
Riverside Municipal Airport
Riverside
Arlanza
Ramona
Canyon Crest
Moreno Valley
Beaumont
Riverside Fwy
Mission Grove
Orangecrest
La Sierra South
Woodcrest
Moreno Valley
Lake Perris State Recreation Area
Perris Reservoir
Lake Mathews
Nuevo
San Jacinto
Perris
Perris Valley Airport
Homeland
Hemet-Ryan Airport
Hemet
Corona Freeway
Sun City
Canyon Lake
Menifee
Diamond Valley Lake
Winchester Rd
Lake Elsinore
Lake Elsinore
Lakeland Village
Escondido Fwy
60
215
10
79
74
15

Car Pros KIA Sales and Service Center =0.669"~0.67"

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

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

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

Santa Ana River Watershed
Santa Margarita Watershed

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

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

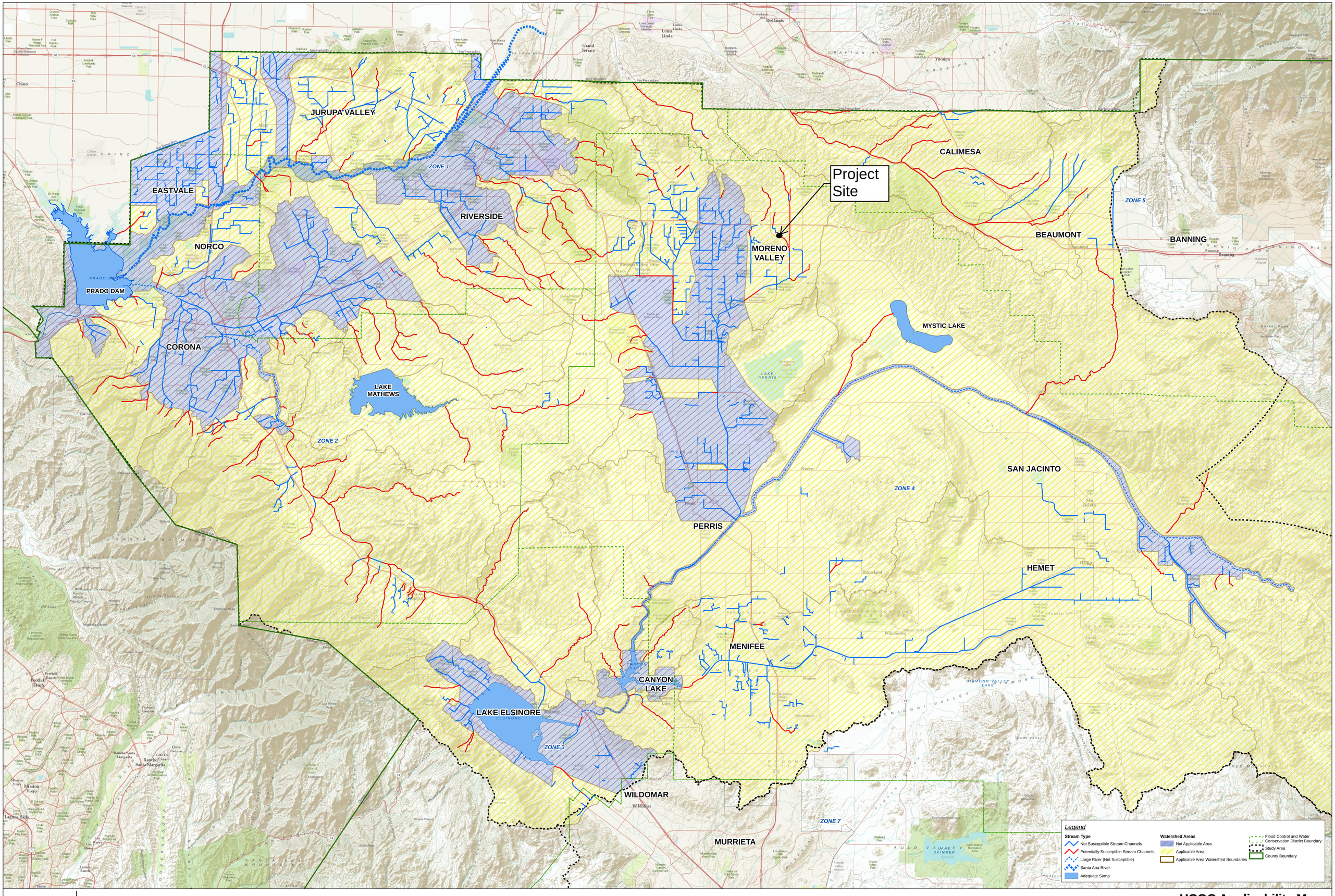
N

Rain Gage Locations

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

Isohyetal Map for the 85th Percentile 24 hour Storm Event

July 2011



HCOC Applicability Map

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

Map 2

WQMP Project Report

County of Riverside Stormwater Program

Santa Ana River Watershed Geodatabase

Wednesday, January 30, 2019

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

Project Site Parcel Number(s):	488390015, 488390016
Latitude/Longitude:	33.9337, -117.1746
Thomas Brothers Page:	718
Project Site Acreage:	6.10
Watershed(s):	SANTA ANA
This Project Site Resides in the following Hydrologic Unit (s) (HUC):	**HUC Name** - HUC Number **Moreno Valley** - 180702020304
The HUCs Contribute stormwater to the following 303d listed water bodies and TMDLs which may include drainage from your proposed Project Site:	**WBID Name** - WBID Number **Canyon Lake (Railroad Canyon Reservoir)** - CAL8021100019990208151525 **Elsinore, Lake** - CAL8023100019990208151100
These 303d listed Water bodies and TMDLs have the following Pollutants of Concern (POC):	**Bacterial Indicators** - Pathogens **Nutrients** - Nutrients, Organic Enrichment/Low Dissolved Oxygen **Other Organics** - PCBs (Polychlorinated biphenyls) **Toxicity** - Sediment Toxicity, Unknown Toxicity
Limitations on Infiltration:	**Project Site Onsite Soils Group(s)** - A, B **Known Groundwater Contamination Plumes within 1000'** - No **Adjacent Water Supply Wells(s)** - No information available please contact your local water agency for more information. Your local contact agency is EASTERN MUNICIPAL W.D.. Your local wholesaler contact agency is METROPOLITAN WATER DISTRICT.
Environmentally Sensitive Areas within 200'(Fish and Wildlife Habitat/Species):	None
Environmentally Sensitive Areas within 200'(CVMSHCP):	None
Environmentally Sensitive Areas within 200'(WRMSHCP):	Burrowing Owl Survey Required Area
Groundwater elevation from Mean Sea Level:	1560
85th Percentile Design Storm Depth (in):	0.669
Groundwater Basin:	Perris-North
MSHCP/CVMSHCP Criteria Cell(s):	No Data
Retention Ordinance Information:	No Data
Studies and Reports Related to Project Site:	Comprehensive Nutrient Reduction Plan IBI Scores - Southern Cal bulletin118_4-sc water_fact_3_7.11 8039-SAR-Hydromodification Moreno MDP West San Jacinto GW Basin Management Plan Moreno ADP Report Moreno ADP Map

Appendix 2: Construction Plans

Grading and Drainage Plans

CITY OF MORENO VALLEY
PLOT PLAN FOR
CAR PROS - KIA SALES AND SERVICE FACILITY

OWNER / APPLICANT:
MV HOLDINGS, LLC
181 S. 333RD STREET # C
FEDERAL WAY, WA 98003

OWNER'S REPRESENTATIVE / CONTACT
EPD SOLUTIONS
2030 MAIN STREET # 1200
IRVINE, CA 92614
(949) 278-5413
ANDREA ARCILLA
ANDREA@EPDSOLUTIONS.COM

ENGINEER
KIMLEY HORN & ASSOCIATES, INC.
3880 LEMON STREET # 420
RIVERSIDE, CA 92501
ATTN: BOBBY KOHLTFARBER
(951) 543-9870
BOBBY.KOHLTFARBER@KIMLEY-HORN.COM

SURVEY
GRENIER AND SONS
28212 HORIZON CT
SUN CITY, CA 92585
ATTN: ANDY GRENIER, LS 7891
(951) 543-8462
ANDYG@GRENIER-AND-SONS.COM

SURVEY DATE
FEBRUARY 19, 2019

DATE PREPARED
5/17/19

ARCHITECT
CARLILE COATSWORTH ARCHITECTS, INC.
2495 CAMPUS DRIVE, 2ND FLOOR
ORVINE, CA 92612
(949) 833-1930
JAMIE C. POLADIAN, AIA

LEGAL DESCRIPTION
PARCEL 7 AND 8 OF PARCEL MAP NO. 23244, IN THE CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS PER MAP RECORDED IN BOOK 161, PAGES 16 THROUGH 24 INCLUSIVE OF PARCEL MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.

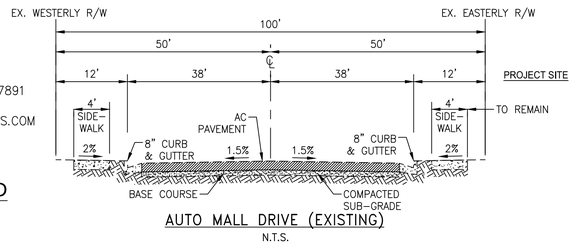
FEMA
THE SUBJECT PROPERTY LIES WITHIN ZONE "X" – AREAS OF 0.2% ANNUAL CHANCE FLOOD SHOWN ON FLOOD INSURANCE RATE MAP PREPARED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY, COMMUNITY.PANEL NUMBER 06065C0770G, WHICH BEARS AN EFFECTIVE DATE AUGUST 28, 2008.

PROPERTY ADDRESS
NORTHEAST CORNER OF AUTO MALL DRIVE AND MORENO BEACH DRIVE INTERSECTION IN THE CITY OF MORENO VALLEY, CALIFORNIA.

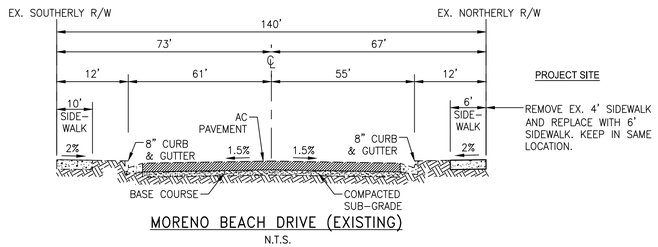
EASEMENTS
- ITEM 2D: THE FACT THAT THE OWNERSHIP OF SAID LAND DOES NOT INCLUDE RIGHTS OF ACCESS TO OR FROM MORENO BEACH DRIVE, SUCH RIGHTS HAVING BEEN RELINQUISHED BY PARCEL MAP NO. 23244.
- ITEM 6D: AN EASEMENT GRANTED TO SOUTHERN CALIFORNIA EDISON COMPANY, A CORPORATION FOR ELECTRIC SYSTEMS AND COMMUNICATION SYSTEMS PURPOSES RECORDED JULY 3, 1990 AS INSTRUMENT NO. 246837, OFFICIAL RECORDS.
- ITEM 8D: AN EASEMENT GRANTED TO GENERAL TELEPHONE COMPANY OF CALIFORNIA, A CORPORATION AND EASTERN MUNICIPAL WATER DISTRICT. A MUNICIPAL WATER DISTRICT FOR UTILITY PURPOSES RECORDED JUNE 22, 1990 AS INSTRUMENT NO. 231986, OFFICIAL RECORDS.
- ITEM 3C: AN EASEMENT FOR LANDSCAPE PURPOSES AS SHOWN OR AS OFFERED FOR DEDICATION ON PARCEL MAP 23244.
- ITEM 5C: AN EASEMENT GRANTED TO GENERAL TELEPHONE COMPANY OF CALIFORNIA, A CORPORATION AND EASTERN MUNICIPAL WATER DISTRICT. A MUNICIPAL WATER DISTRICT FOR UTILITY PURPOSES RECORDED JUNE 22, 1990 AS INSTRUMENT NO. 231986, OFFICIAL RECORDS.
- ITEM 6C: AN EASEMENT GRANTED TO SOUTHERN CALIFORNIA EDISON COMPANY, A CORPORATION FOR ELECTRIC SYSTEMS AND COMMUNICATION SYSTEMS PURPOSES RECORDED JULY 3,1990 AS INSTRUMENT NO. 246837, OFFICIAL RECORDS.

UTILITIES
WATER:	EASTERN MUNICIPAL WATER DISTRICT (800) 426-3693
SEWER	EASTERN MUNICIPAL WATER DISTRICT (800) 426-3693
TELEPHONE:	FRONTIER COMMUNICATIONS (855) 679-3074
GAS:	THE GAS COMPANY (800) 427-2200
ELECTRIC:	SO. CAL. EDISON CO. (800) 684-8123
CABLE:	SPECTRUM CABLE CO. (855) 757-7328

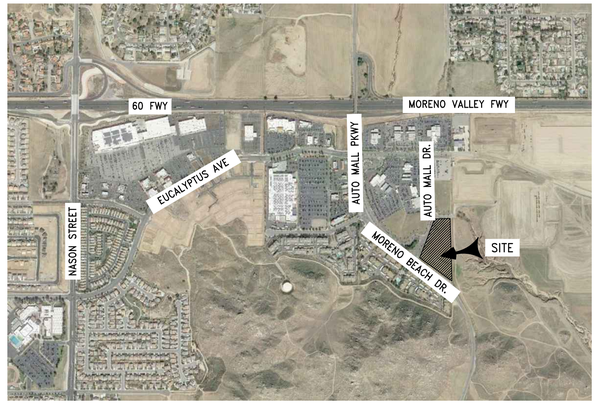
GENERAL NOTES:
1. ALL ROOF DRAINS TO DRAIN TO CONCRETE SPLASH PAD.
2. ROOF DRAINS TO BE DIRECTED TO A LANDSCAPE AREA.



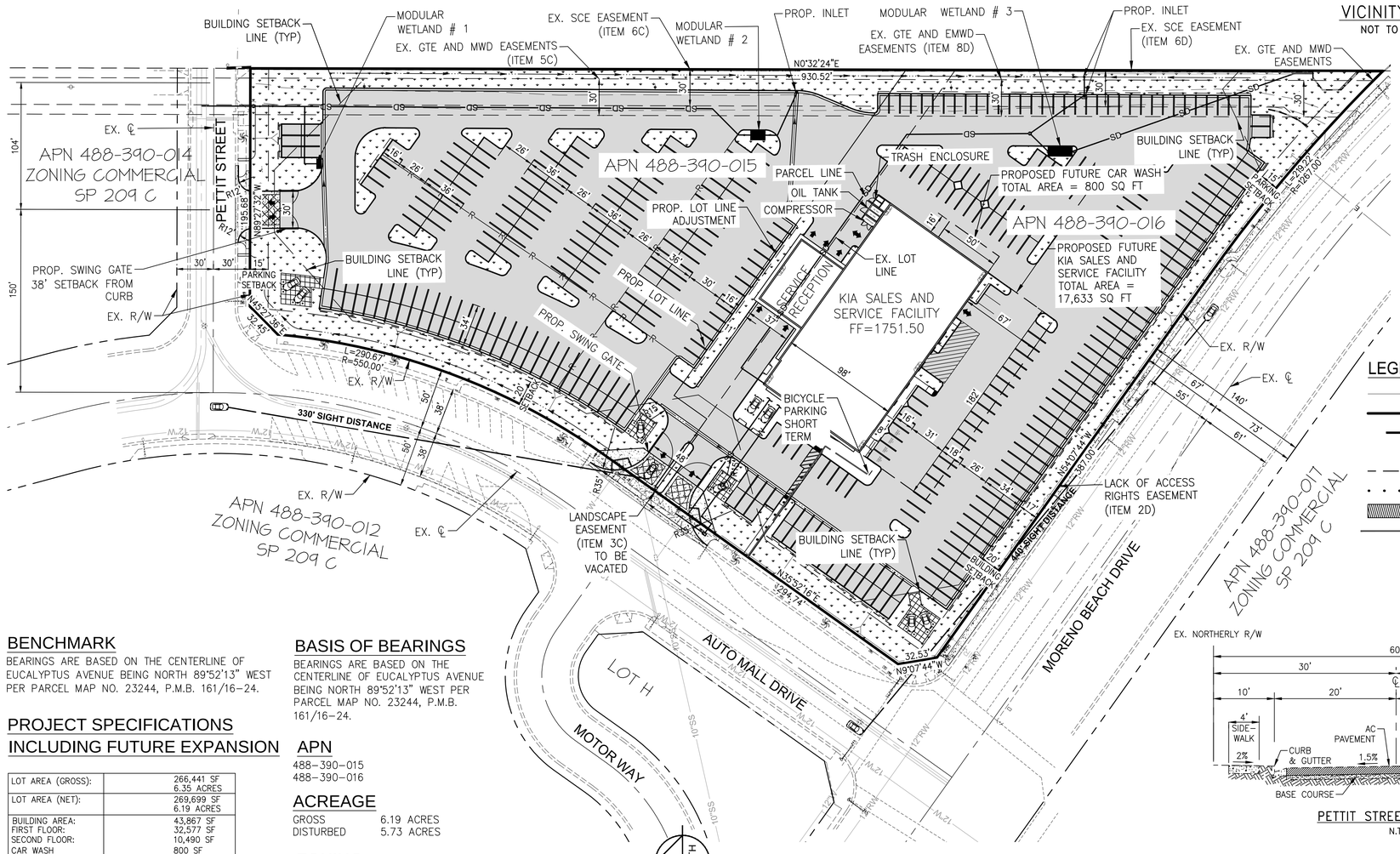
AUTO MALL DRIVE (EXISTING)
N.T.S.



MORENO BEACH DRIVE (EXISTING)
N.T.S.



VICINITY MAP
NOT TO SCALE



BENCHMARK
BEARINGS ARE BASED ON THE CENTERLINE OF EUCALYPTUS AVENUE BEING NORTH 89°52'13" WEST PER PARCEL MAP NO. 23244, P.M.B. 161/16-24.

BASIS OF BEARINGS
BEARINGS ARE BASED ON THE CENTERLINE OF EUCALYPTUS AVENUE BEING NORTH 89°52'13" WEST PER PARCEL MAP NO. 23244, P.M.B. 161/16-24.

PROJECT SPECIFICATIONS INCLUDING FUTURE EXPANSION

LOT AREA (GROSS):		266,441 SF 6.35 ACRES
LOT AREA (NET):		269,699 SF 6.19 ACRES
BUILDING AREA: FIRST FLOOR: SECOND FLOOR: CAR WASH		43,867 SF 32,577 SF 10,490 SF 800 SF
COVERAGE (ON NET):		12.38%
FLOOR AREA RATIO	(ON NET):	16.27%
PARKING REQUIRED: 24,414 SF @ 1 / 2,000 SF		22 SPACES
PARKING PROVIDED STANDARD: ADA		56 SPACES 52 SPACES 4 SPACES
LANDSCAPE PROVIDED:		60,680 SF (22.5%)

APN
488-390-015
488-390-016

ACREAGE
GROSS 6.19 ACRES
DISTURBED 5.73 ACRES

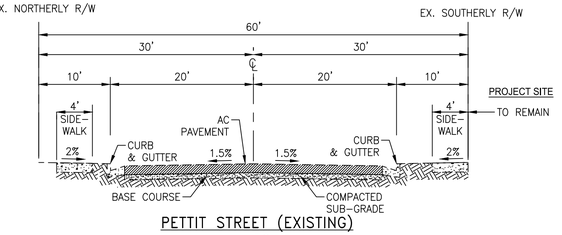
ZONING
SP 209-C
COMMERCIAL

CONTOUR INTERVAL
1'

GRAPHIC SCALE IN FEET
0 25 50 100
SCALE 1" = 50'

ABBREVIATIONS:
AC	ACRES
APN	ASSESSOR'S PARCEL NUMBER
BLDG	BUILDING
CO	CLEAN OUT
EX	EXISTING
EG	EXISTING GROUND
FF	FINISHED FLOOR ELEVATION
FG	FINISHED GRADE
FH	FIRE HYDRANT
FL	FLOW LINE
FS	FINISHED SURFACE
FW	FIRE WATER
GB	GRADE BREAK
INV	INVERT
MH	MANHOLE
POC	POINT OF CONNECTION
PROP	PROPOSED
RL	RIDGE LINE
R/W	RIGHT-OF-WAY
SF	SQUARE FEET
STBK	SETBACK
SWLK	SIDEWALK
TC	TOP OF CURB
TRW	TOP OF RETAINING WALL
TYP	TYPICAL
C&G	CURB AND GUTTER

LEGEND
- CENTERLINE
- RIGHT-OF-WAY (R/W)
- STRIPING
- PROP. LIGHT
- FUTURE EXPANSION BLDG LIMITS
- ACCESSIBLE PATH OF TRAVEL
- 4' R/W DEDICATION
- BICYCLE PATH OF TRAVEL



PETTIT STREET (EXISTING)
N.T.S.

PEN19-0047

IMPORTANT NOTICE
SECTION 4216/4217 OF THE GOVERNMENT CODE REQUIRES A DIG ALERT IDENTIFICATION NUMBER TO BE ISSUED BEFORE A "PERMIT TO EXCAVATE" WILL BE VALID.
UNDERGROUND SERVICE ALERT
TOLL FREE 1-800-422-4133
TWO WORKING DAYS BEFORE YOU DIG

DRAWN BY	RS
DESIGN BY	RS
CHECKED BY	BK

Kimley»Horn

3880 LEMON STREET, SUITE 420
RIVERSIDE, CA 92501
PHONE: (951) 543-9868
WWW.KIMLEY-HORN.COM

BOBBY KOHLTFARBER No. C68141 CIVIL

CITY OF MORENO VALLEY
PLOT PLAN
FOR
CAR PROS – KIA SALES AND SERVICE FACILITY
COVER SHEET

1
SHEET 1 OF 3
CITY I.D. NO.
PEN19-0047

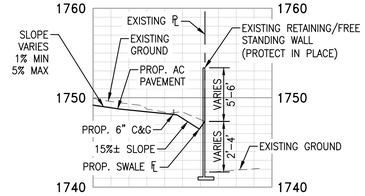
\\RIVFP01\CA_RIV\RIV_LDEV\194117001_CCA_KIA_MORENO_VALLEY_\CAD\PLANSHEETS\PRELIMINARY FOR CUP SUBMITTAL\1 COVER SHEET CUP.DWG 5/17/2019 11:18:40 AM 3RD REVIEW

WALL NOTE:

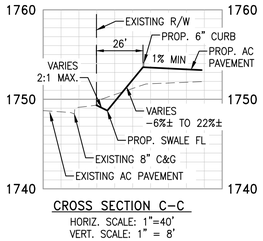
ADDITIONAL COURSES TO BE ADDED TO EXISTING WALL TO MAKE IT A MINIMUM OF 6' HIGH MEASURED FROM THE FINISH GRADE. IF SCE OWNS THE WALL, AN APPROVAL SHALL BE OBTAINED FROM SCE PRIOR TO ADDING COURSES FOR PROPER CLEARANCE TO THE EXISTING POWER LINES.

LEGEND

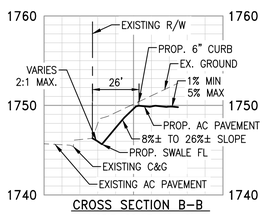
- CENTERLINE
- RIGHT-OF-WAY (R/W)
- STRIPING
- PROP. LIGHT
- 4' R/W DEDICATION
- FIRE TRUCK/DELIVERY TRUCK/ TRASH TRUCK CIRCULATION PER CALTRANS DESIGN MANUAL TURN TEMPLATES
- PROPOSED LOT LINE ADJUSTMENT



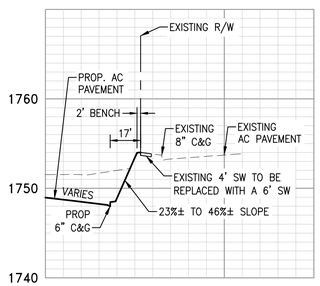
CROSS SECTION A–A
HORIZ. SCALE: 1"=40'
VERT. SCALE: 1" = 8'



CROSS SECTION C–C
HORIZ. SCALE: 1"=40'
VERT. SCALE: 1" = 8'



CROSS SECTION B–B
HORIZ. SCALE: 1"=40'
VERT. SCALE: 1" = 8'



CROSS SECTION D–D
HORIZ. SCALE: 1"=40'
VERT. SCALE: 1" = 8'

ESTIMATED EARTHWORK QUANTITIES

CUT:	19,600 CY
FILL:	1,215 CY
NET:	18,385 CY – EXPORT

NOTE: THE ABOVE QUANTITIES ARE APPROXIMATE IN PLACE VOLUMES CALCULATED FROM THE EXISTING GROUND TO THE PROPOSED FINISHED GRADE. EXISTING GROUND IS DEFINED BY THE CONTOURS AND SPOT GRADES ON THE BASE SURVEY. PROPOSED FINISHED GRADE IS DEFINED AS THE FINAL GRADE AS INDICATED ON THE GRADING PLAN(S).

THE EARTHWORK QUANTITIES ABOVE ARE FOR PERMIT PURPOSES ONLY. THEY HAVE NOT BEEN FACTORED TO ACCOUNT FOR CHANGES IN VOLUME DUE TO BULKING, CLEARING AND GRUBBING, SHRINKAGE, OVER– EXCAVATION AND RE–COMPACTION, AND CONSTRUCTION METHODS. NOR DO THEY ACCOUNT FOR THE THICKNESS OF PAVEMENT SECTIONS, FOOTINGS, SLABS, REUSE OF PULVERIZED MATERIALS THAT WILL UNDERLIE NEW PAVEMENTS, ETC. THE CONTRACTOR SHALL RELY ON THEIR OWN EARTHWORK ESTIMATES FOR BIDDING PURPOSES.

ROOF DRAIN KEY NOTES:

1. INTERNAL ROOF DRAIN TO BE CONNECTED TOGETHER UNDER THE ROOF AND ROUTED TO ADJACENT LANDSCAPE AREAS.
2. EXTERNAL ROOF DRAIN TO BE CONNECTED TO STORM DRAIN SYSTEM AS SHOWN.

NOTES:

1– A COMMUNICATION CONDUIT ALONG PROJECT FRONTAGE ON MORENO BEACH DRIVE MAY BE REQUIRED PER CITY STANDARD NO. MVSI–186–0
2–FOR–SALE VEHICLE LOADING/UNLOADING SHALL BE DONE ON–SITE WITHIN THE PROJECT PARKING LOT
3–NO PARKING SIGNS SHALL BE INSTALLED ON PETTIT STREET

GRAPHIC SCALE IN FEET
0 20 40 80
SCALE 1" = 40'

DRAWN BY	RS
DESIGN BY	RS
CHECKED BY	BK

Kimley»Horn

3880 LEMON STREET, SUITE 420
RIVERSIDE, CA 92501
PHONE: (951) 543–9868
WWW.KIMLEY–HORN.COM

BOBBY KOHLTFARBER No. C68141 CIVIL

CITY OF MORENO VALLEY

PLOT PLAN FOR CAR PROS – KIA SALES AND SERVICE FACILITY CONCEPTUAL GRADING PLAN

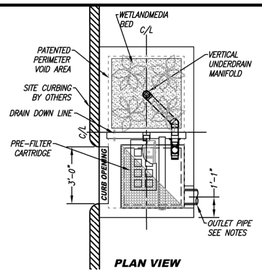
PEN19-0047

SHEET 2 OF 3
CITY I.D. NO. PEN19-0047

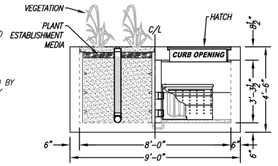
3RD REVIEW

\\RIVFP01\CA_RIV\RIV_LDEV\194117001_CCA_KIA_MORENO_VALLEY_\CAD\PLANSHEETS\PRELIMINARY FOR CUP SUBMITTAL\2 GRADING SHEET CUP.DWG 5/17/2019 12:25:52 PM

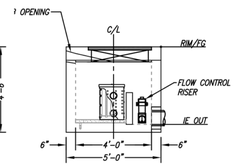
SITE SPECIFIC DATA			
PROJECT NUMBER	194117001		
ORDER NUMBER			
PROJECT NAME	CAR PROS KIA		
PROJECT LOCATION	MORENO VALLEY		
STRUCTURE ID	BMP-1		
TREATMENT REQUIRED			
VOLUME BASED (CF)	FLOW BASED (CFS)		
N/A	0.1		
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE		1.97	
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	1745.7	HDPE	6"
INLET PIPE 2			
OUTLET PIPE	1745.7	HDPE	6"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	1749.8	1749.8	1749.8
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	36" X 36"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			TBD
ORIFICE SIZE (DIA. INCHES)			TBD
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.			



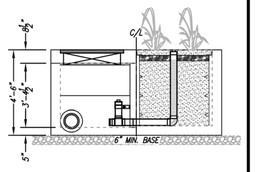
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.115
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

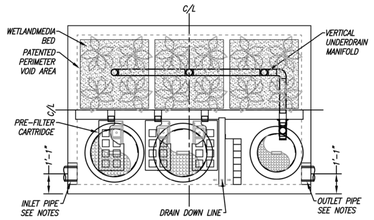
1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.

MWS-L-4-8-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

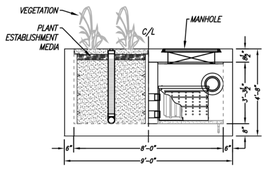
BMP-1
N.T.S.

3

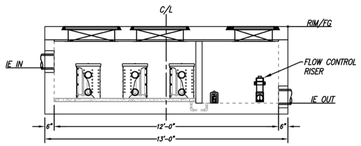
SITE SPECIFIC DATA			
PROJECT NUMBER	194117001		
ORDER NUMBER			
PROJECT NAME	CAR PROS KIA		
PROJECT LOCATION	MORENO VALLEY		
STRUCTURE ID	BMP-2		
TREATMENT REQUIRED			
VOLUME BASED (CF)	FLOW BASED (CFS)		
N/A	0.3		
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE		4.26	
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	1743.5	HDPE	12"
INLET PIPE 2			
OUTLET PIPE	1743.5	HDPE	12"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	1747.6	1747.6	1747.6
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	2EA ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			TBD
ORIFICE SIZE (DIA. INCHES)			TBD
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.			



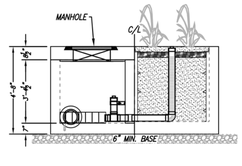
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.346
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASS. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

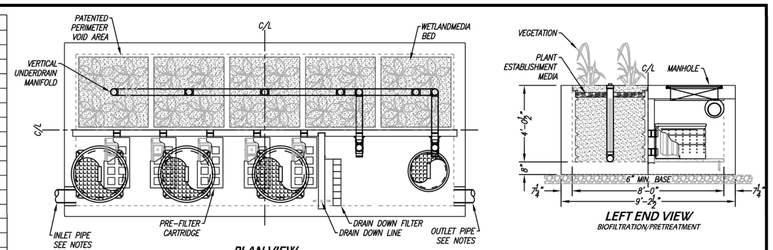
1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.

MWS-L-8-12-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

BMP-2
N.T.S.

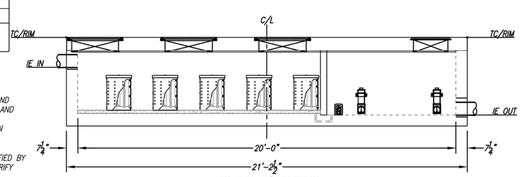
4

SITE SPECIFIC DATA			
PROJECT NAME	CAR PROS KIA		
PROJECT LOCATION	MORENO VALLEY		
STRUCTURE ID	BMP-3		
TREATMENT REQUIRED			
VOLUME BASED (CF)	FLOW BASED (CFS)		
N/A	0.5		
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE		8.13	
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	1742.5	HDPE	12"
INLET PIPE 2			
OUTLET PIPE	1742.5	HDPE	12"
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	1746.6	1746.6	1746.6
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			11.85
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø2.43"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			

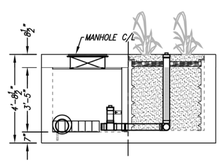


PLAN VIEW

LEFT END VIEW
BIOFILTRATION/PRETREATMENT



ELEVATION VIEW



RIGHT END VIEW
DISCHARGE/BIOFILTRATION

TREATMENT FLOW (CFS)	0.577
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

INSTALLATION NOTES

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3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

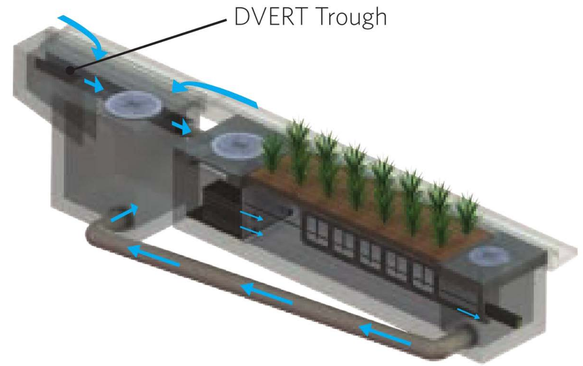
1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

MWS-L-8-20-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

BMP-3
N.T.S.

5

DVERT LOW FLOW DIVERSION



MODULAR WETLAND BYPASS SYSTEM
N.T.S.

PEN19-0047

DRAWN BY	RS
DESIGN BY	RS
CHECKED BY	BK

Kimley»Horn

3880 LEMON STREET, SUITE 420
RIVERSIDE, CA 92501
PHONE: (951) 543-9868
WWW.KIMLEY-HORN.COM

ROBERT KOHL FARRIER No. C68141 CIVIL

CITY OF MORENO VALLEY

PLOT PLAN FOR CAR PROS – KIA SALES AND SERVICE FACILITY DETAILS

3

SHEET 3 OF 3

CITY I.D. NO. PEN19-0047

3RD REVIEW

\\RIVFP01\CA_RIV_RIV_LDEV\194117001_CCA_KIA_MORENO_VALLEY_\CAD\PLANSHEETS\PRELIMINARY FOR CUP SUBMITTAL\3 DETAIL SHEET CUP.DWG 5/17/2019 10:38:19 AM

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Western Riverside Area, California

January 30, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,610 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Western Riverside Area, California
Survey Area Data: Version 11, Sep 12, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 14, 2015—Jan 21, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
GkD	Gorgonio loamy sand, channeled, 2 to 15 percent slopes	0.8	13.6%
GyC2	Greenfield sandy loam, 2 to 8 percent slopes, eroded	1.3	21.7%
HcD2	Hanford coarse sandy loam, 8 to 15 percent slopes, eroded	0.1	2.0%
PaC2	Pachappa fine sandy loam, 2 to 8 percent slopes, eroded	3.8	62.7%
Totals for Area of Interest		**6.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Western Riverside Area, California

GkD—Gorgonio loamy sand, channeled, 2 to 15 percent slopes

Map Unit Setting

National map unit symbol: hcvd
Elevation: 20 to 3,000 feet
Mean annual precipitation: 8 to 25 inches
Mean annual air temperature: 46 to 63 degrees F
Frost-free period: 110 to 310 days
Farmland classification: Not prime farmland

Map Unit Composition

Gorgonio and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gorgonio

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 15 inches: loamy sand
H2 - 15 to 60 inches: stratified gravelly loamy sand to gravelly loamy fine sand

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: SANDY ALLUVIAL (1975) (R019XD069CA)
Hydric soil rating: No

Minor Components

Riverwash

Percent of map unit: 10 percent
Landform: Drainageways
Hydric soil rating: Yes

Riverwash
Percent of map unit: 4 percent
Landform: Channels
Hydric soil rating: Yes

Soboba
Percent of map unit: 3 percent
Hydric soil rating: No

Tujunga
Percent of map unit: 3 percent
Hydric soil rating: No

GyC2—Greenfield sandy loam, 2 to 8 percent slopes, eroded

Map Unit Setting
National map unit symbol: hcvw
Elevation: 100 to 3,500 feet
Mean annual precipitation: 9 to 20 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 200 to 300 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Greenfield and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenfield

Setting
Landform: Alluvial fans, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile
H1 - 0 to 26 inches: sandy loam
H2 - 26 to 43 inches: fine sandy loam
H3 - 43 to 60 inches: loam
H4 - 60 to 72 inches: stratified loamy sand to sandy loam

Properties and qualities
Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: LOAMY (1975) (R019XD029CA)
Hydric soil rating: No

Minor Components

Hanford

Percent of map unit: 3 percent
Hydric soil rating: No

Pachappa

Percent of map unit: 3 percent
Hydric soil rating: No

Arlington

Percent of map unit: 3 percent
Hydric soil rating: No

Ramona

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 3 percent
Hydric soil rating: No

HcD2—Hanford coarse sandy loam, 8 to 15 percent slopes, eroded

Map Unit Setting

National map unit symbol: hcw3
Elevation: 150 to 900 feet
Mean annual precipitation: 9 to 20 inches
Mean annual air temperature: 63 to 64 degrees F
Frost-free period: 250 to 280 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hanford and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hanford

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 8 inches: coarse sandy loam
H2 - 8 to 40 inches: fine sandy loam
H3 - 40 to 60 inches: stratified loamy sand to coarse sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: SANDY (R020XD012CA)
Hydric soil rating: No

Minor Components

Tujunga

Percent of map unit: 5 percent
Hydric soil rating: No

Greenfield

Percent of map unit: 5 percent
Hydric soil rating: No

Ramona

Percent of map unit: 5 percent
Hydric soil rating: No

PaC2—Pachappa fine sandy loam, 2 to 8 percent slopes, eroded

Map Unit Setting

National map unit symbol: hcxp

Elevation: 1,000 feet
Mean annual precipitation: 14 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 270 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Pachappa and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pachappa

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 20 inches: fine sandy loam
H2 - 20 to 40 inches: loam
H3 - 40 to 63 inches: fine sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: LOAMY (1975) (R019XD029CA)
Hydric soil rating: No

Minor Components

San emigdio

Percent of map unit: 5 percent
Hydric soil rating: No

Hanford

Percent of map unit: 5 percent
Hydric soil rating: No

Greenfield

Percent of map unit: 5 percent

Hydric soil rating: No

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GEOTECHNICAL INVESTIGATION AND PERCOLATION TEST RESULTS

KIA MORENO VALLEY
EAST OF MORENO BEACH DRIVE AND AUTO MALL WAY
MORENO VALLEY, CALIFORNIA

GEOCON
WEST, INC.

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

CAR PROS AUTOMOTIVE GROUP
FEDERAL WAY, WASHINGTON

JANUARY 18, 2019
PROJECT NO. T2844-22-01

Project No. T2844-22-01
January 18, 2019

Cars Pros Automotive Group
181 S 333rd Street, Building C, Suite 210
Federal Way, Washington 98002

Attention: Mr. Ken Phillips

Subject: GEOTECHNICAL INVESTIGATION
AND PERCOLATION TEST RESULTS
KIA MORENO VALLEY
EAST OF MORENO BEACH DRIVE
AND AUTO MALL DRIVE
MORENO VALLEY, CALIFORNIA

Dear Mr. Phillips:

In accordance with your authorization of Proposal No. IE-2287, Geocon West Inc. (Geocon) herein submits the results of our geotechnical investigation and percolation test results for the subject site. The accompanying report presents the results of our study and conclusions and recommendations pertaining to the geotechnical aspects of the proposed automotive sales lot. The site is considered suitable for development provided the recommendations of this report are followed.

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

Very truly yours,

GEOCON WEST, INC.

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(e-mail) Addressee

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GEOTECHNICAL INVESTIGATION
AND PERCOLATION TEST RESULTS

1. PURPOSE AND SCOPE

This report presents the results of our geotechnical investigation and percolation tests for the planned automotive sales development located east of the intersection of Moreno Beach Drive and Auto Mall Drive, in the city of Moreno Valley, California (see *Vicinity Map*, Figure 1). The purpose of the geotechnical investigation is to evaluate the surface and subsurface soil conditions and general site geology, and to identify geotechnical constraints that may affect development of the property. Percolation testing was performed to provide information for site storm water infiltration design. This investigation also included a review of readily available published and unpublished geologic literature (see *List of References*).

The scope of this investigation included performing a site reconnaissance, field exploration, engineering analyses, and preparing this report. We performed our field investigation on December 17 and 18, 2018 by drilling ten small-diameter borings to a maximum depth of 51½ feet below the existing ground surface. Four of the borings were used to perform percolation testing. The *Geologic Map*, Figure 2, presents the approximate locations of the borings. *Appendix A* provides a detailed discussion of the field investigation including logs of the borings and percolation test results. Details of the laboratory tests and a summary of the test results are presented in *Appendix B* and on the boring logs in *Appendix A*.

Recommendations presented herein are based on analyses of data obtained from our site investigation and our understanding of proposed site development. References reviewed to prepare this report are provided in the *List of References*. If project details vary significantly from those described herein, Geocon should be contacted to evaluate the necessity for review and possible revision of this report.

2. SITE AND PROJECT DESCRIPTION

The subject site is located southeast of the intersection of Moreno Beach Drive and Auto Mall Drive in the city of Moreno Valley, California. The site is bounded on the west by Auto Mall Drive, the north by Petit Street, the south by Moreno Beach Drive, and on the east by a parcel line. The site is currently vacant and appears to be periodically disked for weed abatement. Periodic use of the site as a parking lot was observed during our site exploration. Access to the property is from Petit Street. The existing grades range from approximate elevation 1,750 feet above Mean Sea Level (MSL) in the north to 1,755 feet above MSL in the south. A stockpile is located in the southern portion of the site, as shown on Figure 2. The maximum height of the stockpile is approximately 5 feet. The site is at latitude 33.93375 and longitude -117.17466.

Based on the *Site Plan,* prepared by Carlile Coatsworth Architects, Inc., we understand that the proposed construction consists of a 24,661-square-foot sales and service facility, car wash, several vehicle display areas, with associated parking and infrastructure. A grading plan has not been provided for our review; however, based on current site conditions, cuts and fills of less than 10 feet are expected at the site.

Based on the preliminary plans, we understand that the proposed building will be constructed of concrete masonry unit (CMU) walls and concrete cast-in-place or tilt-up walls and supported on conventional spread footing foundations with a concrete slab-on-grade floor. We expect column loads will be up to 100 kips and wall loads will be up to 10 kips per linear foot. Preliminary geotechnical recommendations for design of the structure are based on these assumptions and provided herein.

The site descriptions and proposed development are based on a site reconnaissance, review of published geologic literature, our field investigation, a review of the conceptual plans, and discussions with you. If development plans differ from those described herein, Geocon should be contacted for review of the plans and possible revisions to this report.

3. GEOLOGIC SETTING

The site is located within the Perris block of the northern Peninsular Ranges Geomorphic Province (Province), defined as a relatively stable area between the Elsinore and San Jacinto fault zones. In the vicinity of the site, the geomorphology consists of older alluvial fan deposits. The Peninsular Ranges are bounded by the Transverse Ranges (San Gabriel and San Bernardino Mountains) to the north and the Colorado Desert Geomorphic Province to the east. The Peninsular Ranges Geomorphic Province extends westward into the Pacific Ocean and southward to the tip of Baja California. Overall, the Province is characterized by Cretaceous-age granitic rock and a lesser amount of Mesozoic-age metamorphic rock overlain by terrestrial and marine sediments. Faulting within the Province is typically northwest trending and includes the San Andreas, San Jacinto, Elsinore, and Newport-Inglewood faults.

