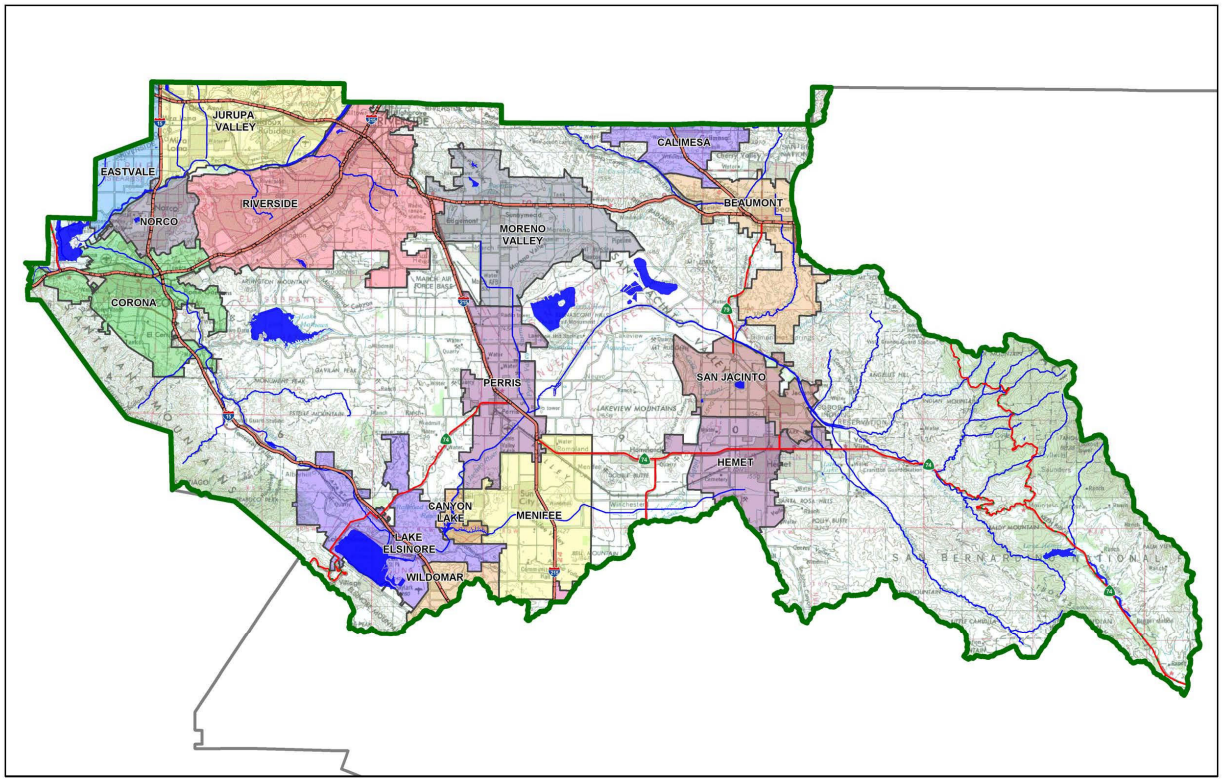
Project Specific Water Quality Management Plan

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

Project Title: Thrifty Oil Warehouse Facility

Development No: PPT220047

Design Review/Case No:



☒ **Preliminary**
☐ **Final**

Original Date Prepared: September 26th, 2022

Revision Date(s): July 26, 2023

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

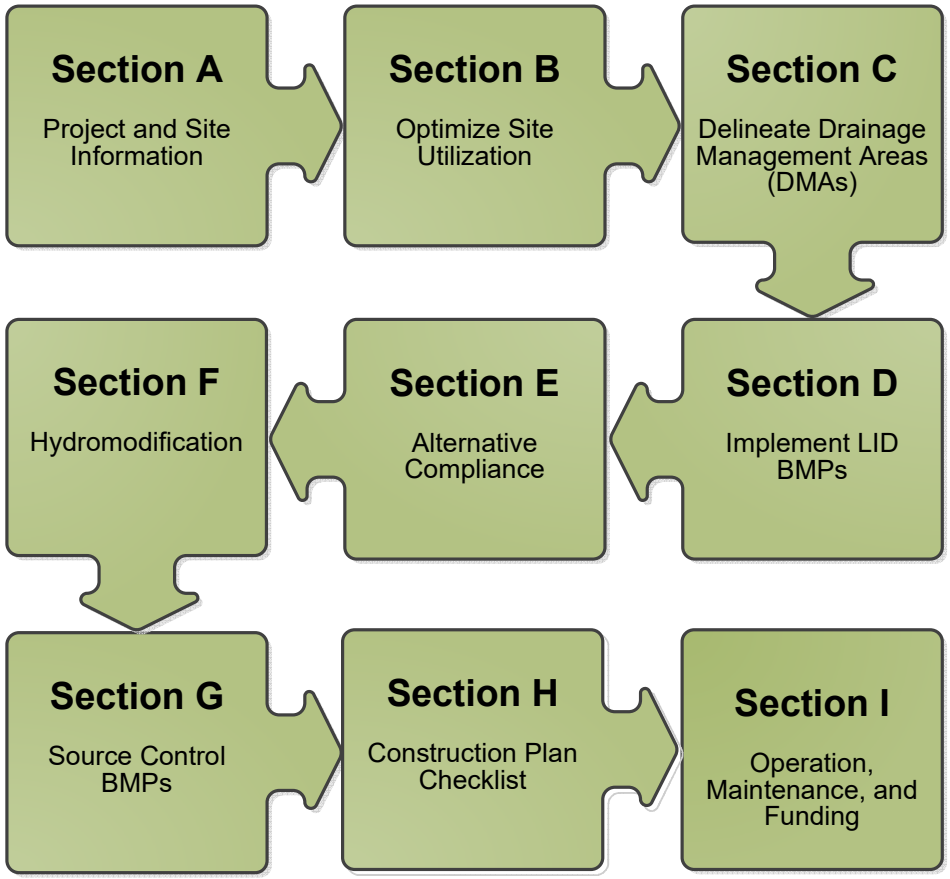
Contact Information:

Prepared for:
Thrifty Oil Company
13116 Imperial Hwy
Santa Fe Springs, CA 90670
(310) 418-6588
swandel@ordencompany.com

Prepared by:
Armstrong & Brooks Consulting Engineers
1350 E Chase Dr.
Corona, CA 92881
(951) 372-8400
bill@armstrongbrooks.com

A Brief Introduction

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



OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared by Armstrong and Brooks Consulting Engineers for Thrifty Oil Company for their Tobacco Road project.

This WQMP is intended to comply with the requirements of the Riverside County 2010 SAR MS4 Permit and Riverside County Municipal Code Section XII.D 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 Riverside County Water Quality Ordinance Order No. R8-2010-0033 (MS4 Permit).

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

Owner's Signature	Date
Stephane Wandel	Executive Director of Acquisitions & Development
Owner's Printed Name	Owner's Title/Position

PREPARER'S CERTIFICATION

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

Preparer's Signature	Date
Bill Brooks	Principal
Preparer's Printed Name	Preparer's Title/Position

Preparer's Licensure:

Table of Contents

List of Tables

List of Appendices

Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Industrial
Planning Area:	Mead Valley Area Plan I-P Zone (Industrial Park)
Community Name:	N/A
Development Name:	N/A
PROJECT LOCATION	
Latitude & Longitude (DMS): 33°49'13" N, 117°14'57" W	
Project Watershed and Sub-Watershed: Santa Ana Watershed	
Gross Acres: 9.14 Acres APN(s): 317-260-016, 317-260-015 Map Book and Page No.: MB 1/5	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Warehouse
Proposed or Potential SIC Code(s)	4225
Area of Impervious Project Footprint (SF)	398,102
Total Area of proposed Impervious Surfaces within the Project Footprint (SF)/or Replacement	341,933
Does the project consist of offsite road improvements?	☒ Y ☐ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the Project limits Footprint (SF)	0
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	N/A
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☒ Y ☐ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	
What is the Water Quality Design Storm Depth for the project?	0.59 ft

A.1 Maps and Site Plans

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

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

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

A.2 Identify Receiving Waters

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

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Perris Valley Drain	N/A	N/A	N/A
San Jacinto River Reach 3	None	AGR*,GWR*,REC1*,REC2*,WARM*,WILD*	N/A
San Jacinto River Reach 2	None	AGR,GWR,WILD,MUN,REC1,REC2,WARM	N/A
Canyon Lake (Railroad Canyon Reservoir)	Nutrients	WILD, REC2,WARM,GWR,MUN,REC1,AGR	N/A
San Jacinto River Reach 1	None	AGR*,GWR*,REC1*,REC2*,WARM*,WILD*	N/A
Lake Elsinore	DDT, Nutrients, Low Dissolved Oxygen, PCBs, Toxicity	REC1, REC2, WARM, WILD	N/A

Denotes **Intermittent Beneficial Use*

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)*	☐ 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?

Yes, based on topographical evidence the site currently drains to the northeast corner and the grading for the site mimics current site drainage. Proposed grading and proposed storm drains will allow for site runoff to be conveyed to a proposed underground detention chamber below the eastern truck parking lot. Overflow from this proposed facility will be discharged using a side-flow weir to distribute the storm water runoff linearly (non-concentrated) at a rate per linear foot less than existing, predeveloped conditions

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

No, a small percentage of the existing site is covered by vegetation making it infeasible to protect. Vegetation will be placed through proposed landscaping areas within proposed parking islands and alongside sidewalks.

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

Yes, infiltration capacity was estimated per attached Geotechnical Report generated for the site and was used in determining the BMPs applied to the site.

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

Yes, impervious area was minimized through the implementation of landscaped parking islands throughout the site instead of impervious asphalt/concrete.

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

No, however all site runoff will be routed to the underground detention chambers which will also infiltrate into the gravel bed.

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 A	Mixed	398,102	D

[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)

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]

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

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]

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

DMA Name or ID	BMP Name or ID
DMA A	UNDERGROUND DETENTION CHAMBER 1

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:		
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?		X
If Yes, list affected DMAs:		
…geotechnical report identify other site-specific factors that would preclude effective and safe infiltration?		X
Describe here:		

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.

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:

Type of Landscaping (Conservation Design or Active Turf):

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:

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:

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:

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

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

Toilet Use Feasibility

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

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

Projected Number of Daily Toilet Users:

Project Type:

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:

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:

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:

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)**

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.

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 A	☒	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

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.

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	*UNDERGROUND DET. CHAMBER 1*		
	[A]		[B]	[C]	[A] x [C]			
DMA-A	*398,102*	*Mixed Surface Types*	*0.87**	*0.69*	*275,536.6*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Composition:								
	186,993	*Roofs*	*1.0*					
	114,896	*Asphalt*	*1.0*					
	40,044	*Concrete*	*1.0*					
	56,169	*Ornamental Landscaping*	*0.1*					
	A_T= 398,102				Σ = 275,536.6	0.59	13,547	***16,143***

* Per Section 2.3.1 of the 2012 Santa Watershed Region WQMP Guidance Document, a composite effective impervious fraction can be used when multiple surfaces types are present in a DMA. A composite effective impervious fraction has been used for DMA-A (see *Composition* rows for each surface type and its respective area). There is only one DMA for the proposed site (DMA-A) due to proposed site grading conveying all on-site storm water runoff to **one** underground infiltration BMP.

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]
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]				
						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]

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

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

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

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

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

If Yes, HCOC criteria do not apply.

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

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

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

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

Table F.1 Hydrologic Conditions of Concern Summary

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

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

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

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

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

Project site identified to be within a non-HCOC applicable area on HCOC applicability map included in Appendix 7. HCOC applicability map also indicates that all downstream conveyance channels that receive runoff from the project are classified as "not susceptible stream channels."

F.2 HCOC Mitigation

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

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

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

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

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

Section G: Source Control BMPs

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

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

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

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

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

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
On-site storm drain inlets	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control 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 Appendix 10.
Landscape/ Outdoor Pesticide Use	Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the	Maintain landscaping using minimum or no pesticides.

	use of fertilizers and pesticides that can contribute to stormwater pollution. To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	See applicable operational BMPs in SC-41, " Building and Grounds Maintenance," in Appendix 10.
Refuse areas	State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	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 Appendix 10.
Loading Docks		Move loaded and unloaded items indoors as soon as possible. See Fact Sheet SC-30, "Outdoor Loading and Unloading," in Appendix 10.
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.

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)
UNDERGROUND DETENTION CHAMBER #1	Detention and Infiltration below eastern truck parking on site	WQMP Exhibit, Conceptual Grading Plan	

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: Property Owner will be responsible for BMP maintenance.

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

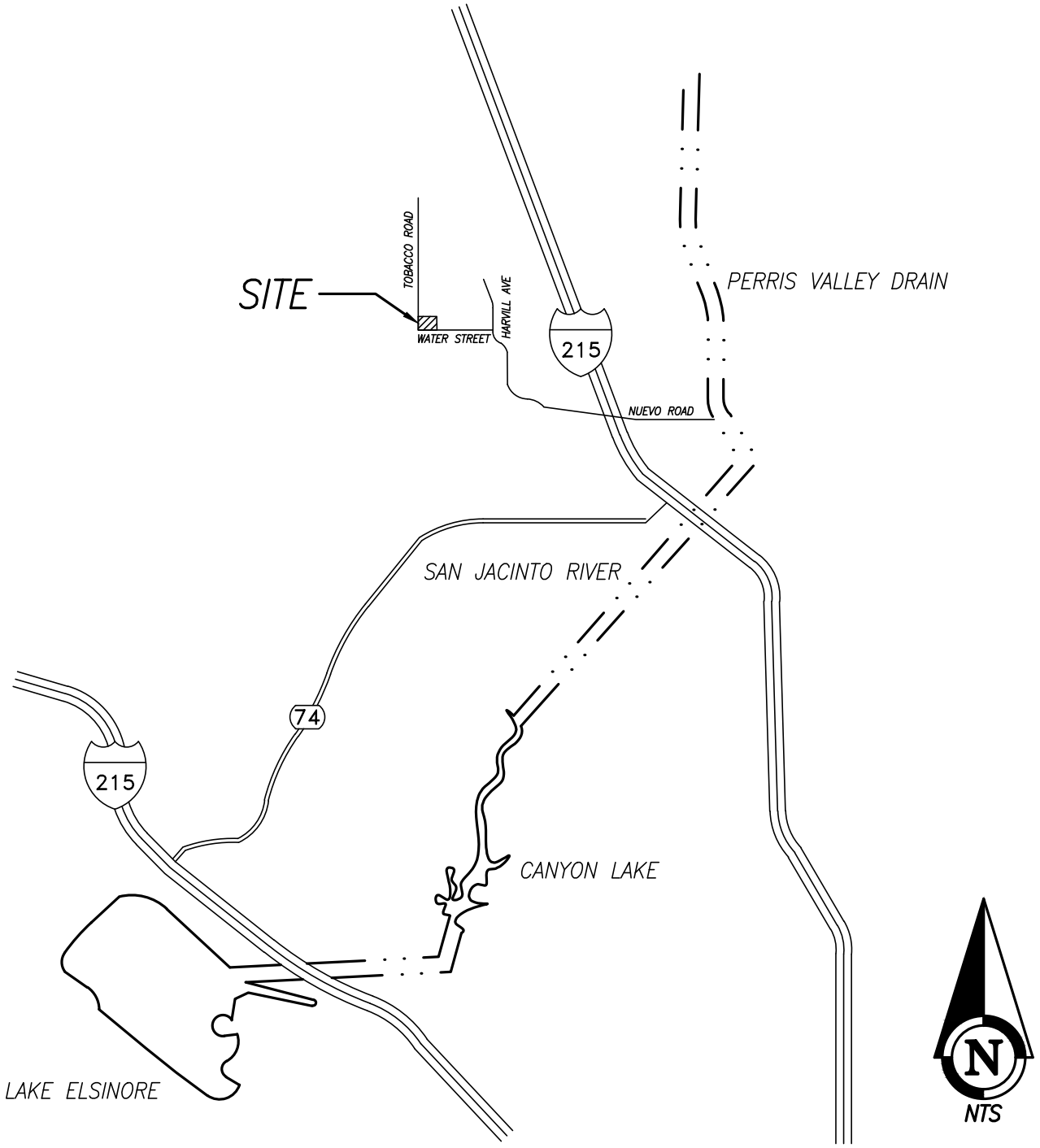
☐ Y ☒ N

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.

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

RECEIVING WATERS MAP

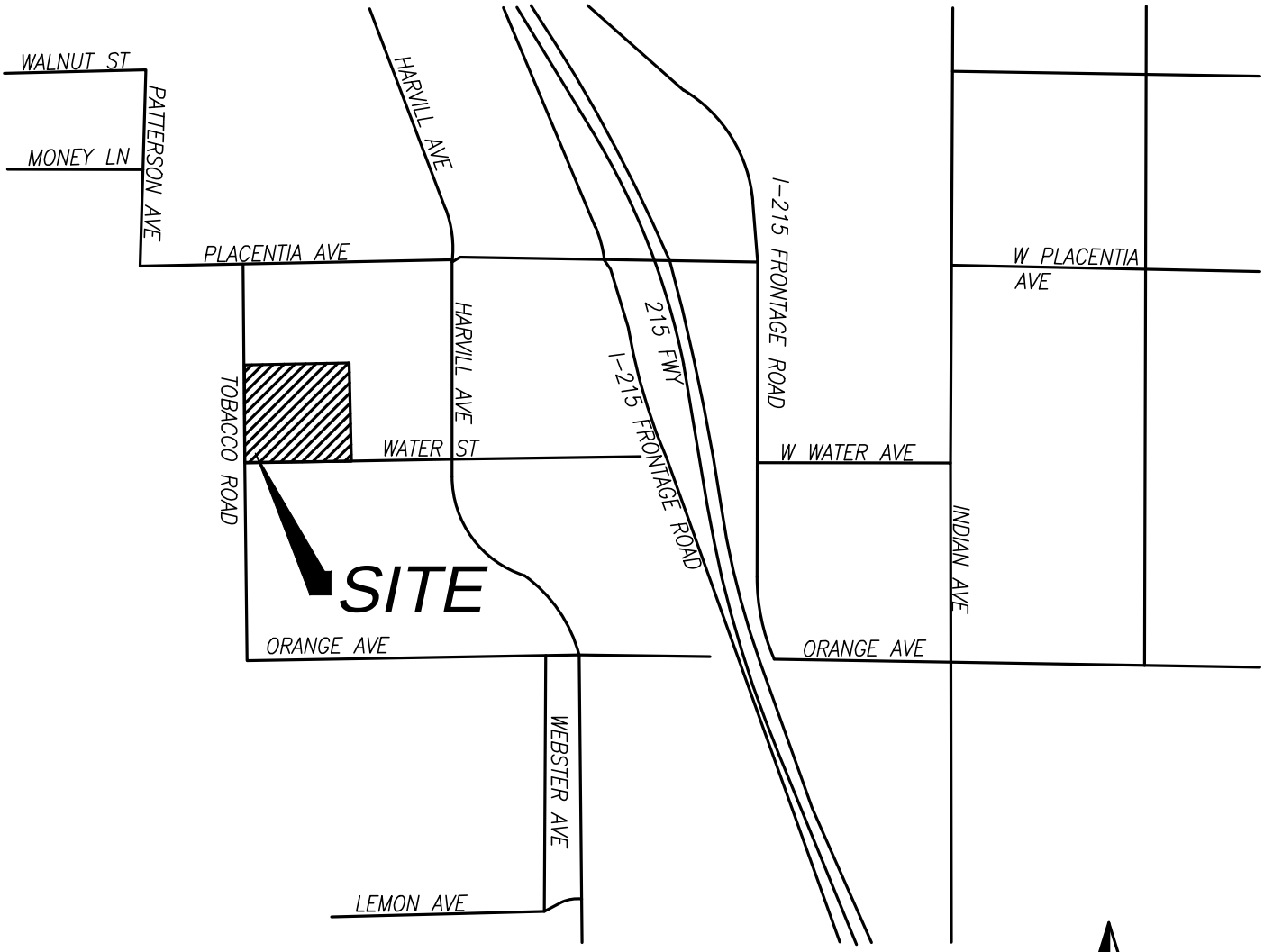


Armstrong & Brooks Consulting Engineers, Inc.
Civil Engineering · Water Resources · Surveying

1350 E. Chase Drive. Corona, CA 92881
Mail: P.O. Box 78088, Corona, CA 92887
Ph. (951) 372-8400, Fax (951) 372-8430

RECEIVING WATERS MAP
FOR
THRIFTY OIL
WAREHOUSE FACILITY
COUNTY OF RIVERSIDE

VICINITY MAP



Armstrong & Brooks Consulting Engineers, Inc.
Civil Engineering · Water Resources · Surveying

1350 E. Chase Drive. Corona, CA 92881
Mail: P.O. Box 78088, Corona, CA 92887
Ph. (951) 372-8400, Fax (951) 372-8430

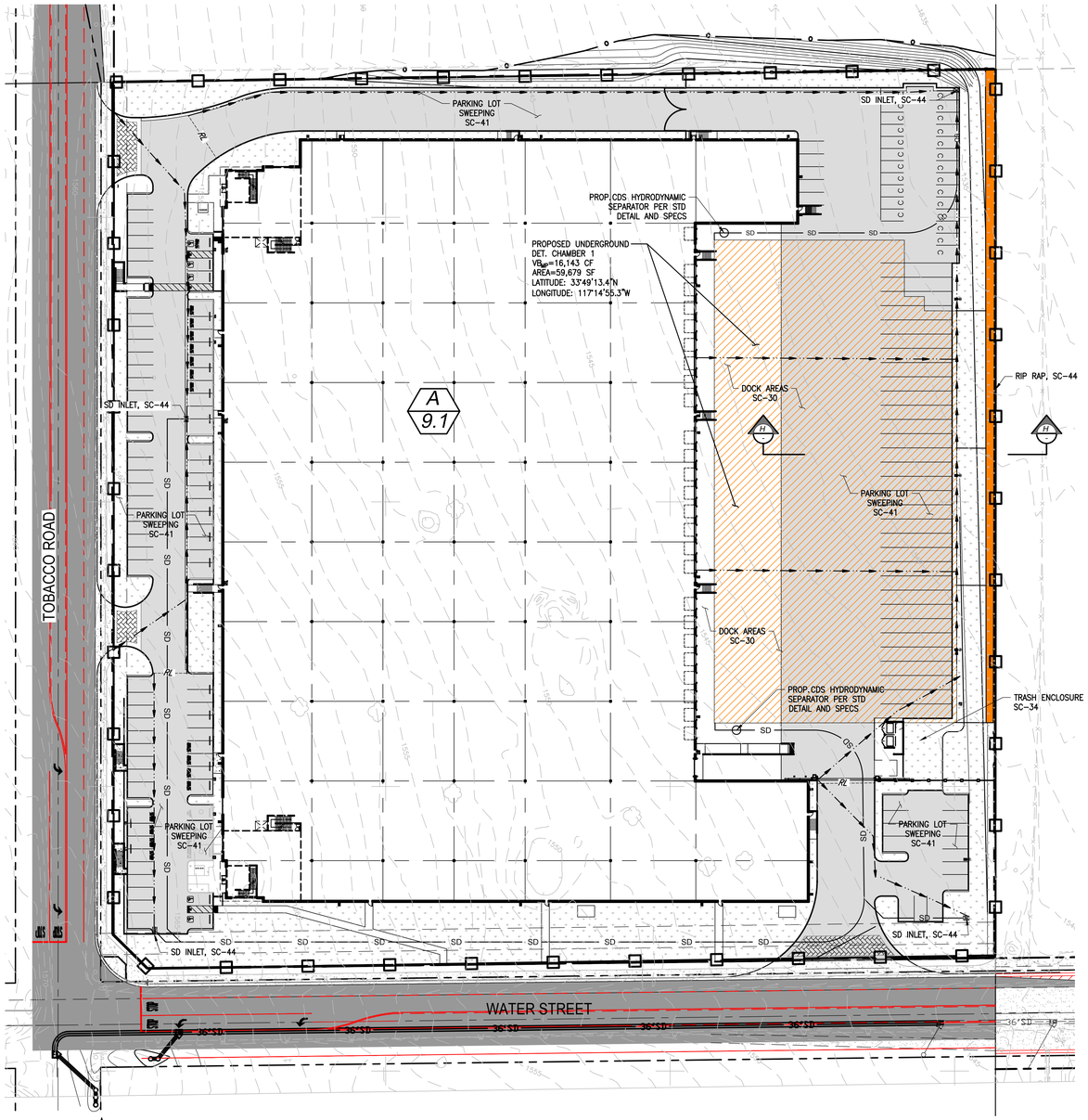
VICINITY MAP
FOR
THRIFTY OIL
WAREHOUSE FACILITY
COUNTY OF RIVERSIDE

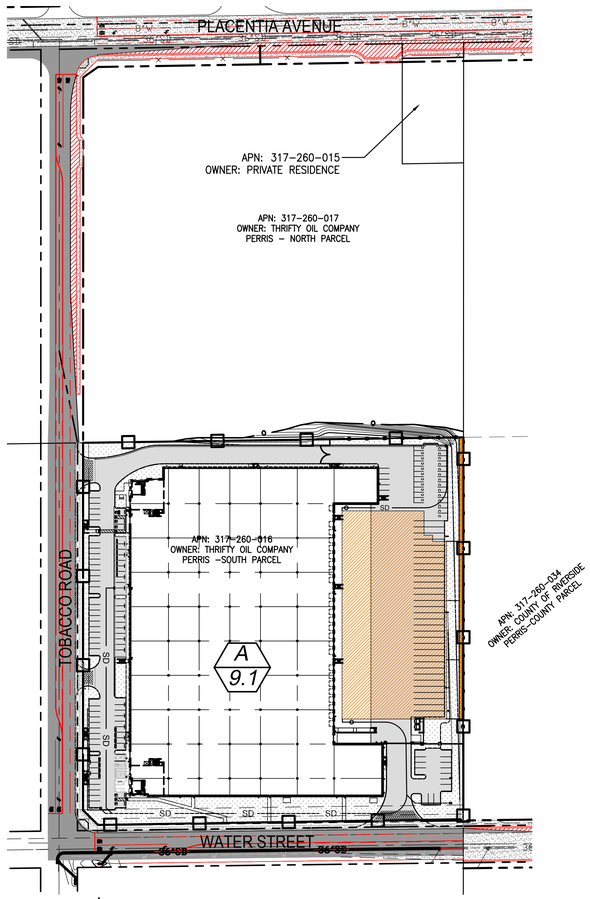
PRELIMINARY WATER QUALITY MANAGEMENT PLAN

FOR

Thrifty Oil Warehouse Facility

County of Riverside





40 0 40 80 120

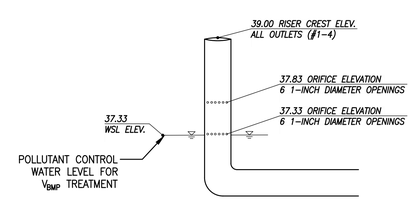
SCALE 1" = 40'

100 0 100 200 300

SCALE 1" = 100'

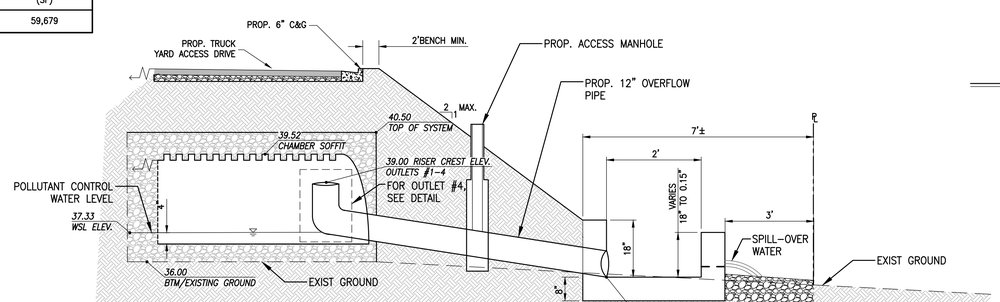
DMA ID	IMPERVIOUS AREA (SF)	PERVIOUS AREA (ORNAMENTAL LANDSCAPE) (SF)	TOTAL AREA (SF)	BMP ID	DCV (CF)	V_{BMP} (CF)	PROP. AREA (SF)
DMA-A	341,933	56,169	398,102	UNDERGROUND DET. CHAMBER 1	13,547	16,143	59,679

IMPERVIOUS AREA BREAKDOWN (SF)	
ROOFS	186,993
ASPHALT	114,896
CONCRETE	40,044



OUTLET #4 DETAIL

NTS

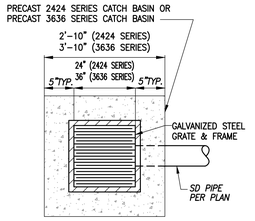


SECTION H-H

NTS

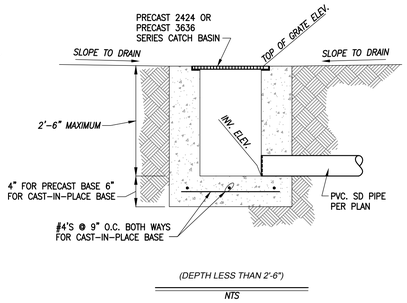
LEGEND

- U/G WATER
- O/H CABLE
- U/G DATA
- CENTERLINE
- R/W LINE
- PROPOSED RIP-RAP / GRAVEL
- PROPOSED PCC PAVING
- PROPOSED AC PAVING
- PROPOSED OFF-SITE AC PAVING
- PROPOSED LANDSCAPING
- PROPOSED UNDERGROUND CHAMBERMAXX FACILITY
- CONCRETE U-DITCH OVERFLOW WEIR
- PROPOSED STREET WIDENING AC BY OTHERS
- DMA BOUNDARY
- A / X.X — SUBAREA/ACREAGE
- STORM DRAIN INLET



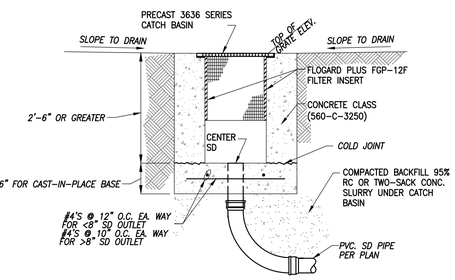
PLAN VIEW

NTS



(DEPTH LESS THAN 2'-6")

NTS



(DEPTH 2'-6" OR GREATER)

NTS

PRECAST SERIES CATCH BASIN DETAIL

NTS

PRELIMINARY WATER QUALITY MANAGEMENT PLAN

FOR

Thrifty Oil Warehouse Facility

County of Riverside

PREPARED BY:

Armstrong & Brooks Consulting Engineers, Inc.

Civil Engineering · Water Resources · Surveying

1350 E. Chase Drive. Corona, CA 92881

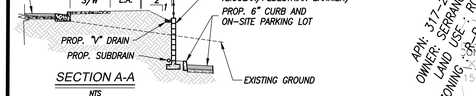
Mail: P.O. Box 78088, Corona, CA 92877

Ph. (951) 372-8400, Fax (951) 372-8430

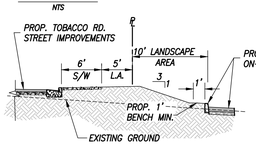
Appendix 2: Construction Plans

Grading and Drainage Plans

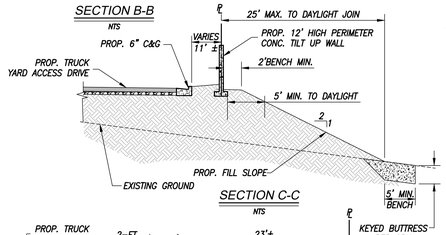
PLOT PLAN : COUNTY OF RIVERSIDE CASE NO: PPT220047



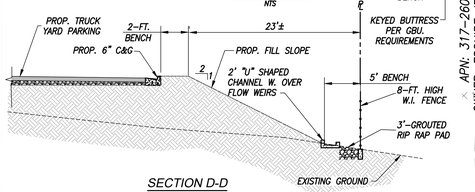
SECTION A-A
NTS



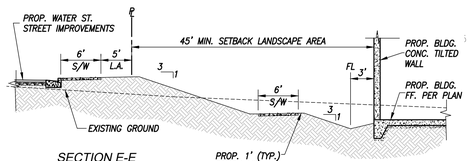
SECTION B-B
NTS



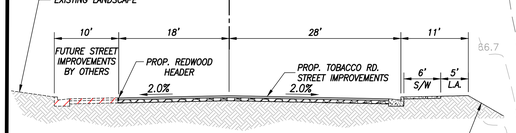
SECTION C-C
NTS



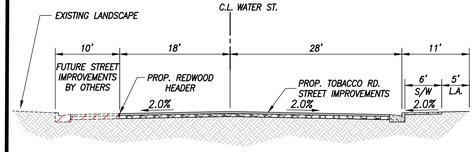
SECTION D-D
NTS



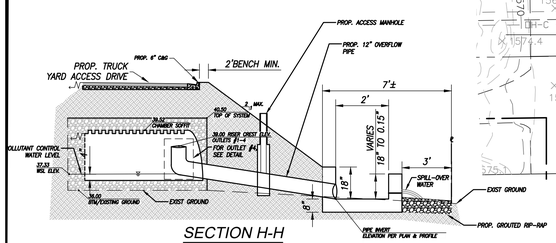
SECTION E-E
NTS



SECTION F-F
NTS



SECTION G-G
NTS



SECTION H-H
NTS

APN: 317-260-005
OWNER: SERRANO SILVANO
LAND USE : RC-VLDR
ZONING : R-R-1, CZ #6312

APN: 317-260-014
OWNER: ESQUIRE JEAN PIERRE
LAND USE : RC-VLDR
ZONING : A-1-1, CZ #6312

APN: 317-260-017
OWNER: THRIFTY OIL COMPANY
PERRIS – NORTH PARCEL
LAND USE : RC-VLDR
ZONING : R-R-1, CZ #6312

APN: 317-260-016
OWNER: THRIFTY OIL COMPANY
PERRIS –SOUTH PARCEL
LAND USE : BP
ZONING : I-P, CZ NUMBER 5676

APN: 317-260-034
OWNER: COUNTY OF RIVERSIDE
PERRIS COUNTY PARCEL
LAND USE : BP
ZONING : M-SC

APN: 317-260-015
OWNER: THRIFTY OIL COMPANY

APN: 317-270-002
OWNER: SSR INV CO
LAND USE : BP
ZONING : I-P, CZ #7830

APN: 317-270-015
OWNER: BCIF HARVILL BUSINESS CENTER LP
LAND USE : BP
ZONING : M-SC

TOBACCO ROAD

OFFICE

UNDERGROUND STORAGE CHAMBER FACILITY

WATER STREET

S=0.50%
SLOPING FF/PAD

FF=1553.70 TO 1551.81
PAD=1553.03 TO 1551.14

HALF-STREET FLOW
Q_{50} = 0.72 CFS
Q_{100} = 1.02 CFS

ON-SITE FLOWS
Q_{50} = 3.34 CFS
Q_{100} = 5.43 CFS

APPROXIMATE DAYLIGHT GRADING LIMITS
PROPERTY OWNED BY APPLICANT (T.O.C.)

N89° 10' 39"E 620.10'

4 RISERS @ 0.55'=2.20'
50.46 BTM STAIRS

8 RISERS @ 0.5'=4.0'

9 RISERS @ 0.5'=4.5'

4' MAX. RET. WALL

PROPOSED 36" STORM DRAIN (L=665± L.F.) R.C.D.F.C. & W.C.D. LATERAL H-10 MDP SD) (SHEET SHT. 3)

PROPOSED 36" CMP RISER INLETS PER RCFC/WCD STD. CB108 (SEE DETAIL ON SHEET 3)
Q100=134.4 CFS, Q10=88.0 CFS
OFF-SITE DRAINAGE STUDY TO BE SUBMITTED FOR REVIEW

1/2-SITE IMPROVEMENTS
PLUS 18-FEET OF AC WIDENING PER RCRD STD. 111

JOIN EXIST. 36" RCP MANHOLE STUB-OUT PER PLOT PLAN PPT220002) & PROP. STREET IMPROVEMENTS Q100=148 CFS, Q10=93 CFS

PROPOSED 8" SEWER LINE (L=1245± L.F.) TO HARVILL AVE. TIE-IN (EMWD SEWER) SEE SHEET 3

PROP. 36" RCP SD LATERAL H-10 (R.C.F.C.D. & W.C.D. MDP PER PLOT PLAN PPT220002) & STREET IMPROVEMENTS, SEE SHEET 3

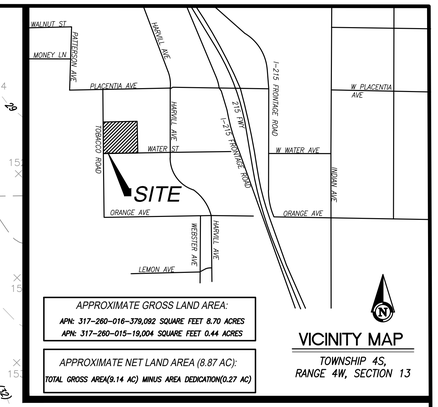
30' VACATED PUBLIC R/W PER ABS22001 OWNED BY THRIFTY OIL CO.

30' VACATED R/W PER OFFICIAL RECORD 2950/489

FUT. PCC SIDEWALK

HALF-STREET FLOW
Q_{50} = 0.82 CFS
Q_{100} = 0.95 CFS

SCALE 1" = 30'



VICINITY MAP
TOWNSHIP 4S, RANGE 4W, SECTION 13

APPROXIMATE GROSS LAND AREA:
APN: 317-260-016-379,092 SQUARE FEET 8.70 ACRES
APN: 317-260-015-19,004 SQUARE FEET 0.44 ACRES

APPROXIMATE NET LAND AREA (8.87 AC):
TOTAL GROSS AREA(9.14 AC) MINUS AREA DEDICATION(0.27 AC)

LEGAL DESCRIPTION: APN: 317-260-016

LOT 6 OF OAKES AND SAWYERS SUBDIVISION, IN THE COUNTY OF RIVERSIDE, STAC OF CALIFORNIA, AS PER MAP RECORDED IN BOOK 1, PAGE 5, OF MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.

EXCEPT THEREFROM THE EASTERLY 30 FEET, AND THE WESTERLY 30 FEET LYING IN TOBACCO ROAD.

LEGAL DESCRIPTION: APN: 317-260-015

THE EAST 30 FEET OF LOT 6 OF OAKES AND SAWYERS SUBDIVISION, IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS PER MAP FILED IN BOOK 1, PAGE 5 OF MAPS, RECORDS OF SAID COUNTY.

