MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

DEEP CREEK & ROCK SPRINGS ROAD GAS STATION & CONVENIENCE STORE

APN 0438-165-33

Prepared for:

MAIDA HOLDING, INC.
13302 Ranchero Road
Oak Hills, Ca. 92344

Prepared by:

ALR ENGINEERING & TESTING
18361 Symeron Road
Apple Valley, Ca. 92307
760-242-3130

Submittal Date: 6-27-18

Revision No. and Date: Insert No and Current Revision Date

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Revision No. and Date: Insert No and Current Revision Date

Revision No. and Date: Insert No and Current Revision Date

Revision No. and Date: Insert No and Current Revision Date

Final Approval Date:_____

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for MARK MAIDA by ALR ENGINEERING & TESTING. The WQMP is intended to comply with the requirements of the SAN BERNARDINO COUNTY and the Phase II Small MS4 General Permit for the Mojave River Watershed. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the Phase II Small MS4 Permit and the intent of San Bernardino County (unincorporated areas of Phelan, Oak Hills, Spring Valley Lake and Victorville) and the incorporated cities of Hesperia and Victorville and the Town of Apple Valley. Once the undersigned transfers its interest in the property, its successors in interest and the city/county/town shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 0438-165-33

Owner's Signature			
Owner Name:	MARK MAIDA		
Title	OWNER/DEVELOPER		
Company			
Address	13302 RANCHERO ROAD, OAK HILLS, CA. 92344		
Email			
Telephone #			
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 0438-165-33

"The selection, sizing and design of storm water treatment and other storm water quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of the California State Water Resources Control Board Order No. 2013-0001-DWQ.

Engineer:	STEPHAN M. LONGORIA	PE Stamp Below
Title	PRINCIPAL ENGINEER	
Company	ALR ENGINEERING & TESTING	
Address	18361 SYMERON ROAD, APPLE VALLEY, CA. 92307	
Email	alrengineeringtesting@gmail.com	
Telephone #	760-242-3130	
Signature		
Date	7/2/18	

Table of Contents

Forms

Section I – Introduction

This WQMP template has been prepared specifically for the Phase II Small MS4 General Permit in the Mojave River Watershed. This location is within the jurisdiction of the Lahontan Regional Water Quality Control Board (LRWQCB). This document should not be confused with the WQMP template for the Santa Ana Phase I area of San Bernardino County.

WQMP preparers must refer to the MS4 Permit for the Mojave Watershed WQMP template and Technical Guidance (TGD) document found at: http://cms.sbcounty.gov/dpw/Land/NPDES.aspx to find pertinent arid region and Mojave River Watershed specific references and requirements.

Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name	DEEP CREEK GAS STATION				
Project Owner Contact Name:	MARK MAIDA				
Mailing Address:	13302 RANCHERO ROAD, OAK HILLS, CA. 92344	E-mail Address:		Telephone:	
Permit/Application Number(s):		Tract/Parcel Map Number(s):			
Additional Information/ Comments:					
Description of Project:	THIS PROPOSED PROJECT WILL BE A 4,999 SF GAS STATION WITH A CONVENIENCE STORE ON A 2.92 GROSS ACRE PARCEL.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.					

Section 2 Project Description

2.1 Project Information

The WQMP shall provide the information listed below. The information provided for Conceptual/ Preliminary WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long-term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

2.1.1 Project Sizing Categorization

If the Project is greater than 5,000 square feet, and not on the excluded list as found on Section 1.4 of the TGD, the Project is a Regulated Development Project.

If the Project is creating and/or replacing greater than 2,500 square feet but less than 5,000 square feet of impervious surface area, then it is considered a Site Design Only project. This criterion is applicable to all development types including detached single-family homes that create and/or replace greater than 2,500 square feet of impervious area and are not part of a larger plan of development.

Form 2.1-1 Description of Proposed Project

1 Regulated Development Project Category (Select all that apply):			
☒ #1 New development involving the creation of 5,000 ft² or more of impervious surface collectively over entire site	☐ #2 Significant re-development involving the addition or replacement of 5,000 ft² or more of impervious surface on an already developed site	☐ #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface	☐ #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface
☐ Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft.) *Will require source control Site Design Measures. Use the "PCMP" Template. Do not use this WQMP Template.*			

2 Project Area (ft2):	65,457	3 Number of Dwelling Units:	0	4 SIC Code:	447110

5 Is Project going to be phased? Yes ☐ No ☒ *If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.*

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project storm water facilities. Describe any lot-level storm water features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP storm water facilities:

THE PROPERTY IS OWNED AND WILL BE MANAGED BY MARK MAIDA. MR. MAIDA WILL BE RESPONSIBLE FOR THE LONG-TERM MAINTENANCE OF THE WQMP STORM WATER FACILITIES DESCRIBED WITHIN. THE LONG-TERM MAINTENANCE WILL TRANSFER WITH PROPERTY OWNER.

2.3 Potential Stormwater Pollutants

Best Management Practices (BMP) measures for pollutant generating activities and sources shall be designed consistent with recommendations from the CASQA Storm water BMP Handbook for New Development and Redevelopment (or an equivalent manual). Pollutant generating activities must be considered when determining the overall pollutants of concern for the Project as presented in Form 2.3-1.

Determine and describe expected storm water pollutants of concern based on land uses and site activities (refer to Table 3-2 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☐	N ☒	PER TABLE 2-1
Nutrients - Phosphorous	E ☐	N ☒	PER TABLE 2-1
Nutrients - Nitrogen	E ☐	N ☒	PER TABLE 2-1
Noxious Aquatic Plants	E ☐	N ☒	PER TABLE 2-1
Sediment	E ☐	N ☒	PER TABLE 2-1
Metals	E ☒	N ☐	
Oil and Grease	E ☒	N ☐	
Trash/Debris	E ☒	N ☐	
Pesticides / Herbicides	E ☒	N ☐	
Organic Compounds	E ☒	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMPs through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed Drainage Management Areas (DMAs)) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site. ***If the project has more than one drainage area for storm water management, then complete additional versions of these forms for each DA / outlet. A map presenting the DMAs must be included as an appendix to the WQMP document.***

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34.414324	Longitude -117.22505	Thomas Bros Map page 4477

1 San Bernardino County climatic region: ☒ Desert

2 Does the site have more than one drainage area (DA): Yes☐ No☒ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA C flows to DA1 DMA A	*Ex. Bioretention overflow to vegetated bioswale with 4' bottom width, 5:1 side slopes and bed slope of 0.01. Conveys runoff for 1000' through DMA 1 to existing catch basin on SE corner of property*
DA1 DMA A to Outlet 1	
DA1 DMA B to Outlet 1	
DA2 to Outlet 2	

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	65,457			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use* http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf	3			
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	A			
5 Longest flowpath length (ft)	180			
6 Longest flowpath slope (ft/ft)	0.01			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	78			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50%* ***Attach photos of site to support rating***	65			

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1 (use only as needed for additional DMA w/in DA 1)				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA E	DMA F	DMA G	DMA H
1 DMA drainage area (ft^2)				
2 Existing site impervious area (ft^2)				
3 Antecedent moisture condition *For desert areas, use* http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf				
4 Hydrologic soil group *County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*				
5 Longest flowpath length (ft)				
6 Longest flowpath slope (ft/ft)				
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*				
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*				

Form 3-3 Watershed Description for Drainage Area

Receiving waters Refer to SWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	MOJAVE RIVER WATERSHED
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	NO EXISTING TMDLS
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	FLOURIDE, SULFATES, TOTAL DISSOLVED SOLIDS
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	NONE
Hydromodification Assessment	☐ Yes *Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMPs and Site Design BMP Measures

The information and data in this section are required for both Regulated Development and Site Design Only Projects. Source Control BMPs and Site Design BMP Measures are the basis of site-specific pollution management.

4.1.1 Source Control BMPs

Non-structural and structural source control BMP are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities.

The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

The identified list of source control BMPs correspond to the CASQA Storm water BMP Handbook for New Development and Redevelopment.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Storm water BMPs	☒	☐	DOCUMENTS AND MAINTENANCE REQUIREMENTS WILL BE GIVEN TO THE OWNER
N2	Activity Restrictions	☐	☒	NO KNOWN RESTRICTIONS EXIST AT THIS TIME
N3	Landscape Management BMPs	☒	☐	THE LANDSCAPING WILL BE MAINTAINED AT ALL TIMES
N4	BMP Maintenance	☒	☐	THE STRUCTURAL BMPS WILL BE MAINTAINED ANNUALLY
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	THIS PROJECT IS A GAS STATION WITH A CONVENIENCE STORE
N6	Local Water Quality Ordinances	☒	☐	ALL RUNOFF WILL DRAIN TO THE RETENTION BASIN
N7	Spill Contingency Plan	☒	☐	A SPILL CONTINGENCY PLAN WILL BE PROVIDED AND IMPLEMENTED ON SITE
N8	Underground Storage Tank Compliance	☐	☒	THE UNDERGROUND FUEL TANK WILL COMPLY WITH STATE AND FEDERAL MANDATES
N9	Hazardous Materials Disclosure Compliance	☒	☐	ALL APPROPRIATE DISCLOSURES WILL BE UTILIZED WHEN NEEDED

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☒	☐	THE SITE WILL FOLLOW ARTICLE 8O OF THE UNIFORM FIRE CODE
N11	Litter/Debris Control Program	☒	☐	ALL TRASH ENCLOSURES WILL HAVE COVERS OR ROOF STRUCTURES
N12	Employee Training	☒	☐	EMPLOYEES WILL BE TRAINED FOR ALL POSSIBLE CONTINGENCIES AT THE SITE
N13	Housekeeping of Loading Docks	☐	☒	NO LOADING DOCKS ON SITE
N14	Catch Basin Inspection Program	☒	☐	THE CATCH BASINS ON SITE WILL BE INSPECTED AFTER EVERY STORM EVENT OR ANNUALLY
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	ALL PAVED AREAS WILL BE CLEANED EVERY FALL
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	NO OTHER MEASURES ARE INDENTIFIED
N17	Comply with all other applicable NPDES permits	☒	☐	SITE WILL COMPLY WITH CGP AND THE SWPPP DURING CONSTRUCTION

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	THE INLETS WILL HAVE "NO DUMPING" STENCILED ON THE CONCRETE NEAR INLET
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	NO OUTDOOR STORAGE ONSITE
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	DUMPSTER TO HAVE COVERS
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (State-wide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	AS DESCRIBED IN THE BMP INFORMATION SHEETS
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	ALL LANSCAPING TO FOLLOW COUNTY CODE
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☐	☒	ALL RUNOFF TO REMAIN ONSITE AND DRAINED TO THE RETENTION BASIN
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	NO DOCKS ONSITE
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	NO MAINTENANCE BAYS ONSITE
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	NO VEHICLE WASH AREAS ONSITE
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	NO OUTDOOR PROCESSING AREAS ONSITE

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	NO EQUIPMENT WASH AREAS ONSITE
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☒	☐	FUELING AREAS ONSITE WILL BE KEPT PER BMP
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	NO HILLSIDE LANDSCAPING ONSITE
S14	Wash water control for food preparation areas	☐	☒	NO FOOD PREPARATION AREAS ONSITE
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	NO CAR WASH RACKS ONSITE

4.1.2 Site Design BMPs

As part of the planning phase of a project, the site design practices associated with new LID requirements in the Phase II Small MS4 Permit must be considered. Site design BMP measures can result in smaller Design Capture Volume (DCV) to be managed by both LID and hydromodification control BMPs by reducing runoff generation.

As is stated in the Permit, it is necessary to evaluate site conditions such as soil type(s), existing vegetation and flow paths will influence the overall site design.

Describe site design and drainage plan including:

- A narrative of site design practices utilized or rationale for not using practices
- A narrative of how site plan incorporates preventive site design practices
- Include an attached Site Plan layout which shows how preventative site design practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Site Design Practices Checklist

Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☐ No ☒ Explanation: Entire constructed area will be paved and buildings draining to a retention basin
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☐ No ☒ Explanation: Retention Basin will be used for Storm Water runoff
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: The Retention Basin will used to collect all runoff waters
Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain storm water to storage or infiltration BMPs instead of to storm drain: Yes ☒ No ☐ Explanation: The Retention Basin will collect all storm water runoff
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: Not feasible in the desert
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: The entire site will be graded and constructed for the intended purpose
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation.: Yes ☐ No ☒ Explanation: Most of the area will be disturbed but landscaping will be employed
Minimize unnecessary compaction in storm water retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: The area of the Retention Basin is to the Northeast corner of the parcel which will not be disturbed

Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: **The Retention Basin will used as shown on site plan**
Stake off areas that will be used for landscaping to minimize compaction during construction: Yes ☐ No ☒ Explanation: **The areas of landscaping will have fill material placed before planting**
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation: **Limited rainfall expected in the desert**
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☐ No ☒ Explanation: **There are no streams near by the project site**

It is noted that, in the Phase II Small MS4 Permit, site design elements for green roofs and vegetative swales are required. Due to the local climatology in the Mojave River Watershed, proactive measures are taken to maximize the amount of drought tolerant vegetation. It is not practical in this region to have green roofs or vegetative swales. As part of site design the project proponent should utilize locally recommended vegetation types for landscaping. Typical landscaping recommendations are found in following local references:

San Bernardino County Special Districts:

Guide to High Desert Landscaping -
http://www.specialdistricts.org/Modules/ShowDocument.aspx?documentid=795

Recommended High-Desert Plants -
http://www.specialdistricts.org/modules/showdocument.aspx?documentid=553

Mojave Water Agency:

Desert Ranch: http://www.mojavewater.org/files/desertranchgardenprototype.pdf

Summertree: http://www.mojavewater.org/files/Summertree-Native-Plant-Brochure.pdf

Thornless Garden: http://www.mojavewater.org/files/thornlessgardenprototype.pdf

Mediterranean Garden: http://www.mojavewater.org/files/mediterraneangardenprototype.pdf

Lush and Efficient Garden: http://www.mojavewater.org/files/lushandefficientgardenprototype.pdf

Alliance for Water Awareness and Conservation (AWAC) outdoor tips – http://hdawac.org/save-outdoors.html

4.2 Treatment BMPs

After implementation and design of both Source Control BMPs and Site Design BMP measures, any remaining runoff from impervious DMAs must be directed to one or more on-site, treatment BMPs (LID or biotreatment) designed to infiltrate, evaportranspire, and/or bioretain the amount of runoff specified in Permit Section E.12.e (ii)(c) Numeric Sizing Criteria for Storm Water Retention and Treatment.

4.2.1 Project Specific Hydrology Characterization

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in Section E.12.e.ii.c and Section E.12.f of the Phase II Small MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection from hydromodification.

If the project has more than one outlet for storm water runoff, then complete additional versions of these forms for each DA / outlet.

It is noted that in the Phase II Small MS4 Permit jurisdictions, the LID BMP Design Capture Volume criteria is based on the 2-year rain event. The hydromodification performance criterion is based on the 10-year rain event.

