MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

Palmdale Road Retail

APN: 3103-561-11 & 12

Prepared for:

Rich Development, LLC

600 North Tustin Avenue, Suite 150

Santa Ana, CA 92705

714-835-3311

Prepared by:

David Evans and Associates

18484 Outer Highway 18 North, Suite 225

Apple Valley, CA 92307

Submittal Date: August 8, 2022

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

Final Approval Date:_____

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for Rich Development, LLC by David Evans and Associates. The WQMP is intended to comply with the requirements of the City of Victorville 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):	TBD
Tract/Parcel Map Number(s):	Parcels 3 and 4 of Parcel Map 2962	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			3103-561-11 & 12

Owner's Signature			
Owner Name: Joseph Rich			
Title	Owner		
Company	Palmdale Victorville, LLC		
Address	1000 N Western Ave #200 San Pedro, CA 90732		
Email	joerich@richdevelopment.com		
Telephone #	310-547-3326		
Signature		Date	November 21, 2022

Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	Parcels 3 and 4 of Parcel Map 2962	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			3103-561-11 & 12

"The selection, sizing and design of stormwater treatment and other stormwater 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: Bret Thopre PE		PE Stamp Below
Title	Project Manager	
Company	David Evans and Associates	
Address	18484 Outer Highway 18 North, Suite 225, Apple Valley, CA 92307	
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Signature		
Date	11-21-2022	

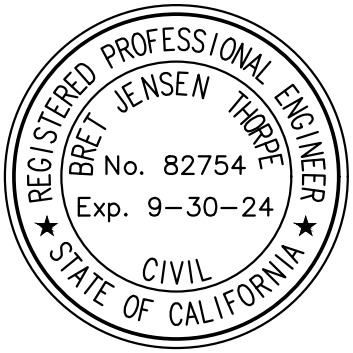


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Section I – Introduction

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	Palmdale Road Retail				
Project Owner Contact Name:	Cosbey Watson Jr.				
Mailing Address:	600 N. Tustin Avenue Suite 150 Santa Ana, CA 92705	E-mail Address:	cwatson@richdevelopment.com	Telephone:	714-835-3311
Permit/Application Number(s):			Tract/Parcel Map Number(s):	Parcels 3 and 4 of Parcel Map 2962	
Additional Information/ Comments:					
Description of Project:	The Project is located within the City of Victorville, north of Bear Valley Road and east of Cantina Road. Latitude 34d 30m 26s, Longitude -117d 23m 39s. The Project consists of a car wash and a drive-thru Coffe Shop along with associated parking and drive aisles on 2.32 Acres. The site has no off-site run-on. On-site storm water will be conveyed to small on-site retention basin and three depressed landscape areas and/or picked up into catch basin with inlet filters and conveyed to an underground detention basin. Overflows will be conveyed to the storm drain channel on the east side of the Project. This Project is a "Priorty" Project and will require a WQMP.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	The Project Site will capture 2.22 acres of the storm flows into catch basins with Pure flow catch basin inserts as a pretreatment BMP for trash and oils and convey the storm water into an underground detention basin to serve as the infiltration BMP. Localized on-lot infiltration BMPs are also used north of the car wash area and west of the Coffee Shop. Overflows from the Basin will drain into an existing storm drain channel located on the east side of the project. There is a small area of 0.1 acre that drains northeast to an existing drainage easement to the east that is within the boundary of the site. That area will be landscaped so it will remain 100% pervious. With the improvement of landscaping this area will not have an increase in storm drainage and will be less than the existing run-off rates as the soil will be amended and will result in increased natural infiltration. The area is also considered self-treating for certain pollutants. The area will still need to be maintained for trash and illicit discharges, as well as the normal maintenance for landscape and irrigation.				

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):	101,059	**3** Number of Dwelling Units:		**4** SIC Code:	7542, 5812

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 stormwater facilities. Describe any lot-level stormwater 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 stormwater facilities:

Ownership of the project will be held with Rich Development LLC. Long term maintenance will be the responsibility of the owner. This includes BMP maintenance, catch basin inspection, storm drain maintenance, efficient irrigation, landscape maintenance, etc the property is sold or transferred.

Rich Development, LLC

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(714) 835-3311

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No onsite infrastructure will be transferred to a Public Agency after completion. A Property Owners Association (POA) will not be formed for long-term maintenance of the stormwater facilities.

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 Stormwater 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 stormwater 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 ☐	Potential source - Parking lot, trash, wild bird and pet wastes.
Nutrients - Phosphorous	E ☒	N ☐	Potential source - Landscape
Nutrients - Nitrogen	E ☒	N ☐	Potential Source - Landscape
Noxious Aquatic Plants	E ☐	N ☒	
Sediment	E ☒	N ☐	Solid materials/ suspended solids from land surface is expected in addition to sediments from erosion.
Metals	E ☒	N ☐	Metal pollutants expected from vehicles circulating the parking lot, including tire wear and brake dust.
Oil and Grease	E ☒	N ☐	Surface area of parking lot and drive-thru will contribute to pollution from leaking vehicles and grease for production
Trash/Debris	E ☒	N ☐	Trash and debris pollution from general litter is expected on site from facility occupants, visitors and any work that may be performed on site premises.
Pesticides / Herbicides	E ☒	N ☐	Expected pollutants from maintenance of the site landscape area is expected.
Organic Compounds	E ☒	N ☐	Use of cleaning solvents/chemicals and maintenace of landscape area will contribute to pollution from organic compounds.
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 stormwater 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 34d 30' 26"	Longitude -117d 23' 39"	Thomas Bros Map page
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	DA 1 drains to NE area to UG Basin
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)	101,059			
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*	2			
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)	456			
6 Longest flowpath slope (ft/ft)	0.015			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Natural Cover Barren			
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***	Poor			

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
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	None
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Mojave River below lower narrows not listed in the 303d listed waters
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	Desert Tortoise Habitat Cat 2 Mojave Ground Squirrel
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 Stormwater 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 Stormwater BMPs	☒	☐	General information will be provided to the owner on housekeeping practices that contribute to the protection of storm water. The property owner and property manager will be familiar with the contents of this document and the BMPs used on the site. The owner will provide education materials to tenants (if applicable) on BMPs and housekeeping practices that contribute to the protection of storm water.
N2	Activity Restrictions	☒	☐	The property owner/manager shall control the discharge of the stormwater pollutants from this site through activity restrictions. Restrictions shall be provided to all new tenants/occupants through lease terms, or other mechanism upon first occupancy of the lease space and annually thereafter. Enforcement of activity restriction shall be on going during the operation of the project site.
N3	Landscape Management BMPs	☒	☐	The property owner, building operators, and landscape maintenance contractors will practice on going landscape maintenance BMPs consistent with applicable local ordinances and will regular inspect the irrigation system for signs of erosion or sediment debris buildup and clean/repair as needed.
N4	BMP Maintenance	☒	☐	The property owner/manager will maintain all post construction BMPs consistent with the O&M plan described in section 5 of this document (Form 5-1).
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No hazardous wastes will be generated during the operation of the proposed projects.
N6	Local Water Quality Ordinances	☒	☐	The owner shall comply with the City of Victorville Stormwater Ordinance through the implementation of BMP's.
N7	Spill Contingency Plan	☒	☐	Building operators shall prepare specific plans based on materials onsite for the cleanup of spills. Plans shall mandate stock piling of cleanup materials, notification of agencies, disposal, documentation, etc. Storage shall comply with Hazmat Regulations and any required contingency plans.

Form 4.1-1 Non-Structural Source Control BMPs				
N8	Underground Storage Tank Compliance	☒	☐	The restaurant will have grease interceptors.
N9	Hazardous Materials Disclosure Compliance	☐	☒	

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	☒	☐	This project will be developed and operated in accordance with Article 80 of the Uniform Fire Code.
N11	Litter/Debris Control Program	☒	☐	The building operator shall prepare and implement an employee training program. This program shall include but not be limited to instructions on spill cleanup, litter control, and material storage procedures.
N12	Employee Training	☒	☐	The property owner/manager shall prepare and implement an employee-training program in accordance with California Storm Water Quality Association Standards and BMP. This program shall be reviewed on a bi-annual basis or with the every new edition of the Stormwater Best Management Practice Handbook for Industrial and Commercial. See appendix for all educational material.
N13	Housekeeping of Loading Docks	☐	☒	No loading docks.
N14	Catch Basin Inspection Program	☒	☐	Catch basins shall be inspected visually on a monthly basis; the entire storm drain system shall be inspected and cleaned prior to the start of the rainy season.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Parking areas will be swept regularly using a vacuum assisted sweeper. Frequency will depend on waste accumulations with a minimum of once per month and prior to the start of the rainy season.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Project is not classified as a public agency project
N17	Comply with all other applicable NPDES permits	☒	☐	The developer will comply with the California statwide Construction General Permit during construction and all future occupants of the site shall comply with the requirements of the statewide General Stormwater Permit.

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)	☒	☐	All storm drain inlets shall have Stenciling illustrating an anti-dumping message.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	This development does not include the storage of materials outdoors.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash storage areas shall be located away from storm drain inlets. All trash dumpsters/containers will be required to have a lid on at all times to prevent direct precipitation and prevent any rainfall from entering containers.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	Irrigation systems will be designed to each landscaped area's specific water need. Irrigation controls shall include rain-triggered shutoff devices to prevent irrigation after precipitation.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscaped areas shall be below a minimum of 1" to 2" below the top of curb or walk.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☐	☒	NA
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No covered dock areas within the new development.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No covered maintnence bays within the new development.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash areas proposed within new development
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No processing areas proposed within new development

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 proposed within new development.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling areas proposed within new development.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside areas proposed within new development.
S14	Wash water control for food preparation areas	☐	☒	No outside food preparation areas proposed within new development.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No community car wash racks proposed within new development.

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: For this development, minimizing impervious areas was done to the MEP.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: Underground infiltration system bottom with natural soils, no compaction. Four areas will use localized on-lot infiltration BMPs and the landscaped areas will include improvement and maintenance of soils.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: The use of UG detention basin will be designed to mitgate time of concentration, hydromod. and Design Capture Volume. The on-site basin and depressed landscape areas will also provide additional mitigation.
Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain : Yes ☒ No ☐ Explanation: Four areas of localized on-lot infiltration will be used.
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: This project does not have porous pavment.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: There is no significant existing vegetation and sensitive areas to protect.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☒ No ☐ Explanation: landscaping will be provided in the areas not paved.

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: There is no compactions under the bottom of the undeground infiltration system.
Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☒ No ☐ Explanation: Two areas will use rock and landscape vegetative swales.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☐ No ☒ Explanation: Landscapes areas are too small.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation: Not practical.
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☐ No ☒ Explanation: Not adjacent to any streams

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 stormwater 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): 101,059	**2** Imperviousness after applying preventative site design practices (Imp%): 90%	**3** Runoff Coefficient (Rc): _0.73 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.377 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.47 *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): 5,641 *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** 8,825 *Form 4.2-3 Item 12*	**2** 14.05 *Form 4.2-4 Item 13*	**3** 2.14 *Form 4.2-5 Item 10*
Post-developed	**4** 18,513 *Form 4.2-3 Item 13*	**5** 4.85 *Form 4.2-4 Item 14*	**6** 4.78 *Form 4.2-5 Item 14*
Difference	**7** *9,688* *Item 4 – Item 1*	**8** *9.20* *Item 2 – Item 5*	**9** 2.64 *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *110%* *Item 7 / Item 1*	**11** *65%* *Item 8 / Item 2*	**12** 122% *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)								
3a DMA Area, ft² *sum of areas of DMA should equal area of DA*								
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*			See HCOC calcs in Appendix D					
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)								
3b DMA Area, ft² *sum of areas of DMA should equal area of DA*								
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								

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): 2.62
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft³): 8,825
*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): 18,513
*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): 8,762
*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*								

See HCOC calcs in Appendix D

13 Pre-developed time of concentration (min): 14.05 *Minimum of Item 12 pre-developed DMA*

14 Post-developed time of concentration (min): 4.85 *Minimum of Item 12 post-developed DMA*

15 Additional time of concentration needed to meet hydromodification requirement (min): 8.50 $T_{C\text{-}Hydro}$ = *(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*

See HCOC calcs in Appendix D

8 Pre-developed Q_p at T_c for DMA A: 2.71 *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): 2.71 *Maximum of Item 8, 9, and 10 (including additional forms as needed)*		
11 Post-developed Q_p at T_c for DMA A: 4.78 *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): 4.78 *Maximum of Item 11, 12, and 13 (including additional forms as needed)*		
15 Peak runoff reduction needed to meet Hydromodification Requirement (cfs): 1.83 *$Q_{p\text{-}hydro}$ = (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? Yes ☐ No ☒ *Refer to Section 5.3.2.1 of the TGD for WQMP*
If Yes, Provide basis: (attach)
[2] Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒ (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 stormwater infiltration would result in significantly increased risks of geotechnical hazards.
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? Yes ☐ No ☒ *See Section 3.5 of the TGD for WQMP and WAP*
If Yes, Provide basis: (attach)
[7] Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒ *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.* [8] Any answer from Item 4 through Item 6 is "Yes": Yes ☐ No ☒ *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.* [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 1 DMA A BMP Type HSC	DA 1 DMA A BMP Type HSC	DA 1 DMA A BMP Type HSC *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)	1260	316	673
8 Ponding depth (ft) (min. 0.5 ft.)	2	0.5	1
9 Surface area of amended soil/gravel (ft^2)	775	140	373
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)	1	1	1
11 Average porosity of amended soil/gravel	0.40	0.40	0.4
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*	2,830	214	822
13 Runoff volume retention from on-lot infiltration (ft^3): 4,388 total of four on-lot infiltration BMPs		$V_{retention}$ *=Sum of Item 12 for all BMPs*	

Form 4.3-2 Site Design Hydrologic Source Control 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 1 DMA A BMP Type HSC	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)	803		
8 Ponding depth (ft)	0.5		
9 Surface area of amended soil/gravel (ft^2)	301		
10 Average depth of amended soil/gravel (ft)	1		
11 Average porosity of amended soil/gravel	0.4		
12 Retention volume achieved from on-lot infiltration (ft^3) *$V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*	522		
13 Runoff volume retention from on-lot infiltration (ft^3): 4,388 total of four on-lot infiltration BMPs *$V_{retention}$ =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: 4,388 *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.

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

1 Remaining LID DCV not met by site design BMP (ft^3): 1,775 *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 1 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*			
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*			
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*			
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*			
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*			
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*			
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*			
10 Amended soil porosity			
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*			
12 Gravel porosity			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
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))]*			
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	5,530		
16 Total Retention Volume from LID Infiltration BMPs: 5,530 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: 98% *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): 5,641 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design BMP (ft^3): 4,388 *Copy Item18 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 5,530 *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): 8,762 *(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): 4,388 *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): 4,374 *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site BMPs (ft^3): 5,530

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 ☒ TC is reduced by the depress landscape areas and the underground detention basin.
- 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 ☒ The basin routing demonstrates Qpeak is reduced to below the existing undeveloped condition Q10

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 Stormwater 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
Catch Basin w/ Filter Insert	Owner	Inspect for illegal dumping and /or debris accumulation. Clean filters whenever 25% of filter capacity is exceeded by debris accumulation.	Twice per year and after major storm event
Landscape Maintenance	Owner	Maintain landscape area vegetation, slope protection and grades, adjacent to hardscape and prevent discharges of landscape maintence waste into storm drains.	Weekly
Roadways and Parking Areas	Owner	Clean and remove accumulated sand and debris in parking lots and along roadway. Sweep pavement in lieu of using house or water spray. Ensure stormwater runoff is not impeded by deposit of debris and accumulated sediment by ground maintenance staff.	Inspect after wind storm or minium monthy
Litter Control	Owner	Site to be inspected and all litter be collected and disposed of in trash containers. Inspection and maintence to be performed by Owner	Weekly
Signage and StencilCBs	Owner	CLean the stencil/ signage surface to remove andy excess dirt. Re-paint if necessary. Reference Casqa SD-13	Anually

Detention Basin	Owner	Maintain per Manfacturer's recommendations. Inspect annually and clean	Annually

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

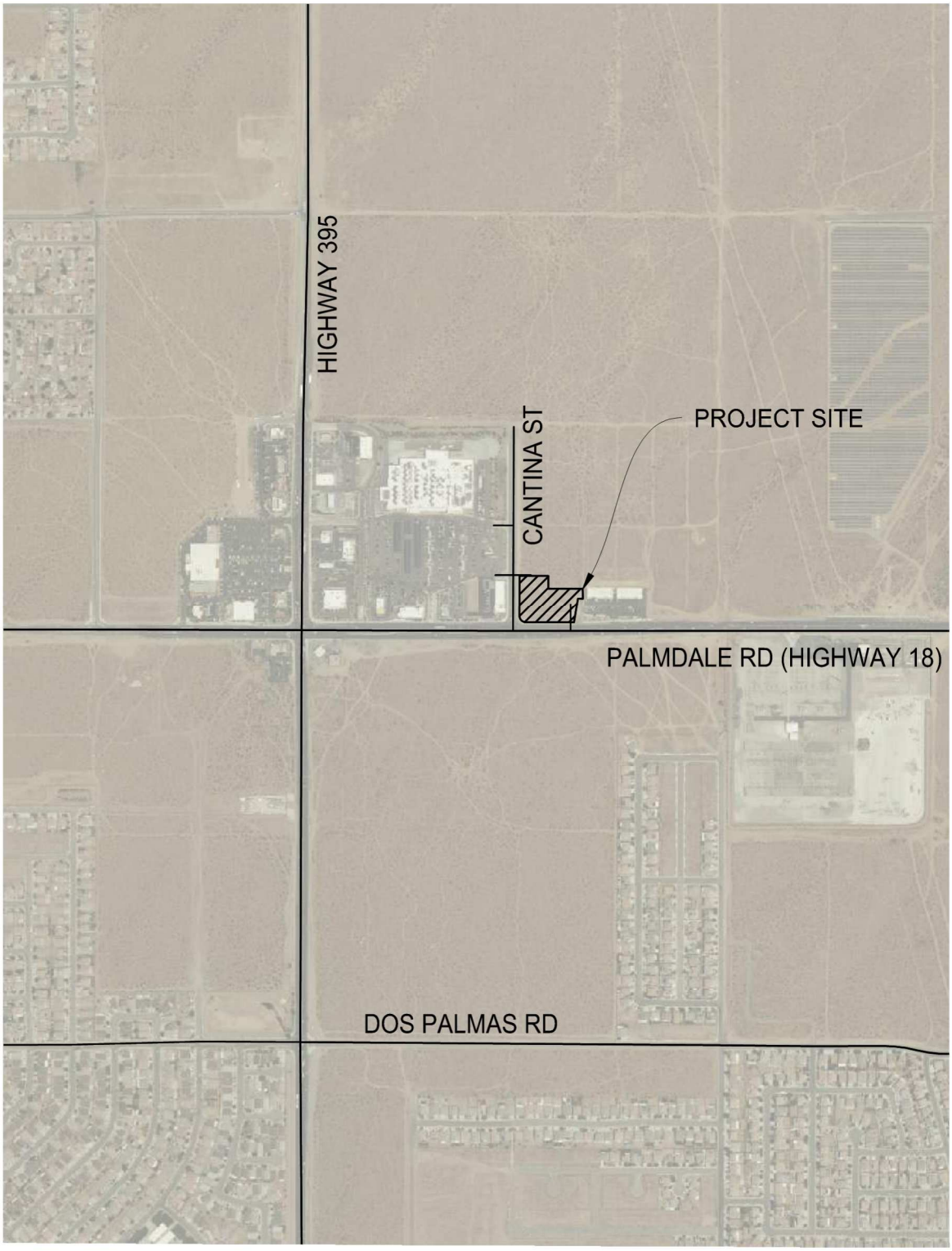
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

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

Appendix A

Vicinity Map



N

NOT TO SCALE

DAVID EVANS AND ASSOCIATES INC.

EXHIBIT A: VICINITY MAP

PALMDALE ROAD RETAIL DEVELOPMENT
VICTORVILLE, CALIFORNIA

Drawing Name: P:\RD\EV00000005\04000CAD\EXHIBITS\SCOPE\Exhibit A.dwg
Last Opened: Oct 18, 2021 - 4:05pm by: Thm

Attachment B

- WQMP Exhibit

A EASEMENT FOR PUBLIC UTILITIES GRANTED TO CITY OF VICTORVILLE RECORDING NO: BOOK 8860, PAGE 417 OFFICIAL RECORDS

B EASEMENT FOR PUBLIC UTILITIES GRANTED TO STATE OF CALIFORNIA RECORDING DATE: FEBRUARY 18, 1992. RECORDING NO: 92-56171 OFFICIAL RECORDS

C EASEMENT FOR HIGHWAY AND ROAD PURPOSES GRANTED TO CITY OF VICTORVILLE RECORDING NO: BOOK 8860, PAGE 405 OFFICIAL RECORDS.

D PROPOSED EASEMENT IN FAVOR OF PARCEL "B" FOR INGRESS/EGRESS, PARKING AND TEMPORARY CONSTRUCTION

PARCEL "A"
DOC#2022-0198686

PARCEL "B"
DOC#2022-0198686

CANTINA STREET

PALMDALE ROAD

AUTOMATED CARWASH 3,600 SF
FF= 20.01
PAD= 19.48

COFFEE 1,000 SF
FF= 18.60
PAD= 18.55

PR. WATER QUALITY BASIN
RETENTION VOLUME = 2,830 CF

PR. DEPRESSED LANDSCAPE AREA FOR WATER QUALITY TREATMENT
RETENTION VOLUME = 214 CF

PR. DEPRESSED LANDSCAPE AREA FOR WATER QUALITY TREATMENT
RETENTION VOLUME = 522 CF

PR. DEPRESSED LANDSCAPE AREA FOR WATER QUALITY TREATMENT
RETENTION VOLUME = 822 CF

STORMTECH UNDERGROUND DETENTION BASIN
VOLUME = 5530 CF

DA-1
DMA-A
2.32

DMA-B
0.1

PR. 3' MAX. HEIGHT RETAINING WALL

PR. 6' HEIGHT FENCE

GRADING LIMITS

PR. OVERFLOW

EX. HEADWALL

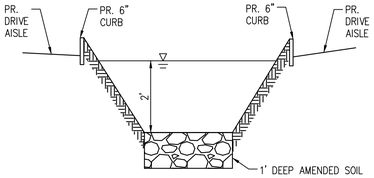
EX. CONCRETE CHANNEL

EX. 18"HDPE PER P-1007

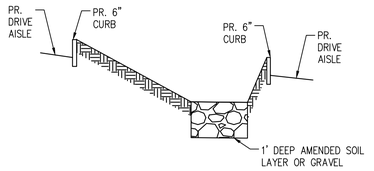
EX. CB PER P-1007

VICTORVILLE VILLAGE
APN: 3103-561-27-0-000

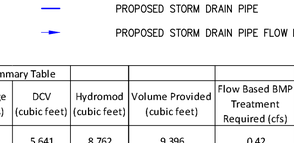
SECTION A-A:
HORIZ: 1"=10'
VERT: 1"=2'



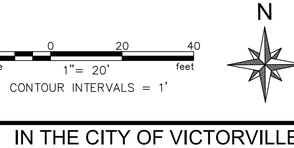
SECTION B-B:
HORIZ: 1"=10'
VERT: 1"=2'



SECTION C-C:
HORIZ: 1"=10'
VERT: 1"=2'



SECTION D-D:
HORIZ: 1"=10'
VERT: 1"=2'



LEGEND:

- HYDROLOGY BOUNDARY
- FLOWLINE
- A / 7.96 — DRAINAGE AREA ID / TOTAL ACREAGE
- FLOW DIRECTION
- CATCH BASIN INLET W/ BIO-CLEAN FILTER INSERTS
- FS ELEVATION / INV ELEVATION (NODE #) — CONCENTRATION/NODE ID
- XXXX — PROPOSED CONTOUR
- (XXXX) — EXISTING CONTOUR
- PROPOSED LANDSCAPE AREA
- PROPOSED UNDERGROUND DETENTION AREA (SEE APPENDIX B FOR CROSS SECTION AND DETAILS)
- PROPOSED WQMP TREATMENT AREA
- PROPOSED STORM DRAIN PIPE
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

Water Quality Summary Table						
Area ID	Acreage (Acres)	DCV (cubic feet)	Hydromod (cubic feet)	Volume Provided (cubic feet)	Flow Based BMP Treatment Required (cfs)	Flow Based BMP Treatment Provided (cfs)
DA-1 DMA-A	2.02	5,641	8,762	9,396	0.42	2.85/ each for catch basins 1-6
DMA-B	0.1					
Total	2.12	5,641	8,762	9,396	0.42	17

*Area DMA-B is all landscaping and considered self-retaining and self-treating.

