MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

Amethyst Crossing

WHERE APPLICABLE, INSERT GRADING PERMIT NO., BUILDING PERMIT NO., TRACT NUMBER, LAND DEVELOPMENT FILE NO., CUP, SUP AND/OR APN (SPECIFY LOT NUMBERS IF SITE IS A PORTION OF A TRACT)

Prepared for:

High Desert Ventures LLC

5567 Reseda Boulevard, Suite 318

Tarzana, CA 91356

Tel: (818) 881-5868

Prepared by:

David Evans and Associates

18484 Outer Highway 18 North, Suite 225

Apple Valley, CA 92307

(760) 524-9100

Submittal Date: August 2021

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

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

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

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

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

Final Approval Date:_____

Project Owner's Certification

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

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

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	
Tract/Parcel Map Number(s):	PM 18553, parcel 1 and 4	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			3072-211-13, 3072-277-16

Owner's Signature		
Owner Name: Bobby Younessi		
Title	Manager	
Company	High Desert Ventures LLC	
Address	5567 Reseda Boulevard, Suite 318 Tarzana, CA 91356	
Email		
Telephone #	(818) 881-5868	
Signature	Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	
Tract/Parcel Map Number(s):	PM 18553, parcel 1 and 4	Building Permit Number(s):	
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"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of the California State Water Resources Control Board Order No. 2013-0001-DWQ.

Engineer: Bret Jensen Thorpe		PE Stamp Below
Title	Project Manager	
Company	David Evans & Associates, Inc.	
Address	18484 Outer Highway 18,North, Suite 225, Apple Valley, CA 92307	
Email	bthorpe@deainc.com	
Telephone #	Project Manager	
Signature		
Date		

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Preparer's Certification

Project Data			
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Address	18484 Outer Highway 18,North, Suite 225, Apple Valley, CA 92307	
Email	bthorpe@deainc.com	
Telephone #	Project Manager	
Signature		
Date		

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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	Amethyst Crossing				
Project Owner Contact Name:	Bobby Younessi				
Mailing Address:	High Desert Ventures LLC 5567 Reseda Boulevard, Suite 318 Tarzana, CA 91356	E-mail Address:		Telephone:	(818) 881-5868
Permit/Application Number(s):	TBD		Tract/Parcel Map Number(s):		PM 18553, parcel 1 and 4
Additional Information/ Comments:					
Description of Project:	The project is located within the City of Victorville at the southeast corner of Bear Valley Road and Amethyst road. Latitude - 34d 28' 11", Longitude – 117d 21' 45" The Project consists of a retail commercial and associated parking and drive aisles. The site will be graded to intercept the off-site run-on, at its south boundary, and conveyed to Pluto Drive.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	The Project site is approximately 11.4 acres located in the City of Victorville at the southeast corner of Bear Valley Road and Amethyst Road. Land to the north is developed with commercial and residential, as well, as the land to the west. The land on the east is vacant and the land on the south is vacant except for a small medical building on 1.8 acres and a Church on 6 arces. The existing site is vacant with sparse vegetation. It appears it may have been cleared at one time. The site and the upstream area slopes to the north east at mild slope of 1.7%. For the proposed condition, the Project consists of a commercial site with stores and resturants. The site run-off will be directed via sheet flow and ribbon gutters to catch basins on-site and conveyed to an underground retention system on the easterly side on the Project. The system is using Storm Tech products, includes a pretreatment row. Overflows will leave the site via storm drain and be connected to the existing Bear Valley Road storm drain. City drawing no. S-000830. The proposed underground StormTech infiltration system to capture and treat storm water runoff for the site, as well as the BMP's practice in this project, the proposed landscaped areas, trees also employed to the accommodate the storm water treatment strategies.				

Section 2 Project Description

2.1 Project Information

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

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

2.1.1 Project Sizing Categorization

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

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

Form 2.1-1 Description of Proposed Project

1 Regulated Development Project Category (Select all that apply):

☒ #1 New development involving the creation of 5,000 ft² or more of impervious surface collectively over entire site	☐ #2 Significant re-development involving the addition or replacement of 5,000 ft² or more of impervious surface on an already developed site	☐ #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface	☐ #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface

☐ Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft.) *Will require source control Site Design Measures. Use the "PCMP" Template. Do not use this WQMP Template.*

2 Project Area (ft2):	496,584	**3** Number of Dwelling Units:	8	**4** SIC Code:	6512, 5912

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

2.2 Property Ownership/Management

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

Form 2.2-1 Property Ownership/Management

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

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

High Desert Ventures LLC

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Attn: Bobby Younessi

No onsite infrastructure will be transferred to a public agency after completion. A property owner's association (POA) will be formed for long-term maintenance of project stormwater facilites.

The improvements within the Public Right of Way in Amethyst and Bear Valley Road consisting street improvements and storm drain will transfer to the City of Victorville upon acceptance of those improvements and maintanance will become the Responsibility of the City of Victorville.

2.3 Potential Stormwater Pollutants

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

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

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Wild Bird and Pet Waste, Garbage, Food Waste, Animals, Restroom
Nutrients - Phosphorous	E ☒	N ☐	Fertilizers, Waste, & Garbage, Landscaped area
Nutrients - Nitrogen	E ☒	N ☐	Potential Source – Landscape, Fertilizer, Food Waste, Garbage
Noxious Aquatic Plants	E ☐	N ☒	NA
Sediment	E ☒	N ☐	Solid materials/ suspended solids from land surface is expected in addition to sediments from erosion, Landscaped area & Undeveloped pads.
Metals	E ☒	N ☐	Metal pollutants expected from vehicles circulating the parking lot, including tire wear and brake dust.
Oil and Grease	E ☒	N ☐	Surface area of parking lot and drive-thru will contribute to pollution from leaking vehicles and grease for production
Trash/Debris	E ☒	N ☐	Surface area of parking lot and drive-thru will contribute to pollution from leaking vehicles and grease for production
Pesticides / Herbicides	E ☒	N ☐	Expected pollutants from maintenance of the site landscape area is expected.
Organic Compounds	E ☒	N ☐	Use of cleaning solvents/chemicals and maintenace of landscape area will contribute to pollution from organic compounds.
Other: Other: Toxic Organic Compounds	E ☒	N ☐	Parking lots in general.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

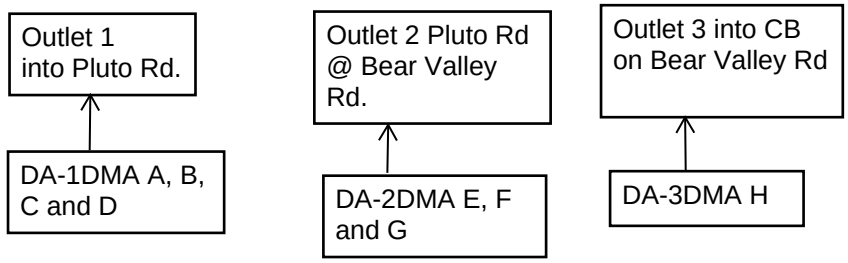
Describe the project site conditions that will facilitate the selection of BMPs through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34d 28m 11s	Longitude 117d 21m 45s	Thomas Bros Map page

1 San Bernardino County climatic region: ☒ Desert

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



Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA C flows to DA1 DMA A	*Ex. Bioretention overflow to vegetated bioswale with 4' bottom width, 5:1 side slopes and bed slope of 0.01. Conveys runoff for 1000' through DMA 1 to existing catch basin on SE corner of property*
DA1 to Outlet 1	DMA A and DMA C drain to underground (UG) Basin A-2 to Outlet 1. DMA B drains to UG Basin A-2 to outlet 1. DMA D drains to Bioretention Basin A and overflows to UG Basin A-1 to Outlet 1.
DA2 to Outlet 2	DMA E drains to Bioretention Basin B and overflows to UG basin B. DMA F drains to Bioretention Basin C and overflows into UG Basin B. DMA G drians to UG Basin B. UG Basin B to Outlet 2.
DA3 to Outlet 3	DMA H drains to UG Basin C to Outlet 3 (CB on Bear Valley Rd.)

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1-3*

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)	497,455			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2			
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	A			
5 Longest flowpath length (ft)	951			
6 Longest flowpath slope (ft/ft)	0.177			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Natural Cover Barren			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50%* ***Attach photos of site to support rating***	poor			

*Not broken out into multiple DMAs and DAs due to entire site has the same existing Hydrologic characteristics.

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

Form 3-3 Watershed Description for Drainage Area

Receiving waters Refer to SWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Mojave River
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	None
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Mojave River Mojave Forks Reservoir outlet to Upper Narrows Fluoride
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	NA
Hydromodification Assessment	☒ Yes *Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal* ☐ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMPs and Site Design BMP Measures

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

4.1.1 Source Control BMPs

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

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

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

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	General information will be provided to the owner on housekeeping practices that contribute to the protection of storm water. The property owner and property manager will be familiar with the contents of this document and the BMPs used on the site. The owner will provide education materials to tenants (if applicable) on BMPs and housekeeping practices that contribute to the protection of storm water
N2	Activity Restrictions	☒	☐	The property owner/manager shall control the discharge of the stormwater pollutants from this site through activity restrictions. Restrictions shall be provided to all new tenants/occupants through lease terms, or other mechanism upon first occupancy of the lease space and annually thereafter. Enforcement of activity restriction shall be on going during the operation of the project site
N3	Landscape Management BMPs	☒	☐	The property owner, building operators, and landscape maintenance contractors will practice on going landscape maintenance BMPs consistent with applicable local ordinances and will regular inspect the irrigation system for signs of erosion or sediment debris buildup and clean/repair as needed.
N4	BMP Maintenance	☒	☐	The property owner/manager will maintain all post construction BMPs consistent with the O&M plan described in section 5 of this document (Form 5-1).
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	Storage of hazardous materials or waste on site must comply will all Title 22 CCR regulations

Form 4.1-1 Non-Structural Source Control BMPs

N6	Local Water Quality Ordinances	☒	☐	The owner shall comply with the City of Victorville's Stormwater Ordinance through the implementation of BMPs.
N7	Spill Contingency Plan	☒	☐	Building operators shall prepare specific plans based on materials onsite for the cleanup of spills. Plans shall mandate stock piling of cleanup materials, notification of agencies, disposal, documentation, etc. Storage shall comply with Hazmat Regulations and any required contingency plans
N8	Underground Storage Tank Compliance	☒	☐	The restaurants will have grease interceptors.
N9	Hazardous Materials Disclosure Compliance	☐	☒	NA

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☒	☐	The site shall conform to the building code requirements for fire safety implementation and all fire code requirements, regardless of product stored.
N11	Litter/Debris Control Program	☒	☐	The owner shall be responsible for trash and litter to be swept from the site and dumped into a City approved dumpster with lids. The owner shall contract with the city of Ontario or local trash collector to empty dumpsters on a weekly basis. Additionally ground maintenance personnel shall police the grounds for any litter.
N12	Employee Training	☒	☐	The owner will ensure that all employees are also familiar with onsite BMPs and necessary maintenance required by the tenants/ employees. Owner will check with the City and county at least once a year to obtain new updated educational materials and provide these materials to tenants/employees. Employees shall be trained to cleanup spills and participate in ongoing maintenance. The WQMP requires annual employee training and new hire training within 2 months.
N13	Housekeeping of Loading Docks	☐	☒	No Loading Docks in this project
N14	Catch Basin Inspection Program	☒	☐	Catch basins shall be inspected visually on a monthly basis; the entire storm drain system shall be inspected and cleaned prior to the start of the rainy season.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Parking and dock areas will be swept regularly using a vacuum assisted sweeper. Frequency will depend on waste accumulations with a minimum of once per month and prior to the start of the rainy season.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Project is not classified as a public agency project

N17	Comply with all other applicable NPDES permits	☒	☐	The developer will comply with the California statewide Construction General Permit during construction and all future occupants of the site shall comply with the requirements of the statewide General Stormwater Permit.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	All storm drain inlets shall have Stenciling illustrating an anti-dumping message.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	This development does not include the storage of materials outdoors.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash storage areas shall be located away from storm drain inlets. All trash dumpsters/containers will be required to have a lid on at all times to prevent direct precipitation and prevent any rainfall from entering containers.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	Irrigation systems will be designed to each landscaped area's specific water need. Irrigation controls shall include rain-triggered shutoff devices to prevent irrigation after precipitation.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscaped areas shall be below a minimum of 1" to 2" below the top of curb or walk.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☐	☒	No slopes proposed within new development.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No docks proposed within new development.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No covered maintenance bays
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash areas proposed within new development
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No processing areas proposed within new development

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment wash area on site. Owner will not allow outdoor processing area on this site
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling area onsite. Owner will not allow fueling area on this site.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	Not a hillside project
S14	Wash water control for food preparation areas	☐	☒	No food preparation area on site
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No community car wash racks on site

4.1.2 Site Design BMPs

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

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

Describe site design and drainage plan including:

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

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

Form 4.1-3 Site Design Practices Checklist

Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☒ No ☐ Explanation: : Landscaped areas and trees are increase the pervious area and decrease impervious areas.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: Underground infiltration system bottom with natural soils, no compaction.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: After development the use of Bioretention Basins and UG detention basins will be designed to mitigated time of concentration. Overflows and any storm drainage leaving the site will flow into Bear Valley Road as it does it the existing cond.
Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain : Yes ☒ No ☐ Explanation: Landscaped area next to buildings are disconnect the impervious areas. Roof top drains into landscaped areas
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: This project does not proposed porous pavement.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: There is no significant existing vegetation and sensitive areas to protect.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☐ No ☒ Explanation: There is no re-vegetation areas on site.

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

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

San Bernardino County Special Districts:

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

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

Mojave Water Agency:

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

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

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

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

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

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

4.2 Treatment BMPs

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

4.2.1 Project Specific Hydrology Characterization

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

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

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

Methods applied in the following forms include:

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

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
1 Project area DA 1 (ft^2): 349,351	**2** Imperviousness after applying preventative site design practices (Imp%): 88%	**3** Runoff Coefficient (Rc): _0.7018 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.404 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.4998 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 20,045 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

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

Is the change in post- and pre- condition flows captured on-site? : Yes ☒ No ☐

If "Yes", then complete Hydromodification assessment of site hydrology for 10yr storm event using Forms 4.2-3 through 4.2-5 and insert results below *(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual- Addendum 1)*

If "No," then proceed to Section 4.3 BMP Selection and Sizing

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** 32451 *Form 4.2-3 Item 12*	**2** 16.6 *Form 4.2-4 Item 13*	**3** 9.92 *Form 4.2-5 Item 10*
Post-developed	**4** 57298 *Form 4.2-3 Item 13*	**5** 10.55 *Form 4.2-4 Item 14*	**6** 14 *Form 4.2-5 Item 14*
Difference	**7** *24847* *Item 4 – Item 1*	**8** *6.05* *Item 2 – Item 5*	**9** *4.08* *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *77%* *Item 7 / Item 1*	**11** *36%* *Item 8 / Item 2*	**12** *41%* *Item 9 / Item 3*

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

Weighted Curve Number Determination for: Pre-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type	barren							
2a Hydrologic Soil Group (HSG)	A							
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	349350							
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	78							
Weighted Curve Number Determination for: Post-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type	landscape							
2b Hydrologic Soil Group (HSG)	A							
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	349350							
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	32							

5 Pre-Developed area-weighted CN: 78.0	**7** Pre-developed soil storage capacity, S (in): 2.82 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 0.564 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 90	**8** Post-developed soil storage capacity, S (in): 1.11 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.22 *I_a = 0.2 * Item 8*

11 Precipitation for 10 yr, 24 hr storm (in): 2.98
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 32451
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3): 57298
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet hydromodification requirement, (ft^3): 21,985
*Vhydro = (Item 13 * 0.95) – Item 12*

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

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

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

See unit Hydrograph in Appendix D HCOC Analysis

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

Compute peak runoff for pre- and post-developed conditions

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

See unit Hydrograph in Appendix D HCOC Analysis

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2)

1 Project area DA 2 (ft^2): 57,064	**2** Imperviousness after applying preventative site design practices (Imp%): 88	**3** Runoff Coefficient (Rc): _0.7018 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*

4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.404 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

5 Compute P_6, Mean 6-hr Precipitation (inches): 0.4998

*P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*

6 Drawdown Rate

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

24-hrs ☐
48-hrs ☒

7 Compute design capture volume, DCV (ft^3): 3,247

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

Form 4.2-2 Summary of HCOC Assessment (DA 2)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☒ No ☐

Go to: http://sbcounty.permitrack.com/WAP/

If "Yes", then complete HCOC assessment of site hydrology for 2yr 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)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** 5,303 *Form 4.2-3 Item 12*	**2** 14.9 *Form 4.2-4 Item 13*	**3** 2.01 *Form 4.2-5 Item 10*
Post-developed	**4** 9,329 *Form 4.2-3 Item 13*	**5** 5.90 *Form 4.2-4 Item 14*	**6** 2.94 *Form 4.2-5 Item 14*
Difference	**7** *4,026* *Item 4 – Item 1*	**8** *9.0* *Item 2 – Item 5*	**9** *0.93* *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *76%* *Item 7 / Item 1*	**11** *60%* *Item 8 / Item 2*	**12** *46%* *Item 9 / Item 3*

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 2)

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							
2a Hydrologic Soil Group (HSG)	A							
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	57064							
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	78							
Weighted Curve Number Determination for: Post-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type	Landscape							
2b Hydrologic Soil Group (HSG)	A							
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	57064							
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	32							

5 Pre-Developed area-weighted CN: 78	**7** Pre-developed soil storage capacity, S (in): 2.92 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 1.11 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 90	**8** Post-developed soil storage capacity, S (in): 1.11 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.22 *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in): 2.98

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

12 Pre-developed Volume (ft^3): 5,303

*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3): 9,329

*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet HCOC Requirement, (ft^3): 3,591

*V_{HCOC} = (Item 13 * 0.95) – Item 12*

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 3)

1 Project area DA 3 (ft^2): 91,040	**2** Imperviousness after applying preventative site design practices (Imp%): 88	**3** Runoff Coefficient (Rc): _0.7018 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*

4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.404 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*

5 Compute P_6, Mean 6-hr Precipitation (inches): 0.4998

*P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*

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

7 Compute design capture volume, DCV (ft^3): 5,224

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

Form 4.2-2 Summary of HCOC Assessment (DA 3)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☐ No ☐

Go to: http://sbcounty.permitrack.com/WAP/

If "Yes", then complete HCOC assessment of site hydrology for 2yr 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)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** 8,460 *Form 4.2-3 Item 12*	**2** 14 *Form 4.2-4 Item 13*	**3** 2.68 *Form 4.2-5 Item 10*
Post-developed	**4** 14,932 *Form 4.2-3 Item 13*	**5** 7.68 *Form 4.2-4 Item 14*	**6** 4.48 *Form 4.2-5 Item 14*
Difference	**7** *6,462* *Item 4 – Item 1*	**8** *6.32* *Item 2 – Item 5*	**9** *1.8* *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *77%* *Item 7 / Item 1*	**11** *45%* *Item 8 / Item 2*	**12** *67%* *Item 9 / Item 3*

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 3)

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							
2a Hydrologic Soil Group (HSG)	A							
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	91,040							
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	78							
Weighted Curve Number Determination for: Post-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type	Landscape							
2b Hydrologic Soil Group (HSG)	A							
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	91,040							
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	32							

5 Pre-Developed area-weighted CN: 78	**7** Pre-developed soil storage capacity, S (in): 2.82 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 0.567 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 90	**8** Post-developed soil storage capacity, S (in): 1.11 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.22 *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in): 2.98

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

12 Pre-developed Volume (ft^3): 8,457

*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3): 14,932

*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet HCOC Requirement, (ft^3): 5,729

*V_{HCOC} = (Item 13 * 0.95) – Item 12*

4.3 BMP Selection and Sizing

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

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

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

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

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

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

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

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

4.3.1 Exceptions to Requirements for Bioretention Facilities

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

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

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

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

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

4.3.2 Site Design BMP

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

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

Form 4.3-2 Site Design BMPs (DA 1)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3):	$V_{retention}$ *=Sum of Item 4 for all BMPs*		
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☒ No ☐ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA 1 DMA B BMP Type HSC Vegetative swales	DA 1 DMA D BMP Type HSC Bio. Basin A	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)	1095	2404	
8 Ponding depth (ft) (min. 0.5 ft.)	0.5	1	
9 Surface area of amended soil/gravel (ft^2)	1095	1202	
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)	1	2	
11 Average porosity of amended soil/gravel	0.4	0.4	
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*	985	3365	
13 Runoff volume retention from on-lot infiltration (ft^3): 4350	$V_{retention}$ *=Sum of Item 12 for all BMPs*		

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

14 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 14-18. If no, proceed to Item 19*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Number of Street Trees			
16 Average canopy cover over impervious area (ft^2)			
17 Runoff volume retention from street trees (ft^3) $V_{retention}$ *= Item 15 * Item 16 * (0.05/12) assume runoff retention of 0.05 inches*			
18 Runoff volume retention from street tree BMPs (ft^3): $V_{retention}$ *= Sum of Item 17 for all BMPs*			
19 Total Retention Volume from Site Design BMPs: 4350 *Sum of Items 5, 13 and 18*			

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 2)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☐ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3): *$V_{retention}$ =Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☒ No ☐ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA 2 DMA E BMP Type HSC Bio. Basin B	DA 2 DMA F BMP Type HSC Bio. Basin C	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)	963	930	
8 Ponding depth (ft)	0.5	0.5	
9 Surface area of amended soil/gravel (ft^2)	500	450	
10 Average depth of amended soil/gravel (ft)	2	2	
11 Average porosity of amended soil/gravel	0.4	0.4	
12 Retention volume achieved from on-lot infiltration (ft^3) *$V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*	881	775	
13 Runoff volume retention from on-lot infiltration (ft^3): 1656 *$V_{retention}$ =Sum of Item 12 for all BMPs*			

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA 2)

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☐ *If yes, complete Items 15-20. If no, proceed to Item 21*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Rooftop area planned for ET BMP (ft^2)			
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*			
17 Daily ET demand (ft^3/day) *Item 15 * (Item 16 / 12)*			
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*			
19 Retention Volume (ft^3) *$V_{retention}$ = Item 17 * (Item 18 / 24)*			
20 Runoff volume retention from evapotranspiration BMPs (ft^3): *$V_{retention}$ =Sum of Item 19 for all BMPs*			
21 Implementation of Street Trees: Yes ☐ No ☐ *If yes, complete Items 22-25. If no, proceed to Item 26*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft^2)			
24 Runoff volume retention from street trees (ft^3) *$V_{retention}$ = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*			
25 Runoff volume retention from street tree BMPs (ft^3): *$V_{retention}$ = Sum of Item 24 for all BMPs*			
26 Implementation of residential rain barrels/cisterns: Yes ☐ No ☐ *If yes, complete Items 27-29; If no, proceed to Item 30*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft^3) *$V_{retention}$ = Item 27 * 3*			
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): *$V_{retention}$ =Sum of Item 28 for all BMPs*			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 1656 *Sum of Items 5, 13, 20, 25 and 29*			

4.3.3 Infiltration BMPs

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

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

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

4.3.3.1 Allowed Variations for Special Site Conditions

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

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

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

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

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

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

1 Remaining LID DCV not met by site design BMP (ft^3): 15,695 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*			
BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 DMA B BMP Type UG Infiltration	DA 1 DMA A,D BMP Type UG Infiltration	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods*			
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*			
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*			
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*			
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*			
8 Infiltrating surface area, *SA_{BMP}* (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*			
9 Amended soil depth, *d_{media}* (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity			
11 Gravel depth, *d_{media}* (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*			
12 Gravel porosity			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	10,786	7,469	
16 Total Retention Volume from LID Infiltration BMPs: 17,635 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: 100% *Retention% = Item 16 / Form 4.2-1 Item 7*			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐ *If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.*			

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 2)

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 1,618 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 2 DMA E,F BMP Type UG Infiltration	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*			
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*			
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*			
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*			
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*			
8 Infiltrating surface area, *SA_{BMP}* (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*			
9 Amended soil depth, *d_{media}* (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity			
11 Gravel depth, *d_{media}* (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*			
12 Gravel porosity			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	1,935		

16 Total Retention Volume from LID Infiltration BMPs: 1,935 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 100% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

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

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 5,224 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 3 DMA H BMP Type UG Infiltration	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*			
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*			
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*			
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*			
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*			
8 Infiltrating surface area, *SA_{BMP}* (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*			
9 Amended soil depth, *d_{media}* (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity			
11 Gravel depth, *d_{media}* (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*			
12 Gravel porosity			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	5,936		

16 Total Retention Volume from LID Infiltration BMPs: 5,936 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 100% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

4.3.4 Biotreatment BMP

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

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

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

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

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

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

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

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

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

Form 4.3-7 Flow Based Biotreatment (DA 1)

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

4.3.5 Conformance Summary

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

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

1 Total LID DCV for the Project DA-1 (ft^3): 20,045 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design BMP (ft^3): 4,350 *Copy Item18 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 17,635 *Copy Item 16 in Form 4.3-3*

4 On-site biotreatment with volume based biotreatment BMP (ft^3): *Copy Item 3 in Form 4.3-4*

5 Flow capacity provided by flow based biotreatment BMP (cfs): *Copy Item 6 in Form 4.3-4*

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 2)

1 Total LID DCV for the Project DA 2 (ft^3): 3,274 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 1,656 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 2,106 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, 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)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 3)

1 Total LID DCV for the Project DA 3 (ft^3): 5,729 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 5,936 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, 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)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

4.3.6 Hydromodification Control BMP

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

Form 4.3-9 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for hydromodification performance criteria (ft^3): 21,985 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design and infiltration, BMP (ft^3): 22,605 *Sum of Form 4.3-8 Items 2, 3, and 4. Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving hydromodification volume reduction*
3 Remaining volume for hydromodification volume capture (ft^3): 0 *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site BMPs (ft^3):

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

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

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

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

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

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

Form 4.3-10 Hydromodification Control BMPs (DA 2)

1 Volume reduction needed for HCOC performance criteria (ft^3): 3,591
*(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*

2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): 3,762 *Sum of Form 4.3-9 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 HCOC volume reduction*

3 Remaining volume for HCOC volume capture (ft^3): 0 *Item 1 – Item 2*

4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ *Attach in-stream control BMP selection and evaluation to this WQMP*

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

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

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☐
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- 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 ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☒

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

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

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☒
  BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

Form 4.3-10 Hydromodification Control BMPs (DA 3)

1 Volume reduction needed for HCOC performance criteria (ft^3): 5,729
*(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*

2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): 5,936 *Sum of Form 4.3-9 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 HCOC volume reduction*

3 Remaining volume for HCOC volume capture (ft^3): 0 *Item 1 – Item 2*

4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ *Attach in-stream control BMP selection and evaluation to this WQMP*

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

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

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☐
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- 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 ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☒

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

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

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☒
  BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

4.4 Alternative Compliance Plan (if applicable)

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

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

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

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

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

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

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Infiltration Basin	Owner	Regular inspections of system to observe sediment build up and infiltration capacity. Cleaning of accumulated trash, debris and seediment as determined by inspections. Cleaning is recommended during dry weather. See manufacturer recommendations for additional maintenance activities	Monthly and within 48 hours follwing a significant storm event to verify there is no standing water
Catch Basin /w Filter Insert	Owner	Inspect for illegal dumping and /or debris accumulation. Clean filters whenever 25% of filter capacity is exceeded by debris accumulation	Twice per year and after major storm event
Landscape Maintenance	Owner	Maintain landscape area vegetation, slope protection and grades, adjacent to hardscape and prevent discharges of landscape maintenance waste into storm drains	Weekly
Roadways & Parking Area	Owner	Clean and remove accumulated sand and debris in parking lots and along roadway. Sweep pavement in lieu of using house or water spray. Ensure stormwater runoff is not impeded by deposit of debris and accumulated sediment by ground maintenance staff.	Inspect after wind storm or minimum monthly

Litter Control	Owner	Site to be inspected and all litter be collected and disposed of in trash containers. Inspection and maintenance to be performed by Owner	Weekly
Signage and Stencil	Owner	Clean the stencil/signage surface to remove any excess dirt Re-paint if necessary.	Annually
Bioretention basins	Owner	Inspect catchment area for an excessive sediment, trash, and/or debris accumulation on surface. Clean up excessive sediment, trash, and/or debris accumulation. Litter leaves and debris should be removed from Basin to reduce risk of clogging. Clean grated inlet and filter inserts.	4 times Annually, and after heavy rain

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

6.3 Post Construction

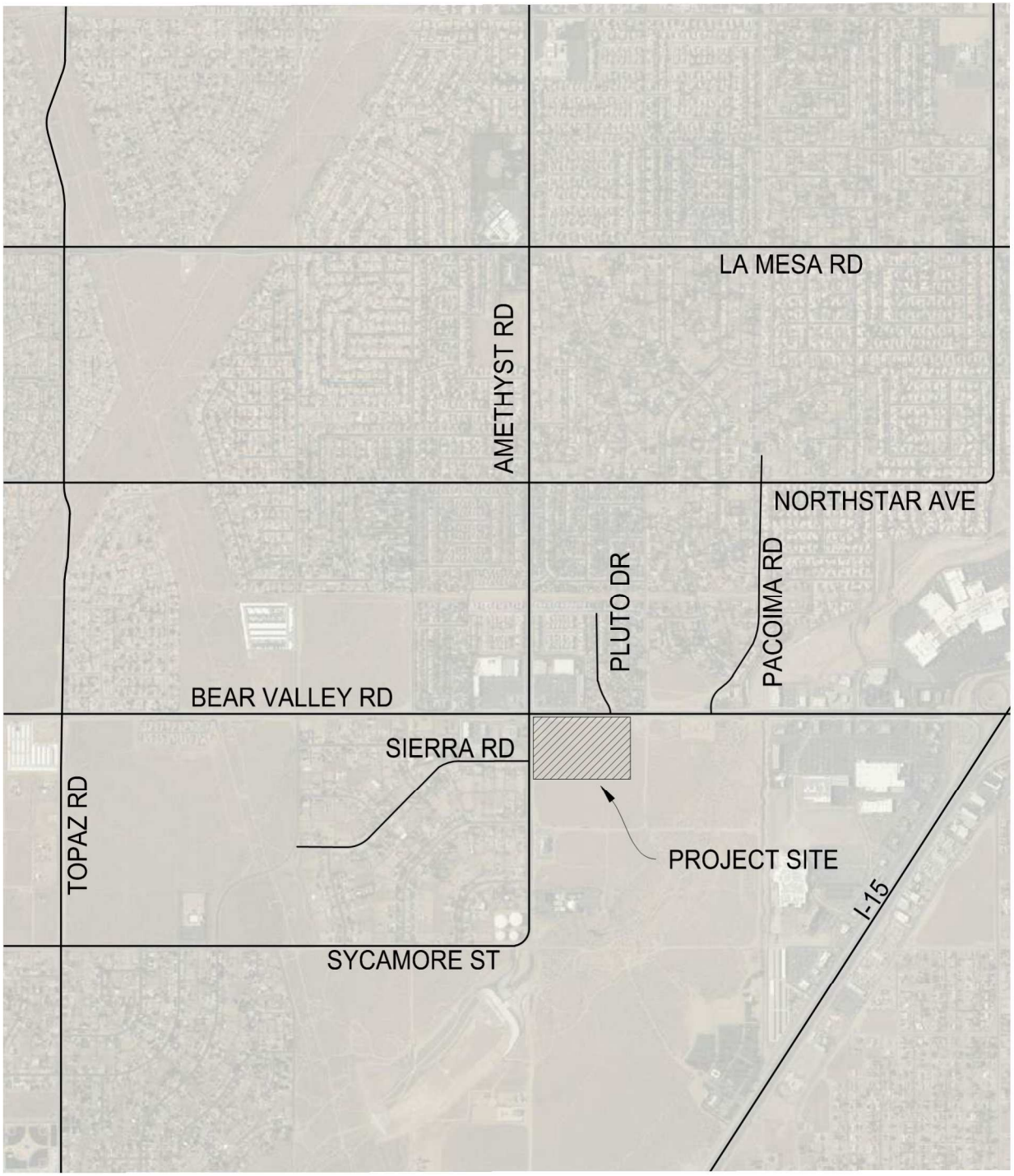
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

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

Appendix A

Vicinity Map



N

NOT TO SCALE

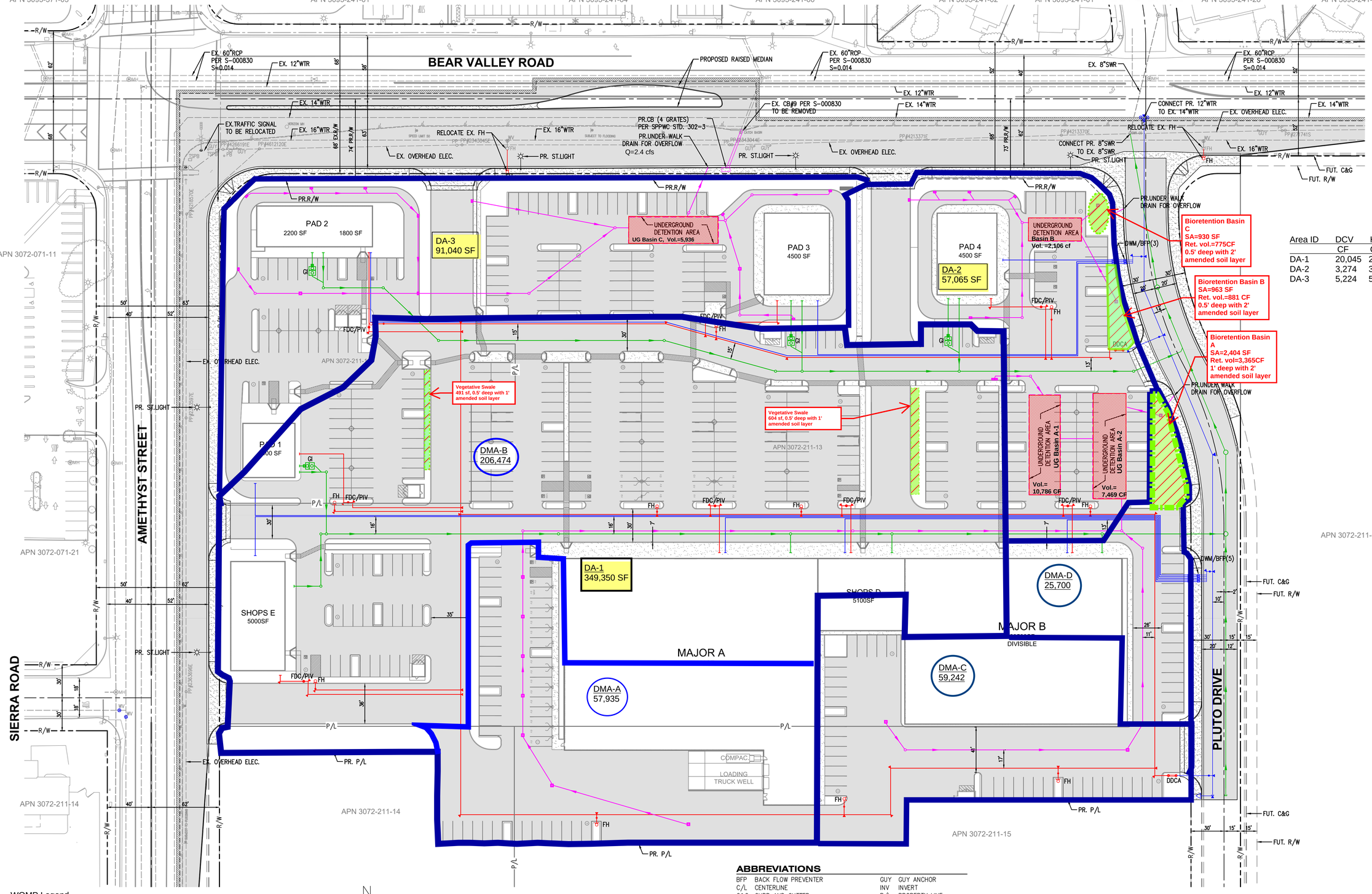
DAVID EVANS AND ASSOCIATES INC.

EXHIBIT A: VICINITY MAP
AMETHYST CROSSING
VICTORVILLE, CALIFORNIA

Drawing Name: P:\HHIGP00000002\040CAD\EXHIBITS\01_Traffic Scope\Exhibit A.dwg
Last Opened: Aug 13, 2021 - 4:50pm by: Tinn

Appendix B

WQMP Site Plan



Area ID	DCV	HCOC	PROVIDED
	CF	CF	CF
DA-1	20,045	21,985	22,605
DA-2	3,274	3,591	3,762
DA-3	5,224	5,729	5,936

NOT FOR CONSTRUCTION

WQMP Legend

- Bioretention Area
- DA-1 / 1000 — Area ID (Drainage Area) Area (SF)
- DMA-1 / 1000 — Drainage Management Area Area (SF)

N

scale 1"= 40' (40 0 40 80 feet)

UTILITY LEGEND

- PROPOSED FIRE WATER SERVICE
- PROPOSED DOMESTIC WATER SERVICE/MAIN
- PROPOSED SEWER SERVICE/MAIN
- PROPOSED STORM DRAIN
- PROPOSED SEWER PIPE FLOW DIRECTION
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

ABBREVIATIONS

BFP	BACK FLOW PREVENTER	GUY	GUY ANCHOR
C/L	CENTERLINE	INV	INVERT
C&G	CURB AND GUTTER	P/L	PROPERTY LINE
CB	CATCH BASIN	PIV	POST INDICATOR VALVE
DDCA	DOUBLE DETECTOR CHECK ASSEMBLY	PP	POWER POLE
DWM	DOMESTIC WATER METER	PS	PIPE SLOPE
EG	EXISTING GROUND	PR.	PROPOSED
EL.	ELEVATION	R/W	RIGHT OF WAY
ELEC.	ELECTRIC	ST.	STREET
EX.	EXISTING	SWR	SEWER
FDC	FIRE DEPARTMENT CONNECTION	TG	TOP OF GRATE
FF	FINISH FLOOR	TYP	TYPICAL
FH	FIRE HYDRANT	WTR	WATER
FUT.	FUTURE		

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Apple Valley California 92307
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SSchubert@deainc.com

DATE: 08/14/2021

IN THE CITY OF VICTORVILLE
AMETHYST CROSSINGS

WQMP Site Plan

FILE NO.

DRAWING NO.