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), San Bernardino County requires use of the P_6 method (Form 4.2-1) For pre- and post-development hydrologic calculation, San Bernardino County requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi^2), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for hydromodification performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)

[1] Project area DA 1 (ft^2): 65,457	[2] Imperviousness after applying preventative site design practices (Imp%): 70	[3] Runoff Coefficient (Rc): 0.4939 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*

[4] Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.371
http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

[5] Compute P_6, Mean 6-hr Precipitation (inches): 0.459
*P_6 = Item 4 * C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)*

[6] Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*	24-hrs ☐ 48-hrs ☒

[7] Compute design capture volume, DCV (ft^3): 2,427
*DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)*
Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2

Form 4.2-2 Summary of Hydromodification Assessment (DA 1)

Is the change in post- and pre- condition flows captured on-site?: Yes ☒ No ☐
If "Yes", then complete Hydromodification assessment of site hydrology for 10yr storm event using Forms 4.2-3 through 4.2-5 and insert results below *(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual- Addendum 1)*
If "No," then proceed to Section 4.3 BMP Selection and Sizing

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** *Form 4.2-3 Item 12*	**2** *Form 4.2-4 Item 13*	**3** *Form 4.2-5 Item 10*
Post-developed	**4** *Form 4.2-3 Item 13*	**5** *Form 4.2-4 Item 14*	**6** *Form 4.2-5 Item 14*
Difference	**7** *Item 4 – Item 1*	**8** *Item 2 – Item 5*	**9** *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** % *Item 7 / Item 1*	**11** % *Item 8 / Item 2*	**12** % *Item 9 / Item 3*

Form 4.2-3 Hydromodification Assessment for Runoff Volume (DA 1)

Weighted Curve Number Determination for: Pre-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type								
2a Hydrologic Soil Group (HSG)	A							
3a DMA Area, ft² *sum of areas of DMA should equal area of DA*	65,457							
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	78							
Weighted Curve Number Determination for: Post-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type								
2b Hydrologic Soil Group (HSG)	A							
3b DMA Area, ft² *sum of areas of DMA should equal area of DA*	65,457							
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	98							

5 Pre-Developed area-weighted CN:	**7** Pre-developed soil storage capacity, S (in): *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN:	**8** Post-developed soil storage capacity, S (in): *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): *I_a = 0.2 * Item 8*

11 Precipitation for 10 yr, 24 hr storm (in): 2.46
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft³):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft³):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet hydromodification requirement, (ft³):
*Vhydro = (Item 13 * 0.95) – Item 12*

Form 4.2-4 Hydromodification Assessment for Time of Concentration (DA 1)

Compute time of concentration for pre and post developed conditions for each DA *(For projects using the Hydrology Manual complete the form below)*

Variables	Pre-developed DA1 *Use additional forms if there are more than 4 DMA*				Post-developed DA1 *Use additional forms if there are more than 4 DMA*			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*								
2 Change in elevation (ft)								
3 Slope (ft/ft), S_o = *Item 2 / Item 1*								
4 Land cover								
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*								
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*								
7 Cross-sectional area of channel (ft^2)								
8 Wetted perimeter of channel (ft)								
9 Manning's roughness of channel (n)								
10 Channel flow velocity (ft/sec) V_{fps} = *(1.49 / Item 9) * (Item 7/Item 8)^0.67 * (Item 3)^0.5*								
11 Travel time to outlet (min) T_t = *Item 6 / (Item 10 * 60)*								
12 Total time of concentration (min) T_c = *Item 5 + Item 11*								

13 Pre-developed time of concentration (min):	*Minimum of Item 12 pre-developed DMA*
14 Post-developed time of concentration (min):	*Minimum of Item 12 post-developed DMA*
15 Additional time of concentration needed to meet hydromodification requirement (min):	$T_{C\text{-}Hydro}$ = *(Item 13 * 0.95) – Item 14*

Form 4.2-5 Hydromodification Assessment for Peak Runoff (DA 1)

Compute peak runoff for pre- and post-developed conditions

Variables	Pre-developed DA to Project Outlet (*Use additional forms if more than 3 DMA*)			Post-developed DA to Project Outlet (*Use additional forms if more than 3 DMA*)		
	DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.7 LOG Form 4.2-4 Item 5 /60)*						
2 Drainage Area of each DMA (Acres) *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*						
3 Ratio of pervious area to total area *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*						
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*						
5 Maximum loss rate (in/hr) *F_m = Item 3 * Item 4* *Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*						
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*						
7 Time of concentration adjustment factor for other DMA to site discharge point *Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)*						
DMA A	*n/a*			*n/a*		
DMA B		*n/a*			*n/a*	
DMA C			*n/a*			*n/a*

8 Pre-developed Q_p at T_c for DMA A: *Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*	**9** Pre-developed Q_p at T_c for DMA B: *Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*	**10** Pre-developed Q_p at T_c for DMA C: *Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]*
10 Peak runoff from pre-developed condition confluence analysis (cfs):		*Maximum of Item 8, 9, and 10 (including additional forms as needed)*
11 Post-developed Q_p at T_c for DMA A: *Same as Item 8 for post-developed values*	**12** Post-developed Q_p at T_c for DMA B: *Same as Item 9 for post-developed values*	**13** Post-developed Q_p at T_c for DMA C: *Same as Item 10 for post-developed values*
14 Peak runoff from post-developed condition confluence analysis (cfs):		*Maximum of Item 11, 12, and 13 (including additional forms as needed)*
15 Peak runoff reduction needed to meet Hydromodification Requirement (cfs):		*$Q_{p\text{-}hydro}$ = (Item 14 * 0.95) – Item 10*

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretention) BMPs conform to the project DCV developed to meet performance criteria specified in the Phase II Small MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the Phase II Small MS4 Permit (see Section 5.3 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design Measures (Form 4.3-2)
- Retention and Infiltration BMPs (Form 4.3-3) or
- Biotreatment BMPs (Form 4.3-4).

> Please note that the selected BMPs may also be used as dual purpose for on-site, hydromodification mitigation and management.

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is "Yes," provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Form 4.3-2 to determine the feasibility of applicable Site Design BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable Site Design BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combination of site design, retention and/or infiltration BMPs is unable to mitigate the entire DCV, then the remainder of the volume-based performance criteria that cannot be achieved with site design, retention and/or infiltration BMPs must be managed through biotreatment BMPs. If biotreatment BMPs are used, then they must be sized to provide equivalent effectiveness based on Template Section 4.3.4.

4.3.1 Exceptions to Requirements for Bioretention Facilities

Contingent on a demonstration that use of bioretention or a facility of equivalent effectiveness is infeasible, other types of biotreatment or media filters (such as tree-box-type biofilters or in-vault media filters) may be used for the following categories of Regulated Projects:

1) Projects creating or replacing an acre or less of impervious area, and located in a designated pedestrian-oriented commercial district (i.e., smart growth projects), and having at least 85% of the entire project site covered by permanent structures;

2) Facilities receiving runoff solely from existing (pre-project) impervious areas; and

3) Historic sites, structures or landscapes that cannot alter their original configuration in order to maintain their historic integrity.

Form 4.3-1 Infiltration BMP Feasibility (DA 1)	
Feasibility Criterion – Complete evaluation for each DA on the Project Site	
[1] Would infiltration BMP pose significant risk for groundwater related concerns? *Refer to Section 5.3.2.1 of the TGD for WQMP*	Yes ☐ No ☒
If Yes, Provide basis: (attach)	
[2] Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert): • The location is less than 50 feet away from slopes steeper than 15 percent • The location is less than ten feet from building foundations or an alternative setback. • A study certified by a geotechnical professional or an available watershed study determines that storm water infiltration would result in significantly increased risks of geotechnical hazards.	Yes ☐ No ☒
If Yes, Provide basis: (attach)	
[3] Would infiltration of runoff on a Project site violate downstream water rights?	Yes ☐ No ☒
If Yes, Provide basis: (attach)	
[4] Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils?	Yes ☐ No ☒
If Yes, Provide basis: (attach)	
[5] Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)?	Yes ☐ No ☒
If Yes, Provide basis: (attach)	
[6] Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? *See Section 3.5 of the TGD for WQMP and WAP*	Yes ☐ No ☒
If Yes, Provide basis: (attach)	
[7] Any answer from Item 1 through Item 3 is "Yes": *If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Selection and Evaluation of Biotreatment BMP.* *If no, then proceed to Item 8 below.*	Yes ☐ No ☒
[8] Any answer from Item 4 through Item 6 is "Yes": *If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Site Design BMP.* *If no, then proceed to Item 9, below.*	Yes ☐ No ☒
[9] All answers to Item 1 through Item 6 are "No": *Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP.* *Proceed to Form 4.3-2, Site Design BMPs.*	

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design Measures reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design Measures shall be provided except where they are mutually exclusive

with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design BMPs (DA 1)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3):	$V_{retention}$ *=Sum of Item 4 for all BMPs*		
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft) (min. 0.5 ft.)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ = *(Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3):	$V_{retention}$ *=Sum of Item 12 for all BMPs*		

Form 4.3-2 cont. Site Design BMPs (DA 1)

14 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 14-18. If no, proceed to Item 19*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Number of Street Trees			
16 Average canopy cover over impervious area (ft^2)			
17 Runoff volume retention from street trees (ft^3) $V_{retention}$ = *Item 15 * Item 16 * (0.05/12) assume runoff retention of 0.05 inches*			
18 Runoff volume retention from street tree BMPs (ft^3):	$V_{retention}$ = *Sum of Item 17 for all BMPs*		
19 Total Retention Volume from Site Design BMPs:	*Sum of Items 5, 13 and 18*		

4.3.3 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix C of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3.

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5 of the TGD for WQMP)

If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

4.3.3.1 Allowed Variations for Special Site Conditions

The bioretention system design parameters of this Section may be adjusted for the following special site conditions:

1) Facilities located within 10 feet of structures or other potential geotechnical hazards established by the geotechnical expert for the project may incorporate an impervious cutoff wall between the bioretention facility and the structure or other geotechnical hazard.

2) Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities located where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner and may locate the underdrain discharge at the bottom of the subsurface drainage/storage layer (this configuration is commonly known as a "flow-through planter").

3) Facilities located in areas of high groundwater, highly infiltrative soils or where connection of underdrain to a surface drain or to a subsurface storm drain are infeasible, may omit the underdrain.

4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites may be required to provide adequate pretreatment to address pollutants of concern unless these high-risk areas are isolated from storm water runoff or bioretention areas with no chance of spill migration.

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 1)

1 Remaining LID DCV not met by site design BMP (ft^3): *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*			
BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods*	6.08		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.0		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	3.04		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	5.0		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	1.5		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	2888		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	0		
10 Amended soil porosity	0		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	3.75		
12 Gravel porosity	0.40		
13 Duration of storm as basin is filling (hrs) *Typical ~3hrs*	3.0		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	10,859		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	0		
16 Total Retention Volume from LID Infiltration BMPs: 10,859 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: 4.47% *Retention% = Item 16 / Form 4.2-1 Item 7*			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐ *If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.*			

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-4 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV. Biotreatment computations are included as follows:

- Use Form 4.3-5 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-6 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-7 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-4 Selection and Evaluation of Biotreatment BMP (DA 1)

1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): *Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-5 and 4.3-6 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-7 to compute treated flow*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-5 Item 15 + Form 4.3-6 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-5 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains

Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*			
2 Amended soil infiltration rate *Typical ~ 5.0*			
3 Amended soil infiltration safety factor *Typical ~ 2.0*			
4 Amended soil design percolation rate (in/hr) P_{design} = *Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*			
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Ponding Depth (ft) d_{BMP} = *Minimum of (1/12 * Item 4 * Item 5) or Item 6*			
8 Amended soil surface area (ft^2)			
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity, *n*			
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
12 Gravel porosity, *n*			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Biotreated Volume (ft^3) $V_{biotreated}$ = *Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: *Sum of Item 14 for all volume-based BMPs included in this form*			

Form 4.3-6 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type *Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (E.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.*	DA DMA BMP Type		DA DMA BMP Type *(Use additional forms for more BMPs)*	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft^2) A_{bottom} = *Item 2 * Item 3*				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft^2) $A_{surface}$ =*(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))*				
8 Storage volume (ft^3) *For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details* V =*Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]*				
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*				
10 Outflow rate (cfs) Q_{BMP} = *(Item $8_{forebay}$ + Item 8_{basin}) / (Item 9 * 3600)*				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft^3) $V_{biotreated}$ = *(Item $8_{forebay}$ + Item 8_{basin}) +(Item 10 * Item 11 * 3600)*				
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-7 Flow Based Biotreatment (DA 1)

Biotreatment BMP Type *Vegetated swale, vegetated filter strip, or other comparable proprietary BMP*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5*			
2 Flow depth for water quality treatment (ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
3 Bed slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
4 Manning's roughness coefficient			
5 Bottom width (ft) b_w = *(Form 4.3-5 Item 6 * Item 4) / (1.49 * Item 2^1.67 * Item 3^0.5)*			
6 Side Slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Cross sectional area (ft^2) *A = (Item 5 * Item 2) + (Item 6 * Item 2^2)*			
8 Water quality flow velocity (ft/sec) *V = Form 4.3-5 Item 6 / Item 7*			
9 Hydraulic residence time (min) *Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Length of flow based BMP (ft) *L = Item 8 * Item 9 * 60*			
11 Water surface area at water quality flow depth (ft^2) SA_{top} = *(Item 5 + (2 * Item 2 * Item 6)) * Item 10*			

4.3.5 Conformance Summary

Complete Form 4.3-8 to demonstrate how on-site LID DCV is met with proposed site design, infiltration, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1	Total LID DCV for the Project DA-1 (ft^3): *Copy Item 7 in Form 4.2-1*
2	On-site retention with site design BMP (ft^3): *Copy Item18 in Form 4.3-2*
3	On-site retention with LID infiltration BMP (ft^3): *Copy Item 16 in Form 4.3-3*
4	On-site biotreatment with volume based biotreatment BMP (ft^3): *Copy Item 3 in Form 4.3-4*
5	Flow capacity provided by flow based biotreatment BMP (cfs): *Copy Item 6 in Form 4.3-4*
6	LID BMP performance criteria are achieved if answer to any of the following is "Yes": • Full retention of LID DCV with site design or infiltration BMP: Yes ☐ No ☐ *If yes, sum of Items 2, 3, and 4 is greater than Item 1* • Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐ *If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized* ▪ On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐ *If yes, Form 4.3-1 Items 7 and 8 were both checked yes*
7	If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance: • Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐ *Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance,* V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%* • Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated: 1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐ 2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐ 3) Equal or greater protection against shock loadings and spills; ☐ 4) Equal or greater accessibility and ease of inspection and maintenance. ☐

4.3.6 Hydromodification Control BMP

Use Form 4.3-9 to compute the remaining runoff volume retention, after Site Design BMPs are implemented, needed to address hydromodification, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential hydromodification. Describe the proposed hydromodification treatment control BMP. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-9 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for hydromodification performance criteria (ft^3): *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design and infiltration, BMP (ft^3): *Sum of Form 4.3-8 Items 2, 3, and 4. Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving hydromodification volume reduction*
3 Remaining volume for hydromodification volume capture (ft^3): *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site BMPs (ft^3):

5 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☐

If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP ☐
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐

6 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☐

If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs ☐

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance.

Alternative Designs — Facilities, or a combination of facilities, of a different design than in Permit Section E.12.e.(ii)(f) may be permitted if all of the following measures of equivalent effectiveness are demonstrated:

1) Equal or greater amount of runoff infiltrated or evapotranspired;

2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment;

3) Equal or greater protection against shock loadings and spills;

4) Equal or greater accessibility and ease of inspection and maintenance.

The Project Proponent will need to obtain written approval for an alternative design from the Lahontan Regional Water Board Executive Officer (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMPs included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance (refer to Section 8, Post Construction BMP Requirements, in the TGD for WQMP). Fully complete Form 5-1 summarizing all BMP included in the WQMP. Attach additional forms as needed. The WQMP shall also include a detailed Operation and Maintenance Plan for all BMP and a Maintenance Agreement. The Maintenance Agreement must also be attached to the WQMP.

Note that at time of Project construction completion, the Maintenance Agreement must be completed, signed, notarized and submitted to the County Storm-water Department

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
SC-10	Owner/Management	**Non-Storm water Discharges**	**Continual**
SC-11	Owner/Management	**Spill Prevention, Control & Cleanup**	**Continual**
SC-20	Owner/Management	**Vehicle and Equipment Fueling**	**Continual**
SC-41	Owner/Management	**Building & Grounds Maintenance**	**Continual**
SC-43	Owner/Management	**Parking Area Maintenance**	**Continual**
BG-22	Owner/Management	**Automotive Service – Service Station**	**Continual**
TC-10	Owner/Management	**Infiltration Trench**	**After Rain Event**
TC-11	Owner/Management	**Infiltration Basin**	**After Rain Event**
MP-52	Owner/Management	**Drain Inlet Insert**	**After Rain Event**

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

6.2 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3 Post Construction

Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

- BMP Educational Materials
- Activity Restriction – C,C&R's & Lease Agreements

RECORDING REQUESTED BY:
County of San Bernardino
Department of Public Works

AND WHEN RECORDED MAIL TO:
County of San Bernardino
Department of Public Works
825 E. Third Street, Room 117
San Bernardino, CA 92415-0835

SPACE ABOVE THIS LINE FOR RECORDER'S USE

COVENANT AND AGREEMENT REGARDING WATER QUALITY MANAGEMENT PLAN AND STORMWATER BEST MANAGEMENT PRACTICES TRANSFER, ACCESS AND MAINTENANCE

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

OWNER NAME: MAIDA HOLDINGS, INC.

PROPERTY ADDRESS: SW CORNER OF DEEK CREEK RD. & ROCK SPRINGS RD.

