

MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

Tentative Tract 18487

APN 3096-361-02

Prepared for:

Ed Grimes

5238 Caliente Blvd

Oakhills, CA 92344

(760) 949-1716

Prepared by:

Kimley Horn & Associates

3880 Lemon Street, Su. 420

Riverside CA, 92501

951-543-9870

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Revision No. and Date: _____

Revision No. and Date: _____

Revision No. and Date: _____

Final Approval Date: APPROVED BY
BILL HEMSLEY
- 3/28/19

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for Everett Grimes by Kimley-Horn & 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):	PLN17-00008	Grading Permit Number(s):	
Tract/Parcel Map Number(s):	TTR 18487	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 3096-361-02, Tentative Tract Map No 18487
Owner's Signature			
Owner Name: Everett L. Grimes			
Title	Owner		
Company	N/A		
Address	5238 Caliente Blvd		
Email	saundraaguirre1@gmail.com, Saundra@kw.com		
Telephone #	(760) 261-8253		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	PLN17-00008	Grading Permit Number(s):	
Tract/Parcel Map Number(s):	TTR 18487	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 3096-361-02, Tentative Tract Map No 18487

"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: Bobby Kohltfarber, PE		PE Stamp Below 
Title	Civil Engineer	
Company	Kimley-Horn & Associates	
Address	3890 11 th Street, Suite 217, Riverside, CA 92501	
Email	Bobby.Kohltfarber@Kimley-Horn.com	
Telephone #	951-543-9870	
Signature	<i>Bobby Kohltfarber</i>	
Date	2/14/19	

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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		Tentative Tract Map No 18487			
Project Owner Contact Name:		Everett L. Grimes			
Mailing Address:	5238 Calient Blvd	E-mail Address:	saundraaguirre1@gmail.com, Saundra@kw.com	Telephone:	(760) 261-8253
Permit/Application Number(s):		PLN17-00008	Tract/Parcel Map Number(s):	TTR 18487	
Additional Information/ Comments:		See section 6 for vicinity map and site plans.			
Description of Project:		<p>The project is located on approximately 19 acres of land within the City of Victorville. The existing site is divided into 2 lots. Parcel 1 is a 5.2 acre commercial site and Parcel 2 is a 14.90 acre single family residential site. Parcel 2 will be developed into 55 residential lots and a lot for the infiltration basin through TTM No. 18487. The project will include mass and precise grading, roadway improvements, sewer, water and storm drain appurtenances to support the is new single family development. This PWQMP is intended for Parcel 2. Parcel 1 will be developed at a later date and will have its own PWQMP.</p>			
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.		<p>This is the preliminary WQMP. A series of storm drain inlets and storm drain pipes will convey the project runoff to a detention basin located on Lot B and then transmit flows to surface flow drainage similar to existing conditions.</p> <p>The site is currently native soils and the proposed condition would be to grade the site for single family residential</p> <p>This report is our Comceptual WQMP and no jurisdiccional conditions have been provided for this project.</p>			

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):					
<input checked="" type="checkbox"/> #1 New development involving the creation of 5,000 ft ² or more of impervious surface collectively over entire site	<input type="checkbox"/> #2 Significant re-development involving the addition or replacement of 5,000 ft ² or more of impervious surface on an already developed site	<input checked="" type="checkbox"/> #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface	<input type="checkbox"/> #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface		
<input type="checkbox"/> Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft.) <i>Will require source control Site Design Measures. Use the "PCMP" Template. Do not use this WQMP Template.</i>					
2 Project Area (ft ²):	649,044	3 Number of Dwelling Units:	55	4 SIC Code:	1521
5 Is Project going to be phased? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.</i>					

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:

Currently the property is own by Everett L. Grimes. The proposed storm water facilities will be maintained by Everett L. Grimes until a drainage facility assesment district is created for a HOA for Tract 18487.

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
	E <input type="checkbox"/>	N <input type="checkbox"/>	
Pathogens (Bacterial / Virus)	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Pathogens (Bacterial/Virus) can be expected to be a pollutant of concern for stormwater runoff due to the development being for a detached single family residential development.
Nutrients - Phosphorous	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	The nutrient Phosphorous can be expected as a pollutant of concern for the detached single family residential development.
Nutrients - Nitrogen	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	The nutrient Nitrogen can be expected as a pollutant of concern for the detached single family residential development.
Noxious Aquatic Plants	E <input type="checkbox"/>	N <input checked="" type="checkbox"/>	Not expected for site.
Sediment	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Sediment can be expected as a pollutant of concern for the detached single family residential development.
Metals	E <input type="checkbox"/>	N <input checked="" type="checkbox"/>	Metals are not expected as a pollutant of concern for the detached single family residential development.
Oil and Grease	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Oil and grease can be expected on the detached single family residential development as a pollutant of concern for stormwater runoff.
Trash/Debris	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Trash and debris can be expected on the detached single family residential development as a pollutant of concern for stormwater runoff.
Pesticides / Herbicides	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Pesticides/Herbicides can be expected on the detached single family residential development if landscaping is expected on-site, otherwise not expected to be a concern in stormwater runoff.
Organic Compounds	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Organic Compounds can be expected as a pollutant of concern for the detached single family residential development if landscaping is expected on-site, otherwise not expected to be a concern in stormwater runoff.
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	N/A
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	N/A

Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	N/A
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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 <i>take GPS measurement at approximate center of site</i>	Latitude 34.4911 Longitude 117.404 Thomas Bros Map page 4385
¹ San Bernardino County climatic region: <input checked="" type="checkbox"/> Desert	
² Does the site have more than one drainage area (DA): Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>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</i>	
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	<i>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</i>
DA1 DMA A to Outlet 1	The site drains from the southwest corner of the parcel to a low point located on the northern property line where ponding builds up for about 2 feet.
DA1 DMA B to Outlet 1	Once the water ponds for approximately 2 feet, the water discharges to the east along the northern boundary and reaching Pena Road. There are currently no drainage facilities within the project limits. This runoff then will continue flowing north and eventually drain to the Mojave River.

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DA2 to Outlet 2	The only areas not captured within the DMA's listed above is the driveway entrances to the tract. These areas will spill to the public curb and gutter system.
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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)	649,044	N/A	N/A	N/A
2 Existing site impervious area (ft ²)	0	N/A	N/A	N/A
3 Antecedent moisture condition <i>For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf</i>	AMC II	N/A	N/A	N/A
4 Hydrologic soil group <i>Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf</i>	Type A	N/A	N/A	N/A
5 Longest flowpath length (ft)	1,309	N/A	N/A	N/A
6 Longest flowpath slope (ft/ft)	.0087	N/A	N/A	N/A
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	Barren	N/A	N/A	N/A
8 Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating</i>	N/A	N/A	N/A	N/A

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)	N/A	N/A	N/A	N/A
2 Existing site impervious area (ft ²)	N/A	N/A	N/A	N/A
3 Antecedent moisture condition <i>For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf</i>	N/A	N/A	N/A	N/A
4 Hydrologic soil group <i>County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf</i>	N/A	N/A	N/A	N/A
5 Longest flowpath length (ft)	N/A	N/A	N/A	N/A
6 Longest flowpath slope (ft/ft)	N/A	N/A	N/A	N/A
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	N/A	N/A	N/A	N/A
8 Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating</i>	N/A	N/A	N/A	N/A

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 (receiving water is below the narrows)
Applicable TMDLs http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	No applicable TMDLs are applicable
303(d) listed impairments http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	N/A
Environmentally Sensitive Areas (ESA) Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP	N/A
Hydromodification Assessment	<input checked="" type="checkbox"/> Yes Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal <input type="checkbox"/> 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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner to provide periodically education material to new home owners on general housekeeping practices that contribute to the protections of stormwater quality and enviromental awareness materials. (See Appendix B attached.)
N2	Activity Restrictions	<input type="checkbox"/>	<input checked="" type="checkbox"/>	POA will not be formed.
N3	Landscape Management BMPs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Landscape maintenance district proposed for lots within the tract.
N4	BMP Maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Drainage Faiclity Assesment District proposed for tract - To maintain BMP's and Drainage Facilities
N5	Title 22 CCR Compliance (How development will comply)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The project will comply with Title 22 CCR Compliance.
N6	Local Water Quality Ordinances	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Project to comply with local MS4 Permit. The project will comply with all applicable local water quality ordinances.
N7	Spill Contingency Plan	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A
N8	Underground Storage Tank Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A No proposed underground storage tanks; therefore underground storage tank compliance is not required.
N9	Hazardous Materials Disclosure Compliance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner to provide education material to new home owners on disposal of hazardous material. (See Appendix B attached.)

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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The project will comply with article 80 of the Uniform Fire Code.
N11	Litter/Debris Control Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Local trash collecting services will collect trash from each lot weekly.
N12	Employee Training	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A
N13	Housekeeping of Loading Docks	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A
N14	Catch Basin Inspection Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Drainage Facility Assessment District proposed for tract - To maintain BMP's and Drainage Facilities
N15	Vacuum Sweeping of Private Streets and Parking Lots	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Streets will be swept using a vacuum assisted sweeper prior to the storm season, in late summer or early fall, prior to the start of the rainy season or equivalent as required by the governing jurisdiction.
N16	Other Non-structural Measures for Public Agency Projects	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A
N17	Comply with all other applicable NPDES permits	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The project will comply with all other applicable NPDES Permits.

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)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Stormdrain stencilling and signage will be highly visible and placed directly adjacent to the storm drain inlet containing a brief statement that prohibits the dumping of improper materials into the MS4.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A for detached residential homes
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A for detached residential homes
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)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Each residential lot to have front yard L/S with drought tolerant vegetation.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	<input checked="" type="checkbox"/>	<input type="checkbox"/>	All landscape pockets, setback areas, parkway strips, etc. will be graded at a minimum of 2 inches below top of curb or sidewalk for increased retention/infiltration of stormwater and irrigation water.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A for detached residential homes
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A for detached residential homes
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A for detached residential homes

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S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A for detached residential homes
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)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Will only be applicable during construction. Not required for detached residential homes after construction is completed.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Will only be applicable during construction. Not required for detached residential homes after construction is completed.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A site is not located on a hillside.
S14	Wash water control for food preparation areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A for detached residential homes
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A for detached residential homes

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
<p>Site Design Practices <i>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</i></p>
<p>Minimize impervious areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Layout of interior streets and lots to minimized impervious area for single family residential development. Commercial area will require separate WQMP once final use is determined.</p>
<p>Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: On-site basin will be design to be an infiltration facility. Each residential lot will include a swale/sediment trap in proposed catch basins. A bioswale will be adjacent to the ROW of Mesa View Drive.</p>
<p>Preserve existing drainage patterns and time of concentration: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Proposed flow is transmitted across the project from the south to the north through the proposed storm drain system. Existing drainage flows from South West corner to North East corner.</p>
<p>Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain : Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Drainage for each residential unit will be transmitted to a bioswale then sheetflow to the street.</p>
<p>Use of Porous Pavement.: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Porous pavement will not be used for street layout.</p>
<p>Protect existing vegetation and sensitive areas: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Existing vegetation will all be removed. There are no sensitive areas on site.</p>
<p>Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Each residential lot to have front yard L/S with drought tolerant vegetation.</p>

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Unnecessary compaction in stormwater detention basin.
Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Underground piping is needed to convey flows through proposed street in Tract 18487 to proposed basin.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: No proposed infiltration swales. N/A for project.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Rain Barrels and Cisterns will not be used for the proposed single family residential project.
Stream Setbacks. Includes a specified distance from an adjacent stream: : Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: There is no existing stream going through the site.

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

San Bernardino County Special Districts:

Guide to High Desert Landscaping -

<http://www.specialdistricts.org/Modules/ShowDocument.aspx?documentid=795>

Recommended High-Desert Plants -

<http://www.specialdistricts.org/modules/showdocument.aspx?documentid=553>

Mojave Water Agency:

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

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

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

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

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

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

4.2 Treatment BMPs

After implementation and design of both Source Control BMPs and Site Design BMP measures, any remaining runoff from impervious DMAs must be directed to one or more on-site, treatment BMPs (LID or biotreatment) designed to infiltrate, evapotranspire, 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 mi²), 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): <p style="text-align: center;">649,044</p>	2 Imperviousness after applying preventative site design practices (Imp%): 50%	3 Runoff Coefficient (Rc): <u> </u> 0.340 $R_c = 0.858(Imp\%)^{0.3} - 0.78(Imp\%)^{0.2} + 0.774(Imp\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period P _{2yr-1hr} (in): 0.391 http://hdsc.nws.noaa.gov/hdsc/pfds/so/sca_pfds.html		
5 Compute P ₆ , Mean 6-hr Precipitation (inches): 0.484 <i>P₆ = Item 4 * C₁, where C₁ is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)</i>		
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 <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 17,472 <i>DCV = 1/12 * [Item 1 * Item 3 * Item 5 * C₂], where C₂ is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)</i> 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 <input checked="" type="checkbox"/> No <input type="checkbox"/> 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 56,259 <i>Form 4.2-3 Item 12</i>	2 28.63 <i>Form 4.2-4 Item 13</i>	3 9.84 <i>Form 4.2-5 Item 10</i>
Post-developed	4 5,183 <i>Form 4.2-3 Item 13</i>	5 14.05 <i>Form 4.2-4 Item 14</i>	6 18.23 <i>Form 4.2-5 Item 14</i>
Difference	7 51,076 <i>Item 4 – Item 1</i>	8 14.58 <i>Item 2 – Item 5</i>	9 8.39 <i>Item 6 – Item 3</i>
Difference (as % of pre-developed)	10 90% <i>Item 7 / Item 1</i>	11 51% <i>Item 8 / Item 2</i>	12 85% <i>Item 9 / Item 3</i>

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	Barren	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2a Hydrologic Soil Group (HSG)	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3a DMA Area, ft ² <i>sum of areas of DMA should equal area of DA</i>	649,044	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4a Curve Number (CN) <i>use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>	78	N/A	N/A	N/A	N/A	N/A	N/A	N/A
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	residential	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2b Hydrologic Soil Group (HSG)	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3b DMA Area, ft ² <i>sum of areas of DMA should equal area of DA</i>	649,044	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4b Curve Number (CN) <i>use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>	32	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5 Pre-Developed area-weighted CN: 78	7 Pre-developed soil storage capacity, S (in): 2.82 <i>S = (1000 / Item 5) - 10</i>				9 Initial abstraction, I _a (in): 0.56 <i>I_a = 0.2 * Item 7</i>			
6 Post-Developed area-weighted CN: 32	8 Post-developed soil storage capacity, S (in): 21.25 <i>S = (1000 / Item 6) - 10</i>				10 Initial abstraction, I _a (in): 4.25 <i>I_a = 0.2 * Item 8</i>			
11 Precipitation for 10 yr, 24 hr storm (in): 2.87 <i>Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html</i>								
12 Pre-developed Volume (ft ³): 56,259 <i>V_{pre} = (1 / 12) * (Item sum of Item 3) * [(Item 11 - Item 9)^2 / ((Item 11 - Item 9 + Item 7))]</i>								
13 Post-developed Volume (ft ³): 5,183 <i>V_{pre} = (1 / 12) * (Item sum of Item 3) * [(Item 11 - Item 10)^2 / ((Item 11 - Item 10 + Item 8))]</i>								
14 Volume Reduction needed to meet hydromodification requirement, (ft ³): -51,334 <i>V_{hydro} = (Item 13 * 0.95) - Item 12</i>								

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 <i>Use additional forms if there are more than 4 DMA</i>				Post-developed DA1 <i>Use additional forms if there are more than 4 DMA</i>			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) <i>Use Form 3-2 Item 5 for pre-developed condition</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 Change in elevation (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3 Slope (ft/ft), $S_o = \text{Item 2} / \text{Item 1}$	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4 Land cover	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5 Initial DMA Time of Concentration (min) <i>Appendix C-1 of the TGD for WQMP</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6 Length of conveyance from DMA outlet to project site outlet (ft) <i>May be zero if DMA outlet is at project site outlet</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7 Cross-sectional area of channel (ft ²)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8 Wetted perimeter of channel (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9 Manning's roughness of channel (n)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10 Channel flow velocity (ft/sec) $V_{fps} = (1.49 / \text{Item 9}) * (\text{Item 7}/\text{Item 8})^{0.67} * (\text{Item 3})^{0.5}$	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11 Travel time to outlet (min) $T_t = \text{Item 6} / (\text{Item 10} * 60)$	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12 Total time of concentration (min) $T_c = \text{Item 5} + \text{Item 11}$	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13 Pre-developed time of concentration (min): 28.63 <i>Minimum of Item 12 pre-developed DMA</i>								
14 Post-developed time of concentration (min): 14.05 <i>Minimum of Item 12 post-developed DMA</i>								
15 Additional time of concentration needed to meet hydromodification requirement (min): 13.15 $T_{C-Hydro} = (\text{Item 13} * 0.95) - \text{Item 14}$								

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 $I_{peak} = 10^{(LOG Form 4.2-1 Item 4 - 0.7 LOG Form 4.2-4 Item 5 / 60)}$	0.66	N/A	N/A	1.08	1.08	N/A
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)	14.9	N/A	N/A	14.17	0.73	N/A
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)	1	N/A	N/A	.50	0.5	N/A
4 Pervious area infiltration rate (in/hr) Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP	0.32	N/A	N/A	0.32	0.32	N/A
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)	0.32	N/A	N/A	0.16	0.16	N/A
6 Peak Flow from DMA (cfs) $Q_p = Item 2 * 0.9 * (Item 1 - Item 5)$	9.84	N/A	N/A	18.2	1.28	N/A
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	N/A	n/a	N/A
	DMA B	N/A	n/a	N/A	1	n/a
	DMA C	N/A	N/A	n/a	N/A	N/A
8 Pre-developed Q_p at T_c for DMA A: 9.84 $Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB}) / (Item 1_{DMAB} - Item 5_{DMAB}) * Item 7_{DMAA/2}] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC}) / (Item 1_{DMAC} - Item 5_{DMAC}) * Item 7_{DMAA/3}]$	9 Pre-developed Q_p at T_c for DMA B: N/A $Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA}) / (Item 1_{DMAA} - Item 5_{DMAA}) * Item 7_{DMAB/1}] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC}) / (Item 1_{DMAC} - Item 5_{DMAC}) * Item 7_{DMAB/3}]$		10 Pre-developed Q_p at T_c for DMA C: N/A $Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA}) / (Item 1_{DMAA} - Item 5_{DMAA}) * Item 7_{DMAC/1}] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB}) / (Item 1_{DMAB} - Item 5_{DMAB}) * Item 7_{DMAC/2}]$			
10 Peak runoff from pre-developed condition confluence analysis (cfs): 9.84 Maximum of Item 8, 9, and 10 (including additional forms as needed)						
11 Post-developed Q_p at T_c for DMA A: 18.2 Same as Item 8 for post-developed values	12 Post-developed Q_p at T_c for DMA B: 1.28 Same as Item 9 for post-developed values		13 Post-developed Q_p at T_c for DMA C: N/A Same as Item 10 for post-developed values			
14 Peak runoff from post-developed condition confluence analysis (cfs): 18.2 Maximum of Item 11, 12, and 13 (including additional forms as needed)						
15 Peak runoff reduction needed to meet Hydromodification Requirement (cfs): 1.81 $Q_{p-hydro} = (Item 14 * 0.95) - Item 10$						

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretenention) 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	
<p>¹ Would infiltration BMP pose significant risk for groundwater related concerns? <i>Refer to Section 5.3.2.1 of the TGD for WQMP</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>² Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):</p> <ul style="list-style-type: none"> • 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. 	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>³ Would infiltration of runoff on a Project site violate downstream water rights?</p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>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?</p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>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)?</p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>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? <i>See Section 3.5 of the TGD for WQMP and WAP</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>⁷ Any answer from Item 1 through Item 3 is “Yes”: <i>If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Selection and Evaluation of Biotreatment BMP.</i> <i>If no, then proceed to Item 8 below.</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<p>⁸ Any answer from Item 4 through Item 6 is “Yes”: <i>If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Site Design BMP.</i> <i>If no, then proceed to Item 9, below.</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<p>⁹ All answers to Item 1 through Item 6 are “No”: <i>Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP.</i> <i>Proceed to Form 4.3-2, Site Design BMPs.</i></p>	

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

Form 4.3-2 cont. Site Design BMPs (DA 1)			
14 Implementation of Street Trees: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 14-18. If no, proceed to Item 19</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
15 Number of Street Trees	N/A	N/A	N/A
16 Average canopy cover over impervious area (ft ²)	N/A	N/A	N/A
17 Runoff volume retention from street trees (ft ³) <i>V_{retention} = Item 15 * Item 16 * (0.05/12) assume runoff retention of 0.05 inches</i>	N/A	N/A	N/A
18 Runoff volume retention from street tree BMPs (ft ³): N/A <i>V_{retention} = Sum of Item 17 for all BMPs</i>			
19 Total Retention Volume from Site Design BMPs: N/A <i>Sum of Items 5, 13 and 18</i>			

4.3.3 Infiltration BMPs

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

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

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

4.3.3.1 Allowed Variations for Special Site Conditions

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

- 1) Facilities located within 10 feet of structures or other potential geotechnical hazards established by the geotechnical expert for the project may incorporate an impervious cutoff wall between the bioretention facility and the structure or other geotechnical hazard.
- 2) Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities located where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner and may locate the underdrain discharge at the bottom of the subsurface drainage/storage layer (this configuration is commonly known as a “flow-through planter”).
- 3) Facilities located in areas of high groundwater, highly infiltrative soils or where connection of underdrain to a surface drain or to a subsurface storm drain are infeasible, may omit the underdrain.
- 4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites may be required to provide adequate pretreatment to address pollutants of concern unless these high-risk areas are isolated from storm water runoff or bioretention areas with no chance of spill migration.