The San Jacinto fault zones is located approximately 1.8 miles to the northeast. Geologic units within the site consist of very old alluvial fan deposits and a stockpile of undocumented fill.

4. SOIL AND GEOLOGIC CONDITIONS

We observed very old alluvial fan deposits with a thin mantle of overlying undocumented fill during our field investigation. The occurrence, distribution and description of the geologic units encountered are shown on the *Geologic Map*, Figure 2 and the boring logs in *Appendix A*. The surficial soils and geologic units are described herein in order of increasing age.

4.1 Undocumented Fill (afu)

Undocumented fill was observed throughout the site in the top 1 to 4 feet of the borings during our geotechnical investigation. The stockpile of undocumented fill in the south-central portion of the site was observed to be approximately 5 feet thick. As observed the undocumented fill consists of loose to medium dense, dry to damp, reddish brown silty sand. A minor amount of clayey sand was also encountered.

4.2 Very Old Alluvial Fan Deposits (Qvof)

Very old alluvium was observed underlying the undocumented fill through the site. As observed, the older alluvium consists predominately of damp to moist, medium dense to very dense silty sand. Lesser amounts of clayey sand, sandy silt, and sandy clay was also encountered.

5. GROUNDWATER

We did not encounter groundwater or seepage during the site investigation. According to the California Department of Water Resources, several wells in the area indicated a depth to groundwater in excess of 190 feet below the existing ground surface. It is not uncommon for seepage conditions to develop where none previously existed. Groundwater and seepage are dependent on seasonal precipitation, irrigation, land use, among other factors, and varies as a result. Proper surface drainage will be important to future performance of the project.

6. GEOLOGIC HAZARDS

6.1 Faulting

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

The site is not within a currently established State of California Alquist-Priolo Earthquake Fault Zone or a Riverside County Fault Hazard Zone for surface fault rupture hazards. No active or potentially active faults with the potential for surface fault rupture are known to pass directly beneath the site.

According to the *Fault Activity Map of California* (2010), 18 known active faults are located within a search radius of 50 miles from the property. The nearest known active fault is the Claremont fault segment of the San Jacinto fault zone, located approximately 2 miles west of the site, and is the dominant source of potential ground motion. Earthquakes that might occur on these fault zones or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. Table 6.1.1 lists the estimated maximum earthquake magnitude for the most dominant faults in relationship to the site location.

TABLE 6.1.1
KNOWN ACTIVE FAULTS WITHIN 50 MILES OF THE SITE

Fault Name	Maximum Earthquake Magnitude (Mw)	Distance from Site (miles)	Direction from Site
San Jacinto (Claremont)	6.7	2	NE
San Jacinto (Casa Loma)	6.9	2.8	E
San Gorgonio Pass	7.6	8	E
Banning	7.2	10	SE
San Andreas (San Bernardino)	8.2	12	NE
San Jacinto	7.8	13	N
San Jacinto (Glen Helen)	6.7	13	N
Elsinore (Main Street)	6.7	21	W
Chino	6.7	22	W
Elsinore (Glen Ivy North)	6.8	23	WSW
Elsinore (Whittier)	6.9	24	W
Morongo Valley	7.2	28	E
Pinto Mountain	7.3	35	E
San Andreas Fault (South Branch)	8.2	40	SE
Burt Mountain	6.8	41	ENE
San Jacinto (Clark)	6.8	43	N
San Andreas Fault (North Branch)	8.2	47	N
Newport-Inglewood	7.5	50	SW

Historic earthquakes in southern California of magnitude 6.0 and greater, their magnitude, distance, and direction from the site are listed in Table 6.1.2.

TABLE 6.1.2
HISTORIC EARTHQUAKE EVENTS WITH REPECT TO THE SITE

Earthquake (Oldest to Youngest)	Date of Earthquake	Magnitude	Distance to Epicenter (Miles)	Direction to Epicenter
San Jacinto	December 25, 1899	6.7	16	SE
San Jacinto	April 21, 1918	6.8	16	SE
Loma Linda Area	July 22, 1923	6.3	6	NW
Long Beach	March 10, 1933	6.4	50	WSW
Buck Ridge	March 25, 1937	6.0	64	ESE
Imperial Valley	May 18, 1940	6.9	51	E
Desert Hot Springs	December 4, 1948	6.0	45	E
Arroyo Salada	March 19, 1954	6.4	77	E
Borrego Mountain	April 8, 1968	6.5	84	SE
San Fernando	February 9, 1971	6.6	84	WNW
Joshua Tree	April 22, 1992	6.1	54	E
Landers	June 28, 1992	7.3	50	ENE
Big Bear	June 28, 1992	6.4	29	NE
Northridge	January 17, 1994	6.7	88	WNW
Hector Mine	October 16, 1999	7.1	73	NE

6.2 Ground Rupture

Ground surface rupture occurs when movement along a fault is sufficient to cause a gap or rupture where the upper edge of the fault zone intersects the earth surface. The potential for ground rupture is considered to be very low due to the absence of active or potentially active faults at the subject site.

6.3 Liquefaction

Liquefaction typically occurs when a site is located in a zone with seismic activity, onsite soils are cohesionless or silt/clay with low plasticity, groundwater is encountered within 50 feet of the surface, and soil has a relative density less than about 70 percent. If the four previous criteria are met, a seismic event could result in a rapid pore water pressure increase from the earthquake-generated ground accelerations. Due to the lack of a permanent, near-surface groundwater table and the dense to very dense nature of the old alluvial fan deposits, liquefaction potential for the site is negligible and not a design consideration.

6.4 Expansive Soil

The older alluvium generally consists of silty or clayey sands with lesser amounts of sandy silts and sandy clays. Laboratory testing results indicate samples of the near surface soils exhibits a “very low” expansion potential (expansion index [EI] of 20 or less) with test results showing expansion index of 3.

6.5 Hydrocompression

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

Soils obtained during our investigation were tested for hydrocompression and exhibited a collapse potential up to 2.2 percent when loaded to the expected post-grading pressures. The test results indicate that the soils are classified as having a "slight" (0.1 to 2.0 percent) to "moderate" (2.1 to 6.0) degree of specimen collapse in accordance with ASTM D5333.

6.6 Seiches and Tsunamis

Seiches are caused by the movement of an inland body of water due to the movement from seismic forces. The site is located approximately 5.1 miles north of Lake Perris. In the unlikely event of a seiche, water is anticipated to be confined to the young alluvial valley channel south of the site.

A tsunami is a series of long-period waves generated in the ocean by a sudden displacement of large volumes of water. Causes of tsunamis include underwater earthquakes, volcanic eruptions, or offshore slope failures. The site is located approximately 36 miles from the Pacific Ocean at an elevation greater than 1,500 feet MSL. Therefore, the risk of tsunamis affecting the site is negligible and not a design consideration.

6.7 Inundation

According to the State of California, Department of Water Resources, *Inundation Map for Perris Dam*, dated April 29, 1975, the site is not within an inundation zone due to dam failure. Therefore, inundation due to dam failure is not a design consideration.

6.8 Landslides

Landslides are not mapped on or near the site. Due to the relatively level topography at the site, the potential for landslides at the property or at a location that could impact the site is negligible and not a design consideration.

6.9 Rock Fall Hazards

Rock falls are not a design consideration due to the lack of natural bedrock slopes above and adjacent to the site.

6.10 Slope Stability

Based on the preliminary site plans and relatively level topography at the site, cut and fill slopes are anticipated to be less than 5 feet in height at inclinations no steeper than 2:1 (h:v). In general, permanent, cut slopes and graded fill slopes constructed with on-site soils inclined no steeper than 2:1 (h:v) with vertical heights of 5 feet or less are anticipated to have adequate factors of safety. Fill keys should be constructed in accordance with the standard grading specifications in *Appendix C*. Grading of fill slopes should be designed in accordance with the requirements of Moreno Valley and the 2016 California Building Code (CBC).

7. SITE INFILTRATION

Percolation testing was performed in accordance with the procedures in *Riverside County Flood Control and Water Conservation District LID BMP, Appendix A.* The percolation test locations are depicted on the *Geologic Map* (see Figures 2 and 3).

A 3-inch diameter perforated PVC pipe in silt filter sock was placed in each percolation test hole and approximately 2 inches of gravel was placed at the bottom of the PVC pipe. The test locations were pre-saturated prior to testing. Percolation testing was begun within 24 hours after the holes were presaturated. Percolation data sheets are presented in *Appendix A* of this report. Calculations to convert the percolation test rate to infiltration test rates are presented in Table 7.0 below. Note that the Handbook requires a factor of safety of 3 be applied to the values below based on the test method used.

TABLE 7.0
INFILTRATION TEST RATES FOR PERCOLATION AREAS

Parameter	P-1	P-2	P-3	P-4
Depth (inches)	91.2	79.0	117.4	120.0
Test Type	Normal	Normal	Normal	Normal
Change in head over time: ΔH (inches)	0.1	1.1	0.1	0.5
Average head: Havg (inches)	41.6	11.9	41.0	24.6
Time Interval (minutes): Δt (minutes)	30	30	30	30
Radius of test hole: r (inches)	4	4	4	4
Tested Infiltration Rate: It (inches/hour)	0.01	0.31	0.01	0.07

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 General

8.1.1 From a geotechnical engineering standpoint, the site is suitable for construction of the proposed auto facility development provided the recommendations presented herein are implemented in design and construction of the project.

8.1.2 Potential geologic hazards at the site include seismic shaking and hydrocompression.

8.1.3 The site is located approximately 2 miles from the nearest active fault. Based on our background research and previous investigation, it is our opinion active, potentially active, or inactive faults do not extend across the site. Risks associated with seismic activity consist of the potential for moderate to strong seismic shaking.

8.1.4 Our field investigation indicates the site is blanketed by undocumented fill over very old alluvium. The undocumented fill and upper portion of the very old alluvium are not considered suitable for the support of compacted fill and settlement-sensitive structures. Remedial grading of the surficial soil will be required as discussed herein. The existing site soils are suitable for re-use as engineered fill provided the recommendations in the *Grading* section of this report are followed.

8.1.5 Soil samples tested for hydrocompression exhibit a collapse potential of up to 2.2 percent for the site. The test results indicate that the degree of specimen collapse would be classified as "moderate" (2.1 to 6.0 percent), in accordance with ASTM D 5333. Remedial grading will assist in reducing the collapse potential of the near-surface soils. However, precautionary measures will be needed to mitigate the potential for hydrocompression of deeper soils. Proper site drainage should be maintained. Landscape planters that saturate the subsurface or storm water infiltration structures should not be used within 20 feet of the proposed building or other on grade improvements. Localized surface settlement should be expected in the vicinity of the storm water infiltration structures or other areas where water is allowed to infiltrate to the subsurface.

8.1.6 Moisture contents in the borings varied and the upper portions were below optimum moisture content. Moisture conditioning of the soils should be expected during construction. Special handling of the soil should be anticipated, particularly if grading occurs during the rainy season.

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

8.1.8 The laboratory tests indicate that the site soils are non-expansive and have a "very low" expansion potential. If medium to highly expansive soils are encountered at the site, they should be exported from the site or selectively graded and placed in the deeper fill areas to allow for the placement of low expansion material at the finish pad grade.

8.1.9 Grading plans were not available for our review, however, cuts and fill of less than 10 feet are anticipated to achieve planned finish grades.

8.1.10 Although not encountered in our exploration, cobbles may be encountered during site grading and may present difficulty for site excavations. The contractor should be prepared to perform site excavations in these conditions.

8.1.11 We did not encounter groundwater during our investigation and do not expect groundwater would impact site improvements. However, wet conditions and seepage could affect proposed construction if grading and improvement operations occur during or shortly after a rain event.

8.1.12 Proper drainage should be maintained in order to preserve the design properties of the fill in the sheet-graded pad and slope areas.

8.1.13 The planned structures can be supported on a shallow foundation system with a slab-on-grade floor system.

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

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

8.2 Excavation and Soil Characteristics

8.2.1 Excavation of the very old alluvium should be possible with moderate to heavy effort using conventional heavy-duty equipment.

8.2.2 The soil encountered in the field investigation is considered to be "non-expansive" (expansion index [EI] of less than 20) as defined by 2016 California Building Code (CBC) Section 1803.5.3. Table 8.2.2 presents soil classifications based on the expansion index. Based on the laboratory test results, we expect a majority of the soil encountered will possess a "very low" expansion potential (EI between 0 and 20). Medium to highly expansive soils may be encountered at the site and should not be placed within 4 feet of the proposed foundations, flatwork or paving improvements. Additional testing for expansion potential should be performed during grading and once final grades are achieved.

TABLE 8.2.2
EXPANSION CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	ASTM D 4829 Expansion Classification	2016 CBC Expansion Classification
0 – 20	**Very Low**	**Non-Expansive**
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

8.2.3 We performed laboratory tests on samples of the site materials to evaluate the percentage of water-soluble sulfate content. *Appendix B* presents results of the laboratory water-soluble sulfate content tests. The test results indicate the on-site materials at the location tested possess a sulfate content of 0.001 percent (10 parts per million [ppm]) equating to an exposure class of "S0" as defined by 2016 CBC Section 1904.3 and ACI 318. Table 8.2.3 presents a summary of concrete requirements set forth by 2016 CBC Section 1904.3 and ACI 318. The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

TABLE 8.2.3
REQUIREMENTS FOR CONCRETE EXPOSED TO SULFATE-CONTAINING SOLUTIONS

Exposure Class	Water-Soluble Sulfate (SO_4) Percent by Weight	Cement Type (ASTM C 150)	Maximum Water to Cement Ratio by Weight[1]	Minimum Compressive Strength (psi)
S0	**SO_4<0.10**	**No Type Restriction**	**n/a**	**2,500**
S1	0.10≤SO_4<0.20	II	0.50	4,000
S2	0.20≤SO_4≤2.00	V	0.45	4,500
S3	SO_4>2.00	V+Pozzolan or Slag	0.45	4,500

[1] Maximum water to cement ratio limits do not apply to lightweight concrete

8.2.4 Laboratory testing indicates the site soils have a minimum electrical resistivity of 4,600 ohm-cm, possess 98 ppm chloride, 10 ppm sulfate, and a pH of 8.3. As shown in Table 8.2.4 below, the site would not be classified as "corrosive" to buried improvements, in accordance with the Caltrans Corrosion Guidelines (Caltrans, 2018).

TABLE 8.2.4
CALTRANS CORROSION GUIDELINES

Corrosion Exposure	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)	pH
Corrosive	<1,100	500 or greater	1,500 or greater	5.5 or less

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

8.3 Seismic Design Criteria

8.3.1 We used the computer program *U.S. Seismic Design Maps*, provided by the California Office of Statewide Health Planning and Development (OSHPD) to evaluate the seismic design criteria. Table 8.3.1 summarizes site-specific design criteria obtained from the 2016 California Building Code (CBC; Based on the 2015 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The short spectral response uses a period of 0.2 second. The building structure and improvements as currently proposed should be designed using a Site Class D in accordance with ASCE 7-10 Section 20.3.1. We evaluated the Site Class based on the discussion in Section 1613.3.2 of the 2016 CBC and Table 20.3-1 of ASCE 7-10 using blow count data presented on the boring logs in *Appendix A*. The values presented in Table 8.3.1 are for the risk-targeted maximum considered earthquake (MCE_R).

TABLE 8.3.1
2016 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2016 CBC Reference
Site Class	D	Section 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	2.146g	Figure 1613.3.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.971g	Figure 1613.3.1(2)
Site Coefficient, F_A	1.00	Table 1613.3.3(1)
Site Coefficient, F_V	1.50	Table 1613.3.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	2.146g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	1.457g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	1.431g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.971g	Section 1613.3.4 (Eqn 16-40)

8.3.2 Table 8.3.2 presents additional seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10 for the mapped maximum considered geometric mean (MCE_G).

TABLE 8.3.2
2016 CBC SITE ACCELERATION PARAMETERS

Parameter	Value	ASCE 7-10 Reference
Site Class	D	Section 1613.3.2
Mapped MCE_G Peak Ground Acceleration, PGA	0.83g	Figures 2 through 42-7
Site Coefficient, F_{PGA}	1.00	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.83g	Section 11.8.3 (Eqn 11.8-1)

8.3.3 Conformance to the criteria in Tables 8.3.1 and 8.3.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

8.4 Temporary Excavations

8.4.1 The recommendations included herein are provided for temporary excavations. It is the responsibility of the contractor to provide a safe excavation during the construction of the proposed project.

8.4.2 Excavations on the order of 5 to 15 feet in vertical height are expected during grading operations and utility installation. The contractor's competent person should evaluate the necessity for lay back of vertical cut areas. Vertical excavations up to 5 feet may be attempted where loose soils or caving sands are not present, and where not surcharged by existing structures or vehicle/construction equipment loads.

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

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

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

8.5 Grading

8.5.1 Grading should be performed in accordance with the recommendations provided in this report, the *Recommended Grading Specifications* contained in *Appendix C* and Moreno Valley Standards.

8.5.2 Prior to commencing grading, a pre-construction conference should be held at the site with the owner/developer, city inspector, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling requirements can be discussed at that time.

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

8.5.4 Undocumented fill and the upper portion of the very old alluvium in the building areas should be removed to expose competent older alluvium. Based on our findings, we expect the existing soils within approximately 5 feet of the existing ground surface will require remedial excavation and proper compaction. Areas of loose, dry, or compressible soils will require additional excavation and processing prior to fill placement. Removals should extend at least 3 feet below the bottom of the planned foundations, and the excavations should be extended laterally a minimum distance of 5 feet beyond the building footprint or for a distance equal to the depth of removal, whichever is greater. Where the lateral over-excavation is not possible, structural setbacks or deepened footings may be required.

8.5.5 Removals in pavement and walkway areas should extend at least 2 feet beneath the pavement or flatwork subgrade elevation.

8.5.6 The actual depth of removal should be evaluated by the engineering geologist during grading operations. Deeper excavations may be required if dry, loose, soft, or porous materials are present at the base of the removals. The bottom of the excavations should be scarified to a depth of at least 1 foot, moisture conditioned as necessary, and properly compacted.

8.5.7 The site should then be brought to final subgrade elevations with fill compacted in layers. In general, soil native to the site is suitable for use as fill if free from vegetation, debris and other deleterious material. Layers of fill should be about 6 to 8 inches in loose thickness and no thicker than will allow for adequate bonding and compaction. Fill, including backfill and scarified ground surfaces, should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content, as determined in accordance with ASTM D 1557. Fill materials placed below optimum moisture content may require additional moisture conditioning prior to placing additional fill. The upper 12 inches of subgrade soil underlying pavement should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content shortly before paving operations.

8.5.8 Import fill soil (if necessary) should consist of granular materials with a “very low” expansion potential (EI of less than 20), free of deleterious material and rock fragments larger than 6 inches and should be compacted as recommended herein. Geocon should be notified of the import soil source and should perform laboratory testing of import soil prior to its arrival at the site to determine its suitability as fill material.

8.5.9 Foundation excavation bottoms must be observed and approved in writing by the Geotechnical Engineer, prior to placing fill, steel, gravel or concrete.

8.6 Utility Trench Backfill

8.6.1 Utility trenches should be properly backfilled in accordance with the requirements of Moreno Valley and the latest edition of the *Standard Specifications for Public Works Construction* (Greenbook). The pipes should be bedded with well graded crushed rock or clean sands (Sand Equivalent greater than 30) to a depth of at least one foot over the pipe. The bedding material must be inspected and approved in writing by the Geotechnical Engineer (a representative of Geocon). The use of well graded crushed rock is only acceptable if used in conjunction with filter fabric to prevent the gravel from having direct contact with soil. The remainder of the trench backfill may be derived from onsite soil or approved import soil, compacted as necessary, until the required compaction is obtained. Backfill of utility trenches should not contain rocks greater than 3 inches in diameter. The use of 2-sack slurry and controlled low strength material (CLSM) are also acceptable as backfill. However, consideration should be given to the possibility of differential settlement where the slurry ends and earthen backfill begins. These transitions should be minimized and additional stabilization should be considered at these transitions.

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

8.7 Earthwork Grading Factors

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

8.8 Foundation and Concrete Slab-On-Grade Recommendations

8.8.1 The foundation recommendations presented herein are for the proposed buildings subsequent to the recommended grading assuming that the buildings are founded in soils with a low expansion potential. If soils with a medium or high expansion potential are placed within 4 feet of finish grade, then Geocon should be contacted for additional recommendations. The proposed structure can be supported on a shallow foundation system bearing in newly placed compacted fill.

8.8.2 Foundations for the structure should consist of either continuous strip footings and/or isolated spread footings. Continuous footings should be at least 18 inches wide and extend at least 18 inches below lowest adjacent pad grade. Isolated spread footings should have a minimum width of 24 inches and should also extend at least 18 inches below lowest adjacent pad grade. A wall/column footing dimension detail depicting footing embedment is provided on Figure 3.

8.8.3 From a geotechnical engineering standpoint, concrete slabs-on-grade for the structure should be at least 4 inches thick and be reinforced with at least No. 3 steel reinforcing bars placed 24 inches on center in both directions. The concrete slab-on-grade recommendations are based on soil support characteristics only. The project structural engineer should evaluate the structural requirements of the concrete slab for supporting equipment and storage loads. A thicker concrete slab may be required for heavier loading conditions. To reduce the effects of differential settlement on the foundation system, thickened slabs and/or an increase in steel reinforcement can provide a benefit to reduce concrete cracking.

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

8.8.5 The recommendations presented herein are based on soil characteristics only (EI of 20 or less) and are not intended to replace steel reinforcement required for structural considerations.

8.8.6 Foundations may be designed for an allowable soil bearing pressure of 3,500 pounds per square foot (psf) (dead plus live load). The value presented herein is for dead plus live loads and may be increased by one-third when considering transient loads due to wind or seismic forces.

8.8.7 The maximum expected static settlement for the planned structures supported on conventional foundation systems with the above allowable bearing pressure and deriving support in engineered fill is estimated to be 1 inch and to occur below the heaviest loaded structural element. Differential settlement is estimated to be on the order of ½ inch over a horizontal distance of 40 feet. Once the design and foundation loading configuration proceeds to a more finalized plan, the estimated settlements within this report should be reviewed and revised, if necessary

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

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

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

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

8.8.12 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil (if present), differential settlement of existing soil, or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

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

8.9 Concrete Flatwork

8.9.1 Exterior concrete flatwork not subject to vehicular traffic should be constructed in accordance with the recommendations herein. Slab panels should be a minimum of 4 inches thick and, when in excess of 8 feet square, should be reinforced with No. 3 reinforcing bars spaced 24 inches on center in each direction to reduce the potential for wide cracking. In addition, concrete flatwork should be provided with crack control joints to reduce and/or control shrinkage cracking. Crack control spacing should be determined by the project structural engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing. Subgrade soil for exterior slabs not subjected to vehicle loads should be compacted in accordance with criteria presented in the grading section prior to concrete placement. Subgrade soil should be properly compacted and the moisture content of subgrade soil should be checked prior to placing concrete.

8.9.2 Even with the incorporation of the recommendations within this report, the exterior concrete flatwork has a likelihood of experiencing some movement due to swelling or settlement; therefore, the steel reinforcement should overlap continuously in flatwork to reduce the potential for vertical offsets within flatwork. Additionally, flatwork should be structurally connected to the curbs, where possible, to reduce the potential for offsets between the curbs and the flatwork.

8.9.3 Where exterior flatwork abuts structures at entrant or exit points, the exterior slab should be dowelled into the structure's foundation stemwall. This recommendation is intended to reduce the potential for differential elevations that could result from differential settlement or minor heave of the flatwork. Dowelling details should be designed by the project structural engineer.

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

8.10 Conventional Retaining Walls

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

8.10.2 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid density of 35 pounds per cubic foot (pcf). Where the backfill will be inclined at no steeper than 2:1 (horizontal to vertical), an active soil pressure of 60 pcf is recommended. These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an EI of 50 or less. For walls where backfill materials do not conform to the criteria herein, Geocon should be consulted for additional recommendations.

8.10.3 Unrestrained walls are those that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall in feet) at the top of the wall. Where walls are restrained from movement at the top, walls with a level backfill surface should be designed for a soil pressure equivalent to the pressure exerted by a fluid density of 55 pcf.

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

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

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

8.10.7 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and waterproofed as required by the project architect. The soil immediately adjacent to the backfilled retaining wall should be composed of free draining material completely wrapped in Mirafi 140N (or equivalent) filter fabric for a lateral distance of 1 foot for the bottom two-thirds of the height of the retaining wall. The upper one-third should be backfilled with less permeable compacted fill to reduce water infiltration. Alternatively, a drainage panel, such as a Miradrain 6000 or equivalent, can be placed along the back of the wall. A typical drain detail for each option is shown on Figure 4. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The recommendations herein assume a properly compacted backfill (EI of 50 or less) with no hydrostatic forces or imposed surcharge load. If conditions different than those described are expected or if specific drainage details are desired, Geocon should be contacted for additional recommendations.

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

8.11 Lateral Loading

8.11.1 To resist lateral loads, a passive pressure exerted by an equivalent fluid density of 350 pounds per cubic foot (pcf) should be used for the design of footings or shear keys. The allowable passive pressure assumes a horizontal surface extending at least 5 feet, or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in design for passive resistance.

8.11.2 If friction is to be used to resist lateral loads, an allowable coefficient of friction between soil and concrete of 0.40 should be used for design. The friction coefficient may be reduced depending on the vapor barrier or waterproofing material used for construction in accordance with the manufacturer's recommendations.

8.11.3 The passive and frictional resistant loads can be combined for design purposes. The lateral passive pressures may be increased by one-third when considering transient loads due to wind or seismic forces.

8.12 Preliminary Pavement Recommendations

8.12.1 We calculated the flexible pavement sections in general conformance with the *Caltrans Method of Flexible Pavement Design* (Highway Design Manual, Section 608.4) and Moreno Valley specifications using a range of Traffic Indices. The project civil engineer and owner should evaluate the final Traffic Index for the pavements and review the pavement designations to determine appropriate locations for pavement thickness. Based on our laboratory testing we have used a preliminary R-value of 30 for the subgrade soils for the purposes of this analysis. The final pavement sections should be based on the R-value of the subgrade soil encountered at final subgrade elevation. Table 8.12.1 presents the preliminary flexible pavement sections.

TABLE 8.12.1
PRELIMINARY FLEXIBLE PAVEMENT SECTION

Location	Assumed Traffic Index	Subgrade R-Value	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
Driveways for automobiles and light-duty vehicles	5.5	30	3.0	7.0
Medium truck traffic areas	6.0	30	3.5	8.0
Driveways for heavy truck and fire truck traffic	7.0	30	4.0	10.0
Collector Roadways	8.0	30	5.0	11.0

8.12.2 Prior to placing base materials, the upper 12 inches of the subgrade soil should be scarified, moisture conditioned as necessary, and recompacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content as determined by ASTM D 1557. Similarly, the base material should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content. Asphalt concrete should be compacted to a density of at least 95 percent of the laboratory Hveem density in accordance with ASTM D 2726.

8.12.3 Base materials should conform to Section 26 of the *Standard Specifications for The State of California Department of Transportation (Caltrans)*. The asphalt concrete should conform to Section 203-6 of the *Standard Specifications for Public Works Construction (Greenbook)*.

8.12.4 A rigid Portland cement concrete (PCC) pavement section should be placed in heavy truck areas, driveway aprons, and cross gutters. We calculated the rigid pavement section in general conformance with the procedure recommended by the American Concrete Institute report ACI 330R *Guide for Design and Construction of Concrete Parking Lots* using the parameters presented in Table 8.12.4.

TABLE 8.12.4
RIGID PAVEMENT DESIGN PARAMETERS

Design Parameter	Design Value
Modulus of subgrade reaction, k	150 pci
Modulus of rupture for concrete, M_R	500 psi
Traffic Category, TC	C and D
Average daily truck traffic, ADTT	100 and 700

8.12.5 Based on the criteria presented herein, the PCC pavement sections should have a minimum thickness as presented in Table 8.12.5.

TABLE 8.12.5
RIGID PAVEMENT RECOMMENDATIONS

Location	Portland Cement Concrete (inches)
Automobile Parking Stalls (TC=C)	6.5
Heavy Truck and Fire Lane Areas (TC=D)	7.5

8.12.6 The PCC pavement should be placed over subgrade soil that is compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content. This pavement section is based on a minimum concrete compressive strength of approximately 3,000 psi (pounds per square inch).

8.12.7 A thickened edge or integral curb should be constructed on the outside of concrete slabs subjected to wheel loads. The thickened edge should be 1.2 times the slab thickness or a minimum thickness of 2 inches, whichever results in a thicker edge, and taper back to the recommended slab thickness 4 feet behind the face of the slab (e.g., 6-inch and 7.5-inch-thick slabs would have an 8- and 9.5-inch-thick edge, respectively). Reinforcing steel will not be necessary within the concrete for geotechnical purposes with the possible exception of dowels at construction joints as discussed herein.

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

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

8.13 Temporary Excavations

8.13.1 Excavations on the order of 5 to 15 feet below the existing ground surface are expected for construction of the proposed utility improvements; and we expect that the proposed utilities will be installed with conventional cut-and-cover methods.

8.13.2 The excavations will expose fill and very old alluvial soils which are suitable for vertical excavations up to 5 feet where loose soils or caving sands are not present and where not surcharged by adjacent traffic or structures.

8.13.3 Vertical excavations greater than 5 feet will require sloping measures in order to provide a stable excavation. Where sufficient space is available, temporary unsurcharged embankments should be designed by the contractor's competent person in accordance with OSHA regulations.

8.13.4 Where there is insufficient space for sloped excavations, shoring or trench shields should be used to support excavations. Shoring may also be necessary where sloped excavation could remove vertical or lateral support of existing improvements, including existing utilities and adjacent structures. Recommendations for temporary shoring can be provided in an addendum if needed.

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

8.14 Site Drainage and Moisture Protection

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

8.14.2 Landscape planters that saturate the subsurface should not be used within 20 feet of the proposed structure or other settlement sensitive on grade improvements. Localized surface settlement should be anticipated in areas where water is allowed to infiltrate into the subsurface.

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

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

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

8.15 Grading and Foundation Plan Review

8.15.1 Geocon should review the project grading and foundation plans prior to final design submittal to verify that the plans have been prepared in substantial conformance with the recommendations of this report and to provide additional analyses or recommendations, if necessary.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

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

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

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

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

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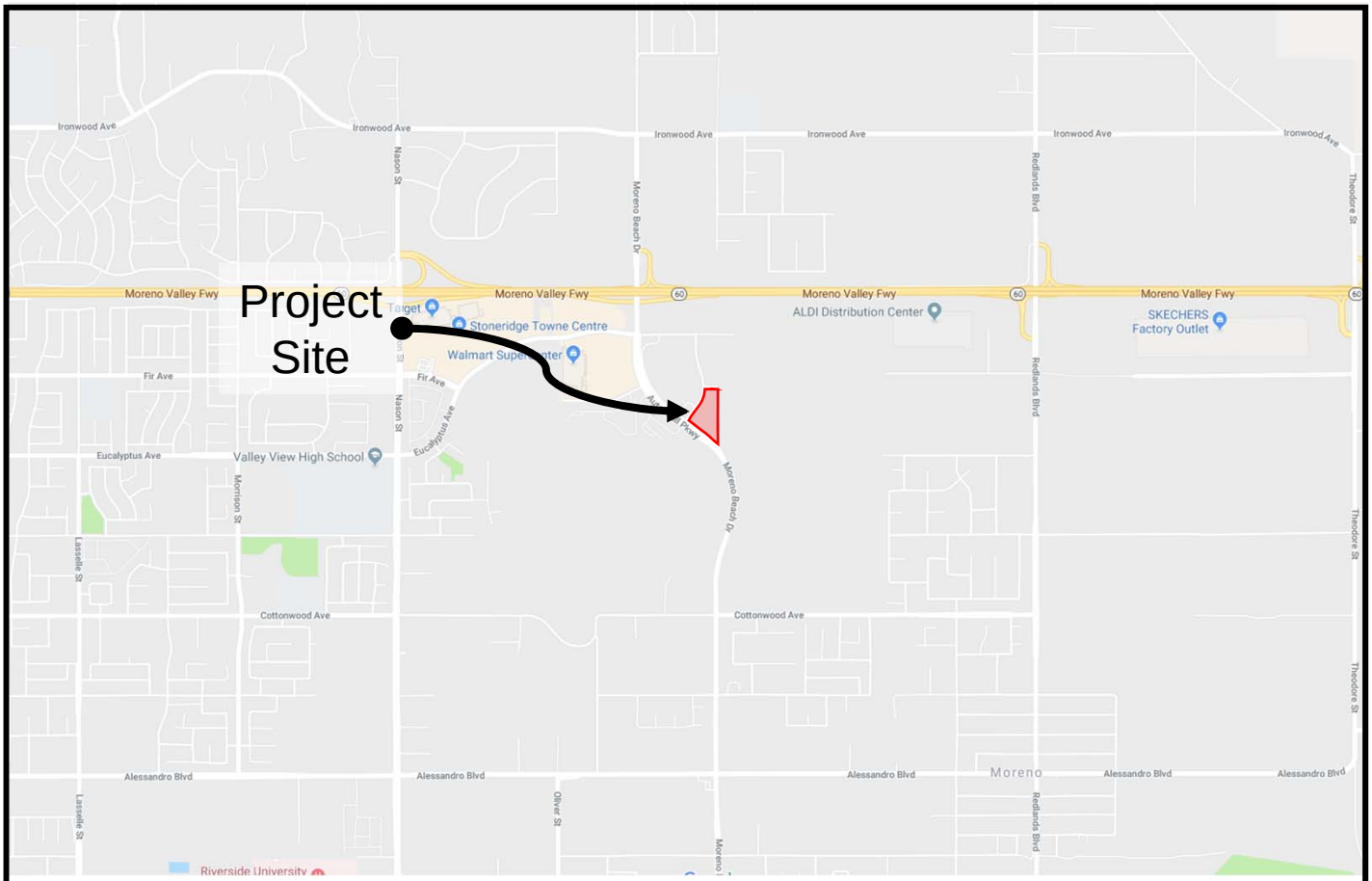

N

1000 ft

SOURCE: Google Maps, 2019

VICINITY MAP

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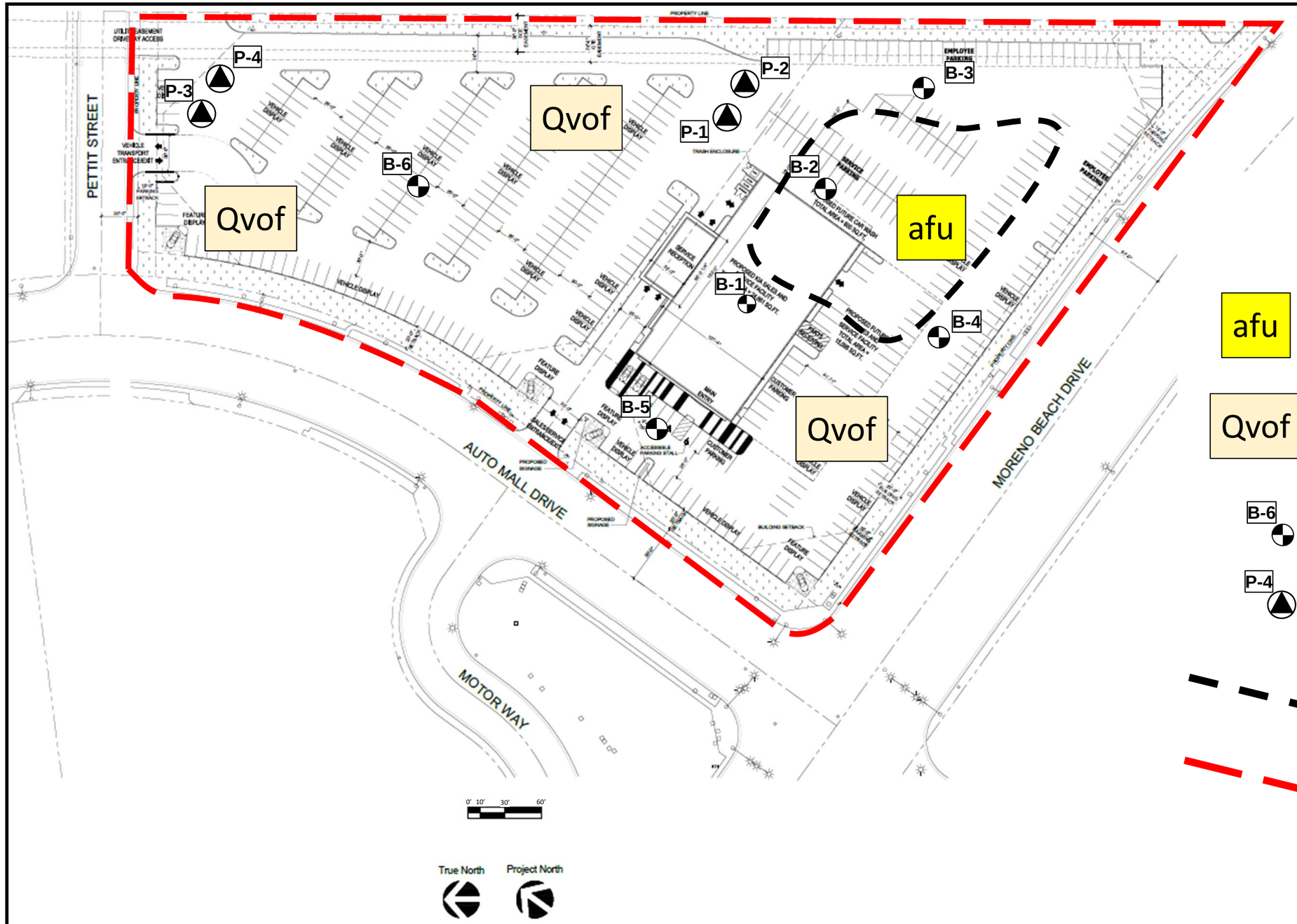
41571 CORNING PLACE, SUITE 101, MURRIETA, CA 92562-7065
PHONE 951-304-2300 FAX 951-304-2392

PDT		

KIA MORENO VALLEY
EAST OF MORENO BEACH DRIVE
AND AUTO MALL DRIVE
MORENO VALLEY, CALIFORNIA

JANUARY, 2019	PROJECT NO. T2844-22-01	FIG. 1



GEOCON LEGEND

Locations are approximate

afu ..... UNDOCUMENTED FILL

Qvof ..... VERY OLD ALLUVIAL FAN DEPOSITS

B-6 ..... BORING LOCATION

P-4 ..... PERCOLATION TEST LOCATION

..... GEOLOGIC CONTACT

..... LIMITS OF THIS REPORT

Source: Carlile Coatsworth Architects, Inc., dated January 17, 2019

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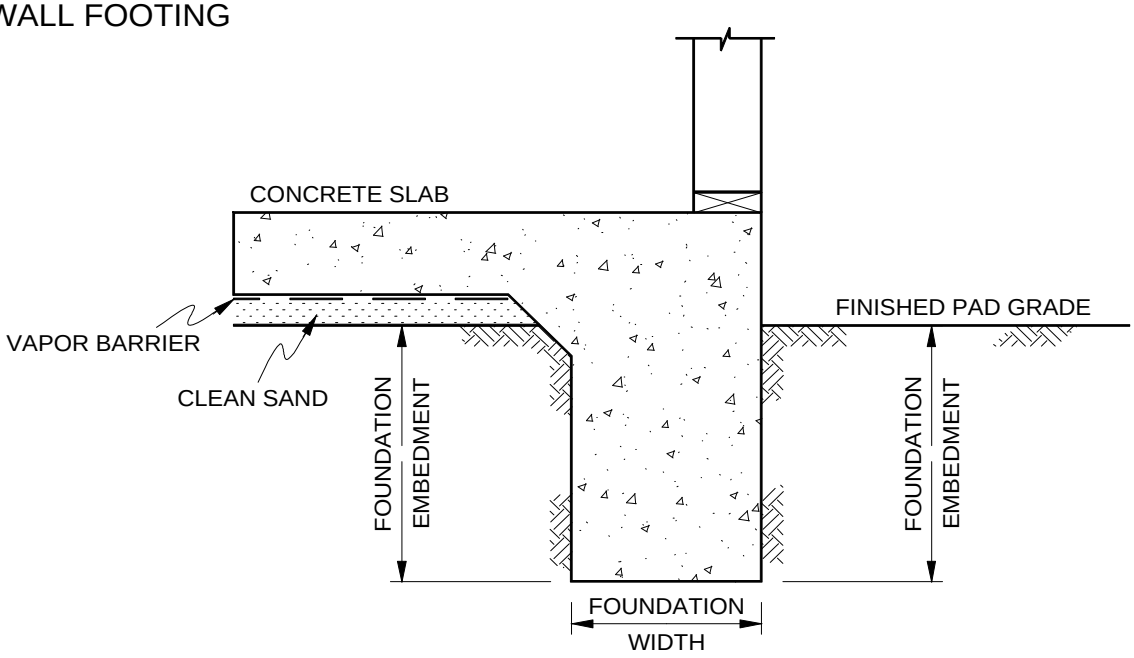
GEOLOGIC MAP

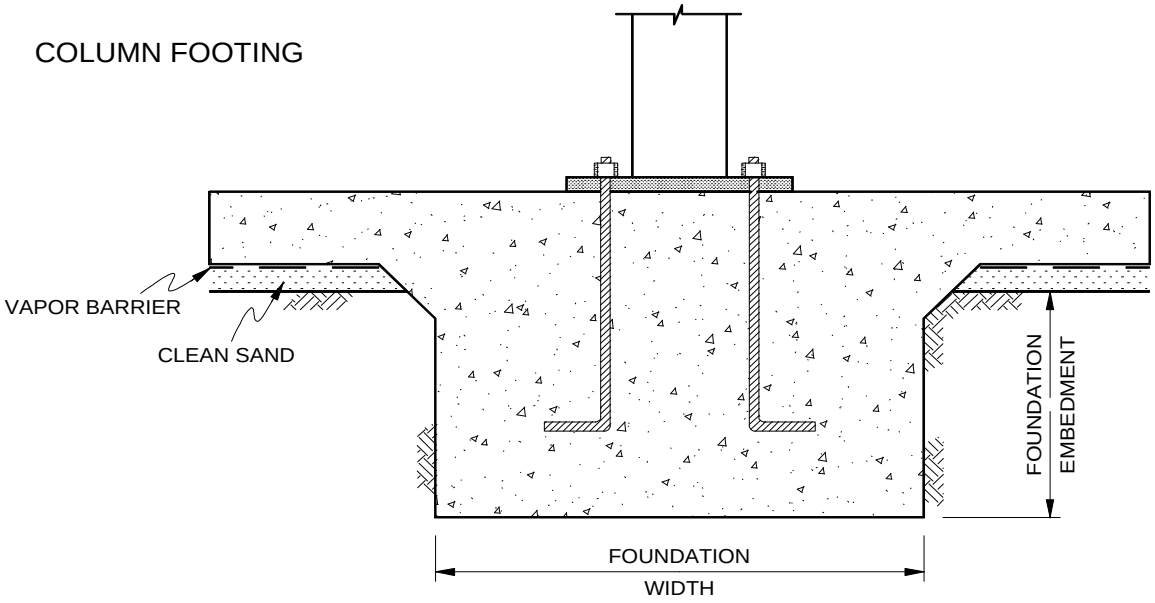
KIA MORENO VALLEY
EAST OF MORENO BEACH DRIVE
AND AUTO MALL DRIVE
MORENO VALLEY, CALIFORNIA

JANUARY, 2019 | PROJECT NO. T2844-22-01 | FIG. 2

WALL FOOTING



COLUMN FOOTING



NOTE: SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

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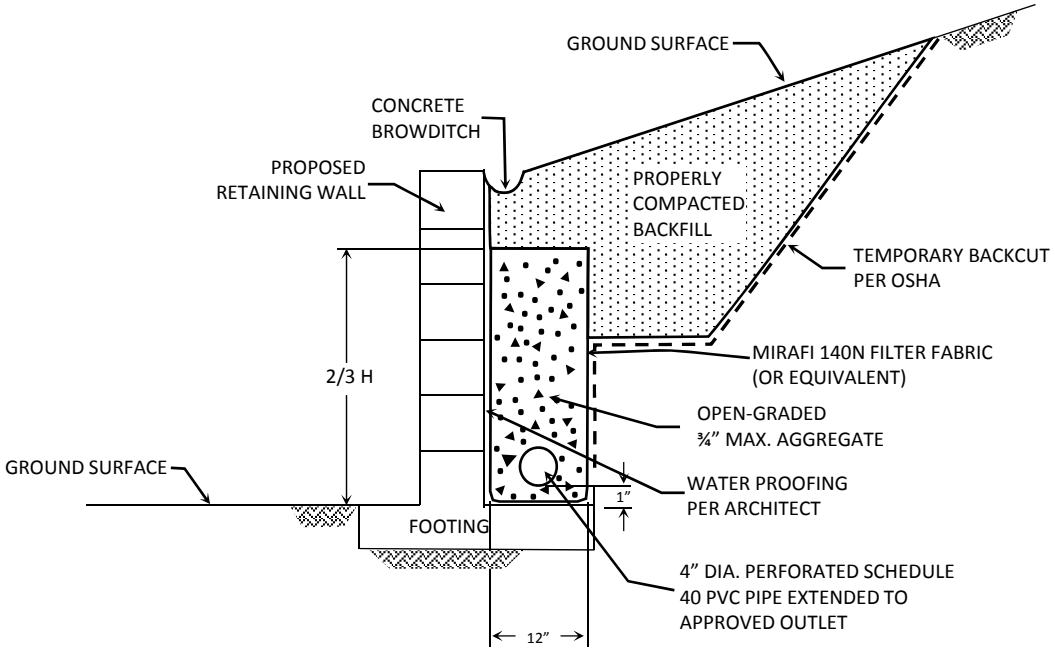
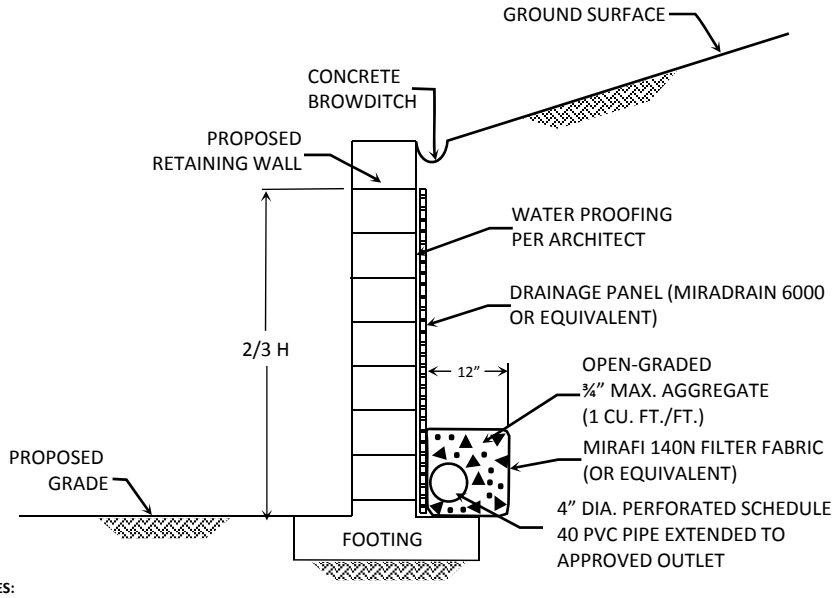
WALL / COLUMN FOOTING DETAIL

KIA MORENO VALLEY
EAST OF MORENO BEACH DRIVE
AND AUTO MALL DRIVE
MORENO VALLEY, CALIFORNIA

JANUARY, 2019	PROJECT NO. T2844-22-01	FIG. 3





NOTES:

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

CONCRETE BROW DITCH RECOMMENDED FOR SLOPE HEIGHTS
GREATER THAN 6 FEET

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

GEOCON
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PDT		

KIA MORENO VALLEY
EAST OF MORENO BEACH DRIVE
AND AUTO MALL DRIVE
MORENO VALLEY, CALIFORNIA

JANUARY, 2019	PROJECT NO. T2367-22-02	FIG. 4

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

Field work for our investigation included a subsurface exploration, soil sampling, and percolation testing. The *Geologic Map*, Figure 2 presents the locations of the exploratory borings. Boring logs and an explanation of the geologic units encountered are presented in figures following the text in this appendix. We located the borings in the field using existing reference points. Therefore, actual boring locations may deviate slightly. We performed a field investigation on December 17, 2018 which consisted of drilling 10 exploratory borings to a maximum depth of approximately 51½ feet below existing grade with a CME 75 drill rig equipped with 8-inch-diameter hollow-stem auger.