APPLE VALLEY, CA. 92308

APN: 0438-165-33

THIS AGREEMENT is made and entered into in

_____ ,California, this _____ day of

_____ , by and between

_____ , hereinafter

referred to as Owner, and the COUNTY OF SAN BERNARDINO, a political subdivision of the State of California, hereinafter referred to as "the County";

WHEREAS, the Owner owns real property ("Property") in the County of San Bernardino, State of California, more specifically described in Exhibit "A" and depicted in Exhibit "B", each of which exhibits is attached hereto and incorporated herein by this reference; and

WHEREAS, at the time of initial approval of development project known as DEEP CREEK COMMERCIAL DEVELOPMENT within the Property described herein, the County required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff; and

WHEREAS, the Owner has chosen to install and/or implement BMPs as described in the Water Quality Management Plan, dated 6-28-18, on file with the County and incorporated herein by this reference, hereinafter referred to as "WQMP", to minimize pollutants in urban runoff and to minimize other adverse impacts of urban runoff; and

WHEREAS, said WQMP has been certified by the Owner and reviewed and approved by the County; and

WHEREAS, the Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of all BMPs in the WQMP and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs.

NOW THEREFORE, it is mutually stipulated and agreed as follows:

1. Owner shall comply with the WQMP

2. All maintenance or replacement of BMPs proposed as part of the WQMP are the sole responsibility of the Owner in accordance with the terms of this Agreement.

3. Owner hereby provides the County's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by the County Director of Public Works, no advance notice, for the purpose of inspection, sampling, testing of the BMPs, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 5 below. The County shall make every effort at all times to minimize or avoid interference with Owner's use of the Property. Denial of access to any premises or facility that contains WQMP features is a breach of this Agreement and may also be a violation of the County's Pollutant Discharge Elimination System regulations, which on the effective date of this Agreement are found in County Code Sections 35.0101 et seq. If there is reasonable cause to believe that an illicit discharge or breach of this Agreement is occurring on the premises then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction in addition to other enforcement actions. Owner recognizes that the County may perform routine and regular inspections, as well as emergency inspections, of the BMPs. Owner or Owner's successors or assigns shall pay County for all costs incurred by County in the inspection, sampling, testing of the BMPs within thirty (30) calendar days of County invoice.

4. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the County, the Owner shall provide the County with documentation identifying the material(s) removed, the quantity, and disposal destination), testing construction or reconstruction.

5. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) business days of being given written notice by the County , the County is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense against the Property and/or to the Owner or Owner's successors or assigns, including administrative costs, attorneys fees and interest thereon at the maximum rate authorized by the County Code from the date of the notice of expense until paid in full. Owner or Owner's successors or assigns shall pay County within thirty (30) calendar days of County invoice.

6. The County may require the owner to post security in form and for a time period satisfactory to the County to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the County may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the surety(ies) to perform the obligations of this Agreement.

7. The County agrees, from time to time, within ten (10) business days after request of Owner, to execute and deliver to Owner, or Owner's designee, an estoppel certificate requested by Owner, stating that this Agreement is in full force and effect, and that Owner is not in default hereunder with regard to any maintenance or payment obligations (or specifying in detail the nature of Owner's default). Owner shall pay all costs and expenses incurred by the County in its investigation of whether to issue an estoppel certificate within thirty (30) calendar days after receipt of a County invoice and prior to the County's issuance of such certificate. Where the County cannot issue an estoppel certificate, Owner shall pay the County within thirty (30) calendar days of receipt of a County invoice.

8. Owner shall not change any BMPs identified in the WQMP without an amendment to this Agreement approved by authorized representatives of both the County and the Owner.

9. County and Owner shall comply with all applicable laws, ordinances, rules, regulations, court orders and government agency orders now or hereinafter in effect in carrying out the terms of this Agreement. If a provision of this Agreement is terminated or held to be invalid, illegal or unenforceable, the validity, legality and enforceability of the remaining provisions shall remain in full effect.

10. In addition to any remedy available to County under this Agreement, if Owner violates any term of this Agreement and does not cure the violation within the time already provided in this Agreement, or, if not provided, within thirty (30) calendar days, or within such time authorized by the County if said cure reasonably requires more than the subject time, the County may bring an action at law or in equity in a court of competent jurisdiction to enforce compliance by the Owner with the terms of this Agreement. In such action, the County may recover any damages to which the County may be entitled for the violation, enjoin the violation by temporary or permanent injunction without the necessity of proving actual damages or the inadequacy of otherwise available legal remedies, or obtain other equitable relief, including, but not limited to, the restoration of the Property and/or the BMPs identified in the WQMP to the condition in which it/they existed prior to any such violation or injury.

11. This Agreement shall be recorded in the Office of the Recorder of San Bernardino County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the County, including interest as herein above set forth, subject to foreclosure in event of default in payment.

12. In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to hold the County harmless and pay all costs incurred by the County in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

13. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.

14. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of

this Agreement. Owner shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the County at the same time such notice is provided to the successor.

15. Time is of the essence in the performance of this Agreement.

16. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

17. Owner agrees to indemnify, defend (with counsel reasonably approved by the County) and hold harmless the County and its authorized officers, employees, agents and volunteers from any and all claims, actions, losses, damages, and/or liability arising out of this Agreement from any cause whatsoever, including the acts, errors or omissions of any person and for any costs or expenses incurred by the County on account of any claim except where such indemnification is prohibited by law. This indemnification provision shall apply regardless of the existence or degree of fault of indemnitees. The Owner's indemnification obligation applies to the County's "active" as well as "passive" negligence but does not apply to the County's "sole negligence" or "willful misconduct" within the meaning of Civil Code Section 2782, or to any claims, actions, losses, damages, and/or liabilities, to the extent caused by the acts or omissions of any third party contractors undertaking any work (other than field inspections) or other maintenance on the Property on behalf of the County under this Agreement..

[REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK]

IF TO COUNTY :

Director of Public Works

825 E. Third Street, Room 117

San Bernardino, CA 92415-0835

IF TO OWNER:

_____

_____

_____

IN WITNESS THEREOF, the parties hereto have affixed their signatures as of the date first written above.

OWNER:

Signature: _____

Name: MARK MAIDA

Title: OWNER/DEVELOPER

Date: _____

FOR: Maintenance Agreement, dated _____, for the project known as APPLE VALLEY COMMERCIAL DEVELOPMENT

(APN) 0438-165-33,

As described in the WQMP dated 6-28-18.

OWNER:

Signature: _____

Name: _____

Title: _____

Date: _____

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation.

ACCEPTED BY:

_____

GERRY NEWCOMBE, Director of Public Works

Date: _____

Attachment: Notary Acknowledgement

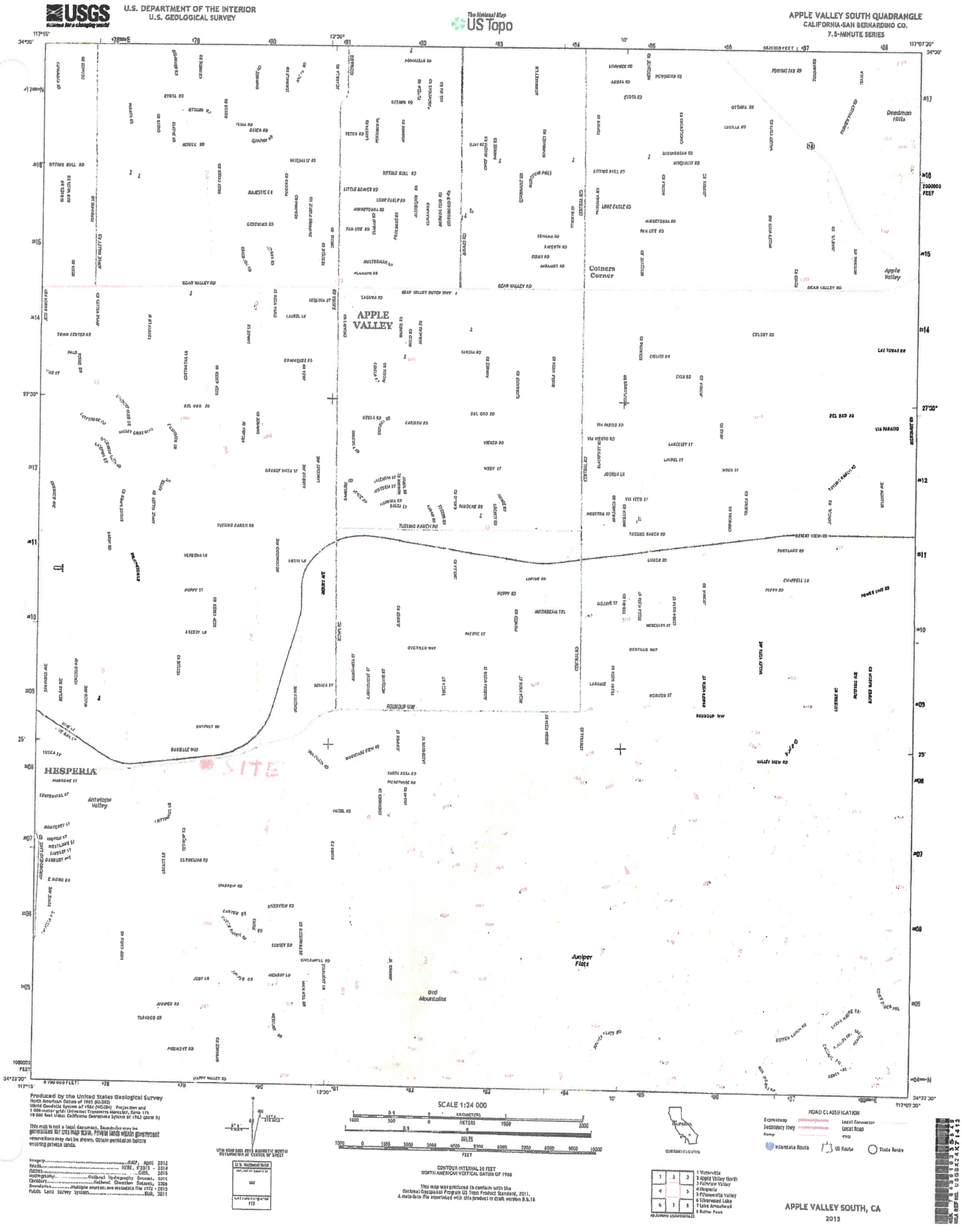
ATTACHMENT 1
Notary Acknowledgement)

EXHIBIT A
(Legal Description)

APN 0438-165-33

Located on the Southwest corner of Deep Creek Road and Rock Springs Road in the County of San Bernardino, State of California, a portion of Section 19, T.4N., R.3W per S.B.B.& M

EXHIBIT B
(Map/illustration)

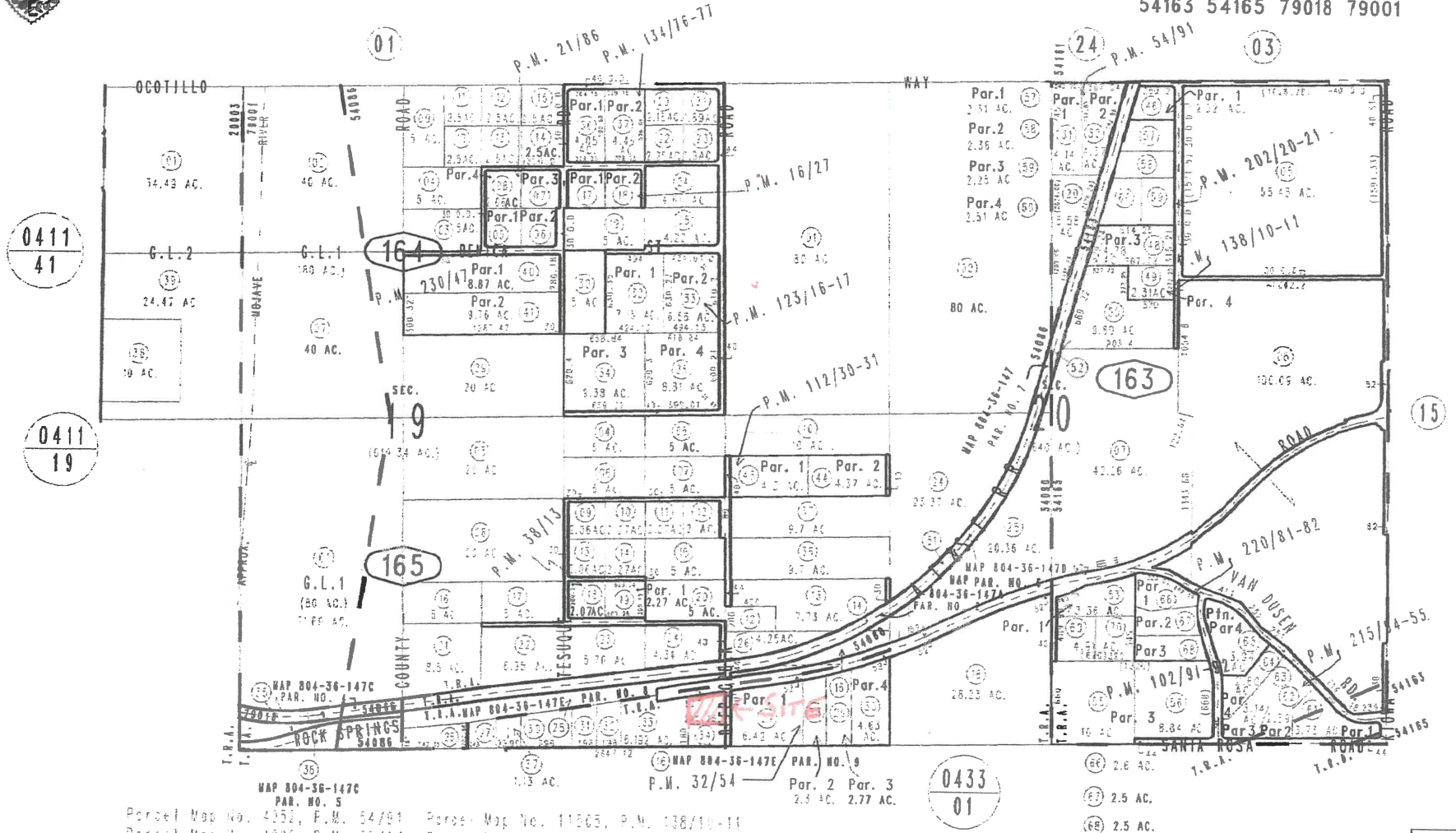

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
The National Map
US Topo
APPLE VALLEY SOUTH QUADRANGLE
CALIFORNIA-SAN BERNARDINO CO.
7.5-MINUTE SERIES
APPLE VALLEY
HESPERIA
SITE
Antelope Valley
Juniper Flats
Old Woman Mountains
Deadman Hills
Coiners Corner
Apple Valley
SCALE 1:24 000
METERS
FEET
MILES
ROAD CLASSIFICATION
Interstate Route
US Route
State Route
APPLE VALLEY SOUTH, CA
2013

THIS MAP IS FOR THE PURPOSE OF AD VALOREM TAXATION ONLY.

Ptn. Fractional Sec.19 & Sec.20, T.4N.,R.3W., S.B.B.&M.

