MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

US Cold Storage

APN(S): 3064-421-01, -02-, & -03

Prepared for:

DR. Prem Reddy Family Foundation

16850 Bear Valley Road

Victorville, CA 92395

Prepared by:

Joseph E. Bonadiman & Associates, Inc.

234 North Arrowhead Avenue

San Bernardino, CA 92408

(909) 885-3806

Submittal Date: May 2020

Revision No. and Date: _____

Revision No. and Date: _____

Revision No. and Date: _____

Revision No. and Date: _____

Final Approval Date:______________________

Project Owner's Certification

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

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

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN(S): 3064-421-01, -02-, & -03

Owner's Signature			
Owner Name: DR. Prem Reddy **Family Foundation**			
Title			
Representative			
Address	16850 Bear **Valley Road**, Victorville, CA 92395		
Email			
Telephone #			
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN(S): 3064-421-01, -02-, & -03

"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: James T. Stanton		PE Stamp Below
Title	Vice President of Engineering	
Company	Joseph E. Bonadiman & **Associates, Inc.**	
Address	234 North **Arrowhead Avenue** San Bernardino, CA 92408	
Email	jts@bonadiman.com	
Telephone #	(909) **885-3806**	
Signature		
Date		

Table of Contents

Forms

Section I – Introduction

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

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

Section 1 Discretionary Permit(s)

<table>
<tr><th colspan="6">Form 1-1 Project Information</th></tr>
<tr><td colspan="2">Project Name</td><td colspan="4">US Cold Storage</td></tr>
<tr><td colspan="2">Project Owner Contact Name:</td><td colspan="4"></td></tr>
<tr><td>Mailing Address:</td><td>16850 Bear Valley Road
Victorville, CA 92395</td><td>E-mail Address:</td><td></td><td>Telephone:</td><td></td></tr>
<tr><td colspan="2">Permit/Application Number(s):</td><td></td><td>Tract/Parcel Map Number(s):</td><td colspan="2"></td></tr>
<tr><td colspan="2">Additional Information/
Comments:</td><td colspan="4"></td></tr>
<tr><td colspan="2">Description of Project:</td><td colspan="4">The proposed project is a warehouse facility with offices. The project site is currently vacant. The project will be phased and a LID BMP will be sized to treat the total build out of the project.</td></tr>
<tr><td colspan="2">Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.</td><td colspan="4"></td></tr>
</table>

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.

<table>
<tr><th colspan="4">Form 2.1-1 Description of Proposed Project</th></tr>
<tr><td colspan="4">1 Regulated Development Project Category (Select all that apply):</td></tr>
<tr><td>☒ #1 New development involving the creation of 5,000 ft^2 or more of impervious surface collectively over entire site</td><td>☐ #2 Significant re-development involving the addition or replacement of 5,000 ft^2 or more of impervious surface on an already developed site</td><td>☐ #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface</td><td>☐ #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface</td></tr>
<tr><td colspan="4">☐ 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.</td></tr>
</table>

2 Project Area (ft2):	3,429,986	3 Number of Dwelling Units:	0	4 SIC Code:	

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:
The owner listed below will be responsible for long-term maintenance of WQMP stormwater facilities. DR. Prem Reddy **Family Foundation** 16850 Bear **Valley Road** Victorville, CA 92395

2.3 Potential Stormwater Pollutants

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

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

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Potential sources include animal waste.
Nutrients - Phosphorous	E ☒	N ☐	Potential sources include fertilizers and eroded soils.
Nutrients - Nitrogen	E ☒	N ☐	Potential sources include fertilizers and eroded soils.
Noxious Aquatic Plants	E ☒	N ☐	Potential sources from urban runoff include fertilizers and eroded soils
Sediment	E ☒	N ☐	Potential sources include eroded soils.
Metals	E ☒	N ☐	Potential source emissions from brake pad and tire tread wear associated with driving.
Oil and Grease	E ☒	N ☐	Potential source include petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids.
Trash/Debris	E ☒	N ☐	Potential source include paper, plastic, polystyrene packing foam, and aluminum materials.
Pesticides / Herbicides	E ☒	N ☐	Potential source include fertilizers and pest sprays.
Organic Compounds	E ☒	N ☐	Potential sources include solvents and cleaning compounds.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

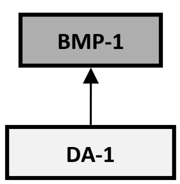
Describe the project site conditions that will facilitate the selection of BMPs through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34.435452°	Longitude -117.395137°	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 BMP1	Site sheet flows to catch basins that enters proposed basin.