We collected bulk and relatively undisturbed samples from the borings by driving a 3-inch O. D., California Modified Sampler into the "undisturbed" soil mass with blows from a 140-pound hammer falling 30 inches on an auto hammer. The California Modified Sampler was equipped with 1-inch high by 2$^{3}/_{8}$-inch inside diameter brass sampler rings to facilitate removal and testing. Relatively undisturbed samples and bulk samples of disturbed soils were transported to our laboratory for testing. The type of sample is noted on the exploratory boring logs.

The samplers were driven 18 inches into the bottom of the excavations. Blow counts are recorded for every 6 inches the sampler is driven. The penetration resistances shown on the boring logs are shown in terms of blows per foot. The values indicated on the boring logs are the sum of the last 12 inches of the sampler if driven 18 inches. If the sampler was not driven for 18 inches, an approximate value is calculated in term of blows per foot or the final 6-inch interval is reported. These values are not to be taken as N-values, adjustments have not been applied. We estimated elevations shown on the boring logs from a topographic map.

We visually examined the soil conditions encountered within the borings, classified, and logged in general accordance with the Unified Soil Classification System (USCS). Logs of the borings are presented on Figures A-1 through A-10. The logs depict the general soil and geologic conditions encountered and the depth at which we obtained the samples.

Percolation testing was performed on December 18, 2018 in accordance with *Riverside County Flood Control and Water Conservation District, LID BMP Manual, Appendix A.* The percolation tests were run in accordance with *Section 2.3., Shallow Percolation Test*. The percolation test data is presented on Figures A-11 and A-14.

PROJECT NO. T2844-22-01

BORING B-1

ELEV. (MSL.) **1756** DATE COMPLETED **12/17/2018**

EQUIPMENT **HOLLOW STEM AUGER** BY: **PDT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B-1@0-5'			SM	**UNDOCUMENTED FILL (afu)** Silty SAND, loose, dry, reddish brown; fine to medium sand; some gravel and cobble; some concrete chunks			
2								
	B-1@2.5'			SM	**VERY OLD ALLUVIAL FAN DEPOSITS (Qvof)** Silty SAND, very dense, damp, light brown; fine to coarse sand	85	124.6	4.6
4								
	B-1@5'				-Becomes dark reddish brown; damp; trace coarse sand; trace gravel; trace carbonate stringers	80	130.4	5.3
6								
8	B-1@7.5				-Becomes dense, moist; fine sand; some mica	56	125.4	7.8
10	B-1@10'				-Some medium sand	69	132.9	7.9
				ML	Sandy SILT, hard, moist, dark gray; fine sand; trace medium sand			
12								
14					-Becomes dark brown; some clay			
	B-1@15'			SM	Silty SAND, dense, moist, reddish brown; fine to medium sand; trace mica	60		
16								
18								
20	B-1@20				-Becomes very dense	80	126.0	10.8
22								
24								
	B-1@25'				-Becomes medium dense	44		
26								
28								

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

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. T2844-22-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING B-1** ELEV. (MSL.) **1756** DATE COMPLETED **12/17/2018** EQUIPMENT **HOLLOW STEM AUGER** BY: **PDT**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
30	B-1@30'			SM	Silty SAND, medium dense, moist, reddish brown; trace coarse sand; trace gravel; increase in silt	12		
32								
34								
36	B-1@35'				-Becomes brownish red; fine sand; trace medium sand	44		
38								
40	B-1@40'				-Some carbonate stringers	23		
42								
44								
46	B-1@45'				-Becomes dense; strong brown; fine to mediun sand; carbonate stringers; micaceous	62		
48								
50	B-1@50					34		
					Total depth 51.5 feet Groundwater not encountered Penetration resistance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 4/9/2018			

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

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

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

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GEOCON

PROJECT NO. T2844-22-01

BORING B-2

ELEV. (MSL.) **1753** DATE COMPLETED **12/17/2018**

EQUIPMENT **HOLLOW STEM AUGER** BY: **PDT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, dry, reddish brown; fine to medium sand			
2	B-2@2.5'					50/6"	117.3	6.2
4				ML	**VERY OLD ALLUVIAL FAN DEPOSITS (Qvof)** Sandy SILT, stiff, damp, light brown; fine sand			
6	B-2@5-10 B-2@5'					33	96.7	9.6
8	B-2@7.5'				-Becomes moist moist, dark brown; micaceous	21	106.1	11.5
10	B-2@10'					24	102.9	10.3
12								
14				SM	Silty SAND, medium dense, moist, strong brown; fine sand			
16	B-2@15'					40		
18								
20	B-2@20'					42	128.0	4.5
22								
24								
26	B-2@25'				-Becomes dense	63		
					Total depth 26.5 feet Groundwater not encountered Penetration resistance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 4/9/2018			

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

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. T2844-22-01

BORING B-3

ELEV. (MSL.) **1751** DATE COMPLETED **12/17/2018**

EQUIPMENT **HOLLOW STEM AUGER** BY: **PDT**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED FILL (afu)** Silty SAND, loose, dry, reddish brown; fine to medium sand; some gravel and cobble			
2				SM	**VERY OLD ALLUVIAL FAN DEPOSITS (Qvof)** Silty SAND, very dense, damp, brownish red; fine to medium sand; carbonate stringers			
	B-3@2.5'					50/6"		
4								
	B-3@5-10				-Becomes moist; strong brown	50/6"	127.9	7.5
6	B-3@5'							
	B-3@7.5'				-Trace carbonate stringers; micaceous	50/6"		
8				ML	Sandy SILT, hard, moist, dark brown; fine sand			
10	B-3@10'					44		
12								
				CL	Sandy CLAY, stiff, moist, dark brown; fine sand			
14								
	B-3@15'					14	117.1	11.1
16								
				SC	Clayey SAND, medium dense, moist, reddish brown, fine to coarse sand; trace carbonate stringers			
18								
20	B-3@20'					44		
					Total depth 21.5 feet Groundwater not encountered Penetration resistance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 12/17/2018			

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

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. T2844-22-01

BORING B-4

ELEV. (MSL.) **1756** DATE COMPLETED **12/17/2018**

EQUIPMENT **HOLLOW STEM AUGER** BY: **ATS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED FILL (afu)** Silty SAND, dense, damp, brown; fine sand; some coarse sand; trace gravel			
2								
4	B-4@2.5' B-4@2.5-7.5'			SM	**VERY OLD ALLUVIAL FAN DEPOSITS (Qvof)** Silty SAND, very dense, damp, light brown; fine sand; some medium and coarse sand; trace mica; root hairs	50/5"		
6	B-4@5'				-Becomes dense, strong brown; trace pinhole porosity; micaceous	63		
8	B-4@7.5'				-Becomes very dense; moist	85	130.9	7.0
10	B-4@10'				-Becomes dense; dark gray; fine sand	53		
12								
14								
16	B-4@15'				-Becomes very dense; brownish gray; some medium and coarse sand	50/5"		
18								
20	B-4@20'			SC	Clayaey SAND, medium dense, damp, reddish brown; fine sand; some coarse sand	42	135.2	6.1
					Total depth 21.5 feet Groundwater not encountered Penetration resistance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 12/17/2018			

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

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. T2844-22-01

BORING B-5

ELEV. (MSL.) **1755** DATE COMPLETED **12/17/2018**

EQUIPMENT **HOLLOW STEM AUGER** BY: **ATS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B-5@0-5'			SM	**UNDOCUMENTED FILL (afu)** Silty SAND, dense, damp, brown; fine sand; some coarse sand; trace gravel			
2								
	B-5@2.5'			SM	**VERY OLD ALLUVIAL FAN DEPOSITS (Qvof)** Silty SAND, very dense, moist, light brown; fine sand; some medium and coarse sand; trace mica; root hairs	66	116.6	6.5
4								
	B-5@5'				-Becomes very dense, moist, strong brown; pinhole porosity; micaceous	50/4"	134.1	7.6
6								
8	B-5@7.5'			SC	Clayey SAND, very dense, moist, dark brown; fine sand; trace medium and coarse sand; trace gravel; pinhole porosity; trace mica	50/6"	130.7	7.8
10	B-5@10'				-Becomes dense; reddish brown	50		
12								
14								
	B-5@15'				-Becomes brown	57	132.4	6.1
16								
18								
20	B-5@20'			SM	Silty SAND, medium dense, moist, light brown; fine sand; some medium and coarse sand; pinhole porosity	32		
					Total depth 21.5 feet Groundwater not encountered Penetration resistance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 12/17/2018			

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

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. T2844-22-01

BORING B-6

ELEV. (MSL.) **1752** DATE COMPLETED **12/17/2018**

EQUIPMENT **HOLLOW STEM AUGER** BY: **ATS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B-6@0-5'			SM	**UNDOCUMENTED FILL (afu)** Silty SAND, dense, damp, brown; fine sand; trace gravel; root hairs			
2	B-6@2.5'			SP	Poorly Graded SAND, very dense, moist, light yellowish brown; fine sand; some medium and coarse sand; trace mica	50/5"	129.6	6.0
4	B-6@5'			SC	Clayey SAND, very dense, moist, light reddish brown; fine sand; pinhole porosity	50/6"		
6	B-6@7.5'			SM	Silty SAND, very dense, moist, grayish brown; fine sane; pinhole porosity	50/6"	131.5	6.0
8	B-6@10'					50/6"		
10	B-6@15'			SC	Clayey SAND, dense, moist, gray, fine sand	72		
12					Total depth 16.5 feet Groundwater not encountered Penetration resistance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 12/17/2018			
14								
16								

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

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. T2844-22-01

BORING P-1

ELEV. (MSL.) **1751** DATE COMPLETED **12/17/2018**

EQUIPMENT **HOLLOW STEM AUGER** BY: **ATS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, dry, medium brown; fine sand; some medium and coarse sand			
2				SM	**VERY OLD ALLUVIAL FAN DEPOSITS (Qvof)** Silty SAND, dense, damp, brown; fine to medium sand; some coarse sand; trace gravel			
4								
6								
	P-1@7-8'							
8					Total depth 8 feet Groundwater not encountered Set as Percolation Test P-1 Backfilled with cuttings 12/18/2018			

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

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. T2844-22-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING P-2** ELEV. (MSL.) **1751** DATE COMPLETED **12/17/2018** EQUIPMENT **HOLLOW STEM AUGER** BY: **ATS**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, dry, medium brown; fine sand; some medium and coarse sand			
2				SM	**VERY OLD ALLUVIAL FAN DEPOSITS (Qvof)** Silty SAND, dense, damp, brown; fine to medium sand; some coarse sand; trace gravel			
4								
6	P-2@6-7"				Total depth 7 feet Groundwater not encountered Set as Percolation Test P-2 Backfilled with cuttings 12/18/2018			

Figure A-8,
Log of Boring P-2, Page 1 of 1

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

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

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

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GEOCON

PROJECT NO. T2844-22-01

BORING P-3

ELEV. (MSL.) **1751** DATE COMPLETED **12/17/2018**

EQUIPMENT **HOLLOW STEM AUGER** BY: **ATS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**UNDOCUMENTED FILL (afu)** Clayey SAND, medium dense, damp, medium brown; fine sand; some coarse sand			
2				SC	**VERY OLD ALLUVIAL FAN DEPOSITS (Qvof)** Clayey SAND, dense, damp, light olive brown; fine sand; some coarse sand			
4								
6				SM	Silty SAND, dense, damp, medium brown; fine sand			
8								
10	P-3@9-10			ML	Sandy SILT, stiff, moist, dark yellowish brown; fine to medium sand; trace coarse sand			

Total depth 10 feet
Groundwater not encountered
Set as Percolation Test P-3
Backfilled with cuttings 12/18/2018

T2843-22-01 BORING LOGS.GPJ

Figure A-9,
Log of Boring P-3, Page 1 of 1

SAMPLE SYMBOLS

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

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

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

GEOCON

PROJECT NO. T2844-22-01

BORING P-4

ELEV. (MSL.) **1752** DATE COMPLETED **12/17/2018**

EQUIPMENT **HOLLOW STEM AUGER** BY: **ATS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**UNDOCUMENTED FILL (afu)** Clayey SAND, medium dense, damp, medium brown; fine sand; some coarse sand			
2				SC	**VERY OLD ALLUVIAL FAN DEPOSITS (Qvof)** Clayey SAND, dense, damp, light olive brown; fine sand; some coarse sand			
4								
6				SM	Silty SAND, dense, damp, medium brown; fine sand			
8								
10	P-4@9-10			ML	Sandy SILT, stiff, moist, dark yellowish brown; fine to medium sand; trace coarse sand			

Total depth 10 feet
Groundwater not encountered
Set as Percolation Test P-4
Backfilled with cuttings 11/27/2018

Figure A-10,
Log of Boring P-4, Page 1 of 1

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

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

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

GEOCON

PERCOLATION TEST REPORT

Project Name:		KIA Moreno Valley			**Project No.:**		T2844-22-01
Test Hole No.:		P-1			**Date Excavated:**		12/17/2018
Length of Test Pipe:			108.0	inches	**Soil Classification:**		SM
Height of Pipe above Ground:			16.8	inches	**Presoak Date:**		12/17/2018
Depth of Test Hole:			91.2	inches	**Perc Test Date:**		12/18/2018
Check for Sandy Soil Criteria Tested by:				SP	**Percolation Tested by:**		SP
Water level measured from bottom of hole							

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	8:52 AM 9:17 AM	25	25	43.2	43.1	0.1	208
2	9:17 AM 9:42 AM	25	50	43.1	43.0	0.1	208
			Soil Criteria: Normal				

Percolation Test

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Head (in)	Final Water Head (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	9:42 AM 10:12 AM	30	30	43.1	43.0	0.1	250
2	10:12 AM 10:42 AM	30	60	43.0	42.8	0.1	250
3	10:42 AM 11:12 AM	30	90	42.8	42.6	0.2	125
4	11:12 AM 11:42 AM	30	120	42.6	42.5	0.1	250
5	11:42 AM 12:12 PM	30	150	42.5	42.4	0.1	250
6	12:12 PM 12:42 PM	30	180	42.4	42.2	0.1	250
7	12:42 PM 1:12 PM	30	210	42.2	42.1	0.1	250
8	1:12 PM 1:42 PM	30	240	42.1	42.0	0.1	250
9	1:42 PM 2:12 PM	30	270	42.0	41.9	0.1	250
10	2:12 PM 2:42 PM	30	300	41.9	41.8	0.1	250
11	2:42 PM 3:12 PM	30	330	41.8	41.6	0.1	250
12	3:12 PM 3:42 PM	30	360	41.6	41.5	0.1	250

Infiltration Rate (in/hr):			0.01				
Radius of test hole (in):			4				**Figure A-11**
Average Head (in):			41.6				

PERCOLATION TEST REPORT

Project Name:		KIA Moreno Valley			**Project No.:**		T2844-22-01
Test Hole No.:		P-2			**Date Excavated:**		12/17/2018
Length of Test Pipe:			95.8	inches	**Soil Classification:**		SM
Height of Pipe above Ground:			16.8	inches	**Presoak Date:**		12/17/2018
Depth of Test Hole:			79.0	inches	**Perc Test Date:**		12/18/2018
Check for Sandy Soil Criteria Tested by:				SP	**Percolation Tested by:**		SP
Water level measured from bottom of hole							

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	8:56 AM 9:21 AM	25	25	23.4	23.0	0.4	69
2	9:21 AM 9:46 AM	25	50	23.0	22.9	0.1	208
			Soil Criteria: Normal				

Percolation Test

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Head (in)	Final Water Head (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	9:46 AM 10:16 AM	30	30	22.9	22.6	0.4	83
2	10:16 AM 10:46 AM	30	60	22.6	22.2	0.4	83
3	10:46 AM 11:16 AM	30	90	22.2	21.4	0.8	36
4	11:16 AM 11:46 AM	30	120	21.4	20.2	1.2	25
5	11:46 AM 12:16 PM	30	150	20.2	19.1	1.1	28
6	12:16 PM 12:46 PM	30	180	19.1	18.0	1.1	28
7	12:46 PM 1:16 PM	30	210	18.0	16.8	1.2	25
8	1:16 PM 1:46 PM	30	240	16.8	15.7	1.1	28
9	1:46 PM 2:16 PM	30	270	15.7	14.6	1.1	28
10	2:16 PM 2:46 PM	30	300	14.6	13.6	1.1	28
11	2:46 PM 3:16 PM	30	330	13.6	12.5	1.1	28
12	3:16 PM 3:46 PM	30	360	12.5	11.4	1.1	28

Infiltration Rate (in/hr):			0.31				
Radius of test hole (in):			4				**Figure A-12**
Average Head (in):			11.9				

PERCOLATION TEST REPORT

Project Name:		KIA Moreno Valley			**Project No.:**		T2844-22-01
Test Hole No.:		P-3			**Date Excavated:**		12/17/2018
Length of Test Pipe:			119.8	inches	**Soil Classification:**		ML
Height of Pipe above Ground:			2.4	inches	**Presoak Date:**		12/17/2018
Depth of Test Hole:			117.4	inches	**Perc Test Date:**		12/18/2018
Check for Sandy Soil Criteria Tested by:				SP	**Percolation Tested by:**		SP
Water level measured from bottom of hole							

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	9:03 AM 9:28 AM	25	25	42.6	42.5	0.1	208
2	9:28 AM 9:53 AM	25	50	42.5	42.4	0.1	208
			Soil Criteria: Normal				

Percolation Test

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Head (in)	Final Water Head (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	9:53 AM 10:23 AM	30	30	42.4	42.2	0.1	250
2	10:23 AM 10:53 AM	30	60	42.2	42.1	0.1	250
3	10:53 AM 11:23 AM	30	90	42.1	42.0	0.1	250
4	11:23 AM 11:53 AM	30	120	42.0	41.9	0.1	250
5	11:53 AM 12:23 PM	30	150	41.9	41.8	0.1	250
6	12:23 PM 12:53 PM	30	180	41.8	41.6	0.1	250
7	12:53 PM 1:23 PM	30	210	41.6	41.5	0.1	250
8	1:23 PM 1:53 PM	30	240	41.5	41.4	0.1	250
9	1:53 PM 2:23 PM	30	270	41.4	41.3	0.1	250
10	2:23 PM 2:53 PM	30	300	41.3	41.2	0.1	250
11	2:53 PM 3:23 PM	30	330	41.2	41.0	0.1	250
12	3:23 PM 3:53 PM	30	360	41.0	40.9	0.1	250

Infiltration Rate (in/hr):			0.01				
Radius of test hole (in):			4				**Figure A-13**
Average Head (in):			41.0				

PERCOLATION TEST REPORT							
Project Name:		KIA Moreno Valley			**Project No.:**		T2844-22-01
Test Hole No.:		P-4			**Date Excavated:**		12/17/2018
Length of Test Pipe:			120.0	inches	**Soil Classification:**		ML
Height of Pipe above Ground:			0.0	inches	**Presoak Date:**		12/17/2018
Depth of Test Hole:			120.0	inches	**Perc Test Date:**		12/18/2018
Check for Sandy Soil Criteria Tested by:				SP	**Percolation Tested by:**		SP
Water level measured from bottom of hole							
Sandy Soil Criteria Test							
Trial No.	**Time**	**Time Interval (min)**	**Total Elapsed Time (min)**	**Initial Water Level (in)**	**Final Water Level (in)**	**Δ in Water Level (inches)**	**Percolation Rate (min/inch)**
1	9:06 AM 9:31 AM	25	25	31.3	31.2	0.1	208
2	9:31 AM 9:56 AM	25	50	31.2	30.6	0.6	42
			Soil Criteria: Normal				
			Percolation Test				
Reading No.	**Time**	**Time Interval (min)**	**Total Elapsed Time (min)**	**Initial Water Head (in)**	**Final Water Head (in)**	**Δ in Water Level (inches)**	**Percolation Rate (min/inch)**
1	9:56 AM 10:26 AM	30	30	30.6	30.5	0.1	250
2	10:26 AM 10:56 AM	30	60	30.5	29.9	0.6	50
3	10:56 AM 11:26 AM	30	90	29.9	29.3	0.6	50
4	11:26 AM 11:56 AM	30	120	29.3	28.7	0.6	50
5	11:56 AM 12:26 PM	30	150	28.7	28.1	0.6	50
6	12:26 PM 12:56 PM	30	180	28.1	27.5	0.6	50
7	12:56 PM 1:26 PM	30	210	27.5	26.9	0.6	50
8	1:26 PM 1:56 PM	30	240	26.9	26.4	0.5	63
9	1:56 PM 2:26 PM	30	270	26.4	25.9	0.5	63
10	2:26 PM 2:56 PM	30	300	25.9	25.3	0.6	50
11	2:56 PM 3:26 PM	30	330	25.3	24.8	0.5	63
12	3:26 PM 3:56 PM	30	360	24.8	24.4	0.5	63
Infiltration Rate (in/hr):			0.07				
Radius of test hole (in):			4				**Figure A-14**
Average Head (in):			24.6				

APPENDIX B

APPENDIX B

LABORATORY TESTING

We performed laboratory tests in accordance with current, generally accepted test methods of ASTM International (ASTM) or other suggested procedures. We analyzed selected soil samples for *in-situ* density and moisture content, maximum dry density and optimum moisture content, expansion index, corrosivity, grain size distribution, consolidation characteristics, R-value and direct shear strength. The results of the laboratory tests are presented on Figures B-1 through B-5. The in-place dry density and moisture content of the samples tested are presented on the boring logs in *Appendix A*.

SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS ASTM D1557

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% of dry wt.)
B-1 @ 0-5’	Silty SAND (SM), reddish brown to light brown	135.2	6.7

SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS ASTM D4829

Sample No.	Moisture Content		After Test Dry Density (pcf)	Expansion Index
	Before Test (%)	After Test (%)		
B-5 @ 0-5’	7.6	12.5	120.0	3

SUMMARY OF CORROSIVITY TEST RESULTS

Sample No.	Chloride Content (ppm)	Sulfate Content (%)	pH	Resistivity (ohm-centimeter)
B-1 @ 0-5’	98	0.001	8.3	4,600

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

SUMMARY OF LABORATORY R-VALUE TEST RESULTS ASTM D2844

Sample No.	R-Value
B-6 @ 0-5”	33

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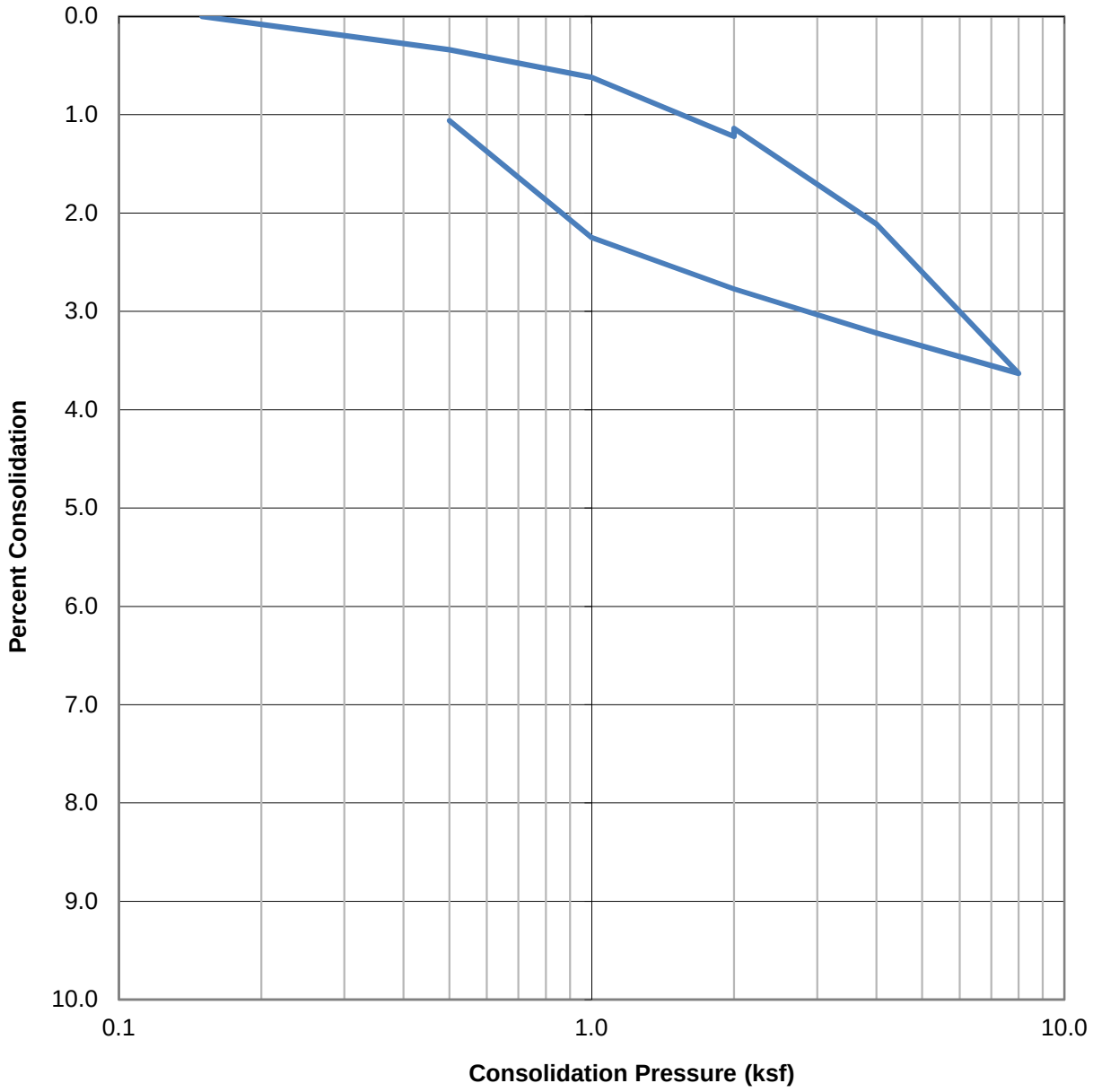
LABORATORY TEST RESULTS

KIA MORENO VALLEY
EAST OF MORENO BEACH DRIVE
AND AUTO MALL DRIVE
MORENO VALLEY, CALIFORNIA

JANUARY, 2019 | PROJECT NO. T2844-22-01 | FIG B-1

WATER ADDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B-2 @ 7.5'	ML	106.1	11.5	22.1

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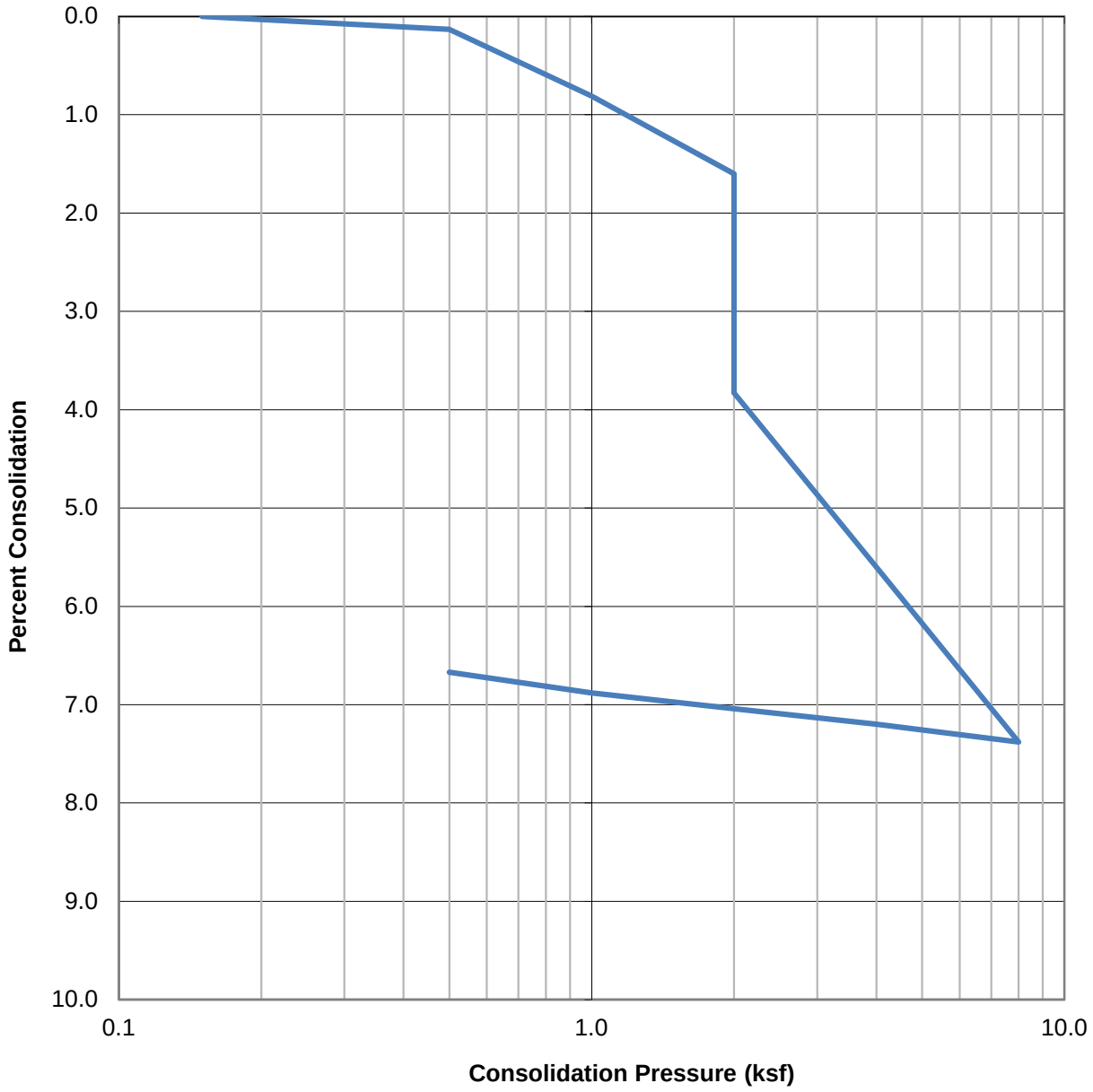
CONSOLIDATION TEST RESULTS

KIA MORENO VALLEY
EAST OF MORENO BEACH DRIVE
AND AUTO MALL DRIVE
MORENO VALLEY, CALIFORNIA

JANUARY, 2019	PROJECT NO. T2844-22-01	FIG B-2

WATER ADDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B-5 @ 2.5'	SM	116.6	6.5	13.1

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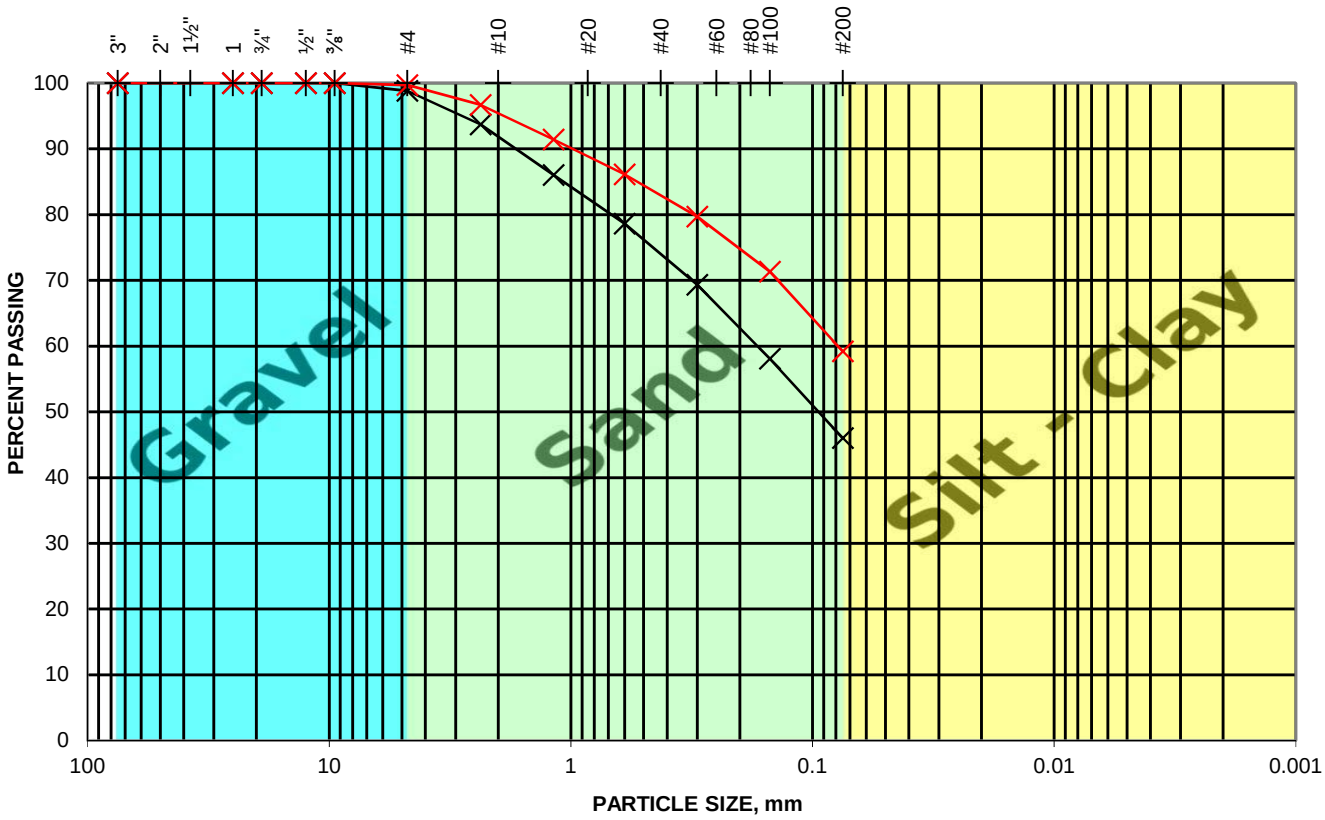
CONSOLIDATION TEST RESULTS

KIA MORENO VALLEY
EAST OF MORENO BEACH DRIVE
AND AUTO MALL DRIVE
MORENO VALLEY, CALIFORNIA

JANUARY, 2019 | PROJECT NO. T2844-22-01 | FIG B-3



SAMPLE ID	SAMPLE DESCRIPTION
P-1/P-2 Blend	SM - Silty Sand, trace gravel
P-3/P-4 Blend	ML - Sandy SILT

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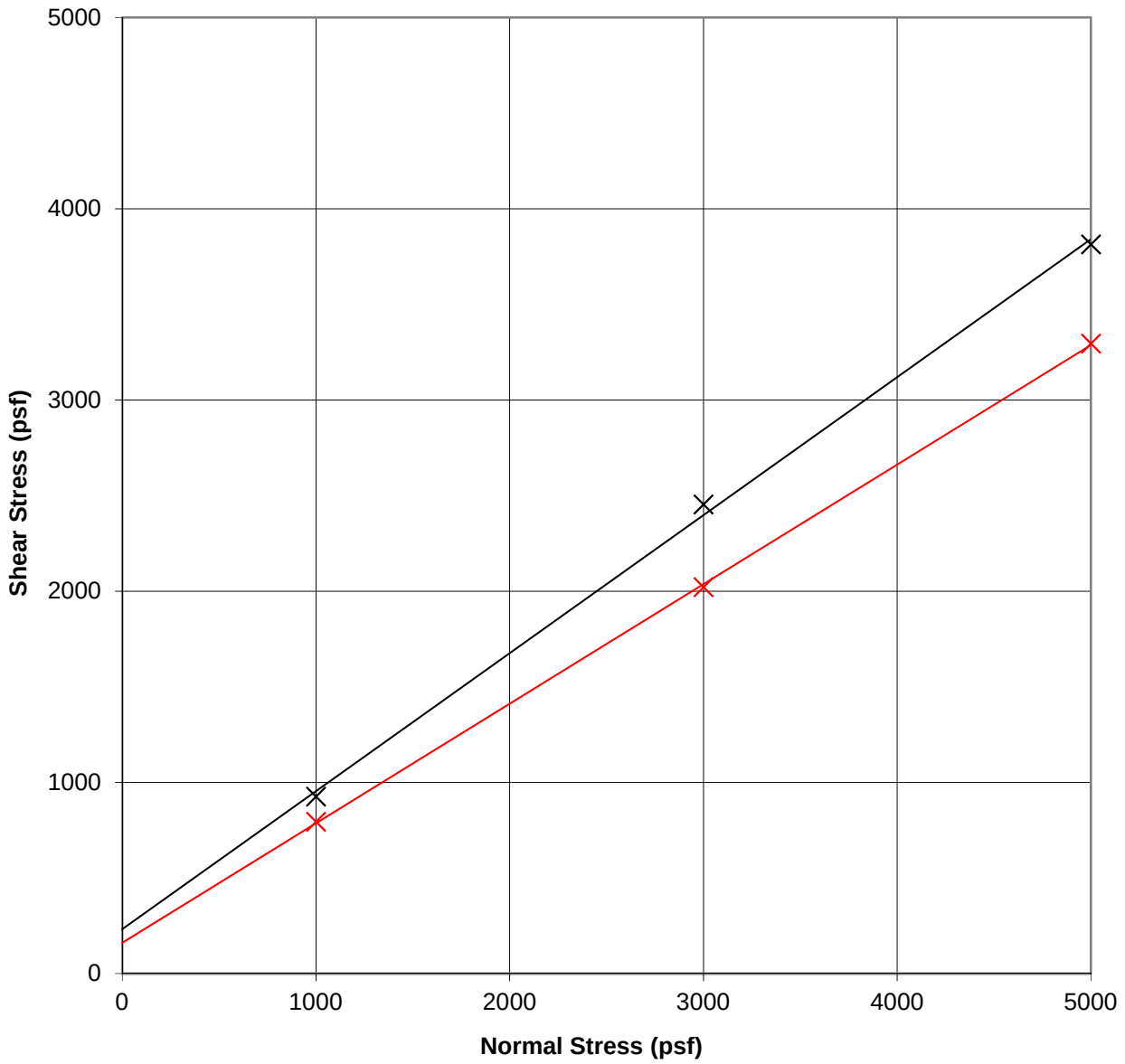
GRAIN SIZE DISTRIBUTION

KIA MORENO VALLEY
EAST OF MORENO BEACH DRIVE
AND AUTO MALL DRIVE
MORENO VALLEY, CALIFORNIA

JANUARY, 2019	PROJECT NO. T2844-22-01	FIG B-4



SAMPLE ID	SOIL TYPE	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)	C (psf)	ϕ (deg)
*B-1 @ 0-5'	SM	121.7	6.7	11.3	230	36
B-2 @ 5'	ML	96.7	9.6	23.3	160	32

*Sample remolded to approximately 90% of the test maximum dry density at optimum moisture content.