LEGEND

- CB – CATCH BASIN
- FH – FIRE HYDRANT
- SMH – SEWER MANHOLE
- SDMH – STORM DRAIN MANHOLE
- WV – WATER VALVE
- EXISTING TREE
- CHAINLINK FENCE
- COMMUNICATIONS
- SEWER
- OVERHEAD ELECTRICAL
- WATER
- EXISTING GROUND CONTOUR
- CENTERLINE
- R/W LINE
- FUTURE STREET IMP. BY OTHERS
- BOUNDARY
- RETAINING WALL
- PROPOSED UNDERGROUND STORMWATER DETENTION SYSTEM (STORM CHAMBER OR EQUAL) TOTAL STORAGE PROVIDED = 143,746 CUBIC FEET
- PROPOSED ASPHALT CONCRETE & BASE (STREET WIDENING)
- PROPOSED ASPHALT CONCRETE & BASE ON-SITE PAVING
- PROPOSED CONCRETE PAVING
- PROPOSED LANDSCAPING
- CONCRETE U-DITCH OVERFLOW WEIR

ABBREVIATIONS

AC	ASPHALT CONCRETE	N	NORTH
℄	CENTERLINE	OH-C	OVERHEAD CONDUIT
C&G	CURB & GUTTER	PCC	PORTLAND CEMENT CONCRETE
COMM.	COMMUNICATION	℗	PROPERTY LINE
CONC.	CONCRETE	PROP.	PROPOSED
DIA.	DIAMETER	R	RANGE
DWG.	DRAWING	RCFC&WCD	RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
E	EAST		
EXIST.	EXISTING	R.W.	RETAINING WALL
F.F.	FINISHED FLOOR	R/W	RIGHT-OF-WAY
F.G.	FINISHED GRADE	S	SOUTH
F.H.	FIRE HYDRANT	SCE	SOUTHERN CALIFORNIA EDISON
F.L.	FLOW LINE	SD	STORM DRAIN
F.S.	FINISHED SURFACE	T	TOWNSHIP
G.B.	GRADE BREAK	TC	TOP OF CURB
G.N.V.	GROUND NOT VISIBLE	T.O.C.	THRIFTY OIL COMPANY
H	HEIGHT	TE	TRASH ENCLOSURE
L.A.	LANDSCAPE AREA/LANDSCAPE ARCH.		

General Notes

1. THERE ARE NO PERMITTED GROUNDWATER WELLS OR ACTIVE WELLS ON-SITE.
2. THERE IS NO OVERHEAD POWER RUNNING ALONG WATER ST. OR TOBACCO RD. ALONG THE PROJECT FRONTAGE
3. A PARCEL MERGER APPLICATION WILL BE SUBMITTED CONCURRENTLY WITH GRADING PLANS SUBMITTALS, THERE ARE NO EXIST. EASEMENTS ON-SITE
4. THE ALUC APPLICATION HAS BEEN PROCESSED AND WILL BE SUBMITTED TO PLANNER JACKIE VEGA FOR PROCESSING AND PUBLIC HEARING, MARCH ARB, ZONE C2
5. THERE ARE NO EXISTING UTILITY EASEMENTS OR ENCUMBRANCES AFFECTING TITLE OR DEVELOPMENT RIGHTS ON-SUBJECT PROPERTY
6. THE SUBJECT PROPERTY IS NOT SUBJECT TO LIQUEFACTION, OTHER GEOLOGIC HAZARDS, SUBJECT TO OVERFLOW, INUNDATION, OR FLOOD HAZARDS.
7. SAID DESCRIBED PROPERTY IS LOCATED WITHIN AN AREA HAVING A ZONE DESIGNATION "X" (AREA OF MINIMAL FLOOD HAZARD) BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY, ON FLOOD INSURANCE RATE MAP NO. 06065C1430H
8. SEE ARCHITUECTUAL SITE PLAN, SHEET DAB-A1.1 FOR DEVELOPMENT TABLE AREA SUMMARIES , BUILDING AREA, PARKING, LANDSCAPE AND CALCULATIONS
9. EX. ZONING I-P PROP. ZONING I-P EXISTING GENERAL PLAN LAND USE DESIGNATION BP, NOT IN A SPECIFIC PLAN, COMMUNITY ADVISORY COUNCIL: MEAD VALLEY MAC
10. SCHOOL DISTRICT : VAL VERDE UNIFIED
11. EXIST. LAND USE : VACANT
12. SEE PRELIMINARY HYDROLOGY AND HYDRAULICS REPORT FOR UNDERGROUND STORMWATER DISPOSAL, INFILTRATION AND ROUTING CALCULATIONS FOR S.D. SYSTEM
13. SEE PRELIMINARY WQMP REPORT FOR BMP'S, SIZING, MAINTENANCE AND CALCULATIONS

UTILITY PURVEYORS

WATER:	EASTERN MUNICIPAL WATER DISTRICT
SEWER:	EASTERN MUNICIPAL WATER DISTRICT
ELECTRIC:	SOUTHERN CALIFORNIA EDISON
GAS:	SOUTHERN CALIFORNIA GAS COMPANY
CABLE:	CHARTER
TELE:	FRONTIER
WASTE:	WASTE MANAGEMENT COMPANY

EARTHWORK QUANTITIES

CUT = 12,411 CU. YD.
FILL = 50,412 CU. YD.
NET = 38,000 CU. YD.

DATE OF PLOT : 7-26-2023

PREPARED BY:
Armstrong & Brooks Consulting Engineers, Inc.
Civil Engineering · Water Resources · Surveying
1350 E. Chase Drive, Corona, CA 92881
Mail: P.O. Box 78088, Corona, CA 92887
Ph. (951) 372-8400, Fax (951) 372-8430

REGISTERED PROFESSIONAL ENGINEER WILLIAM D. BROOKS No.C053144 Exp. 6/30/25 CIVIL STATE OF CALIFORNIA

COUNTY OF RIVERSIDE - THRIFTY OIL
CONCEPTUAL GRADING AND DRAINAGE PLAN - SCHEME 13
APN'S 317-260-015 AND 317-260-016

SHEET 1 OF 4

PLOT PLAN : COUNTY OF RIVERSIDE CASE NO: PPT220047

APN: 317-260-005
OWNER: SERRANO SILVANO

APN: 317-260-014
OWNER: ESQUIRE JEAN PIERRE

APN: 317-260-017
OWNER: THRIFTY OIL CO
PERRIS – NORTH PARCEL

APPROXIMATE DAYLIGHT GRADING LIMITS
PROPERTY OWNED BY APPLICANT (T.O.C.)

APN: 317-260-034
OWNER: COUNTY OF RIVERSIDE
PERRIS COUNTY PARCEL

APN: 317-260-015
OWNER: THRIFTY OIL COMPANY

APN: 317-260-016

APN: 317-270-002
OWNER: SSR INV CO

APN: 317-270-015
OWNER: BCIF HARVILL
BUSINESS CENTER LP

TOBACCO ROAD

HARVILL ROAD

WATER STREET

OFFICE

UNDERGROUND STORAGE CHAMBER FACILITY

HALF-STREET FLOW
Q_{10} = 0.72 CFS
Q_{100} = 1.02 CFS

HALF-STREET FLOW
Q_{10} = 0.82 CFS
Q_{100} = 0.95 CFS

PROP. FH #6
PROP. 10" DDC #2
PROP. POST INDICATING VALVE #2
PROP. FH #5
PROP. FH #4
PROP. POST INDICATING VALVE #3
PROP. FIRE RISER #2
PROP. FIRE RISER #3
PROP. SEWER 1547.22 I.E.
PROP. SEWER 1548.00 I.E.
PROP. SEWER 1550.00 I.E.
PROP. 6" SEWER 1.0% SLOPE
PROP. 6" SEWER 1.33% SLOPE
PROP. FH #3
PROP. POST INDICATING VALVE #3
PROP. FH #7
PROP. 10" DDC #3
PROP. VALVE #1
PROP. FIRE RISER #1
PROP. FH #2
PROP. 4" SEWER 3.23% SLOPE
PROP. SEWER 1541.22 I.E.
PROP. SEWER 1540.00 I.E.
PROP. FIRE RISER #5
PROP. FIRE RISER #4
PROP. VALVE #4
PROP. S/W P.O.T.
PROP. VALVE #5
PROP. 10" DDC #4
PROP. FH #9
PROP. FH #10
PROP. 10" DDC #1
PROP. FH #1
PROP. R/W
PROP. SDMH
PROP. SMH
4' MAX. RET. WALL
PROPOSED 8" SEWER LINE (L=1245± L.F.) TO HARVILL AVE. TIE-IN (EMWD SEWER)
PROPOSED 36" STORM DRAIN (L=665± L.F.) R.C.D.F.C. & W.C.D. LATERAL H-10 MDP SD)
PROPOSED 36" CMP RISER INLETS PER RCFC/WCD STD. CB108 (SEE DETAIL ON SHEET 3) Q100=134.4 CFS, Q10=88.0 CFS OFF-SITE DRAINAGE STUDY TO BE SUBMITTED FOR REVIEW
PROP. SEWER EMWD SLOPE = 4.0%
PROP. SEWER 1536.00 I.E.
JOIN EXIST. 36" RCP MANHOLE STUB-OUT PER PLOT PLAN PPT220002) & PROP. STREET IMPROVEMENTS Q100=148 CFS, Q10=93 CFS
PROP. 36" RCP SD LATERAL H-10 (R.C.F.C.D. & W.C.D. MDP PER PLOT PLAN PPT220002)
PROP. SEWER EMWD SLOPE = 5.0%
PROP. SEWER EMWD SLOPE = 4.0%
PROP. SEWER EMWD TIE /W (1501.5 IE)
PROP. SEWER EMWD SLOPE = 5.0%

S=0.50%
SLOPING FF/PAD

FF=1553.70 TO 1551.81
PAD=1553.03 TO 1551.14

N 89° 10' 39" E 620.10'
N 89° 17' 45" E 595.78'
N 00° 01' 13" E 624.52'
N 00° 01' 13" E 598.93'

MATCH LINE (SEE BOTTOM RIGHT)
MATCH LINE (SEE UPPER LEFT)

UTILITY PURVEYORS

WATER:	EASTERN MUNICIPAL WATER DISTRICT
SEWER:	EASTERN MUNICIPAL WATER DISTRICT
ELECTRIC:	SOUTHERN CALIFORNIA EDISON
GAS:	SOUTHERN CALIFORNIA GAS COMPANY
CABLE:	CHARTER
TELE:	FRONTIER
WATSE:	WASTE MANAGEMENT

FIRE FLOW DEMAND
4,000 GPM FOR 4 HOURS (ESTIMATE)

DOMESTIC WATER DEMAND
102 GPM PEAK

IRRIGATION DEMAND
42 GPM PEAK

SANITARY SEWER
33 GPM PEAK

VICINITY MAP

WALNUT ST
MONEY LN
PERRIS BLVD
HARVILL AVE
PLACENTIA AVE
W PLACENTIA AVE
TOBACCO ROAD
WATER ST
SITE
I-215 FREEWAY
W WATER AVE
INDIAN AVE
ORANGE AVE
REDLANDS AVE
LEMON AVE

APPROXIMATE GROSS LAND AREA:
APN: 317-260-016-379,092 SQUARE FEET 8.70 ACRES
APN: 317-260-015-19,004 SQUARE FEET 0.44 ACRES

APPROXIMATE NET LAND AREA (8.87 AC):
TOTAL GROSS AREA(9.14 AC) MINUS AREA DEDICATION(0.27 AC)

TOWNSHIP 4S,
RANGE 4W, SECTION 13

LEGEND

- CB — CATCH BASIN
- FH — FIRE HYDRANT
- SMH — SEWER MANHOLE
- SDMH — STORM DRAIN MANHOLE
- WV — WATER VALVE
- EXISTING TREE
- X — CHAINLINK FENCE
- COM — COMMUNICATIONS
- S — SEWER
- OH — OVERHEAD ELECTRICAL
- W — WATER
- 590 — EXISTING GROUND CONTOUR
- CENTERLINE
- R/W LINE
- BOUNDARY
- RETAINING WALL
- PROPOSED UNDERGROUND STORMWATER DETENTION SYSTEM (STORM CHAMBER OR EQUAL)
- PROPOSED ASPHALT CONCRETE & BASE (STREET WIDENING)
- PROPOSED ASPHALT CONCRETE & BASE ON-SITE PAVING
- PROPOSED CONCRETE PAVING
- PROPOSED LANDSCAPING
- FUTURE STREET IMP. BY OTHERS

ABBREVIATIONS

AC	ASPHALT CONCRETE	N	NORTH
℄	CENTERLINE	OH-C	OVERHEAD CONDUIT
C&G	CURB & GUTTER	PCC	PORTLAND CEMENT CONCRETE
COMM.	COMMUNICATION	ℙ	PROPERTY LINE
CONC.	CONCRETE	PROP.	PROPOSED
DIA.	DIAMETER	R	RANGE
DWG.	DRAWING	RCFC&WCD	RIVERSIDE COUNTY FLOOD CONTROL
E	EAST		& WATER CONSERVATION DISTRICT
EXIST.	EXISTING	RW.	RETAINING WALL
F.F.	FINISHED FLOOR	R/W	RIGHT-OF-WAY
F.G.	FINISHED GRADE	S	SOUTH
F.H.	FIRE HYDRANT	SCE	SOUTHERN CALIFORNIA EDISON
F.L.	FLOW LINE	SD	STORM DRAIN
F.S.	FINISHED SURFACE	SS	SANITARY SEWER
FW	FIRE WATER	T	TOWNSHIP
G.B.	GRADE BREAK	TC	TOP OF CURB
G.N.V.	GROUND NOT VISIBLE	T.O.C.	THRIFTY OIL COMPANY
H	HEIGHT	TE	TRASH ENCLOSURE
L.A.	LANDSCAPE AREA/LANDSCAPE ARCH.		

DATE OF PLOT: 7-26-2023

PREPARED BY:
Armstrong & Brooks Consulting Engineers, Inc.
Civil Engineering · Water Resources · Surveying
1350 E. Chase Drive. Corona, CA 92881
Mail: P.O. Box 78088, Corona, CA 92887
Ph. (951) 372-8400, Fax (951) 372-8430

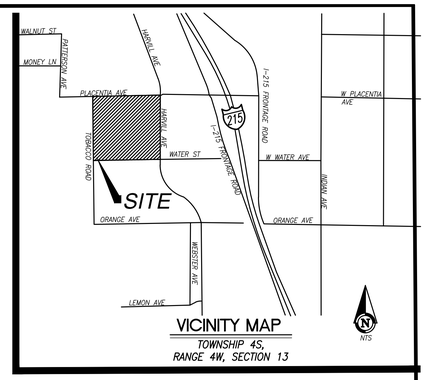
REGISTERED PROFESSIONAL ENGINEER
WILLIAM D. BROOKS
No. 053144
Exp. 6/30/25
CIVIL
STATE OF CALIFORNIA

COUNTY OF RIVERSIDE - THRIFTY OIL
CONCEPTUAL UTILITIES PLAN
PLAN - SCHEME 13
APN'S 317-260-015 AND 317-260-016

SHEET 2 OF 4

PLOT PLAN : COUNTY OF RIVERSIDE CASE NO: PPT220047

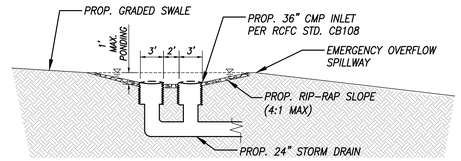
PLACENTIA AVENUE
DEDICATED BY OTHERS
16+63.70
1553.21 FS
℄ PER IP 200047
EXIST. P.P. TO BE UNDERGROUNDED
1/2-STREET IMPROVEMENTS WIDEN 17-FEET W. 6-INCH C & G PER RCRD STD. 94 (15-FEET EXIST.) PAVEMENT PER IP200047 SPP DELTA 3
FUTURE 6' SIDEWALK
PROP. R/W
FUTURE 10' TRAIL
265' TAPER (15') 35 MPH
APN: 317-260-015 OWNER: PRIVATE RESIDENCE LAND USE : RC-VLDR ZONING : R-R-1, CZ #6312
10' MULTIPURPOSE TRAIL
PROPOSED 48" CMP RISER OVERFLOW AND 36-INCH SD CONNECTION (L=70 FT.) W. SDMH NO. 4
PROPOSED 54" STORM DRAIN LATERAL H-10, R.C.F.C. & W.C.D. MDP - JOIN EXISTING 66-INCH RCP W. MANHOLE NO. 4
PROPOSED 54" STORM DRAIN LATERAL H-10, R.C.F.C. & W.C.D. MDP - (L=1384± L.F.)
APN: 317-260-017
OWNER: THRIFTY OIL COMPANY
PERRIS - NORTH PARCEL
LAND USE : RC-VLDR
ZONING : R-R-1, CZ #6312
1/2-STREET IMPROVEMENTS PLUS 18-FEET OF AC WIDENING PER RCRD STD. 111
245' TAPER (12') 35 MPH
APN: 317-260-005
OWNER: SERRANO SILVANO
LAND USE : RC-VLDR
ZONING : R-R-1, CZ #6312
APN: 317-260-016
OWNER: THRIFTY OIL COMPANY
PERRIS -SOUTH PARCEL
LAND USE : BP
ZONING : I-P, CZ NUMBER 5676
APN: 317-260-014
OWNER: ESQUIRE JEAN PIERRE
LAND USE : RC-VLDR
ZONING : A-1-1, CZ #6312
TOBACCO ROAD
APN: 317-260-015
OWNER: THRIFTY OIL COMPANY
PERRIS-SOUTH PARCEL (VACATED R/W)
LAND USE : BP
ZONING : I-P, CZ NUMBER 5676
APN: 317-260-034
OWNER: COUNTY OF RIVERSIDE
PERRIS-COUNTY PARCEL
LAND USE : BP
ZONING : M-SC
HARVILL AVENUE
FUTURE 6' SIDEWALK
15' DEDICATION FOR TRAIL SYSTEM
PROPOSED 6' S/W
PROPOSED 8" SEWER LINE (L=1245± L.F.) TO HARVILL AVE. TIE-IN (EMWD SEWER)
℄ TOBACCO ROAD ESTABLISHED AT RECORD ANGLE TO WATER ROAD PER R1
WATER STREET
PROP. SWR
PROPOSED 36" STORM DRAIN (L=665± L.F.) R.C.D.F.C. & W.C.D. LATERAL H-10 MDP SD)
PROPOSED 36" CMP RISER INLETS PER RCFC/WCD STD. CB108 (SEE DETAIL THIS SHEET) Q100=134.4 CFS, Q10=88.0 CFS OFF-SITE DRAINAGE STUDY TO BE SUBMITTED FOR REVIEW
1/2-STREET IMPROVEMENTS PLUS 18-FEET OF AC WIDENING PER RCRD STD. 111
JOIN EXIST. 36" RCP MANHOLE STUB-OUT PER PLOT PLAN PPT220002) & PROP. STREET IMPROVEMENTS PER PP
APN: 317-270-002
OWNER: SSR INV CO
LAND USE : BP
ZONING : I-P, CZ #7830
PROPOSED 8" VCP SEWER LINE (L=1245±) PER EMWD STDS.
EXIST. 8" VCP SEWER STUB-OUT JOIN LOCATION
APN: 317-270-015
OWNER: BCIF HARVILL BUSINESS CENTER LP
LAND USE : BP
ZONING : M-SC
140' TAPER (8") 35 MPH
SCALE 1" = 60'



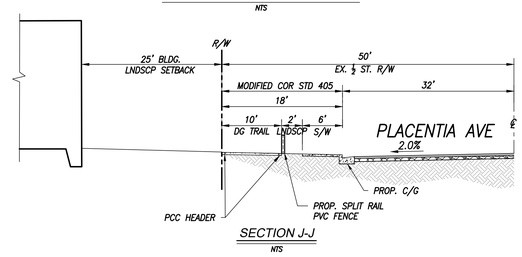
VICINITY MAP
TOWNSHIP 4S, RANGE 4W, SECTION 13

LEGEND

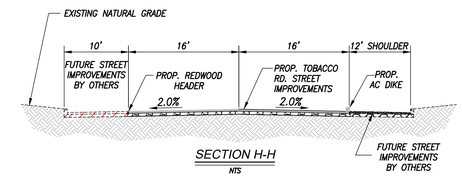
- PROPOSED ASPHALT CONCRETE & BASE (STREET WIDENING)
- PROPOSED PCC SIDEWALK / CURB & GUTTER
- PROPOSED STREET WIDENING AC BY OTHERS
- PROPOSED D.G. MULTIPURPOSE TRAIL



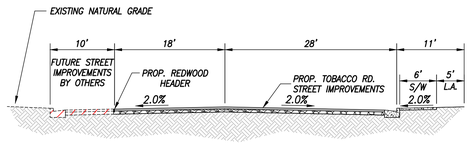
36" CMP INLET TYPICAL DETAIL
NTS



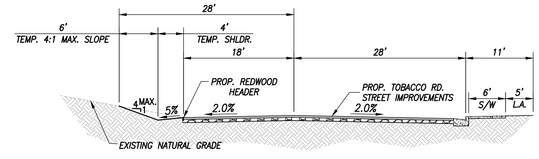
SECTION J-J
NTS



SECTION H-H
NTS



SECTION G-G
NTS



SECTION F-F
NTS

TOBACCO ROAD & WATER STREET IMPROVEMENTS
SEE SHEET NO. 4 FOR TRUCK TURNING MOVEMENTS

DATE OF PLOT : 7-26-2023

PREPARED BY:
Armstrong & Brooks Consulting Engineers, Inc.
Civil Engineering · Water Resources · Surveying
1350 E. Chase Drive. Corona, CA 92881
Mail: P.O. Box 78088, Corona, CA 92887
Ph. (951) 372-8400, Fax (951) 372-8430

REGISTERED PROFESSIONAL ENGINEER WILLIAM D. BROOKS No.053114 Exp. 6/30/25 CIVIL STATE OF CALIFORNIA

COUNTY OF RIVERSIDE - THRIFTY OIL

OFF-SITE IMPROVEMENT EXHIBIT PLAN - SCHEME 13

APN'S 317-260-015 AND 317-260-016

SHEET 3 OF 4

PLOT PLAN : COUNTY OF RIVERSIDE CASE NO: PPT220047

PLACENTIA AVENUE

DEDICATED BY OTHERS

1/2-STREET IMPROVEMENTS WIDEN 17-FEET W. 6-INCH C & G PER RCRD STD. 94 (15-FEET EXIST.) PAVEMENT PER IP200047 SPP DELTA 3

16+63.70
1553.21 FS
℄ PER IP 200047

EXIST. P.P. TO BE UNDERGROUNDED

265' TAPER (15') 35 MPH

FUTURE 6' SIDEWALK
PROP. R/W
FUTURE 10' TRAIL

APN: 317-260-015
OWNER: PRIVATE RESIDENCE
LAND USE : RC-VLDR
ZONING : R-R-1, CZ #6312

10' MULTIPURPOSE TRAIL

APN: 317-260-017
OWNER: THRIFTY OIL COMPANY
PERRIS - NORTH PARCEL
LAND USE : RC-VLDR
ZONING : R-R-1, CZ #6312

1/2-STREET IMPROVEMENTS PLUS 18-FEET OF AC WIDENING PER RCRD STD. 111

APN: 317-260-005
OWNER: SERRANO SILVANO
LAND USE : RC-VLDR
ZONING : R-R-1, CZ #6312

245' TAPER (12') 35 MPH

APN: 317-260-014
OWNER: ESQUIRE JEAN PIERRE
LAND USE : RC-VLDR
ZONING : A-1-1, CZ #6312

APN: 317-260-016
OWNER: THRIFTY OIL COMPANY
PERRIS -SOUTH PARCEL
LAND USE : BP
ZONING : I-P, CZ NUMBER 5676

TOBACCO ROAD

PROPOSED 6' S/W

℄ TOBACCO ROAD ESTABLISHED AT RECORD ANGLE TO WATER ROAD PER R1

PROP. SMH

1/2-STREET IMPROVEMENTS PLUS 18-FEET OF AC WIDENING PER RCRD STD. 111

APN: 317-270-002
OWNER: SSR INV CO
LAND USE : BP
ZONING : I-P, CZ #7830

APN: 317-260-015
OWNER: THRIFTY OIL COMPANY
PERRIS-SOUTH PARCEL (VACATED R/W)
LAND USE : BP
ZONING : I-P, CZ NUMBER 5676

140' TAPER (8') 35 MPH

WATER STREET

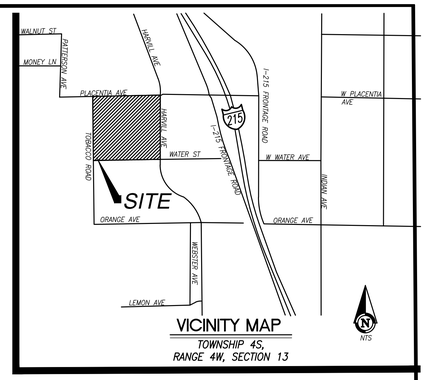
APN: 317-260-034
OWNER: COUNTY OF RIVERSIDE
PERRIS-COUNTY PARCEL
LAND USE : BP
ZONING : M-SC

APN: 317-270-015
OWNER: BCIF HARVILL BUSINESS CENTER LP
LAND USE : BP
ZONING : M-SC

FUTURE 6' SIDEWALK

15' DEDICATION FOR TRAIL SYSTEM

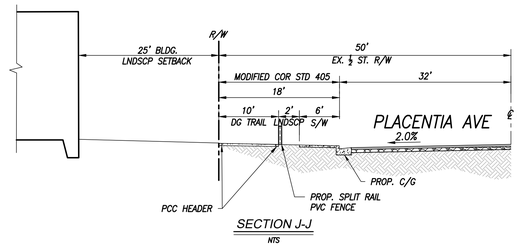
HARVILL AVENUE



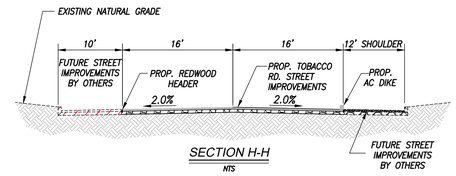
VICINITY MAP
TOWNSHIP 4S, RANGE 4W, SECTION 13

LEGEND

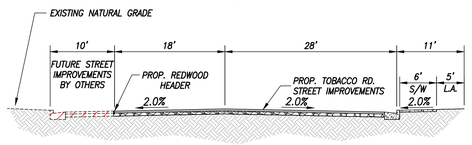
- PROPOSED ASPHALT CONCRETE & BASE (STREET WIDENING)
- PROPOSED PCC SIDEWALK / CURB & GUTTER
- PROPOSED STREET WIDENING AC BY OTHERS
- PROPOSED D.G. MULTIPURPOSE TRAIL



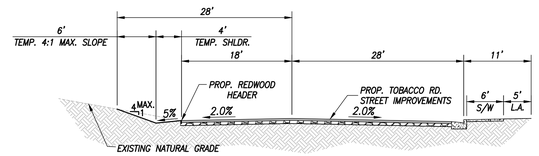
SECTION J-J
NTS



SECTION H-H
NTS



SECTION G-G
NTS



SECTION F-F
NTS

TOBACCO ROAD & WATER STREET IMPROVEMENTS

SCALE 1" = 60'

DATE OF PLOT : 7-26-2023

PREPARED BY:
Armstrong & Brooks Consulting Engineers, Inc.
Civil Engineering · Water Resources · Surveying
1350 E. Chase Drive. Corona, CA 92881
Mail: P.O. Box 78088, Corona, CA 92887
Ph. (951) 372-8400, Fax (951) 372-8430

REGISTERED PROFESSIONAL ENGINEER WILLIAM D. BROOKS No. 053144 Exp. 6/30/25 CIVIL STATE OF CALIFORNIA

COUNTY OF RIVERSIDE - THRIFTY OIL

OFFSITE TRUCK TURNING MOVEMENTS PLAN - SCHEME 13

APN'S 317-260-015 AND 317-260-016

SHEET 4 OF 4

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

Geotechnical Engineering Exploration and Analysis

Proposed Commercial Tilt-up Building
23628 Water Street
Perris, CA

Prepared For:

Thrifty Oil Company
Santa Fe Springs, CA

Project No. G-021422
March 26, 2022

GEOTECHNICAL
ENVIRONMENTAL
CONSULTANTS

GEO
ENVIRONMENTAL
RESOURCES
INC

GEO ENVIRONMENTAL RESOURCES INC

GEOTECHNICAL ENVIRONMENTAL CONSULTANTS

March 26, 2022

Thrifty Oil Company
Santa Fe Springs, California

Attention: Mrs. Jamie Jones
Project Manager

Subject: Geotechnical Engineering Exploration and Analysis
Proposed Commercial Tilt-up Building
23628 Water Street, Perris, California
Project No. G-021422

Dear Mrs. Jones:

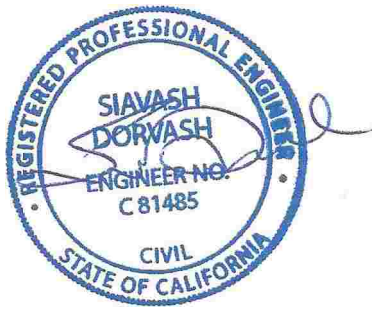
In accordance with your request and authorization, **Geotechnical Engineering Exploration and Analysis** has been conducted for the above referenced site. Conclusions and recommendations developed from the exploration and analysis are discussed in the accompanying report.

We appreciate the opportunity to be of service on this project. If we may be of additional assistance, should geotechnical related problems occur or to provide observation and testing services during construction, please do not hesitate to call at any time.

Very truly yours,
GEO ENVIRONMENTAL RESOURCES, INC.

Alexander A. Rastegar
Project Engineer

S. Dorvash. P.E.



2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

TABLE OF CONTENTS

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

APPENDICES

Appendix A: Boring Logs

Appendix B: Laboratory Testing

Appendix C: Figures

Appendix D: General Notes

Appendix E: USGS Seismic Design Parameters

Appendix F: percolation Feasibility study

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

1.0 PROPOSED DEVELOPMENT

Based on the information obtain from proposed plan (SHEET DAB-A1.1), which was received by the project manager, the proposed development consists of construction of 194,479 S.F. of commercial concrete tilt-up building within the above subject property.

Based on the information obtained during our site reconnaissance, the subject property is a vacant parcel located within the southwest corner of the Water Street and Tobacco Road. It appears that the subject property use to be part of a larger parcel, which was bordered by Water Street to the south, Placentia Avenue to the north, Harvill Avenue to the east and Tobacco Road to the west.

However, as indicated above, our subject property lies within the southwest portion of the original parcel and it is bordered by the Water Street to the south, Tobacco Road to the west and vacant parcels to the east and north. Our subject property is relatively flat and is covered with grass, vegetation and various size trees. In addition, we will also provide infiltration rate for potential retention basin located along the east side of the subject property.

2.0 SCOPE OF SERVICES

This report provides the results of a geotechnical engineering exploration and analysis for the construction of the proposed commercial building and other related improvements. We performed a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis in order to provide geotechnical grading and design recommendations for the proposed commercial building and other related improvement.

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

3.0 SITE LOCATION

The subject property is located at address of 23628 Water Street in Perris, California. The subject property is bordered by an existing vacant parcels to the east, north, Water Street to the south and Tobacco Road to the west.

4.0 SUBSURFACE EXPLORATION

4.1 Subsurface Exploration

Total of five (6) Borings were excavated within the area of the proposed developments to the depths ranging from of 11½ -to-29 ½ feet below existing backyard grade. The approximate boring locations are shown on the boring location plan **(Figure 1, Appendix C).** The Borings was advanced by the drilling rig. Boring No.6 was conducted for the purpose of the Infiltration Tests.

The relatively undisturbed soil samples were collected at approximate every 1½-3 ½ ft. Soil sampling was conducted in accordance with ASTM D1587 and D3550 Standard Specifications. Soil sample was visually reviewed and classified in the field pursuant to ASTM D2488, placed in sealed containers and transported to our laboratory for further review and testing. **Field and laboratory testing is enclosed in Appendix B**. The terms and symbols on the test boring logs are defined in the **General Notes in Appendix D**.

4.2 Local Geology

Based on review of the **GEOLOGIC MAP OF THE PERRIS QUADRANGLE BY THOMAS W. DIBBLEE, JR., 2003,** the native material was identified as **Alluvial fan Deposits (Qoa). However, CGS SEISMIC ZONATION** Identify the native material as either **Qof, which is Old Alluvial Fan Deposits or Qvof-Very Old Alluvial Fan Deposits.**

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

4.3 Subsurface Conditions

The subsurface soil profile at test boring No.1 consists of silty fine to coarse sand, light to orange brown in color, dry to damp and loose to very dense extended to the maximum explored depth of 29 ½ feet below existing grade.

4.4 Groundwater

Ground water was not encountered during our sub surface exploration. However, it is not uncommon for groundwater or seepage conditions to develop where none previously existed. Groundwater elevations are dependent on seasonal precipitation, irrigation; land use, among other factors, and vary as a result.

4.5 Expansive Potential

Expansion Index (EI) test was conducted according to the ASTM (D-2429) on bulk samples (1-4 feet) from Boring No.1 of the near-surface materials. Results indicated that the near-surface material are low expansive with in expansion potential of (EI = 10).

4.6 Laboratory Testing

The relatively undisturbed soil samples were subjected to various laboratory tests such as Water-Content Determination (ASTM D2216), Moisture-Unit Weight Relationships (ASTM D-1557), Consolidation Test (ASTM D-2435) and Direct-Shear Test (ASTM D-3080).

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

4.7 Sulfate Potential

Based on our review of laboratory testing result, the water-soluble sulfate (SO4) content is (17.6 mg/kg), according to ACI 318 Section 4.3.1 (type V) concrete is not required to be utilized due to the Sulfate content of soil for the proposed project.

4.8 Corrosion Potential

Based on the review of laboratory test result the on- site soil possess a PH of **7.2** (EPA 9045B) and Resistivity of 9300 (Ohm-cm). Therefore, the on-site soil has been classified as having "**Mildly Corrosive"** potential. And the project Structural Engineer should provide specific recommendation for mitigation and protection, as necessary.

5.0 PERCOLATION FEASIBILITY STUDY

Percolation feasibility study for design for the proposed retention basin has been conducted in accordance with County of Riverside retention basin design guidelines. A copy of Percolation Feasibility Study and its result is referenced in **Appendix F** of this report under "Percolation Feasibility Study".

6.0 GEOLOGIC AND SEISMICITY

6.1 Seismic Design Parameters

The site is located at approximately 33.7825 Latitude and -117.2286 longitudes. Any new structural related construction must be designed in accordance with the requirements of the latest edition of the California Uniform Building Code (CBC). The CBC provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, seismic zoning, occupancy, and the seismic design parameters.

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

The Site Seismic Parameters presented below are based on the Mapped Acceleration Parameters (Ss and S1) as well as the Site Coefficients and Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameters. Based on the California Building Code, the site is classified as class D based on Table 1613.5.2 (Site Class definitions).

The following parameters may be utilized for the subject site. In addition, copies of most current USGS Design Maps Summary is in Appendix E of this report.

SITE SEISMIC PARAMETERS	
Mapped 0.2 second Period Spectral Acceleration, Ss	1.455
Mapped 1.0 second Period Spectral Acceleration, S1	0.548
Site Coefficient for Site Class "D", Fa	1.2
Site Coefficient for Site Class "D", Fv	Null-See Section 11.4.8
Maximum Considered Earthquake Spectral Response Acceleration Parameters at 0.2 second, SMS	1.746
Maximum Considered Earthquake Spectral Response Acceleration Parameters at 1 second, SM1	Null-See Section 11.4.8
Design Spectral Response Acceleration parameter for 0.2 Second, SDS	1.164
Design Spectral Response Acceleration parameter for 0.2 Second, SD1	Null-See Section 11.4.8

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

6.2 Geological Hazards

It is our judgment, that based on the specific data and information contained or referenced in this report, the construction of the proposed commercial building will be safe against hazards from landslides, settlement or slippage, and they would not adversely affect the stability of the existing and adjacent structures, provided the recommendations presented herein are properly interpreted and implemented.

7.0 SECONDARY SEISMIC EFFECTS

The primary geologic hazard at the sites is moderate to strong ground shaking caused by an earthquake on any of the local or regional faults. The potential for secondary geologic hazards was also evaluated including, liquefaction, dynamic settlement.

7.1 Liquefaction

Liquefaction is the loss of strength in generally cohesion less, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors in which influence the potential for liquefaction include groundwater table elevation, soil type and grain size characteristics, and relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface.

However, based on the review of **"CGS Seismic Zonation Program"** as well as the **GEOLOGIC MAP OF PERRIS QUADRANGLE BY THOMAS W. DIBBLEE, JR., 2005**, the subject property is NOT located within "Liquefiable" area.

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

7.2 Surface Rupture

Based on research of available literature and results of site reconnaissance, no known active or potentially active faults underlie the subject site. In addition, the subject site is not located within any **Alquist-Priolo** Earthquake Fault Zone. Based on these considerations, the potential for surface ground rupture at the subject site is considered moderate.

7.3 Landslide

As indicated previously, the subject property is relatively flat. In addition, based on review of "CGS Seismic Hazards Zonation "the subject property is NOT located within potential "Landslide" area.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the result of sub-surface exploration, laboratory testing, and research, it is the finding of this firm that the construction of the proposed commercial building is considered feasible from a geotechnical engineering standpoint provided the advice and recommendations presented herein are followed and implemented during construction.

Results of moisture-density testing revealed that majority of the near-surface material are in dry to damp condition. In addition, results of Consolidation Tests, which were conducted on the randomly selected soil samples at various depths also indicated excessive consolidation under potential building pressure.

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

Therefore, we are recommending that in order to develop a uniform sub-surface layer with increased support characteristics with proper in-situ moisture content, following completion of the existing vegetation and tree removal, the proposed building pad area should be over-excavated to approximate depth of **eight (8) feet below proposed Rough Finished Grade (RFG)** elevation or an equivalent of **four (4) feet below the proposed foundation subgrade (whichever is lower in elevation).**

Upon completion of the over-excavation, the exposed subgrade within the entire pad area should be scarified to depth of 12-inch, moisture conditioned as necessary and poof-rolled and compacted to at least 90 percent of its Maximum Laboratory dry Density as determined by the (ASTM D-1557) Test Method. The scarification should be conducted on both directions of the proposed building area.

The main purpose of the compaction and/or proof rolling is to detect any yielding and/or loose soils, which should be remove to depth of firm subgrade, which should be determined and confirmed by a representative from this office.