Hesperia Unified
City of Hesperia
Apple Valley Unified
Tax Rate Area
20003 54066 54086
54088 54090 54161
54163 54165 79018 79001

0438 - 16



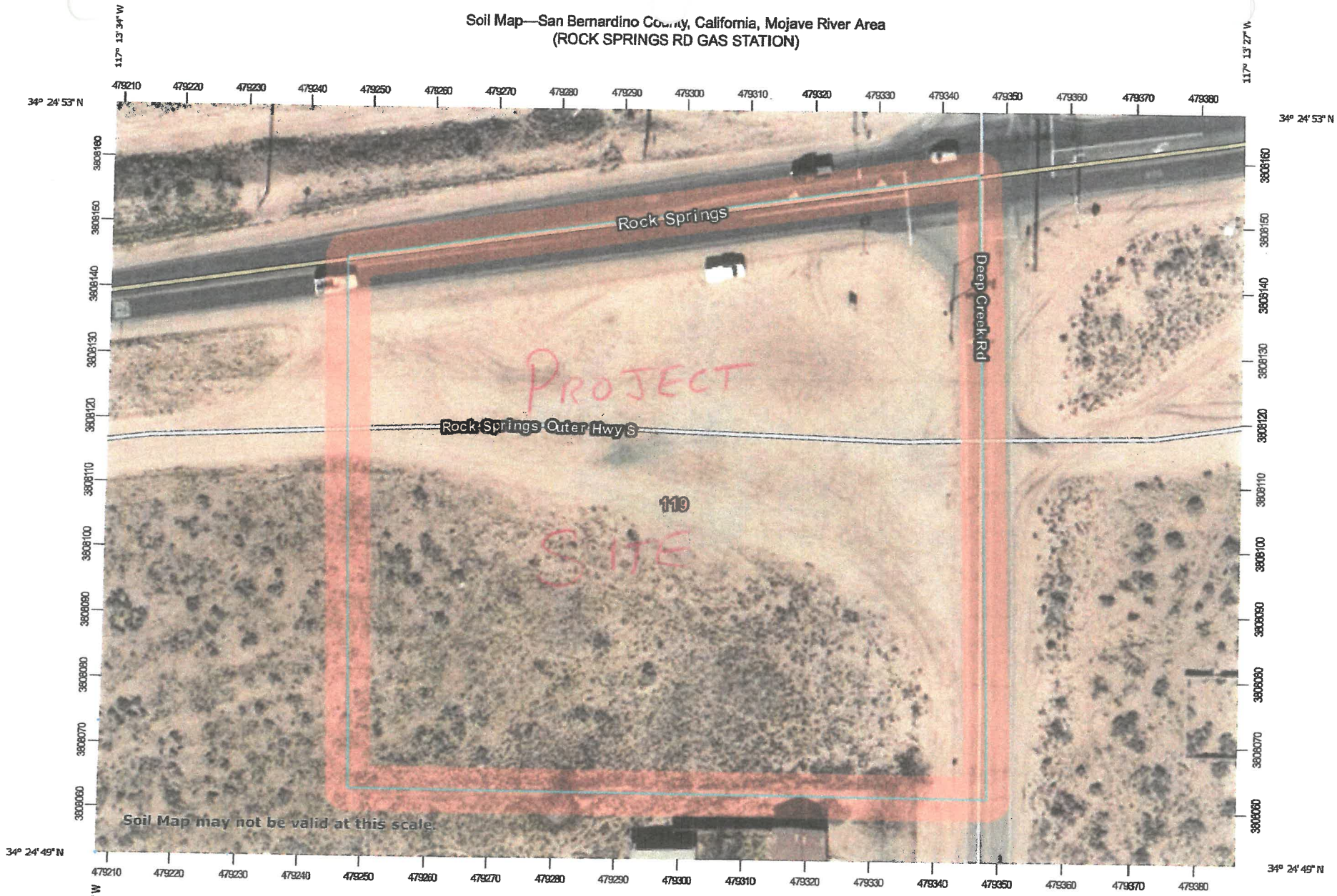
Parcel Map No. 4052, P.M. 54/91
Parcel Map No. 4036, P.M. 38/13
Parcel Map No. 2478, P.M. 21/86
Parcel Map No. 3496, P.M. 32/54
Parcel Map No. 1864, P.M. 16/27
Parcel Map No. 11565, P.M. 138/10-11
Parcel Map No. 11142, P.M. 134/76-77
Parcel Map No. 10633, P.M. 123/16-17
Parcel Map No. 10709, P.M. 112/30-31
Ptn. Parcel Map No. 7048, P.M. 102/91-92
Parcel Map No. 17031, P.M. 230/47
Parcel Map No. 17189, P.M. 220/81-82
Parcel Map No. 16966, P.M. 215/54-55
Parcel Map No. 15316, P.M. 202/20-21

Assessor's Map
Book 0438 Page 16
San Bernardino County

April 2004

REVISED
02/22/16 KC
05/24/17 KA

Soil Map—San Bernardino County, California, Mojave River Area
(ROCK SPRINGS RD GAS STATION)



Map Scale: 1:815 if printed on A landscape (11" x 8.5") sheet.

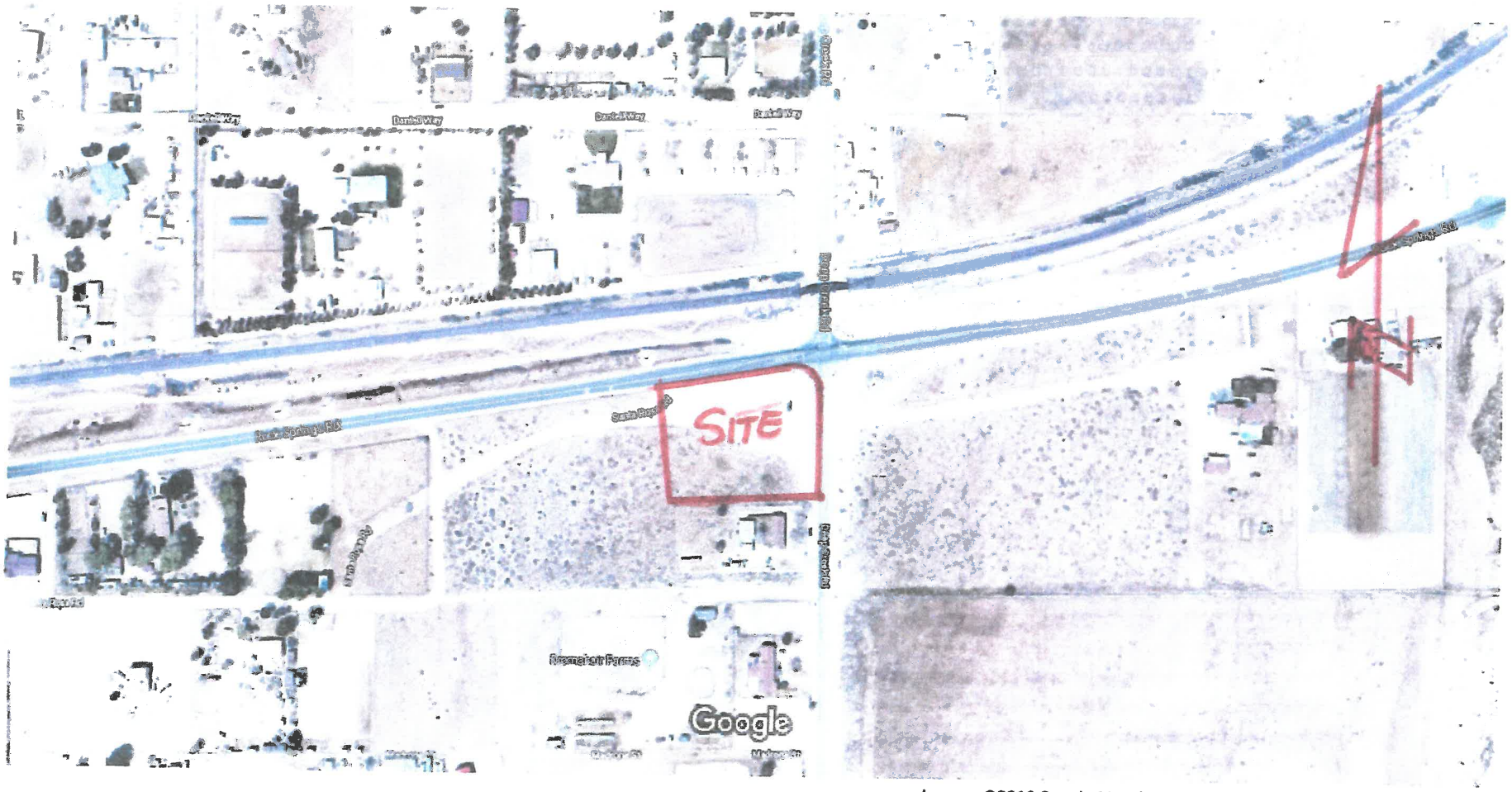
N

Meters: 0 10 20 40 60

Feet: 0 35 70 140 210

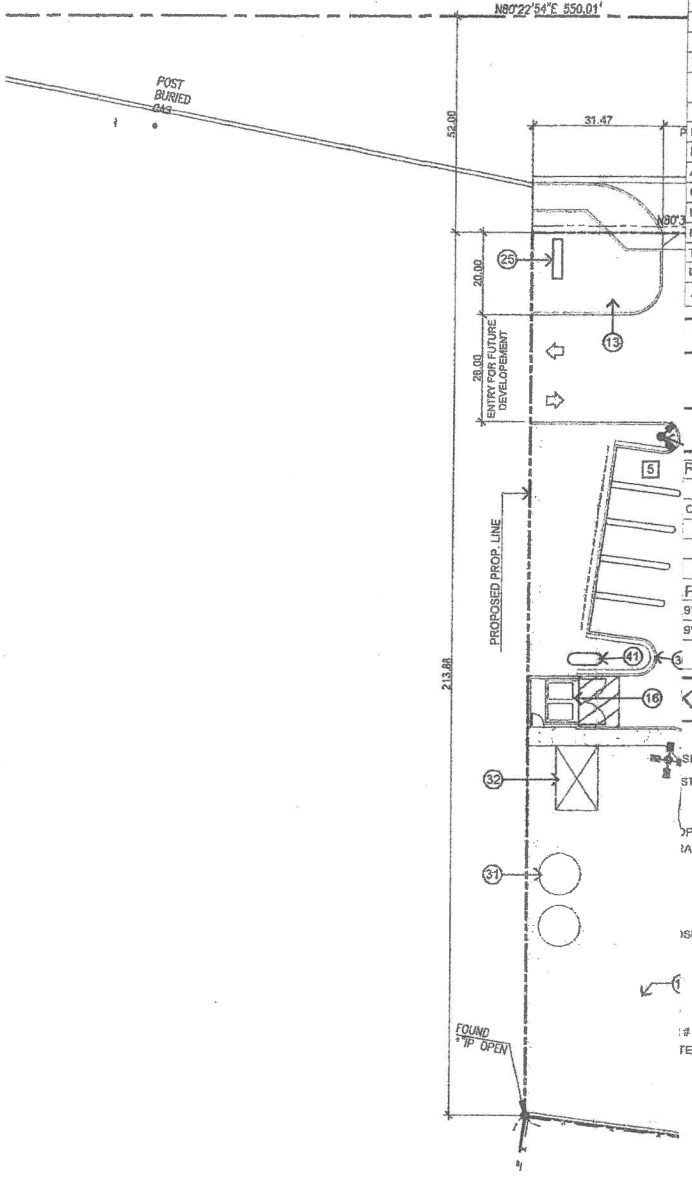
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

Google Maps DEEP CREEK RD GAS STATION



Imagery ©2018 Google, Map data ©2018 Google 100 ft

FOR OFFICIAL USE



SITE DATA

A.P.N:
0438-165-33

LEGAL DESCRIPTION:
PORTION OF SECTION 19, T.4N., R.3W., S.B.M., AS SHOWN ON RS 122/59, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.

ASSESSOR'S PARCEL NO.: APN 0438-165-33

APPROXIMATE AREA: 273,788 S.F., 6.285 ACRES

SITE AREA	
AREA	SQ. FOOTAGE
GROSS LAND AREA (6.29 ACRES)	273,788 S.F.
NET LAND AREA (6.12 ACRES)	266,546 S.F.
NOT A PART (4.62 ACRES)	201,089 S.F.
PROJECT NET LAND AREA (1.50 ACRES)	65,457 S.F.

PROPOSED LAND AREA & COVERAGE		
AREA	SQ. FOOTAGE	% COVERAGE
BUILDING AREA (TOTAL)	4,999	7.6%
FUELING CANOPY AREA	4,599	7.0%
A/C PAVING	33,095	50.4%
CONCRETE HARDSCAPE & CURBING	3,728	5.6%
LANDSCAPED AREA	16,370	25.0%
RETENTION BASIN	2,888	4.4%
TOTAL NET LAND AREA COVERAGE =	65,679	100%
LANDSCAPED AREA (BEYOND PROPERTY LINE)	1,813	NOT A PART
45,718 SQ. FT. OF IMPERVIOUS AREA		

SCOPE OF WORK

TO PARCEL OFF A 1.5 ACRES LAND AREA OF THE 6.12 ACRES NET SITE AREA FOR A PROPOSED GAS STATION AND C-STORE.

PARKING DATA

REQUIRED PARKING PER G.F.A.			
AREA	RATIO	S.F.	# SPACES
CONVENIENCE STORE	1:250	4,999	20
		TOTAL REQUIRED	20

PROVIDED PARKING:		
9'x19' ACCESSIBLE PARKING STALLS	=	2 SPACES
9'x18' STANDARD PARKING STALLS	=	34 SPACES
TOTAL PROVIDED	=	36 SPACES

KEYED NOTES

23. CONCRETE SCREED LINES IN A 5' SQUARE GRID PATTERN
24. 123 LINEAR FT. OF DRIVE THRU - 8 CARS STACKED
25. GAS PRICING MONUMENT SIGN
26. FIRE HYDRANT
27. CONC. SPILLWAY FOR RETENTION BASIN OVERFLOW
28. NOT USED
29. 30' HIGH ILLUMINATED TENANT SITE SIGNAGE
30. CONCRETE 12" WIDE AT END PARKING STALLS
31. 10,000 GAL. WATER STORAGE TANK (TYP. OF 2)
32. WATER PUMP HOUSE
33. CONC. GUTTER FOR SITE DRAINAGE
34. 4" DIA. DRAIN FROM SEPTIC TANK TO LEACH FIELD
35. PROPOSED 95' LINEAR LENGTH LEACH FIELD SYSTEM WITH 95' BACKUP LEACH FIELD
36. PROPOSED RETENTION BASIN WITH 36" DEEP GRAVEL BASE
37. C 1 AGENT HYDROCARBON FILTER VAULT
38. PROPOSED UNDERSIDEWALK DRAIN SEE CITY STANDARD
39. PROPOSED 1500 GAL SEPTIC TANK
40. PROPOSED 1000 GAL GREASE TRAP AND SAMPLE BOX
41. PROPANE TANK
42. WHEEL STOPS PER CITY STANDARD
43. FUEL VENT SYSTEM

STEENO DESIGN STUDIO INC.
ARCHITECTURE ◆ DESIGN ◆ PLANNING
11774 HESPERIA ROAD, SUITE B ◆ HESPERIA, CA. 92345
PHONE (760) 244-5001 ◆ FAX (760) 244-1948
www.steenodesign.com

DATE FINISHED
APRIL 2018

REVISIONS

PROJECT: GAS STATION DEVELOPMENT

DEEP CREEK ROAD GAS STATION

PROJECT ADDRESS:
APN: 0438-165-33
DEEP CREEK ROAD
APPLE VALLEY, CA 92308

CONTACT INFO:
KAMAL ALNAJJAR TRUST
18564 HWY 18
APPLE VALLEY, CA 92307

JOB NO.
C17-430

SHEET NAME:
SITE PLAN

PAGE
A-0

Non-Stormwater Discharges SC-10

Description

Non-stormwater discharges (NSWDs) are flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain if local regulations allow. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include: potable water sources, fire hydrant flushing, air conditioner condensate, landscape irrigation drainage and landscape watering, emergency firefighting, etc. as discussed in Section 2.

However there are certain non-stormwater discharges that pose an environmental concern. These discharges may originate from illegal dumping of industrial material or wastes and illegal connections such as internal floor drains, appliances, industrial processes, sinks, and toilets that are illegally connected to the nearby storm drainage system through on-site drainage and piping. These unauthorized discharges (examples of which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains.

Non-stormwater discharges will need to be addressed through a combination of detection and elimination. The ultimate goal is to effectively eliminate unauthorized non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of

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

pollutants on streets and into the storm drain system and downstream water bodies.

Approach

Initially the Discharger must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is the elimination of unauthorized non-stormwater discharges. See other BMP Fact Sheets for activity-specific pollution prevention procedures.

General Pollution Prevention Protocols

- Implement waste management controls described in SC-34 Waste Handling and Disposal.
- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.
- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" or similar stenciled or demarcated next to them to warn against ignorant or unintentional dumping of pollutants into the storm drainage system.
- Manage and control sources of water such as hose bibs, faucets, wash racks, irrigation heads, etc. Identify hoses and faucets in the SWPPP, and post signage for appropriate use.

Non-Stormwater Discharge Investigation Protocols

Identifying the sources of non-stormwater discharges requires the Discharger to conduct an investigation of the facility at regular intervals. There are several categories of non-stormwater discharges:

- Visible, easily identifiable discharges, typically generated as surface runoff, such as uncontained surface runoff from vehicle or equipment washing; and
- Non-visible, (e.g., subsurface) discharges into the site drainage system through a variety of pathways that are not obvious.

The approach to detecting and eliminating non-stormwater discharges will vary considerably, as discussed below:

Visible and identifiable discharges

- Conduct routine inspections of the facilities and of each major activity area and identify visible evidence of unauthorized non-stormwater discharges. This may include:
  - ✓ Visual observations of actual discharges occurring;

- ✓ Evidence of surface staining, discoloring etc. that indicates that discharges have occurred;
- ✓ Pools of water in low lying areas when a rain event has not occurred; and
- ✓ Discussions with operations personnel to understand practices that may lead to unauthorized discharges.

- ☐ If evidence of non-stormwater discharges is discovered:
  - ✓ Document the location and circumstances using Worksheets 5 and 6 (Section 2 of the manual), including digital photos;
  - ✓ Identify and implement any quick remedy or corrective action (e.g., moving uncovered containers inside or to a proper location); and
  - ✓ Develop a plan to eliminate the discharge. Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge.