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area's sub-watershed, provide the following characteristics	DA 1			
1 DMA drainage area (ft^2)	3,429,986			
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*	II			
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)	3,216			
6 Longest flowpath slope (ft/ft)	0.013			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Desert Shrub			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50%* ***Attach photos of site to support rating***	Poor			

Form 3-3 Watershed Description for Drainage Area 1	
Receiving waters Refer to SWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Oro Grande Wash Mojave River
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Oro Grande Wash - None Mojave River - None
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Oro Grande Wash - None Mojave River - Fluoride
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	Areas within 200': Desert Tortoise Habitat Cat 3
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	☒	☐	The Property Owner will provide practical information materials to the first residents/occupants/tenants on general housekeeping practices that contribute to the protection of stormwater quality. These materials will be initially included in the approved WQMP. Thereafter any new or revised materials will be provided to the property owner by the county NPDES department.
N2	Activity Restrictions	☒	☐	Activity restrictions will be imposed by the owner to limit exposure of stormwater to potential pollutants listed above in table 2.3-1.Restrictions will include fertilizers and pesticides be applied by certified persons.
N3	Landscape Management BMPs	☒	☐	Owner will ensure landscaping and irrigation is properly maintained. Fertilizers and pesticides be applied by certified persons. Check for damaged irrigation equipment or erosion and repair as needed. This indormation has been derived from information in CASQA handout "Landscape Management", which is provided in appendix B of the O&M plan.
N4	BMP Maintenance	☒	☐	The property owner will be responsible for all the applicable BMP maintenance for the non-structural and structural BMPs. See forms 4.1-1, 4.1-2 and 5-1 for BMP list as well as the WQMP O&M plan for maintenance activities.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No hazardous waste storage is proposed for this project.
N6	Local Water Quality Ordinances	☒	☐	This project will comply with NPDES Permit No. CAS618036 by implementation of the approved WQMP.
N7	Spill Contingency Plan	☐	☒	No outdoor material storage or hazardous material storage is proposed.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tanks are proposed.
N9	Hazardous Materials Disclosure Compliance	☐	☒	Per San Bernardino County Fire, Hazardous Materials Division, the basic quantities for disclosure are: hazardous materials at or exceeding 55 gallons, 500 pounds, or 200 cubic feet at any time in the course of a year. The proposed use of this site does not meet this threshold.

Form 4.1-1 Non-Structural Source Control BMPs				
N10	Uniform Fire Code Implementation	☐	☒	Project plans are reviewed for compliance by local fire protection agency based on determination by planning department. Article 80 of the Uniform Fire Code deals with storage of Hazardous Materials, which are not being stored on this site.
N11	Litter/Debris Control Program	☒	☐	Litter/Debris inspection and clean up will be made part of the regular grounds maintenance and house keeping. At-least once a week. When trash/debris is seen it will be cleaned up as soon as possible.
N12	Employee Training	☒	☐	Employees will be trained on the BMPs included in this report. The training material will be innitially provided by the property owner per N1 above. See O&M plan in the approved WQMP for BMP handouts, based on the intended use, to be used in initial training.
N13	Housekeeping of Loading Docks	☒	☐	Loading Dock areas will be dry swept regularly and equipment inspected for leaks. Clean or repair as needed.
N14	Catch Basin Inspection Program	☒	☐	The owner will have at least 80 percent of drainage facilities inspected, cleaned and maintained on an annual basis with 100 percent of the facilities included in a two-year period. Cleaning will take place in the late summer/early fall prior to the start of the rainy season. This indormation has been derived from information in CASQA handout MP-52, which is provided in appendix B of the O&M plan.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	At a minimum paved parking areas of a business shall be swept, using a vacuum assisted sweeper, in late summer or early fall, prior to the start of the rainy season. This indormation has been derived from information in CASQA handout SC-43, which is provided in appendix B of the O&M plan.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Project is not a public agency Priority Project and this is not required by the local jurisdiction.
N17	Comply with all other applicable NPDES permits	☒	☐	The proposed site will comply with current NPDES permit requirements through implementation of the site specific Storm Water Pollution Prevension Plan (SWPPP) BMPs. Refer to separate SWPPP document.