The foundation system may consist of either independently poured spread footings or a monolithically poured foundation and floor slab thereby using a turned-down slab construction technique. The parameter and column pad footings should be embedded at least 30- inch into the newly placed and compacted structural fill material. However, the actual depth of embedment should be provided by the project structural engineer. Column and continuous footings may be designed for a maximum, allowable soil bearing strength of 2,000 pounds per square foot (psf).

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

8.1 Site Preparation and Grading

Subgrade Preparation within the Building pad Area

As indicated in section 7.0, we are recommending that in order to develop a uniform sub-surface layer with increased support characteristics, following completion of the trees and vegetation removal, the proposed building area should be over-excavated to approximate depth of eight (8) feet below proposed Rough Finished Grade (RFG) elevation or an equivalent of four (4) feet below the proposed foundation subgrade (whichever is lower in elevation).

Upon completion of over-excavation, the exposed subgrade within the entire pad area should be scarified to depth of 12-inch, moisture conditioned as necessary and compacted to 90 percent of Maximum Laboratory Dry Density, as determined by (ASTM D-1557) Test Method.

Any loose or otherwise unsuitable soil that is encountered during compaction and proof rolling should be removed to depth of firm subgrade, which should be determined and confirmed by a representative from this office.

The entire grading operation should be conducted in presence of a representative from this office. And the ultimate depth of removal as well as bottom scarification and compacting should be verified and confirmed by our representative as well.

8.2 Pavement Grading Recommendation

Following removal of all the grass, vegetation and trees and necessary cuts. We are recommending that the entire new pavement area should be over-excavated to depth of 24-inch below its Proposed Rough Finished Grade (RFG). Upon completion, the exposed subgrade should be scarified to depth of 12-inch, moisture conditioned, and compacted to at least 90 percent of its Maximum Dry Density as Determined by the (ASTM D 1557-12) Test Method.

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

8.3 Fill Placement

All the new fill soils should be placed in 8-10 inches thick loose lift and each lift should be Moisture conditioned to the suitable moisture content and compacted to at least 90 percent of the Maximum Laboratory Dry Density as determined by (ASTM D 1557-12) Test Method.

On-site soils may be utilized as structural fill provided they are free of debris and moisture conditioned as necessary to the satisfaction of our field representative.

All grading and fill placement activities should be completed in accordance with the requirements of the City of Perris and/or County of Riverside Grading Guidelines. All fill soils should be compacted to at least 90 percent of the Maximum Laboratory Dry Density as determined by (ASTM D 1557-12).

Compaction tests should be performed periodically by a representative from this office as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at random locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the project specification.

8.4 Imported Structural Fill

In general, all imported structural fill soils (If needed) should consist of low to non-expansive (EI<20), well-graded soil. Imported soils should be evaluated by a geotechnical engineer or his representative prior to placement.

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

8.5 Utility Trench Backfill

In general, all the new utility trench backfill should also be compacted to at least 90 percent of the Maximum Laboratory Dry Density as determined by (ASTM D- 1557-12). Compacted trench backfill should be performed to the requirement of the local grading guidelines. The trench backfill soils should be compaction tested where possible, probed and visually evaluated elsewhere.

8.6 Temporary Excavation

In general, temporary excavation higher than four (4) feet should be sloped back to 1:1(Vertical: Horizontal).

9.0 CONSTRUCTION CONSIDERATION

9.1 Excavation Difficulties

During our subsurface exploration very dense material was encountered at approximate depths of 7-to-10 feet below existing grade. Therefore, some excavation difficulties should be anticipated.

9.2 Over-Sized Partials

During the demolition of the current structure, if "over-sized" particles encountered in excessive quantities, proper segregation should be conducted in order to make the excavated materials suitable for fill placement or remove them from the excavation area.

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

10.0 FOUNDATION DESIGN AND CONSTRUCTION

10.1 Shallow Foundation Parameters for the Building (Structural Fill)

1- An allowable Soil Bearing pressure of 2,000 (psf)
2- An allowable At-Rest pressure of 56.5 (psf) **USE 60** (psf)
3- An allowable Active pressure of 66.5 (psf) **USE 70** (psf)
4- An allowable passive pressure of 390.0 (psf) **USE 300** (psf)
5- Friction angle of 32 degree
6- The proposed footing dimension should be provided by the project structural engineer, however, the proposed continuous and column pad footing should be embedded at least 36-inch into newly placed and compacted structural fill soil.

10.2 Footing Reinforcement

The minimum longitudinal steel reinforcing within proposed wall and column pad footing should be performed by the project structural engineer. The Bearing suitability of the exposed subgrade within the footing excavation should be evaluated by a representative from this office prior to placement of the reinforcement.

10.3 Floor Slab Design and Construction for Commercial Building

Based on the recommended subgrade preparation and the anticipated live floor loading, a 6-inch thick concrete slab over 6-inch aggregate base course, which have been moisture conditioned and compacted is considered to be suitable. It is recommended that the Concrete control joints at 30 times slab thickness (per foot) be provided in order to lower the potential of concrete slab shrinkage.

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

One (1)-inch thick layer of sand may be needed between the slab and the aggregate base course to promote proper curing. The minimum slab reinforcing should be No. 3 bars at 18-inch on-center spacing each way with the slab structurally connected to the perimeter footings. However, the actual size of the slab reinforcement should be provided by the project structural engineer.

10.4 Foundation Static Settlement

The majority of settlement will occur during the initial application of the load, which is during the construction of the new tilt-up building. Following completion of the tilt-up Construction, we expect no more than 1-inch total and ¾ -inch differential for the static settlement over span 100 feet.

10.5 Drainage

All the site drainage should be collected and transferred to the street in non-erosive drainage devices. The proposed tilt-up building should be provided with roof drainage as well.

Drainage should not be allowed to pond anywhere on the site, and especially not against any foundation. The ground immediately adjacent to the foundation shall be sloped away from the new structure at a slope of not less than one-unit vertical in 20 units horizontal (5 percent slope) for a minimum distance of 10 feet of horizontal distance measured perpendicular to the face of the wall.

If physical obstructions or lot lines prohibit 10 feet of horizontal distance, a 5-percent slope shall be provided to an approved alternative method of diverting water away from the foundation.

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

10.11 Grading and Foundation Plan Review

It is recommended that proposed grading and foundation plans be reviewed by this office prior to finalization to verify that the plans have been prepared in conformance with the geotechnical recommendations presented in this report and if necessary to provide additional analyses or recommendations.

11.0 RETAINING WALL DESIGN

11.1 Wall Design

For simplicity and ease of report interpretation the following chart had been prepared to show the at rest, active and passive lateral pressures for the proposed retaining walls up to 10 feet high. The design is based on the compacted soil parameters, assuming level-backfill.

ITEM	VALUE1
At-Rest Case	56.5psf/ft (use 60) psf/ft
Active Case	66.5 psf/ft (use 70) psf/ft
Passive Case	390.0 (use 300) psf/ft
*Note: The values are based on Compacted Soil.	

Retaining walls greater than 6 feet in height should be designed for seismic lateral earth pressures. The "**Total seismic earth pressure",** which is a combination of "static earth pressure' and "**incremental seismic pressure".** The pressure distribution may be considered to be a triangle with the maximum pressure at the bottom. The resultant of this force may be assumed to be at 1/3 the height of the wall from the bottom of the wall.

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

The **"incremental seismic pressure"** can be calculated as the difference of "total seismic earth pressure" and "static earth pressure. Note**, Any computed seismic increment of lateral earth pressure should not be added to the static (at-rest) lateral earth pressures".**

11.2 General requirement for wall design

Foundation and retaining walls shall be designed to resist live loads surcharge from sidewalk pedestrian traffic and street traffic according to **LADBS P/BC 2017- 141** besides lateral soil load according **LADBS P/BC 2011-083** which are minimum design loads for lateral soil pressure.

In General, and if needed, surcharge loads shall be applied where vehicular load or pedestrian loads are expected to act on the surface behind a shored excavation or retaining wall within a distance equal to the height of the excavation or wall. In the case of the live load:
Method B of the LADBS (P/BC 2017- 141) is applicable where site-specific lateral earth pressure coefficients are provided in the Soils Report.

$$q = k \times \gamma_s \times H_{eq}$$

Where:
q = lateral surcharge pressure (psf) in rectangular distribution
k = active or at-rest earth pressure coefficient from Soils Report
γ_s = total unit weight of soil (pcf)
H_{eq} = equivalent height of soil from "Table 1" below

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

Table 1*

Equivalent Height of Soil for Vehicular Loading on Retaining Wall and Shoring Parallel to Traffic

Excavation/Wall Height (ft)	Distance from the edge of excavation (ft)	
	0.0 ft	1.0 ft or further
5.0	5.0	2.0
10.0	3.5	2.0
≥20.0	2.0	2.0

* From Table 3.11.6.4-2 of the AASHTO document referenced above.

Additional design Requirement

L.A.B.C. Sections 1610.1 and 1807.2 cover the design of retaining walls as follows:

1610.1 General. Basement, foundation and retaining walls shall be designed to resist lateral soil loads. Soil loads specified in **Table 1610.1** shall be used as the minimum design lateral soil loads unless specified otherwise in a soil calculation approved by the building designer. Basement walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Retaining walls free to move and rotate at the top are permitted to be designed for active pressure.

Design lateral pressure from surcharge loads shall be added to the lateral earth pressure load. Design lateral pressure shall be increased if soils with expansion potential are present at the site.

Retaining walls should also be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift. In addition, retaining walls should also be designed to resist lateral pressure of the retained material determined in accordance with accepted engineering principles.

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

Additionally, unless a soil report is submitted to and approved by the department indicating that expansive soils do not exist, the footings for all retaining walls must extend a minimum of 24-inch below the natural and finish grades in accordance with the requirements contained **in IB P/BC 2011-116 FOR EXPANSIVE SOIL CONDITIONS.**

11.3 Retaining Wall Drainage

Retaining walls should be provided with a drainage system at the base of the walls. The drainage should consist of a 4-inch in diameter-perforated pipe, embedded within a 12-inch thick clean gravel wrapped in a geosynthetic filtration fabric.

11.4 Retaining Wall Backfill

The following is our general guidelines for the backfill within all the proposed retaining wall (s) regardless of their heights. Following placement of the drainage system the on-site soils may be utilized as backfill material behind the proposed retaining walls. The backfill material should be free of any debris as well as the over-sized particles to satisfactory of the project geotechnical engineer.

If needed, the fill material should be moisture conditioned as necessary, placed in thin lifts (8-to-10 inches) and each lift should be compacted with grading equipment to 90 percent of its Maximum Laboratory Dry Density.

As an alternative, the proposed retaining walls may be backfilled with import material with low expansion (EI<20). The imported soil should be evaluated and confirmed by the Geotechnical engineer prior to usage.

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

12.0 PAVEMENT RECOMMENDATION

12.1 Asphalt Pavement

Based on these findings and assuming traffic index (TI=7) the following table presents the recommended thickness for the new flexible pavement structure consisting of asphaltic concrete over a granular base, along with the appropriate CALTRANS specifications for proper materials and placement procedures.

Preliminary Pavement Recommendations

	Parking Spots (Light Traffic Area)	**Driveways and aprons (Heavy Traffic Areas)**
PCC Section: Portland Cement Concrete	6.0-Inch Thick PCC over 6.0-Inch thick Layer of Aggregate Base Course, which had been reinforced	8.0-Inch Thick over 6.0-inch Thick Layer of Aggregate Base Course, which had been reinforced
Asphalt Section Asphaltic Concrete	4-Inch Thick AC over 8-Inch thick layer of Aggregate Base Course	4-Inch Thick AC over 12-Inch Thick Layer of Aggregate Base Course

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

The underlying subgrade should be scarified to depth of 12-inch, moisture conditioned as necessary and Compacted to at least 90 percent of Maximum Laboratory Dry Density as Determined by (ASTM D-1557-12) Test Method.

The new Aggregate Base Course material should be moisture conditioned as necessary and compacted to at least 95 percent of the Maximum Laboratory Dry Density as determined by (ASTM D-1557-12) test method. Asphalt Concrete (AC) should be compacted to a minimum of 95 percent of the laboratory Marshall Density.

12.2 Exterior Concrete Flat Work

The preparation of the subgrade soils within the flat work area such as side walk is as follows, the upper 6-inch of pavement over subgrade soils, which had been scarified to depth of 12-inch, moisture conditioned as necessary and compacted to at least 90 percent of the Maximum Laboratory Dry Density as determined by (ASTM D 1557-12) test method.

13.0 EXPLORATION LIMITATIONS

The conclusions and recommendations presented in this report are based on the findings and observations in the field and the results of laboratory tests performed on representative samples. The soils encountered in the boreholes are believed to be representative of the investigated area; however, soil characteristics can vary throughout the site. Geo Environmental Resources Inc. should be notified if subsurface conditions are encountered which differ from those described in this report.

This report has not been prepared for use by parties or projects other than those named and described above. It may not contain sufficient information for other parties or other purposes.

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

The conclusions and recommendations presented in this report are professional opinions. These opinions have been derived in accordance with current standards of geotechnical engineering and engineering geology practice, field observations and laboratory test results. No other warranty is expressed or implied.

Samples secured for this investigation will be retained in our laboratory for a period of thirty (30) days from the date of this report and will be disposed after this period unless other arrangements are made.

14.0 REFERENCES

a) United States Geologic Survey (USGS),
b) 2008b, National Seismic Hazards Maps-Fault Parameters
c) California Building Code (CBC) latest addition
d) Geologic Map of the Perris Quadrangle
e) Perris Quadrangle by (Thomas W. Dibblee, Jr., 2003)
f) California Geological Survey (Cgs Seismic Zonation)

2511 West La Palma Ave., Suite E
Anaheim, CA 92801
(714) 995-9001

APPENDIX A

Boring Log

LOG OF BORING

B-1

Project Location:23628 Water Street, Perris
Surface Elevation (ft): EL:100.0

Date Drilled: 2/20/2022
Project No: G-021422

Depth (ft)	USCS Class.	Summary of subsurface conditions	Sample Depth (ft)	Sample	Blow count (N)	Moisture (%)	Wet Unit Wt. (pcf)
-1	SM	Brown Silty Fine Sand, Trace Roots(Top Soil) Dry to Damp, Loose To the depth of (1 1/2) ft	-1	S	8	2.3	
-3	SM/SC	Orange Brown Silty Fine Sand with Clay to Clayey Fine Sand, Alluvial Deposits(Qof) Dry to Damp, Dense	-3	S	34	3.4	
-5	SM/SC	Same Alluvial deposits (Qof) Damp very Dense	-5	S	70	2.7	119.8
-7		Same Alluvial Deposits (Qof) Damp, Dense	-7	S	46	3.7	123.2
-9		To the depth of (9 1/2) ft					
		Light Brown Silty Fine to Coarse Sand (Cemeneted) Alluvial Deposits (Qof) Damp to moist, Very Dense	-10	S	68	5.3	
-15			-15	S	67	5.3	134.2
-20		Same Alluvial deposits (Qof) Damp to Moist, Very Dense Light Brown Silty Fine to Coarse Sand (Cemeneted) with CALICHÉ Damp to moist, Very Dense	-20	S	3"/64	5.2	-
-25		Same Damp to Moist, Very Dense	-25	S	5"/69	5.7	126.7
-30		Terminated at the depth of 29 1/2 ft					

GERI **Geo Environmental Resources, Inc.**
2511 West La Palma Ave., Suite E
Anaheim, California 92801

D =Drive sample
S = SPT sample

Plate

LOG OF BORING

B-2

Project Location:23628 Water Street, Perris
Surface Elevation (ft): EL:100.0

Date Drilled: 2/20/2022
Project No: G-021422

Depth (ft)	USCS Class.	Summary of subsurface conditions	Sample Depth (ft)	Sample	Blow count (N)	Moisture (%)	Wet Unit Wt. (pcf)
-1	SM	Top Soil Brown to Orange Brown Silty Fine Sand Trace Root, Dry, Loose To the depth of (1 1/2) ft	-1	S	6	2.1	
-3	SM	Orange Brown Silty Fine to Coarse sand, Trace to little Clay Dry to Damp, Dense	-3	S	32	3.3	119.2
-5	SM	Same Dry to Damp, Dense	-5	S	48	3.9	
-7	SM	Same Dry, Very Dense	-7	S	54	2.7	126.3
-10	SM	Orange Brown Silty Fine to Coarse Sand Trace Clay with CALICHE Alluvial Deposit (Qof) Damp to Moist, Very Dense	-10	S	4"/63	5.7	129.5
-15	SM	Same Alluvial Deposits (Qof) Damp to Moist, Very Dense	-15	S	5"/56	5.3	--
-20	SM	Same Alluvial Deposits, Damp to Moist, Very Dense Terminated at the depth of (23 1/2) ft	-20	S	64	5.4	132.6
-25							
-30							
-35							

GERI **Geo Environmental Resources, Inc.**
2511 West La Palma Ave., Suite E
Anaheim, California 92801

D =Drive sample
S = SPT sample

Plate

LOG OF BORING

B-3

Project Location:23628 Water Street, Perris
Surface Elevation (ft): EL:100.0

Date Drilled: 2/20/2022
Project No: G-021422

Depth (ft)	USCS Class.	Summary of subsurface conditions	Sample Depth (ft)	Sample	Blow count (N)	Moisture (%)	Dry Unit Wt. (pcf)
	SM	Top Soil Brown Silty Fine Sand, Trace Roots					
-1		Dry, Loose	-1	S	8	2.3	--
-3	SM	Orange Brown Silty Fine to Medium Sand (Cemented), Alluvial Deposite (Qof) Damp to Moist, Very Dense	-3	S	55	4.7	--
-5	SM	Same Damp to Moist, Very Dense, Alluvial Deposite,	-5	S	51	4.6	--
-9							
-10		Same Moist, Very Dense Terminated at the depth of (11 1/2) ft	-10	S	54	5.7	
		.					

LOG OF BORING

B-4

Project Location:23628 Water Street, Perris
Surface Elevation (ft): EL:100.0

Date Drilled: 2/20/2022
Project No: G-021422

Depth (ft)	USCS Class.	Summary of subsurface conditions	Sample Depth (ft)	Sample	Blow count (N)	Moisture (%)	Dry Unit Wt. (pcf)
-1	SM	Top Soil Brown Silty Fine Sand, Trace Root Dry, Loose To the depth of (1 1/2) ft	-1	S	5	2.1	--
-3	SM/SC	Orange Brown Silty Fine to Coarse Sand, Trace Clay to Clayey Fine Coarse sand Alluvial Deposits (Qof), Damp, Dense	-3	S	45	2.9	122.7
-5		Same Damp, Dense Alluvial Deposits (Qof)	-5	S	50	3.2	
-7	SM/SC	Light Brown Silty Fine to medium Sand (Cemented), Trace CALICHE Damp to Moist, Very Dense	-7	S	4"/64	4.3	
-9							
-10	SM/SC	Damp to Moist, Very Dense	-10	D		4.5	124.6
		To the depth of (14 1/2) ft					
-15	SM	Brown Silty Fine to Coarse Sand, Trace Clay with CALICHE (Cemented) Damp to Moist, Very Dense	-15	D	65	5.3	126.7
-20	SM	Same Damp to Moist, Very Dense Alluvial Deposit (Qof) Terminated at the depth of (23 1/2) ft	-20	D	5"/69	5.6	133.4
-25							

GERI **Geo Environmental Resources, Inc.**
2511 West La Palma Ave., Suite E
Anaheim, California 92801

D =Drive sample
S = SPT sample

Plate

LOG OF BORING

B-5

Project Location:23628 Water Street, Perris
Surface Elevation (ft): EL:100.0

Date Drilled: 2/20/2022
Project No: G-021422

Depth (ft)	USCS Class.	Summary of subsurface conditions	Sample Depth (ft)	Sample	Blow count (N)	Moisture (%)	Dry Unit Wt. (pcf)
-1	SM	Brown Silty Fine to Coarse Sand, Trace Clay Alluvial Deposits (Qof) Dry to damp, Dense					
-3			-3	S	41	3.1	
-5	SM	Orange Brown Silty Fine to Coarse Sand (Cemented) with CALICHE Alluvial Deposit (Qof) Moist, Very Dense	-5	S	56	7.5	130.9
-7	SM	Same Alluvial Deposit (Qof) Moist, Very Dense	-7	S	5"/56	8.2	--
-10	SM	Light Brown Silty Fine to Coarse Sand (Cemented) Alluvial Deposit (Qof) Moist, Very Dense	-10	S	3"/64	9.3	--
-15	SM	Same Alluvial Deposite (Qof) Moist, Very Dense	-15	S	71	6.1	133.5
-20	SM	Same Alluvial Deposit Damp to Moist, Very Dense	-20	S	59	5.8	
-25	SM	Same Cemeneted with CALICHE Damp to Moist, Very Dense Terminated at the depth of (29 1/2) ft	-25	S	3"/61	5.6	
-30							

GERI **Geo Environmental Resources, Inc.**
2511 West La Palma Ave., Suite E
Anaheim, California 92801

D =Drive sample
S = SPT sample

Plate

LOG OF BORING

B-6

Project Location:23628 Water Street, Perris
Surface Elevation (ft): EL:100.0

Date Drilled: 2/20/2022
Project No: G-021422

Depth (ft)	USCS Class.	Summary of subsurface conditions	Sample Depth (ft)	Sample	Blow count (N)	Moisture (%)	Wet Unit Wt. (pcf)
-1	SM	Brown Silty Fine Sand, Trace Roots(Top Soil) Dry to Damp, Loose To the depth of (1 1/2) ft	-1	D		3.5	
-3	SM/SC	Orange Silty Fine Sand with Clay to Clayey Fine Sand, Alluvial Deposits(Qof) Dry to Damp, Dense	-3	D		2.9	
-5	SM/SC	Same Alluvial deposits (Qof) Damp very Dense	-5	D		3.2	120.1
-7		Same Alluvial Deposits (Qof) Damp, Dense	-7	D		3.9	123.1
-10		To the depth of (10) ft					

GERI **Geo Environmental Resources, Inc.**
2511 West La Palma Ave., Suite E
Anaheim, California 92801

D =Drive sample
S = SPT sample

Plate

APPENDIX B

Laboratory Testing

Geo Environmental Resources Inc.

CONSOLIDATION TEST NO.1

Location: Perris-23628 Water Street

Boring No: B-1

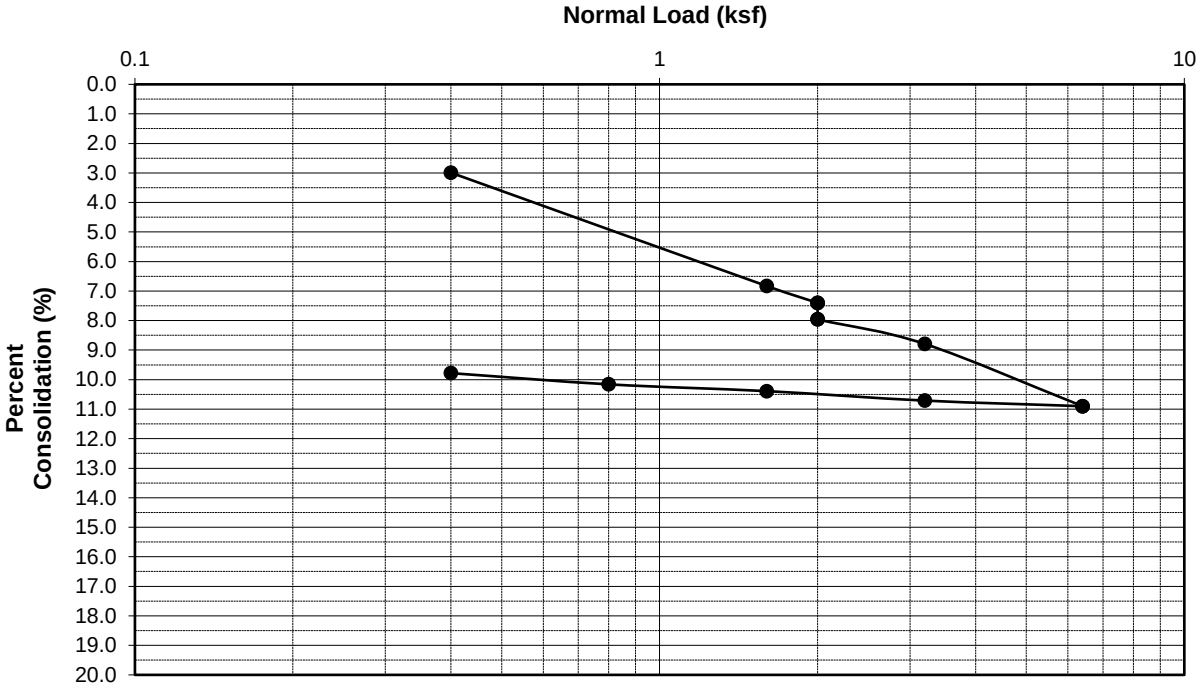
Soil Type: Light Brown Silty fine Sand

Tested By: RK

Project No G-021422

Depth: 5feet

Date: 2/22/2022



Geo Environmental Resources Inc.

CONSOLIDATION TEST NO.2

Location: Perris-23628 Water Street

Boring No: B-2

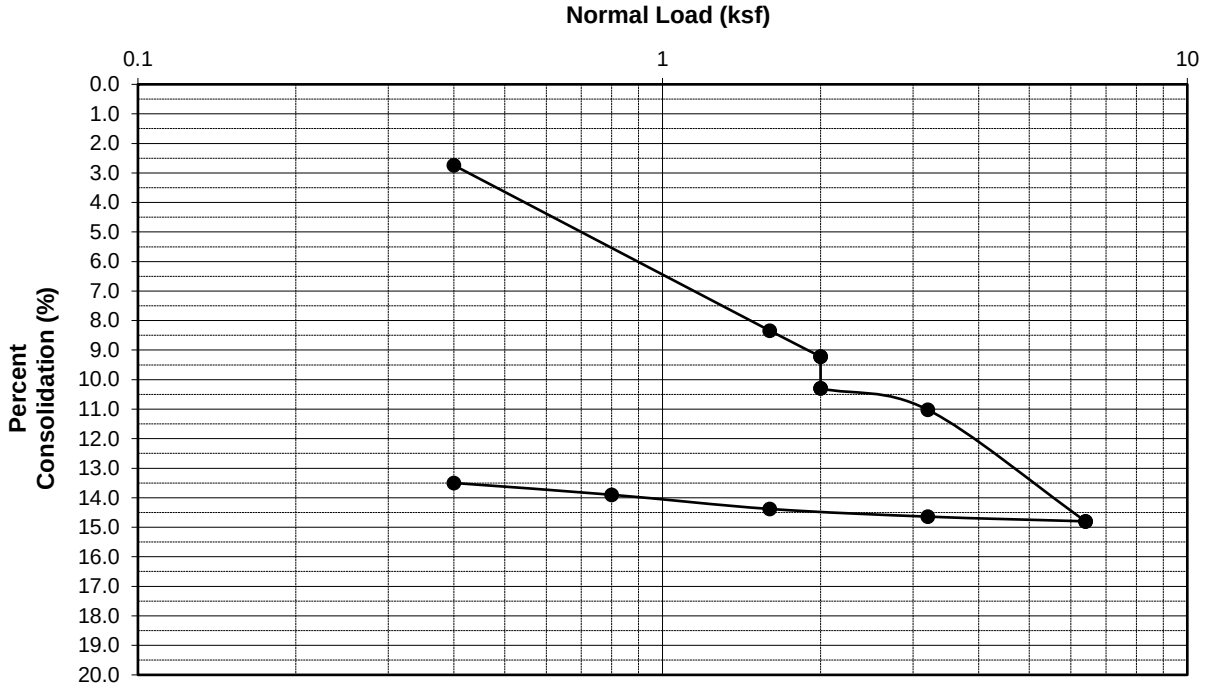
Soil Type: Olive-brown silty f-sand

Tested By: RK

Project No G-021422

Depth: 7 feet

Date: 2/23/2022



Geo Environmental Resources Inc.

CONSOLIDATION TEST NO.3

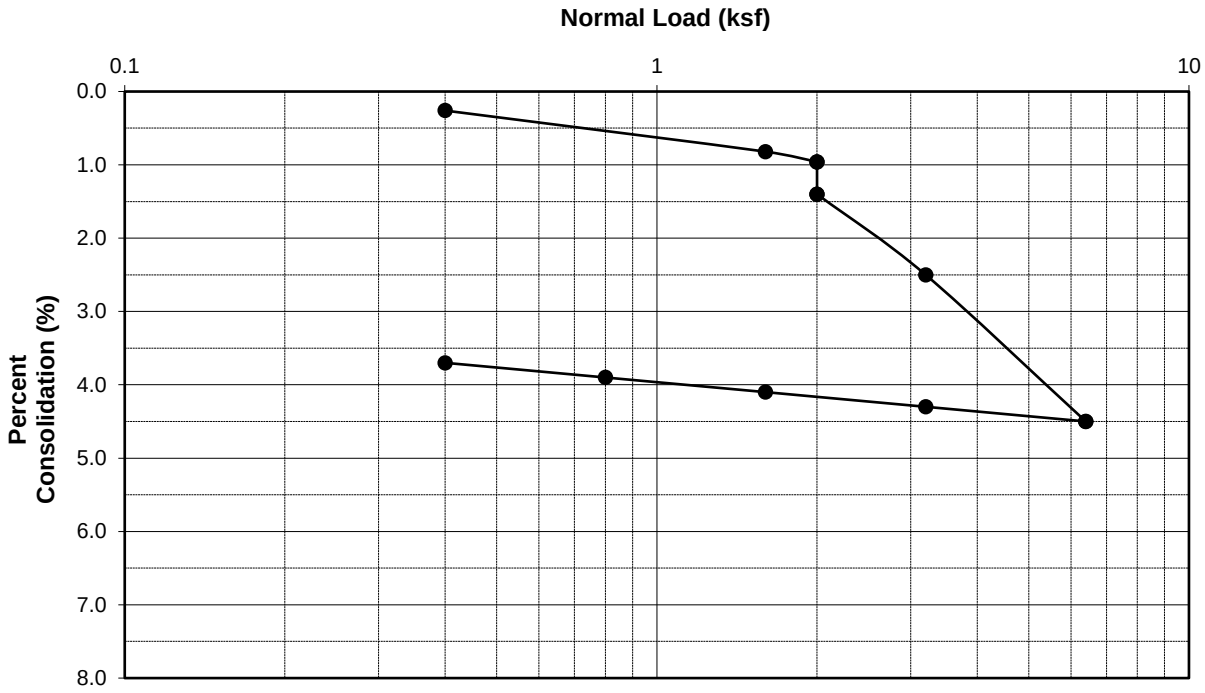
Location: Perris-23628 water Street Boring No: B-1

Soil Type: Orange brown silty fine to coarse sand Tested By: RK

Project No G-021422 Depth: Bulk Sample

Date: 2/25/2022

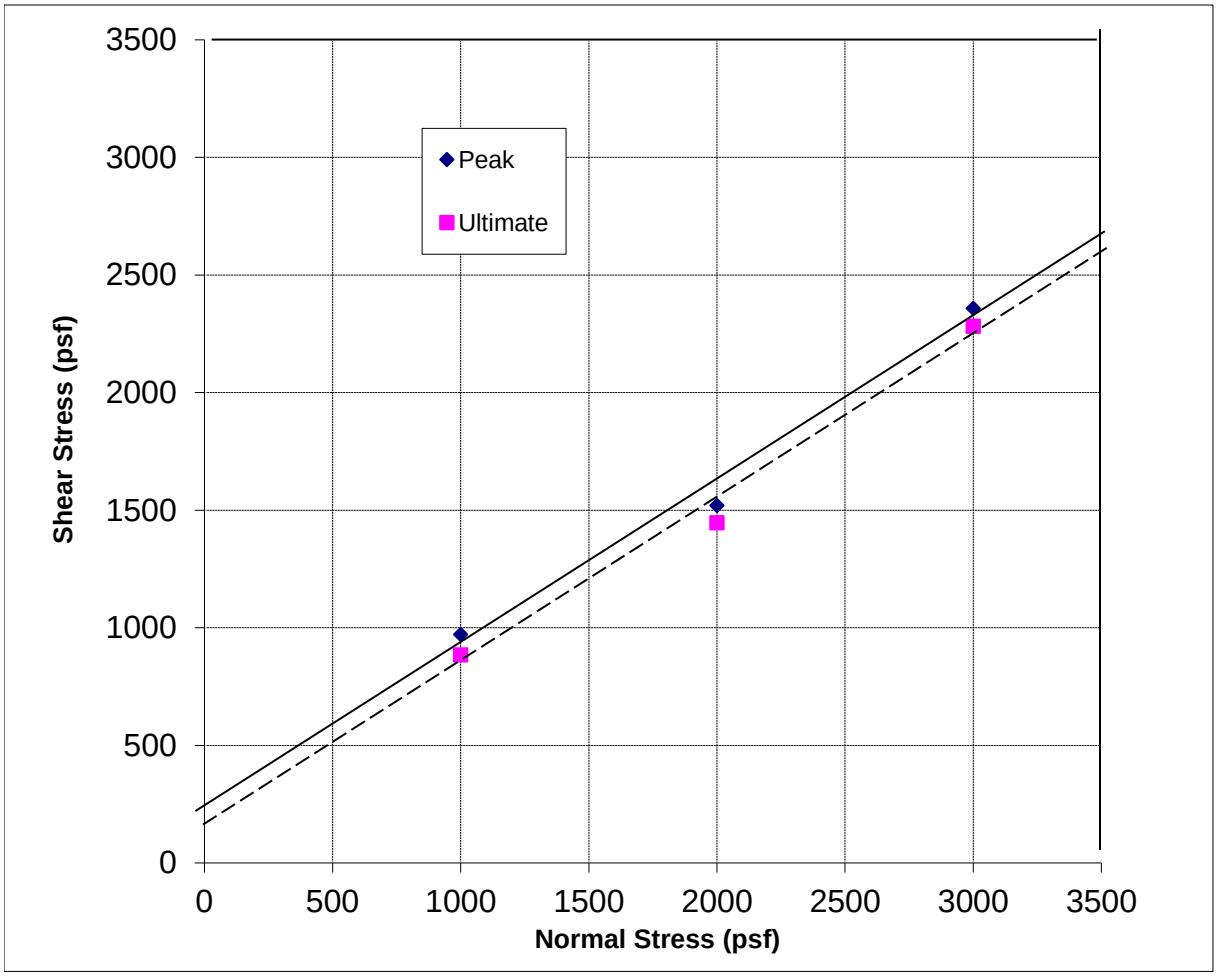
REMOLDED SAMPLE



Geo Environmental Resources Inc.

DIRECT SHEAR TEST NO.1

Location : Perris-23628 Water Street
Boring No: B-1
Soil Type: Orange brown silty f-c sand
Tested by: RK
Project No: G-021422
Depth: Bulk (3-7 feet)
Date: 2/27/2022
REMOLDED SAMPLE

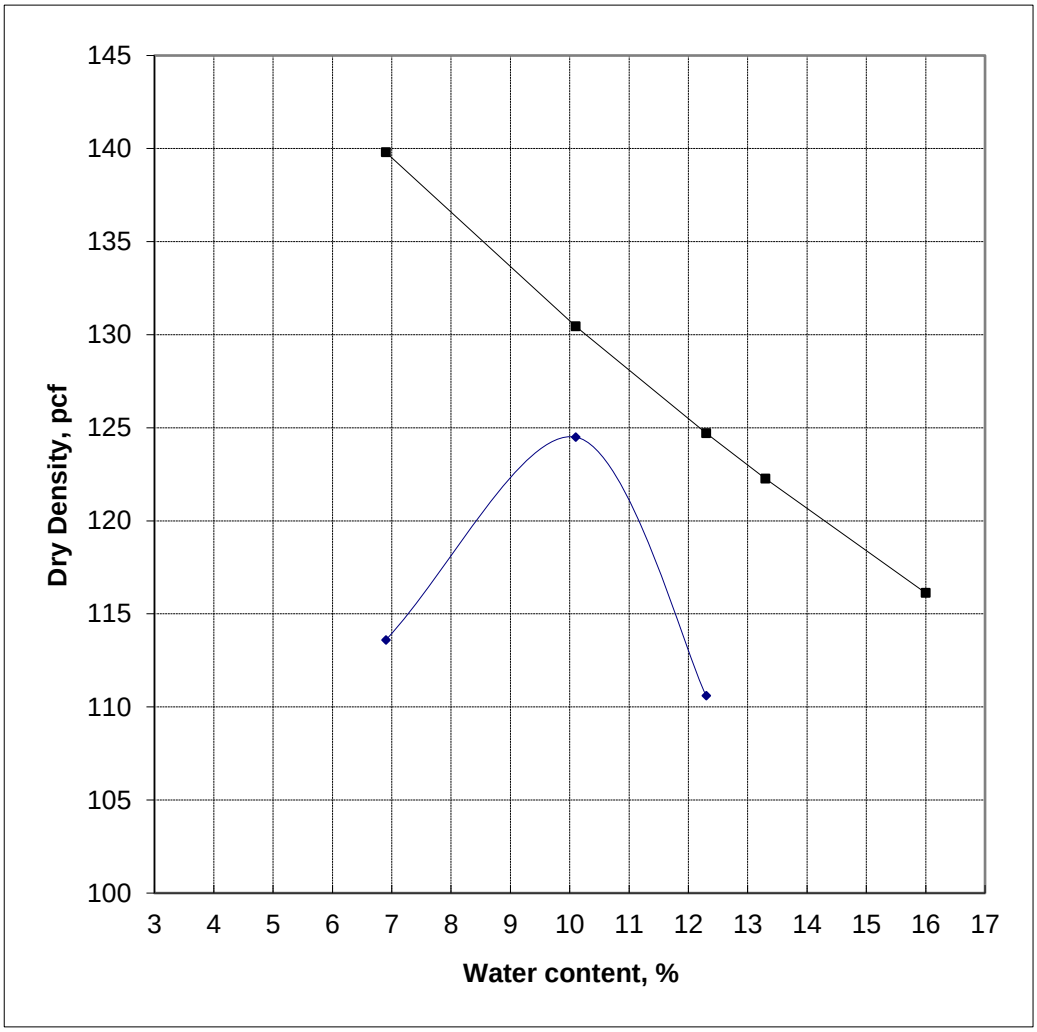


	Peak	Ultimate
Cohesion (psf)	220	160
Friction Angle (deg.)	32	32

Geo Environmental Resources Inc.