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

1 Remaining LID DCV not met by site design BMP (ft³): 17,472 $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 19}$

BMP Type <i>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</i>	DA 1 DMA 1 Infiltration Basin BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
2 Infiltration rate of underlying soils (in/hr) <i>See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods</i>	0.65 (Per County Soils Maps)		
3 Infiltration safety factor <i>See TGD Section 5.4.2 and Appendix D</i>	2		
4 Design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$	0.32		
5 Ponded water drawdown time (hr) <i>Copy Item 6 in Form 4.2-1</i>	48		
6 Maximum ponding depth (ft) <i>BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details</i>	5.80		
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$	1.3		
8 Infiltrating surface area, SA_{BMP} (ft ²) <i>the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP</i>	11,112		
9 Amended soil depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details</i>	1.0		
10 Amended soil porosity	.25		
11 Gravel depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details</i>	1		
12 Gravel porosity	.33		
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>	3		
14 Above Ground Retention Volume (ft ³) $V_{retention} = \text{Item 8} * [\text{Item 7} + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$	21,779		
15 Underground Retention Volume (ft ³) <i>Volume determined using manufacturer's specifications and calculations</i>	N/A		
16 Total Retention Volume from LID Infiltration BMPs: 21,779 <i>(Sum of Items 14 and 15 for all infiltration BMP included in plan)</i>			
17 Fraction of DCV achieved with infiltration BMP: 124.65% $\text{Retention\%} = \text{Item 16} / \text{Form 4.2-1 Item 7}$			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>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.</i>			

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): <i>Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16</i>	List pollutants of concern <i>Copy from Form 2.3-1.</i>	
2 Biotreatment BMP Selected <i>(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)</i>	Volume-based biotreatment <i>Use Forms 4.3-5 and 4.3-6 to compute treated volume</i> <input type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet extended detention <input type="checkbox"/> Dry extended detention	Flow-based biotreatment <i>Use Form 4.3-7 to compute treated flow</i> <input type="checkbox"/> Vegetated swale <input type="checkbox"/> Vegetated filter strip <input type="checkbox"/> Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft ³): <i>Form 4.3-5 Item 15 + Form 4.3-6 Item 13</i>	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft ³): <i>Item 1 – Item 3</i>	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % <i>Item 4 / Item 1</i>
6 Flow-based biotreatment BMP capacity provided (cfs): <i>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)</i>		
7 Metrics for MEP determination: <ul style="list-style-type: none"> • 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: <input type="checkbox"/> <i>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.</i> 		

Form 4.3-5 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains			
Biotreatment BMP Type <i>(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)</i>	DA BMP Type	DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
1 Pollutants addressed with BMP <i>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</i>	N/A	N/A	N/A
2 Amended soil infiltration rate <i>Typical ~ 5.0</i>	N/A	N/A	N/A
3 Amended soil infiltration safety factor <i>Typical ~ 2.0</i>	N/A	N/A	N/A
4 Amended soil design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$	N/A	N/A	N/A
5 Ponded water drawdown time (hr) <i>Copy Item 6 from Form 4.2-1</i>	N/A	N/A	N/A
6 Maximum ponding depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	N/A	N/A	N/A
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$	N/A	N/A	N/A
8 Amended soil surface area (ft ²)	N/A	N/A	N/A
9 Amended soil depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	N/A	N/A	N/A
10 Amended soil porosity, <i>n</i>	N/A	N/A	N/A
11 Gravel depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	N/A	N/A	N/A
12 Gravel porosity, <i>n</i>	N/A	N/A	N/A
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>	N/A	N/A	N/A
14 Biotreated Volume (ft ³) $V_{biotreated} = \text{Item 8} * [(\text{Item 7} / 2) + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$	N/A	N/A	N/A
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: N/A <i>Sum of Item 14 for all volume-based BMPs included in this form</i>			

Form 4.3-6 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention				
Biotreatment BMP Type <i>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.</i>	DA DMA BMP Type		DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin <i>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</i>	N/A	N/A	N/A	N/A
2 Bottom width (ft)	N/A	N/A	N/A	N/A
3 Bottom length (ft)	N/A	N/A	N/A	N/A
4 Bottom area (ft ²) <i>A_{bottom} = Item 2 * Item 3</i>	N/A	N/A	N/A	N/A
5 Side slope (ft/ft)	N/A	N/A	N/A	N/A
6 Depth of storage (ft)	N/A	N/A	N/A	N/A
7 Water surface area (ft ²) <i>A_{surface} = (Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))</i>	N/A	N/A	N/A	N/A
8 Storage volume (ft ³) <i>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}]</i>	N/A	N/A	N/A	N/A
9 Drawdown Time (hrs) <i>Copy Item 6 from Form 2.1</i>	N/A		N/A	
10 Outflow rate (cfs) <i>Q_{BMP} = (Item 8_{forebay} + Item 8_{basin}) / (Item 9 * 3600)</i>	N/A		N/A	
11 Duration of design storm event (hrs)	N/A		N/A	
12 Biotreated Volume (ft ³) <i>V_{biotreated} = (Item 8_{forebay} + Item 8_{basin}) + (Item 10 * Item 11 * 3600)</i>	N/A		N/A	
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : N/A <i>(Sum of Item 12 for all BMP included in plan)</i>				

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

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): 17,472 <i>Copy Item 7 in Form 4.2-1</i>
2	On-site retention with site design BMP (ft ³): 0 <i>Copy Item 18 in Form 4.3-2</i>
3	On-site retention with LID infiltration BMP (ft ³): 21,779 <i>Copy Item 16 in Form 4.3-3</i>
4	On-site biotreatment with volume based biotreatment BMP (ft ³): 0 <i>Copy Item 3 in Form 4.3-4</i>
5	Flow capacity provided by flow based biotreatment BMP (cfs): 0 <i>Copy Item 6 in Form 4.3-4</i>
6	<p>LID BMP performance criteria are achieved if answer to any of the following is "Yes":</p> <ul style="list-style-type: none"> • Full retention of LID DCV with site design or infiltration BMP: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, sum of Items 2, 3, and 4 is greater than Item 1</i> • 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 <input type="checkbox"/> No <input type="checkbox"/> <i>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</i> ▪ 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 <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, Form 4.3-1 Items 7 and 8 were both checked yes</i>
7	<p>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:</p> <ul style="list-style-type: none"> • Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: <input type="checkbox"/> <i>Checked yes if Form 4.3-4 Item 7 is 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, $V_{alt} = (Item\ 1 - Item\ 2 - Item\ 3 - Item\ 4 - Item\ 5) * (100 - Form\ 2.4-1\ Item\ 2)\%$</i> • 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: <ul style="list-style-type: none"> 1) Equal or greater amount of runoff infiltrated or evapotranspired; <input type="checkbox"/> 2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; <input type="checkbox"/> 3) Equal or greater protection against shock loadings and spills; <input type="checkbox"/> 4) Equal or greater accessibility and ease of inspection and maintenance. <input type="checkbox"/>

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)	
<p>1 Volume reduction needed for hydromodification performance criteria (ft³): 41,040 <i>(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1</i></p>	<p>2 On-site retention with site design and infiltration, BMP (ft³): 21,779 <i>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</i></p>
<p>3 Remaining volume for hydromodification volume capture (ft³): 19,261 <i>Item 1 – Item 2</i></p>	<p>4 Volume capture provided by incorporating additional on-site BMPs (ft³): Proposed infiltration/detention basin. Volume 95,905 cubic feet</p>
<p>5 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p> <p><i>If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:</i></p> <ul style="list-style-type: none"> • Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP <input checked="" type="checkbox"/> • 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 <input type="checkbox"/> 	
<p>6 Form 4.2-2 Item 12 less than or equal to 5%: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p> <p><i>If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:</i></p> <ul style="list-style-type: none"> • Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs <input checked="" type="checkbox"/> 	

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	Responsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Infiltration Basin	HOA	Infiltration/Bioretention area must be cleaned at least quarterly (every month), including prior to the start of the rainy season (October 1 st), and after each storm event.	Quarterly

MOJAVE RIVER WATERSHED Water Quality Management Plan (WQMP)

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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

Attachment A – Site Plan

VESTING TENTATIVE TRACT MAP No. 18487 CITY OF VICTORVILLE

BENCH MARK

V-212 3248.52

LA MESA & HIGHWAY 395 146' E/O EAST EP
HWY 395 & 87' SE OF FIRE HYDRANT
VICTORVILLE CITY BENCHMARKS
JANUARY 15, 2003

LEGAL DESCRIPTION

THE SOUTH 1/2 OF THE NORTH 1/2 OF THE NORTH 1/2 OF THE
SOUTHEAST 1/4 OF SECTION 28, TOWNSHIP 5 NORTH, RANGE 5
WEST, SAN BERNARDINO BASE AND MERIDIAN, ACCORDING TO
THE OFFICIAL PLAT THEREOF.

APN: 3096-361-02-0-000

OWNER

MR. ED GRIMES
5238 CALIENTE BLVD.
OAKHILLS, CA 92344
PHONE (760) 949-1716

LAND USE

EX. - VACANT LAND
PROP. - SINGLE FAMILY R-1

AREA

GROSS = 830,254 SF (19.06 AC)
NET = 723,173 SF (16.60 AC)

ZONING

EX. - R-1
PROP. - R-1
MIN LOT SIZE 7200 SF

DENSITY

RESIDENTIAL
55 LOTS/14.9 AC=3.89 LOTS/AC

LOT BREAKDOWN

LOTS 1-55 RESIDENTIAL LOTS
LOT A - LANDSCAPE (LMAD) 10FT WIDE
LOT B - LANDSCAPE (LMAD) 10FT WIDE
LOT C - LANDSCAPE (LMAD) 10FT WIDE
LOT D - LANDSCAPE (LMAD) 10FT WIDE
LOT E - DRAINAGE BASIN, ASSESSMENT DISTRICT (DFAD)
REMAINDER - COMMERCIAL

EXISTING EASEMENTS

EASEMENTS SHOWN ON THIS PLAT ARE BASED ON A COPY OF
TITLE INSURANCE REPORT BY FIRST AMERICAN TITLE COMPANY
DATED JULY 26, 2007 AS ORDER NO. NHSB-2649796. CCL
DOES NOT ACCEPT RESPONSIBILITY FOR THE COMPLETENESS OR
ACCURACY OF THIS REPORT.

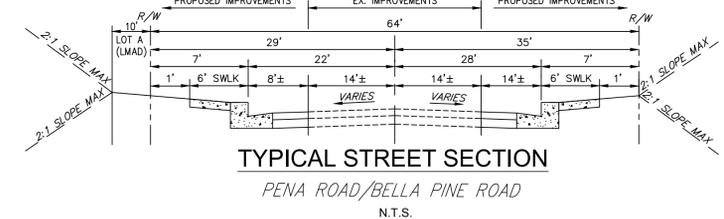
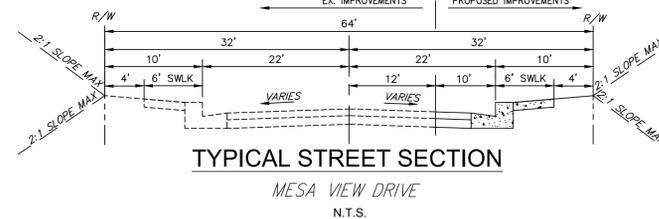
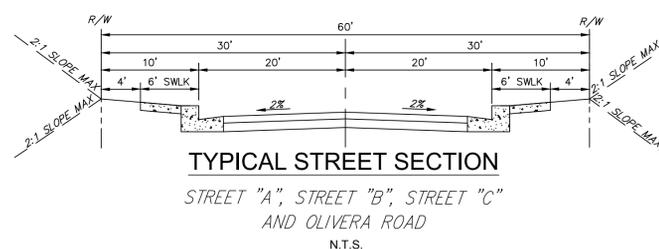
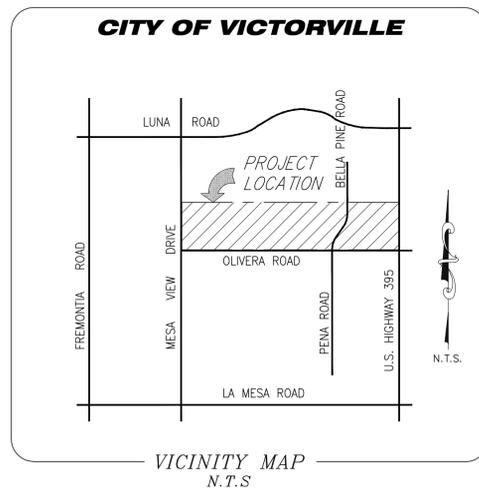
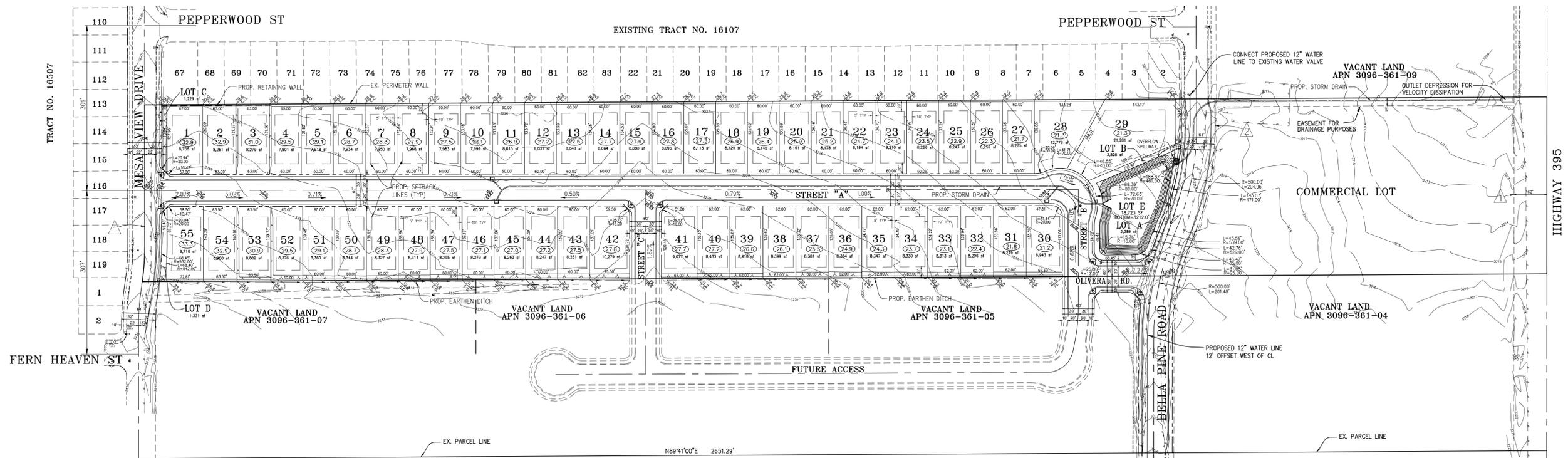
AN OFFER OF DEDICATION FOR STREETS, HIGHWAYS, SEWERS,
DRAINAGE, PUBLIC UTILITIES, AND PUBLIC ACCESS PURPOSES
AND INCIDENTAL PURPOSES, RECORDED JUNE 24, 1993 AS
INSTRUMENT NO. 93-269747 OF OFFICIAL RECORDS.

AN EASEMENT FOR STREETS, HIGHWAYS, SEWERS, DRAINAGE,
PUBLIC UTILITIES, AND PUBLIC ACCESS AND INCIDENTAL
PURPOSES, RECORDED MAY 19, 2004 AS INSTRUMENT NO.
2004-0351207 OF OFFICIAL RECORDS.

I HEREBY CERTIFY THAT THIS TRACT MAP WAS PREPARED UNDER
MY SUPERVISION AND IS TRUE AND CORRECT TO THE BEST OF MY
KNOWLEDGE AND THAT ALL EASEMENTS OF RECORD ARE SHOWN
PER TITLE REPORT BY TICOR TITLE, DATED FEBRUARY 1, 2017, TITLE
REFERENCE NO. 00277774-993-SS1.

BOBBY KOHLFARBER DATE
PE NO. 68141

SCALE: 1"=100'



PREPARED FOR:
MR. ED GRIMES
5238 CALIENTE BLVD.
OAKHILLS, CA 92344
PHONE (760) 949-1716

Kimley»Horn
3880 LEMON STREET, SUITE 420
RIVERSIDE, CA 92501
(714) 786-6316

CITY OF VICTORVILLE
VESTING
TENTATIVE TRACT MAP
NO. 18487

SCALE: 1"=100'
DESIGNED: LNJ
DRAWN: AS
CHECKED: DL
099481003
SHEET NO.
1 OF 1

PLOT DATE: 11-19-18

FILE:K:\RIV_LDEV\099481003 Victorville Parcel Map\Design\CADD\Plan Sheets\TM\099481003-VT.M.dwg

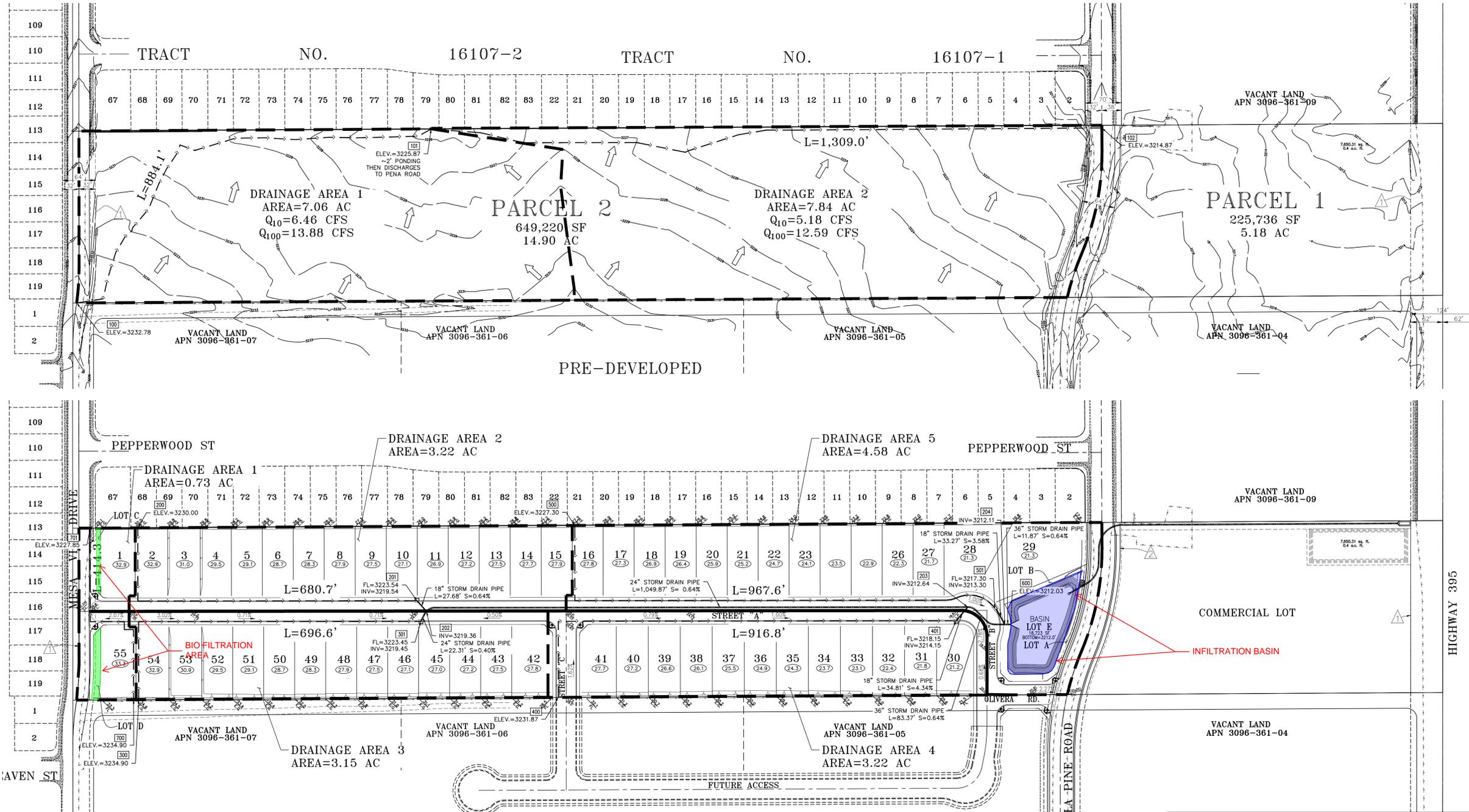
DRAINAGE EXHIBIT

TENTATIVE PARCEL MAP NO. 18487

CITY OF VICTORVILLE

BENCH MARK
 V-212 3248.52
 LA MESA & HIGHWAY 395 146' E/O EAST EP
 HWY 395 & 87' SE OF FIRE HYDRANT
 VICTORVILLE CITY BENCHMARKS
 JANUARY 15, 2003

TRACT NO. 16507
TRACT NO. 16536
TRACT NO. 16507
TRACT NO. 16536



LEGEND
 DRAINAGE BASIN BOUNDARY ———
 EXISTING CONTOUR ———
 SHEET FLOW →
 HYDROLOGY NODE [700]