20 0 20 40
scale 1"= 20' feet
CONTOUR INTERVALS = 1'

N

NOT FOR CONSTRUCTION

DATE: 06/2022

IN THE CITY OF VICTORVILLE
PALMDALE ROAD RETAIL DEVELOPMENT

WQMP SITE PLAN

FILE NO.

DRAWING NO.
SH. 1 OF 1

DAVID EVANS AND ASSOCIATES INC.
18484 Outer Highway 18 N Suite 225
Apple Valley California 92307
Phone: 760.524.9100
SSchubert@deainc.com

Plot Date: 11/21/2022 5:16 PM
Save Date: 11/18/2022 3:40 PM
By: Jose Aguilar
File: P:\RIRDEV\0000000\0600\INFO\0670\Reports\WQMP\CAD\WQMP Exhibit_New.dwg

Appendix C

LID BMP sizing Calculations

Hall & Foreman, Inc.
Engineering • Surveying • Planning • Landscape Architecture

SUBJECT	By	Date	Job No	Sheet of
San Bernardino County Volume BMP	Samantha Razon	30-Jun-22	RDEV00000005	

Design Procedure for BMP Design Volume

85th percentile runoff

Designer: Helen Wilson
Company: DEA Inc
Date: 30-Jun-2022
Project: Palmdale Retail
Location: San Bernardino County

1. Determine Runoff coefficient				
a. Determine total impervious area	$I_{mpervious}$ =	2.09	acres	**(1)**
b. Determine total tributary area	A_{total} =	2.32	acres	**(2)**
c. Determine impervious fraction **i = (1) / (2)**	i =	0.90		**(3)**
d. Composite Runoff Coefficient $C = 0.858i^3 - 0.780i^2 + 0.774i + 0.040$	C_{BMP} =	0.732		**(4)**
2. Determine the Area Averaged "6-hour Mean Storm Rainfall"				
a. Regression Coefficient	P_{6r} =	1.24		**(5)**
b. Rainfall	P =	0.377	in	**(6)**
c. 6 Hour Mean Storm Rainfall **P_6 = (5)*(6)**	P_6 =	0.47	in	**(7)**
a. Drawdown time a =1.582 for 24 hours a = 1.963 for 48 hours	a =	1.963		**(8)**
b. P_0 = a*CBMP*P_6 **P_o = (8)*(4)*(7)**	P_0 =	0.67		**(9)**
4. Calculate Target Storage Volume				
a. V_0 = (P0*A)/12 = **(9) x (2)/12** [in-feet]	V_0 =	0.13	acre-ft	**(10)**
	V_0 =	**5,640.24**	**ft^3**	**(11)**

Tustin Office: 714.665.4500 Tel / 714.665-4501 Fax
Santa Clarita Office: 661.284.7400 Tel / 661.284.7401 Fax
Victorville Office: 760.524.9100 Tel / 760.524.9101 Fax
Temecula Office: 909.294.9300 Tel / 909.294.9301 Fax

Hall & Foreman, Inc.
Engineering • Surveying • Planning • Landscape Architecture

SUBJECT	By	Date	Job No	Sheet of
San Bernardino County Flow BMP	Helen Wilson	30-Jun-22	REDV0005	

Design Procedure for BMP Design Flow
Uniform Intensity Design Flow

Designer: Helen Wilson
Company: Hall & Forman, Inc.
Date: 30-Jun-2022
Project: Palmdale Retail
Location: San Bernardino County

1. Determine BMP Drainage Area				
a. Determine drainage area	A_{total} =	2.32	acres	**(1)**
b. Determine the area average 2 year 1 hour rainfall from the NOAA Atlas 14 precipitation depths	I =	0.377	in/hr	**(2)**
2. Determine Runoff coefficient				
a. Determine total impervious area	$I_{mpervious}$ =	2.09	acres	**(3)**
b. Determine total tributary area	A_{total} =	2.32	acres	**(4)**
c. Determine impervious fraction **i = (3) / (4)**	i =	0.90		**(5)**
d. Composite Runoff Coefficient $C = 0.858i^3 - 0.780i^2 + 0.774i + 0.040$	C_{BMP} =	0.730		**(6)**
3. Determine the Region Drainage Area (Valley, Mountain or Desert				
a. Region Drainage Area		Desert		**(7)**
b. Regression Coefficient	$I_{regression}$	0.33		**(8)**
c. Safety Factor	SF	2		**(9)**
c. I_{BMP} = I*I regression*SF= **(2)*(8)*(9)**	I_{BMP}	0.25	in/hr	**(10)**
4. Calculate the target BMP Flow rate Q				
a. $Q_{BMP} = C_{BMP} \times I_{BMP} \times A$ = **(6) x (10) x (1)**	**Q_{BMP} =**	**0.42**	**cfs**	**(10)**

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Santa Clarita Office: 661.284.7400 Tel / 661.284.7401 Fax
Victorville Office: 760.524.9100 Tel / 760.524.9101 Fax
Temecula Office: 909.294.9300 Tel / 909.294.9301 Fax

Appendix D

HCOC Analysis

U n i t H y d r o g r a p h A n a l y s i s

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Study date 06/30/22

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6385

Palmdale and Cantina, NE corner
10-year existing condition

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
2.32	1	0.65
Rainfall data for year 10		
2.32	6	1.35
Rainfall data for year 10		
2.32	24	2.62

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******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
78.0	78.0	2.32	1.000	0.404	1.000	0.404

Area-averaged adjusted loss rate Fm (In/Hr) = 0.404

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
2.32	1.000	78.0	78.0	2.82	0.331

Area-averaged catchment yield fraction, Y = 0.331
Area-averaged low loss fraction, Yb = 0.669
User entry of time of concentration = 0.234 (hours)
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Watershed area = 2.32(Ac.)
Catchment Lag time = 0.187 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 44.5157
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.404(In/Hr)
Average low loss rate fraction (Yb) = 0.669 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.308(In)
Computed peak 30-minute rainfall = 0.528(In)
Specified peak 1-hour rainfall = 0.650(In)
Computed peak 3-hour rainfall = 1.018(In)
Specified peak 6-hour rainfall = 1.350(In)
Specified peak 24-hour rainfall = 2.620(In)

Rainfall depth area reduction factors:
Using a total area of 2.32(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.308(In)
30-minute factor = 1.000 Adjusted rainfall = 0.528(In)
1-hour factor = 1.000 Adjusted rainfall = 0.650(In)
3-hour factor = 1.000 Adjusted rainfall = 1.017(In)
6-hour factor = 1.000 Adjusted rainfall = 1.350(In)
24-hour factor = 1.000 Adjusted rainfall = 2.620(In)

U n i t H y d r o g r a p h
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Interval 'S' Graph Unit Hydrograph

Number	Mean values ((CFS))	
	(K = 28.06 (CFS))	
1	3.271	0.918
2	23.997	5.815
3	54.972	8.691
4	69.700	4.132
5	78.140	2.368
6	83.701	1.560
7	87.807	1.152
8	90.685	0.808
9	92.933	0.631
10	94.679	0.490
11	96.051	0.385
12	97.105	0.296
13	97.842	0.207
14	98.322	0.135
15	98.846	0.147
16	99.370	0.147
17	99.716	0.097
18	100.000	0.080

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3084	0.3084
2	0.3797	0.0713
3	0.4288	0.0491
4	0.4674	0.0387
5	0.4998	0.0324
6	0.5279	0.0281
7	0.5529	0.0250
8	0.5755	0.0226
9	0.5962	0.0207
10	0.6153	0.0191
11	0.6332	0.0178
12	0.6499	0.0167
13	0.6715	0.0216
14	0.6921	0.0206
15	0.7119	0.0198
16	0.7309	0.0190
17	0.7492	0.0183
18	0.7669	0.0177
19	0.7840	0.0171
20	0.8005	0.0166
21	0.8166	0.0161
22	0.8323	0.0156
23	0.8475	0.0152
24	0.8624	0.0148
25	0.8768	0.0145

26	0.8910	0.0141
27	0.9048	0.0138
28	0.9183	0.0135
29	0.9316	0.0132
30	0.9446	0.0130
31	0.9573	0.0127
32	0.9698	0.0125
33	0.9820	0.0123
34	0.9940	0.0120
35	1.0059	0.0118
36	1.0175	0.0116
37	1.0289	0.0114
38	1.0402	0.0113
39	1.0513	0.0111
40	1.0622	0.0109
41	1.0729	0.0108
42	1.0835	0.0106
43	1.0940	0.0105
44	1.1043	0.0103
45	1.1145	0.0102
46	1.1245	0.0100
47	1.1344	0.0099
48	1.1442	0.0098
49	1.1539	0.0097
50	1.1634	0.0095
51	1.1728	0.0094
52	1.1822	0.0093
53	1.1914	0.0092
54	1.2005	0.0091
55	1.2095	0.0090
56	1.2185	0.0089
57	1.2273	0.0088
58	1.2360	0.0087
59	1.2447	0.0086
60	1.2532	0.0086
61	1.2617	0.0085
62	1.2701	0.0084
63	1.2784	0.0083
64	1.2867	0.0082
65	1.2948	0.0082
66	1.3029	0.0081
67	1.3109	0.0080
68	1.3189	0.0079
69	1.3268	0.0079
70	1.3346	0.0078
71	1.3423	0.0077
72	1.3500	0.0077
73	1.3589	0.0089
74	1.3678	0.0089
75	1.3766	0.0088

76	1.3854	0.0087
77	1.3940	0.0087
78	1.4027	0.0086
79	1.4112	0.0086
80	1.4198	0.0085
81	1.4282	0.0085
82	1.4366	0.0084
83	1.4450	0.0084
84	1.4533	0.0083
85	1.4615	0.0082
86	1.4697	0.0082
87	1.4779	0.0081
88	1.4860	0.0081
89	1.4940	0.0081
90	1.5020	0.0080
91	1.5100	0.0080
92	1.5179	0.0079
93	1.5258	0.0079
94	1.5336	0.0078
95	1.5414	0.0078
96	1.5491	0.0077
97	1.5568	0.0077
98	1.5645	0.0077
99	1.5721	0.0076
100	1.5797	0.0076
101	1.5872	0.0075
102	1.5947	0.0075
103	1.6022	0.0075
104	1.6096	0.0074
105	1.6170	0.0074
106	1.6243	0.0073
107	1.6316	0.0073
108	1.6389	0.0073
109	1.6462	0.0072
110	1.6534	0.0072
111	1.6605	0.0072
112	1.6677	0.0071
113	1.6748	0.0071
114	1.6819	0.0071
115	1.6889	0.0070
116	1.6959	0.0070
117	1.7029	0.0070
118	1.7098	0.0069
119	1.7167	0.0069
120	1.7236	0.0069
121	1.7305	0.0069
122	1.7373	0.0068
123	1.7441	0.0068
124	1.7509	0.0068
125	1.7576	0.0067

126	1.7643	0.0067
127	1.7710	0.0067
128	1.7777	0.0067
129	1.7843	0.0066
130	1.7909	0.0066
131	1.7975	0.0066
132	1.8040	0.0065
133	1.8105	0.0065
134	1.8170	0.0065
135	1.8235	0.0065
136	1.8300	0.0064
137	1.8364	0.0064
138	1.8428	0.0064
139	1.8492	0.0064
140	1.8555	0.0064
141	1.8618	0.0063
142	1.8681	0.0063
143	1.8744	0.0063
144	1.8807	0.0063
145	1.8869	0.0062
146	1.8931	0.0062
147	1.8993	0.0062
148	1.9055	0.0062
149	1.9116	0.0061
150	1.9178	0.0061
151	1.9239	0.0061
152	1.9300	0.0061
153	1.9360	0.0061
154	1.9421	0.0060
155	1.9481	0.0060
156	1.9541	0.0060
157	1.9601	0.0060
158	1.9660	0.0060
159	1.9720	0.0059
160	1.9779	0.0059
161	1.9838	0.0059
162	1.9897	0.0059
163	1.9955	0.0059
164	2.0014	0.0058
165	2.0072	0.0058
166	2.0130	0.0058
167	2.0188	0.0058
168	2.0246	0.0058
169	2.0303	0.0058
170	2.0361	0.0057
171	2.0418	0.0057
172	2.0475	0.0057
173	2.0532	0.0057
174	2.0589	0.0057
175	2.0645	0.0057

176	2.0701	0.0056
177	2.0758	0.0056
178	2.0814	0.0056
179	2.0869	0.0056
180	2.0925	0.0056
181	2.0981	0.0056
182	2.1036	0.0055
183	2.1091	0.0055
184	2.1146	0.0055
185	2.1201	0.0055
186	2.1256	0.0055
187	2.1310	0.0055
188	2.1365	0.0054
189	2.1419	0.0054
190	2.1473	0.0054
191	2.1527	0.0054
192	2.1581	0.0054
193	2.1635	0.0054
194	2.1688	0.0054
195	2.1742	0.0053
196	2.1795	0.0053
197	2.1848	0.0053
198	2.1901	0.0053
199	2.1954	0.0053
200	2.2007	0.0053
201	2.2059	0.0053
202	2.2112	0.0052
203	2.2164	0.0052
204	2.2216	0.0052
205	2.2268	0.0052
206	2.2320	0.0052
207	2.2372	0.0052
208	2.2423	0.0052
209	2.2475	0.0051
210	2.2526	0.0051
211	2.2578	0.0051
212	2.2629	0.0051
213	2.2680	0.0051
214	2.2730	0.0051
215	2.2781	0.0051
216	2.2832	0.0051
217	2.2882	0.0050
218	2.2933	0.0050
219	2.2983	0.0050
220	2.3033	0.0050
221	2.3083	0.0050
222	2.3133	0.0050
223	2.3183	0.0050
224	2.3232	0.0050
225	2.3282	0.0050

226	2.3331	0.0049
227	2.3381	0.0049
228	2.3430	0.0049
229	2.3479	0.0049
230	2.3528	0.0049
231	2.3577	0.0049
232	2.3626	0.0049
233	2.3674	0.0049
234	2.3723	0.0049
235	2.3771	0.0048
236	2.3820	0.0048
237	2.3868	0.0048
238	2.3916	0.0048
239	2.3964	0.0048
240	2.4012	0.0048
241	2.4060	0.0048
242	2.4107	0.0048
243	2.4155	0.0048
244	2.4203	0.0047
245	2.4250	0.0047
246	2.4297	0.0047
247	2.4344	0.0047
248	2.4391	0.0047
249	2.4438	0.0047
250	2.4485	0.0047
251	2.4532	0.0047
252	2.4579	0.0047
253	2.4625	0.0047
254	2.4672	0.0047
255	2.4718	0.0046
256	2.4765	0.0046
257	2.4811	0.0046
258	2.4857	0.0046
259	2.4903	0.0046
260	2.4949	0.0046
261	2.4995	0.0046
262	2.5041	0.0046
263	2.5086	0.0046
264	2.5132	0.0046
265	2.5177	0.0045
266	2.5223	0.0045
267	2.5268	0.0045
268	2.5313	0.0045
269	2.5358	0.0045
270	2.5404	0.0045
271	2.5448	0.0045
272	2.5493	0.0045
273	2.5538	0.0045
274	2.5583	0.0045
275	2.5627	0.0045

276	2.5672	0.0045
277	2.5716	0.0044
278	2.5761	0.0044
279	2.5805	0.0044
280	2.5849	0.0044
281	2.5893	0.0044
282	2.5937	0.0044
283	2.5981	0.0044
284	2.6025	0.0044
285	2.6069	0.0044
286	2.6113	0.0044
287	2.6156	0.0044
288	2.6200	0.0044

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0044	0.0029	0.0014
2	0.0044	0.0029	0.0014
3	0.0044	0.0029	0.0014
4	0.0044	0.0029	0.0015
5	0.0044	0.0029	0.0015
6	0.0044	0.0030	0.0015
7	0.0044	0.0030	0.0015
8	0.0044	0.0030	0.0015
9	0.0045	0.0030	0.0015
10	0.0045	0.0030	0.0015
11	0.0045	0.0030	0.0015
12	0.0045	0.0030	0.0015
13	0.0045	0.0030	0.0015
14	0.0045	0.0030	0.0015
15	0.0045	0.0030	0.0015
16	0.0045	0.0030	0.0015
17	0.0046	0.0030	0.0015
18	0.0046	0.0031	0.0015
19	0.0046	0.0031	0.0015
20	0.0046	0.0031	0.0015
21	0.0046	0.0031	0.0015
22	0.0046	0.0031	0.0015
23	0.0046	0.0031	0.0015
24	0.0047	0.0031	0.0015
25	0.0047	0.0031	0.0015
26	0.0047	0.0031	0.0015
27	0.0047	0.0031	0.0016
28	0.0047	0.0032	0.0016
29	0.0047	0.0032	0.0016
30	0.0047	0.0032	0.0016
31	0.0048	0.0032	0.0016
32	0.0048	0.0032	0.0016

33	0.0048	0.0032	0.0016
34	0.0048	0.0032	0.0016
35	0.0048	0.0032	0.0016
36	0.0048	0.0032	0.0016
37	0.0049	0.0032	0.0016
38	0.0049	0.0033	0.0016
39	0.0049	0.0033	0.0016
40	0.0049	0.0033	0.0016
41	0.0049	0.0033	0.0016
42	0.0049	0.0033	0.0016
43	0.0050	0.0033	0.0016
44	0.0050	0.0033	0.0016
45	0.0050	0.0033	0.0017
46	0.0050	0.0033	0.0017
47	0.0050	0.0034	0.0017
48	0.0050	0.0034	0.0017
49	0.0051	0.0034	0.0017
50	0.0051	0.0034	0.0017
51	0.0051	0.0034	0.0017
52	0.0051	0.0034	0.0017
53	0.0051	0.0034	0.0017
54	0.0051	0.0034	0.0017
55	0.0052	0.0035	0.0017
56	0.0052	0.0035	0.0017
57	0.0052	0.0035	0.0017
58	0.0052	0.0035	0.0017
59	0.0053	0.0035	0.0017
60	0.0053	0.0035	0.0017
61	0.0053	0.0035	0.0018
62	0.0053	0.0036	0.0018
63	0.0053	0.0036	0.0018
64	0.0054	0.0036	0.0018
65	0.0054	0.0036	0.0018
66	0.0054	0.0036	0.0018
67	0.0054	0.0036	0.0018
68	0.0054	0.0036	0.0018
69	0.0055	0.0037	0.0018
70	0.0055	0.0037	0.0018
71	0.0055	0.0037	0.0018
72	0.0055	0.0037	0.0018
73	0.0056	0.0037	0.0018
74	0.0056	0.0037	0.0018
75	0.0056	0.0038	0.0019
76	0.0056	0.0038	0.0019
77	0.0057	0.0038	0.0019
78	0.0057	0.0038	0.0019
79	0.0057	0.0038	0.0019
80	0.0057	0.0038	0.0019
81	0.0058	0.0039	0.0019
82	0.0058	0.0039	0.0019

83	0.0058	0.0039	0.0019
84	0.0058	0.0039	0.0019
85	0.0059	0.0039	0.0019
86	0.0059	0.0040	0.0020
87	0.0059	0.0040	0.0020
88	0.0060	0.0040	0.0020
89	0.0060	0.0040	0.0020
90	0.0060	0.0040	0.0020
91	0.0061	0.0041	0.0020
92	0.0061	0.0041	0.0020
93	0.0061	0.0041	0.0020
94	0.0061	0.0041	0.0020
95	0.0062	0.0041	0.0020
96	0.0062	0.0042	0.0021
97	0.0063	0.0042	0.0021
98	0.0063	0.0042	0.0021
99	0.0063	0.0042	0.0021
100	0.0064	0.0043	0.0021
101	0.0064	0.0043	0.0021
102	0.0064	0.0043	0.0021
103	0.0065	0.0043	0.0021
104	0.0065	0.0043	0.0021
105	0.0065	0.0044	0.0022
106	0.0066	0.0044	0.0022
107	0.0066	0.0044	0.0022
108	0.0067	0.0045	0.0022
109	0.0067	0.0045	0.0022
110	0.0067	0.0045	0.0022
111	0.0068	0.0045	0.0022
112	0.0068	0.0046	0.0023
113	0.0069	0.0046	0.0023
114	0.0069	0.0046	0.0023
115	0.0070	0.0047	0.0023
116	0.0070	0.0047	0.0023
117	0.0071	0.0047	0.0023
118	0.0071	0.0048	0.0024
119	0.0072	0.0048	0.0024
120	0.0072	0.0048	0.0024
121	0.0073	0.0049	0.0024
122	0.0073	0.0049	0.0024
123	0.0074	0.0049	0.0024
124	0.0074	0.0050	0.0025
125	0.0075	0.0050	0.0025
126	0.0075	0.0050	0.0025
127	0.0076	0.0051	0.0025
128	0.0077	0.0051	0.0025
129	0.0077	0.0052	0.0026
130	0.0078	0.0052	0.0026
131	0.0079	0.0053	0.0026
132	0.0079	0.0053	0.0026

133	0.0080	0.0054	0.0026
134	0.0081	0.0054	0.0027
135	0.0081	0.0055	0.0027
136	0.0082	0.0055	0.0027
137	0.0083	0.0056	0.0027
138	0.0084	0.0056	0.0028
139	0.0085	0.0057	0.0028
140	0.0085	0.0057	0.0028
141	0.0086	0.0058	0.0029
142	0.0087	0.0058	0.0029
143	0.0088	0.0059	0.0029
144	0.0089	0.0059	0.0029
145	0.0077	0.0051	0.0025
146	0.0077	0.0052	0.0026
147	0.0079	0.0053	0.0026
148	0.0079	0.0053	0.0026
149	0.0081	0.0054	0.0027
150	0.0082	0.0055	0.0027
151	0.0083	0.0056	0.0028
152	0.0084	0.0056	0.0028
153	0.0086	0.0057	0.0028
154	0.0086	0.0058	0.0029
155	0.0088	0.0059	0.0029
156	0.0089	0.0060	0.0030
157	0.0091	0.0061	0.0030
158	0.0092	0.0062	0.0031
159	0.0094	0.0063	0.0031
160	0.0095	0.0064	0.0032
161	0.0098	0.0065	0.0032
162	0.0099	0.0066	0.0033
163	0.0102	0.0068	0.0034
164	0.0103	0.0069	0.0034
165	0.0106	0.0071	0.0035
166	0.0108	0.0072	0.0036
167	0.0111	0.0074	0.0037
168	0.0113	0.0075	0.0037
169	0.0116	0.0078	0.0038
170	0.0118	0.0079	0.0039
171	0.0123	0.0082	0.0041
172	0.0125	0.0084	0.0041
173	0.0130	0.0087	0.0043
174	0.0132	0.0089	0.0044
175	0.0138	0.0093	0.0046
176	0.0141	0.0095	0.0047
177	0.0148	0.0099	0.0049
178	0.0152	0.0102	0.0050
179	0.0161	0.0108	0.0053
180	0.0166	0.0111	0.0055
181	0.0177	0.0118	0.0058
182	0.0183	0.0122	0.0061