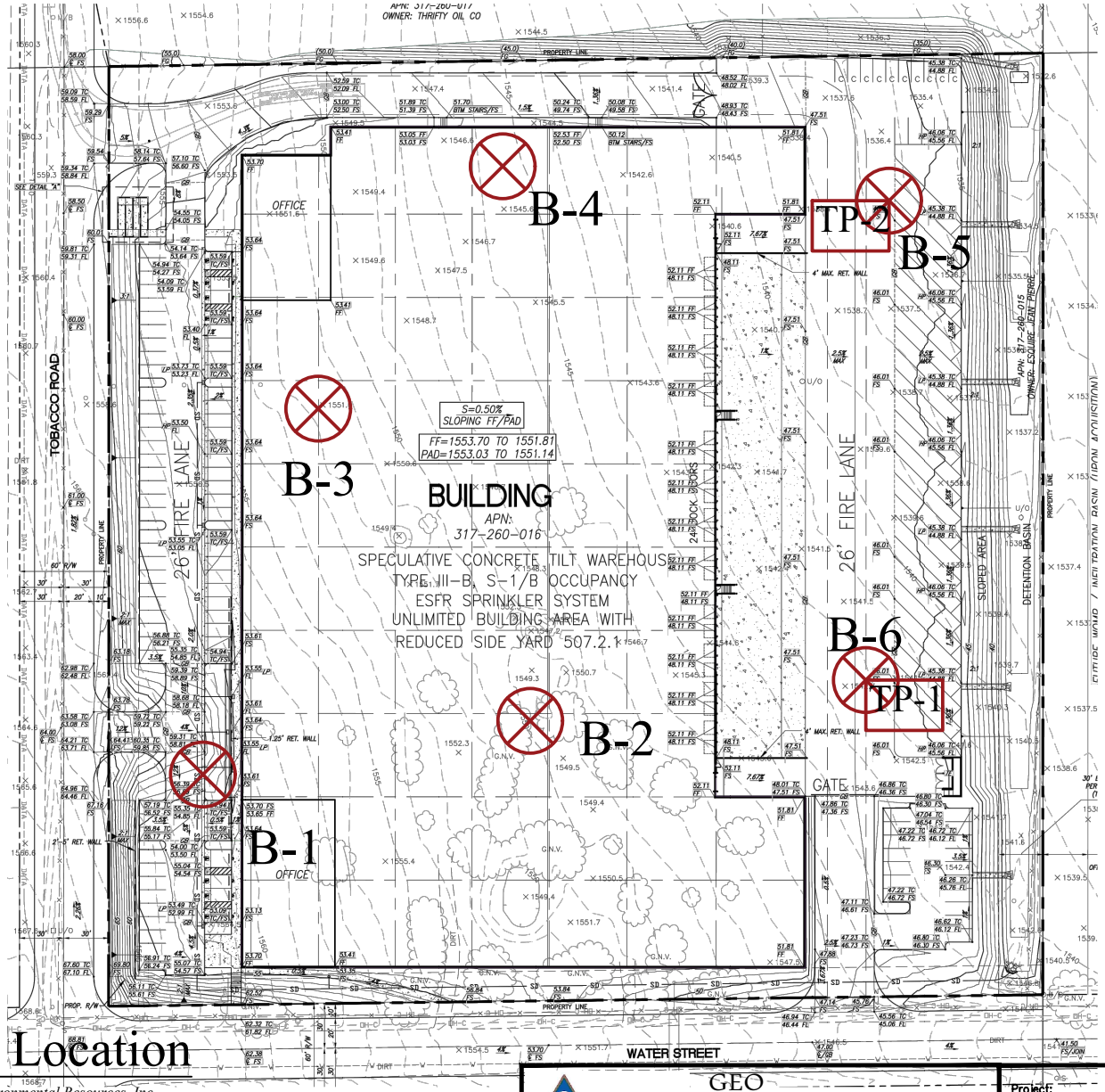
MAXIMUM DENSITY TEST

Location : Perris-23628 Water Street
Boring No: B-1
Soil Type: Orange brown silty f-c sand
Tested by: MG
Project No G-021422
Depth: Bulk (3-7) feet
Date: 2/21/2022
Proctor No.1 124.5 @ 10.0



APPENDIX C

Figures



Plan & Boring Location

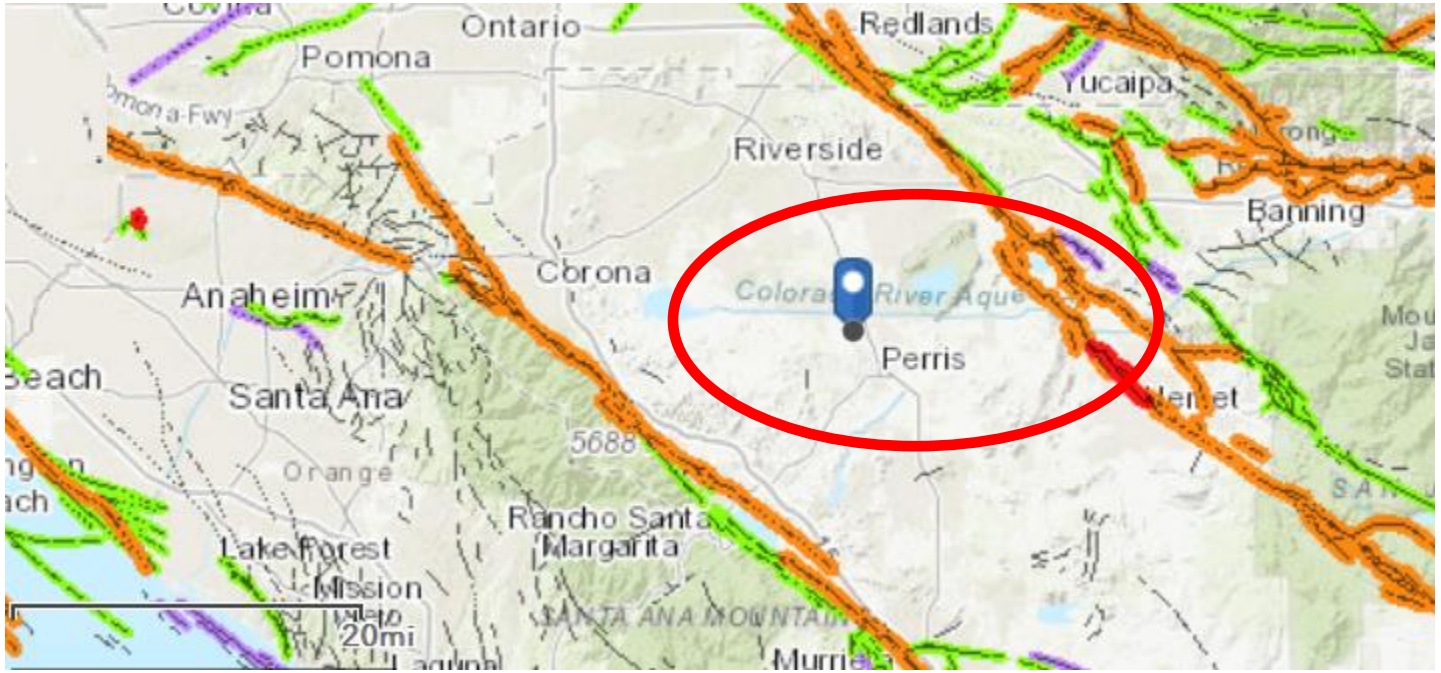
Based on the drawing that was sent to GEO Environmental Resources, Inc

B-1 *Approximate Boring Location*
P-1 *Approximate Percolation Test Location*

GEO ENVIRONMENTAL RESOURCES INC
GEOTECHNICAL ENVIRONMENTAL CONSULTANTS

GEO ENVIRONMENTAL RESOURCES, INC.
TEL: (714) 995-9001 FAX: (714) 995-9008

Project:		
Proposed Tiltup		
ADDRESS: 23628 Water Street, Perris		
Project NO: G-021422	SCALE: As Mentioned	FIG.:1



SYMBOL EXPLANATION

Fault traces on land are indicated by solid lines where well located, by dashed lines where approximately located or inferred, and by dotted lines where concealed by younger rocks or by lakes or bays. Fault traces are queried where continuation or existence is uncertain. All offshore faults based on seismic reflection profile records are shown as solid lines where well defined, dashed where inferred, queried where uncertain.

Holocene fault displacement (during past 11,700 years) without historic record.

Late Quaternary fault displacement (during past 700,000 years).

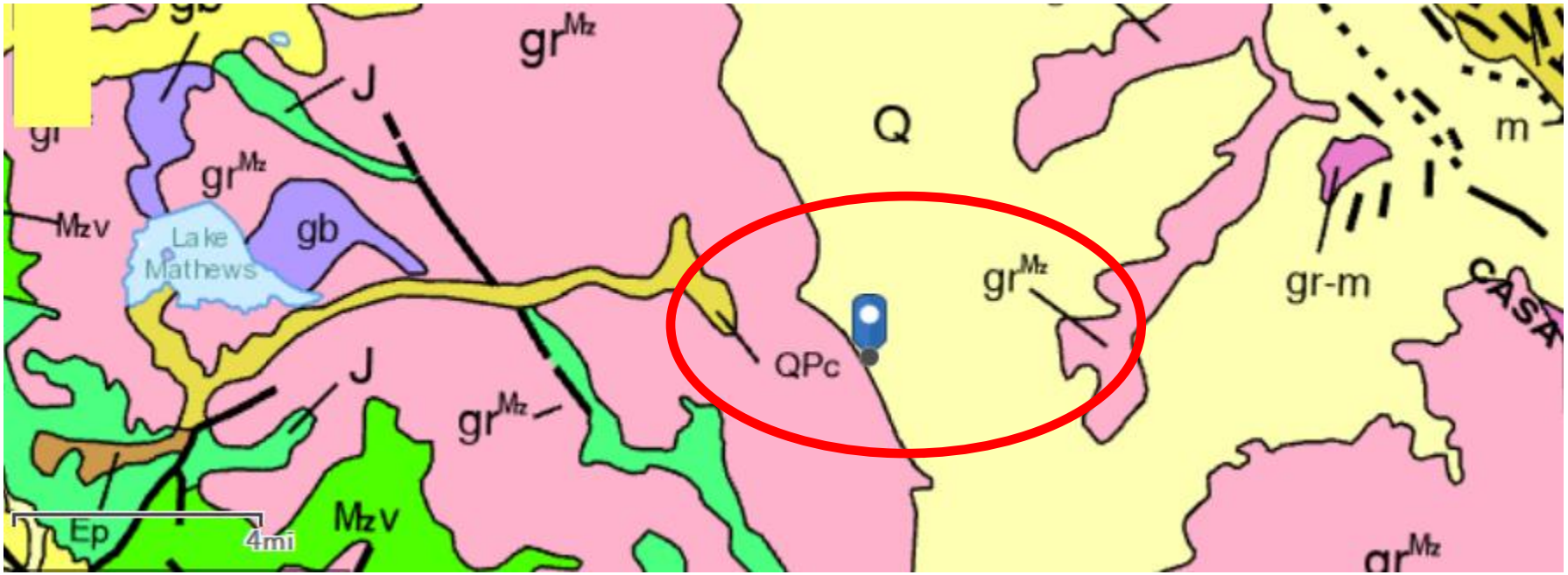
Quaternary fault (age undifferentiated).

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement.

491

Numbers refer to annotations listed in the appendices of the accompanying report.

Geo Environmental Resources, Inc	
Figure 2	Fault Activity Map of California (2010)
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	California Department of Conservation



DESCRIPTION OF MAP UNITS

QUATERNARY DEPOSITS

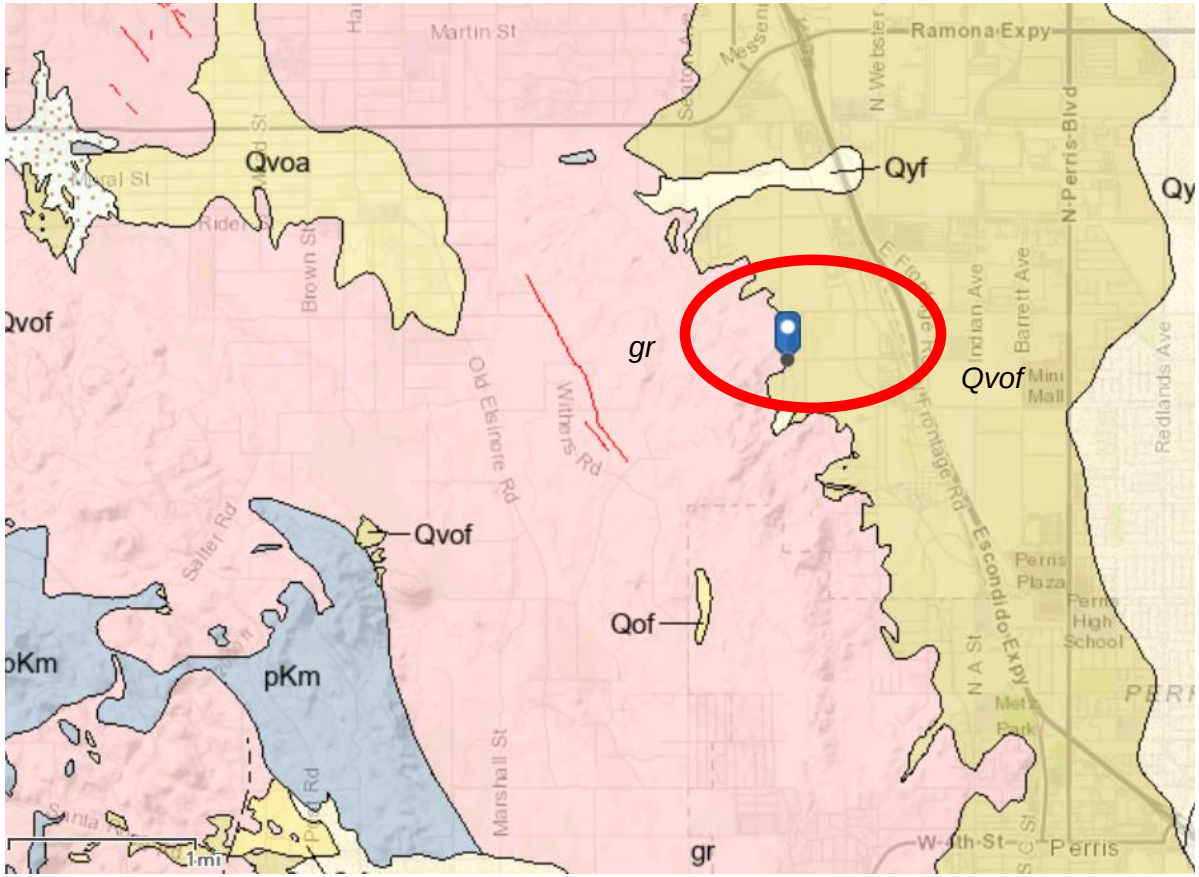
Qs	Extensive marine and nonmarine sand deposits, generally near the coast or desert playas
Q	Alluvium, lake, playa, and terrace deposits; unconsolidated and semi-consolidated
Qls	Selected large landslides
Qg	Glacial till and moraines. Found at high elevations mostly in the Sierra Nevada and Klamath Mountains
Qoa	Older alluvium, lake, playa, and terrace deposits
QPc	Pleistocene and/or Pliocene sandstone, shale, and gravels deposits; mostly loosely consolidated

MESOZOIC PLUTONIC ROCKS

gr^{Mz}	Mesozoic granite, quartz monzonite, granodiorite, and quartz diorite
um	Ultramafic rocks, mostly serpentine. Minor peridotite, gabbro, and diabase; chiefly Mesozoic
gb	Gabbro and dark dioritic rocks; chiefly Mesozoic
gr	Undated granitic rocks

- ✓ California Geological Survey, Geologic Data Map No. 2
- ✓ Compilation and Interpretation by: Charles W. Jennings (1977)
- ✓ Updated version by: Carlos Gutierrez, William Bryant, George Saucedo, and Chris Wills
- ✓ Graphics by: Milind Patel, Ellen Sander, Jim Thompson, Barbara Wanish and Milton Fonseca

Geo Environmental Resources, Inc	
Figure 3	Local Geology Map of California (2010)
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	California Department of Conservation



Middle to Early Pleistocene (Surficial Deposits)

Qvow	Very Old Alluvial Wash Deposits
Qvof	Very Old Alluvial Fan Deposits
Qvov	Very Old Alluvial Valley Deposits
Qvot	Very Old Terrace Deposits
Qvol	Very Old Lacustrine, Playa, and Estuarine (Paralic) Deposits
Qvoe	Very Old Eolian and Dune Deposits

Mesozoic and Older (Bedrock)

Kss	Coarse-grained Cretaceous age formations of sedimentary origin
Ksh	Fine-grained Cretaceous age formations of sedimentary origin
Kv	Cretaceous age formations of volcanic origin
pKm	Cretaceous and pre-Cretaceous metamorphic formations of sedimentary and volcanic origin
sp	Serpentinite of all ages
gr	Granitic and other intrusive crystalline rocks of all ages

Geo Environmental Resources, Inc

Figure 4	USGS
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	GEOLOGIC MAP OF LOS ANGELES COUNTY, CALIFORNIA

Fault Zone

Liquefaction Zone

Landslide Zone

Liquefaction Landslide Overlap Zone

Area Not Evaluated for Liquefaction or Landslides

Geo Environmental Resources, Inc	
Figure 5	Hazard map/Active fault
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	California Department of Conservation

Fault Zone

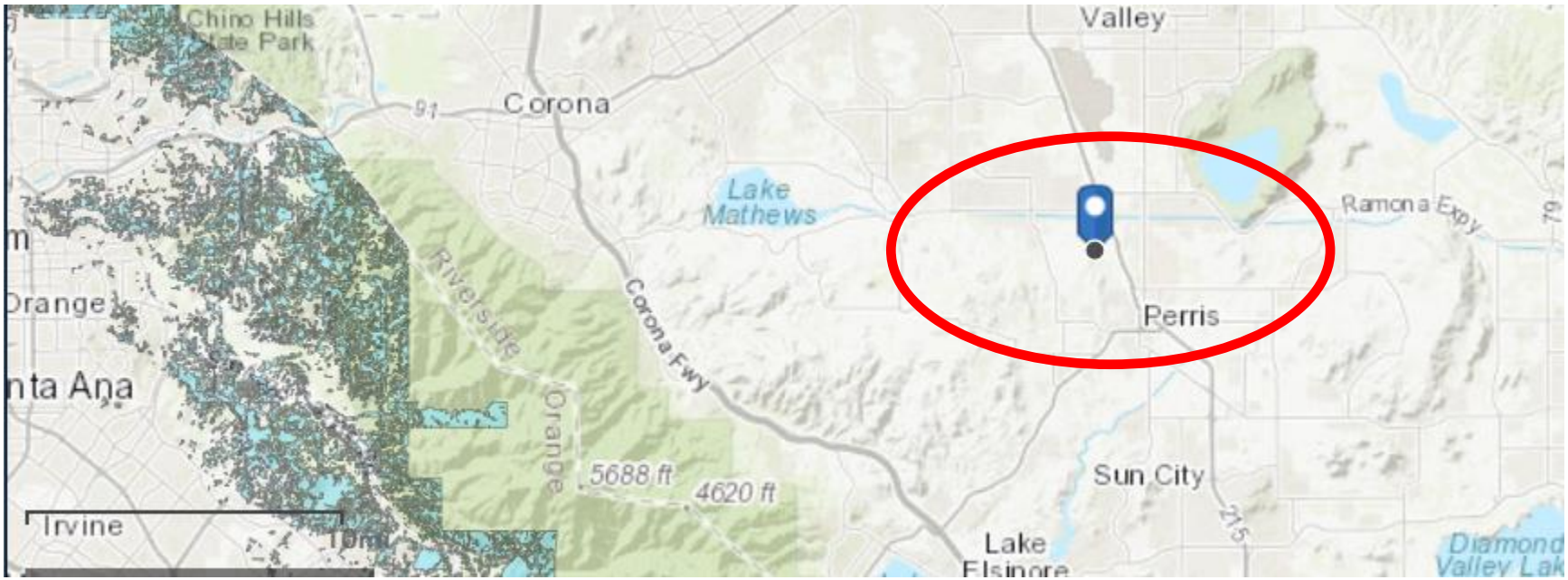
Liquefaction Zone

Landslide Zone

Liquefaction Landslide Overlap Zone

Area Not Evaluated for Liquefaction or Landslides

Geo Environmental Resources, Inc	
Figure 6	Hazard map/Liquefaction Zone
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	California Department of Conservation



Fault Zone

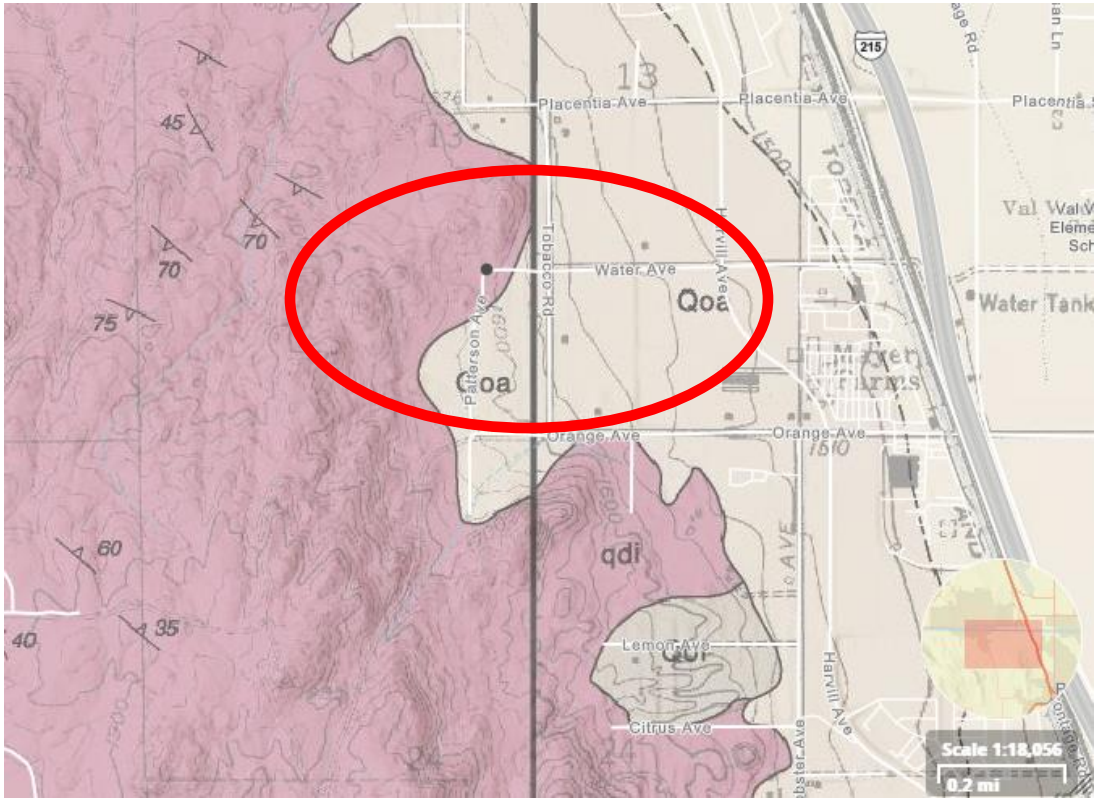
Liquefaction Zone

Landslide Zone

Liquefaction Landslide Overlap Zone

Area Not Evaluated for Liquefaction or Landslides

Geo Environmental Resources, Inc	
Figure 7	Hazard map/Landslide Zone
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	California Department of Conservation



qdi *Quartz diorite (includes Perris quartz diorite of Dudley, 1935, renamed Vat Verde Tonalite by Osborn, 1939, included in Bonsal Tonalite of Larsen, 1948, and Val Verde Tonalite by Morton and Cox, 2001, in east area: gray to light gray, massive to more commonly gneissoid, composed mostly of sodic plagioclase feldspar and the remainder of quartz, biotite and hornblende, and very minor potassic feldspar, contains few to abundant dark gray discoid inclusions; (xenoliths) oriented parallel to gneissoid structure of rock; radiometric age 105.7 MA, Ar 40/Ar 39 age of hornblende, 100 MA, biotite 95 MA, and potassic feldspar 85.5 MA (Morton 2001)*

Qoa

OLDER SURFICIAL SEDIMENTS

Slightly indurated, much dissected alluvial sediments

Qoa *Alluvial sand, commonly pebbly, light reddish brown, arkosic, includes alluvial fan gravel at base of hill terranes*

Geo Environmental Resources, Inc	
Figure 8	Geology Map
Project Address:	23628 Water Street Perris
Project No:	G-021422
Reference:	USGS

APPENDIX D

General Notes

GENERAL NOTES

SAMPLE IDENTIFICATION

All samples are visually classified in general accordance with the Unified Soil Classification System (ASTM D-2487-75 or D-2488-75)

DESCRIPTIVE TERM (% BY DRY WEIGHT)

Trace:	1-10%
Little:	11-20%
Some:	21-35%
And/Adjective	36-50%

PARTICLE SIZE (DIAMETER)

Boulders:	8 in and larger
Cobbles:	3 in to 8 in
Gravel:	coarse - ¾ to 3 in
	fine - No. 4 (4.76 mm) to ¾ in
Sand:	coarse - No. 4 (4.76 mm) to No. 10 (2.0 mm)
	medium - No. 10 (2.0 mm) to No. 40 (0.42 mm)
	fine - No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt:	No. 200 (0.074 mm) and smaller (Non-plastic)
Clay:	No. 200 (0.074 mm) and smaller (Plastic)

SOIL PROPERTY SYMBOLS

Dd:	Dry Density (pcf)
LL:	Liquid Limit, percent
PL:	Plastic Limit, percent
PI:	Plasticity Index (LL-PL)
LOI:	Loss on Ignition, percent
Gs:	Specific Gravity
K:	Coefficient of Permeability
w:	Moisture content, percent
qp:	Calibrated Penetrometer Resistance, tsf
qs:	Vane-Shear Strength, tsf
qu:	Unconfined Compressive Strength, tsf
qc:	Static Cone Penetrometer Resistance Correlated to Unconfined Compressive Strength, tsf
PID:	Results of vapor analysis conducted on representative samples utilizing a Photoionization Detector calibrated to a benzene standard. Results expressed in HNU-units (BDL=Below Detection Limits)

DRILLING AND SAMPLING SYMBOLS

SS:	Split-Spoon
ST:	Shelby Tube - 3" O.D. (except where noted)
CS:	3" O.D. California Ring Sampler
DC:	Dynamic Cone Penetrometer per ASTM Special Technical Publication No. 399
AU:	Auger Sample
DB:	Diamond Bit
CB:	Carbide Bit
WS:	Wash Sample
RB:	Rock-Roller Bit
BS:	Bulk Sample
Note:	Depth intervals for sampling shown on Record of Subsurface Exploration are not indicative of sample recovery, but position where sampling initiated

N: Penetration Resistance per 6 inch interval, or fraction thereof, for a standard 2 inch O.D. (1⅜ inch I.D.) split spoon sampler driven with a 140 pound weight free-falling 30 inches. Performed in general accordance with Standard Penetration Test Specifications (ASTM D-1586). N in blows per foot equals sum of N values where plus sign is shown

Nc: Penetration Resistance per 1¾ inches of Dynamic Cone Penetrometer. Approximately equivalent to Standard Penetration Test N-Value in blows per foot.

Nr: Penetration Resistance per 6 inch interval, or fraction thereof, for California Ring Sampler driven with a 140 pound weight free-falling 30 inches per ASTM D-3550. Not equivalent to Standard Penetration Test N-Value.

SOIL STRENGTH CHARACTERISTICS

COHESIVE (CLAYEY) SOILS

COMPARATIVE CONSISTENCY	BLOWS PER FOOT (N)	UNCONFINED COMPRESSIVE STRENGTH (TSF)
Very Soft	0-2	0-0.25
Soft	3-4	0.25-0.50
Medium Stiff	5-8	0.50-1.00
Stiff	9-15	1.00-2.00
Very Stiff	16-30	2.00-4.00
Hard	31+	4.00+

DEGREE OF PLASTICITY	PI
None to Slight	0-4
Slight	5-10
Medium	11-30
High to Very High	31+

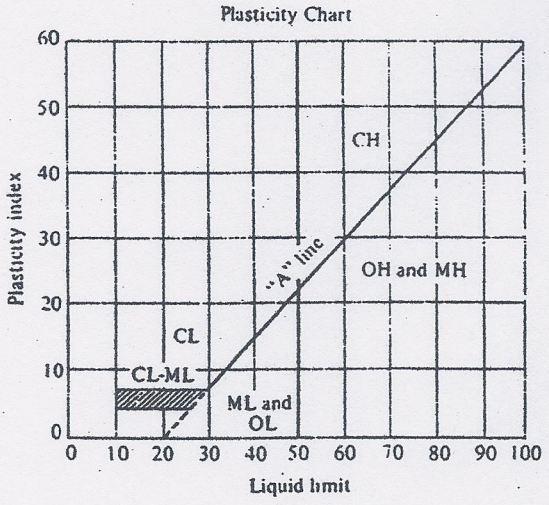
NON-COHESIVE (GRANULAR) SOILS

RELATIVE DENSITY	BLOWS PER FOOT (N)
Very Loose	0-4
Loose	5-10
Firm	11-30
Dense	31-50
Very Dense	51+

DEGREE OF EXPANSIVE POTENTIAL	PI
Low	0-15
Medium	15-25
High	25+

UNIFIED SOIL CLASSIFICATION SYSTEM. (ASTM D-2487)

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria	
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 per cent: GW, GP, SW, SP; More than 12 per cent: GM, GC, SM, SC; 5 to 12 per cent: *Borderline* cases requiring dual symbols[b]	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM[a] d / u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits below "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM[a] d / u	Silty sands, sand-silt mixtures	Atterberg limits above "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH	Inorganic clays of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity, organic silts		
	Highly organic soils		Pt	Peat and other highly organic soils		



[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.

[b] Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

CHARACTERISTICS AND RATINGS OF UNIFIED SOIL SYSTEM CLASSES FOR SOIL CONSTRUCTION *									
Class	Compaction Characteristics	Max. Dry Density Standard Proctor (pcf)	Compressibility and Expansion	Drainage and Permeability	Value as an Embankment Material	Value as Subgrade When Not Subject to Frost	Value as Base Course	Value as Temporary Pavement	
								With Dust Palliative	With Bituminous Treatment
GW	Good: tractor, rubber-tired, steel wheel or vibratory roller	125-135	Almost none	Good drainage, pervious	Very stable	Excellent	Good	Fair to Poor	Excellent
GP	Good: tractor, rubber-tired, steel wheel or vibratory roller	115-125	Almost none	Good drainage, pervious	Reasonably stable	Excellent to good	Poor to fair	Poor	
GM	Good: rubber-tired or light sheepsfoot roller	120-135	Slight	Poor drainage, semipervious	Reasonably stable	Excellent to good	Fair to poor	Poor	Poor to fair
GC	Good to fair: rubber-tired or sheepsfoot roller	115-130	Slight	Poor drainage, impervious	Reasonably stable	Good	Good to fair **	Excellent	Excellent
SW	Good: tractor, rubber-tired or vibratory roller	110-130	Almost none	Good drainage, pervious	Very stable	Good	Fair to poor	Fair to poor	Good
SP	Good: tractor, rubber-tired or vibratory roller	100-120	Almost none	Good drainage, pervious	Reasonably stable when dense	Good to fair	Poor	Poor	Poor to fair
SM	Good: rubber-tired or sheepsfoot roller	110-125	Slight	Poor drainage, impervious	Reasonably stable when dense	Good to fair	Poor	Poor	Poor to fair
SC	Good to fair: rubber-tired or sheepsfoot roller	105-125	Slight to medium	Poor drainage, impervious	Reasonably stable	Good to fair	Fair to poor	Excellent	Excellent
ML	Good to poor: rubber-tired or sheepsfoot roller	95-120	Slight to medium	Poor drainage, impervious	Poor stability, high density required	Fair to poor	Not suitable	Poor	Poor
CL	Good to fair: sheepsfoot or rubber-tired roller	95-120	Medium	No drainage, impervious	Good stability	Fair to poor	Not suitable	Poor	Poor
OL	Fair to poor: sheepsfoot or rubber-tired roller	80-100	Medium to high	Poor drainage, impervious	Unstable, should not be used	Poor	Not suitable	Not suitable	Not suitable
MH	Fair to poor: sheepsfoot or rubber-tired roller	70-95	High	Poor drainage, impervious	Poor stability, should not be used	Poor	Not suitable	Very poor	Not suitable
CH	Fair to poor: sheepsfoot roller	80-105	Very high	No drainage, impervious	Fair stability, may soften on expansion	Poor to very poor	Not suitable	Very poor	Not suitable
OH	Fair to poor: sheepsfoot roller	65-100	High	No drainage, impervious	Unstable, should not be used	Very poor	Not suitable	Not suitable	Not suitable
Pt	Not suitable		Very high	Fair to poor drainage	Should not be used	Not suitable	Not suitable	Not suitable	Not suitable

* "The Unified Classification: Appendix A - Characteristics of Soil, Groups Pertaining to Roads and Airfields, and Appendix B - Characteristics of Soil Groups Pertaining to Embankments and Foundations," Technical Memorandum 357, U.S. Waterways Ixperiment Station, Vicksburg, 1953.

** Not suitable if subject to frost.

APPENDIX E

USGS Seismic Design Parameters

Proposed Tilt up

Perris, CA, USA

Latitude, Longitude: 33.7825194, -117.2286478

Date	4/6/2022, 4:24:57 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	1.455	MCE_R ground motion. (for 0.2 second period)
S_1	0.538	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.746	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.164	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.6	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.455	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.554	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.538	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.585	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.936	Mapped value of the risk coefficient at short periods
C_{R1}	0.919	Mapped value of the risk coefficient at a period of 1 s

DISCLAIMER

While the information presented on this website is believed to be correct, SEAOC /OSHPD and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in this web application should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. SEAOC / OSHPD do not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the seismic data provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the search results of this website.

APPENDIX F

Percolation Feasibility Study

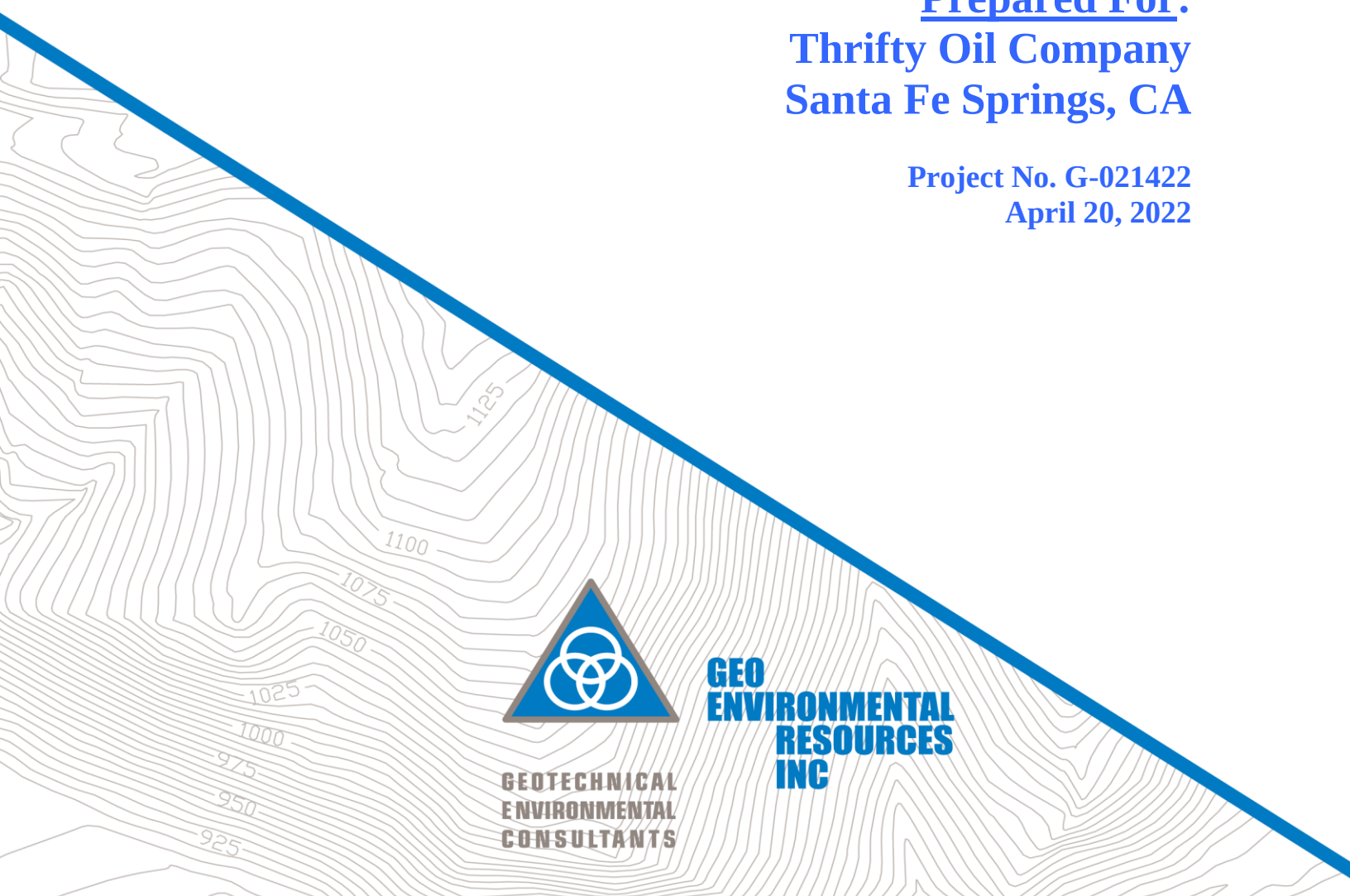
Geotechnical Engineering Exploration and Analysis

Percolation Feasibility Study Results

23628 Water Street, Perris, CA

Prepared For:
Thrifty Oil Company
Santa Fe Springs, CA

Project No. G-021422
April 20, 2022



GEOTECHNICAL
ENVIRONMENTAL
CONSULTANTS

GEO
ENVIRONMENTAL
RESOURCES
INC

1. PURPOSE AND SCOPE

This report provides the results of our recent percolation feasibility study for the proposed Tilt-up Commercial structure. The purpose of the study is to present the results of the field evaluation for the infiltration rate for the storm water runoff at the subject property.

Peculation test was conducted in accordance with **ASTM D 3385 "STANDARD TEST METHOD FOR INFILTRATION RATE OF SOILS IN FIELD USING DOUBLE-RING INFILTROMETER".** Two (2) locations have been designated to conduct the percolation test procedure. Please review the "Site Location Plan" Figure No.1 to review the approximate percolation tests location. The main purpose of multiple-locations is to obtain additional infiltration rates.