- ☐ Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge. Make sure the facility SWPPP is up-to-date and includes applicable BMPs to address the non-stormwater discharge.

Other Illegal Discharges (Non visible)

Illicit Connections

- ☐ Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- ☐ Isolate problem areas and plug illicit discharge points.
- ☐ Locate and evaluate discharges to the storm drain system.
- ☐ Visual Inspection and Inventory:
  - ✓ Inventory and inspect each discharge point during dry weather.
  - ✓ Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system.
  - ✓ Non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- ☐ A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system.

- Inspect the path of loading/unloading area drain inlets and floor drains in older buildings.

- Never assume storm drains are connected to the sanitary sewer system.

Monitoring for investigation/detection of illegal discharges

- If a suspected illegal or unknown discharge is detected, monitoring of the discharge may help identify the content and/or suggest the source. This may be done with a field screening analysis, flow meter measurements, or by collecting a sample for laboratory analysis. Section 5 and Appendix D describe the necessary field equipment and procedures for field investigations.

- Investigative monitoring may be conducted over time. For example if, a discharge is intermittent, then monitoring might be conducted to determine the timing of the discharge to determine the source.

- Investigative monitoring may be conducted over a spatial area. For example, if a discharge is observed in a pipe, then monitoring might be conducted at accessible upstream locations in order to pinpoint the source of the discharge.

- Generally, investigative monitoring requiring collection of samples and submittal for lab analysis requires proper planning and specially trained staff.

Smoke Testing

Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two piping systems. Smoke testing is generally performed at a downstream location and the smoke is forced upstream using blowers to create positive pressure. The advantage to smoke testing is that it can potentially identify multiple potential discharge sources at once.

- Smoke testing uses a harmless, non-toxic smoke cartridges developed specifically for this purpose.

- Smoke testing requires specialized equipment (e.g., cartridges, blowers) and is generally only appropriate for specially trained staff.

- A Standard Operating Procedure (SOP) for smoke testing is highly desirable. The SOP should address the following elements:

  - ✓ Proper planning and notification of nearby residents and emergency services is necessary since introducing smoke into the system may result in false alarms;

  - ✓ During dry weather, the stormwater collection system is filled with smoke and then traced back to sources;

- ✓ Temporary isolation of segments of pipe using sand bags is often needed to force the smoke into leaking pipes; and
- ✓ The appearance of smoke in a waste vent pipe, at a sewer manhole, or even the base of a toilet indicates that there may be a connection between the sanitary and storm water systems.

- Most municipal wastewater agencies will have necessary staff and equipment to conduct smoke testing and they should be contacted if cross connections with the sanitary sewer are suspected. See SC-44 Drainage System Maintenance for more information.

Dye Testing

- Dye testing is typically performed when there is a suspected specific pollutant source and location (i.e., leaking sanitary sewer) and there is evidence of dry weather flows in the stormwater collection system.
- Dye is released at a probable upstream source location, either the facility's sanitary or process wastewater system. The dye must be released with a sufficient volume of water to flush the system.
- Operators then visually examine the downstream discharge points from the stormwater collection system for the presence of the dye.
- Dye testing can be performed informally using commercially available products in order to conduct an initial investigation for fairly obvious cross-connections.
- More detailed dye testing should be performed by properly trained staff and follow SOPs. Specialized equipment such as fluorometers may be necessary to detect low concentrations of dye.
- Most municipal wastewater agencies will have necessary staff and equipment to conduct dye testing and they should be contacted if cross connections with the sanitary sewer are suspected.

TV Inspection of Drainage System

- Closed Circuit Television (CCTV) can be employed to visually identify illicit connections to the industrial storm drainage system. Two types of CCTV systems are available: (1) a small specially designed camera that can be manually pushed on a stiff cable through storm drains to observe the interior of the piping, or (2) a larger remote operated video camera on treads or wheels that can be guided through storm drains to view the interior of the pipe.
- CCTV systems often include a high-pressure water jet and camera on a flexible cable. The water jet cleans debris and biofilm off the inside of pipes so the camera can take video images of the pipe condition.

- CCTV units can detect large cracks and other defects such as offsets in pipe ends caused by root intrusions or shifting substrate.
- CCTV can also be used to detect dye introduced into the sanitary sewer.
- CCTV inspections require specialized equipment and properly trained staff and are generally best left to specialized contractors or municipal public works staff.

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks may include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. These wastes can cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - ✓ Illegal dumping hot spots;
  - ✓ Types and quantities (in some cases) of wastes;
  - ✓ Patterns in time of occurrence (time of day/night, month, or year);
  - ✓ Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills);
  - ✓ An anonymous tip/reporting mechanism; and
  - ✓ Evidence of responsible parties (e.g., tagging, encampments, etc.).
- One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

Once a site has been cleaned:

- Post "No Dumping" signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Inspection

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

Spill and Leak Prevention and Response

- ☐ On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
- ☐ Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- ☐ Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- ☐ For larger spills, a private spill cleanup company or Hazmat team may be necessary.
- ☐ See SC-11 Spill Prevention Control and Cleanup.

Employee Training Program

- ☐ Training of technical staff in identifying and documenting illegal dumping incidents is required. The frequency of training must be presented in the SWPPP, and depends on site-specific industrial materials and activities.
- ☐ Consider posting a quick reference table near storm drains to reinforce training.
- ☐ Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.
- ☐ Educate employees about spill prevention and cleanup.
- ☐ Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan. Employees should be able to identify work/jobs with high potential for spills and suggest methods to reduce possibility.
- ☐ Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.

- Conduct spill response drills annually (if no events occurred) in order to evaluate the effectiveness of the plan.
- When a responsible party is identified, educate the party on the impacts of his or her actions.

Quality Assurance and Record Keeping

Performance Evaluation

- Annually review internal investigation results; assess whether goals were met and what changes or improvements are necessary.
- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.
- Develop document and data management procedures.
- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.
- Annually document and report the results of the program.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.
- Document training activities.

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."

- Many facilities do not have accurate, up-to-date 'as-built' plans or drawings which may be necessary in order to conduct non-stormwater discharge assessments.
  - ✓ Online tools such as Google Earth™ can provide an aerial view of the facility and may be useful in understanding drainage patterns and potential sources of non-stormwater discharges
  - ✓ Local municipal jurisdictions may have useful drainage systems maps.

- Video surveillance cameras are commonly used to secure the perimeter of industrial facilities against break-ins and theft. These surveillance systems may also be useful for capturing illegal dumping activities. Minor, temporary adjustments to the field of view of existing surveillance camera systems to target known or suspected problem areas may be a cost-effective way of capturing illegal dumping activities and identifying the perpetrators.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital facility cost requirements may be minimal unless cross-connections to storm drains are detected.
- Indoor floor drains may require re-plumbing if cross-connections are detected.
- Leaky sanitary sewers will require repair or replacement which can have significant costs depending on the size and industrial activity at the facility.

Maintenance (including administrative and staffing)

- The primary effort is for staff time and depends on how aggressively a program is implemented.
- Costs for containment, and disposal of any leak or discharge is borne by the Discharger.
- Illicit connections can be difficult to locate especially if there is groundwater infiltration.
- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Permit Requirements

The IGP authorizes certain Non-Storm Water Discharges (NSWDs) provided BMPs are included in the SWPPP and implemented to:

- Reduce or prevent the contact of authorized NSWDs with materials or equipment that are potential sources of pollutants;
- Reduce, to the extent practicable, the flow or volume of authorized NSWDs;
- Ensure that authorized NSWDs do not contain quantities of pollutants that cause or contribute to an exceedance of a water quality standards (WQS); and,

- Reduce or prevent discharges of pollutants in authorized NSWDs in a manner that reflects best industry practice considering technological availability and economic practicability and achievability."

References and Resources

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

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Spill Prevention, Control & Cleanup SC-11

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental spills. Preparation for accidental spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify hazardous material storage areas, specify material handling procedures, describe spill response procedures, and provide locations of spill clean-up equipment and materials. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills. An adequate supply of spill clean-up materials must be maintained onsite.

Approach

General Pollution Prevention Protocols

- ☐ Develop procedures to prevent/mitigate spills to storm drain systems.
- ☐ Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- ☐ Establish procedures and/or controls to minimize spills and leaks. The procedures should address:
  - ✓ Description of the facility, owner and address, activities, chemicals, and quantities present;

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	✓

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- ✓ Facility map of the locations of industrial materials;
- ✓ Notification and evacuation procedures;
- ✓ Cleanup instructions;
- ✓ Identification of responsible departments; and
- ✓ Identify key spill response personnel.

- ☐ Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.

Spill and Leak Prevention and Response

Spill Prevention

- ☐ Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- ☐ If illegal dumping is observed at the facility:
  - ✓ Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
  - ✓ Landscaping and beautification efforts may also discourage illegal dumping.
  - ✓ Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.

- ☐ Store and contain liquid materials in such a manner that if the container is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.

- ☐ If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.

Preventative Maintenance

- ☐ Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.

- ☐ Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

- ☐ Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*

- ☐ Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

- ☐ Label all containers according to their contents (e.g., solvent, gasoline).

- ☐ Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).

- ☐ Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).

- ☐ Identify key spill response personnel.

Spill Response

- ☐ Clean up leaks and spills immediately.

- ☐ Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).

- ☐ On paved surfaces, clean up spills with as little water as possible.

  - ✓ Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills.

  - ✓ If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

  - ✓ If possible use physical methods for the cleanup of dry chemicals (e.g., brooms, shovels, sweepers, or vacuums).

- ☐ Never hose down or bury dry material spills. Sweep up the material and dispose of properly.

- ☐ Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.

- ☐ For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board or local authority as location regulations dictate.

- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).

- Report spills to 911 for dispatch and clean-up assistance when needed. Do not contact fire agencies directly.

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

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

Employee Training Program

- Educate employees about spill prevention and cleanup.

- Well-trained employees can reduce human errors that lead to accidental releases or spills:

  - ✓ The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur; and
  - ✓ Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.

- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan (Health & Safety Code Chapter 6.67).
- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.
- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.
- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- Develop spill prevention and control plan, provide and document training, conduct inspections of material storage areas, and supply spill kits.
- Extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- Date and time of the incident;
- Weather conditions;
- Duration of the spill/leak/discharge;

- Cause of the spill/leak/discharge;
- Response procedures implemented;
- Persons notified; and
- Environmental problems associated with the spill/leak/discharge.

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- Date and time the inspection was performed;
- Name of the inspector;
- Items inspected;
- Problems noted;
- Corrective action required; and
- Date corrective action was taken.

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- Installation problems;
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves);
- External corrosion and structural failure;
- Spills and overfills due to operator error; and
- Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa.

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanges, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently relocate accumulated stormwater during the wet season.

- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Immediately drain all fluids from wrecked vehicles.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use absorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- ☐ Design the fueling area to prevent the run-on of stormwater and the runoff of spills:

  Cover fueling area if possible.

  Use a perimeter drain or slope pavement inward with drainage to a sump.

  Pave fueling area with concrete rather than asphalt.

- ☐ If dead-end sump is not used to collect spills, install an oil/water separator.
- ☐ Install vapor recovery nozzles to help control drips as well as air pollution.
- ☐ Discourage "topping-off' of fuel tanks.
- ☐ Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- ☐ Use absorbent materials on small spills and general cleaning rather than hosing down the area. Remove the absorbent materials promptly.
- ☐ Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- ☐ Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- ☐ Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- ☐ Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities.

The program should:

- ☐ Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department).
- ☐ Develop procedures to prevent/mitigate spills to storm drain systems.
- ☐ Identify responsible departments.

- ☐ Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- ☐ Address spills at municipal facilities, as well as public areas.
- ☐ Provide training concerning spill prevention, response and cleanup to all appropriate personnel.

References and Resources

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

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

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

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

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

The Stormwater Managers Resource Center. http://www.stormwatercenter.net/.

Vehicle and Equipment Fueling SC-20

Description

Spills and leaks that occur during vehicle and equipment fueling can contribute hydrocarbons, oil and grease, as well as heavy metals, to stormwater runoff. Implementing the following management practices can help prevent fuel spills and leaks.

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

- Use properly maintained off-site fueling stations whenever possible. These businesses are better equipped to handle fuel and spills properly.
- Focus pollution prevention activities on containment of spills and leaks, most of which may occur during liquid transfers.

Good Housekeeping

- "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.
- Manage materials and waste properly (see Material Handling and Waste Management) to reduce adverse impacts on stormwater quality.
- Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.
- Post signs at sinks to remind employees not to pour wastes down drains.

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	✓

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- ☐ Clean yard storm drain inlets(s) regularly and especially after large storms.
- ☐ Do not pour materials down storm drains.
- ☐ Build a shed or temporary roof over fueling area to limit exposure to rain.
- ☐ Post signs to remind employees and customers not to top off the fuel tank when filling and signs that ban customers and employees from changing engine oil or other fluids at that location.
- ☐ Report leaking vehicles to fleet maintenance.
- ☐ Ensure the following safeguards are in place:
  - ✓ Overflow protection devices on tank systems to warn the operator or automatically shut down transfer pumps when the tank reaches full capacity.
  - ✓ Protective guards around tanks and piping to prevent vehicle or forklift damage.
  - ✓ Clear tagging or labeling of all valves to reduce human error.
  - ✓ Emergency shut-off and emergency phone number.

Preventative Maintenance

Fuel Dispensing Areas

- ☐ Inspect vehicles and equipment for leaks regularly and repair immediately.
- ☐ Sweep the fueling area weekly, if it is paved, to collect loose particles, and wipe up spills with rags and other absorbent material immediately. Do not hose down the area to a storm drain.
- ☐ Fit underground storage tanks with spill containment and overfill prevention systems meeting the requirements of Section 2635(b) of Title 23 of the California Code of Regulations.
- ☐ Fit fuel dispensing nozzles with "hold-open latches" (automatic shutoffs) except where prohibited by local fire departments.
- ☐ Post signs at the fuel dispenser or fuel island warning vehicle owners/operators against "topping off" of vehicle fuel tanks.
- ☐ Design fueling area to prevent stormwater runoff and spills. Use a perimeter drain or slope pavement inward with drainage to sump; regularly remove materials accumulated in sump.
- ☐ Pave area with concrete rather than asphalt.

- ☐ Cover fueling area with an overhanging roof structure or canopy so that precipitation cannot come in contact with the fueling area. Where covering is not feasible and the fuel island is surrounded by pavement, apply a suitable sealant that protects the asphalt from spilled fuels.

- ☐ Install vapor recovery nozzles to help control drips as well as air pollution.

- ☐ Use secondary containment when transferring fuel from the tank truck to the fuel tank. Cover storm drains in the vicinity during transfer.

Air/Water Supply Area

- ☐ Minimize the possibility of stormwater pollution from air/water supply areas by doing at least one of the following:

  - ✓ Spot clean leaks and drips routinely to prevent runoff of spillage.

  - ✓ Grade and pave the air/water supply area to prevent run-on of stormwater.

  - ✓ Install a roof over the air/water supply area.

  - ✓ Install a low containment berm around the air/water supply area.

Inspection

- ☐ Aboveground Tank Leak and Spill Control:

  - ✓ Check for external corrosion and structural failure.

  - ✓ Check for spills and overfills due to operator error.

  - ✓ Check for failure of piping system.

  - ✓ Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.

  - ✓ Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.

  - ✓ Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.

  - ✓ Conduct integrity testing periodically by a qualified professional.

- ☐ Inspect and clean, if necessary, storm drain inlets and catch basins within the facility boundary before October 1 each year.

Spill Response and Prevention Procedures

- ☐ Keep your spill prevention and control plan up-to-date.
- ☐ Maintain an adequate stockpile of spill cleanup materials at locations where it will be readily accessible.
- ☐ Clean leaks, drips, and other spills with as little water as possible.
  - ✓ Use rags for small spills,
  - ✓ Use a damp mop for general cleanup,
  - ✓ Use dry absorbent material for larger spills.
- ☐ Use the following three-step method for cleaning floors:
  - ✓ Clean spills with rags or other absorbent materials
  - ✓ Sweep floor using dry absorbent material
  - ✓ Mop the floor. Mop water may be discharged to the sanitary sewer via a toilet or sink.
- ☐ Remove the adsorbent materials promptly and dispose of properly when using absorbent materials on small spills.
- ☐ Store portable absorbent booms (long flexible shafts or barriers made of absorbent material) in unbermed fueling areas.
- ☐ Report spills promptly.
- ☐ If a dead-end sump is not used to collect spills, install an oil/water separator.

Material Handling and Waste Management

- ☐ 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 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.