183	0.0198	0.0132	0.0065
184	0.0206	0.0138	0.0068
185	0.0167	0.0112	0.0055
186	0.0178	0.0119	0.0059
187	0.0207	0.0139	0.0068
188	0.0226	0.0151	0.0075
189	0.0281	0.0188	0.0093
190	0.0324	0.0217	0.0107
191	0.0491	0.0329	0.0162
192	0.0713	0.0336	0.0377
193	0.3084	0.0336	0.2748
194	0.0387	0.0259	0.0128
195	0.0250	0.0167	0.0083
196	0.0191	0.0128	0.0063
197	0.0216	0.0144	0.0071
198	0.0190	0.0127	0.0063
199	0.0171	0.0114	0.0057
200	0.0156	0.0105	0.0052
201	0.0145	0.0097	0.0048
202	0.0135	0.0091	0.0045
203	0.0127	0.0085	0.0042
204	0.0120	0.0081	0.0040
205	0.0114	0.0077	0.0038
206	0.0109	0.0073	0.0036
207	0.0105	0.0070	0.0035
208	0.0100	0.0067	0.0033
209	0.0097	0.0065	0.0032
210	0.0093	0.0062	0.0031
211	0.0090	0.0060	0.0030
212	0.0087	0.0058	0.0029
213	0.0085	0.0057	0.0028
214	0.0082	0.0055	0.0027
215	0.0080	0.0054	0.0027
216	0.0078	0.0052	0.0026
217	0.0089	0.0060	0.0030
218	0.0087	0.0059	0.0029
219	0.0086	0.0057	0.0028
220	0.0084	0.0056	0.0028
221	0.0082	0.0055	0.0027
222	0.0081	0.0054	0.0027
223	0.0080	0.0053	0.0026
224	0.0078	0.0052	0.0026
225	0.0077	0.0052	0.0025
226	0.0076	0.0051	0.0025
227	0.0075	0.0050	0.0025
228	0.0073	0.0049	0.0024
229	0.0072	0.0048	0.0024
230	0.0071	0.0048	0.0024
231	0.0070	0.0047	0.0023
232	0.0069	0.0046	0.0023

233	0.0069	0.0046	0.0023
234	0.0068	0.0045	0.0022
235	0.0067	0.0045	0.0022
236	0.0066	0.0044	0.0022
237	0.0065	0.0044	0.0022
238	0.0064	0.0043	0.0021
239	0.0064	0.0043	0.0021
240	0.0063	0.0042	0.0021
241	0.0062	0.0042	0.0021
242	0.0062	0.0041	0.0020
243	0.0061	0.0041	0.0020
244	0.0060	0.0040	0.0020
245	0.0060	0.0040	0.0020
246	0.0059	0.0040	0.0020
247	0.0059	0.0039	0.0019
248	0.0058	0.0039	0.0019
249	0.0058	0.0039	0.0019
250	0.0057	0.0038	0.0019
251	0.0057	0.0038	0.0019
252	0.0056	0.0037	0.0019
253	0.0056	0.0037	0.0018
254	0.0055	0.0037	0.0018
255	0.0055	0.0037	0.0018
256	0.0054	0.0036	0.0018
257	0.0054	0.0036	0.0018
258	0.0053	0.0036	0.0018
259	0.0053	0.0035	0.0017
260	0.0052	0.0035	0.0017
261	0.0052	0.0035	0.0017
262	0.0052	0.0035	0.0017
263	0.0051	0.0034	0.0017
264	0.0051	0.0034	0.0017
265	0.0050	0.0034	0.0017
266	0.0050	0.0034	0.0017
267	0.0050	0.0033	0.0016
268	0.0049	0.0033	0.0016
269	0.0049	0.0033	0.0016
270	0.0049	0.0033	0.0016
271	0.0048	0.0032	0.0016
272	0.0048	0.0032	0.0016
273	0.0048	0.0032	0.0016
274	0.0047	0.0032	0.0016
275	0.0047	0.0032	0.0016
276	0.0047	0.0031	0.0016
277	0.0047	0.0031	0.0015
278	0.0046	0.0031	0.0015
279	0.0046	0.0031	0.0015
280	0.0046	0.0031	0.0015
281	0.0045	0.0030	0.0015
282	0.0045	0.0030	0.0015

283	0.0045	0.0030	0.0015
284	0.0045	0.0030	0.0015
285	0.0044	0.0030	0.0015
286	0.0044	0.0030	0.0015
287	0.0044	0.0029	0.0015
288	0.0044	0.0029	0.0014

Total soil rain loss = 1.57(In)
Total effective rainfall = 1.05(In)
Peak flow rate in flood hydrograph = 2.71(CFS)

++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

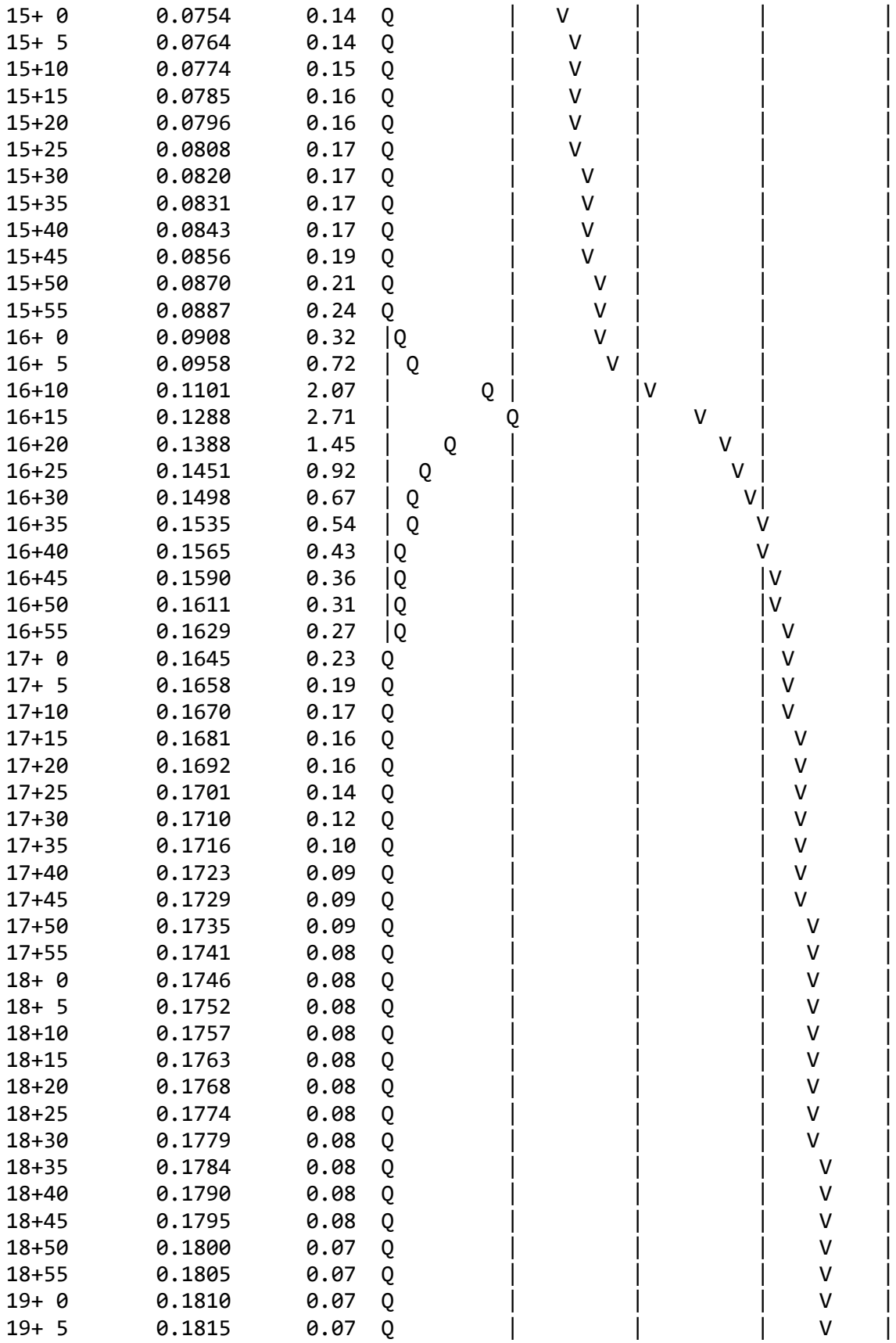
Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.00	Q				
0+10	0.0001	0.01	Q				
0+15	0.0002	0.02	Q				
0+20	0.0004	0.03	Q				
0+25	0.0006	0.03	Q				
0+30	0.0009	0.03	Q				
0+35	0.0011	0.04	Q				
0+40	0.0014	0.04	Q				
0+45	0.0016	0.04	Q				
0+50	0.0019	0.04	Q				
0+55	0.0022	0.04	Q				
1+ 0	0.0025	0.04	Q				
1+ 5	0.0027	0.04	Q				
1+10	0.0030	0.04	Q				
1+15	0.0033	0.04	Q				
1+20	0.0036	0.04	Q				
1+25	0.0039	0.04	Q				
1+30	0.0042	0.04	Q				
1+35	0.0045	0.04	Q				
1+40	0.0047	0.04	Q				
1+45	0.0050	0.04	Q				
1+50	0.0053	0.04	QV				
1+55	0.0056	0.04	QV				
2+ 0	0.0059	0.04	QV				
2+ 5	0.0062	0.04	QV				
2+10	0.0065	0.04	QV				
2+15	0.0068	0.04	QV				
2+20	0.0071	0.04	QV				
2+25	0.0074	0.04	QV				

2+30	0.0077	0.04	QV	|	|	|	|
2+35	0.0080	0.04	QV	|	|	|	|
2+40	0.0083	0.04	QV	|	|	|	|
2+45	0.0086	0.04	QV	|	|	|	|
2+50	0.0089	0.04	QV	|	|	|	|
2+55	0.0092	0.04	QV	|	|	|	|
3+ 0	0.0095	0.04	QV	|	|	|	|
3+ 5	0.0098	0.04	QV	|	|	|	|
3+10	0.0101	0.04	QV	|	|	|	|
3+15	0.0104	0.04	Q V	|	|	|	|
3+20	0.0108	0.04	Q V	|	|	|	|
3+25	0.0111	0.05	Q V	|	|	|	|
3+30	0.0114	0.05	Q V	|	|	|	|
3+35	0.0117	0.05	Q V	|	|	|	|
3+40	0.0120	0.05	Q V	|	|	|	|
3+45	0.0123	0.05	Q V	|	|	|	|
3+50	0.0126	0.05	Q V	|	|	|	|
3+55	0.0130	0.05	Q V	|	|	|	|
4+ 0	0.0133	0.05	Q V	|	|	|	|
4+ 5	0.0136	0.05	Q V	|	|	|	|
4+10	0.0139	0.05	Q V	|	|	|	|
4+15	0.0142	0.05	Q V	|	|	|	|
4+20	0.0146	0.05	Q V	|	|	|	|
4+25	0.0149	0.05	Q V	|	|	|	|
4+30	0.0152	0.05	Q V	|	|	|	|
4+35	0.0155	0.05	Q V	|	|	|	|
4+40	0.0159	0.05	Q V	|	|	|	|
4+45	0.0162	0.05	Q V	|	|	|	|
4+50	0.0165	0.05	Q V	|	|	|	|
4+55	0.0169	0.05	Q V	|	|	|	|
5+ 0	0.0172	0.05	Q V	|	|	|	|
5+ 5	0.0175	0.05	Q V	|	|	|	|
5+10	0.0179	0.05	Q V	|	|	|	|
5+15	0.0182	0.05	Q V	|	|	|	|
5+20	0.0185	0.05	Q V	|	|	|	|
5+25	0.0189	0.05	Q V	|	|	|	|
5+30	0.0192	0.05	Q V	|	|	|	|
5+35	0.0196	0.05	Q V	|	|	|	|
5+40	0.0199	0.05	Q V	|	|	|	|
5+45	0.0202	0.05	Q V	|	|	|	|
5+50	0.0206	0.05	Q V	|	|	|	|
5+55	0.0209	0.05	Q V	|	|	|	|
6+ 0	0.0213	0.05	Q V	|	|	|	|
6+ 5	0.0216	0.05	Q V	|	|	|	|
6+10	0.0220	0.05	Q V	|	|	|	|
6+15	0.0223	0.05	Q V	|	|	|	|
6+20	0.0227	0.05	Q V	|	|	|	|
6+25	0.0231	0.05	Q V	|	|	|	|
6+30	0.0234	0.05	Q V	|	|	|	|
6+35	0.0238	0.05	Q V	|	|	|	|

6+40	0.0241	0.05	Q	V	|	|	|	|
6+45	0.0245	0.05	Q	V	|	|	|	|
6+50	0.0249	0.05	Q	V	|	|	|	|
6+55	0.0252	0.05	Q	V	|	|	|	|
7+ 0	0.0256	0.05	Q	V	|	|	|	|
7+ 5	0.0260	0.05	Q	V	|	|	|	|
7+10	0.0263	0.05	Q	V	|	|	|	|
7+15	0.0267	0.05	Q	V	|	|	|	|
7+20	0.0271	0.05	Q	V	|	|	|	|
7+25	0.0275	0.05	Q	V	|	|	|	|
7+30	0.0278	0.06	Q	V	|	|	|	|
7+35	0.0282	0.06	Q	V	|	|	|	|
7+40	0.0286	0.06	Q	V	|	|	|	|
7+45	0.0290	0.06	Q	V	|	|	|	|
7+50	0.0294	0.06	Q	V	|	|	|	|
7+55	0.0298	0.06	Q	V	|	|	|	|
8+ 0	0.0302	0.06	Q	V	|	|	|	|
8+ 5	0.0306	0.06	Q	V	|	|	|	|
8+10	0.0309	0.06	Q	V	|	|	|	|
8+15	0.0313	0.06	Q	V	|	|	|	|
8+20	0.0317	0.06	Q	V	|	|	|	|
8+25	0.0321	0.06	Q	V	|	|	|	|
8+30	0.0325	0.06	Q	V	|	|	|	|
8+35	0.0330	0.06	Q	V	|	|	|	|
8+40	0.0334	0.06	Q	V	|	|	|	|
8+45	0.0338	0.06	Q	V	|	|	|	|
8+50	0.0342	0.06	Q	V	|	|	|	|
8+55	0.0346	0.06	Q	V	|	|	|	|
9+ 0	0.0350	0.06	Q	V	|	|	|	|
9+ 5	0.0354	0.06	Q	V	|	|	|	|
9+10	0.0359	0.06	Q	V	|	|	|	|
9+15	0.0363	0.06	Q	V	|	|	|	|
9+20	0.0367	0.06	Q	V	|	|	|	|
9+25	0.0371	0.06	Q	V	|	|	|	|
9+30	0.0376	0.06	Q	V	|	|	|	|
9+35	0.0380	0.06	Q	V	|	|	|	|
9+40	0.0385	0.06	Q	V	|	|	|	|
9+45	0.0389	0.06	Q	V	|	|	|	|
9+50	0.0393	0.06	Q	V	|	|	|	|
9+55	0.0398	0.07	Q	V	|	|	|	|
10+ 0	0.0402	0.07	Q	V	|	|	|	|
10+ 5	0.0407	0.07	Q	V	|	|	|	|
10+10	0.0412	0.07	Q	V	|	|	|	|
10+15	0.0416	0.07	Q	V	|	|	|	|
10+20	0.0421	0.07	Q	V	|	|	|	|
10+25	0.0425	0.07	Q	V	|	|	|	|
10+30	0.0430	0.07	Q	V	|	|	|	|
10+35	0.0435	0.07	Q	V	|	|	|	|
10+40	0.0440	0.07	Q	V	|	|	|	|
10+45	0.0444	0.07	Q	V	|	|	|	|

```
10+50       0.0449      0.07  Q       V |          |          |          |
10+55       0.0454      0.07  Q       V |          |          |          |
11+ 0       0.0459      0.07  Q        V|          |          |          |
11+ 5       0.0464      0.07  Q        V|          |          |          |
11+10       0.0469      0.07  Q        V|          |          |          |
11+15       0.0474      0.07  Q        V|          |          |          |
11+20       0.0479      0.07  Q        V|          |          |          |
11+25       0.0484      0.07  Q        V|          |          |          |
11+30       0.0490      0.08  Q        V|          |          |          |
11+35       0.0495      0.08  Q        V|          |          |          |
11+40       0.0500      0.08  Q        V|          |          |          |
11+45       0.0505      0.08  Q        V|          |          |          |
11+50       0.0511      0.08  Q         V          |          |          |
11+55       0.0516      0.08  Q         V          |          |          |
12+ 0       0.0522      0.08  Q         V          |          |          |
12+ 5       0.0527      0.08  Q         V          |          |          |
12+10       0.0533      0.08  Q         V          |          |          |
12+15       0.0538      0.08  Q         V          |          |          |
12+20       0.0543      0.07  Q         V          |          |          |
12+25       0.0548      0.07  Q         V          |          |          |
12+30       0.0553      0.07  Q         V          |          |          |
12+35       0.0559      0.08  Q         V          |          |          |
12+40       0.0564      0.08  Q         |V         |          |          |
12+45       0.0569      0.08  Q         |V         |          |          |
12+50       0.0574      0.08  Q         |V         |          |          |
12+55       0.0580      0.08  Q         |V         |          |          |
13+ 0       0.0585      0.08  Q         |V         |          |          |
13+ 5       0.0591      0.08  Q         |V         |          |          |
13+10       0.0596      0.08  Q         |V         |          |          |
13+15       0.0602      0.08  Q         |V         |          |          |
13+20       0.0608      0.08  Q         |V         |          |          |
13+25       0.0614      0.09  Q         | V        |          |          |
13+30       0.0620      0.09  Q         | V        |          |          |
13+35       0.0626      0.09  Q         | V        |          |          |
13+40       0.0632      0.09  Q         | V        |          |          |
13+45       0.0639      0.09  Q         | V        |          |          |
13+50       0.0645      0.09  Q         | V        |          |          |
13+55       0.0652      0.10  Q         | V        |          |          |
14+ 0       0.0658      0.10  Q         | V        |          |          |
14+ 5       0.0665      0.10  Q         |  V       |          |          |
14+10       0.0672      0.10  Q         |  V       |          |          |
14+15       0.0679      0.10  Q         |  V       |          |          |
14+20       0.0687      0.11  Q         |  V       |          |          |
14+25       0.0694      0.11  Q         |  V       |          |          |
14+30       0.0702      0.11  Q         |  V       |          |          |
14+35       0.0710      0.12  Q         |  V       |          |          |
14+40       0.0718      0.12  Q         |   V      |          |          |
14+45       0.0727      0.12  Q         |   V      |          |          |
14+50       0.0736      0.13  Q         |   V      |          |          |
14+55       0.0745      0.13  Q         |   V      |          |          |
```



19+10	0.1820	0.07	Q	|	|	|	V |
19+15	0.1824	0.07	Q	|	|	|	V |
19+20	0.1829	0.07	Q	|	|	|	V |
19+25	0.1834	0.07	Q	|	|	|	V |
19+30	0.1838	0.07	Q	|	|	|	V |
19+35	0.1843	0.06	Q	|	|	|	V |
19+40	0.1847	0.06	Q	|	|	|	V |
19+45	0.1851	0.06	Q	|	|	|	V |
19+50	0.1856	0.06	Q	|	|	|	V |
19+55	0.1860	0.06	Q	|	|	|	V |
20+ 0	0.1864	0.06	Q	|	|	|	V |
20+ 5	0.1868	0.06	Q	|	|	|	V |
20+10	0.1872	0.06	Q	|	|	|	V |
20+15	0.1876	0.06	Q	|	|	|	V |
20+20	0.1880	0.06	Q	|	|	|	V |
20+25	0.1884	0.06	Q	|	|	|	V |
20+30	0.1888	0.06	Q	|	|	|	V |
20+35	0.1892	0.06	Q	|	|	|	V |
20+40	0.1896	0.06	Q	|	|	|	V |
20+45	0.1900	0.06	Q	|	|	|	V |
20+50	0.1904	0.05	Q	|	|	|	V |
20+55	0.1907	0.05	Q	|	|	|	V |
21+ 0	0.1911	0.05	Q	|	|	|	V |
21+ 5	0.1915	0.05	Q	|	|	|	V |
21+10	0.1918	0.05	Q	|	|	|	V |
21+15	0.1922	0.05	Q	|	|	|	V |
21+20	0.1925	0.05	Q	|	|	|	V |
21+25	0.1929	0.05	Q	|	|	|	V |
21+30	0.1933	0.05	Q	|	|	|	V |
21+35	0.1936	0.05	Q	|	|	|	V |
21+40	0.1939	0.05	Q	|	|	|	V |
21+45	0.1943	0.05	Q	|	|	|	V |
21+50	0.1946	0.05	Q	|	|	|	V |
21+55	0.1950	0.05	Q	|	|	|	V |
22+ 0	0.1953	0.05	Q	|	|	|	V |
22+ 5	0.1956	0.05	Q	|	|	|	V |
22+10	0.1960	0.05	Q	|	|	|	V |
22+15	0.1963	0.05	Q	|	|	|	V |
22+20	0.1966	0.05	Q	|	|	|	V |
22+25	0.1969	0.05	Q	|	|	|	V |
22+30	0.1972	0.05	Q	|	|	|	V |
22+35	0.1976	0.05	Q	|	|	|	V |
22+40	0.1979	0.05	Q	|	|	|	V |
22+45	0.1982	0.05	Q	|	|	|	V |
22+50	0.1985	0.05	Q	|	|	|	V |
22+55	0.1988	0.04	Q	|	|	|	V|
23+ 0	0.1991	0.04	Q	|	|	|	V|
23+ 5	0.1994	0.04	Q	|	|	|	V|
23+10	0.1997	0.04	Q	|	|	|	V|
23+15	0.2000	0.04	Q	|	|	|	V|

```
   23+20       0.2003      0.04  Q         |         |         |         V|
   23+25       0.2006      0.04  Q         |         |         |         V|
   23+30       0.2009      0.04  Q         |         |         |         V|
   23+35       0.2012      0.04  Q         |         |         |         V|
   23+40       0.2015      0.04  Q         |         |         |         V|
   23+45       0.2018      0.04  Q         |         |         |         V|
   23+50       0.2021      0.04  Q         |         |         |         V|
   23+55       0.2024      0.04  Q         |         |         |         V|
   24+ 0       0.2026      0.04  Q         |         |         |         V|
-------------------------------------------------------------------------
```

U n i t H y d r o g r a p h A n a l y s i s

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Study date 06/30/22

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6385

Palmdale and Cantina, NE corner
developed, 10-year
Area A

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
2.32	1	0.65
Rainfall data for year 10		
2.32	6	1.35
Rainfall data for year 10		
2.32	24	2.62

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	32.0	2.32	1.000	0.978	0.100	0.098