NOTES
 PRE-DEVELOPED CONDITIONS:
 $Q_{10} = 9.84$ CFS
 $Q_{100} = 23.92$ CFS
 POST-DEVELOPED CONDITIONS:
 $Q_{10} = 18.23$ CFS
 $Q_{100} = 35.17$ CFS

SCALE: 1"=100'

PRE & POST DEVELOPMENT EXHIBIT

PREPARED FOR: MR. ED GRIMES 5238 CALIENTE BLVD. OAKHILLS, CA 92344 PHONE (760) 949-1716	<h2 style="margin: 0;">Kimley»Horn</h2> <p style="font-size: small; margin: 0;">3880 LEMON STREET SUITE 420 RIVERSIDE, CA 92501 PHONE: 747-900-8400 WWW.KIMLEY-HORN.COM</p>	<h3 style="margin: 0;">CITY OF VICTORVILLE</h3> <h2 style="margin: 0;">DRAINAGE EXHIBIT</h2> <h3 style="margin: 0;">VESTING TENTATIVE PARCEL MAP</h3> <h4 style="margin: 0;">NO. 18487</h4>	SCALE: 1"=100' DESIGNED: LA DRAWN: LA CHECKED: BK 099481003 SHEET NO. 1 OF 2
---	---	---	---

Attachment B – Calculations

Victorville Parcel Map 18487- Victorville, CA
Infiltration/Bioretention with No Underdrain Calculations

DMA	Total S.F.	Perv. S.F.	Imperv. S.F.	% Perv.	% Imperv.	Rc	P ₆	DCV
A-1	649,044	324,522	324,522	50.0%	50.0%	0.339	0.484	17,423
Overall	649,044	324,522	324,522					17,423

DMA A-1	
P _{design} =	0.32 in/hr
SA _{inf} =	11,112 ft ²
T _{fill} =	3 hr
d _{ponded} =	1.3 ft
d _{soil} =	1 ft
n _{soil} =	0.25
d _{gravel} =	1 ft
n _{gravel} =	0.33

V _{ret} =	21,780	< 17,423 (DCV)
--------------------	--------	----------------

V _{Total} =	21,780	> 17,423 (Total DCV)
----------------------	--------	----------------------

Attachment C – Time of Concentration Sheets

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
(c) Copyright 1983-2011 Advanced Engineering Software (aes)
Ver. 18.0 Release Date: 07/01/2011 License ID 1499

Analysis prepared by:

Kimley-Horn and Associates, Inc.
765 The City Drive
Suite 200
Orange, CA 92868

***** DESCRIPTION OF STUDY *****
* VESTING TENTATIVE PARCEL MAP 18487 *
* REV 5-22-18 *
* 10VPEX.RES *

FILE NAME: 10VPEX.DAT
TIME/DATE OF STUDY: 12:12 05/24/2018

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 10.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 8.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 1.00
USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL
10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 0.678
100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 1.130
COMPUTED RAINFALL INTENSITY DATA:
STORM EVENT = 10.00 1-HOUR INTENSITY(INCH/HOUR) = 0.6848
SLOPE OF INTENSITY DURATION CURVE = 0.7000

ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF-WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN-SIDE / OUT-SIDE/PARK-WAY	CURB HEIGHT (FT)	GUTTER WIDTH (FT)	GEOMETRIES: LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0312	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 100.00 TO NODE 101.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 884.10
ELEVATION DATA: UPSTREAM(FEET) = 3232.78 DOWNSTREAM(FEET) = 3225.87

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 20.901
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 1.433

```

SUBAREA Tc AND LOSS RATE DATA(AMC II):
  DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp      Ap      SCS      Tc
    LAND USE            GROUP   (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
NATURAL POOR COVER
"BARREN"                A         7.06      0.42     1.000     78     20.90
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA RUNOFF(CFS) = 6.46
TOTAL AREA(ACRES) = 7.06 PEAK FLOW RATE(CFS) = 6.46

*****
FLOW PROCESS FROM NODE 101.00 TO NODE 102.00 IS CODE = 51
-----
>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 3225.87 DOWNSTREAM(FEET) = 3214.87
CHANNEL LENGTH THRU SUBAREA(FEET) = 1309.00 CHANNEL SLOPE = 0.0084
CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 3.000
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH(FEET) = 2.00
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 1.150
SUBAREA LOSS RATE DATA(AMC II):
  DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp      Ap      SCS
    LAND USE            GROUP   (ACRES) (INCH/HR) (DECIMAL) CN
NATURAL POOR COVER
"BARREN"                A         7.84      0.42     1.000     78
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 9.07
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 2.82
AVERAGE FLOW DEPTH(FEET) = 1.03 TRAVEL TIME(MIN.) = 7.73
Tc(MIN.) = 28.63
SUBAREA AREA(ACRES) = 7.84 SUBAREA RUNOFF(CFS) = 5.18
EFFECTIVE AREA(ACRES) = 14.90 AREA-AVERAGED Fm(INCH/HR) = 0.42
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 1.00
TOTAL AREA(ACRES) = 14.9 PEAK FLOW RATE(CFS) = 9.84

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 1.07 FLOW VELOCITY(FEET/SEC.) = 2.89
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 102.00 = 2193.10 FEET.
=====
END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 14.9 TC(MIN.) = 28.63
EFFECTIVE AREA(ACRES) = 14.90 AREA-AVERAGED Fm(INCH/HR) = 0.42
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 1.000
PEAK FLOW RATE(CFS) = 9.84
=====
END OF RATIONAL METHOD ANALYSIS

```

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
(c) Copyright 1983-2011 Advanced Engineering Software (aes)
Ver. 18.0 Release Date: 07/01/2011 License ID 1499

Analysis prepared by:

Kimley-Horn and Associates, Inc.
765 The City Drive
Suite 200
Orange, CA 92868

***** DESCRIPTION OF STUDY *****
* VESTING TENTATIVE PARCEL MAP 18487 *
* REV 5-22-18 *
* VP10P.RES *

FILE NAME: VP10P.DAT
TIME/DATE OF STUDY: 14:35 05/22/2018

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 10.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 8.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 1.00
USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL
10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 0.678
100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) = 1.130
COMPUTED RAINFALL INTENSITY DATA:
STORM EVENT = 10.00 1-HOUR INTENSITY(INCH/HOUR) = 0.6848
SLOPE OF INTENSITY DURATION CURVE = 0.7000

ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 700.00 TO NODE 701.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 414.30
ELEVATION DATA: UPSTREAM(FEET) = 3234.90 DOWNSTREAM(FEET) = 3227.85

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 9.788
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.436

```

SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp      Ap      SCS  Tc
LAND USE                GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
RESIDENTIAL
"5-7 DWELLINGS/ACRE"    A        0.73    0.98    0.500    32   9.79
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.98
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.500
SUBAREA RUNOFF(CFS) = 1.28
TOTAL AREA(ACRES) = 0.73 PEAK FLOW RATE(CFS) = 1.28
*****
FLOW PROCESS FROM NODE 200.00 TO NODE 201.00 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 680.70
ELEVATION DATA: UPSTREAM(FEET) = 3230.00 DOWNSTREAM(FEET) = 3223.54

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 13.418
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 1.954
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp      Ap      SCS  Tc
LAND USE                GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
RESIDENTIAL
"5-7 DWELLINGS/ACRE"    A        3.22    0.98    0.500    32  13.42
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.98
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.500
SUBAREA RUNOFF(CFS) = 4.25
TOTAL AREA(ACRES) = 3.22 PEAK FLOW RATE(CFS) = 4.25
*****
FLOW PROCESS FROM NODE 201.00 TO NODE 202.00 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 3219.54 DOWNSTREAM(FEET) = 3219.36
FLOW LENGTH(FEET) = 27.68 MANNING'S N = 0.013
DEPTH OF FLOW IN 15.0 INCH PIPE IS 10.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.73
ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 4.25
PIPE TRAVEL TIME(MIN.) = 0.10 Tc(MIN.) = 13.52
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 202.00 = 708.38 FEET.
*****
FLOW PROCESS FROM NODE 202.00 TO NODE 202.00 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 13.52
RAINFALL INTENSITY(INCH/HR) = 1.94
AREA-AVERAGED Fm(INCH/HR) = 0.49
AREA-AVERAGED Fp(INCH/HR) = 0.98
AREA-AVERAGED Ap = 0.50
EFFECTIVE STREAM AREA(ACRES) = 3.22
TOTAL STREAM AREA(ACRES) = 3.22
PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.25
*****
FLOW PROCESS FROM NODE 300.00 TO NODE 301.00 IS CODE = 21
-----

```

```

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 696.60
ELEVATION DATA: UPSTREAM(FEET) = 3234.90 DOWNSTREAM(FEET) = 3223.45

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 12.133
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.096
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
"5-7 DWELLINGS/ACRE" A 3.15 0.98 0.500 32 12.13
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.98
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.500
SUBAREA RUNOFF(CFS) = 4.56
TOTAL AREA(ACRES) = 3.15 PEAK FLOW RATE(CFS) = 4.56

*****
FLOW PROCESS FROM NODE 301.00 TO NODE 202.00 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 3219.45 DOWNSTREAM(FEET) = 3219.36
FLOW LENGTH(FEET) = 22.31 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 4.06
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 4.56
PIPE TRAVEL TIME(MIN.) = 0.09 Tc(MIN.) = 12.22
LONGEST FLOWPATH FROM NODE 300.00 TO NODE 202.00 = 718.91 FEET.

*****
FLOW PROCESS FROM NODE 202.00 TO NODE 202.00 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 12.22
RAINFALL INTENSITY(INCH/HR) = 2.09
AREA-AVERAGED Fm(INCH/HR) = 0.49
AREA-AVERAGED Fp(INCH/HR) = 0.98
AREA-AVERAGED Ap = 0.50
EFFECTIVE STREAM AREA(ACRES) = 3.15
TOTAL STREAM AREA(ACRES) = 3.15
PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.56

** CONFLUENCE DATA **
STREAM Q Tc Intensity Fp(Fm) Ap Ae HEADWATER
NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE
1 4.25 13.52 1.944 0.98( 0.49) 0.50 3.2 200.00
2 4.56 12.22 2.085 0.98( 0.49) 0.50 3.2 300.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM Q Tc Intensity Fp(Fm) Ap Ae HEADWATER
NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE
1 8.78 12.22 2.085 0.98( 0.49) 0.50 6.1 300.00
2 8.41 13.52 1.944 0.98( 0.49) 0.50 6.4 200.00

```

```

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      8.78      Tc(MIN.) =      12.22
EFFECTIVE AREA(ACRES) =      6.06      AREA-AVERAGED Fm(INCH/HR) =      0.49
AREA-AVERAGED Fp(INCH/HR) =      0.98      AREA-AVERAGED Ap =      0.50
TOTAL AREA(ACRES) =      6.4
LONGEST FLOWPATH FROM NODE      300.00 TO NODE      202.00 =      718.91 FEET.

*****
FLOW PROCESS FROM NODE      202.00 TO NODE      203.00 IS CODE = 31
-----
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 3219.36 DOWNSTREAM(FEET) = 3212.64
FLOW LENGTH(FEET) = 1049.87 MANNING'S N = 0.013
DEPTH OF FLOW IN 21.0 INCH PIPE IS 12.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.69
ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 8.78
PIPE TRAVEL TIME(MIN.) = 3.08 Tc(MIN.) = 15.30
LONGEST FLOWPATH FROM NODE      300.00 TO NODE      203.00 =      1768.78 FEET.

*****
FLOW PROCESS FROM NODE      203.00 TO NODE      203.00 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 15.30
RAINFALL INTENSITY(INCH/HR) = 1.78
AREA-AVERAGED Fm(INCH/HR) = 0.49
AREA-AVERAGED Fp(INCH/HR) = 0.98
AREA-AVERAGED Ap = 0.50
EFFECTIVE STREAM AREA(ACRES) = 6.06
TOTAL STREAM AREA(ACRES) = 6.37
PEAK FLOW RATE(CFS) AT CONFLUENCE = 8.78

*****
FLOW PROCESS FROM NODE      400.00 TO NODE      401.00 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 916.80
ELEVATION DATA: UPSTREAM(FEET) = 3231.87 DOWNSTREAM(FEET) = 3218.15

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 13.799
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 1.916
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp      Ap      SCS  Tc
LAND USE              GROUP  (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
RESIDENTIAL
"5-7 DWELLINGS/ACRE"  A      3.22      0.98      0.500      32  13.80
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.98
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.500
SUBAREA RUNOFF(CFS) = 4.14
TOTAL AREA(ACRES) = 3.22 PEAK FLOW RATE(CFS) = 4.14

*****
FLOW PROCESS FROM NODE      203.00 TO NODE      203.00 IS CODE = 1
-----
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<
=====

```

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 13.80
 RAINFALL INTENSITY(INCH/HR) = 1.92
 AREA-AVERAGED Fm(INCH/HR) = 0.49
 AREA-AVERAGED Fp(INCH/HR) = 0.98
 AREA-AVERAGED Ap = 0.50
 EFFECTIVE STREAM AREA(ACRES) = 3.22
 TOTAL STREAM AREA(ACRES) = 3.22
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.14

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	8.78	15.30	1.782	0.98(0.49)	0.50	6.1	300.00
1	8.41	16.62	1.682	0.98(0.49)	0.50	6.4	200.00
2	4.14	13.80	1.916	0.98(0.49)	0.50	3.2	400.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	12.87	13.80	1.916	0.98(0.49)	0.50	8.7	400.00
2	12.53	15.30	1.782	0.98(0.49)	0.50	9.3	300.00
3	11.87	16.62	1.682	0.98(0.49)	0.50	9.6	200.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 12.87 Tc(MIN.) = 13.80
 EFFECTIVE AREA(ACRES) = 8.69 AREA-AVERAGED Fm(INCH/HR) = 0.49
 AREA-AVERAGED Fp(INCH/HR) = 0.98 AREA-AVERAGED Ap = 0.50
 TOTAL AREA(ACRES) = 9.6
 LONGEST FLOWPATH FROM NODE 300.00 TO NODE 203.00 = 1768.78 FEET.

 FLOW PROCESS FROM NODE 203.00 TO NODE 204.00 IS CODE = 31

 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
 =====
 ELEVATION DATA: UPSTREAM(FEET) = 3212.64 DOWNSTREAM(FEET) = 3212.11
 FLOW LENGTH(FEET) = 83.37 MANNING'S N = 0.013
 DEPTH OF FLOW IN 24.0 INCH PIPE IS 15.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 6.24
 ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 12.87
 PIPE TRAVEL TIME(MIN.) = 0.22 Tc(MIN.) = 14.02
 LONGEST FLOWPATH FROM NODE 300.00 TO NODE 204.00 = 1852.15 FEET.

 FLOW PROCESS FROM NODE 204.00 TO NODE 204.00 IS CODE = 1

 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 =====
 TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MIN.) = 14.02
 RAINFALL INTENSITY(INCH/HR) = 1.89
 AREA-AVERAGED Fm(INCH/HR) = 0.49
 AREA-AVERAGED Fp(INCH/HR) = 0.98
 AREA-AVERAGED Ap = 0.50
 EFFECTIVE STREAM AREA(ACRES) = 8.69
 TOTAL STREAM AREA(ACRES) = 9.59
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 12.87

 FLOW PROCESS FROM NODE 500.00 TO NODE 501.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
 =====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 967.60
 ELEVATION DATA: UPSTREAM(FEET) = 3227.30 DOWNSTREAM(FEET) = 3217.30

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 15.183
 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 1.792
 SUBAREA Tc AND LOSS RATE DATA(AMC II):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE" A 4.58 0.98 0.500 32 15.18
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.97
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.500
 SUBAREA RUNOFF(CFS) = 5.38
 TOTAL AREA(ACRES) = 4.58 PEAK FLOW RATE(CFS) = 5.38

 FLOW PROCESS FROM NODE 501.00 TO NODE 204.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
 =====

ELEVATION DATA: UPSTREAM(FEET) = 3213.30 DOWNSTREAM(FEET) = 3212.11
 FLOW LENGTH(FEET) = 33.27 MANNING'S N = 0.013
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 8.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 9.53
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 5.38
 PIPE TRAVEL TIME(MIN.) = 0.06 Tc(MIN.) = 15.24
 LONGEST FLOWPATH FROM NODE 500.00 TO NODE 204.00 = 1000.87 FEET.

 FLOW PROCESS FROM NODE 204.00 TO NODE 204.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
 =====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 15.24
 RAINFALL INTENSITY(INCH/HR) = 1.79
 AREA-AVERAGED Fm(INCH/HR) = 0.49
 AREA-AVERAGED Fp(INCH/HR) = 0.97
 AREA-AVERAGED Ap = 0.50
 EFFECTIVE STREAM AREA(ACRES) = 4.58
 TOTAL STREAM AREA(ACRES) = 4.58
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 5.38

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	12.87	14.02	1.895	0.98(0.49)	0.50	8.7	400.00
1	12.53	15.53	1.764	0.98(0.49)	0.50	9.3	300.00
1	11.87	16.85	1.666	0.98(0.49)	0.50	9.6	200.00
2	5.38	15.24	1.787	0.97(0.49)	0.50	4.6	500.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	18.23	14.02	1.895	0.98(0.49)	0.50	12.9	400.00
2	17.97	15.24	1.787	0.98(0.49)	0.50	13.7	500.00
3	17.81	15.53	1.764	0.98(0.49)	0.50	13.9	300.00
4	16.74	16.85	1.666	0.98(0.49)	0.50	14.2	200.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 18.23 Tc(MIN.) = 14.02
 EFFECTIVE AREA(ACRES) = 12.90 AREA-AVERAGED Fm(INCH/HR) = 0.49
 AREA-AVERAGED Fp(INCH/HR) = 0.98 AREA-AVERAGED Ap = 0.50
 TOTAL AREA(ACRES) = 14.2
 LONGEST FLOWPATH FROM NODE 300.00 TO NODE 204.00 = 1852.15 FEET.

 FLOW PROCESS FROM NODE 204.00 TO NODE 600.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 3212.11 DOWNSTREAM(FEET) = 3212.03
 FLOW LENGTH(FEET) = 11.87 MANNING'S N = 0.013
 DEPTH OF FLOW IN 24.0 INCH PIPE IS 19.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 6.74
 ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 18.23
 PIPE TRAVEL TIME(MIN.) = 0.03 Tc(MIN.) = 14.05
 LONGEST FLOWPATH FROM NODE 300.00 TO NODE 600.00 = 1864.02 FEET.

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 14.2 TC(MIN.) = 14.05
 EFFECTIVE AREA(ACRES) = 12.90 AREA-AVERAGED Fm(INCH/HR) = 0.49
 AREA-AVERAGED Fp(INCH/HR) = 0.98 AREA-AVERAGED Ap = 0.500
 PEAK FLOW RATE(CFS) = 18.23

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	18.23	14.05	1.892	0.98(0.49)	0.50	12.9	400.00
2	17.97	15.27	1.785	0.98(0.49)	0.50	13.7	500.00
3	17.81	15.56	1.761	0.98(0.49)	0.50	13.9	300.00
4	16.74	16.88	1.664	0.98(0.49)	0.50	14.2	200.00

=====

END OF RATIONAL METHOD ANALYSIS

Soil Map—San Bernardino County, California, Mojave River Area



Map Scale: 1:3,370 if printed on A landscape (11" x 8.5") sheet.



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

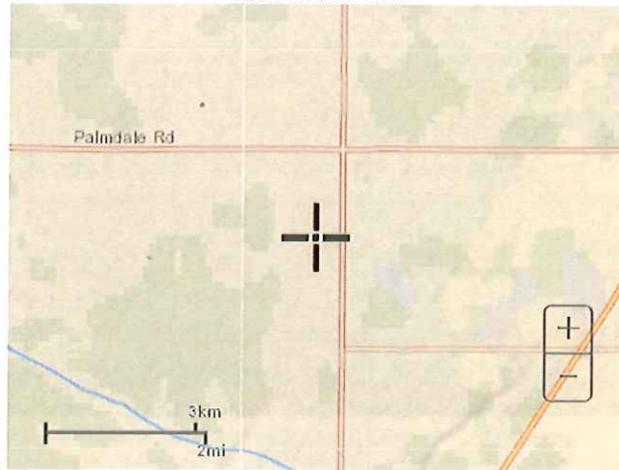


Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



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
Natural 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 in profile: 1 percent
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

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

Curve (I) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
<u>NATURAL COVERS -</u>					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
<u>URBAN COVERS -</u>					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
<u>AGRICULTURAL COVERS -</u>					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94

Ex Condition →

Prop. Condition →

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

CURVE NUMBERS
FOR
PERVIOUS AREAS

Curve (I) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
AGRICULTURAL COVERS (Continued)					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

- All curve numbers are for Antecedent Moisture Condition (AMC) II.
- Quality of cover definitions:

 Poor-Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.

 Good-Heavy or dense cover with more than 75 percent of the ground surface protected.
- See Figure C-2 for definition of cover types.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

**CURVE NUMBERS
FOR
PERVIOUS AREAS**

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent (2)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential: (3)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2 dwellings/acre	20 - 40	30
3-4 dwellings/acre	30 - 50	40
5-7 dwellings/acre	35 - 55	50
8-10 dwellings/acre	50 - 70	60
More than 10 dwellings/acre	65 - 90	80
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 - 100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.
2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.
3. For typical equestrian subdivisions increase impervious area 5 percent over the values recommended in the table above.