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 and catch basins being constructed or modified will be labeled. Stenciled labels shall be blue on a white background with lettering 2-1/2" in height and reading "No Dumping – Drains to River." In lieu of a stencil, a catch basin curb marker that is at least 4" in height or diameter and contains a similar message may be used. A painted circular stencil shall not be bigger than 8" in diameter. Catch basin labels will be inspected once annually and relabeled as necessary to maintain legibility. This information has been derived from information in CASQA handout SD-13, which is provided in appendix B of the O&M plan.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor material storage is proposed.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash storage areas will be designed in accordance with the reviewing juristiction development code and will provide secondary trash containment for the trash bins, as required by NPDES Permit No. CAS618036. These areas will provide storage of the state compliant receptacles with attached lids, that are provided by the local refuse service provider. Trash bin lids will be kept closed. See approved grading plan for construction.
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)	☒	☐	Owner will ensure landscaping and irrigation is properly maintained and will follow any future state or local irrigation requirements. landscaping and irrigation will be installed per the approved landscaping plans,which will incorporate rain-triggered shutoff devices and automatic irrigations controllers. This information has been derived from information in CASQA handout SD-12, which is provided in appendix B of the O&M plan.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscape areas are designed with a minimum of 1 inch below adjacent impervious areas.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☐	☒	No significant slopes or channels proposed.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☒	☐	Dock areas will be swept and cleaned.

Form 4.1-2 Structural Source Control BMPs				
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenance bays are proposed.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle washingis proposed.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing proposed.
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment washing proposed.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling is proposed.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside landscaping is proposed.
S14	Wash water control for food preparation areas	☐	☒	No food preparation proposed.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No car washing proposed.

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: Impervious area has been minimized as much as possible for the proposed use of this site by adding landscaping and proposing gravel parking for phase 2.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: Landscape and BMP areas will be marked, with flagging tape or other method at the contractor's discression, durning construction to minimize compaction and maximize natural infiltration capacity.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: Existing drainage patterns and time of concentration will change due to the proposed development. The TC of runoff leaving the site will not be less thatn existing, see HCOC calculations.
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: Impervious areas have been disconnected as much as possible for this site. This was done by using gravel for phase 2.
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: Porous pavement will not be used. The LID BMP used to meet this target is a infiltration basin.
Protect existing vegetation and sensitive areas: Yes ☒ No ☐ Explanation: Disturbed areas will be re-vegetated where possible, see site plan for proposed landscaping areas. No sensitive areas exist on-site.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☒ No ☐ Explanation: Disturbed areas will be re-vegetated where possible, see site plan for proposed landscaping areas.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Infiltration BMP areas will be marked, with flagging tape or other method at the contractor's discression, durning construction to minimize compaction and maximize natural infiltration capacity.

Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: This is not practical based on existing site topography and the grading for the proposed site use. The LID BMP used to meet this target is a infiltration basin.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: Landscape areas will be marked, with flagging tape or other method at the contractor's discression, durning construction to minimize compaction and maximize natural infiltration capacity.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation: This is not practical for this commercial site. The LID BMP used to meet this target is a infiltration basin.
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☒ No ☐ Explanation: There are no adjacent streams.

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

San Bernardino County Special Districts:

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

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

Mojave Water Agency:

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

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

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

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

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

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

4.2 Treatment BMPs

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

4.2.1 Project Specific Hydrology Characterization

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

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

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

Methods applied in the following forms include:

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

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
1 Project area DA 1 (ft^2): 3,429,986	2 Imperviousness after applying preventative site design practices (Imp%): 68.95	3 Runoff Coefficient (Rc): _0.484 *$R_c = 0.858(Imp\%)^{3} - 0.78(Imp\%)^{2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): 0.441 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.545 *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): 148,187 *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	1 249,076 *Form 4.2-3 Item 12*	2 24.30 *Form 4.2-4 Item 13*	3 50.81 *Form 4.2-5 Item 10*
Post-developed	4 735,075 *Form 4.2-3 Item 13*	5 79.98 *Form 4.2-4 Item 14*	6 23.70 *Form 4.2-5 Item 14*
Difference	7 485,999 *Item 4 – Item 1*	8 55.68 *Item 2 – Item 5*	9 -27.11 *Item 6 – Item 3*
Difference (as % of pre-developed)	10 195% *Item 7 / Item 1*	11 229% *Item 8 / Item 2*	12 -53% *Item 9 / Item 3*

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

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

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

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

12 Pre-developed Volume (ft^3):
*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):
*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):
*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): *$T_{C-Hydro}$ = (Item 13 * 0.95) – Item 14*								

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

Compute peak runoff for pre- and post-developed conditions

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

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

4.3 BMP Selection and Sizing

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

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

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

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

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

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

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

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

4.3.1 Exceptions to Requirements for Bioretention Facilities

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

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

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

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

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

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design Measures reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design Measures shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design BMPs (DA 1)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 0 $V_{retention}$ *=Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft) (min. 0.5 ft.)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3): 0 $V_{retention}$ *=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): 0 *$V_{retention}$ = Sum of Item 17 for all BMPs*			
19 Total Retention Volume from Site Design BMPs: 0 *Sum of Items 5, 13 and 18*			