2. SUBSURFACE EXPLORATION

Percolation test No.1 was conducted next to Boring No.6 and Percolation No.2 was performed adjacent to the Boring No.5. For percolation, No.1 Test Pit No.1 was excavated to an approximate depth of 80 inches below the existing grade. Test pit Number 2, which was excavated for per was excavated to an approximate depth of 84 inches below the existing grade. Both two test pits were excavated with the help of backhoe and field equipment. The exposed subgrade within both locations were saturated 24-hours prior to actual percolation test.

3. SUBSURFACE CONDITION

The subsurface soil encountered in Test Pit No 1 (TP-1) consisted of Brown Silty Fine to Coarse Sand, Trace Clay Alluvial Deposits (Qof) Dry to damp to the depth of about 18 inches, which was underlain by Orange Silty Fine Sand with Clay to Clayey Fine Sand, Alluvial Deposits (Qof) to the depth of 8 feet. The samples were obtain by the help of the hand auger and field equipment and it was obtained at the corner of test pit, where the percolation had been performed.

2511 west La Palma Avenue, Suite E
Anaheim, CA, (714) 995-9001

In case of Test pit No 2 (TP-2), Soil classified as Brown Silty Fine to Coarse Sand, Trace Clay

Alluvial Deposits (Qof), Dry to damp and dense. This layer was continued to the depth of 3 feet. Then after that we observed Cemented soil with CALICHE, Alluvial Deposit (Qof) and moist which was very dense as well

Detailed geotechnical subsurface condition was originally discussed in our original geotechnical report (G-021422), which was prepared as Proposed Tilt up.

According to attached figure 6, the subject site is not located within a "Liquefaction Zone" based on the review of the liquefaction map of California (California Department of Conservation). Also there is no evidence of near-surface groundwater in our subsurface exploration. Within Test Pit No.1 and 2 there was no groundwater encountered to maximum explored depth.

4. GEOTECHNICAL CONSIDERATIONS

The followings were considered prior to test procedure. :

1. Water infiltration into the ground should be at least 10 feet above the groundwater table.
2. The distance between the infiltration facility and the adjacent private property lines should be at least 10 feet.
3. The minimum foundation set back should be at least 10 feet from the infiltration facility.

4. Test Procedure

The double ring infiltrometer test (ASTM D 3385) is a well recognized and documented technique for directly measuring the soil infiltration rate of a site. Double ring infiltration was developed in response to the fact that smaller (less than 40 inch diameter) single ring infiltrometers tend to overestimate vertical infiltration rates. This has been attributed to the fact that the flow of water beneath the cylinder is not purely vertical and diverges laterally.

2511 west La Palma Avenue, Suite E

Anaheim, CA, (714) 995-9001

Double ring infiltrometers minimize the error associated with the single-ring method because the water level in the outer ring forces vertical infiltration of water in the inner ring. Care should be taken when driving the rings into the ground as there can be a poor connection between the ring wall and the soil. This poor connection can cause a leakage of water along the ring wall and an overestimation of the infiltration rate. Another potential source of error is attributed to the size of the cylinders. As such, the use of cylinder sizes less than those prescribed in ASTM D 3385 is not recommended by most codes.

Geo Environmental Resources, double ring infiltrometer consists of a 12-inch inner ring and a 24-inch outer ring. While there are two operational techniques used with the double-ring infiltrometer, the constant head method and the falling head method; ASTM D3385 mandates the use of the constant head method.

With the constant head method, water is consistently added to both the outer and inner rings to maintain a constant level throughout the testing. The volume of water needed to maintain the fixed level of the inner ring is measured. To help maintain a constant head, a variety of devices may be used. A hook gauge, steel tape or rule, or length of steel or plastic rod pointed on one end, can be used for measuring and controlling the depth of liquid (head) in the infiltrometer ring. If available, a graduated Mariotte tube or automatic flow control system may also be used.

On the other hand and with the falling head method, which has been used in this report, the falling level of the water is measured in each time interval and ultimately, as shown in following tables, a final report shall be provided and, based on the test results, an infiltration rate shall be recommended. The final number is average of previous 4-infiltration rate.

2511 west La Palma Avenue, Suite E
Anaheim, CA, (714) 995-9001

5. FINDINGS AND CONCLUSIONS

Result of Percolation test **No.1 indicates 5.25 inch/hr.** with a percolation **No.2 indicating 4.7 inch/hr.** Attached please see percolation tables and graphs.

($\boldsymbol{Final\ Infiltration\ rate} = \frac{\boldsymbol{Infiltration\ rate\ from\ test}}{\boldsymbol{Factor\ of\ safety}}$) **The minimum recommended factor of safety will be two (2).** Therefore, the actual infiltration rate of subject property will be half of the obtained infiltration rate**.**

three (3).

a third

It is our opinion that due the variability within the near-surface soil, the lower infiltration rate (Infiltration No.2) should be considered to utilize in the design. Therefore, the recommended infiltration rate is 2.35 Inch/hr.

1.57 in/hr

1. The infiltration of the storm water will not result in ground settlement that could affect adversely the proposed structure.
2. All results and findings are based on level (Horizontal) surface area. Effect of any slope or inclination shall be considered to evaluate the final Percolation rate.
3. The proposed infiltration facility should be designed in such way that in case of "Drainage Capacity Failure" overflow to street.

2511 west La Palma Avenue, Suite E
Anaheim, CA, (714) 995-9001

Figure 20: Approximate location and depth of the test.

Figure 21: Using bentonite to seal the apparatus, Soil was firm and dry

Figure 22: Position of laser meter and method of reading level of the water.

Figure 23: Accuracy of Reading water level by laser meter. Test was done by reading level of the water at specific time intervals

2511 west La Palma Avenue, Suite E
Anaheim, CA, (714) 995-9001

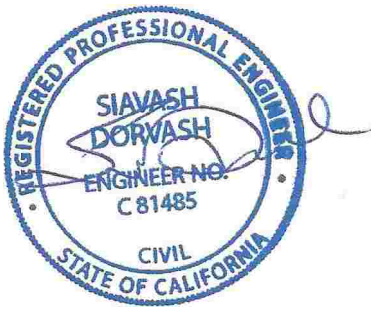
We appreciate the opportunity to be of service on this report. If we may be of additional Assistance, should Geotechnical Related problems occurs, please do not hesitate to contact us at Any time.

Very truly yours,

GEO ENVIRONMENTAL RESOURCES, INC.

Alexander A. Rastegar

Project Engineer



S. Dorvash, P.E.

2511 west La Palma Avenue, Suite E

Anaheim, CA, (714) 995-9001

GEO ENVIRONMENTAL RESOURCES INC
GEOTECHNICAL ENVIRONMENTAL CONSULTANTS

Double Ring Infiltration Test Data

ASTM D3385 – 18 & City Guide

Date of Test **4/14/2021**

		Inner Ring Diameter:	12 inch	Liquid:	Tap Water
Project Name:	**Proposed Tilt-up**	Outer Ring Diameter:	24 inch	Liquid Temperature:	63°-70° f
Project Address:	**23628 Water Street, Perris**	Height Of Ring:	24 inch	Type of Test:	Falling Head
		Depth to the Soil:	6 Inch	Weather Temperature:	65°-90° f
Project number:	**G-021422**	Method of measuring the surface of the water :	Laser	Weather:	Sunny
				Soil Type:	Native Soil

Percolation Location 1 (TP-1)

				Inner Ring		*Annular Ring*				
Trial Number	*Time (hour:min)*		*Elapsed time (Δt)*	*Elevation Inch(H)*	*ΔH*	*Elevation Inch(H)*	*ΔH*	*Liquid Temperature*	*Infiltration Rate - Annular (Inch/hour)*	*Infiltration Rate -Inner (Inch/hour)*
	Start	9:30	0:15	5 3/16		6 4/16			-	-
1	End	9:45		7 2/16	1 15/16	8 9/16	2 5/16	64	-	-
	Start	10:00	0:15	9 3/16	2 1/16	11	2 7/16	64	-	-
2	End	10:15		11 4/16	2 1/16	13 7/16	2 7/16	64	-	-
	Start	10:30	0:15	13 5/16	2 1/16	Water (5 9/16))	2 8/16	64	9 11/16	**8 2/16**
3	End	10:45		15 5/16	2	8	2 7/16	64	9 13/16	**8 3/16**
	Start	11:00	0:15	Water(5 4/16)	2 1/16	10 6/16	2 6/16	64	9 12/16	**8 3/16**
4	End	11:15		7 5/16	2 1/16	12 12/16	2 6/16	65	9 10/16	**8 3/16**
	Start	11:30	0:15	9 5/16	2	15 1/16	2 5/16	65	9 7/16	**8 2/16**
5	End	11:45		11 4/16	1 15/16	Water (6 3/16))	2 7/16	65	9 7/16	**8 1/16**
	Start	12:00	0:15	13 3/16	1 15/16	8 10/16	2 7/16	65	9 8/16	**7 15/16**
6	End	12:15		15 1/16	1 14/16	10 15/16	2 5/16	65	9 8/16	**7 12/16**
	Start	12:30	0:15	Water(5 4/16)	2	13 5/16	2 6/16	66	9 9/16	**7 12/16**
7	End	12:45		7 4/16	2	15 10/16	2 5/16	66	9 7/16	**7 13/16**
	Start	13:00	0:15	9 2/16	1 14/16	(Water)5 3/16	2 7/16	66	9 7/16	**7 12/16**
8	End	13:15		10 14/16	1 12/16	7 8/16	2 5/16	66	9 7/16	**7 10/16**
	Start	13:30	0:15	12 8/16	1 10/16	9 13/16	2 5/16	66	9 6/16	**7 4/16**
9	End	13:45		14 1/16	1 9/16	12	2 3/16	70	9 4/16	**6 13/16**
	Start	14:00	0:15	Water(5 10/16)	1 14/16	14 1/16	2 1/16	70	8 14/16	**6 13/16**
10	End	14:15		7 4/16	1 10/16	(Water)5 3/16	2	70	8 9/16	**6 11/16**
	Start	14:30	0:15	8 13/16	1 9/16	7 5/16	2 2/16	70	8 6/16	**6 10/16**
11	End	14:45		10 6/16	1 9/16	9 5/16	2	70	8 3/16	**6 10/16**
	Start	15:00	0:15	11 14/16	1 8/16	11 3/16	1 14/16	70	8	**6 4/16**
12	End	15:15		13 5/16	1 7/16	13	1 13/16	72	7 13/16	**6 1/16**
	Start	15:30	0:15	14 11/16	1 6/16	(Water)5 7/16	1 12/16	72	7 8/16	**5 14/16**
13	End	15:45		Water(6 6/16)	1 7/16	7 2/16	1 13/16	72	7 5/16	**5 12/16**
	Start	16:00	0:15	7 12/16	1 6/16	8 12/16	1 10/16	72	7 1/16	**5 10/16**
14	End	16:15		9 1/16	1 5/16	10 4/16	1 8/16	73	6 8/16	**5 8/16**
	Start	16:30	0:15	10 6/16	1 5/16	11 12/16	1 8/16	74	6 5/16	**5 7/16**
15	End	16:45		11 11/16	1 5/16	13 4/16	1 8/16	75	6 2/16	**5 5/16**
	Start	17:00	0:15	13	1 5/16	14 12/16	1 8/16	76	6	**5 4/16**
16	End	17:15		14 5/16	1 5/16	16 4/16	1 8/16	77	6	**5 4/16**

Infiltration Rate (Inch/Hour): *5 5/16*

5.25

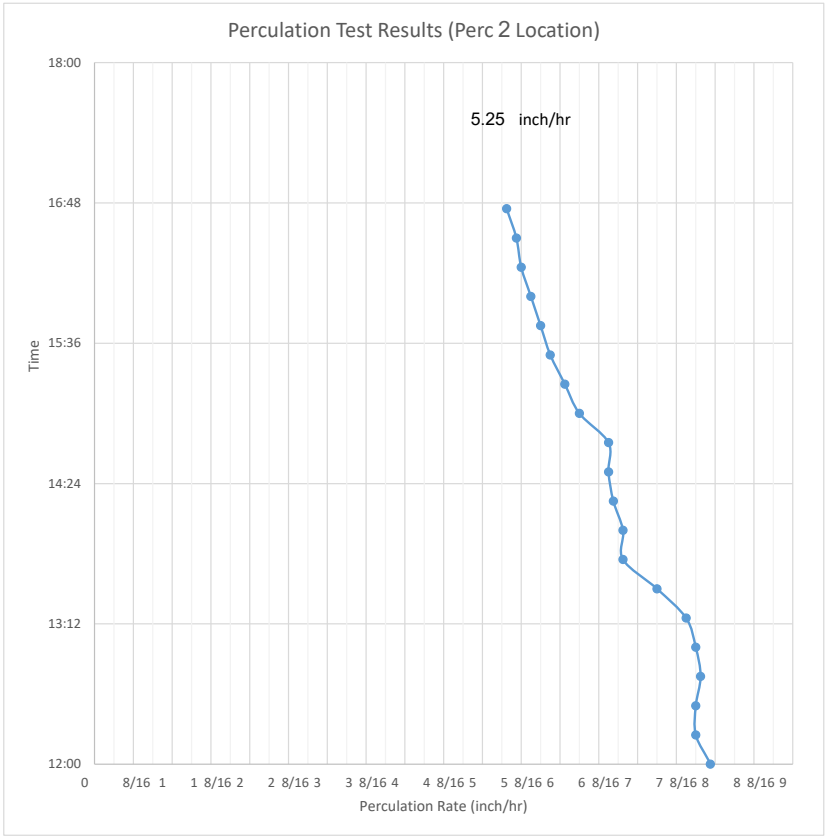
GEO ENVIRONMENTAL RESOURCES INC
GEOTECHNICAL ENVIRONMENTAL CONSULTANTS

Double Ring Infiltration Test Data

ASTM D3385 – 18 & City Guide

Date of Test **4/14/2021**

		Inner Ring Diameter:	12 inch	Liquid:	Tap Water
Project Name:	**Proposed Tilt-up**	Outer Ring Diameter:	24 inch	Liquid Temperature:	63°-70° f
Project Address:	**23628 Water Street, Perris**	Height Of Ring:	24 inch	Type of Test:	Falling Head
		Depth to the Soil:	6 Inch	Weather Temperature:	65°-90° f
Project number:	**G-021422**	Method of measuring the surface of the water :	Laser	Weather:	Sunny
				Soil Type:	Native Soil



GEO ENVIRONMENTAL RESOURCES INC
GEOTECHNICAL ENVIRONMENTAL CONSULTANTS

Double Ring Infiltration Test Data

ASTM D3385 – 18 & City Guide

Date of Test **4/15/2021**

		Inner Ring Diameter:	12 inch	Liquid:	Tap Water
Project Name:	**Proposed Tilt-up**	Outer Ring Diameter:	24 inch	Liquid Temperature:	63°-70° f
Project Address:	**23628 Water Street, Perris**	Height Of Ring:	24 inch	Type of Test:	Falling Head
		Depth to the Soil:	6 Inch	Weather Temperature:	67°-87° f
Project number:	**G-021422**	Method of measuring the surface of the water :	Laser	Weather:	Sunny
				Soil Type:	Native Soil

Percolation Location TP-2

				Inner Ring		*Annular Ring*				
Trial Number	*Time (hour:min)*		*Elapsed time (Δt)*	*Elevation Inch(H)*	*ΔH*	*Elevation Inch(H)*	*ΔH*	*Liquid Temperature*	*Infiltration Rate - Annular (Inch/hour)*	*Infiltration Rate -Inner (Inch/hour)*
	Start	9:00	0:15	5 14/16		5 11/16			-	-
1	End	9:15		8	2 2/16	7 15/16	2 4/16	64	-	-
	Start	9:30	0:15	10 4/16	2 4/16	10 6/16	2 7/16	64	-	-
2	End	9:45		12 6/16	2 2/16	12 11/16	2 5/16	64	-	-
	Start	10:00	0:15	14 8/16	2 2/16	Water (5 1/16)	2 4/16	64	9 4/16	**8 10/16**
3	End	10:15		16 8/16	2	7 7/16	2 6/16	64	9 6/16	**8 8/16**
	Start	10:30	0:15	Water(5 8/16)	2 2/16	9 10/16	2 3/16	64	9 2/16	**8 6/16**
4	End	10:45		7 8/16	2	11 14/16	2 4/16	65	8 15/16	**8 4/16**
	Start	11:00	0:15	9 9/16	2 1/16	14	2 2/16	65	8 13/16	**8 3/16**
5	End	11:15		11 9/16	2	Water (5 1/16))	2 3/16	65	8 10/16	**8 3/16**
	Start	11:30	0:15	13 8/16	1 15/16	7 5/16	2 4/16	65	8 11/16	**8**
6	End	11:45		15 7/16	1 15/16	9 6/16	2 1/16	65	8 10/16	**7 15/16**
	Start	12:00	0:15	Water(5 15/16)	1 14/16	11 6/16	2	66	8 8/16	**7 12/16**
7	End	12:15		7 15/16	2	13 4/16	1 14/16	66	8 3/16	**7 12/16**
	Start	12:30	0:15	9 13/16	1 14/16	15 2/16	1 14/16	66	7 13/16	**7 11/16**
8	End	12:45		11 9/16	1 12/16	Water(5 5/16)	1 12/16	66	7 8/16	**7 8/16**
	Start	13:00	0:15	13 5/16	1 12/16	7 2/16	1 12/16	66	7 4/16	**7 6/16**
9	End	13:15		15	1 11/16	8 13/16	1 11/16	70	7 1/16	**7 1/16**
	Start	13:30	0:15	Water(5 2/16)	1 11/16	9 8/16	11/16	70	5 14/16	**6 14/16**
10	End	13:45		6 15/16	1 13/16	11 2/16	1 10/16	70	5 12/16	**6 15/16**
	Start	14:00	0:15	8 8/16	1 9/16	12 11/16	1 9/16	70	5 9/16	**6 12/16**
11	End	14:15		10 1/16	1 9/16	14 3/16	1 8/16	70	5 6/16	**6 10/16**
	Start	14:30	0:15	11 8/16	1 7/16	Water (5 5/16)	1 8/16	70	6 3/16	**6 6/16**
12	End	14:45		12 13/16	1 5/16	6 15/16	1 10/16	72	6 3/16	**5 14/16**
	Start	15:00	0:15	14 1/16	1 4/16	8 6/16	1 7/16	72	5 14/16	**5 9/16**
13	End	15:15		Water(5 12/16)	1 3/16	9 10/16	1 4/16	72	5 10/16	**5 3/16**
	Start	15:30	0:15	7	1 4/16	10 15/16	1 5/16	72	5 7/16	**5**
14	End	15:45		8 3/16	1 3/16	12 3/16	1 4/16	73	5 5/16	**4 14/16**
	Start	16:00	0:15	9 5/16	1 2/16	13 7/16	1 4/16	74	5	**4 12/16**
15	End	16:15		10 7/16	1 2/16	14 11/16	1 4/16	75	5 1/16	**4 11/16**
	Start	16:30	0:15	11 9/16	1 2/16	15 15/16	1 4/16	76	5	**4 9/16**
16	End	16:45		12 11/16	1 2/16					

Infiltration Rate (Inch/Hour): ***4 11/16 =4.7***

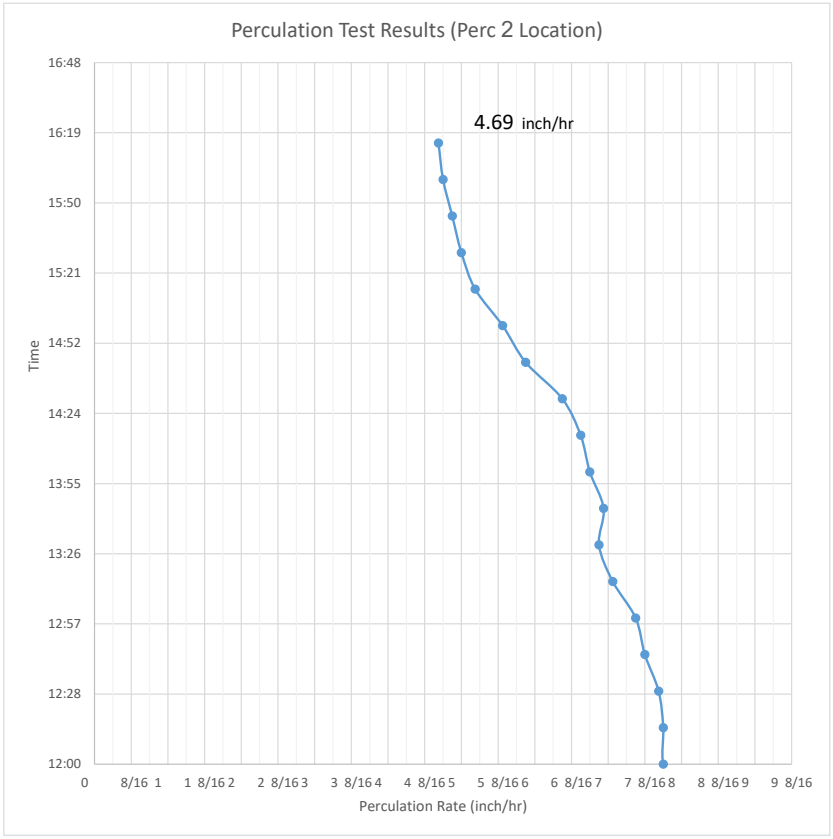
GEO ENVIRONMENTAL RESOURCES INC
GEOTECHNICAL ENVIRONMENTAL CONSULTANTS

Double Ring Infiltration Test Data

ASTM D3385 – 18 & City Guide

Date of Test **4/14/2021**

		Inner Ring Diameter:	12 inch	Liquid:	Tap Water
Project Name:	**Proposed Tilt-up**	Outer Ring Diameter:	24 inch	Liquid Temperature:	63°-70° f
Project Address:	**23628 Water Street, Perris**	Height Of Ring:	24 inch	Type of Test:	Falling Head
		Depth to the Soil:	6 Inch	Weather Temperature:	65°-90° f
Project number:	**G-021422**	Method of measuring the surface of the water :	Laser	Weather:	Sunny
				Soil Type:	Native Soil



Appendix 4: Historical Site Conditions

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

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

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

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

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

SITE LOCATION

DESIGN STORM DEPTH = 0.59 IN

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

N

Rain Gage Locations

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

Isohyetal Map for the 85th Percentile 24 hour Storm Event

July 2011

Santa Ana Watershed - BMP Design Volume, V_{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	Armstrong & Brooks Consulting Engineers	Date	6/15/2023
Designed by	Joshua Groenheim	Case No	
Company Project Number/Name	121.1999 Thrifty Perris Tobacco Road		

BMP Identification

BMP NAME / ID: UNDERGROUND DETENTION CHAMBER 1

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85}= 0.59 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA A	*398,102*	*Mixed Surface Types*	*0.873017217*	*0.69*	*275536.6*			
	398102		***Total***		**275536.6**	**0.59**	***13547.2***	***16,143***

Notes:

Infiltration Basin - Design Procedure (Rev. 03-2012)	BMP ID CHAMBER 1	Legend:	Required Entries / Calculated Cells

Company Name: ARMSTRONG & BROOKS — Date: 2/23/2023

Designed by: JOSHUA GROENHEIM — County/City Case No.:

Design Volume

a) Tributary area (BMP subarea)	A_T =	9.1	acres
b) Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	13,547	ft^3

Maximum Depth

a) Infiltration rate	I =	4.7	in/hr
b) Factor of Safety (See Table 1, Appendix A: "Infiltration Testing" from this BMP Handbook)	FS =	3	
c) Calculate D_1 $D_1 = \frac{I\ (in/hr) \times 72\ hrs}{12\ (in/ft) \times FS}$	D_1 =	9.4	ft
d) Enter the depth of freeboard (at least 1 ft)		1	ft
e) Enter depth to historic high ground water (measured from **top** of basin)		50	ft
f) Enter depth to top of bedrock or impermeable layer (measured from **top** of basin)		10	ft
g) D_2 is the smaller of: Depth to groundwater - (10 ft + freeboard) and Depth to impermeable layer - (5 ft + freeboard)	D_2 =	4.0	ft
h) D_{MAX} is the smaller value of D_1 and D_2 but shall not exceed 5 feet	D_{MAX} =	4.0	ft

Basin Geometry

a) Basin side slopes (no steeper than 4:1)	z =		:1
b) Proposed basin depth (excluding freeboard)	d_B =	0.3333	ft
c) Minimum bottom surface area of basin ($A_S = V_{BMP}/d_B$)	A_S =	40645	ft^2
d) Proposed Design Surface Area	A_D =	59679	ft^2

Forebay

a) Forebay volume (minimum 0.5% V_{BMP})	Volume =	68	ft^3
b) Forebay depth (height of berm/splashwall. 1 foot min.)	Depth =		ft
c) Forebay surface area (minimum)	Area =		ft^2
d) Full height notch-type weir	Width (W) =		in

Notes:

	SITE ELEVATION (ft)	Relative Elevation (in)	Chamber Storage Volume (cf)	Stone storage volume (cf)	Cumulative Volume increment (cf)	Cumulative storage volume (cf)
Stone	40.53	54.30	47.20	41.47	2.25	88.67
	40.36	52.30	47.20	39.21	2.25	86.41
	40.19	50.30	47.20	36.96	2.25	84.16
	40.03	48.30	47.20	34.70	2.25	81.90
	39.86	46.30	47.20	32.45	2.25	79.65
	39.69	44.30	47.20	30.20	2.25	77.40
ChamberMaxx Chambers	39.53	42.30	47.20	27.94	0.62	75.14
	39.42	41.00	47.20	27.32	1.13	74.52
	39.33	40.00	47.20	26.19	1.13	73.39
	39.25	39.00	47.20	25.07	1.13	72.27
	39.17	38.00	47.20	23.94	1.56	71.14
	39.08	37.00	46.48	23.10	1.76	69.58
	39.00	36.00	45.43	22.39	1.83	67.82
	38.92	35.00	44.26	21.74	1.90	65.99
	38.83	34.00	42.97	21.12	1.96	64.09
	38.75	33.00	41.58	20.55	2.02	62.13
	38.67	32.00	40.09	20.02	2.07	60.11
	38.58	31.00	38.53	19.52	2.11	58.05
	38.50	30.00	36.89	19.05	2.15	55.94
	38.42	29.00	35.18	18.61	2.18	53.79
	38.33	28.00	33.42	18.18	2.22	51.60
	38.25	27.00	31.60	17.78	2.24	49.39
	38.17	26.00	29.74	17.40	2.27	47.14
	38.08	25.00	27.84	17.03	2.29	44.87
	38.00	24.00	25.90	16.68	2.31	42.58
	37.92	23.00	23.93	16.35	2.33	40.27
	37.83	22.00	21.92	16.02	2.35	37.94
	37.75	21.00	19.88	15.71	2.37	35.59
	37.67	20.00	17.82	15.41	2.39	33.23
	37.58	19.00	15.72	15.12	2.40	30.84
	37.50	18.00	13.59	14.85	2.42	28.44
	37.42	17.00	11.43	14.58	2.45	26.01
	37.33	16.00	9.23	14.34	2.47	23.57
	37.25	15.00	6.99	14.10	2.50	21.10
	37.17	14.00	4.71	13.89	2.52	18.60
	37.08	13.00	2.38	13.69	2.56	16.08
Stone	37.00	12.00	0.00	13.52	2.25	13.52
	36.83	10.00	0.00	11.27	2.25	11.27
	36.67	8.00	0.00	9.01	2.25	9.01
	36.50	6.00	0.00	6.76	2.25	6.76
	36.33	4.00	0.00	4.51	2.25	4.51
	36.17	2.00	0.00	2.25	0.00	2.25
	36.00					

SEE NEXT PAGE (PG. 2) FOR CONTINUATION

SITE ELEVATION	OUTLET DESCRIPTION AND ELEVATION	FLOOD CONTROL STAGE	∑OUTFLOW FROM CHAMBERS	FLOOD CONTROL STORAGE VOLUME	FLOOD CONTROL STORAGE VOLUME	CUMUMULATIVE CHAMBER STORAGE	n=	1607 chambers
(ft)		(ft)	(CFS)	(AC*FT)	(CF)	(cf)		
40.53				2.402	104613	120757		
40.36				2.318	100992	117135		
40.19				2.235	97370	113513		
40.03				2.152	93748	109892		
39.86				2.069	90127	106270		
39.69				1.986	86505	102649		
39.53		2.167	11.170	1.903	82884	99027		
39.42		2.083	10.228	1.880	81880	98023		
39.33		2.000	8.511	1.838	80069	96212		
39.25		1.917	5.677	1.797	78258	94401		
39.17		1.833	3.282	1.755	76447	92591		
39.08		1.750	1.430	1.697	73942	90086		
39.00	(4) 39.00 CREST ELEV. RISERS	1.667	0.411	1.633	71120	87263		
38.92		1.583	0.398	1.565	68176	84319		
38.83		1.500	0.386	1.495	65122	81266		
38.75		1.417	0.372	1.423	61970	78113		
38.67		1.333	0.358	1.348	58728	74872		
38.58		1.250	0.344	1.272	55408	71551		
38.50		1.167	0.329	1.194	52016	68160		
38.42		1.083	0.313	1.115	48562	64705		
38.33		1.000	0.296	1.034	45051	61194		
38.25		0.917	0.278	0.952	41490	57634		
38.17		0.833	0.258	0.870	37885	54029		
38.08		0.750	0.237	0.786	34240	50384		
38.00		0.667	0.212	0.702	30559	46703		
37.92		0.583	0.182	0.616	26845	42988		
37.83	[(6) 1" diameter holes] 37.83 Elevation	0.500	0.123	0.530	23100	39243		
37.75		0.417	0.112	0.444	19325	35468		
37.67		0.333	0.100	0.356	15521	31664		
37.58		0.250	0.087	0.268	11688	27831		
37.50		0.167	0.071	0.180	7825	23968		
37.42		0.083	0.050	0.090	3930	20073		
37.33	[(6) 1" diameter holes] 37.33 Elevation				0	16143		POLLUTANT CONTROL WATER SURFACE LEVEL
37.25						12176		
37.17						8166		
37.08						4110		
37.00						0		
36.83						0		
36.67						0		
36.50						0		
36.33						0		
36.17						0		
36.00								

ChamberMaxx Project Details

Description

The ChamberMaxx corrugated, open-bottom plastic infiltration chamber system allows you to meet stormwater runoff reduction requirements and maximize available land space by providing economic infiltration below grade. ChamberMaxx maximizes storage volume in a small footprint, and its low-profile shape is ideal for sites with shallow footprints.

Project Information

Project Name 20863 - 121.1999 Thrifty Oil Perris
Location Perris, CA
Date March 27 2023

Design Parameters	
Pretreatment Method	Hydrodynamic Separator
Storage Volume	72219ft³
Limiting Length	290ft
Limiting Width	100ft
Invert Depth	7ft
Number of Headers	1
Header Diameter	24in
Spacing Between Chambers	5.6in
Porous Stone Width at Sides	12in
Porous Stone Width at Ends	12in
Porous Stone Width at Above	12in
Porous Stone Width at Below	12in
Porosity	40%
Include Porous Storage Between Chambers	Yes

Chamber Information	
Start Units	72
Middle Units	1463
End Units	72
Required Chambers	1607
Manifold Tees	71
Manifold Elbows	1
Number of Rows	72
Chambers per Row	39
Storage Calculations	
Chamber Storage	75994.4ft³
Header Storage	2589.23ft³
Porous Stone Storage	72310.33ft³
Total Storage Provided	150128.82ft³
Percentage of Storage Provided	207.88%
System Dimensions and Other Mat'l	
Rectangular Footprint	171.18x343.53ft
Total Excavation	17423.5y³
Stone Backfill	6681.97y³
Remaining Backfill to Pavement	7568.33y³
Woven Geotextile Qty	0y²
Non-Woven Geotextile Qty	6533.81y²
Scour Protection Fitting	343.53x7.5ft
Approximate Truckloads	7

PROJECT SUMMARY

DESIGN PARAMETERS

- PRETREATMENT METHOD = Hydrodynamic Separator
- STORAGE VOLUME REQUIRED = 72219ft³
- INVERT DEPTH = 7ft
- MANIFOLD DIAMETER = 24in.
- SPACING BETWEEN CHAMBERS = 5.6in.
- SIDE PERIMETER STONE WIDTH = 12in.
- END PERIMETER STONE WIDTH = 12in.
- TOP PERIMETER STONE WIDTH = 12in.
- BOTTOM PERIMETER STONE WIDTH = 12in.
- STONE POROSITY = 40%

SYSTEM DETAILS

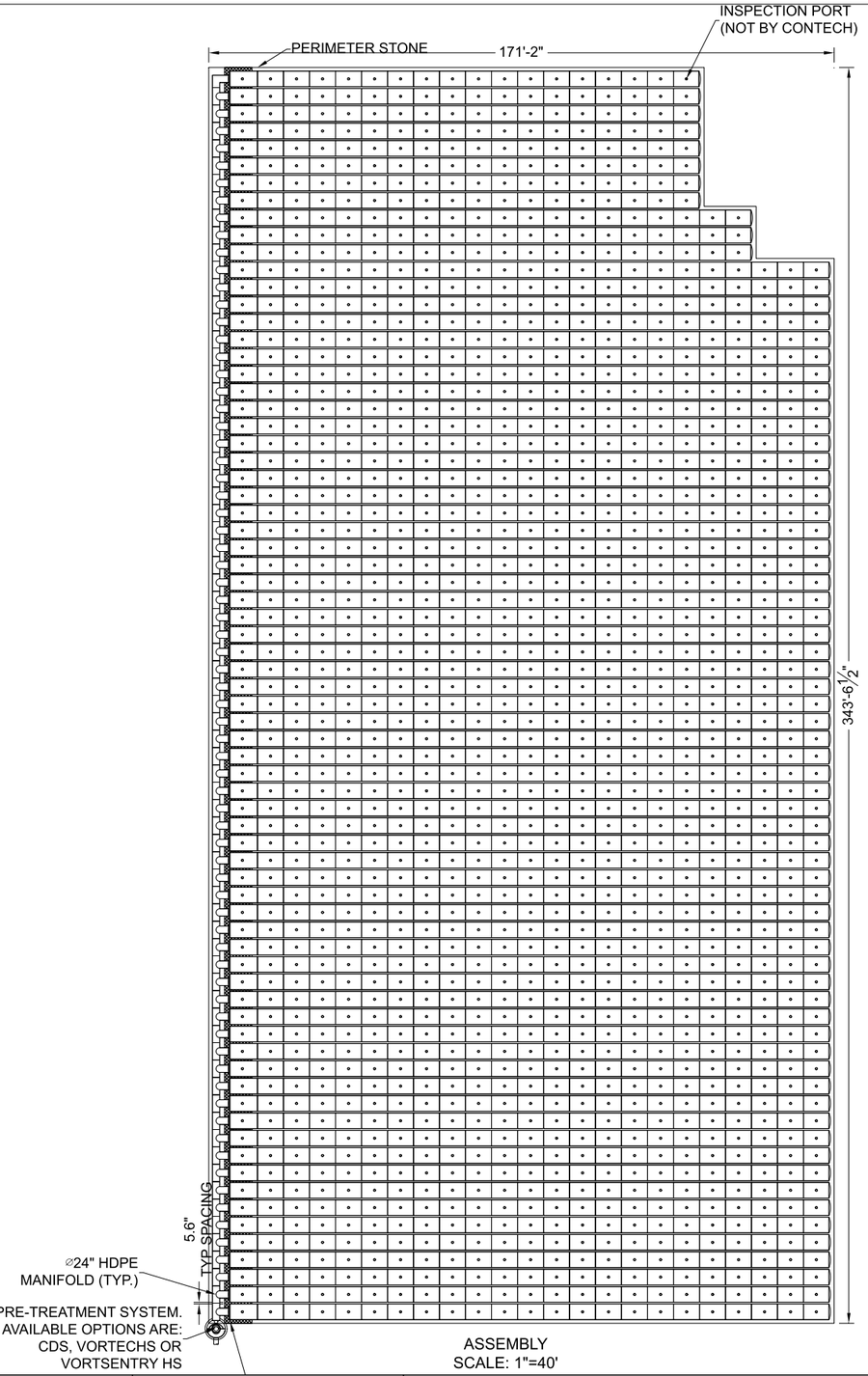
- TOTAL ELBOW MANIFOLDS = 1
- TOTAL TEE MANIFOLDS = 71
- TOTAL START CHAMBERS = 72
- TOTAL MID CHAMBERS = 1463
- TOTAL END CHAMBERS = 72
- TOTAL NUMBER OF CHAMBERS = 1607
- NUMBER OF ROWS = 72
- CHAMBERS PER ROW = 39
- CHAMBER STORAGE VOLUME = 75994.4ft³
- MANIFOLD STORAGE VOLUME = 1824.09ft³
- BACKFILL STORAGE VOLUME = 72310.33ft³
- TOTAL STORAGE PROVIDED = 150128.82ft³

SYSTEM DIMENSIONS AND OTHER MATERIALS

- RECTANGULAR FOOTPRINT = 171.18x343.53ft
- TOTAL EXCAVATION = 17423.5y³
- STONE BACKFILL = 6681.97y³
- REMAINING BACKFILL TO PAVEMENT = 7568.33y³
- WOVEN GEOTEXTILE QTY = 0y²
- NON-WOVEN GEOTEXTILE QTY = 6533.81y²
- SCOUR PROTECTION FITTING = 343.53x7.5ft
- APPROXIMATE TRUCKLOADS = 7

GENERAL NOTES

1. ALL ELEVATIONS, DIMENSIONS AND LOCATIONS OF RISERS AND INLETS SHALL BE VERIFIED BY THE ENGINEER OF RECORD.
2. PRIOR TO INSTALLATION OF THE CHAMBERMAXX SYSTEM A PRE-CONSTRUCTION MEETING SHALL BE CONDUCTED. THOSE REQUIRED TO ATTEND ARE THE SUPPLIER OF THE SYSTEM, THE GENERAL CONTRACTOR, SUB-CONTRACTORS AND THE ENGINEER.
3. CHAMBERMAXX CHAMBERS ARE MANUFACTURED FROM POLYPROPYLENE PLASTIC.
4. CHAMBERMAXX SYSTEM TO MEET AASHTO HS20/HS25 LIVE LOADING, PER AASHTO LRFD SECTION 12.
5. ACCESS COVERS TO MEET AASHTO HS20/HS25 LIVE LOADING.
6. MINIMUM COVER IS 18-INCHES TO BOTTOM OF FLEXIBLE PAVEMENT OR TO TOP OF RIGID PAVEMENT. FOR COVER HEIGHTS GREATER THAN 96-INCHES CONTACT YOUR LOCAL REPRESENTATIVE.
7. ALL PARTS PROVIDED BY CONTECH UNLESS OTHERWISE NOTED.
8. FOR INFORMATION ON PRE-TREATMENT SYSTEMS, REFERENCE CONTECH PRE-TREATMENT SYSTEM STANDARD DETAILS OR CONTACT YOUR LOCAL REPRESENTATIVE.
9. CHAMBERMAXX BY CONTECH ENGINEERED SOLUTIONS (800) 925-5240



ASSEMBLY
SCALE: 1"=40'

MARK	DATE	REVISION DESCRIPTION	BY

CONTECH® ENGINEERED SOLUTIONS LLC
www.ContechES.com
8301 State Highway 29 North, Alexandria, MN 56308
800-328-2047 320-852-7500 320-852-7067 FAX

CHAMBERMaxx® PATENT PENDING

CONTECH
DYODS
DRAWING

DYO20863 121.1999 Perris Thrifty

121.1999 Thrifty Oil Perris

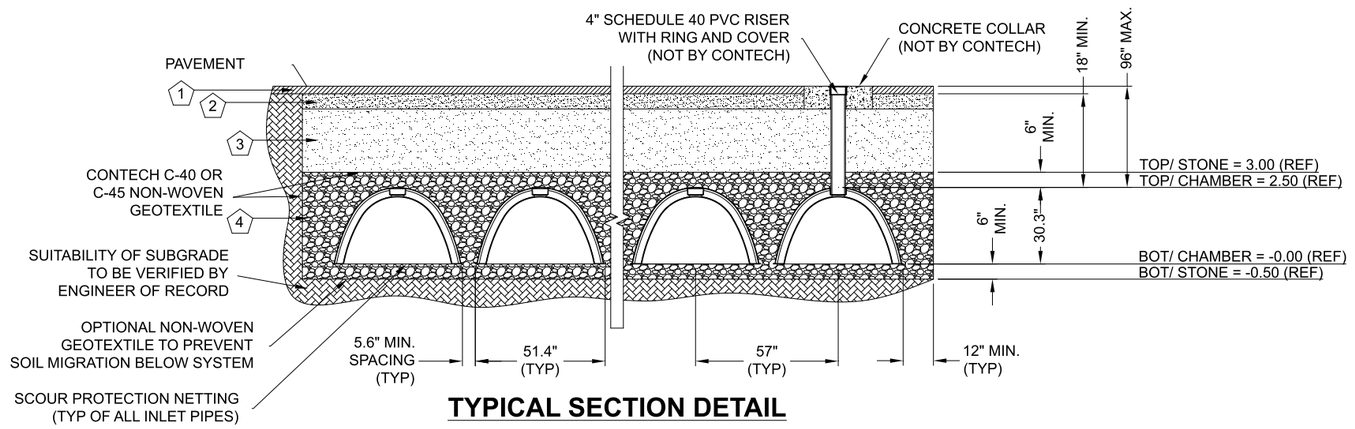
Perris, CA

CHAMBERMAXX

PROJECT No.:	SEQ. No.:	DATE:
13576	20863	03/27/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D1 OF D4		

INSTALLATION NOTES

1.CHAMBERMAXX INSTALLATION GUIDE TO BE REVIEWED BY CONTRACTOR PRIOR TO INSTALLATION.
2.PRIOR TO PLACING BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, UNSUITABLE MATERIAL SHALL BE REMOVED AND BROUGHT BACK TO GRADE WITH FILL MATERIAL AS APPROVED BY THE ENGINEER OF RECORD. ONCE THE FOUNDATION PREPARATION IS COMPLETE, THE BEDDING MATERIAL CAN BE PLACED.
3.THE SCOUR PROTECTION NETTING TO EXTEND 1'-0" BEYOND OUTSIDE EDGE OF INLET CHAMBERS.
4.COVER ANY OPEN VOID SPACES GREATER THAN 3/4" ON CHAMBERS WITH A NON-WOVEN GEOTEXTILE TO PREVENT INFILTRATION OF BACKFILL MATERIAL.
5.STONE EMBEDMENT MATERIAL SHALL BE INSTALLED TO 95% STANDARD PROCTOR DENSITY AND PLACED IN 6-INCH TO 8-INCH LIFTS SUCH THAT THERE IS NO MORE THAN A TWO LIFT DIFFERENTIAL BETWEEN ANY OF THE CHAMBERS AT ANY TIME. GRANULAR BACKFILL MATERIAL SHALL BE COMPACTED TO 90% SPD. BACKFILLING SHALL BE ADVANCED ALONG THE LENGTH OF THE CHAMBER ROWS AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING AND DISPLACEMENT OF THE CHAMBERS. THE MINIMUM CHAMBER SPACING MUST BE MAINTAINED.
6.REFER TO CHAMBERMAXX INSTALLATION GUIDE FOR TEMPORARY CONSTRUCTION LOADING GUIDELINES.
7.IT IS ALWAYS THE CONTRACTOR'S RESPONSIBILITY TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.
8.GENERAL INSTALLATION METHODS AND MATERIALS TO BE IN ACCORDANCE WITH ASTM D2321.