SH. 1 OF 1

By: Shane Schubert
By: Smsc File: P:\HH\IGP00000020400CAD\SHEETSEC\CONCEPT PLANS\SHEET 3.dwg
Plot Date: 8/14/2021 6:39 PM
Save Date: 8/14/2021 6:38 PM

Appendix C

LID BMP sizing Calculations

LID Sizing

Bioswales In DA-1 DMA-B

Two Areas = 491 sf and 604 sf = 1,095 sf
Depth =0.5 foot
Porosity=0.4
Depth of gravel or amended soil layer=1 foot
Surface area of gravel layer=1,095 sf

1095 sf x 0.5 ft + (1095 x 1 ft x 0.4) = **985 CF**

Bioretention Basin A in DA-1
Area=2,404 sf
Depth=1 foot
Porosity=0.4
Depth of gravel or amended soil layer = 2 foot
Surface area of gravel layer=1,202 sf

2,404 x 1 ft + (1,202 sf x 2 ft x 0.4) = **3,365 CF**

Bioretention Basin B in DA-2
Area=963 sf
Depth=0.5 foot
Porosity=0.4
Depth of gravel or amended soil layer = 1 foot
Surface area of gravel layer=500 sf

963 x 0.5 ft + (500 sf x 1ft x 0.4) = **881 CF**

Bioretention Basin C in DA-2
Area=930 sf
Depth=0.5 foot
Porosity=0.4
Depth of gravel or amended soil layer = 1 foot
Surface area of gravel layer=450 sf
930 x 0.5 ft + (450 sf x 1ft x 0.4) = **775 CF**

Appendix D

HCOC Analysis

Unit Hydrograph summary

Unit Hydrograph Method

		Undeveloped		Developed		Mitigated		
Area ID	Area (sf)	TC (hour)	Q10 peak (cfs)	TC (hour)	Q10 peak (cfs)	TC (hour)	Q10 Peak (cfs)	HCOC Volume 10-yr (ac.ft)*
DA-1	349,350	0.277	9.92	0.176	14	0.383	6.22	21,985
DA-2	57,065	0.248	2.01	0.0983	2.94	0.228	1.29	3,591
DA-3	91,040	0.233	2.68	0.128	7.68	0.291	2.38	5,729
	11.42	0.758	**14.61**			**0.902**	**9.89**	

*See forms 4.2-3

Summary of DCV and HCOC

	DA-1	DA-2	DA-3
Area (SF)	**349,350**	**57,065**	**91,040**
DCV (CF)*	20,045	3,274	5,224
HCOC (CF)**	21,985	3,591	5,729
Site design BMPs Provided***	(4,350)	(1,656)	
Underground detention systems minimum needed (CF)	10,422 UG Basin A-1 7,213 UG Basin A-2 **17,635**	**1,935** UG Basin B	**5,729** UG Basin C
Underground detention systems provided (CF)	10,786 UG Basin A-1 7,469 UG Basin A-2 **18,255**	**2,106** UG Basin B	**5,936** UG Basin C

*See forms 4.2-1

**See forms 4.2-3

***See forms 4.3-2

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

Study date 08/23/21

++

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

Program License Serial Number 6385

Amethyst Crossing
Undeveloped 10-year
Area DA-1

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
8.02	1	0.70
Rainfall data for year 10		
8.02	6	1.47
Rainfall data for year 10		
8.02	24	2.98

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
78.0	78.0	8.02	1.000	0.404	1.000	0.404

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

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
8.02	1.000	78.0	78.0	2.82	0.374

Area-averaged catchment yield fraction, Y = 0.374
Area-averaged low loss fraction, Yb = 0.626
User entry of time of concentration = 0.277 (hours)
++
Watershed area = 8.02(Ac.)
Catchment Lag time = 0.222 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 37.6053
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.404(In/Hr)
Average low loss rate fraction (Yb) = 0.626 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.332(In)
Computed peak 30-minute rainfall = 0.569(In)
Specified peak 1-hour rainfall = 0.700(In)
Computed peak 3-hour rainfall = 1.103(In)
Specified peak 6-hour rainfall = 1.470(In)
Specified peak 24-hour rainfall = 2.980(In)

Rainfall depth area reduction factors:
Using a total area of 8.02(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.332(In)
30-minute factor = 1.000 Adjusted rainfall = 0.568(In)
1-hour factor = 1.000 Adjusted rainfall = 0.700(In)
3-hour factor = 1.000 Adjusted rainfall = 1.103(In)
6-hour factor = 1.000 Adjusted rainfall = 1.470(In)
24-hour factor = 1.000 Adjusted rainfall = 2.980(In)

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

Number	Mean values ((CFS))	
	(K = 96.99 (CFS))	
1	2.494	2.419
2	16.047	13.145
3	45.472	28.541
4	63.116	17.113
5	72.713	9.308
6	79.133	6.227
7	83.671	4.402
8	87.234	3.455
9	89.869	2.556
10	91.934	2.003
11	93.649	1.663
12	95.004	1.314
13	96.122	1.085
14	97.025	0.876
15	97.694	0.649
16	98.129	0.422
17	98.546	0.404
18	98.997	0.438
19	99.432	0.422
20	99.708	0.268
21	100.000	0.134

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3320	0.3320
2	0.4088	0.0767
3	0.4617	0.0529
4	0.5033	0.0416
5	0.5381	0.0348
6	0.5684	0.0303
7	0.5953	0.0269
8	0.6196	0.0243
9	0.6419	0.0223
10	0.6625	0.0206
11	0.6817	0.0192
12	0.6997	0.0180
13	0.7233	0.0236
14	0.7459	0.0226
15	0.7675	0.0216
16	0.7883	0.0208
17	0.8084	0.0201
18	0.8278	0.0194
19	0.8465	0.0188
20	0.8647	0.0182
21	0.8824	0.0177
22	0.8995	0.0172

23	0.9163	0.0167
24	0.9326	0.0163
25	0.9485	0.0159
26	0.9640	0.0155
27	0.9792	0.0152
28	0.9941	0.0149
29	1.0086	0.0146
30	1.0229	0.0143
31	1.0369	0.0140
32	1.0506	0.0137
33	1.0641	0.0135
34	1.0774	0.0132
35	1.0904	0.0130
36	1.1032	0.0128
37	1.1158	0.0126
38	1.1282	0.0124
39	1.1404	0.0122
40	1.1524	0.0120
41	1.1642	0.0118
42	1.1759	0.0117
43	1.1874	0.0115
44	1.1988	0.0114
45	1.2100	0.0112
46	1.2210	0.0111
47	1.2320	0.0109
48	1.2428	0.0108
49	1.2534	0.0107
50	1.2639	0.0105
51	1.2743	0.0104
52	1.2846	0.0103
53	1.2948	0.0102
54	1.3049	0.0101
55	1.3148	0.0100
56	1.3247	0.0098
57	1.3344	0.0097
58	1.3441	0.0096
59	1.3536	0.0095
60	1.3631	0.0095
61	1.3724	0.0094
62	1.3817	0.0093
63	1.3909	0.0092
64	1.4000	0.0091
65	1.4090	0.0090
66	1.4179	0.0089
67	1.4268	0.0089
68	1.4356	0.0088
69	1.4443	0.0087
70	1.4529	0.0086
71	1.4615	0.0086
72	1.4700	0.0085

73	1.4803	0.0104
74	1.4906	0.0103
75	1.5009	0.0102
76	1.5110	0.0102
77	1.5211	0.0101
78	1.5312	0.0100
79	1.5412	0.0100
80	1.5511	0.0099
81	1.5609	0.0099
82	1.5707	0.0098
83	1.5805	0.0097
84	1.5901	0.0097
85	1.5998	0.0096
86	1.6093	0.0096
87	1.6188	0.0095
88	1.6283	0.0095
89	1.6377	0.0094
90	1.6471	0.0094
91	1.6564	0.0093
92	1.6656	0.0093
93	1.6748	0.0092
94	1.6840	0.0092
95	1.6931	0.0091
96	1.7021	0.0091
97	1.7112	0.0090
98	1.7201	0.0090
99	1.7290	0.0089
100	1.7379	0.0089
101	1.7468	0.0088
102	1.7556	0.0088
103	1.7643	0.0088
104	1.7730	0.0087
105	1.7817	0.0087
106	1.7903	0.0086
107	1.7989	0.0086
108	1.8075	0.0086
109	1.8160	0.0085
110	1.8245	0.0085
111	1.8329	0.0084
112	1.8413	0.0084
113	1.8497	0.0084
114	1.8580	0.0083
115	1.8663	0.0083
116	1.8745	0.0083
117	1.8827	0.0082
118	1.8909	0.0082
119	1.8991	0.0082
120	1.9072	0.0081
121	1.9153	0.0081
122	1.9233	0.0081

123	1.9314	0.0080
124	1.9393	0.0080
125	1.9473	0.0080
126	1.9552	0.0079
127	1.9631	0.0079
128	1.9710	0.0079
129	1.9788	0.0078
130	1.9866	0.0078
131	1.9944	0.0078
132	2.0021	0.0077
133	2.0099	0.0077
134	2.0176	0.0077
135	2.0252	0.0077
136	2.0328	0.0076
137	2.0405	0.0076
138	2.0480	0.0076
139	2.0556	0.0076
140	2.0631	0.0075
141	2.0706	0.0075
142	2.0781	0.0075
143	2.0855	0.0074
144	2.0930	0.0074
145	2.1003	0.0074
146	2.1077	0.0074
147	2.1151	0.0073
148	2.1224	0.0073
149	2.1297	0.0073
150	2.1370	0.0073
151	2.1442	0.0073
152	2.1514	0.0072
153	2.1586	0.0072
154	2.1658	0.0072
155	2.1730	0.0072
156	2.1801	0.0071
157	2.1872	0.0071
158	2.1943	0.0071
159	2.2014	0.0071
160	2.2084	0.0070
161	2.2155	0.0070
162	2.2225	0.0070
163	2.2294	0.0070
164	2.2364	0.0070
165	2.2433	0.0069
166	2.2503	0.0069
167	2.2572	0.0069
168	2.2640	0.0069
169	2.2709	0.0069
170	2.2777	0.0068
171	2.2846	0.0068
172	2.2914	0.0068

173	2.2982	0.0068
174	2.3049	0.0068
175	2.3117	0.0067
176	2.3184	0.0067
177	2.3251	0.0067
178	2.3318	0.0067
179	2.3384	0.0067
180	2.3451	0.0067
181	2.3517	0.0066
182	2.3583	0.0066
183	2.3649	0.0066
184	2.3715	0.0066
185	2.3781	0.0066
186	2.3846	0.0065
187	2.3911	0.0065
188	2.3977	0.0065
189	2.4041	0.0065
190	2.4106	0.0065
191	2.4171	0.0065
192	2.4235	0.0064
193	2.4300	0.0064
194	2.4364	0.0064
195	2.4428	0.0064
196	2.4491	0.0064
197	2.4555	0.0064
198	2.4618	0.0063
199	2.4682	0.0063
200	2.4745	0.0063
201	2.4808	0.0063
202	2.4871	0.0063
203	2.4933	0.0063
204	2.4996	0.0063
205	2.5058	0.0062
206	2.5121	0.0062
207	2.5183	0.0062
208	2.5245	0.0062
209	2.5306	0.0062
210	2.5368	0.0062
211	2.5430	0.0062
212	2.5491	0.0061
213	2.5552	0.0061
214	2.5613	0.0061
215	2.5674	0.0061
216	2.5735	0.0061
217	2.5796	0.0061
218	2.5856	0.0061
219	2.5917	0.0060
220	2.5977	0.0060
221	2.6037	0.0060
222	2.6097	0.0060

223	2.6157	0.0060
224	2.6216	0.0060
225	2.6276	0.0060
226	2.6336	0.0059
227	2.6395	0.0059
228	2.6454	0.0059
229	2.6513	0.0059
230	2.6572	0.0059
231	2.6631	0.0059
232	2.6690	0.0059
233	2.6748	0.0059
234	2.6807	0.0058
235	2.6865	0.0058
236	2.6923	0.0058
237	2.6981	0.0058
238	2.7039	0.0058
239	2.7097	0.0058
240	2.7155	0.0058
241	2.7213	0.0058
242	2.7270	0.0058
243	2.7327	0.0057
244	2.7385	0.0057
245	2.7442	0.0057
246	2.7499	0.0057
247	2.7556	0.0057
248	2.7613	0.0057
249	2.7669	0.0057
250	2.7726	0.0057
251	2.7782	0.0056
252	2.7839	0.0056
253	2.7895	0.0056
254	2.7951	0.0056
255	2.8007	0.0056
256	2.8063	0.0056
257	2.8119	0.0056
258	2.8175	0.0056
259	2.8230	0.0056
260	2.8286	0.0056
261	2.8341	0.0055
262	2.8397	0.0055
263	2.8452	0.0055
264	2.8507	0.0055
265	2.8562	0.0055
266	2.8617	0.0055
267	2.8671	0.0055
268	2.8726	0.0055
269	2.8781	0.0055
270	2.8835	0.0054
271	2.8890	0.0054
272	2.8944	0.0054

273	2.8998	0.0054
274	2.9052	0.0054
275	2.9106	0.0054
276	2.9160	0.0054
277	2.9214	0.0054
278	2.9268	0.0054
279	2.9321	0.0054
280	2.9375	0.0054
281	2.9428	0.0053
282	2.9482	0.0053
283	2.9535	0.0053
284	2.9588	0.0053
285	2.9641	0.0053
286	2.9694	0.0053
287	2.9747	0.0053
288	2.9800	0.0053

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0053	0.0033	0.0020
2	0.0053	0.0033	0.0020
3	0.0053	0.0033	0.0020
4	0.0053	0.0033	0.0020
5	0.0053	0.0033	0.0020
6	0.0053	0.0033	0.0020
7	0.0054	0.0034	0.0020
8	0.0054	0.0034	0.0020
9	0.0054	0.0034	0.0020
10	0.0054	0.0034	0.0020
11	0.0054	0.0034	0.0020
12	0.0054	0.0034	0.0020
13	0.0054	0.0034	0.0020
14	0.0055	0.0034	0.0020
15	0.0055	0.0034	0.0020
16	0.0055	0.0034	0.0021
17	0.0055	0.0034	0.0021
18	0.0055	0.0035	0.0021
19	0.0055	0.0035	0.0021
20	0.0056	0.0035	0.0021
21	0.0056	0.0035	0.0021
22	0.0056	0.0035	0.0021
23	0.0056	0.0035	0.0021
24	0.0056	0.0035	0.0021
25	0.0056	0.0035	0.0021
26	0.0056	0.0035	0.0021
27	0.0057	0.0035	0.0021
28	0.0057	0.0036	0.0021
29	0.0057	0.0036	0.0021

30	0.0057	0.0036	0.0021
31	0.0057	0.0036	0.0021
32	0.0058	0.0036	0.0022
33	0.0058	0.0036	0.0022
34	0.0058	0.0036	0.0022
35	0.0058	0.0036	0.0022
36	0.0058	0.0036	0.0022
37	0.0058	0.0037	0.0022
38	0.0059	0.0037	0.0022
39	0.0059	0.0037	0.0022
40	0.0059	0.0037	0.0022
41	0.0059	0.0037	0.0022
42	0.0059	0.0037	0.0022
43	0.0060	0.0037	0.0022
44	0.0060	0.0037	0.0022
45	0.0060	0.0038	0.0022
46	0.0060	0.0038	0.0022
47	0.0060	0.0038	0.0023
48	0.0061	0.0038	0.0023
49	0.0061	0.0038	0.0023
50	0.0061	0.0038	0.0023
51	0.0061	0.0038	0.0023
52	0.0061	0.0038	0.0023
53	0.0062	0.0039	0.0023
54	0.0062	0.0039	0.0023
55	0.0062	0.0039	0.0023
56	0.0062	0.0039	0.0023
57	0.0063	0.0039	0.0023
58	0.0063	0.0039	0.0023
59	0.0063	0.0039	0.0024
60	0.0063	0.0040	0.0024
61	0.0063	0.0040	0.0024
62	0.0064	0.0040	0.0024
63	0.0064	0.0040	0.0024
64	0.0064	0.0040	0.0024
65	0.0064	0.0040	0.0024
66	0.0065	0.0040	0.0024
67	0.0065	0.0041	0.0024
68	0.0065	0.0041	0.0024
69	0.0065	0.0041	0.0024
70	0.0066	0.0041	0.0025
71	0.0066	0.0041	0.0025
72	0.0066	0.0041	0.0025
73	0.0067	0.0042	0.0025
74	0.0067	0.0042	0.0025
75	0.0067	0.0042	0.0025
76	0.0067	0.0042	0.0025
77	0.0068	0.0042	0.0025
78	0.0068	0.0042	0.0025
79	0.0068	0.0043	0.0026

80	0.0068	0.0043	0.0026
81	0.0069	0.0043	0.0026
82	0.0069	0.0043	0.0026
83	0.0069	0.0043	0.0026
84	0.0070	0.0044	0.0026
85	0.0070	0.0044	0.0026
86	0.0070	0.0044	0.0026
87	0.0071	0.0044	0.0026
88	0.0071	0.0044	0.0027
89	0.0071	0.0045	0.0027
90	0.0072	0.0045	0.0027
91	0.0072	0.0045	0.0027
92	0.0072	0.0045	0.0027
93	0.0073	0.0046	0.0027
94	0.0073	0.0046	0.0027
95	0.0073	0.0046	0.0027
96	0.0074	0.0046	0.0028
97	0.0074	0.0046	0.0028
98	0.0074	0.0047	0.0028
99	0.0075	0.0047	0.0028
100	0.0075	0.0047	0.0028
101	0.0076	0.0047	0.0028
102	0.0076	0.0048	0.0028
103	0.0077	0.0048	0.0029
104	0.0077	0.0048	0.0029
105	0.0077	0.0048	0.0029
106	0.0078	0.0049	0.0029
107	0.0078	0.0049	0.0029
108	0.0079	0.0049	0.0029
109	0.0079	0.0050	0.0030
110	0.0080	0.0050	0.0030
111	0.0080	0.0050	0.0030
112	0.0081	0.0050	0.0030
113	0.0081	0.0051	0.0030
114	0.0082	0.0051	0.0030
115	0.0082	0.0051	0.0031
116	0.0083	0.0052	0.0031
117	0.0083	0.0052	0.0031
118	0.0084	0.0052	0.0031
119	0.0084	0.0053	0.0032
120	0.0085	0.0053	0.0032
121	0.0086	0.0054	0.0032
122	0.0086	0.0054	0.0032
123	0.0087	0.0054	0.0032
124	0.0087	0.0055	0.0033
125	0.0088	0.0055	0.0033
126	0.0088	0.0055	0.0033
127	0.0089	0.0056	0.0033
128	0.0090	0.0056	0.0034
129	0.0091	0.0057	0.0034

130	0.0091	0.0057	0.0034
131	0.0092	0.0058	0.0034
132	0.0093	0.0058	0.0035
133	0.0094	0.0059	0.0035
134	0.0094	0.0059	0.0035
135	0.0095	0.0060	0.0036
136	0.0096	0.0060	0.0036
137	0.0097	0.0061	0.0036
138	0.0097	0.0061	0.0036
139	0.0099	0.0062	0.0037
140	0.0099	0.0062	0.0037
141	0.0100	0.0063	0.0038
142	0.0101	0.0063	0.0038
143	0.0102	0.0064	0.0038
144	0.0103	0.0064	0.0039
145	0.0085	0.0053	0.0032
146	0.0086	0.0054	0.0032
147	0.0087	0.0054	0.0033
148	0.0088	0.0055	0.0033
149	0.0089	0.0056	0.0033
150	0.0090	0.0056	0.0034
151	0.0092	0.0057	0.0034
152	0.0093	0.0058	0.0035
153	0.0095	0.0059	0.0035
154	0.0095	0.0060	0.0036
155	0.0097	0.0061	0.0036
156	0.0098	0.0062	0.0037
157	0.0101	0.0063	0.0038
158	0.0102	0.0064	0.0038
159	0.0104	0.0065	0.0039
160	0.0105	0.0066	0.0039
161	0.0108	0.0068	0.0040
162	0.0109	0.0068	0.0041
163	0.0112	0.0070	0.0042
164	0.0114	0.0071	0.0042
165	0.0117	0.0073	0.0044
166	0.0118	0.0074	0.0044
167	0.0122	0.0076	0.0046
168	0.0124	0.0078	0.0046
169	0.0128	0.0080	0.0048
170	0.0130	0.0081	0.0049
171	0.0135	0.0084	0.0050
172	0.0137	0.0086	0.0051
173	0.0143	0.0089	0.0053
174	0.0146	0.0091	0.0054
175	0.0152	0.0095	0.0057
176	0.0155	0.0097	0.0058
177	0.0163	0.0102	0.0061
178	0.0167	0.0105	0.0063
179	0.0177	0.0111	0.0066

180	0.0182	0.0114	0.0068
181	0.0194	0.0121	0.0072
182	0.0201	0.0126	0.0075
183	0.0216	0.0135	0.0081
184	0.0226	0.0141	0.0084
185	0.0180	0.0113	0.0067
186	0.0192	0.0120	0.0072
187	0.0223	0.0139	0.0083
188	0.0243	0.0152	0.0091
189	0.0303	0.0189	0.0113
190	0.0348	0.0218	0.0130
191	0.0529	0.0331	0.0198
192	0.0767	0.0336	0.0431
193	0.3320	0.0336	0.2984
194	0.0416	0.0260	0.0156
195	0.0269	0.0168	0.0101
196	0.0206	0.0129	0.0077
197	0.0236	0.0148	0.0088
198	0.0208	0.0130	0.0078
199	0.0188	0.0117	0.0070
200	0.0172	0.0108	0.0064
201	0.0159	0.0100	0.0060
202	0.0149	0.0093	0.0056
203	0.0140	0.0088	0.0052
204	0.0132	0.0083	0.0050
205	0.0126	0.0079	0.0047
206	0.0120	0.0075	0.0045
207	0.0115	0.0072	0.0043
208	0.0111	0.0069	0.0041
209	0.0107	0.0067	0.0040
210	0.0103	0.0064	0.0038
211	0.0100	0.0062	0.0037
212	0.0096	0.0060	0.0036
213	0.0094	0.0059	0.0035
214	0.0091	0.0057	0.0034
215	0.0089	0.0055	0.0033
216	0.0086	0.0054	0.0032
217	0.0104	0.0065	0.0039
218	0.0102	0.0064	0.0038
219	0.0100	0.0062	0.0037
220	0.0098	0.0061	0.0037
221	0.0096	0.0060	0.0036
222	0.0095	0.0059	0.0035
223	0.0093	0.0058	0.0035
224	0.0092	0.0057	0.0034
225	0.0090	0.0056	0.0034
226	0.0089	0.0056	0.0033
227	0.0088	0.0055	0.0033
228	0.0086	0.0054	0.0032
229	0.0085	0.0053	0.0032

230	0.0084	0.0053	0.0031
231	0.0083	0.0052	0.0031
232	0.0082	0.0051	0.0031
233	0.0081	0.0051	0.0030
234	0.0080	0.0050	0.0030
235	0.0079	0.0049	0.0030
236	0.0078	0.0049	0.0029
237	0.0077	0.0048	0.0029
238	0.0076	0.0048	0.0029
239	0.0076	0.0047	0.0028
240	0.0075	0.0047	0.0028
241	0.0074	0.0046	0.0028
242	0.0073	0.0046	0.0027
243	0.0073	0.0045	0.0027
244	0.0072	0.0045	0.0027
245	0.0071	0.0045	0.0027
246	0.0070	0.0044	0.0026
247	0.0070	0.0044	0.0026
248	0.0069	0.0043	0.0026
249	0.0069	0.0043	0.0026
250	0.0068	0.0043	0.0025
251	0.0067	0.0042	0.0025
252	0.0067	0.0042	0.0025
253	0.0066	0.0042	0.0025
254	0.0066	0.0041	0.0025
255	0.0065	0.0041	0.0024
256	0.0065	0.0041	0.0024
257	0.0064	0.0040	0.0024
258	0.0064	0.0040	0.0024
259	0.0063	0.0040	0.0024
260	0.0063	0.0039	0.0024
261	0.0062	0.0039	0.0023
262	0.0062	0.0039	0.0023
263	0.0062	0.0039	0.0023
264	0.0061	0.0038	0.0023
265	0.0061	0.0038	0.0023
266	0.0060	0.0038	0.0023
267	0.0060	0.0037	0.0022
268	0.0059	0.0037	0.0022
269	0.0059	0.0037	0.0022
270	0.0059	0.0037	0.0022
271	0.0058	0.0037	0.0022
272	0.0058	0.0036	0.0022
273	0.0058	0.0036	0.0022
274	0.0057	0.0036	0.0021
275	0.0057	0.0036	0.0021
276	0.0057	0.0035	0.0021
277	0.0056	0.0035	0.0021
278	0.0056	0.0035	0.0021
279	0.0056	0.0035	0.0021

280	0.0055	0.0035	0.0021
281	0.0055	0.0034	0.0021
282	0.0055	0.0034	0.0020
283	0.0054	0.0034	0.0020
284	0.0054	0.0034	0.0020
285	0.0054	0.0034	0.0020
286	0.0054	0.0034	0.0020
287	0.0053	0.0033	0.0020
288	0.0053	0.0033	0.0020

Total soil rain loss = 1.68(In)
Total effective rainfall = 1.30(In)
Peak flow rate in flood hydrograph = 9.92(CFS)

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

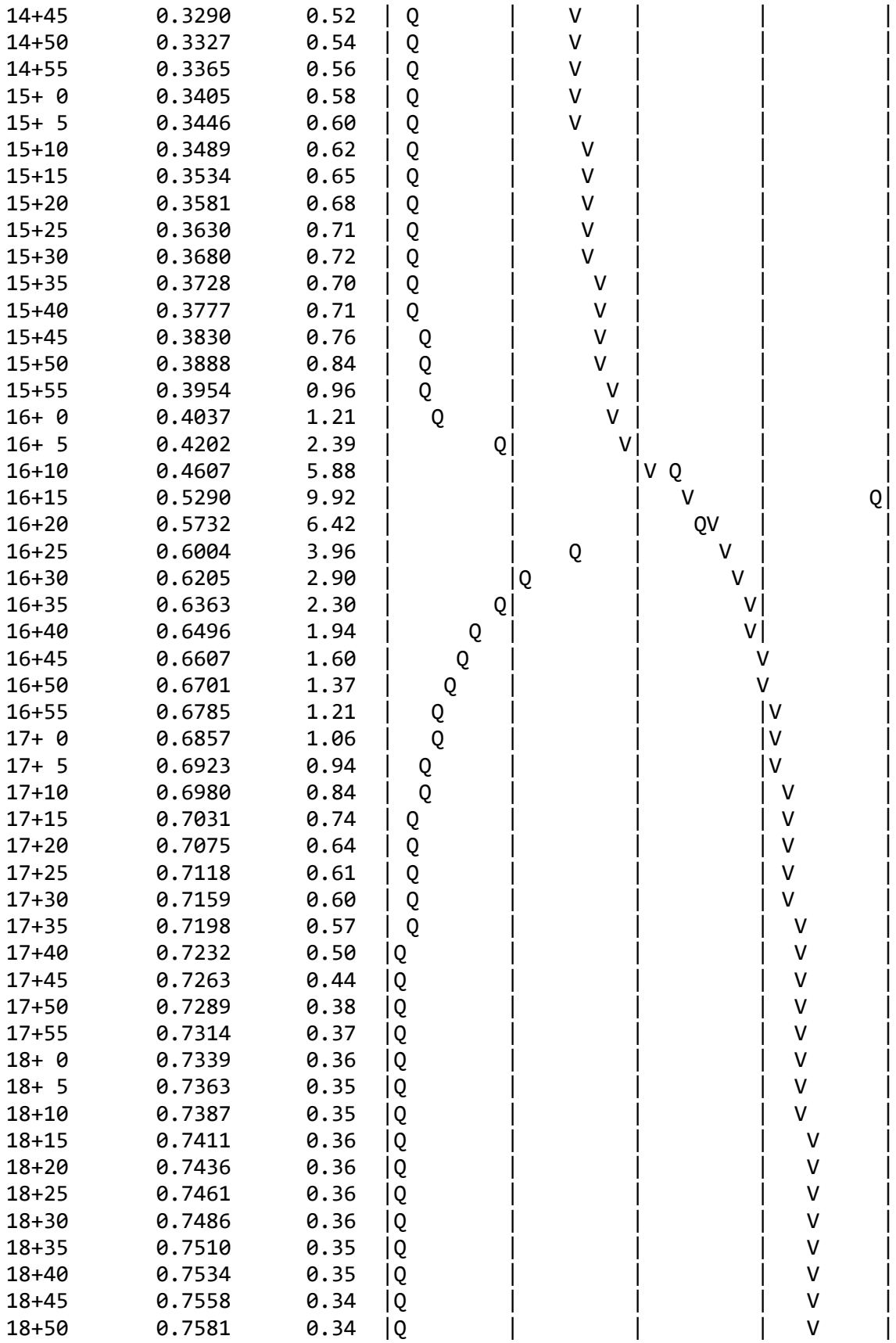
Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.00	Q	|	|	|	|
0+10	0.0002	0.03	Q	|	|	|	|
0+15	0.0008	0.09	Q	|	|	|	|
0+20	0.0017	0.12	Q	|	|	|	|
0+25	0.0026	0.14	Q	|	|	|	|
0+30	0.0037	0.15	Q	|	|	|	|
0+35	0.0048	0.16	Q	|	|	|	|
0+40	0.0060	0.17	Q	|	|	|	|
0+45	0.0072	0.17	Q	|	|	|	|
0+50	0.0084	0.18	Q	|	|	|	|
0+55	0.0097	0.18	Q	|	|	|	|
1+ 0	0.0109	0.19	Q	|	|	|	|
1+ 5	0.0122	0.19	Q	|	|	|	|
1+10	0.0135	0.19	Q	|	|	|	|
1+15	0.0149	0.19	Q	|	|	|	|
1+20	0.0162	0.19	Q	|	|	|	|
1+25	0.0175	0.19	Q	|	|	|	|
1+30	0.0189	0.20	Q	|	|	|	|
1+35	0.0203	0.20	Q	|	|	|	|
1+40	0.0216	0.20	Q	|	|	|	|
1+45	0.0230	0.20	QV	|	|	|	|
1+50	0.0244	0.20	QV	|	|	|	|
1+55	0.0258	0.20	QV	|	|	|	|
2+ 0	0.0271	0.20	QV	|	|	|	|
2+ 5	0.0285	0.20	QV	|	|	|	|
2+10	0.0299	0.20	QV	|	|	|	|

2+15	0.0313	0.20	QV	|	|	|	|
2+20	0.0327	0.20	QV	|	|	|	|
2+25	0.0341	0.20	QV	|	|	|	|
2+30	0.0355	0.20	QV	|	|	|	|
2+35	0.0370	0.21	QV	|	|	|	|
2+40	0.0384	0.21	QV	|	|	|	|
2+45	0.0398	0.21	QV	|	|	|	|
2+50	0.0412	0.21	QV	|	|	|	|
2+55	0.0427	0.21	QV	|	|	|	|
3+ 0	0.0441	0.21	Q V	|	|	|	|
3+ 5	0.0455	0.21	Q V	|	|	|	|
3+10	0.0470	0.21	Q V	|	|	|	|
3+15	0.0484	0.21	Q V	|	|	|	|
3+20	0.0499	0.21	Q V	|	|	|	|
3+25	0.0513	0.21	Q V	|	|	|	|
3+30	0.0528	0.21	Q V	|	|	|	|
3+35	0.0543	0.21	Q V	|	|	|	|
3+40	0.0557	0.21	Q V	|	|	|	|
3+45	0.0572	0.21	Q V	|	|	|	|
3+50	0.0587	0.22	Q V	|	|	|	|
3+55	0.0602	0.22	Q V	|	|	|	|
4+ 0	0.0617	0.22	Q V	|	|	|	|
4+ 5	0.0632	0.22	Q V	|	|	|	|
4+10	0.0647	0.22	Q V	|	|	|	|
4+15	0.0662	0.22	Q V	|	|	|	|
4+20	0.0677	0.22	Q V	|	|	|	|
4+25	0.0692	0.22	Q V	|	|	|	|
4+30	0.0707	0.22	Q V	|	|	|	|
4+35	0.0723	0.22	Q V	|	|	|	|
4+40	0.0738	0.22	Q V	|	|	|	|
4+45	0.0753	0.22	Q V	|	|	|	|
4+50	0.0769	0.22	Q V	|	|	|	|
4+55	0.0784	0.22	Q V	|	|	|	|
5+ 0	0.0800	0.23	Q V	|	|	|	|
5+ 5	0.0815	0.23	Q V	|	|	|	|
5+10	0.0831	0.23	Q V	|	|	|	|
5+15	0.0847	0.23	Q V	|	|	|	|
5+20	0.0862	0.23	Q V	|	|	|	|
5+25	0.0878	0.23	Q V	|	|	|	|
5+30	0.0894	0.23	Q V	|	|	|	|
5+35	0.0910	0.23	Q V	|	|	|	|
5+40	0.0926	0.23	Q V	|	|	|	|
5+45	0.0942	0.23	Q V	|	|	|	|
5+50	0.0958	0.23	Q V	|	|	|	|
5+55	0.0975	0.24	Q V	|	|	|	|
6+ 0	0.0991	0.24	Q V	|	|	|	|
6+ 5	0.1007	0.24	Q V	|	|	|	|
6+10	0.1024	0.24	Q V	|	|	|	|
6+15	0.1040	0.24	Q V	|	|	|	|
6+20	0.1057	0.24	Q V	|	|	|	|

```
 6+25       0.1073      0.24  Q   V     |          |          |          |
 6+30       0.1090      0.24  Q    V    |          |          |          |
 6+35       0.1106      0.24  Q    V    |          |          |          |
 6+40       0.1123      0.24  Q    V    |          |          |          |
 6+45       0.1140      0.24  Q    V    |          |          |          |
 6+50       0.1157      0.25  Q    V    |          |          |          |
 6+55       0.1174      0.25  Q    V    |          |          |          |
 7+ 0       0.1191      0.25  Q    V    |          |          |          |
 7+ 5       0.1208      0.25  Q    V    |          |          |          |
 7+10       0.1226      0.25  |Q   V    |          |          |          |
 7+15       0.1243      0.25  |Q   V    |          |          |          |
 7+20       0.1260      0.25  |Q   V    |          |          |          |
 7+25       0.1278      0.25  |Q   V    |          |          |          |
 7+30       0.1295      0.25  |Q   V    |          |          |          |
 7+35       0.1313      0.26  |Q    V   |          |          |          |
 7+40       0.1331      0.26  |Q    V   |          |          |          |
 7+45       0.1348      0.26  |Q    V   |          |          |          |
 7+50       0.1366      0.26  |Q    V   |          |          |          |
 7+55       0.1384      0.26  |Q    V   |          |          |          |
 8+ 0       0.1402      0.26  |Q    V   |          |          |          |
 8+ 5       0.1421      0.26  |Q    V   |          |          |          |
 8+10       0.1439      0.26  |Q    V   |          |          |          |
 8+15       0.1457      0.27  |Q    V   |          |          |          |
 8+20       0.1476      0.27  |Q    V   |          |          |          |
 8+25       0.1494      0.27  |Q    V   |          |          |          |
 8+30       0.1513      0.27  |Q    V   |          |          |          |
 8+35       0.1531      0.27  |Q     V  |          |          |          |
 8+40       0.1550      0.27  |Q     V  |          |          |          |
 8+45       0.1569      0.27  |Q     V  |          |          |          |
 8+50       0.1588      0.28  |Q     V  |          |          |          |
 8+55       0.1607      0.28  |Q     V  |          |          |          |
 9+ 0       0.1626      0.28  |Q     V  |          |          |          |
 9+ 5       0.1646      0.28  |Q     V  |          |          |          |
 9+10       0.1665      0.28  |Q     V  |          |          |          |
 9+15       0.1685      0.28  |Q     V  |          |          |          |
 9+20       0.1704      0.29  |Q     V  |          |          |          |
 9+25       0.1724      0.29  |Q     V  |          |          |          |
 9+30       0.1744      0.29  |Q      V |          |          |          |
 9+35       0.1764      0.29  |Q      V |          |          |          |
 9+40       0.1784      0.29  |Q      V |          |          |          |
 9+45       0.1804      0.29  |Q      V |          |          |          |
 9+50       0.1825      0.30  |Q      V |          |          |          |
 9+55       0.1845      0.30  |Q      V |          |          |          |
10+ 0       0.1866      0.30  |Q      V |          |          |          |
10+ 5       0.1887      0.30  |Q      V |          |          |          |
10+10       0.1908      0.30  |Q      V |          |          |          |
10+15       0.1929      0.31  |Q      V |          |          |          |
10+20       0.1950      0.31  |Q      V |          |          |          |
10+25       0.1971      0.31  |Q       V|          |          |          |
10+30       0.1993      0.31  |Q       V|          |          |          |
```

```
10+35       0.2014      0.31  |Q       V|         |         |         |
10+40       0.2036      0.32  |Q       V|         |         |         |
10+45       0.2058      0.32  |Q       V|         |         |         |
10+50       0.2080      0.32  |Q       V|         |         |         |
10+55       0.2102      0.32  |Q       V|         |         |         |
11+ 0       0.2125      0.33  |Q       V|         |         |         |
11+ 5       0.2147      0.33  |Q       V|         |         |         |
11+10       0.2170      0.33  |Q       V|         |         |         |
11+15       0.2193      0.33  |Q        V         |         |         |
11+20       0.2216      0.34  |Q        V         |         |         |
11+25       0.2240      0.34  |Q        V         |         |         |
11+30       0.2263      0.34  |Q        V         |         |         |
11+35       0.2287      0.34  |Q        V         |         |         |
11+40       0.2311      0.35  |Q        V         |         |         |
11+45       0.2335      0.35  |Q        V         |         |         |
11+50       0.2360      0.35  |Q        V         |         |         |
11+55       0.2384      0.36  |Q        V         |         |         |
12+ 0       0.2409      0.36  |Q        |V         |         |         |
12+ 5       0.2434      0.36  |Q        |V         |         |         |
12+10       0.2458      0.36  |Q        |V         |         |         |
12+15       0.2482      0.34  |Q        |V         |         |         |
12+20       0.2504      0.33  |Q        |V         |         |         |
12+25       0.2527      0.33  |Q        |V         |         |         |
12+30       0.2549      0.33  |Q        |V         |         |         |
12+35       0.2572      0.33  |Q        |V         |         |         |
12+40       0.2595      0.33  |Q        |V         |         |         |
12+45       0.2617      0.33  |Q        | V        |         |         |
12+50       0.2640      0.33  |Q        | V        |         |         |
12+55       0.2664      0.34  |Q        | V        |         |         |
13+ 0       0.2687      0.34  |Q        | V        |         |         |
13+ 5       0.2711      0.35  |Q        | V        |         |         |
13+10       0.2735      0.35  |Q        | V        |         |         |
13+15       0.2760      0.36  |Q        | V        |         |         |
13+20       0.2784      0.36  |Q        | V        |         |         |
13+25       0.2810      0.37  |Q        | V        |         |         |
13+30       0.2835      0.37  |Q        |  V       |         |         |
13+35       0.2861      0.38  |Q        |  V       |         |         |
13+40       0.2888      0.38  |Q        |  V       |         |         |
13+45       0.2915      0.39  |Q        |  V       |         |         |
13+50       0.2942      0.40  |Q        |  V       |         |         |
13+55       0.2970      0.41  |Q        |  V       |         |         |
14+ 0       0.2999      0.42  |Q        |  V       |         |         |
14+ 5       0.3028      0.42  |Q        |  V       |         |         |
14+10       0.3058      0.43  |Q        |   V      |         |         |
14+15       0.3089      0.44  |Q        |   V      |         |         |
14+20       0.3120      0.45  |Q        |   V      |         |         |
14+25       0.3152      0.47  |Q        |   V      |         |         |
14+30       0.3185      0.48  |Q        |   V      |         |         |
14+35       0.3219      0.49  |Q        |   V      |         |         |
14+40       0.3254      0.51  | Q       |   V      |         |         |
```



```
18+55       0.7604      0.33  |Q        |         |         |   V     |
19+ 0       0.7627      0.33  |Q        |         |         |    V    |
19+ 5       0.7649      0.33  |Q        |         |         |    V    |
19+10       0.7671      0.32  |Q        |         |         |    V    |
19+15       0.7693      0.32  |Q        |         |         |    V    |
19+20       0.7714      0.31  |Q        |         |         |    V    |
19+25       0.7736      0.31  |Q        |         |         |    V    |
19+30       0.7757      0.30  |Q        |         |         |    V    |
19+35       0.7777      0.30  |Q        |         |         |    V    |
19+40       0.7798      0.30  |Q        |         |         |    V    |
19+45       0.7818      0.29  |Q        |         |         |    V    |
19+50       0.7838      0.29  |Q        |         |         |     V   |
19+55       0.7858      0.29  |Q        |         |         |     V   |
20+ 0       0.7877      0.28  |Q        |         |         |     V   |
20+ 5       0.7896      0.28  |Q        |         |         |     V   |
20+10       0.7915      0.28  |Q        |         |         |     V   |
20+15       0.7934      0.27  |Q        |         |         |     V   |
20+20       0.7953      0.27  |Q        |         |         |     V   |
20+25       0.7972      0.27  |Q        |         |         |     V   |
20+30       0.7990      0.27  |Q        |         |         |     V   |
20+35       0.8008      0.26  |Q        |         |         |     V   |
20+40       0.8026      0.26  |Q        |         |         |     V   |
20+45       0.8044      0.26  |Q        |         |         |      V  |
20+50       0.8061      0.26  |Q        |         |         |      V  |
20+55       0.8079      0.25  |Q        |         |         |      V  |
21+ 0       0.8096      0.25  |Q        |         |         |      V  |
21+ 5       0.8113      0.25  Q         |         |         |      V  |
21+10       0.8130      0.25  Q         |         |         |      V  |
21+15       0.8147      0.24  Q         |         |         |      V  |
21+20       0.8164      0.24  Q         |         |         |      V  |
21+25       0.8180      0.24  Q         |         |         |      V  |
21+30       0.8197      0.24  Q         |         |         |      V  |
21+35       0.8213      0.24  Q         |         |         |      V  |
21+40       0.8229      0.23  Q         |         |         |      V  |
21+45       0.8245      0.23  Q         |         |         |      V  |
21+50       0.8261      0.23  Q         |         |         |       V |
21+55       0.8277      0.23  Q         |         |         |       V |
22+ 0       0.8292      0.23  Q         |         |         |       V |
22+ 5       0.8308      0.23  Q         |         |         |       V |
22+10       0.8323      0.22  Q         |         |         |       V |
22+15       0.8339      0.22  Q         |         |         |       V |
22+20       0.8354      0.22  Q         |         |         |       V |
22+25       0.8369      0.22  Q         |         |         |       V |
22+30       0.8384      0.22  Q         |         |         |       V |
22+35       0.8399      0.22  Q         |         |         |       V |
22+40       0.8414      0.22  Q         |         |         |       V |
22+45       0.8429      0.21  Q         |         |         |       V |
22+50       0.8443      0.21  Q         |         |         |       V |
22+55       0.8458      0.21  Q         |         |         |       V |
23+ 0       0.8472      0.21  Q         |         |         |       V |
```