Area-averaged adjusted loss rate Fm (In/Hr) = 0.098

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
0.23	0.100	32.0	32.0	13.10	0.000
2.09	0.900	98.0	98.0	0.20	0.912

Area-averaged catchment yield fraction, Y = 0.821
Area-averaged low loss fraction, Yb = 0.179
User entry of time of concentration = 0.080 (hours)
++
Watershed area = 2.32(Ac.)
Catchment Lag time = 0.064 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 130.2083
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.098(In/Hr)
Average low loss rate fraction (Yb) = 0.179 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.308(In)
Computed peak 30-minute rainfall = 0.528(In)
Specified peak 1-hour rainfall = 0.650(In)
Computed peak 3-hour rainfall = 1.018(In)
Specified peak 6-hour rainfall = 1.350(In)
Specified peak 24-hour rainfall = 2.620(In)

Rainfall depth area reduction factors:
Using a total area of 2.32(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.308(In)
30-minute factor = 1.000 Adjusted rainfall = 0.528(In)
1-hour factor = 1.000 Adjusted rainfall = 0.650(In)
3-hour factor = 1.000 Adjusted rainfall = 1.017(In)
6-hour factor = 1.000 Adjusted rainfall = 1.350(In)
24-hour factor = 1.000 Adjusted rainfall = 2.620(In)

U n i t H y d r o g r a p h
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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 28.06 (CFS))	
1	26.489	7.432
2	76.395	14.002
3	89.977	3.811
4	95.624	1.584
5	98.153	0.710
6	100.000	0.518

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3084	0.3084
2	0.3797	0.0713
3	0.4288	0.0491
4	0.4674	0.0387
5	0.4998	0.0324
6	0.5279	0.0281
7	0.5529	0.0250
8	0.5755	0.0226
9	0.5962	0.0207
10	0.6153	0.0191
11	0.6332	0.0178
12	0.6499	0.0167
13	0.6715	0.0216
14	0.6921	0.0206
15	0.7119	0.0198
16	0.7309	0.0190
17	0.7492	0.0183
18	0.7669	0.0177
19	0.7840	0.0171
20	0.8005	0.0166
21	0.8166	0.0161
22	0.8323	0.0156
23	0.8475	0.0152
24	0.8624	0.0148
25	0.8768	0.0145
26	0.8910	0.0141
27	0.9048	0.0138
28	0.9183	0.0135
29	0.9316	0.0132
30	0.9446	0.0130
31	0.9573	0.0127
32	0.9698	0.0125
33	0.9820	0.0123
34	0.9940	0.0120
35	1.0059	0.0118
36	1.0175	0.0116

37	1.0289	0.0114
38	1.0402	0.0113
39	1.0513	0.0111
40	1.0622	0.0109
41	1.0729	0.0108
42	1.0835	0.0106
43	1.0940	0.0105
44	1.1043	0.0103
45	1.1145	0.0102
46	1.1245	0.0100
47	1.1344	0.0099
48	1.1442	0.0098
49	1.1539	0.0097
50	1.1634	0.0095
51	1.1728	0.0094
52	1.1822	0.0093
53	1.1914	0.0092
54	1.2005	0.0091
55	1.2095	0.0090
56	1.2185	0.0089
57	1.2273	0.0088
58	1.2360	0.0087
59	1.2447	0.0086
60	1.2532	0.0086
61	1.2617	0.0085
62	1.2701	0.0084
63	1.2784	0.0083
64	1.2867	0.0082
65	1.2948	0.0082
66	1.3029	0.0081
67	1.3109	0.0080
68	1.3189	0.0079
69	1.3268	0.0079
70	1.3346	0.0078
71	1.3423	0.0077
72	1.3500	0.0077
73	1.3589	0.0089
74	1.3678	0.0089
75	1.3766	0.0088
76	1.3854	0.0087
77	1.3940	0.0087
78	1.4027	0.0086
79	1.4112	0.0086
80	1.4198	0.0085
81	1.4282	0.0085
82	1.4366	0.0084
83	1.4450	0.0084
84	1.4533	0.0083
85	1.4615	0.0082
86	1.4697	0.0082

87	1.4779	0.0081
88	1.4860	0.0081
89	1.4940	0.0081
90	1.5020	0.0080
91	1.5100	0.0080
92	1.5179	0.0079
93	1.5258	0.0079
94	1.5336	0.0078
95	1.5414	0.0078
96	1.5491	0.0077
97	1.5568	0.0077
98	1.5645	0.0077
99	1.5721	0.0076
100	1.5797	0.0076
101	1.5872	0.0075
102	1.5947	0.0075
103	1.6022	0.0075
104	1.6096	0.0074
105	1.6170	0.0074
106	1.6243	0.0073
107	1.6316	0.0073
108	1.6389	0.0073
109	1.6462	0.0072
110	1.6534	0.0072
111	1.6605	0.0072
112	1.6677	0.0071
113	1.6748	0.0071
114	1.6819	0.0071
115	1.6889	0.0070
116	1.6959	0.0070
117	1.7029	0.0070
118	1.7098	0.0069
119	1.7167	0.0069
120	1.7236	0.0069
121	1.7305	0.0069
122	1.7373	0.0068
123	1.7441	0.0068
124	1.7509	0.0068
125	1.7576	0.0067
126	1.7643	0.0067
127	1.7710	0.0067
128	1.7777	0.0067
129	1.7843	0.0066
130	1.7909	0.0066
131	1.7975	0.0066
132	1.8040	0.0065
133	1.8105	0.0065
134	1.8170	0.0065
135	1.8235	0.0065
136	1.8300	0.0064

137	1.8364	0.0064
138	1.8428	0.0064
139	1.8492	0.0064
140	1.8555	0.0064
141	1.8618	0.0063
142	1.8681	0.0063
143	1.8744	0.0063
144	1.8807	0.0063
145	1.8869	0.0062
146	1.8931	0.0062
147	1.8993	0.0062
148	1.9055	0.0062
149	1.9116	0.0061
150	1.9178	0.0061
151	1.9239	0.0061
152	1.9300	0.0061
153	1.9360	0.0061
154	1.9421	0.0060
155	1.9481	0.0060
156	1.9541	0.0060
157	1.9601	0.0060
158	1.9660	0.0060
159	1.9720	0.0059
160	1.9779	0.0059
161	1.9838	0.0059
162	1.9897	0.0059
163	1.9955	0.0059
164	2.0014	0.0058
165	2.0072	0.0058
166	2.0130	0.0058
167	2.0188	0.0058
168	2.0246	0.0058
169	2.0303	0.0058
170	2.0361	0.0057
171	2.0418	0.0057
172	2.0475	0.0057
173	2.0532	0.0057
174	2.0589	0.0057
175	2.0645	0.0057
176	2.0701	0.0056
177	2.0758	0.0056
178	2.0814	0.0056
179	2.0869	0.0056
180	2.0925	0.0056
181	2.0981	0.0056
182	2.1036	0.0055
183	2.1091	0.0055
184	2.1146	0.0055
185	2.1201	0.0055
186	2.1256	0.0055

187	2.1310	0.0055
188	2.1365	0.0054
189	2.1419	0.0054
190	2.1473	0.0054
191	2.1527	0.0054
192	2.1581	0.0054
193	2.1635	0.0054
194	2.1688	0.0054
195	2.1742	0.0053
196	2.1795	0.0053
197	2.1848	0.0053
198	2.1901	0.0053
199	2.1954	0.0053
200	2.2007	0.0053
201	2.2059	0.0053
202	2.2112	0.0052
203	2.2164	0.0052
204	2.2216	0.0052
205	2.2268	0.0052
206	2.2320	0.0052
207	2.2372	0.0052
208	2.2423	0.0052
209	2.2475	0.0051
210	2.2526	0.0051
211	2.2578	0.0051
212	2.2629	0.0051
213	2.2680	0.0051
214	2.2730	0.0051
215	2.2781	0.0051
216	2.2832	0.0051
217	2.2882	0.0050
218	2.2933	0.0050
219	2.2983	0.0050
220	2.3033	0.0050
221	2.3083	0.0050
222	2.3133	0.0050
223	2.3183	0.0050
224	2.3232	0.0050
225	2.3282	0.0050
226	2.3331	0.0049
227	2.3381	0.0049
228	2.3430	0.0049
229	2.3479	0.0049
230	2.3528	0.0049
231	2.3577	0.0049
232	2.3626	0.0049
233	2.3674	0.0049
234	2.3723	0.0049
235	2.3771	0.0048
236	2.3820	0.0048

237	2.3868	0.0048
238	2.3916	0.0048
239	2.3964	0.0048
240	2.4012	0.0048
241	2.4060	0.0048
242	2.4107	0.0048
243	2.4155	0.0048
244	2.4203	0.0047
245	2.4250	0.0047
246	2.4297	0.0047
247	2.4344	0.0047
248	2.4391	0.0047
249	2.4438	0.0047
250	2.4485	0.0047
251	2.4532	0.0047
252	2.4579	0.0047
253	2.4625	0.0047
254	2.4672	0.0047
255	2.4718	0.0046
256	2.4765	0.0046
257	2.4811	0.0046
258	2.4857	0.0046
259	2.4903	0.0046
260	2.4949	0.0046
261	2.4995	0.0046
262	2.5041	0.0046
263	2.5086	0.0046
264	2.5132	0.0046
265	2.5177	0.0045
266	2.5223	0.0045
267	2.5268	0.0045
268	2.5313	0.0045
269	2.5358	0.0045
270	2.5404	0.0045
271	2.5448	0.0045
272	2.5493	0.0045
273	2.5538	0.0045
274	2.5583	0.0045
275	2.5627	0.0045
276	2.5672	0.0045
277	2.5716	0.0044
278	2.5761	0.0044
279	2.5805	0.0044
280	2.5849	0.0044
281	2.5893	0.0044
282	2.5937	0.0044
283	2.5981	0.0044
284	2.6025	0.0044
285	2.6069	0.0044
286	2.6113	0.0044

287	2.6156	0.0044	
288	2.6200	0.0044	

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0044	0.0008	0.0036
2	0.0044	0.0008	0.0036
3	0.0044	0.0008	0.0036
4	0.0044	0.0008	0.0036
5	0.0044	0.0008	0.0036
6	0.0044	0.0008	0.0036
7	0.0044	0.0008	0.0036
8	0.0044	0.0008	0.0036
9	0.0045	0.0008	0.0037
10	0.0045	0.0008	0.0037
11	0.0045	0.0008	0.0037
12	0.0045	0.0008	0.0037
13	0.0045	0.0008	0.0037
14	0.0045	0.0008	0.0037
15	0.0045	0.0008	0.0037
16	0.0045	0.0008	0.0037
17	0.0046	0.0008	0.0037
18	0.0046	0.0008	0.0037
19	0.0046	0.0008	0.0038
20	0.0046	0.0008	0.0038
21	0.0046	0.0008	0.0038
22	0.0046	0.0008	0.0038
23	0.0046	0.0008	0.0038
24	0.0047	0.0008	0.0038
25	0.0047	0.0008	0.0038
26	0.0047	0.0008	0.0038
27	0.0047	0.0008	0.0039
28	0.0047	0.0008	0.0039
29	0.0047	0.0008	0.0039
30	0.0047	0.0008	0.0039
31	0.0048	0.0009	0.0039
32	0.0048	0.0009	0.0039
33	0.0048	0.0009	0.0039
34	0.0048	0.0009	0.0039
35	0.0048	0.0009	0.0040
36	0.0048	0.0009	0.0040
37	0.0049	0.0009	0.0040
38	0.0049	0.0009	0.0040
39	0.0049	0.0009	0.0040
40	0.0049	0.0009	0.0040
41	0.0049	0.0009	0.0040
42	0.0049	0.0009	0.0040
43	0.0050	0.0009	0.0041

44	0.0050	0.0009	0.0041
45	0.0050	0.0009	0.0041
46	0.0050	0.0009	0.0041
47	0.0050	0.0009	0.0041
48	0.0050	0.0009	0.0041
49	0.0051	0.0009	0.0042
50	0.0051	0.0009	0.0042
51	0.0051	0.0009	0.0042
52	0.0051	0.0009	0.0042
53	0.0051	0.0009	0.0042
54	0.0051	0.0009	0.0042
55	0.0052	0.0009	0.0042
56	0.0052	0.0009	0.0043
57	0.0052	0.0009	0.0043
58	0.0052	0.0009	0.0043
59	0.0053	0.0009	0.0043
60	0.0053	0.0009	0.0043
61	0.0053	0.0009	0.0043
62	0.0053	0.0010	0.0044
63	0.0053	0.0010	0.0044
64	0.0054	0.0010	0.0044
65	0.0054	0.0010	0.0044
66	0.0054	0.0010	0.0044
67	0.0054	0.0010	0.0045
68	0.0054	0.0010	0.0045
69	0.0055	0.0010	0.0045
70	0.0055	0.0010	0.0045
71	0.0055	0.0010	0.0045
72	0.0055	0.0010	0.0045
73	0.0056	0.0010	0.0046
74	0.0056	0.0010	0.0046
75	0.0056	0.0010	0.0046
76	0.0056	0.0010	0.0046
77	0.0057	0.0010	0.0047
78	0.0057	0.0010	0.0047
79	0.0057	0.0010	0.0047
80	0.0057	0.0010	0.0047
81	0.0058	0.0010	0.0047
82	0.0058	0.0010	0.0048
83	0.0058	0.0010	0.0048
84	0.0058	0.0010	0.0048
85	0.0059	0.0011	0.0048
86	0.0059	0.0011	0.0048
87	0.0059	0.0011	0.0049
88	0.0060	0.0011	0.0049
89	0.0060	0.0011	0.0049
90	0.0060	0.0011	0.0049
91	0.0061	0.0011	0.0050
92	0.0061	0.0011	0.0050
93	0.0061	0.0011	0.0050

94	0.0061	0.0011	0.0050
95	0.0062	0.0011	0.0051
96	0.0062	0.0011	0.0051
97	0.0063	0.0011	0.0051
98	0.0063	0.0011	0.0052
99	0.0063	0.0011	0.0052
100	0.0064	0.0011	0.0052
101	0.0064	0.0011	0.0053
102	0.0064	0.0011	0.0053
103	0.0065	0.0012	0.0053
104	0.0065	0.0012	0.0053
105	0.0065	0.0012	0.0054
106	0.0066	0.0012	0.0054
107	0.0066	0.0012	0.0054
108	0.0067	0.0012	0.0055
109	0.0067	0.0012	0.0055
110	0.0067	0.0012	0.0055
111	0.0068	0.0012	0.0056
112	0.0068	0.0012	0.0056
113	0.0069	0.0012	0.0057
114	0.0069	0.0012	0.0057
115	0.0070	0.0012	0.0057
116	0.0070	0.0013	0.0058
117	0.0071	0.0013	0.0058
118	0.0071	0.0013	0.0058
119	0.0072	0.0013	0.0059
120	0.0072	0.0013	0.0059
121	0.0073	0.0013	0.0060
122	0.0073	0.0013	0.0060
123	0.0074	0.0013	0.0061
124	0.0074	0.0013	0.0061
125	0.0075	0.0013	0.0062
126	0.0075	0.0013	0.0062
127	0.0076	0.0014	0.0063
128	0.0077	0.0014	0.0063
129	0.0077	0.0014	0.0064
130	0.0078	0.0014	0.0064
131	0.0079	0.0014	0.0065
132	0.0079	0.0014	0.0065
133	0.0080	0.0014	0.0066
134	0.0081	0.0014	0.0066
135	0.0081	0.0015	0.0067
136	0.0082	0.0015	0.0067
137	0.0083	0.0015	0.0068
138	0.0084	0.0015	0.0069
139	0.0085	0.0015	0.0069
140	0.0085	0.0015	0.0070
141	0.0086	0.0015	0.0071
142	0.0087	0.0016	0.0071
143	0.0088	0.0016	0.0072

144	0.0089	0.0016	0.0073
145	0.0077	0.0014	0.0063
146	0.0077	0.0014	0.0064
147	0.0079	0.0014	0.0065
148	0.0079	0.0014	0.0065
149	0.0081	0.0014	0.0066
150	0.0082	0.0015	0.0067
151	0.0083	0.0015	0.0068
152	0.0084	0.0015	0.0069
153	0.0086	0.0015	0.0070
154	0.0086	0.0015	0.0071
155	0.0088	0.0016	0.0072
156	0.0089	0.0016	0.0073
157	0.0091	0.0016	0.0075
158	0.0092	0.0017	0.0076
159	0.0094	0.0017	0.0077
160	0.0095	0.0017	0.0078
161	0.0098	0.0018	0.0080
162	0.0099	0.0018	0.0081
163	0.0102	0.0018	0.0083
164	0.0103	0.0018	0.0085
165	0.0106	0.0019	0.0087
166	0.0108	0.0019	0.0088
167	0.0111	0.0020	0.0091
168	0.0113	0.0020	0.0092
169	0.0116	0.0021	0.0095
170	0.0118	0.0021	0.0097
171	0.0123	0.0022	0.0101
172	0.0125	0.0022	0.0102
173	0.0130	0.0023	0.0107
174	0.0132	0.0024	0.0109
175	0.0138	0.0025	0.0114
176	0.0141	0.0025	0.0116
177	0.0148	0.0027	0.0122
178	0.0152	0.0027	0.0125
179	0.0161	0.0029	0.0132
180	0.0166	0.0030	0.0136
181	0.0177	0.0032	0.0145
182	0.0183	0.0033	0.0150
183	0.0198	0.0035	0.0162
184	0.0206	0.0037	0.0169
185	0.0167	0.0030	0.0137
186	0.0178	0.0032	0.0147
187	0.0207	0.0037	0.0170
188	0.0226	0.0040	0.0186
189	0.0281	0.0050	0.0231
190	0.0324	0.0058	0.0266
191	0.0491	0.0081	0.0410
192	0.0713	0.0081	0.0631
193	0.3084	0.0081	0.3002

194	0.0387	0.0069	0.0317
195	0.0250	0.0045	0.0205
196	0.0191	0.0034	0.0157
197	0.0216	0.0039	0.0177
198	0.0190	0.0034	0.0156
199	0.0171	0.0031	0.0140
200	0.0156	0.0028	0.0128
201	0.0145	0.0026	0.0119
202	0.0135	0.0024	0.0111
203	0.0127	0.0023	0.0104
204	0.0120	0.0022	0.0099
205	0.0114	0.0020	0.0094
206	0.0109	0.0020	0.0090
207	0.0105	0.0019	0.0086
208	0.0100	0.0018	0.0082
209	0.0097	0.0017	0.0079
210	0.0093	0.0017	0.0077
211	0.0090	0.0016	0.0074
212	0.0087	0.0016	0.0072
213	0.0085	0.0015	0.0070
214	0.0082	0.0015	0.0068
215	0.0080	0.0014	0.0066
216	0.0078	0.0014	0.0064
217	0.0089	0.0016	0.0073
218	0.0087	0.0016	0.0072
219	0.0086	0.0015	0.0070
220	0.0084	0.0015	0.0069
221	0.0082	0.0015	0.0068
222	0.0081	0.0014	0.0067
223	0.0080	0.0014	0.0065
224	0.0078	0.0014	0.0064
225	0.0077	0.0014	0.0063
226	0.0076	0.0014	0.0062
227	0.0075	0.0013	0.0061
228	0.0073	0.0013	0.0060
229	0.0072	0.0013	0.0059
230	0.0071	0.0013	0.0059
231	0.0070	0.0013	0.0058
232	0.0069	0.0012	0.0057
233	0.0069	0.0012	0.0056
234	0.0068	0.0012	0.0056
235	0.0067	0.0012	0.0055
236	0.0066	0.0012	0.0054
237	0.0065	0.0012	0.0054
238	0.0064	0.0012	0.0053
239	0.0064	0.0011	0.0052
240	0.0063	0.0011	0.0052
241	0.0062	0.0011	0.0051
242	0.0062	0.0011	0.0051
243	0.0061	0.0011	0.0050

244	0.0060	0.0011	0.0050
245	0.0060	0.0011	0.0049
246	0.0059	0.0011	0.0049
247	0.0059	0.0010	0.0048
248	0.0058	0.0010	0.0048
249	0.0058	0.0010	0.0047
250	0.0057	0.0010	0.0047
251	0.0057	0.0010	0.0046
252	0.0056	0.0010	0.0046
253	0.0056	0.0010	0.0046
254	0.0055	0.0010	0.0045
255	0.0055	0.0010	0.0045
256	0.0054	0.0010	0.0044
257	0.0054	0.0010	0.0044
258	0.0053	0.0010	0.0044
259	0.0053	0.0009	0.0043
260	0.0052	0.0009	0.0043
261	0.0052	0.0009	0.0043
262	0.0052	0.0009	0.0042
263	0.0051	0.0009	0.0042
264	0.0051	0.0009	0.0042
265	0.0050	0.0009	0.0041
266	0.0050	0.0009	0.0041
267	0.0050	0.0009	0.0041
268	0.0049	0.0009	0.0041
269	0.0049	0.0009	0.0040
270	0.0049	0.0009	0.0040
271	0.0048	0.0009	0.0040
272	0.0048	0.0009	0.0040
273	0.0048	0.0009	0.0039
274	0.0047	0.0009	0.0039
275	0.0047	0.0008	0.0039
276	0.0047	0.0008	0.0039
277	0.0047	0.0008	0.0038
278	0.0046	0.0008	0.0038
279	0.0046	0.0008	0.0038
280	0.0046	0.0008	0.0038
281	0.0045	0.0008	0.0037
282	0.0045	0.0008	0.0037
283	0.0045	0.0008	0.0037
284	0.0045	0.0008	0.0037
285	0.0044	0.0008	0.0036
286	0.0044	0.0008	0.0036
287	0.0044	0.0008	0.0036
288	0.0044	0.0008	0.0036

Total soil rain loss = 0.42(In)
Total effective rainfall = 2.20(In)
Peak flow rate in flood hydrograph = 4.78(CFS)