C.5. ANTECEDENT MOISTURE CONDITION (AMC)

The definitions for the AMC classifications are:

AMC I: Lowest runoff potential. The watershed soils are dry enough to allow satisfactory grading or cultivation to take place.

AMC II: Moderate runoff potential; an average study condition.

AMC III: Highest runoff potential. The watershed is practically saturated from antecedent rains. Heavy rainfall or light rainfall and low temperatures have occurred within the last five days.

For runoff hydrograph studies based on this manual it is assumed that a low AMC index (high loss rates) will be used in developing short return period storms, and a moderate to high AMC index (low loss rates) will be used in developing longer return period storms (e.g., 100 year). For the purposes of design hydrology, AMC I will be used for the 2- and 5-year return frequency storms. For the case of 10-, 25-, 50-year return frequency design storms, AMC II will be used. For 100-year storm analysis, AMC III shall be used. In detention basin design studies, AMC III conditions shall be considered in order to identify any downstream flooding potential.

C.5.1. Adjustment of Curve Numbers (CN) for AMC

The CN values selected for a particular soil cover type and quality also depend upon the AMC condition assumed. The CN values listed in Figure C-3 correspond to AMC II and require adjustment in order to represent either AMC I or AMC III. Table C.1 provides the necessary CN adjustments to account for AMC changes for hydrologic studies in San Bernardino County.

TABLE C.1. CURVE NUMBER RELATIONSHIPS

CN for AMC Condition II	Corresponding CN for AMC Condition	
	I	III
100	100	100
95	87	99
90	78	98
85	70	97
80	63	94
75	57	91
70	51	87
65	45	83
60	40	79
55	35	75
50	31	70
45	27	65
40	23	60
35	19	55
30	15	50
25	12	45
20	9	39
15	7	33
10	4	26
5	2	17
0	0	0

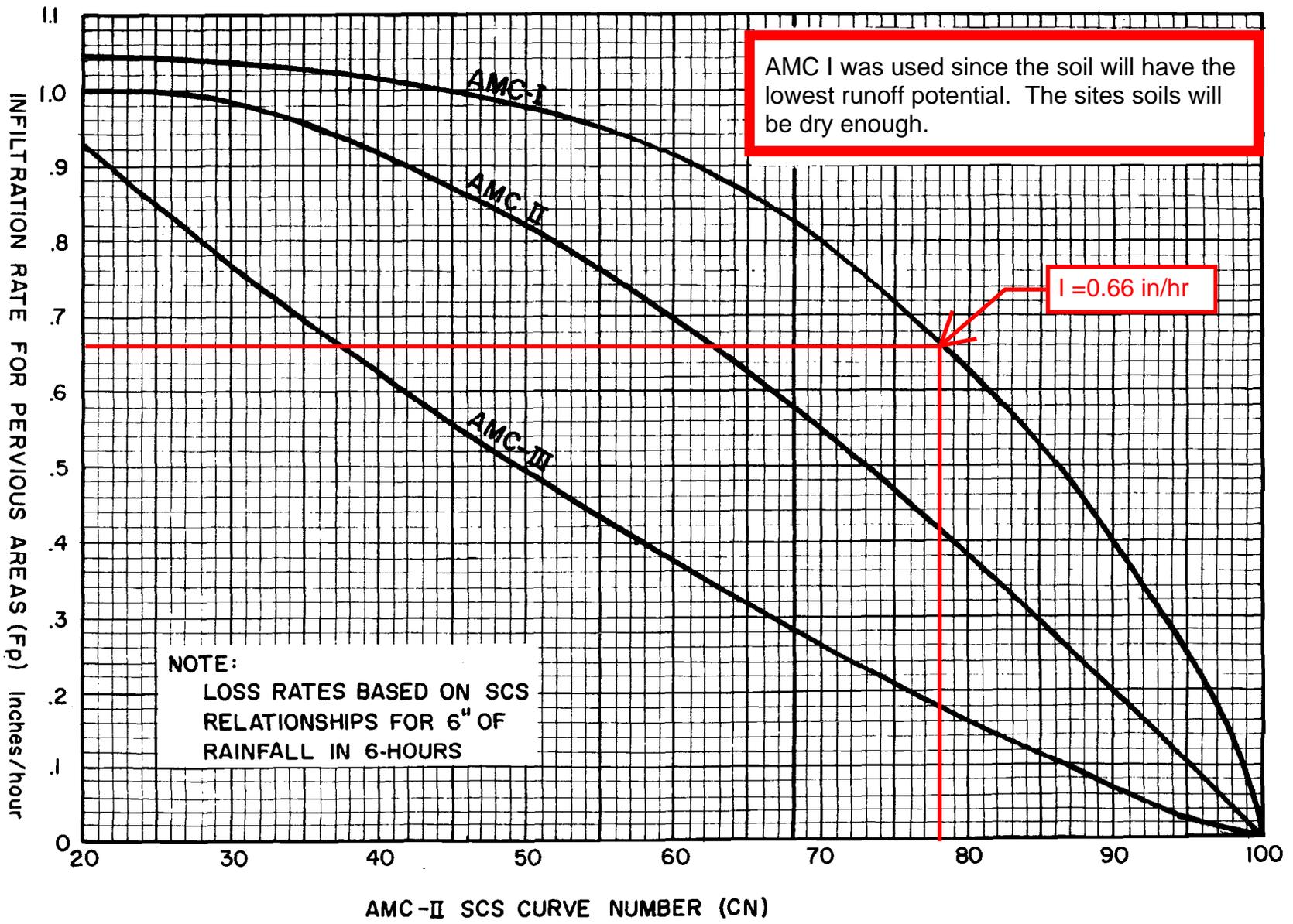
C.6. ESTIMATION OF LOSS RATES

In estimating loss rates for design hydrology, a watershed curve number (CN) is determined for each soil-cover complex within the watershed using Figure C-3. The working range of CN values is between 0 and 98, where a low CN indicates low runoff potential (high infiltration), and a high CN indicates high runoff potential (low infiltration). Selection of a CN takes into account the major factors affecting loss rates on pervious surfaces including the hydrologic soil group, cover type and quality, and antecedent moisture condition (AMC).

Also included in the CN selection are the effects of "initial abstraction" (Ia) which represents the combined effects of other effective rainfall losses including depression storage, vegetation interception, evaporation, and transpiration, among other factors.

**SAN BERNARDINO COUNTY
HYDROLOGY MANUAL**

**INFILTRATION RATE FOR
PERVIOUS AREAS VERSUS
SCS CURVE NUMBERS**



AMC I was used since the soil will have the lowest runoff potential. The sites soils will be dry enough.

$I = 0.66 \text{ in/hr}$

Attachment D– BMP Fact Sheet

INF-3: Bioretention with no Underdrain

Bioretention stormwater treatment facilities are landscaped shallow depressions that capture and filter stormwater runoff. These facilities function as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. The facilities normally consist of a ponding area, mulch layer, planting soils, and plants. As stormwater passes down through the planting soil, pollutants are filtered, adsorbed, and biodegraded by the soil and plants. For areas with low permeability native soils or steep slopes, bioretention areas can be designed with an underdrain system that routes the treated runoff to the storm drain system rather than depending entirely on infiltration.



Feasibility Screening Considerations

- Bioretention with no underdrains shall pass infiltration infeasibility screening criteria to be considered for use.

Opportunity Criteria

- Land use may include commercial, residential, mixed use, institutional, and subdivisions. Bioretention may also be applied in parking lot islands, cul-de-sacs, traffic circles, road shoulders, and road medians.
- Drainage area is ≤ 5 acres, preferably ≤ 1 acre.
- Area available for infiltration.
- Soils are adequate for infiltration or can be amended to improve infiltration capacity. Site slope is less than 15 percent.

OC-Specific Design Criteria and Considerations

- Placement of BMPs should observe geotechnical recommendations with respect to geological hazards (e.g. landslides, liquefaction zones, erosion, etc.) and set-backs (e.g., foundations, utilities, roadways, etc.)
- Depth to mounded seasonally high groundwater shall not be less than 5 feet.
- If sheet flow is conveyed to the treatment area over stabilized grassed areas, the site must be graded in such a way that minimizes erosive conditions; sheet flow velocities should not exceed 1 foot per second.
- Ponding depth should not exceed 18 inches; fencing may be required if ponding depth exceeds 6 inches to mitigate the risk of drowning.
- Planting/storage media shall be based on the recommendations contained in MISC-1: Planting/Storage Media
- The minimum amended soil depth is 1.5 feet (3 feet is preferred).
- The maximum drawdown time of the planting soil is 48 hours.

- Infiltration pathways may need to be restricted due to the close proximity of roads, foundations, or other infrastructure. A geomembrane liner, or other equivalent water proofing, may be placed along the vertical walls to reduce lateral flows. This liner should have a minimum thickness of 30 mils.
- Plant materials should be tolerant of summer drought, ponding fluctuations, and saturated soil conditions for 48 hours; native plant species and/or hardy cultivars that are not invasive and do not require chemical fertilizers or pesticides should be used to the maximum extent feasible.
- The bioretention area should be covered with 2-4 inches (average 3 inches) of mulch at startup and an additional placement of 1-2 inches of mulch should be added annually.
- An optional gravel drainage layer may be installed below planting media to augment storage volume.
- An overflow device is required at the top of the ponding depth.
- Dispersed flow or energy dissipation (i.e. splash rocks) for piped inlets should be provided at basin inlet to prevent erosion.

Simple Sizing Method for Bioretention with no Underdrain

If the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1** is used to size a bioretention area with underdrains, the user calculates the DCV and designs the system with geometry required to draw down the DCV in 48 hours. The sizing steps are as follows:

Step 1: Determine the Bioretention Design Capture Volume

Calculate the DCV using the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1**.

Step 2: Determine the 48-hour Ponding Depth

The depth of effective storage depth that can be drawn down in 48 hours can be calculated using the following equation:

$$d_{48} = K_{DESIGN} \times 4$$

Where:

d_{48} = bioretention 48-hour effective depth, ft

K_{DESIGN} = bioretention design infiltration rate, in/hr (See **Appendix VII**)

This is the maximum effective depth of the basin below the overflow device to achieve drawdown in 48 hours. Effective depth includes ponding water and media/aggregate pore space.

Step 3: Design System Geometry to Provide d_{48}

Design system geometry such that

$$d_{48} \geq d_{EFFECTIVE} = (d_P + n_M d_M + n_G d_G)$$

Where:

d_{48} = depth of water that can drain in 48 hours

$d_{EFFECTIVE}$ = total effective depth of water stored in bioretention area, ft

d_P = bioretention ponding depth, ft (should be less than or equal to 1.5 ft)

n_M = bioretention media porosity

d_M = bioretention media depth, ft

n_G = bioretention gravel layer porosity; 0.35 may be assumed where other information is not available

d_G = bioretention gravel layer depth, ft

Step 4: Calculate the Required Infiltrating Area

The required infiltrating area (i.e. measured at the media surface) can be calculated using the following equation:

$$A = DCV / d_{EFFECTIVE}$$

Where:

A = required infiltrating area, sq-ft (measured as the media surface area)

DCV = design capture volume, cu-ft (see Step 1)

$d_{EFFECTIVE}$ = total effective depth of water stored in bioretention area, ft (from Step 3)

This does not include the side slopes, access roads, etc. which would increase bioretention footprint.

Capture Efficiency Method for Bioretention with no Underdrain

If BMP geometry has already been defined and deviates from the 48 hour drawdown time, the designer can use the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs (See **Appendix III.3.2**) to determine the fraction of the DCV that must be provided to manage 80 percent of average annual runoff volume. This method accounts for drawdown time different than 48 hours.

Step 1: Determine the drawdown time associated with the selected basin geometry

$$DD = (d_{EFFECTIVE} / K_{DESIGN}) \times 12 \text{ in/ft}$$

Where:

DD = time to completely drain infiltration basin ponding depth, hours

$$d_{EFFECTIVE} \leq (d_P + n_M d_M + n_G d_G)$$

d_P = bioretention ponding depth, ft (should be less than or equal to 1.5 ft)

n_M = bioretention media porosity

d_M = bioretention media depth, ft

n_G = bioretention gravel layer porosity; 0.35 may be assumed where other information is not available

d_G = bioretention gravel layer depth, ft

K_{DESIGN} = basin design infiltration rate, in/hr (See **Appendix VII**)

Step 2: Determine the Required Adjusted DCV for this Drawdown Time

Use the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs (See **Appendix III.3.2**) to calculate the fraction of the DCV the basin must hold to achieve 80 percent capture of average annual stormwater runoff volume based on the basin drawdown time calculated above.

Step 4: Check that the Bioretention Effective Depth Drains in no Greater than 96 Hours

$$DD = (d_{EFFECTIVE} / K_{DESIGN}) \times 12$$

Where:

DD = time to completely drain bioretention facility, hours

$d_{EFFECTIVE}$ = total effective depth of water stored in bioretention area, ft (from Step 3)

K_{DESIGN} = basin design infiltration rate, in/hr (See **Appendix VII**)

If DD_{ALL} is greater than 96 hours, adjust bioretention media depth and/or gravel layer depth until DD is less than 96 hours. This duration is based on preventing extended periods of saturation from causing plant mortality.

Step 5: Determine the Basin Infiltrating Area Needed

The required infiltrating area (i.e. the surface area of the top of the media layer) can be calculated using the following equation:

$$A = DCV / d_{EFFECTIVE}$$

Where:

A = required infiltrating area, sq-ft (measured at the media surface)

DCV = design capture volume, adjusted for drawdown time, cu-ft (see Step 1)

$d_{EFFECTIVE}$ = total effective depth of water stored in bioretention area, ft (from Step 3)

This does not include the side slopes, access roads, etc. which would increase bioretention footprint. If the area required is greater than the selected basin area, adjust surface area or adjust ponding depth and recalculate required area until the required area is achieved.

Configuration for Use in a Treatment Train

- Bioretention areas may be preceded in a treatment train by HSCs in the drainage area, which would reduce the required volume of the bioretention cell.
- Bioretention areas can be incorporated in a treatment train to provide enhanced water quality treatment and reductions in runoff volume and rate. For example, runoff can be collected from a roadway in a vegetated swale that then flows to a bioretention area. Similarly, bioretention could be used to manage overflow from a cistern.

Additional References for Design Guidance

- CASQA BMP Handbook for New and Redevelopment:
<http://www.cabmphandbooks.com/Documents/Development/TC-32.pdf>
 - SMC LID Manual (pp 68):
http://www.lowimpactdevelopment.org/guest75/pub/All_Projects/SoCal_LID_Manual/SoCalLID_Manual_FINAL_040910.pdf
 - Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 5:
http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf
 - San Diego County LID Handbook Appendix 4 (Factsheet 7):
<http://www.sdcountry.ca.gov/dplu/docs/LID-Appendices.pdf>
 - Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4.
http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850
- County of Los Angeles Low Impact Development Standards Manual, Chapter 5:
http://dpw.lacounty.gov/wmd/LA_County_LID_Manual.pdf

Attachment E – Geotechnical Report

Attachment F – Educational Materials

LIST OF EDUCATION MATERIALS PROVIDED

1. THE OCEAN BEGINS AT YOUR FRONT DOOR
2. PROPER MAINTENANCE PRACTICES FOR YOUR BUSINESS
3. TIPS FOR LANDSCAPE & GARDENING
4. TIPS FOR PEST CONTROL
5. LANDSCAPE MAINTENANCE
6. SC-10: NON-STORMWATER DISCHARGE
7. SC-30: OUTDOOR LOADING/UNLOADING
8. SC-34: WASTE HANDLING & DISPOSAL
9. SC-41: BUILDING & GROUNDS MAINTENANCE
10. SC-43: PARKING/STORAGE AREA MAINTENANCE
11. SC-44: DRAINAGE SYSTEM MAINTENANCE
12. SC-70: ROAD AND STREET MAINTENANCE
13. SD-10: SITE DESIGN & LANDSCAPE PLANNING
14. SD-12: EFFICIENT IRRIGATION
15. SD-13: STORM DRAIN SIGNAGE
16. SD-32: TRASH STORAGE AREAS
17. SD-34: OUTDOOR MATERIAL STORAGE AREAS

The Ocean Begins at Your Front Door



PROJECT
Possution
PREVENTION

Follow these simple steps to help reduce water pollution:

Household Activities

- Do not rinse spills with water. Use dry cleanup methods such as applying cat litter or another absorbent material, sweep and dispose of in the trash. Take items such as used or excess batteries, oven cleaners, automotive fluids, painting products and cathode ray tubes, like TVs and computer monitors, to a Household Hazardous Waste Collection Center (HHWCC).
- For a HHWCC near you call (714) 834-6752 or visit www.oilandfills.com.
- Do not hose down your driveway, sidewalk or patio to the street, gutter or storm drain. Sweep up debris and dispose of it in the trash.

Automotive

- Take your vehicle to a commercial car wash whenever possible. If you wash your vehicle at home, choose soaps, cleaners, or detergents labeled non-toxic, phosphate-free or biodegradable. Vegetable and citrus-based products are typically safest for the environment.
- Do not allow washwater from vehicle washing to drain into the street, gutter or storm drain. Excess washwater should be disposed of in the sanitary sewer (through a sink or toilet) or onto an absorbent surface like your lawn.
- Monitor your vehicles for leaks and place a pan under leaks. Keep your vehicles well maintained to stop and prevent leaks.
- Never pour oil or antifreeze in the street, gutter or storm drain. Recycle these substances at a service station, a waste oil collection center or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.1800cleanup.org.

Pool Maintenance

- Pool and spa water must be dechlorinated and free of excess acid, alkali or color to be allowed in the street, gutter or storm drain.
- When it is not raining, drain dechlorinated pool and spa water directly into the sanitary sewer.
- Some cities may have ordinances that do not allow pool water to be disposed of in the storm drain. Check with your city.

Landscape and Gardening

- Do not over-water. Water your lawn and garden by hand to control the amount of water you use or set irrigation systems to reflect seasonal water needs. If water flows off your yard onto your driveway or sidewalk, your system is over-watering. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of waste by composting, hauling it to a permitted landfill, or as green waste through your city's recycling program.
- Follow directions on pesticides and fertilizer, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Take unwanted pesticides to a HHWCC to be recycled. For locations and hours of HHWCC, call (714) 834-6752 or visit www.oilandfills.com.

Trash

- Place trash and litter that cannot be recycled in securely covered trash cans.
- Whenever possible, buy recycled products.
- Remember: Reduce, Reuse, Recycle.

Pet Care

- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash. Pet waste, if left outdoors, can wash into the street, gutter or storm drain.
- If possible, bathe your pets indoors. If you must bathe your pet outside, wash it on your lawn or another absorbent/permeable surface to keep the washwater from entering the street, gutter or storm drain.
- Follow directions for use of pet care products and dispose of any unused products at a HHWCC.

Common Pollutants

Home Maintenance

- Detergents, cleaners and solvents
- Oil and latex paint
- Swimming pool chemicals
- Outdoor trash and litter

Lawn and Garden

- Pet and animal waste
- Pesticides
- Clippings, leaves and soil
- Fertilizer

Automobile

- Oil and grease
- Radiator fluids and antifreeze
- Cleaning chemicals
- Brake pad dust

The Ocean Begins at Your Front Door



Never allow pollutants to enter the street, gutter or storm drain!

Did You Know?

- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution is sometimes called “non-point source” pollution.
- There are two types of non-point source pollution: stormwater and urban runoff pollution.
- Stormwater runoff results from rainfall. When rainstorms cause large volumes of water to rinse the urban landscape, picking up pollutants along the way.
- Urban runoff can happen any time of the year when excessive water use from irrigation, vehicle washing and other sources carries trash, lawn clippings and other urban pollutants into storm drains.

Where Does It Go?

- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer systems; unlike water in sanitary sewers (from sinks or toilets), water in storm drains is not treated before entering our waterways.

Sources of Non-Point Source Pollution

- Automotive leaks and spills.
- Improper disposal of used oil and other engine fluids.
- Metals found in vehicle exhaust, weathered paint, rust, metal plating and tires.
- Pesticides and fertilizers from lawns, gardens and farms.
- Improper disposal of cleaners, paint and paint removers.
- Soil erosion and dust debris from landscape and construction activities.
- Litter, lawn clippings, animal waste, and other organic matter.
- Oil stains on parking lots and paved surfaces.



The Effect on the Ocean



Non-point source pollution can have a serious impact on water quality in Orange County. Pollutants from the storm drain system can harm marine life

as well as coastal and wetland habitats. They can also degrade recreation areas such as beaches, harbors and bays.

Stormwater quality management programs have been developed throughout Orange County to educate and encourage the public to protect water quality, monitor runoff in the storm drain system, investigate illegal dumping and maintain storm drains.

Support from Orange County residents and businesses is needed to improve water quality and reduce urban runoff pollution. Proper use and disposal of materials will help stop pollution before it reaches the storm drain and the ocean.