4.3.3 Infiltration BMPs

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

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

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

4.3.3.1 Allowed Variations for Special Site Conditions

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

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

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

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

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

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

1 Remaining LID DCV not met by site design BMP (ft^3): 148,187 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods*	0.00		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	5.00		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	0.00		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*			
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	0.20		
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	0.40		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
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*			

16 Total Retention Volume from LID Infiltration BMPs: 0 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 0% *Retention% = Item 16 / Form 4.2-1 Item 7*

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

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

4.3.4 Biotreatment BMP

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

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

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

<table>
<tr><th colspan="6">Form 4.3-4 Selection and Evaluation of Biotreatment BMP (DA 1)</th></tr>
<tr><td colspan="3">1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3):
148,187 Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16</td><td colspan="3">List pollutants of concern Copy from Form 2.3-1.
Pathogens, Nutrients, Noxious Aquadic Plants, Sediment, Metals, Oil & Grease, Trash/Debris, Pesticides/Herbisides, Organic Compounds.</td></tr>
<tr><td rowspan="2">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)</td><td colspan="3">Volume-based biotreatment
Use Forms 4.3-5 and 4.3-6 to compute treated volume</td><td colspan="2">Flow-based biotreatment
Use Form 4.3-7 to compute treated flow</td></tr>
<tr><td colspan="3">☒ Bioretention with underdrain
☐ Planter box with underdrain
☐ Constructed wetlands
☐ Wet extended detention
☐ Dry extended detention</td><td colspan="2">☐ Vegetated swale
☐ Vegetated filter strip
☐ Proprietary biotreatment</td></tr>
<tr><td colspan="2">3 Volume biotreated in volume based biotreatment BMP (ft^3): Form 4.3-5 Item 15 + Form 4.3-6 Item 13</td><td colspan="2">4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): Item 1 – Item 3</td><td colspan="2">5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % Item 4 / Item 1</td></tr>
<tr><td colspan="6">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)</td></tr>
<tr><td colspan="6">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.</td></tr>
</table>

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 1 DMA BMP Type Bioretention w/underdrain	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*	Pathogens, Nutrients, Noxious Aquadic Plants, Sediment, Metals, Oil & Grease, Trash/Debris, Pesticides/Herbisides, Organic Compounds.		
2 Amended soil infiltration rate *Typical ~ 5.0*	5.00		
3 Amended soil infiltration safety factor *Typical ~ 2.0*	2.00		
4 Amended soil design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	2.50		
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*	48		
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	1.50		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12 * Item 4 * Item 5) or Item 6*	1.50		
8 Amended soil surface area (ft^2)	74238		
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	1.5		
10 Amended soil porosity, *n*	0.15		
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	1.5		
12 Gravel porosity, *n*	0.4		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
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))]*	163324		
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 163324 *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): 148,187 *Copy Item 7 in Form 4.2-1*
2 On-site retention with site design BMP (ft^3): 0 *Copy Item18 in Form 4.3-2*
3 On-site retention with LID infiltration BMP (ft^3): 0 *Copy Item 16 in Form 4.3-3*
4 On-site biotreatment with volume based biotreatment BMP (ft^3): 163,324 *Copy Item 3 in Form 4.3-4*
5 Flow capacity provided by flow based biotreatment BMP (cfs): 0.00 *Copy Item 6 in Form 4.3-4*
6 LID BMP performance criteria are achieved if answer to any of the following is "Yes": • Full retention of LID DCV with site design or infiltration BMP: Yes ☐ No ☒ *If yes, sum of Items 2, 3, and 4 is greater than Item 1* • Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☒ No ☐ *If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized* ▪ On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐ *If yes, Form 4.3-1 Items 7 and 8 were both checked yes*
7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance: • Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐ *Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%* • Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated: 1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐ 2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐ 3) Equal or greater protection against shock loadings and spills; ☐ 4) Equal or greater accessibility and ease of inspection and maintenance. ☐

4.3.6 Hydromodification Control BMP

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

Form 4.3-9 Hydromodification Control BMPs (DA 1)	
1 Volume reduction needed for hydromodification performance criteria (ft^3): 449,245 *(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): 0 *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): 449,245 *Item 1 – Item 2*	4 Volume capture provided by incorporating additional on-site BMPs (ft^3): 0
5 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☒ *If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:* • Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP ☒ • Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐	
6 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☒ No ☐ *If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:* • Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs ☐	