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

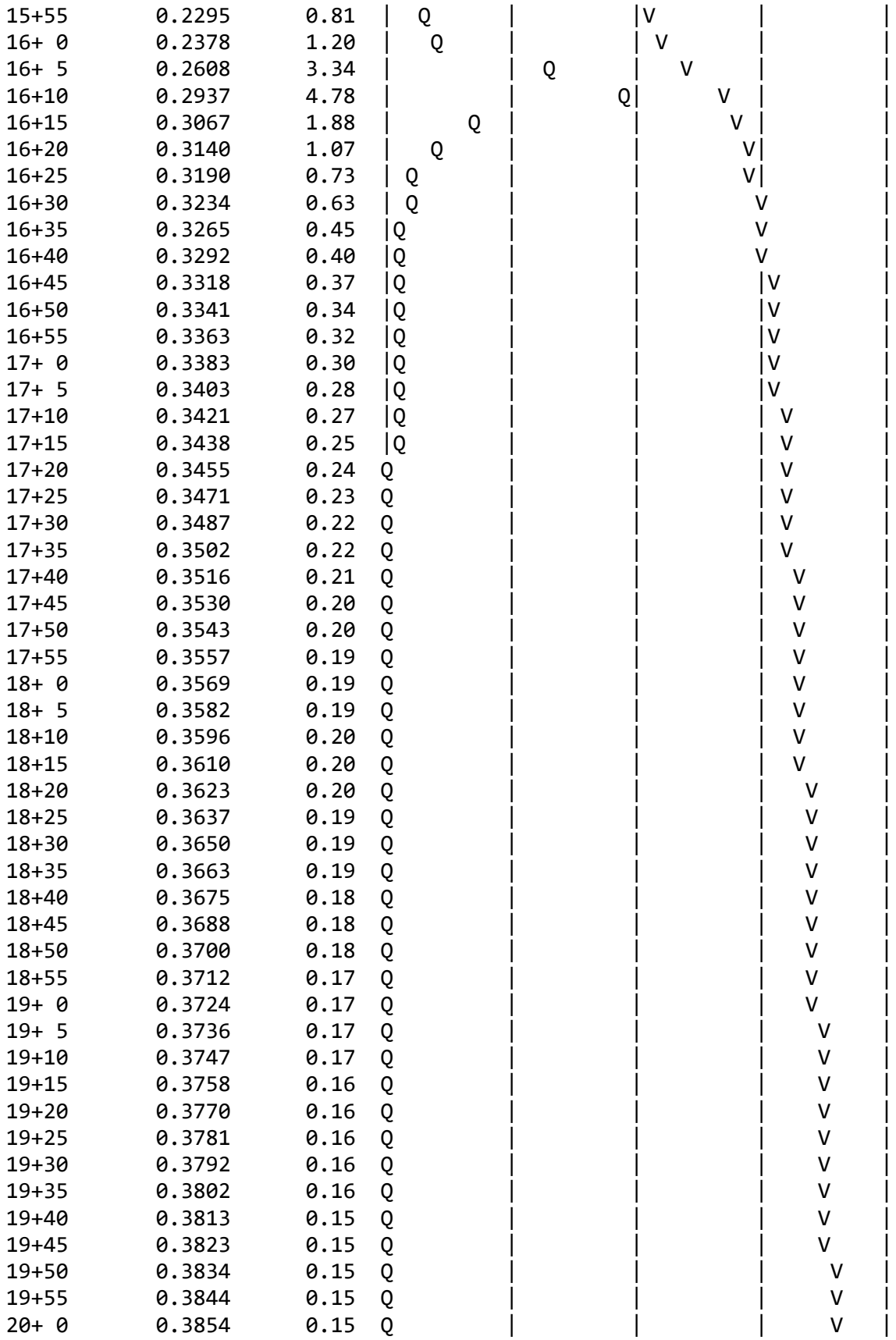
Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0002	0.03	Q				
0+10	0.0007	0.08	Q				
0+15	0.0013	0.09	Q				
0+20	0.0020	0.10	Q				
0+25	0.0027	0.10	Q				
0+30	0.0034	0.10	Q				
0+35	0.0041	0.10	Q				
0+40	0.0048	0.10	Q				
0+45	0.0055	0.10	Q				
0+50	0.0062	0.10	Q				
0+55	0.0069	0.10	Q				
1+ 0	0.0076	0.10	Q				
1+ 5	0.0083	0.10	Q				
1+10	0.0090	0.10	Q				
1+15	0.0098	0.10	Q				
1+20	0.0105	0.10	Q				
1+25	0.0112	0.10	QV				
1+30	0.0119	0.10	QV				
1+35	0.0126	0.11	QV				
1+40	0.0134	0.11	QV				
1+45	0.0141	0.11	QV				
1+50	0.0148	0.11	QV				
1+55	0.0156	0.11	QV				
2+ 0	0.0163	0.11	QV				
2+ 5	0.0170	0.11	QV				
2+10	0.0178	0.11	QV				
2+15	0.0185	0.11	QV				
2+20	0.0193	0.11	QV				
2+25	0.0200	0.11	QV				
2+30	0.0208	0.11	QV				
2+35	0.0215	0.11	Q V				
2+40	0.0223	0.11	Q V				
2+45	0.0230	0.11	Q V				
2+50	0.0238	0.11	Q V				
2+55	0.0245	0.11	Q V				
3+ 0	0.0253	0.11	Q V				
3+ 5	0.0261	0.11	Q V				
3+10	0.0268	0.11	Q V				
3+15	0.0276	0.11	Q V				
3+20	0.0284	0.11	Q V				

3+25	0.0292	0.11	Q V	|	|	|	|
3+30	0.0299	0.11	Q V	|	|	|	|
3+35	0.0307	0.11	Q V	|	|	|	|
3+40	0.0315	0.11	Q V	|	|	|	|
3+45	0.0323	0.11	Q V	|	|	|	|
3+50	0.0331	0.11	Q V	|	|	|	|
3+55	0.0339	0.12	Q V	|	|	|	|
4+ 0	0.0347	0.12	Q V	|	|	|	|
4+ 5	0.0355	0.12	Q V	|	|	|	|
4+10	0.0363	0.12	Q V	|	|	|	|
4+15	0.0371	0.12	Q V	|	|	|	|
4+20	0.0379	0.12	Q V	|	|	|	|
4+25	0.0387	0.12	Q V	|	|	|	|
4+30	0.0395	0.12	Q V	|	|	|	|
4+35	0.0403	0.12	Q V	|	|	|	|
4+40	0.0412	0.12	Q V	|	|	|	|
4+45	0.0420	0.12	Q V	|	|	|	|
4+50	0.0428	0.12	Q V	|	|	|	|
4+55	0.0436	0.12	Q V	|	|	|	|
5+ 0	0.0445	0.12	Q V	|	|	|	|
5+ 5	0.0453	0.12	Q V	|	|	|	|
5+10	0.0461	0.12	Q V	|	|	|	|
5+15	0.0470	0.12	Q V	|	|	|	|
5+20	0.0478	0.12	Q V	|	|	|	|
5+25	0.0487	0.12	Q V	|	|	|	|
5+30	0.0495	0.12	Q V	|	|	|	|
5+35	0.0504	0.12	Q V	|	|	|	|
5+40	0.0513	0.12	Q V	|	|	|	|
5+45	0.0521	0.13	Q V	|	|	|	|
5+50	0.0530	0.13	Q V	|	|	|	|
5+55	0.0539	0.13	Q V	|	|	|	|
6+ 0	0.0547	0.13	Q V	|	|	|	|
6+ 5	0.0556	0.13	Q V	|	|	|	|
6+10	0.0565	0.13	Q V	|	|	|	|
6+15	0.0574	0.13	Q V	|	|	|	|
6+20	0.0583	0.13	Q V	|	|	|	|
6+25	0.0592	0.13	Q V	|	|	|	|
6+30	0.0601	0.13	Q V	|	|	|	|
6+35	0.0610	0.13	Q V	|	|	|	|
6+40	0.0619	0.13	Q V	|	|	|	|
6+45	0.0628	0.13	Q V	|	|	|	|
6+50	0.0637	0.13	Q V	|	|	|	|
6+55	0.0646	0.13	Q V	|	|	|	|
7+ 0	0.0655	0.13	Q V	|	|	|	|
7+ 5	0.0665	0.13	Q V	|	|	|	|
7+10	0.0674	0.14	Q V	|	|	|	|
7+15	0.0683	0.14	Q V	|	|	|	|
7+20	0.0693	0.14	Q V	|	|	|	|
7+25	0.0702	0.14	Q V	|	|	|	|
7+30	0.0712	0.14	Q V	|	|	|	|

7+35	0.0721	0.14	Q	V	|	|	|	|
7+40	0.0731	0.14	Q	V	|	|	|	|
7+45	0.0741	0.14	Q	V	|	|	|	|
7+50	0.0750	0.14	Q	V	|	|	|	|
7+55	0.0760	0.14	Q	V	|	|	|	|
8+ 0	0.0770	0.14	Q	V	|	|	|	|
8+ 5	0.0780	0.14	Q	V	|	|	|	|
8+10	0.0790	0.14	Q	V	|	|	|	|
8+15	0.0800	0.14	Q	V	|	|	|	|
8+20	0.0810	0.15	Q	V	|	|	|	|
8+25	0.0820	0.15	Q	V	|	|	|	|
8+30	0.0830	0.15	Q	V	|	|	|	|
8+35	0.0840	0.15	Q	V	|	|	|	|
8+40	0.0850	0.15	Q	V	|	|	|	|
8+45	0.0861	0.15	Q	V	|	|	|	|
8+50	0.0871	0.15	Q	V	|	|	|	|
8+55	0.0881	0.15	Q	V	|	|	|	|
9+ 0	0.0892	0.15	Q	V	|	|	|	|
9+ 5	0.0902	0.15	Q	V	|	|	|	|
9+10	0.0913	0.15	Q	V	|	|	|	|
9+15	0.0924	0.16	Q	V	|	|	|	|
9+20	0.0934	0.16	Q	V	|	|	|	|
9+25	0.0945	0.16	Q	V	|	|	|	|
9+30	0.0956	0.16	Q	V	|	|	|	|
9+35	0.0967	0.16	Q	V|		|	|	|
9+40	0.0978	0.16	Q	V|		|	|	|
9+45	0.0989	0.16	Q	V|		|	|	|
9+50	0.1001	0.16	Q	V|		|	|	|
9+55	0.1012	0.16	Q	V|		|	|	|
10+ 0	0.1023	0.16	Q	V|		|	|	|
10+ 5	0.1035	0.17	Q	V|		|	|	|
10+10	0.1046	0.17	Q	V|		|	|	|
10+15	0.1058	0.17	Q	V|		|	|	|
10+20	0.1069	0.17	Q	V		|	|	|
10+25	0.1081	0.17	Q	V		|	|	|
10+30	0.1093	0.17	Q	V		|	|	|
10+35	0.1105	0.17	Q	V		|	|	|
10+40	0.1117	0.18	Q	V		|	|	|
10+45	0.1129	0.18	Q	V		|	|	|
10+50	0.1141	0.18	Q	V		|	|	|
10+55	0.1154	0.18	Q	V		|	|	|
11+ 0	0.1166	0.18	Q	V		|	|	|
11+ 5	0.1179	0.18	Q	|	V	|	|	|
11+10	0.1192	0.18	Q	|	V	|	|	|
11+15	0.1204	0.19	Q	|	V	|	|	|
11+20	0.1217	0.19	Q	|	V	|	|	|
11+25	0.1230	0.19	Q	|	V	|	|	|
11+30	0.1243	0.19	Q	|	V	|	|	|
11+35	0.1257	0.19	Q	|	V	|	|	|
11+40	0.1270	0.19	Q	|	V	|	|	|

```
11+45       0.1284      0.20  Q         | V       |         |         |
11+50       0.1297      0.20  Q         | V       |         |         |
11+55       0.1311      0.20  Q         | V       |         |         |
12+ 0       0.1325      0.20  Q         | V       |         |         |
12+ 5       0.1338      0.20  Q         | V       |         |         |
12+10       0.1351      0.18  Q         | V       |         |         |
12+15       0.1364      0.18  Q         | V       |         |         |
12+20       0.1376      0.18  Q         | V       |         |         |
12+25       0.1389      0.18  Q         |  V      |         |         |
12+30       0.1402      0.19  Q         |  V      |         |         |
12+35       0.1415      0.19  Q         |  V      |         |         |
12+40       0.1428      0.19  Q         |  V      |         |         |
12+45       0.1441      0.19  Q         |  V      |         |         |
12+50       0.1455      0.20  Q         |  V      |         |         |
12+55       0.1468      0.20  Q         |  V      |         |         |
13+ 0       0.1482      0.20  Q         |  V      |         |         |
13+ 5       0.1496      0.21  Q         |   V     |         |         |
13+10       0.1511      0.21  Q         |   V     |         |         |
13+15       0.1525      0.21  Q         |   V     |         |         |
13+20       0.1540      0.22  Q         |   V     |         |         |
13+25       0.1555      0.22  Q         |   V     |         |         |
13+30       0.1571      0.22  Q         |   V     |         |         |
13+35       0.1587      0.23  Q         |   V     |         |         |
13+40       0.1603      0.23  Q         |    V    |         |         |
13+45       0.1619      0.24  Q         |    V    |         |         |
13+50       0.1636      0.24  Q         |    V    |         |         |
13+55       0.1653      0.25  Q         |    V    |         |         |
14+ 0       0.1670      0.25  |Q        |    V    |         |         |
14+ 5       0.1688      0.26  |Q        |    V    |         |         |
14+10       0.1707      0.27  |Q        |     V   |         |         |
14+15       0.1725      0.27  |Q        |     V   |         |         |
14+20       0.1745      0.28  |Q        |     V   |         |         |
14+25       0.1764      0.29  |Q        |     V   |         |         |
14+30       0.1785      0.30  |Q        |     V   |         |         |
14+35       0.1806      0.31  |Q        |     V   |         |         |
14+40       0.1828      0.32  |Q        |      V  |         |         |
14+45       0.1850      0.33  |Q        |      V  |         |         |
14+50       0.1874      0.34  |Q        |      V  |         |         |
14+55       0.1898      0.35  |Q        |      V  |         |         |
15+ 0       0.1923      0.37  |Q        |       V |         |         |
15+ 5       0.1950      0.38  |Q        |       V |         |         |
15+10       0.1977      0.40  |Q        |       V |         |         |
15+15       0.2006      0.42  |Q        |       V |         |         |
15+20       0.2037      0.45  |Q        |        V|         |         |
15+25       0.2068      0.44  |Q        |        V|         |         |
15+30       0.2096      0.41  |Q        |        V|         |         |
15+35       0.2126      0.43  |Q        |        V|         |         |
15+40       0.2158      0.47  |Q        |         V         |         |
15+45       0.2195      0.54  | Q       |         V         |         |
15+50       0.2239      0.64  | Q       |         |V        |         |
```