For More Information

Orange County Stormwater Program

California Environmental Protection Agency

www.calepa.ca.gov

- **Air Resources Board**
www.arb.ca.gov
- **Department of Pesticide Regulation**
www.cdpr.ca.gov
- **Department of Toxic Substances Control**
www.dtsc.ca.gov
- **Integrated Waste Management Board**
www.ciwmb.ca.gov
- **Office of Environmental Health Hazard Assessment**
www.oehha.ca.gov
- **State Water Resources Control Board**
www.waterboards.ca.gov

Earth 911 - Community-Specific Environmental Information 1-800-cleanup or visit www.1800cleanup.org

Health Care Agency's Ocean and Bay Water Closure and Posting Hotline
(714) 433-6400 or visit www.ocbeachinfo.com

Integrated Waste Management Dept. of Orange County (714) 834-6752 or visit www.oclandfills.com for information on household hazardous waste collection centers, recycling centers and solid waste collection

O.C. Agriculture Commissioner
(714) 447-7100 or visit www.ocagcomm.com

Stormwater Best Management Practice Handbook
Visit www.cabmphandbooks.com

UC Master Gardener Hotline
(714) 708-1646 or visit www.uccemg.com

The Orange County Stormwater Program has created and moderates an electronic mailing list to facilitate communications, take questions and exchange ideas among its users about issues and topics related to stormwater and urban runoff and the implementation of program elements. To join the list, please send an email to ocstormwaterinfo-join@list.ocwatersheds.com

Aliso Viejo	(949)	425-2535
Anaheim Public Works Operations	(714)	765-6860
Brea Engineering.	(714)	990-7666
Buena Park Public Works	(714)	562-3655
Costa Mesa Public Services.	(714)	754-5323
Cypress Public Works.	(714)	229-6740
Dana Point Public Works.	(949)	248-3584
Fountain Valley Public Works	(714)	593-4441
Fullerton Engineering Dept..	(714)	738-6853
Garden Grove Public Works	(714)	741-5956
Huntington Beach Public Works	(714)	536-5431
Irvine Public Works.	(949)	724-6315
La Habra Public Services.	(562)	905-9792
La Palma Public Works	(714)	690-3310
Laguna Beach Water Quality.	(949)	497-0378
Laguna Hills Public Services.	(949)	707-2650
Laguna Niguel Public Works	(949)	362-4337
Laguna Woods Public Works.	(949)	639-0500
Lake Forest Public Works	(949)	461-3480
Los Alamitos Community Dev.	(562)	431-3538
Mission Viejo Public Works	(949)	470-3056
Newport Beach, Code & Water Quality Enforcement	(949)	644-3215
Orange Public Works.	(714)	532-6480
Placentia Public Works	(714)	993-8245
Rancho Santa Margarita	(949)	635-1800
San Clemente Environmental Programs	(949)	361-6143
San Juan Capistrano Engineering	(949)	234-4413
Santa Ana Public Works	(714)	647-3380
Seal Beach Engineering	(562)	431-2527 x317
Stanton Public Works.	(714)	379-9222 x204
Tustin Public Works/Engineering.	(714)	573-3150
Villa Park Engineering	(714)	998-1500
Westminster Public Works/Engineering	(714)	898-3311 x446
Yorba Linda Engineering	(714)	961-7138
Orange County Stormwater Program	(877)	897-7455
Orange County 24-Hour Water Pollution Problem Reporting Hotline 1-877-89-SPILL (1-877-897-7455)		

On-line Water Pollution Problem Reporting Form

www.ocwatersheds.com





Preventing water pollution at your commercial/industrial site

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many landscape and building maintenance activities can lead to water pollution if you're not careful. Paint, chemicals, plant clippings and other materials can be blown or washed into storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour soap or fertilizers into the ocean, so why would you let them enter the storm drains? Follow these easy tips to help prevent water pollution.

Some types of industrial facilities are required to obtain coverage under the State General Industrial Permit. For more information visit: www.swrcb.ca.gov/stormwater/industrial.html

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit www.ocwatersheds.com

To report a spill, call the **Orange County 24-Hour Water Pollution Problem Reporting Hotline** at **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.



RECYCLE
USED OIL



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Help Prevent Ocean Pollution:

Proper Maintenance Practices for Your Business



The Ocean Begins at Your Front Door



Proper Maintenance Practices for your Business

Landscape Maintenance

- Compost grass clippings, leaves, sticks and other vegetation, or dispose of it at a permitted landfill or in green waste containers. Do not dispose of these materials in the street, gutter or storm drain.
- Irrigate slowly and inspect the system for leaks, overspraying and runoff. Adjust automatic timers to avoid overwatering.
- Follow label directions for the use and disposal of fertilizers and pesticides.
- Do not apply pesticides or fertilizers if rain is expected within 48 hours or if wind speeds are above 5 mph.
- Do not spray pesticides within 100 feet of waterways.
- Fertilizers should be worked into the soil rather than dumped onto the surface.
- If fertilizer is spilled on the pavement or sidewalk, sweep it up immediately and place it back in the container.

Building Maintenance

- Never allow washwater, sweepings or sediment to enter the storm drain.
- Sweep up dry spills and use cat litter, towels or similar materials to absorb wet spills. Dispose of it in the trash.
- If you wash your building, sidewalk or parking lot, you **must** contain the water. Use a shop vac to collect the water and contact your city or sanitation agency for proper disposal information. Do not let water enter the street, gutter or storm drain.
- Use drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of materials in the trash.
- Use a ground cloth or oversized tub for mixing paint and cleaning tools.
- Use a damp mop or broom to clean floors.
- Cover dumpsters to keep insects, animals, rainwater and sand from entering. Keep the area around the dumpster clear of trash and debris. Do not overfill the dumpster.

- Call your trash hauler to replace leaking dumpsters.
- Do not dump any toxic substance or liquid waste on the pavement, the ground, or near a storm drain. Even materials that seem harmless such as latex paint or biodegradable cleaners can damage the environment.
- Recycle paints, solvents and other materials. For more information about recycling and collection centers, visit www.oclandfills.com.
- Store materials indoors or under cover and away from storm drains.
- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry, carpet, plastic, pipes, drywall, rocks, dirt, and green waste. For a listing of construction and demolition recycling locations in your area, visit www.ciwmb.ca.gov/recycle.
- Properly label materials. Familiarize employees with Material Safety Data Sheets.

NEVER DISPOSE
OF ANYTHING
IN THE STORM
DRAIN.



Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Fertilizers, pesticides and other chemicals that are left on yards or driveways can be blown or washed into storm drains that flow to the ocean. Overwatering lawns can also send materials into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour gardening products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit www.ocwatersheds.com

UCCE Master Gardener Hotline:
(714) 708-1646

To report a spill, call the **Orange County 24-Hour Water Pollution Problem Reporting Hotline** **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

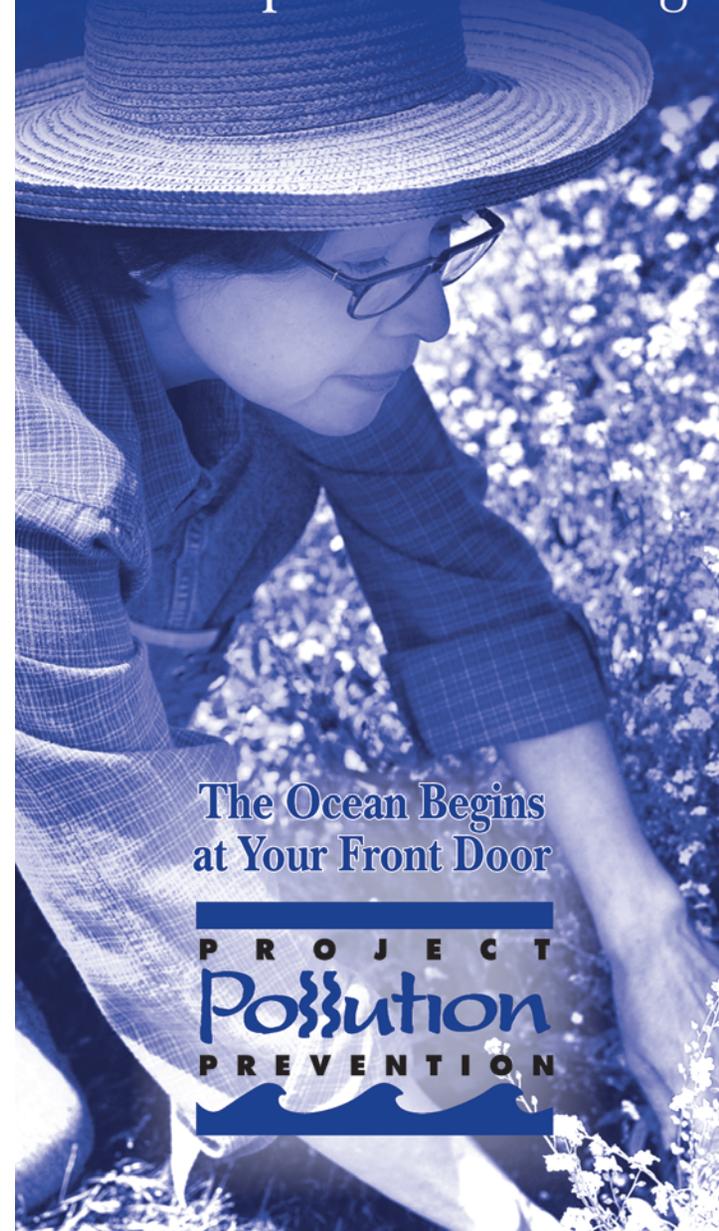
The tips contained in this brochure provide useful information to help prevent water pollution while landscaping or gardening. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.



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Help Prevent Ocean Pollution:

Tips for Landscape & Gardening



The Ocean Begins
at Your Front Door



Tips for Landscape & Gardening

Never allow gardening products or polluted water to enter the street, gutter or storm drain.

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.
- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.



- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro spray systems. Periodically inspect and fix leaks and misdirected sprinklers.

- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.



- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.



- Rinse empty pesticide containers and re-use rinse water as you would use the

product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.

- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit www.ipm.ucdavis.edu.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

Household Hazardous Waste Collection Centers

Anaheim:	1071 N. Blue Gum St.
Huntington Beach:	17121 Nichols St.
Irvine:	6411 Oak Canyon
San Juan Capistrano:	32250 La Pata Ave.

For more information, call (714) 834-6752 or visit www.oilandfills.com



Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as pest control can lead to water pollution if you're not careful. Pesticide treatments must be planned and applied properly to ensure that pesticides do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump pesticides into the ocean, so don't let it enter the storm drains. Pesticides can cause significant damage to our environment if used improperly. If you are thinking of using a pesticide to control a pest, there are some important things to consider.

For more information,
please call
University of California Cooperative
Extension Master Gardeners at
(714) 708-1646
or visit these Web sites:
www.uccemg.org
www.ipm.ucdavis.edu

For instructions on collecting a specimen
sample visit the Orange County
Agriculture Commissioner's website at:
http://www.ocagcomm.com/ser_lab.asp

To report a spill, call the
**Orange County 24-Hour
Water Pollution Problem
Reporting Hotline**
at 1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

Information From:
Cheryl Wilen, Area IPM Advisor; Darren Haver,
Watershed Management Advisor; Mary
Louise Flint, IPM Education and Publication
Director; Pamela M. Geisel, Environmental
Horticulture Advisor; Carolyn L. Unruh,
University of California Cooperative
Extension staff writer. Photos courtesy of
the UC Statewide IPM Program and
Darren Haver.

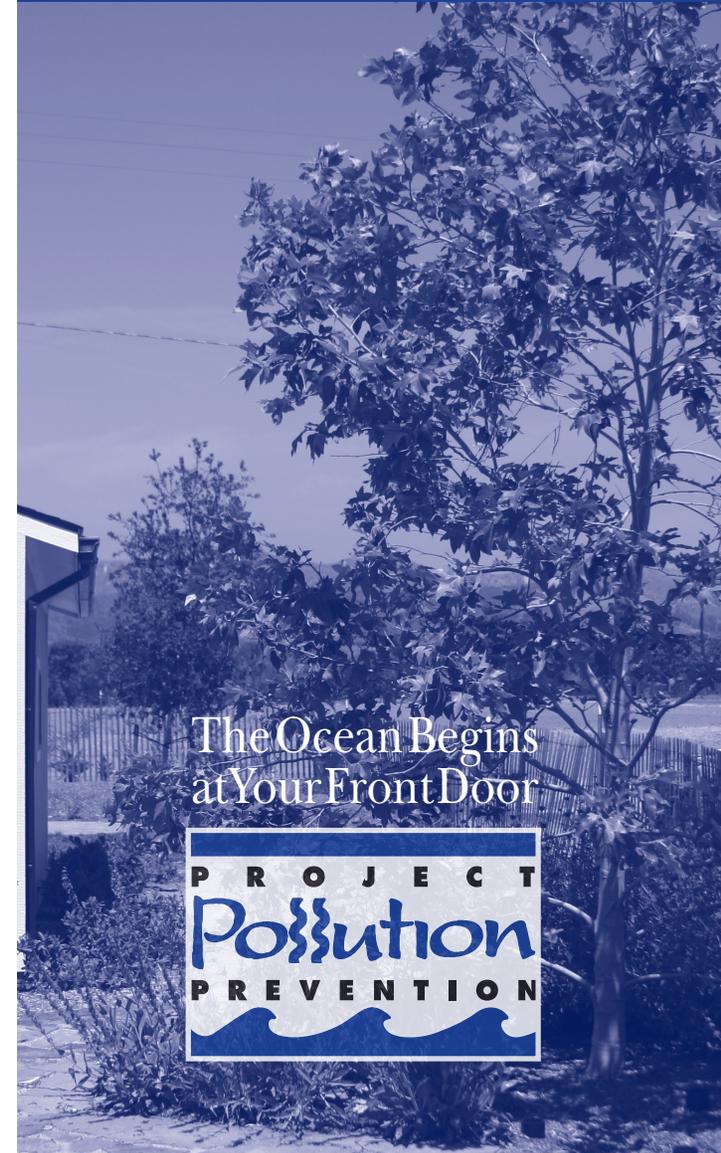
Funding for this brochure has been provided in full
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Costa-Machado Water Act of 2000 (Prop. 13).



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Help Prevent Ocean Pollution:

Responsible Pest Control



The Ocean Begins
at Your Front Door



Tips for Pest Control

Key Steps to Follow:

Step 1: Correctly identify the pest (insect, weed, rodent, or disease) and verify that it is actually causing the problem.



This is important because beneficial insects are often mistaken for pests and sprayed with pesticides needlessly.

Consult with a Certified Nursery Professional at a local nursery or garden center or send a sample of the pest to the Orange County Agricultural Commissioner's Office.

Determine if the pest is still present – even though you see damage, the pest may have left.

Step 2: Determine how many pests are present and causing damage.



Small pest populations may be controlled more safely using non-pesticide techniques. These include removing food sources, washing off leaves with a strong stream of water, blocking entry into the home using caulking and replacing problem plants with ones less susceptible to pests.

Integrated Pest Management (IPM) usually combines several least toxic pest control methods for long-term prevention and management of pest problems without harming you, your family, or the environment.



Step 3: If a pesticide must be used, choose the least toxic chemical.

Obtain information on the least toxic pesticides that are effective at controlling the target pest from the UC Statewide Integrated Pest Management (IPM) Program's Web site at www.ipm.ucdavis.edu.

Seek out the assistance of a Certified Nursery Professional at a local nursery or garden center when selecting a pesticide. Purchase the smallest amount of pesticide available.

Apply the pesticide to the pest during its most vulnerable life stage. This information can be found on the pesticide label.

Step 4: Wear appropriate protective clothing.

Follow pesticide labels regarding specific types of protective equipment you should wear. Protective clothing should always be washed separately from other clothing.

Step 5: Continuously monitor external conditions when applying pesticides such as weather, irrigation, and the presence of children and animals.

Never apply pesticides when rain is predicted within the next 48 hours. Also, do not water after applying pesticides unless the directions say it is necessary.

Apply pesticides when the air is still; breezy conditions may cause the spray or dust to drift away from your targeted area.

In case of an emergency call 911 and/or the regional poison control number at (714) 634-5988 or (800) 544-4404 (CA only).

For general questions you may also visit www.calpoison.org.

Step 6: In the event of accidental spills, sweep up or use an absorbent agent to remove any excess pesticides. Avoid the use of water.

Be prepared. Have a broom, dust pan, or dry absorbent material, such as cat litter, newspapers or paper towels, ready to assist in cleaning up spills.

Contain and clean up the spill right away. Place contaminated materials in a doubled plastic bag. All materials used to clean up the spill should be properly disposed of according to your local Household Hazardous Waste Disposal site.

Step 7: Properly store and dispose of unused pesticides.

Purchase Ready-To-Use (RTU) products to avoid storing large concentrated quantities of pesticides.



Store unused chemicals in a locked cabinet.

Unused pesticide chemicals may be disposed of at a Household Hazardous Waste Collection Center.

Empty pesticide containers should be triple rinsed prior to disposing of them in the trash.

Household Hazardous Waste
Collection Center
(714) 834-6752
www.oilandfills.com



IC7. LANDSCAPE MAINTENANCE

Best Management Practices (BMPs)

A BMP is a technique, measure or structural control that is used for a given set of conditions to improve the quality of the stormwater runoff in a cost effective manner¹. The minimum required BMPs for this activity are outlined in the box to the right. Implementation of pollution prevention/good housekeeping measures may reduce or eliminate the need to implement other more costly or complicated procedures. Proper employee training is key to the success of BMP implementation.

The BMPs outlined in this fact sheet target the following pollutants:

Targeted Constituents	
Sediment	x
Nutrients	x
Floatable Materials	x
Metals	
Bacteria	x
Oil & Grease	
Organics & Toxicants	
Pesticides	x
Oxygen Demanding	x

MINIMUM BEST MANAGEMENT PRACTICES

Pollution Prevention/Good Housekeeping

- Properly store and dispose of gardening wastes.
- Use mulch or other erosion control measures on exposed soils.
- Properly manage irrigation and runoff.
- Properly store and dispose of chemicals.
- Properly manage pesticide and herbicide use.
- Properly manage fertilizer use.

Stencil storm drains

Training

- Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.
- Provide on-going employee training in pollution prevention.

Provided below are specific procedures associated with each of the minimum BMPs along with procedures for additional BMPs that should be considered if this activity takes place at a facility located near a sensitive waterbody. In order to meet the requirements for medium and high priority facilities, the owners/operators must select, install and maintain appropriate BMPs on site. Since the selection of the appropriate BMPs is a site-specific process, the types and numbers of additional BMPs will vary for each facility.

1. Take steps to reduce landscape maintenance requirements.

- Where feasible, retain and/or plant native vegetation with features that are determined to be beneficial. Native vegetation usually requires less maintenance than planting new vegetation.
- When planting or replanting consider using low water use flowers, trees, shrubs, and groundcovers.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.

2. Properly store and dispose of gardening wastes.

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage at a permitted landfill or by composting.
- Do not dispose of gardening wastes in streets, waterways, or storm drainage systems.
- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm and/or cover.

3. Use mulch or other erosion control measures on exposed soils.

¹ EPA " Preliminary Data Summary of Urban Stormwater Best Management Practices"

4. Properly manage irrigation and runoff.

- Irrigate slowly or pulse irrigate so the infiltration rate of the soil is not exceeded.
- Inspect irrigation system regularly for leaks and to ensure that excessive runoff is not occurring.
- 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.
- Use automatic timers to minimize runoff.
- Use popup sprinkler heads in areas with a lot of activity or where pipes may be broken. Consider the use of mechanisms that reduce water flow to broken sprinkler heads.

5. Properly store and dispose of chemicals.

- Implement storage requirements for pesticide products with guidance from the local fire department and/or County Agricultural Commissioner.
- Provide secondary containment for chemical storage.
- Dispose of empty containers according to the instructions on the container label.
- Triple rinse containers and use rinse water as product.

6. Properly manage pesticide and herbicide use.

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of pesticides and herbicides and training of applicators and pest control advisors.
- Follow manufacturers' recommendations and label directions.
- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule). When applicable use less toxic pesticides that will do the job. Avoid use of copper-based pesticides if possible. Use the minimum amount of chemicals needed for the job.
- Do not apply pesticides if rain is expected or if wind speeds are above 5 mph.
- Do not mix or prepare pesticides 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 targeted pest.
- Whenever possible, use mechanical methods of vegetation removal rather than applying herbicides. Use hand weeding where practical.
- Do not apply any chemicals directly to surface waters, unless the application is approved and permitted by the state. Do not spray pesticides within 100 feet of open waters.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- When conducting mechanical or manual weed control, avoid loosening the soil, which could lead to erosion.
- Purchase only the amount of pesticide that you can reasonably use in a given time period.
- 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.

7. Properly manage fertilizer use.

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers.
- Follow manufacturers' recommendations and label directions.
- Employ techniques to minimize off-target application (e.g. spray drift) of fertilizer, including consideration of alternative application techniques. Calibrate fertilizer distributors to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Use slow release fertilizers whenever possible to minimize leaching

8. Incorporate the following integrated pest management techniques where appropriate:

- Mulching can be used to prevent weeds where turf is absent.
- Remove insects by hand and place in soapy water or vegetable oil. Alternatively, remove insects with water or vacuum them off the plants.
- Use species-specific traps (e.g. pheromone-based traps or colored sticky cards).
- Sprinkle the ground surface with abrasive diatomaceous earth to prevent infestations by soft-bodied insects and slugs. Slugs also can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
- In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
- Small mammals and birds can be excluded using fences, netting, and tree trunk guards.
- Promote beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders that prey on detrimental pest species.