4.4 Alternative Compliance Plan (if applicable)

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

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

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

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

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

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

<table>
<tr><th colspan="6">Form 5-1 BMP Inspection and Maintenance
(use additional forms as necessary)</th></tr>
<tr><th>BMP</th><th>Source Control BMP Identifier</th><th>Reponsible Party(s)</th><th>Inspection Activities Required</th><th>Maintenance Activities Required</th><th>Minimum Frequency of Activities</th></tr>
<tr><td rowspan="2">Building & Grounds Maintenance</td><td rowspan="2">~</td><td rowspan="2">DR. Prem Reddy Family Foundation</td><td>Inspect site for trash and debris</td><td>Clean up trash and debris</td><td>Weekly</td></tr>
<tr><td colspan="3">These maintenance activities have been derived from information in CASQA handout SC-41, which is provided in appendix B of the O&M plan.</td></tr>
<tr><td rowspan="3">Bioretention</td><td rowspan="3">~</td><td rowspan="3">DR. Prem Reddy Family Foundation</td><td>Inspect for trash, debris, sediment and damage.</td><td>Clean trash, debris, sediment and repair damage if needed</td><td>Monthly and after major storm events</td></tr>
<tr><td>Inspect mulch and plants</td><td>re-mulch and/or re-plant as needed</td><td>Annually</td></tr>
<tr><td colspan="3">These maintenance activities have been derived from information in CASQA handout TC-32, which is provided in appendix B of the O&M plan.</td></tr>
<tr><td>Education of Property Owners, Tenants & Occupants on Stormwater BMPs</td><td>N1</td><td>DR. Prem Reddy Family Foundation</td><td>The Property Owner will provide practical information materials to the first residents/occupants/tenants on general housekeeping practices that contribute to the protection of stormwater quality.</td><td>These materials will be initially included in the approved WQMP. Thereafter such materials will be available through the local jurisdiction’s storm water education program.</td><td>At time of hire/occupancy and annualy</td></tr>
</table>

			The current website is www.sbcountystormwater.org		
Activity Restrictions	N2	DR. **Prem Reddy Family Foundation**	- Vehicles and equipment will not be washed or maintenanced in areas exposed to storm water - do not use water to clean impervious areas - Restrictions shall conform to local water quality ordinance.		Revised annually prior to training (N1)
Landscape Management	N3	DR. **Prem Reddy Family Foundation**	Application of pesticides or herbicides shall be done by a licensed professional		When Applicable
			Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring.	Adjust timers, sprinkler heads and make repairs as needed	Monthly
			These maintenance activities have been derived from information in CASQA handout "Landscape Management", which is provided in appendix B of the O&M plan.		
BMP Maintenance	N4	DR. **Prem Reddy Family Foundation**	Identify responsibility for implementation of each non-structural BMP and scheduled cleaning and/or maintenance of all structural BMP facilities.	Maintain BMPs per Form 5-1	Per Form 5-1
Local Water Quality Ordinances	N6	DR. **Prem Reddy Family Foundation**	Local water quality ordinances shall be followed per local agency.	Implement this WQMP and comply with supplemental information provided by local jurisdiction in the future	As needed.
Spill prevention	N7	DR. **Prem Reddy Family Foundation**	Liquids with the potential to contaminate storm water shall not be stored outdoors. Containers shall be labeled according to their contents and inspected for leaks	Inspect storage areas and containers	Annually (prior to October 1st)
			Sorbent materials shall be kept on-site to be used in the event that a spill occurs	Inspect spill cleanup materials and restock if necessary	Annually and after spills
			These maintenance activities have been derived from information in CASQA handout SC-11, which is provided in appendix B of the O&M plan.		
Uniform Fire Code Implementation	N10	DR. **Prem Reddy Family**	An inventory of hazardous materials stored (including cleaning chemicals) on site will be created	Hazardous material inventory will be kept up to date as materials change	Monthly

		Foundation	Compliance with Article 80 of the Uniform Fire enforced by the fire protection agency.	Comply with requirements provided after fire protection agency inspections	After inspections
Litter/Debris Control Program	N11	DR. **Prem Reddy Family Foundation**	Implement trash management and litter control procedures in common areas to reduce pollution of drainage area	Empty trash receptacles	Weekly
Employee Training	N12	DR. **Prem Reddy Family Foundation**	Educational materials on general housekeeping practices for the protection of storm water quality shall be provided to employees.	Materials are available through local jurisdiction's storm water education program.	At time of hire
			Employees will be trained by the property owner or tenant on the implementation of this WQMP	Review WQMP material prior to annual training	Annually
			The current website is www.sbcountystormwater.org		
Housekeeping of Loading Docks	N13,S7	DR. **Prem Reddy Family Foundation**	Implementation of regular sweeping program and litter control	Dry-sweep loading areas and pick up trash	Monthly
			Check loading and unloading equipment regularly for leaks	Make repairs as needed	Monthly
			These maintenance activities have been derived from information in CASQA handout SD-31, which is provided in appendix B of the O&M plan.		
Catch Basin Inserts	N14	DR. **Prem Reddy Family Foundation**	Inspect for trash, debris and damage	Clean and repair as needed	Monthly
			These maintenance activities have been derived from information in CASQA handout MP-52, which is provided in appendix B of the O&M plan.		
Sweeping	N15	DR. **Prem Reddy Family Foundation**	Inspect parking lots for debris accumulation	Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the potential discharge of pollutants into the storm water conveyance system	Annually (prior to October 1st)