23+ 5	0.8487	0.21	Q	|	|	|	V|
23+10	0.8501	0.21	Q	|	|	|	V|
23+15	0.8515	0.21	Q	|	|	|	V|
23+20	0.8529	0.21	Q	|	|	|	V|
23+25	0.8543	0.20	Q	|	|	|	V|
23+30	0.8557	0.20	Q	|	|	|	V|
23+35	0.8571	0.20	Q	|	|	|	V|
23+40	0.8585	0.20	Q	|	|	|	V|
23+45	0.8599	0.20	Q	|	|	|	V|
23+50	0.8612	0.20	Q	|	|	|	V|
23+55	0.8626	0.20	Q	|	|	|	V|
24+ 0	0.8639	0.20	Q	|	|	|	V|

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

Study date 08/23/21

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

Program License Serial Number 6385

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amethyst Crossing
undeveloped 10-year
Area DA-2

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
1.31	1	0.70
Rainfall data for year 10		
1.31	6	1.47
Rainfall data for year 10		
1.31	24	2.98

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	32.0	1.31	1.000	0.978	0.100	0.098

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

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
0.13	0.100	32.0	32.0	14.90	0.000
1.18	0.900	98.0	98.0	0.20	0.922

Area-averaged catchment yield fraction, Y = 0.830
Area-averaged low loss fraction, Yb = 0.170
User entry of time of concentration = 0.248 (hours)
++
Watershed area = 1.31(Ac.)
Catchment Lag time = 0.198 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 42.0027
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.098(In/Hr)
Average low loss rate fraction (Yb) = 0.170 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.332(In)
Computed peak 30-minute rainfall = 0.569(In)
Specified peak 1-hour rainfall = 0.700(In)
Computed peak 3-hour rainfall = 1.103(In)
Specified peak 6-hour rainfall = 1.470(In)
Specified peak 24-hour rainfall = 2.980(In)

Rainfall depth area reduction factors:
Using a total area of 1.31(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.332(In)
30-minute factor = 1.000 Adjusted rainfall = 0.569(In)
1-hour factor = 1.000 Adjusted rainfall = 0.700(In)
3-hour factor = 1.000 Adjusted rainfall = 1.103(In)
6-hour factor = 1.000 Adjusted rainfall = 1.470(In)
24-hour factor = 1.000 Adjusted rainfall = 2.980(In)

U n i t H y d r o g r a p h
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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 15.84 (CFS))	
1	2.974	0.471
2	21.006	2.857
3	51.910	4.896
4	67.528	2.474
5	76.361	1.399
6	82.185	0.923
7	86.441	0.674
8	89.587	0.498
9	91.918	0.369
10	93.809	0.300
11	95.281	0.233
12	96.457	0.186
13	97.351	0.142
14	97.969	0.098
15	98.412	0.070
16	98.912	0.079
17	99.403	0.078
18	99.719	0.050
19	100.000	0.045

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3321	0.3321
2	0.4089	0.0768
3	0.4618	0.0529
4	0.5034	0.0416
5	0.5383	0.0349
6	0.5685	0.0303
7	0.5955	0.0269
8	0.6198	0.0243
9	0.6421	0.0223
10	0.6627	0.0206
11	0.6819	0.0192
12	0.7000	0.0180
13	0.7235	0.0236
14	0.7461	0.0226
15	0.7677	0.0216
16	0.7885	0.0208
17	0.8086	0.0200
18	0.8279	0.0194
19	0.8467	0.0187
20	0.8649	0.0182
21	0.8825	0.0177
22	0.8997	0.0172
23	0.9164	0.0167

24	0.9327	0.0163
25	0.9486	0.0159
26	0.9641	0.0155
27	0.9793	0.0152
28	0.9942	0.0149
29	1.0087	0.0146
30	1.0230	0.0143
31	1.0370	0.0140
32	1.0507	0.0137
33	1.0642	0.0135
34	1.0774	0.0132
35	1.0904	0.0130
36	1.1032	0.0128
37	1.1158	0.0126
38	1.1282	0.0124
39	1.1404	0.0122
40	1.1524	0.0120
41	1.1643	0.0118
42	1.1759	0.0117
43	1.1875	0.0115
44	1.1988	0.0114
45	1.2100	0.0112
46	1.2211	0.0111
47	1.2320	0.0109
48	1.2428	0.0108
49	1.2534	0.0107
50	1.2640	0.0105
51	1.2744	0.0104
52	1.2847	0.0103
53	1.2948	0.0102
54	1.3049	0.0101
55	1.3149	0.0100
56	1.3247	0.0098
57	1.3345	0.0097
58	1.3441	0.0096
59	1.3536	0.0095
60	1.3631	0.0095
61	1.3725	0.0094
62	1.3817	0.0093
63	1.3909	0.0092
64	1.4000	0.0091
65	1.4090	0.0090
66	1.4180	0.0089
67	1.4268	0.0089
68	1.4356	0.0088
69	1.4443	0.0087
70	1.4529	0.0086
71	1.4615	0.0086
72	1.4700	0.0085
73	1.4804	0.0104

74	1.4907	0.0103
75	1.5009	0.0102
76	1.5111	0.0102
77	1.5212	0.0101
78	1.5312	0.0100
79	1.5412	0.0100
80	1.5511	0.0099
81	1.5610	0.0099
82	1.5707	0.0098
83	1.5805	0.0097
84	1.5902	0.0097
85	1.5998	0.0096
86	1.6094	0.0096
87	1.6189	0.0095
88	1.6283	0.0095
89	1.6377	0.0094
90	1.6471	0.0094
91	1.6564	0.0093
92	1.6656	0.0093
93	1.6748	0.0092
94	1.6840	0.0092
95	1.6931	0.0091
96	1.7022	0.0091
97	1.7112	0.0090
98	1.7202	0.0090
99	1.7291	0.0089
100	1.7380	0.0089
101	1.7468	0.0088
102	1.7556	0.0088
103	1.7643	0.0088
104	1.7731	0.0087
105	1.7817	0.0087
106	1.7904	0.0086
107	1.7989	0.0086
108	1.8075	0.0086
109	1.8160	0.0085
110	1.8245	0.0085
111	1.8329	0.0084
112	1.8413	0.0084
113	1.8497	0.0084
114	1.8580	0.0083
115	1.8663	0.0083
116	1.8746	0.0083
117	1.8828	0.0082
118	1.8910	0.0082
119	1.8991	0.0082
120	1.9072	0.0081
121	1.9153	0.0081
122	1.9234	0.0081
123	1.9314	0.0080

124	1.9394	0.0080
125	1.9473	0.0080
126	1.9553	0.0079
127	1.9632	0.0079
128	1.9710	0.0079
129	1.9789	0.0078
130	1.9867	0.0078
131	1.9944	0.0078
132	2.0022	0.0077
133	2.0099	0.0077
134	2.0176	0.0077
135	2.0252	0.0077
136	2.0329	0.0076
137	2.0405	0.0076
138	2.0481	0.0076
139	2.0556	0.0076
140	2.0631	0.0075
141	2.0706	0.0075
142	2.0781	0.0075
143	2.0856	0.0074
144	2.0930	0.0074
145	2.1004	0.0074
146	2.1078	0.0074
147	2.1151	0.0073
148	2.1224	0.0073
149	2.1297	0.0073
150	2.1370	0.0073
151	2.1442	0.0073
152	2.1515	0.0072
153	2.1587	0.0072
154	2.1659	0.0072
155	2.1730	0.0072
156	2.1801	0.0071
157	2.1873	0.0071
158	2.1943	0.0071
159	2.2014	0.0071
160	2.2085	0.0070
161	2.2155	0.0070
162	2.2225	0.0070
163	2.2295	0.0070
164	2.2364	0.0070
165	2.2434	0.0069
166	2.2503	0.0069
167	2.2572	0.0069
168	2.2641	0.0069
169	2.2709	0.0069
170	2.2778	0.0068
171	2.2846	0.0068
172	2.2914	0.0068
173	2.2982	0.0068

174	2.3049	0.0068
175	2.3117	0.0067
176	2.3184	0.0067
177	2.3251	0.0067
178	2.3318	0.0067
179	2.3385	0.0067
180	2.3451	0.0067
181	2.3518	0.0066
182	2.3584	0.0066
183	2.3650	0.0066
184	2.3715	0.0066
185	2.3781	0.0066
186	2.3846	0.0065
187	2.3912	0.0065
188	2.3977	0.0065
189	2.4042	0.0065
190	2.4107	0.0065
191	2.4171	0.0065
192	2.4236	0.0064
193	2.4300	0.0064
194	2.4364	0.0064
195	2.4428	0.0064
196	2.4492	0.0064
197	2.4555	0.0064
198	2.4619	0.0063
199	2.4682	0.0063
200	2.4745	0.0063
201	2.4808	0.0063
202	2.4871	0.0063
203	2.4934	0.0063
204	2.4996	0.0063
205	2.5059	0.0062
206	2.5121	0.0062
207	2.5183	0.0062
208	2.5245	0.0062
209	2.5307	0.0062
210	2.5368	0.0062
211	2.5430	0.0062
212	2.5491	0.0061
213	2.5552	0.0061
214	2.5613	0.0061
215	2.5674	0.0061
216	2.5735	0.0061
217	2.5796	0.0061
218	2.5856	0.0061
219	2.5917	0.0060
220	2.5977	0.0060
221	2.6037	0.0060
222	2.6097	0.0060
223	2.6157	0.0060

224	2.6217	0.0060
225	2.6276	0.0060
226	2.6336	0.0059
227	2.6395	0.0059
228	2.6454	0.0059
229	2.6513	0.0059
230	2.6572	0.0059
231	2.6631	0.0059
232	2.6690	0.0059
233	2.6749	0.0059
234	2.6807	0.0058
235	2.6865	0.0058
236	2.6924	0.0058
237	2.6982	0.0058
238	2.7040	0.0058
239	2.7097	0.0058
240	2.7155	0.0058
241	2.7213	0.0058
242	2.7270	0.0058
243	2.7328	0.0057
244	2.7385	0.0057
245	2.7442	0.0057
246	2.7499	0.0057
247	2.7556	0.0057
248	2.7613	0.0057
249	2.7670	0.0057
250	2.7726	0.0057
251	2.7783	0.0056
252	2.7839	0.0056
253	2.7895	0.0056
254	2.7951	0.0056
255	2.8007	0.0056
256	2.8063	0.0056
257	2.8119	0.0056
258	2.8175	0.0056
259	2.8231	0.0056
260	2.8286	0.0056
261	2.8341	0.0055
262	2.8397	0.0055
263	2.8452	0.0055
264	2.8507	0.0055
265	2.8562	0.0055
266	2.8617	0.0055
267	2.8672	0.0055
268	2.8726	0.0055
269	2.8781	0.0055
270	2.8836	0.0054
271	2.8890	0.0054
272	2.8944	0.0054
273	2.8998	0.0054

274	2.9053	0.0054
275	2.9107	0.0054
276	2.9160	0.0054
277	2.9214	0.0054
278	2.9268	0.0054
279	2.9322	0.0054
280	2.9375	0.0054
281	2.9429	0.0053
282	2.9482	0.0053
283	2.9535	0.0053
284	2.9588	0.0053
285	2.9641	0.0053
286	2.9694	0.0053
287	2.9747	0.0053
288	2.9800	0.0053

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0053	0.0009	0.0044
2	0.0053	0.0009	0.0044
3	0.0053	0.0009	0.0044
4	0.0053	0.0009	0.0044
5	0.0053	0.0009	0.0044
6	0.0053	0.0009	0.0044
7	0.0054	0.0009	0.0045
8	0.0054	0.0009	0.0045
9	0.0054	0.0009	0.0045
10	0.0054	0.0009	0.0045
11	0.0054	0.0009	0.0045
12	0.0054	0.0009	0.0045
13	0.0054	0.0009	0.0045
14	0.0055	0.0009	0.0045
15	0.0055	0.0009	0.0045
16	0.0055	0.0009	0.0046
17	0.0055	0.0009	0.0046
18	0.0055	0.0009	0.0046
19	0.0055	0.0009	0.0046
20	0.0056	0.0009	0.0046
21	0.0056	0.0009	0.0046
22	0.0056	0.0009	0.0046
23	0.0056	0.0010	0.0047
24	0.0056	0.0010	0.0047
25	0.0056	0.0010	0.0047
26	0.0056	0.0010	0.0047
27	0.0057	0.0010	0.0047
28	0.0057	0.0010	0.0047
29	0.0057	0.0010	0.0047
30	0.0057	0.0010	0.0047

31	0.0057	0.0010	0.0048
32	0.0058	0.0010	0.0048
33	0.0058	0.0010	0.0048
34	0.0058	0.0010	0.0048
35	0.0058	0.0010	0.0048
36	0.0058	0.0010	0.0048
37	0.0058	0.0010	0.0049
38	0.0059	0.0010	0.0049
39	0.0059	0.0010	0.0049
40	0.0059	0.0010	0.0049
41	0.0059	0.0010	0.0049
42	0.0059	0.0010	0.0049
43	0.0060	0.0010	0.0049
44	0.0060	0.0010	0.0050
45	0.0060	0.0010	0.0050
46	0.0060	0.0010	0.0050
47	0.0060	0.0010	0.0050
48	0.0061	0.0010	0.0050
49	0.0061	0.0010	0.0050
50	0.0061	0.0010	0.0051
51	0.0061	0.0010	0.0051
52	0.0061	0.0010	0.0051
53	0.0062	0.0010	0.0051
54	0.0062	0.0011	0.0051
55	0.0062	0.0011	0.0052
56	0.0062	0.0011	0.0052
57	0.0063	0.0011	0.0052
58	0.0063	0.0011	0.0052
59	0.0063	0.0011	0.0052
60	0.0063	0.0011	0.0052
61	0.0063	0.0011	0.0053
62	0.0064	0.0011	0.0053
63	0.0064	0.0011	0.0053
64	0.0064	0.0011	0.0053
65	0.0064	0.0011	0.0053
66	0.0065	0.0011	0.0054
67	0.0065	0.0011	0.0054
68	0.0065	0.0011	0.0054
69	0.0065	0.0011	0.0054
70	0.0066	0.0011	0.0054
71	0.0066	0.0011	0.0055
72	0.0066	0.0011	0.0055
73	0.0067	0.0011	0.0055
74	0.0067	0.0011	0.0055
75	0.0067	0.0011	0.0056
76	0.0067	0.0011	0.0056
77	0.0068	0.0011	0.0056
78	0.0068	0.0012	0.0056
79	0.0068	0.0012	0.0057
80	0.0068	0.0012	0.0057

81	0.0069	0.0012	0.0057
82	0.0069	0.0012	0.0057
83	0.0069	0.0012	0.0058
84	0.0070	0.0012	0.0058
85	0.0070	0.0012	0.0058
86	0.0070	0.0012	0.0058
87	0.0071	0.0012	0.0059
88	0.0071	0.0012	0.0059
89	0.0071	0.0012	0.0059
90	0.0072	0.0012	0.0059
91	0.0072	0.0012	0.0060
92	0.0072	0.0012	0.0060
93	0.0073	0.0012	0.0060
94	0.0073	0.0012	0.0061
95	0.0073	0.0012	0.0061
96	0.0074	0.0013	0.0061
97	0.0074	0.0013	0.0062
98	0.0074	0.0013	0.0062
99	0.0075	0.0013	0.0062
100	0.0075	0.0013	0.0062
101	0.0076	0.0013	0.0063
102	0.0076	0.0013	0.0063
103	0.0077	0.0013	0.0064
104	0.0077	0.0013	0.0064
105	0.0077	0.0013	0.0064
106	0.0078	0.0013	0.0065
107	0.0078	0.0013	0.0065
108	0.0079	0.0013	0.0065
109	0.0079	0.0013	0.0066
110	0.0080	0.0014	0.0066
111	0.0080	0.0014	0.0067
112	0.0081	0.0014	0.0067
113	0.0081	0.0014	0.0067
114	0.0082	0.0014	0.0068
115	0.0082	0.0014	0.0068
116	0.0083	0.0014	0.0069
117	0.0083	0.0014	0.0069
118	0.0084	0.0014	0.0069
119	0.0084	0.0014	0.0070
120	0.0085	0.0014	0.0070
121	0.0086	0.0015	0.0071
122	0.0086	0.0015	0.0071
123	0.0087	0.0015	0.0072
124	0.0087	0.0015	0.0072
125	0.0088	0.0015	0.0073
126	0.0088	0.0015	0.0073
127	0.0089	0.0015	0.0074
128	0.0090	0.0015	0.0074
129	0.0091	0.0015	0.0075
130	0.0091	0.0015	0.0076

131	0.0092	0.0016	0.0076
132	0.0093	0.0016	0.0077
133	0.0094	0.0016	0.0078
134	0.0094	0.0016	0.0078
135	0.0095	0.0016	0.0079
136	0.0096	0.0016	0.0079
137	0.0097	0.0016	0.0080
138	0.0097	0.0017	0.0081
139	0.0099	0.0017	0.0082
140	0.0099	0.0017	0.0082
141	0.0100	0.0017	0.0083
142	0.0101	0.0017	0.0084
143	0.0102	0.0017	0.0085
144	0.0103	0.0018	0.0086
145	0.0085	0.0014	0.0070
146	0.0086	0.0015	0.0071
147	0.0087	0.0015	0.0072
148	0.0088	0.0015	0.0073
149	0.0089	0.0015	0.0074
150	0.0090	0.0015	0.0075
151	0.0092	0.0016	0.0076
152	0.0093	0.0016	0.0077
153	0.0095	0.0016	0.0078
154	0.0095	0.0016	0.0079
155	0.0097	0.0017	0.0081
156	0.0098	0.0017	0.0082
157	0.0101	0.0017	0.0084
158	0.0102	0.0017	0.0084
159	0.0104	0.0018	0.0086
160	0.0105	0.0018	0.0087
161	0.0108	0.0018	0.0090
162	0.0109	0.0019	0.0091
163	0.0112	0.0019	0.0093
164	0.0114	0.0019	0.0094
165	0.0117	0.0020	0.0097
166	0.0118	0.0020	0.0098
167	0.0122	0.0021	0.0101
168	0.0124	0.0021	0.0103
169	0.0128	0.0022	0.0106
170	0.0130	0.0022	0.0108
171	0.0135	0.0023	0.0112
172	0.0137	0.0023	0.0114
173	0.0143	0.0024	0.0118
174	0.0146	0.0025	0.0121
175	0.0152	0.0026	0.0126
176	0.0155	0.0026	0.0129
177	0.0163	0.0028	0.0135
178	0.0167	0.0028	0.0139
179	0.0177	0.0030	0.0147
180	0.0182	0.0031	0.0151

181	0.0194	0.0033	0.0161
182	0.0200	0.0034	0.0166
183	0.0216	0.0037	0.0179
184	0.0226	0.0038	0.0187
185	0.0180	0.0031	0.0150
186	0.0192	0.0033	0.0160
187	0.0223	0.0038	0.0185
188	0.0243	0.0041	0.0202
189	0.0303	0.0051	0.0251
190	0.0349	0.0059	0.0289
191	0.0529	0.0081	0.0447
192	0.0768	0.0081	0.0686
193	0.3321	0.0081	0.3240
194	0.0416	0.0071	0.0346
195	0.0269	0.0046	0.0223
196	0.0206	0.0035	0.0171
197	0.0236	0.0040	0.0196
198	0.0208	0.0035	0.0173
199	0.0187	0.0032	0.0156
200	0.0172	0.0029	0.0142
201	0.0159	0.0027	0.0132
202	0.0149	0.0025	0.0123
203	0.0140	0.0024	0.0116
204	0.0132	0.0022	0.0110
205	0.0126	0.0021	0.0104
206	0.0120	0.0020	0.0100
207	0.0115	0.0020	0.0096
208	0.0111	0.0019	0.0092
209	0.0107	0.0018	0.0088
210	0.0103	0.0017	0.0085
211	0.0100	0.0017	0.0083
212	0.0096	0.0016	0.0080
213	0.0094	0.0016	0.0078
214	0.0091	0.0015	0.0076
215	0.0089	0.0015	0.0074
216	0.0086	0.0015	0.0072
217	0.0104	0.0018	0.0086
218	0.0102	0.0017	0.0084
219	0.0100	0.0017	0.0083
220	0.0098	0.0017	0.0081
221	0.0096	0.0016	0.0080
222	0.0095	0.0016	0.0079
223	0.0093	0.0016	0.0077
224	0.0092	0.0016	0.0076
225	0.0090	0.0015	0.0075
226	0.0089	0.0015	0.0074
227	0.0088	0.0015	0.0073
228	0.0086	0.0015	0.0072
229	0.0085	0.0014	0.0071
230	0.0084	0.0014	0.0070

231	0.0083	0.0014	0.0069
232	0.0082	0.0014	0.0068
233	0.0081	0.0014	0.0067
234	0.0080	0.0014	0.0066
235	0.0079	0.0013	0.0066
236	0.0078	0.0013	0.0065
237	0.0077	0.0013	0.0064
238	0.0076	0.0013	0.0063
239	0.0076	0.0013	0.0063
240	0.0075	0.0013	0.0062
241	0.0074	0.0013	0.0061
242	0.0073	0.0012	0.0061
243	0.0073	0.0012	0.0060
244	0.0072	0.0012	0.0060
245	0.0071	0.0012	0.0059
246	0.0070	0.0012	0.0058
247	0.0070	0.0012	0.0058
248	0.0069	0.0012	0.0057
249	0.0069	0.0012	0.0057
250	0.0068	0.0012	0.0056
251	0.0067	0.0011	0.0056
252	0.0067	0.0011	0.0056
253	0.0066	0.0011	0.0055
254	0.0066	0.0011	0.0055
255	0.0065	0.0011	0.0054
256	0.0065	0.0011	0.0054
257	0.0064	0.0011	0.0053
258	0.0064	0.0011	0.0053
259	0.0063	0.0011	0.0053
260	0.0063	0.0011	0.0052
261	0.0062	0.0011	0.0052
262	0.0062	0.0011	0.0051
263	0.0062	0.0010	0.0051
264	0.0061	0.0010	0.0051
265	0.0061	0.0010	0.0050
266	0.0060	0.0010	0.0050
267	0.0060	0.0010	0.0050
268	0.0059	0.0010	0.0049
269	0.0059	0.0010	0.0049
270	0.0059	0.0010	0.0049
271	0.0058	0.0010	0.0048
272	0.0058	0.0010	0.0048
273	0.0058	0.0010	0.0048
274	0.0057	0.0010	0.0048
275	0.0057	0.0010	0.0047
276	0.0057	0.0010	0.0047
277	0.0056	0.0010	0.0047
278	0.0056	0.0010	0.0046
279	0.0056	0.0009	0.0046
280	0.0055	0.0009	0.0046

281	0.0055	0.0009	0.0046
282	0.0055	0.0009	0.0045
283	0.0054	0.0009	0.0045
284	0.0054	0.0009	0.0045
285	0.0054	0.0009	0.0045
286	0.0054	0.0009	0.0044
287	0.0053	0.0009	0.0044
288	0.0053	0.0009	0.0044

Total soil rain loss = 0.45(In)
Total effective rainfall = 2.53(In)
Peak flow rate in flood hydrograph = 2.01(CFS)

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

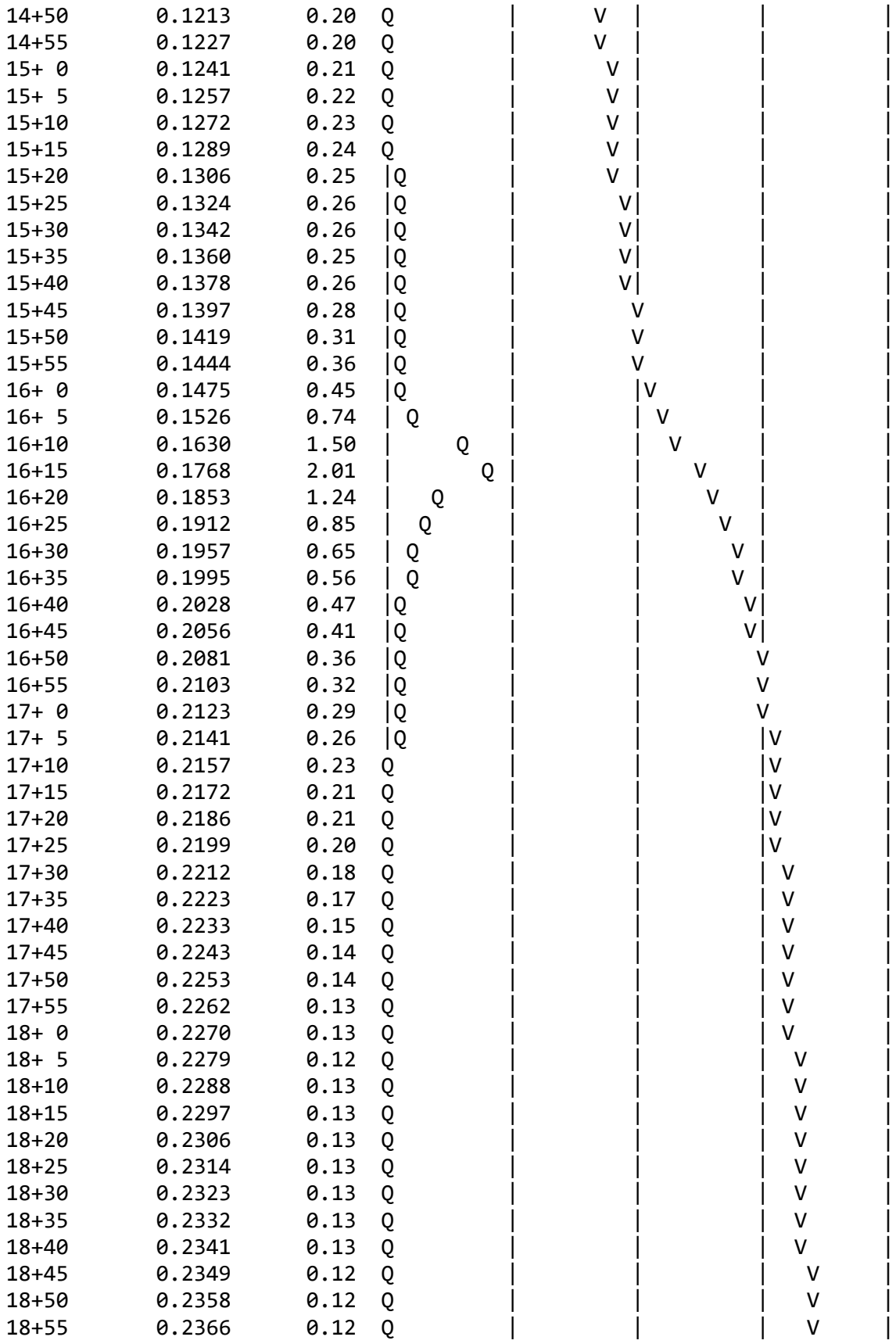
Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.00	Q	|	|	|	|
0+10	0.0001	0.01	Q	|	|	|	|
0+15	0.0004	0.04	Q	|	|	|	|
0+20	0.0007	0.05	Q	|	|	|	|
0+25	0.0011	0.05	Q	|	|	|	|
0+30	0.0014	0.06	Q	|	|	|	|
0+35	0.0019	0.06	Q	|	|	|	|
0+40	0.0023	0.06	Q	|	|	|	|
0+45	0.0027	0.06	Q	|	|	|	|
0+50	0.0032	0.07	Q	|	|	|	|
0+55	0.0037	0.07	Q	|	|	|	|
1+ 0	0.0041	0.07	Q	|	|	|	|
1+ 5	0.0046	0.07	Q	|	|	|	|
1+10	0.0051	0.07	Q	|	|	|	|
1+15	0.0056	0.07	Q	|	|	|	|
1+20	0.0061	0.07	Q	|	|	|	|
1+25	0.0066	0.07	Q	|	|	|	|
1+30	0.0070	0.07	QV	|	|	|	|
1+35	0.0075	0.07	QV	|	|	|	|
1+40	0.0080	0.07	QV	|	|	|	|
1+45	0.0085	0.07	QV	|	|	|	|
1+50	0.0090	0.07	QV	|	|	|	|
1+55	0.0095	0.07	QV	|	|	|	|
2+ 0	0.0100	0.07	QV	|	|	|	|
2+ 5	0.0106	0.07	QV	|	|	|	|
2+10	0.0111	0.07	QV	|	|	|	|
2+15	0.0116	0.07	QV	|	|	|	|

2+20	0.0121	0.07	QV	|	|	|	|
2+25	0.0126	0.07	QV	|	|	|	|
2+30	0.0131	0.07	QV	|	|	|	|
2+35	0.0136	0.07	QV	|	|	|	|
2+40	0.0141	0.07	Q V	|	|	|	|
2+45	0.0146	0.08	Q V	|	|	|	|
2+50	0.0152	0.08	Q V	|	|	|	|
2+55	0.0157	0.08	Q V	|	|	|	|
3+ 0	0.0162	0.08	Q V	|	|	|	|
3+ 5	0.0167	0.08	Q V	|	|	|	|
3+10	0.0173	0.08	Q V	|	|	|	|
3+15	0.0178	0.08	Q V	|	|	|	|
3+20	0.0183	0.08	Q V	|	|	|	|
3+25	0.0188	0.08	Q V	|	|	|	|
3+30	0.0194	0.08	Q V	|	|	|	|
3+35	0.0199	0.08	Q V	|	|	|	|
3+40	0.0204	0.08	Q V	|	|	|	|
3+45	0.0210	0.08	Q V	|	|	|	|
3+50	0.0215	0.08	Q V	|	|	|	|
3+55	0.0221	0.08	Q V	|	|	|	|
4+ 0	0.0226	0.08	Q V	|	|	|	|
4+ 5	0.0231	0.08	Q V	|	|	|	|
4+10	0.0237	0.08	Q V	|	|	|	|
4+15	0.0242	0.08	Q V	|	|	|	|
4+20	0.0248	0.08	Q V	|	|	|	|
4+25	0.0253	0.08	Q V	|	|	|	|
4+30	0.0259	0.08	Q V	|	|	|	|
4+35	0.0264	0.08	Q V	|	|	|	|
4+40	0.0270	0.08	Q V	|	|	|	|
4+45	0.0276	0.08	Q V	|	|	|	|
4+50	0.0281	0.08	Q V	|	|	|	|
4+55	0.0287	0.08	Q V	|	|	|	|
5+ 0	0.0293	0.08	Q V	|	|	|	|
5+ 5	0.0298	0.08	Q V	|	|	|	|
5+10	0.0304	0.08	Q V	|	|	|	|
5+15	0.0310	0.08	Q V	|	|	|	|
5+20	0.0315	0.08	Q V	|	|	|	|
5+25	0.0321	0.08	Q V	|	|	|	|
5+30	0.0327	0.08	Q V	|	|	|	|
5+35	0.0333	0.08	Q V	|	|	|	|
5+40	0.0338	0.08	Q V	|	|	|	|
5+45	0.0344	0.08	Q V	|	|	|	|
5+50	0.0350	0.09	Q V	|	|	|	|
5+55	0.0356	0.09	Q V	|	|	|	|
6+ 0	0.0362	0.09	Q V	|	|	|	|
6+ 5	0.0368	0.09	Q V	|	|	|	|
6+10	0.0374	0.09	Q V	|	|	|	|
6+15	0.0380	0.09	Q V	|	|	|	|
6+20	0.0386	0.09	Q V	|	|	|	|
6+25	0.0392	0.09	Q V	|	|	|	|

6+30	0.0398	0.09	Q	V	|	|	|	|
6+35	0.0404	0.09	Q	V	|	|	|	|
6+40	0.0410	0.09	Q	V	|	|	|	|
6+45	0.0416	0.09	Q	V	|	|	|	|
6+50	0.0422	0.09	Q	V	|	|	|	|
6+55	0.0429	0.09	Q	V	|	|	|	|
7+ 0	0.0435	0.09	Q	V	|	|	|	|
7+ 5	0.0441	0.09	Q	V	|	|	|	|
7+10	0.0447	0.09	Q	V	|	|	|	|
7+15	0.0454	0.09	Q	V	|	|	|	|
7+20	0.0460	0.09	Q	V	|	|	|	|
7+25	0.0466	0.09	Q	V	|	|	|	|
7+30	0.0473	0.09	Q	V	|	|	|	|
7+35	0.0479	0.09	Q	V	|	|	|	|
7+40	0.0486	0.09	Q	V	|	|	|	|
7+45	0.0492	0.09	Q	V	|	|	|	|
7+50	0.0499	0.09	Q	V	|	|	|	|
7+55	0.0505	0.09	Q	V	|	|	|	|
8+ 0	0.0512	0.10	Q	V	|	|	|	|
8+ 5	0.0518	0.10	Q	V	|	|	|	|
8+10	0.0525	0.10	Q	V	|	|	|	|
8+15	0.0532	0.10	Q	V	|	|	|	|
8+20	0.0538	0.10	Q	V	|	|	|	|
8+25	0.0545	0.10	Q	V	|	|	|	|
8+30	0.0552	0.10	Q	V	|	|	|	|
8+35	0.0559	0.10	Q	V	|	|	|	|
8+40	0.0565	0.10	Q	V	|	|	|	|
8+45	0.0572	0.10	Q	V	|	|	|	|
8+50	0.0579	0.10	Q	V	|	|	|	|
8+55	0.0586	0.10	Q	V	|	|	|	|
9+ 0	0.0593	0.10	Q	V	|	|	|	|
9+ 5	0.0600	0.10	Q	V	|	|	|	|
9+10	0.0607	0.10	Q	V	|	|	|	|
9+15	0.0614	0.10	Q	V	|	|	|	|
9+20	0.0621	0.10	Q	V	|	|	|	|
9+25	0.0629	0.10	Q	V	|	|	|	|
9+30	0.0636	0.11	Q	V	|	|	|	|
9+35	0.0643	0.11	Q	V	|	|	|	|
9+40	0.0651	0.11	Q	V	|	|	|	|
9+45	0.0658	0.11	Q	V	|	|	|	|
9+50	0.0665	0.11	Q	V	|	|	|	|
9+55	0.0673	0.11	Q	V	|	|	|	|
10+ 0	0.0680	0.11	Q	V	|	|	|	|
10+ 5	0.0688	0.11	Q	V	|	|	|	|
10+10	0.0695	0.11	Q	V	|	|	|	|
10+15	0.0703	0.11	Q	V	|	|	|	|
10+20	0.0711	0.11	Q	V	|	|	|	|
10+25	0.0719	0.11	Q	V	|	|	|	|
10+30	0.0726	0.11	Q	V	|	|	|	|
10+35	0.0734	0.11	Q	V	|	|	|	|

```
10+40       0.0742      0.12  Q         V         |         |         |
10+45       0.0750      0.12  Q         V         |         |         |
10+50       0.0758      0.12  Q         V         |         |         |
10+55       0.0766      0.12  Q         |V        |         |         |
11+ 0       0.0775      0.12  Q         |V        |         |         |
11+ 5       0.0783      0.12  Q         |V        |         |         |
11+10       0.0791      0.12  Q         |V        |         |         |
11+15       0.0799      0.12  Q         |V        |         |         |
11+20       0.0808      0.12  Q         |V        |         |         |
11+25       0.0816      0.12  Q         |V        |         |         |
11+30       0.0825      0.12  Q         |V        |         |         |
11+35       0.0834      0.13  Q         | V       |         |         |
11+40       0.0842      0.13  Q         | V       |         |         |
11+45       0.0851      0.13  Q         | V       |         |         |
11+50       0.0860      0.13  Q         | V       |         |         |
11+55       0.0869      0.13  Q         | V       |         |         |
12+ 0       0.0878      0.13  Q         | V       |         |         |
12+ 5       0.0887      0.13  Q         | V       |         |         |
12+10       0.0896      0.13  Q         | V       |         |         |
12+15       0.0904      0.12  Q         |  V      |         |         |
12+20       0.0912      0.12  Q         |  V      |         |         |
12+25       0.0921      0.12  Q         |  V      |         |         |
12+30       0.0929      0.12  Q         |  V      |         |         |
12+35       0.0937      0.12  Q         |  V      |         |         |
12+40       0.0945      0.12  Q         |  V      |         |         |
12+45       0.0953      0.12  Q         |  V      |         |         |
12+50       0.0962      0.12  Q         |  V      |         |         |
12+55       0.0970      0.12  Q         |   V     |         |         |
13+ 0       0.0979      0.12  Q         |   V     |         |         |
13+ 5       0.0988      0.13  Q         |   V     |         |         |
13+10       0.0996      0.13  Q         |   V     |         |         |
13+15       0.1005      0.13  Q         |   V     |         |         |
13+20       0.1014      0.13  Q         |   V     |         |         |
13+25       0.1023      0.13  Q         |   V     |         |         |
13+30       0.1033      0.14  Q         |   V     |         |         |
13+35       0.1042      0.14  Q         |    V    |         |         |
13+40       0.1052      0.14  Q         |    V    |         |         |
13+45       0.1062      0.14  Q         |    V    |         |         |
13+50       0.1072      0.15  Q         |    V    |         |         |
13+55       0.1082      0.15  Q         |    V    |         |         |
14+ 0       0.1093      0.15  Q         |    V    |         |         |
14+ 5       0.1103      0.16  Q         |     V   |         |         |
14+10       0.1114      0.16  Q         |     V   |         |         |
14+15       0.1126      0.16  Q         |     V   |         |         |
14+20       0.1137      0.17  Q         |     V   |         |         |
14+25       0.1149      0.17  Q         |     V   |         |         |
14+30       0.1161      0.18  Q         |     V   |         |         |
14+35       0.1173      0.18  Q         |      V  |         |         |
14+40       0.1186      0.19  Q         |      V  |         |         |
14+45       0.1199      0.19  Q         |      V  |         |         |
```


14+50 0.1213 0.20
14+55 0.1227 0.20
15+ 0 0.1241 0.21
15+ 5 0.1257 0.22
15+10 0.1272 0.23
15+15 0.1289 0.24
15+20 0.1306 0.25
15+25 0.1324 0.26
15+30 0.1342 0.26
15+35 0.1360 0.25
15+40 0.1378 0.26
15+45 0.1397 0.28
15+50 0.1419 0.31
15+55 0.1444 0.36
16+ 0 0.1475 0.45
16+ 5 0.1526 0.74
16+10 0.1630 1.50
16+15 0.1768 2.01
16+20 0.1853 1.24
16+25 0.1912 0.85
16+30 0.1957 0.65
16+35 0.1995 0.56
16+40 0.2028 0.47
16+45 0.2056 0.41
16+50 0.2081 0.36
16+55 0.2103 0.32
17+ 0 0.2123 0.29
17+ 5 0.2141 0.26
17+10 0.2157 0.23
17+15 0.2172 0.21
17+20 0.2186 0.21
17+25 0.2199 0.20
17+30 0.2212 0.18
17+35 0.2223 0.17
17+40 0.2233 0.15
17+45 0.2243 0.14
17+50 0.2253 0.14
17+55 0.2262 0.13
18+ 0 0.2270 0.13
18+ 5 0.2279 0.12
18+10 0.2288 0.13
18+15 0.2297 0.13
18+20 0.2306 0.13
18+25 0.2314 0.13
18+30 0.2323 0.13
18+35 0.2332 0.13
18+40 0.2341 0.13
18+45 0.2349 0.12
18+50 0.2358 0.12
18+55 0.2366 0.12