Training

- 1. Train employees on these BMPs, storm water discharge prohibitions, and wastewater discharge requirements.**
- 2. Educate and train employees on the use of pesticides and pesticide application techniques. Only employees properly trained to use pesticides can apply them.**
- 3. Train and encourage employees to use integrated pest management techniques.**
- 4. Train employees on proper spill containment and cleanup.**
 - Establish training that provides employees with the proper tools and knowledge to immediately begin cleaning up a spill.
 - Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
 - Fact sheet IC17 discusses Spill Prevention and Control in detail.
- 5. Establish a regular training schedule, train all new employees, and conduct annual refresher training.**
- 6. Use a training log or similar method to document training.**

Stencil storm drains

Storm drain system signs act as highly visible source controls that are typically stenciled directly adjacent to storm drain inlets. Stencils should read "No Dumping Drains to Ocean".

References

California Storm Water Best Management Practice Handbook. Industrial and Commercial. 2003. www.cabmphandbooks.com

California Storm Water Best Management Practice Handbooks. Industrial/Commercial 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.

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. King County Surface Water Management. July 1995. On-line: <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Stormwater Management Manual for Western Washington. Volume IV Source Control BMPs. Prepared by Washington State Department of Ecology Water Quality Program. Publication No. 99-14. August 2001.

Water Quality Handbook for Nurseries. Oklahoma Cooperative Extension Service. Division of Agricultural Sciences and Natural Resources. Oklahoma State University. E-951. September 1999.

For additional information contact:

County of Orange/ OC Watersheds

Main: (714) 955-0600

24 hr Water Pollution Hotline: 1-877-89-SPILL

or visit our website at www.ocwatersheds.com



Objectives

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

Description

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

Approach

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

Targeted Constituents

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



Pollution Prevention

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

Suggested Protocols***Recommended Complaint Investigation Equipment***

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

General

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

- See SC44 Stormwater Drainage System Maintenance for additional information.

Illicit Connections

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

Visual Inspection and Inventory

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

Review Infield Piping

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

Smoke Testing

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

Dye Testing

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

TV Inspection of Drainage System

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

Illegal Dumping

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

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

Once a site has been cleaned:

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

Inspection

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

Reporting

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

Training

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

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

Spill Response and Prevention

- See SC11 Spill Prevention Control and Cleanup.

Other Considerations

- Many facilities do not have accurate, up-to-date schematic drawings.

Requirements

Costs (including capital and operation & maintenance)

- The primary cost is for staff time and depends on how aggressively a program is implemented.
- Cost for containment and disposal is borne by the discharger.
- Illicit connections can be difficult to locate especially if there is groundwater infiltration.
- Indoor floor drains may require re-plumbing if cross-connections to storm drains are detected.

Maintenance (including administrative and staffing)

- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Further Detail of the BMP

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. All of these wastes cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- Establish a system for tracking incidents. The system should be designed to identify the following:
 - Illegal dumping hot spots

- Types and quantities (in some cases) of wastes
- Patterns in time of occurrence (time of day/night, month, or year)
- Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills)
- Responsible parties

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

What constitutes a “non-stormwater” discharge?

- Non-stormwater discharges to the stormwater collection system may include any water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

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

Performance Evaluation

- Review annually internal investigation results; assess whether goals were met and what changes or improvements are necessary.
- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.

References and Resources

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

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

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

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

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



Objectives

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

Description

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

Approach

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

Pollution Prevention

- Keep accurate maintenance logs to evaluate materials removed and improvements made.
- Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- Limit exposure of material to rainfall whenever possible.
- Prevent stormwater run-on.
- Check equipment regularly for leaks.

Targeted Constituents

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



Suggested Protocols***Loading and Unloading – General Guidelines***

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

Inspection

- Check loading and unloading equipment regularly for leaks, including valves, pumps, flanges and connections.
- Look for dust or fumes during loading or unloading operations.

Training

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

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Contain leaks during transfer.
- Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all and ensure that employees are familiar with the site's spill control plan and proper spill cleanup procedures.
- Have an emergency spill cleanup plan readily available.
- Use drip pans or comparable devices when transferring oils, solvents, and paints.

Other Considerations (Limitations and Regulations)

- Space and time limitations may preclude all transfers from being performed indoors or under cover.
- It may not be possible to conduct transfers only during dry weather.

Requirements

Costs

Costs should be low except when covering a large loading/unloading area.

Maintenance

- Conduct regular inspections and make repairs as necessary. The frequency of repairs will depend on the age of the facility.
- Check loading and unloading equipment regularly for leaks.
- Conduct regular broom dry-sweeping of area.

Supplemental Information

Further Detail of the BMP

Special Circumstances for Indoor Loading/Unloading of Materials

Loading or unloading of liquids should occur in the manufacturing building so that any spills that are not completely retained can be discharged to the sanitary sewer, treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
 - The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
 - The transfer area should be designed to prevent run-on of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.

- The transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer. A positive control valve should be installed on the drain.
- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:
 - Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles. Use drip pans when making and breaking connections.
 - Drip pan systems should be installed between the rails to collect spillage from tank cars.

References and Resources

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

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

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

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

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



Objectives

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

Description

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

Approach

Pollution Prevention

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

Targeted Constituents

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



Suggested Protocols*General*

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run-on and runoff with a berm. The waste containers or piles must be covered except when in use.
- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
- Check storage containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the storage area regularly. If it is paved, do not hose down the area to a storm drain.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain.
- Transfer waste from damaged containers into safe containers.
- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.

Controlling Litter

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

Waste Collection

- Keep waste collection areas clean.
- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.

Good Housekeeping

- Use all of the product before disposing of the container.
- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.

Chemical/Hazardous Wastes

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers and protect them from vandalism.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.

Run-on/Runoff Prevention

- Prevent stormwater run-on from entering the waste management area by enclosing the area or building a berm around the area.
- Prevent waste materials from directly contacting rain.
- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- Cover the area with a permanent roof if feasible.
- Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- Move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.

Inspection

- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Check waste management areas for leaking containers or spills.

- Repair leaking equipment including valves, lines, seals, or pumps promptly.

Training

- Train staff in pollution prevention measures and proper disposal methods.
- Train employees and contractors in proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.
- Train employees and subcontractors in proper hazardous waste management.

Spill Response and Prevention

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

Other Considerations (Limitations and Regulations)

Hazardous waste cannot be reused or recycled; it must be disposed of by a licensed hazardous waste hauler.

Requirements***Costs***

Capital and O&M costs for these programs will vary substantially depending on the size of the facility and the types of waste handled. Costs should be low if there is an inventory program in place.

Maintenance

- None except for maintaining equipment for material tracking program.

Supplemental Information***Further Detail of the BMP******Land Treatment System***

Minimize runoff of polluted stormwater from land application by:

- Choosing a site where slopes are under 6%, the soil is permeable, there is a low water table, it is located away from wetlands or marshes, and there is a closed drainage system

- Avoiding application of waste to the site when it is raining or when the ground is saturated with water
- Growing vegetation on land disposal areas to stabilize soils and reduce the volume of surface water runoff from the site
- Maintaining adequate barriers between the land application site and the receiving waters (planted strips are particularly good)
- Using erosion control techniques such as mulching and matting, filter fences, straw bales, diversion terracing, and sediment basins
- Performing routine maintenance to ensure the erosion control or site stabilization measures are working

Examples

The port of Long Beach has a state-of-the-art database for identifying potential pollutant sources, documenting facility management practices, and tracking pollutants.

References and Resources

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

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

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

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



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.

Objectives

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

Targeted Constituents

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



SC-41 Building & Grounds Maintenance

- 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.

SC-41 Building & Grounds Maintenance

- 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



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.

Objectives

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

Targeted Constituents

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



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.

Parking/Storage Area Maintenance SC-43

- 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>

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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/>



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Approach

Pollution Prevention

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Suggested Protocols

Catch Basins/Inlet Structures

- Staff should regularly inspect facilities to ensure compliance with the following:
 - Immediate repair of any deterioration threatening structural integrity.
 - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
 - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

Targeted Constituents

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



SC-44 Drainage System Maintenance

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

Storm Drain Conveyance System

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

Pump Stations

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

Open Channel

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

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
 - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?
- Record locations of apparent illegal discharges/illicit connections?
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Eliminate the discharge once the origin of flow is established.
- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
 - Illegal dumping hot spots
 - Types and quantities (in some cases) of wastes
 - Patterns in time of occurrence (time of day/night, month, or year)
 - Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills)
 - Responsible parties
- Post “No Dumping” signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- Have staff involved in detection and removal of illicit connections trained in the following:
 - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Clean up all spills and leaks using “dry” methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements***Costs***

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:
 - Purchase and installation of signs.
 - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.
 - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.
 - Purchase of landfill space to dispose of illegally-dumped items and material.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

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

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

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

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

SC-44 Drainage System Maintenance

References and Resources

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

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

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

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

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm



Objectives

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

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>

Description

Streets, roads, and highways are significant sources of pollutants in stormwater discharges, and operation and maintenance (O&M) practices, if not conducted properly, can contribute to the problem. Stormwater pollution from roadway and bridge maintenance should be addressed on a site-specific basis. Use of the procedures outlined below, that address street sweeping and repair, bridge and structure maintenance, and unpaved roads will reduce pollutants in stormwater.

Approach

Pollution Prevention

- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal)
- Recycle paint and other materials whenever possible.
- Enlist the help of citizens to keep yard waste, used oil, and other wastes out of the gutter.

Suggested Protocols

Street Sweeping and Cleaning

- Maintain a consistent sweeping schedule. Provide minimum monthly sweeping of curbed streets.
- Perform street cleaning during dry weather if possible.



- Avoid wet cleaning or flushing of street, and utilize dry methods where possible.
- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc. For example:
 - Increase the sweeping frequency for streets with high pollutant loadings, especially in high traffic and industrial areas.
 - Increase the sweeping frequency just before the wet season to remove sediments accumulated during the summer.
 - Increase the sweeping frequency for streets in special problem areas such as special events, high litter or erosion zones.
- Maintain cleaning equipment in good working condition and purchase replacement equipment as needed. Old sweepers should be replaced with new technologically advanced sweepers (preferably regenerative air sweepers) that maximize pollutant removal.
- Operate sweepers at manufacturer requested optimal speed levels to increase effectiveness.
- To increase sweeping effectiveness consider the following:
 - Institute a parking policy to restrict parking in problematic areas during periods of street sweeping.
 - Post permanent street sweeping signs in problematic areas; use temporary signs if installation of permanent signs is not possible.
 - Develop and distribute flyers notifying residents of street sweeping schedules.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- If available use vacuum or regenerative air sweepers in the high sediment and trash areas (typically industrial/commercial).
- Keep accurate logs of the number of curb-miles swept and the amount of waste collected.
- Dispose of street sweeping debris and dirt at a landfill.
- Do not store swept material along the side of the street or near a storm drain inlet.
- Keep debris storage to a minimum during the wet season or make sure debris piles are contained (e.g. by berming the area) or covered (e.g. with tarps or permanent covers).

Street Repair and Maintenance

Pavement marking

- Schedule pavement marking activities for dry weather.

- Develop paint handling procedures for proper use, storage, and disposal of paints.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.
- Provide drop cloths and drip pans in paint mixing areas.
- Properly maintain application equipment.
- Street sweep thermoplastic grindings. Yellow thermoplastic grindings may require special handling as they may contain lead.
- Paints containing lead or tributyltin are considered a hazardous waste and must be disposed of properly.
- Use water based paints whenever possible. If using water based paints, clean the application equipment in a sink that is connected to the sanitary sewer.
- Properly store leftover paints if they are to be kept for the next job, or dispose of properly.

Concrete installation and repair

- Schedule asphalt and concrete activities for dry weather.
- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place sandbags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- When making saw cuts in pavement, use as little water as possible and perform during dry weather. Cover each storm drain inlet completely with filter fabric or plastic during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site. Alternatively, a small onsite vacuum may be used to pick up the slurry as this will prohibit slurry from reaching storm drain inlets.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

Patching, resurfacing, and surface sealing

- Schedule patching, resurfacing and surface sealing for dry weather.
- Stockpile materials away from streets, gutter areas, storm drain inlets or watercourses. During wet weather, cover stockpiles with plastic tarps or berm around them if necessary to prevent transport of materials in runoff.
- Pre-heat, transfer or load hot bituminous material away from drainage systems or watercourses.
- Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and maintenance holes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from covered maintenance holes and storm drain inlets when the job is complete.
- Prevent excess material from exposed aggregate concrete or similar treatments from entering streets or storm drain inlets. Designate an area for clean up and proper disposal of excess materials.
- Use only as much water as necessary for dust control, to avoid runoff.
- Sweep, never hose down streets to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains.
- 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.

Equipment cleaning maintenance and storage

- Inspect equipment daily and repair any leaks. Place drip pans or absorbent materials under heavy equipment when not in use.
- Perform major equipment repairs at the corporation yard, when practical.
- If refueling or repairing vehicles and equipment must be done onsite, use a location away from storm drain inlets and watercourses.
- Clean equipment including sprayers, sprayer paint supply lines, patch and paving equipment, and mud jacking equipment at the end of each day. Clean in a sink or other area (e.g. vehicle wash area) that is connected to the sanitary sewer.

*Bridge and Structure Maintenance**Paint and Paint Removal*

- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Do not transfer or load paint near storm drain inlets or watercourses.

- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint container.
- Plug nearby storm drain inlets prior to starting painting where there is significant risk of a spill reaching storm drains. Remove plugs when job is completed.
- If sand blasting is used to remove paint, cover nearby storm drain inlets prior to starting work.
- Perform work on a maintenance traveler or platform, or use suspended netting or tarps to capture paint, rust, paint removing agents, or other materials, to prevent discharge of materials to surface waters if the bridge crosses a watercourse. If sanding, use a sander with a vacuum filter bag.
- Capture all clean-up water, and dispose of properly.
- Recycle paint when possible (e.g. paint may be used for graffiti removal activities). Dispose of unused paint at an appropriate household hazardous waste facility.

Graffiti Removal

- Schedule graffiti removal activities for dry weather.
- Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.
- When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal above.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a landscaped or dirt area. If such an area is not available, filter runoff through an appropriate filtering device (e.g. filter fabric) to keep sand, particles, and debris out of storm drains.
- If a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound), plug nearby storm drains and vacuum/pump wash water to the sanitary sewer.
- Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).

Repair Work

- Prevent concrete, steel, wood, metal parts, tools, or other work materials from entering storm drains or watercourses.
- Thoroughly clean up the job site when the repair work is completed.
- When cleaning guardrails or fences follow the appropriate surface cleaning methods (depending on the type of surface) outlined in SC-71 Plaza & Sidewalk Cleaning fact sheet.

- If painting is conducted, follow the painting and paint removal procedures above.
- If graffiti removal is conducted, follow the graffiti removal procedures above.
- If construction takes place, see the Construction Activity BMP Handbook.
- Recycle materials whenever possible.

Unpaved Roads and Trails

- Stabilize exposed soil areas to prevent soil from eroding during rain events. This is particularly important on steep slopes.
- For roadside areas with exposed soils, the most cost-effective choice is to vegetate the area, preferably with a mulch or binder that will hold the soils in place while the vegetation is establishing. Native vegetation should be used if possible.
- If vegetation cannot be established immediately, apply temporary erosion control mats/blankets; a comma straw, or gravel as appropriate.
- If sediment is already eroded and mobilized in roadside areas, temporary controls should be installed. These may include: sediment control fences, fabric-covered triangular dikes, gravel-filled burlap bags, biobags, or hay bales staked in place.

Non-Stormwater Discharges

Field crews should be aware of non-stormwater discharges as part of their ongoing street maintenance efforts.

- Refer to SC-10 Non-Stormwater Discharges
- Identify location, time and estimated quantity of discharges.
- Notify appropriate personnel.

Training

- Train employees regarding proper street sweeping operation and street repair and maintenance.
- Instruct employees and subcontractors to ensure that measures to reduce the stormwater impacts of roadway/bridge maintenance are being followed.
- Require engineering staff and/or consulting A/E firms to address stormwater quality in new bridge designs or existing bridge retrofits.
- Use a training log or similar method to document training.
- Train employees on proper spill containment and clean up, and in identifying non-stormwater discharges.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan 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

- Densely populated areas or heavily used streets may require parking regulations to clear streets for cleaning.
- No currently available conventional sweeper is effective at removing oil and grease. Mechanical sweepers are not effective at removing finer sediments.
- Limitations may arise in the location of new bridges. The availability and cost of land and other economic and political factors may dictate where the placement of a new bridge will occur. Better design of the bridge to control runoff is required if it is being placed near sensitive waters.

Requirements

Costs

- The maintenance of local roads and bridges is already a consideration of most community public works or transportation departments. Therefore, the cost of pollutant reducing management practices will involve the training and equipment required to implement these new practices.
- The largest expenditures for street sweeping programs are in staffing and equipment. The capital cost for a conventional street sweeper is between \$60,000 and \$120,000. Newer technologies might have prices approaching \$180,000. The average useful life of a conventional sweeper is about four years, and programs must budget for equipment replacement. Sweeping frequencies will determine equipment life, so programs that sweep more often should expect to have a higher cost of replacement.
- A street sweeping program may require the following.
 - Sweeper operators, maintenance, supervisory, and administrative personnel are required.
 - Traffic control officers may be required to enforce parking restrictions.
 - Skillful design of cleaning routes is required for program to be productive.
 - Arrangements must be made for disposal of collected wastes.

- If investing in newer technologies, training for operators must be included in operation and maintenance budgets. Costs for public education are small, and mostly deal with the need to obey parking restrictions and litter control. Parking tickets are an effective reminder to obey parking rules, as well as being a source of revenue.

Maintenance

- Not applicable

Supplemental Information***Further Detail of the BMP******Street sweeping***

There are advantages and disadvantages to the two common types of sweepers. The best choice depends on your specific conditions. Many communities find it useful to have a compliment of both types in their fleet.

Mechanical Broom Sweepers - More effective at picking up large debris and cleaning wet streets. Less costly to purchase and operate. Create more airborne dust.

Vacuum Sweepers - More effective at removing fine particles and associated heavy metals. Ineffective at cleaning wet streets. Noisier than mechanical broom sweepers which may restrict areas or times of operation. May require an advance vehicle to remove large debris.

Street Flushers - Not affected by biggest interference to cleaning, parked cars. May remove finer sediments, moving them toward the gutter and stormwater inlets. For this reason, flushing fell out of favor and is now used primarily after sweeping. Flushing may be effective for combined sewer systems. Presently street flushing is not allowed under most NPDES permits.

Cross-Media Transfer of Pollutants

The California Air Resources Board (ARB) has established state ambient air quality standards including a standard for respirable particulate matter (less than or equal to 10 microns in diameter, symbolized as PM₁₀). In the effort to sweep up finer sediments to remove attached heavy metals, municipalities should be aware that fine dust, that cannot be captured by the sweeping equipment and becomes airborne, could lead to issues of worker and public safety.

Bridges

Bridges that carry vehicular traffic generate some of the more direct discharges of runoff to surface waters. Bridge scupper drains cause a direct discharge of stormwater into receiving waters and have been shown to carry relatively high concentrations of pollutants. Bridge maintenance also generates wastes that may be either directly deposited to the water below or carried to the receiving water by stormwater. The following steps will help reduce the stormwater impacts of bridge maintenance:

- Site new bridges so that significant adverse impacts to wetlands, sensitive areas, critical habitat, and riparian vegetation are minimized.

- Design new bridges to avoid the use of scupper drains and route runoff to land for treatment control. Existing scupper drains should be cleaned on a regular basis to avoid sediment/debris accumulation.
- Reduce the discharge of pollutants to surface waters during maintenance by using suspended traps, vacuums, or booms in the water to capture paint, rust, and paint removing agents. Many of these wastes may be hazardous. Properly dispose of this waste by referring to CA21 (Hazardous Waste Management) in the Construction Handbook.
- Train employees and subcontractors to reduce the discharge of wastes during bridge maintenance.

De-icing

- Do not over-apply deicing salt and sand, and routinely calibrate spreaders.
- Near reservoirs, restrict the application of deicing salt and redirect any runoff away from reservoirs.
- Consider using alternative deicing agents (less toxic, biodegradable, etc.).

References and Resources

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.

Orange County Stormwater Program

http://www.ocwatersheds.com/stormwater/swp_introduction.asp

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

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. 2001. Fresh Concrete and Mortar Application Best Management Practices for the Construction Industry. June.

Santa Clara Valley Urban Runoff Pollution Prevention Program. 2001. Roadwork and Paving Best Management Practices for the Construction Industry. June.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Roadway and Bridge Maintenance. On-line http://www.epa.gov/npdes/menuofbmps/poll_13.htm

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.



SD-10 Site Design & Landscape Planning

Designing New Installations

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

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

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

Conserve Natural Areas during Landscape Planning

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

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

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

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

Site Design & Landscape Planning SD-10

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.

SD-10 Site Design & Landscape Planning

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.



Design Objectives

- Maximize Infiltration
- Provide Retention
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- 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.



- 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.

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Design Objectives

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- 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.

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.

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.

Design Objectives

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



- 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.

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Design Objectives

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- Prohibit Dumping of Improper Materials
- ✓ Contain Pollutant
- Collect and Convey

Description

Proper design of outdoor storage areas for materials reduces opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the stormwater conveyance system. Materials may be in the form of raw products, by-products, finished products, and waste products. The type of pollutants associated with the materials will vary depending on the type of commercial or industrial activity.

Approach

Outdoor storage areas require a drainage approach different from the typical infiltration/detention strategy. In outdoor storage areas, infiltration is discouraged. Containment is encouraged. Preventative measures include enclosures, secondary containment structures and impervious surfaces.