15+55 0.2295 0.81
16+ 0 0.2378 1.20
16+ 5 0.2608 3.34
16+10 0.2937 4.78
16+15 0.3067 1.88
16+20 0.3140 1.07
16+25 0.3190 0.73
16+30 0.3234 0.63
16+35 0.3265 0.45
16+40 0.3292 0.40
16+45 0.3318 0.37
16+50 0.3341 0.34
16+55 0.3363 0.32
17+ 0 0.3383 0.30
17+ 5 0.3403 0.28
17+10 0.3421 0.27
17+15 0.3438 0.25
17+20 0.3455 0.24
17+25 0.3471 0.23
17+30 0.3487 0.22
17+35 0.3502 0.22
17+40 0.3516 0.21
17+45 0.3530 0.20
17+50 0.3543 0.20
17+55 0.3557 0.19
18+ 0 0.3569 0.19
18+ 5 0.3582 0.19
18+10 0.3596 0.20
18+15 0.3610 0.20
18+20 0.3623 0.20
18+25 0.3637 0.19
18+30 0.3650 0.19
18+35 0.3663 0.19
18+40 0.3675 0.18
18+45 0.3688 0.18
18+50 0.3700 0.18
18+55 0.3712 0.17
19+ 0 0.3724 0.17
19+ 5 0.3736 0.17
19+10 0.3747 0.17
19+15 0.3758 0.16
19+20 0.3770 0.16
19+25 0.3781 0.16
19+30 0.3792 0.16
19+35 0.3802 0.16
19+40 0.3813 0.15
19+45 0.3823 0.15
19+50 0.3834 0.15
19+55 0.3844 0.15
20+ 0 0.3854 0.15

```
  20+ 5       0.3864      0.15  Q         |          |          |     V    |
  20+10       0.3874      0.14  Q         |          |          |     V    |
  20+15       0.3884      0.14  Q         |          |          |     V    |
  20+20       0.3894      0.14  Q         |          |          |     V    |
  20+25       0.3903      0.14  Q         |          |          |     V    |
  20+30       0.3913      0.14  Q         |          |          |     V    |
  20+35       0.3922      0.14  Q         |          |          |     V    |
  20+40       0.3932      0.14  Q         |          |          |     V    |
  20+45       0.3941      0.13  Q         |          |          |      V   |
  20+50       0.3950      0.13  Q         |          |          |      V   |
  20+55       0.3959      0.13  Q         |          |          |      V   |
  21+ 0       0.3968      0.13  Q         |          |          |      V   |
  21+ 5       0.3977      0.13  Q         |          |          |      V   |
  21+10       0.3986      0.13  Q         |          |          |      V   |
  21+15       0.3994      0.13  Q         |          |          |      V   |
  21+20       0.4003      0.13  Q         |          |          |      V   |
  21+25       0.4012      0.12  Q         |          |          |      V   |
  21+30       0.4020      0.12  Q         |          |          |      V   |
  21+35       0.4029      0.12  Q         |          |          |      V   |
  21+40       0.4037      0.12  Q         |          |          |      V   |
  21+45       0.4045      0.12  Q         |          |          |       V  |
  21+50       0.4054      0.12  Q         |          |          |       V  |
  21+55       0.4062      0.12  Q         |          |          |       V  |
  22+ 0       0.4070      0.12  Q         |          |          |       V  |
  22+ 5       0.4078      0.12  Q         |          |          |       V  |
  22+10       0.4086      0.12  Q         |          |          |       V  |
  22+15       0.4094      0.12  Q         |          |          |       V  |
  22+20       0.4102      0.11  Q         |          |          |       V  |
  22+25       0.4110      0.11  Q         |          |          |       V  |
  22+30       0.4118      0.11  Q         |          |          |       V  |
  22+35       0.4125      0.11  Q         |          |          |       V  |
  22+40       0.4133      0.11  Q         |          |          |       V  |
  22+45       0.4141      0.11  Q         |          |          |       V  |
  22+50       0.4148      0.11  Q         |          |          |       V  |
  22+55       0.4156      0.11  Q         |          |          |        V |
  23+ 0       0.4163      0.11  Q         |          |          |        V |
  23+ 5       0.4171      0.11  Q         |          |          |        V |
  23+10       0.4178      0.11  Q         |          |          |        V |
  23+15       0.4185      0.11  Q         |          |          |        V |
  23+20       0.4193      0.11  Q         |          |          |        V |
  23+25       0.4200      0.11  Q         |          |          |        V |
  23+30       0.4207      0.10  Q         |          |          |        V |
  23+35       0.4214      0.10  Q         |          |          |        V |
  23+40       0.4222      0.10  Q         |          |          |        V |
  23+45       0.4229      0.10  Q         |          |          |        V |
  23+50       0.4236      0.10  Q         |          |          |        V |
  23+55       0.4243      0.10  Q         |          |          |        V |
  24+ 0       0.4250      0.10  Q         |          |          |        V |
-------------------------------------------------------------------------
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Attachment E – Soil Information

- USGS Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for San Bernardino County, California, Mojave River Area



February 9, 2022

Preface

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

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

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

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

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

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

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How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

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

Soil Map

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

Custom Soil Resource Report
Soil Map (Cantina and Palmdale road)



Map Scale: 1:1,120 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 13, Sep 13, 2021

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

Date(s) aerial images were photographed: Mar 27, 2021—May 24, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Cantina and Palmdale road)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
112	CAJON SAND, 0 TO 2 PERCENT SLOPES	4.4	100.0%
Totals for Area of Interest		**4.4**	**100.0%**

Map Unit Descriptions (Cantina and Palmdale road)

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The

delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

San Bernardino County, California, Mojave River Area

112—CAJON SAND, 0 TO 2 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hkrj
Elevation: 1,800 to 3,200 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 180 to 290 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Cajon

Setting

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

Typical profile

H1 - 0 to 7 inches: sand
H2 - 7 to 25 inches: sand
H3 - 25 to 45 inches: gravelly sand
H4 - 45 to 60 inches: stratified sand to loamy fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

Minor Components

Manet

Percent of map unit: 5 percent

Landform: Playas
Hydric soil rating: Yes

Kimberlina
Percent of map unit: 5 percent

Helendale
Percent of map unit: 5 percent

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Attachment F

- BMP Fact Sheets

Site Design & Landscape Planning SD-10



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Spill Prevention, Control & Cleanup SC-11



Objectives

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

Description

Spills and leaks, if not properly controlled, can adversely impact the storm drain system and receiving waters. Due to the type of work or the materials involved, many activities that occur either at a municipal facility or as a part of municipal field programs have the potential for accidental spills and leaks. Proper spill response planning and preparation can enable municipal employees to effectively respond to problems when they occur and minimize the discharge of pollutants to the environment.

Targeted Constituents

Sediment	
Nutrients	☑
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Approach

- An effective spill response and control plan should include:
  - Spill/leak prevention measures;
  - Spill response procedures;
  - Spill cleanup procedures;
  - Reporting; and
  - Training
- A well thought out and implemented plan can prevent pollutants from entering the storm drainage system and can be used as a tool for training personnel to prevent and control future spills as well.

Pollution Prevention

- Develop and implement a Spill Prevention Control and Response Plan. The plan should include:

- A description of the facility, the address, activities and materials involved
- Identification of key spill response personnel
- Identification of the potential spill areas or operations prone to spills/leaks
- Identification of which areas should be or are bermed to contain spills/leaks
- Facility map identifying the key locations of areas, activities, materials, structural BMPs, etc.
- Material handling procedures
- Spill response procedures including:
  - Assessment of the site and potential impacts
  - Containment of the material
  - Notification of the proper personnel and evacuation procedures
  - Clean up of the site
  - Disposal of the waste material and
  - Proper record keeping

- Product substitution – use less toxic materials (i.e. use water based paints instead of oil based paints)
- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of materials that are brought into the facility or into the field.

Suggested Protocols

Spill/Leak Prevention Measures

- If possible, move material handling indoors, under cover, or away from storm drains or sensitive water bodies.
- Properly label all containers so that the contents are easily identifiable.
- Berm storage areas so that if a spill or leak occurs, the material is contained.
- Cover outside storage areas either with a permanent structure or with a seasonal one such as a tarp so that rain can not come into contact with the materials.
- Check containers (and any containment sumps) often for leaks and spills. Replace containers that are leaking, corroded, or otherwise deteriorating with containers in good condition. Collect all spilled liquids and properly dispose of them.

- Store, contain and transfer liquid materials in such a manner that if the container is ruptured or the contents spilled, they will not discharge, flow or be washed into the storm drainage system, surface waters, or groundwater.
- Place drip pans or absorbent materials beneath all mounted taps and at all potential drip and spill locations during the filling and unloading of containers. Any collected liquids or soiled absorbent materials should be reused/recycled or properly disposed of.
- For field programs, only transport the minimum amount of material needed for the daily activities and transfer materials between containers at a municipal yard where leaks and spill are easier to control.
- If paved, sweep and clean storage areas monthly, do not use water to hose down the area unless all of the water will be collected and disposed of properly.
- Install a spill control device (such as a tee section) in any catch basins that collect runoff from any storage areas if the materials stored are oil, gas, or other materials that separate from and float on water. This will allow for easier cleanup if a spill occurs.
- If necessary, protect catch basins while conducting field activities so that if a spill occurs, the material will be contained.

Training

- Educate employees about spill prevention, spill response and cleanup on a routine basis.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
  - The employees should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan if one is available.
- Training of staff from all municipal departments should focus on recognizing and reporting potential or current spills/leaks and who they should contact.
- Employees responsible for aboveground storage tanks and liquid transfers for large bulk containers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

Spill Response and Prevention

- Identify key spill response personnel and train employees on who they are.
- Store and maintain appropriate spill cleanup materials in a clearly marked location near storage areas; and train employees to ensure familiarity with the site's spill control plan and/or proper spill cleanup procedures.
- Locate spill cleanup materials, such as absorbents, where they will be readily accessible (e.g. near storage and maintenance areas, on field trucks).

SC-11 Spill Prevention, Control & Cleanup

- Follow the Spill Prevention Control and Countermeasure Plan if one is available.
- If a spill occurs, notify the key spill response personnel immediately. If the material is unknown or hazardous, the local fire department may also need to be contacted.
- If safe to do so, attempt to contain the material and block the nearby storm drains so that the area impacted is minimized. If the material is unknown or hazardous wait for properly trained personnel to contain the materials.
- Perform an assessment of the area where the spill occurred and the downstream area that it could impact. Relay this information to the key spill response and clean up personnel.

Spill Cleanup Procedures

- Small non-hazardous spills
  - Use a rag, damp cloth or absorbent materials for general clean up of liquids
  - Use brooms or shovels for the general clean up of dry materials
  - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
  - Dispose of any waste materials properly
  - Clean or dispose of any equipment used to clean up the spill properly
- Large non-hazardous spills
  - Use absorbent materials for general clean up of liquids
  - Use brooms, shovels or street sweepers for the general clean up of dry materials
  - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
  - Dispose of any waste materials properly
  - Clean or dispose of any equipment used to clean up the spill properly
- For hazardous or very large spills, a private cleanup company or Hazmat team may need to be contacted to assess the situation and conduct the cleanup and disposal of the materials.
- Chemical cleanups of material can be achieved with the use of absorbents, gels, and foams. Remove the adsorbent materials promptly and dispose of according to regulations.
- 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.

Reporting

- Report any spills immediately to the identified key municipal spill response personnel.

- Report spills in accordance with applicable reporting laws. Spills that pose an immediate threat to human health or the environment must be reported immediately to the Office of Emergency Service (OES)
- Spills that pose an immediate threat to human health or the environment may also need to be reported within 24 hours to the Regional Water Quality Control Board.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour)
- After the spill has been contained and cleaned up, a detailed report about the incident should be generated and kept on file (see the section on Reporting below). The incident may also be used in briefing staff about proper procedures

Other Considerations

- 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 Plan (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, if permitted to do so, prohibiting any hard connections to the storm drain.

Requirements

Costs

- 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 wastes, contaminated soil and water is very expensive

Maintenance

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the response and containment of a spill. A good record keeping system helps the municipality minimize incident recurrence, correctly respond with appropriate containment and 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 drain.

These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

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

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

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

Examples

The City of Palo Alto includes spill prevention and control as a major element of its highly effective program for municipal vehicle maintenance shops.

References and Resources

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

Orange County Stormwater Program
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)
http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf

Efficient Irrigation SD-12



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13



Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.
- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Building & Grounds Maintenance SC-41



Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

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

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

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

Landscaping Activities

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

Building Repair, Remodeling, and Construction

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

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

Mowing, Trimming, and Planting

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

Fertilizer and Pesticide Management

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

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

Inspection

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

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

References and Resources

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

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

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

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

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

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

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

Parking/Storage Area Maintenance SC-43



Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

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SC-43 Parking/Storage Area Maintenance

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

Surface Cleaning

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

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

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

Spill Response and Prevention

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

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

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

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

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

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

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

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

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

Housekeeping Practices SC-60

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

Objectives

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

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.
- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Dispose of wash water, sweepings, and sediments, properly.
- Recycle or dispose of fluids properly.
- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.
- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).
- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

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- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plant up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

Requirements

Costs

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

Maintenance

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

Supplemental Information

Further Detail of the BMP

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

Examples

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.
http://www.nalms.org/bclss/bmphome.html#bmp

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

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

Orange County Stormwater Program
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Mateo STOPPP - (http://stoppp.tripod.com/bmp.html)

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Curb Inlet Filter

Trash Capture

Comprehensive Stormwater Solutions

Bio Clean

A Forterra Company



OVERVIEW

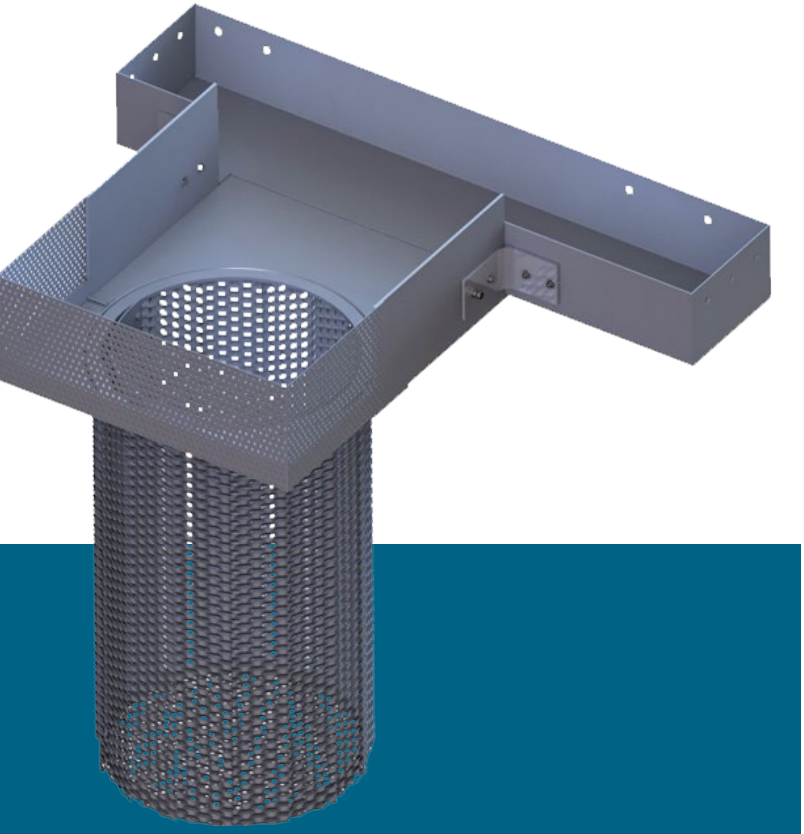
The Bio Clean Curb Inlet Filter is an insertable catch basin filter system designed to capture fine to coarse sediments, floatable trash, debris, and hydrocarbons conveyed in stormwater runoff. The filter system is available in three different model types: Full Trash Capture, Multi-Level Screening (MLS), and the revolutionary Kraken type media filter insert model.

The Curb Inlet Filter is an effective and economical solution to help property owners, developers, and municipalities meet local, state, and federal water quality requirements and regulations.

The expandable trough system is designed to convey water quality design flows through the filter basket while allowing peak flows to bypass over the trough without resuspending captured pollutants. The modular design of the trough system makes it adaptable to any size or type of curb inlet catch basin.

The Curb Inlet Filter provides easy access for maintenance from the surface without having to enter the catch basin. Maintenance service takes about 15 minutes and requires no confined space entry.

This filtration system addresses a wide array of pollutants including trash and debris, sediments, TSS, nutrients, metals, and hydrocarbons.



FULL TRASH CAPTURE TYPE

PERFORMANCE

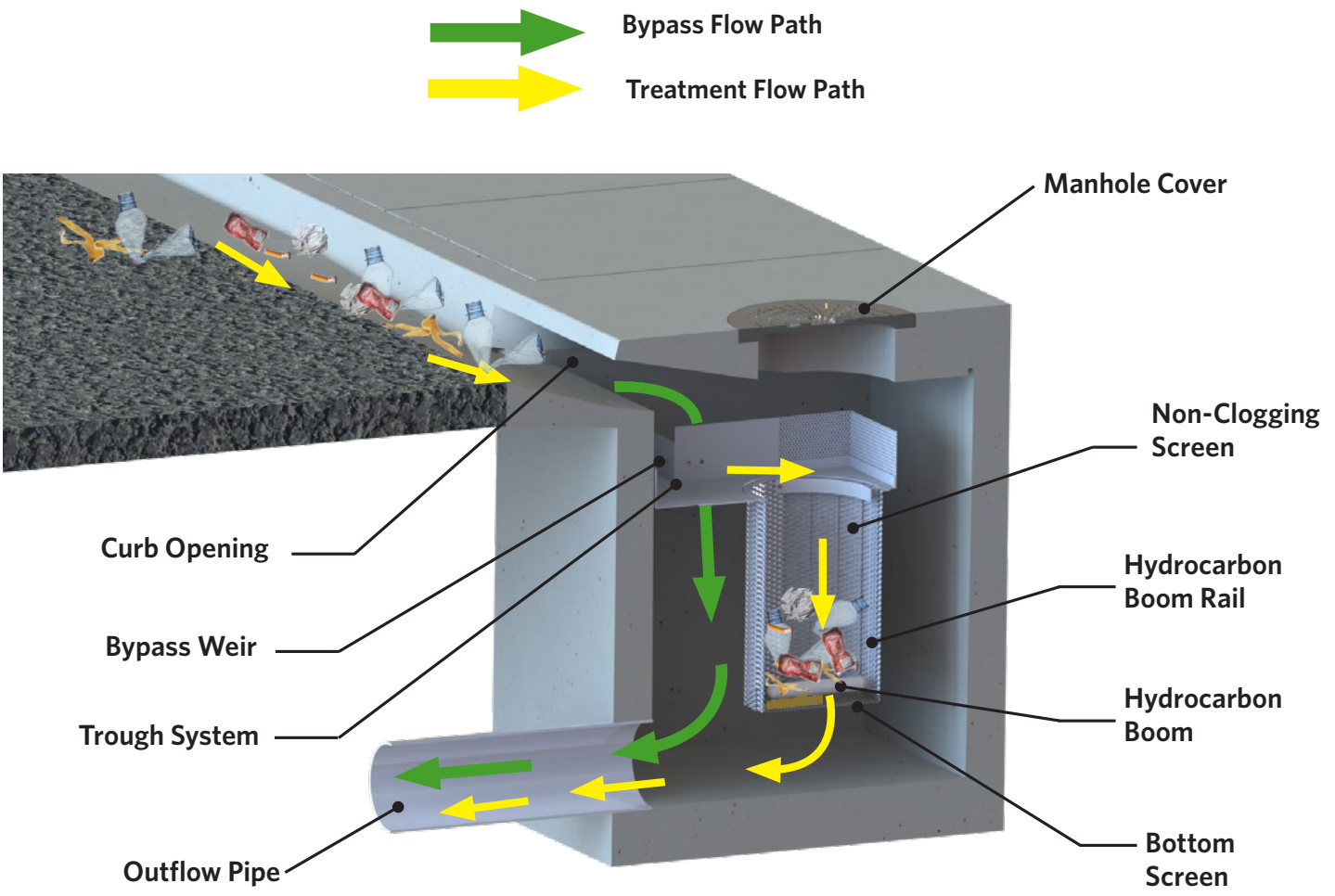
100% REMOVAL OF TRASH AND DEBRIS

- MEETS FULL CAPTURE REQUIREMENTS

ADVANTAGES

- 8-YEAR WARRANTY
- WORKS IN ANY SIZE CATCH BASIN
- NO NETS OR GEOFABRICS
- 15+ YEARS USER LIFE
- EASIEST TO MAINTAIN TROUGH SYSTEM ALLOWS FOR 15-MINUTE OR LESS SERVICE TIME
- STAINLESS STEEL AND FIBERGLASS CONSTRUCTION

OPERATION



APPLICATIONS

- Parking Lots
- Roadways

SPECIFICATIONS

MODEL #	TREATMENT FLOW CAPACITY (cfs)	BYPASS FLOW (cfs)
BIO-CURB-FULL	2.85	UNLIMITED

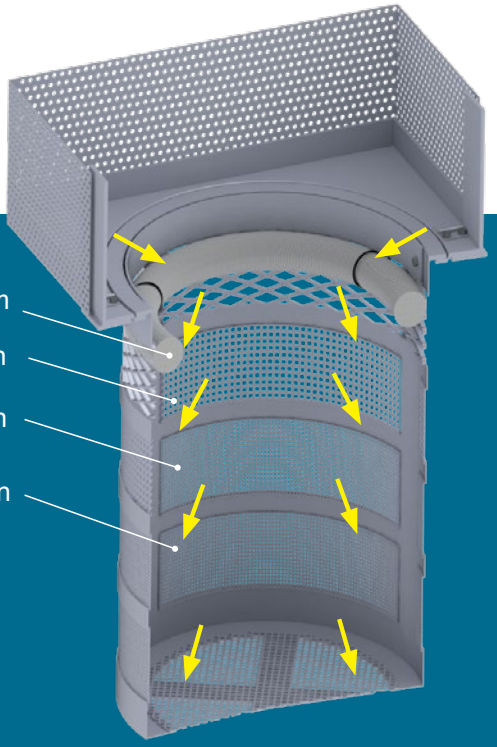
Note: Treatment flow rate limited to the weir capacity - actual flow rates of the filter basket is greater than 2.85 cfs.
Various depth filter baskets available.

CURB INLET FILTER

The Bio Clean Multi-Level Screening Curb Inlet Filter is the standard configuration used for more than a decade and provides the best overall performance for all pollutants of concern.

OPERATION

Treatment Flow Path



MULTI-LEVEL SCREENING

PERFORMANCE

80% REMOVAL OF SEDIMENTS	100% REMOVAL OF TRASH	100% REMOVAL OF FOLIAGE

- MEDIUM LEVEL REMOVAL FOR PARTICULATE METALS AND NUTRIENTS
- INCLUDES HYDROCARBON BOOM FOR REMOVAL OF OILS AND GREASE

SPECIFICATIONS

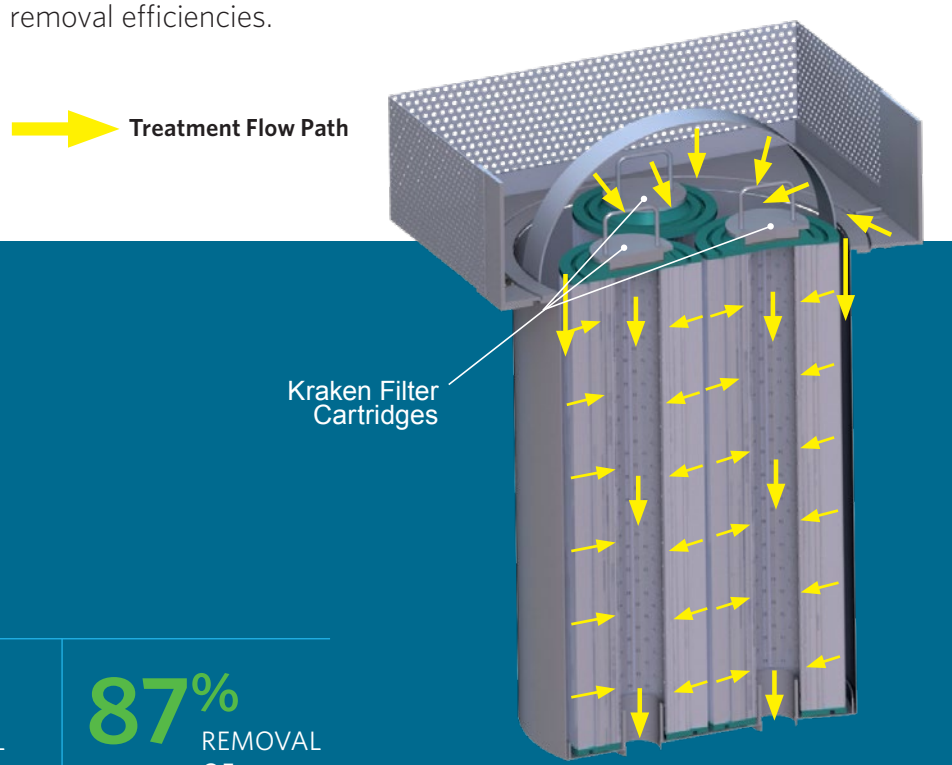
MODEL #	SCREEN TREATMENT FLOW (cfs)	BYPASS FLOW (cfs)
BIO-CURB-MLS	2.85	UNLIMITED

Note: Treatment flow rate limited to the weir capacity – actual flow rates of the filter basket is greater than 2.85 cfs.
Various depth filter baskets available.

CURB INLET MEDIA FILTER

The Bio Clean Kraken Curb Inlet Media Filter is an advanced membrane filter for increased removal efficiencies.

OPERATION



KRAKEN TYPE

PERFORMANCE

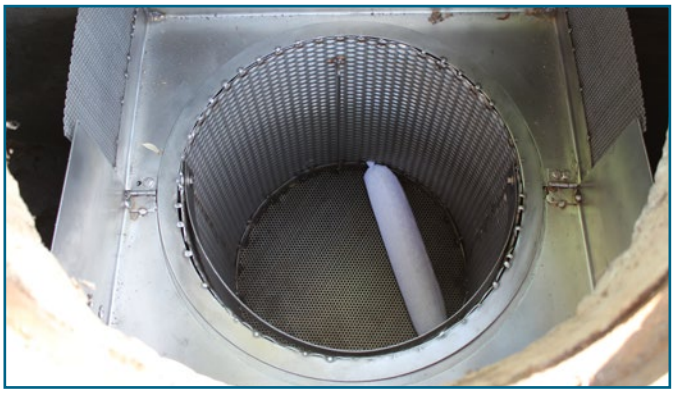
85% REMOVAL OF FINE TSS	**52%** REMOVAL OF COPPER	**87%** REMOVAL OF LEAD	
58% REMOVAL OF ZINC	**60%** REMOVAL OF FECAL COLIFORM (BACTERIA)	**81% - 95%** REMOVAL OF OILS AND GREASE (MOTOR OIL)	**72%** REMOVAL OF DISSOLVED PHOSPHORUS

SPECIFICATIONS

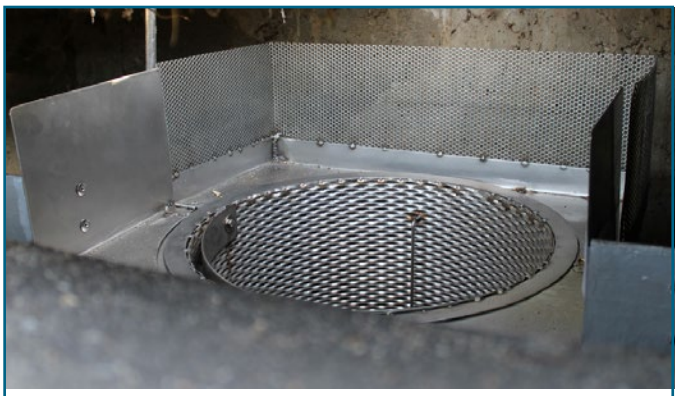
MODEL #	MEDIA TREATMENT FLOW (cfs)	BYPASS FLOW (cfs)
BIO-CURB-KMF-30	0.11	UNLIMITED

Note: Media treatment flow rate based on three 30" tall Kraken filter cartridges. Various filter basket and Kraken Filter Cartridge heights available.

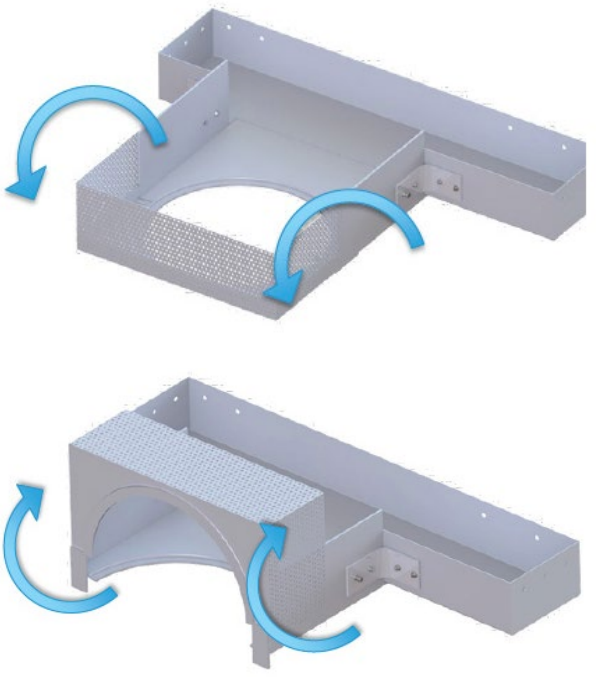
INSTALLATION



Always positioned under manhole opening.



The Curb Inlet Filter features a folding weir that hinges up after the basket is removed to allow easy access to the catch basin if needed.



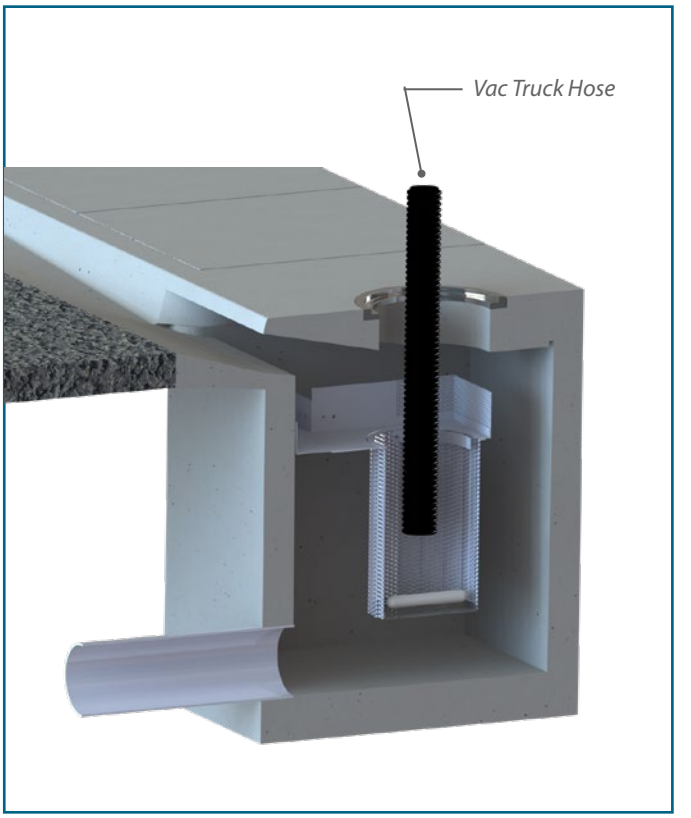
MAINTENANCE



Cleaned easily with vac truck, without catch basin entry, and about 15 minutes is required for service.



Easily removed without entry into basin.







Bio Clean
A Forterra Company

398 Via El Centro
Oceanside, CA 92058
855.566.3938
stormwater@forterrabp.com
biocleanenvironmental.com

072718R1

Attachment G

- Educational Materials



The Updated Model Water Efficient Landscape Ordinance

CALIFORNIA DEPARTMENT OF WATER RESOURCES

Landscapes are essential to the quality of life in California. They provide areas for recreation, enhance the environment, clean the air and water, prevent erosion, offer fire protection and replace ecosystems lost to development.

California's economic prosperity and environmental quality are dependant on an adequate supply of water for beneficial uses. In California, about half of the urban water used is for landscape irrigation. Ensuring **efficient landscapes** in new developments and reducing water waste in existing landscapes are the most cost-effective ways to stretch our limited water supplies and ensure that we continue to have sufficient water for California to prosper.





The Water Conservation in Landscaping Act of 2006 (Assembly Bill 1881, Laird) requires cities, counties, and charter cities and charter counties, to adopt landscape water conservation ordinances by January 1, 2010. Pursuant to this law, the Department of Water Resources (DWR) has prepared a Model Water Efficient Landscape Ordinance (Model Ordinance) for use by local agencies. The Model Ordinance was approved by the Office of Administrative Law on September 10, 2009. The Model Ordinance became effective on September 10.

All local agencies must adopt a water efficient landscape ordinance by **January 1, 2010**. The local agencies may adopt the state Model Ordinance, or craft an ordinance to fit local conditions. In addition, several local agencies may collaborate and craft a region-wide ordinance. In any case, the adopted ordinance must be as effective as the Model Ordinance in regard to water conservation.

For more information, please visit our web site at
http://www.water.ca.gov/wateruseefficiency/landscapeordinance/

DWR October 2009

Model Water Efficient Landscape Ordinance
CALIFORNIA DEPARTMENT OF WATER RESOURCES



Important points to consider...

Water purveyors have an important role.

The enabling statute was directed to local agencies that make land use decisions and approve land development. Active participation by water purveyors can make the implementation, enforcement and follow-up actions of an ordinance more effective.

Most new and rehabilitated landscapes are subject to a water efficient landscape ordinance. Public landscapes and private development projects including developer installed single family and multi-family residential landscapes with at least 2500 sq. ft. of landscape area are subject to the Model Ordinance .