19+ 0	0.2374	0.12	Q	|	|	|	V |
19+ 5	0.2382	0.12	Q	|	|	|	V |
19+10	0.2390	0.12	Q	|	|	|	V |
19+15	0.2398	0.11	Q	|	|	|	V |
19+20	0.2406	0.11	Q	|	|	|	V |
19+25	0.2414	0.11	Q	|	|	|	V |
19+30	0.2421	0.11	Q	|	|	|	V |
19+35	0.2429	0.11	Q	|	|	|	V |
19+40	0.2436	0.11	Q	|	|	|	V |
19+45	0.2443	0.11	Q	|	|	|	V |
19+50	0.2451	0.10	Q	|	|	|	V |
19+55	0.2458	0.10	Q	|	|	|	V |
20+ 0	0.2465	0.10	Q	|	|	|	V |
20+ 5	0.2472	0.10	Q	|	|	|	V |
20+10	0.2479	0.10	Q	|	|	|	V |
20+15	0.2485	0.10	Q	|	|	|	V |
20+20	0.2492	0.10	Q	|	|	|	V |
20+25	0.2499	0.10	Q	|	|	|	V |
20+30	0.2506	0.10	Q	|	|	|	V |
20+35	0.2512	0.10	Q	|	|	|	V |
20+40	0.2519	0.09	Q	|	|	|	V |
20+45	0.2525	0.09	Q	|	|	|	V |
20+50	0.2531	0.09	Q	|	|	|	V |
20+55	0.2538	0.09	Q	|	|	|	V |
21+ 0	0.2544	0.09	Q	|	|	|	V |
21+ 5	0.2550	0.09	Q	|	|	|	V |
21+10	0.2556	0.09	Q	|	|	|	V |
21+15	0.2562	0.09	Q	|	|	|	V |
21+20	0.2568	0.09	Q	|	|	|	V |
21+25	0.2574	0.09	Q	|	|	|	V |
21+30	0.2580	0.09	Q	|	|	|	V |
21+35	0.2586	0.09	Q	|	|	|	V |
21+40	0.2592	0.08	Q	|	|	|	V |
21+45	0.2598	0.08	Q	|	|	|	V |
21+50	0.2604	0.08	Q	|	|	|	V |
21+55	0.2609	0.08	Q	|	|	|	V |
22+ 0	0.2615	0.08	Q	|	|	|	V |
22+ 5	0.2621	0.08	Q	|	|	|	V |
22+10	0.2626	0.08	Q	|	|	|	V |
22+15	0.2632	0.08	Q	|	|	|	V |
22+20	0.2637	0.08	Q	|	|	|	V |
22+25	0.2643	0.08	Q	|	|	|	V |
22+30	0.2648	0.08	Q	|	|	|	V |
22+35	0.2654	0.08	Q	|	|	|	V |
22+40	0.2659	0.08	Q	|	|	|	V |
22+45	0.2664	0.08	Q	|	|	|	V |
22+50	0.2670	0.08	Q	|	|	|	V |
22+55	0.2675	0.08	Q	|	|	|	V |
23+ 0	0.2680	0.08	Q	|	|	|	V |
23+ 5	0.2685	0.08	Q	|	|	|	V |

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   23+10       0.2691      0.08  Q          |          |          |         V|
   23+15       0.2696      0.07  Q          |          |          |         V|
   23+20       0.2701      0.07  Q          |          |          |         V|
   23+25       0.2706      0.07  Q          |          |          |         V|
   23+30       0.2711      0.07  Q          |          |          |         V|
   23+35       0.2716      0.07  Q          |          |          |         V|
   23+40       0.2721      0.07  Q          |          |          |         V|
   23+45       0.2726      0.07  Q          |          |          |         V|
   23+50       0.2731      0.07  Q          |          |          |         V|
   23+55       0.2736      0.07  Q          |          |          |         V|
   24+ 0       0.2741      0.07  Q          |          |          |         V|
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U n i t H y d r o g r a p h A n a l y s i s

Study date 08/23/21

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

Program License Serial Number 6385

Amethyst Crossing
Area DA-3
undeveloped

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
2.09	1	0.70
Rainfall data for year 10		
2.09	6	1.47
Rainfall data for year 10		
2.09	24	2.98

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
78.0	78.0	2.09	1.000	0.404	1.000	0.404

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

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
2.09	1.000	78.0	78.0	2.82	0.374

Area-averaged catchment yield fraction, Y = 0.374
Area-averaged low loss fraction, Yb = 0.626
User entry of time of concentration = 0.233 (hours)
++
Watershed area = 2.09(Ac.)
Catchment Lag time = 0.186 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 44.7067
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.404(In/Hr)
Average low loss rate fraction (Yb) = 0.626 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.332(In)
Computed peak 30-minute rainfall = 0.569(In)
Specified peak 1-hour rainfall = 0.700(In)
Computed peak 3-hour rainfall = 1.103(In)
Specified peak 6-hour rainfall = 1.470(In)
Specified peak 24-hour rainfall = 2.980(In)

Rainfall depth area reduction factors:
Using a total area of 2.09(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.332(In)
30-minute factor = 1.000 Adjusted rainfall = 0.569(In)
1-hour factor = 1.000 Adjusted rainfall = 0.700(In)
3-hour factor = 1.000 Adjusted rainfall = 1.103(In)
6-hour factor = 1.000 Adjusted rainfall = 1.470(In)
24-hour factor = 1.000 Adjusted rainfall = 2.980(In)

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

Number	Mean values	((CFS))
	(K = 25.28 (CFS))	
1	3.294	0.833
2	24.225	5.291
3	55.190	7.827
4	69.857	3.707
5	78.269	2.126
6	83.811	1.401
7	87.902	1.034
8	90.765	0.724
9	93.006	0.566
10	94.740	0.438
11	96.104	0.345
12	97.148	0.264
13	97.872	0.183
14	98.350	0.121
15	98.879	0.134
16	99.400	0.132
17	99.735	0.085
18	100.000	0.067

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3321	0.3321
2	0.4089	0.0768
3	0.4618	0.0529
4	0.5034	0.0416
5	0.5383	0.0349
6	0.5685	0.0303
7	0.5954	0.0269
8	0.6198	0.0243
9	0.6421	0.0223
10	0.6627	0.0206
11	0.6819	0.0192
12	0.6999	0.0180
13	0.7235	0.0236
14	0.7461	0.0226
15	0.7677	0.0216
16	0.7885	0.0208
17	0.8085	0.0200
18	0.8279	0.0194
19	0.8467	0.0187
20	0.8648	0.0182
21	0.8825	0.0177
22	0.8997	0.0172
23	0.9164	0.0167
24	0.9327	0.0163
25	0.9486	0.0159

26	0.9641	0.0155
27	0.9793	0.0152
28	0.9942	0.0149
29	1.0087	0.0146
30	1.0230	0.0143
31	1.0370	0.0140
32	1.0507	0.0137
33	1.0642	0.0135
34	1.0774	0.0132
35	1.0904	0.0130
36	1.1032	0.0128
37	1.1158	0.0126
38	1.1282	0.0124
39	1.1404	0.0122
40	1.1524	0.0120
41	1.1643	0.0118
42	1.1759	0.0117
43	1.1874	0.0115
44	1.1988	0.0114
45	1.2100	0.0112
46	1.2211	0.0111
47	1.2320	0.0109
48	1.2428	0.0108
49	1.2534	0.0107
50	1.2640	0.0105
51	1.2744	0.0104
52	1.2847	0.0103
53	1.2948	0.0102
54	1.3049	0.0101
55	1.3149	0.0100
56	1.3247	0.0098
57	1.3344	0.0097
58	1.3441	0.0096
59	1.3536	0.0095
60	1.3631	0.0095
61	1.3725	0.0094
62	1.3817	0.0093
63	1.3909	0.0092
64	1.4000	0.0091
65	1.4090	0.0090
66	1.4180	0.0089
67	1.4268	0.0089
68	1.4356	0.0088
69	1.4443	0.0087
70	1.4529	0.0086
71	1.4615	0.0086
72	1.4700	0.0085
73	1.4804	0.0104
74	1.4907	0.0103
75	1.5009	0.0102

76	1.5111	0.0102
77	1.5212	0.0101
78	1.5312	0.0100
79	1.5412	0.0100
80	1.5511	0.0099
81	1.5610	0.0099
82	1.5707	0.0098
83	1.5805	0.0097
84	1.5902	0.0097
85	1.5998	0.0096
86	1.6093	0.0096
87	1.6189	0.0095
88	1.6283	0.0095
89	1.6377	0.0094
90	1.6471	0.0094
91	1.6564	0.0093
92	1.6656	0.0093
93	1.6748	0.0092
94	1.6840	0.0092
95	1.6931	0.0091
96	1.7022	0.0091
97	1.7112	0.0090
98	1.7202	0.0090
99	1.7291	0.0089
100	1.7380	0.0089
101	1.7468	0.0088
102	1.7556	0.0088
103	1.7643	0.0088
104	1.7731	0.0087
105	1.7817	0.0087
106	1.7904	0.0086
107	1.7989	0.0086
108	1.8075	0.0086
109	1.8160	0.0085
110	1.8245	0.0085
111	1.8329	0.0084
112	1.8413	0.0084
113	1.8497	0.0084
114	1.8580	0.0083
115	1.8663	0.0083
116	1.8745	0.0083
117	1.8828	0.0082
118	1.8910	0.0082
119	1.8991	0.0082
120	1.9072	0.0081
121	1.9153	0.0081
122	1.9234	0.0081
123	1.9314	0.0080
124	1.9394	0.0080
125	1.9473	0.0080

126	1.9553	0.0079
127	1.9631	0.0079
128	1.9710	0.0079
129	1.9788	0.0078
130	1.9867	0.0078
131	1.9944	0.0078
132	2.0022	0.0077
133	2.0099	0.0077
134	2.0176	0.0077
135	2.0252	0.0077
136	2.0329	0.0076
137	2.0405	0.0076
138	2.0481	0.0076
139	2.0556	0.0076
140	2.0631	0.0075
141	2.0706	0.0075
142	2.0781	0.0075
143	2.0856	0.0074
144	2.0930	0.0074
145	2.1004	0.0074
146	2.1077	0.0074
147	2.1151	0.0073
148	2.1224	0.0073
149	2.1297	0.0073
150	2.1370	0.0073
151	2.1442	0.0073
152	2.1515	0.0072
153	2.1587	0.0072
154	2.1658	0.0072
155	2.1730	0.0072
156	2.1801	0.0071
157	2.1873	0.0071
158	2.1943	0.0071
159	2.2014	0.0071
160	2.2085	0.0070
161	2.2155	0.0070
162	2.2225	0.0070
163	2.2295	0.0070
164	2.2364	0.0070
165	2.2434	0.0069
166	2.2503	0.0069
167	2.2572	0.0069
168	2.2641	0.0069
169	2.2709	0.0069
170	2.2778	0.0068
171	2.2846	0.0068
172	2.2914	0.0068
173	2.2982	0.0068
174	2.3049	0.0068
175	2.3117	0.0067

176	2.3184	0.0067
177	2.3251	0.0067
178	2.3318	0.0067
179	2.3385	0.0067
180	2.3451	0.0067
181	2.3518	0.0066
182	2.3584	0.0066
183	2.3650	0.0066
184	2.3715	0.0066
185	2.3781	0.0066
186	2.3846	0.0065
187	2.3912	0.0065
188	2.3977	0.0065
189	2.4042	0.0065
190	2.4107	0.0065
191	2.4171	0.0065
192	2.4236	0.0064
193	2.4300	0.0064
194	2.4364	0.0064
195	2.4428	0.0064
196	2.4492	0.0064
197	2.4555	0.0064
198	2.4619	0.0063
199	2.4682	0.0063
200	2.4745	0.0063
201	2.4808	0.0063
202	2.4871	0.0063
203	2.4934	0.0063
204	2.4996	0.0063
205	2.5059	0.0062
206	2.5121	0.0062
207	2.5183	0.0062
208	2.5245	0.0062
209	2.5307	0.0062
210	2.5368	0.0062
211	2.5430	0.0062
212	2.5491	0.0061
213	2.5552	0.0061
214	2.5613	0.0061
215	2.5674	0.0061
216	2.5735	0.0061
217	2.5796	0.0061
218	2.5856	0.0061
219	2.5917	0.0060
220	2.5977	0.0060
221	2.6037	0.0060
222	2.6097	0.0060
223	2.6157	0.0060
224	2.6217	0.0060
225	2.6276	0.0060

226	2.6336	0.0059
227	2.6395	0.0059
228	2.6454	0.0059
229	2.6513	0.0059
230	2.6572	0.0059
231	2.6631	0.0059
232	2.6690	0.0059
233	2.6748	0.0059
234	2.6807	0.0058
235	2.6865	0.0058
236	2.6924	0.0058
237	2.6982	0.0058
238	2.7040	0.0058
239	2.7097	0.0058
240	2.7155	0.0058
241	2.7213	0.0058
242	2.7270	0.0058
243	2.7328	0.0057
244	2.7385	0.0057
245	2.7442	0.0057
246	2.7499	0.0057
247	2.7556	0.0057
248	2.7613	0.0057
249	2.7670	0.0057
250	2.7726	0.0057
251	2.7783	0.0056
252	2.7839	0.0056
253	2.7895	0.0056
254	2.7951	0.0056
255	2.8007	0.0056
256	2.8063	0.0056
257	2.8119	0.0056
258	2.8175	0.0056
259	2.8231	0.0056
260	2.8286	0.0056
261	2.8341	0.0055
262	2.8397	0.0055
263	2.8452	0.0055
264	2.8507	0.0055
265	2.8562	0.0055
266	2.8617	0.0055
267	2.8672	0.0055
268	2.8726	0.0055
269	2.8781	0.0055
270	2.8835	0.0054
271	2.8890	0.0054
272	2.8944	0.0054
273	2.8998	0.0054
274	2.9052	0.0054
275	2.9106	0.0054

276	2.9160	0.0054	
277	2.9214	0.0054	
278	2.9268	0.0054	
279	2.9322	0.0054	
280	2.9375	0.0054	
281	2.9428	0.0053	
282	2.9482	0.0053	
283	2.9535	0.0053	
284	2.9588	0.0053	
285	2.9641	0.0053	
286	2.9694	0.0053	
287	2.9747	0.0053	
288	2.9800	0.0053	

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0053	0.0033	0.0020
2	0.0053	0.0033	0.0020
3	0.0053	0.0033	0.0020
4	0.0053	0.0033	0.0020
5	0.0053	0.0033	0.0020
6	0.0053	0.0033	0.0020
7	0.0054	0.0034	0.0020
8	0.0054	0.0034	0.0020
9	0.0054	0.0034	0.0020
10	0.0054	0.0034	0.0020
11	0.0054	0.0034	0.0020
12	0.0054	0.0034	0.0020
13	0.0054	0.0034	0.0020
14	0.0055	0.0034	0.0020
15	0.0055	0.0034	0.0020
16	0.0055	0.0034	0.0021
17	0.0055	0.0034	0.0021
18	0.0055	0.0035	0.0021
19	0.0055	0.0035	0.0021
20	0.0056	0.0035	0.0021
21	0.0056	0.0035	0.0021
22	0.0056	0.0035	0.0021
23	0.0056	0.0035	0.0021
24	0.0056	0.0035	0.0021
25	0.0056	0.0035	0.0021
26	0.0056	0.0035	0.0021
27	0.0057	0.0035	0.0021
28	0.0057	0.0036	0.0021
29	0.0057	0.0036	0.0021
30	0.0057	0.0036	0.0021
31	0.0057	0.0036	0.0021
32	0.0058	0.0036	0.0022

33	0.0058	0.0036	0.0022
34	0.0058	0.0036	0.0022
35	0.0058	0.0036	0.0022
36	0.0058	0.0036	0.0022
37	0.0058	0.0037	0.0022
38	0.0059	0.0037	0.0022
39	0.0059	0.0037	0.0022
40	0.0059	0.0037	0.0022
41	0.0059	0.0037	0.0022
42	0.0059	0.0037	0.0022
43	0.0060	0.0037	0.0022
44	0.0060	0.0037	0.0022
45	0.0060	0.0038	0.0022
46	0.0060	0.0038	0.0022
47	0.0060	0.0038	0.0023
48	0.0061	0.0038	0.0023
49	0.0061	0.0038	0.0023
50	0.0061	0.0038	0.0023
51	0.0061	0.0038	0.0023
52	0.0061	0.0038	0.0023
53	0.0062	0.0039	0.0023
54	0.0062	0.0039	0.0023
55	0.0062	0.0039	0.0023
56	0.0062	0.0039	0.0023
57	0.0063	0.0039	0.0023
58	0.0063	0.0039	0.0023
59	0.0063	0.0039	0.0024
60	0.0063	0.0040	0.0024
61	0.0063	0.0040	0.0024
62	0.0064	0.0040	0.0024
63	0.0064	0.0040	0.0024
64	0.0064	0.0040	0.0024
65	0.0064	0.0040	0.0024
66	0.0065	0.0040	0.0024
67	0.0065	0.0041	0.0024
68	0.0065	0.0041	0.0024
69	0.0065	0.0041	0.0024
70	0.0066	0.0041	0.0025
71	0.0066	0.0041	0.0025
72	0.0066	0.0041	0.0025
73	0.0067	0.0042	0.0025
74	0.0067	0.0042	0.0025
75	0.0067	0.0042	0.0025
76	0.0067	0.0042	0.0025
77	0.0068	0.0042	0.0025
78	0.0068	0.0042	0.0025
79	0.0068	0.0043	0.0026
80	0.0068	0.0043	0.0026
81	0.0069	0.0043	0.0026
82	0.0069	0.0043	0.0026

83	0.0069	0.0043	0.0026
84	0.0070	0.0044	0.0026
85	0.0070	0.0044	0.0026
86	0.0070	0.0044	0.0026
87	0.0071	0.0044	0.0026
88	0.0071	0.0044	0.0027
89	0.0071	0.0045	0.0027
90	0.0072	0.0045	0.0027
91	0.0072	0.0045	0.0027
92	0.0072	0.0045	0.0027
93	0.0073	0.0046	0.0027
94	0.0073	0.0046	0.0027
95	0.0073	0.0046	0.0027
96	0.0074	0.0046	0.0028
97	0.0074	0.0046	0.0028
98	0.0074	0.0047	0.0028
99	0.0075	0.0047	0.0028
100	0.0075	0.0047	0.0028
101	0.0076	0.0047	0.0028
102	0.0076	0.0048	0.0028
103	0.0077	0.0048	0.0029
104	0.0077	0.0048	0.0029
105	0.0077	0.0048	0.0029
106	0.0078	0.0049	0.0029
107	0.0078	0.0049	0.0029
108	0.0079	0.0049	0.0029
109	0.0079	0.0050	0.0030
110	0.0080	0.0050	0.0030
111	0.0080	0.0050	0.0030
112	0.0081	0.0050	0.0030
113	0.0081	0.0051	0.0030
114	0.0082	0.0051	0.0030
115	0.0082	0.0051	0.0031
116	0.0083	0.0052	0.0031
117	0.0083	0.0052	0.0031
118	0.0084	0.0052	0.0031
119	0.0084	0.0053	0.0032
120	0.0085	0.0053	0.0032
121	0.0086	0.0054	0.0032
122	0.0086	0.0054	0.0032
123	0.0087	0.0054	0.0032
124	0.0087	0.0055	0.0033
125	0.0088	0.0055	0.0033
126	0.0088	0.0055	0.0033
127	0.0089	0.0056	0.0033
128	0.0090	0.0056	0.0034
129	0.0091	0.0057	0.0034
130	0.0091	0.0057	0.0034
131	0.0092	0.0058	0.0034
132	0.0093	0.0058	0.0035

133	0.0094	0.0059	0.0035
134	0.0094	0.0059	0.0035
135	0.0095	0.0060	0.0036
136	0.0096	0.0060	0.0036
137	0.0097	0.0061	0.0036
138	0.0097	0.0061	0.0036
139	0.0099	0.0062	0.0037
140	0.0099	0.0062	0.0037
141	0.0100	0.0063	0.0038
142	0.0101	0.0063	0.0038
143	0.0102	0.0064	0.0038
144	0.0103	0.0064	0.0039
145	0.0085	0.0053	0.0032
146	0.0086	0.0054	0.0032
147	0.0087	0.0054	0.0033
148	0.0088	0.0055	0.0033
149	0.0089	0.0056	0.0033
150	0.0090	0.0056	0.0034
151	0.0092	0.0057	0.0034
152	0.0093	0.0058	0.0035
153	0.0095	0.0059	0.0035
154	0.0095	0.0060	0.0036
155	0.0097	0.0061	0.0036
156	0.0098	0.0062	0.0037
157	0.0101	0.0063	0.0038
158	0.0102	0.0064	0.0038
159	0.0104	0.0065	0.0039
160	0.0105	0.0066	0.0039
161	0.0108	0.0068	0.0040
162	0.0109	0.0068	0.0041
163	0.0112	0.0070	0.0042
164	0.0114	0.0071	0.0042
165	0.0117	0.0073	0.0044
166	0.0118	0.0074	0.0044
167	0.0122	0.0076	0.0046
168	0.0124	0.0078	0.0046
169	0.0128	0.0080	0.0048
170	0.0130	0.0081	0.0049
171	0.0135	0.0084	0.0050
172	0.0137	0.0086	0.0051
173	0.0143	0.0089	0.0053
174	0.0146	0.0091	0.0054
175	0.0152	0.0095	0.0057
176	0.0155	0.0097	0.0058
177	0.0163	0.0102	0.0061
178	0.0167	0.0105	0.0063
179	0.0177	0.0111	0.0066
180	0.0182	0.0114	0.0068
181	0.0194	0.0121	0.0072
182	0.0200	0.0125	0.0075

183	0.0216	0.0135	0.0081
184	0.0226	0.0141	0.0084
185	0.0180	0.0113	0.0067
186	0.0192	0.0120	0.0072
187	0.0223	0.0140	0.0083
188	0.0243	0.0152	0.0091
189	0.0303	0.0189	0.0113
190	0.0349	0.0218	0.0130
191	0.0529	0.0331	0.0198
192	0.0768	0.0336	0.0431
193	0.3321	0.0336	0.2985
194	0.0416	0.0261	0.0156
195	0.0269	0.0168	0.0101
196	0.0206	0.0129	0.0077
197	0.0236	0.0148	0.0088
198	0.0208	0.0130	0.0078
199	0.0187	0.0117	0.0070
200	0.0172	0.0107	0.0064
201	0.0159	0.0100	0.0059
202	0.0149	0.0093	0.0056
203	0.0140	0.0088	0.0052
204	0.0132	0.0083	0.0050
205	0.0126	0.0079	0.0047
206	0.0120	0.0075	0.0045
207	0.0115	0.0072	0.0043
208	0.0111	0.0069	0.0041
209	0.0107	0.0067	0.0040
210	0.0103	0.0064	0.0038
211	0.0100	0.0062	0.0037
212	0.0096	0.0060	0.0036
213	0.0094	0.0059	0.0035
214	0.0091	0.0057	0.0034
215	0.0089	0.0055	0.0033
216	0.0086	0.0054	0.0032
217	0.0104	0.0065	0.0039
218	0.0102	0.0064	0.0038
219	0.0100	0.0062	0.0037
220	0.0098	0.0061	0.0037
221	0.0096	0.0060	0.0036
222	0.0095	0.0059	0.0035
223	0.0093	0.0058	0.0035
224	0.0092	0.0057	0.0034
225	0.0090	0.0056	0.0034
226	0.0089	0.0056	0.0033
227	0.0088	0.0055	0.0033
228	0.0086	0.0054	0.0032
229	0.0085	0.0053	0.0032
230	0.0084	0.0053	0.0031
231	0.0083	0.0052	0.0031
232	0.0082	0.0051	0.0031

233	0.0081	0.0051	0.0030
234	0.0080	0.0050	0.0030
235	0.0079	0.0049	0.0030
236	0.0078	0.0049	0.0029
237	0.0077	0.0048	0.0029
238	0.0076	0.0048	0.0029
239	0.0076	0.0047	0.0028
240	0.0075	0.0047	0.0028
241	0.0074	0.0046	0.0028
242	0.0073	0.0046	0.0027
243	0.0073	0.0045	0.0027
244	0.0072	0.0045	0.0027
245	0.0071	0.0045	0.0027
246	0.0070	0.0044	0.0026
247	0.0070	0.0044	0.0026
248	0.0069	0.0043	0.0026
249	0.0069	0.0043	0.0026
250	0.0068	0.0043	0.0025
251	0.0067	0.0042	0.0025
252	0.0067	0.0042	0.0025
253	0.0066	0.0042	0.0025
254	0.0066	0.0041	0.0025
255	0.0065	0.0041	0.0024
256	0.0065	0.0041	0.0024
257	0.0064	0.0040	0.0024
258	0.0064	0.0040	0.0024
259	0.0063	0.0040	0.0024
260	0.0063	0.0039	0.0024
261	0.0062	0.0039	0.0023
262	0.0062	0.0039	0.0023
263	0.0062	0.0039	0.0023
264	0.0061	0.0038	0.0023
265	0.0061	0.0038	0.0023
266	0.0060	0.0038	0.0023
267	0.0060	0.0037	0.0022
268	0.0059	0.0037	0.0022
269	0.0059	0.0037	0.0022
270	0.0059	0.0037	0.0022
271	0.0058	0.0037	0.0022
272	0.0058	0.0036	0.0022
273	0.0058	0.0036	0.0022
274	0.0057	0.0036	0.0021
275	0.0057	0.0036	0.0021
276	0.0057	0.0035	0.0021
277	0.0056	0.0035	0.0021
278	0.0056	0.0035	0.0021
279	0.0056	0.0035	0.0021
280	0.0055	0.0035	0.0021
281	0.0055	0.0034	0.0021
282	0.0055	0.0034	0.0020

283	0.0054	0.0034	0.0020
284	0.0054	0.0034	0.0020
285	0.0054	0.0034	0.0020
286	0.0054	0.0034	0.0020
287	0.0053	0.0033	0.0020
288	0.0053	0.0033	0.0020

Total soil rain loss = 1.68(In)
Total effective rainfall = 1.30(In)
Peak flow rate in flood hydrograph = 2.68(CFS)

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

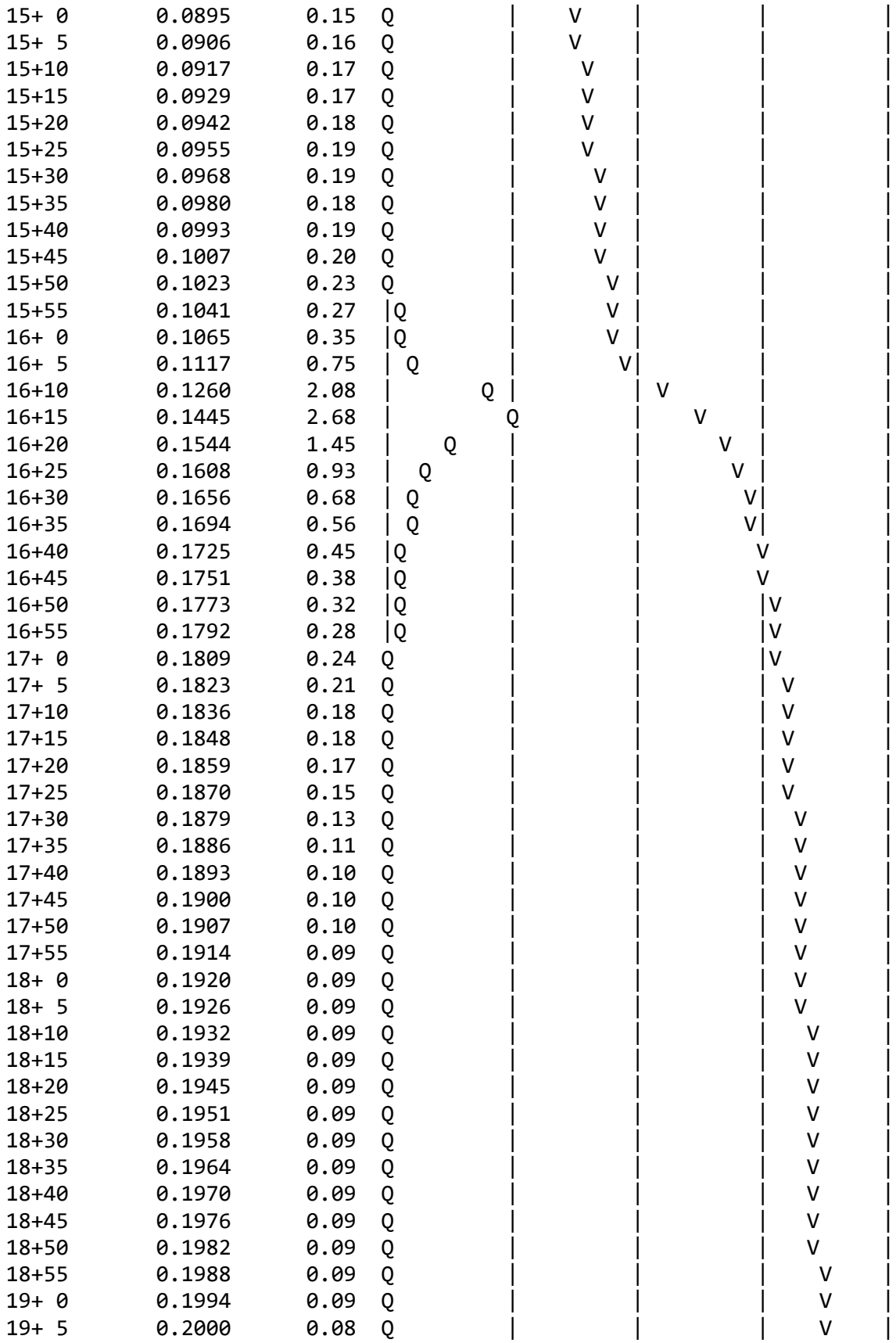
Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.00	Q				
0+10	0.0001	0.01	Q				
0+15	0.0003	0.03	Q				
0+20	0.0005	0.03	Q				
0+25	0.0008	0.04	Q				
0+30	0.0011	0.04	Q				
0+35	0.0014	0.04	Q				
0+40	0.0017	0.05	Q				
0+45	0.0020	0.05	Q				
0+50	0.0024	0.05	Q				
0+55	0.0027	0.05	Q				
1+ 0	0.0030	0.05	Q				
1+ 5	0.0034	0.05	Q				
1+10	0.0037	0.05	Q				
1+15	0.0041	0.05	Q				
1+20	0.0044	0.05	Q				
1+25	0.0048	0.05	Q				
1+30	0.0051	0.05	Q				
1+35	0.0055	0.05	Q				
1+40	0.0059	0.05	QV				
1+45	0.0062	0.05	QV				
1+50	0.0066	0.05	QV				
1+55	0.0069	0.05	QV				
2+ 0	0.0073	0.05	QV				
2+ 5	0.0077	0.05	QV				
2+10	0.0080	0.05	QV				
2+15	0.0084	0.05	QV				
2+20	0.0088	0.05	QV				
2+25	0.0091	0.05	QV				

2+30	0.0095	0.05	QV	|	|	|	|
2+35	0.0099	0.05	QV	|	|	|	|
2+40	0.0102	0.05	QV	|	|	|	|
2+45	0.0106	0.05	QV	|	|	|	|
2+50	0.0110	0.05	QV	|	|	|	|
2+55	0.0114	0.05	Q V	|	|	|	|
3+ 0	0.0117	0.05	Q V	|	|	|	|
3+ 5	0.0121	0.05	Q V	|	|	|	|
3+10	0.0125	0.05	Q V	|	|	|	|
3+15	0.0129	0.06	Q V	|	|	|	|
3+20	0.0132	0.06	Q V	|	|	|	|
3+25	0.0136	0.06	Q V	|	|	|	|
3+30	0.0140	0.06	Q V	|	|	|	|
3+35	0.0144	0.06	Q V	|	|	|	|
3+40	0.0148	0.06	Q V	|	|	|	|
3+45	0.0152	0.06	Q V	|	|	|	|
3+50	0.0156	0.06	Q V	|	|	|	|
3+55	0.0159	0.06	Q V	|	|	|	|
4+ 0	0.0163	0.06	Q V	|	|	|	|
4+ 5	0.0167	0.06	Q V	|	|	|	|
4+10	0.0171	0.06	Q V	|	|	|	|
4+15	0.0175	0.06	Q V	|	|	|	|
4+20	0.0179	0.06	Q V	|	|	|	|
4+25	0.0183	0.06	Q V	|	|	|	|
4+30	0.0187	0.06	Q V	|	|	|	|
4+35	0.0191	0.06	Q V	|	|	|	|
4+40	0.0195	0.06	Q V	|	|	|	|
4+45	0.0199	0.06	Q V	|	|	|	|
4+50	0.0203	0.06	Q V	|	|	|	|
4+55	0.0207	0.06	Q V	|	|	|	|
5+ 0	0.0211	0.06	Q V	|	|	|	|
5+ 5	0.0215	0.06	Q V	|	|	|	|
5+10	0.0219	0.06	Q V	|	|	|	|
5+15	0.0223	0.06	Q V	|	|	|	|
5+20	0.0228	0.06	Q V	|	|	|	|
5+25	0.0232	0.06	Q V	|	|	|	|
5+30	0.0236	0.06	Q V	|	|	|	|
5+35	0.0240	0.06	Q V	|	|	|	|
5+40	0.0244	0.06	Q V	|	|	|	|
5+45	0.0248	0.06	Q V	|	|	|	|
5+50	0.0253	0.06	Q V	|	|	|	|
5+55	0.0257	0.06	Q V	|	|	|	|
6+ 0	0.0261	0.06	Q V	|	|	|	|
6+ 5	0.0265	0.06	Q V	|	|	|	|
6+10	0.0270	0.06	Q V	|	|	|	|
6+15	0.0274	0.06	Q V	|	|	|	|
6+20	0.0278	0.06	Q V	|	|	|	|
6+25	0.0283	0.06	Q V	|	|	|	|
6+30	0.0287	0.06	Q V	|	|	|	|
6+35	0.0291	0.06	Q V	|	|	|	|

6+40	0.0296	0.06	Q	V	|	|	|	|
6+45	0.0300	0.06	Q	V	|	|	|	|
6+50	0.0305	0.06	Q	V	|	|	|	|
6+55	0.0309	0.06	Q	V	|	|	|	|
7+ 0	0.0314	0.06	Q	V	|	|	|	|
7+ 5	0.0318	0.07	Q	V	|	|	|	|
7+10	0.0323	0.07	Q	V	|	|	|	|
7+15	0.0327	0.07	Q	V	|	|	|	|
7+20	0.0332	0.07	Q	V	|	|	|	|
7+25	0.0336	0.07	Q	V	|	|	|	|
7+30	0.0341	0.07	Q	V	|	|	|	|
7+35	0.0345	0.07	Q	V	|	|	|	|
7+40	0.0350	0.07	Q	V	|	|	|	|
7+45	0.0355	0.07	Q	V	|	|	|	|
7+50	0.0359	0.07	Q	V	|	|	|	|
7+55	0.0364	0.07	Q	V	|	|	|	|
8+ 0	0.0369	0.07	Q	V	|	|	|	|
8+ 5	0.0374	0.07	Q	V	|	|	|	|
8+10	0.0378	0.07	Q	V	|	|	|	|
8+15	0.0383	0.07	Q	V	|	|	|	|
8+20	0.0388	0.07	Q	V	|	|	|	|
8+25	0.0393	0.07	Q	V	|	|	|	|
8+30	0.0398	0.07	Q	V	|	|	|	|
8+35	0.0403	0.07	Q	V	|	|	|	|
8+40	0.0408	0.07	Q	V	|	|	|	|
8+45	0.0412	0.07	Q	V	|	|	|	|
8+50	0.0417	0.07	Q	V	|	|	|	|
8+55	0.0422	0.07	Q	V	|	|	|	|
9+ 0	0.0427	0.07	Q	V	|	|	|	|
9+ 5	0.0433	0.07	Q	V	|	|	|	|
9+10	0.0438	0.07	Q	V	|	|	|	|
9+15	0.0443	0.07	Q	V	|	|	|	|
9+20	0.0448	0.07	Q	V	|	|	|	|
9+25	0.0453	0.08	Q	V	|	|	|	|
9+30	0.0458	0.08	Q	V	|	|	|	|
9+35	0.0464	0.08	Q	V	|	|	|	|
9+40	0.0469	0.08	Q	V	|	|	|	|
9+45	0.0474	0.08	Q	V	|	|	|	|
9+50	0.0479	0.08	Q	V	|	|	|	|
9+55	0.0485	0.08	Q	V	|	|	|	|
10+ 0	0.0490	0.08	Q	V	|	|	|	|
10+ 5	0.0496	0.08	Q	V	|	|	|	|
10+10	0.0501	0.08	Q	V	|	|	|	|
10+15	0.0507	0.08	Q	V	|	|	|	|
10+20	0.0512	0.08	Q	V	|	|	|	|
10+25	0.0518	0.08	Q	V	|	|	|	|
10+30	0.0523	0.08	Q	V	|	|	|	|
10+35	0.0529	0.08	Q	V	|	|	|	|
10+40	0.0535	0.08	Q	V	|	|	|	|
10+45	0.0541	0.08	Q	V	|	|	|	|

```
10+50       0.0546      0.08  Q        V|         |          |          |
10+55       0.0552      0.08  Q        V|         |          |          |
11+ 0       0.0558      0.09  Q        V|         |          |          |
11+ 5       0.0564      0.09  Q        V|         |          |          |
11+10       0.0570      0.09  Q         V         |          |          |
11+15       0.0576      0.09  Q         V         |          |          |
11+20       0.0582      0.09  Q         V         |          |          |
11+25       0.0588      0.09  Q         V         |          |          |
11+30       0.0594      0.09  Q         V         |          |          |
11+35       0.0601      0.09  Q         V         |          |          |
11+40       0.0607      0.09  Q         V         |          |          |
11+45       0.0613      0.09  Q         V         |          |          |
11+50       0.0620      0.09  Q         V         |          |          |
11+55       0.0626      0.09  Q         |V        |          |          |
12+ 0       0.0633      0.09  Q         |V        |          |          |
12+ 5       0.0639      0.09  Q         |V        |          |          |
12+10       0.0645      0.09  Q         |V        |          |          |
12+15       0.0651      0.09  Q         |V        |          |          |
12+20       0.0657      0.09  Q         |V        |          |          |
12+25       0.0663      0.08  Q         |V        |          |          |
12+30       0.0669      0.08  Q         |V        |          |          |
12+35       0.0675      0.09  Q         |V        |          |          |
12+40       0.0681      0.09  Q         | V       |          |          |
12+45       0.0687      0.09  Q         | V       |          |          |
12+50       0.0693      0.09  Q         | V       |          |          |
12+55       0.0699      0.09  Q         | V       |          |          |
13+ 0       0.0705      0.09  Q         | V       |          |          |
13+ 5       0.0711      0.09  Q         | V       |          |          |
13+10       0.0718      0.09  Q         | V       |          |          |
13+15       0.0724      0.09  Q         | V       |          |          |
13+20       0.0731      0.09  Q         | V       |          |          |
13+25       0.0737      0.10  Q         | V       |          |          |
13+30       0.0744      0.10  Q         |  V      |          |          |
13+35       0.0751      0.10  Q         |  V      |          |          |
13+40       0.0758      0.10  Q         |  V      |          |          |
13+45       0.0765      0.10  Q         |  V      |          |          |
13+50       0.0772      0.11  Q         |  V      |          |          |
13+55       0.0780      0.11  Q         |  V      |          |          |
14+ 0       0.0787      0.11  Q         |  V      |          |          |
14+ 5       0.0795      0.11  Q         |   V     |          |          |
14+10       0.0803      0.11  Q         |   V     |          |          |
14+15       0.0811      0.12  Q         |   V     |          |          |
14+20       0.0819      0.12  Q         |   V     |          |          |
14+25       0.0828      0.12  Q         |   V     |          |          |
14+30       0.0836      0.13  Q         |   V     |          |          |
14+35       0.0845      0.13  Q         |   V     |          |          |
14+40       0.0854      0.13  Q         |    V    |          |          |
14+45       0.0864      0.14  Q         |    V    |          |          |
14+50       0.0874      0.14  Q         |    V    |          |          |
14+55       0.0884      0.15  Q         |    V    |          |          |
```