			These maintenance activities have been derived from information in CASQA handout SC-43, which is provided in appendix B of the O&M plan.		
NPDES Permits	N17	DR. **Prem Reddy Family Foundation**	Approval and implementation of this WQMP	Implement this WQMP	On going
			The owner/tenant shall insure that a industrial SWPPP is created if required based on the use of the site	Implement site specific SWPPP	Per separate SWPPP
Provide storm drain system stenciling and signage	S1	DR. **Prem Reddy Family Foundation**	Inspected storm drain system stenciling and signage	relabeled as necessary to maintain legibility	Annually
			These maintenance activities have been derived from information in CASQA handout SD-13, which is provided in appendix B of the O&M plan.		
Trash Enclosure	S3	DR. **Prem Reddy Family Foundation**	Inspect trash enclosure for debris	Clean enclosure area and dry sweep	Monthly
			Inspect receptacle for damage/leaks	Contact contracted refuse company for replacement as needed	Monthly
			See CASQA handout SD-32 in Appendix B of O&M plan for more detailed information.		
Use Efficient Irrigation Systems and Landscape Design	S4	DR. **Prem Reddy Family Foundation**	Designing irrigation systems to each landscape area's specific water requirements	Adjust irrigation system as needed to prevent overwatering	Monthly
			Irrigation systems shall conform to The Water Conservation in Landscaping Act of 2006, Assembly Bill (AB 1881). These maintenance activities have been derived from information in CASQA handout SD-12, which is provided in appendix B of the O&M plan.		
Finished Grade of Landscape Areas	S5	DR. **Prem Reddy Family Foundation**	Landscape areas are to be constructed with a minimum of 1 inch below adjacent impervious areas.	Adjust landscape areas so they are a minimum of 1 inch below adjacent impervious areas.	After construction
Protect slopes & channels & provide energy dissipation	S6	DR. **Prem Reddy Family Foundation**	Inspect for trash/debris at energy dissipaters, such as riprap, at the outlets of storm drains including basins	Clean and repair as needed	Annually
Hillside Landscaping	S13	DR. **Prem Reddy Family Foundati**	Inspect for disturbed hillside areas in and around project site	Hillside areas that are disturbed shall be landscaped with deep-rooted, drought tolerant	After construction

		on		plant species selected for erosion control, satisfactory to the local jurisdiction.	
			These maintenance activities have been derived from information in CASQA handout SD-10, which is provided in appendix B of the O&M plan.		

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.