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DIRECT SHEAR TEST RESULTS
KIA MORENO VALLEY
EAST OF MORENO BEACH DRIVE
AND AUTO MALL DRIVE
MORENO VALLEY, CALIFORNIA

JANUARY, 2019 | PROJECT NO. T2844-22-01 | FIG B-5

APPENDIX C

APPENDIX C

RECOMMENDED GRADING SPECIFICATIONS

FOR

KIA MORENO VALLEY
SOUTHEAST OF MORENO BEACH DRIVE
AND AUTO MALL WAY
MORENO VALLEY, CALIFORNIA

PROJECT NO. T2844-22-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

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

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

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

2. DEFINITIONS

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

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

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

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

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

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

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

3. MATERIALS

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

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

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

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

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

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

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

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

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

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

4. CLEARING AND PREPARING AREAS TO BE FILLED

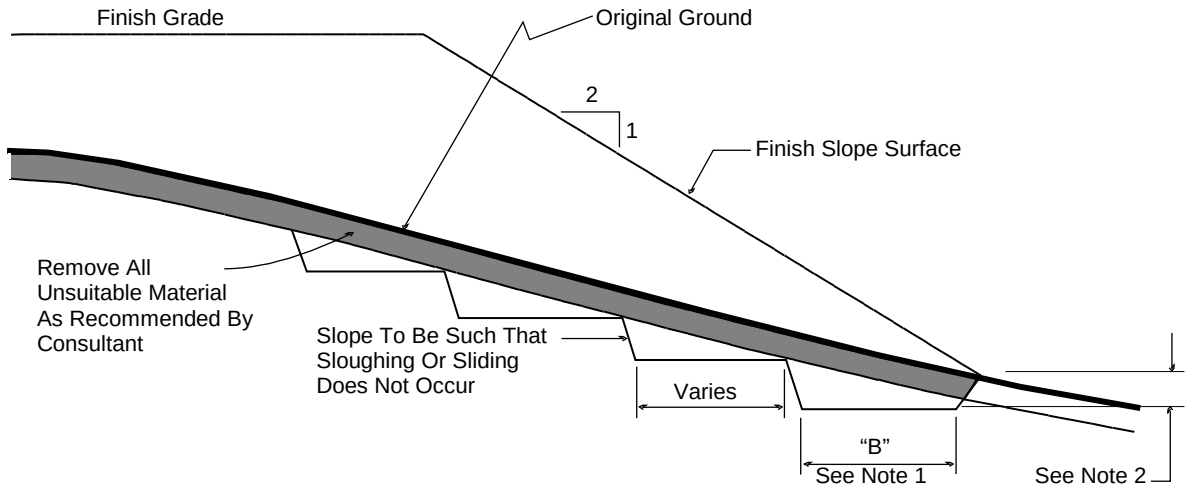
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material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

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

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

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

TYPICAL BENCHING DETAIL



No Scale

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

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

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

5. COMPACTION EQUIPMENT

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

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

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

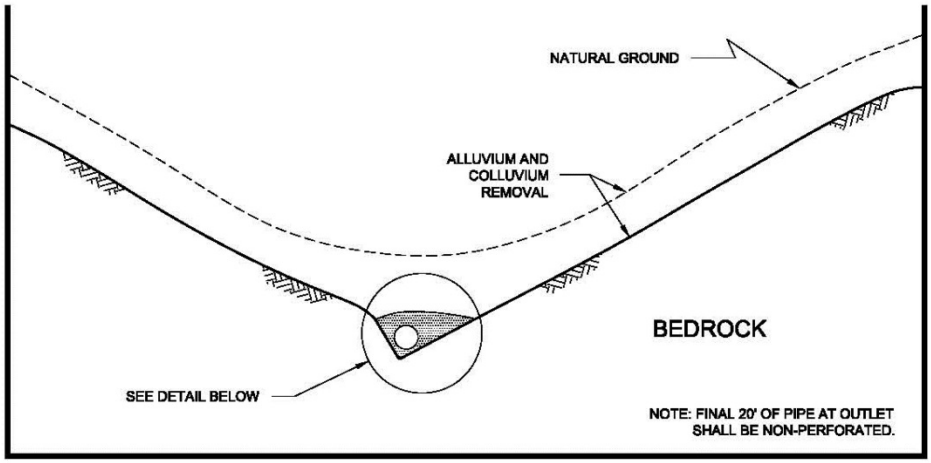
6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant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

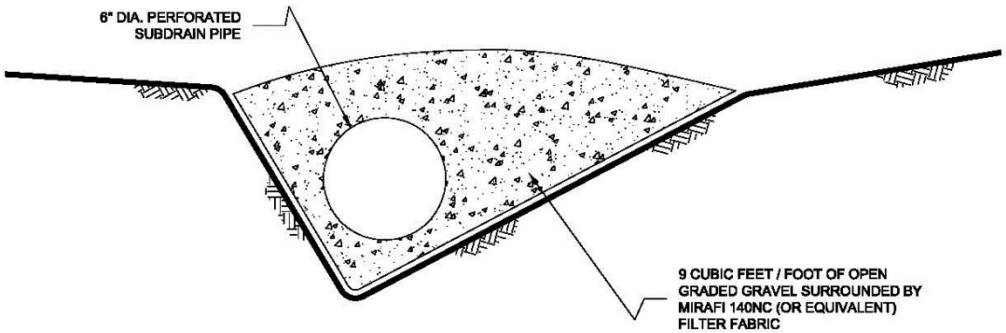
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

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

TYPICAL CANYON DRAIN DETAIL





NOTES:

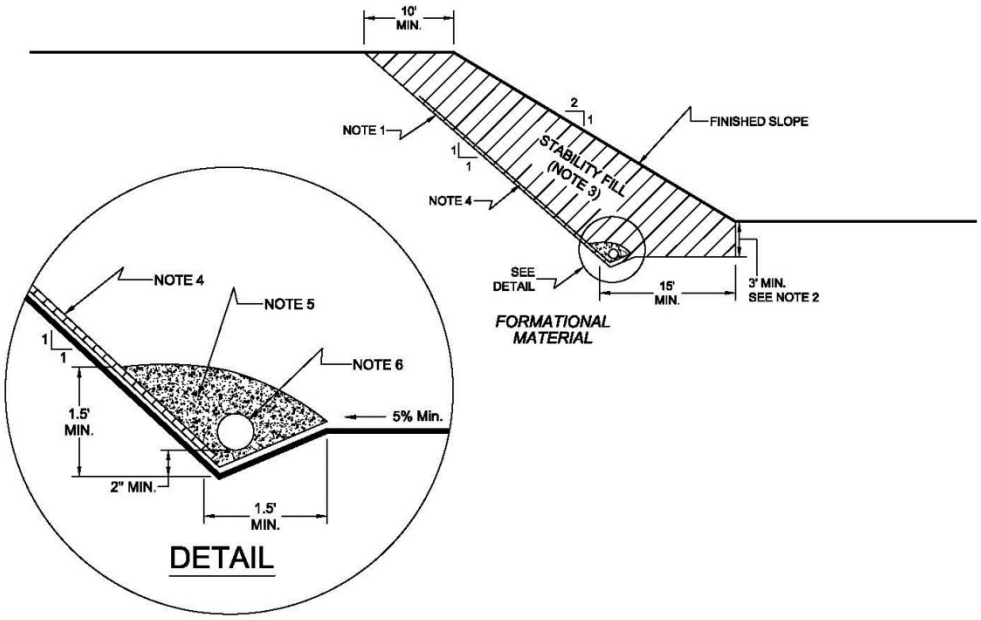
1.....6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS
IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

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

NO SCALE

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

TYPICAL STABILITY FILL DETAIL



NOTES:

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

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

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

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

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

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

NO SCALE

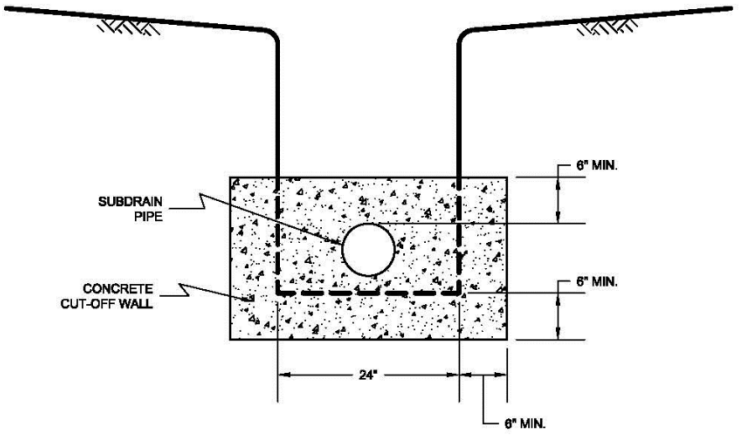
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing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

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

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

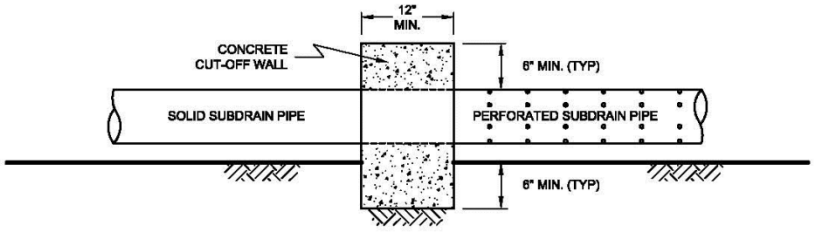
TYPICAL CUT OFF WALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW

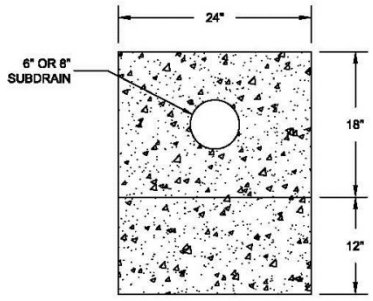


NO SCALE

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

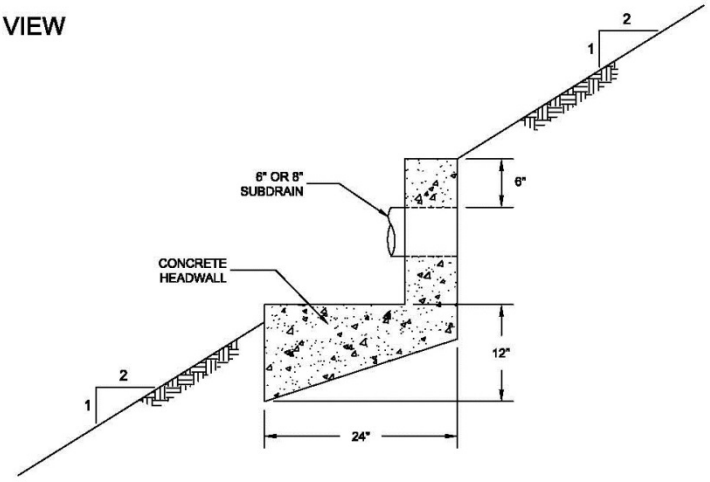
TYPICAL HEADWALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW



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

NO SCALE

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

8. OBSERVATION AND TESTING

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

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

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

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

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

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

8.6.1 Soil and Soil-Rock Fills:

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

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

Appendix 4: Historical Site Conditions

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

TO BE PROVIDED IN FINAL WQMP

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

N/A

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

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

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

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

Company Name: Kimley-Horn | Date: 5/15/2019
Designed by: Xochitl Ortega | Case No:
Company Project Number/Name: Car Pros KIA Sales and Service Center

BMP Identification

BMP NAME / ID: BMP-1

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	*DMA-1*	*27742*	*Concrete or Asphalt*	*1*	*0.89*	*24745.9*			
		27742	***Total***			24745.9	0.20	*0.1*	*0.115*

Notes:

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

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

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

Company Name	Kimley-Horn	Date	5/15/2019
Designed by	Xochitl Ortega	Case No	
Company Project Number/Name	Car Pros KIA Sales and Service Center		

BMP Identification

BMP NAME / ID: BMP-2

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

DMAs

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)*
DMA-2	*61584*	*Concrete or Asphalt*	*1*	*0.89*	*54932.9*			
	61584		***Total***		**54932.9**	**0.20**	***0.3***	***0.346***

Notes:

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

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

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

Company Name: Kimley-Horn | Date: 5/15/2019

Designed by: Xochitl Ortega | Case No:

Company Project Number/Name: Car Pros KIA Sales and Service Center

BMP Identification

BMP NAME / ID: BMP-3

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity: I = 0.20 in/hr

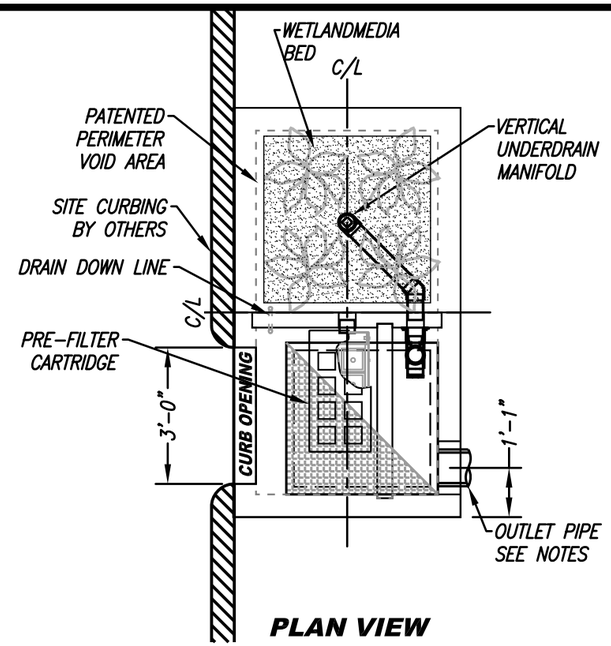
Drainage Management Area Tabulation

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	*DMA-3A*	*126015*	*Concrete or Asphalt*	*1*	*0.89*	*112405.4*			
	DMA-3B	*32340*	*Ornamental Landscaping*	*0.1*	*0.11046*	*3572.2*			
		158355	***Total***			**115977.6**	**0.20**	***0.5***	***0.577***

Notes:

SITE SPECIFIC DATA			
PROJECT NUMBER	SEE CONSTRUCTION PLANS		
ORDER NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)	FLOW BASED (CFS)		
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	36" X 36"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			TBD
ORIFICE SIZE (DIA. INCHES)			TBD
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.			



PLAN VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

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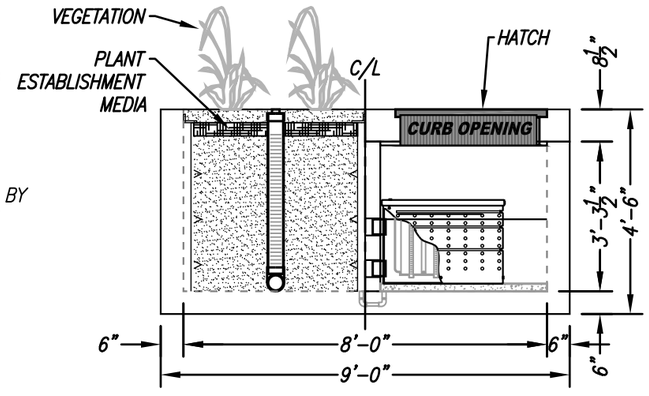
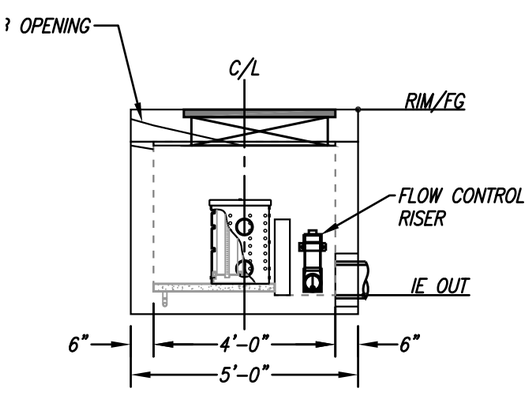
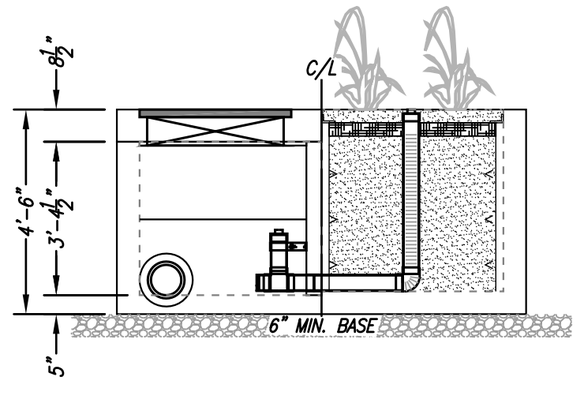
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

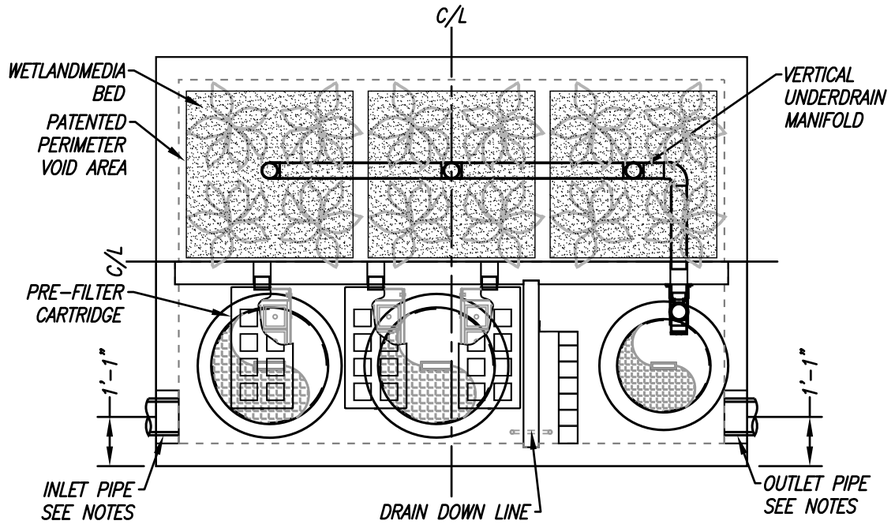
TREATMENT FLOW (CFS)	0.115
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MODULAR WETLANDS

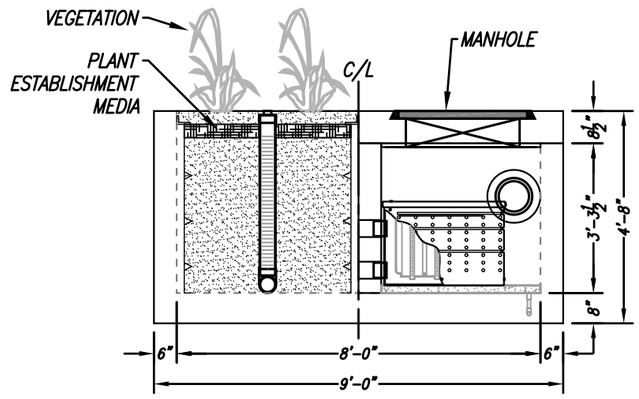
Bio Clean
A Forterra Company

MWS-L-4-8-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

SITE SPECIFIC DATA			
PROJECT NUMBER	SEE CONSTRUCTION PLANS		
ORDER NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)	FLOW BASED (CFS)		
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	2EA ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			TBD
ORIFICE SIZE (DIA. INCHES)			TBD
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.			



PLAN VIEW



LEFT END VIEW

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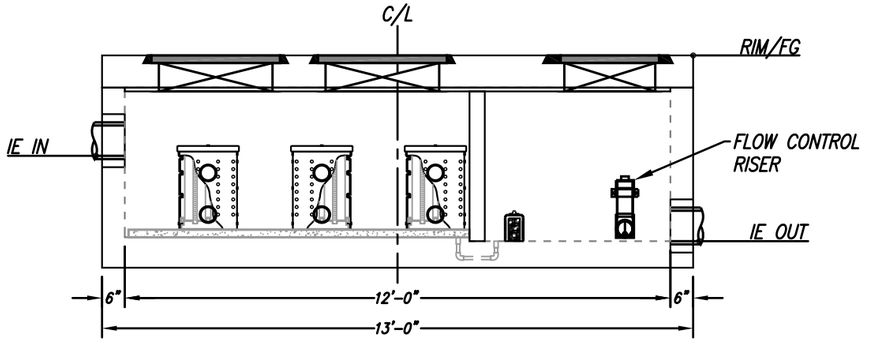
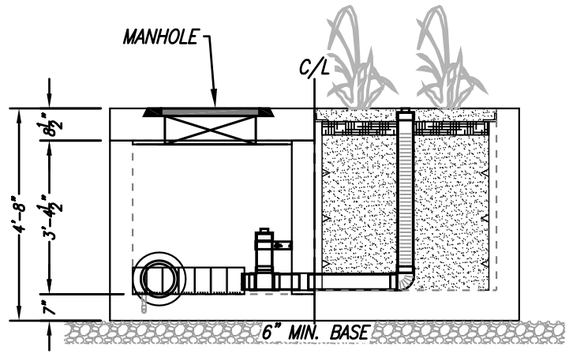


ELEVATION VIEW



RIGHT END VIEW

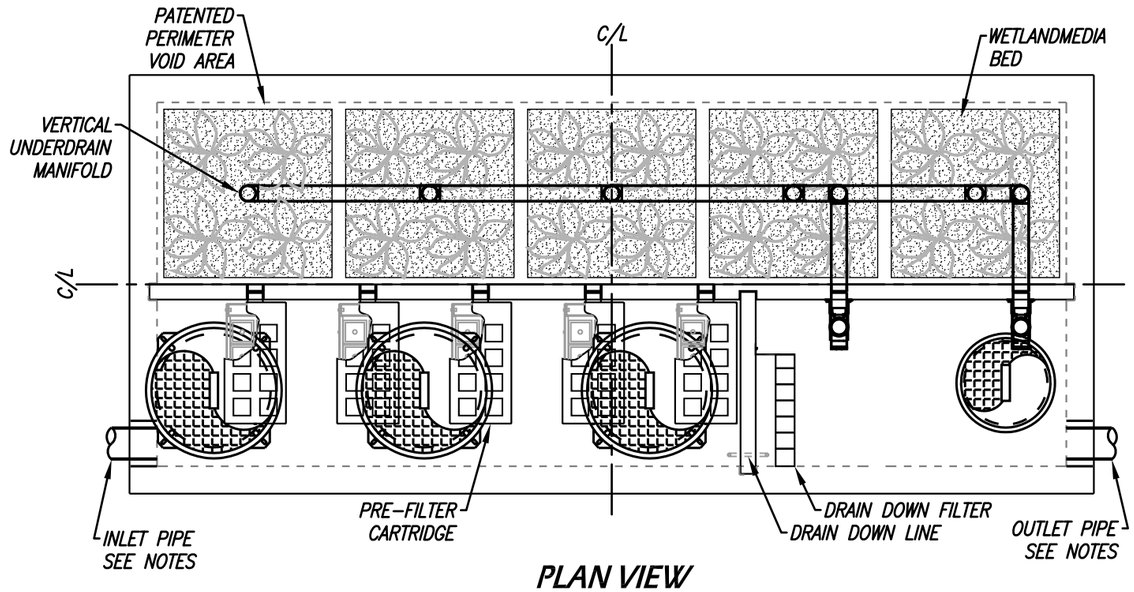
TREATMENT FLOW (CFS)	0.346
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MODULAR WETLANDS

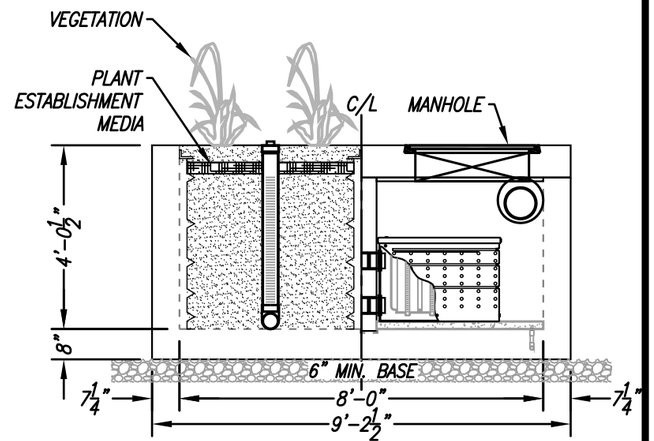
Bio Clean
A Forterra Company

MWS-L-8-12-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

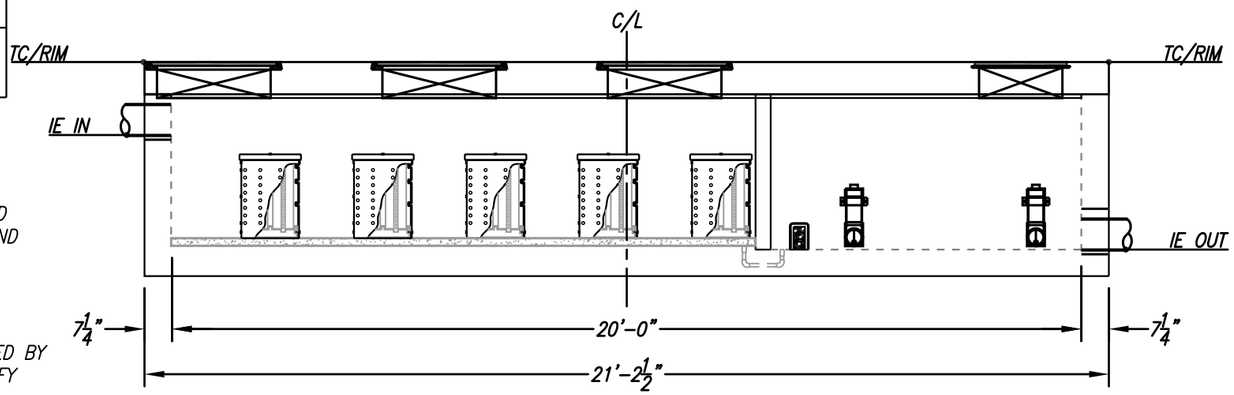
SITE SPECIFIC DATA			
PROJECT NAME		SEE CONSTRUCTION PLANS	
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			11.85
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø2.43"
MAXIMUM PICK WEIGHT (LBS)			TBD
NOTES:			



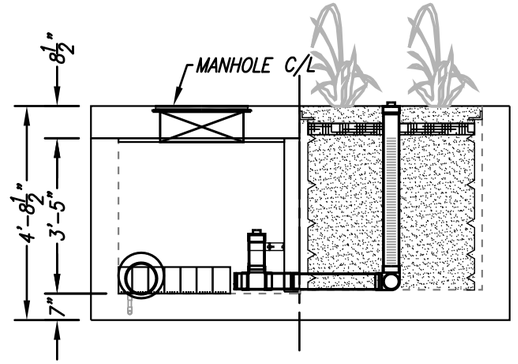
PLAN VIEW



LEFT END VIEW
BIOFILTRATION/PRETREATMENT



ELEVATION VIEW



RIGHT END VIEW
DISCHARGE/BIOFILTRATION

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON–SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

TREATMENT FLOW (CFS)	0.577
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MODULAR WETLANDS
www.ModularWetlands.com | (855) 5MOD-WET

MWS-L-8-20-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

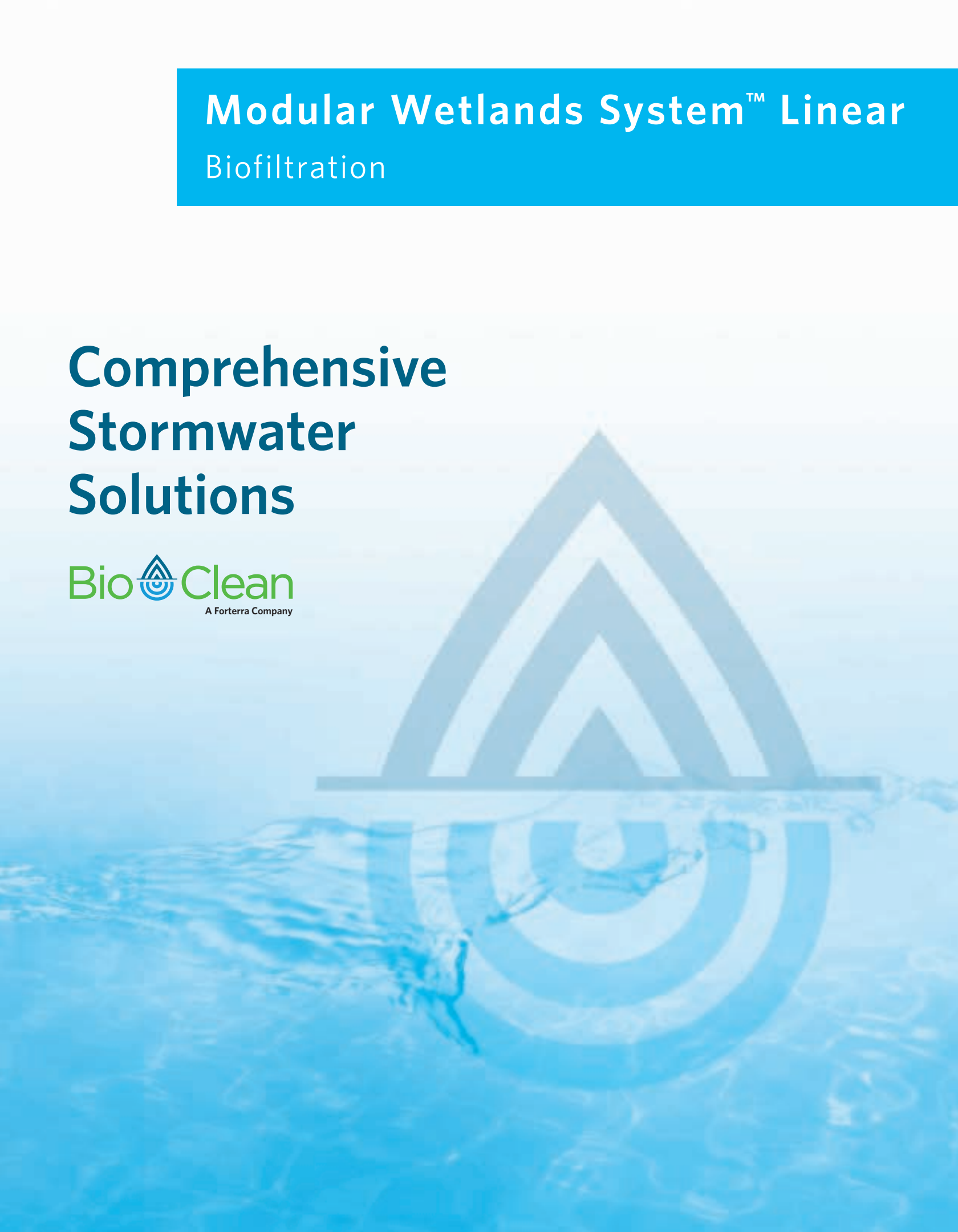
6/2/15/JOHN

Modular Wetlands System™ Linear

Biofiltration

Comprehensive Stormwater Solutions

Bio Clean
A Forterra Company



OVERVIEW

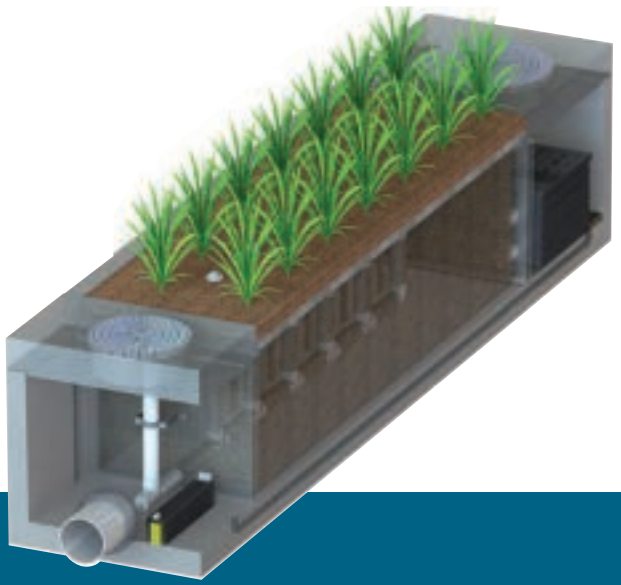
The Bio Clean Modular Wetlands System™ Linear (MWS Linear) represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pretreatment, the MWS Linear incorporates an advanced pretreatment chamber that includes separation and pre-filter cartridges. In this chamber, sediment and hydrocarbons are removed from runoff before entering the biofiltration chamber, in turn reducing maintenance costs and improving performance.

The Urban Impact

For hundreds of years, natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as our cities grow and develop, these natural wetlands have perished under countless roads, rooftops, and parking lots.

Plant A Wetland

Without natural wetlands, our cities are deprived of water purification, flood control, and land stability. Modular Wetlands and the MWS Linear re-establish nature's presence and rejuvenate waterways in urban areas.



PERFORMANCE

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons, and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With its advanced pretreatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses nature's ability to process, transform, and remove even the most harmful pollutants.

66% REMOVAL OF DISSOLVED ZINC	**69%** REMOVAL OF TOTAL ZINC	**38%** REMOVAL OF DISSOLVED COPPER	**64%** REMOVAL OF TOTAL PHOSPHORUS	
45% REMOVAL OF NITROGEN	**50%** REMOVAL OF TOTAL COPPER	**95%** REMOVAL OF MOTOR OIL	**67%** REMOVAL OF ORTHO PHOSPHORUS	**85%** REMOVAL OF TSS

APPROVALS

The MWS Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation and perhaps the world.

WASHINGTON STATE TAPE APPROVED

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft^2 loading rate. The highest performing BMP on the market for all main pollutant categories.

DEQ ASSIGNMENT

The Virginia Department of Environmental Quality assigned the MWS Linear, the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Regulation technical criteria.

MARYLAND DEPARTMENT OF THE ENVIRONMENT APPROVED

Granted Environmental Site Design (ESD) status for new construction, redevelopment, and retrofitting when designed in accordance with the design manual.

MASTEP EVALUATION

The University of Massachusetts at Amherst – Water Resources Research Center issued a technical evaluation report noting removal rates up to 84% TSS, 70% total phosphorus, 68.5% total zinc, and more.

RHODE ISLAND DEM APPROVED

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% pathogens, 30% total phosphorus, and 30% total nitrogen.

ADVANTAGES

- HORIZONTAL FLOW BIOFILTRATION
- GREATER FILTER SURFACE AREA
- PRETREATMENT CHAMBER
- PATENTED PERIMETER VOID AREA
- FLOW CONTROL
- NO DEPRESSED PLANTER AREA
- AUTO DRAINDOWN MEANS NO MOSQUITO VECTOR

OPERATION

The MWS Linear is the most efficient and versatile biofiltration system on the market, and it is the only system with horizontal flow which improves performance, reduces footprint, and minimizes maintenance. Figure 1 and Figure 2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

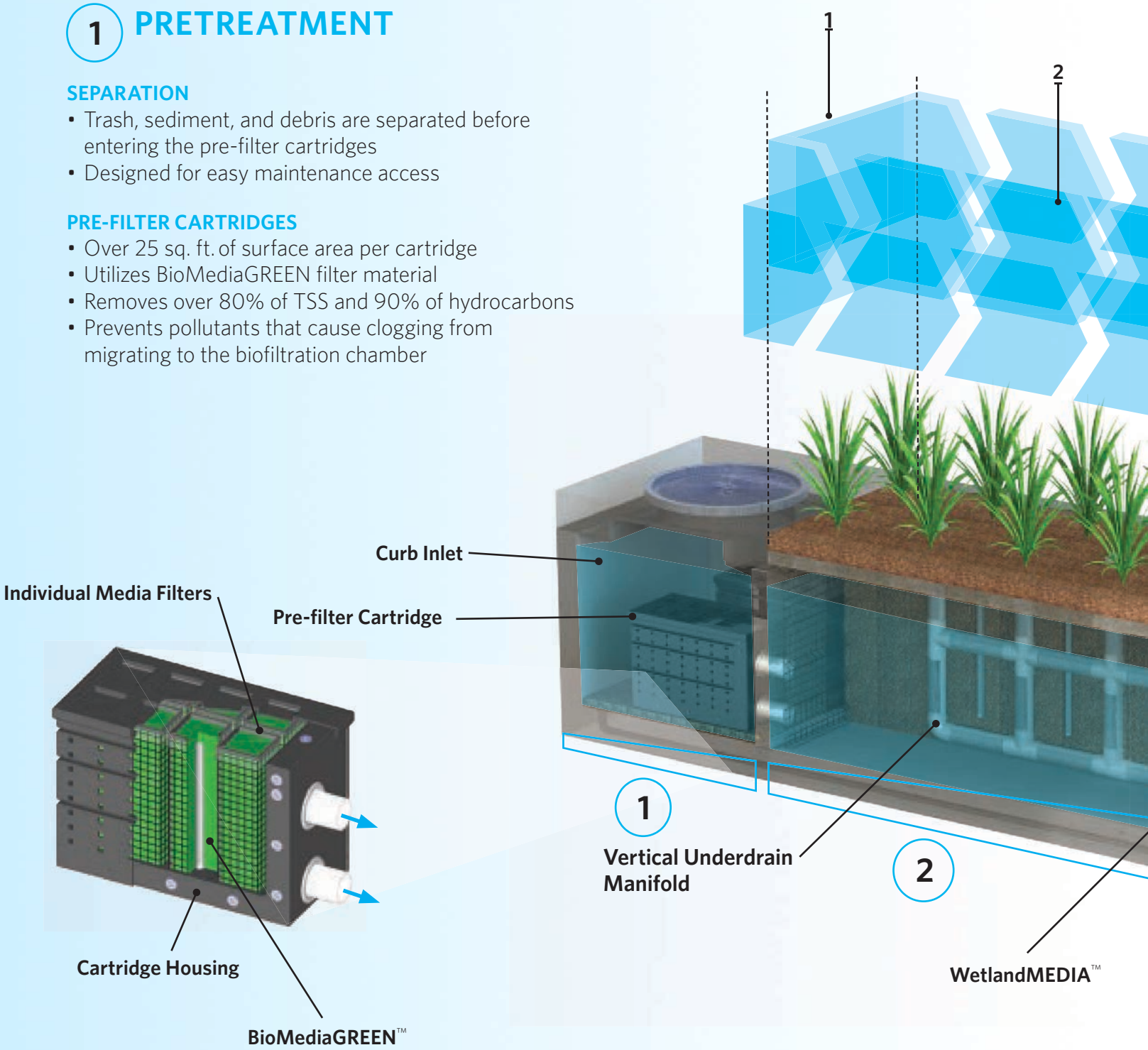
1 PRETREATMENT

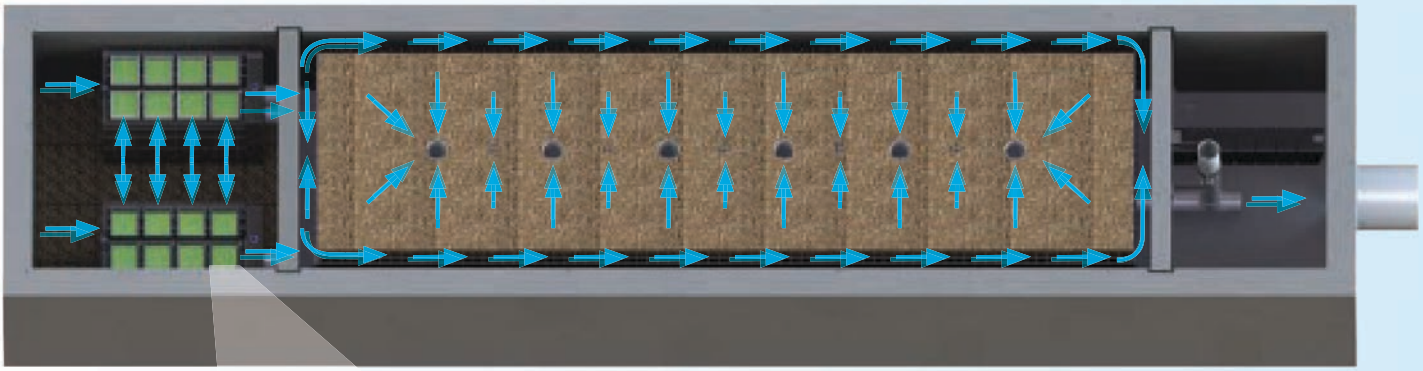
SEPARATION

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

PRE-FILTER CARTRIDGES

- Over 25 sq. ft. of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS and 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber





2x to 3x more surface area than traditional downward flow bioretention systems.