15+ 0 0.0895 0.15
15+ 5 0.0906 0.16
15+10 0.0917 0.17
15+15 0.0929 0.17
15+20 0.0942 0.18
15+25 0.0955 0.19
15+30 0.0968 0.19
15+35 0.0980 0.18
15+40 0.0993 0.19
15+45 0.1007 0.20
15+50 0.1023 0.23
15+55 0.1041 0.27
16+ 0 0.1065 0.35
16+ 5 0.1117 0.75
16+10 0.1260 2.08
16+15 0.1445 2.68
16+20 0.1544 1.45
16+25 0.1608 0.93
16+30 0.1656 0.68
16+35 0.1694 0.56
16+40 0.1725 0.45
16+45 0.1751 0.38
16+50 0.1773 0.32
16+55 0.1792 0.28
17+ 0 0.1809 0.24
17+ 5 0.1823 0.21
17+10 0.1836 0.18
17+15 0.1848 0.18
17+20 0.1859 0.17
17+25 0.1870 0.15
17+30 0.1879 0.13
17+35 0.1886 0.11
17+40 0.1893 0.10
17+45 0.1900 0.10
17+50 0.1907 0.10
17+55 0.1914 0.09
18+ 0 0.1920 0.09
18+ 5 0.1926 0.09
18+10 0.1932 0.09
18+15 0.1939 0.09
18+20 0.1945 0.09
18+25 0.1951 0.09
18+30 0.1958 0.09
18+35 0.1964 0.09
18+40 0.1970 0.09
18+45 0.1976 0.09
18+50 0.1982 0.09
18+55 0.1988 0.09
19+ 0 0.1994 0.09
19+ 5 0.2000 0.08

```
19+10       0.2006      0.08  Q        |          |          |    V     |
19+15       0.2011      0.08  Q        |          |          |    V     |
19+20       0.2017      0.08  Q        |          |          |    V     |
19+25       0.2023      0.08  Q        |          |          |    V     |
19+30       0.2028      0.08  Q        |          |          |    V     |
19+35       0.2033      0.08  Q        |          |          |    V     |
19+40       0.2039      0.08  Q        |          |          |    V     |
19+45       0.2044      0.08  Q        |          |          |     V    |
19+50       0.2049      0.08  Q        |          |          |     V    |
19+55       0.2054      0.07  Q        |          |          |     V    |
20+ 0       0.2059      0.07  Q        |          |          |     V    |
20+ 5       0.2064      0.07  Q        |          |          |     V    |
20+10       0.2069      0.07  Q        |          |          |     V    |
20+15       0.2074      0.07  Q        |          |          |     V    |
20+20       0.2079      0.07  Q        |          |          |     V    |
20+25       0.2084      0.07  Q        |          |          |     V    |
20+30       0.2088      0.07  Q        |          |          |     V    |
20+35       0.2093      0.07  Q        |          |          |     V    |
20+40       0.2098      0.07  Q        |          |          |     V    |
20+45       0.2102      0.07  Q        |          |          |      V   |
20+50       0.2107      0.07  Q        |          |          |      V   |
20+55       0.2111      0.07  Q        |          |          |      V   |
21+ 0       0.2116      0.07  Q        |          |          |      V   |
21+ 5       0.2120      0.06  Q        |          |          |      V   |
21+10       0.2125      0.06  Q        |          |          |      V   |
21+15       0.2129      0.06  Q        |          |          |      V   |
21+20       0.2133      0.06  Q        |          |          |      V   |
21+25       0.2138      0.06  Q        |          |          |      V   |
21+30       0.2142      0.06  Q        |          |          |      V   |
21+35       0.2146      0.06  Q        |          |          |      V   |
21+40       0.2150      0.06  Q        |          |          |      V   |
21+45       0.2155      0.06  Q        |          |          |      V   |
21+50       0.2159      0.06  Q        |          |          |       V  |
21+55       0.2163      0.06  Q        |          |          |       V  |
22+ 0       0.2167      0.06  Q        |          |          |       V  |
22+ 5       0.2171      0.06  Q        |          |          |       V  |
22+10       0.2175      0.06  Q        |          |          |       V  |
22+15       0.2179      0.06  Q        |          |          |       V  |
22+20       0.2183      0.06  Q        |          |          |       V  |
22+25       0.2187      0.06  Q        |          |          |       V  |
22+30       0.2191      0.06  Q        |          |          |       V  |
22+35       0.2195      0.06  Q        |          |          |       V  |
22+40       0.2199      0.06  Q        |          |          |       V  |
22+45       0.2202      0.06  Q        |          |          |       V  |
22+50       0.2206      0.06  Q        |          |          |       V  |
22+55       0.2210      0.05  Q        |          |          |       V  |
23+ 0       0.2214      0.05  Q        |          |          |        V |
23+ 5       0.2217      0.05  Q        |          |          |        V |
23+10       0.2221      0.05  Q        |          |          |        V |
23+15       0.2225      0.05  Q        |          |          |        V |
```

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   23+20       0.2229      0.05  Q         |          |          |         V|
   23+25       0.2232      0.05  Q         |          |          |         V|
   23+30       0.2236      0.05  Q         |          |          |         V|
   23+35       0.2239      0.05  Q         |          |          |         V|
   23+40       0.2243      0.05  Q         |          |          |         V|
   23+45       0.2247      0.05  Q         |          |          |         V|
   23+50       0.2250      0.05  Q         |          |          |         V|
   23+55       0.2254      0.05  Q         |          |          |         V|
   24+ 0       0.2257      0.05  Q         |          |          |         V|
-------------------------------------------------------------------------
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U n i t H y d r o g r a p h A n a l y s i s

Study date 08/23/21

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

Program License Serial Number 6385

Amethyst Crossing
Developed 10-year
Area DA-1

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
8.02	1	0.70
Rainfall data for year 10		
8.02	6	1.47
Rainfall data for year 10		
8.02	24	2.98

++++++++++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	32.0	8.02	1.000	0.978	0.100	0.098

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

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
0.80	0.100	32.0	32.0	14.90	0.000
7.22	0.900	98.0	98.0	0.20	0.922

Area-averaged catchment yield fraction, Y = 0.830
Area-averaged low loss fraction, Yb = 0.170
User entry of time of concentration = 0.176 (hours)
++
Watershed area = 8.02(Ac.)
Catchment Lag time = 0.141 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 59.1856
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.098(In/Hr)
Average low loss rate fraction (Yb) = 0.170 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.332(In)
Computed peak 30-minute rainfall = 0.569(In)
Specified peak 1-hour rainfall = 0.700(In)
Computed peak 3-hour rainfall = 1.103(In)
Specified peak 6-hour rainfall = 1.470(In)
Specified peak 24-hour rainfall = 2.980(In)

Rainfall depth area reduction factors:
Using a total area of 8.02(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.332(In)
30-minute factor = 1.000 Adjusted rainfall = 0.568(In)
1-hour factor = 1.000 Adjusted rainfall = 0.700(In)
3-hour factor = 1.000 Adjusted rainfall = 1.103(In)
6-hour factor = 1.000 Adjusted rainfall = 1.470(In)
24-hour factor = 1.000 Adjusted rainfall = 2.980(In)

U n i t H y d r o g r a p h
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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 96.99 (CFS))	
1	5.433	5.270
2	40.654	34.161
3	67.555	26.092
4	79.056	11.154
5	85.791	6.533
6	90.196	4.272
7	93.196	2.910
8	95.355	2.094
9	96.908	1.506
10	97.902	0.965
11	98.559	0.636
12	99.263	0.683
13	99.749	0.472
14	100.000	0.244

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3320	0.3320
2	0.4088	0.0767
3	0.4617	0.0529
4	0.5033	0.0416
5	0.5381	0.0348
6	0.5684	0.0303
7	0.5953	0.0269
8	0.6196	0.0243
9	0.6419	0.0223
10	0.6625	0.0206
11	0.6817	0.0192
12	0.6997	0.0180
13	0.7233	0.0236
14	0.7459	0.0226
15	0.7675	0.0216
16	0.7883	0.0208
17	0.8084	0.0201
18	0.8278	0.0194
19	0.8465	0.0188
20	0.8647	0.0182
21	0.8824	0.0177
22	0.8995	0.0172
23	0.9163	0.0167
24	0.9326	0.0163
25	0.9485	0.0159
26	0.9640	0.0155
27	0.9792	0.0152
28	0.9941	0.0149

29	1.0086	0.0146
30	1.0229	0.0143
31	1.0369	0.0140
32	1.0506	0.0137
33	1.0641	0.0135
34	1.0774	0.0132
35	1.0904	0.0130
36	1.1032	0.0128
37	1.1158	0.0126
38	1.1282	0.0124
39	1.1404	0.0122
40	1.1524	0.0120
41	1.1642	0.0118
42	1.1759	0.0117
43	1.1874	0.0115
44	1.1988	0.0114
45	1.2100	0.0112
46	1.2210	0.0111
47	1.2320	0.0109
48	1.2428	0.0108
49	1.2534	0.0107
50	1.2639	0.0105
51	1.2743	0.0104
52	1.2846	0.0103
53	1.2948	0.0102
54	1.3049	0.0101
55	1.3148	0.0100
56	1.3247	0.0098
57	1.3344	0.0097
58	1.3441	0.0096
59	1.3536	0.0095
60	1.3631	0.0095
61	1.3724	0.0094
62	1.3817	0.0093
63	1.3909	0.0092
64	1.4000	0.0091
65	1.4090	0.0090
66	1.4179	0.0089
67	1.4268	0.0089
68	1.4356	0.0088
69	1.4443	0.0087
70	1.4529	0.0086
71	1.4615	0.0086
72	1.4700	0.0085
73	1.4803	0.0104
74	1.4906	0.0103
75	1.5009	0.0102
76	1.5110	0.0102
77	1.5211	0.0101
78	1.5312	0.0100

79	1.5412	0.0100
80	1.5511	0.0099
81	1.5609	0.0099
82	1.5707	0.0098
83	1.5805	0.0097
84	1.5901	0.0097
85	1.5998	0.0096
86	1.6093	0.0096
87	1.6188	0.0095
88	1.6283	0.0095
89	1.6377	0.0094
90	1.6471	0.0094
91	1.6564	0.0093
92	1.6656	0.0093
93	1.6748	0.0092
94	1.6840	0.0092
95	1.6931	0.0091
96	1.7021	0.0091
97	1.7112	0.0090
98	1.7201	0.0090
99	1.7290	0.0089
100	1.7379	0.0089
101	1.7468	0.0088
102	1.7556	0.0088
103	1.7643	0.0088
104	1.7730	0.0087
105	1.7817	0.0087
106	1.7903	0.0086
107	1.7989	0.0086
108	1.8075	0.0086
109	1.8160	0.0085
110	1.8245	0.0085
111	1.8329	0.0084
112	1.8413	0.0084
113	1.8497	0.0084
114	1.8580	0.0083
115	1.8663	0.0083
116	1.8745	0.0083
117	1.8827	0.0082
118	1.8909	0.0082
119	1.8991	0.0082
120	1.9072	0.0081
121	1.9153	0.0081
122	1.9233	0.0081
123	1.9314	0.0080
124	1.9393	0.0080
125	1.9473	0.0080
126	1.9552	0.0079
127	1.9631	0.0079
128	1.9710	0.0079

129	1.9788	0.0078
130	1.9866	0.0078
131	1.9944	0.0078
132	2.0021	0.0077
133	2.0099	0.0077
134	2.0176	0.0077
135	2.0252	0.0077
136	2.0328	0.0076
137	2.0405	0.0076
138	2.0480	0.0076
139	2.0556	0.0076
140	2.0631	0.0075
141	2.0706	0.0075
142	2.0781	0.0075
143	2.0855	0.0074
144	2.0930	0.0074
145	2.1003	0.0074
146	2.1077	0.0074
147	2.1151	0.0073
148	2.1224	0.0073
149	2.1297	0.0073
150	2.1370	0.0073
151	2.1442	0.0073
152	2.1514	0.0072
153	2.1586	0.0072
154	2.1658	0.0072
155	2.1730	0.0072
156	2.1801	0.0071
157	2.1872	0.0071
158	2.1943	0.0071
159	2.2014	0.0071
160	2.2084	0.0070
161	2.2155	0.0070
162	2.2225	0.0070
163	2.2294	0.0070
164	2.2364	0.0070
165	2.2433	0.0069
166	2.2503	0.0069
167	2.2572	0.0069
168	2.2640	0.0069
169	2.2709	0.0069
170	2.2777	0.0068
171	2.2846	0.0068
172	2.2914	0.0068
173	2.2982	0.0068
174	2.3049	0.0068
175	2.3117	0.0067
176	2.3184	0.0067
177	2.3251	0.0067
178	2.3318	0.0067

179	2.3384	0.0067
180	2.3451	0.0067
181	2.3517	0.0066
182	2.3583	0.0066
183	2.3649	0.0066
184	2.3715	0.0066
185	2.3781	0.0066
186	2.3846	0.0065
187	2.3911	0.0065
188	2.3977	0.0065
189	2.4041	0.0065
190	2.4106	0.0065
191	2.4171	0.0065
192	2.4235	0.0064
193	2.4300	0.0064
194	2.4364	0.0064
195	2.4428	0.0064
196	2.4491	0.0064
197	2.4555	0.0064
198	2.4618	0.0063
199	2.4682	0.0063
200	2.4745	0.0063
201	2.4808	0.0063
202	2.4871	0.0063
203	2.4933	0.0063
204	2.4996	0.0063
205	2.5058	0.0062
206	2.5121	0.0062
207	2.5183	0.0062
208	2.5245	0.0062
209	2.5306	0.0062
210	2.5368	0.0062
211	2.5430	0.0062
212	2.5491	0.0061
213	2.5552	0.0061
214	2.5613	0.0061
215	2.5674	0.0061
216	2.5735	0.0061
217	2.5796	0.0061
218	2.5856	0.0061
219	2.5917	0.0060
220	2.5977	0.0060
221	2.6037	0.0060
222	2.6097	0.0060
223	2.6157	0.0060
224	2.6216	0.0060
225	2.6276	0.0060
226	2.6336	0.0059
227	2.6395	0.0059
228	2.6454	0.0059

229	2.6513	0.0059
230	2.6572	0.0059
231	2.6631	0.0059
232	2.6690	0.0059
233	2.6748	0.0059
234	2.6807	0.0058
235	2.6865	0.0058
236	2.6923	0.0058
237	2.6981	0.0058
238	2.7039	0.0058
239	2.7097	0.0058
240	2.7155	0.0058
241	2.7213	0.0058
242	2.7270	0.0058
243	2.7327	0.0057
244	2.7385	0.0057
245	2.7442	0.0057
246	2.7499	0.0057
247	2.7556	0.0057
248	2.7613	0.0057
249	2.7669	0.0057
250	2.7726	0.0057
251	2.7782	0.0056
252	2.7839	0.0056
253	2.7895	0.0056
254	2.7951	0.0056
255	2.8007	0.0056
256	2.8063	0.0056
257	2.8119	0.0056
258	2.8175	0.0056
259	2.8230	0.0056
260	2.8286	0.0056
261	2.8341	0.0055
262	2.8397	0.0055
263	2.8452	0.0055
264	2.8507	0.0055
265	2.8562	0.0055
266	2.8617	0.0055
267	2.8671	0.0055
268	2.8726	0.0055
269	2.8781	0.0055
270	2.8835	0.0054
271	2.8890	0.0054
272	2.8944	0.0054
273	2.8998	0.0054
274	2.9052	0.0054
275	2.9106	0.0054
276	2.9160	0.0054
277	2.9214	0.0054
278	2.9268	0.0054

279	2.9321	0.0054
280	2.9375	0.0054
281	2.9428	0.0053
282	2.9482	0.0053
283	2.9535	0.0053
284	2.9588	0.0053
285	2.9641	0.0053
286	2.9694	0.0053
287	2.9747	0.0053
288	2.9800	0.0053

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0053	0.0009	0.0044
2	0.0053	0.0009	0.0044
3	0.0053	0.0009	0.0044
4	0.0053	0.0009	0.0044
5	0.0053	0.0009	0.0044
6	0.0053	0.0009	0.0044
7	0.0054	0.0009	0.0045
8	0.0054	0.0009	0.0045
9	0.0054	0.0009	0.0045
10	0.0054	0.0009	0.0045
11	0.0054	0.0009	0.0045
12	0.0054	0.0009	0.0045
13	0.0054	0.0009	0.0045
14	0.0055	0.0009	0.0045
15	0.0055	0.0009	0.0045
16	0.0055	0.0009	0.0046
17	0.0055	0.0009	0.0046
18	0.0055	0.0009	0.0046
19	0.0055	0.0009	0.0046
20	0.0056	0.0009	0.0046
21	0.0056	0.0009	0.0046
22	0.0056	0.0009	0.0046
23	0.0056	0.0010	0.0047
24	0.0056	0.0010	0.0047
25	0.0056	0.0010	0.0047
26	0.0056	0.0010	0.0047
27	0.0057	0.0010	0.0047
28	0.0057	0.0010	0.0047
29	0.0057	0.0010	0.0047
30	0.0057	0.0010	0.0047
31	0.0057	0.0010	0.0048
32	0.0058	0.0010	0.0048
33	0.0058	0.0010	0.0048
34	0.0058	0.0010	0.0048
35	0.0058	0.0010	0.0048

36	0.0058	0.0010	0.0048
37	0.0058	0.0010	0.0049
38	0.0059	0.0010	0.0049
39	0.0059	0.0010	0.0049
40	0.0059	0.0010	0.0049
41	0.0059	0.0010	0.0049
42	0.0059	0.0010	0.0049
43	0.0060	0.0010	0.0049
44	0.0060	0.0010	0.0050
45	0.0060	0.0010	0.0050
46	0.0060	0.0010	0.0050
47	0.0060	0.0010	0.0050
48	0.0061	0.0010	0.0050
49	0.0061	0.0010	0.0050
50	0.0061	0.0010	0.0051
51	0.0061	0.0010	0.0051
52	0.0061	0.0010	0.0051
53	0.0062	0.0010	0.0051
54	0.0062	0.0011	0.0051
55	0.0062	0.0011	0.0052
56	0.0062	0.0011	0.0052
57	0.0063	0.0011	0.0052
58	0.0063	0.0011	0.0052
59	0.0063	0.0011	0.0052
60	0.0063	0.0011	0.0052
61	0.0063	0.0011	0.0053
62	0.0064	0.0011	0.0053
63	0.0064	0.0011	0.0053
64	0.0064	0.0011	0.0053
65	0.0064	0.0011	0.0053
66	0.0065	0.0011	0.0054
67	0.0065	0.0011	0.0054
68	0.0065	0.0011	0.0054
69	0.0065	0.0011	0.0054
70	0.0066	0.0011	0.0054
71	0.0066	0.0011	0.0055
72	0.0066	0.0011	0.0055
73	0.0067	0.0011	0.0055
74	0.0067	0.0011	0.0055
75	0.0067	0.0011	0.0056
76	0.0067	0.0011	0.0056
77	0.0068	0.0011	0.0056
78	0.0068	0.0012	0.0056
79	0.0068	0.0012	0.0057
80	0.0068	0.0012	0.0057
81	0.0069	0.0012	0.0057
82	0.0069	0.0012	0.0057
83	0.0069	0.0012	0.0058
84	0.0070	0.0012	0.0058
85	0.0070	0.0012	0.0058

86	0.0070	0.0012	0.0058
87	0.0071	0.0012	0.0059
88	0.0071	0.0012	0.0059
89	0.0071	0.0012	0.0059
90	0.0072	0.0012	0.0059
91	0.0072	0.0012	0.0060
92	0.0072	0.0012	0.0060
93	0.0073	0.0012	0.0060
94	0.0073	0.0012	0.0061
95	0.0073	0.0012	0.0061
96	0.0074	0.0013	0.0061
97	0.0074	0.0013	0.0062
98	0.0074	0.0013	0.0062
99	0.0075	0.0013	0.0062
100	0.0075	0.0013	0.0062
101	0.0076	0.0013	0.0063
102	0.0076	0.0013	0.0063
103	0.0077	0.0013	0.0064
104	0.0077	0.0013	0.0064
105	0.0077	0.0013	0.0064
106	0.0078	0.0013	0.0065
107	0.0078	0.0013	0.0065
108	0.0079	0.0013	0.0065
109	0.0079	0.0013	0.0066
110	0.0080	0.0014	0.0066
111	0.0080	0.0014	0.0067
112	0.0081	0.0014	0.0067
113	0.0081	0.0014	0.0067
114	0.0082	0.0014	0.0068
115	0.0082	0.0014	0.0068
116	0.0083	0.0014	0.0069
117	0.0083	0.0014	0.0069
118	0.0084	0.0014	0.0069
119	0.0084	0.0014	0.0070
120	0.0085	0.0014	0.0070
121	0.0086	0.0015	0.0071
122	0.0086	0.0015	0.0071
123	0.0087	0.0015	0.0072
124	0.0087	0.0015	0.0072
125	0.0088	0.0015	0.0073
126	0.0088	0.0015	0.0073
127	0.0089	0.0015	0.0074
128	0.0090	0.0015	0.0074
129	0.0091	0.0015	0.0075
130	0.0091	0.0015	0.0076
131	0.0092	0.0016	0.0076
132	0.0093	0.0016	0.0077
133	0.0094	0.0016	0.0078
134	0.0094	0.0016	0.0078
135	0.0095	0.0016	0.0079

136	0.0096	0.0016	0.0079
137	0.0097	0.0016	0.0080
138	0.0097	0.0017	0.0081
139	0.0099	0.0017	0.0082
140	0.0099	0.0017	0.0082
141	0.0100	0.0017	0.0083
142	0.0101	0.0017	0.0084
143	0.0102	0.0017	0.0085
144	0.0103	0.0018	0.0086
145	0.0085	0.0014	0.0070
146	0.0086	0.0015	0.0071
147	0.0087	0.0015	0.0072
148	0.0088	0.0015	0.0073
149	0.0089	0.0015	0.0074
150	0.0090	0.0015	0.0075
151	0.0092	0.0016	0.0076
152	0.0093	0.0016	0.0077
153	0.0095	0.0016	0.0078
154	0.0095	0.0016	0.0079
155	0.0097	0.0017	0.0081
156	0.0098	0.0017	0.0082
157	0.0101	0.0017	0.0084
158	0.0102	0.0017	0.0084
159	0.0104	0.0018	0.0086
160	0.0105	0.0018	0.0087
161	0.0108	0.0018	0.0090
162	0.0109	0.0019	0.0091
163	0.0112	0.0019	0.0093
164	0.0114	0.0019	0.0094
165	0.0117	0.0020	0.0097
166	0.0118	0.0020	0.0098
167	0.0122	0.0021	0.0101
168	0.0124	0.0021	0.0103
169	0.0128	0.0022	0.0106
170	0.0130	0.0022	0.0108
171	0.0135	0.0023	0.0112
172	0.0137	0.0023	0.0114
173	0.0143	0.0024	0.0118
174	0.0146	0.0025	0.0121
175	0.0152	0.0026	0.0126
176	0.0155	0.0026	0.0129
177	0.0163	0.0028	0.0135
178	0.0167	0.0028	0.0139
179	0.0177	0.0030	0.0147
180	0.0182	0.0031	0.0151
181	0.0194	0.0033	0.0161
182	0.0201	0.0034	0.0166
183	0.0216	0.0037	0.0180
184	0.0226	0.0038	0.0187
185	0.0180	0.0031	0.0150

186	0.0192	0.0033	0.0160
187	0.0223	0.0038	0.0185
188	0.0243	0.0041	0.0202
189	0.0303	0.0051	0.0251
190	0.0348	0.0059	0.0289
191	0.0529	0.0081	0.0447
192	0.0767	0.0081	0.0686
193	0.3320	0.0081	0.3239
194	0.0416	0.0071	0.0345
195	0.0269	0.0046	0.0223
196	0.0206	0.0035	0.0171
197	0.0236	0.0040	0.0196
198	0.0208	0.0035	0.0173
199	0.0188	0.0032	0.0156
200	0.0172	0.0029	0.0143
201	0.0159	0.0027	0.0132
202	0.0149	0.0025	0.0123
203	0.0140	0.0024	0.0116
204	0.0132	0.0023	0.0110
205	0.0126	0.0021	0.0104
206	0.0120	0.0020	0.0100
207	0.0115	0.0020	0.0096
208	0.0111	0.0019	0.0092
209	0.0107	0.0018	0.0088
210	0.0103	0.0017	0.0085
211	0.0100	0.0017	0.0083
212	0.0096	0.0016	0.0080
213	0.0094	0.0016	0.0078
214	0.0091	0.0015	0.0076
215	0.0089	0.0015	0.0074
216	0.0086	0.0015	0.0072
217	0.0104	0.0018	0.0086
218	0.0102	0.0017	0.0084
219	0.0100	0.0017	0.0083
220	0.0098	0.0017	0.0081
221	0.0096	0.0016	0.0080
222	0.0095	0.0016	0.0079
223	0.0093	0.0016	0.0077
224	0.0092	0.0016	0.0076
225	0.0090	0.0015	0.0075
226	0.0089	0.0015	0.0074
227	0.0088	0.0015	0.0073
228	0.0086	0.0015	0.0072
229	0.0085	0.0014	0.0071
230	0.0084	0.0014	0.0070
231	0.0083	0.0014	0.0069
232	0.0082	0.0014	0.0068
233	0.0081	0.0014	0.0067
234	0.0080	0.0014	0.0066
235	0.0079	0.0013	0.0066

236	0.0078	0.0013	0.0065
237	0.0077	0.0013	0.0064
238	0.0076	0.0013	0.0063
239	0.0076	0.0013	0.0063
240	0.0075	0.0013	0.0062
241	0.0074	0.0013	0.0061
242	0.0073	0.0012	0.0061
243	0.0073	0.0012	0.0060
244	0.0072	0.0012	0.0060
245	0.0071	0.0012	0.0059
246	0.0070	0.0012	0.0058
247	0.0070	0.0012	0.0058
248	0.0069	0.0012	0.0057
249	0.0069	0.0012	0.0057
250	0.0068	0.0012	0.0056
251	0.0067	0.0011	0.0056
252	0.0067	0.0011	0.0056
253	0.0066	0.0011	0.0055
254	0.0066	0.0011	0.0055
255	0.0065	0.0011	0.0054
256	0.0065	0.0011	0.0054
257	0.0064	0.0011	0.0053
258	0.0064	0.0011	0.0053
259	0.0063	0.0011	0.0053
260	0.0063	0.0011	0.0052
261	0.0062	0.0011	0.0052
262	0.0062	0.0011	0.0051
263	0.0062	0.0010	0.0051
264	0.0061	0.0010	0.0051
265	0.0061	0.0010	0.0050
266	0.0060	0.0010	0.0050
267	0.0060	0.0010	0.0050
268	0.0059	0.0010	0.0049
269	0.0059	0.0010	0.0049
270	0.0059	0.0010	0.0049
271	0.0058	0.0010	0.0048
272	0.0058	0.0010	0.0048
273	0.0058	0.0010	0.0048
274	0.0057	0.0010	0.0048
275	0.0057	0.0010	0.0047
276	0.0057	0.0010	0.0047
277	0.0056	0.0010	0.0047
278	0.0056	0.0010	0.0046
279	0.0056	0.0009	0.0046
280	0.0055	0.0009	0.0046
281	0.0055	0.0009	0.0046
282	0.0055	0.0009	0.0045
283	0.0054	0.0009	0.0045
284	0.0054	0.0009	0.0045
285	0.0054	0.0009	0.0045

286	0.0054	0.0009	0.0044
287	0.0053	0.0009	0.0044
288	0.0053	0.0009	0.0044

Total soil rain loss = 0.45(In)
Total effective rainfall = 2.53(In)
Peak flow rate in flood hydrograph = 14.00(CFS)

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

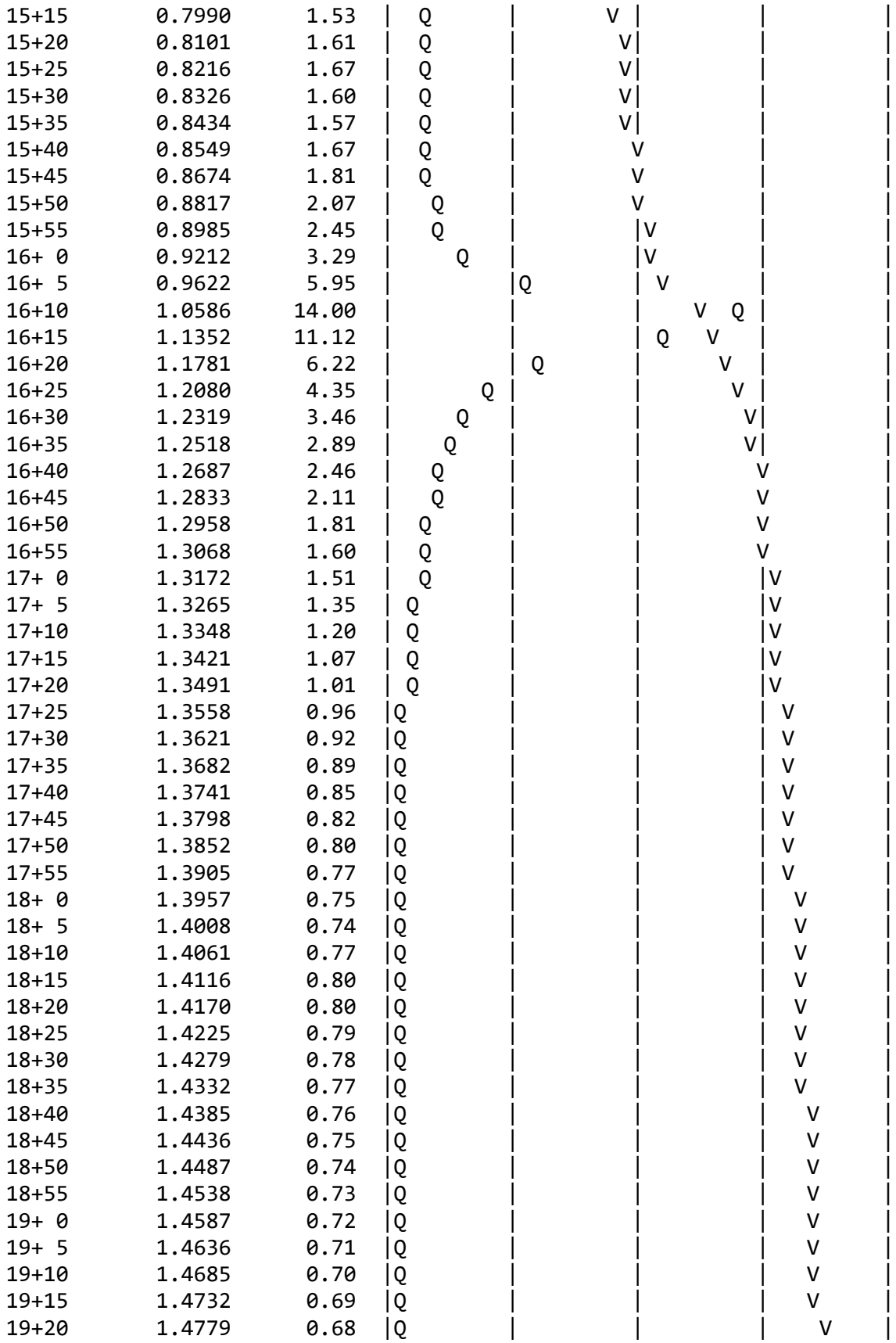
Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+ 5	0.0002	0.02	Q				
0+10	0.0013	0.17	Q				
0+15	0.0033	0.29	Q				
0+20	0.0057	0.34	Q				
0+25	0.0082	0.37	Q				
0+30	0.0108	0.39	Q				
0+35	0.0136	0.40	Q				
0+40	0.0164	0.41	Q				
0+45	0.0193	0.42	Q				
0+50	0.0222	0.42	Q				
0+55	0.0251	0.43	Q				
1+ 0	0.0281	0.43	Q				
1+ 5	0.0311	0.43	Q				
1+10	0.0341	0.44	Q				
1+15	0.0371	0.44	Q				
1+20	0.0402	0.44	Q				
1+25	0.0432	0.44	QV				
1+30	0.0462	0.44	QV				
1+35	0.0493	0.44	QV				
1+40	0.0523	0.44	QV				
1+45	0.0554	0.45	QV				
1+50	0.0585	0.45	QV				
1+55	0.0616	0.45	QV				
2+ 0	0.0647	0.45	QV				
2+ 5	0.0678	0.45	QV				
2+10	0.0709	0.45	QV				
2+15	0.0740	0.45	QV				
2+20	0.0771	0.45	QV				
2+25	0.0803	0.46	QV				
2+30	0.0834	0.46	QV				
2+35	0.0866	0.46	Q V				
2+40	0.0897	0.46	Q V				

```
2+45       0.0929      0.46  Q V       |         |         |         |
2+50       0.0961      0.46  Q V       |         |         |         |
2+55       0.0993      0.46  Q V       |         |         |         |
3+ 0       0.1025      0.47  Q V       |         |         |         |
3+ 5       0.1057      0.47  Q V       |         |         |         |
3+10       0.1089      0.47  Q V       |         |         |         |
3+15       0.1122      0.47  Q V       |         |         |         |
3+20       0.1154      0.47  Q V       |         |         |         |
3+25       0.1187      0.47  Q V       |         |         |         |
3+30       0.1219      0.47  Q V       |         |         |         |
3+35       0.1252      0.48  Q V       |         |         |         |
3+40       0.1285      0.48  Q  V      |         |         |         |
3+45       0.1318      0.48  Q  V      |         |         |         |
3+50       0.1351      0.48  Q  V      |         |         |         |
3+55       0.1384      0.48  Q  V      |         |         |         |
4+ 0       0.1417      0.48  Q  V      |         |         |         |
4+ 5       0.1451      0.49  Q  V      |         |         |         |
4+10       0.1484      0.49  Q  V      |         |         |         |
4+15       0.1518      0.49  Q  V      |         |         |         |
4+20       0.1552      0.49  Q  V      |         |         |         |
4+25       0.1586      0.49  Q  V      |         |         |         |
4+30       0.1620      0.49  Q  V      |         |         |         |
4+35       0.1654      0.50  Q  V      |         |         |         |
4+40       0.1688      0.50  Q  V      |         |         |         |
4+45       0.1722      0.50  Q   V     |         |         |         |
4+50       0.1757      0.50  |Q  V     |         |         |         |
4+55       0.1791      0.50  |Q  V     |         |         |         |
5+ 0       0.1826      0.50  |Q  V     |         |         |         |
5+ 5       0.1861      0.51  |Q  V     |         |         |         |
5+10       0.1896      0.51  |Q  V     |         |         |         |
5+15       0.1931      0.51  |Q  V     |         |         |         |
5+20       0.1966      0.51  |Q  V     |         |         |         |
5+25       0.2002      0.51  |Q  V     |         |         |         |
5+30       0.2037      0.52  |Q  V     |         |         |         |
5+35       0.2073      0.52  |Q  V     |         |         |         |
5+40       0.2108      0.52  |Q  V     |         |         |         |
5+45       0.2144      0.52  |Q   V    |         |         |         |
5+50       0.2180      0.52  |Q   V    |         |         |         |
5+55       0.2217      0.53  |Q   V    |         |         |         |
6+ 0       0.2253      0.53  |Q   V    |         |         |         |
6+ 5       0.2289      0.53  |Q   V    |         |         |         |
6+10       0.2326      0.53  |Q   V    |         |         |         |
6+15       0.2363      0.53  |Q   V    |         |         |         |
6+20       0.2400      0.54  |Q   V    |         |         |         |
6+25       0.2437      0.54  |Q   V    |         |         |         |
6+30       0.2474      0.54  |Q   V    |         |         |         |
6+35       0.2511      0.54  |Q   V    |         |         |         |
6+40       0.2549      0.55  |Q    V   |         |         |         |
6+45       0.2587      0.55  |Q    V   |         |         |         |
6+50       0.2625      0.55  |Q    V   |         |         |         |
```