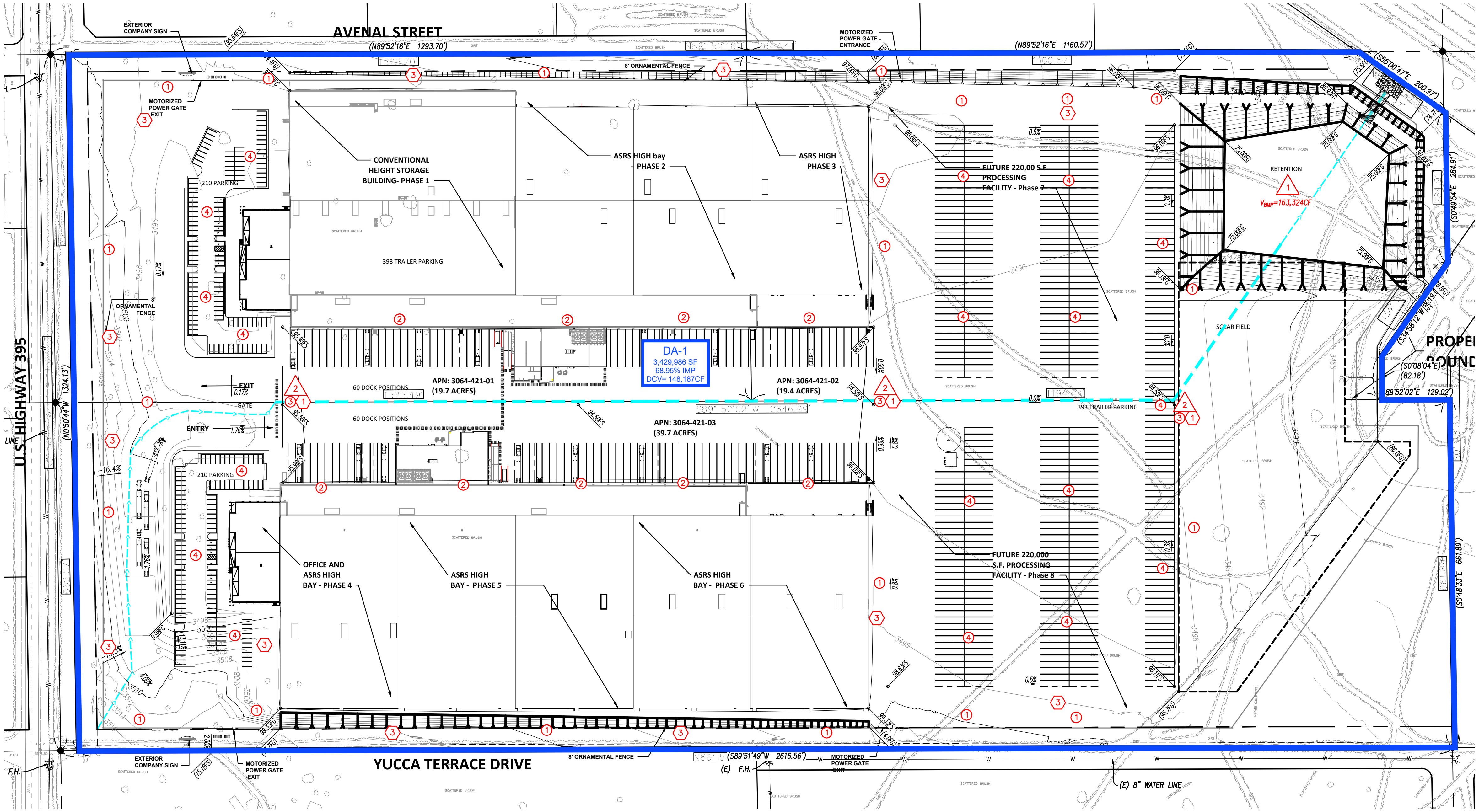
6.3 Post Construction

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 6.1 – Site Plan and Drainage Plan



OWNER INFORMATION:

DR. PREM REDDY FAMILY FOUNDATION
16850 BEAR VALLEY ROAD
VICTORVILLE, CA 92395

TEL. (***) ***-****

W.Q.M.P. NOTES:

1.) THIS WQMP EXHIBIT SHALL NOT BE USED FOR CONSTRUCTION. SEE APPROVED GRADING PLANS FOR CONSTRUCTIONS DETAILS AND CROSS-SECTIONS.

2.) STRUCTURAL BMPS MAY BE SUBSTITUTED FOR EQUIVALENT PRODUCTS WITH WRITTEN APPROVAL FROM THE ENGINEER OF RECORD, BASED ON AVAILABILITY AT TIME OF CONSTRUCTION.

3.) TREATMENT CONTROL BMPS MAY BE SUBSTITUTED FOR EQUIVALENT PRODUCTS WITH WRITTEN APPROVAL FROM THE ENGINEER OF RECORD.

LEGEND:

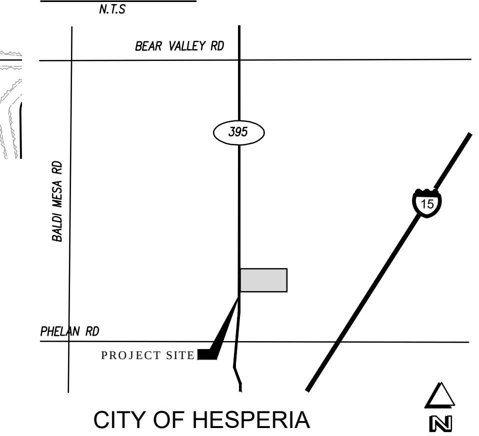
W.Q.M.P DRAINAGE AREA

PROPERTY LIMITS

FLOW LINE

VICINITY MAP

N.T.S



CITY OF HESPERIA

NON-STRUCTURAL SOURCE CONTROL BMPS (FORM 4.1-1):

- EDUCATION OF PROPERTY OWNERS, TENANTS AND OCCUPANTS ON STORMWATER BMPS [N1]
- ACTIVITY RESTRICTIONS [N2]
- 1 LANDSCAPE MANAGEMENT BMPS [N3]
- BMP MAINTENANCE [N4]
- LOCAL WATER QUALITY ORDINANCES [N6]
- LITTER/DEBRIS CONTROL PROGRAM [N11]
- EMPLOYEE TRAINING [N12]
- 2 HOUSEKEEPING OF LOADING DOCKS [N13] (CASQA SD-31)
- 3 CATCH BASIN INSPECTION PROGRAM [N14] (CASQA SC-44)
- 4 VACUUM SWEEPING OF PRIVATE STREETS AND PARKING LOTS [N15] (CASQA SC-43)
- COMPLY WITH ALL OTHER APPLICABLE NPDES PERMITS [N17]