Figure 2, Top View

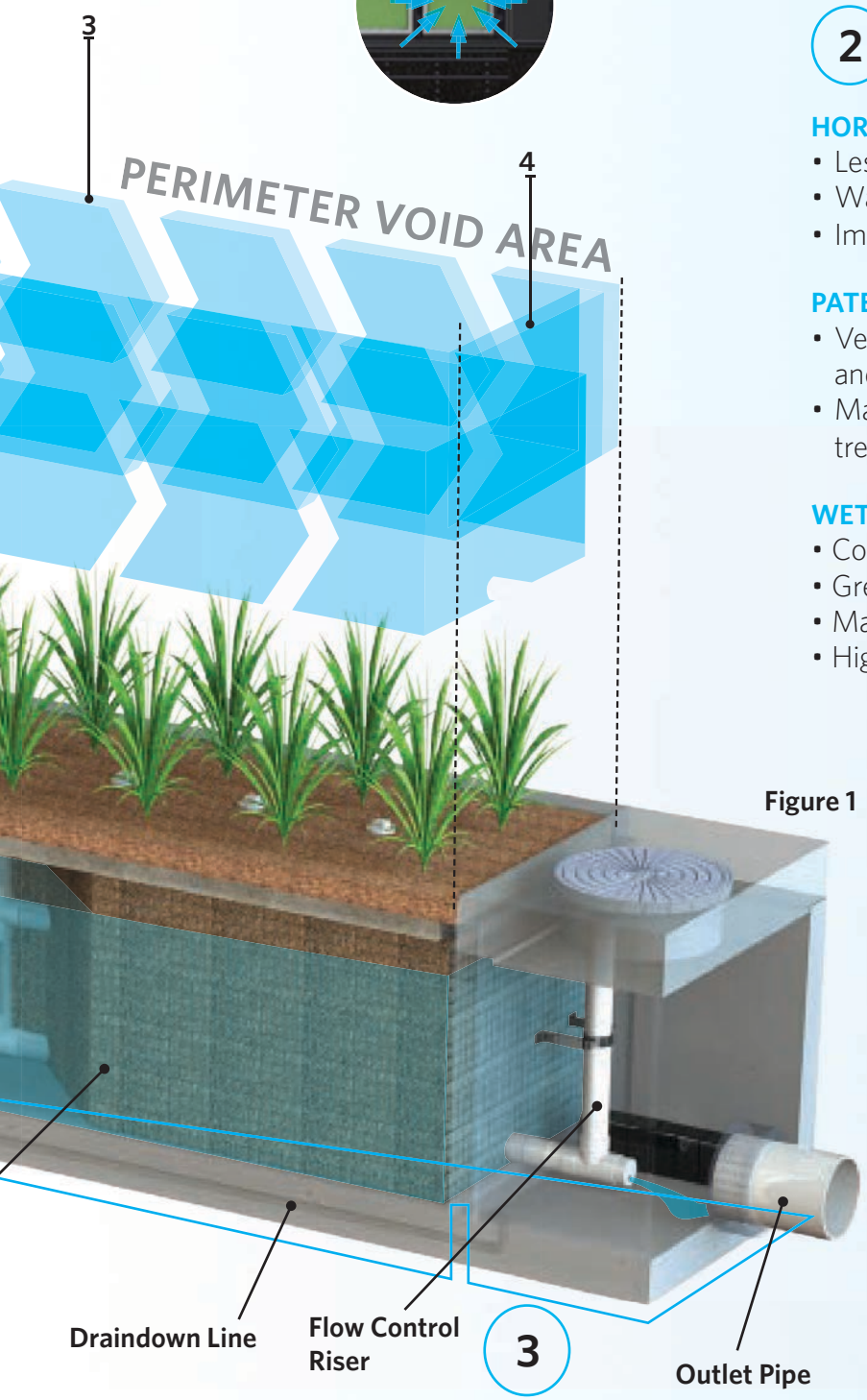


Figure 1

2 BIOFILTRATION

HORIZONTAL FLOW

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

PATENTED PERIMETER VOID AREA

- Vertically extends void area between the walls and the WetlandMEDIA on all four sides
- Maximizes surface area of the media for higher treatment capacity

WETLANDMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and lightweight

3 DISCHARGE

FLOW CONTROL

- Orifice plate controls flow of water through WetlandMEDIA to a level lower than the media's capacity
- Extends the life of the media and improves performance

DRAINDOWN FILTER

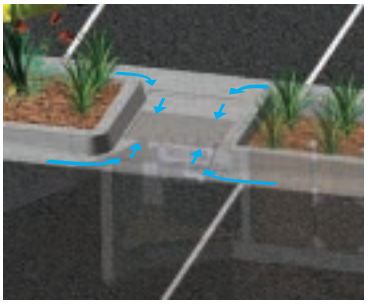
- The draindown is an optional feature that completely drains the pretreatment chamber
- Water that drains from the pretreatment chamber between storm events will be treated

CONFIGURATIONS

The MWS Linear is the preferred biofiltration system of civil engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your storm drain design.

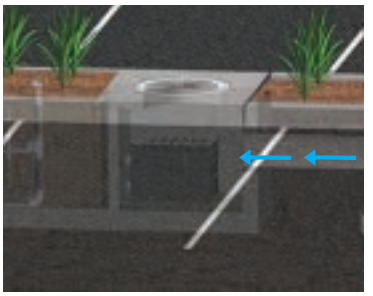
CURB TYPE

The Curb Type configuration accepts sheet flow through a curb opening and is commonly used along roadways and parking lots. It can be used in sump or flow-by conditions. Length of curb opening varies based on model and size.



GRATE TYPE

The Grate Type configuration offers the same features and benefits as the Curb Type but with a grated/drop inlet above the systems pretreatment chamber. It has the added benefit of allowing pedestrian access over the inlet. ADA-compliant grates are available to assure easy and safe access. The Grate Type can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



VAULT TYPE

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pretreatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/ bioretention systems. Another benefit of the "pipe-in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

DOWNSPOUT TYPE

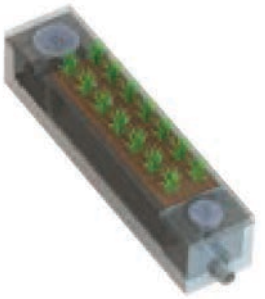
The Downspout Type is a variation of the Vault Type and is designed to accept a vertical downspout pipe from rooftop and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter, and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

ORIENTATIONS

SIDE-BY-SIDE

The Side-By-Side orientation places the pretreatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side.This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.

END-TO-END



The End-To-End orientation places the pretreatment and discharge chambers on opposite ends of the biofiltration chamber, therefore minimizing the width of the system to 5 ft. (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is that bypass must be external.

BYPASS

INTERNAL BYPASS WEIR (SIDE-BY-SIDE ONLY)

The Side-By-Side orientation places the pretreatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pretreatment chamber directly to the discharge chamber.

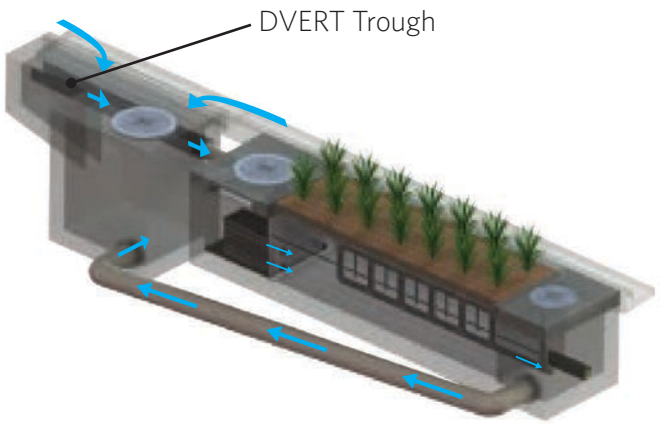
EXTERNAL DIVERSION WEIR STRUCTURE

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

FLOW-BY-DESIGN

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

DVERT LOW FLOW DIVERSION



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allow the MWS Linear to be installed anywhere space is available.

SPECIFICATIONS

FLOW-BASED

The MWS Linear can be used in stand-alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface, it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

MODEL #	DIMENSIONS	WETLANDMEDIA SURFACE AREA (sq.ft.)	TREATMENT FLOW RATE (cfs)
MWS-L-4-4	4′ x 4′	23	0.052
MWS-L-4-6	4′ x 6′	32	0.073
MWS-L-4-8	4′ x 8′	50	0.115
MWS-L-4-13	4′ x 13′	63	0.144
MWS-L-4-15	4′ x 15′	76	0.175
MWS-L-4-17	4′ x 17′	90	0.206
MWS-L-4-19	4′ x 19′	103	0.237
MWS-L-4-21	4′ x 21′	117	0.268
MWS-L-6-8	7′ x 9′	64	0.147
MWS-L-8-8	8′ x 8′	100	0.230
MWS-L-8-12	8′ x 12′	151	0.346
MWS-L-8-16	8′ x 16′	201	0.462
MWS-L-8-20	9′ x 21′	252	0.577
MWS-L-8-24	9′ x 25′	302	0.693

APPLICATIONS

The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

INDUSTRIAL

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA-mandated effluent limits for dissolved metals and other pollutants.

RESIDENTIAL

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.

STREETS

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and it offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

PARKING LOTS

Parking lots are designed to maximize space and the MWS Linear's 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.

COMMERCIAL

Compared to bioretention systems, the MWS Linear can treat far more area in less space, meeting treatment and volume control requirements.

MIXED USE

The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications include:

• Agriculture • Reuse • Low Impact Development • Waste Water

PLANT SELECTION

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade, the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more contact time so that pollutants are more successfully decomposed, volatilized, and incorporated into the biomass of the MWS Linear's micro/macro flora and fauna.

A wide range of plants are suitable for use in the MWS Linear, but selections vary by location and climate. View suitable plants by visiting biocleanenvironmental.com/plants.

INSTALLATION

The MWS Linear is simple, easy to install, and has a space-efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles precast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians are available to supervise installations and provide technical support.

MAINTENANCE

Reduce your maintenance costs, man hours, and materials with the MWS Linear. Unlike other biofiltration systems that provide no pretreatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pretreatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pretreatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pretreatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long-term operation, and there is absolutely no need to replace expensive biofiltration media.

Bio Clean
A Forterra Company

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stormwater@forterrabp.com
biocleanenvironmental.com

072318R1

Installation Guidelines for Modular Wetland System

Delivery & Unloading/Lifting

1. Modular Wetland Systems, Inc. shall deliver the unit(s) to the site in coordination with the Contractor.

2. The Contractor will require spreader bars and chains/cables to safely and securely lift the main structure, risers a set of suitable lifting hooks, knuckles, shackles and eye bolts.

3. The main structure and lid can be lifted together or separately.

   Please see Modular Wetland Weights and Lifting Details. Contact Modular Wetlands for additional lifting details.

Inspection

1. Inspection of the Modular Wetland unit and all parts contained in or shipped outside of the unit shall be inspected at time of delivery by the site Engineer/Inspector and the Contractor. Any non-conformance to approved drawings or damage to any part of the system shall be documented on the Modular Wetland shipping ticket. Damage to the unit during and after unloading shall be corrected at the expense of the Contractor. Any necessary repairs to the Modular Wetland unit shall be made to the acceptance of the Engineer/Inspector.

Site Preparation

1. The Contractor is responsible for providing adequate and complete site/inlet protection when the Modular Wetland unit is installed prior to final site stabilization (full landscaping, grass cover, final paving, and street sweeping completed).

2. The Contractor shall adhere to all jurisdictional and/or OSHA safety rules in providing temporary shoring of the excavation.

3. The Contractor or Owner is responsible for appropriately barricading the Modular Wetland unit from traffic (in accordance with local codes).

Installation Guidelines for Modular Wetland System

Installation

1. Each unit shall be constructed at the locations and elevations according to the sizes shown on the approved drawings. Any modifications to the elevation or location shall be at the direction of and approved by the Engineer.

2. The unit shall be placed on the compacted sub-grade with a minimum 6-inch gravel base matching the final grade of the curb line in the area of the unit. The unit is to be placed such that the unit and top slab match the grade of the curb in the area of the unit. Compact undisturbed sub-grade materials to 95% of maximum density at +1% to 2% of the optimum moisture. Unsuitable material below sub-grade shall be replaced to site engineer's approval. Please see Modular Wetlands Weights and Lifting Details. Contact Modular Wetlands for guidance where slope exceeds 5%.

3. Once the unit is set, the internal wooden forms and protective silt fabric cover must be left intact (if WetlandMedia pre-installed). The top lid(s) should be sealed onto the box section before backfilling, using a non-shrink grout, butyl rubber or similar waterproof seal. The boards on the top of the lid and boards sealed in the unit's throat must NOT be removed. The Supplier will remove these sections at the time of activation.

4. Outlet connections shall be aligned and sealed to meet the approved drawings with modifications necessary to meet site conditions and local regulations. The correct outlet will be marked on the Modular Wetland unit.

5. Backfilling should be performed in a careful manner, bringing the appropriate fill material up in 6-inch lifts on all sides. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of the Modular Wetland unit shall conform to ASTM specification C891 "Standard Practice for Installation of Underground Precast Utility Structures" unless specified otherwise in contract documents.

6. It is the responsibility of the Contractor to provide curb and gutter and transition to the Modular Wetland unit for proper stormwater flow into the system through the throat, pipe or grate opening. A standard drawing of the throat and gutter detail is available in the following section; however the plans and contract documents supersede all standard drawings. Several variations of the standard design are available. Effective bypass for the Modular Wetland System is essential for correct operation (i.e. bypass to an overflow at lower elevation).

Installation Procedure

The contractor **MUST** provide all rigging And lifting apparatus, such as all cables, chains or straps and a set of lifting hooks, shackles, knuckles and eye bolts.

It is the contractor's responsibility to provide suitable lifting equipment to off-load the Modular Wetland unit.

Modular Wetland units are designed to be off-loaded using the contractor's spreader bar.

1. Apply Butyl Tape Seal

Apply butyl tape seal along the top of the box section. Butyl tape seal is provided with every unit.

Modular Wetland installed protective throat board and installed silt fabric must be left in place to protect the unit from construction sediment.

2. Unload and Set Box

Unload the Modular Wetland unit
the prepared hole with appropriate sub-grade.*

* Compacted sub-grade with a minimum
of six inches of gravel base which must match
the final grade of curb line the area of the unit.

3. Set Top On Box

Set the top slab on the box.

The Contractor is responsible for providing
adequate and complete site/inlet protection
when the Modular Wetland is installed prior
to final site stabilization (full landscaping,
grass cover, final paving, and street sweeping
completed).

4. Connect Outfall Pipe

The correct outlet will be marked on the
Modular Wetland.

Invert of outlet pipe **MUST** be even
with the floor of the system.

5. Install Curb & Gutter

It is the responsibility of the Contractor to provide curb and gutter and transition to the Modular Wetland for proper flow into the system through a 5”- 7” throat opening. A standard drawing of the throat and gutter detail in the following section. CONTRACTOR RESPONSIBLE FOR GROUTING IN ANY VISIBLE LIFTING POINTS.

6. Activation

Activation is performed **ONLY** by Modular Wetland personnel.

Activation can occur once the project site is fully stabilized (full landscaping, grass cover, final paving and street sweeping completed) and there is a 5” - 7” throat opening.

Call 760-433-7640 to schedule your activation.

NOTE: WetlandMedia Installation

For Larger models (MWS-L-4-13 and above) the system will be delivered without WetlandMedia pre-installed to minimize pick weight and prevent contamination of the media during construction. For these models the WetlandMedia will be delivered in bulk or in super sacks. It will be responsibility of the contractor to fill the system with the WetlandMedia during the installation process. Installation of the WetlandMedia can be done after the unit is fully installed to avoid contamination. See following pages for details.

WetlandMedia Install (if applicable)

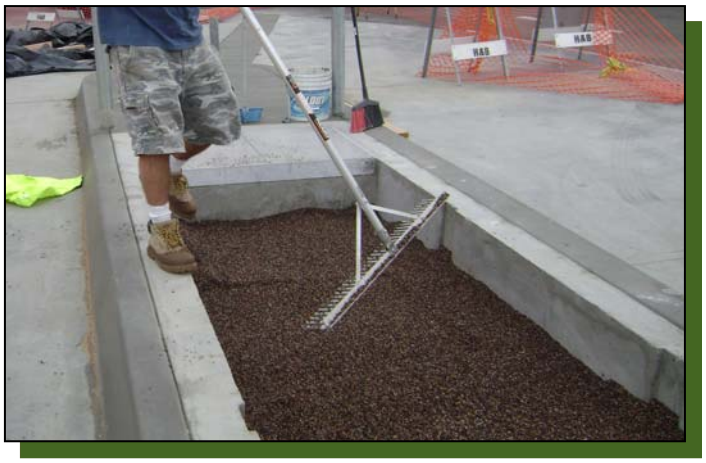
1. Fill WetlandMedia

Position super sack of WetlandMedia over wetland chamber. Bottom of sack should not be more than 2' above top of system. Open sack and fill evenly*.

* One to several hundred cubic yards of WetlandMedia will be required based upon the model number and size of the system. For large scale jobs WetlandMedia will be delivered in bulk and will require a bobcat of similar to fill the system. All equipment is the responsibility of the contractor.

2. Install Plant Propagation Layer

Fill WetlandMedia up to 9" below the top of the wetland chamber. Level out the WetlandMedia as shown. Ensure that the level does not vary more than one inch or plant growth will be affected.

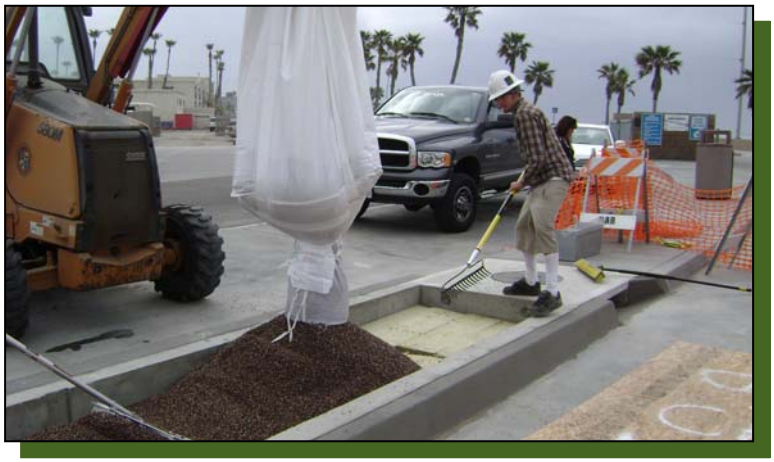


3. Install Plant Propagation Layer

Utilize plant propagation blocks provided by the manufacturer. Each block is approximately 40" by 6" by 3" thick. Blocks shall be placed side by side and end to end and cover the entire length and width of the wetland chamber unless specified.

4. Finish Filling WetlandMedia

After plant propagation blocks are installed repeat step 1 and fill the system to the top of the wetland chamber as shown. WetlandMedia must be filled within 2” of the top of the unit.



5. Planting

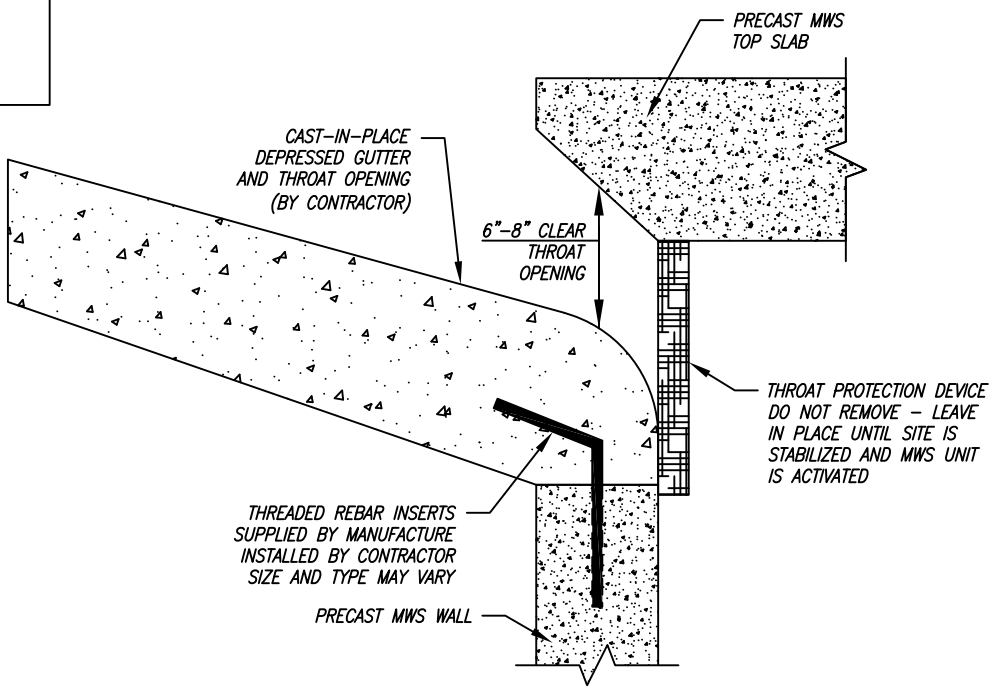
After system is filled with WetlandMedia planting of vegetation can begin. Utilizing 1 gallon plants dig down until The plant propagation blocks are reached. Remove plant and it’s root ball from the container. Set the bottom of the root ball on the tops of the blocks. Fill hole back in with WetlandMedia. After planting a thorough watering of the plants is necessary. The plant propagation blocks must be saturated to provide a water source for the plants during the establishment phase. It is recommended that hand watering is done three times a week for the first two months. Hand water can be supplemented with drip or spray irrigation after the second week. Please call the manufacturer for more details on plants, planting arrangement and irrigation options.

NOTE: planting is required on all units, including units delivered with WetlandMedia pre-installed.

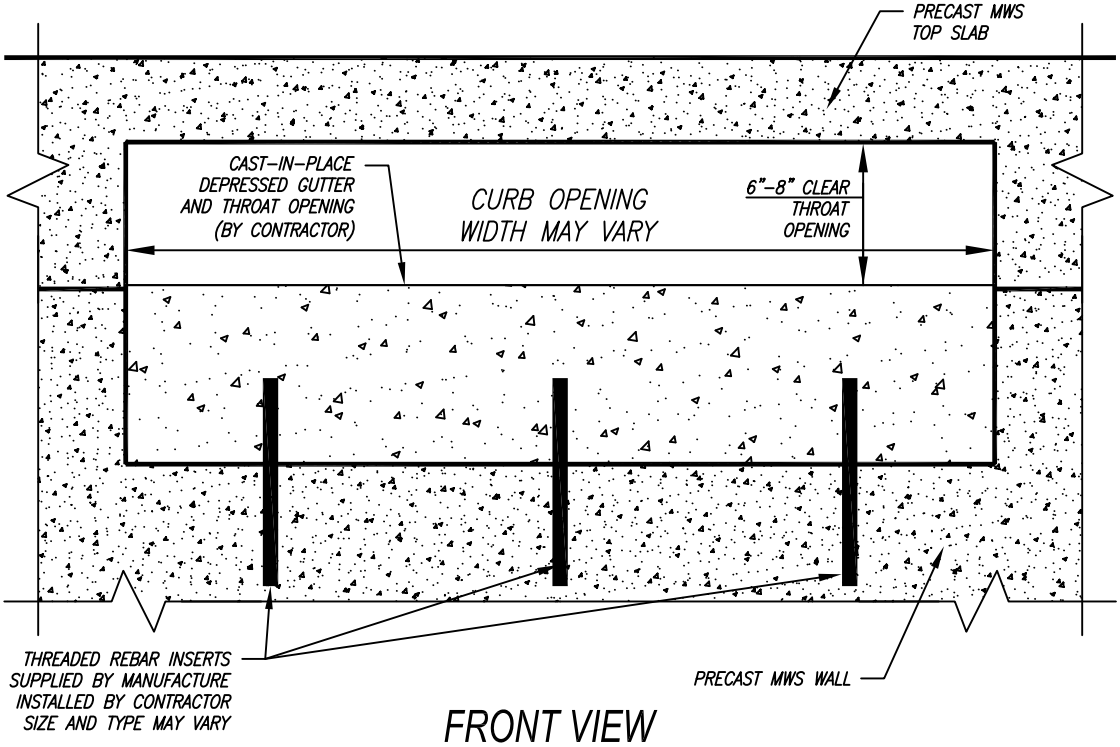
Curb and Gutter Details

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com



SECTION VIEW
STANDARD MODULAR WETLAND CURB OPENING



FRONT VIEW
STANDARD MODULAR WETLAND CURB OPENING

MODULAR WETLAND SYSTEMS INC.
P.O. BOX 869
OCEANSIDE, CA 92049
www.ModularWetlands.com

	NAME	DATE
DRAWN	John	5/3/13
EDITED		

TITLE: MWS LINEAR 2.0 CURB INLET DETAILS

COMMENTS:

SIZE	DWG. NO.	REV

SCALE NTS	UNITS = INCHES	SHEET 1 OF 1

Weights and Lifting Details

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

MWS-L 2.0 Max Pick Weights

Model #	Size (O.D)	Size (I.D)	Unit Weight (lbs)	Media Weight (lbs)	Total Weight (lbs)
MWS-L-4-4	5' x 5'	4' x 4'	7500.0	1607.7	9107.7
MWS-L-4-6 MWS-L-4-6.5	5' x 7' 5 x 7.5'	4' x 6' 4' x 6.5'	11,000 11,500	1798.9	12,619.2 13,119.2
MWS-L-4-8	5' x 9'	8' x 4'	12500	3966	16466
MWS-L-4-13	5' x 14'	13' x 4'	21200	5895	27095
MWS-L-4-15	5' x 16'	15' x 4'	23700	8039	31739
MWS-L-4-17	5' x 18'	17' x 4'	26500	10182	36682
MWS-L-4-19	5' x 20'	19' x 4'	28300	12326	40626
MWS-L-4-21	5' x 22'	21' x 4'	30000	14470	44470
MWS-L-6-8	7' x 9'	6' x 8'	24000	6109	30109
MWS-L-8-8	9' x 9'	8' x 8'	32000	8253	40253
MWS-L-8-12	9' x 13'	8' x 12'	44000	12540	56540
MWS-L-8-16	9' x 17'	8' x 16'	47000	16828	63828
			Max Pick Weight if Shipped Without Media Installed		Max Pick Weight if Shipped With Media Installed

Note: All weights listed hereon are standard max pick weights, actual pick weights may vary based upon state and local regulations and variation in concerte and rebar standards. For project specific pick weights contact the manufacturer prior to shipping of the unit(s). Is is the contractors responsibility to off-load the unit with an adequate size crane. Units are shipped with WetlandMEDIA in superbags and installed by contractor.

When Available see project contract terms, if lifting points are on the inside of the unit due to custom designs or installations requiring pionts to be on the inside the media will be shipped in bags and the contractor will be reponsibile to install after the unit is installed. For example, units places against a wall.

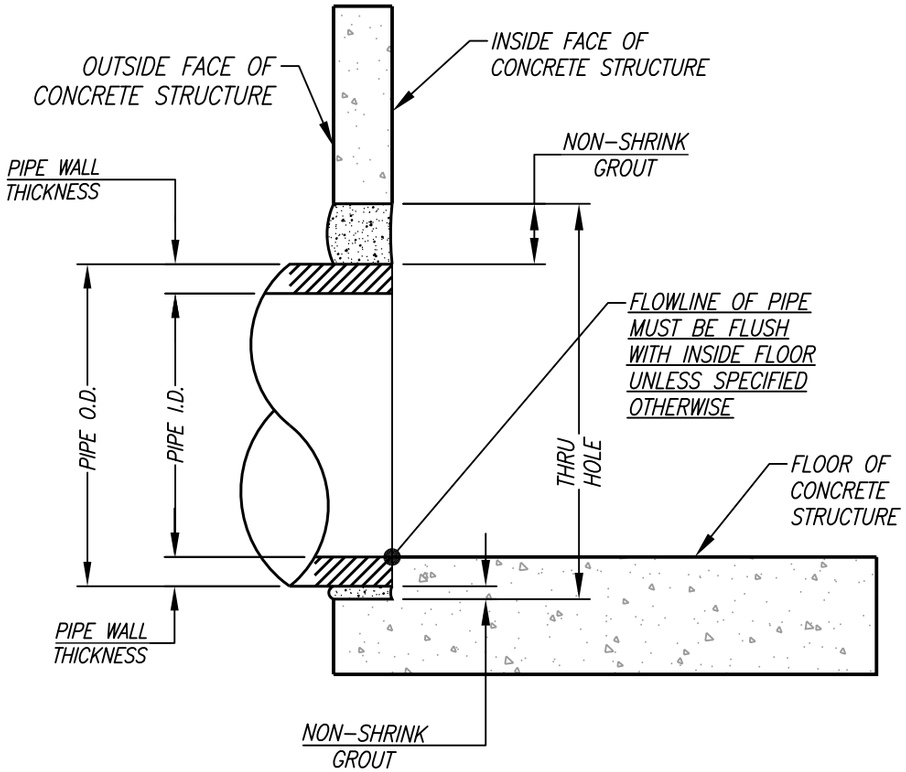
For Questions or Comments Please Call 888-566-3938 or email: info@modularwetlands.com

MODULAR WETLANDS™

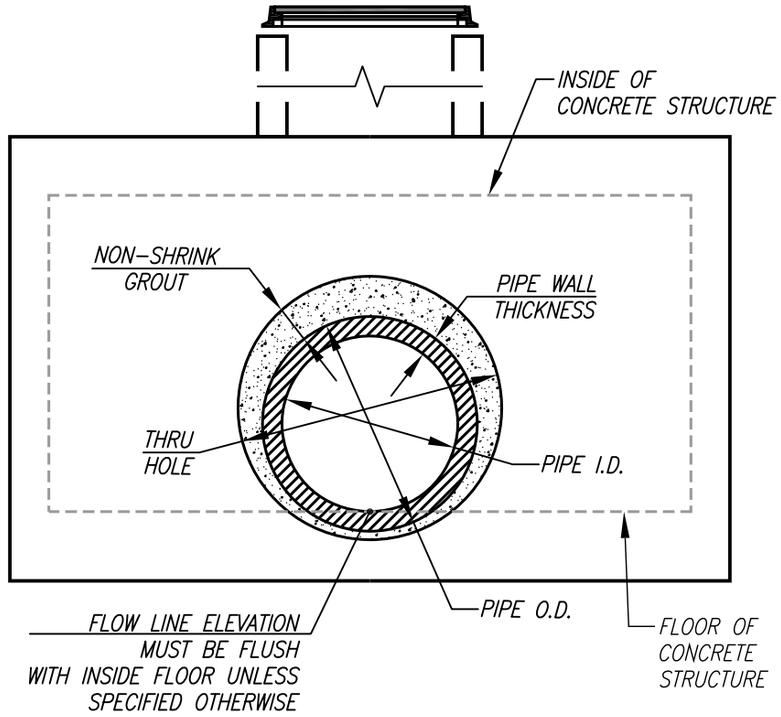
Connection Details

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com



ELEVATION VIEW



END VIEW

INSTALLATION NOTES

1. ALL CONNECTION PIPES SUPPLIED AND INSTALLED BY CONTRACTOR. MODULAR WETLAND UNIT WILL BE DELIVERED WITH A THRU HOLE AND ITS THE CONTRACTORS RESPONSIBILITY TO SUPPLY PIPE, AND ALL LABOR AND MATERIAL TO CONNECT PIPE AND SEAL UNIT WATER TIGHT INCLUDING BUT NOT LIMITED TO GROUT, CONCRETE LUG, REBAR, PLUG, ANCHORS, COUPLER, FITTINGS AND/OR ALL SUPPORT AND CONNECTING HARDWARE.
2. ALL CONNECTIONS ARE TO BE FLUSH WITH THE INSIDE SURFACE OF THE CONCRETE STRUCTURE. (CAN NOT INTRUDE BEYOND FLUSH) ALL PIPE FLOWLINES SHALL BE FLUSH WITH INSIDE FLOOR UNLESS SPECIFIED OTHERWISE.
3. ALL GROUT AND/OR CONCRETE SHALL BE NON–SHRINK AND MEET OR EXCEED LOCAL PIPE CONNECTION STANDARDS.
4. REFER TO AGENCY SPECIFICATIONS WHERE APPLICABLE.

MODULAR WETLANDS

PIPE CONNECTION
STANDARD DETAIL

Section [_____]
Modular Subsurface Flow Wetland System

PART 1 – GENERAL

01.01.00 Purpose
The purpose of this specification is to establish generally acceptable criteria for Modular Subsurface Flow Wetland Systems used for biofiltration of stormwater runoff including dry weather flows and other contaminated water sources. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to provide for identification of devices complying with this specification.

01.02.00 Description
Modular Subsurface Flow Wetland Systems (MSFWS) are used for filtration of stormwater runoff including dry weather flows. The MSFWS is a pre-engineered biofiltration system composed of a pretreatment chamber containing filtration cartridges, a horizontal flow biofiltration chamber with a peripheral void area and a centralized and vertically extending underdrain, the biofiltration chamber containing a sorptive media mix which does not contain any organic material and a layer of plant establishment media, and a discharge chamber containing an orifice control structure . Treated water flows horizontally in series through the pretreatment chamber cartridges, biofiltration chamber and orifice control structure.

01.03.00 Manufacturer
The manufacturer of the MSFWS shall be one that is regularly engaged in the engineering design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which have a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the MSFWS(s) shall be a filter device Manufactured by Bio Clean Environmental Services, Inc., or Modular Wetland Systems, Inc., or assigned distributors or licensees. Bio Clean Environmental Services Inc., and Modular Wetland Systems, Inc., can be reached at:

Corporate Headquarters:
Bio Clean Environmental Service, Inc.
2972 San Luis Rey Road
Oceanside, CA 92058
Phone: (760) 433-7640
Fax: (760) 433-3176
www.biocleanenvironmental.net

Corporate Headquarters:
Modular Wetland Systems, Inc.
P.O. Box 869
Oceanside, CA 92049
Phone: (760) 433-7650
www.modularwetlands.net

01.04.00 Submittals

01.04.01 Shop drawings are to be submitted with each order to the contractor and consulting engineer.

01.04.02 Shop drawings are to detail the MSFWS and all components required and the sequence for installation, including:

- System configuration with primary dimensions
- Interior components
- Any accessory equipment called out on shop drawings

01.04.03 Inspection and maintenance documentation submitted upon request.

01.05.00 Work Included

01.05.01 Specification requirements for installation of MSFWS.

01.05.02 Manufacturer to supply components of the MSFWS(s):

- Pretreatment chamber components (pre-assembled)
- Concrete Structure(s)
- Biofiltration chamber components (pre-assembled)
- Flow control discharge structure (pre-assembled)

01.06.00 Reference Standards

ASTM C 29	Standard Test Method for Unit Weight and Voids in Aggregate
ASTM C 88	C 88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C131	C 131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregates by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 330	C 330 Standard Specification for Lightweight Aggregate for Structural Concrete
ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft.-lbf/ft3 (600 kN-m/m3)
ASTM D 1621	10 Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
ASTM D 1777	ASTM D1777 - 96(2007) Standard Test Method for Thickness of Textile Materials
ASTM D 4716	Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
AASHTO T 99-01	Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in) Drop
AASHTO T 104	Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
AASHTO T 260	Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials.
AASHTO T 288	Standard Method of Test for Determining Minimum Laboratory Soil Resistivity
AASHTO T 289	Standard Method of Test for Determining ph of Soil for Use in Corrosion Testing
AASHTO T 291	Standard Method of Test for Determining Water Soluble Chloride Ion Content in Soil
AASHTO T 290	T 290 Standard Method of Test for Determining Water Soluble Sulfate Ion Content in Soil

PART 2 – COMPONENTS

The Modular Subsurface Flow Wetland Systems (MSFWS) and all of its components shall be self-contained within a concrete structure constructed of concrete with a minimum 28 day compressive strength of 5,000 psi, with reinforcing per ASTM A 615, Grade 60, and supports and H20 loading as indicated by AASHTO. Each Chamber shall have appropriate access hatches for easy maintenance and sized to allow removal of all internal components without disassembly. All water transfer system components shall conform with the following;

- Filter netting shall be 100% Polyester with a number 16 sieve size, and strength tested per ASTM D 3787.
- Drainage cells shall be manufactured of lightweight injection-molded plastic and have a minimum compressive strength test of 6,000 psi and a void area along the surface making contact with the filter media of 75% or greater. The cells shall be at least 2" in thickness and allow water to freely flow in all four directions.

02.01.00 Pretreatment Chamber Components

02.01.01 Filter Cartridges shall operate at a loading rate not to exceed 3 gallons per minute per square foot surface area.

02.01.02 Drain Down System shall include a pervious floor that allows water to drain into the underdrain pipe that is connected to the discharge chamber.

02.02.00 Biofiltration Chamber Components

02.02.01 Media shall consist of ceramic material produced by expanding and vitrifying select material in a rotary kiln. Media must be produced to meet the requirements of ASTM C330, ASTM C331, and AASHTO M195. Aggregates must have a minimum 24-hour water absorption of 10.5% mass. Media shall not contain any organic material. Flow through media shall be horizontal from the outer perimeter of the chamber toward the centralized and vertically extending underdrain. The retention time in the media shall be at least 3 minutes. Downward flow filters are not acceptable alternatives. The thickness of the media shall be at least 19" from influent end to effluent end. The loading rate on the media shall not exceed 1.1 gallons per minute per square foot surface area. Media must be contained within structure that spaces the surface of the media at least 2" from all vertically extending walls of the concrete structure.

02.02.02 Planting shall be native, drought tolerant species recommend by manufacturer and/or landscape architect.

02.02.03 Plant Support Media shall be made of a 3" thick moisture retention cell that is inert and contains no chemicals or fertilizers, is not made of organic material and has an internal void percentage of 80%.

02.03.00 Discharge Chamber

The discharge device shall house a flow control orifice plate that restricts flows greater than designed treatment flow rate. All piping components shall be made of a high-density polyethylene. The discharge chamber shall also contain a drain down filter if specified on the drawing.

PART 3 – PERFORMANCE

03.01.00 General

03.01.01 Function - The MSFWS has no moving internal components and functions based on gravity flow, unless otherwise specified. The MSFWS is composed of a pretreatment chamber, a biofiltration chamber and a discharge chamber. The pretreatment device houses cartridge media filters, which consist of filter media housed in a perforated enclosure. The untreated runoff flows into the system via subsurface piping and or surface inlet. Water entering the system is forced through the filter cartridge enclosures by gravity flow. Then the flow contacts the filter media. The flow through the media is horizontal toward the center of each individual media filter. In the center of the media shall be a round slotted PVC pipe of no greater than 1.5" in diameter. The slotted PVC pipe shall extend downward into the water transfer cavity of the cartridge. The slotted PVC pipe shall be threaded on the bottom to connect to the water transfer cavity. After pollutants have been removed by the filter media the water discharges the pretreatment chamber and flows into the water transfer system and is conveyed to the biofiltration chamber. Once runoff has been filtered by the biofiltration chamber it is collected by the vertical underdrain and conveyed to a discharge chamber equipped with a flow control orifice plate. Finally the treated flow exits the system.

03.01.02 Pollutants - The MSFWS will remove and retain debris, sediments, TSS, dissolved and particulate metals and nutrients including nitrogen and phosphorus species, bacteria, BOD, oxygen demanding substances, organic compounds and hydrocarbons entering the filter during frequent storm events and continuous dry weather flows.

03.01.03 Treatment Flow Rate and Bypass - The MSFWS operates in-line. The MSFWS will treat 100% of the required water quality treatment flow based on a minimum filtration capacities listed in section 03.02.00. The size of the system must match those provided on the drawing to ensure proper performance and hydraulic residence time.

Minimum Treatment Capabilities

• System must be capable of treating flows to the specified treatment flow rate on the drawings. The flow rate shall be controlled by an orifice plate.

PART 4 - EXECUTION

04.01.00 General

The installation of the MSFWS shall conform to all applicable national, state, state highway, municipal and local specifications.

04.02.00 Installation

The Contractor shall furnish all labor, equipment, materials and incidentals required to install the (MSFWS) device(s) and appurtenances in accordance with the drawings and these specifications.

04.02.01 Grading and Excavation site shall be properly surveyed by a registered professional surveyor, and clearly marked with excavation limits and elevations. After site is marked it is the responsibility of the contractor to contact local utility companies and/or DigAlert to check for underground utilities. All grading permits shall be approved by governing agencies before commencement of grading and excavation. Soil conditions shall be tested in accordance with the governing agencies requirements. All earth removed shall be transported, disposed, stored, and handled per governing agencies standards. It is the responsibility of the contractor to install and maintain proper erosion control measures during grading and excavation operations.

04.02.02 Compaction – All soil shall be compacted per registered professional soils engineer's recommendations prior to installation of MSFWS components.

04.02.03 Backfill shall be placed according to a registered professional soils engineer's recommendations, and with a minimum of 6" of gravel under all concrete structures.

04.02.04 Concrete Structures – After backfill has been inspected by the governing agency and approved the concrete structures shall be lifted and placed in proper position per plans.

04.02.05 Subsurface Flow Wetland Media shall be carefully loaded into area so not to damage the Wetland Liner or Water Transfer Systems. The entire wetland area shall be filled to a level 9 inches below finished surface.

04.02.06 Planting layer shall be installed per manufacturer's drawings and consist of a minimum 3" grow enhancement media that ensures greater than 95% plant survival rate, and 6" of wetland media. Planting shall consist of native plants recommended by manufacturer and/or landscape architect. Planting shall be drip irrigated for at least the first 3 months to insure long term plant growth. No chemical herbicides, pesticides, or fertilizers shall be used in the planting or care and maintenance of the planted area.

04.03.00 Shipping, Storage and Handling

04.03.01 Shipping – MSFWS shall be shipped to the contractor's address or job site, and is the responsibility of the contractor to offload the unit(s) and place in the exact site of installation.

04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the MSFWS and all components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be born by the contractor. The MSFWS(s) and all components shall always be stored indoors and transported inside the original shipping container until the unit(s) are ready to be installed. The MSFWS shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

04.04.00 Maintenance and Inspection

04.04.01 Inspection – After installation, the contractor shall demonstrate that the MSFWS has been properly installed at the correct location(s), elevations, and with appropriate components. All components associated with the MSFWS and its installation shall be subject to inspection by the engineer at the place of installation. In addition, the contractor shall demonstrate that the MSFWS has been installed per the manufacturer's specifications and recommendations. All

components shall be inspected by a qualified person once a year and results of inspection shall be kept in an inspection log.

04.04.02 Maintenance – The manufacturer recommends cleaning and debris removal maintenance of once a year and replacement of the Cartridge Filters as needed. The maintenance shall be performed by someone qualified. A Maintenance Manual is available upon request from the manufacturer. The manual has detailed information regarding the maintenance of the MSFWS. A Maintenance/Inspection record shall be kept by the maintenance operator. The record shall include any maintenance activities preformed, amount and description of debris collected, and the condition of the filter.

04.04.03 Material Disposal - All debris, trash, organics, and sediments captured by the MSFWS shall be transported and disposed of at an approved facility for disposal in accordance with local and state requirements. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

PART 5 – QUALITY ASSURNACE

05.01.00 Warranty

The Manufacturer shall guarantee the MSFWS against all manufacturing defects in materials and workmanship for a period of (5) years from the date of delivery to the _____. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The MSFWS is limited to recommended application for which it was designed.

05.02.00 Performance Certification

The MSFWS manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certificate” certifying the MSFWS is capable of achieving the specified removal efficiency for suspended solids, phosphorous and dissolved metals.