6+55	0.2663	0.55	|Q V |	|	|	|
7+ 0	0.2701	0.55	|Q V |	|	|	|
7+ 5	0.2739	0.56	|Q V |	|	|	|
7+10	0.2778	0.56	|Q V |	|	|	|
7+15	0.2817	0.56	|Q V |	|	|	|
7+20	0.2855	0.56	|Q V |	|	|	|
7+25	0.2894	0.57	|Q V |	|	|	|
7+30	0.2934	0.57	|Q V |	|	|	|
7+35	0.2973	0.57	|Q V |	|	|	|
7+40	0.3013	0.58	|Q V |	|	|	|
7+45	0.3053	0.58	|Q V |	|	|	|
7+50	0.3093	0.58	|Q V |	|	|	|
7+55	0.3133	0.58	|Q V |	|	|	|
8+ 0	0.3173	0.59	|Q V |	|	|	|
8+ 5	0.3214	0.59	|Q V |	|	|	|
8+10	0.3255	0.59	|Q V |	|	|	|
8+15	0.3296	0.60	|Q V |	|	|	|
8+20	0.3337	0.60	|Q V |	|	|	|
8+25	0.3378	0.60	|Q V |	|	|	|
8+30	0.3420	0.60	|Q V |	|	|	|
8+35	0.3462	0.61	|Q V |	|	|	|
8+40	0.3504	0.61	|Q V |	|	|	|
8+45	0.3546	0.61	|Q V |	|	|	|
8+50	0.3589	0.62	|Q V |	|	|	|
8+55	0.3632	0.62	|Q V |	|	|	|
9+ 0	0.3675	0.62	|Q V |	|	|	|
9+ 5	0.3718	0.63	|Q V |	|	|	|
9+10	0.3762	0.63	|Q V |	|	|	|
9+15	0.3805	0.64	|Q V|	|	|	|
9+20	0.3849	0.64	|Q V|	|	|	|
9+25	0.3894	0.64	|Q V|	|	|	|
9+30	0.3938	0.65	|Q V|	|	|	|
9+35	0.3983	0.65	|Q V|	|	|	|
9+40	0.4028	0.66	|Q V|	|	|	|
9+45	0.4074	0.66	|Q V|	|	|	|
9+50	0.4119	0.66	|Q V|	|	|	|
9+55	0.4165	0.67	|Q V|	|	|	|
10+ 0	0.4212	0.67	|Q V|	|	|	|
10+ 5	0.4258	0.68	|Q V	|	|	|
10+10	0.4305	0.68	|Q V	|	|	|
10+15	0.4352	0.69	|Q V	|	|	|
10+20	0.4400	0.69	|Q V	|	|	|
10+25	0.4448	0.69	|Q V	|	|	|
10+30	0.4496	0.70	|Q V	|	|	|
10+35	0.4544	0.70	|Q V	|	|	|
10+40	0.4593	0.71	|Q V	|	|	|
10+45	0.4643	0.72	|Q V	|	|	|
10+50	0.4692	0.72	|Q |V	|	|	|
10+55	0.4742	0.73	|Q |V	|	|	|
11+ 0	0.4793	0.73	|Q |V	|	|	|

```
11+ 5       0.4843      0.74  |Q        |V        |         |         |
11+10       0.4895      0.74  |Q        |V        |         |         |
11+15       0.4946      0.75  |Q        |V        |         |         |
11+20       0.4998      0.76  |Q        |V        |         |         |
11+25       0.5051      0.76  |Q        |V        |         |         |
11+30       0.5104      0.77  |Q        | V       |         |         |
11+35       0.5157      0.77  |Q        | V       |         |         |
11+40       0.5211      0.78  |Q        | V       |         |         |
11+45       0.5265      0.79  |Q        | V       |         |         |
11+50       0.5320      0.80  |Q        | V       |         |         |
11+55       0.5375      0.80  |Q        | V       |         |         |
12+ 0       0.5431      0.81  |Q        | V       |         |         |
12+ 5       0.5487      0.81  |Q        | V       |         |         |
12+10       0.5540      0.76  |Q        |  V      |         |         |
12+15       0.5590      0.73  |Q        |  V      |         |         |
12+20       0.5639      0.72  |Q        |  V      |         |         |
12+25       0.5689      0.72  |Q        |  V      |         |         |
12+30       0.5738      0.72  |Q        |  V      |         |         |
12+35       0.5788      0.72  |Q        |  V      |         |         |
12+40       0.5839      0.73  |Q        |  V      |         |         |
12+45       0.5889      0.74  |Q        |  V      |         |         |
12+50       0.5941      0.75  |Q        |   V     |         |         |
12+55       0.5993      0.76  |Q        |   V     |         |         |
13+ 0       0.6046      0.77  |Q        |   V     |         |         |
13+ 5       0.6099      0.78  |Q        |   V     |         |         |
13+10       0.6154      0.79  |Q        |   V     |         |         |
13+15       0.6209      0.80  |Q        |   V     |         |         |
13+20       0.6265      0.82  |Q        |   V     |         |         |
13+25       0.6322      0.83  |Q        |   V     |         |         |
13+30       0.6381      0.84  |Q        |    V    |         |         |
13+35       0.6440      0.86  |Q        |    V    |         |         |
13+40       0.6500      0.88  |Q        |    V    |         |         |
13+45       0.6562      0.89  |Q        |    V    |         |         |
13+50       0.6624      0.91  |Q        |    V    |         |         |
13+55       0.6688      0.93  |Q        |    V    |         |         |
14+ 0       0.6754      0.95  |Q        |     V   |         |         |
14+ 5       0.6820      0.97  |Q        |     V   |         |         |
14+10       0.6889      0.99  |Q        |     V   |         |         |
14+15       0.6959      1.02  | Q       |     V   |         |         |
14+20       0.7031      1.04  | Q       |     V   |         |         |
14+25       0.7104      1.07  | Q       |     V   |         |         |
14+30       0.7180      1.10  | Q       |      V  |         |         |
14+35       0.7258      1.13  | Q       |      V  |         |         |
14+40       0.7339      1.17  | Q       |      V  |         |         |
14+45       0.7421      1.20  | Q       |      V  |         |         |
14+50       0.7507      1.25  | Q       |      V  |         |         |
14+55       0.7596      1.29  | Q       |      V  |         |         |
15+ 0       0.7688      1.34  | Q       |       V |         |         |
15+ 5       0.7784      1.39  | Q       |       V |         |         |
15+10       0.7885      1.46  | Q       |       V |         |         |
```



```
19+25       1.4826      0.67  |Q        |         |         |    V    |
19+30       1.4871      0.66  |Q        |         |         |    V    |
19+35       1.4916      0.66  |Q        |         |         |    V    |
19+40       1.4961      0.65  |Q        |         |         |    V    |
19+45       1.5005      0.64  |Q        |         |         |    V    |
19+50       1.5049      0.63  |Q        |         |         |    V    |
19+55       1.5092      0.63  |Q        |         |         |    V    |
20+ 0       1.5134      0.62  |Q        |         |         |    V    |
20+ 5       1.5177      0.61  |Q        |         |         |    V    |
20+10       1.5218      0.61  |Q        |         |         |     V   |
20+15       1.5259      0.60  |Q        |         |         |     V   |
20+20       1.5300      0.59  |Q        |         |         |     V   |
20+25       1.5341      0.59  |Q        |         |         |     V   |
20+30       1.5381      0.58  |Q        |         |         |     V   |
20+35       1.5420      0.58  |Q        |         |         |     V   |
20+40       1.5460      0.57  |Q        |         |         |     V   |
20+45       1.5499      0.57  |Q        |         |         |     V   |
20+50       1.5537      0.56  |Q        |         |         |     V   |
20+55       1.5575      0.56  |Q        |         |         |     V   |
21+ 0       1.5613      0.55  |Q        |         |         |     V   |
21+ 5       1.5651      0.55  |Q        |         |         |      V  |
21+10       1.5688      0.54  |Q        |         |         |      V  |
21+15       1.5725      0.54  |Q        |         |         |      V  |
21+20       1.5762      0.53  |Q        |         |         |      V  |
21+25       1.5798      0.53  |Q        |         |         |      V  |
21+30       1.5834      0.52  |Q        |         |         |      V  |
21+35       1.5870      0.52  |Q        |         |         |      V  |
21+40       1.5905      0.52  |Q        |         |         |      V  |
21+45       1.5941      0.51  |Q        |         |         |      V  |
21+50       1.5976      0.51  |Q        |         |         |      V  |
21+55       1.6010      0.50  |Q        |         |         |      V  |
22+ 0       1.6045      0.50  |Q        |         |         |       V |
22+ 5       1.6079      0.50  Q         |         |         |       V |
22+10       1.6113      0.49  Q         |         |         |       V |
22+15       1.6147      0.49  Q         |         |         |       V |
22+20       1.6180      0.49  Q         |         |         |       V |
22+25       1.6214      0.48  Q         |         |         |       V |
22+30       1.6247      0.48  Q         |         |         |       V |
22+35       1.6280      0.48  Q         |         |         |       V |
22+40       1.6312      0.47  Q         |         |         |       V |
22+45       1.6345      0.47  Q         |         |         |       V |
22+50       1.6377      0.47  Q         |         |         |       V |
22+55       1.6409      0.47  Q         |         |         |       V |
23+ 0       1.6441      0.46  Q         |         |         |       V |
23+ 5       1.6473      0.46  Q         |         |         |        V|
23+10       1.6504      0.46  Q         |         |         |        V|
23+15       1.6535      0.45  Q         |         |         |        V|
23+20       1.6567      0.45  Q         |         |         |        V|
23+25       1.6597      0.45  Q         |         |         |        V|
23+30       1.6628      0.45  Q         |         |         |        V|
```

23+35	1.6659	0.44	Q	|	|	|	V|
23+40	1.6689	0.44	Q	|	|	|	V|
23+45	1.6719	0.44	Q	|	|	|	V|
23+50	1.6750	0.44	Q	|	|	|	V|
23+55	1.6779	0.43	Q	|	|	|	V|
24+ 0	1.6809	0.43	Q	|	|	|	V|

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

Study date 08/23/21

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

Program License Serial Number 6385

Amethyst Crossing
Developed 10-year
Area DA-2

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
1.31	1	0.70
Rainfall data for year 10		
1.31	6	1.47
Rainfall data for year 10		
1.31	24	2.98

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	32.0	1.31	1.000	0.978	0.100	0.098

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

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
0.13	0.100	32.0	32.0	14.90	0.000
1.18	0.900	98.0	98.0	0.20	0.922

Area-averaged catchment yield fraction, Y = 0.830
Area-averaged low loss fraction, Yb = 0.170
User entry of time of concentration = 0.098 (hours)
++
Watershed area = 1.31(Ac.)
Catchment Lag time = 0.079 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 105.9681
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.098(In/Hr)
Average low loss rate fraction (Yb) = 0.170 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.332(In)
Computed peak 30-minute rainfall = 0.569(In)
Specified peak 1-hour rainfall = 0.700(In)
Computed peak 3-hour rainfall = 1.103(In)
Specified peak 6-hour rainfall = 1.470(In)
Specified peak 24-hour rainfall = 2.980(In)

Rainfall depth area reduction factors:
Using a total area of 1.31(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.332(In)
30-minute factor = 1.000 Adjusted rainfall = 0.569(In)
1-hour factor = 1.000 Adjusted rainfall = 0.700(In)
3-hour factor = 1.000 Adjusted rainfall = 1.103(In)
6-hour factor = 1.000 Adjusted rainfall = 1.470(In)
24-hour factor = 1.000 Adjusted rainfall = 2.980(In)

U n i t H y d r o g r a p h
++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 15.84 (CFS))	
1	19.170	3.037
2	69.391	7.956
3	85.462	2.546
4	92.491	1.114
5	96.239	0.594
6	98.125	0.299
7	99.318	0.189
8	100.000	0.108

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3321	0.3321
2	0.4089	0.0768
3	0.4618	0.0529
4	0.5034	0.0416
5	0.5383	0.0349
6	0.5685	0.0303
7	0.5955	0.0269
8	0.6198	0.0243
9	0.6421	0.0223
10	0.6627	0.0206
11	0.6819	0.0192
12	0.7000	0.0180
13	0.7235	0.0236
14	0.7461	0.0226
15	0.7677	0.0216
16	0.7885	0.0208
17	0.8086	0.0200
18	0.8279	0.0194
19	0.8467	0.0187
20	0.8649	0.0182
21	0.8825	0.0177
22	0.8997	0.0172
23	0.9164	0.0167
24	0.9327	0.0163
25	0.9486	0.0159
26	0.9641	0.0155
27	0.9793	0.0152
28	0.9942	0.0149
29	1.0087	0.0146
30	1.0230	0.0143
31	1.0370	0.0140
32	1.0507	0.0137
33	1.0642	0.0135
34	1.0774	0.0132

35	1.0904	0.0130
36	1.1032	0.0128
37	1.1158	0.0126
38	1.1282	0.0124
39	1.1404	0.0122
40	1.1524	0.0120
41	1.1643	0.0118
42	1.1759	0.0117
43	1.1875	0.0115
44	1.1988	0.0114
45	1.2100	0.0112
46	1.2211	0.0111
47	1.2320	0.0109
48	1.2428	0.0108
49	1.2534	0.0107
50	1.2640	0.0105
51	1.2744	0.0104
52	1.2847	0.0103
53	1.2948	0.0102
54	1.3049	0.0101
55	1.3149	0.0100
56	1.3247	0.0098
57	1.3345	0.0097
58	1.3441	0.0096
59	1.3536	0.0095
60	1.3631	0.0095
61	1.3725	0.0094
62	1.3817	0.0093
63	1.3909	0.0092
64	1.4000	0.0091
65	1.4090	0.0090
66	1.4180	0.0089
67	1.4268	0.0089
68	1.4356	0.0088
69	1.4443	0.0087
70	1.4529	0.0086
71	1.4615	0.0086
72	1.4700	0.0085
73	1.4804	0.0104
74	1.4907	0.0103
75	1.5009	0.0102
76	1.5111	0.0102
77	1.5212	0.0101
78	1.5312	0.0100
79	1.5412	0.0100
80	1.5511	0.0099
81	1.5610	0.0099
82	1.5707	0.0098
83	1.5805	0.0097
84	1.5902	0.0097

85	1.5998	0.0096
86	1.6094	0.0096
87	1.6189	0.0095
88	1.6283	0.0095
89	1.6377	0.0094
90	1.6471	0.0094
91	1.6564	0.0093
92	1.6656	0.0093
93	1.6748	0.0092
94	1.6840	0.0092
95	1.6931	0.0091
96	1.7022	0.0091
97	1.7112	0.0090
98	1.7202	0.0090
99	1.7291	0.0089
100	1.7380	0.0089
101	1.7468	0.0088
102	1.7556	0.0088
103	1.7643	0.0088
104	1.7731	0.0087
105	1.7817	0.0087
106	1.7904	0.0086
107	1.7989	0.0086
108	1.8075	0.0086
109	1.8160	0.0085
110	1.8245	0.0085
111	1.8329	0.0084
112	1.8413	0.0084
113	1.8497	0.0084
114	1.8580	0.0083
115	1.8663	0.0083
116	1.8746	0.0083
117	1.8828	0.0082
118	1.8910	0.0082
119	1.8991	0.0082
120	1.9072	0.0081
121	1.9153	0.0081
122	1.9234	0.0081
123	1.9314	0.0080
124	1.9394	0.0080
125	1.9473	0.0080
126	1.9553	0.0079
127	1.9632	0.0079
128	1.9710	0.0079
129	1.9789	0.0078
130	1.9867	0.0078
131	1.9944	0.0078
132	2.0022	0.0077
133	2.0099	0.0077
134	2.0176	0.0077

135	2.0252	0.0077
136	2.0329	0.0076
137	2.0405	0.0076
138	2.0481	0.0076
139	2.0556	0.0076
140	2.0631	0.0075
141	2.0706	0.0075
142	2.0781	0.0075
143	2.0856	0.0074
144	2.0930	0.0074
145	2.1004	0.0074
146	2.1078	0.0074
147	2.1151	0.0073
148	2.1224	0.0073
149	2.1297	0.0073
150	2.1370	0.0073
151	2.1442	0.0073
152	2.1515	0.0072
153	2.1587	0.0072
154	2.1659	0.0072
155	2.1730	0.0072
156	2.1801	0.0071
157	2.1873	0.0071
158	2.1943	0.0071
159	2.2014	0.0071
160	2.2085	0.0070
161	2.2155	0.0070
162	2.2225	0.0070
163	2.2295	0.0070
164	2.2364	0.0070
165	2.2434	0.0069
166	2.2503	0.0069
167	2.2572	0.0069
168	2.2641	0.0069
169	2.2709	0.0069
170	2.2778	0.0068
171	2.2846	0.0068
172	2.2914	0.0068
173	2.2982	0.0068
174	2.3049	0.0068
175	2.3117	0.0067
176	2.3184	0.0067
177	2.3251	0.0067
178	2.3318	0.0067
179	2.3385	0.0067
180	2.3451	0.0067
181	2.3518	0.0066
182	2.3584	0.0066
183	2.3650	0.0066
184	2.3715	0.0066

185	2.3781	0.0066
186	2.3846	0.0065
187	2.3912	0.0065
188	2.3977	0.0065
189	2.4042	0.0065
190	2.4107	0.0065
191	2.4171	0.0065
192	2.4236	0.0064
193	2.4300	0.0064
194	2.4364	0.0064
195	2.4428	0.0064
196	2.4492	0.0064
197	2.4555	0.0064
198	2.4619	0.0063
199	2.4682	0.0063
200	2.4745	0.0063
201	2.4808	0.0063
202	2.4871	0.0063
203	2.4934	0.0063
204	2.4996	0.0063
205	2.5059	0.0062
206	2.5121	0.0062
207	2.5183	0.0062
208	2.5245	0.0062
209	2.5307	0.0062
210	2.5368	0.0062
211	2.5430	0.0062
212	2.5491	0.0061
213	2.5552	0.0061
214	2.5613	0.0061
215	2.5674	0.0061
216	2.5735	0.0061
217	2.5796	0.0061
218	2.5856	0.0061
219	2.5917	0.0060
220	2.5977	0.0060
221	2.6037	0.0060
222	2.6097	0.0060
223	2.6157	0.0060
224	2.6217	0.0060
225	2.6276	0.0060
226	2.6336	0.0059
227	2.6395	0.0059
228	2.6454	0.0059
229	2.6513	0.0059
230	2.6572	0.0059
231	2.6631	0.0059
232	2.6690	0.0059
233	2.6749	0.0059
234	2.6807	0.0058

235	2.6865	0.0058
236	2.6924	0.0058
237	2.6982	0.0058
238	2.7040	0.0058
239	2.7097	0.0058
240	2.7155	0.0058
241	2.7213	0.0058
242	2.7270	0.0058
243	2.7328	0.0057
244	2.7385	0.0057
245	2.7442	0.0057
246	2.7499	0.0057
247	2.7556	0.0057
248	2.7613	0.0057
249	2.7670	0.0057
250	2.7726	0.0057
251	2.7783	0.0056
252	2.7839	0.0056
253	2.7895	0.0056
254	2.7951	0.0056
255	2.8007	0.0056
256	2.8063	0.0056
257	2.8119	0.0056
258	2.8175	0.0056
259	2.8231	0.0056
260	2.8286	0.0056
261	2.8341	0.0055
262	2.8397	0.0055
263	2.8452	0.0055
264	2.8507	0.0055
265	2.8562	0.0055
266	2.8617	0.0055
267	2.8672	0.0055
268	2.8726	0.0055
269	2.8781	0.0055
270	2.8836	0.0054
271	2.8890	0.0054
272	2.8944	0.0054
273	2.8998	0.0054
274	2.9053	0.0054
275	2.9107	0.0054
276	2.9160	0.0054
277	2.9214	0.0054
278	2.9268	0.0054
279	2.9322	0.0054
280	2.9375	0.0054
281	2.9429	0.0053
282	2.9482	0.0053
283	2.9535	0.0053
284	2.9588	0.0053

285	2.9641	0.0053	
286	2.9694	0.0053	
287	2.9747	0.0053	
288	2.9800	0.0053	

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0053	0.0009	0.0044
2	0.0053	0.0009	0.0044
3	0.0053	0.0009	0.0044
4	0.0053	0.0009	0.0044
5	0.0053	0.0009	0.0044
6	0.0053	0.0009	0.0044
7	0.0054	0.0009	0.0045
8	0.0054	0.0009	0.0045
9	0.0054	0.0009	0.0045
10	0.0054	0.0009	0.0045
11	0.0054	0.0009	0.0045
12	0.0054	0.0009	0.0045
13	0.0054	0.0009	0.0045
14	0.0055	0.0009	0.0045
15	0.0055	0.0009	0.0045
16	0.0055	0.0009	0.0046
17	0.0055	0.0009	0.0046
18	0.0055	0.0009	0.0046
19	0.0055	0.0009	0.0046
20	0.0056	0.0009	0.0046
21	0.0056	0.0009	0.0046
22	0.0056	0.0009	0.0046
23	0.0056	0.0010	0.0047
24	0.0056	0.0010	0.0047
25	0.0056	0.0010	0.0047
26	0.0056	0.0010	0.0047
27	0.0057	0.0010	0.0047
28	0.0057	0.0010	0.0047
29	0.0057	0.0010	0.0047
30	0.0057	0.0010	0.0047
31	0.0057	0.0010	0.0048
32	0.0058	0.0010	0.0048
33	0.0058	0.0010	0.0048
34	0.0058	0.0010	0.0048
35	0.0058	0.0010	0.0048
36	0.0058	0.0010	0.0048
37	0.0058	0.0010	0.0049
38	0.0059	0.0010	0.0049
39	0.0059	0.0010	0.0049
40	0.0059	0.0010	0.0049
41	0.0059	0.0010	0.0049

42	0.0059	0.0010	0.0049
43	0.0060	0.0010	0.0049
44	0.0060	0.0010	0.0050
45	0.0060	0.0010	0.0050
46	0.0060	0.0010	0.0050
47	0.0060	0.0010	0.0050
48	0.0061	0.0010	0.0050
49	0.0061	0.0010	0.0050
50	0.0061	0.0010	0.0051
51	0.0061	0.0010	0.0051
52	0.0061	0.0010	0.0051
53	0.0062	0.0010	0.0051
54	0.0062	0.0011	0.0051
55	0.0062	0.0011	0.0052
56	0.0062	0.0011	0.0052
57	0.0063	0.0011	0.0052
58	0.0063	0.0011	0.0052
59	0.0063	0.0011	0.0052
60	0.0063	0.0011	0.0052
61	0.0063	0.0011	0.0053
62	0.0064	0.0011	0.0053
63	0.0064	0.0011	0.0053
64	0.0064	0.0011	0.0053
65	0.0064	0.0011	0.0053
66	0.0065	0.0011	0.0054
67	0.0065	0.0011	0.0054
68	0.0065	0.0011	0.0054
69	0.0065	0.0011	0.0054
70	0.0066	0.0011	0.0054
71	0.0066	0.0011	0.0055
72	0.0066	0.0011	0.0055
73	0.0067	0.0011	0.0055
74	0.0067	0.0011	0.0055
75	0.0067	0.0011	0.0056
76	0.0067	0.0011	0.0056
77	0.0068	0.0011	0.0056
78	0.0068	0.0012	0.0056
79	0.0068	0.0012	0.0057
80	0.0068	0.0012	0.0057
81	0.0069	0.0012	0.0057
82	0.0069	0.0012	0.0057
83	0.0069	0.0012	0.0058
84	0.0070	0.0012	0.0058
85	0.0070	0.0012	0.0058
86	0.0070	0.0012	0.0058
87	0.0071	0.0012	0.0059
88	0.0071	0.0012	0.0059
89	0.0071	0.0012	0.0059
90	0.0072	0.0012	0.0059
91	0.0072	0.0012	0.0060

92	0.0072	0.0012	0.0060
93	0.0073	0.0012	0.0060
94	0.0073	0.0012	0.0061
95	0.0073	0.0012	0.0061
96	0.0074	0.0013	0.0061
97	0.0074	0.0013	0.0062
98	0.0074	0.0013	0.0062
99	0.0075	0.0013	0.0062
100	0.0075	0.0013	0.0062
101	0.0076	0.0013	0.0063
102	0.0076	0.0013	0.0063
103	0.0077	0.0013	0.0064
104	0.0077	0.0013	0.0064
105	0.0077	0.0013	0.0064
106	0.0078	0.0013	0.0065
107	0.0078	0.0013	0.0065
108	0.0079	0.0013	0.0065
109	0.0079	0.0013	0.0066
110	0.0080	0.0014	0.0066
111	0.0080	0.0014	0.0067
112	0.0081	0.0014	0.0067
113	0.0081	0.0014	0.0067
114	0.0082	0.0014	0.0068
115	0.0082	0.0014	0.0068
116	0.0083	0.0014	0.0069
117	0.0083	0.0014	0.0069
118	0.0084	0.0014	0.0069
119	0.0084	0.0014	0.0070
120	0.0085	0.0014	0.0070
121	0.0086	0.0015	0.0071
122	0.0086	0.0015	0.0071
123	0.0087	0.0015	0.0072
124	0.0087	0.0015	0.0072
125	0.0088	0.0015	0.0073
126	0.0088	0.0015	0.0073
127	0.0089	0.0015	0.0074
128	0.0090	0.0015	0.0074
129	0.0091	0.0015	0.0075
130	0.0091	0.0015	0.0076
131	0.0092	0.0016	0.0076
132	0.0093	0.0016	0.0077
133	0.0094	0.0016	0.0078
134	0.0094	0.0016	0.0078
135	0.0095	0.0016	0.0079
136	0.0096	0.0016	0.0079
137	0.0097	0.0016	0.0080
138	0.0097	0.0017	0.0081
139	0.0099	0.0017	0.0082
140	0.0099	0.0017	0.0082
141	0.0100	0.0017	0.0083

142	0.0101	0.0017	0.0084
143	0.0102	0.0017	0.0085
144	0.0103	0.0018	0.0086
145	0.0085	0.0014	0.0070
146	0.0086	0.0015	0.0071
147	0.0087	0.0015	0.0072
148	0.0088	0.0015	0.0073
149	0.0089	0.0015	0.0074
150	0.0090	0.0015	0.0075
151	0.0092	0.0016	0.0076
152	0.0093	0.0016	0.0077
153	0.0095	0.0016	0.0078
154	0.0095	0.0016	0.0079
155	0.0097	0.0017	0.0081
156	0.0098	0.0017	0.0082
157	0.0101	0.0017	0.0084
158	0.0102	0.0017	0.0084
159	0.0104	0.0018	0.0086
160	0.0105	0.0018	0.0087
161	0.0108	0.0018	0.0090
162	0.0109	0.0019	0.0091
163	0.0112	0.0019	0.0093
164	0.0114	0.0019	0.0094
165	0.0117	0.0020	0.0097
166	0.0118	0.0020	0.0098
167	0.0122	0.0021	0.0101
168	0.0124	0.0021	0.0103
169	0.0128	0.0022	0.0106
170	0.0130	0.0022	0.0108
171	0.0135	0.0023	0.0112
172	0.0137	0.0023	0.0114
173	0.0143	0.0024	0.0118
174	0.0146	0.0025	0.0121
175	0.0152	0.0026	0.0126
176	0.0155	0.0026	0.0129
177	0.0163	0.0028	0.0135
178	0.0167	0.0028	0.0139
179	0.0177	0.0030	0.0147
180	0.0182	0.0031	0.0151
181	0.0194	0.0033	0.0161
182	0.0200	0.0034	0.0166
183	0.0216	0.0037	0.0179
184	0.0226	0.0038	0.0187
185	0.0180	0.0031	0.0150
186	0.0192	0.0033	0.0160
187	0.0223	0.0038	0.0185
188	0.0243	0.0041	0.0202
189	0.0303	0.0051	0.0251
190	0.0349	0.0059	0.0289
191	0.0529	0.0081	0.0447

192	0.0768	0.0081	0.0686
193	0.3321	0.0081	0.3240
194	0.0416	0.0071	0.0346
195	0.0269	0.0046	0.0223
196	0.0206	0.0035	0.0171
197	0.0236	0.0040	0.0196
198	0.0208	0.0035	0.0173
199	0.0187	0.0032	0.0156
200	0.0172	0.0029	0.0142
201	0.0159	0.0027	0.0132
202	0.0149	0.0025	0.0123
203	0.0140	0.0024	0.0116
204	0.0132	0.0022	0.0110
205	0.0126	0.0021	0.0104
206	0.0120	0.0020	0.0100
207	0.0115	0.0020	0.0096
208	0.0111	0.0019	0.0092
209	0.0107	0.0018	0.0088
210	0.0103	0.0017	0.0085
211	0.0100	0.0017	0.0083
212	0.0096	0.0016	0.0080
213	0.0094	0.0016	0.0078
214	0.0091	0.0015	0.0076
215	0.0089	0.0015	0.0074
216	0.0086	0.0015	0.0072
217	0.0104	0.0018	0.0086
218	0.0102	0.0017	0.0084
219	0.0100	0.0017	0.0083
220	0.0098	0.0017	0.0081
221	0.0096	0.0016	0.0080
222	0.0095	0.0016	0.0079
223	0.0093	0.0016	0.0077
224	0.0092	0.0016	0.0076
225	0.0090	0.0015	0.0075
226	0.0089	0.0015	0.0074
227	0.0088	0.0015	0.0073
228	0.0086	0.0015	0.0072
229	0.0085	0.0014	0.0071
230	0.0084	0.0014	0.0070
231	0.0083	0.0014	0.0069
232	0.0082	0.0014	0.0068
233	0.0081	0.0014	0.0067
234	0.0080	0.0014	0.0066
235	0.0079	0.0013	0.0066
236	0.0078	0.0013	0.0065
237	0.0077	0.0013	0.0064
238	0.0076	0.0013	0.0063
239	0.0076	0.0013	0.0063
240	0.0075	0.0013	0.0062
241	0.0074	0.0013	0.0061

242	0.0073	0.0012	0.0061
243	0.0073	0.0012	0.0060
244	0.0072	0.0012	0.0060
245	0.0071	0.0012	0.0059
246	0.0070	0.0012	0.0058
247	0.0070	0.0012	0.0058
248	0.0069	0.0012	0.0057
249	0.0069	0.0012	0.0057
250	0.0068	0.0012	0.0056
251	0.0067	0.0011	0.0056
252	0.0067	0.0011	0.0056
253	0.0066	0.0011	0.0055
254	0.0066	0.0011	0.0055
255	0.0065	0.0011	0.0054
256	0.0065	0.0011	0.0054
257	0.0064	0.0011	0.0053
258	0.0064	0.0011	0.0053
259	0.0063	0.0011	0.0053
260	0.0063	0.0011	0.0052
261	0.0062	0.0011	0.0052
262	0.0062	0.0011	0.0051
263	0.0062	0.0010	0.0051
264	0.0061	0.0010	0.0051
265	0.0061	0.0010	0.0050
266	0.0060	0.0010	0.0050
267	0.0060	0.0010	0.0050
268	0.0059	0.0010	0.0049
269	0.0059	0.0010	0.0049
270	0.0059	0.0010	0.0049
271	0.0058	0.0010	0.0048
272	0.0058	0.0010	0.0048
273	0.0058	0.0010	0.0048
274	0.0057	0.0010	0.0048
275	0.0057	0.0010	0.0047
276	0.0057	0.0010	0.0047
277	0.0056	0.0010	0.0047
278	0.0056	0.0010	0.0046
279	0.0056	0.0009	0.0046
280	0.0055	0.0009	0.0046
281	0.0055	0.0009	0.0046
282	0.0055	0.0009	0.0045
283	0.0054	0.0009	0.0045
284	0.0054	0.0009	0.0045
285	0.0054	0.0009	0.0045
286	0.0054	0.0009	0.0044
287	0.0053	0.0009	0.0044
288	0.0053	0.0009	0.0044

Total soil rain loss = 0.45(In)

Total effective rainfall = 2.53(In)
Peak flow rate in flood hydrograph = 2.94(CFS)

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

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0001	0.01	Q				
0+10	0.0004	0.05	Q				
0+15	0.0008	0.06	Q				
0+20	0.0013	0.06	Q				
0+25	0.0017	0.07	Q				
0+30	0.0022	0.07	Q				
0+35	0.0027	0.07	Q				
0+40	0.0032	0.07	Q				
0+45	0.0037	0.07	Q				
0+50	0.0042	0.07	Q				
0+55	0.0046	0.07	Q				
1+ 0	0.0051	0.07	Q				
1+ 5	0.0056	0.07	Q				
1+10	0.0061	0.07	Q				
1+15	0.0066	0.07	Q				
1+20	0.0071	0.07	QV				
1+25	0.0076	0.07	QV				
1+30	0.0081	0.07	QV				
1+35	0.0086	0.07	QV				
1+40	0.0091	0.07	QV				
1+45	0.0096	0.07	QV				
1+50	0.0101	0.07	QV				
1+55	0.0106	0.07	QV				
2+ 0	0.0111	0.07	QV				
2+ 5	0.0116	0.07	QV				
2+10	0.0121	0.07	QV				
2+15	0.0126	0.07	QV				
2+20	0.0132	0.07	QV				
2+25	0.0137	0.07	QV				
2+30	0.0142	0.07	Q V				
2+35	0.0147	0.08	Q V				
2+40	0.0152	0.08	Q V				
2+45	0.0157	0.08	Q V				
2+50	0.0163	0.08	Q V				
2+55	0.0168	0.08	Q V				
3+ 0	0.0173	0.08	Q V				
3+ 5	0.0178	0.08	Q V				
3+10	0.0184	0.08	Q V				

3+15	0.0189	0.08	Q V	|	|	|	|
3+20	0.0194	0.08	Q V	|	|	|	|
3+25	0.0200	0.08	Q V	|	|	|	|
3+30	0.0205	0.08	Q V	|	|	|	|
3+35	0.0210	0.08	Q V	|	|	|	|
3+40	0.0216	0.08	Q V	|	|	|	|
3+45	0.0221	0.08	Q V	|	|	|	|
3+50	0.0227	0.08	Q V	|	|	|	|
3+55	0.0232	0.08	Q V	|	|	|	|
4+ 0	0.0238	0.08	Q V	|	|	|	|
4+ 5	0.0243	0.08	Q V	|	|	|	|
4+10	0.0249	0.08	Q V	|	|	|	|
4+15	0.0254	0.08	Q V	|	|	|	|
4+20	0.0260	0.08	Q V	|	|	|	|
4+25	0.0265	0.08	Q V	|	|	|	|
4+30	0.0271	0.08	Q V	|	|	|	|
4+35	0.0276	0.08	Q V	|	|	|	|
4+40	0.0282	0.08	Q V	|	|	|	|
4+45	0.0288	0.08	Q V	|	|	|	|
4+50	0.0293	0.08	Q V	|	|	|	|
4+55	0.0299	0.08	Q V	|	|	|	|
5+ 0	0.0305	0.08	Q V	|	|	|	|
5+ 5	0.0310	0.08	Q V	|	|	|	|
5+10	0.0316	0.08	Q V	|	|	|	|
5+15	0.0322	0.08	Q V	|	|	|	|
5+20	0.0328	0.08	Q V	|	|	|	|
5+25	0.0333	0.08	Q V	|	|	|	|
5+30	0.0339	0.08	Q V	|	|	|	|
5+35	0.0345	0.08	Q V	|	|	|	|
5+40	0.0351	0.09	Q V	|	|	|	|
5+45	0.0357	0.09	Q V	|	|	|	|
5+50	0.0363	0.09	Q V	|	|	|	|
5+55	0.0369	0.09	Q V	|	|	|	|
6+ 0	0.0375	0.09	Q V	|	|	|	|
6+ 5	0.0381	0.09	Q V	|	|	|	|
6+10	0.0387	0.09	Q V	|	|	|	|
6+15	0.0393	0.09	Q V	|	|	|	|
6+20	0.0399	0.09	Q V	|	|	|	|
6+25	0.0405	0.09	Q V	|	|	|	|
6+30	0.0411	0.09	Q V	|	|	|	|
6+35	0.0417	0.09	Q V	|	|	|	|
6+40	0.0423	0.09	Q V	|	|	|	|
6+45	0.0429	0.09	Q V	|	|	|	|
6+50	0.0436	0.09	Q V	|	|	|	|
6+55	0.0442	0.09	Q V	|	|	|	|
7+ 0	0.0448	0.09	Q V	|	|	|	|
7+ 5	0.0454	0.09	Q V	|	|	|	|
7+10	0.0461	0.09	Q V	|	|	|	|
7+15	0.0467	0.09	Q V	|	|	|	|
7+20	0.0473	0.09	Q V	|	|	|	|

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 7+25       0.0480      0.09  Q     V   |          |          |          |
 7+30       0.0486      0.09  Q      V  |          |          |          |
 7+35       0.0493      0.09  Q      V  |          |          |          |
 7+40       0.0499      0.09  Q      V  |          |          |          |
 7+45       0.0506      0.09  Q      V  |          |          |          |
 7+50       0.0512      0.10  Q      V  |          |          |          |
 7+55       0.0519      0.10  Q      V  |          |          |          |
 8+ 0       0.0526      0.10  Q      V  |          |          |          |
 8+ 5       0.0532      0.10  Q      V  |          |          |          |
 8+10       0.0539      0.10  Q      V  |          |          |          |
 8+15       0.0546      0.10  Q      V  |          |          |          |
 8+20       0.0552      0.10  Q       V |          |          |          |
 8+25       0.0559      0.10  Q       V |          |          |          |
 8+30       0.0566      0.10  Q       V |          |          |          |
 8+35       0.0573      0.10  Q       V |          |          |          |
 8+40       0.0580      0.10  Q       V |          |          |          |
 8+45       0.0587      0.10  Q       V |          |          |          |
 8+50       0.0594      0.10  Q       V |          |          |          |
 8+55       0.0601      0.10  Q       V |          |          |          |
 9+ 0       0.0608      0.10  Q       V |          |          |          |
 9+ 5       0.0615      0.10  Q       V |          |          |          |
 9+10       0.0622      0.10  Q        V|          |          |          |
 9+15       0.0629      0.10  Q        V|          |          |          |
 9+20       0.0637      0.11  Q        V|          |          |          |
 9+25       0.0644      0.11  Q        V|          |          |          |
 9+30       0.0651      0.11  Q        V|          |          |          |
 9+35       0.0659      0.11  Q        V|          |          |          |
 9+40       0.0666      0.11  Q        V|          |          |          |
 9+45       0.0674      0.11  Q        V|          |          |          |
 9+50       0.0681      0.11  Q        V|          |          |          |
 9+55       0.0689      0.11  Q        V|          |          |          |
10+ 0       0.0696      0.11  Q         V          |          |          |
10+ 5       0.0704      0.11  Q         V          |          |          |
10+10       0.0712      0.11  Q         V          |          |          |
10+15       0.0719      0.11  Q         V          |          |          |
10+20       0.0727      0.11  Q         V          |          |          |
10+25       0.0735      0.11  Q         V          |          |          |
10+30       0.0743      0.12  Q         V          |          |          |
10+35       0.0751      0.12  Q         V          |          |          |
10+40       0.0759      0.12  Q          |V         |          |          |
10+45       0.0767      0.12  Q          |V         |          |          |
10+50       0.0775      0.12  Q          |V         |          |          |
10+55       0.0784      0.12  Q          |V         |          |          |
11+ 0       0.0792      0.12  Q          |V         |          |          |
11+ 5       0.0800      0.12  Q          |V         |          |          |
11+10       0.0809      0.12  Q          |V         |          |          |
11+15       0.0817      0.12  Q          |V         |          |          |
11+20       0.0826      0.12  Q          |V         |          |          |
11+25       0.0834      0.13  Q          | V        |          |          |
11+30       0.0843      0.13  Q          | V        |          |          |
```

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11+35       0.0852      0.13  Q         | V       |         |         |
11+40       0.0861      0.13  Q         | V       |         |         |
11+45       0.0870      0.13  Q         | V       |         |         |
11+50       0.0879      0.13  Q         | V       |         |         |
11+55       0.0888      0.13  Q         | V       |         |         |
12+ 0       0.0897      0.13  Q         |  V      |         |         |
12+ 5       0.0906      0.13  Q         |  V      |         |         |
12+10       0.0914      0.12  Q         |  V      |         |         |
12+15       0.0922      0.12  Q         |  V      |         |         |
12+20       0.0930      0.12  Q         |  V      |         |         |
12+25       0.0938      0.12  Q         |  V      |         |         |
12+30       0.0946      0.12  Q         |  V      |         |         |
12+35       0.0955      0.12  Q         |  V      |         |         |
12+40       0.0963      0.12  Q         |  V      |         |         |
12+45       0.0971      0.12  Q         |   V     |         |         |
12+50       0.0980      0.12  Q         |   V     |         |         |
12+55       0.0988      0.13  Q         |   V     |         |         |
13+ 0       0.0997      0.13  Q         |   V     |         |         |
13+ 5       0.1006      0.13  Q         |   V     |         |         |
13+10       0.1015      0.13  Q         |   V     |         |         |
13+15       0.1024      0.13  Q         |   V     |         |         |
13+20       0.1033      0.14  Q         |   V     |         |         |
13+25       0.1043      0.14  Q         |    V    |         |         |
13+30       0.1053      0.14  Q         |    V    |         |         |
13+35       0.1062      0.14  Q         |    V    |         |         |
13+40       0.1073      0.15  Q         |    V    |         |         |
13+45       0.1083      0.15  Q         |    V    |         |         |
13+50       0.1093      0.15  Q         |    V    |         |         |
13+55       0.1104      0.16  Q         |     V   |         |         |
14+ 0       0.1115      0.16  Q         |     V   |         |         |
14+ 5       0.1126      0.16  Q         |     V   |         |         |
14+10       0.1137      0.17  Q         |     V   |         |         |
14+15       0.1149      0.17  Q         |     V   |         |         |
14+20       0.1161      0.17  Q         |     V   |         |         |
14+25       0.1174      0.18  Q         |      V  |         |         |
14+30       0.1186      0.18  Q         |      V  |         |         |
14+35       0.1199      0.19  Q         |      V  |         |         |
14+40       0.1213      0.20  Q         |      V  |         |         |
14+45       0.1227      0.20  Q         |      V  |         |         |
14+50       0.1241      0.21  Q         |       V |         |         |
14+55       0.1257      0.22  Q         |       V |         |         |
15+ 0       0.1272      0.23  Q         |       V |         |         |
15+ 5       0.1289      0.24  Q         |       V |         |         |
15+10       0.1306      0.25  Q         |       V |         |         |
15+15       0.1324      0.26  |Q        |        V|         |         |
15+20       0.1343      0.28  |Q        |        V|         |         |
15+25       0.1362      0.28  |Q        |        V|         |         |
15+30       0.1379      0.25  |Q        |         V         |         |
15+35       0.1397      0.26  |Q        |         V         |         |
15+40       0.1417      0.29  |Q        |         V         |         |
```