Employee Training Program

- ☐ Educate employees about facility-wide pollution prevention measures and goals.
- ☐ Train designated employees (e.g., those involved with the handling or management of fuels) on proper fueling and cleanup procedures.
- ☐ Train designated employees upon hiring and annually thereafter on proper methods for handling and disposing of waste. Make sure that all employees understand stormwater discharge prohibitions, wastewater discharge requirements, and these best management practices.
- ☐ Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
- ☐ Use a training log or similar method to document training. The training log should include entries for:
  - ✓ Training topic,
  - ✓ Trainer,
  - ✓ Attendees,
  - ✓ Frequency,
  - ✓ Comments,
  - ✓ Target date for completion of training, and
  - ✓ Date completed.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for vehicle and equipment fueling, quantities of materials removed, and improvement actions.
- Keep accurate logs of spill response actions that document what types of liquids were 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

- The retrofitting of existing fueling areas to minimize stormwater exposure or spill runoff can be expensive. Good design must occur during the initial installation. Extruded curb along the "upstream" side of the fueling area to prevent stormwater run-on is of modest cost.
- 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.
- For facilities responsible for pre-treating their wastewater prior to discharging, the proper functioning of structural treatment system is an important maintenance consideration.
- Routine cleanout of sumps and oil/water separators is required for the devices to maintain their effectiveness, usually at least once a month. During periods of heavy rainfall, cleanout is required more often to ensure pollutants are not washed through the system. Sediment removal is also required on a regular basis to keep the device working efficiently.

Supplemental Information

Designing New Installations

The elements listed below should be included in the design and construction of new or substantially remodeled facilities.

Fuel Dispensing Areas

- Fuel dispensing areas must be paved with Portland cement concrete (or, equivalent smooth impervious surface), with a 2 to 4% slope to prevent ponding, and must be

separated from the rest of the site by a grade break that prevents run-on of stormwater to the extent practicable. The fuel dispensing area is defined as extending 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus 1 foot, whichever is less. The paving around the fuel dispensing area may exceed the minimum dimensions of the "fuel dispensing area" stated above.

- ☐ The fuel dispensing area must be covered, and the cover's minimum dimensions must be equal to or greater than the area within the grade break or the fuel dispensing area, as defined above. The cover must not drain onto the fuel dispensing area.

- ☐ If necessary, install and maintain an oil control device in the appropriate catch basin(s) to treat runoff from the fueling area.

Outdoor Waste Receptacle Area

- ☐ Grade and pave the outdoor waste receptacle area to prevent run-on of stormwater to the extent practicable.

Air/Water Supply Area

- ☐ Grade and pave the air/water supply area to prevent run-on of stormwater to the extent practicable.

Designated Fueling Area

- ☐ If your facility has large numbers of mobile equipment working throughout the site and you currently fuel them with a mobile fuel truck, consider establishing a designated fueling area. With the exception of tracked equipment such as bulldozers and perhaps small forklifts, most vehicles should be able to travel to a designated area with little lost time. Place temporary "caps" over nearby catch basins or manhole covers so that if a spill occurs it is prevented from entering the storm drain.

Examples

The Spill Prevention Control and Countermeasure (SPCC) Plan, which is required by law for some facilities, is an effective program to reduce the number of accidental spills and minimize contamination of stormwater runoff.

The City of Palo Alto has an effective program for commercial vehicle service facilities. Many of the program's elements, including specific BMP guidance and lists of equipment suppliers, are also applicable to industrial facilities.

References and Resources

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 8 Vehicle, Pavement and Building Washing*. 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 –Vehicle Washing. 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 – Stormwater Menu of BMPs - Municipal Vehicle and Equipment Washing, Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=132.

Washington State Department of Ecology, 2012. *Vehicle and Equipment Washwater Discharges Best Management Practices Manual*. Publication no. WQ-R-95-056. Available online at: https://fortress.wa.gov/ecy/publications/publications/95056.pdf.

Building & Grounds Maintenance SC-41

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.

General Pollution Prevention Protocols

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

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	✓

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- Clean work areas at the end of each work shift using dry cleaning methods such as sweeping and vacuuming.

Good Housekeeping

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. See also SC-40, Contaminated and Erodible Areas, for more information.

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

- ☐ 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.

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.

Spill Response and Prevention Procedures

- ☐ 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.

Material Handling and Waste 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.
- ☐ 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.

Employee Training Program

- ☐ 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 needs of individual staff.

Quality Assurance and Record Keeping

- ☐ Keep accurate logs that document maintenance activities performed and minimum BMP measures implemented.
- ☐ 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

- Additional capital costs are not anticipated for building and grounds maintenance. Implementation of the minimum BMPs described above should be conducted as part of regular site operations.

Maintenance

- Maintenance activities for the BMPs described above will be minimal, and no additional cost is anticipated.

Supplemental Information

Fire Sprinkler Line Flushing

Site 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

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

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook.* Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

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http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

US EPA, 1997. *Best Management Practices Handbook for Hazardous Waste Containers*. Available online at: http://www.epa.gov/region6/6en/h/handbk4.pdf.

Ventura Countywide Stormwater Management Program Clean Business Fact Sheets. Available online at:
http://www.vcstormwater.org/documents/programs_business/building.pdf.

Parking Area Maintenance SC-43

Description

Parking lots can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

BMPs for other outdoor areas on site (loading/unloading, material storage, and equipment operations) are described in SC-30 through SC-33.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Encourage advanced designs and maintenance strategies for impervious parking lots. Refer to the treatment control BMP fact sheets in this manual for additional information.
- ☐ Keep accurate maintenance logs to evaluate BMP implementation.

Good Housekeeping

- ☐ Keep all parking areas clean and orderly. Remove debris, litter, and sediments in a timely fashion.
- ☐ Post "No Littering" signs and enforce anti-litter laws.

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	✓

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- ☐ Provide an adequate number of litter receptacles.
- ☐ Clean out and cover litter receptacles frequently to prevent spillage.

Preventative Maintenance

Inspection

Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.

- ☐ Inspect cleaning equipment/sweepers for leaks on a regular basis.

Surface Cleaning

- ☐ Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- ☐ Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- ☐ Sweep all parking lots at least once before the onset of the wet season.
- ☐ Dispose of parking lot sweeping debris and dirt at a landfill.
- ☐ Follow the procedures below if water is used to clean surfaces:
  - ✓ Block the storm drain or contain runoff.
  - ✓ Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
- ☐ Follow the procedures below when cleaning heavy oily deposits:
  - ✓ Clean oily spots with absorbent materials.
  - ✓ Use a screen or filter fabric over inlet, then wash surfaces.
  - ✓ Do not allow discharges to the storm drain.
  - ✓ Vacuum/pump discharges to a tank or discharge to sanitary sewer.
  - ✓ Dispose of spilled materials and absorbents appropriately.

Surface Repair

- ☐ Check local ordinance for SUSMP/LID ordinance.
- ☐ Preheat, transfer or load hot bituminous material away from storm drain inlets.
- ☐ Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- ☐ Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in

place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.

- Use only as much water as necessary for dust control during sweeping to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Spill Response and Prevention Procedures

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Employee Training Program

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Use a training log or similar method to document training.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for parking area 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.
- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital investments may be required at some sites to purchase sweeping equipment, train sweeper operators, install oil/water/sand separators, or implement advanced BMPs. These costs can vary significantly depending upon site conditions and the amount of BMPs required.

Maintenance

- Sweep and clean parking lots regularly to minimize pollutant transport into storm drains from stormwater runoff.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Maintain advanced BMPs such as vegetated swales, infiltration trenches, or detention basins as appropriate. Refer to the treatment control fact sheets for more information.

Supplemental Information

Advanced BMPs

Some parking areas may require advanced BMPs to further reduce pollutants in stormwater runoff, and a few examples are listed below. Refer to the Treatment Control Fact Sheets and the New Development and Redevelopment Manual for more information.

- When possible, direct sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.

References and Resources

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

California Stormwater Quality Association, 2003. *New Development and Redevelopment Stormwater Best Management Practice Handbook.* Available online at: https://www.casqa.org/resources/bmp-handbooks/new-development-redevelopment-bmp-handbook.

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook.* Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

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Pollution from Surface Cleaning Folder, 1996, 2003. Bay Area Stormwater Management Agencies Association. Available online at: http://basmaa.org/Portals/0/documents/pdf/Pollution%20from%20Surface%20Cleaning.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.

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

US EPA. *Post-Construction Stormwater Management in New Development and Redevelopment*. BMP Fact Sheets. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=5.

BG-22 Automotive Service – Service Stations

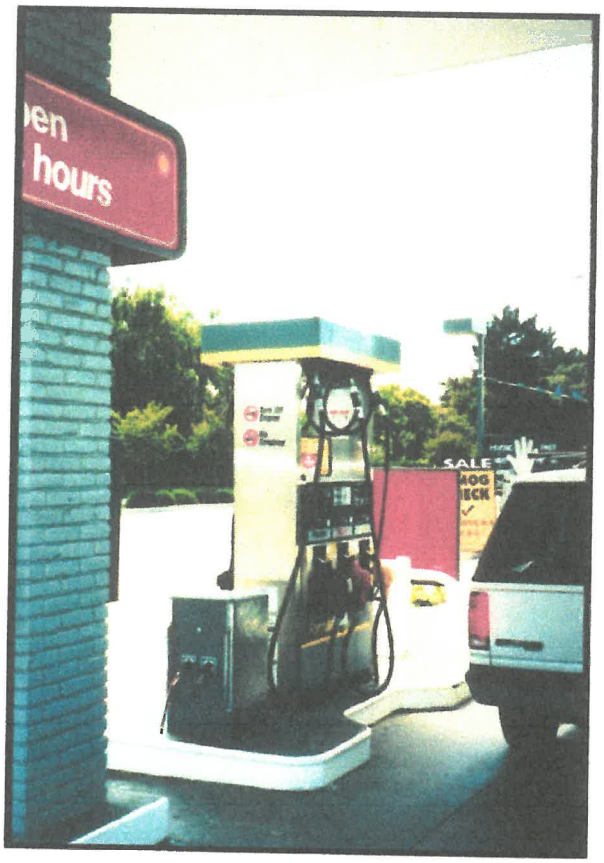

Photo Credit: Geoff Brosseau

Description

This category includes facilities that provide vehicle fueling services, including self-serve facilities as well as those that provide a car washing facility. Information specific to auto dismantling, body repair, and maintenance is provided in other guide sheets.

Pollutant Sources

The following are sources of pollutants:

- Fueling,
- Spills,
- Surface cleaning, and
- Air/Water supply.
- Dumpster and trash can areas

Pollutants can include:

- Heavy metals (copper, lead, nickel, and zinc),
- Hydrocarbons (oil and grease, PAHs),
- Toxic chemicals (benzene, toluene, xylene, MTBE),
- Detergents
- Food waste and trash

Approach

Minimize exposure of rain and runoff to fueling areas by using cover and containment. In and around these areas, use good housekeeping to minimize the generation of pollutants. Make stormwater pollution prevention BMPs a part of standard operating procedures and the employee training program. Provide employee education materials in the first language of employees, as necessary.

Coverage

These best management practices cover the following activities or areas:

- Fuel dispensing
- Underground storage tanks
- Air/Water supply
- Outdoor waste receptacles
- Car washing facilities

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BG-22 Automotive Service – Service Stations

Retail gasoline outlets will typically have these activities/areas onsite. Outdoor activities/areas are potentially exposed to stormwater runoff, and pollutants can also be transported to the storm drain system via leaks or spills. The best management practices described in this guide are intended to be implemented, monitored, and maintained on a year round basis. Training of employees in good housekeeping measures and spill and leak prevention is critical in preventing discharge of pollutants in stormwater.

Source Control BMPs

The best management practices are listed by activity or area. Existing Facilities

Fuel Dispensing Areas	☐ Maintain fuel dispensing areas using dry cleanup methods such as sweeping for removal of litter and debris, or use of rags and absorbents for leaks and spills. Fueling areas should never be washed down unless the wash water is collected and disposed of properly. ☐ Fit fuel dispensing nozzles with "hold-open latches" (automatic shutoffs) except where prohibited by local fire departments. ☐ Post signs at the fuel dispenser or fuel island warning vehicle owners/operators against "topping off" of vehicle fuel tanks ☐ Train employees in implementing proper leak and spill prevention and cleanup practices. Major spills require specialized materials and emergency support personnel.
Under-ground Storage Tanks	☐ Fit underground storage tanks with spill containment and overfill prevention systems meeting the requirements of Section 2635(b) of Title 23 of the California Code of Regulations. ☐ Train employees in implementing proper leak and spill prevention and cleanup practices. Major spills require specialized materials and emergency support personnel.
Facility – General	☐ "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly. ☐ Maintain and keep current, as required by other regulations, a spill response plan and ensure that employees are trained on the elements of the plan. ☐ Manage materials and waste to reduce adverse impacts on stormwater quality. ☐ Train all employees upon hiring and annually thereafter on proper methods for handling and disposing of waste. Make sure that all employees understand stormwater discharge prohibitions, wastewater discharge requirements, and these best management practices. Use a training log or similar method to document training. ☐ Label/stencil drain inlets within the facility boundary to remind employees and customers whether they flow to an oil/water separator, directly to the sewer, or to a storm drain. Labels are not necessary for plumbing fixtures directly connected to the sanitary sewer. ☐ Routinely inspect and clean if necessary, storm drain inlets and catch basins within the facility boundary before the beginning of the rainy season (e.g. October 1) each year.

Outdoor Waste Receptacle Area	□ Spot clean leaks and drips routinely to prevent runoff of spillage. □ Minimize the possibility of stormwater pollution from outside waste receptacles by implementing at least one of the following: ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed, or ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater, or ✓ Install a roof over the waste receptacle area, or ✓ Install a low containment berm around the waste receptacle area, or ✓ Use and maintain drip pans under waste receptacles
Air/ Water Supply Area	□ Minimize the possibility of stormwater pollution from air/water supply areas by implementing at least one of the following: ✓ Spot clean leaks and drips routinely to prevent runoff of spillage, or ✓ Grade and pave the air/water supply area to prevent run-on of stormwater, or ✓ Install a roof over the air/water supply area, or ✓ Install a low containment berm around the air/water supply area.
Car Washing Facility	□ Install a wash water treatment system; do not discharge wash water directly to the storm drain. □ Minimize the possibility of stormwater pollution from car washing facilities by implementing the following: ✓ Grade and pave the car wash area to prevent run-on of stormwater, ✓ Install a roof over the car wash area, ✓ Slope the car wash area toward the wash water treatment system, not the storm drain, and ✓ Train employees in implementing proper leak and spill prevention and cleanup practices.

Treatment Control BMPs

If treatment controls are installed at the facility, see Section 4 of this Handbook for information on inspecting and maintaining the BMPs.

For information on designing treatment controls, see Section 5 of the New Development and Redevelopment Planning Handbook.

More Information

Booklets, Checklists, Fact Sheets, and Pamphlets

Alameda County Clean Water Program, 2012, Tips for a Cleaner Bay: How Your Vehicle Service Facility Can Prevent Stormwater Pollution. Available on-line at: http://www.cleanwaterprogram.org/uploads/IIDC%20Vehicle%202012.pdf.

California Department of Toxic Control Substances, undated website, *California Green Station Program, Vehicle Service and Repair (VSR).* Includes fact sheets, training modules, and other resources. Available on-line at https://dtsc.ca.gov/PollutionPrevention/VSR.cfm.

Infiltration Trench TC-10

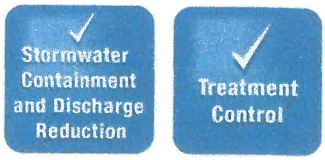
General Description

An infiltration trench is a gravel-filled trench that receives stormwater runoff. Runoff is stored in the void space between the stones and infiltrates through the bottom and sides of the trench into the soil matrix. Infiltration trenches promote stormwater infiltration, reduce discharge of stormwater to receiving waters and provide pollutant removal. Pretreatment using buffer strips, swales, or detention basins is important for limiting amounts of sediment, oil & grease, and trash and debris entering the trench which can clog and render the trench ineffective.

Inspection/Maintenance Considerations

Frequency of clogging is dependent on effectiveness of pretreatment, such as vegetated buffer strips (see TC-31), vegetated swales (see TC-30), and detention basins (see TC-22) at removing sediments. Generally, clogging is occurring if the trench shows signs of long surface ponding. Clogging often occurs within the surface layer and removing and replacing the top 2-3 inches of the surface media may improve performance. If the clogging is subsurface, as determined by observing an inspection well, then completely removing the media and rehabbing the trench is needed. Clogged infiltration trenches with surface standing water can become a nuisance due to mosquito breeding. Maintenance efforts associated with infiltration trenches should include frequent inspections to ensure that water infiltrates into the subsurface completely at a recommended infiltration rate of 96 hours or less to prevent creating mosquito and other vector habitats.