Homeowner provided landscaping at single family and multi-family homes are subject to the Model Ordinance if the landscape area is at least 5000 sq. ft

Existing landscapes are also subject to the Model Ordinance.

Water waste is common in landscapes that are poorly designed or not well maintained. Water waste (from runoff, overspray, low head drainage, leaks and excessive amounts of applied irrigation water in landscapes is prohibited by Section 2, Article X of the California Constitution.

Any landscape installed prior to January 1, 2010, that is at least one acre in size may be subject to irrigation audits, irrigation surveys or water use analysis programs for evaluating irrigation system performance and adherence to the Maximum Applied Water Allowance as defined in the 1992 Model Ordinance with an Evapotranspiration Adjustment Factor (ETAF) of 0.8. Local agencies and water purveyors (designated by the local agency) may institute these or other programs to increase efficiency in existing landscapes.

All new landscapes will be assigned a water budget.

The water budget approach is a provision in the statute that ensures a landscape is allowed sufficient water. There are two water budgets in the Model Ordinance; the Maximum Applied Water Allowance (MAWA) and the Estimated Total Water Use (ETWU).

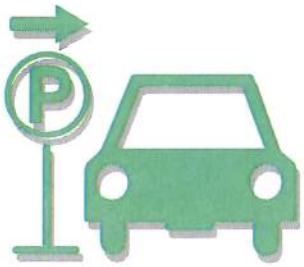
The MAWA, is the water budget used for compliance and is an annual water allowance based on landscape area, local evapotranspiration and ETAF of 0.7. The ETWU is an annual water use estimation for design purposes and is based on the water needs of the plants actually chosen for a given landscape. The ETWU may not exceed the MAWA.

Water efficient landscapes offer multiple benefits.

Water efficient landscapes will stretch our limited water supplies. Other benefits include reduced irrigation runoff, reduced pollution of waterways, less property damage, less green waste, increased drought resistance and a smaller carbon footprint.

The Department of Water Resources will offer technical assistance.

The Department plans to offer a series of workshops, publications and other assistance for successful adoption and implementation of the Model Ordinance or local water efficient landscape ordinances. Information regarding these resources may be found on the DWR website: **http://www.water.ca.gov/wateruseefficiency/landscapeordinance/**
Questions on the Model Ordinance may be sent by e-mail to DWR staff at: **mweo@water.ca.gov.**



R-3
AUTOMOBILE PARKING

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	
Bacteria	
Foaming Agents	
Metals	X
Hydrocarbons	X
Hazardous Materials	x
Pesticides and Herbicides	
Other	

Parked automobiles may contribute pollutants to the storm drain because poorly maintained vehicles may leak fluids containing hydrocarbons, metals, and other pollutants. In addition, heavily soiled automobiles may drop clods of dirt onto the parking surface, contributing to the sediment load when runoff is present. During rain events, or wash-down activities, the pollutants may be carried into the storm drain system. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before parking your car. Remember - The ocean starts at your front door.

Required Activities

- If required, vehicles have to be removed from the street during designated street sweeping/cleaning times.
- If the automobile is leaking, place a pan or similar collection device under the automobile, until such time as the leak may be repaired.
- Use dry cleaning methods to remove any materials deposited by vehicles (e.g. adsorbents for fluid leaks, sweeping for soil clod deposits).

Recommended Activities

- Park automobiles over permeable surfaces (e.g. gravel, or porous cement).
- Limit vehicle parking to covered areas.
- Perform routine maintenance to minimize fluid leaks, and maximize fuel efficiency.

For additional information contact:
County of Orange, OC **Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com



R-8
WATER CONSERVATION

Excessive irrigation and/or the overuse of water is often the most significant factor in transporting pollutants to the storm drain system. Pollutants from a wide variety of sources including automobile repair and maintenance, automobile washing, automobile parking, home and garden care activities and pet care may dissolve in the water and be transported to the storm drain. In addition, particles and materials coated with fertilizers and pesticides may be suspended in the flow and be transported to the storm drain.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x

Hosing off outside areas to wash them down not only consumes large quantities of water, but also transports any pollutants, sediments, and waste to the storm drain system. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before using water. Remember - The ocean starts at your front door.

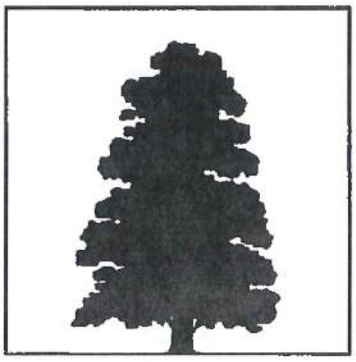
Required Activities

- Irrigation systems must be properly adjusted to reflect seasonal water needs.
- Do not hose off outside surfaces to clean, sweep with a broom instead.

Recommended Activities

- Fix any leaking faucets and eliminate unnecessary water sources.
- Use xeroscaping and drought tolerant landscaping to reduce the watering needs.
- Do not over watering lawns or gardens. Over watering wastes water and promotes diseases.
- Use a bucket to re-soak sponges/rags while washing automobiles and other items outdoors. Use hose only for rinsing.
- Wash automobiles at a commercial car wash employing water recycling.

For additional information contact:
County of Orange, OC **Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com



FP-2

LANDSCAPE MAINTENANCE

The model procedures described below focus on minimizing the discharge of pesticides and fertilizers, landscape waste, trash, debris, and other pollutants to the storm drain system and receiving waters. Landscape maintenance practices may involve one or more of the following activities:

1. **Mowing, Trimming/Weeding, and Planting**
2. **Irrigation**
3. **Fertilizer and Pesticide Management**
4. **Managing Landscape Waste**
5. **Erosion Control**

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for landscape maintenance include:

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools. Refer to Appendix D, Fertilizer and Pesticide Management Guidance for further details.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) will preserve the landscapes water efficiency.
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Mowing, Trimming/Weeding, and Planting

Mowing, Trimming/Weeding

✓ Whenever possible, use mechanical methods of vegetation removal rather than applying herbicides. Use hand weeding where practical.

- ✓ When conducting mechanical or manual weed control, avoid loosening the soil, which could erode into streams or storm drains.
- ✓ Use coarse textured mulches or geotextiles to suppress weed growth and reduce the use of herbicides.
- ✓ Do not blow or rake leaves, etc. into the street or place yard waste in gutters or on dirt shoulders. Sweep up any leaves, litter or residue in gutters or on street.
- ✓ Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this procedure sheet).
- ✓ Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- ✓ Where feasible, retain and/or plant selected native vegetation whose features are determined to be beneficial. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting ornamental vegetation.
- ✓ When planting or replanting consider using low water use groundcovers.

OPTIONAL:

- Careful soil mixing and layering techniques using a topsoil mix or composted organic material can be used as an effective measure to reduce herbicide use and watering.

2. Irrigation

- ✓ Utilize water delivery rates that do not exceed the infiltration rate of the soil.
- ✓ Use timers appropriately or a drip system to prevent runoff and then only irrigate as much as is needed.
- ✓ 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.
- ✓ Where practical, use automatic timers to minimize runoff.
- ✓ Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- ✓ If re-claimed water is used for irrigation, ensure that there is no runoff from the landscaped area(s).
- ✓ If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.

3. Fertilizer and Pesticide Management

Usage

- ✓ Utilize a comprehensive management system that incorporates integrated pest management techniques.
- ✓ 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.
- ✓ Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution.
- ✓ Pesticide application must be under the supervision of a California qualified pesticide applicator.
- ✓ When applicable use the least toxic pesticides that will do the job. Avoid use of copper-based pesticides if possible.
- ✓ Do not mix or prepare pesticides or fertilizers for application near storm drains.
- ✓ Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- ✓ Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- ✓ Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- ✓ Periodically test soils for determining proper fertilizer use.
- ✓ Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- ✓ Inspect pesticide/fertilizer equipment and transportation vehicles daily.
- ✓ Refer to Appendix D for further guidance on Fertilizer and Pesticide management

OPTIONAL:

- Work fertilizers into the soil rather than dumping or broadcasting them onto the surface.
- Use beneficial insects where possible to control pests (green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders prey on detrimental pest species).
- Use slow release fertilizers whenever possible to minimize leaching.

Scheduling

- ✓ Do not use pesticides if rain is expected within 24 hours.
- ✓ Apply pesticides only when wind speeds are low (less than 5 mph).

Disposal

- ✓ Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- ✓ Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- ✓ Dispose of empty pesticide containers according to the instructions on the container label.

4. Managing Landscape Waste

Also see Waste Handling and Disposal procedure sheet

- ✓ Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- ✓ Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- ✓ Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.
- ✓ Inspection of drainage facilities should be conducted to detect illegal dumping of clippings/cuttings in or near these facilities. Materials found should be picked up and properly disposed of.
- ✓ Landscape wastes in and around storm drain inlets should be avoided by either using bagging equipment or by manually picking up the material.

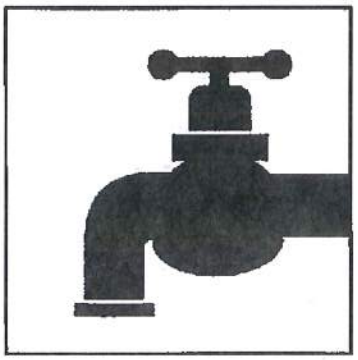
5. Erosion Control

Also see Waste Handling and Disposal procedure sheet

- ✓ Maintain vegetative cover on medians and embankments to prevent soil erosion. Apply mulch or leave clippings to serve as additional cover for soil stabilization and to reduce the velocity of storm water runoff.
- ✓ Minimize the use of disking as a means of vegetation management because the practice may result in erodable barren soil.
- ✓ Confine excavated materials to pervious surfaces away from storm drain inlets, sidewalks, pavement, and ditches. Material must be covered if rain is expected.

LIMITATIONS:

Alternative pest/weed controls may not be available, suitable, or effective in every case.



FP-6

WATER AND SEWER UTILITY OPERATION AND MAINTENANCE

Although the operation and maintenance of public utilities are not considered themselves a chronic source of stormwater pollution, some activities and accidents can result in the discharge of pollutants that can pose a threat to both human health and the quality of receiving waters if they enter the storm drain system. Activities associated with the operation and maintenance of water and sewer utilities to prevent and handle such incidents include the following:

1. **Water Line Maintenance**
2. **Sanitary Sewer Maintenance**
3. **Spill/Leak/Overflow Control, Response, and Containment**

Cities that do not provide maintenance of water and sewer utilities should coordinate with the contracting agency responsible for these activities and ensure that these model procedures are followed.

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for water and sewer utility operation and maintenance include:

- Inspect potential non-storm water discharge flow paths and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Water Line Maintenance

Procedures can be employed to reduce pollutants from discharges associated with water utility operation and maintenance activities. Planned discharges may include fire hydrant testing, flushing water supply mains after new construction, flushing lines due to complaints of taste and odor, dewatering mains for maintenance work. Unplanned discharges from treated, recycled water, raw water, and groundwater systems operation and maintenance activities can occur from water main breaks, sheared fire hydrants, equipment malfunction, and operator error.

Planned Discharges

✓ For planned discharges use one of the following options:

- Reuse water for dust suppression, irrigation, or construction compaction
- Discharge to the sanitary sewer system with approval
- Discharge to the storm drain system or to a creek using applicable pollution control measures listed below (this option is ONLY applicable to uncontaminated pumped ground water, water line flushing, fire hydrant testing and flushing, discharges from potable water sources other than water main breaks) and may require a permit from the Regional Water Quality Control Board.

✓ If water is discharged to a storm drain inlet (catch basin), control measures must be put in place to control potential pollutants (i.e. sediment, chlorine, etc.). Examples of some storm drain inlet protection options include:

- Silt fence – appropriate where the inlet drains a relatively flat area.
- Gravel and wire mesh sediment filter – Appropriate where concentrated flows are expected.
- Wooden weir and fabric – use at curb inlets where a compact installation is desired.

✓ Prior to discharge, inspect discharge flow path and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).

✓ Select appropriate pollution control measure(s) considering the receiving system (i.e. curb inlet, drop inlet, culvert, creek, etc.) and ensure that the control device(s) fit properly.

✓ General design considerations for inlet protection devices include the following:

- The device should be constructed such that cleaning and disposal of trapped sediment is made easy, while minimizing interference with discharge activities.
- Devices should be constructed so that any standing water resulting from the discharge will not cause excessive inconvenience or flooding/damage to adjacent land or structures.

✓ The effectiveness of control devices must be monitored during the discharge period and any necessary repairs or modifications made as needed.

OPTIONAL:

- Sediment removal may be enhanced by placing filter fabric, gravel bags, etc. at storm drain inlets.

Unplanned Discharges

✓ Stop the discharge as quickly as possible by turning off water source.

✓ Inspect flow path of the discharged water:

- Control erosion along the flow path.
- Identify areas that may produce significant sediment or gullies, use sandbags to redirect the flow.
- Identify erodible areas which may need to be repaired or protected during subsequent repairs or corrective actions

✓ If repairs or corrective action will cause additional discharges of water, select the appropriate procedures for erosion control, chlorine residual, turbidity, and chemical additives. Prevent potential pollutants from entering the flow path and ensure that no additional discharged water enters storm drain inlets.

2. Sanitary Sewer Maintenance

Applicable to municipalities who own and operated a sewage collection system. Facilities that are covered under this program include sanitary sewer pipes and pump stations owned and operated by the Permittee. The owner of the sanitary sewer facilities is the entity responsible for carrying out this prevention and response program.

Sewer System Cleaning

- ✓ Sewer lines should be cleaned on a regular basis to remove grease, grit, and other debris that may lead to sewer backups.
- ✓ Establish routine maintenance program. Cleaning should be conducted at an established minimum frequency and more frequently for problem areas such as restaurants that are identified
- ✓ Cleaning activities may require removal of tree roots and other identified obstructions.

Preventative and Corrective Maintenance

- ✓ During routine maintenance and inspection note the condition of sanitary sewer structures and identify areas that need repair or maintenance. Items to note may include the following:
  - cracked/deteriorating pipes
  - leaking joints/seals at manhole
  - frequent line plugs
  - line generally flows at or near capacity
  - suspected infiltration or exfiltration
- ✓ Document suggestions and requests for repair and report the information to the appropriate manager or supervisor.
- ✓ Prioritize repairs based on the nature and severity of the problem. Immediate clearing of blockage or repair is required where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, sewer line blockages). These repairs may be temporary until scheduled or capital improvements can be completed.
- ✓ Review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure.

3. Spill/Leak/Overflow Control, Response, and Containment

Control

Also see Drainage System procedures sheet

- ✓ Refer to countywide *Illicit Discharge Detection and Elimination Program.* Components of this program include:
  - Investigation/inspection and follow-up
  - Elimination of illicit discharges and connections
  - Enforcement of ordinances
  - Respond to sewage spills

- Facilitate public reporting of illicit discharges and connections. A citizen's hotline for reporting observed overflow conditions should be established to supplement the field screening efforts being conducted by the Principal Permittee.

Response and Containment

- ✓ Establish lead department/agency responsible for spill response and containment. Provide coordination within departments.
- ✓ When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system to the maximum extent practicable by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.).
- ✓ If a spill reaches the storm drain notify County of Orange Health Care Agency through Control One at (714) 628-7208.
- ✓ Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.
- ✓ Record required information at the spill site.
- ✓ Perform field tests as necessary to determine the source of the spill.
- ✓ Develop additional notification procedures regarding spill reporting as needed.

LIMITATIONS:

Private property access rights needed to perform testing along storm drain right-of-ways. Requirements of municipal ordinance authority for suspected source verification testing necessary for guaranteed rights of entry.

REFERENCES:

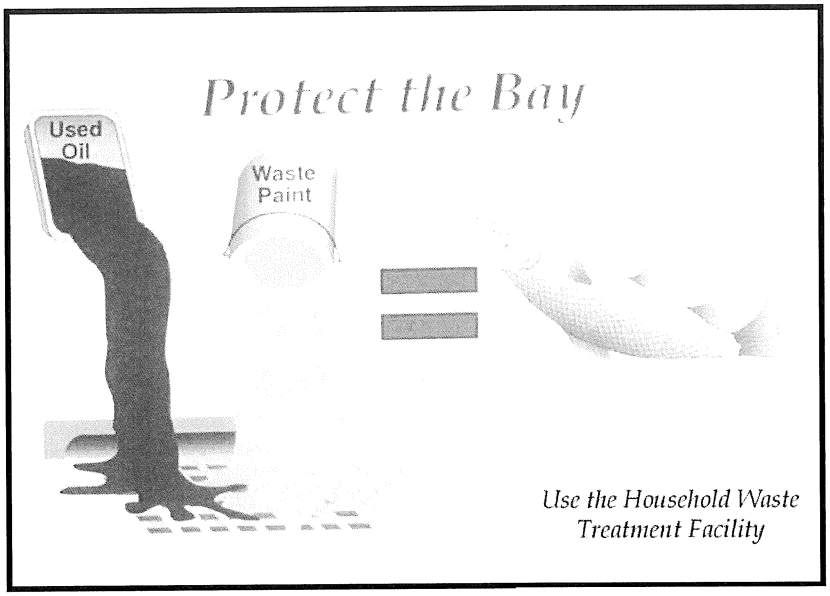
California Storm Water Best Management Practice Handbooks. Municipal Best Management Practice Handbook. Prepared by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line: http://ladpw.org/wmd/npdes/public_TC.cfm

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

Santa Clara Valley Urban Runoff Pollution Prevention Program. Water Utility Pollution Prevention Plan.

Non-Stormwater Discharges SC-10



Graphic by: Margie Winter

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

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

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. For municipalities non-stormwater discharges present themselves in two situations. One is from fixed facilities owned and/or operated by the municipality. The other situation is non-stormwater discharges that are discovered during the normal operation of a field program. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, and surface cleaning. However, there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances (such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants) into storm drains. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges.

Approach

The municipality must address non-stormwater discharges from its fixed facilities by assessing the types of non-stormwater discharges and implementing BMPs for the discharges determined to pose environmental concern. For field programs the field staff must be

CASQA California Stormwater Quality Association

trained to now what to look for regarding non-stormwater discharges and the procedures to follow in investigating the detected discharges.

Suggested Protocols

Fixed Facility

General

- Post "No Dumping" signs with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Landscaping and beautification efforts of hot spots might 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.

Illicit Connections

- Locate discharges from the fixed facility drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- Use techniques such as smoke testing, dye testing and television camera inspection (as noted below) to verify physical connections.
- Isolate problem areas and plug illicit discharge points.

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 several days following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

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

Smoke Testing

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.

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

Dye Testing

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

TV Inspection of Storm Sewer

- TV Cameras can be employed to visually identify illicit connections to the fixed facility storm drain system.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Clean up spills on paved surfaces 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 fact sheet SC-11 Spill Prevention, Control, and Clean Up.

Field Program

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially ones that involve more than one jurisdiction and those that are not classified as hazardous, which are often not responded to as effectively as they need to be.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- See SC-74 Stormwater Drainage System Maintenance for additional information.

Field Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- During routine field program maintenance field staff should look for evidence of illegal discharges or illicit connection:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections and notify appropriate investigating agency.
- If trained, conduct field investigation of non-stormwater discharges to determine whether they pose a threat to water quality.

Recommended Complaint Investigation Equipment

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

- Educational materials

Reporting

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

Enforcement

- Educate the responsible party if identified on the impacts of their actions, explain the stormwater requirements, and provide information regarding Best Management Practices (BMP), as appropriate. Initiate follow-up and/or enforcement procedures.
- If an illegal discharge is traced to a commercial, residential or industrial source, conduct the following activities or coordinate the following activities with the appropriate agency:
  - Contact the responsible party to discuss methods of eliminating the non-stormwater discharge, including disposal options, recycling, and possible discharge to the sanitary sewer (if within POTW limits).
  - Provide information regarding BMPs to the responsible party, where appropriate.
  - Begin enforcement procedures, if appropriate.
  - Continue inspection and follow-up activities until the illicit discharge activity has ceased.
- If an illegal discharge is traced to a commercial or industrial activity, coordinate information on the discharge with the jurisdiction's commercial and industrial facility inspection program.

Training

- Train technical staff to identify and document illegal dumping incidents.
- 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 if one should occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Train employees to identify non-stormwater discharges and report them to the appropriate departments.
- Train staff who have the authority to conduct surveillance and inspections, and write citations for those caught illegally dumping.

- Train municipal staff responsible for surveillance and inspection in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
  - OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and federal OSHA 29 CFR 1910.146).
  - Procedural training (field screening, sampling, smoke/dye testing, TV inspection).
- Educate the identified responsible party on the impacts of his or her actions.

Spill Response and Prevention

- See SC-11 Spill Prevention Control and Clean Up

Other Considerations

- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The cost of fees for dumping at a proper waste disposal facility are often more than the fine for an illegal dumping offense, thereby discouraging people from complying with the law. The absence of routine or affordable pickup service for trash and recyclables in some communities also encourages illegal dumping. A lack of understanding regarding applicable laws or the inadequacy of existing laws may also contribute to the problem.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Many facilities do not have accurate, up-to-date schematic drawings.
- Can be difficult to locate illicit connections especially if there is groundwater infiltration.

Requirements

Costs

- Eliminating illicit connections can be expensive especially if structural modifications are required such re-plumbing cross connections under an existing slab.
- Minor cost to train field crews regarding the identification of non-stormwater discharges. The primary cost is for a fully integrated program to identify and eliminate illicit connections and illegal dumping. However, by combining with other municipal programs (i.e. pretreatment program) cost may be lowered.
- Municipal cost for containment and disposal may be borne by the discharger.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

What constitutes a "non-stormwater" discharge?

- Non-stormwater discharges are discharges not made up entirely of stormwater and include water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, landscape irrigation, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