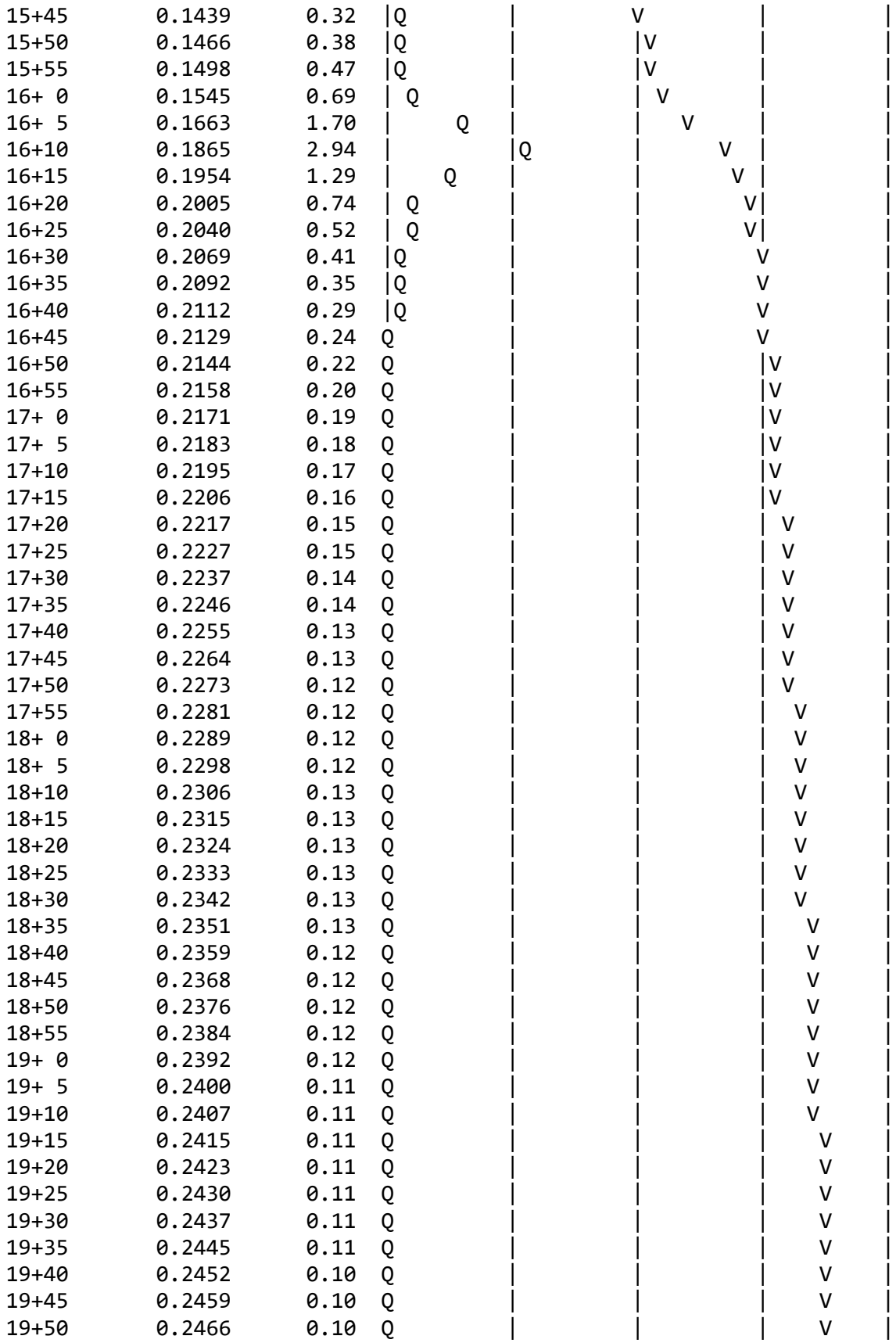

```
19+55       0.2473      0.10  Q         |          |          |    V     |
20+ 0       0.2480      0.10  Q         |          |          |    V     |
20+ 5       0.2487      0.10  Q         |          |          |     V    |
20+10       0.2493      0.10  Q         |          |          |     V    |
20+15       0.2500      0.10  Q         |          |          |     V    |
20+20       0.2507      0.10  Q         |          |          |     V    |
20+25       0.2513      0.09  Q         |          |          |     V    |
20+30       0.2520      0.09  Q         |          |          |     V    |
20+35       0.2526      0.09  Q         |          |          |     V    |
20+40       0.2532      0.09  Q         |          |          |     V    |
20+45       0.2539      0.09  Q         |          |          |     V    |
20+50       0.2545      0.09  Q         |          |          |     V    |
20+55       0.2551      0.09  Q         |          |          |      V   |
21+ 0       0.2557      0.09  Q         |          |          |      V   |
21+ 5       0.2563      0.09  Q         |          |          |      V   |
21+10       0.2569      0.09  Q         |          |          |      V   |
21+15       0.2575      0.09  Q         |          |          |      V   |
21+20       0.2581      0.09  Q         |          |          |      V   |
21+25       0.2587      0.09  Q         |          |          |      V   |
21+30       0.2593      0.08  Q         |          |          |      V   |
21+35       0.2599      0.08  Q         |          |          |      V   |
21+40       0.2605      0.08  Q         |          |          |      V   |
21+45       0.2610      0.08  Q         |          |          |      V   |
21+50       0.2616      0.08  Q         |          |          |      V   |
21+55       0.2622      0.08  Q         |          |          |       V  |
22+ 0       0.2627      0.08  Q         |          |          |       V  |
22+ 5       0.2633      0.08  Q         |          |          |       V  |
22+10       0.2638      0.08  Q         |          |          |       V  |
22+15       0.2644      0.08  Q         |          |          |       V  |
22+20       0.2649      0.08  Q         |          |          |       V  |
22+25       0.2654      0.08  Q         |          |          |       V  |
22+30       0.2660      0.08  Q         |          |          |       V  |
22+35       0.2665      0.08  Q         |          |          |       V  |
22+40       0.2670      0.08  Q         |          |          |       V  |
22+45       0.2676      0.08  Q         |          |          |       V  |
22+50       0.2681      0.08  Q         |          |          |       V  |
22+55       0.2686      0.08  Q         |          |          |       V  |
23+ 0       0.2691      0.08  Q         |          |          |        V |
23+ 5       0.2696      0.07  Q         |          |          |        V |
23+10       0.2702      0.07  Q         |          |          |        V |
23+15       0.2707      0.07  Q         |          |          |        V |
23+20       0.2712      0.07  Q         |          |          |        V |
23+25       0.2717      0.07  Q         |          |          |        V |
23+30       0.2722      0.07  Q         |          |          |        V |
23+35       0.2727      0.07  Q         |          |          |        V |
23+40       0.2732      0.07  Q         |          |          |        V |
23+45       0.2737      0.07  Q         |          |          |        V |
23+50       0.2741      0.07  Q         |          |          |        V |
23+55       0.2746      0.07  Q         |          |          |        V |
24+ 0       0.2751      0.07  Q         |          |          |        V |
```

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

Study date 08/23/21

++

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

Program License Serial Number 6385

Amethyst Crossing
Area DA-3 10-year
developed

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
2.09	1	0.70
Rainfall data for year 10		
2.09	6	1.47
Rainfall data for year 10		
2.09	24	2.98

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	32.0	0.00	0.000	0.978	0.100	0.098
32.0	32.0	2.09	1.000	0.978	0.100	0.098

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

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
0.00	0.000	32.0	32.0	14.90	0.000
0.21	0.100	32.0	32.0	14.90	0.000
1.88	0.900	98.0	98.0	0.20	0.922

Area-averaged catchment yield fraction, Y = 0.830
Area-averaged low loss fraction, Yb = 0.170
User entry of time of concentration = 0.128 (hours)
++
Watershed area = 2.09(Ac.)
Catchment Lag time = 0.102 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 81.3802
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.098(In/Hr)
Average low loss rate fraction (Yb) = 0.170 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.332(In)
Computed peak 30-minute rainfall = 0.569(In)
Specified peak 1-hour rainfall = 0.700(In)
Computed peak 3-hour rainfall = 1.103(In)
Specified peak 6-hour rainfall = 1.470(In)
Specified peak 24-hour rainfall = 2.980(In)

Rainfall depth area reduction factors:
Using a total area of 2.09(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.332(In)
30-minute factor = 1.000 Adjusted rainfall = 0.569(In)
1-hour factor = 1.000 Adjusted rainfall = 0.700(In)
3-hour factor = 1.000 Adjusted rainfall = 1.103(In)
6-hour factor = 1.000 Adjusted rainfall = 1.470(In)
24-hour factor = 1.000 Adjusted rainfall = 2.980(In)

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

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 25.28 (CFS))	
1	11.154	2.819
2	58.218	11.896
3	78.343	5.087
4	87.310	2.267
5	92.321	1.266
6	95.446	0.790
7	97.396	0.493
8	98.436	0.263
9	99.364	0.235
10	100.000	0.161

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3321	0.3321
2	0.4089	0.0768
3	0.4618	0.0529
4	0.5034	0.0416
5	0.5383	0.0349
6	0.5685	0.0303
7	0.5954	0.0269
8	0.6198	0.0243
9	0.6421	0.0223
10	0.6627	0.0206
11	0.6819	0.0192
12	0.6999	0.0180
13	0.7235	0.0236
14	0.7461	0.0226
15	0.7677	0.0216
16	0.7885	0.0208
17	0.8085	0.0200
18	0.8279	0.0194
19	0.8467	0.0187
20	0.8648	0.0182
21	0.8825	0.0177
22	0.8997	0.0172
23	0.9164	0.0167
24	0.9327	0.0163
25	0.9486	0.0159
26	0.9641	0.0155
27	0.9793	0.0152
28	0.9942	0.0149
29	1.0087	0.0146

30	1.0230	0.0143
31	1.0370	0.0140
32	1.0507	0.0137
33	1.0642	0.0135
34	1.0774	0.0132
35	1.0904	0.0130
36	1.1032	0.0128
37	1.1158	0.0126
38	1.1282	0.0124
39	1.1404	0.0122
40	1.1524	0.0120
41	1.1643	0.0118
42	1.1759	0.0117
43	1.1874	0.0115
44	1.1988	0.0114
45	1.2100	0.0112
46	1.2211	0.0111
47	1.2320	0.0109
48	1.2428	0.0108
49	1.2534	0.0107
50	1.2640	0.0105
51	1.2744	0.0104
52	1.2847	0.0103
53	1.2948	0.0102
54	1.3049	0.0101
55	1.3149	0.0100
56	1.3247	0.0098
57	1.3344	0.0097
58	1.3441	0.0096
59	1.3536	0.0095
60	1.3631	0.0095
61	1.3725	0.0094
62	1.3817	0.0093
63	1.3909	0.0092
64	1.4000	0.0091
65	1.4090	0.0090
66	1.4180	0.0089
67	1.4268	0.0089
68	1.4356	0.0088
69	1.4443	0.0087
70	1.4529	0.0086
71	1.4615	0.0086
72	1.4700	0.0085
73	1.4804	0.0104
74	1.4907	0.0103
75	1.5009	0.0102
76	1.5111	0.0102
77	1.5212	0.0101
78	1.5312	0.0100
79	1.5412	0.0100

80	1.5511	0.0099
81	1.5610	0.0099
82	1.5707	0.0098
83	1.5805	0.0097
84	1.5902	0.0097
85	1.5998	0.0096
86	1.6093	0.0096
87	1.6189	0.0095
88	1.6283	0.0095
89	1.6377	0.0094
90	1.6471	0.0094
91	1.6564	0.0093
92	1.6656	0.0093
93	1.6748	0.0092
94	1.6840	0.0092
95	1.6931	0.0091
96	1.7022	0.0091
97	1.7112	0.0090
98	1.7202	0.0090
99	1.7291	0.0089
100	1.7380	0.0089
101	1.7468	0.0088
102	1.7556	0.0088
103	1.7643	0.0088
104	1.7731	0.0087
105	1.7817	0.0087
106	1.7904	0.0086
107	1.7989	0.0086
108	1.8075	0.0086
109	1.8160	0.0085
110	1.8245	0.0085
111	1.8329	0.0084
112	1.8413	0.0084
113	1.8497	0.0084
114	1.8580	0.0083
115	1.8663	0.0083
116	1.8745	0.0083
117	1.8828	0.0082
118	1.8910	0.0082
119	1.8991	0.0082
120	1.9072	0.0081
121	1.9153	0.0081
122	1.9234	0.0081
123	1.9314	0.0080
124	1.9394	0.0080
125	1.9473	0.0080
126	1.9553	0.0079
127	1.9631	0.0079
128	1.9710	0.0079
129	1.9788	0.0078

130	1.9867	0.0078
131	1.9944	0.0078
132	2.0022	0.0077
133	2.0099	0.0077
134	2.0176	0.0077
135	2.0252	0.0077
136	2.0329	0.0076
137	2.0405	0.0076
138	2.0481	0.0076
139	2.0556	0.0076
140	2.0631	0.0075
141	2.0706	0.0075
142	2.0781	0.0075
143	2.0856	0.0074
144	2.0930	0.0074
145	2.1004	0.0074
146	2.1077	0.0074
147	2.1151	0.0073
148	2.1224	0.0073
149	2.1297	0.0073
150	2.1370	0.0073
151	2.1442	0.0073
152	2.1515	0.0072
153	2.1587	0.0072
154	2.1658	0.0072
155	2.1730	0.0072
156	2.1801	0.0071
157	2.1873	0.0071
158	2.1943	0.0071
159	2.2014	0.0071
160	2.2085	0.0070
161	2.2155	0.0070
162	2.2225	0.0070
163	2.2295	0.0070
164	2.2364	0.0070
165	2.2434	0.0069
166	2.2503	0.0069
167	2.2572	0.0069
168	2.2641	0.0069
169	2.2709	0.0069
170	2.2778	0.0068
171	2.2846	0.0068
172	2.2914	0.0068
173	2.2982	0.0068
174	2.3049	0.0068
175	2.3117	0.0067
176	2.3184	0.0067
177	2.3251	0.0067
178	2.3318	0.0067
179	2.3385	0.0067

180	2.3451	0.0067
181	2.3518	0.0066
182	2.3584	0.0066
183	2.3650	0.0066
184	2.3715	0.0066
185	2.3781	0.0066
186	2.3846	0.0065
187	2.3912	0.0065
188	2.3977	0.0065
189	2.4042	0.0065
190	2.4107	0.0065
191	2.4171	0.0065
192	2.4236	0.0064
193	2.4300	0.0064
194	2.4364	0.0064
195	2.4428	0.0064
196	2.4492	0.0064
197	2.4555	0.0064
198	2.4619	0.0063
199	2.4682	0.0063
200	2.4745	0.0063
201	2.4808	0.0063
202	2.4871	0.0063
203	2.4934	0.0063
204	2.4996	0.0063
205	2.5059	0.0062
206	2.5121	0.0062
207	2.5183	0.0062
208	2.5245	0.0062
209	2.5307	0.0062
210	2.5368	0.0062
211	2.5430	0.0062
212	2.5491	0.0061
213	2.5552	0.0061
214	2.5613	0.0061
215	2.5674	0.0061
216	2.5735	0.0061
217	2.5796	0.0061
218	2.5856	0.0061
219	2.5917	0.0060
220	2.5977	0.0060
221	2.6037	0.0060
222	2.6097	0.0060
223	2.6157	0.0060
224	2.6217	0.0060
225	2.6276	0.0060
226	2.6336	0.0059
227	2.6395	0.0059
228	2.6454	0.0059
229	2.6513	0.0059

230	2.6572	0.0059
231	2.6631	0.0059
232	2.6690	0.0059
233	2.6748	0.0059
234	2.6807	0.0058
235	2.6865	0.0058
236	2.6924	0.0058
237	2.6982	0.0058
238	2.7040	0.0058
239	2.7097	0.0058
240	2.7155	0.0058
241	2.7213	0.0058
242	2.7270	0.0058
243	2.7328	0.0057
244	2.7385	0.0057
245	2.7442	0.0057
246	2.7499	0.0057
247	2.7556	0.0057
248	2.7613	0.0057
249	2.7670	0.0057
250	2.7726	0.0057
251	2.7783	0.0056
252	2.7839	0.0056
253	2.7895	0.0056
254	2.7951	0.0056
255	2.8007	0.0056
256	2.8063	0.0056
257	2.8119	0.0056
258	2.8175	0.0056
259	2.8231	0.0056
260	2.8286	0.0056
261	2.8341	0.0055
262	2.8397	0.0055
263	2.8452	0.0055
264	2.8507	0.0055
265	2.8562	0.0055
266	2.8617	0.0055
267	2.8672	0.0055
268	2.8726	0.0055
269	2.8781	0.0055
270	2.8835	0.0054
271	2.8890	0.0054
272	2.8944	0.0054
273	2.8998	0.0054
274	2.9052	0.0054
275	2.9106	0.0054
276	2.9160	0.0054
277	2.9214	0.0054
278	2.9268	0.0054
279	2.9322	0.0054

280	2.9375	0.0054
281	2.9428	0.0053
282	2.9482	0.0053
283	2.9535	0.0053
284	2.9588	0.0053
285	2.9641	0.0053
286	2.9694	0.0053
287	2.9747	0.0053
288	2.9800	0.0053

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0053	0.0009	0.0044
2	0.0053	0.0009	0.0044
3	0.0053	0.0009	0.0044
4	0.0053	0.0009	0.0044
5	0.0053	0.0009	0.0044
6	0.0053	0.0009	0.0044
7	0.0054	0.0009	0.0045
8	0.0054	0.0009	0.0045
9	0.0054	0.0009	0.0045
10	0.0054	0.0009	0.0045
11	0.0054	0.0009	0.0045
12	0.0054	0.0009	0.0045
13	0.0054	0.0009	0.0045
14	0.0055	0.0009	0.0045
15	0.0055	0.0009	0.0045
16	0.0055	0.0009	0.0046
17	0.0055	0.0009	0.0046
18	0.0055	0.0009	0.0046
19	0.0055	0.0009	0.0046
20	0.0056	0.0009	0.0046
21	0.0056	0.0009	0.0046
22	0.0056	0.0009	0.0046
23	0.0056	0.0010	0.0047
24	0.0056	0.0010	0.0047
25	0.0056	0.0010	0.0047
26	0.0056	0.0010	0.0047
27	0.0057	0.0010	0.0047
28	0.0057	0.0010	0.0047
29	0.0057	0.0010	0.0047
30	0.0057	0.0010	0.0047
31	0.0057	0.0010	0.0048
32	0.0058	0.0010	0.0048
33	0.0058	0.0010	0.0048
34	0.0058	0.0010	0.0048
35	0.0058	0.0010	0.0048
36	0.0058	0.0010	0.0048

37	0.0058	0.0010	0.0049
38	0.0059	0.0010	0.0049
39	0.0059	0.0010	0.0049
40	0.0059	0.0010	0.0049
41	0.0059	0.0010	0.0049
42	0.0059	0.0010	0.0049
43	0.0060	0.0010	0.0049
44	0.0060	0.0010	0.0050
45	0.0060	0.0010	0.0050
46	0.0060	0.0010	0.0050
47	0.0060	0.0010	0.0050
48	0.0061	0.0010	0.0050
49	0.0061	0.0010	0.0050
50	0.0061	0.0010	0.0051
51	0.0061	0.0010	0.0051
52	0.0061	0.0010	0.0051
53	0.0062	0.0010	0.0051
54	0.0062	0.0011	0.0051
55	0.0062	0.0011	0.0052
56	0.0062	0.0011	0.0052
57	0.0063	0.0011	0.0052
58	0.0063	0.0011	0.0052
59	0.0063	0.0011	0.0052
60	0.0063	0.0011	0.0052
61	0.0063	0.0011	0.0053
62	0.0064	0.0011	0.0053
63	0.0064	0.0011	0.0053
64	0.0064	0.0011	0.0053
65	0.0064	0.0011	0.0053
66	0.0065	0.0011	0.0054
67	0.0065	0.0011	0.0054
68	0.0065	0.0011	0.0054
69	0.0065	0.0011	0.0054
70	0.0066	0.0011	0.0054
71	0.0066	0.0011	0.0055
72	0.0066	0.0011	0.0055
73	0.0067	0.0011	0.0055
74	0.0067	0.0011	0.0055
75	0.0067	0.0011	0.0056
76	0.0067	0.0011	0.0056
77	0.0068	0.0011	0.0056
78	0.0068	0.0012	0.0056
79	0.0068	0.0012	0.0057
80	0.0068	0.0012	0.0057
81	0.0069	0.0012	0.0057
82	0.0069	0.0012	0.0057
83	0.0069	0.0012	0.0058
84	0.0070	0.0012	0.0058
85	0.0070	0.0012	0.0058
86	0.0070	0.0012	0.0058

87	0.0071	0.0012	0.0059
88	0.0071	0.0012	0.0059
89	0.0071	0.0012	0.0059
90	0.0072	0.0012	0.0059
91	0.0072	0.0012	0.0060
92	0.0072	0.0012	0.0060
93	0.0073	0.0012	0.0060
94	0.0073	0.0012	0.0061
95	0.0073	0.0012	0.0061
96	0.0074	0.0013	0.0061
97	0.0074	0.0013	0.0062
98	0.0074	0.0013	0.0062
99	0.0075	0.0013	0.0062
100	0.0075	0.0013	0.0062
101	0.0076	0.0013	0.0063
102	0.0076	0.0013	0.0063
103	0.0077	0.0013	0.0064
104	0.0077	0.0013	0.0064
105	0.0077	0.0013	0.0064
106	0.0078	0.0013	0.0065
107	0.0078	0.0013	0.0065
108	0.0079	0.0013	0.0065
109	0.0079	0.0013	0.0066
110	0.0080	0.0014	0.0066
111	0.0080	0.0014	0.0067
112	0.0081	0.0014	0.0067
113	0.0081	0.0014	0.0067
114	0.0082	0.0014	0.0068
115	0.0082	0.0014	0.0068
116	0.0083	0.0014	0.0069
117	0.0083	0.0014	0.0069
118	0.0084	0.0014	0.0069
119	0.0084	0.0014	0.0070
120	0.0085	0.0014	0.0070
121	0.0086	0.0015	0.0071
122	0.0086	0.0015	0.0071
123	0.0087	0.0015	0.0072
124	0.0087	0.0015	0.0072
125	0.0088	0.0015	0.0073
126	0.0088	0.0015	0.0073
127	0.0089	0.0015	0.0074
128	0.0090	0.0015	0.0074
129	0.0091	0.0015	0.0075
130	0.0091	0.0015	0.0076
131	0.0092	0.0016	0.0076
132	0.0093	0.0016	0.0077
133	0.0094	0.0016	0.0078
134	0.0094	0.0016	0.0078
135	0.0095	0.0016	0.0079
136	0.0096	0.0016	0.0079

137	0.0097	0.0016	0.0080
138	0.0097	0.0017	0.0081
139	0.0099	0.0017	0.0082
140	0.0099	0.0017	0.0082
141	0.0100	0.0017	0.0083
142	0.0101	0.0017	0.0084
143	0.0102	0.0017	0.0085
144	0.0103	0.0018	0.0086
145	0.0085	0.0014	0.0070
146	0.0086	0.0015	0.0071
147	0.0087	0.0015	0.0072
148	0.0088	0.0015	0.0073
149	0.0089	0.0015	0.0074
150	0.0090	0.0015	0.0075
151	0.0092	0.0016	0.0076
152	0.0093	0.0016	0.0077
153	0.0095	0.0016	0.0078
154	0.0095	0.0016	0.0079
155	0.0097	0.0017	0.0081
156	0.0098	0.0017	0.0082
157	0.0101	0.0017	0.0084
158	0.0102	0.0017	0.0084
159	0.0104	0.0018	0.0086
160	0.0105	0.0018	0.0087
161	0.0108	0.0018	0.0090
162	0.0109	0.0019	0.0091
163	0.0112	0.0019	0.0093
164	0.0114	0.0019	0.0094
165	0.0117	0.0020	0.0097
166	0.0118	0.0020	0.0098
167	0.0122	0.0021	0.0101
168	0.0124	0.0021	0.0103
169	0.0128	0.0022	0.0106
170	0.0130	0.0022	0.0108
171	0.0135	0.0023	0.0112
172	0.0137	0.0023	0.0114
173	0.0143	0.0024	0.0118
174	0.0146	0.0025	0.0121
175	0.0152	0.0026	0.0126
176	0.0155	0.0026	0.0129
177	0.0163	0.0028	0.0135
178	0.0167	0.0028	0.0139
179	0.0177	0.0030	0.0147
180	0.0182	0.0031	0.0151
181	0.0194	0.0033	0.0161
182	0.0200	0.0034	0.0166
183	0.0216	0.0037	0.0180
184	0.0226	0.0038	0.0187
185	0.0180	0.0031	0.0150
186	0.0192	0.0033	0.0160

187	0.0223	0.0038	0.0185
188	0.0243	0.0041	0.0202
189	0.0303	0.0051	0.0251
190	0.0349	0.0059	0.0289
191	0.0529	0.0081	0.0447
192	0.0768	0.0081	0.0686
193	0.3321	0.0081	0.3240
194	0.0416	0.0071	0.0345
195	0.0269	0.0046	0.0223
196	0.0206	0.0035	0.0171
197	0.0236	0.0040	0.0196
198	0.0208	0.0035	0.0173
199	0.0187	0.0032	0.0156
200	0.0172	0.0029	0.0142
201	0.0159	0.0027	0.0132
202	0.0149	0.0025	0.0123
203	0.0140	0.0024	0.0116
204	0.0132	0.0023	0.0110
205	0.0126	0.0021	0.0104
206	0.0120	0.0020	0.0100
207	0.0115	0.0020	0.0096
208	0.0111	0.0019	0.0092
209	0.0107	0.0018	0.0088
210	0.0103	0.0017	0.0085
211	0.0100	0.0017	0.0083
212	0.0096	0.0016	0.0080
213	0.0094	0.0016	0.0078
214	0.0091	0.0015	0.0076
215	0.0089	0.0015	0.0074
216	0.0086	0.0015	0.0072
217	0.0104	0.0018	0.0086
218	0.0102	0.0017	0.0084
219	0.0100	0.0017	0.0083
220	0.0098	0.0017	0.0081
221	0.0096	0.0016	0.0080
222	0.0095	0.0016	0.0079
223	0.0093	0.0016	0.0077
224	0.0092	0.0016	0.0076
225	0.0090	0.0015	0.0075
226	0.0089	0.0015	0.0074
227	0.0088	0.0015	0.0073
228	0.0086	0.0015	0.0072
229	0.0085	0.0014	0.0071
230	0.0084	0.0014	0.0070
231	0.0083	0.0014	0.0069
232	0.0082	0.0014	0.0068
233	0.0081	0.0014	0.0067
234	0.0080	0.0014	0.0066
235	0.0079	0.0013	0.0066
236	0.0078	0.0013	0.0065

237	0.0077	0.0013	0.0064
238	0.0076	0.0013	0.0063
239	0.0076	0.0013	0.0063
240	0.0075	0.0013	0.0062
241	0.0074	0.0013	0.0061
242	0.0073	0.0012	0.0061
243	0.0073	0.0012	0.0060
244	0.0072	0.0012	0.0060
245	0.0071	0.0012	0.0059
246	0.0070	0.0012	0.0058
247	0.0070	0.0012	0.0058
248	0.0069	0.0012	0.0057
249	0.0069	0.0012	0.0057
250	0.0068	0.0012	0.0056
251	0.0067	0.0011	0.0056
252	0.0067	0.0011	0.0056
253	0.0066	0.0011	0.0055
254	0.0066	0.0011	0.0055
255	0.0065	0.0011	0.0054
256	0.0065	0.0011	0.0054
257	0.0064	0.0011	0.0053
258	0.0064	0.0011	0.0053
259	0.0063	0.0011	0.0053
260	0.0063	0.0011	0.0052
261	0.0062	0.0011	0.0052
262	0.0062	0.0011	0.0051
263	0.0062	0.0010	0.0051
264	0.0061	0.0010	0.0051
265	0.0061	0.0010	0.0050
266	0.0060	0.0010	0.0050
267	0.0060	0.0010	0.0050
268	0.0059	0.0010	0.0049
269	0.0059	0.0010	0.0049
270	0.0059	0.0010	0.0049
271	0.0058	0.0010	0.0048
272	0.0058	0.0010	0.0048
273	0.0058	0.0010	0.0048
274	0.0057	0.0010	0.0048
275	0.0057	0.0010	0.0047
276	0.0057	0.0010	0.0047
277	0.0056	0.0010	0.0047
278	0.0056	0.0010	0.0046
279	0.0056	0.0009	0.0046
280	0.0055	0.0009	0.0046
281	0.0055	0.0009	0.0046
282	0.0055	0.0009	0.0045
283	0.0054	0.0009	0.0045
284	0.0054	0.0009	0.0045
285	0.0054	0.0009	0.0045
286	0.0054	0.0009	0.0044

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     287              0.0053           0.0009              0.0044
     288              0.0053           0.0009              0.0044
     ---------------------------------------------------------------------
     ---------------------------------------------------------------------
     Total soil rain loss =      0.45(In)
     Total effective rainfall =      2.53(In)
     Peak flow rate in flood hydrograph =      4.48(CFS)
     ---------------------------------------------------------------------
     +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                         24 - H O U R    S T O R M
                    R u n o f f      H y d r o g r a p h
     ---------------------------------------------------------------------
                 Hydrograph in   5   Minute intervals ((CFS))

     ---------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
----------------------------------------------------------------------------
  0+ 5       0.0001      0.01  Q         |         |         |         |
  0+10       0.0005      0.06  Q         |         |         |         |
  0+15       0.0011      0.09  Q         |         |         |         |
  0+20       0.0018      0.10  Q         |         |         |         |
  0+25       0.0025      0.10  Q         |         |         |         |
  0+30       0.0032      0.11  Q         |         |         |         |
  0+35       0.0040      0.11  Q         |         |         |         |
  0+40       0.0048      0.11  Q         |         |         |         |
  0+45       0.0055      0.11  Q         |         |         |         |
  0+50       0.0063      0.11  Q         |         |         |         |
  0+55       0.0071      0.11  Q         |         |         |         |
  1+ 0       0.0079      0.11  Q         |         |         |         |
  1+ 5       0.0086      0.11  Q         |         |         |         |
  1+10       0.0094      0.11  Q         |         |         |         |
  1+15       0.0102      0.11  Q         |         |         |         |
  1+20       0.0110      0.11  QV        |         |         |         |
  1+25       0.0118      0.11  QV        |         |         |         |
  1+30       0.0126      0.12  QV        |         |         |         |
  1+35       0.0134      0.12  QV        |         |         |         |
  1+40       0.0142      0.12  QV        |         |         |         |
  1+45       0.0150      0.12  QV        |         |         |         |
  1+50       0.0158      0.12  QV        |         |         |         |
  1+55       0.0166      0.12  QV        |         |         |         |
  2+ 0       0.0174      0.12  QV        |         |         |         |
  2+ 5       0.0182      0.12  QV        |         |         |         |
  2+10       0.0190      0.12  QV        |         |         |         |
  2+15       0.0198      0.12  QV        |         |         |         |
  2+20       0.0207      0.12  QV        |         |         |         |
  2+25       0.0215      0.12  QV        |         |         |         |
  2+30       0.0223      0.12  Q V       |         |         |         |
  2+35       0.0231      0.12  Q V       |         |         |         |
  2+40       0.0239      0.12  Q V       |         |         |         |
  2+45       0.0248      0.12  Q V       |         |         |         |
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2+50	0.0256	0.12	Q V	|	|	|	|
2+55	0.0264	0.12	Q V	|	|	|	|
3+ 0	0.0273	0.12	Q V	|	|	|	|
3+ 5	0.0281	0.12	Q V	|	|	|	|
3+10	0.0290	0.12	Q V	|	|	|	|
3+15	0.0298	0.12	Q V	|	|	|	|
3+20	0.0307	0.12	Q V	|	|	|	|
3+25	0.0315	0.12	Q V	|	|	|	|
3+30	0.0324	0.12	Q V	|	|	|	|
3+35	0.0332	0.12	Q V	|	|	|	|
3+40	0.0341	0.12	Q V	|	|	|	|
3+45	0.0349	0.13	Q V	|	|	|	|
3+50	0.0358	0.13	Q V	|	|	|	|
3+55	0.0367	0.13	Q V	|	|	|	|
4+ 0	0.0375	0.13	Q V	|	|	|	|
4+ 5	0.0384	0.13	Q V	|	|	|	|
4+10	0.0393	0.13	Q V	|	|	|	|
4+15	0.0402	0.13	Q V	|	|	|	|
4+20	0.0410	0.13	Q V	|	|	|	|
4+25	0.0419	0.13	Q V	|	|	|	|
4+30	0.0428	0.13	Q V	|	|	|	|
4+35	0.0437	0.13	Q V	|	|	|	|
4+40	0.0446	0.13	Q V	|	|	|	|
4+45	0.0455	0.13	Q V	|	|	|	|
4+50	0.0464	0.13	Q V	|	|	|	|
4+55	0.0473	0.13	Q V	|	|	|	|
5+ 0	0.0482	0.13	Q V	|	|	|	|
5+ 5	0.0491	0.13	Q V	|	|	|	|
5+10	0.0500	0.13	Q V	|	|	|	|
5+15	0.0509	0.13	Q V	|	|	|	|
5+20	0.0519	0.13	Q V	|	|	|	|
5+25	0.0528	0.13	Q V	|	|	|	|
5+30	0.0537	0.13	Q V	|	|	|	|
5+35	0.0546	0.14	Q V	|	|	|	|
5+40	0.0556	0.14	Q V	|	|	|	|
5+45	0.0565	0.14	Q V	|	|	|	|
5+50	0.0575	0.14	Q V	|	|	|	|
5+55	0.0584	0.14	Q V	|	|	|	|
6+ 0	0.0594	0.14	Q V	|	|	|	|
6+ 5	0.0603	0.14	Q V	|	|	|	|
6+10	0.0613	0.14	Q V	|	|	|	|
6+15	0.0622	0.14	Q V	|	|	|	|
6+20	0.0632	0.14	Q V	|	|	|	|
6+25	0.0642	0.14	Q V	|	|	|	|
6+30	0.0651	0.14	Q V	|	|	|	|
6+35	0.0661	0.14	Q V	|	|	|	|
6+40	0.0671	0.14	Q V	|	|	|	|
6+45	0.0681	0.14	Q V	|	|	|	|
6+50	0.0691	0.14	Q V	|	|	|	|
6+55	0.0701	0.14	Q V	|	|	|	|

7+ 0	0.0711	0.15	Q	V	|	|	|	|
7+ 5	0.0721	0.15	Q	V	|	|	|	|
7+10	0.0731	0.15	Q	V	|	|	|	|
7+15	0.0741	0.15	Q	V	|	|	|	|
7+20	0.0751	0.15	Q	V	|	|	|	|
7+25	0.0761	0.15	Q	V	|	|	|	|
7+30	0.0771	0.15	Q	V	|	|	|	|
7+35	0.0782	0.15	Q	V	|	|	|	|
7+40	0.0792	0.15	Q	V	|	|	|	|
7+45	0.0803	0.15	Q	V	|	|	|	|
7+50	0.0813	0.15	Q	V	|	|	|	|
7+55	0.0824	0.15	Q	V	|	|	|	|
8+ 0	0.0834	0.15	Q	V	|	|	|	|
8+ 5	0.0845	0.15	Q	V	|	|	|	|
8+10	0.0855	0.15	Q	V	|	|	|	|
8+15	0.0866	0.16	Q	V	|	|	|	|
8+20	0.0877	0.16	Q	V	|	|	|	|
8+25	0.0888	0.16	Q	V	|	|	|	|
8+30	0.0899	0.16	Q	V	|	|	|	|
8+35	0.0910	0.16	Q	V	|	|	|	|
8+40	0.0921	0.16	Q	V	|	|	|	|
8+45	0.0932	0.16	Q	V	|	|	|	|
8+50	0.0943	0.16	Q	V	|	|	|	|
8+55	0.0954	0.16	Q	V	|	|	|	|
9+ 0	0.0965	0.16	Q	V	|	|	|	|
9+ 5	0.0977	0.16	Q	V	|	|	|	|
9+10	0.0988	0.17	Q	V	|	|	|	|
9+15	0.0999	0.17	Q	V	|	|	|	|
9+20	0.1011	0.17	Q	V	|	|	|	|
9+25	0.1023	0.17	Q	V	|	|	|	|
9+30	0.1034	0.17	Q	V	|	|	|	|
9+35	0.1046	0.17	Q	V	|	|	|	|
9+40	0.1058	0.17	Q	V	|	|	|	|
9+45	0.1070	0.17	Q	V	|	|	|	|
9+50	0.1082	0.17	Q	V	|	|	|	|
9+55	0.1094	0.17	Q	V	|	|	|	|
10+ 0	0.1106	0.18	Q	V	|	|	|	|
10+ 5	0.1118	0.18	Q	V	|	|	|	|
10+10	0.1130	0.18	Q	V	|	|	|	|
10+15	0.1143	0.18	Q	V	|	|	|	|
10+20	0.1155	0.18	Q	V	|	|	|	|
10+25	0.1168	0.18	Q	V	|	|	|	|
10+30	0.1180	0.18	Q	V	|	|	|	|
10+35	0.1193	0.18	Q	V	|	|	|	|
10+40	0.1206	0.19	Q	V	|	|	|	|
10+45	0.1219	0.19	Q	|	V	|	|	|
10+50	0.1232	0.19	Q	|	V	|	|	|
10+55	0.1245	0.19	Q	|	V	|	|	|
11+ 0	0.1258	0.19	Q	|	V	|	|	|
11+ 5	0.1271	0.19	Q	|	V	|	|	|