TYPICAL SECTION DETAIL

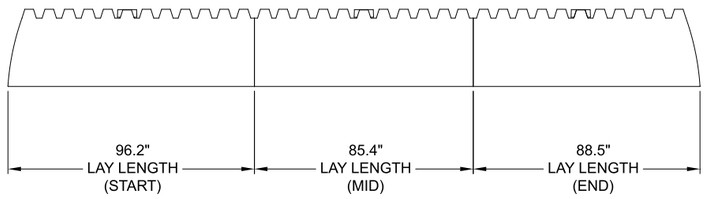
NOT TO SCALE

KEY
1. FLEXIBLE PAVEMENT.
2. GRANULAR ROAD BASE.
3. ANY SUITABLE NATIVE OR GENERAL BACKFILL, SEE ENGINEER PLANS.
4. THE BACKFILL MATERIAL SHALL BE FREE-DRAINING ANGULAR WASHED STONE 3/4" - 2" PARTICLE SIZE. MATERIAL SHALL BE PLACED IN 8"-10" MAXIMUM LIFTS. MATERIAL SHALL BE WORKED INTO THE CHAMBER SPACING BY MEANS OF SHOVEL-SLICING, RODDING, AIR-TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS. COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE PROJECT ENGINEER OR THEIR REPRESENTATIVE IS SATISFIED WITH THE LEVEL OF COMPACTION. INADEQUATE COMPACTION CAN LEAD TO EXCESSIVE DEFLECTIONS WITHIN THE SYSTEM AND SETTLEMENT OF THE SOILS OVER THE SYSTEM. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO-LIFT DIFFERENTIAL BETWEEN THE SIDES OF ANY CHAMBER IN THE SYSTEM AT ALL TIMES DURING THE BACKFILL PROCESS. BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON ANY PIPES IN THE SYSTEM.

EQUIPMENT USED TO PLACE AND COMPACT THE BACKFILL SHALL BE OF A SIZE AND TYPE SO AS NOT TO DISTORT, DAMAGE, OR DISPLACE THE CHAMBERS. ATTENTION MUST BE GIVEN TO PROVIDING ADEQUATE MINIMUM COVER FOR SUCH EQUIPMENT, AND MAINTAIN BALANCED LOADING ON ALL CHAMBERS IN THE SYSTEM, DURING ALL SUCH OPERATIONS.

OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS. CONTACT YOUR LOCAL CONTECH REPRESENTATIVE FOR DETAILS.

CHAMBERMAXX DESIGN DETAILS			
FEATURE	START CHAMBER	MIDDLE CHAMBER	END CHAMBER
OVERALL CHAMBER HEIGHT - IN	30.3	30.3	30.3
OVERALL CHAMBER WIDTH - IN	51.4	51.4	51.4
ACTUAL LENGTH - IN	98.4	91.0	92.0
INSTALLED LAY LENGTHS - IN	96.2	85.4	88.5
CHAMBER STORAGE VOLUME - CF	50.2	47.2	46.2
CHAMBER STORAGE PER LINEAR FOOT - CF/LF	6.3	6.6	6.3
*MIN. INSTALLED CHAMBER VOLUME - CF	78.1	75.1	74.1
*MIN. INSTALLED CHAMBER VOLUME PER LINEAR FOOT - CF/LF	9.7	10.6	10.0
CHAMBER WEIGHT - LB	83	73	76
*6" OF STONE ABOVE AND BELOW CHAMBER, 5.6" CHAMBER SPACING AND 40% POROSITY			



TYPICAL ELEVATION VIEW

NOT TO SCALE

MARK	DATE	REVISION DESCRIPTION	BY

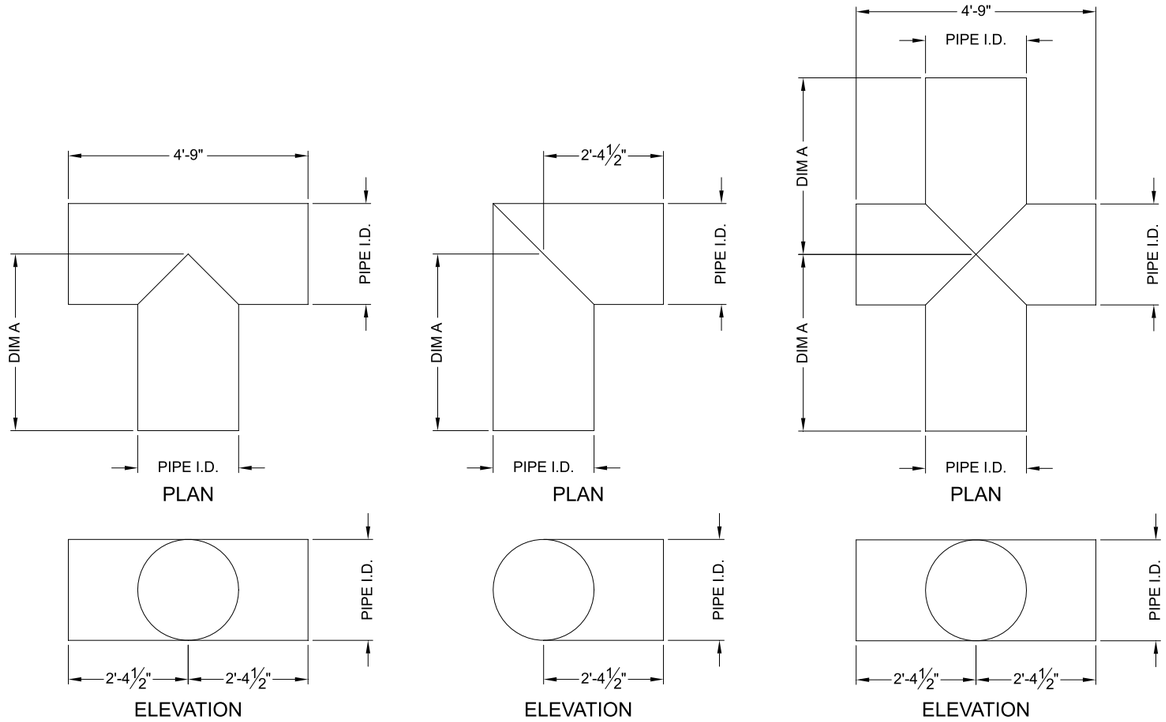
CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
8301 State Highway 29 North, Alexandria, MN 56308
800-328-2047 320-852-7500 320-852-7067 FAX

CHAMBERMaxx®
PATENT PENDING

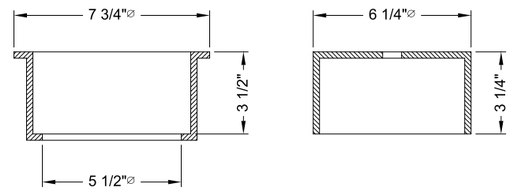
CONTECH
DYODS
DRAWING

DYO20863 121.1999 Perris Thrifty
121.1999 Thrifty Oil Perris
Perris, CA
CHAMBERMAXX

PROJECT No.:	SEQ. No.:	DATE:
13576	20863	03/27/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D2 OF D4		

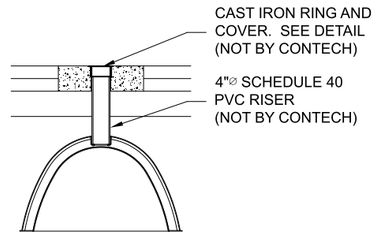


TEE **ELBOW** **CROSS-OVER**



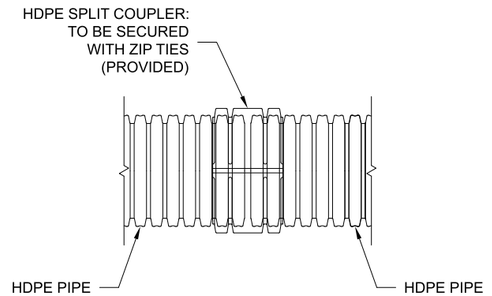
RING AND COVER DETAIL

NOT TO SCALE



INSPECTION PORT DETAIL

NOT TO SCALE



HDPE SPLIT COUPLER DETAIL

STANDARD MANIFOLD COMPONENTS - NOT TO SCALE				
	AVAILABLE DIAMETERS - INCHES			
TEE	12	15	18	24
ELBOW	12	15	18	24
DIM A	42	42	48	48

GENERAL NOTES:

1. FITTING MATERIAL TO BE MANUFACTURED FROM CORRUGATED HIGH DENSITY POLYETHYLENE, AASHTO M294 PIPE.
2. FITTINGS TO BE FABRICATED IN ACCORDANCE WITH THE REQUIREMENT OF AASHTO M294.
3. FITTINGS DESIGNED TO PROTRUDE 6" INTO THE END OF THE INLET CHAMBERS.
4. MANIFOLD TEE AND ELBOW JOINT TO BE CONNECTED UTILIZING HDPE SPLIT COUPLERS.

TYPICAL MANIFOLD DETAILS

HDPE SPLIT COUPLERS	
COUPLER SIZE	PART NUMBER
12"⌀ SPLIT COUPLER	PEF12SPCP
15"⌀ SPLIT COUPLER	PEF15SPCP
18"⌀ SPLIT COUPLER	PEF18SPCP
24"⌀ SPLIT COUPLER	PEF24SPCP

MARK	DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
8301 State Highway 29 North, Alexandria, MN 56308
800-328-2047 320-852-7500 320-852-7067 FAX

CHAMBERMaxx® PATENT PENDING

CONTECH
DYODS
DRAWING

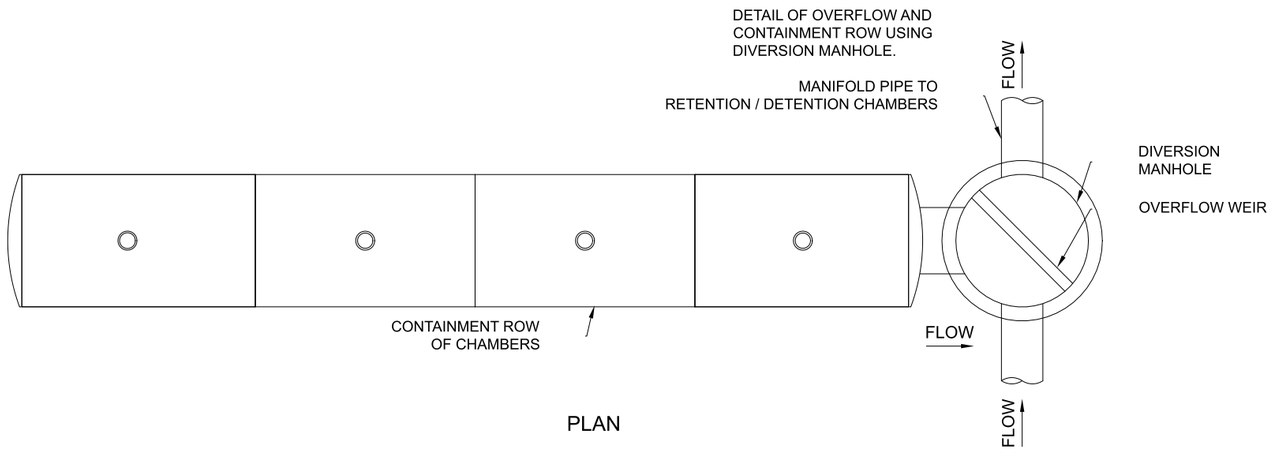
DYO20863 121.1999 Perris Thrifty

121.1999 Thrifty Oil Perris

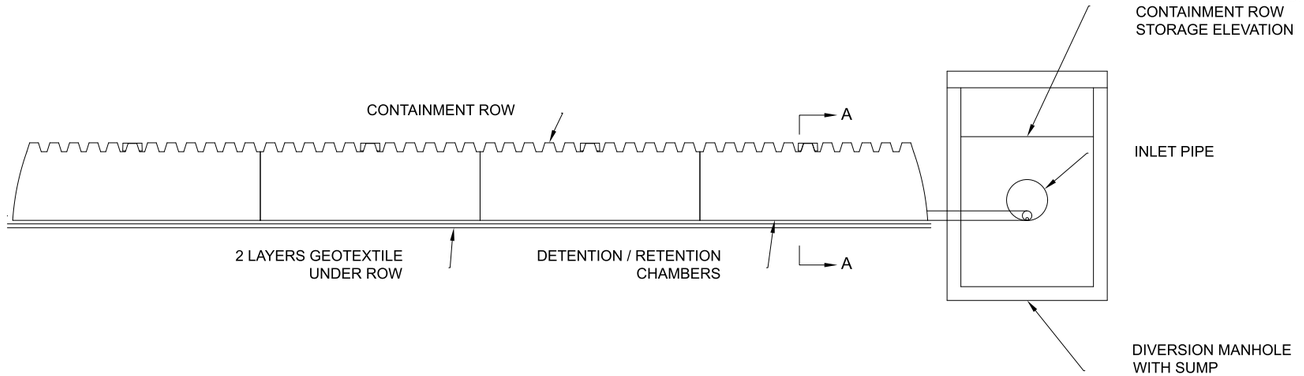
Perris, CA

CHAMBERMAXX

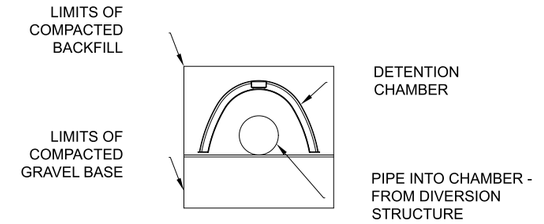
PROJECT No.:	SEQ. No.:	DATE:
13576	20863	03/27/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D3 OF D4		



PLAN



ELEVATION



SECTION A-A

CONTAINMENT ROW DETAILS

NOT TO SCALE

MARK	DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
8301 State Highway 29 North, Alexandria, MN 56308
800-328-2047 320-852-7500 320-852-7067 FAX

CHAMBERMaxx®
PATENT PENDING

CONTECH
DYODS
DRAWING

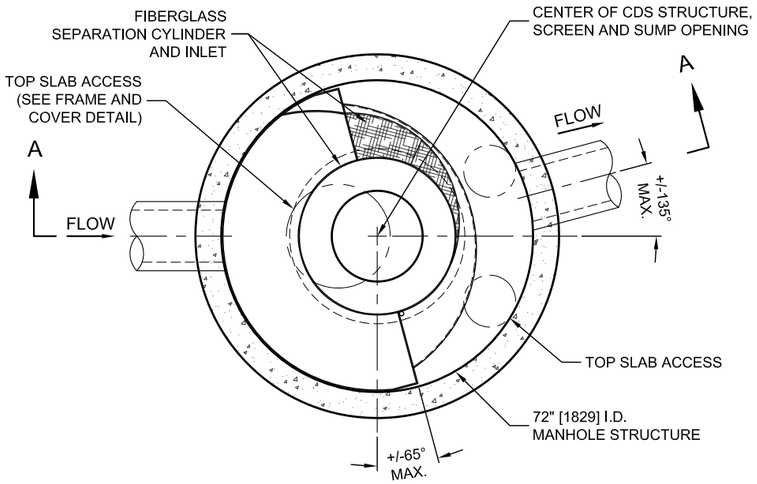
DYO20863 121.1999 Perris Thrifty

121.1999 Thrifty Oil Perris

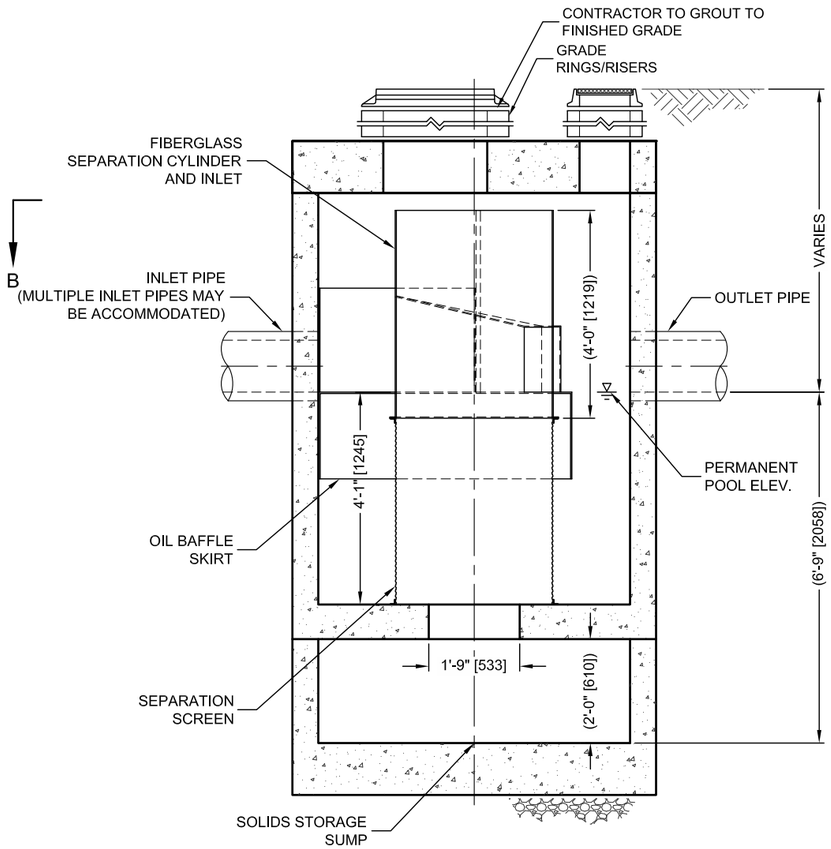
Perris, CA

CHAMBERMAXX

PROJECT No.:	SEQ. No.:	DATE:
13576	20863	03/27/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D4 OF D4		



PLAN VIEW B-B
N.T.S.

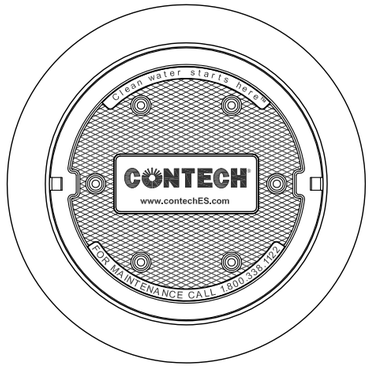


ELEVATION A-A
N.T.S.

CDS3035-6-C DESIGN NOTES

THE STANDARD CDS3035-6-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

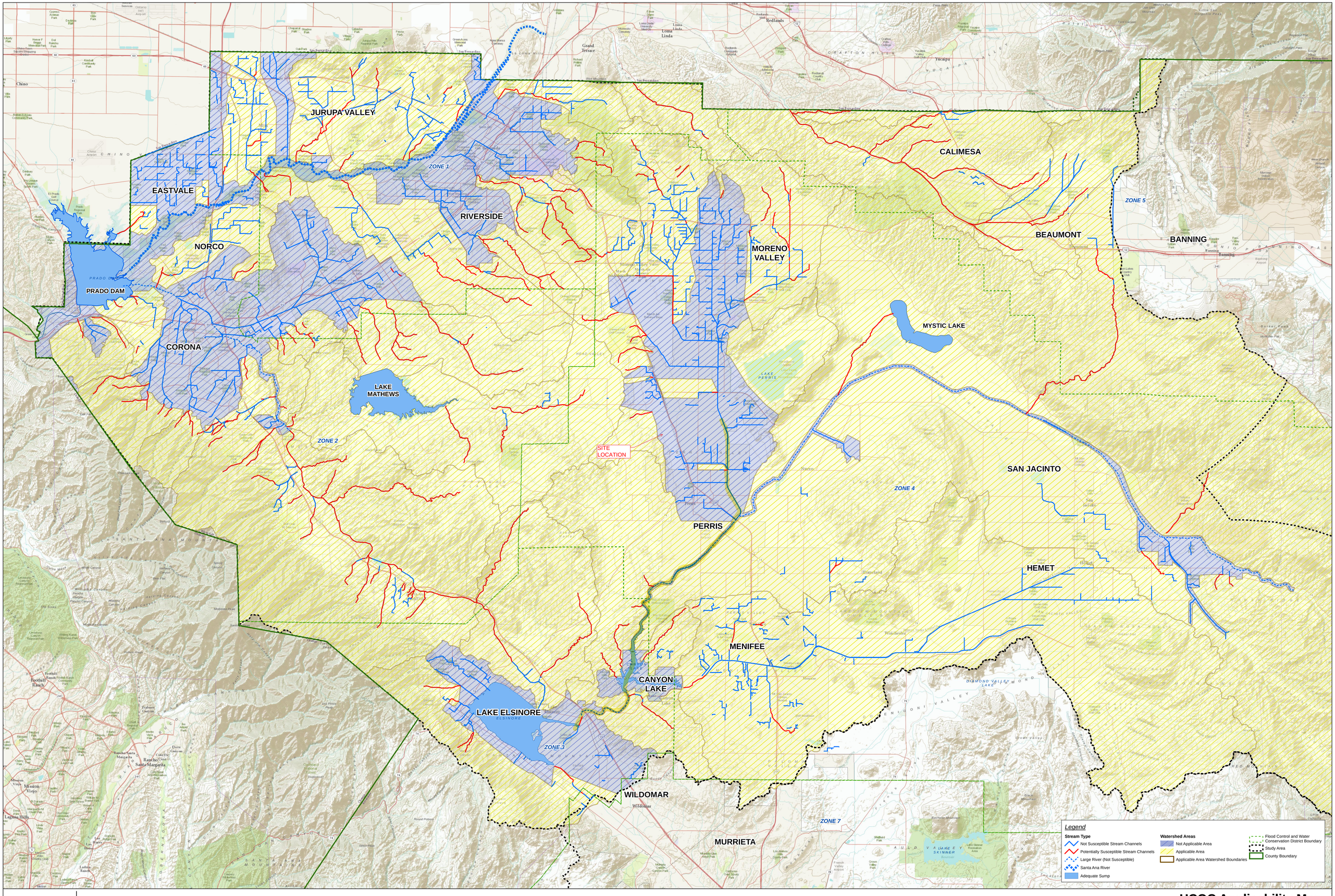
INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS3035-6-C
INLINE CDS
STANDARD DETAIL

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern



HCOC Applicability Map

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

Map 2

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included 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/Downloads/LandscapeGardenBrochure.pdf** ☐ **Provide IPM information to new owners, lessees and operators.**

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included 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

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included 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/

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included 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

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included 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 shutoff 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.**

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included 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/**

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included 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.**

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included 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**

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included 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

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included 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

Appendix 10: Educational Materials

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

CONTECH®
ENGINEERED SOLUTIONS

ChamberMaxx®
Design Guide

Table of Contents

CONTECH®
ENGINEERED SOLUTIONS

Detention System Design Tools

Design Your Own Detention System (DYODS®)

Contech's DYODS is an exclusive, online design tool that allows you to design your own detention or infiltration system. DYODS fully automates the layout process for stormwater detention and infiltration systems and produces CAD and PDF files that can be used for creating plans and specs, and for estimating total installed costs.

Features of the new tool include:

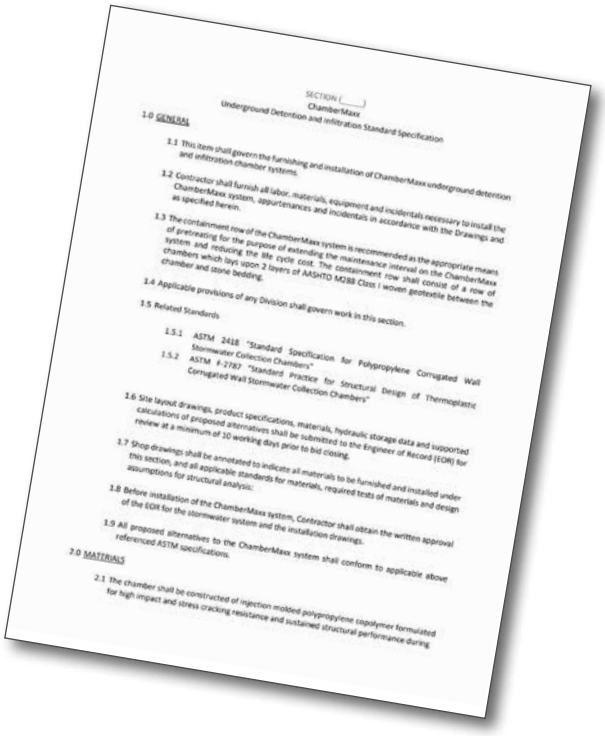
- Optimizes design and layout for cost efficiency
- "Drag and drop" feature allow users to customize layout
- Design multiple systems per project and save for future use
- Provides instant access to customized, project specific drawings
- CAD/PDF files provided for use in creating plans and specs

The DYODS tool is available at www.conteches.com/DYO.

Online Product Design Worksheet (PDW)

Our in-house team of engineers can support you through the entire permitting process. Just enter your information into the online form, and one of our in-house engineers will contact you with specific recommendations for your project.

The Detention Product Design Worksheet is available at www.conteches.com/detentionpdw



Engineering Services & Support

Contech has regional engineering offices and local stormwater consultants trained to provide the following services:

- Regulatory guidance and permitting assistance
- Preliminary standard details and/or site specific final drawings and specifications
- Low Impact Development design assistance
- Engineering calculations for hydraulics/hydrology, buoyancy, and stage-storage
- Review of preliminary site design, feasibility screening, and layout assistance
- Value Engineering - cost estimates and options analysis
- Pre-construction support, project scheduling, and contractor coordination
- Installation and construction support
- Maintenance support, including: guidance manuals, training/demonstrations, and certified contractor identification

ChamberMaxx Overview

The ChamberMaxx corrugated, open-bottom chamber system allows you to meet runoff reduction requirements by providing economic infiltration. Design your low impact development (LID) site by incorporating this belowgrade system to maximize available land for development or green space. ChamberMaxx is most effective on sites where the depth from finished grade to storm sewer outlet is less than 54-inches (1.37-meters).

The ChamberMaxx polypropylene stormwater detention/infiltration chamber has undergone extensive development and structural qualification investigation meeting the performance requirements of the ASTM F2418 Standard Specification for Polypropylene Corrugated Wall Stormwater Collection Chambers. The following is a summary of the design qualification.

The ChamberMaxx chamber is produced by an injection molding process with a high quality UV stabilized co-polymer polypropylene which meets the ASTM F2418 material classification requirement as PP0330B99945 per ASTM D4101. An extensive test program demonstrates that the ChamberMaxx chambers exceed the minimum material performance requirements set forth by the product specification for short term and both 50 and 75 year strength, stiffness, and toughness, including material environmental stress crack resistance (ESCR) which exceeds industry requirements.

The ChamberMaxx structural qualification to ASTM F2418 includes a CANDE FEA predicted installed structural performance which safely meets the AASHTO LRFD Section 12 Design Specification for Buried Structures. As required, performance verification through full scale installation and monitoring was conducted in successful support of the safety of the chamber design and installation.

The ChamberMaxx chamber installation was evaluated for safety with AASHTO load factors for the vehicle and earth fill condition of 1.75 and 1.95 respectively. The general installation capabilities in accordance with AASHTO are:

- Live Load AASHTO Design Truck HS25 (HL93)
- Minimum Cover (HS25): 18 in.
- Maximum Cover, 75 years: 8 ft.

Chamber Manufacturing

The ChamberMaxx chamber and virtually all of its materials of construction are manufactured at ISO 9001 certified US facilities. The chambers are produced with state of the art structural web injection molding equipment resulting in a reliable, high quality product. Weighing approximately 80 pounds, the chamber has a minimum average wall thickness of .175 inches (4.45 mm) and measures approximately 51 x 30 x 91 inches (1.30 x .76 x 2.31 meters) in overall dimension.

A ChamberMaxx system is comprised of start chambers, middle chambers, and end chambers. The end cap of the chamber is integrated into the start and end chambers, thereby making chamber installation fast and efficient.

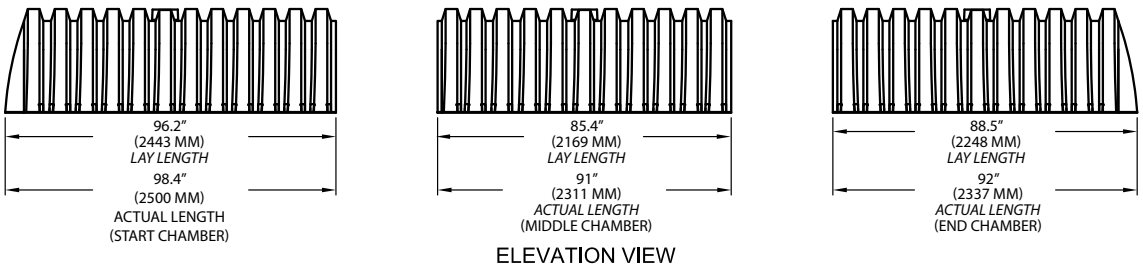
Application-System Configurations

The open-bottom plastic chamber allows infiltration into surrounding soil, effectively achieving runoff reduction objectives often required by an LID design. By utilizing subsurface infiltration, space is preserved for development, runoff is reduced or eliminated and groundwater recharge can occur. The ChamberMaxx is ideal when you need to maximize storage capacity in a shallow footprint.

Subsurface Infiltration

An open bottom plastic chamber the ChamberMaxx allows infiltration into surrounding soils, effectively achieving runoff reduction objectives often required by in an LID (low impact development) design.

Best practice designs for subsurface infiltration include pretreatment to reduce cost and frequency of maintenance while ensuring the infiltration capacity of the facility. Contech has multiple options for pretratment.



ELEVATION VIEW

Bioretention

ChamberMaxx is designed with a minimum of 6" stone above and below the units. The ChamberMaxx can help make bioretention practical by storing 75.1 CF per unit, including storage in stone, before discharging back into the surrounding soil.

Detention

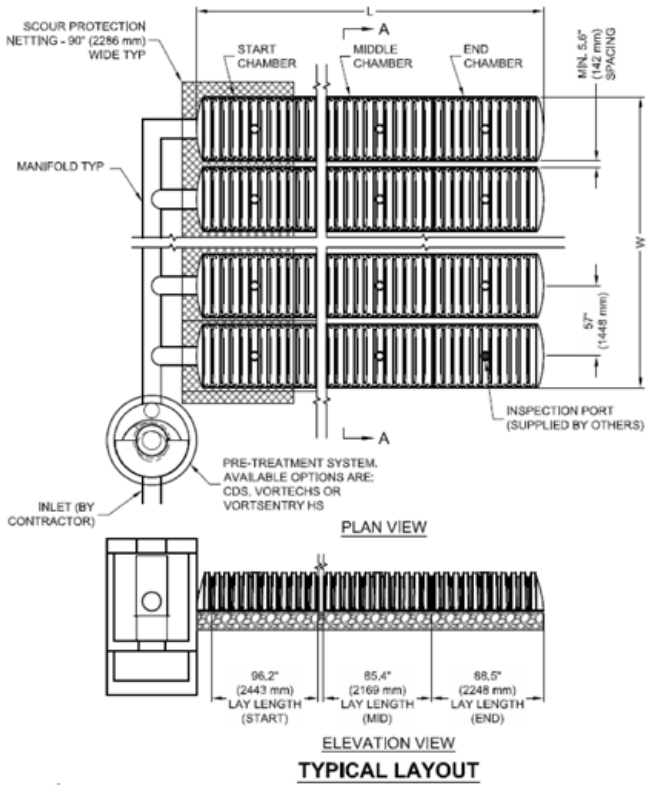
ChamberMaxx systems can also be used for detention applications where infiltraton of stored water is minimized. Minimization of infiltration can be accomplished by wrapping the entire chamber system and stone backfill in an impermeable thermoplastic liner.

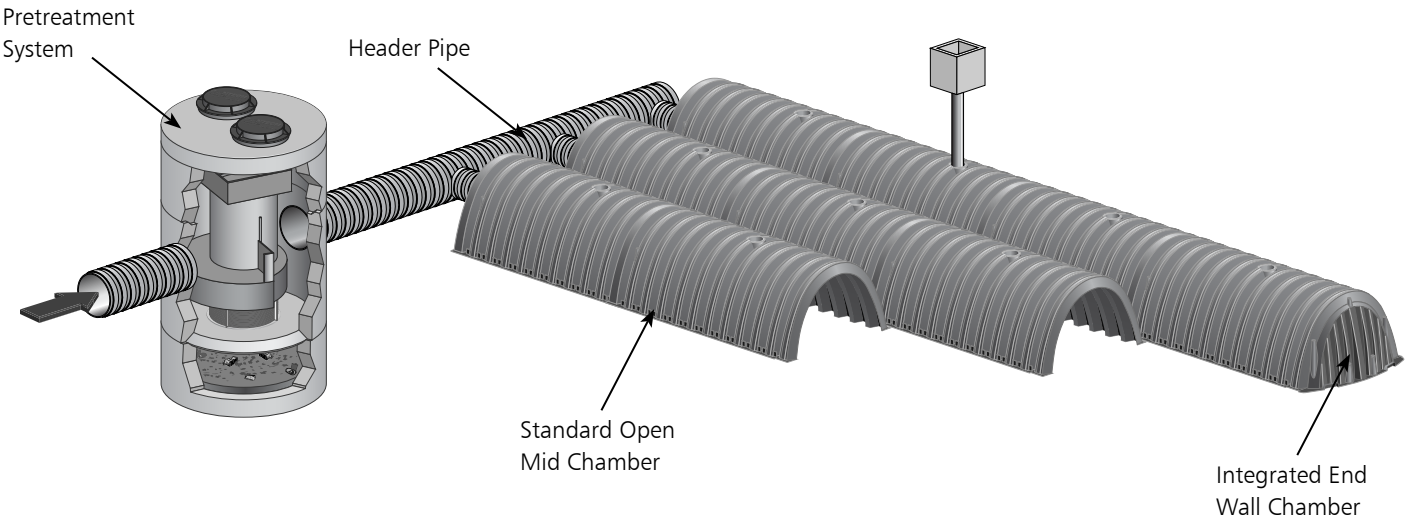
Inlet Congifurations

ChamberMaxx systems are compatible with various inlet configurations. The inlet configuration selected for a design should be based on the site requirements and local regulations. Pretreatment is recommended for all detention/retention systems regardless of type. The initial removal of sediment in a pretreatment device allows easy inspection and unobstructed maintenance. Contech offers standard inlet pretreatment configurations in the form of upstream pretreatment devices or the ChamberMaxx Containment Row.