Suitable Applications

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

Design Considerations

Some materials are more of a concern than others. Toxic and hazardous materials must be prevented from coming in contact with stormwater. Non-toxic or non-hazardous materials do not have to be prevented from stormwater contact. However, these materials may have toxic effects on receiving waters if allowed to be discharged with stormwater in significant quantities. Accumulated material on an impervious surface could result in significant impact on the rivers or streams that receive the runoff.

Material may be stored in a variety of ways, including bulk piles, containers, shelving, stacking, and tanks. Stormwater contamination may be prevented by eliminating the possibility of stormwater contact with the material storage areas either through diversion, cover, or capture of the stormwater. Control measures may also include minimizing the storage area. Design requirements



SD-34 Outdoor Material Storage Areas

for material storage areas are governed by Building and Fire Codes, and by current City or County ordinances and zoning requirements. Control measures are site specific, and must meet local agency requirements.

Designing New Installations

Where proposed project plans include outdoor areas for storage of materials that may contribute pollutants to the stormwater conveyance system, the following structural or treatment BMPS should be considered:

- Materials with the potential to contaminate stormwater should be: (1) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the stormwater conveyance system, or (2) protected by secondary containment structures such as berms, dikes, or curbs.
- The storage area should be paved and sufficiently impervious to contain leaks and spills.
- The storage area should slope towards a dead-end sump to contain spills and direct runoff from downspouts/roofs should be directed away from storage areas.
- The storage area should have a roof or awning that extends beyond the storage area to minimize collection of stormwater within the secondary containment area. A manufactured storage shed may be used for small containers.

Note that the location(s) of installations of where these preventative measures will be employed must be included on the map or plans identifying BMPs.

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

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permits.

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.

Outdoor Material Storage Areas SD-34

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.

Attachment G – 303d List

2010 California 303(d) List of Water Quality Limited Segments*

Water quality limited segments requiring a TMDL(5A), being addressed by TMDL(5B), and/or being addressed by an action other than TMDL(5C).

REGION	REGION NAME	WATER BODY NAME	WBID	WATER BODY TYPE	WBTYPE CODE	INTEGRATED REPORT CATEGORY	USGS CATALOGING UNIT*	CALWATER WATERSHED	ESTIMATED SIZE AFFECTED	UNIT	POLLUTANT	POLLUTANT CATEGORY	FINAL LISTING DECISION	TMDL REQUIREMENT STATUS**	EXPECTED TMDL COMPLETION DATE***	EXPECTED ATTAINMENT DATE***	USEPA TMDL APPROVED DATE***	COMMENTS INCLUDED ON 303(d) LIST
6	Regional Board 6 - Lahontan Region	Mojave River (Mojave Forks Reservoir outlet to Upper Narrows)	CAR6282000020080816195148	River & Stream	R	5	18090208	62820000	15	Miles	Fluoride	Other Inorganics	List on 303(d) list (TMDL required list)	5A	2021			
6	Regional Board 6 - Lahontan Region	Mojave River (Upper Narrows to Lower Narrows)	CAR6282000020080817142158	River & Stream	R	5	18090208	62820000	4.0	Miles	Fluoride	Other Inorganics	List on 303(d) list (TMDL required list)	5A	2021			
6	Regional Board 6 - Lahontan Region	Mojave River (Upper Narrows to Lower Narrows)	CAR6282000020080817142158	River & Stream	R	5	18090208	62820000	4.0	Miles	Sulfates	Other Inorganics	List on 303(d) list (TMDL required list)	5A	2021			
6	Regional Board 6 - Lahontan Region	Mojave River (Upper Narrows to Lower Narrows)	CAR6282000020080817142158	River & Stream	R	5	18090208	62820000	4.0	Miles	Total Dissolved Solids	Salinity	List on 303(d) list (TMDL required list)	5A	2021			

Attachment H – Operation and Maintenance Plan

**Infiltration/Detention Basin Maintenance Plan for
Victorville Parcel Map 18487 – Victorville, CA**

February 2017

Project Address and Cross Streets: Victorville Parcel Map 18487

Assessor's Parcel No.: 3096-361-02

Property Owner: Everett L Grimes Phone No.: (760) 261-8253

Designated Contact: _____ Phone No.: _____

Mailing Address: _____

The property contains 1 infiltration/detention basin located as described below and as shown in the attached site plan

Infiltration/Detention Basin is the method of treatment for the drainage area.

DMA-1 direct flow from impervious areas to the infiltration/detention basin where storm water can infiltrate.

Routine Maintenance Activities

The principal maintenance objectives are to ensure that water flows unimpeded into the infiltration/detention basin and landscaping remains attractive in appearance. Table 1 shows the routine maintenance activities, and the frequency at which they will be conducted.

Table 1 Routine Maintenance Activities for the Infiltration/Detention Basin		
No.	Maintenance Task	Frequency of Task
1	Remove and replace all dead and diseased vegetation. Treat vegetation using preventative and low-toxic methods.	Twice a year
2	Maintain vegetation. Prune and weed to keep flow- through infiltration/detention basin neat and orderly in appearance.	As needed
3	Check that soil is at appropriate depth.	Before wet season and as necessary
4	Remove accumulated sediment, litter, and debris from the infiltration/detention basin and dispose of properly. Confirm that no clogging will occur and that the riser is not clogged.	Before wet season and as necessary
5	Inspect infiltration/detention basin using the attached inspection checklist.	Monthly, or after large storm events, and after

Prohibitions

The use of pesticides and quick release fertilizers shall be minimized, and the principles of integrated pest management (IPM) followed:

1. Employ non-chemical controls (biological, physical and cultural controls) before using chemicals to treat a pest problem.
2. Prune plants properly and at the appropriate time of year.
3. Provide adequate irrigation for landscape plants. Do not over water.
4. Limit fertilizer use unless soil testing indicates a deficiency. Slow-release or organic fertilizer is preferable. Check with municipality for specific requirements.
5. Pest control should avoid harming non-target organisms, or negatively affecting air and water quality and public health. Apply chemical controls only when monitoring indicates that preventative and non-chemical methods are not keeping pests below acceptable levels. When pesticides are required, apply the least toxic and the least persistent pesticide that will provide adequate pest control. Do not apply pesticides on a prescheduled basis.
6. Sweep up spilled fertilizer and pesticides. Do not wash away or bury such spills.
7. Do not over apply pesticide. Spray only where the infestation exists. Follow the manufacturer's instructions for mixing and applying materials.
8. Only licensed, trained pesticide applicators shall apply pesticides.
9. Apply pesticides at the appropriate time to maximize their effectiveness and minimize the likelihood of discharging pesticides into runoff. With the exception of pre-emergent pesticides, avoid application if rain is expected.
10. Unwanted/unused pesticides shall be disposed as hazardous waste.

Inspections

The attached infiltration/detention basin Inspection and Maintenance Checklist shall be used to conduct inspections monthly (or as needed), identify needed maintenance, and record maintenance that is conducted.

Infiltration/Detention Basin Inspection and Maintenance Checklist

Property Address: Victorville Parcel Map 18487 (APN: 3096-361-02)

Property Owner: Everett L Grimes

Date of Inspection: _____ Type of Inspection: Monthly Pre-Wet Season

After heavy runoff End of Wet Season

Inspector(s): _____ Other: _____

Defect	Conditions When Maintenance Is Needed	Maintenance Needed? (Y/N)	Comments (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)	Results Expected When Maintenance Is Performed
1. Vegetation	Vegetation is dead, diseased and/or overgrown.			Vegetation is healthy and attractive in appearance.
2. Soil	Soil too deep or too shallow.			Soil is at proper depth (per soil specifications) for optimum filtration and flow.
3. Sediment, Trash and Debris Accumulation	Sediment, trash and debris accumulated in the infiltration/detention basin. Basin is not infiltrating.			Sediment, trash and debris removed from the infiltration/detention basin and disposed of properly. Basin drains within 48 hours.
4. Clogs	Soil too deep or too shallow. Sediment, trash and debris accumulated in the infiltration/detention basin. Riser is clogged.			Basin infiltrates per design specifications.
5. Miscellaneous	Any condition not covered above that needs attention in order for the flow-through the storm drain system/infiltration basin to function as designed.			Meet the design specifications.

Attachment I – Basin Routing Calculations

Project Summary

Title	Victorville Parcel Map
Engineer	
Company	Kimley-Horn and Associates
Date	5/24/2018

Notes

Due to a ridge line bisecting the site, the develop site requires an onsite storm drain system to convey flows to the infiltration basin located on the southeast portion of the parcel. The interior storm drain system was sized using the associated catch basin flows and it was determined that a 24-inch diameter pipe will conveyed the flows at a 0.64% slope within the streets to the catch basin adjacent to the infiltration basin. The flows will then confluence into a 36-inch diameter pipe and are conveyed into the basin. The basin will have a 24 inch diameter riser with seven (7) 3" orifices to control runoff from the infiltration basin. The onsite infiltration basin was sized by routing the developed 35.17 cfs.

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Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft ³)	Time to Peak (min)	Peak Flow (ft ³ /s)
On-site Area	Post-Development 100	0	269,730.000	1,000.000	35.17

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft ³)	Time to Peak (min)	Peak Flow (ft ³ /s)
O-1	Post-Development 100	0	250,204.000	1,020.000	22.35

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft ³)	Time to Peak (min)	Peak Flow (ft ³ /s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft ³)
Underground Vault (IN)	Post-Development 100	0	276,570.000	1,000.000	35.17	(N/A)	(N/A)
Underground Vault (OUT)	Post-Development 100	0	250,204.000	1,020.000	22.35	3,217.51	87,186.000

Subsection: Read Hydrograph
 Label: On-site Area

Peak Discharge	35.17 ft ³ /s
Time to Peak	1,000.000 min
Hydrograph Volume	269,730.000 ft ³

HYDROGRAPH ORDINATES (ft³/s)

Output Time Increment = 50.000 min

Time on left represents time for first value in each row.

Time (min)	Flow (ft ³ /s)				
0.000	0.00	1.15	1.19	1.24	1.27
250.000	1.30	1.36	1.41	1.46	1.51
500.000	1.59	1.68	1.78	1.89	2.05
750.000	1.95	2.29	2.62	3.23	6.63
1,000.000	35.17	3.51	2.44	1.91	1.83
1,250.000	1.62	1.46	1.34	1.27	1.19
1,500.000	1.14	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Addition Summary
Label: O-1

Summary for Hydrograph Addition at 'O-1'

Upstream Link	Upstream Node
Outlet-1	Underground Vault

Node Inflows

Inflow Type	Element	Volume (ft ³)	Time to Peak (min)	Flow (Peak) (ft ³ /s)
Flow (From)	Outlet-1	250,203.578	1,020.000	22.35
Flow (In)	O-1	250,203.578	1,020.000	22.35

Subsection: Time vs. Elevation
 Label: Underground Vault (IN)

Time vs. Elevation (ft)

Output Time increment = 5.000 min
 Time on left represents time for first value in each row.

Time (min)	Elevation (ft)				
0.000	3,211.00	3,211.00	3,211.01	3,211.01	3,211.03
25.000	3,211.04	3,211.06	3,211.08	3,211.11	3,211.13
50.000	3,211.17	3,211.20	3,211.23	3,211.26	3,211.30
75.000	3,211.33	3,211.36	3,211.40	3,211.43	3,211.46
100.000	3,211.49	3,211.53	3,211.56	3,211.59	3,211.61
125.000	3,211.64	3,211.67	3,211.69	3,211.71	3,211.73
150.000	3,211.75	3,211.77	3,211.79	3,211.81	3,211.82
175.000	3,211.84	3,211.85	3,211.87	3,211.88	3,211.89
200.000	3,211.91	3,211.92	3,211.93	3,211.94	3,211.95
225.000	3,211.96	3,211.97	3,211.97	3,211.98	3,211.99
250.000	3,212.00	3,212.00	3,212.01	3,212.02	3,212.02
275.000	3,212.03	3,212.04	3,212.04	3,212.05	3,212.05
300.000	3,212.06	3,212.07	3,212.07	3,212.08	3,212.09
325.000	3,212.09	3,212.10	3,212.11	3,212.11	3,212.12
350.000	3,212.12	3,212.13	3,212.14	3,212.14	3,212.15
375.000	3,212.16	3,212.16	3,212.17	3,212.17	3,212.18
400.000	3,212.19	3,212.19	3,212.20	3,212.20	3,212.21
425.000	3,212.22	3,212.22	3,212.23	3,212.23	3,212.24
450.000	3,212.24	3,212.25	3,212.26	3,212.26	3,212.27
475.000	3,212.28	3,212.28	3,212.29	3,212.29	3,212.30
500.000	3,212.31	3,212.31	3,212.32	3,212.33	3,212.33
525.000	3,212.34	3,212.35	3,212.35	3,212.36	3,212.37
550.000	3,212.38	3,212.38	3,212.39	3,212.40	3,212.41
575.000	3,212.41	3,212.42	3,212.43	3,212.44	3,212.44
600.000	3,212.45	3,212.46	3,212.47	3,212.48	3,212.48
625.000	3,212.49	3,212.50	3,212.51	3,212.52	3,212.53
650.000	3,212.54	3,212.54	3,212.55	3,212.56	3,212.57
675.000	3,212.58	3,212.59	3,212.60	3,212.61	3,212.62
700.000	3,212.63	3,212.64	3,212.65	3,212.66	3,212.67
725.000	3,212.68	3,212.69	3,212.70	3,212.70	3,212.71
750.000	3,212.72	3,212.72	3,212.73	3,212.74	3,212.75
775.000	3,212.76	3,212.77	3,212.78	3,212.79	3,212.80
800.000	3,212.81	3,212.82	3,212.84	3,212.85	3,212.87
825.000	3,212.88	3,212.90	3,212.91	3,212.93	3,212.95
850.000	3,212.96	3,212.98	3,213.00	3,213.02	3,213.04
875.000	3,213.06	3,213.09	3,213.11	3,213.14	3,213.16
900.000	3,213.19	3,213.22	3,213.26	3,213.31	3,213.36
925.000	3,213.43	3,213.50	3,213.57	3,213.66	3,213.75
950.000	3,213.85	3,213.98	3,214.17	3,214.43	3,214.74
975.000	3,215.10	3,215.49	3,215.92	3,216.34	3,216.70
1,000.000	3,217.01	3,217.24	3,217.40	3,217.49	3,217.51
1,025.000	3,217.49	3,217.42	3,217.31	3,217.15	3,216.97
1,050.000	3,216.75	3,216.56	3,216.42	3,216.31	3,216.22

Subsection: Time vs. Elevation
 Label: Underground Vault (IN)

Time vs. Elevation (ft)

Output Time increment = 5.000 min
 Time on left represents time for first value in each row.

Time (min)	Elevation (ft)				
1,075.000	3,216.16	3,216.11	3,216.07	3,216.04	3,216.02
1,100.000	3,215.99	3,215.97	3,215.95	3,215.93	3,215.90
1,125.000	3,215.88	3,215.85	3,215.82	3,215.80	3,215.77
1,150.000	3,215.74	3,215.71	3,215.68	3,215.65	3,215.62
1,175.000	3,215.59	3,215.56	3,215.53	3,215.50	3,215.47
1,200.000	3,215.44	3,215.42	3,215.39	3,215.36	3,215.33
1,225.000	3,215.30	3,215.27	3,215.24	3,215.21	3,215.18
1,250.000	3,215.15	3,215.12	3,215.09	3,215.05	3,215.02
1,275.000	3,214.99	3,214.96	3,214.92	3,214.89	3,214.85
1,300.000	3,214.82	3,214.78	3,214.74	3,214.71	3,214.67
1,325.000	3,214.64	3,214.61	3,214.57	3,214.54	3,214.50
1,350.000	3,214.47	3,214.43	3,214.40	3,214.37	3,214.33
1,375.000	3,214.30	3,214.27	3,214.23	3,214.20	3,214.17
1,400.000	3,214.14	3,214.10	3,214.07	3,214.04	3,214.01
1,425.000	3,213.98	3,213.94	3,213.91	3,213.88	3,213.85
1,450.000	3,213.81	3,213.78	3,213.75	3,213.72	3,213.69
1,475.000	3,213.66	3,213.63	3,213.60	3,213.57	3,213.54
1,500.000	3,213.51	3,213.48	3,213.45	3,213.43	3,213.40
1,525.000	3,213.37	3,213.35	3,213.32	3,213.29	3,213.27
1,550.000	3,213.24	3,213.22	3,213.20	3,213.17	3,213.15
1,575.000	3,213.12	3,213.10	3,213.08	3,213.06	3,213.04
1,600.000	3,213.01	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Time vs. Volume
 Label: Underground Vault

Time vs. Volume (ft³)

Output Time increment = 5.000 min
 Time on left represents time for first value in each row.

Time (min)	Volume (ft ³)				
0.000	0.000	17.000	69.000	155.000	275.000
25.000	429.000	617.000	840.000	1,095.000	1,385.000
50.000	1,708.000	2,049.000	2,389.000	2,729.000	3,070.000
75.000	3,411.000	3,752.000	4,094.000	4,436.000	4,777.000
100.000	5,119.000	5,454.000	5,773.000	6,074.000	6,360.000
125.000	6,632.000	6,889.000	7,133.000	7,364.000	7,584.000
150.000	7,792.000	7,990.000	8,178.000	8,356.000	8,524.000
175.000	8,684.000	8,835.000	8,979.000	9,115.000	9,245.000
200.000	9,368.000	9,484.000	9,595.000	9,701.000	9,801.000
225.000	9,897.000	9,988.000	10,075.000	10,157.000	10,236.000
250.000	10,311.000	10,384.000	10,456.000	10,528.000	10,600.000
275.000	10,672.000	10,745.000	10,817.000	10,889.000	10,961.000
300.000	11,033.000	11,106.000	11,177.000	11,249.000	11,320.000
325.000	11,391.000	11,462.000	11,532.000	11,603.000	11,673.000
350.000	11,742.000	11,812.000	11,881.000	11,950.000	12,019.000
375.000	12,088.000	12,157.000	12,225.000	12,293.000	12,361.000
400.000	12,429.000	12,496.000	12,564.000	12,631.000	12,698.000
425.000	12,765.000	12,832.000	12,898.000	12,965.000	13,031.000
450.000	13,097.000	13,164.000	13,231.000	13,299.000	13,368.000
475.000	13,437.000	13,507.000	13,578.000	13,649.000	13,721.000
500.000	13,794.000	13,867.000	13,941.000	14,016.000	14,092.000
525.000	14,169.000	14,246.000	14,325.000	14,404.000	14,483.000
550.000	14,564.000	14,645.000	14,727.000	14,811.000	14,895.000
575.000	14,980.000	15,066.000	15,153.000	15,240.000	15,329.000
600.000	15,418.000	15,508.000	15,599.000	15,692.000	15,785.000
625.000	15,879.000	15,974.000	16,070.000	16,168.000	16,265.000
650.000	16,364.000	16,465.000	16,567.000	16,672.000	16,779.000
675.000	16,888.000	17,000.000	17,113.000	17,228.000	17,345.000
700.000	17,465.000	17,582.000	17,693.000	17,798.000	17,898.000
725.000	17,993.000	18,082.000	18,166.000	18,245.000	18,320.000
750.000	18,389.000	18,460.000	18,540.000	18,628.000	18,723.000
775.000	18,827.000	18,938.000	19,056.000	19,182.000	19,314.000
800.000	19,454.000	19,599.000	19,752.000	19,910.000	20,074.000
825.000	20,244.000	20,419.000	20,600.000	20,786.000	20,978.000
850.000	21,174.000	21,380.000	21,599.000	21,832.000	22,079.000
875.000	22,341.000	22,617.000	22,908.000	23,212.000	23,529.000
900.000	23,861.000	24,246.000	24,728.000	25,303.000	25,971.000
925.000	26,730.000	27,579.000	28,517.000	29,542.000	30,653.000
950.000	31,848.000	33,501.000	35,983.000	39,289.000	43,409.000
975.000	48,337.000	54,071.000	60,610.000	67,192.000	73,009.000
1,000.000	78,128.000	82,254.000	85,049.000	86,651.000	87,186.000
1,025.000	86,765.000	85,487.000	83,443.000	80,713.000	77,411.000
1,050.000	73,894.000	70,831.000	68,510.000	66,745.000	65,395.000

Subsection: Time vs. Volume
 Label: Underground Vault

Time vs. Volume (ft³)

Output Time increment = 5.000 min
 Time on left represents time for first value in each row.