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11+10       0.1285      0.19  Q         |V        |         |         |
11+15       0.1298      0.20  Q         |V        |         |         |
11+20       0.1312      0.20  Q         |V        |         |         |
11+25       0.1325      0.20  Q         | V       |         |         |
11+30       0.1339      0.20  Q         | V       |         |         |
11+35       0.1353      0.20  Q         | V       |         |         |
11+40       0.1367      0.21  Q         | V       |         |         |
11+45       0.1382      0.21  Q         | V       |         |         |
11+50       0.1396      0.21  Q         | V       |         |         |
11+55       0.1411      0.21  Q         | V       |         |         |
12+ 0       0.1425      0.21  Q         | V       |         |         |
12+ 5       0.1440      0.21  Q         |  V      |         |         |
12+10       0.1453      0.19  Q         |  V      |         |         |
12+15       0.1466      0.19  Q         |  V      |         |         |
12+20       0.1479      0.19  Q         |  V      |         |         |
12+25       0.1491      0.19  Q         |  V      |         |         |
12+30       0.1504      0.19  Q         |  V      |         |         |
12+35       0.1517      0.19  Q         |  V      |         |         |
12+40       0.1531      0.19  Q         |  V      |         |         |
12+45       0.1544      0.19  Q         |   V     |         |         |
12+50       0.1557      0.20  Q         |   V     |         |         |
12+55       0.1571      0.20  Q         |   V     |         |         |
13+ 0       0.1585      0.20  Q         |   V     |         |         |
13+ 5       0.1599      0.20  Q         |   V     |         |         |
13+10       0.1613      0.21  Q         |   V     |         |         |
13+15       0.1628      0.21  Q         |   V     |         |         |
13+20       0.1643      0.22  Q         |   V     |         |         |
13+25       0.1658      0.22  Q         |    V    |         |         |
13+30       0.1673      0.22  Q         |    V    |         |         |
13+35       0.1689      0.23  Q         |    V    |         |         |
13+40       0.1705      0.23  Q         |    V    |         |         |
13+45       0.1721      0.24  Q         |    V    |         |         |
13+50       0.1737      0.24  Q         |    V    |         |         |
13+55       0.1754      0.25  Q         |    V    |         |         |
14+ 0       0.1771      0.25  |Q        |     V   |         |         |
14+ 5       0.1789      0.26  |Q        |     V   |         |         |
14+10       0.1807      0.26  |Q        |     V   |         |         |
14+15       0.1826      0.27  |Q        |     V   |         |         |
14+20       0.1845      0.28  |Q        |     V   |         |         |
14+25       0.1864      0.28  |Q        |     V   |         |         |
14+30       0.1884      0.29  |Q        |      V  |         |         |
14+35       0.1905      0.30  |Q        |      V  |         |         |
14+40       0.1926      0.31  |Q        |      V  |         |         |
14+45       0.1948      0.32  |Q        |      V  |         |         |
14+50       0.1971      0.33  |Q        |      V  |         |         |
14+55       0.1995      0.34  |Q        |       V |         |         |
15+ 0       0.2019      0.36  |Q        |       V |         |         |
15+ 5       0.2045      0.37  |Q        |       V |         |         |
15+10       0.2072      0.39  |Q        |       V |         |         |
15+15       0.2100      0.41  |Q        |        V|         |         |
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15+20       0.2130      0.43  |Q         |         V|          |          |
15+25       0.2161      0.44  |Q         |         V|          |          |
15+30       0.2189      0.41  |Q         |         V|          |          |
15+35       0.2217      0.41  |Q         |          V          |          |
15+40       0.2248      0.45  |Q         |          V          |          |
15+45       0.2282      0.49  |Q         |          V          |          |
15+50       0.2322      0.58  | Q        |          |V         |          |
15+55       0.2370      0.70  | Q        |          |V         |          |
16+ 0       0.2438      0.99  |  Q       |          | V        |          |
16+ 5       0.2582      2.09  |        Q |          |  V       |          |
16+10       0.2891      4.48  |          |       Q  |     V    |          |
16+15       0.3055      2.38  |         Q|          |      V   |          |
16+20       0.3149      1.37  |    Q     |          |       V  |          |
16+25       0.3215      0.95  |  Q       |          |        V|          |
16+30       0.3268      0.78  |  Q       |          |        V|          |
16+35       0.3312      0.64  | Q        |          |         V          |
16+40       0.3348      0.52  | Q        |          |         V          |
16+45       0.3381      0.47  |Q         |          |         V          |
16+50       0.3409      0.41  |Q         |          |         V          |
16+55       0.3432      0.34  |Q         |          |         |V         |
17+ 0       0.3454      0.31  |Q         |          |         |V         |
17+ 5       0.3474      0.29  |Q         |          |         |V         |
17+10       0.3493      0.28  |Q         |          |         |V         |
17+15       0.3512      0.26  |Q         |          |         |V         |
17+20       0.3529      0.25  |Q         |          |         | V        |
17+25       0.3546      0.24  Q          |          |         | V        |
17+30       0.3562      0.23  Q          |          |         | V        |
17+35       0.3577      0.22  Q          |          |         | V        |
17+40       0.3592      0.22  Q          |          |         | V        |
17+45       0.3606      0.21  Q          |          |         | V        |
17+50       0.3620      0.20  Q          |          |         | V        |
17+55       0.3634      0.20  Q          |          |         |  V       |
18+ 0       0.3647      0.19  Q          |          |         |  V       |
18+ 5       0.3660      0.19  Q          |          |         |  V       |
18+10       0.3674      0.20  Q          |          |         |  V       |
18+15       0.3688      0.21  Q          |          |         |  V       |
18+20       0.3703      0.21  Q          |          |         |  V       |
18+25       0.3717      0.21  Q          |          |         |  V       |
18+30       0.3731      0.20  Q          |          |         |  V       |
18+35       0.3744      0.20  Q          |          |         |   V      |
18+40       0.3758      0.20  Q          |          |         |   V      |
18+45       0.3771      0.19  Q          |          |         |   V      |
18+50       0.3785      0.19  Q          |          |         |   V      |
18+55       0.3798      0.19  Q          |          |         |   V      |
19+ 0       0.3811      0.19  Q          |          |         |   V      |
19+ 5       0.3823      0.18  Q          |          |         |   V      |
19+10       0.3836      0.18  Q          |          |         |   V      |
19+15       0.3848      0.18  Q          |          |         |   V      |
19+20       0.3860      0.18  Q          |          |         |    V     |
19+25       0.3872      0.17  Q          |          |         |    V     |
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19+30       0.3884      0.17  Q        |          |          |    V     |
19+35       0.3895      0.17  Q        |          |          |    V     |
19+40       0.3907      0.17  Q        |          |          |    V     |
19+45       0.3918      0.17  Q        |          |          |    V     |
19+50       0.3930      0.16  Q        |          |          |    V     |
19+55       0.3941      0.16  Q        |          |          |    V     |
20+ 0       0.3952      0.16  Q        |          |          |    V     |
20+ 5       0.3963      0.16  Q        |          |          |     V    |
20+10       0.3973      0.16  Q        |          |          |     V    |
20+15       0.3984      0.15  Q        |          |          |     V    |
20+20       0.3995      0.15  Q        |          |          |     V    |
20+25       0.4005      0.15  Q        |          |          |     V    |
20+30       0.4015      0.15  Q        |          |          |     V    |
20+35       0.4026      0.15  Q        |          |          |     V    |
20+40       0.4036      0.15  Q        |          |          |     V    |
20+45       0.4046      0.15  Q        |          |          |     V    |
20+50       0.4056      0.15  Q        |          |          |     V    |
20+55       0.4066      0.14  Q        |          |          |     V    |
21+ 0       0.4076      0.14  Q        |          |          |      V   |
21+ 5       0.4085      0.14  Q        |          |          |      V   |
21+10       0.4095      0.14  Q        |          |          |      V   |
21+15       0.4105      0.14  Q        |          |          |      V   |
21+20       0.4114      0.14  Q        |          |          |      V   |
21+25       0.4124      0.14  Q        |          |          |      V   |
21+30       0.4133      0.14  Q        |          |          |      V   |
21+35       0.4142      0.13  Q        |          |          |      V   |
21+40       0.4151      0.13  Q        |          |          |      V   |
21+45       0.4161      0.13  Q        |          |          |      V   |
21+50       0.4170      0.13  Q        |          |          |      V   |
21+55       0.4179      0.13  Q        |          |          |      V   |
22+ 0       0.4188      0.13  Q        |          |          |       V  |
22+ 5       0.4196      0.13  Q        |          |          |       V  |
22+10       0.4205      0.13  Q        |          |          |       V  |
22+15       0.4214      0.13  Q        |          |          |       V  |
22+20       0.4223      0.13  Q        |          |          |       V  |
22+25       0.4231      0.13  Q        |          |          |       V  |
22+30       0.4240      0.12  Q        |          |          |       V  |
22+35       0.4248      0.12  Q        |          |          |       V  |
22+40       0.4257      0.12  Q        |          |          |       V  |
22+45       0.4265      0.12  Q        |          |          |       V  |
22+50       0.4274      0.12  Q        |          |          |       V  |
22+55       0.4282      0.12  Q        |          |          |       V  |
23+ 0       0.4290      0.12  Q        |          |          |        V |
23+ 5       0.4298      0.12  Q        |          |          |        V |
23+10       0.4307      0.12  Q        |          |          |        V |
23+15       0.4315      0.12  Q        |          |          |        V |
23+20       0.4323      0.12  Q        |          |          |        V |
23+25       0.4331      0.12  Q        |          |          |        V |
23+30       0.4339      0.12  Q        |          |          |        V |
23+35       0.4347      0.12  Q        |          |          |        V |
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   23+40       0.4355      0.11  Q         |         |         |        V|
   23+45       0.4363      0.11  Q         |         |         |        V|
   23+50       0.4370      0.11  Q         |         |         |        V|
   23+55       0.4378      0.11  Q         |         |         |        V|
   24+ 0       0.4386      0.11  Q         |         |         |        V|
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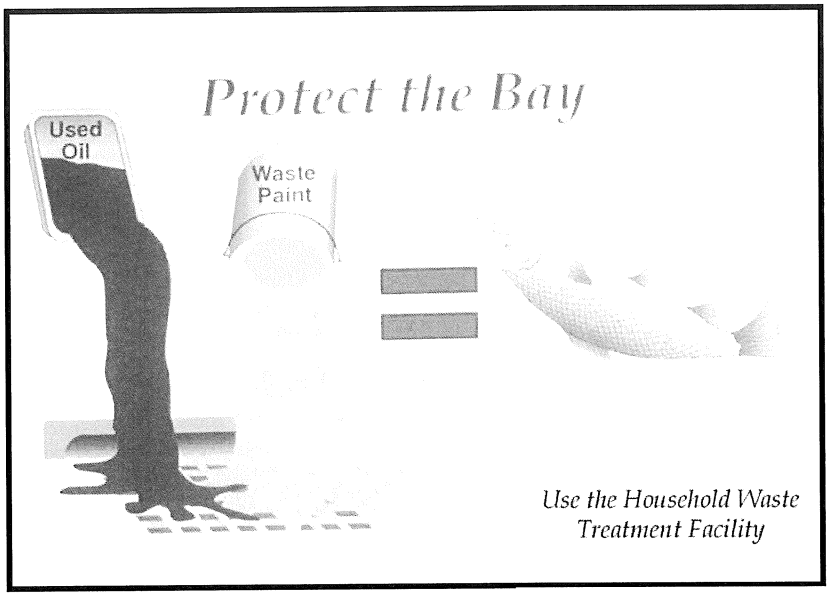
Appendix E

BMP Fact Sheets

Non-Stormwater Discharges SC-10



Graphic by: Margie Winter

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

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

Description

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

Approach

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

CASQA California Stormwater Quality Association

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

Suggested Protocols

Fixed Facility

General

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

Illicit Connections

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

Visual Inspection and Inventory

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

Review Infield Piping

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

Smoke Testing

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

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

Dye Testing

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

TV Inspection of Storm Sewer

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

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Clean up spills on paved surfaces with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.
- See fact sheet SC-11 Spill Prevention, Control, and Clean Up.

Field Program

General

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

Field Inspection

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

Recommended Complaint Investigation Equipment

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

- Educational materials

Reporting

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

Enforcement

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

Training

- Train technical staff to identify and document illegal dumping incidents.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Train employees to identify non-stormwater discharges and report them to the appropriate departments.
- Train staff who have the authority to conduct surveillance and inspections, and write citations for those caught illegally dumping.

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

Spill Response and Prevention

- See SC-11 Spill Prevention Control and Clean Up

Other Considerations

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

Requirements

Costs

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

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

What constitutes a "non-stormwater" discharge?

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

Permit Requirements

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

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

Illegal Dumping

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

Outreach

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

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

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  - Footing drains;
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  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
  - Lawn watering.

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

Storm Drain Stenciling

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

Oil Recycling

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

Household Hazardous Waste

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

Examples

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

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

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

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

References and Resources

http://www.stormwatercenter.net/

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

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

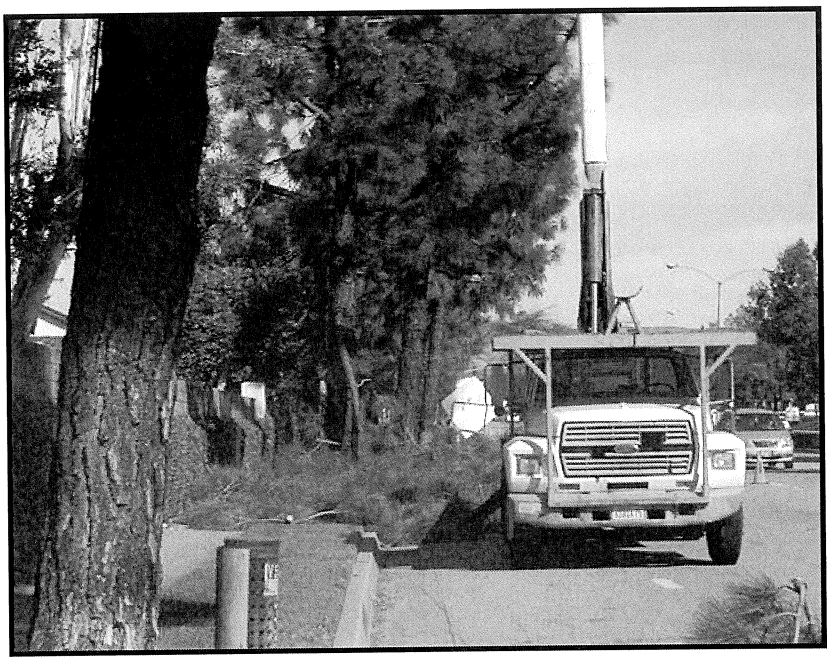
Orange County Stormwater Program,
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

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

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

Landscape Maintenance

SC-73



Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

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

Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Approach

Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

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- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

Suggested Protocols

Mowing, Trimming, and Weeding

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.
- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.
- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.
- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.
- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).
- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.
- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.
- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

Irrigation

- Where practical, use automatic timers to minimize runoff.
- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.
- 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.
- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.
- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:
  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.
  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.
  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.
  - Slugs 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, tree trunk guards.
  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.
- 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 pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 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 pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

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.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.
- Use a training log or similar method to document training.

Spill Response and Prevention

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

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in "agricultural use" areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.
- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.
- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Waste Management

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

Contractors and Other Pesticide Users

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

References and Resources

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

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

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

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

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: http://www.epa.gov/npdes/menuofbmps/poll_8.htm

Drainage System Maintenance SC-74

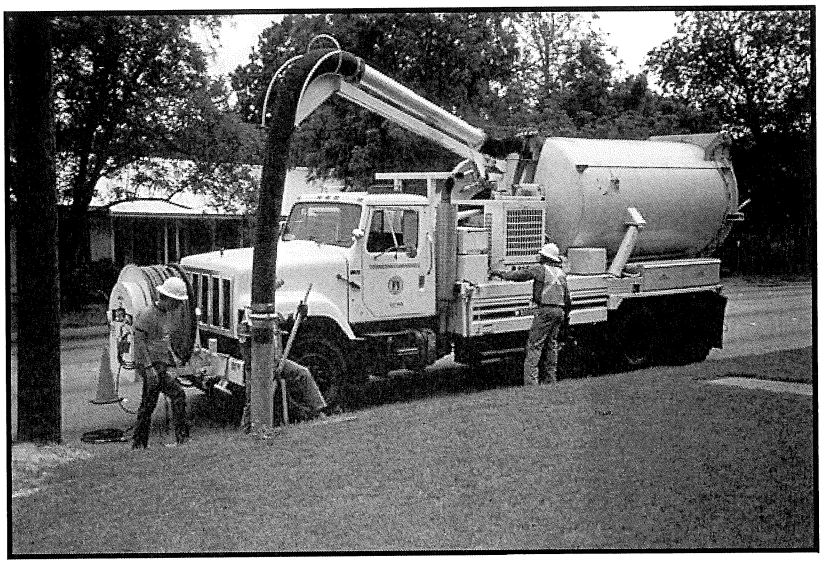

Photo Credit: Geoff Brosseau

Objectives

- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Targeted Constituents

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

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure 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 SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

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- 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.
- Record the amount of waste collected.
- 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 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 of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

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 flushed effluent and pump to the sanitary sewer for treatment.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to 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 steam 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

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
  - 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 up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas 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.

- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).
- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Only properly trained individuals are allowed to handle hazardous materials/wastes.
- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.
- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.
- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

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

Other Considerations

- Cleanup 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 disposal of flushed effluent to sanitary sewer may be prohibited in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Private property access rights may be needed to track illegal discharges up gradient.

- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.

- 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. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from "environmental fees" or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.

- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.

- Arrangements must be made for proper disposal of collected wastes.

- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. The 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, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect 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 re-collect 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 percent for organics and 55-65 percent 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 drain flushing.

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows we allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for steam alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to he reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank aid watershed instability arid floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

References and Resources

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

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

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) Municipal Activities Model Program Guidance. 2001. Project Clean Water. November.

United States Environmental Protection Agency (USEPA). 1999. Stormwater Management Fact Sheet Non-stormwater Discharges to Storm Sewers. EPA 832-F-99-022. Office of Water, Washington, D.C. September.

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United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Illegal Dumping Control. On line: http://www.epa.gov/npdes/menuofbmps/poll_7.htm

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

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.

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Designing New Installations

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

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

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

Conserve Natural Areas during Landscape Planning

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

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

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

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

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

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

Protection of Slopes and Channels during Landscape Design

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

Redeveloping Existing Installations

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

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

Other Resources

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

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

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

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

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

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

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

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

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barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

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.

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

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– 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.

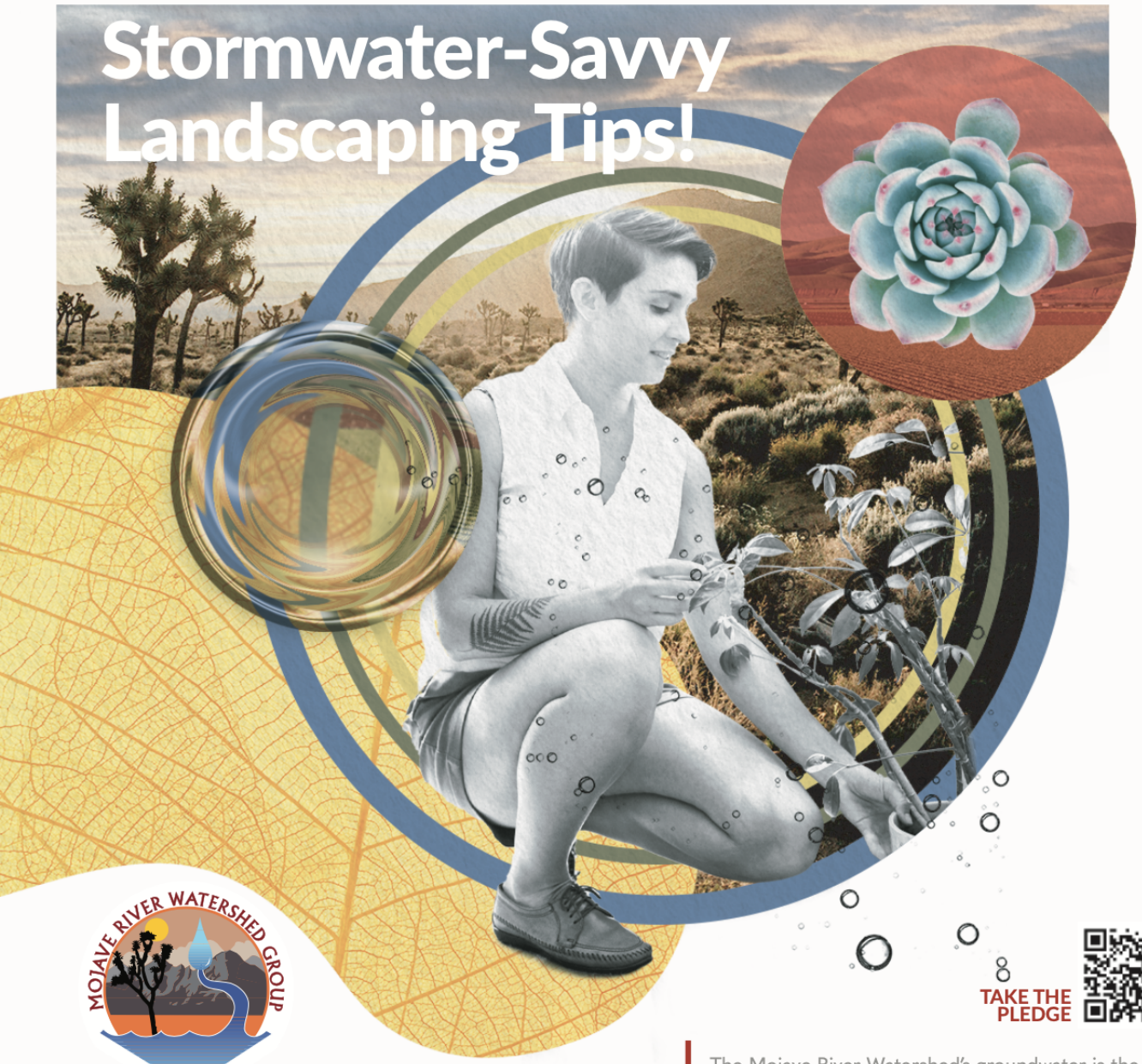
Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

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

Appendix F

Educational Material

Stormwater-Savvy Landscaping Tips!



Pesticides, herbicides and fertilizers that contain harmful chemicals can wash into our Mojave River Watershed and cause stormwater pollution. There are simple things we can do to protect our High Desert water supply without sacrificing beautiful lawns and gardens.

Choose to be stormwater-savvy in just 7 easy steps.

1. **Use nontoxic products, they're just as effective and better for our water supply**
2. **Never apply pesticides, herbicides or fertilizers 24 hours before a rain storm**
3. **Avoid applying treatment products near a driveway or gutter**
4. **Opt for spot treatment rather than blanketing large areas**
5. **Store lawn and gardening products in a sealed container to prevent spillage and runoff**
6. **Choose native plants and grasses that are drought tolerant and pest resistant**
7. **Sweep and throw away lawn debris in a green waste trash bin**

Always dispose of leftover fertilizer, herbicides and pesticides at a Household Hazardous Waste Collection Center.

MOJAVE RIVER WATERSHED GROUP

mojaveriver.org

@mojaveriver

@mojavewatershed

TAKE THE PLEDGE

The Mojave River Watershed's groundwater is the main source of water for many High Desert residents, plants and wildlife. It's up to us to keep it clean.

Household Hazardous Waste Collection Centers

- Town of Apple Valley Household Hazardous Waste Facility
  13450 Nomwaket Road
- City of Hesperia Household Hazardous Waste Facility
  17443 Lemon Street
- City of Victorville Household Hazardous Waste Collection Center
  Located on Loves Lane behind the San Bernardino County Fairgrounds

Appendix G

Maintenance Manual

Amethyst Crossing

OPERATION
AND MAINTENANCE MANUAL

Table of Contents

1. Discussion

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

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

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

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

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

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

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

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

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

2.Inspection and Maintenance Responsibility Form 5-1

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Infiltration Basin	**Owner**	Regular inspections of system to observe sediment build up and infiltration capacity. Cleaning of accumulated trash, debris and seediment as determined by inspections. Cleaning is recommended during dry weather. See manufacturer recommendations for additional maintenance activities	Monthly and within 48 hours follwing a significant storm event to verify there is no standing water
Catch Basin /w Filter Insert	**Owner**	Inspect for illegal dumping and /or debris accumulation. Clean filters whenever 25% of filter capacity is exceeded by debris accumulation	At least 2 times a year and after any Storm Event
Landscape Maintenance	**Owner**	Maintain landscape area vegetation, slope protection and grades, adjacent to hardscape and prevent discharges of landscape maintenance waste into storm drains	Weekly
Roadways & Parking Area	**Owner**	Clean and remove accumulated sand and debris in parking lots and along roadway. Sweep pavement in lieu of using house or water spray. Ensure stormwater runoff is not impeded by deposit of debris and accumulated sediment by ground maintenance staff.	Inspect after wind storm or minimum monthly
Litter Control	**Owner**	Site to be inspected and all litter be collected and disposed of in trash containers. Inspection and maintenance to be performed by HOA	Weekly
Signage and Stencil	**Owner**	Clean the stencil/signage surface to remove any excess dirt Re-paint if necessary.	Annually
Bioretention basins	**Owner**	Inspect catchment area for an excessive sediment, trash, and/or debris accumulation on surface. Clean up excessive sediment, trash, and/or debris accumulation. Litter leaves and debris should be removed from Basin to reduce risk of clogging. Clean grated inlet and filter inserts.	4 times Annually, and after heavy rain

3. Inspection and Maintenance Log

Detention Basin Inspections and Maintenance Checklist

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

Location:

Owner Name:

Address: Phone Number

Site Status:

Date: Time: Site conditions:

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

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

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

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

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

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Bioswale
Inspections and Maintenance Checklist

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

Location:

Owner Name:

Address: Phone Number

Site Status:

Date: Time: Site conditions:

Constructed Wetland Type: _____

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

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

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Constructed Wetland Ponding Areas (if applicable)				
Wetland vegetation present and healthy?	A / **M** / S			
Vegetation removal needed?	A / **M** / S			
Floatable debris removal needed?	A / **M** / S			
Shoreline problem?	A / **M** / S			
Erosion at outfalls into pond?	A / **M** / S			
Headwalls and endwalls in good condition?	A / **M** / S			
Encroachment into pond or easement area?	**A** / M / S			
Hazards				
Have there been complaints from residents?	A / **M** / S			
Public hazards noted?	A / **M** / S			

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

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

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Bioretention
Inspections and Maintenance Checklist

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

Location: _____

Owner Name: _____

Address: _____ Phone Number _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____

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

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

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

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

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Sand Filter
Inspections and Maintenance Checklist

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

Location:

Owner Name:

Address: Phone Number

Site Status:

Date: Time: Site conditions:

Sand Filter Type: Perimeter Filter ____ Underground Filter ____ Above Ground Filter ____

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

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

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

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

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Infiltration Trench
Inspections and Maintenance Checklist

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

Location:

Owner Name:

Address: Phone Number

Site Status:

Date: Time: Site conditions:

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

Inspection Items	**Inspection Frequency**	**Inspected? (Yes/No)**	**Maintenance Needed? (Yes/No)**	**Comments/Description**
Debris Removal				
Trench surface clear of debris?	A / **M** / S			
Inlets / inflow pipes free of debris?	A / **M** / S			
Overflow spillway clear of debris?	A / **M** / S			
Vegetation				
Mowing done when necessary?	A / **M** / S			
Fertilizer per specification?	A / **M** / S			
Any evidence of erosion?	A / **M** / S			
Contributing drainage area stabilized?	A / **M** / S			
Dewatering)				
Trench dewaters between storms?	A / **M** / S			
Sediment traps, forebays, or pretreatment swales				
Obviously trapping sediment?	**A** / M / S			
Greater than 50% of original storage volume remaining?	**A** / M / S			
Sediment removal of trench				
Any evidence of sedimentation in trench?	**A** / M / S			
Does sediment accumulation currently require removal?	**A** / M / S			
Inlets				
Good condition (no need for repair)?	**A** / M / S			
Any evidence of erosion?	**A** / M / S			
Outlets/overflow spillway				
Good Condition (no need for repair)?	**A** / M / S			
Any evidence of erosion?	**A** / M / S			

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Aggregate repairs				
Surface of aggregate clean?	**A** / M / S			
Top layer of stone in need of replacement?	**A** / M / S			
Trench in need of rehabilitation?	**A** / M / S			
Observation wells				
Evidence of clogging (failure to percolate)?	A / **M** / S			

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

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

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

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

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

Location: _____

Owner Name: _____

Address: _____ Phone Number _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____

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

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

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

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

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

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Buffers
Inspections and Maintenance Checklist

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

Location: _____

Owner Name: _____

Address: _____ Phone Number _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____

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

Inspection Items	**Inspection Frequency**	**Inspected? (Yes/No)**	**Maintenance Needed? (Yes/No)**	**Comments/Description**
Vegetation				
Mowing done when necessary?	A / **M** / S			
Surrounding area fully stabilized? (no evidence of eroding material into buffer)?	A / **M** / S			
Vegetation healthy?	A / **M** / S			
Level Spreader				
Vegetation is healthy?	A / **M** / S			
Lip of spreader shows no signs of erosion?	A / **M** / S			
Sediment noted in spreader?	A / **M** / S			

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

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

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Proprietary BMP
Inspections and Maintenance Checklist

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

Location:

Owner Name:

Address: Phone Number

Site Status:

Date: Time: Site conditions:

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

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

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

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

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Green Roof Inspections and Maintenance Checklist

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

Location: _____

Owner Name: _____

Address: _____ Phone Number _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____

Green Roof Type: Extensive Roof Cover ☐ Intensive Roof Garden ☐

Inspection Frequency Key: A=annual; M=monthly; S=after major storms; G=monthly during April-September growing season
***BOLD** = recommended frequency*

Inspection Items	**Inspection Frequency**	**Inspected? (Yes/No)**	**Maintenance Needed? (Yes/No)**	**Comments/Description**
Debris Removal				
Gutter inlets blocked by plan debris/trash or plant growth hindered by debris?	A / **M** / S / G			
Inlets and Outlets free of debris?	A / **M** / S			
Vegetation				
Any evidence of additional irrigation needs?	A / M / S / **G**			
Fallen leaves/debris interfering with plant health?	A / **M** / S / G			
Any dead plants to be replaced?	A / **M** / S / G			
Any need for weeding/mowing/trimming?	A / M / S / **G**			
Soil Substrate/Growing Medium				
Any evidence of wind/water erosion?	**A** / M / S / G			
Structural Components				
Any evidence of structural deterioration?	**A** / M / S / G			
Load-bearing walls in good condition?	**A** / M / S / G			
Spalling or cracking of structural parts?	**A** / M / S / G			
Access/maintenance routes maintained and free of debris?	A / **M** / S / G			
Other				
Any locations of standing water that may harbor insect infestations?	A / M / **S** / G			
	A / M / S / G			

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

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

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Permeable Pavement
Inspections and Maintenance Checklist

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

Location:

Owner Name:

Address: Phone Number

Site Status:

Date: Time: Site conditions:

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

Inspection Items	**Inspection Frequency**	**Inspected? (Yes/No)**	**Maintenance Needed? (Yes/No)**	**Comments/Description**
Pavement Area				
Pavement area free of debris?	A / **M** / S			
Inlets and Outlets unobstructed?	A / **M** / S			
Is any water standing after a storm event?	A / M / **S**			
Any evidence of clogged pores that require vacuum-sweeping?	A / **M** / S			
Access to pervious pavement (egress and ingress routes) safe and efficient?	A / **M** / S			
Vegetation				
Adjacent area fully stabilized (no evidence of eroding material into or from pervious pavement area)?	**A** / M / S			
Any noticeable irrigation needs?	A / **M** / S			
Fallen leaves/plant debris collecting in paving area?	A / **M** / S			
Grass height over 4 inches?	A / **M** / S			
Vegetation health affected by oil/grease from vehicles?	**A** / M / S			
Other	**A** / M / S			
Hazards				
Obstructions or debris affecting overflows/emergency spillway?	A / **M** / S			
Load-bearing capability of pavement intact?	A / **M** / S			

Inspector Comments: _____

_____

_____

_____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

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

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

4. Maintenance Agreement

5. Reference Material

6. BMP Fact Sheets

7. WQMP Exhibit

Appendix H

Storm Tech underground detention vault reports

UG Basin A-1

User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	No
Project Name:	Amethyst Crossing
Engineer:	N/A
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	10422 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	18 in.
Design Constraint Dimensions:	(30 ft. x 200 ft.)

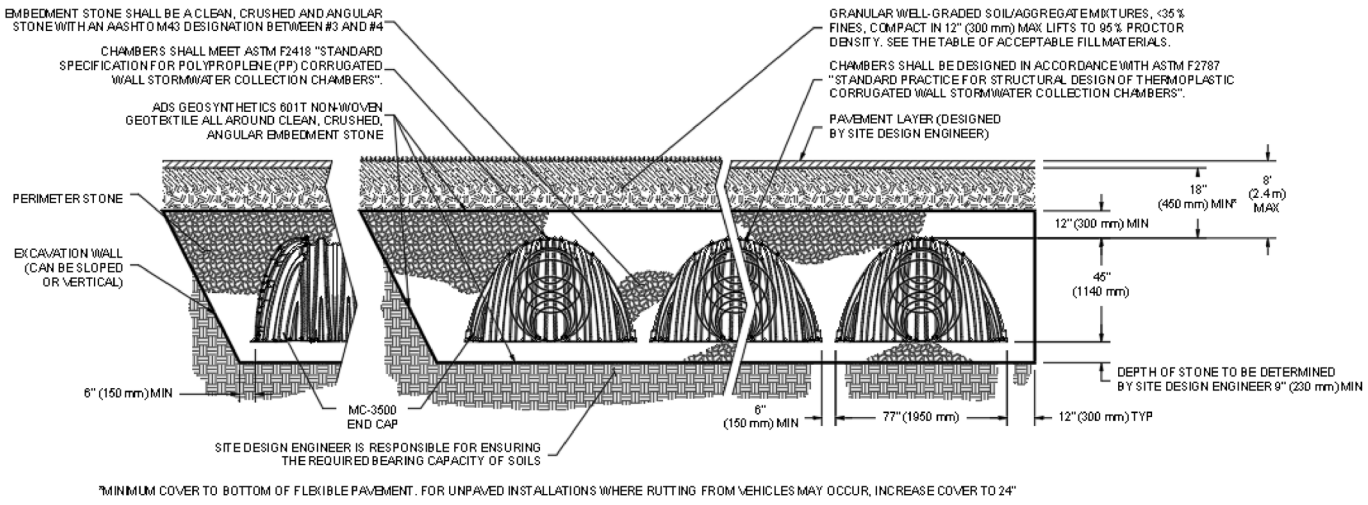
Results

System Volume and Bed Size

Installed Storage Volume:	10786.33 cubic ft.
Storage Volume Per Chamber:	109.90 cubic ft.
Number Of Chambers Required:	56
Number Of End Caps Required:	6
Chamber Rows:	3
Maximum Length:	146.05 ft.
Maximum Width:	22.25 ft.
Approx. Bed Size Required:	3200.02 square ft.

System Components

Amount Of Stone Required:	420.60 cubic yards
Volume Of Excavation (Not Including Fill):	651.86 cubic yards
Total Non-woven Geotextile Required:	1100.18 square yards
Woven Geotextile Required (excluding Isolator Row):	33.46 square yards
Woven Geotextile Required (Isolator Row):	163.24 square yards
Total Woven Geotextile Required:	196.70 square yards



UG Basin A-2

User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	Yes
Project Name:	Amethyst Crossing
Engineer:	N/A
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	7213 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	18 in.
Design Constraint Dimensions:	(30 ft. x 200 ft.)

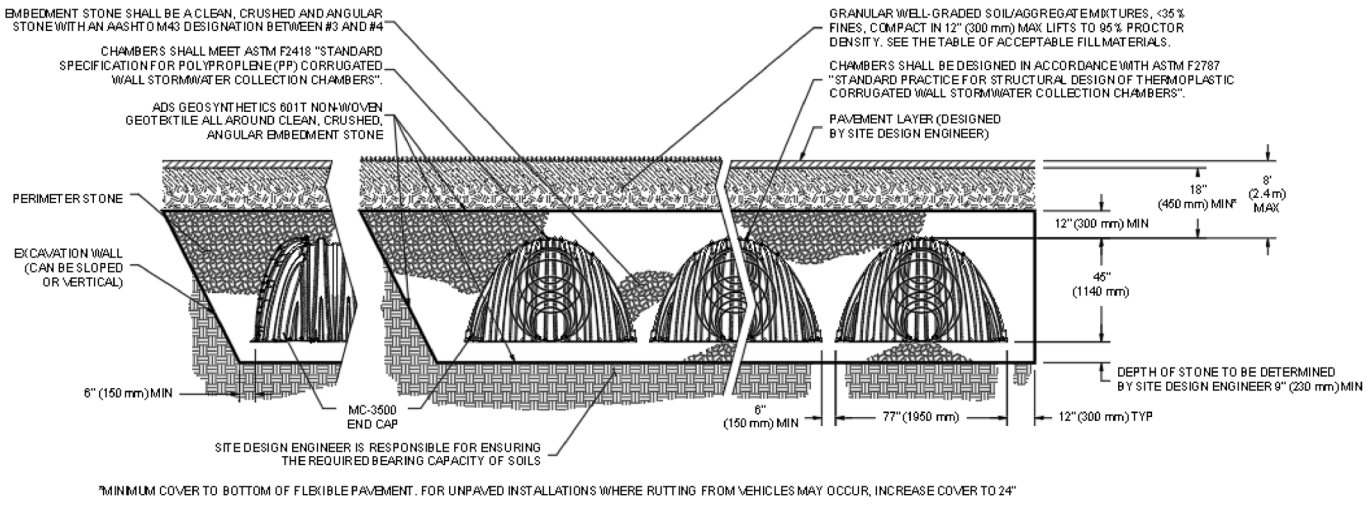
Results

System Volume and Bed Size

Installed Storage Volume:	7469.48 cubic ft.
Storage Volume Per Chamber:	109.90 cubic ft.
Number Of Chambers Required:	37
Number Of End Caps Required:	4
Chamber Rows:	2
Maximum Length:	145.85 ft.
Maximum Width:	15.93 ft.
Approx. Bed Size Required:	2269.97 square ft.

System Components

Amount Of Stone Required:	309.59 cubic yards
Volume Of Excavation (Not Including Fill):	462.40 cubic yards
Total Non-woven Geotextile Required:	842.61 square yards
Woven Geotextile Required (excluding Isolator Row):	16.73 square yards
Woven Geotextile Required (Isolator Row):	163.24 square yards
Total Woven Geotextile Required:	179.97 square yards



Underground Basin B

User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	Yes
Project Name:	Amethyst Crossing
Engineer:	N/A
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	1935 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	18 in.
Design Constraint Dimensions:	(20 ft. x 45 ft.)

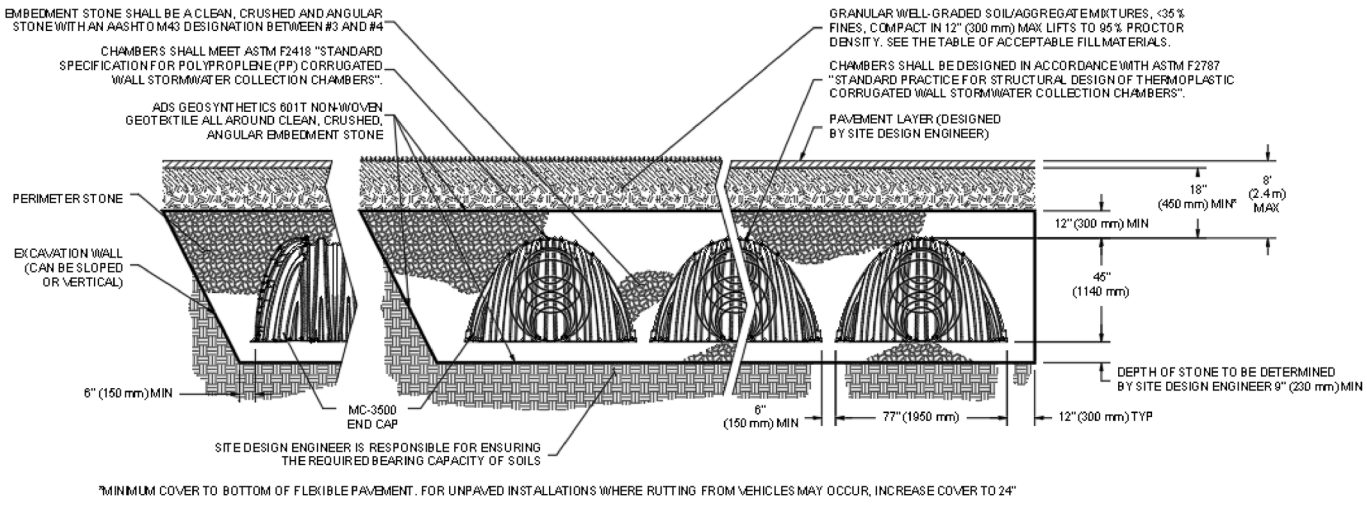
Results

System Volume and Bed Size

Installed Storage Volume:	2106.15 cubic ft.
Storage Volume Per Chamber:	109.90 cubic ft.
Number Of Chambers Required:	9
Number Of End Caps Required:	4
Chamber Rows:	2
Maximum Length:	45.51 ft.
Maximum Width:	15.93 ft.
Approx. Bed Size Required:	671.33 square ft.

System Components

Amount Of Stone Required:	97.91 cubic yards
Volume Of Excavation (Not Including Fill):	136.75 cubic yards
Total Non-woven Geotextile Required:	269.14 square yards
Woven Geotextile Required (excluding Isolator Row):	16.73 square yards
Woven Geotextile Required (Isolator Row):	46.18 square yards
Total Woven Geotextile Required:	62.91 square yards



UG Basin C

User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	Yes
Project Name:	Amethyst Crossing
Engineer:	N/A
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	5729 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	18 in.
Design Constraint Dimensions:	(24 ft. x 85 ft.)

Results

System Volume and Bed Size

Installed Storage Volume:	5936.75 cubic ft.
Storage Volume Per Chamber:	109.90 cubic ft.
Number Of Chambers Required:	29
Number Of End Caps Required:	6
Chamber Rows:	3
Maximum Length:	81.35 ft.
Maximum Width:	22.85 ft.
Approx. Bed Size Required:	1804.93 square ft.

System Components

Amount Of Stone Required:	246.32 cubic yards
Volume Of Excavation (Not Including Fill):	367.67 cubic yards
Total Non-woven Geotextile Required:	634.14 square yards
Woven Geotextile Required (excluding Isolator Row):	33.46 square yards
Woven Geotextile Required (Isolator Row):	87.99 square yards
Total Woven Geotextile Required:	121.45 square yards