Pretreatment Devices

In some jurisdictions, it is required to use devices for pretreatment of stormwater prior to entry to stormwater systems. By pretreating the stormwater prior to entry into the ChamberMaxx system, pollutants such as hydrocarbons and sediment may be captured, thereby extending the service life of the chamber system. Pretreatment devices vary in complexity and effectiveness. Several non-proprietary options exist in the form of deep sump manholes, oil grit separators, and bio-swales. Contech offers pretreatment devices such as the CDS and VortSentry HS for designs that require more stringent levels of pollutant removal. See Contech's website to design your own pretreatment device: www.conteches.com/dyohds.





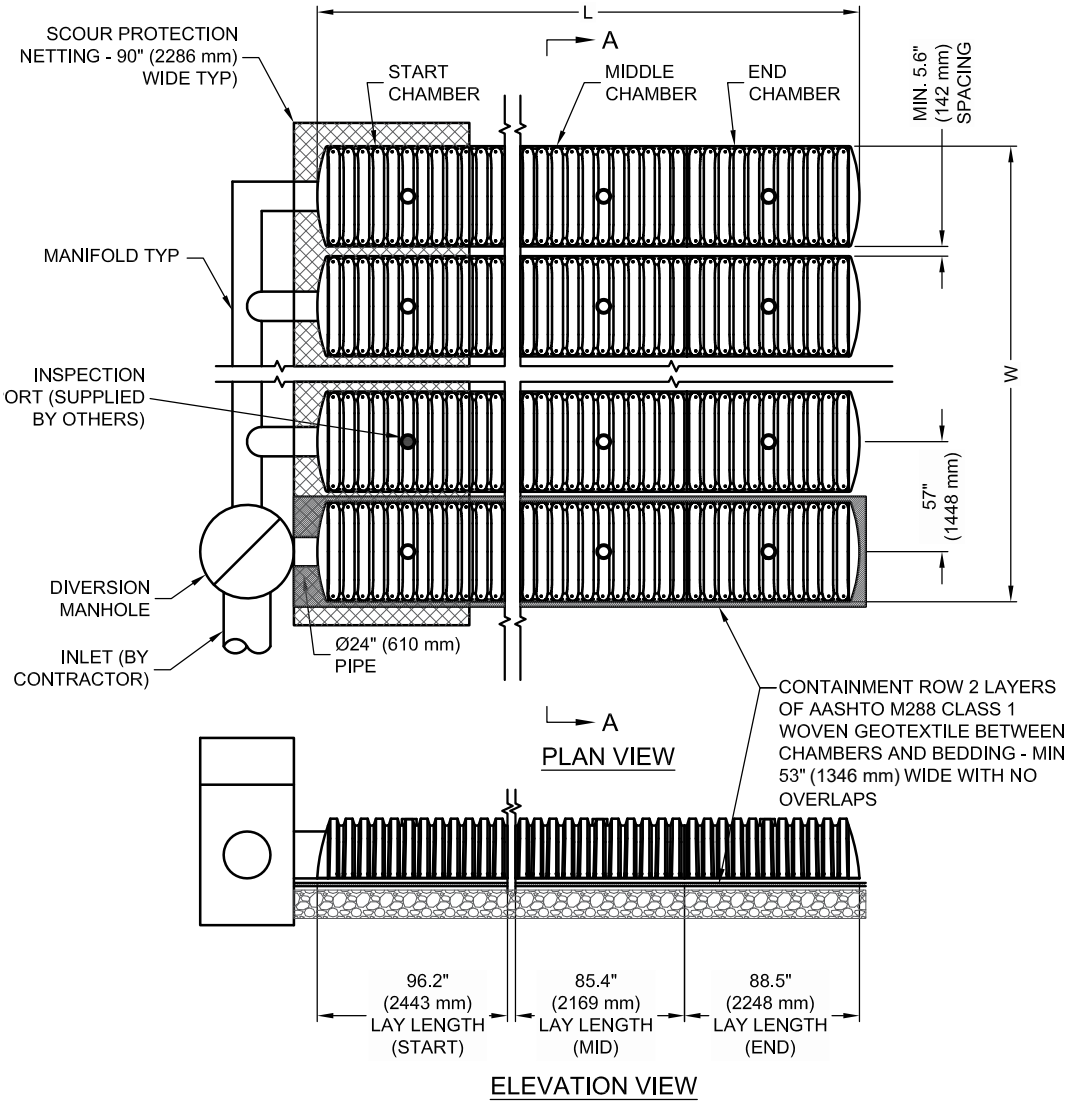
ChamberMaxx Containment Row

Hydrodynamic separators and filtration devices provide the most efficient sediment removal and extended maintenance interval, and are recommended as pretreatment for ChamberMaxx systems. The ChamberMaxx Containment Row should be considered as basic, low cost treatment strategy and should only be considered where sediment loading to the ChamberMaxx system is assumed to be minimal.

The Containment Row is designed to provide TSS removal by direct screening through 2 layers of AASHTO M288 Class 1 Woven Geotextile, located between the containment row chamber and the stone bedding.

The ChamberMaxx Containment Row should be designed with a sumped diversion manhole at the inlet of the Containment Row. The diversion manhole should be designed to allow access for inspection and maintenance of the Containment Row in addition to diverting the required amount of stormwater into the Containment Row for treatment, and a sump for collection of sediment. Once the Containment Row has reached capacity, the overflow should then be distributed to the remainder of the chamber rows by a manifold.

Containment Rows can be sized for water quality volume or water quality flow rate. Contact your local Contech representative at 800-338-1122 for project specific sizing of a Containment Row.



Inlet Manifold Design

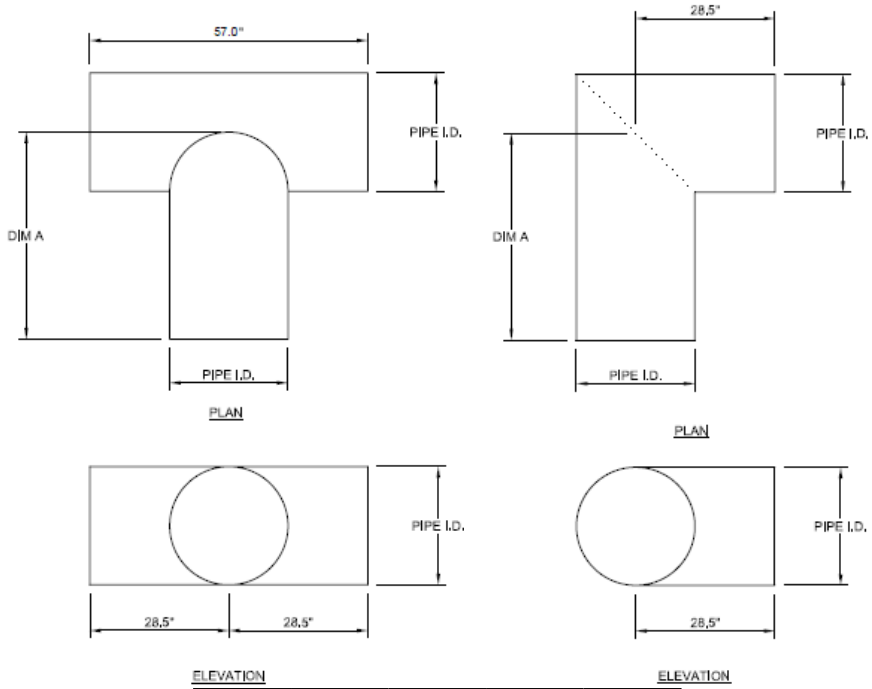
All ChamberMaxx systems require inlet manifolds to ensure that the incoming flow is distributed throughout all chamber rows. The integral end cap of the chamber system can accept up to a 24-inch diameter (0.61m) inlet pipe.

The inlet manifold should be designed to provide ample conveyance of peak flows without creating an unacceptable backwater condition on the upstream structures and piping. To reduce the scour potential of the foundation stone under the chambers from the influent flow, Contech requires the installation of scour protection netting at the manifold entrance to any inlet chamber, extending 1' (0.30 m) beyond the outside edge of the chamber.

When designing an inlet manifold for a ChamberMaxx system, the specifying engineer is responsible for confirmation that the manifold meets the hydraulic needs of the project. The manifold diameter should be equal to or larger than the upstream pipe leading from the site to the chamber system. Contech offers standard high density polyethylene (HDPE) manifold fittings in various sizes to accommodate most project needs.

Contech provides Mar Mac Polyseal couplers to connect manifold fittings, please reference www.MarMac.com for additional information on the provided couplers.

ChamberMaxx cannot accept a pipe directly into the side of the chamber. To accommodate this configuration, the row should be broken up by use of one end chamber and one start chamber to create two separate rows. The inlet pipe should then be joined to a manifold tee that connects into the new start and end chambers. Otherwise, all pipe connections should be made at a manifold or directly stubbed into the end a chamber.



STANDARD MANIFOLD COMPONENTS				
	AVAILABLE DIAMETERS (IN)			
TEE	12	15	18	24
ELBOW	12	15	18	24
DIM A	42	42	48	48

GENERAL NOTES:

1. FITTING MATERIAL TO BE MANUFACTURED FROM CORRUGATED HIGH DENSITY POLYETHYLENE, AASHTO M294 PIPE.
2. FITTINGS TO BE FABRICATED IN ACCORDANCE WITH THE REQUIREMENTS OF AASHTO M294.
3. FITTINGS DESIGNED TO PROTRUDE 8" INTO END OF THE INLET CHAMBERS.
4. MANIFOLD TEE AND ELBOW JOINTS TO BE CONNECTED UTILIZING MAR-MAC POLYSEAL COUPLERS. REFERENCE WWW.MARMAC.COM

Outlet Manifold Design

Some ChamberMaxx systems may require an outlet for volumes in excess of the chamber system capacity. An outlet manifold should be designed to ensure that excess volume or peak flows can be conveyed to downstream structures.

In circumstances where infiltration into the surrounding soil is not an option, an underdrain may be used to completely drain the stone bed below the invert of the chamber. The underdrain should connect to the downstream drainage structure and should accommodate free drainage as required.

Other outlet scenarios may include outlet pipes located higher than the invert of the chambers to allow a designed volume to infiltrate through the base stone before exiting the system, or an outlet control structure external to the chamber system to achieve the same effect. These are common scenarios used for recharging groundwater and replicating a site's pre-construction runoff characteristics.

Outlet manifolds should not directly connect to a Containment Row but should be connected to as many standard chamber rows as required to achieve the desired hydraulic conditions. The outlet manifold fittings provided by Contech are the same HDPE fittings used for inlet manifolds and should be installed and connected in the same way.

Foundation Requirements

ChamberMaxx systems require a bedding of at least 6 inches (152.4mm) of crushed stone below the chambers. With a 6 inch (152.4mm) bedding depth a soil bearing capacity of 4 ksf (191.52 kPa) is required for 8 feet of cover over the top of the chambers and a soil bearing capacity of 2ksf (95.76 kPa)is needed for 18 inches (457.2mm) of cover over the top of the chambers. If the soil bearing pressure does not meet the minimum requirements, a geotechnical engineer should evaluate the application and make the appropriate recommendations to improve the bearing capacity to suit the application.

System Sizing

ChamberMaxx systems store water in the chamber itself and also in the void space of the stone backfill. The "Installed Storage Volume" in the table below shows the water storage capacity for the chamber and stone system assuming a 40% stone void ratio.

The ChamberMaxx DYODS (Design Your Own Detention System) is available for online sizing of ChamberMaxx systems. This tool can be found at www.ContechES.com. For assistance sizing a ChamberMaxx system, Contech Design Engineering services can be contacted at 1-800-338-1122 or through your local Contech representative. Modeling for the ChamberMaxx system is also available in HydroCAD®.

Sizing a ChamberMaxx System

The steps outlined below provide the necessary calculations to size a ChamberMaxx System.

1. Determine the Storage Volume (V_s).
   Required Storage Volume should be determined by the design engineer per project requirements.

2. Determine the number of chambers required (C).

Chamber Part	Width		Height		Weight		Actual Length		Installed Length*		Storage Volume		Installed Storage Volume*	
	in	(m)	in	(m)	lbs	(kg)	in	(m)	in	(m)	cf	(m^3)	cf	(m^3)
Start	51.4	(1.31)	30.3	(0.77)	83.0	(37.65)	98.4	(2.50)	96.2	(2.44)	50.2	(1.42)	78.1	(2.21)
Middle	51.4	(1.31)	30.3	(0.77)	73.0	(33.11)	91.0	(2.31)	85.4	(2.17)	47.2	(1.34)	75.1	(2.13)
End	51.4	(1.31)	30.3	(0.77)	76.0	(34.47)	92.0	(2.34)	88.5	(2.25)	46.2	(1.31)	74.1	(2.10)

** 6" (152 mm) of stone above and below chamber, 5.6" (142 mm) chamber spacing and 40% porosity.*

To calculate the number of chambers needed to store the required volume (Vs), divide the storage volume by the volume of the chamber. For systems with a predetermined number of rows (r), multiply the sum of the start and end chamber volumes by the row count to determine the remainder of middle chambers required.

$$C = C_{start} + C_{mid} + Cend$$

$$C_{start} \& C_{end} = \text{number of rows, r}$$

$$Cmid = Vs / [(Vstart + Vend)*r + Vmid]$$

For systems with an undetermined number of rows, the chamber count can be estimated by using the volume of the middle chamber, ignoring the start and middle chambers.

$$C = Vs / V_{mid}$$

3. Determine the system footprint.
   To determine the system length: Divide the number of middle chambers required (Cmid) by the number of rows (r), rounding up (n). This will be number of middle chambers required in the longest row. Add up the installed lengths of 1 start, 1 end, and the required count of middle chambers. After adding the length of perimeter stone around start and end chambers (minimum 12"or .3048 m), the total length is the system length.

   $$n = C_{mid}/r$$

   $$L = 12" + L_{start} + n*L_{mid} + L_{end} + 12"$$
   $$(.3048m + L_{start} + n*L_{mid} + L_{end} + .3048m)$$

   To determine the system width: Multiply the chamber width (51.4" or 1.31 m) by the number of rows (r). Add the total chamber width plus chamber spacing multiplied by (r-1) and the perimeter stone (minimum 12" or 0.30 mm). Standard spacing between chambers is 5.6"(396.2 mm). The resulting sum is the system width.

   $$W = 12"+ r*51.4" + (r-1)*5.6" + 12"$$
   $$(.3048m + r*1.306m + (r-1)*0.3962m + .3048m)$$

4. Determine the amount of stone (Vst).
   To determine the amount of clean, crushed, angular stone is required for the ChamberMaxx System, multiply the number of start, middle, and end chambers by their respective stone volumes in the table below.

Chamber Type	Amount of stone needed per chamber (cubic feet)	Amount of stone needed per chamber (cubic meters)
Start Chamber	78.69	2.228
Middle Chamber	69.85	1.978
End Chamber	72.36	2.049

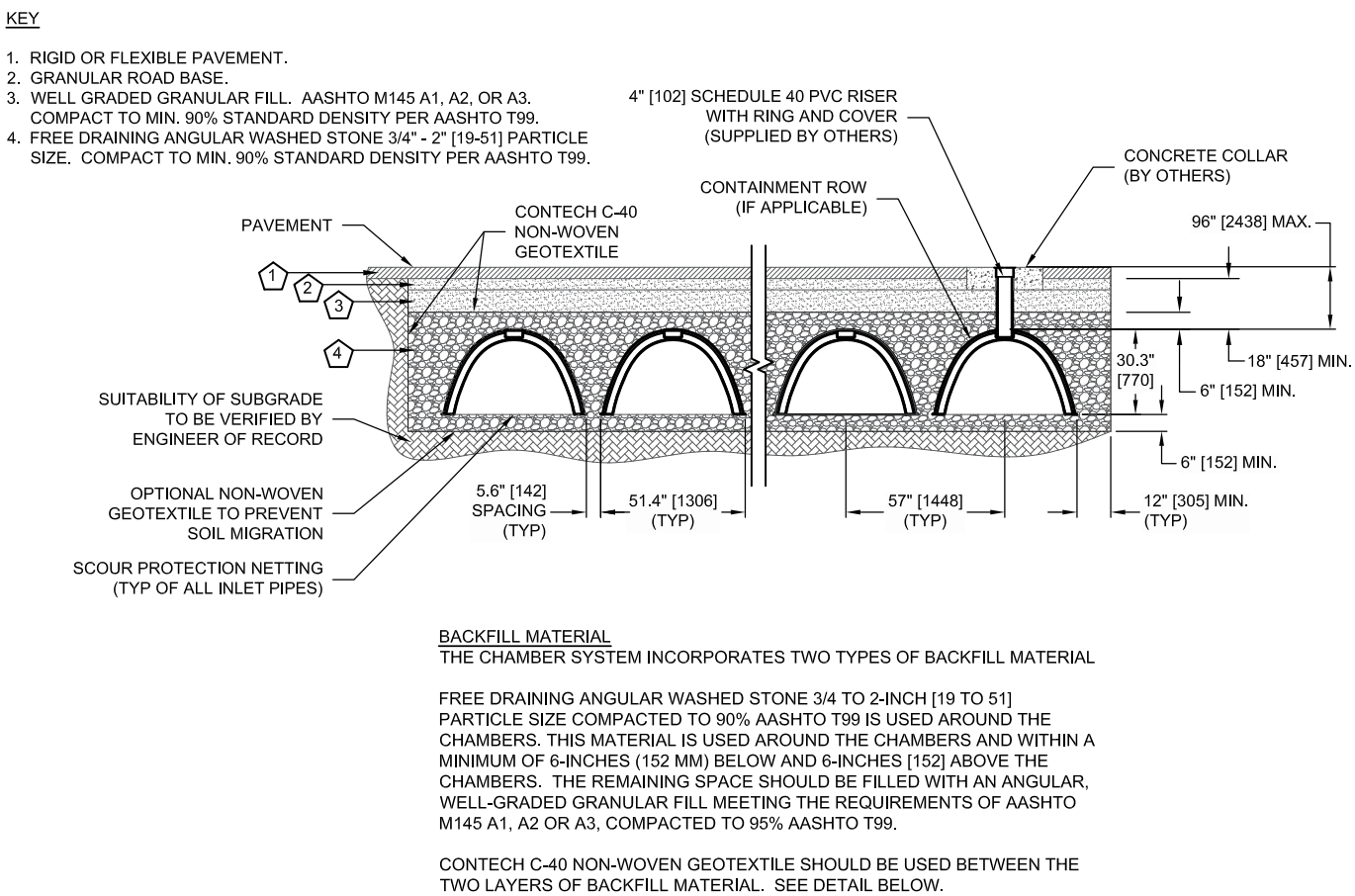
Stage Storage Table

	Elevation		Chamber Storage Volume		Stone Storage Volume		Cumulative Volume Increment		Cumulative Storage Volume	
	(in)	(m)	(cf)	(m^3)	(cf)	(m^3)	(cf)	(m^3)	(cf)	(m^3)
STONE	42.30	1.07	47.20	1.34	27.94	0.79	1.13	0.03	75.14	2.13
	41.30	1.05	47.20	1.34	26.82	0.76	1.13	0.03	74.02	2.09
	40.30	1.02	47.20	1.34	25.69	0.73	1.13	0.03	72.89	2.06
	39.30	1.00	47.20	1.34	24.56	0.70	1.13	0.03	71.76	2.03
	38.30	0.97	47.20	1.34	23.44	0.66	1.13	0.03	70.64	2.00
	37.30	0.95	47.20	1.34	22.31	0.63	1.13	0.03	69.51	1.97
CHAMBERMAXX CHAMBERS	36.30	0.92	47.20	1.34	21.18	0.60	0.62	0.02	68.38	1.94
	35.00	0.89	47.20	1.34	20.56	0.58	1.13	0.03	67.76	1.92
	34.00	0.86	47.20	1.34	19.43	0.55	1.13	0.03	66.63	1.89
	33.00	0.84	47.20	1.34	18.30	0.52	1.13	0.03	65.50	1.85
	32.00	0.81	47.20	1.34	17.18	0.49	1.56	0.04	64.38	1.82
	31.00	0.79	46.48	1.32	16.34	0.46	1.76	0.05	62.82	1.78
	30.00	0.76	45.43	1.29	15.63	0.44	1.83	0.05	61.06	1.73
	29.00	0.74	44.26	1.25	14.98	0.42	1.90	0.05	59.23	1.68
	28.00	0.71	42.97	1.22	14.36	0.41	1.96	0.06	57.33	1.62
	27.00	0.69	41.58	1.18	13.79	0.39	2.02	0.06	55.37	1.57
	26.00	0.66	40.09	1.13	13.26	0.38	2.07	0.06	53.35	1.51
	25.00	0.64	38.53	1.09	12.76	0.36	2.11	0.06	51.29	1.45
	24.00	0.61	36.89	1.04	12.29	0.35	2.15	0.06	49.18	1.39
	23.00	0.58	35.18	1.00	11.84	0.34	2.18	0.06	47.03	1.33
	22.00	0.56	33.42	0.95	11.42	0.32	2.22	0.06	44.84	1.27
	21.00	0.53	31.60	0.89	11.02	0.31	2.24	0.06	42.63	1.21
	20.00	0.51	29.74	0.84	10.64	0.30	2.27	0.06	40.38	1.14
	19.00	0.48	27.84	0.79	10.27	0.29	2.29	0.06	38.11	1.08
	18.00	0.46	25.90	0.73	9.92	0.28	2.31	0.07	35.82	1.01
	17.00	0.43	23.93	0.68	9.59	0.27	2.33	0.07	33.51	0.95
	16.00	0.41	21.92	0.62	9.26	0.26	2.35	0.07	31.18	0.88
	15.00	0.38	19.88	0.56	8.95	0.25	2.37	0.07	28.83	0.82
	14.00	0.36	17.82	0.50	8.65	0.24	2.39	0.07	26.46	0.75
	13.00	0.33	15.72	0.44	8.36	0.24	2.40	0.07	24.08	0.68
	12.00	0.30	13.59	0.38	8.09	0.23	2.42	0.07	21.68	0.61
	11.00	0.28	11.43	0.32	7.82	0.22	2.45	0.07	19.25	0.54
	10.00	0.25	9.23	0.26	7.58	0.21	2.47	0.07	16.81	0.48
	9.00	0.23	6.99	0.20	7.34	0.21	2.50	0.07	14.34	0.41
	8.00	0.20	4.71	0.13	7.13	0.20	2.52	0.07	11.84	0.34
	7.00	0.18	2.38	0.07	6.93	0.20	2.56	0.07	9.32	0.26
STONE	6.00	0.15	0.00	0.00	6.76	0.19	1.13	0.03	6.76	0.19
	5.00	0.13	0.00	0.00	5.63	0.16	1.13	0.03	5.63	0.16
	4.00	0.10	0.00	0.00	4.51	0.13	1.13	0.03	4.51	0.13
	3.00	0.08	0.00	0.00	3.38	0.10	1.13	0.03	3.38	0.10
	2.00	0.05	0.00	0.00	2.25	0.06	1.13	0.03	2.25	0.06
	1.00	0.03	0.00	0.00	1.13	0.03	0.00	0.00	1.13	0.03

ChamberMaxx Flow Routing

Proper design of any detention system typically requires that flow routing be performed. Engineers at Contech can be a valuable resource when designing a ChamberMaxx retention system. Typically, stage- storage curves are utilized in the analysis. A Contech stage-storage calculator is available for download on www.ContechES.com. This information can simply be inserted into common hydrology/ hydraulic software such as HydroCAD, HydroFlow, PondPack or TR20. This makes a flow routing design with ChamberMaxx just as simple as an aboveground pond design.

ChamberMaxx - Backfill Detail



BACKFILL MATERIAL
THE CHAMBER SYSTEM INCORPORATES TWO TYPES OF BACKFILL MATERIAL

FREE DRAINING ANGULAR WASHED STONE 3/4 TO 2-INCH [19 TO 51] PARTICLE SIZE COMPACTED TO 90% AASHTO T99 IS USED AROUND THE CHAMBERS. THIS MATERIAL IS USED AROUND THE CHAMBERS AND WITHIN A MINIMUM OF 6-INCHES (152 MM) BELOW AND 6-INCHES [152] ABOVE THE CHAMBERS. THE REMAINING SPACE SHOULD BE FILLED WITH AN ANGULAR, WELL-GRADED GRANULAR FILL MEETING THE REQUIREMENTS OF AASHTO M145 A1, A2 OR A3, COMPACTED TO 95% AASHTO T99.

CONTECH C-40 NON-WOVEN GEOTEXTILE SHOULD BE USED BETWEEN THE TWO LAYERS OF BACKFILL MATERIAL. SEE DETAIL BELOW.

Inspection And Maintenance

ChamberMaxx Safety

Before entering into any storm sewer or underground retention/ detention system check to make sure all OSHA and local safety regulations and guidelines are observed during the maintenance process. Hard hats, safety glasses, steel-toed boots and any other appropriate personal protective equipment shall be worn at all times.

Inspection Frequency

Inspections are recommended at a minimum annually. The first year of operation may require more frequent inspections. Frequency of inspections will vary significantly on the local site conditions. An individual inspection schedule should be established for each site.

Inspections

Inspection is the key to effective maintenance and is easily performed. Inspections may need to be performed more often in the winter months in climates where sanding operations may lead to rapid sediment accumulations, or in equipment washdown areas. It is very useful to keep a record of each inspection. A sample inspection log is included for your use.

The entire treatment train should be inspected and maintained. The treatment train may consist of an upstream sump manhole, manifold system or pre-treatment HDS device. Inspections should start at the upstream device and continue downstream to the discharge orifice if incorporated into the chamber system.

Pre-Treatment Device Inspection

Inspection and maintenance procedures provided by the manufacturer should be followed for pre-treatment systems such as a CDS®, Vortechs®, VortSentry® or VortSentry® HS. Expected pollutants will be floatable trash, sediment and oil and grease. Pre-treatement devices are recommended for all detention/ retention devices regardless of type.

Containment Row™ Inspection

The optional Containment Row consists of a diversion concrete manhole with a weir, and a row of chambers placed on woven geotextile. The diversion weir directs the first flush flows into the Containment Row of chambers. The majority of sediment will be captured in the Containment Row due to the extended detention time which allows the particles to settle out. Higher flows overtop (bypass) the weir into the manifold system.

The Containment Row will typically be located in the first row of chambers connected to the diversion manhole. Inspection can be done through accessing the diversion manhole and visually inspecting the Containment Row through the inlet pipe. Inspection ports throughout the system can be used for visual observation and measurement of sediment accumulation using a stadia rod. When the depth of sediment accumulates over 4-inch (102 mm), cleanout is recommended.

Manifold System Inspection

The main manifold pipe can be inspected from the diversion manhole upstream. When a quarter of the pipe volume has been filled with sediment the header system should be maintained.

Visual Inspection

Maintenance or further investigation may be required if any of the following conditions exist:

- Evidence of an unusual amount of silt and soil build-up on the surface.
- Clogged outlet drainpipe.
- System does not drain to the elevation of the lowest pipe in dry conditions.
- Evidence of potholes or sinkholes

Maintenance

Underground stormwater retention/detention systems should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities rather than the size or configuration of the system. If accumulated silt is interfering with the operation of the detention system (i.e.: blocking outlet pipes or deposits significantly reduce the storage capacity of the system) it should be removed.

It is easiest to maintain a system when there is no flow entering. For this reason, cleanout should be scheduled during dry weather.

A vacuum truck or other similar devices can be used to remove sediment from the treatment train. Starting upstream, maintain manholes with sumps and any pre-treatment devices (following manufacturer recommended procedures). Once maintenance is complete, replace all caps, lids and covers. It is important to document maintenance events on the Inspection and Maintenance Log.

Header System Maintenance

If maintenance is required, use a high pressure nozzle with rear facing jets to wash the sediments and debris into the diversion manhole. Use the vacuum hose stinger nozzle to remove the washed sediments from the sump of the diversion manhole. It is important to not flush sediments into the chamber system during the maintenance process.

Containment Row™ Maintenance

If maintenance is required, a JetVac truck utilizing a high pressure nozzle (sledge dredging tool) with rear facing jets will be required. Insert the nozzle from the diversion manhole into the Containment Row through the inlet pipe. Turn the water feed hose on and feed the supply hose until the nozzle has reached the end of the Containment Row. Withdraw the nozzle slowly.

The tool will backflush the Containment Row forcing debris into the diversion manhole sump. Use the stringer vacuum hose to remove the sediments and debris from the sump of the diversion manhole. Multiple passes may be required to fully cleanout the Containment Row. Vacuum out the diversion manhole and remove all debris. See Figure 1.

Figure 1. Containment Row shown with high pressure cleaning nozzle.

APPENDIX A: ChamberMaxx Specification with Pretreatment

SPECIFICATION:

ChamberMaxx

Underground Detention and Infiltration Standard Specification with Pretreatment Device

1.0 GENERAL

1.1 This item shall govern the furnishing and installation of ChamberMaxx underground detention and infiltration chamber systems.

1.2 Contractor shall furnish all labor, materials, equipment and incidentals necessary to install the ChamberMaxx system, appurtenances and incidentals in accordance with the Drawings and as specified herein.

1.3 A stormwater treatment device upstream of the ChamberMaxx system is recommended as the appropriate means of pretreating for the purpose of extending the maintenance interval on the ChamberMaxx system and reducing the life cycle cost. Both engineered solutions shall be provided by a single supplier/manufacturer. Filtration by wrapping a chamber row with geotextile is not an acceptable means of pretreatment.

1.4 Applicable provisions of any Division shall govern work in this section.

1.5 Related Standards

1.5.1 ASTM 2418 "Standard Specification for Polypropylene Corrugated Wall Stormwater Collection Chambers"

1.5.2 ASTM F-2787 "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers"

1.6 Site layout drawings, product specifications, materials, hydraulic storage data and supported calculations of proposed alternatives shall be submitted to the Engineer of Record (EOR) for review at a minimum of 10 working days prior to bid closing.

1.7 Shop drawings shall be annotated to indicate all materials to be furnished and installed under this section, and all applicable standards for materials, required tests of materials and design assumptions for structural analysis:

1.8 Before installation of the ChamberMaxx system, Contractor shall obtain the written approval of the EOR for the stormwater system and the installation drawings.

1.9 All proposed alternatives to the ChamberMaxx system shall conform to applicable above referenced ASTM specifications.

2.0 MATERIALS

2.1 The chamber shall be constructed of injection molded polypropylene copolymer formulated for high impact and stress cracking resistance and sustained structural performance during high temperatures. The chamber shall be designed and manufactured in accordance to ASTM F-2418 and F-2787.

2.2 The chamber shall be designed to AASHTO LRFD Bridge Design Specifications (Section 12), as applied to material and performance requirements for buried thermoplastic pipes. Design live load shall be the AASHTO HS-20 and HS-25 truck, including multiple lane presence factors, over a minimum cover of 18 inches and chamber row spacing of 5 inches or greater.

2.3 The chamber system shall be comprised of three chamber configurations: The MIDDLE chambers shall be open-ended to allow unobstructed hydraulic flow, inspection, and maintenance. The START and END chambers shall each have an integral end wall designed to resist loading at the start and end of the chamber rows. The chambers within a row shall be installed with overlapping end corrugations.

2.4 The nominal dimensions of the START chamber shall be 51.4 inches wide, 30.3 inches tall, and 98.4 inches long. The nominal dimensions of the MIDDLE chamber shall be 51.4 inches wide, 30.3 inches tall, and 91.0 inches long. The nominal dimensions of the END chamber shall be 51.4 inches wide, 30.3 inches tall, and 92.0 inches long. The nominal storage volume inside the chamber shall be 77 cubic feet when utilizing 6" of stone above and below chamber with 40% stone porosity per ChamberMaxx standard detail.

2.5 The chamber shall have a continuously-curved, arch-shaped section profile.

2.6 The START and END chamber integral end wall shall be structurally suitable for cutting and inserting inlet pipes and shall provide a range of pipe diameter indicants up to 24" diameter as cutting templates.

2.7 The chamber shall be a corrugated, open-bottom design and top vent orifices for hydraulic pressure equalization. Corrugation valleys and crests shall be sub-corrugated to increase stiffness.

2.8 The chamber shall have a circular cut line for an optional reinforced inspection port configured to accept a 4" Schedule 40 pipe.

2.9 The END chambers shall be capable of being cut to shorter lengths to accommodate site specific requirements.

2.10The chamber shall be supported by integral structural

footings comprised of load dispersing toe ribs and longitudinally aligned stiffening ribs.

2.11 The manufacturer of the ChamberMaxx system shall be one that has regularly been engaged in the engineering design and production of these systems for at least eight (8) years and which has a history of successful production, acceptable to the Engineer of Record (EOR). In accordance with the Drawings, the ChamberMaxx system shall be supplied by:

Contech Engineered Solutions
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

3.0 PERFORMANCE

3.1 The ChamberMaxx system proposal shall be sized in accordance to the design provided and approved by the Engineer of Record (EOR). Any Contractor deviating from the design shown on the plans, to include: material, footprint, etc., shall provide to the EOR a summary report on stage-storage curves, design calculations, HydroCAD modeling and engineering drawings.

3.2 ChamberMaxx row spacing and stone base thickness cannot be altered with consultation from Contech Engineered Solutions, LLC.

3.3 The ChamberMaxx system shall be designed so as the hydraulic grade line will increase evenly throughout whereas transverse movement from one storage compartment to another shall not be permitted. All storage compartments shall be connected via manifold (or connecting pipe) versus by entirely transporting stormwater through stone.

3.4 A stormwater pretreatment device is recommended upstream of the ChamberMaxx system as follows:

3.4.1 Infiltration: Where feasible, the selected stormwater treatment device upstream of an infiltration system shall be a filter system and have General Use Level Designation (GULD) for Basic Treatment by the Washington State Department of Ecology or demonstrate equivalent performance in independently verified field testing following a peer reviewed testing protocol, and must be sized consistent with the system producing those results.

3.4.2 Detention: Where feasible, the selected Stormwater treatment device upstream of a detention system shall be a separator system and have GULD for Pretreatment by the WADOE or demonstrate equivalent performance in independently verified field testing following a peer reviewed testing protocol, and must be sized consistent with the system producing those results.

3.4.3 Selected pretreatment stormwater device shall incorporate a physical barrier capable of capturing and retaining trash and debris (i.e.: floatable and neutrally buoyant materials) for all flows up to the treatment capacity of the device.

3.4.4 The application of wrapping a system with geotextile of any branding or material type, that allows the passage of stormwater, shall not be regarded as an acceptable treatment or pretreatment device.

3.4.5 The manufacturer of the selected Stormwater treatment device shall have been regularly engaged in the engineering design and production of systems for the physical treatment of Stormwater runoff for 15 years.

3.4.6 In order to not restrict the Owner's ability to maintain the stormwater pretreatment device, the minimum dimension providing access from the ground surface to the sump chamber shall be 20 inches in diameter.

4.0 EXECUTION

4.1 The ChamberMaxx system shall be installed per the Contech "ChamberMaxx Stormwater Retention System Standard Installation Detail", available from local Contech representative or from www.conteches.com.

4.2 For temporary construction vehicle loads, an extra amount of compacted cover may be required over the top of the chambers. The Height-of-Cover shall meet the minimum requirements shown in the Contech "ChamberMaxx Stormwater Retention System Standard Installation Detail". The use of heavy construction equipment necessitates greater protection for the chambers than finished grade cover minimums for normal highway traffic.

4.3 The contractor shall follow Occupational Safety and Health Association (OSHA) guidelines for safe practices in executing the installation process in accordance with the manufacturer/supplier installation recommendations.

4.4 Contractor is required to participate in an on-site preconstruction meeting with the supplier prior to the scheduled delivery date of the ChamberMaxx system.

APPENDIX B: ChamberMaxx Specification with Containment Row

ChamberMaxx

Underground Detention and Infiltration Standard Specification with Containment Row

5.0 GENERAL

5.1 This item shall govern the furnishing and installation of ChamberMaxx underground detention and infiltration chamber systems.

5.2 Contractor shall furnish all labor, materials, equipment and incidentals necessary to install the ChamberMaxx system, appurtenances and incidentals in accordance with the Drawings and as specified herein.

5.3 The containment row of the ChamberMaxx system is recommended as the appropriate means of pretreating for the purpose of extending the maintenance interval on the ChamberMaxx system and reducing the life cycle cost.

5.4 Applicable provisions of any Division shall govern work in this section.

5.5 Related Standards

5.5.1 ASTM 2418 "Standard Specification for Polypropylene Corrugated Wall Stormwater Collection Chambers"

5.5.2 ASTM F-2787 "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers"

5.6 Site layout drawings, product specifications, materials, hydraulic storage data and supported calculations of proposed alternatives shall be submitted to the Engineer of Record (EOR) for review at a minimum of 10 working days prior to bid closing.

5.7 Shop drawings shall be annotated to indicate all materials to be furnished and installed under this section, and all applicable standards for materials, required tests of materials and design assumptions for structural analysis:

5.8 Before installation of the ChamberMaxx system, Contractor shall obtain the written approval of the EOR for the stormwater system and the installation drawings.

5.9 All proposed alternatives to the ChamberMaxx system shall conform to applicable above referenced ASTM specifications.

6.0 MATERIALS

6.1 The chamber shall be constructed of injection molded polypropylene copolymer formulated for high impact and stress cracking resistance and sustained structural performance during high temperatures. The chamber shall be designed and manufactured in accordance to ASTM F-2418 and F-2787.

6.2 The chamber shall be designed to AASHTO LRFD Bridge Design Specifications (Section 12), as applied to material and performance requirements for buried thermoplastic pipes. Design live load shall be the AASHTO HS-20 and HS-25 truck, including multiple lane presence factors, over a minimum cover of 18 inches and chamber row spacing of 5 inches or greater.

6.3 The chamber system shall be comprised of three chamber configurations: The MIDDLE chambers shall be open-ended to allow unobstructed hydraulic flow, inspection, and maintenance. The START and END chambers shall each have an integral end wall designed to resist loading at the start and end of the chamber rows. The chambers within a row shall be installed with overlapping end corrugations.