Time (min)	Volume (ft ³)				
1,075.000	64,356.000	63,550.000	62,919.000	62,418.000	62,015.000
1,100.000	61,675.000	61,348.000	61,009.000	60,656.000	60,290.000
1,125.000	59,912.000	59,521.000	59,118.000	58,702.000	58,273.000
1,150.000	57,833.000	57,387.000	56,942.000	56,499.000	56,057.000
1,175.000	55,616.000	55,177.000	54,739.000	54,302.000	53,866.000
1,200.000	53,432.000	52,997.000	52,560.000	52,119.000	51,677.000
1,225.000	51,231.000	50,783.000	50,333.000	49,880.000	49,425.000
1,250.000	48,967.000	48,507.000	48,047.000	47,586.000	47,123.000
1,275.000	46,660.000	46,197.000	45,735.000	45,272.000	44,810.000
1,300.000	44,349.000	43,888.000	43,429.000	42,972.000	42,516.000
1,325.000	42,062.000	41,609.000	41,157.000	40,707.000	40,259.000
1,350.000	39,812.000	39,367.000	38,925.000	38,486.000	38,050.000
1,375.000	37,616.000	37,185.000	36,757.000	36,332.000	35,909.000
1,400.000	35,489.000	35,072.000	34,656.000	34,243.000	33,833.000
1,425.000	33,425.000	33,020.000	32,619.000	32,222.000	31,828.000
1,450.000	31,438.000	31,052.000	30,670.000	30,292.000	29,918.000
1,475.000	29,549.000	29,183.000	28,822.000	28,464.000	28,110.000
1,500.000	27,760.000	27,415.000	27,075.000	26,740.000	26,409.000
1,525.000	26,084.000	25,764.000	25,448.000	25,137.000	24,831.000
1,550.000	24,530.000	24,233.000	23,940.000	23,652.000	23,368.000
1,575.000	23,088.000	22,812.000	22,541.000	22,274.000	22,010.000
1,600.000	21,751.000	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Elevation vs. Volume Curve
Label: Underground Vault

Elevation-Volume

Pond Elevation (ft)	Pond Volume (ft ³)
3,211.00	0.000
3,212.00	10,348.910
3,213.00	21,574.120
3,214.00	33,702.590
3,215.00	46,761.520
3,216.00	61,763.580
3,217.00	77,935.350
3,218.00	95,905.870

Subsection: Outlet Input Data

Label: Composite Outlet Structure - 1

Requested Pond Water Surface Elevations	
Minimum (Headwater)	3,211.00 ft
Increment (Headwater)	1.00 ft
Maximum (Headwater)	3,218.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Stand Pipe	Riser - 1	Forward	TW	3,216.00	3,218.00
Orifice-Circular	Orifice - 2	Forward	TW	3,211.50	3,218.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data

Label: Composite Outlet Structure - 1

Structure ID: Orifice - 2	
Structure Type: Orifice-Circular	
Number of Openings	7
Elevation	3,211.50 ft
Orifice Diameter	3.0 in
Orifice Coefficient	0.600

Structure ID: Riser - 1	
Structure Type: Stand Pipe	
Number of Openings	1
Elevation	3,216.00 ft
Diameter	24.0 in
Orifice Area	3.1 ft ²
Orifice Coefficient	0.600
Weir Length	6.28 ft
Weir Coefficient	3.00 (ft ^{0.5})/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	True

Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	10
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft ³ /s
Flow Tolerance (Maximum)	10.000 ft ³ /s

Subsection: Individual Outlet Curves
 Label: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
 Structure ID = Orifice - 2 (Orifice-Circular)

 Upstream ID = (Pond Water Surface)
 Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft ³ /s)	Tailwater Elevation (ft)	Convergence Error (ft)
3,211.00	0.00	(N/A)	0.00
3,211.50	0.00	(N/A)	0.00
3,212.00	1.01	(N/A)	0.00
3,213.00	1.94	(N/A)	0.00
3,214.00	2.55	(N/A)	0.00
3,215.00	3.04	(N/A)	0.00
3,216.00	3.46	(N/A)	0.00
3,217.00	3.83	(N/A)	0.00
3,218.00	4.18	(N/A)	0.00

Computation Messages

HW & TW below invert
 Upstream HW &
 DNstream TW < Inv.El
 H =.38
 H =1.38
 H =2.38
 H =3.38
 H =4.38
 H =5.38
 H =6.38

Subsection: Individual Outlet Curves
 Label: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
 Structure ID = Riser - 1 (Stand Pipe)

 Upstream ID = (Pond Water Surface)
 Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft ³ /s)	Tailwater Elevation (ft)	Convergence Error (ft)
3,211.00	0.00	(N/A)	0.00
3,211.50	0.00	(N/A)	0.00
3,212.00	0.00	(N/A)	0.00
3,213.00	0.00	(N/A)	0.00
3,214.00	0.00	(N/A)	0.00
3,215.00	0.00	(N/A)	0.00
3,216.00	0.00	(N/A)	0.00
3,217.00	15.12	(N/A)	0.00
3,218.00	21.38	(N/A)	0.00

Computation Messages

HW & TW <
 Inv.El.=3216.000
 Weir: H =0ft
 Orifice: H =1.00; Riser
 orifice equation
 controlling.
 Orifice: H =2.00; Riser
 orifice equation
 controlling.

Subsection: Composite Rating Curve
 Label: Composite Outlet Structure - 1

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft ³ /s)	Tailwater Elevation (ft)	Convergence Error (ft)
3,211.00	0.00	(N/A)	0.00
3,211.50	0.00	(N/A)	0.00
3,212.00	1.01	(N/A)	0.00
3,213.00	1.94	(N/A)	0.00
3,214.00	2.55	(N/A)	0.00
3,215.00	3.04	(N/A)	0.00
3,216.00	3.46	(N/A)	0.00
3,217.00	18.95	(N/A)	0.00
3,218.00	25.56	(N/A)	0.00

Contributing Structures

None Contributing
None Contributing
Orifice - 2
Riser - 1 + Orifice - 2
Riser - 1 + Orifice - 2
Riser - 1 + Orifice - 2

Subsection: Diverted Hydrograph
 Label: Outlet-1

Peak Discharge	22.35 ft ³ /s
Time to Peak	1,020.000 min
Hydrograph Volume	250,203.579 ft ³

HYDROGRAPH ORDINATES (ft³/s)

Output Time Increment = 5.000 min

Time on left represents time for first value in each row.

Time (min)	Flow (ft ³ /s)				
100.000	0.00	0.05	0.12	0.18	0.23
125.000	0.29	0.34	0.38	0.43	0.47
150.000	0.51	0.55	0.59	0.62	0.66
175.000	0.69	0.72	0.74	0.77	0.80
200.000	0.82	0.84	0.87	0.89	0.91
225.000	0.92	0.94	0.96	0.98	0.99
250.000	1.01	1.02	1.02	1.03	1.03
275.000	1.04	1.05	1.05	1.06	1.06
300.000	1.07	1.08	1.08	1.09	1.09
325.000	1.10	1.10	1.11	1.12	1.12
350.000	1.13	1.13	1.14	1.14	1.15
375.000	1.16	1.16	1.17	1.17	1.18
400.000	1.18	1.19	1.20	1.20	1.21
425.000	1.21	1.22	1.22	1.23	1.23
450.000	1.24	1.25	1.25	1.26	1.26
475.000	1.27	1.27	1.28	1.29	1.29
500.000	1.30	1.30	1.31	1.32	1.32
525.000	1.33	1.33	1.34	1.35	1.35
550.000	1.36	1.37	1.37	1.38	1.39
575.000	1.39	1.40	1.41	1.42	1.42
600.000	1.43	1.44	1.45	1.45	1.46
625.000	1.47	1.48	1.49	1.49	1.50
650.000	1.51	1.52	1.53	1.53	1.54
675.000	1.55	1.56	1.57	1.58	1.59
700.000	1.60	1.61	1.62	1.63	1.64
725.000	1.64	1.65	1.66	1.66	1.67
750.000	1.68	1.68	1.69	1.70	1.70
775.000	1.71	1.72	1.73	1.74	1.75
800.000	1.76	1.78	1.79	1.80	1.82
825.000	1.83	1.84	1.86	1.87	1.89
850.000	1.91	1.92	1.94	1.95	1.96
875.000	1.98	1.99	2.01	2.02	2.04
900.000	2.05	2.07	2.10	2.13	2.16
925.000	2.20	2.24	2.29	2.34	2.40
950.000	2.46	2.54	2.63	2.76	2.91
975.000	3.08	3.24	3.43	8.66	14.23
1,000.000	19.03	20.54	21.57	22.16	22.35
1,025.000	22.20	21.73	20.98	19.98	18.45
1,050.000	15.08	12.15	9.92	8.23	6.94

Subsection: Diverted Hydrograph
 Label: Outlet-1

HYDROGRAPH ORDINATES (ft³/s)
 Output Time Increment = 5.000 min
 Time on left represents time for first value in each row.

Time (min)	Flow (ft ³ /s)				
1,075.000	5.94	5.17	4.57	4.09	3.70
1,100.000	3.46	3.45	3.44	3.43	3.42
1,125.000	3.41	3.40	3.38	3.37	3.36
1,150.000	3.35	3.34	3.32	3.31	3.30
1,175.000	3.29	3.27	3.26	3.25	3.24
1,200.000	3.23	3.21	3.20	3.19	3.18
1,225.000	3.16	3.15	3.14	3.13	3.11
1,250.000	3.10	3.09	3.07	3.06	3.05
1,275.000	3.03	3.02	3.00	2.98	2.97
1,300.000	2.95	2.93	2.91	2.90	2.88
1,325.000	2.86	2.85	2.83	2.81	2.79
1,350.000	2.78	2.76	2.74	2.73	2.71
1,375.000	2.70	2.68	2.66	2.65	2.63
1,400.000	2.62	2.60	2.58	2.57	2.55
1,425.000	2.53	2.51	2.49	2.47	2.45
1,450.000	2.43	2.42	2.40	2.38	2.36
1,475.000	2.34	2.32	2.30	2.29	2.27
1,500.000	2.25	2.23	2.22	2.20	2.18
1,525.000	2.17	2.15	2.13	2.12	2.10
1,550.000	2.09	2.07	2.06	2.04	2.03
1,575.000	2.02	2.00	1.99	1.97	1.96
1,600.000	1.95	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Elevation-Volume-Flow Table (Pond)
 Label: Underground Vault

Infiltration	
Infiltration Method (Computed)	Constant
Infiltration Rate (Constant)	0.05 ft ³ /s

Initial Conditions	
Elevation (Water Surface, Initial)	3,211.00 ft
Volume (Initial)	0.000 ft ³
Flow (Initial Outlet)	0.00 ft ³ /s
Flow (Initial Infiltration)	0.00 ft ³ /s
Flow (Initial, Total)	0.00 ft ³ /s
Time Increment	5.000 min

Elevation (ft)	Outflow (ft ³ /s)	Storage (ft ³)	Area (acres)	Infiltration (ft ³ /s)	Flow (Total) (ft ³ /s)	2S/t + O (ft ³ /s)
3,211.00	0.00	0.000	0.000	0.00	0.00	0.00
3,211.50	0.00	5,174.455	0.000	0.05	0.05	34.55
3,212.00	1.01	10,348.910	0.000	0.05	1.06	70.06
3,213.00	1.94	21,574.120	0.000	0.05	1.99	145.82
3,214.00	2.55	33,702.590	0.000	0.05	2.60	227.28
3,215.00	3.04	46,761.520	0.000	0.05	3.09	314.83
3,216.00	3.46	61,763.580	0.000	0.05	3.51	415.27
3,217.00	18.95	77,935.350	0.000	0.05	19.00	538.57
3,218.00	25.56	95,905.870	0.000	0.05	25.61	664.98

Subsection: Level Pool Pond Routing Summary
 Label: Underground Vault (IN)

Infiltration	
Infiltration Method (Computed)	Constant
Infiltration Rate (Constant)	0.05 ft ³ /s

Initial Conditions	
Elevation (Water Surface, Initial)	3,211.00 ft
Volume (Initial)	0.000 ft ³
Flow (Initial Outlet)	0.00 ft ³ /s
Flow (Initial Infiltration)	0.00 ft ³ /s
Flow (Initial, Total)	0.00 ft ³ /s
Time Increment	5.000 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	35.17 ft ³ /s	Time to Peak (Flow, In)	1,000.000 min
Infiltration (Peak)	0.05 ft ³ /s	Time to Peak (Infiltration)	105.000 min
Flow (Peak Outlet)	22.35 ft ³ /s	Time to Peak (Flow, Outlet)	1,020.000 min

Elevation (Water Surface, Peak)	3,217.51 ft
Volume (Peak)	87,186.003 ft ³

Mass Balance (ft ³)	
Volume (Initial)	0.000 ft ³
Volume (Total Inflow)	276,570.000 ft ³
Volume (Total Infiltration)	4,630.000 ft ³
Volume (Total Outlet Outflow)	250,204.000 ft ³
Volume (Retained)	21,158.000 ft ³
Volume (Unrouted)	-578.000 ft ³
Error (Mass Balance)	0.2 %

Subsection: Pond Infiltration Hydrograph
 Label: Underground Vault (INF)

Peak Discharge	0.05 ft ³ /s
Time to Peak	605.000 min
Hydrograph Volume	4,615.314 ft ³

HYDROGRAPH ORDINATES (ft³/s)

Output Time Increment = 5.000 min

Time on left represents time for first value in each row.

Time (min)	Flow (ft ³ /s)				
10.000	0.00	0.00	0.00	0.00	0.01
35.000	0.01	0.01	0.01	0.02	0.02
60.000	0.02	0.03	0.03	0.03	0.04
85.000	0.04	0.04	0.05	0.05	0.05
110.000	0.05	0.05	0.05	0.05	0.05
135.000	0.05	0.05	0.05	0.05	0.05
160.000	0.05	0.05	0.05	0.05	0.05
185.000	0.05	0.05	0.05	0.05	0.05
210.000	0.05	0.05	0.05	0.05	0.05
235.000	0.05	0.05	0.05	0.05	0.05
260.000	0.05	0.05	0.05	0.05	0.05
285.000	0.05	0.05	0.05	0.05	0.05
310.000	0.05	0.05	0.05	0.05	0.05
335.000	0.05	0.05	0.05	0.05	0.05
360.000	0.05	0.05	0.05	0.05	0.05
385.000	0.05	0.05	0.05	0.05	0.05
410.000	0.05	0.05	0.05	0.05	0.05
435.000	0.05	0.05	0.05	0.05	0.05
460.000	0.05	0.05	0.05	0.05	0.05
485.000	0.05	0.05	0.05	0.05	0.05
510.000	0.05	0.05	0.05	0.05	0.05
535.000	0.05	0.05	0.05	0.05	0.05
560.000	0.05	0.05	0.05	0.05	0.05
585.000	0.05	0.05	0.05	0.05	0.05
610.000	0.05	0.05	0.05	0.05	0.05
635.000	0.05	0.05	0.05	0.05	0.05
660.000	0.05	0.05	0.05	0.05	0.05
685.000	0.05	0.05	0.05	0.05	0.05
710.000	0.05	0.05	0.05	0.05	0.05
735.000	0.05	0.05	0.05	0.05	0.05
760.000	0.05	0.05	0.05	0.05	0.05
785.000	0.05	0.05	0.05	0.05	0.05
810.000	0.05	0.05	0.05	0.05	0.05
835.000	0.05	0.05	0.05	0.05	0.05
860.000	0.05	0.05	0.05	0.05	0.05
885.000	0.05	0.05	0.05	0.05	0.05
910.000	0.05	0.05	0.05	0.05	0.05
935.000	0.05	0.05	0.05	0.05	0.05
960.000	0.05	0.05	0.05	0.05	0.05

Subsection: Pond Infiltration Hydrograph
 Label: Underground Vault (INF)

HYDROGRAPH ORDINATES (ft³/s)
 Output Time Increment = 5.000 min
 Time on left represents time for first value in each row.

Time (min)	Flow (ft ³ /s)				
985.000	0.05	0.05	0.05	0.05	0.05
1,010.000	0.05	0.05	0.05	0.05	0.05
1,035.000	0.05	0.05	0.05	0.05	0.05
1,060.000	0.05	0.05	0.05	0.05	0.05
1,085.000	0.05	0.05	0.05	0.05	0.05
1,110.000	0.05	0.05	0.05	0.05	0.05
1,135.000	0.05	0.05	0.05	0.05	0.05
1,160.000	0.05	0.05	0.05	0.05	0.05
1,185.000	0.05	0.05	0.05	0.05	0.05
1,210.000	0.05	0.05	0.05	0.05	0.05
1,235.000	0.05	0.05	0.05	0.05	0.05
1,260.000	0.05	0.05	0.05	0.05	0.05
1,285.000	0.05	0.05	0.05	0.05	0.05
1,310.000	0.05	0.05	0.05	0.05	0.05
1,335.000	0.05	0.05	0.05	0.05	0.05
1,360.000	0.05	0.05	0.05	0.05	0.05
1,385.000	0.05	0.05	0.05	0.05	0.05
1,410.000	0.05	0.05	0.05	0.05	0.05
1,435.000	0.05	0.05	0.05	0.05	0.05
1,460.000	0.05	0.05	0.05	0.05	0.05
1,485.000	0.05	0.05	0.05	0.05	0.05
1,510.000	0.05	0.05	0.05	0.05	0.05
1,535.000	0.05	0.05	0.05	0.05	0.05
1,560.000	0.05	0.05	0.05	0.05	0.05
1,585.000	0.05	0.05	0.05	0.05	(N/A)

Subsection: Pond Routed Hydrograph (total out)
 Label: Underground Vault (OUT)

Peak Discharge	22.35 ft ³ /s
Time to Peak	1,020.000 min
Hydrograph Volume	250,203.579 ft ³

HYDROGRAPH ORDINATES (ft³/s)

Output Time Increment = 5.000 min

Time on left represents time for first value in each row.

Time (min)	Flow (ft ³ /s)				
100.000	0.00	0.05	0.12	0.18	0.23
125.000	0.29	0.34	0.38	0.43	0.47
150.000	0.51	0.55	0.59	0.62	0.66
175.000	0.69	0.72	0.74	0.77	0.80
200.000	0.82	0.84	0.87	0.89	0.91
225.000	0.92	0.94	0.96	0.98	0.99
250.000	1.01	1.02	1.02	1.03	1.03
275.000	1.04	1.05	1.05	1.06	1.06
300.000	1.07	1.08	1.08	1.09	1.09
325.000	1.10	1.10	1.11	1.12	1.12
350.000	1.13	1.13	1.14	1.14	1.15
375.000	1.16	1.16	1.17	1.17	1.18
400.000	1.18	1.19	1.20	1.20	1.21
425.000	1.21	1.22	1.22	1.23	1.23
450.000	1.24	1.25	1.25	1.26	1.26
475.000	1.27	1.27	1.28	1.29	1.29
500.000	1.30	1.30	1.31	1.32	1.32
525.000	1.33	1.33	1.34	1.35	1.35
550.000	1.36	1.37	1.37	1.38	1.39
575.000	1.39	1.40	1.41	1.42	1.42
600.000	1.43	1.44	1.45	1.45	1.46
625.000	1.47	1.48	1.49	1.49	1.50
650.000	1.51	1.52	1.53	1.53	1.54
675.000	1.55	1.56	1.57	1.58	1.59
700.000	1.60	1.61	1.62	1.63	1.64
725.000	1.64	1.65	1.66	1.66	1.67
750.000	1.68	1.68	1.69	1.70	1.70
775.000	1.71	1.72	1.73	1.74	1.75
800.000	1.76	1.78	1.79	1.80	1.82
825.000	1.83	1.84	1.86	1.87	1.89
850.000	1.91	1.92	1.94	1.95	1.96
875.000	1.98	1.99	2.01	2.02	2.04
900.000	2.05	2.07	2.10	2.13	2.16
925.000	2.20	2.24	2.29	2.34	2.40
950.000	2.46	2.54	2.63	2.76	2.91
975.000	3.08	3.24	3.43	8.66	14.23
1,000.000	19.03	20.54	21.57	22.16	22.35
1,025.000	22.20	21.73	20.98	19.98	18.45
1,050.000	15.08	12.15	9.92	8.23	6.94

Subsection: Pond Routed Hydrograph (total out)
 Label: Underground Vault (OUT)

HYDROGRAPH ORDINATES (ft³/s)
 Output Time Increment = 5.000 min
 Time on left represents time for first value in each row.

Time (min)	Flow (ft ³ /s)				
1,075.000	5.94	5.17	4.57	4.09	3.70
1,100.000	3.46	3.45	3.44	3.43	3.42
1,125.000	3.41	3.40	3.38	3.37	3.36
1,150.000	3.35	3.34	3.32	3.31	3.30
1,175.000	3.29	3.27	3.26	3.25	3.24
1,200.000	3.23	3.21	3.20	3.19	3.18
1,225.000	3.16	3.15	3.14	3.13	3.11
1,250.000	3.10	3.09	3.07	3.06	3.05
1,275.000	3.03	3.02	3.00	2.98	2.97
1,300.000	2.95	2.93	2.91	2.90	2.88
1,325.000	2.86	2.85	2.83	2.81	2.79
1,350.000	2.78	2.76	2.74	2.73	2.71
1,375.000	2.70	2.68	2.66	2.65	2.63
1,400.000	2.62	2.60	2.58	2.57	2.55
1,425.000	2.53	2.51	2.49	2.47	2.45
1,450.000	2.43	2.42	2.40	2.38	2.36
1,475.000	2.34	2.32	2.30	2.29	2.27
1,500.000	2.25	2.23	2.22	2.20	2.18
1,525.000	2.17	2.15	2.13	2.12	2.10
1,550.000	2.09	2.07	2.06	2.04	2.03
1,575.000	2.02	2.00	1.99	1.97	1.96
1,600.000	1.95	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Pond Inflow Summary
Label: Underground Vault (IN)

Summary for Hydrograph Addition at 'Underground Vault'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	On-site Area

Node Inflows

Inflow Type	Element	Volume (ft ³)	Time to Peak (min)	Flow (Peak) (ft ³ /s)
Flow (From)	On-site Area	269,730.000	1,000.000	35.17
Flow (In)	Underground Vault	276,570.000	1,000.000	35.17

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