- Current municipal NPDES permits require municipalities to effectively prohibit non-stormwater discharges unless authorized by a separate NPDES permit or allowed in accordance with the current NPDES permit conditions. Typically the current permits allow certain non-stormwater discharges in the storm drain system as long as the discharges are not significant sources of pollutants. In this context the following non-stormwater discharges are typically allowed:
  - Diverted stream flows;
  - Rising found waters;
  - Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20));
  - Uncontaminated pumped ground water;
  - Foundation drains;
  - Springs;
  - Water from crawl space pumps;
  - Footing drains;
  - Air conditioning condensation;
  - Flows from riparian habitats and wetlands;
  - Water line and hydrant flushing ;
  - Landscape irrigation;
  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
  - Lawn watering.

Municipal facilities subject to industrial general permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The state's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Illegal Dumping

- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties

Outreach

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people on the street who are aware of the problem and who have the tools to at least identify the incident, if not correct it. There we a number of ways of accomplishing this:

- Train municipal staff from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report the incidents.
- Deputize municipal staff who may come into contact with illegal dumping with the authority to write illegal dumping tickets for offenders caught in the act (see below).
- Educate the public. As many as 3 out of 4 people do not understand that in most communities the storm drain does not go to the wastewater treatment plant. Unfortunately, with the heavy emphasis in recent years on public education about solid waste management, including recycling and household hazardous waste, the sewer system (both storm and sanitary) has been the likely recipient of cross-media transfers of waste.
- Provide the public with a mechanism for reporting incidents such as a hot line and/or door hanger (see below).
- Help areas where incidents occur more frequently set up environmental watch programs (like crime watch programs).
- Train volunteers to notice and report the presence and suspected source of an observed pollutant to the appropriate public agency.

What constitutes a "non-stormwater" discharge?

- Non-stormwater discharges are discharges not made up entirely of stormwater and include water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, landscape irrigation, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

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  - Water from crawl space pumps;
  - Footing drains;
  - Air conditioning condensation;
  - Flows from riparian habitats and wetlands;
  - Water line and hydrant flushing ;
  - Landscape irrigation;
  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
  - Lawn watering.

Municipal facilities subject to industrial general permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The state's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Storm Drain Stenciling

- Stencil storm drain inlets with a message to prohibit illegal dumpings, especially in areas with waste handling facilities.
- Encourage public reporting of improper waste disposal by a HOTLINE number stenciled onto the storm drain inlet.
- See Supplemental Information section of this fact sheet for further detail on stenciling program approach.

Oil Recycling

- Contract collection and hauling of used oil to a private licensed used oil hauler/recycler.
- Comply with all applicable state and federal regulations regarding storage, handling, and transport of petroleum products.
- Create procedures for collection such as; collection locations and schedule, acceptable containers, and maximum amounts accepted.
- The California Integrated Waste Management Board has a Recycling Hotline, (800) 553-2962, that provides information and recycling locations for used oil.

Household Hazardous Waste

- Provide household hazardous waste (HHW) collection facilities. Several types of collection approaches are available including permanent, periodic, or mobile centers, curbside collection, or a combination of these systems.

Training

- Train municipal employees and contractors in proper and consistent methods for waste disposal.
- Train municipal employees to recognize and report illegal dumping.
- Train employees and subcontractors in proper hazardous waste management.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Federal Regulations (RCRA, SARA, CERCLA) and state regulations exist regarding the disposal of hazardous waste.
- Municipalities are required to have a used oil recycling and a HHW element within their integrate waste management plan.
- Significant liability issues are involved with the collection, handling, and disposal of HHW.

Examples

The City of Palo Alto has developed a public participation program for reporting dumping violations. When a concerned citizen or public employee encounters evidence of illegal dumping, a door hanger (similar in format to hotel "Do Not Disturb" signs) is placed on the front doors in the neighborhood. The door hanger notes that a violation has occurred in the neighborhood, informs the reader why illegal dumping is a problem, and notes that illegal dumping carries a significant financial penalty. Information is also provided on what citizens can do as well as contact numbers for more information or to report a violation.

The Port of Long Beach has a state of the art database incorporating storm drain infrastructure, potential pollutant sources, facility management practices, and a pollutant tracking system.

The State Department of Fish and Game has a hotline for reporting violations called CalTIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).

The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

References and Resources

http://www.stormwatercenter.net/

California's Nonpoint Source Program Plan http://www.co.clark.wa.us/pubworks/bmpman.pdf

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

Orange County Stormwater Program,
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program
(http://www.projectcleanwater.org)

Santa Clara Valley Urban Runoff Pollution Prevention Program
http://www.scvurppp-w2k.com/pdf%20documents/PS_ICID.PDF

Attachment H

- Maintenance Manual & Covenant Agreement

RECORDING REQUESTED BY:

City of Victorville
Engineering Department

AND WHEN RECORDED MAIL TO:

City of Victorville
Engineering Department
14343 Civic Drive
Victorville, CA 92392

SPACE ABOVE THIS LINE FOR RECORDER'S USE

AGREEMENT

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

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

OWNER NAME: Rich Development LLC

PROPERTY ADDRESS: north east corner of Palmdale Blvd. and Cantina Ave.

APN: 3103-561-11 and 12

THIS AGREEMENT is made and entered into in

Victorville, California, this _____ day of

_____, by and between

Owner and City of Victorville, hereinafter

referred to as Owner, and the CITY OF VICTORVILLE, a municipal corporation, located in the County of San Bernardino, State of California, hereinafter referred to as CITY;

WHEREAS, the Owner owns real property ("Property") in the City of Victorville, 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;

WHEREAS, at the time of initial approval of development project known as

Palmdale Road Retail within the Property described herein, the CITY required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff;

WHEREAS, the Owner has chosen to install and/or implement BMPs as described in the Water Quality Management Plan, on file with the CITY, hereinafter referred to as "WQMP", to minimize pollutants in urban runoff and to minimize other adverse impacts of urban runoff;

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

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. 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.

2. Owner hereby provides the City of Victorville'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 City's Director of Public Works, no advance notice, for the purpose of inspection, sampling, testing of the Device, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 3 below. The City 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 violation of the City Stormwater Ordinance. If there is reasonable cause to believe that an illicit discharge or breach of the WQMP operation and maintenance commitments 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.

3. 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 City, the Owner shall provide the City with documentation identifying the material(s) removed, the quantity, and disposal destination.

4. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) days of being given written notice by the City , the City 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 City Code from the date of the notice of expense until paid in full.

5. The City may require the owner to post security in form and for a time period satisfactory to the City to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the City 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 sureties to perform the obligations of the Agreement. As an additional remedy, the Director of Public Works may withdraw any previous stormwater-related approval with respect to the property on which BMPs have been installed and/or implemented until such time as Owner repays to City its reasonable costs incurred in accordance with paragraph 3 above.

6. 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 City, including interest as herein above set forth, subject to foreclosure in event of default in payment.

7. 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 City harmless and pay all costs incurred by the City 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.

8. 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.

9. 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 City at the same time such notice is provided to the successor.

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

11. 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.

12. The Owner its successors and assigns, hereby agrees to save and hold harmless the City, any of its departments, agencies, officers or employees, all of whom while working within their respective authority, from all cost, injury and damage incurred by any of the above, and from any other injury or damage to any person or property whatsoever, any of which is caused by an activity, condition or event arising out of the performance, preparation for performance or nonperformance of any provision of this agreement by the Owner, its agents, or any of its independent contractors.

IF TO CITY:
City of Victorville – Engineering Department

14343 Civic Drive,

Victorville, CA 92392

IF TO OWNER:
Rich Development LLC

Rich Development 600 North Tustin Avenue, Suite 150

Santa Ana, CA 92705

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

OWNER:

Signature: _____

Name: _____

Title:_____

OWNER:

Signature: _____

Name: _____

Title:_____

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation (attach appropriate acknowledgement).

ACCEPTED BY:

_____
Brian W. Gengler., City Engineer for City of Victorville

Date: _____

Attachment: Standard Notary Acknowledgement

EXHIBIT A
(Legal Description)

EXHIBIT B
(Map/illustration)

Palmdale Road Retail

OPERATION
AND MAINTENANCE MANUAL

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1. Discussion

The long-term operation and maintenance of storm water management systems at the Amethyst Crossing property is critical to BMP performance as its design and construction. Proper operation and maintenance practices are outlined in this plan and will ensure that the BMPs will continue to remove and reduce sources of pollutants effectively over the long-term, and therefore, improve water quality. Without proper maintenance, BMPs are likely to fail and no longer provide the necessary Storm water treatment. Common maintenance issues that are encountered include:

- Maintenance that occurs too infrequently
- Owners not understanding the long-term financial burden for the maintenance of a storm water system
- Lack of the knowledge on the maintenance needs of the system and
- Conflicts between municipalities and landowners on who is responsible for maintenance of a storm water system.

To address these issues the following sections have been developed for the project owner

Maintenance Frequency
Maintenance frequency is outlined in Form 5-1. This form clearly identifies required inspection activities, the maintenance schedule, and directs provider to use a log sheet to document inspections and maintenance activities. There is the potential that a City or Regional Board inspector could visit this site and request owner to provide Maintenance records.

BMP Fact Sheets
BMP Fact sheets are provided to supplement BMP maintenance background and provide general knowledge on BMPs.

Maintenance Agreement
The maintenance agreement clearly identifies the project owner as the entity responsible for BMP maintenance and associated costs.

Reference Material
Reference material covers proprietary information for BMPs and recommended maintenance activities.

Inspection and Maintenance Log
The inspection and maintenance log provide a form to document inspections and maintenance. This form is a sample form and other forms can be used as long as they provide the minimum information outlined in this sample log.

WQMP Exhibit
The WQMP exhibit illustrates the spatial distribution of BMPS throughout the site and can be cross-referenced with Form 5-1 to identify where maintenance activities are expected to occur onsite.

2.Inspection and Maintenance Responsibility Form 5-1

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Infiltration Basin	**Owner**	Regular inspections of system to observe sediment build up and infiltration capacity. Cleaning of accumulated trash, debris and seediment as determined by inspections. Cleaning is recommended during dry weather. See manufacturer recommendations for additional maintenance activities	Annually
Catch Basin /w Filter Insert	**Owner**	Inspect for illegal dumping and /or debris accumulation. Clean filters whenever 25% of filter capacity is exceeded by debris accumulation. . See manufacturer recommendations for additional maintenance activities.	At least 2 times a year and after any Storm Event
Landscape Maintenance	**Owner**	Maintain landscape area vegetation, slope protection and grades, adjacent to hardscape and prevent discharges of landscape maintenance waste into storm drains	Weekly
Roadways & Parking Area	**Owner**	Clean and remove accumulated sand and debris in parking lots and along roadway. Sweep pavement in lieu of using house or water spray. Ensure stormwater runoff is not impeded by deposit of debris and accumulated sediment by ground maintenance staff.	Inspect after wind storm or minimum monthly
Litter Control	**Owner**	Site to be inspected and all litter be collected and disposed of in trash containers. Inspection and maintenance to be performed by HOA	Weekly
Signage and Stencil	**Owner**	Clean the stencil/signage surface to remove any excess dirt Re-paint if necessary.	Annually
Localized on-lot infiltration basins and depressed landscape area	**Owner**	Inspect catchment area for an excessive sediment, trash, and/or debris accumulation on surface. Clean up excessive sediment, trash, and/or debris accumulation. Litter leaves and debris should be removed from Basin.	4 times Annually, and after heavy rain

3. Inspection and Maintenance Log

Detention Basin Inspections and Maintenance Checklist

Site Name: Owner Change since last inspection? Y ☐ N ☐

Location:

Owner Name:

Address: Phone Number

Site Status:

Date: Time: Site conditions:

Inspection Frequency Key: A=annual; M=monthly; S=after major storms. ***BOLD*** *= recommended frequency.*

Inspection Items	**Inspection Frequency**	**Inspected? (Yes/No)**	**Maintenance Needed? (Yes/No)**	**Comments/Description**
Embankment and Emergency Spillway				
Vegetation healthy?	**A** / M / **S**			
Erosion on embankment?	**A** / M / **S**			
Animal burrows in embankment?	**A** / M / **S**			
Cracking, sliding, bulging of dam?	**A** / M / **S**			
Drains blocked or not functioning?	**A** / M / **S**			
Leaks or seeps on embankment?	**A** / M / **S**			
Emergency spillway obstructed?	**A** / M / **S**			
Slope protection failure functional?	**A** / M / **S**			
Erosion in/around emergency spillway?	**A** / M / **S**			
Other (describe)	**A** / M / **S**			
Riser and Principal Spillway				
Low-flow orifice functional?	**A** / M / **S**			
Trash rack (Debris removal needed? Corrosion noted?)	**A** / M / **S**			
Sediment buildup in riser?	**A** / M / S			
Concrete/masonry condition (Cracks or displacement? Spalling?)	**A** / M / S			
Metal pipe in good condition?	**A** / M / S			
Control valve operation?	**A** / M / S			
Pond drain valve operation?	**A** / M / S			
Outfall channels function, not eroding?	**A** / M / S			
Other (describe)	**A** / M / S			
Sediment Forebays				
Sedimentation description				
Sediment cleanout needed (over 50% full)?	**A** / M / **S**			

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Permanent Pool Areas (if applicable)				
Undesirable vegetation growth?	A / **M** / S			
Visible pollution?	A / **M** / S			
Shoreline erosion?	A / **M** / S			
Erosion at outfalls into pond?	A / **M** / S			
Headwalls and endwalls in good condition?	A / **M** / S			
Encroachment into pond or easement area by other activities?	A / **M** / S			
Evidence of sediment accumulation?	**A** / M / S			
Dry Pond Areas (if applicable)				
Vegetation adequate?	A / **M** / S			
Undesirable vegetation or woody plant growth?	A / **M** / S			
Excessive sedimentation?	**A** / M / S			
Hazards				
Have there been complaints from residents?	A / **M** / S			
Public hazards noted?	A / **M** / S			

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

If any of the above Inspection items are checked “Yes” for “Maintenance Needed”, list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Bioretention
Inspections and Maintenance Checklist

Site Name: _____ Owner Change since last inspection? Y ☐ N ☐

Location: _____

Owner Name: _____

Address: _____ Phone Number _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____

Inspection Frequency Key: A=annual; M=monthly; S=after major storms. ***BOLD*** *= recommended frequency*

Inspection Items	**Inspection Frequency**	**Inspected? (Yes/No)**	**Maintenance Needed? (Yes/No)**	**Comments/Description**
Treatment Area				
Treatment area free of debris?	A / **M** / S			
Inlets and Outlets unobstructed?	A / **M** / S			
Is there standing water longer than 24 hours after a storm event?	A / M / **S**			
Evidence of erosion?	A / **M** / **S**			
Vegetation				
Surrounding area fully stabilized? (no evidence of material eroding into Bioretention area)	**A** / M / S			
Grass height not more than 6 inches?	A / **M** / S			
Plant height not less than design water depth?	**A** / M / S			
Plant composition according to approved plan?	**A** / M / S			
Vegetation overgrown?	**A** / M / S			
Other				
Hazards				
Have there been complaints from residents?	A / **M** / S			
Public hazards noted?	A / **M** / S			

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

If any of the above Inspection items are checked “Yes” for “Maintenance Needed”, list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Enhanced Swales / Grass Channels / Filter Strips
Inspections and Maintenance Checklist

Site Name: _____ Owner Change since last inspection? Y ☐ N ☐

Location: _____

Owner Name: _____

Address: _____ Phone Number _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____

Inspection Frequency Key: A=annual; M=monthly; S=after major storms. ***BOLD*** *= recommended frequency*

Inspection Items	**Inspection Frequency**	**Inspected? (Yes/No)**	**Maintenance Needed? (Yes/No)**	**Comments/Description**
Debris Removal				
Facility and adjacent area free of debris?	A / **M** / S			
Inlets and Outlets free of debris?	A / **M** / S			
Any dumping of yard wastes into facility?	A / **M** / S			
Litter (branches) removed?	A / **M** / S			
Vegetation				
Surrounding area fully stabilized? (no evidence of material eroding into sand filter)	A / **M** / S			
Grass mowed?	A / **M** / S			
Plant height not less than design water depth?	A / **M** / S			
Fertilized per specification?	A / **M** / S			
Plan composition according to approved plan?	A / **M** / S			
Unauthorized or inappropriate plantings?	A / **M** / S			
Plants healthy? (no diseased or dying vegetation)	A / **M** / S			
Evidence of plants stressed from inadequate watering?	A / **M** / S			
Filtration Capacity				
Clogging from oil or grease?	A / **M** / S			
Facility dewaters between storms?	A / **M** / S			
Water Retention (where required)				
Water holding chambers at normal pool?	A / **M** / S			
Evidence of erosion?				

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Check dams and energy dissipators/sumps				
Any evidence of sedimentation built up?	**A** / M / **S**			
Are sumps grater than 50% full of sediment?	**A** / M / **S**			
Any evidence of erosion and down stream toe of drop structures?	**A** / M / **S**			
Sediment Deposition				
Swale clean of sediments?	**A** / M / S			
Sediment not more than 20% of swale design depth?	**A** / M / S			
Outlet/Overflow Spillway				
In good condition?	**A** / M / S			
Any evidence of erosion?	**A** / M / S			
Any evidence of blockages?	**A** / M / S			
Has facility been filled or blocked inappropriately?	**A** / M / S			

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

If any of the above Inspection items are checked “Yes” for “Maintenance Needed”, list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Proprietary BMP
Inspections and Maintenance Checklist

Site Name: Owner Change since last inspection? Y ☐ N ☐

Location:

Owner Name:

Address: Phone Number

Site Status:

Date: Time: Site conditions:

Inspection Frequency Key: A=annual; M=monthly; S=after major storms. ***BOLD*** *= recommended frequency*

Inspection Items	**Inspection Frequency**	**Inspected? (Yes/No)**	**Maintenance Needed? (Yes/No)**	**Comments/Description**
Debris Removal				
Adjacent area free of debris?	A / **M** / S			
Inlets and Outlets free of debris?	A / **M** / S			
Facility (internally) free of debris?	A / **M** / S			
Vegetation				
Surroundng area fully stabilized? (no evidence of material eroding into sand filter)	**A** / M / S			
Grass mowed?	A / **M** / S			
Water Retention (where required)				
Water holding chambers at normal pool?	A / **M** / S			
Evidence of erosion?	A / **M** / S			
Sediment Deposition				
Filtration chamber free of sediments?	**A** / M / S			
Sedimentation chamber not more than 50% full?	**A** / M / S			
Structural Components				
Any evidence of structural deterioration?	**A** / M / S			
Grates in good condition?	**A** / M / S			
Spalling or cracking of structural parts?	**A** / M / S			
Outlet/Overflow Spillway	**A** / M / S			
Other				
Noticeable odors?	**A** / M / S			
Any evidence of filter(s) clogging?	A / **M** / S			
Evidence of flow bypassing facility?	**A** / M / S			

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

If any of the above Inspection items are checked “Yes” for “Maintenance Needed”, list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

4. Maintenance Agreement

5. Reference Material

6. BMP Fact Sheets

7. WQMP Exhibit

ST. STREET
SWR SEWER
TG TOP OF GRATE
TYP TYPICAL
WTR WATER

LEGEND:

- HYDROLOGY BOUNDARY
- FLOWLINE
- A / 7.96 — DRAINAGE AREA ID / TOTAL ACREAGE
- FLOW DIRECTION
- CATCH BASIN INLET W/ BIO-CLEAN FILTER INSERTS
- FS ELEVATION / INV ELEVATION (NODE #) — CONCENTRATION/NODE ID
- XXXX — PROPOSED CONTOUR
- (XXXX) — EXISTING CONTOUR
- PROPOSED LANDSCAPE AREA
- PROPOSED UNDERGROUND DETENTION AREA
- PROPOSED WQMP TREATMENT AREA
- PROPOSED STORM DRAIN PIPE
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

(A) EASEMENT FOR PUBLIC UTILITIES GRANTED TO CITY OF VICTORVILLE RECORDING NO: BOOK 8860, PAGE 417 OFFICIAL RECORDS

(B) EASEMENT FOR PUBLIC UTILITIES GRANTED TO STATE OF CALIFORNIA RECORDING DATE: FEBRUARY 18, 1992. RECORDING NO: 92-56171 OFFICIAL RECORDS

(C) EASEMENT FOR HIGHWAY AND ROAD PURPOSES GRANTED TO CITY OF VICTORVILLE RECORDING NO: BOOK 8860, PAGE 405 OFFICIAL RECORDS.

(D) PROPOSED EASEMENT IN FAVOR OF PARCEL "B" FOR INGRESS/EGRESS, PARKING AND TEMPORARY CONSTRUCTION

Water Quality Summary Table						
Area ID	Acreage (Acres)	DCV (cubic feet)	Hydromod (cubic feet)	Volume Provided (cubic feet)	Flow Based BMP Treatment Required (cfs)	Flow Based BMP Treatment Provided (cfs)
DA-1 DMA-A	2.02	5,641	8,762	9,396	0.42	2.85/ each for catch basins 1-6
DMA-B	0.1					
Total	2.12	5,641	8,762	9,396	0.42	17

*Area DMA-B is all landscaping and considered self-retaining and self-treating.

N

scale 1"= 20' feet (20 0 20 40)

CONTOUR INTERVALS = 1'

NOT FOR CONSTRUCTION

DATE: 06/2022

IN THE CITY OF VICTORVILLE
PALMDALE ROAD RETAIL DEVELOPMENT

WQMP SITE PLAN

FILE NO.

DRAWING NO. SH. 1 OF 1

DAVID EVANS AND ASSOCIATES INC.
18484 Outer Highway 18 N Suite 225
Apple Valley California 92307
Phone: 760.524.9100
SSchubert@deainc.com

Plot Date: 7/1/2022 9:53 AM
Save Date: 7/1/2022 9:16 AM
By: Jose Aguilar
By: Jla
File: P:\R\RDEV\0000000\05\060\0INFO\0670\Reports\WQMP\CAD\WQMP Exhibit_new.dwg

Attachment I

- Stormtech underground basin specifications

User Inputs

Chamber Model:	MC-7200
Outlet Control Structure:	Yes
Project Name:	
Engineer:	N/A
Project Location:	
Measurement Type:	Imperial
Required Storage Volume:	5280 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(25 ft. x 75 ft.)

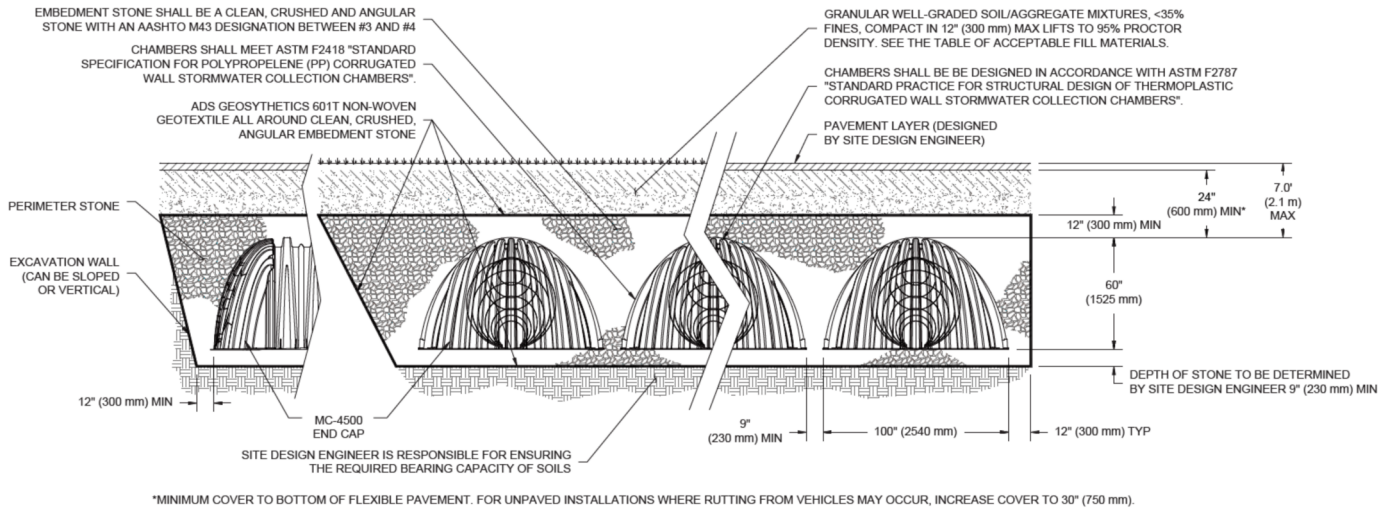
Results

System Volume and Bed Size

Installed Storage Volume:	5530.08 cubic ft.
Storage Volume Per Chamber:	175.90 cubic ft.
Number Of Chambers Required:	17
Number Of End Caps Required:	4
Chamber Rows:	2
Maximum Length:	70.56 ft.
Maximum Width:	20.02 ft.
Approx. Bed Size Required:	1348.56 square ft.

System Components

Amount Of Stone Required:	220.54 cubic yards
Volume Of Excavation (Not Including Fill):	337.14 cubic yards
Total Non-woven Geotextile Required:	522.65 square yards
Woven Geotextile Required (excluding Isolator Row):	21.23 square yards
Woven Geotextile Required (Isolator Row):	151.18 square yards
Total Woven Geotextile Required:	172.41 square yards



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).