6.4 The nominal dimensions of the START chamber shall be 51.4 inches wide, 30.3 inches tall, and 98.4 inches long. The nominal dimensions of the MIDDLE chamber shall be 51.4 inches wide, 30.3 inches tall, and 91.0 inches long. The nominal dimensions of the END chamber shall be 51.4 inches wide, 30.3 inches tall, and 92.0 inches long. The nominal storage volume inside the chamber shall be 77 cubic feet when utilizing 6" of stone above and below chamber with 40% stone porosity per ChamberMaxx standard detail.

6.5 The chamber shall have a continuously-curved, arch-shaped section profile.

6.6 The START and END chamber integral end wall shall be structurally suitable for cutting and inserting inlet pipes and shall provide a range of pipe diameter indicants up to 24" diameter as cutting templates.

6.7 The chamber shall be a corrugated, open-bottom design and top vent orifices for hydraulic pressure equalization. Corrugation valleys and crests shall be sub-corrugated to increase stiffness.

6.8 The chamber shall have a circular cut line for an optional reinforced inspection port configured to accept a 4" Schedule 40 pipe.

6.9 The END chambers shall be capable of being cut to shorter lengths to accommodate site specific requirements.

6.10The chamber shall be supported by integral structural footings comprised of load dispersing toe ribs and longitudinally aligned stiffening ribs.

6.11The manufacturer of the ChamberMaxx system shall be one that has regularly been engaged in the engineering design and production of these systems for at least eight (8) years and which has a history of successful production, acceptable to the Engineer of Record (EOR). In accordance with the Drawings, the ChamberMaxx system shall be supplied by:

Contech Engineered Solutions
9025 Centre Pointe Drive
West Chester, OH, 45069
Tel: 1 800 338 1122

7.0 PERFORMANCE

7.1 The ChamberMaxx system proposal shall be sized in accordance to the design provided and approved by the Engineer of Record (EOR). Any Contractor deviating from the design shown on the plans, to include: material, footprint, etc., shall provide to the EOR a summary report on stage-storage curves, design calculations, HydroCAD modeling and engineering drawings.

7.2 ChamberMaxx row spacing and stone base thickness cannot be altered with consultation from Contech Engineered Solutions, LLC.

7.3 The ChamberMaxx system shall be designed so as the hydraulic grade line will increase evenly throughout whereas transverse movement from one storage compartment to another shall not be permitted. All storage compartments shall be connected via manifold (or connecting pipe) versus by entirely transporting stormwater through stone.

8.0 EXECUTION

8.1 The ChamberMaxx system shall be installed per the Contech "ChamberMaxx Stormwater Retention System Standard Installation Detail", available from local Contech representative or from www.conteches.com.

8.2 For temporary construction vehicle loads, an extra amount of compacted cover may be required over the top of the chambers. The Height-of-Cover shall meet the minimum requirements shown in the Contech "ChamberMaxx Stormwater Retention System Standard Installation Detail". The use of heavy construction equipment necessitates greater protection for the chambers than finished grade cover minimums for normal highway traffic.

8.3 The contractor shall follow Occupational Safety and Health Association (OSHA) guidelines for safe practices in executing the installation process in accordance with the manufacturer/supplier installation recommendations.

8.4 Contractor is required to participate in an on-site preconstruction meeting with the supplier prior to the scheduled delivery date of the ChamberMaxx system.

END SECTION

NOTES:

NOTES:

RECYCLED PAPER

CONTECH ENGINEERED SOLUTIONS

800-338-1122
www.ContechES.com

Support

- Drawings and specifications are available at contechstormwater.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech portfolio includes bridges, drainage, sanitary sewer, stormwater and earth stabilization products. For information on other product offerings, visit www.conteches.com or call 800.338.1122

11/17 PDF CMX Design Guide

CONTECH®
ENGINEERED SOLUTIONS

ChamberMaxx® Retention Installation Guide

CHAMBERMaxx®

ChamberMaxx Retention Installation Guide

The ChamberMaxx system requires adherence to the following installation procedure for the structural integrity of the system to be maintained.

All illustrations and photographs are examples of typical situations. Each individual site will vary, so it is important to follow the engineering project drawings as designed and sealed by a registered Professional Engineer.

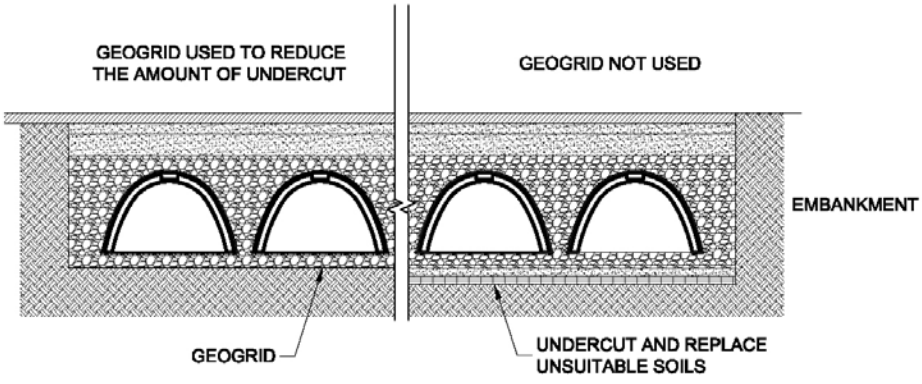
Prior to installation of the ChamberMaxx system a pre-construction meeting shall be conducted. Those required to attend are the supplier of the system, the general contractor, sub-contractors and the project Engineer of record.

Foundation

Construct a foundation that can support the design loading applied by the chambers and adjacent backfill weight as well as maintain its integrity during construction. A minimum of an extra foot of perimeter excavation is required for proper fit and adequate compaction. Excavation must be free of standing water. Dewater if present.

If soft or unsuitable soils are encountered, remove unsuitable material and bring back to grade with fill material as approved by the Engineer of record. See Detail A. The structural fill material gradation should not allow the migration of fines, which can cause settlement of the chamber system and possibly the above pavement, and occlusion of the void space in the bedding. If the structural fill material is not compatible with the underlying soils a Contech C-40, non-woven 4 oz separation geotextile, should be used as a separator.

Grade the foundation subgrade to a uniform and stable grade. If the subgrade is clay or relatively non-porous and the construction sequence will last for an extended period of time, it is best to slope the grade to one end of the system. This will allow excess water to drain quickly, preventing saturation of the subgrade.



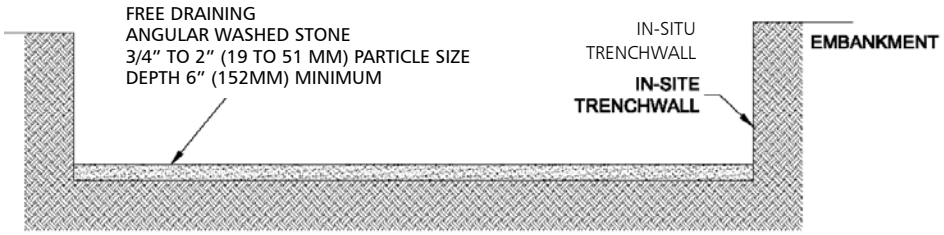
SECTION

DETAIL A

Bedding

A 6-inch (152 mm) minimum thickness, well-graded, free-draining angular washed stone 3/4 to 2-inch (19 to 51 mm) particle size is the required chamber bedding. Refer to project engineering plans for subgrade soil preparation and required stone foundation thickness. If the construction equipment will operate for an extended period of time on the bedding, use an engineering fabric or a geogrid to ensure the base material maintains its integrity. Bedding material is to be compacted to 90% AASHTO T99 standard proctor density. Do not use heavy equipment on bedding material to avoid excessive soil compaction. See Detail B.

Grade the base to a smooth, uniform grade to allow for the proper placement of chambers.



SECTION

DETAIL B

In-Situ Trench Wall

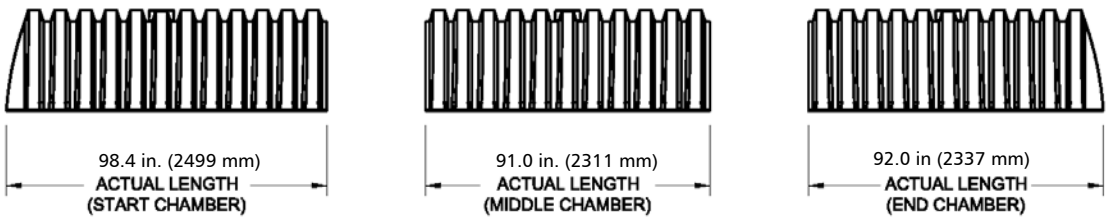
The trench wall must be capable of supporting the load that the chamber sheds as the system is loaded. If soils are not capable of supporting these loads, the integrity of the system can be compromised. Perform a simple soil pressure check using the applied loads to determine the limits of excavation beyond the edge of the outer most row of chambers. Wrap the walls with Contech C-40 non-woven geotextile to help prevent soil migration.

In most cases the requirements for a safe work environment and proper backfill placement and compaction take care of this concern.

ChamberMaxx Units

All systems are comprised of the Start, Mid and End chambers. The Start and End chambers are marked accordingly with a label on each end.

The maximum weight of a single chamber is 83 lbs. (37.65 kg) which allows the chamber to be hand carried. See Detail C.



ELEVATION VIEW

DETAIL C

Layout of the Manifold System

Temporarily layout the manifold system per the project engineering plans. Place the Start chamber of each row in your system. Standard spacing between rows is 5.6", with a minimum of 5" required between each row.. Use a reciprocating saw to cut the inlet pipe diameter hole out from the Start chamber at the correct inlet height. Insert the inlet pipe from the assembled manifold system into each Start chamber. Cover any open void spaces greater than 3/4-inch (19 mm) on the chambers with a non-woven geotextile to prevent infiltration of backfill material.

Layout of the Optional Containment Row

For ease of access during a maintenance operation, ChamberMaxx retention systems may have an optional Containment Row to allow for containment and settlement of sediments and associated pollutants during the initial flows of storm events. This row of chambers is set on top of a 2 layers of AASHTO M288 Class 1 woven geotextile a minimum of 53" wide with no overlaps.

1. Install diversion manhole per site plan.
2. Rollout the 12.5 ft (150 inch) wide woven geotextile and cut to the required length of the containment row while leaving 3-ft (.19m) overlap at each end of the chamber row. Fold the geotextile lengthwise creating 2 layers of 75" wide woven geotextile. Center the 2 layers of geotextile on the location of the containment row. The 75" wide geotextile layers will overlap approximately 1 ft of width on each side of the containment row. It may be necessary to temporarily weigh down the edges of the geotextile material to prevent displacement from wind.
3. Lay chambers for the Containment Row on the 2 layers of woven geotextile per the plans starting at the Start chamber, see Setting Units for installation instructions. It may be necessary to mark position of chambers on geotextile to ensure proper location during placement of chambers.
4. Install inlet connector pipe in Start chamber wall from the diversion manhole per plans.
5. Confirms the width of woven geotextile leaves a minimum of 6" around chamber along the sides. See Detail D.
6. Wrap the sides of the woven geotextile around the sides of the containment row and pin it to ensure that it does not unwrap during backfill
7. Fold overlapping ends of woven geotextile at the ends of the containment row so that they are flat against the end walls and fully wrapped around the inlet pipe of the containment row. Attach with construction tape as needed to keep the geotextile from moving during backfill.
8. Layout remaining chambers of retention system and header manifold per plans. See page 6.

Laying Out Scour Protection Netting

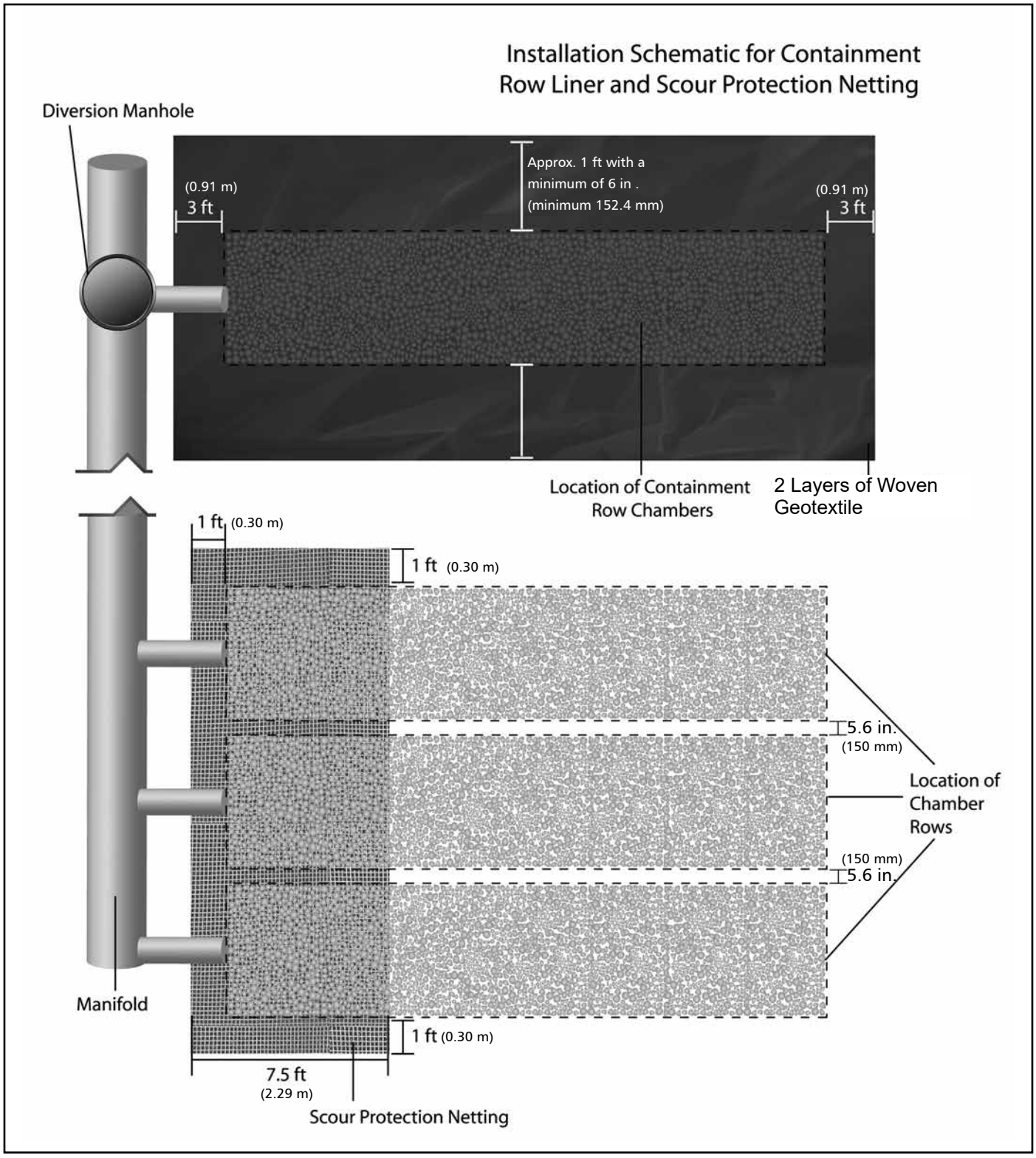
To insure the bedding is not disrupted as flows enter the system, rollout the Scour Protection Netting material perpendicular to the inlet chambers. In the area of the inlet chambers, lay the material with a one foot overlap towards the manifold system and footprint area. Tension material as needed to provide intimate contact with the bedding stone. When the inlet chamber is installed, this will "pin" the netting material in place. Inspect to insure netting is flat with no wrinkles and has intimate contact with the bedding stone. See Detail D.

Setting Units

Overlap the Mid chamber corrugation over the end of the Start chamber. Standard spacing between rows is 5.6", with a minimum of 5" required between each row. Always refer to the engineering plans for chamber arrangement. The End chamber will be the final chamber in each row.

Inspection Viewports

Where identified on the engineering project plans cut a 4-inch (102 mm) diameter hole in the reinforced circular port on the top of the chamber. Build an inspection port from PVC Schedule 40 pipe. Cut pipe to an oversized length, screw three small angle irons approximately 1-inch (25 mm) from the end of pipe. Anchor the riser in place on the chamber to keep secured during the backfill process. Install ring and cover on top of the riser pipe. After backfill, place an access casting in a concrete collar. To avoid crushing the inspection port riser, be sure concrete does not attach to riser pipe.


Installation Schematic for Containment
Row Liner and Scour Protection Netting
Diversion Manhole
(0.91 m)
3 ft
Approx. 1 ft with a
minimum of 6 in .
(minimum 152.4 mm)
(0.91 m)
3 ft
Location of Containment
Row Chambers
2 Layers of Woven
Geotextile
1 ft (0.30 m)
1 ft (0.30 m)
5.6 in.
(150 mm)
Location of
Chamber
Rows
(150 mm)
5.6 in.
Manifold
1 ft (0.30 m)
7.5 ft
(2.29 m)
Scour Protection Netting

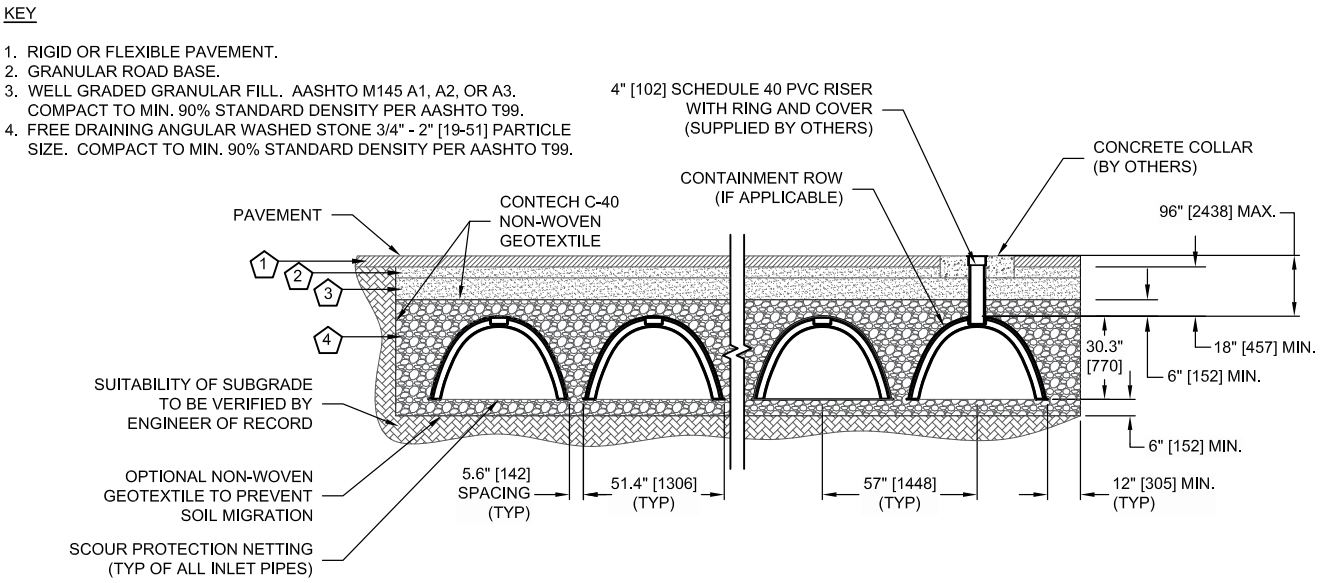
DETAIL D

Backfill Material

The chamber System incorporates two types of backfill material.

Free draining angular washed stone 3/4 to 2-inch (19 to 152 mm) particle size compacted to 90% AASHTO T99 is used around the chambers. This material is used around the chambers and within a minimum of 6-inches (152 mm) below and 6-inches (152 mm) above the chambers. The remaining space should be filled with an angular, well-graded granular fill meeting the requirements of AASHTO M145 A1, A2 or A3, compacted to 90% AASHTO T99.

Contech C-40 Non-Woven Geotextile should be used between the two layers of backfill material. See Detail E.



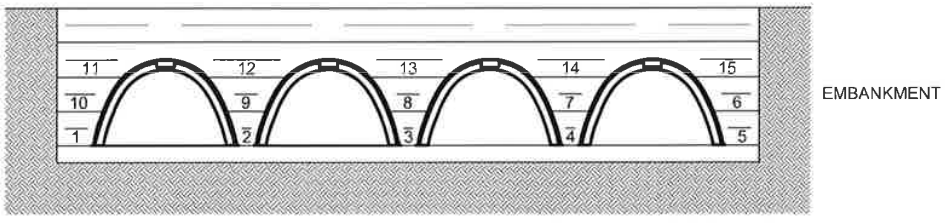
DETAIL E

Backfill Placement

Place backfill material in 6 to 8-inch (152 to 203 mm) loose lifts and compact to 90% AASHTO T99. Use mechanical hand tampers or approved compacting equipment to compact all backfill and embankment immediately adjacent to each side of the installation and over top of the installation to a minimum depth of 18-inches (457 mm). Place backfill so there is no more than a two lift differential between any of the chambers at anytime during the backfilling process. Advance the backfill along the length of the chamber system at the same rate to avoid differential loading on the chambers. Backfilling at differential heights from one side of the chamber to the other in excess of 16-inches (407 mm) can cause chamber distortion or potential collapse. Advance balanced lifts across the width of the system evenly along the length of the chambers as you backfill. See Detail F.

Use only lightweight tracked dozers (D-4 dozer or smaller) not exceeding 1,100 lbs/sf (0.54 kg/cm^2) ground pressure to spread backfill lifts over top of the chamber system. Maintain a minimum of 6-inch (152 mm) cover on top of chambers for the initial lifts.

For large systems use conveyor systems, backhoes with long reaches or draglines with stone buckets may be used to place backfill. Once minimum cover for construction loading across the entire width of the system is reached, advance the equipment to the end of the recently placed fill, and begin the sequence again until the system is completely backfilled. This type of construction sequence provides room for stockpiled backfill directly behind the backhoe, as well as the movement of construction traffic. Material stockpiles on top of the backfilled chamber system should be limited to six feet in total high above the structure and must provide balanced loading across all chambers. To determine the proper cover over the chambers to allow the movement of construction equipment, contact your local Contech Representative.



DETAIL F - TYPICAL BACKFILL SEQUENCE

Construction Loading

Typically, the minimum cover specified for a project assumes HS-20 or HS-25 live load. Because construction loads often exceed design live loads, increased temporary minimum cover requirements are necessary. Since construction equipment varies from job to job, it is best to address equipment specification and minimum cover requirements with our local Contech representative during the pre-construction meeting.

Equipment Restriction	
BACKFILL LEVEL*	ALLOWABLE CONSTRUCTION EQUIPMENT**
4 – Bedding	*No restrictions.*
4 – Back to Top of Chambers	*No equipment js permitted on or nearby the chambers. conveyors or excavators located such that their loads do not influence the chambers should be used to place the backfill stone. Stone should be worked between the chambers by hand.*
4 – Backfill Over the Top of the Chambers	*no wheel loads should be applied over the system. once 6" of stone has been placed over the crown of the chambers, lightweight tracked dozers with a maximum ground pressure of 1,100 psf are permitted over the structure. dozers must spread stone working in a direction parallel with the chamber rows; not working across the chamber rows. also, only small, walk behind compaction equipment can be used over the chambers until a minimum of 12" of cover is over the chambers.*
2 or 3 Select Fill Over the Chambers	*once 18" of compacted material is over the chambers, highway vehicles with axle loads of 32,000 pounds or less can be operated over the structures. front end loaders can be operated over the structures as long as the maximum wheel load does not exceed 16,000 pounds. compaction equipment can be operated over the structures as long as the dynamic force from the drum does not exceed 20,000 pounds and the gross vehicle weight does not exceed 12,000 pounds.*

** Please reference Detail E on page 7.*
*** Contact your local Contech Representative for questions on the use of specific pieces of construction equipment.*

Contractor Tool Checklist

- Wire cutters
- Stone bucket
- Transit or laser level
- Forklift or other type of equipment to unload chambers
- Reciprocating saw or router (to custom cut the end walls and inspection ports)
- Approved compaction equipment
- Excavator to dig trench and place stone and soil backfill
- Stone conveyor/light weight tracked dozer not exceeding 1,100 lbs/sf (0.54 kg/cm^2) to grade backfill

Material Checklist

Start, Mid and End ChamberMaxx chambers	Supplied by Contech
Manifold System	Supplied by Contech
Scour Protection Netting	Supplied by Contech
Contech C-40 Non-woven geotextile	Supplied by Contech
Containment Row Diversion Manhole if required)	Supplied by Contech
Containment Row AASHTO M288 Class 1 Woven Geotextile	Supplied by Contech
Free draining angular washed stone 3/4"-2" (.019 to .05 m) backfill material	Supplied by Contractor
Well graded granular backfill material	Supplied by Contractor
Construction Tape / Adhesive	Supplied by Contractor
Inspection port materials	Supplied by Contractor

ChamberMaxx Pre-Construction Checklist

Contech Field Contact and Phone: _____

Contech Plant Contact and Phone: _____

Contractor Contact and Phone: _____

Project Name: _____

Site Address: _____

Precon Attendees: _____

Topics to Review:

- ☐ Truck access and chamber storage availability/expectation
- ☐ Chamber unloading and handling safety, equipment and procedures
- ☐ System layout and fabrication drawing review
- ☐ Shipping schedule and installation sequence
- ☐ Scour protection netting layout
- ☐ Configuration and assembly
- ☐ Backfill material selection and placement procedure
- ☐ Backfill sequence, lift thickness and balanced loading
- ☐ Compaction requirement (90%) and equipment
- ☐ Additional Containment Row™ construction/liner material layout
- ☐ Inspection port installation

Notes: _____

_____

_____

_____

CHAMBERMaxx™

CONTECH ENGINEERED SOLUTIONS

Support

- Drawings and specifications are available at ContechES.com.
- Site-specific design support is available from Contech Engineered Solutions.

800.338.1122
www.ContechES.com

Outdoor Loading/Unloading SC-30

Description

The loading/unloading of materials usually takes place outside on docks or terminals; therefore, materials spilled, leaked, or lost during loading/unloading may collect in the soil or on other surfaces and have the potential to be carried away by wind, stormwater runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move materials. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- Limit exposure of material to rainfall whenever possible.
- Prevent stormwater run-on.
- Check equipment regularly for leaks.

Good Housekeeping

- Develop an operations plan that describes procedures for loading and/or unloading.
- Conduct loading and unloading in dry weather if possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION®

- Cover designated loading/unloading areas to reduce exposure of materials to rain.
- Consider placing a seal or door skirt between delivery vehicles and building to prevent exposure to rain.
- Design loading/unloading area to prevent stormwater run-on, which would include grading or berming the area, and position roof downspouts so they direct stormwater away from the loading/unloading areas.
- Have employees load and unload all materials and equipment in covered areas such as building overhangs at loading docks if feasible.
- Load/unload only at designated loading areas.
- Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections. Several drip pans should be stored in a covered location near the liquid transfer area so that they are always available, yet protected from precipitation when not in use. Drip pans can be made specifically for railroad tracks. Drip pans must be cleaned periodically, and drip collected materials must be disposed of properly.
- Pave loading areas with concrete instead of asphalt.
- Avoid placing storm drains inlets in the area.
- Grade and/or berm the loading/unloading area with drainage to sump; regularly remove materials accumulated in sump.

Spill Response and Prevention Procedures

- Keep your spill prevention and control plan up-to-date or have an emergency spill cleanup plan readily available, as applicable.
- Contain leaks during transfer.
- Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all employees.
- Ensure that employees are familiar with the site's spill control plan and proper spill cleanup procedures.
- Use drip pans or comparable devices when transferring oils, solvents, and paints.

Material Handling and Waste Management

- Spot clean leaks and drips routinely to prevent runoff of spillage.
- Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.

- Do not put used or leftover cleaning solutions, solvents, and automotive fluids in the storm drain or sanitary sewer.
- Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
  - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
  - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
  - ✓ Install a roof over the waste receptacle area.
  - ✓ Install a low containment berm around the waste receptacle area.
  - ✓ Use and maintain drip pans under waste receptacles.
- Post "no littering" signs.
- Perform work area clean-up and dry sweep after daily operations.

Employee Training Program

- Train employees (e.g., fork lift operators) and contractors on proper spill containment and cleanup.
- Have employees trained in spill containment and cleanup present during loading/unloading.
- Train employees in proper handling techniques during liquid transfers to avoid spills.
- Make sure forklift operators are properly trained on loading and unloading procedures.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document activities performed, quantities of materials removed, and improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.
- Keep accurate logs of daily clean-up operations.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- Space and time limitations may preclude all transfers from being performed indoors or under cover.
  - ✓ Designate specific areas for outdoor loading and unloading.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.
- It may not be possible to conduct transfers only during dry weather.
  - ✓ Limit materials and equipment rainfall exposure to all extents practicable.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

Many facilities will already have indoor or covered areas where loading/unloading takes place and will require no additional capital expenditures.

If outdoor activities are required, construction of berms or other means to retain spills and leaks may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.

Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.

- Conduct regular inspections and make repairs and improvements as necessary.
- Check loading and unloading equipment regularly for leaks.
- Conduct regular broom dry-sweeping of area. Do not wash with water.

Supplemental Information

Loading and Unloading of Liquids

- Loading or unloading of liquids should occur in the manufacturing building so that any spills that are not completely retained can be discharged to the sanitary sewer,

treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
  - ✓ The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
  - ✓ The transfer area should be designed to prevent run-on of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.
  - ✓ The transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer. A positive control valve should be installed on the drain.
- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:
  - ✓ Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles. Use drip pans when making and breaking connections.
  - ✓ Drip pan systems should be installed between the rails to collect spillage from tank cars.

References and Resources

Minnesota Pollution Control Agency, *Industrial Stormwater Best Management Practices Guidebook BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: http://www.pca.state.mn.us/index.php/view-document.html?gid=10557.

New Jersey Department of Environmental Protection, 2013. *Basic Industrial Stormwater General Permit Guidance Document NJPDES General Permit No NJ0088315*. Available online at: http://www.nj.gov/dep/dwq/pdf/5G2_guidance_color.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

Oregon Department of Environmental Quality, 2013. *Industrial Stormwater Best Management Practices Manual- BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: http://www.deq.state.or.us/wq/wqpermit/docs/IndBMP021413.pdf.

Sacramento Stormwater Management Program, *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

Sacramento County Environmental Management Stormwater Program: *Best Management Practices*. Available online at: http://www.emd.saccounty.net/EnvHealth/Stormwater/Stormwater-BMPs.html.

Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp-w2k.com/.

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA's Multi Sector General Permit. Available online at: http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm.

Waste Handling & Disposal SC-34

Description

Improper storage and handling of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, reuse, and recycling; and preventing run-on and runoff.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Accomplish reduction in the amount of waste generated using the following source controls:
  - ✓ Production planning and sequencing;
  - ✓ Process or equipment modification;
  - ✓ Raw material substitution or elimination;
  - ✓ Loss prevention and housekeeping;
  - ✓ Waste segregation and separation; and
  - ✓ Close loop recycling.
- ☐ Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.
- ☐ Recycle materials whenever possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION®

- Use the entire product before disposing of the container.
- To the extent possible, store wastes under cover or indoors after ensuring all safety concerns such as fire hazard and ventilation are addressed.
- Provide containers for each waste stream at each work station. Allow time after shift to clean area.

Good Housekeeping

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run-on and runoff with a berm. The waste containers or piles must be covered except when in use.
- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain. Clean in a designated wash area that drains to a clarifier.
- Transfer waste from damaged containers into safe containers.
- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.
- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.
- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- If possible, move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.

Preventative Maintenance

- Prevent stormwater run-on from entering the waste management area by enclosing the area or building a berm around the area.
- Prevent waste materials from directly contacting rain.

- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- Cover the area with a permanent roof if feasible.
- Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- Check waste containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the waste management area regularly. Use dry methods when possible (e.g., sweeping, vacuuming, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.

Spill Response and Prevention Procedures

- Keep your spill prevention and plan up-to-date.
- Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills.
- Collect all spilled liquids and properly dispose of them.
- Store and maintain appropriate spill cleanup materials in a location known to all near the designated wash area.
- Ensure that vehicles transporting waste have spill prevention equipment that can prevent spills during transport. Spill prevention equipment includes:
  - ✓ Vehicles equipped with baffles for liquid waste; and
  - ✓ Trucks with sealed gates and spill guards for solid waste.

Material Handling and Waste Management

Litter Control

- Post "No Littering" signs and enforce anti-litter laws.
- Provide a sufficient number of litter receptacles for the facility.
- Clean out and cover litter receptacles frequently to prevent spillage.

Waste Collection

- Keep waste collection areas clean.

- ☐ Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.
- ☐ Secure solid waste containers; containers must be closed tightly when not in use.
- ☐ Do not fill waste containers with washout water or any other liquid.
- ☐ Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).
- ☐ Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal. Affix labels to all waste containers.

Chemical/Hazardous Wastes

- ☐ Select designated hazardous waste collection areas on-site.
- ☐ Store hazardous materials and wastes in covered containers and protect them from vandalism.
- ☐ Place hazardous waste containers in secondary containment.
- ☐ Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- ☐ Hazardous waste cannot be reused or recycled; it must be disposed of by a licensed hazardous waste hauler.

Employee Training Program

- ☐ Educate employees about pollution prevention measures and goals.
- ☐ Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- ☐ Train employees and subcontractors in proper hazardous waste management.
- ☐ Use a training log or similar method to document training.
- ☐ Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

Quality Assurance and Record Keeping

- ☐ Keep accurate maintenance logs that document minimum BMP activities performed for waste handling and disposal, types and quantities of waste disposed of, and any improvement actions.
- ☐ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.

- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital costs will vary substantially depending on the size of the facility and the types of waste handled. Significant capital costs may be associated with reducing wastes by modifying processes or implementing closed-loop recycling.
- Many facilities will already have indoor covered areas where waste materials will be stored and will require no additional capital expenditures for providing cover.
- If outdoor storage of wastes is required, construction of berms or other means to prevent stormwater run-on and runoff may require appropriate constructed systems for containment.
- Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

- Check waste containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the waste management area regularly. Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.

References and Resources

Minnesota Pollution Control Agency, *Industrial Stormwater Best Management Practices Guidebook*. Available online at: http://www.pca.state.mn.us/index.php/view-document.html?gid=10557.

New Jersey Department of Environmental Protection, 2013. *Basic Industrial Stormwater General Permit Guidance Document NJPDES General Permit No NJ0088315,* Revised. Available online at: http://www.nj.gov/dep/dwq/pdf/5G2_guidance_color.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities

Oregon Department of Environmental Quality, 2013. *Industrial Stormwater Best Management Practices Manual- BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: http://www.deq.state.or.us/wq/wqpermit/docs/IndBMP021413.pdf.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

Sacramento County Environmental Management Stormwater Program: Best Management Practices. Available online at: http://www.emd.saccounty.net/EnvHealth/Stormwater/Stormwater-BMPs.html.

Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp-w2k.com/

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA's Multi Sector General Permit. Available online at: http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm.

Building & Grounds Maintenance SC-41

Objectives

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

Targeted Constituents

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

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

CASQA California Stormwater Quality Association

- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Training

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- Clean up spills immediately.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.
- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Drainage System Maintenance SC-44

Description

As a consequence of its function, the stormwater drainage facilities on site convey stormwater that may contain certain pollutants either to the offsite conveyance system that collects and transports urban runoff and stormwater, or directly to receiving waters. The protocols in this fact sheet are intended to reduce pollutants leaving the site to the offsite drainage infrastructure or to receiving waters through proper on-site conveyance system operation and maintenance. The targeted constituents will vary depending on site characteristics and operations.

Approach

Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.
- ☐ Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.

Good Housekeeping

Illicit Connections and Discharges

- ☐ Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION®

- ✓ Identify evidence of spills such as paints, discoloring, odors, etc.
- ✓ Record locations of apparent illegal discharges/illicit connections.
- ✓ Track flows back to potential discharges and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- ✓ Eliminate the discharge once the origin of flow is established.

□ Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" or similar stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

□ Refer to fact sheet SC-10 Non-Stormwater Discharges for additional information.

Illegal Dumping

□ Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.

□ Establish a system for tracking incidents. The system should be designed to identify the following:

- ✓ Illegal dumping hot spots;
- ✓ Types and quantities (in some cases) of wastes;
- ✓ Patterns in time of occurrence (time of day/night, month, or year);
- ✓ Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills); and
- ✓ Responsible parties.

□ Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.

□ Refer to fact sheet SC-10 Non-Stormwater Discharges for additional information.

Preventative Maintenance

Catch Basins/Inlet Structures

□ Staff should regularly inspect facilities to ensure compliance with the following:

- ✓ Immediate repair of any deterioration threatening structural integrity.
- ✓ Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.

- ☐ Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- ☐ Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Prioritize storm drain inlets; clean and repair as needed.
- ☐ Keep accurate logs of the number of catch basins cleaned.
- ☐ Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- ☐ Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- ☐ Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- ☐ Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- ☐ Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- ☐ Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- ☐ Conduct routine maintenance at each pump station.
- ☐ Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- ☐ Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.
- ☐ Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Wildlife. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Army Corps of Engineers and USFWS.

Spill Response and Prevention Procedures

- ☐ Keep your spill prevention control plan up-to-date.

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.

Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- Train employees and subcontractors in proper hazardous waste management.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
- Have staff involved in detection and removal of illicit connections trained in the following:
  - ✓ OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
  - ✓ OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
  - ✓ Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for drainage system maintenance, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Keep accurate logs of illicit connections, illicit discharges, and illegal dumping into the storm drain system including how wastes were cleaned up and disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Provided below are typical limitations and recommended "work-arounds" for drainage system maintenance:

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.

  - ✓ Perform all maintenance onsite and do not flush accumulated material downstream to private property or riparian habitats.

- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, and liquid/sediment disposal.

  - ✓ Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.

- Regulations may include adoption of substantial penalties for illegal dumping and disposal.

  - ✓ Do not dump illegal materials anywhere onsite.

  - ✓ Identify illicit connections, illicit discharge, and illegal dumping.

  - ✓ Cleanup spills immediately and properly dispose of wastes.

- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the sanitary sewer system.

  - ✓ Collect all materials and pollutants accumulated in drainage system and dispose of according to local regulations.

  - ✓ Install debris excluders in areas with a trash TMDL.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital costs will vary substantially depending on the size of the facility and characteristics of the drainage system. Significant capital costs may be associated with purchasing water trucks, vacuum trucks, and any other necessary cleaning equipment or improving the drainage infrastructure to reduce the potential .

- Developing and implementing a site specific drainage system maintenance plan will require additional capital if a similar program is not already in place.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.
- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Supplemental Information

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used if allowed or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual.*

Knox County Tennessee *Stormwater Management Manual* Chapter 5 Drainage System Maintenance, 2008. Available online at: http://www.knoxcounty.org/stormwater/manual/Volume%201/knoxco_swmm_v1_chap5_jan2008.pdf.

US EPA. Storm Drain System Cleaning, 2012. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=102.