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

```
**************************************************************************
  INTEGRATED RATIONAL METHOD/UH METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                     (RCFC&WCD)  1978 HYDROLOGY MANUAL
          (c) Copyright 1982-2011 Advanced Engineering Software (aes)
                     (Rational Tabling Version 18.0)
                  Release Date: 07/01/2011  License ID 1499

                           Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* CAR PROS KIA SALES AND SERVICE FACILITY                                *
* XO 5/16/19                                                             *
* KMV2E.RES                                                              *
 **************************************************************************

  FILE NAME: KMV2E.DAT
  TIME/DATE OF STUDY: 10:33 05/16/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 1.00
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.010
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.820
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.940
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.200
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5003939
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5001161
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =    2.00   1-HOUR INTENSITY(INCH/HOUR) =   0.554
  SLOPE OF INTENSITY DURATION CURVE = 0.5004
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
```

```
  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    VALLEY S-GRAPH USED.
    *24-HOUR (15-MINUTE PERIOD) DESIGN STORM USED.
    UNADJUSTED 24-HOUR RAINFALL DEPTH (INCHES) =   0.67
    USER-SPECIFIED DEPTH-AREA REDUCTION FACTOR:
      FOR 24-HOUR RAINFALL DEPTH =  1.00
    LOW LOSS RATE PERCENTAGE =  0.85
    MINIMUM LOSS RATE PERCENTAGE FOR 24-HOUR STORM =  0.05
  *PRECIPITATION ZONE NUMBER (PZN) = 2.0
  *ANTECEDENT MOISTURE CONDITION (AMC) =  0.00 ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   351.00
  UPSTREAM ELEVATION(FEET) =     60.46
  DOWNSTREAM ELEVATION(FEET) =     50.61
  ELEVATION DIFFERENCE(FEET) =      9.85
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.276
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Runoff      SCS   Tc
       LAND USE            GROUP   (ACRES)   Coefficient    CN  (MIN.)
  NATURAL POOR COVER
  "CHAPARRAL,BROADLEAF"      D        2.96     0.6675       85   11.35
  SUBAREA RUNOFF(CFS) =      2.52
  TOTAL AREA(ACRES) =      2.96   TOTAL RUNOFF(CFS) =      2.52

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
```

```
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   225.00
  UPSTREAM ELEVATION(FEET) =     60.10
  DOWNSTREAM ELEVATION(FEET) =     43.70
  ELEVATION DIFFERENCE(FEET) =     16.40
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.534
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Runoff      SCS   Tc
       LAND USE            GROUP   (ACRES)   Coefficient    CN  (MIN.)
  NATURAL POOR COVER
  "CHAPARRAL,BROADLEAF"      D        3.23     0.6978       85    7.85
  SUBAREA RUNOFF(CFS) =      3.46
  TOTAL AREA(ACRES) =      3.23   TOTAL RUNOFF(CFS) =      3.46
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        3.2  TC(MIN.) =      7.85
  PEAK FLOW RATE(CFS)   =       3.46
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************

             F L O O D    R O U T I N G    A N A L Y S I S

ACCORDING TO RIVERSIDE COUNTY FLOOD CONTORL AND WATER CONSERVATION DISTRICT
                    (RCFC&WCD) 1978 HYDROLOGY MANUAL
         (c) Copyright 1989-2011 Advanced Engineering Software (aes)
                 (Synthetic Unit Hydrograph Version 18.0)
                 Release Date: 05/01/2011  License ID 1499

                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* CAR PROS KIA SALES AND SERVICE FACILITY                                *
* XO 5/16/19                                                             *
* KMV2EU.RES                                                             *
 ************************************************************************

  FILE NAME: KMV2EU.DAT
  TIME/DATE OF STUDY: 11:21 05/16/2019
```

```
**************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =   1
--------------------------------------------------------------------------
  >>>>>SUBAREA RUNOFF (UNIT-HYDROGRAPH ANALYSIS)<<<<<
==========================================================================

      (UNIT-HYDROGRAPH ADDED TO STREAM #1)

         WATERSHED AREA =       2.960 ACRES
         BASEFLOW =   0.000 CFS/SQUARE-MILE
  Warning: Watershed Area is less than 10 acres
         *USER ENTERED "LAG" TIME =    0.151 HOURS
          CAUTION: LAG TIME IS LESS THAN 0.50 HOURS.
          THE 5-MINUTE PERIOD UH MODEL (USED IN THIS COMPUTER PROGRAM)
          MAY BE TOO LARGE FOR PEAK FLOW ESTIMATES.
         VALLEY S-GRAPH SELECTED
         UNIFORM MEAN SOIL-LOSS(INCH/HOUR) =  0.050
         LOW SOIL-LOSS RATE PERCENT(DECIMAL) = 0.500
         MINIMUM SOIL-LOSS RATE(INCH/HOUR) =   0.010
```

KMV2EU.RES

USER-ENTERED RAINFALL = 1.70 INCHES
RCFC&WCD 24-Hour Storm (15-Minute period) SELECTED
RCFC&WCD DEPTH-AREA ADJUSTMENT FACTOR(PLATE E-5.8) = 1.0000

UNIT HYDROGRAPH TIME UNIT = 15.000 MINUTES
UNIT INTERVAL PERCENTAGE OF LAG-TIME = 165.235

UNIT HYDROGRAPH DETERMINATION

INTERVAL NUMBER	"S" GRAPH MEAN VALUES	UNIT HYDROGRAPH ORDINATES(CFS)
1	36.518	4.357
2	82.578	5.496
3	92.837	1.224
4	97.269	0.529
5	98.950	0.201
6	99.520	0.068
7	99.808	0.034
8	99.952	0.017
9	100.000	0.006

UNIT PERIOD (NUMBER)	UNIT RAINFALL (INCHES)	UNIT SOIL-LOSS (INCHES)	EFFECTIVE RAINFALL (INCHES)
1	0.0034	0.0017	0.0017
2	0.0051	0.0025	0.0025
3	0.0051	0.0025	0.0025
4	0.0068	0.0034	0.0034
5	0.0051	0.0025	0.0025
6	0.0051	0.0025	0.0025
7	0.0051	0.0025	0.0025
8	0.0068	0.0034	0.0034
9	0.0068	0.0034	0.0034
10	0.0068	0.0034	0.0034
11	0.0085	0.0042	0.0042
12	0.0085	0.0042	0.0042
13	0.0085	0.0042	0.0042
14	0.0085	0.0042	0.0042

15	0.0085	0.0042	0.0042
16	0.0102	0.0051	0.0051
17	0.0102	0.0051	0.0051
18	0.0119	0.0059	0.0059
19	0.0119	0.0059	0.0059
20	0.0136	0.0068	0.0068
21	0.0102	0.0051	0.0051
22	0.0119	0.0059	0.0059
23	0.0136	0.0068	0.0068
24	0.0136	0.0068	0.0068
25	0.0153	0.0076	0.0076
26	0.0153	0.0076	0.0076
27	0.0170	0.0085	0.0085
28	0.0170	0.0085	0.0085
29	0.0170	0.0085	0.0085
30	0.0187	0.0093	0.0093
31	0.0204	0.0102	0.0102
32	0.0221	0.0110	0.0110
33	0.0255	0.0127	0.0127
34	0.0255	0.0127	0.0127
35	0.0272	0.0136	0.0136
36	0.0289	0.0144	0.0144
37	0.0323	0.0147	0.0176
38	0.0340	0.0143	0.0197
39	0.0357	0.0140	0.0217
40	0.0374	0.0137	0.0237
41	0.0255	0.0127	0.0127
42	0.0255	0.0127	0.0127
43	0.0340	0.0128	0.0212
44	0.0340	0.0125	0.0215
45	0.0323	0.0122	0.0201
46	0.0323	0.0119	0.0204
47	0.0289	0.0116	0.0173
48	0.0306	0.0114	0.0192
49	0.0425	0.0111	0.0314
50	0.0442	0.0108	0.0334
51	0.0476	0.0105	0.0371
52	0.0493	0.0103	0.0390
53	0.0578	0.0100	0.0478
54	0.0578	0.0097	0.0481
55	0.0391	0.0095	0.0296
56	0.0391	0.0092	0.0299
57	0.0459	0.0089	0.0370
58	0.0442	0.0087	0.0355
59	0.0442	0.0084	0.0358
60	0.0425	0.0082	0.0343
61	0.0408	0.0080	0.0328
62	0.0391	0.0077	0.0314

63	0.0323	0.0075	0.0248
64	0.0323	0.0073	0.0250
65	0.0068	0.0034	0.0034
66	0.0068	0.0034	0.0034
67	0.0051	0.0025	0.0025
68	0.0051	0.0025	0.0025
69	0.0085	0.0042	0.0042
70	0.0085	0.0042	0.0042
71	0.0085	0.0042	0.0042
72	0.0068	0.0034	0.0034
73	0.0068	0.0034	0.0034
74	0.0068	0.0034	0.0034
75	0.0051	0.0025	0.0025
76	0.0034	0.0017	0.0017
77	0.0051	0.0025	0.0025
78	0.0068	0.0034	0.0034
79	0.0051	0.0025	0.0025
80	0.0034	0.0017	0.0017
81	0.0051	0.0025	0.0025
82	0.0051	0.0025	0.0025
83	0.0051	0.0025	0.0025
84	0.0034	0.0017	0.0017
85	0.0051	0.0025	0.0025
86	0.0034	0.0017	0.0017
87	0.0051	0.0025	0.0025
88	0.0034	0.0017	0.0017
89	0.0051	0.0025	0.0025
90	0.0034	0.0017	0.0017
91	0.0034	0.0017	0.0017
92	0.0034	0.0017	0.0017
93	0.0034	0.0017	0.0017
94	0.0034	0.0017	0.0017
95	0.0034	0.0017	0.0017
96	0.0034	0.0017	0.0017

TOTAL STORM RAINFALL(INCHES) = 1.70
TOTAL SOIL-LOSS(INCHES) = 0.61
TOTAL EFFECTIVE RAINFALL(INCHES) = 1.09

TOTAL SOIL-LOSS VOLUME(ACRE-FEET) = 0.1504
TOTAL STORM RUNOFF VOLUME(ACRE-FEET) = 0.2688

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2 4 - H O U R S T O R M
R U N O F F H Y D R O G R A P H

HYDROGRAPH IN FIVE-MINUTE UNIT INTERVALS(CFS)
(Note: Time indicated is at END of Each Unit Intervals)

TIME(HRS)	VOLUME(AF)	Q(CFS)	0.	2.5	5.0	7.5	10.0
0.083	0.0001	0.01	Q	.	.	.	.
0.167	0.0001	0.01	Q	.	.	.	.
0.250	0.0002	0.01	Q	.	.	.	.
0.333	0.0003	0.02	Q	.	.	.	.
0.417	0.0004	0.02	Q	.	.	.	.
0.500	0.0006	0.02	Q	.	.	.	.
0.583	0.0008	0.03	Q	.	.	.	.
0.667	0.0010	0.03	Q	.	.	.	.
0.750	0.0011	0.03	Q	.	.	.	.
0.833	0.0014	0.03	Q	.	.	.	.
0.917	0.0016	0.03	Q	.	.	.	.
1.000	0.0018	0.03	Q	.	.	.	.
1.083	0.0021	0.03	Q	.	.	.	.
1.167	0.0023	0.03	Q	.	.	.	.
1.250	0.0025	0.03	Q	.	.	.	.
1.333	0.0027	0.03	Q	.	.	.	.
1.417	0.0030	0.03	Q	.	.	.	.
1.500	0.0032	0.03	Q	.	.	.	.
1.583	0.0034	0.03	Q	.	.	.	.
1.667	0.0036	0.03	Q	.	.	.	.
1.750	0.0038	0.03	Q	.	.	.	.
1.833	0.0040	0.03	Q	.	.	.	.
1.917	0.0043	0.03	Q	.	.	.	.
2.000	0.0045	0.03	Q	.	.	.	.
2.083	0.0048	0.04	Q	.	.	.	.
2.167	0.0051	0.04	Q	.	.	.	.
2.250	0.0053	0.04	Q	.	.	.	.
2.333	0.0056	0.04	Q	.	.	.	.
2.417	0.0059	0.04	Q	.	.	.	.
2.500	0.0061	0.04	Q	.	.	.	.
2.583	0.0065	0.04	Q	.	.	.	.
2.667	0.0068	0.04	QV	.	.	.	.
2.750	0.0071	0.04	QV	.	.	.	.
2.833	0.0074	0.05	QV	.	.	.	.
2.917	0.0077	0.05	QV	.	.	.	.
3.000	0.0081	0.05	QV	.	.	.	.
3.083	0.0084	0.05	QV	.	.	.	.
3.167	0.0088	0.05	QV	.	.	.	.
3.250	0.0091	0.05	QV	.	.	.	.
3.333	0.0094	0.05	QV	.	.	.	.
3.417	0.0098	0.05	QV	.	.	.	.

3.500	0.0101	0.05	QV	.	.	.	.
3.583	0.0105	0.05	QV	.	.	.	.
3.667	0.0108	0.05	QV	.	.	.	.
3.750	0.0112	0.05	QV	.	.	.	.
3.833	0.0116	0.05	QV	.	.	.	.
3.917	0.0119	0.05	QV	.	.	.	.
4.000	0.0123	0.05	QV	.	.	.	.
4.083	0.0127	0.06	QV	.	.	.	.
4.167	0.0131	0.06	QV	.	.	.	.
4.250	0.0135	0.06	Q V	.	.	.	.
4.333	0.0140	0.06	Q V	.	.	.	.
4.417	0.0144	0.06	Q V	.	.	.	.
4.500	0.0148	0.06	Q V	.	.	.	.
4.583	0.0153	0.07	Q V	.	.	.	.
4.667	0.0158	0.07	Q V	.	.	.	.
4.750	0.0163	0.07	Q V	.	.	.	.
4.833	0.0168	0.07	Q V	.	.	.	.
4.917	0.0173	0.07	Q V	.	.	.	.
5.000	0.0178	0.07	Q V	.	.	.	.
5.083	0.0183	0.07	Q V	.	.	.	.
5.167	0.0188	0.07	Q V	.	.	.	.
5.250	0.0193	0.07	Q V	.	.	.	.
5.333	0.0197	0.07	Q V	.	.	.	.
5.417	0.0202	0.07	Q V	.	.	.	.
5.500	0.0207	0.07	Q V	.	.	.	.
5.583	0.0212	0.07	Q V	.	.	.	.
5.667	0.0217	0.07	Q V	.	.	.	.
5.750	0.0222	0.07	Q V	.	.	.	.
5.833	0.0227	0.08	Q V	.	.	.	.
5.917	0.0233	0.08	Q V	.	.	.	.
6.000	0.0238	0.08	Q V	.	.	.	.
6.083	0.0244	0.08	Q V	.	.	.	.
6.167	0.0250	0.08	Q V	.	.	.	.
6.250	0.0256	0.08	Q V	.	.	.	.
6.333	0.0262	0.09	Q V	.	.	.	.
6.417	0.0268	0.09	Q V	.	.	.	.
6.500	0.0274	0.09	Q V	.	.	.	.
6.583	0.0281	0.09	Q V	.	.	.	.
6.667	0.0287	0.09	Q V	.	.	.	.
6.750	0.0294	0.09	Q V	.	.	.	.
6.833	0.0300	0.10	Q V	.	.	.	.
6.917	0.0307	0.10	Q V	.	.	.	.
7.000	0.0314	0.10	Q V	.	.	.	.
7.083	0.0321	0.10	Q V	.	.	.	.
7.167	0.0328	0.10	Q V	.	.	.	.
7.250	0.0335	0.10	Q V	.	.	.	.
7.333	0.0342	0.10	Q V	.	.	.	.
7.417	0.0349	0.10	Q V	.	.	.	.

7.500	0.0357	0.10	Q	V	.	.	.	.
7.583	0.0364	0.11	Q	V	.	.	.	.
7.667	0.0372	0.11	Q	V	.	.	.	.
7.750	0.0380	0.11	Q	V	.	.	.	.
7.833	0.0388	0.12	Q	V	.	.	.	.
7.917	0.0397	0.12	Q	V	.	.	.	.
8.000	0.0405	0.12	Q	V	.	.	.	.
8.083	0.0415	0.14	Q	V	.	.	.	.
8.167	0.0424	0.14	Q	V	.	.	.	.
8.250	0.0434	0.14	Q	V	.	.	.	.
8.333	0.0444	0.15	Q	V	.	.	.	.
8.417	0.0454	0.15	Q	V	.	.	.	.
8.500	0.0464	0.15	Q	V	.	.	.	.
8.583	0.0475	0.15	Q	V	.	.	.	.
8.667	0.0485	0.15	Q	V	.	.	.	.
8.750	0.0496	0.15	Q	V	.	.	.	.
8.833	0.0507	0.16	Q	V	.	.	.	.
8.917	0.0518	0.16	Q	V	.	.	.	.
9.000	0.0530	0.16	Q	V	.	.	.	.
9.083	0.0542	0.18	Q	V	.	.	.	.
9.167	0.0555	0.18	Q	V	.	.	.	.
9.250	0.0568	0.18	Q	V	.	.	.	.
9.333	0.0582	0.21	Q	V	.	.	.	.
9.417	0.0597	0.21	Q	V	.	.	.	.
9.500	0.0611	0.21	Q	V	.	.	.	.
9.583	0.0627	0.24	Q	V	.	.	.	.
9.667	0.0644	0.24	Q	V	.	.	.	.
9.750	0.0660	0.24	Q	V	.	.	.	.
9.833	0.0678	0.26	.Q	V	.	.	.	.
9.917	0.0696	0.26	.Q	V	.	.	.	.
10.000	0.0714	0.26	.Q	V	.	.	.	.
10.083	0.0729	0.23	Q	V	.	.	.	.
10.167	0.0745	0.23	Q	V	.	.	.	.
10.250	0.0761	0.23	Q	V	.	.	.	.
10.333	0.0773	0.17	Q	.V	.	.	.	.
10.417	0.0785	0.17	Q	.V	.	.	.	.
10.500	0.0796	0.17	Q	.V	.	.	.	.
10.583	0.0810	0.20	Q	. V	.	.	.	.
10.667	0.0824	0.20	Q	. V	.	.	.	.
10.750	0.0837	0.20	Q	. V	.	.	.	.
10.833	0.0854	0.24	Q	. V	.	.	.	.
10.917	0.0870	0.24	Q	. V	.	.	.	.
11.000	0.0887	0.24	Q	. V	.	.	.	.
11.083	0.0903	0.24	Q	. V	.	.	.	.
11.167	0.0920	0.24	Q	. V	.	.	.	.
11.250	0.0937	0.24	Q	. V	.	.	.	.
11.333	0.0954	0.24	Q	. V	.	.	.	.
11.417	0.0970	0.24	Q	. V	.	.	.	.

11.500	0.0987	0.24	Q	. V . . .

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TIME(HRS)	VOLUME(AF)	Q(CFS)	0.	2.5	5.0	7.5	10.0
11.583	0.1003	0.23	Q	. V	.	.	.
11.667	0.1018	0.23	Q	. V	.	.	.
11.750	0.1034	0.23	Q	. V	.	.	.
11.833	0.1049	0.22	Q	. V	.	.	.
11.917	0.1065	0.22	Q	. V	.	.	.
12.000	0.1080	0.22	Q	. V	.	.	.
12.083	0.1099	0.28	.Q	. V	.	.	.
12.167	0.1118	0.28	.Q	. V	.	.	.
12.250	0.1138	0.28	.Q	. V	.	.	.
12.333	0.1162	0.36	.Q	. V	.	.	.
12.417	0.1187	0.36	.Q	. V	.	.	.
12.500	0.1212	0.36	.Q	. V	.	.	.
12.583	0.1239	0.40	.Q	. V	.	.	.
12.667	0.1267	0.40	.Q	. V	.	.	.
12.750	0.1294	0.40	.Q	. V	.	.	.
12.833	0.1324	0.44	.Q	. V	.	.	.
12.917	0.1355	0.44	.Q	. V	.	.	.
13.000	0.1385	0.44	.Q	. V	.	.	.
13.083	0.1419	0.49	.Q	. V	.	.	.
13.167	0.1453	0.49	.Q	. V	.	.	.
13.250	0.1487	0.49	.Q	. V	.	.	.
13.333	0.1525	0.55	. Q	. V	.	.	.
13.417	0.1563	0.55	. Q	. V	.	.	.
13.500	0.1601	0.55	. Q	. V	.	.	.
13.583	0.1634	0.48	.Q	. V	.	.	.
13.667	0.1667	0.48	.Q	. V	.	.	.
13.750	0.1700	0.48	.Q	. V	.	.	.
13.833	0.1727	0.39	.Q	. V	.	.	.
13.917	0.1754	0.39	.Q	. V	.	.	.
14.000	0.1781	0.39	.Q	. V	.	.	.
14.083	0.1809	0.40	.Q	. V	.	.	.
14.167	0.1836	0.40	.Q	. V	.	.	.
14.250	0.1864	0.40	.Q	. V	.	.	.
14.333	0.1893	0.43	.Q	. V	.	.	.
14.417	0.1922	0.43	.Q	. V	.	.	.
14.500	0.1952	0.43	.Q	. V	.	.	.
14.583	0.1981	0.42	.Q	. V	.	.	.
14.667	0.2010	0.42	.Q	. V	.	.	.
14.750	0.2039	0.42	.Q	. V	.	.	.
14.833	0.2068	0.42	.Q	. V	.	.	.
14.917	0.2097	0.42	.Q	. V	.	.	.
15.000	0.2126	0.42	.Q	. V	.	.	.
15.083	0.2154	0.41	.Q	. V	.	.	.

15.167	0.2182	0.41	.Q	.	.	. V	.
15.250	0.2210	0.41	.Q	.	.	. V	.
15.333	0.2237	0.39	.Q	.	.	. V	.
15.417	0.2264	0.39	.Q	.	.	. V	.
15.500	0.2290	0.39	.Q	.	.	. V	.
15.583	0.2314	0.35	.Q	.	.	. V	.
15.667	0.2339	0.35	.Q	.	.	. V	.
15.750	0.2363	0.35	.Q	.	.	. V	.
15.833	0.2384	0.31	.Q	.	.	. V	.
15.917	0.2406	0.31	.Q	.	.	. V	.
16.000	0.2427	0.31	.Q	.	.	. V	.
16.083	0.2442	0.21	Q	.	.	. V	.
16.167	0.2456	0.21	Q	.	.	. V	.
16.250	0.2471	0.21	Q	.	.	. V	.
16.333	0.2477	0.09	Q	.	.	. V	.
16.417	0.2483	0.09	Q	.	.	. V	.
16.500	0.2489	0.09	Q	.	.	. V	.
16.583	0.2493	0.06	Q	.	.	. V	.
16.667	0.2497	0.06	Q	.	.	. V	.
16.750	0.2501	0.06	Q	.	.	. V	.
16.833	0.2503	0.04	Q	.	.	. V	.
16.917	0.2506	0.04	Q	.	.	. V	.
17.000	0.2509	0.04	Q	.	.	. V	.
17.083	0.2512	0.04	Q	.	.	. V	.
17.167	0.2514	0.04	Q	.	.	. V	.
17.250	0.2517	0.04	Q	.	.	. V	.
17.333	0.2521	0.05	Q	.	.	. V	.
17.417	0.2524	0.05	Q	.	.	. V	.
17.500	0.2527	0.05	Q	.	.	. V	.
17.583	0.2531	0.05	Q	.	.	. V	.
17.667	0.2534	0.05	Q	.	.	. V	.
17.750	0.2538	0.05	Q	.	.	. V	.
17.833	0.2541	0.05	Q	.	.	. V	.
17.917	0.2544	0.05	Q	.	.	. V	.
18.000	0.2547	0.05	Q	.	.	. V	.
18.083	0.2550	0.04	Q	.	.	. V	.
18.167	0.2553	0.04	Q	.	.	. V	.
18.250	0.2556	0.04	Q	.	.	. V	.
18.333	0.2559	0.04	Q	.	.	. V	.
18.417	0.2562	0.04	Q	.	.	. V	.
18.500	0.2564	0.04	Q	.	.	. V	.
18.583	0.2567	0.04	Q	.	.	. V	.
18.667	0.2570	0.04	Q	.	.	. V	.
18.750	0.2572	0.04	Q	.	.	. V	.
18.833	0.2574	0.03	Q	.	.	. V	.
18.917	0.2576	0.03	Q	.	.	. V	.
19.000	0.2578	0.03	Q	.	.	. V	.
19.083	0.2580	0.03	Q	.	.	. V	.

19.167	0.2582	0.03	Q	.	.	.	V .
19.250	0.2584	0.03	Q	.	.	.	V .
19.333	0.2586	0.03	Q	.	.	.	V .
19.417	0.2588	0.03	Q	.	.	.	V .
19.500	0.2590	0.03	Q	.	.	.	V .
19.583	0.2593	0.03	Q	.	.	.	V .
19.667	0.2595	0.03	Q	.	.	.	V .
19.750	0.2598	0.03	Q	.	.	.	V .
19.833	0.2600	0.03	Q	.	.	.	V .
19.917	0.2601	0.03	Q	.	.	.	V .
20.000	0.2603	0.03	Q	.	.	.	V .
20.083	0.2605	0.03	Q	.	.	.	V .
20.167	0.2607	0.03	Q	.	.	.	V .
20.250	0.2609	0.03	Q	.	.	.	V .
20.333	0.2611	0.03	Q	.	.	.	V .
20.417	0.2613	0.03	Q	.	.	.	V .
20.500	0.2615	0.03	Q	.	.	.	V .
20.583	0.2617	0.03	Q	.	.	.	V .
20.667	0.2619	0.03	Q	.	.	.	V .
20.750	0.2621	0.03	Q	.	.	.	V.
20.833	0.2623	0.03	Q	.	.	.	V.
20.917	0.2625	0.03	Q	.	.	.	V.
21.000	0.2627	0.03	Q	.	.	.	V.
21.083	0.2628	0.03	Q	.	.	.	V.
21.167	0.2630	0.03	Q	.	.	.	V.
21.250	0.2632	0.03	Q	.	.	.	V.
21.333	0.2634	0.03	Q	.	.	.	V.
21.417	0.2635	0.03	Q	.	.	.	V.
21.500	0.2637	0.03	Q	.	.	.	V.
21.583	0.2639	0.03	Q	.	.	.	V.
21.667	0.2641	0.03	Q	.	.	.	V.
21.750	0.2642	0.03	Q	.	.	.	V.
21.833	0.2644	0.03	Q	.	.	.	V.
21.917	0.2646	0.03	Q	.	.	.	V.
22.000	0.2648	0.03	Q	.	.	.	V.
22.083	0.2649	0.03	Q	.	.	.	V.
22.167	0.2651	0.03	Q	.	.	.	V.
22.250	0.2653	0.03	Q	.	.	.	V.
22.333	0.2655	0.03	Q	.	.	.	V.
22.417	0.2656	0.03	Q	.	.	.	V.
22.500	0.2658	0.03	Q	.	.	.	V.
22.583	0.2660	0.02	Q	.	.	.	V.
22.667	0.2661	0.02	Q	.	.	.	V.
22.750	0.2663	0.02	Q	.	.	.	V.
22.833	0.2664	0.02	Q	.	.	.	V.
22.917	0.2665	0.02	Q	.	.	.	V.
23.000	0.2667	0.02	Q	.	.	.	V.
23.083	0.2668	0.02	Q	.	.	.	V.

23.166	0.2670	0.02	Q	.	.	.	V.
23.250	0.2671	0.02	Q	.	.	.	V.
23.333	0.2673	0.02	Q	.	.	.	V.
23.416	0.2674	0.02	Q	.	.	.	V.
23.500	0.2675	0.02	Q	.	.	.	V.
23.583	0.2677	0.02	Q	.	.	.	V.
23.666	0.2678	0.02	Q	.	.	.	V.
23.750	0.2680	0.02	Q	.	.	.	V.
23.833	0.2681	0.02	Q	.	.	.	V.
23.916	0.2682	0.02	Q	.	.	.	V.
24.000	0.2684	0.02	Q	.	.	.	V.

TIME(HRS)	VOLUME(AF)	Q(CFS)	0.	2.5	5.0	7.5	10.0
24.083	0.2685	0.01	Q	.	.	.	V.
24.166	0.2685	0.01	Q	.	.	.	V.
24.250	0.2686	0.01	Q	.	.	.	V.
24.333	0.2687	0.00	Q	.	.	.	V.
24.416	0.2687	0.00	Q	.	.	.	V.
24.500	0.2687	0.00	Q	.	.	.	V.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1470.0
10%	765.0
20%	525.0
30%	435.0
40%	360.0
50%	240.0
60%	210.0
70%	180.0
80%	45.0
90%	30.0

****
FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 1

>>>>>SUBAREA RUNOFF (UNIT-HYDROGRAPH ANALYSIS)<<<<<
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(UNIT-HYDROGRAPH ADDED TO STREAM #1)

WATERSHED AREA = 3.230 ACRES
BASEFLOW = 0.000 CFS/SQUARE-MILE
Warning: Watershed Area is less than 10 acres
*USER ENTERED "LAG" TIME = 0.105 HOURS
CAUTION: LAG TIME IS LESS THAN 0.50 HOURS.
THE 5-MINUTE PERIOD UH MODEL (USED IN THIS COMPUTER PROGRAM)
MAY BE TOO LARGE FOR PEAK FLOW ESTIMATES.
VALLEY S-GRAPH SELECTED
UNIFORM MEAN SOIL-LOSS(INCH/HOUR) = 0.050
LOW SOIL-LOSS RATE PERCENT(DECIMAL) = 0.500
MINIMUM SOIL-LOSS RATE(INCH/HOUR) = 0.010
USER-ENTERED RAINFALL = 1.70 INCHES
RCFC&WCD 24-Hour Storm (15-Minute period) SELECTED
RCFC&WCD DEPTH-AREA ADJUSTMENT FACTOR(PLATE E-5.8) = 1.0000

UNIT HYDROGRAPH TIME UNIT = 15.000 MINUTES
UNIT INTERVAL PERCENTAGE OF LAG-TIME = 238.777

UNIT HYDROGRAPH DETERMINATION

INTERVAL NUMBER	"S" GRAPH MEAN VALUES	UNIT HYDROGRAPH ORDINATES(CFS)
1	49.304	6.420
2	90.106	5.313
3	97.423	0.953
4	99.347	0.251
5	99.739	0.051
6	99.935	0.026
7	100.000	0.009

UNIT PERIOD (NUMBER)	UNIT RAINFALL (INCHES)	UNIT SOIL-LOSS (INCHES)	EFFECTIVE RAINFALL (INCHES)
1	0.0034	0.0017	0.0017
2	0.0051	0.0025	0.0025
3	0.0051	0.0025	0.0025

4	0.0068	0.0034	0.0034
5	0.0051	0.0025	0.0025
6	0.0051	0.0025	0.0025
7	0.0051	0.0025	0.0025
8	0.0068	0.0034	0.0034
9	0.0068	0.0034	0.0034
10	0.0068	0.0034	0.0034
11	0.0085	0.0042	0.0042
12	0.0085	0.0042	0.0042
13	0.0085	0.0042	0.0042
14	0.0085	0.0042	0.0042
15	0.0085	0.0042	0.0042
16	0.0102	0.0051	0.0051
17	0.0102	0.0051	0.0051
18	0.0119	0.0059	0.0059
19	0.0119	0.0059	0.0059
20	0.0136	0.0068	0.0068
21	0.0102	0.0051	0.0051
22	0.0119	0.0059	0.0059
23	0.0136	0.0068	0.0068
24	0.0136	0.0068	0.0068
25	0.0153	0.0076	0.0076
26	0.0153	0.0076	0.0076
27	0.0170	0.0085	0.0085
28	0.0170	0.0085	0.0085
29	0.0170	0.0085	0.0085
30	0.0187	0.0093	0.0093
31	0.0204	0.0102	0.0102
32	0.0221	0.0110	0.0110
33	0.0255	0.0127	0.0127
34	0.0255	0.0127	0.0127
35	0.0272	0.0136	0.0136
36	0.0289	0.0144	0.0144
37	0.0323	0.0147	0.0176
38	0.0340	0.0143	0.0197
39	0.0357	0.0140	0.0217
40	0.0374	0.0137	0.0237
41	0.0255	0.0127	0.0127
42	0.0255	0.0127	0.0127
43	0.0340	0.0128	0.0212
44	0.0340	0.0125	0.0215
45	0.0323	0.0122	0.0201
46	0.0323	0.0119	0.0204
47	0.0289	0.0116	0.0173
48	0.0306	0.0114	0.0192
49	0.0425	0.0111	0.0314
50	0.0442	0.0108	0.0334
51	0.0476	0.0105	0.0371

52	0.0493	0.0103	0.0390
53	0.0578	0.0100	0.0478
54	0.0578	0.0097	0.0481
55	0.0391	0.0095	0.0296
56	0.0391	0.0092	0.0299
57	0.0459	0.0089	0.0370
58	0.0442	0.0087	0.0355
59	0.0442	0.0084	0.0358
60	0.0425	0.0082	0.0343
61	0.0408	0.0080	0.0328
62	0.0391	0.0077	0.0314
63	0.0323	0.0075	0.0248
64	0.0323	0.0073	0.0250
65	0.0068	0.0034	0.0034
66	0.0068	0.0034	0.0034
67	0.0051	0.0025	0.0025
68	0.0051	0.0025	0.0025
69	0.0085	0.0042	0.0042
70	0.0085	0.0042	0.0042
71	0.0085	0.0042	0.0042
72	0.0068	0.0034	0.0034
73	0.0068	0.0034	0.0034
74	0.0068	0.0034	0.0034
75	0.0051	0.0025	0.0025
76	0.0034	0.0017	0.0017
77	0.0051	0.0025	0.0025
78	0.0068	0.0034	0.0034
79	0.0051	0.0025	0.0025
80	0.0034	0.0017	0.0017
81	0.0051	0.0025	0.0025
82	0.0051	0.0025	0.0025
83	0.0051	0.0025	0.0025
84	0.0034	0.0017	0.0017
85	0.0051	0.0025	0.0025
86	0.0034	0.0017	0.0017
87	0.0051	0.0025	0.0025
88	0.0034	0.0017	0.0017
89	0.0051	0.0025	0.0025
90	0.0034	0.0017	0.0017
91	0.0034	0.0017	0.0017
92	0.0034	0.0017	0.0017
93	0.0034	0.0017	0.0017
94	0.0034	0.0017	0.0017
95	0.0034	0.0017	0.0017
96	0.0034	0.0017	0.0017

TOTAL STORM RAINFALL(INCHES) = 1.70
TOTAL SOIL-LOSS(INCHES) = 0.61

TOTAL EFFECTIVE RAINFALL(INCHES) = 1.09

TOTAL SOIL-LOSS VOLUME(ACRE-FEET) = 0.1642
TOTAL STORM RUNOFF VOLUME(ACRE-FEET) = 0.2933

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2 4 - H O U R S T O R M
R U N O F F H Y D R O G R A P H

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HYDROGRAPH IN FIVE-MINUTE UNIT INTERVALS(CFS)
(Note: Time indicated is at END of Each Unit Intervals)

TIME(HRS)	VOLUME(AF)	Q(CFS)	0.	2.5	5.0	7.5	10.0
0.083	0.0001	0.01	Q	.	.	.	.
0.167	0.0002	0.01	Q	.	.	.	.
0.250	0.0002	0.01	Q	.	.	.	.
0.333	0.0004	0.03	Q	.	.	.	.
0.417	0.0006	0.03	Q	.	.	.	.
0.500	0.0008	0.03	Q	.	.	.	.
0.583	0.0010	0.03	Q	.	.	.	.
0.667	0.0012	0.03	Q	.	.	.	.
0.750	0.0014	0.03	Q	.	.	.	.
0.833	0.0017	0.04	Q	.	.	.	.
0.917	0.0019	0.04	Q	.	.	.	.
1.000	0.0022	0.04	Q	.	.	.	.
1.083	0.0025	0.04	Q	.	.	.	.
1.167	0.0027	0.04	Q	.	.	.	.
1.250	0.0030	0.04	Q	.	.	.	.
1.333	0.0032	0.03	Q	.	.	.	.
1.417	0.0034	0.03	Q	.	.	.	.
1.500	0.0037	0.03	Q	.	.	.	.
1.583	0.0039	0.03	Q	.	.	.	.
1.667	0.0041	0.03	Q	.	.	.	.
1.750	0.0044	0.03	Q	.	.	.	.
1.833	0.0046	0.04	Q	.	.	.	.
1.917	0.0049	0.04	Q	.	.	.	.
2.000	0.0052	0.04	Q	.	.	.	.
2.083	0.0055	0.04	Q	.	.	.	.
2.167	0.0058	0.04	Q	.	.	.	.
2.250	0.0061	0.04	Q	.	.	.	.
2.333	0.0064	0.04	Q	.	.	.	.
2.417	0.0067	0.04	Q	.	.	.	.
2.500	0.0070	0.04	Q	.	.	.	.

2.583	0.0073	0.05	Q	.	.	.	.
2.667	0.0076	0.05	QV	.	.	.	.
2.750	0.0080	0.05	QV	.	.	.	.
2.833	0.0084	0.05	QV	.	.	.	.
2.917	0.0087	0.05	QV	.	.	.	.
3.000	0.0091	0.05	QV	.	.	.	.
3.083	0.0095	0.06	QV	.	.	.	.
3.167	0.0099	0.06	QV	.	.	.	.
3.250	0.0102	0.06	QV	.	.	.	.
3.333	0.0106	0.06	QV	.	.	.	.
3.417	0.0110	0.06	QV	.	.	.	.
3.500	0.0114	0.06	QV	.	.	.	.
3.583	0.0118	0.06	QV	.	.	.	.
3.667	0.0121	0.06	QV	.	.	.	.
3.750	0.0125	0.06	QV	.	.	.	.
3.833	0.0129	0.06	QV	.	.	.	.
3.917	0.0134	0.06	QV	.	.	.	.
4.000	0.0138	0.06	QV	.	.	.	.
4.083	0.0142	0.07	QV	.	.	.	.
4.167	0.0147	0.07	Q V	.	.	.	.
4.250	0.0151	0.07	Q V	.	.	.	.
4.333	0.0156	0.07	Q V	.	.	.	.
4.417	0.0161	0.07	Q V	.	.	.	.
4.500	0.0166	0.07	Q V	.	.	.	.
4.583	0.0171	0.08	Q V	.	.	.	.
4.667	0.0177	0.08	Q V	.	.	.	.
4.750	0.0182	0.08	Q V	.	.	.	.
4.833	0.0188	0.08	Q V	.	.	.	.
4.917	0.0193	0.08	Q V	.	.	.	.
5.000	0.0199	0.08	Q V	.	.	.	.
5.083	0.0204	0.08	Q V	.	.	.	.
5.167	0.0210	0.08	Q V	.	.	.	.
5.250	0.0215	0.08	Q V	.	.	.	.
5.333	0.0220	0.07	Q V	.	.	.	.
5.417	0.0225	0.07	Q V	.	.	.	.
5.500	0.0230	0.07	Q V	.	.	.	.
5.583	0.0236	0.08	Q V	.	.	.	.
5.667	0.0241	0.08	Q V	.	.	.	.
5.750	0.0247	0.08	Q V	.	.	.	.
5.833	0.0253	0.09	Q V	.	.	.	.
5.917	0.0259	0.09	Q V	.	.	.	.
6.000	0.0265	0.09	Q V	.	.	.	.
6.083	0.0272	0.09	Q V	.	.	.	.
6.167	0.0278	0.09	Q V	.	.	.	.
6.250	0.0284	0.09	Q V	.	.	.	.
6.333	0.0291	0.10	Q V	.	.	.	.
6.417	0.0298	0.10	Q V	.	.	.	.
6.500	0.0305	0.10	Q V	.	.	.	.

6.583	0.0312	0.10	Q	V	.	.	.	.
6.667	0.0319	0.10	Q	V	.	.	.	.
6.750	0.0326	0.10	Q	V	.	.	.	.
6.833	0.0334	0.11	Q	V	.	.	.	.
6.917	0.0341	0.11	Q	V	.	.	.	.
7.000	0.0349	0.11	Q	V	.	.	.	.
7.083	0.0357	0.11	Q	V	.	.	.	.
7.167	0.0364	0.11	Q	V	.	.	.	.
7.250	0.0372	0.11	Q	V	.	.	.	.
7.333	0.0380	0.12	Q	V	.	.	.	.
7.417	0.0388	0.12	Q	V	.	.	.	.
7.500	0.0396	0.12	Q	V	.	.	.	.
7.583	0.0404	0.13	Q	V	.	.	.	.
7.667	0.0413	0.13	Q	V	.	.	.	.
7.750	0.0422	0.13	Q	V	.	.	.	.
7.833	0.0431	0.14	Q	V	.	.	.	.
7.917	0.0441	0.14	Q	V	.	.	.	.
8.000	0.0450	0.14	Q	V	.	.	.	.
8.083	0.0461	0.15	Q	V	.	.	.	.
8.167	0.0471	0.15	Q	V	.	.	.	.
8.250	0.0482	0.15	Q	V	.	.	.	.
8.333	0.0493	0.16	Q	V	.	.	.	.
8.417	0.0504	0.16	Q	V	.	.	.	.
8.500	0.0516	0.16	Q	V	.	.	.	.
8.583	0.0527	0.17	Q	V	.	.	.	.
8.667	0.0539	0.17	Q	V	.	.	.	.
8.750	0.0551	0.17	Q	V	.	.	.	.
8.833	0.0563	0.18	Q	V	.	.	.	.
8.917	0.0576	0.18	Q	V	.	.	.	.
9.000	0.0588	0.18	Q	V	.	.	.	.
9.083	0.0603	0.21	Q	V	.	.	.	.
9.167	0.0617	0.21	Q	V	.	.	.	.
9.250	0.0631	0.21	Q	V	.	.	.	.
9.333	0.0648	0.24	Q	V	.	.	.	.
9.417	0.0664	0.24	Q	V	.	.	.	.
9.500	0.0680	0.24	Q	V	.	.	.	.
9.583	0.0699	0.27	.Q	V	.	.	.	.
9.667	0.0717	0.27	.Q	V	.	.	.	.
9.750	0.0735	0.27	.Q	V	.	.	.	.
9.833	0.0755	0.29	.Q	V	.	.	.	.
9.917	0.0775	0.29	.Q	V	.	.	.	.
10.000	0.0795	0.29	.Q	V	.	.	.	.
10.083	0.0811	0.23	Q	.V	.	.	.	.
10.167	0.0828	0.23	Q	.V	.	.	.	.
10.250	0.0844	0.23	Q	.V	.	.	.	.
10.333	0.0856	0.18	Q	.V	.	.	.	.
10.417	0.0868	0.18	Q	.V	.	.	.	.
10.500	0.0881	0.18	Q	. V	.	.	.	.

10.583	0.0896	0.22	Q	. V . . .
10.667	0.0912	0.22	Q	. V . . .
10.750	0.0927	0.22	Q	. V . . .
10.833	0.0945	0.27	.Q	. V . . .
10.917	0.0964	0.27	.Q	. V . . .
11.000	0.0982	0.27	.Q	. V . . .
11.083	0.1001	0.27	.Q	. V . . .
11.167	0.1019	0.27	.Q	. V . . .
11.250	0.1038	0.27	.Q	. V . . .
11.333	0.1056	0.26	.Q	. V . . .
11.417	0.1074	0.26	.Q	. V . . .
11.500	0.1092	0.26	.Q	. V . . .