Advanced BMPs Covered



Maintenance Concerns

- *Accumulation of metals*
- *Clogged soil or outlet structures*
- *Vegetation/landscape maintenance*

Targeted Constituents

Sediment	■✱
Nutrients	■
Trash	■✱
Metals	■
Bacteria	■
Oil and Grease	■✱
Organics	■

Legend ***(Removal Effectiveness)***

● Low ■ High ▲ Medium
✱ Requires Pretreatment

Note: The removal effectiveness ratings shown in the table are for properly designed, sited, and maintained BMPs; some configurations will have variations in pollutant effectiveness.

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Infiltration Trench TC-10

Inspection Activities	Suggested Frequency
☐ Inspect after major storms for the first few months to ensure proper functioning. Drain times should be observed to confirm that the designed drain time has been achieved. ☐ Inspect for upslope or adjacent contributing sediment sources and ensure that pretreatment systems are in place.	After construction and semi-annually (beginning and end of rainy season)
☐ Inspect facility for signs of wetness or damage to structures, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, standing water, and material buildup. ☐ Check for standing water or, if available, check observation wells following 3 days of dry weather to ensure proper drain time. ☐ Inspect pretreatment devices and diversion structures for damage, sediment buildup, and structural damage.	Semi-annual and after major storm events
☐ Trenches with filter fabric should be inspected for sediment deposits by removing a small section of the top layer. If inspection indicates that the trench is partially or completely clogged, it should be restored to its design condition.	Annual
Maintenance Activities	**Suggested Frequency**
☐ Repair undercut and eroded areas at inflow and outflow structures. ☐ Remove sediment, debris, and oil/grease from pretreatment devices, forebays, inlet/outlet structures, overflow spillway, and trenches as necessary.	Standard maintenance (as needed)
☐ Remove trash, debris, grass clippings, trees, and other large vegetation from the trench perimeter and dispose of properly. ☐ Mow and trim vegetation to prevent establishment of woody vegetation, and for aesthetic and vector reasons.	Semi-annual, more often as needed
☐ Remove accumulated sediment from the surface of the trench. Replace first layer of aggregate and filter fabric if clogging appears only to be at the surface. ☐ Clean trench when loss of infiltrative capacity is observed. If drawdown time is observed to have increased significantly over the design drawdown time, removal of sediment may be necessary. This is an expensive maintenance activity and the need for it can be minimized through prevention of upstream erosion.	Annual
☐ Monitor ongoing effectiveness and determine if another BMP type or additional pretreatment could improve long-term performance. A qualified designer with knowledge of local soils and BMP design should be consulted in order to make this determination.	Every 5 years

☐ Total rehabilitation of the trench should be conducted to maintain storage capacity within 2/3 of the design treatment volume and 96-hour exfiltration rate limit. ☐ Rehabilitation of the trench should be performed under the direction of a qualified designer with knowledge of local soils and BMP design. General steps for trench rehabilitation include: ✓ Trench walls should be excavated to expose clean soil. ✓ All of the stone aggregate must be removed. Filter fabric may need to be removed from the sides and bottom ✓ Accumulated sediment should be stripped from the trench bottom. At this point the bottom may be scarified or tilled to help induce infiltration. New fabric and clean stone aggregate should be refilled.	Upon reaching target thresholds

Most of the maintenance should be concentrated on the pretreatment practices, such as buffer strips and swales upstream of the trench to limit the amount of sediment that reaches the infiltration trench. Regular inspection should determine if the sediment removal structures require routine maintenance. Infiltration trenches should not be put into operation until the upstream tributary area is stabilized.

Additional Information

Infiltration practices have historically had a high rate of failure compared to other stormwater management practices. One study conducted in Prince George's County, Maryland (Galli, 1992), revealed that less than half of the infiltration trenches investigated (of about 50) were still functioning properly, and less than one-third still functioned properly after 5 years. Many of these practices, however, did not incorporate advanced pretreatment. By carefully selecting the location and improving the design features of infiltration practices, their performance should improve.

It is absolutely critical that settleable particles and floatable materials be removed from runoff water before it enters the infiltration trench. The trench will clog and become nonfunctional if excessive particulate matter is allowed to enter the trench.

Special considerations are required for infiltration trenches to be effective in cold climates – refer to the Stormwater Managers Resource Center for more information.

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Infiltration Basin TC-11

General Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins store stormwater runoff until it gradually exfiltrates into the underlying soil. Pollutant removal occurs through the infiltration of runoff and the adsorption of pollutants into the soil and vegetation. Additional benefits include:

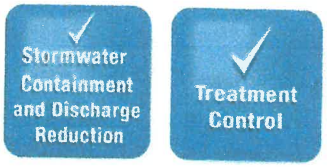
- Reduced runoff volume and attenuation of peak flows, and
- Facilitated groundwater recharge thus helping to maintain low flows in stream systems.

Inspection/Maintenance Considerations

The use and regular maintenance of pretreatment BMPs will significantly minimize maintenance requirements for the basin. Installing vegetated swales or a sediment forebay upstream from the infiltration basin can provide effective pretreatment and reduce maintenance.

Spill response procedures and controls should be implemented to prevent spills from reaching the infiltration system. This BMP may require groundwater monitoring, and basins cannot be put into operation until the upstream tributary area is stabilized.

Advanced BMPs Covered



Maintenance Concerns

- *Vector Control*
- *Clogged soil or outlet structures*
- *Vegetation/Landscape Maintenance*
- *Groundwater contamination*
- *Accumulation of metals*
- *Aesthetics*

Targeted Constituents

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

Legend (Removal Effectiveness)

● Low ▲ Medium ■ High

✱ Requires Pretreatment

Note: The removal effectiveness ratings shown in the table are for properly designed, sited, and maintained BMPs; some configurations will have variations in pollutant effectiveness.

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Inspection Activities	Suggested Frequency
☐ Observe drain time for a storm after completion or modification of the facility to confirm that the desired drain time has been obtained. ☐ Newly established vegetation should be inspected several times to determine if any landscape maintenance (reseeding, irrigation, etc.) is necessary. ☐ Inspect for upslope or adjacent contributing sediment sources and ensure that pretreatment systems are in place.	Post construction and semi-annually (beginning and end of rainy season)
☐ Inspect for the following issues: differential accumulation of sediment, signs of wetness or damage to structures, erosion of the basin floor, dead or dying grass on the bottom, condition of riprap, drain time, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, pretreatment device condition	Semi-annually and after extreme events
Maintenance Activities	**Suggested Frequency**
☐ Factors responsible for clogging should be repaired immediately.	Immediately
☐ Remove invasive weeds once monthly during the first two growing seasons.	Monthly during growing season
☐ Stabilize eroded banks with erosion control mat or mulch and revegetate. ☐ Repair undercut and eroded areas at inflow and outflow structures. ☐ Maintain access to the basin for regular maintenance activities. ☐ Mow as appropriate for vegetative cover species. ☐ Monitor health of vegetation and replace as necessary. ☐ Control mosquitoes as necessary. ☐ Remove litter and debris from infiltration basin area as required. ☐ Trim vegetation to prevent establishment of woody vegetation that decreases storage volume.	Standard maintenance (as needed)
☐ Mow and remove grass clippings, litter, and debris. ☐ Replant eroded or barren spots to prevent erosion and accumulation of sediment.	Semi-annual
☐ Scrape bottom and remove sediment when accumulated sediment reduces original infiltration rate by 25-50%. Restore original cross-section and infiltration rate. Properly dispose of sediment. ☐ Seed or sod to restore ground cover. ☐ Disc or otherwise aerate bottom. ☐ Dethatch basin bottom.	3-5 year maintenance

If there are actual signs of clogging or significant loss of infiltrative capacity the following maintenance activities should be considered:

- ☐ Mechanically de-thatching and/or aerating the top soils along the sides and bottom of the basin.
- ☐ Tilling or dicing to scarify the bottom of the basin

These activities should be on an "as-needed" rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a light tractor.

Clogged infiltration basins with surface standing water can become a breeding area for mosquitoes and midges. Maintenance efforts associated with infiltration basins should include frequent inspections to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 96 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.

Additional Information

In most cases, surface sediment removed from an infiltration basin during periodic maintenance to restore capacity does not contain toxic materials (e/g metals, oil and grease, or organics) at levels posing a hazardous concern. Studies to date indicate that pond sediments are generally below toxicity limits and can be safely landfilled or disposed onsite. Onsite sediment disposal is always preferable (if local authorities permit) as long as the sediments are deposited away from the perimeter to prevent their reentry into the basin. Sediments should be tested for toxic materials in compliance with current landfill requirements and disposed of properly.

Maintenance activities should use lightweight equipment (e.g. bobcat), which will not compact the underlying soil to remove the top layer of sediment. The remaining soil should be tilled and revegetated as soon as possible.

Sediment removal within the basin should be performed when the sediment is dry enough so that it is cracked and readily separates from the basin floor. This minimizes intermixing of the finer sediment with underlying coarser material on the basin floor.

Special maintenance considerations are required maintain infiltration basins effectiveness in cold climates. Treating runoff containing salt-based deicers in an infiltration basin may reduce soil fertility cause vegetation to fail. Incorporating mulch into the soil can help to mitigate this problem. Infiltration basins should not be used to store snow plowed from highways or parking lots. The sand in this snow can clog the basin. In addition, the chlorides and other pollutants can contaminate the groundwater.

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Drain Inlet Insert MP-52

General Description

Drain inlet inserts, also known as catch basin, drop inlet or curb inlet inserts, are used to remove pollutants at the point of entry to the storm drain system. There are a multitude of inserts of various shapes and configurations including baffles, baskets, boxes, fabrics, sorbent media, screens, and skimmers. The effectiveness of drain inlet inserts depends on their design, application, loading, and frequency of maintenance to remove accumulated sediment, trash, and debris.

Inspection/Maintenance Considerations

Routine inspection and maintenance is necessary to maintain functionality of drain inlet inserts and to prevent re-suspension and discharge of accumulated pollutants. Maintenance activities vary depending on the type of drain inlet insert being implemented; refer to the manufacturer's recommendations for more information.

Advanced BMPs Covered

Maintenance Concerns

- *Sediment, Trash, and Debris Accumulations*
- *Pollutant Re-suspension and Discharge*

Targeted Constituents*

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

**Removal Effectiveness varies for different manufacturer designs. See New Development and Redevelopment Handbook-Section 5 for more information.*

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Inspection Activities	Suggested Frequency
☐ Verify that stormwater enters the unit and does not leak around the perimeter.	After construction.
☐ Inspect for sediment, trash, and debris buildup and proper functioning.	At the beginning of the wet season and after significant storms
Maintenance Activities	**Suggested Frequency**
☐ Remove accumulated sediment, trash, and debris. ☐ Replace sorbent media.	At the beginning of the wet season and as necessary

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NOAA Atlas 14, Volume 6, Version 2
Location name: Apple Valley, California, USA*
Latitude: 34.4142°, Longitude: -117.2252°
Elevation: 2892.87 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.085 (0.070-0.103)	0.117 (0.097-0.143)	0.162 (0.133-0.199)	0.200 (0.163-0.247)	0.254 (0.201-0.325)	0.297 (0.230-0.388)	0.343 (0.259-0.459)	0.392 (0.288-0.540)	0.461 (0.325-0.661)	0.516 (0.351-0.766)
10-min	0.121 (0.100-0.148)	0.168 (0.139-0.205)	0.232 (0.191-0.285)	0.286 (0.234-0.354)	0.364 (0.288-0.465)	0.426 (0.330-0.557)	0.492 (0.372-0.659)	0.562 (0.413-0.774)	0.661 (0.466-0.948)	0.740 (0.504-1.10)
15-min	0.147 (0.121-0.179)	0.203 (0.168-0.248)	0.281 (0.231-0.344)	0.346 (0.283-0.428)	0.440 (0.348-0.563)	0.516 (0.399-0.673)	0.595 (0.450-0.796)	0.680 (0.499-0.935)	0.799 (0.563-1.15)	0.895 (0.609-1.33)
30-min	0.207 (0.171-0.253)	0.286 (0.236-0.350)	0.395 (0.325-0.485)	0.487 (0.398-0.603)	0.620 (0.490-0.792)	0.726 (0.562-0.947)	0.838 (0.633-1.12)	0.958 (0.703-1.32)	1.13 (0.793-1.61)	1.26 (0.857-1.87)
60-min	0.268 (0.222-0.328)	0.371 (0.306-0.453)	0.512 (0.422-0.628)	0.632 (0.516-0.781)	0.803 (0.635-1.03)	0.941 (0.728-1.23)	1.09 (0.821-1.45)	1.24 (0.912-1.71)	1.46 (1.03-2.09)	1.63 (1.11-2.42)
2-hr	0.381 (0.315-0.465)	0.507 (0.419-0.621)	0.682 (0.562-0.837)	0.831 (0.679-1.03)	1.04 (0.824-1.33)	1.21 (0.939-1.58)	1.39 (1.05-1.86)	1.58 (1.16-2.18)	1.85 (1.30-2.65)	2.06 (1.40-3.06)
3-hr	0.466 (0.386-0.570)	0.614 (0.507-0.751)	0.817 (0.673-1.00)	0.990 (0.809-1.22)	1.24 (0.977-1.58)	1.44 (1.11-1.87)	1.64 (1.24-2.20)	1.86 (1.37-2.56)	2.17 (1.53-3.11)	2.41 (1.64-3.58)
6-hr	0.641 (0.530-0.783)	0.837 (0.691-1.02)	1.11 (0.910-1.36)	1.33 (1.09-1.65)	1.65 (1.31-2.11)	1.91 (1.48-2.49)	2.18 (1.64-2.91)	2.46 (1.81-3.38)	2.86 (2.01-4.10)	3.17 (2.16-4.70)
12-hr	0.825 (0.682-1.01)	1.10 (0.905-1.34)	1.46 (1.21-1.80)	1.77 (1.45-2.19)	2.20 (1.74-2.81)	2.54 (1.97-3.31)	2.89 (2.18-3.87)	3.26 (2.39-4.48)	3.77 (2.66-5.40)	4.17 (2.84-6.18)
24-hr	1.09 (0.965-1.25)	1.49 (1.32-1.71)	2.02 (1.78-2.33)	2.46 (2.15-2.86)	3.07 (2.60-3.69)	3.54 (2.94-4.35)	4.03 (3.27-5.08)	4.55 (3.58-5.89)	5.25 (3.97-7.09)	5.80 (4.24-8.11)
2-day	1.27 (1.12-1.46)	1.76 (1.56-2.03)	2.42 (2.14-2.80)	2.97 (2.60-3.46)	3.73 (3.16-4.49)	4.32 (3.59-5.31)	4.93 (4.00-6.21)	5.57 (4.39-7.21)	6.45 (4.88-8.70)	7.14 (5.22-9.97)
3-day	1.37 (1.21-1.57)	1.92 (1.70-2.21)	2.67 (2.35-3.08)	3.28 (2.88-3.82)	4.13 (3.50-4.98)	4.80 (3.98-5.90)	5.49 (4.45-6.91)	6.21 (4.90-8.05)	7.22 (5.46-9.74)	8.01 (5.85-11.2)
4-day	1.45 (1.29-1.67)	2.04 (1.81-2.36)	2.86 (2.52-3.30)	3.52 (3.09-4.11)	4.45 (3.77-5.36)	5.17 (4.29-6.36)	5.93 (4.80-7.47)	6.72 (5.29-8.70)	7.81 (5.91-10.5)	8.68 (6.34-12.1)
7-day	1.57 (1.40-1.81)	2.22 (1.97-2.56)	3.11 (2.75-3.60)	3.86 (3.38-4.49)	4.90 (4.15-5.90)	5.71 (4.74-7.02)	6.56 (5.31-8.26)	7.45 (5.87-9.65)	8.68 (6.57-11.7)	9.65 (7.06-13.5)
10-day	1.66 (1.47-1.91)	2.35 (2.08-2.70)	3.30 (2.91-3.81)	4.10 (3.59-4.77)	5.23 (4.43-6.29)	6.12 (5.08-7.52)	7.04 (5.70-8.87)	8.01 (6.31-10.4)	9.37 (7.09-12.6)	10.4 (7.63-14.6)
20-day	1.90 (1.68-2.18)	2.72 (2.40-3.13)	3.87 (3.42-4.47)	4.85 (4.25-5.65)	6.26 (5.30-7.53)	7.38 (6.13-9.08)	8.56 (6.93-10.8)	9.80 (7.72-12.7)	11.5 (8.71-15.5)	12.9 (9.41-18.0)
30-day	2.15 (1.91-2.48)	3.09 (2.74-3.56)	4.43 (3.91-5.12)	5.58 (4.89-6.51)	7.26 (6.15-8.74)	8.60 (7.14-10.6)	10.00 (8.10-12.6)	11.5 (9.05-14.9)	13.5 (10.2-18.3)	15.2 (11.1-21.2)
45-day	2.54 (2.25-2.92)	3.64 (3.22-4.19)	5.23 (4.62-6.04)	6.61 (5.79-7.71)	8.64 (7.33-10.4)	10.3 (8.55-12.7)	12.0 (9.74-15.1)	13.9 (10.9-17.9)	16.4 (12.4-22.1)	18.4 (13.4-25.7)
60-day	2.80 (2.48-3.22)	3.99 (3.53-4.60)	5.74 (5.06-6.63)	7.27 (6.37-8.47)	9.52 (8.07-11.5)	11.4 (9.44-14.0)	13.3 (10.8-16.8)	15.4 (12.1-19.9)	18.3 (13.8-24.7)	20.5 (15.0-28.7)

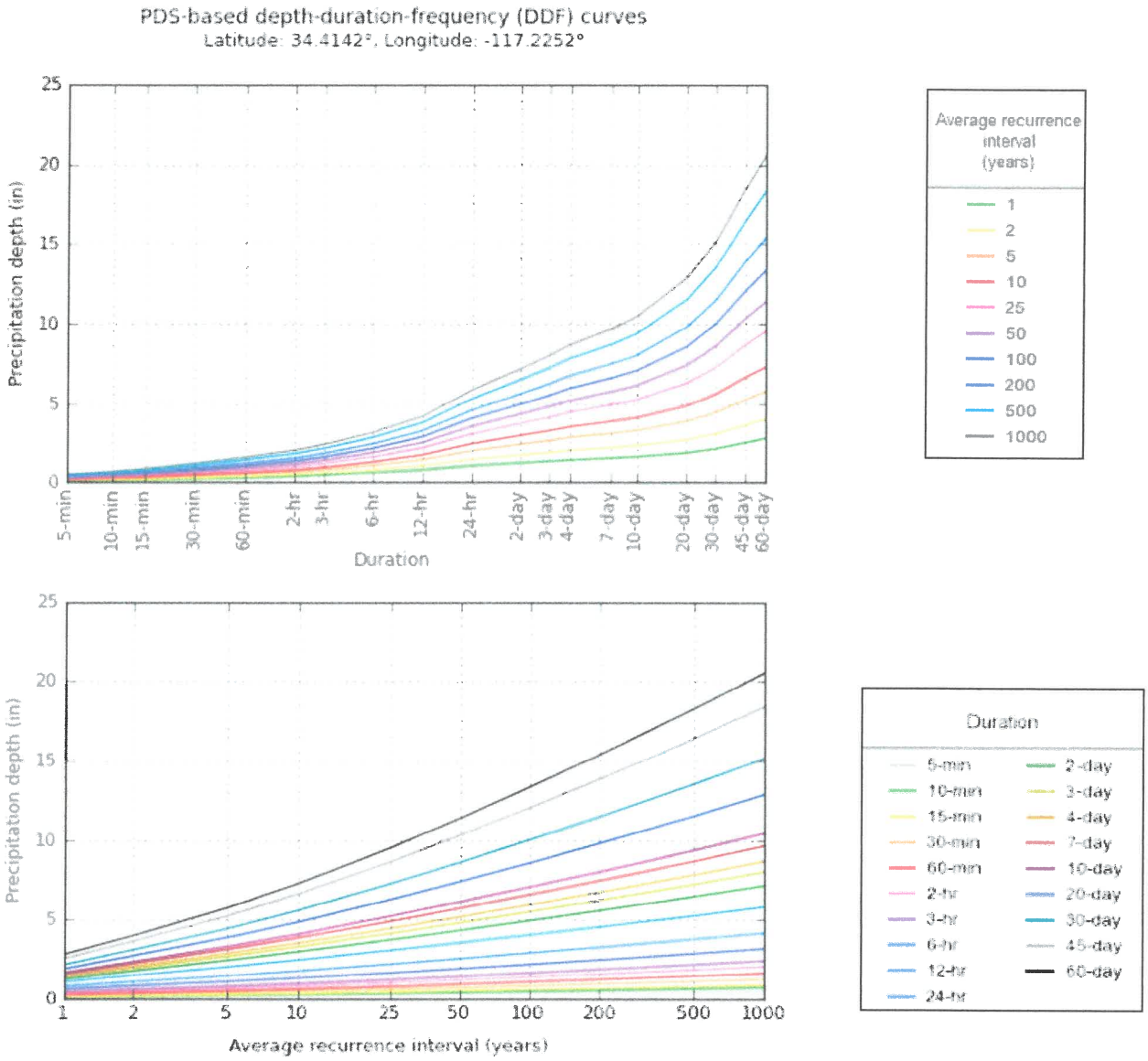
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Fri Jun 29 17:17:23 2018

Back to Top

A. Volume-Based BMP Design: DA 1

1) BMP Drainage Area for S_1 = **1.50 acre**

2) Drainage Area on the NOAA Atlas 14 Precipitation Depths: (***2 year – 1 Hour Rainfall***)

3) PDS-based point precipitation frequency: **0.371 inches**

B. Volume-Based BMP Design:

1) Watershed Imperviousness Ratio: **i** = 70 % / 100 = **0.70**

2) Composite runoff coefficient:

CBMP = $(0.858)(i)^3 - (0.78)(i)^2 + (0.774)(i) + 0.04$
= (0.858)(0.343)-(0.78)(0.49)+(0.774)(0.70)+0.04
= (0.2943) – (0.3822) + (0.5418) + (0.04)
= **0.4939**

3) The Drainage Area is in the **Desert** Region

4) 6-Hour Mean Storm Rainfall: **P6** = (0.371 in) * (1.2371) = **0.4590**

5) Regression constant (a = 1.582 for 24 hours) & (**a = 1.963 for 48 hours**)

6) Maximized Detention Volume: **P0=(a)(CBMP)(P6)** =(1.963)(0.4939)(0.4590) = **0.4450** in

P0 = Maximized Detention Volume, in inches
a = 1.963 for 48 hours drawdown
CBMP = composite runoff coefficient
P6 = 6-hour Mean Storm Rainfall, in inches

7) Target Capture Volume, **V0 = (P0)(A)/12** = $\frac{((0.4450 \text{ in})(1.50 \text{ ac}))(43560 \text{ sf/ac})}{(12 \text{ in/ft})}$ = **2,423 ft^3**

V0 = Target Capture Volume, in acre-feet
P0 = Maximized Detention Volume, in inches
A = BMP Drainage Area, in acres

VO = 2,423 ft^3

8) Volume Provided, **VP = 10,666 ft^3**

The volume provided of 10,666 ft^3 is greater than the calculated target capture volume of 2,423 ft^3; so it is adequate.

ALR ENGINEERING & TESTING

Civil & Geotechnical Engineering w/ Material Testing

18361 Symeron Road, Apple Valley, Ca. 92307

760-810-2031 Cell # - 760-242-3130 Office #

(alrengineeringtesting@gmail.com)

March 25, 2018

INFILTROMETER TEST

APN 0438-165-33

PROPOSED COMMERCIAL DEVELOPMENT

Infiltrometer test for designing the storm water retention system on the 1.70-acre parcel for a proposed 4,500 sf Convenience Store with Fueling Islands.

Located on the Southwest corner of Deep Creek Road and Rock Springs Road, in Apple Valley area of San Bernardino County, California

Prepared for

MIKE MAIDA
13302 Ranchero Road
Oak Hills, Ca. 92344

Project No. 1803409

ALR ENGINEERING & TESTING

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18361 Symeron Road, Apple Valley, Ca. 92307
760-810-2031 Cell # - 760-242-3130 Office #
(alrengineeringtesting@gmail.com)

Project No. 1803409

March 25, 2018

MR. MIKE MAIDA
13302 Ranchero Road
Oak Hills, CA. 92344

Attention: Mr. Mike Maida,

Subject: Report on the Double Ring Infiltrometer Percolation Testing for the Storm Water Retention/Detention basin for the **4,500 sf Convenience-Store and Gas Station Development** on the **1.7**-acre parcel, **APN 0438-165-33**, located on the Southwest corner of Deep Creek Road and Rock Springs Road in Apple Valley area of the County of San Bernardino, California

As per you your authorization, ALR Engineering & Testing performed a ***Double Ring Infiltrometer Test*** (ASTM D3385-09) to determine the rate of absorption for the Storm Water Retention/Detention Basin.

Site Location:

The site is located on the Southwest corner of Deep Creek Road and Rock Springs Road, (Fig. No. 1). The test location for the storm water retention/detention basin is located on the South side of the property as shown on the plot plan (Fig. No. 4).

Test Date:

We excavated the test trench on ***March 25, 2018*** and began testing per ***(ASTM D3385-09).*** The infiltrometer test trench was presoaked and tested all on the same day due to the sandy soil present in the test trench.

Weather Conditions:

The weather was slightly cloudy with an ambient temperature of **58°**.

Testing Personnel:

The engineers on site performing the infiltrometer testing were ***John Longoria, Senior Associate Engineer*** with ***Leroy Longoria, Senior Engineer Technician*** assisting.

Description of Test Site:

The site has an approximate gradient slope of **1%** with a slight gradient slope to the northeast of the property. The trench excavated on site showed that the soil encountered was of a silty **SAND** ***(SM)*** down to approximately a four-foot depth and a Poorly graded **SAND** ***(SP)*** down to approximately the fifteen-foot depth.

Depth to Water Table:

The water table depth at this location is shown to be approximately **80'** beneath the surface profile. These depths are averaged and furnished by the State Water Resources Department and recorded data from the local well sites.

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Equipment Used for the Test:

The test trenches were excavated with a CAT backhoe with a **24"** bucket. The Double-Ring Infiltrometer ***(ASTM D3385-09)*** apparatus was used with a sufficient water supply.

Area of the Rings:

We used two rings for this test, a **12"** diameter ring and a **24"** diameter ring both rings are **20"** high. The area of the rings is calculated as **113 in^2** and **452 in^2** respectively and the annular area is **339 in^2**.

Volume Constants:

The Mariotte Tubes used were **3,000 cc** for the small mariotte tube and **10,000 cc** for the large mariotte tube. The small mariotte tube uses a **5.352 cc/mm** and the large mariotte tube uses a **16.753 cc/mm**.

Scope of Work:

Visual classifications of sub-surface soils encountered in the trench.
Perform infiltrometer percolation testing in a **48"** deep excavated trench.
Prepare this report with our infiltration-percolation recommendations.

Sub-surface Condition:

Our field investigation revealed that the sub-surface soils of silty **SAND (SM)** encountered to the depth of four feet and poorly graded **SAND (SP)** to the fifteen-foot depth explored.

Scope of the Infiltrometer Test:

This test method is a procedure for measuring the rate of infiltration of water into soils using the double-ring infiltrometer. This test method is particularly applicable to relatively uniform fine-grained soils, with an absence of very plastic clays and gravel-size particles with moderate to low resistance to ring penetration. This test method may be conducted at the ground surface or at given depths, and on bare soil or with vegetation in place, depending on the conditions for which infiltration rates are desired.

Summary of Test Method:

The double-ring infiltrometer method consists of driving two open cylinders, one inside the other, into the ground, partially filling the rings with water, and then maintaining the water level at a constant level. The volume of liquid added to the inner ring, to maintain the water level constant is the measure of the volume of water that infiltrates the soil. The volume infiltrated during timed intervals is converted to an incremental infiltration velocity, usually expressed in centimeters per hour or inch per hour and plotted versus elapsed time. The maximum-steady state or average incremental infiltration velocity, depending on the purpose/application of the test is equivalent to the infiltration rate.

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Significance and Use:

This test method is useful for field measurement of the infiltration rate of soils. Infiltration rates have application to such studies as liquid waste disposal, evaluation of potential septic-tank disposal fields, leaching and drainage efficiencies, irrigation requirements, water spreading and recharge. The purpose of the outer ring is to promote one-dimensional, vertical flow beneath the inner ring. Many factors affect the infiltration rate, for example the soil structure, soil layering, condition of the soil surface, degree of saturation of the soil, chemical and physical nature of the soil and of the applied water, and diameter and depth of embedment of the rings. Thus, tests made at the same site are not likely to give identical results and the rate measured by the test method described in this standard is primarily for comparative use.

Double-Ring Infiltrometer Testing in a Shallow Trench:

Infiltration testing was performed in the bottom of the test trench at a depth of four feet. This testing was performed to provide an infiltration rate for the Storm Water Retention/Detention Basin. The testing included using approximately **55** gallons of water percolated over **70** minutes, resulting with a **6.08** in/hour rate and using a Factor of Safety of **2.0**, the result is a **3.04** in/hour rate. Results of the testing and graph is attached within.

General Recommendations for Retention Basin:

The Storm Water Retention/Detention Basin is designed to accommodate the total runoff volume while considering the time it takes to percolate into the ground. Storm flow is generated by rainfall runoff that is significantly larger and limited to the storm event. This requires first storing it in the Storm Water Retention/Detention Basin and then allowing the water to percolate slowly into the ground.

Sincerely,
ALR ENGINEERING & TESTING

John Longoria, EIT, QSP, NICET III, CESSWI, ICC
Senior Associate Engineer

Stephan M. Longoria, PE 74782
Registered Civil Engineer

REGISTERED PROFESSIONAL ENGINEER
STEPHAN M. LONGORIA
No. 74782
CIVIL
STATE OF CALIFORNIA

EXPLORATORY TRENCH NO. TP-1

Project: APN 0438-165-33 **Project # 1803409**

Client: Mike Maida **Date: 3-25-18**

Depth Feet	Sample Type	Moisture Content %	Dry Density pcf.	Lab Test Type	Soil Class		Geotechnical Description
0.5'--					SM		Medium to fine silty SAND with some gravel, Dark Tan, Damp, Medium Dense to Loose
1.0'--							
1.5'--							
2.0'--							Coarse to medium SAND with some gravel, Tan, Damp, Loose
2.5'--					SP		
3.0'--							
3.5'--							
4.0'--							Coarse to medium SAND with much gravel and some rock to 2", Tan, Damp, Loose
4.5'--					SP		
5.0'--							
5.5'--							
6.0'--							
6.5'--							
7.0'--							
7.5'--							
8.0'--							
8.5'--							
9.0'--							
10.0'--							
11.0'--							
12.0'--							
13.0'--							
14.0'--							Bottom of Exploratory Trench

Exploratory Trench No. TP-1 **Plate A-1**

Date: 3/25/2018 **Double Ring Infiltrometer** **ALR Engineering and Testing**

	Area (cm2)	Di (cm)	Factor
Inner	1216	5.08	53.52
Annular	3649	5.08	167.53

Test Location: **APN 0412-182-15** Performed by: **John Longoria**

Penetration of Rings:

Inner: 7.62 cm Both were started at 58.5 cm

Outer: 7.62 cm **10 min pre-soak**

Test No.	Time (hr:mm)	Delta Time Total Time (min)	Inner Reading (cm)	Inner Flow (cm3)	Annular Reading (cm)	Annular Flow (cm3)	Inner Rate (cm/hr)	Annular Rate (cm/hr)	Comments
1		10	58.5	3130.9	58.5	9800.5	15.45	16.11	
		10	0.0		0.0				
2		10	58.5	3130.9	58.5	9800.5	15.45	16.11	
		20	0.0		0.0				
3		10	58.5	3130.9	58.5	9800.5	15.45	16.11	
		30	0.0		0.0				
4		10	58.5	3130.9	58.5	9800.5	15.45	16.11	
		40	0.0		0.0				
5		10	58.5	3130.9	58.5	9800.5	15.45	16.11	
		50	0.0		0.0				
6		10	58.5	3130.9	58.5	9800.5	15.45	16.11	
		60	0.0		0.0				
7		10	58.5	3130.9	58.5	9800.5	15.45	16.11	
		70	0.0		0.0				
8									
9									
10									
11									
12									
13									
14									
15									
16									

Date: 3/25/2018 | Double Ring Infiltrometer | ALR Engineering and Testing

	IN cm/hr	OUT cm/hr	IN in/hr	OUT in/hr
0			0	0
10	15.45	16.11	6.1	6.3
20	15.45	16.11	6.1	6.3
30	15.45	16.11	6.1	6.3
40	15.45	16.11	6.1	6.3
50	15.45	16.11	6.1	6.3
60	15.45	16.11	6.1	6.3
70	15.45	16.11	6.1	6.3

	6.1	
	6.1	
	6.1	
	6.1	
AVERAGE	6.08	in/hr
Factor of Saftey=	2.00	
Design Rate =	3.04	in/hr