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TIME(HRS)	VOLUME(AF)	Q(CFS)	0.	2.5	5.0	7.5	10.0
11.583	0.1109	0.25	Q	. V .	.	.	
11.667	0.1126	0.25	Q	. V .	.	.	
11.750	0.1143	0.25	Q	. V .	.	.	
11.833	0.1160	0.24	Q	. V .	.	.	
11.917	0.1176	0.24	Q	. V .	.	.	
12.000	0.1193	0.24	Q	. V .	.	.	
12.083	0.1215	0.33	.Q	. V .	.	.	
12.167	0.1238	0.33	.Q	. V .	.	.	
12.250	0.1260	0.33	.Q	. V .	.	.	
12.333	0.1288	0.41	.Q	. V .	.	.	
12.417	0.1316	0.41	.Q	. V .	.	.	
12.500	0.1344	0.41	.Q	. V .	.	.	
12.583	0.1375	0.45	.Q	. V .	.	.	
12.667	0.1406	0.45	.Q	. V.	.	.	
12.750	0.1438	0.45	.Q	. V.	.	.	
12.833	0.1471	0.49	.Q	. V	.	.	
12.917	0.1505	0.49	.Q	. V	.	.	
13.000	0.1539	0.49	.Q	. V	.	.	
13.083	0.1577	0.56	. Q	. .V	.	.	
13.167	0.1616	0.56	. Q	. . V	.	.	
13.250	0.1654	0.56	. Q	. . V	.	.	
13.333	0.1697	0.61	. Q	. . V	.	.	
13.417	0.1739	0.61	. Q	. . V	.	.	
13.500	0.1781	0.61	. Q	. . V	.	.	
13.583	0.1816	0.50	. Q	. . V	.	.	
13.667	0.1850	0.50	. Q	. . V	.	.	
13.750	0.1885	0.50	. Q	. . V	.	.	
13.833	0.1913	0.41	.Q	. . V	.	.	
13.917	0.1942	0.41	.Q	. . V	.	.	
14.000	0.1970	0.41	.Q	. . V	.	.	
14.083	0.2000	0.44	.Q	. . V	.	.	
14.167	0.2030	0.44	.Q	. . V	.	.	

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14.250      0.2061      0.44  .Q        .         .       V .          .
14.333      0.2093      0.46  .Q        .         .       V .          .
14.417      0.2125      0.46  .Q        .         .       V .          .
14.500      0.2157      0.46  .Q        .         .        V.          .
14.583      0.2189      0.46  .Q        .         .        V.          .
14.667      0.2221      0.46  .Q        .         .         V          .
14.750      0.2253      0.46  .Q        .         .         V          .
14.833      0.2284      0.46  .Q        .         .         .V         .
14.917      0.2315      0.46  .Q        .         .         .V         .
15.000      0.2347      0.46  .Q        .         .         . V        .
15.083      0.2377      0.44  .Q        .         .         . V        .
15.167      0.2407      0.44  .Q        .         .         . V        .
15.250      0.2437      0.44  .Q        .         .         .  V       .
15.333      0.2466      0.42  .Q        .         .         .  V       .
15.417      0.2495      0.42  .Q        .         .         .   V      .
15.500      0.2524      0.42  .Q        .         .         .   V      .
15.583      0.2550      0.37  .Q        .         .         .   V      .
15.667      0.2575      0.37  .Q        .         .         .    V     .
15.750      0.2600      0.37  .Q        .         .         .    V     .
15.833      0.2623      0.33  .Q        .         .         .    V     .
15.917      0.2646      0.33  .Q        .         .         .     V    .
16.000      0.2669      0.33  .Q        .         .         .     V    .
16.083      0.2682      0.19  Q         .         .         .     V    .
16.167      0.2695      0.19  Q         .         .         .     V    .
16.250      0.2709      0.19  Q         .         .         .     V    .
16.333      0.2714      0.07  Q         .         .         .      V   .
16.417      0.2719      0.07  Q         .         .         .      V   .
16.500      0.2724      0.07  Q         .         .         .      V   .
16.583      0.2727      0.05  Q         .         .         .      V   .
16.667      0.2730      0.05  Q         .         .         .      V   .
16.750      0.2733      0.05  Q         .         .         .      V   .
16.833      0.2736      0.04  Q         .         .         .      V   .
16.917      0.2738      0.04  Q         .         .         .      V   .
17.000      0.2741      0.04  Q         .         .         .      V   .
17.083      0.2744      0.05  Q         .         .         .      V   .
17.167      0.2747      0.05  Q         .         .         .      V   .
17.250      0.2750      0.05  Q         .         .         .      V   .
17.333      0.2754      0.05  Q         .         .         .      V   .
17.417      0.2757      0.05  Q         .         .         .      V   .
17.500      0.2761      0.05  Q         .         .         .      V   .
17.583      0.2765      0.05  Q         .         .         .      V   .
17.667      0.2768      0.05  Q         .         .         .      V   .
17.750      0.2772      0.05  Q         .         .         .      V   .
17.833      0.2776      0.05  Q         .         .         .      V   .
17.917      0.2779      0.05  Q         .         .         .      V   .
18.000      0.2783      0.05  Q         .         .         .      V   .
18.083      0.2786      0.05  Q         .         .         .      V   .
18.167      0.2789      0.05  Q         .         .         .       V  .
```

18.250	0.2792	0.05	Q	.	.	.	V .
18.333	0.2795	0.04	Q	.	.	.	V .
18.417	0.2798	0.04	Q	.	.	.	V .
18.500	0.2801	0.04	Q	.	.	.	V .
18.583	0.2804	0.04	Q	.	.	.	V .
18.667	0.2806	0.04	Q	.	.	.	V .
18.750	0.2809	0.04	Q	.	.	.	V .
18.833	0.2811	0.03	Q	.	.	.	V .
18.917	0.2813	0.03	Q	.	.	.	V .
19.000	0.2815	0.03	Q	.	.	.	V .
19.083	0.2817	0.03	Q	.	.	.	V .
19.167	0.2819	0.03	Q	.	.	.	V .
19.250	0.2821	0.03	Q	.	.	.	V .
19.333	0.2824	0.04	Q	.	.	.	V .
19.417	0.2826	0.04	Q	.	.	.	V .
19.500	0.2829	0.04	Q	.	.	.	V .
19.583	0.2831	0.04	Q	.	.	.	V .
19.667	0.2834	0.04	Q	.	.	.	V .
19.750	0.2837	0.04	Q	.	.	.	V .
19.833	0.2839	0.03	Q	.	.	.	V .
19.917	0.2841	0.03	Q	.	.	.	V .
20.000	0.2843	0.03	Q	.	.	.	V .
20.083	0.2845	0.03	Q	.	.	.	V .
20.167	0.2847	0.03	Q	.	.	.	V .
20.250	0.2849	0.03	Q	.	.	.	V .
20.333	0.2851	0.03	Q	.	.	.	V .
20.417	0.2853	0.03	Q	.	.	.	V .
20.500	0.2855	0.03	Q	.	.	.	V .
20.583	0.2858	0.03	Q	.	.	.	V .
20.667	0.2860	0.03	Q	.	.	.	V.
20.750	0.2862	0.03	Q	.	.	.	V.
20.833	0.2864	0.03	Q	.	.	.	V.
20.917	0.2866	0.03	Q	.	.	.	V.
21.000	0.2868	0.03	Q	.	.	.	V.
21.083	0.2870	0.03	Q	.	.	.	V.
21.167	0.2872	0.03	Q	.	.	.	V.
21.250	0.2874	0.03	Q	.	.	.	V.
21.333	0.2876	0.03	Q	.	.	.	V.
21.417	0.2877	0.03	Q	.	.	.	V.
21.500	0.2879	0.03	Q	.	.	.	V.
21.583	0.2881	0.03	Q	.	.	.	V.
21.667	0.2883	0.03	Q	.	.	.	V.
21.750	0.2885	0.03	Q	.	.	.	V.
21.833	0.2887	0.03	Q	.	.	.	V.
21.917	0.2889	0.03	Q	.	.	.	V.
22.000	0.2891	0.03	Q	.	.	.	V.
22.083	0.2893	0.03	Q	.	.	.	V.
22.167	0.2895	0.03	Q	.	.	.	V.

22.250	0.2897	0.03	Q	.	.	.	V.
22.333	0.2898	0.03	Q	.	.	.	V.
22.417	0.2900	0.03	Q	.	.	.	V.
22.500	0.2902	0.03	Q	.	.	.	V.
22.583	0.2904	0.02	Q	.	.	.	V.
22.667	0.2905	0.02	Q	.	.	.	V.
22.750	0.2907	0.02	Q	.	.	.	V.
22.833	0.2908	0.02	Q	.	.	.	V.
22.917	0.2910	0.02	Q	.	.	.	V.
23.000	0.2912	0.02	Q	.	.	.	V.
23.083	0.2913	0.02	Q	.	.	.	V.
23.166	0.2915	0.02	Q	.	.	.	V.
23.250	0.2916	0.02	Q	.	.	.	V.
23.333	0.2918	0.02	Q	.	.	.	V.
23.416	0.2919	0.02	Q	.	.	.	V.
23.500	0.2921	0.02	Q	.	.	.	V.
23.583	0.2922	0.02	Q	.	.	.	V.
23.666	0.2924	0.02	Q	.	.	.	V.
23.750	0.2925	0.02	Q	.	.	.	V.
23.833	0.2927	0.02	Q	.	.	.	V.
23.916	0.2928	0.02	Q	.	.	.	V.
24.000	0.2930	0.02	Q	.	.	.	V.

↟

TIME(HRS)	VOLUME(AF)	Q(CFS)	0.	2.5	5.0	7.5	10.0
24.083	0.2931	0.01	Q	.	.	.	V.
24.166	0.2931	0.01	Q	.	.	.	V.
24.250	0.2932	0.01	Q	.	.	.	V.
24.333	0.2932	0.00	Q	.	.	.	V.
24.416	0.2932	0.00	Q	.	.	.	V.
24.500	0.2933	0.00	Q	.	.	.	V.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1470.0
10%	750.0
20%	525.0
30%	420.0
40%	330.0
50%	240.0
60%	210.0
70%	150.0

80%	45.0
90%	30.0

==========

END OF FLOODSCx ROUTING ANALYSIS

```
******************************************************************************
  INTEGRATED RATIONAL METHOD/UH METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                     (RCFC&WCD)  1978 HYDROLOGY MANUAL
          (c) Copyright 1982-2011 Advanced Engineering Software (aes)
                     (Rational Tabling Version 18.0)
                  Release Date: 07/01/2011  License ID 1499

                           Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* CAR PROS KIA SALES AND SERVICE FACILITY                                *
* XO 5/16/19                                                             *
* KMV2P.RES                                                              *
 ************************************************************************

  FILE NAME: KMV2P.DAT
  TIME/DATE OF STUDY: 09:52 05/16/2019
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 1.00
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.010
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.820
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.940
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.200
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5003939
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5001161
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =    2.00   1-HOUR INTENSITY(INCH/HOUR) =   0.554
  SLOPE OF INTENSITY DURATION CURVE = 0.5004
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
```

```
  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    VALLEY S-GRAPH USED.
    *24-HOUR (15-MINUTE PERIOD) DESIGN STORM USED.
    UNADJUSTED 24-HOUR RAINFALL DEPTH (INCHES) =   0.67
    USER-SPECIFIED DEPTH-AREA REDUCTION FACTOR:
      FOR 24-HOUR RAINFALL DEPTH =  1.00
    LOW LOSS RATE PERCENTAGE =  0.85
    MINIMUM LOSS RATE PERCENTAGE FOR 24-HOUR STORM =  0.05
  *PRECIPITATION ZONE NUMBER (PZN) = 2.0
  *ANTECEDENT MOISTURE CONDITION (AMC) =  0.00 ASSUMED FOR UNIT HYDROGRAPH METHOD*


****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   324.00
  UPSTREAM ELEVATION(FEET) =     54.30
  DOWNSTREAM ELEVATION(FEET) =     49.80
  ELEVATION DIFFERENCE(FEET) =      4.50
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.602
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Runoff      SCS   Tc
       LAND USE            GROUP   (ACRES)   Coefficient    CN  (MIN.)
  COMMERCIAL                 D        0.64     0.8805       75    7.20
  SUBAREA RUNOFF(CFS) =      0.90
  TOTAL AREA(ACRES) =      0.64   TOTAL RUNOFF(CFS) =      0.90

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    45.70  DOWNSTREAM(FEET) =    39.70
  FLOW LENGTH(FEET) =    57.00   MANNING'S N =  0.015
```

```
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   3.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.31
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.90
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    7.31
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     381.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     21.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   412.00
  UPSTREAM ELEVATION(FEET) =     54.30
  DOWNSTREAM ELEVATION(FEET) =     46.80
  ELEVATION DIFFERENCE(FEET) =      7.50
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.569
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Runoff      SCS   Tc
       LAND USE            GROUP   (ACRES)   Coefficient    CN  (MIN.)
  COMMERCIAL                 D        1.41     0.8801       75    7.51
  SUBAREA RUNOFF(CFS) =      1.95
  TOTAL AREA(ACRES) =      1.41   TOTAL RUNOFF(CFS) =      1.95

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     12.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    44.30  DOWNSTREAM(FEET) =    39.70
  FLOW LENGTH(FEET) =   423.00   MANNING'S N =  0.015
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   6.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.29
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.95
  PIPE TRAVEL TIME(MIN.) =   1.64    Tc(MIN.) =    9.15
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     835.00 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        1.95     9.15       1.421        1.41
 LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     835.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        0.90     7.31       1.589        0.64
 LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     381.00 FEET.

 ****************************WARNING*********************************
 IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
 ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
 WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 ********************************************************************

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1       2.46       7.31        1.589
     2       2.75       9.15        1.421

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       2.75   Tc(MIN.) =    9.15
 TOTAL AREA(ACRES) =        2.0

****************************************************************************
 FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    39.70  DOWNSTREAM(FEET) =    36.50
 FLOW LENGTH(FEET) =    85.00   MANNING'S N =  0.015
 DEPTH OF FLOW IN   9.0 INCH PIPE IS   7.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.19
 ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.75
 PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =    9.35
 LONGEST FLOWPATH FROM NODE     10.00 TO NODE     13.00 =     920.00 FEET.
```

```
**************************************************************************
 FLOW PROCESS FROM NODE     30.00 TO NODE     31.00 IS CODE =  21
--------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   884.00
 UPSTREAM ELEVATION(FEET) =     50.90
 DOWNSTREAM ELEVATION(FEET) =     44.90
 ELEVATION DIFFERENCE(FEET) =      6.00
    2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.182
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Runoff      SCS   Tc
      LAND USE            GROUP   (ACRES)   Coefficient    CN  (MIN.)
 APARTMENTS                 D        3.64     0.8508       75   13.21
 SUBAREA RUNOFF(CFS) =      3.66
 TOTAL AREA(ACRES) =      3.64   TOTAL RUNOFF(CFS) =      3.66

**************************************************************************
 FLOW PROCESS FROM NODE     31.00 TO NODE     32.00 IS CODE =  31
--------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    42.86  DOWNSTREAM(FEET) =    41.60
 FLOW LENGTH(FEET) =   282.00   MANNING'S N =  0.015
 DEPTH OF FLOW IN  15.0 INCH PIPE IS  12.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.48
 ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       3.66
 PIPE TRAVEL TIME(MIN.) =   1.35    Tc(MIN.) =   14.57
 LONGEST FLOWPATH FROM NODE     30.00 TO NODE     32.00 =    1166.00 FEET.
==========================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =        3.6  TC(MIN.) =     14.57
 PEAK FLOW RATE(CFS)   =       3.66
==========================================================================
==========================================================================
 END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************

             F L O O D    R O U T I N G    A N A L Y S I S

ACCORDING TO RIVERSIDE COUNTY FLOOD CONTORL AND WATER CONSERVATION DISTRICT
                    (RCFC&WCD) 1978 HYDROLOGY MANUAL
         (c) Copyright 1989-2011 Advanced Engineering Software (aes)
                 (Synthetic Unit Hydrograph Version 18.0)
                 Release Date: 05/01/2011  License ID 1499

                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* CAR PROS KIA SALES AND SERVICE FACILITY                                *
* XO 5/16/19                                                             *
* KMV2PU.RES                                                             *
 ************************************************************************

  FILE NAME: KMV2PU.DAT
  TIME/DATE OF STUDY: 11:24 05/16/2019
```

```
**************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     13.00 IS CODE =   1
--------------------------------------------------------------------------
  >>>>>SUBAREA RUNOFF (UNIT-HYDROGRAPH ANALYSIS)<<<<<
==========================================================================

      (UNIT-HYDROGRAPH ADDED TO STREAM #1)

         WATERSHED AREA =       2.050 ACRES
         BASEFLOW =   0.000 CFS/SQUARE-MILE
  Warning: Watershed Area is less than 10 acres
         *USER ENTERED "LAG" TIME =    0.125 HOURS
          CAUTION: LAG TIME IS LESS THAN 0.50 HOURS.
          THE 5-MINUTE PERIOD UH MODEL (USED IN THIS COMPUTER PROGRAM)
          MAY BE TOO LARGE FOR PEAK FLOW ESTIMATES.
         VALLEY S-GRAPH SELECTED
         UNIFORM MEAN SOIL-LOSS(INCH/HOUR) =  0.050
         LOW SOIL-LOSS RATE PERCENT(DECIMAL) = 0.500
         MINIMUM SOIL-LOSS RATE(INCH/HOUR) =   0.010
```

KMV2PU.RES

USER-ENTERED RAINFALL = 1.70 INCHES
RCFC&WCD 24-Hour Storm (15-Minute period) SELECTED
RCFC&WCD DEPTH-AREA ADJUSTMENT FACTOR(PLATE E-5.8) = 1.0000

UNIT HYDROGRAPH TIME UNIT = 15.000 MINUTES
UNIT INTERVAL PERCENTAGE OF LAG-TIME = 200.481

UNIT HYDROGRAPH DETERMINATION

INTERVAL NUMBER	"S" GRAPH MEAN VALUES	UNIT HYDROGRAPH ORDINATES(CFS)
1	43.361	3.583
2	86.804	3.590
3	95.553	0.723
4	98.648	0.256
5	99.513	0.071
6	99.805	0.024
7	99.951	0.012
8	100.000	0.004

UNIT PERIOD (NUMBER)	UNIT RAINFALL (INCHES)	UNIT SOIL-LOSS (INCHES)	EFFECTIVE RAINFALL (INCHES)
1	0.0034	0.0017	0.0017
2	0.0051	0.0025	0.0025
3	0.0051	0.0025	0.0025
4	0.0068	0.0034	0.0034
5	0.0051	0.0025	0.0025
6	0.0051	0.0025	0.0025
7	0.0051	0.0025	0.0025
8	0.0068	0.0034	0.0034
9	0.0068	0.0034	0.0034
10	0.0068	0.0034	0.0034
11	0.0085	0.0042	0.0042
12	0.0085	0.0042	0.0042
13	0.0085	0.0042	0.0042
14	0.0085	0.0042	0.0042
15	0.0085	0.0042	0.0042

16	0.0102	0.0051	0.0051
17	0.0102	0.0051	0.0051
18	0.0119	0.0059	0.0059
19	0.0119	0.0059	0.0059
20	0.0136	0.0068	0.0068
21	0.0102	0.0051	0.0051
22	0.0119	0.0059	0.0059
23	0.0136	0.0068	0.0068
24	0.0136	0.0068	0.0068
25	0.0153	0.0076	0.0076
26	0.0153	0.0076	0.0076
27	0.0170	0.0085	0.0085
28	0.0170	0.0085	0.0085
29	0.0170	0.0085	0.0085
30	0.0187	0.0093	0.0093
31	0.0204	0.0102	0.0102
32	0.0221	0.0110	0.0110
33	0.0255	0.0127	0.0127
34	0.0255	0.0127	0.0127
35	0.0272	0.0136	0.0136
36	0.0289	0.0144	0.0144
37	0.0323	0.0147	0.0176
38	0.0340	0.0143	0.0197
39	0.0357	0.0140	0.0217
40	0.0374	0.0137	0.0237
41	0.0255	0.0127	0.0127
42	0.0255	0.0127	0.0127
43	0.0340	0.0128	0.0212
44	0.0340	0.0125	0.0215
45	0.0323	0.0122	0.0201
46	0.0323	0.0119	0.0204
47	0.0289	0.0116	0.0173
48	0.0306	0.0114	0.0192
49	0.0425	0.0111	0.0314
50	0.0442	0.0108	0.0334
51	0.0476	0.0105	0.0371
52	0.0493	0.0103	0.0390
53	0.0578	0.0100	0.0478
54	0.0578	0.0097	0.0481
55	0.0391	0.0095	0.0296
56	0.0391	0.0092	0.0299
57	0.0459	0.0089	0.0370
58	0.0442	0.0087	0.0355
59	0.0442	0.0084	0.0358
60	0.0425	0.0082	0.0343
61	0.0408	0.0080	0.0328
62	0.0391	0.0077	0.0314
63	0.0323	0.0075	0.0248

64	0.0323	0.0073	0.0250
65	0.0068	0.0034	0.0034
66	0.0068	0.0034	0.0034
67	0.0051	0.0025	0.0025
68	0.0051	0.0025	0.0025
69	0.0085	0.0042	0.0042
70	0.0085	0.0042	0.0042
71	0.0085	0.0042	0.0042
72	0.0068	0.0034	0.0034
73	0.0068	0.0034	0.0034
74	0.0068	0.0034	0.0034
75	0.0051	0.0025	0.0025
76	0.0034	0.0017	0.0017
77	0.0051	0.0025	0.0025
78	0.0068	0.0034	0.0034
79	0.0051	0.0025	0.0025
80	0.0034	0.0017	0.0017
81	0.0051	0.0025	0.0025
82	0.0051	0.0025	0.0025
83	0.0051	0.0025	0.0025
84	0.0034	0.0017	0.0017
85	0.0051	0.0025	0.0025
86	0.0034	0.0017	0.0017
87	0.0051	0.0025	0.0025
88	0.0034	0.0017	0.0017
89	0.0051	0.0025	0.0025
90	0.0034	0.0017	0.0017
91	0.0034	0.0017	0.0017
92	0.0034	0.0017	0.0017
93	0.0034	0.0017	0.0017
94	0.0034	0.0017	0.0017
95	0.0034	0.0017	0.0017
96	0.0034	0.0017	0.0017

TOTAL STORM RAINFALL(INCHES) = 1.70
TOTAL SOIL-LOSS(INCHES) = 0.61
TOTAL EFFECTIVE RAINFALL(INCHES) = 1.09

TOTAL SOIL-LOSS VOLUME(ACRE-FEET) = 0.1042
TOTAL STORM RUNOFF VOLUME(ACRE-FEET) = 0.1861

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2 4 - H O U R S T O R M
R U N O F F H Y D R O G R A P H

HYDROGRAPH IN FIVE-MINUTE UNIT INTERVALS(CFS)
(Note: Time indicated is at END of Each Unit Intervals)

TIME(HRS)	VOLUME(AF)	Q(CFS)	0.	2.5	5.0	7.5	10.0
0.083	0.0000	0.01	Q	.	.	.	.
0.167	0.0001	0.01	Q	.	.	.	.
0.250	0.0001	0.01	Q	.	.	.	.
0.333	0.0002	0.02	Q	.	.	.	.
0.417	0.0003	0.02	Q	.	.	.	.
0.500	0.0004	0.02	Q	.	.	.	.
0.583	0.0006	0.02	Q	.	.	.	.
0.667	0.0007	0.02	Q	.	.	.	.
0.750	0.0008	0.02	Q	.	.	.	.
0.833	0.0010	0.02	Q	.	.	.	.
0.917	0.0012	0.02	Q	.	.	.	.
1.000	0.0013	0.02	Q	.	.	.	.
1.083	0.0015	0.02	Q	.	.	.	.
1.167	0.0017	0.02	Q	.	.	.	.
1.250	0.0018	0.02	Q	.	.	.	.
1.333	0.0020	0.02	Q	.	.	.	.
1.417	0.0021	0.02	Q	.	.	.	.
1.500	0.0023	0.02	Q	.	.	.	.
1.583	0.0024	0.02	Q	.	.	.	.
1.667	0.0026	0.02	Q	.	.	.	.
1.750	0.0027	0.02	Q	.	.	.	.
1.833	0.0029	0.02	Q	.	.	.	.
1.917	0.0030	0.02	Q	.	.	.	.
2.000	0.0032	0.02	Q	.	.	.	.
2.083	0.0034	0.03	Q	.	.	.	.
2.167	0.0036	0.03	Q	.	.	.	.
2.250	0.0038	0.03	Q	.	.	.	.
2.333	0.0040	0.03	Q	.	.	.	.
2.417	0.0042	0.03	Q	.	.	.	.
2.500	0.0043	0.03	Q	.	.	.	.
2.583	0.0046	0.03	Q	.	.	.	.
2.667	0.0048	0.03	QV	.	.	.	.
2.750	0.0050	0.03	QV	.	.	.	.
2.833	0.0052	0.03	QV	.	.	.	.
2.917	0.0055	0.03	QV	.	.	.	.
3.000	0.0057	0.03	QV	.	.	.	.
3.083	0.0059	0.03	QV	.	.	.	.
3.167	0.0062	0.03	QV	.	.	.	.
3.250	0.0064	0.03	QV	.	.	.	.
3.333	0.0067	0.04	QV	.	.	.	.
3.417	0.0069	0.04	QV	.	.	.	.
3.500	0.0071	0.04	QV	.	.	.	.

3.583	0.0074	0.04	QV	.	.	.	.
3.667	0.0076	0.04	QV	.	.	.	.
3.750	0.0079	0.04	QV	.	.	.	.
3.833	0.0081	0.04	QV	.	.	.	.
3.917	0.0084	0.04	QV	.	.	.	.
4.000	0.0087	0.04	QV	.	.	.	.
4.083	0.0089	0.04	QV	.	.	.	.
4.167	0.0092	0.04	QV	.	.	.	.
4.250	0.0095	0.04	Q V	.	.	.	.
4.333	0.0098	0.04	Q V	.	.	.	.
4.417	0.0101	0.04	Q V	.	.	.	.
4.500	0.0104	0.04	Q V	.	.	.	.
4.583	0.0108	0.05	Q V	.	.	.	.
4.667	0.0111	0.05	Q V	.	.	.	.
4.750	0.0114	0.05	Q V	.	.	.	.
4.833	0.0118	0.05	Q V	.	.	.	.
4.917	0.0121	0.05	Q V	.	.	.	.
5.000	0.0125	0.05	Q V	.	.	.	.
5.083	0.0128	0.05	Q V	.	.	.	.
5.167	0.0132	0.05	Q V	.	.	.	.
5.250	0.0135	0.05	Q V	.	.	.	.
5.333	0.0138	0.05	Q V	.	.	.	.
5.417	0.0142	0.05	Q V	.	.	.	.
5.500	0.0145	0.05	Q V	.	.	.	.
5.583	0.0148	0.05	Q V	.	.	.	.
5.667	0.0152	0.05	Q V	.	.	.	.
5.750	0.0155	0.05	Q V	.	.	.	.
5.833	0.0159	0.06	Q V	.	.	.	.
5.917	0.0163	0.06	Q V	.	.	.	.
6.000	0.0167	0.06	Q V	.	.	.	.
6.083	0.0171	0.06	Q V	.	.	.	.
6.167	0.0175	0.06	Q V	.	.	.	.
6.250	0.0179	0.06	Q V	.	.	.	.
6.333	0.0183	0.06	Q V	.	.	.	.
6.417	0.0188	0.06	Q V	.	.	.	.
6.500	0.0192	0.06	Q V	.	.	.	.
6.583	0.0196	0.07	Q V	.	.	.	.
6.667	0.0201	0.07	Q V	.	.	.	.
6.750	0.0205	0.07	Q V	.	.	.	.
6.833	0.0210	0.07	Q V	.	.	.	.
6.917	0.0215	0.07	Q V	.	.	.	.
7.000	0.0220	0.07	Q V	.	.	.	.
7.083	0.0225	0.07	Q V	.	.	.	.
7.167	0.0229	0.07	Q V	.	.	.	.
7.250	0.0234	0.07	Q V	.	.	.	.
7.333	0.0239	0.07	Q V	.	.	.	.
7.417	0.0244	0.07	Q V	.	.	.	.
7.500	0.0249	0.07	Q V	.	.	.	.

7.583	0.0255	0.08	Q	V	.	.	.	.
7.667	0.0260	0.08	Q	V	.	.	.	.
7.750	0.0266	0.08	Q	V	.	.	.	.
7.833	0.0272	0.09	Q	V	.	.	.	.
7.917	0.0278	0.09	Q	V	.	.	.	.
8.000	0.0284	0.09	Q	V	.	.	.	.
8.083	0.0290	0.10	Q	V	.	.	.	.
8.167	0.0297	0.10	Q	V	.	.	.	.
8.250	0.0303	0.10	Q	V	.	.	.	.
8.333	0.0310	0.10	Q	V	.	.	.	.
8.417	0.0318	0.10	Q	V	.	.	.	.
8.500	0.0325	0.10	Q	V	.	.	.	.
8.583	0.0332	0.11	Q	V	.	.	.	.
8.667	0.0339	0.11	Q	V	.	.	.	.
8.750	0.0347	0.11	Q	V	.	.	.	.
8.833	0.0355	0.11	Q	V	.	.	.	.
8.917	0.0363	0.11	Q	V	.	.	.	.
9.000	0.0371	0.11	Q	V	.	.	.	.
9.083	0.0379	0.13	Q	V	.	.	.	.
9.167	0.0388	0.13	Q	V	.	.	.	.
9.250	0.0397	0.13	Q	V	.	.	.	.
9.333	0.0408	0.15	Q	V	.	.	.	.
9.417	0.0418	0.15	Q	V	.	.	.	.
9.500	0.0428	0.15	Q	V	.	.	.	.
9.583	0.0440	0.17	Q	V	.	.	.	.
9.667	0.0451	0.17	Q	V	.	.	.	.
9.750	0.0462	0.17	Q	V	.	.	.	.
9.833	0.0475	0.18	Q	V	.	.	.	.
9.917	0.0488	0.18	Q	V	.	.	.	.
10.000	0.0500	0.18	Q	V	.	.	.	.
10.083	0.0511	0.15	Q	V	.	.	.	.
10.167	0.0521	0.15	Q	V	.	.	.	.
10.250	0.0532	0.15	Q	V	.	.	.	.
10.333	0.0540	0.12	Q	V	.	.	.	.
10.417	0.0548	0.12	Q	V	.	.	.	.
10.500	0.0556	0.12	Q	V	.	.	.	.
10.583	0.0565	0.14	Q	V	.	.	.	.
10.667	0.0575	0.14	Q	V	.	.	.	.
10.750	0.0585	0.14	Q	V	.	.	.	.
10.833	0.0596	0.17	Q	V	.	.	.	.
10.917	0.0608	0.17	Q	V	.	.	.	.
11.000	0.0619	0.17	Q	V	.	.	.	.
11.083	0.0631	0.17	Q	V	.	.	.	.
11.167	0.0643	0.17	Q	V	.	.	.	.
11.250	0.0654	0.17	Q	V	.	.	.	.
11.333	0.0666	0.17	Q	V	.	.	.	.
11.417	0.0677	0.17	Q	V	.	.	.	.
11.500	0.0689	0.17	Q	V	.	.	.	.

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TIME(HRS)	VOLUME(AF)	Q(CFS)	0.	2.5	5.0	7.5	10.0
11.583	0.0700	0.16	Q	.	V .	.	.
11.667	0.0711	0.16	Q	.	V .	.	.
11.750	0.0721	0.16	Q	.	V .	.	.
11.833	0.0732	0.15	Q	.	V .	.	.
11.917	0.0743	0.15	Q	.	V .	.	.
12.000	0.0753	0.15	Q	.	V .	.	.
12.083	0.0767	0.20	Q	.	V .	.	.
12.167	0.0781	0.20	Q	.	V .	.	.
12.250	0.0795	0.20	Q	.	V .	.	.
12.333	0.0812	0.25	.Q	.	V .	.	.
12.417	0.0830	0.25	.Q	.	V .	.	.
12.500	0.0847	0.25	.Q	.	V .	.	.
12.583	0.0866	0.28	.Q	.	V .	.	.
12.667	0.0886	0.28	.Q	.	V.	.	.
12.750	0.0905	0.28	.Q	.	V.	.	.
12.833	0.0927	0.31	.Q	.	V.	.	.
12.917	0.0948	0.31	.Q	.	V	.	.
13.000	0.0969	0.31	.Q	.	V	.	.
13.083	0.0993	0.35	.Q	.	.V	.	.
13.167	0.1017	0.35	.Q	.	.V	.	.
13.250	0.1041	0.35	.Q	.	. V	.	.
13.333	0.1068	0.39	.Q	.	. V	.	.
13.417	0.1094	0.39	.Q	.	. V	.	.
13.500	0.1121	0.39	.Q	.	. V	.	.
13.583	0.1143	0.33	.Q	.	. V	.	.
13.667	0.1166	0.33	.Q	.	. V	.	.
13.750	0.1188	0.33	.Q	.	. V	.	.
13.833	0.1207	0.26	.Q	.	. V	.	.
13.917	0.1225	0.26	.Q	.	. V	.	.
14.000	0.1243	0.26	.Q	.	. V	.	.
14.083	0.1262	0.28	.Q	.	. V	.	.
14.167	0.1281	0.28	.Q	.	. V	.	.
14.250	0.1301	0.28	.Q	.	. V	.	.
14.333	0.1321	0.29	.Q	.	. V	.	.
14.417	0.1341	0.29	.Q	.	. V	.	.
14.500	0.1361	0.29	.Q	.	. V.	.	.
14.583	0.1382	0.29	.Q	.	. V.	.	.
14.667	0.1402	0.29	.Q	.	. V	.	.
14.750	0.1422	0.29	.Q	.	. V	.	.
14.833	0.1442	0.29	.Q	.	. V	.	.
14.917	0.1462	0.29	.Q	.	. V	.	.
15.000	0.1482	0.29	.Q	.	. V	.	.
15.083	0.1501	0.28	.Q	.	. V	.	.
15.167	0.1521	0.28	.Q	.	. V	.	.

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15.250      0.1540      0.28  .Q        .         .         .  V       .
15.333      0.1558      0.27  .Q        .         .         .  V       .
15.417      0.1577      0.27  .Q        .         .         .  V       .
15.500      0.1595      0.27  .Q        .         .         .   V      .
15.583      0.1612      0.24  Q         .         .         .   V      .
15.667      0.1628      0.24  Q         .         .         .   V      .
15.750      0.1644      0.24  Q         .         .         .    V     .
15.833      0.1659      0.21  Q         .         .         .    V     .
15.917      0.1674      0.21  Q         .         .         .    V     .
16.000      0.1689      0.21  Q         .         .         .     V    .
16.083      0.1698      0.13  Q         .         .         .     V    .
16.167      0.1707      0.13  Q         .         .         .     V    .
16.250      0.1716      0.13  Q         .         .         .     V    .
16.333      0.1719      0.05  Q         .         .         .     V    .
16.417      0.1723      0.05  Q         .         .         .      V   .
16.500      0.1727      0.05  Q         .         .         .      V   .
16.583      0.1729      0.03  Q         .         .         .      V   .
16.667      0.1731      0.03  Q         .         .         .      V   .
16.750      0.1734      0.03  Q         .         .         .      V   .
16.833      0.1735      0.02  Q         .         .         .      V   .
16.917      0.1737      0.02  Q         .         .         .      V   .
17.000      0.1739      0.02  Q         .         .         .      V   .
17.083      0.1741      0.03  Q         .         .         .      V   .
17.167      0.1743      0.03  Q         .         .         .      V   .
17.250      0.1745      0.03  Q         .         .         .      V   .
17.333      0.1747      0.03  Q         .         .         .      V   .
17.417      0.1749      0.03  Q         .         .         .      V   .
17.500      0.1751      0.03  Q         .         .         .      V   .
17.583      0.1754      0.03  Q         .         .         .      V   .
17.667      0.1756      0.03  Q         .         .         .      V   .
17.750      0.1759      0.03  Q         .         .         .      V   .
17.833      0.1761      0.03  Q         .         .         .      V   .
17.917      0.1763      0.03  Q         .         .         .      V   .
18.000      0.1765      0.03  Q         .         .         .      V   .
18.083      0.1767      0.03  Q         .         .         .      V   .
18.167      0.1769      0.03  Q         .         .         .       V  .
18.250      0.1771      0.03  Q         .         .         .       V  .
18.333      0.1773      0.03  Q         .         .         .       V  .
18.417      0.1775      0.03  Q         .         .         .       V  .
18.500      0.1777      0.03  Q         .         .         .       V  .
18.583      0.1779      0.03  Q         .         .         .       V  .
18.667      0.1781      0.03  Q         .         .         .       V  .
18.750      0.1782      0.03  Q         .         .         .       V  .
18.833      0.1784      0.02  Q         .         .         .       V  .
18.917      0.1785      0.02  Q         .         .         .       V  .
19.000      0.1786      0.02  Q         .         .         .       V  .
19.083      0.1787      0.02  Q         .         .         .       V  .
19.167      0.1789      0.02  Q         .         .         .       V  .
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19.250	0.1790	0.02	Q	.	.	.	V .
19.333	0.1792	0.02	Q	.	.	.	V .
19.417	0.1793	0.02	Q	.	.	.	V .
19.500	0.1795	0.02	Q	.	.	.	V .
19.583	0.1796	0.02	Q	.	.	.	V .
19.667	0.1798	0.02	Q	.	.	.	V .
19.750	0.1800	0.02	Q	.	.	.	V .
19.833	0.1801	0.02	Q	.	.	.	V .
19.917	0.1802	0.02	Q	.	.	.	V .
20.000	0.1804	0.02	Q	.	.	.	V .
20.083	0.1805	0.02	Q	.	.	.	V .
20.167	0.1806	0.02	Q	.	.	.	V .
20.250	0.1807	0.02	Q	.	.	.	V .
20.333	0.1809	0.02	Q	.	.	.	V .
20.417	0.1810	0.02	Q	.	.	.	V .
20.500	0.1812	0.02	Q	.	.	.	V .
20.583	0.1813	0.02	Q	.	.	.	V .
20.667	0.1815	0.02	Q	.	.	.	V .
20.750	0.1816	0.02	Q	.	.	.	V.
20.833	0.1817	0.02	Q	.	.	.	V.
20.917	0.1818	0.02	Q	.	.	.	V.
21.000	0.1820	0.02	Q	.	.	.	V.
21.083	0.1821	0.02	Q	.	.	.	V.
21.167	0.1822	0.02	Q	.	.	.	V.
21.250	0.1823	0.02	Q	.	.	.	V.
21.333	0.1825	0.02	Q	.	.	.	V.
21.417	0.1826	0.02	Q	.	.	.	V.
21.500	0.1827	0.02	Q	.	.	.	V.
21.583	0.1828	0.02	Q	.	.	.	V.
21.667	0.1829	0.02	Q	.	.	.	V.
21.750	0.1831	0.02	Q	.	.	.	V.
21.833	0.1832	0.02	Q	.	.	.	V.
21.917	0.1833	0.02	Q	.	.	.	V.
22.000	0.1834	0.02	Q	.	.	.	V.
22.083	0.1835	0.02	Q	.	.	.	V.
22.167	0.1837	0.02	Q	.	.	.	V.
22.250	0.1838	0.02	Q	.	.	.	V.
22.333	0.1839	0.02	Q	.	.	.	V.
22.417	0.1840	0.02	Q	.	.	.	V.
22.500	0.1842	0.02	Q	.	.	.	V.
22.583	0.1843	0.01	Q	.	.	.	V.
22.667	0.1844	0.01	Q	.	.	.	V.
22.750	0.1845	0.01	Q	.	.	.	V.
22.833	0.1846	0.01	Q	.	.	.	V.
22.917	0.1847	0.01	Q	.	.	.	V.
23.000	0.1847	0.01	Q	.	.	.	V.
23.083	0.1848	0.01	Q	.	.	.	V.
23.166	0.1849	0.01	Q	.	.	.	V.

23.250	0.1850	0.01	Q	.	.	.	V.
23.333	0.1851	0.01	Q	.	.	.	V.
23.416	0.1852	0.01	Q	.	.	.	V.
23.500	0.1853	0.01	Q	.	.	.	V.
23.583	0.1854	0.01	Q	.	.	.	V.
23.666	0.1855	0.01	Q	.	.	.	V.
23.750	0.1856	0.01	Q	.	.	.	V.
23.833	0.1857	0.01	Q	.	.	.	V.
23.916	0.1858	0.01	Q	.	.	.	V.
24.000	0.1859	0.01	Q	.	.	.	V.

TIME(HRS)	VOLUME(AF)	Q(CFS)	0.	2.5	5.0	7.5	10.0
24.083	0.1860	0.01	Q	.	.	.	V.
24.166	0.1860	0.01	Q	.	.	.	V.
24.250	0.1861	0.01	Q	.	.	.	V.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1455.0
10%	750.0
20%	525.0
30%	435.0
40%	330.0
50%	240.0
60%	210.0
70%	150.0
80%	45.0
90%	30.0

FLOW PROCESS FROM NODE 30.00 TO NODE 32.00 IS CODE = 1

>>>>>SUBAREA RUNOFF (UNIT-HYDROGRAPH ANALYSIS)<<<<<

(UNIT-HYDROGRAPH ADDED TO STREAM #1)

WATERSHED AREA = 3.640 ACRES
BASEFLOW = 0.000 CFS/SQUARE-MILE

Warning: Watershed Area is less than 10 acres
*USER ENTERED "LAG" TIME = 0.194 HOURS
CAUTION: LAG TIME IS LESS THAN 0.50 HOURS.
THE 5-MINUTE PERIOD UH MODEL (USED IN THIS COMPUTER PROGRAM)
MAY BE TOO LARGE FOR PEAK FLOW ESTIMATES.
VALLEY S-GRAPH SELECTED
UNIFORM MEAN SOIL-LOSS(INCH/HOUR) = 0.050
LOW SOIL-LOSS RATE PERCENT(DECIMAL) = 0.500
MINIMUM SOIL-LOSS RATE(INCH/HOUR) = 0.010
USER-ENTERED RAINFALL = 1.70 INCHES
RCFC&WCD 24-Hour Storm (15-Minute period) SELECTED
RCFC&WCD DEPTH-AREA ADJUSTMENT FACTOR(PLATE E-5.8) = 1.0000

UNIT HYDROGRAPH TIME UNIT = 15.000 MINUTES
UNIT INTERVAL PERCENTAGE OF LAG-TIME = 128.667

UNIT HYDROGRAPH DETERMINATION

INTERVAL NUMBER	"S" GRAPH MEAN VALUES	UNIT HYDROGRAPH ORDINATES(CFS)
1	27.527	4.039
2	75.994	7.112
3	88.565	1.845
4	94.216	0.829
5	97.329	0.457
6	98.694	0.200
7	99.441	0.110
8	99.777	0.049
9	99.944	0.025
10	100.000	0.008

UNIT PERIOD (NUMBER)	UNIT RAINFALL (INCHES)	UNIT SOIL-LOSS (INCHES)	EFFECTIVE RAINFALL (INCHES)
1	0.0034	0.0017	0.0017
2	0.0051	0.0025	0.0025
3	0.0051	0.0025	0.0025
4	0.0068	0.0034	0.0034

5	0.0051	0.0025	0.0025
6	0.0051	0.0025	0.0025
7	0.0051	0.0025	0.0025
8	0.0068	0.0034	0.0034
9	0.0068	0.0034	0.0034
10	0.0068	0.0034	0.0034
11	0.0085	0.0042	0.0042
12	0.0085	0.0042	0.0042
13	0.0085	0.0042	0.0042
14	0.0085	0.0042	0.0042
15	0.0085	0.0042	0.0042
16	0.0102	0.0051	0.0051
17	0.0102	0.0051	0.0051
18	0.0119	0.0059	0.0059
19	0.0119	0.0059	0.0059
20	0.0136	0.0068	0.0068
21	0.0102	0.0051	0.0051
22	0.0119	0.0059	0.0059
23	0.0136	0.0068	0.0068
24	0.0136	0.0068	0.0068
25	0.0153	0.0076	0.0076
26	0.0153	0.0076	0.0076
27	0.0170	0.0085	0.0085
28	0.0170	0.0085	0.0085
29	0.0170	0.0085	0.0085
30	0.0187	0.0093	0.0093
31	0.0204	0.0102	0.0102
32	0.0221	0.0110	0.0110
33	0.0255	0.0127	0.0127
34	0.0255	0.0127	0.0127
35	0.0272	0.0136	0.0136
36	0.0289	0.0144	0.0144
37	0.0323	0.0147	0.0176
38	0.0340	0.0143	0.0197
39	0.0357	0.0140	0.0217
40	0.0374	0.0137	0.0237
41	0.0255	0.0127	0.0127
42	0.0255	0.0127	0.0127
43	0.0340	0.0128	0.0212
44	0.0340	0.0125	0.0215
45	0.0323	0.0122	0.0201
46	0.0323	0.0119	0.0204
47	0.0289	0.0116	0.0173
48	0.0306	0.0114	0.0192
49	0.0425	0.0111	0.0314
50	0.0442	0.0108	0.0334
51	0.0476	0.0105	0.0371
52	0.0493	0.0103	0.0390

53	0.0578	0.0100	0.0478
54	0.0578	0.0097	0.0481
55	0.0391	0.0095	0.0296
56	0.0391	0.0092	0.0299
57	0.0459	0.0089	0.0370
58	0.0442	0.0087	0.0355
59	0.0442	0.0084	0.0358
60	0.0425	0.0082	0.0343
61	0.0408	0.0080	0.0328
62	0.0391	0.0077	0.0314
63	0.0323	0.0075	0.0248
64	0.0323	0.0073	0.0250
65	0.0068	0.0034	0.0034
66	0.0068	0.0034	0.0034
67	0.0051	0.0025	0.0025
68	0.0051	0.0025	0.0025
69	0.0085	0.0042	0.0042
70	0.0085	0.0042	0.0042
71	0.0085	0.0042	0.0042
72	0.0068	0.0034	0.0034
73	0.0068	0.0034	0.0034
74	0.0068	0.0034	0.0034
75	0.0051	0.0025	0.0025
76	0.0034	0.0017	0.0017
77	0.0051	0.0025	0.0025
78	0.0068	0.0034	0.0034
79	0.0051	0.0025	0.0025
80	0.0034	0.0017	0.0017
81	0.0051	0.0025	0.0025
82	0.0051	0.0025	0.0025
83	0.0051	0.0025	0.0025
84	0.0034	0.0017	0.0017
85	0.0051	0.0025	0.0025
86	0.0034	0.0017	0.0017
87	0.0051	0.0025	0.0025
88	0.0034	0.0017	0.0017
89	0.0051	0.0025	0.0025
90	0.0034	0.0017	0.0017
91	0.0034	0.0017	0.0017
92	0.0034	0.0017	0.0017
93	0.0034	0.0017	0.0017
94	0.0034	0.0017	0.0017
95	0.0034	0.0017	0.0017
96	0.0034	0.0017	0.0017

TOTAL STORM RAINFALL(INCHES) = 1.70
TOTAL SOIL-LOSS(INCHES) = 0.61
TOTAL EFFECTIVE RAINFALL(INCHES) = 1.09

TOTAL SOIL-LOSS VOLUME(ACRE-FEET) = 0.1850
TOTAL STORM RUNOFF VOLUME(ACRE-FEET) = 0.3305

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2 4 - H O U R S T O R M
R U N O F F H Y D R O G R A P H

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HYDROGRAPH IN FIVE-MINUTE UNIT INTERVALS(CFS)
(Note: Time indicated is at END of Each Unit Intervals)

TIME(HRS)	VOLUME(AF)	Q(CFS)	0.	2.5	5.0	7.5	10.0
0.083	0.0000	0.01	Q	.	.	.	.
0.167	0.0001	0.01	Q	.	.	.	.
0.250	0.0001	0.01	Q	.	.	.	.
0.333	0.0003	0.02	Q	.	.	.	.
0.417	0.0005	0.02	Q	.	.	.	.
0.500	0.0006	0.02	Q	.	.	.	.
0.583	0.0008	0.03	Q	.	.	.	.
0.667	0.0010	0.03	Q	.	.	.	.
0.750	0.0013	0.03	Q	.	.	.	.
0.833	0.0015	0.04	Q	.	.	.	.
0.917	0.0018	0.04	Q	.	.	.	.
1.000	0.0020	0.04	Q	.	.	.	.
1.083	0.0023	0.04	Q	.	.	.	.
1.167	0.0026	0.04	Q	.	.	.	.
1.250	0.0029	0.04	Q	.	.	.	.
1.333	0.0032	0.04	Q	.	.	.	.
1.417	0.0034	0.04	Q	.	.	.	.
1.500	0.0037	0.04	Q	.	.	.	.
1.583	0.0040	0.04	Q	.	.	.	.
1.667	0.0042	0.04	Q	.	.	.	.
1.750	0.0045	0.04	Q	.	.	.	.
1.833	0.0048	0.04	Q	.	.	.	.
1.917	0.0051	0.04	Q	.	.	.	.
2.000	0.0053	0.04	Q	.	.	.	.
2.083	0.0057	0.05	Q	.	.	.	.
2.167	0.0060	0.05	Q	.	.	.	.
2.250	0.0063	0.05	Q	.	.	.	.
2.333	0.0066	0.05	Q	.	.	.	.
2.417	0.0070	0.05	Q	.	.	.	.
2.500	0.0073	0.05	Q	.	.	.	.
2.583	0.0077	0.05	Q	.	.	.	.

2.667	0.0080	0.05	Q	.	.	.	.
2.750	0.0084	0.05	QV	.	.	.	.
2.833	0.0088	0.06	QV	.	.	.	.
2.917	0.0092	0.06	QV	.	.	.	.
3.000	0.0096	0.06	QV	.	.	.	.
3.083	0.0100	0.06	QV	.	.	.	.
3.167	0.0105	0.06	QV	.	.	.	.
3.250	0.0109	0.06	QV	.	.	.	.
3.333	0.0113	0.06	QV	.	.	.	.
3.417	0.0117	0.06	QV	.	.	.	.
3.500	0.0121	0.06	QV	.	.	.	.
3.583	0.0126	0.06	QV	.	.	.	.
3.667	0.0130	0.06	QV	.	.	.	.
3.750	0.0134	0.06	QV	.	.	.	.
3.833	0.0139	0.07	QV	.	.	.	.
3.917	0.0143	0.07	QV	.	.	.	.
4.000	0.0148	0.07	QV	.	.	.	.
4.083	0.0153	0.07	QV	.	.	.	.
4.167	0.0158	0.07	QV	.	.	.	.
4.250	0.0163	0.07	QV	.	.	.	.
4.333	0.0168	0.08	Q V	.	.	.	.
4.417	0.0173	0.08	Q V	.	.	.	.
4.500	0.0179	0.08	Q V	.	.	.	.
4.583	0.0184	0.08	Q V	.	.	.	.
4.667	0.0190	0.08	Q V	.	.	.	.
4.750	0.0196	0.08	Q V	.	.	.	.
4.833	0.0202	0.09	Q V	.	.	.	.
4.917	0.0208	0.09	Q V	.	.	.	.
5.000	0.0214	0.09	Q V	.	.	.	.
5.083	0.0220	0.09	Q V	.	.	.	.
5.167	0.0226	0.09	Q V	.	.	.	.
5.250	0.0233	0.09	Q V	.	.	.	.
5.333	0.0238	0.08	Q V	.	.	.	.
5.417	0.0244	0.08	Q V	.	.	.	.
5.500	0.0250	0.08	Q V	.	.	.	.
5.583	0.0256	0.09	Q V	.	.	.	.
5.667	0.0262	0.09	Q V	.	.	.	.
5.750	0.0268	0.09	Q V	.	.	.	.
5.833	0.0275	0.10	Q V	.	.	.	.
5.917	0.0281	0.10	Q V	.	.	.	.
6.000	0.0288	0.10	Q V	.	.	.	.
6.083	0.0295	0.10	Q V	.	.	.	.
6.167	0.0302	0.10	Q V	.	.	.	.
6.250	0.0309	0.10	Q V	.	.	.	.
6.333	0.0316	0.11	Q V	.	.	.	.
6.417	0.0324	0.11	Q V	.	.	.	.
6.500	0.0331	0.11	Q V	.	.	.	.
6.583	0.0339	0.11	Q V	.	.	.	.

6.667	0.0347	0.11	Q	V	.	.	.	.
6.750	0.0355	0.11	Q	V	.	.	.	.
6.833	0.0363	0.12	Q	V	.	.	.	.
6.917	0.0372	0.12	Q	V	.	.	.	.
7.000	0.0380	0.12	Q	V	.	.	.	.
7.083	0.0388	0.12	Q	V	.	.	.	.
7.167	0.0397	0.12	Q	V	.	.	.	.
7.250	0.0405	0.12	Q	V	.	.	.	.
7.333	0.0414	0.13	Q	V	.	.	.	.
7.417	0.0423	0.13	Q	V	.	.	.	.
7.500	0.0432	0.13	Q	V	.	.	.	.
7.583	0.0441	0.14	Q	V	.	.	.	.
7.667	0.0450	0.14	Q	V	.	.	.	.
7.750	0.0460	0.14	Q	V	.	.	.	.
7.833	0.0470	0.15	Q	V	.	.	.	.
7.917	0.0480	0.15	Q	V	.	.	.	.
8.000	0.0491	0.15	Q	V	.	.	.	.
8.083	0.0502	0.16	Q	V	.	.	.	.
8.167	0.0513	0.16	Q	V	.	.	.	.
8.250	0.0524	0.16	Q	V	.	.	.	.
8.333	0.0537	0.18	Q	V	.	.	.	.
8.417	0.0549	0.18	Q	V	.	.	.	.
8.500	0.0561	0.18	Q	V	.	.	.	.
8.583	0.0574	0.19	Q	V	.	.	.	.
8.667	0.0587	0.19	Q	V	.	.	.	.
8.750	0.0600	0.19	Q	V	.	.	.	.
8.833	0.0614	0.20	Q	V	.	.	.	.
8.917	0.0627	0.20	Q	V	.	.	.	.
9.000	0.0641	0.20	Q	V	.	.	.	.
9.083	0.0656	0.22	Q	V	.	.	.	.
9.167	0.0671	0.22	Q	V	.	.	.	.
9.250	0.0686	0.22	Q	V	.	.	.	.
9.333	0.0704	0.25	.Q	V	.	.	.	.
9.417	0.0721	0.25	.Q	V	.	.	.	.
9.500	0.0738	0.25	.Q	V	.	.	.	.
9.583	0.0758	0.28	.Q	V	.	.	.	.
9.667	0.0777	0.28	.Q	V	.	.	.	.
9.750	0.0797	0.28	.Q	V	.	.	.	.
9.833	0.0818	0.31	.Q	V	.	.	.	.
9.917	0.0840	0.31	.Q	V	.	.	.	.
10.000	0.0861	0.31	.Q	V	.	.	.	.
10.083	0.0881	0.29	.Q	V	.	.	.	.
10.167	0.0901	0.29	.Q	V	.	.	.	.
10.250	0.0921	0.29	.Q	V	.	.	.	.
10.333	0.0936	0.22	Q	.V	.	.	.	.
10.417	0.0951	0.22	Q	.V	.	.	.	.
10.500	0.0967	0.22	Q	.V	.	.	.	.
10.583	0.0983	0.24	Q	.V	.	.	.	.

10.667	0.0999	0.24	Q	. V . . .
10.750	0.1015	0.24	Q	. V . . .
10.833	0.1035	0.29	.Q	. V . . .
10.917	0.1055	0.29	.Q	. V . . .
11.000	0.1075	0.29	.Q	. V . . .
11.083	0.1096	0.30	.Q	. V . . .
11.167	0.1116	0.30	.Q	. V . . .
11.250	0.1137	0.30	.Q	. V . . .
11.333	0.1157	0.29	.Q	. V . . .
11.417	0.1178	0.29	.Q	. V . . .
11.500	0.1198	0.29	.Q	. V . . .

TIME(HRS)	VOLUME(AF)	Q(CFS)	0.	2.5	5.0	7.5	10.0
11.583	0.1217	0.28	.Q	. V .	.	.	
11.667	0.1237	0.28	.Q	. V .	.	.	
11.750	0.1257	0.28	.Q	. V .	.	.	
11.833	0.1275	0.27	.Q	. V .	.	.	
11.917	0.1294	0.27	.Q	. V .	.	.	
12.000	0.1313	0.27	.Q	. V .	.	.	
12.083	0.1335	0.33	.Q	. V .	.	.	
12.167	0.1358	0.33	.Q	. V .	.	.	
12.250	0.1381	0.33	.Q	. V .	.	.	
12.333	0.1410	0.43	.Q	. V .	.	.	
12.417	0.1439	0.43	.Q	. V .	.	.	
12.500	0.1469	0.43	.Q	. V .	.	.	
12.583	0.1502	0.48	.Q	. V .	.	.	
12.667	0.1534	0.48	.Q	. V .	.	.	
12.750	0.1567	0.48	.Q	. V .	.	.	
12.833	0.1603	0.53	. Q	. V.	.	.	
12.917	0.1640	0.53	. Q	. V.	.	.	
13.000	0.1676	0.53	. Q	. V	.	.	
13.083	0.1716	0.59	. Q	. V	.	.	
13.167	0.1757	0.59	. Q	. V	.	.	
13.250	0.1797	0.59	. Q	. V	.	.	
13.333	0.1843	0.66	. Q	. . V	.	.	
13.417	0.1889	0.66	. Q	. . V	.	.	
13.500	0.1934	0.66	. Q	. . V	.	.	
13.583	0.1976	0.61	. Q	. . V	.	.	
13.667	0.2018	0.61	. Q	. . V	.	.	
13.750	0.2061	0.61	. Q	. . V	.	.	
13.833	0.2094	0.49	.Q	. . V	.	.	
13.917	0.2128	0.49	.Q	. . V	.	.	
14.000	0.2162	0.49	.Q	. . V	.	.	
14.083	0.2196	0.49	.Q	. . V	.	.	
14.167	0.2230	0.49	.Q	. . V	.	.	
14.250	0.2264	0.49	.Q	. . V	.	.	

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14.333      0.2300      0.52  . Q       .         .      V  .          .
14.417      0.2336      0.52  . Q       .         .       V .          .
14.500      0.2372      0.52  . Q       .         .       V .          .
14.583      0.2408      0.52  . Q       .         .        V.          .
14.667      0.2444      0.52  . Q       .         .        V.          .
14.750      0.2480      0.52  . Q       .         .         V          .
14.833      0.2516      0.52  . Q       .         .         V          .
14.917      0.2551      0.52  . Q       .         .         V          .
15.000      0.2587      0.52  . Q       .         .          V         .
15.083      0.2621      0.50  . Q       .         .         .V         .
15.167      0.2656      0.50  . Q       .         .          . V       .
15.250      0.2691      0.50  . Q       .         .          . V       .
15.333      0.2724      0.48  .Q        .         .          . V       .
15.417      0.2757      0.48  .Q        .         .          .  V      .
15.500      0.2790      0.48  .Q        .         .          .  V      .
15.583      0.2821      0.44  .Q        .         .          .   V     .
15.667      0.2851      0.44  .Q        .         .          .   V     .
15.750      0.2882      0.44  .Q        .         .          .   V     .
15.833      0.2909      0.39  .Q        .         .          .    V    .
15.917      0.2936      0.39  .Q        .         .          .    V    .
16.000      0.2963      0.39  .Q        .         .          .    V    .
16.083      0.2983      0.29  .Q        .         .          .     V   .
16.167      0.3003      0.29  .Q        .         .          .     V   .
16.250      0.3023      0.29  .Q        .         .          .     V   .
16.333      0.3032      0.13  Q         .         .          .     V   .
16.417      0.3041      0.13  Q         .         .          .     V   .
16.500      0.3051      0.13  Q         .         .          .     V   .
16.583      0.3056      0.09  Q         .         .          .     V   .
16.667      0.3062      0.09  Q         .         .          .      V  .
16.750      0.3068      0.09  Q         .         .          .      V  .
16.833      0.3072      0.06  Q         .         .          .      V  .
16.917      0.3077      0.06  Q         .         .          .      V  .
17.000      0.3081      0.06  Q         .         .          .      V  .
17.083      0.3084      0.05  Q         .         .          .      V  .
17.167      0.3088      0.05  Q         .         .          .      V  .
17.250      0.3092      0.05  Q         .         .          .      V  .
17.333      0.3096      0.06  Q         .         .          .      V  .
17.417      0.3100      0.06  Q         .         .          .      V  .
17.500      0.3105      0.06  Q         .         .          .      V  .
17.583      0.3109      0.06  Q         .         .          .      V  .
17.667      0.3113      0.06  Q         .         .          .      V  .
17.750      0.3117      0.06  Q         .         .          .      V  .
17.833      0.3121      0.06  Q         .         .          .      V  .
17.917      0.3125      0.06  Q         .         .          .      V  .
18.000      0.3129      0.06  Q         .         .          .      V  .
18.083      0.3133      0.05  Q         .         .          .      V  .
18.167      0.3137      0.05  Q         .         .          .      V  .
18.250      0.3140      0.05  Q         .         .          .       V .
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18.333	0.3144	0.05	Q	.	.	.	V .
18.417	0.3147	0.05	Q	.	.	.	V .
18.500	0.3151	0.05	Q	.	.	.	V .
18.583	0.3154	0.05	Q	.	.	.	V .
18.667	0.3157	0.05	Q	.	.	.	V .
18.750	0.3161	0.05	Q	.	.	.	V .
18.833	0.3163	0.04	Q	.	.	.	V .
18.917	0.3166	0.04	Q	.	.	.	V .
19.000	0.3168	0.04	Q	.	.	.	V .
19.083	0.3171	0.03	Q	.	.	.	V .
19.167	0.3173	0.03	Q	.	.	.	V .
19.250	0.3175	0.03	Q	.	.	.	V .
19.333	0.3178	0.04	Q	.	.	.	V .
19.417	0.3181	0.04	Q	.	.	.	V .
19.500	0.3183	0.04	Q	.	.	.	V .
19.583	0.3186	0.04	Q	.	.	.	V .
19.667	0.3189	0.04	Q	.	.	.	V .
19.750	0.3192	0.04	Q	.	.	.	V .
19.833	0.3195	0.04	Q	.	.	.	V .
19.917	0.3197	0.04	Q	.	.	.	V .
20.000	0.3200	0.04	Q	.	.	.	V .
20.083	0.3202	0.03	Q	.	.	.	V .
20.167	0.3204	0.03	Q	.	.	.	V .
20.250	0.3206	0.03	Q	.	.	.	V .
20.333	0.3209	0.04	Q	.	.	.	V .
20.417	0.3211	0.04	Q	.	.	.	V .
20.500	0.3214	0.04	Q	.	.	.	V .
20.583	0.3216	0.04	Q	.	.	.	V .
20.667	0.3219	0.04	Q	.	.	.	V .
20.750	0.3221	0.04	Q	.	.	.	V .
20.833	0.3224	0.03	Q	.	.	.	V.
20.917	0.3226	0.03	Q	.	.	.	V.
21.000	0.3228	0.03	Q	.	.	.	V.
21.083	0.3230	0.03	Q	.	.	.	V.
21.167	0.3232	0.03	Q	.	.	.	V.
21.250	0.3235	0.03	Q	.	.	.	V.
21.333	0.3237	0.03	Q	.	.	.	V.
21.417	0.3239	0.03	Q	.	.	.	V.
21.500	0.3241	0.03	Q	.	.	.	V.
21.583	0.3243	0.03	Q	.	.	.	V.
21.667	0.3246	0.03	Q	.	.	.	V.
21.750	0.3248	0.03	Q	.	.	.	V.
21.833	0.3250	0.03	Q	.	.	.	V.
21.917	0.3252	0.03	Q	.	.	.	V.
22.000	0.3254	0.03	Q	.	.	.	V.
22.083	0.3256	0.03	Q	.	.	.	V.
22.167	0.3258	0.03	Q	.	.	.	V.
22.250	0.3261	0.03	Q	.	.	.	V.

22.333	0.3263	0.03	Q	.	.	.	V.
22.417	0.3265	0.03	Q	.	.	.	V.
22.500	0.3267	0.03	Q	.	.	.	V.
22.583	0.3269	0.03	Q	.	.	.	V.
22.667	0.3271	0.03	Q	.	.	.	V.
22.750	0.3273	0.03	Q	.	.	.	V.
22.833	0.3275	0.03	Q	.	.	.	V.
22.917	0.3276	0.03	Q	.	.	.	V.
23.000	0.3278	0.03	Q	.	.	.	V.
23.083	0.3280	0.03	Q	.	.	.	V.
23.166	0.3282	0.03	Q	.	.	.	V.
23.250	0.3283	0.03	Q	.	.	.	V.
23.333	0.3285	0.03	Q	.	.	.	V.
23.416	0.3287	0.03	Q	.	.	.	V.
23.500	0.3289	0.03	Q	.	.	.	V.
23.583	0.3290	0.03	Q	.	.	.	V.
23.666	0.3292	0.03	Q	.	.	.	V.
23.750	0.3294	0.03	Q	.	.	.	V.
23.833	0.3295	0.02	Q	.	.	.	V.
23.916	0.3297	0.02	Q	.	.	.	V.
24.000	0.3299	0.02	Q	.	.	.	V.

↑

TIME(HRS)	VOLUME(AF)	Q(CFS)	0.	2.5	5.0	7.5	10.0
24.083	0.3300	0.02	Q	.	.	.	V.
24.166	0.3301	0.02	Q	.	.	.	V.
24.250	0.3303	0.02	Q	.	.	.	V.
24.333	0.3303	0.01	Q	.	.	.	V.
24.416	0.3303	0.01	Q	.	.	.	V.
24.500	0.3304	0.01	Q	.	.	.	V.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1470.0
10%	765.0
20%	525.0
30%	435.0
40%	375.0
50%	225.0
60%	210.0
70%	180.0
80%	45.0

90% 30.0

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END OF FLOODSCx ROUTING ANALYSIS

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

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

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

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ E. **Pools, spas, ponds, decorative fountains, and other water features.**	☒ **Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)**	☒ **If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.**	☒ **See applicable operational BMPs in** "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at http://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

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
☒ 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/

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
 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

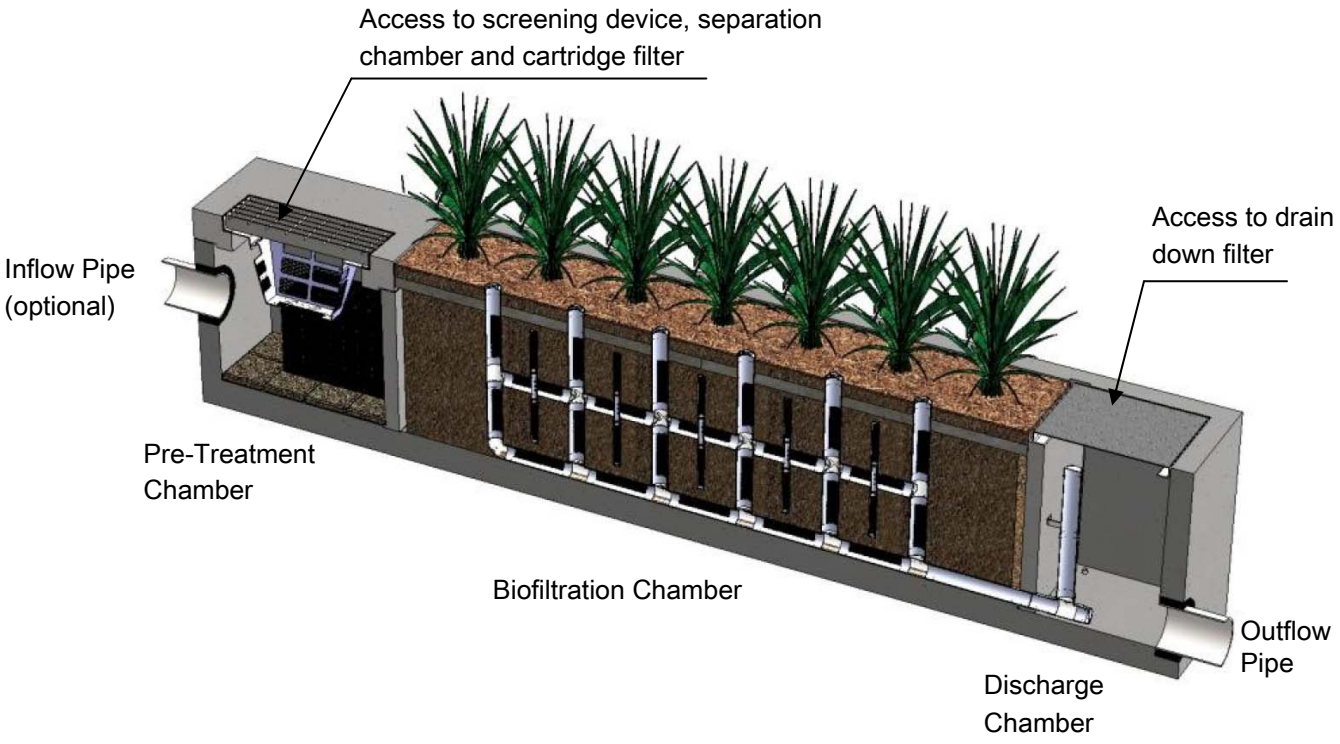
TO BE PROVIDED IN FINAL WQMP

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.

Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.

Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.

Inspection Form

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Inspection Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	**Yes**	**No**	**Comments**
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	**Yes**	**No**
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes:

2972 San Luis Rey Road, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

Maintenance Report

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

2972 San Luis Rey Road, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

Appendix 10: Educational Materials

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

After the Storm

A Citizen's Guide to Understanding Stormwater

WHEN IT RAINS IT DRAINS

EPA 833-B-03-002

January 2003

THE YEAR OF CLEAN WATER
Celebration & Recommitment

EPA United States Environmental Protection Agency

Internet Address (URL) • HTTP://www.epa.gov
Recycled/Recyclable • Printed With Vegetable Oil Based Inks on 100% Postconsumer, Process Chlorine Free Recycled Paper

For more information contact:

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

Why is stormwater runoff a problem?

The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.
- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.
- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

Stormwater Pollution Solutions

Residential

Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Pet waste

Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.

Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Commercial

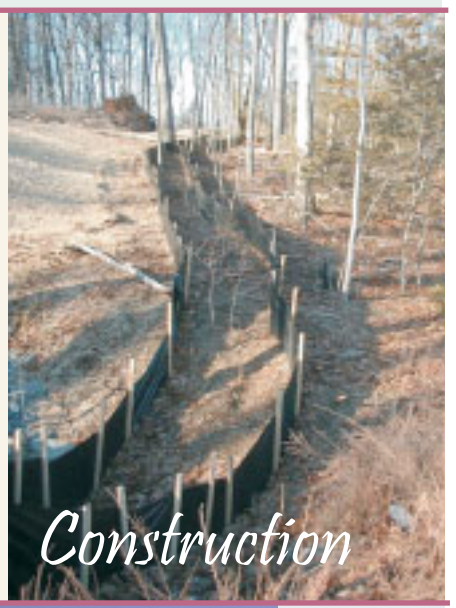
Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

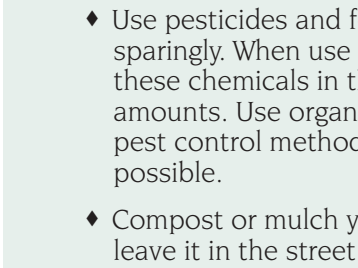
Construction

Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.



Agriculture



Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.

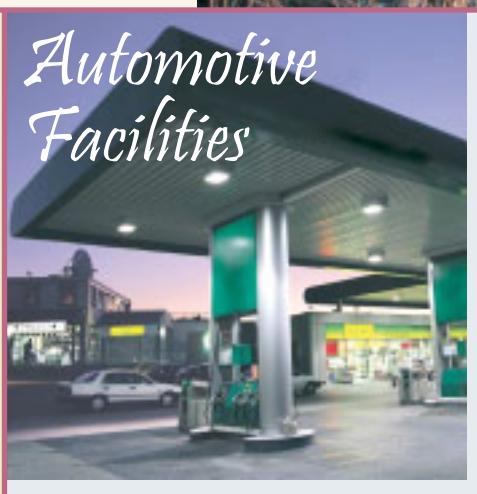
- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.

Forestry

Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.

Automotive Facilities



Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

Stormwater Pollution

What you should know for...

Industrial & Commercial Facilities

Best Management Practices (BMPS) for:

- Industrial Facilities
- Commercial Facilities

Riverside County Stormwater Program Members

City of Banning
(951) 922-3105

City of Beaumont
(951) 769-8520

City of Calimesa
(909) 795-9801

City of Canyon Lake
(951) 244-2955

City of Cathedral City
(760) 770-0340

City of Coachella
(760) 398-3502

City of Corona
(951) 736-2447

City of Desert Hot Springs
(760) 329-6411

City of Eastvale
(951) 361-0900

City of Hemet
(951) 765-2300

City of Indian Wells
(760) 346-2489

City of Indio
(760) 391-4000

City of Jurupa Valley
(951) 332-6464

City of Lake Elsinore
(951) 674-3124

City of La Quinta
(760) 777-7000

City of Menifee
(951) 672-6777

City of Moreno Valley
(951) 413-3000

City of Murrieta
(951) 304-2489

City of Norco
(951) 270-5607

City of Palm Desert
(760) 346-0611

City of Palm Springs
(760) 323-8299

City of Perris
(951) 943-6100

City of Rancho Mirage
(760) 324-4511

City of Riverside
(951) 826-5311

City of San Jacinto
(951) 487-7330

City of Temecula
(951) 694-6444

City of Wildomar
(951) 677-7751

Coachella Valley Water District
(760) 398-2651

County of Riverside
(951) 955-1000

Riverside County Flood Control District
(951) 955-1200

YOU can prevent Stormwater Pollution following these practices...

Industrial and Commercial Facilities

The Riverside County Stormwater Program has identified a number of Best Management Practices (BMPs) for Industrial and Commercial Facilities. These BMPs control and reduce stormwater pollutants from reaching our storm drain system and ultimately our local water bodies. City and County ordinances require businesses to use these BMPs to protect our water quality. Local cities and the County are required to verify implementation of these BMPs by performing regular facility inspections.

Prohibited Discharges

Discontinue all non-stormwater discharges to the storm drain system. It is *prohibited* to discharge any chemicals, paints, debris, wastes or wastewater into the gutter, street or storm drain.

Outdoor Storage BMPs

- Install covers and secondary containment areas for all hazardous materials and wastes stored outdoors in accordance with County and/or City standards.
- Keep all temporary waste containers covered, at all times when not in use.
- Sweep outdoor areas instead of using a hose or pressure washer.
- Move all process operations including vehicle/equipment maintenance inside of the building or under a covered and contained area.
- Wash equipment and vehicles in a contained and covered wash bay which is closed-loop or connected to a clarifier sized to local standards and discharged to a sanitary sewer or take them to a commercial car wash.

Spills and Clean Up BMPs

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep up the area.
- Clean up spills immediately when they occur, using dry clean up methods such as absorbent materials or sweep followed by proper disposal of materials.
- Always have a spill kit available near chemical loading dock doors and vehicle maintenance and fueling areas.
- Follow your Business Emergency Plan, as filed with the local Fire Department.
- Report all prohibited discharges and non-implementation of BMPs to your local Stormwater Coordinator as listed on the back of this pamphlet.
- Report hazardous materials spills to 951-358-5055 or call after hours to 951-782-2973 or, if an emergency, call the Fire Department's Haz Mat Team at 911.

Plastic Manufacturing Facilities BMPs

AB 258 requires plastic product manufacturers to use BMPs, such as safe storage and clean-up procedures to prevent plastic pellets (nurdles) from entering the waterway. The plastic pellets are released into the environment during transporting, packaging and processing and migrate to waterways through the storm drain system. AB 258 will help protect fish and wildlife from the hazards of plastic pollution.

Training BMPs

As prescribed by your City and County Stormwater Ordinance(s), train employees in spill procedures and prohibit non-stormwater discharges to the storm drain system. Applicable BMP examples can be found at www.cabmphandbooks.com.

Permitting

Stormwater discharges associated with specific categories for industrial facilities are regulated by the State Water Resources Control Board through an Industrial Stormwater General Permit. A copy of this General Permit and application forms are available at: www.waterboards.ca.gov, select stormwater then the industrial quick link.

To report illegal dumping or for more information on stormwater pollution prevention call: 1-800-506-2555 or e-mail us at: fcnpdes@rcflood.org.

Landscaping and garden maintenance activities can be major contributors to water pollution. Soils, yard wastes, over-watering and garden chemicals become part of the urban runoff mix that winds its way through streets, gutters and storm drains before entering lakes, rivers, streams, etc. Urban runoff pollution contaminates water and harms aquatic life!

In Riverside County, report illegal discharges into the storm drain, call
1-800-506-2555
"Only Rain Down the Storm Drain"

Important Links:

Riverside County Household Hazardous Waste Collection Information
1-800-304-2226 or www.rivcowm.org

Riverside County Backyard Composting Program
1-800-366-SAVE

Integrated Pest Management (IPM) Solutions
www.ipm.ucdavis.edu

California Master Gardener Programs
www.mastergardeners.org
www.camastergardeners.ucdavis.edu

California Native Plant Society
www.cnps.org

The Riverside County "Only Rain Down the Storm Drain" Pollution Prevention Program gratefully acknowledges Orange County's Storm Water Program for their contribution to this brochure.

...Only Rain Down ...the Storm Drain

What you should know for... Landscape and Gardening

Best Management tips for:

- Professionals
- Novices
- Landscapers
- Gardeners
- Cultivators

Tips for Landscape & Gardening

This brochure will help you to get the most of your lawn and gardening efforts and keep our waterways clean. Clean waterways provide recreation, establish thriving fish habitats, secure safe sanctuaries for wildlife, and add beauty to our communities. NEVER allow gardening products or waste water to enter the street, gutter or storm drain.

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.

- Plant native vegetation to reduce the amount of water, fertilizers and pesticides applied to the landscape.
- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro-spray systems. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.

- Consider recycling your green waste and adding "nature's own fertilizer" to your lawn or garden.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.
- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains or sewers. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting.
- Try natural long-term common sense solutions first. Integrated Pest Management (IPM) can provide landscaping guidance and solutions, such as:
  - **Physical Controls** - Try hand picking, barriers, traps or caulking holes to control weeds and pests.
  - **Biological Controls** - Use predatory insects to control harmful pests.
  - **Chemical Controls** - Check out www.ipm.ucdavis.edu before using chemicals. Remember, all chemicals should be used cautiously and in moderation.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Waste Collection Center to be recycled.
- *Dumping toxics into the street, gutter or storm drain is illegal!*

www.bewaterwise.com Great water conservation tips and drought tolerant garden designs.

www.ourwaterourworld.com Learn how to safely manage home and garden pests.

Additional information can also be found on the back of this brochure.

Helpful telephone numbers and links:

Riverside County Stormwater Protection Partners

Flood Control District	(951) 955-1200
County of Riverside	(951) 955-1000
City of Banning	(951) 922-3105
City of Beaumont	(951) 769-8520
City of Calimesa	(909) 795-9801
City of Canyon Lake	(951) 244-2955
Cathedral City	(760) 770-0327
City of Coachella	(760) 398-4978
City of Corona	(951) 736-2447
City of Desert Hot Springs	(760) 329-6411
City of Eastvale	(951) 361-0900
City of Hemet	(951) 765-2300
City of Indian Wells	(760) 346-2489
City of Indio	(760) 391-4000
City of Lake Elsinore	(951) 674-3124
City of La Quinta	(760) 777-7000
City of Menifee	(951) 672-6777
City of Moreno Valley	(951) 413-3000
City of Murrieta	(951) 304-2489
City of Norco	(951) 270-5607
City of Palm Desert	(760) 346-0611
City of Palm Springs	(760) 323-8299
City of Perris	(951) 943-6100
City of Rancho Mirage	(760) 324-4511
City of Riverside	(951) 361-0900
City of San Jacinto	(951) 654-7337
City of Temecula	(951) 694-6444
City of Wildomar	(951) 677-7751

REPORT ILLEGAL STORM DRAIN DISPOSAL
1-800-506-2555 or e-mail us at
fcnpdes@rcflood.org

- Riverside County Flood Control and Water Conservation District
  www.rcflood.org

Online resources include:

- California Storm Water Quality Association
  www.casqa.org
- State Water Resources Control Board
  www.waterboards.ca.gov
- Power Washers of North America
  www.thepwna.org

Stormwater Pollution

What you should know for...

Outdoor Cleaning Activities and Professional Mobile Service Providers

Storm drain pollution prevention information for:

- Car Washing / Mobile Detailers
- Window and Carpet Cleaners
- Power Washers
- Waterproofers / Street Sweepers
- Equipment cleaners or degreasers and all mobile service providers

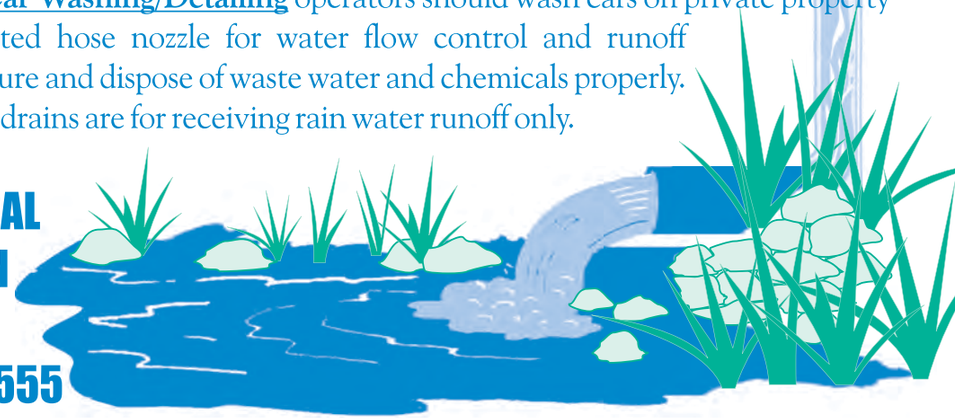
Do you know where street flows actually go?

Storm drains are NOT connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry *rain* water away from developed areas to prevent flooding. Pollutants discharged to storm drains are transported directly into rivers, lakes and streams. Soaps, degreasers, automotive fluids, litter and a host of materials are washed off buildings, sidewalks, plazas and parking areas. Vehicles and equipment must be properly managed to prevent the pollution of local waterways.

Unintentional spills by mobile service operators can flow into storm drains and pollute our waterways. **Avoid mishaps.** *Always* have a **Spill Response Kit** on hand to clean up unintentional spills. Only emergency **Mechanical** repairs should be done in City streets, using drip pans for spills. **Plumbing** should be done on private property. Always store chemicals in a leak-proof container and keep covered when not in use. **Window/Power Washing** waste water shouldn't be released into the streets, but should be disposed of in a sanitary sewer, landscaped area or in the soil. Soiled **Carpet Cleaning** wash water should be filtered before being discharged into the sanitary sewer. Dispose of all filter debris properly. **Car Washing/Detailing** operators should wash cars on private property and use a regulated hose nozzle for water flow control and runoff prevention. Capture and dispose of waste water and chemicals properly. Remember, storm drains are for receiving rain water runoff only.

REPORT ILLEGAL STORM DRAIN DISPOSAL 1-800-506-2555



Help Protect Our Waterways!

Use these guidelines for Outdoor Cleaning Activities and Wash Water Disposal

Did you know that disposing of pollutants into the street, gutter, storm drain or body of water is *PROHIBITED* by law and can result in stiff penalties?

Best Management Practices

Waste wash water from Mechanics, Plumbers, Window/Power Washers, Carpet Cleaners, Car Washing and Mobile Detailing activities may contain significant quantities of motor oil, grease, chemicals, dirt, detergents, brake pad dust, litter and other materials.

Best Management Practices, or BMPs as they are known, are guides to prevent pollutants from entering the storm drains. ***Each of us*** can do our part to keep stormwater clean by using the suggested BMPs below:

Simple solutions for both light and heavy duty jobs:

Do...consider dry cleaning methods first such as a mop, broom, rag or wire brush. Always keep a spill response kit on site.

Do...prepare the work area before power cleaning by using sand bags, rubber mats, vacuum booms, containment pads or temporary berms to keep wash water away from the gutters and storm drains.

Do...use vacuums or other machines to remove and collect loose debris or litter before applying water.

Do...obtain the property owner's permission to dispose of ***small amounts*** of power washing waste water on to landscaped, gravel or unpaved surfaces.

Do...check your local sanitary sewer agency's policies on wash water disposal regulations before disposing of wash water into the sewer. (See list on reverse side)

Do...be aware that if discharging to landscape areas, soapy wash water may damage landscaping. Residual wash water may remain on paved surfaces to evaporate. Sweep up solid residuals and dispose of properly. Vacuum booms are another option for capturing and collecting wash water.

Do...check to see if local ordinances prevent certain activities.

Do not let...wash or waste water from sidewalk, plaza or building cleaning go into a street or storm drain.

Report illegal storm drain disposal
Call Toll Free
1-800-506-2555

Using Cleaning Agents

Try using biodegradable/phosphate-free products. They are easier on the environment, but don't confuse them with being toxic free. Soapy water entering the storm drain system can impact the delicate aquatic environment.

When cleaning surfaces with a ***high-pressure washer*** or ***steam cleaner***, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning can loosen additional material that can contaminate local waterways.

Think Water Conservation

Minimize water use by using high pressure, low volume nozzles. Be sure to check all hoses for leaks. Water is a precious resource, don't let it flow freely and be sure to shut it off in between uses.

Screening Wash Water

Conduct thorough dry cleanup before washing exterior surfaces, such as buildings and decks ***with loose paint***, sidewalks or plaza areas. Keep debris from entering the storm drain after cleaning by first passing the wash water through a "20 mesh" or finer screen to catch the solid materials, then dispose of the mesh in a refuse container. Do not let the remaining wash water enter a street, gutter or storm drain.

Drain Inlet Protection & Collection of Wash Water

- Prior to any washing, block all storm drains with an impervious barrier such as sandbags or berms, or seal the storm drain with plugs or other appropriate materials.
- Create a containment area with berms and traps or take advantage of a low spot to keep wash water contained.
- Wash vehicles and equipment on grassy or gravel areas so that the wash water can seep into the ground.
- Pump or vacuum up all wash water in the contained area.

Concrete/Coring/Saw Cutting and Drilling Projects

Protect any down-gradient inlets by using dry activity techniques whenever possible. If water is used, minimize the amount of water used during the coring/drilling or saw cutting process. Place a barrier of sandbags and/or absorbent berms to protect the storm drain inlet or watercourse. Use a shovel or wet vacuum to remove the residue from the pavement. Do not wash residue or particulate matter into a storm drain inlet or watercourse.