STRUCTURAL SOURCE CONTROL BMPS (FORM 4.1-2):

- 1 PROVIDE STORM DRAIN SYSTEM STENCILLING AND SIGNAGE [S1] (CASQA SD-13)
- 2 DESIGN AND CONSTRUCT TRASH AND WASTE STORAGE AREAS TO REDUCE POLLUTION INTRODUCTION [S3] (CASQA SD-32)
- 3 USE EFFICIENT IRRIGATION SYSTEMS & LANDSCAPE DESIGN, WATER CONSERVATION, SMART CONTROLLERS, AND SOURCE CONTROL [S4] (CASQA SD-12)
- FINISH GRADE OF LANDSCAPED AREAS AT A MINIMUM OF 1-2 INCHES BELOW TOP OF CURB, SIDEWALK, OR PAVEMENT
- 4 COVERED DOCK AREAS [S7] (CASQA SD-31)

PROPOSED TREATMENT CONTROL BMP'S:

- 1 INFILTRATION BASIN (TC-11)
- 2 DRAIN INSERTS (MP-52)

100 0 100 200 300

SCALE: 1"=100'

PRELIMINARY W.Q.M.P.

A.P.N. 3064-421-01, -02-, & -03

US 395

REDUCED

BONADIMAN

JOSEPH E. BONADIMAN & ASSOCIATES, INC.
ENGINEERING • G.I.S. • SURVEYING • PLANNING

TEL. (909) 885-3806

PREPARED FOR: FISHER CONSTRUCTION GROUP				
DRAWN BY: SG	SCALE: 1" = 100'		SHEET: 1 OF 1	
CHECKED BY: J.T.S.	JOB NO: 204728			
DISREGARD PRINTS BEARING EARLIER REVISION DATES	05-08-2020			

Appendix 6.2 – Electronic Data Submittal

Note: A cd containing PDF versions of the WQMP documents will be included in this section during final engineering, when requested by the reviewing agency.

Appendix 6.3 – Post Construction

Note: As indicated in section 8.2.3 of the "Technical Guidance Document for Water Quality Management Plans", dated June 7, 2013, a maintenance agreement may be required by local jurisdiction for proposed BMPs. A maintenance agreement will be provided in this section if requested by the local jurisdiction.

Appendix 6.4 – Other Supporting Documentation

STORMWATER FACILITY MAPPING TOOL

WQMP Project Report

County of San Bernardino Stormwater Program

Santa Ana River Watershed Geodatabase

Monday, May 11, 2020

Note: The information provided in this report and on the Stormwater Geodatabase for the County of San Bernardino Stormwater Program is intended to provide basic guidance in the preparation of the applicant's Water Quality Management Plan (WQMP) and should not be relied upon without independent verification.

Project Site Parcel Number(s):	306442102, 306442103, 306442101
Project Site Acreage:	78.698
HCOC Exempt Area:	No
Closest Receiving Waters: **(Applicant to verify based on local drainage facilities and topography.)**	**System Number** - **Facility Name** - Oro Grande Wash **Owner** - SBCFCD
Closest channel segment's susceptibility to Hydromodification:	EHM
Highest downstream hydromodification susceptibility:	NULL
Is this drainage segment subject to TMDLs?	No
Are there downstream drainage segments subject to TMDLs?	No
Is this drainage segment a 303d listed stream?	No
Are there 303d listed streams downstream?	No
Are there unlined downstream waterbodies?	No
Project Site Onsite Soil Group(s):	A, B
Environmentally Sensitive Areas within 200':	DESERT TORTOISE HABITAT CAT 3
Groundwater Depth (FT):	No data available
Parcels with potential septic tanks within 1000':	Yes
Known Groundwater Contamination Plumes within 1000':	No
Studies and Reports Related to Project Site:	

NOAA Atlas 14, Volume 6, Version 2
Location name: Hesperia, California, USA*
Latitude: 34.4357°, Longitude: -117.395°
Elevation: 3501.72 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.083** (0.069-0.101)	**0.119** (0.098-0.146)	**0.167** (0.137-0.204)	**0.206** (0.168-0.254)	**0.259** (0.205-0.331)	**0.300** (0.232-0.392)	**0.343** (0.259-0.458)	**0.387** (0.284-0.532)	**0.447** (0.315-0.641)	**0.495** (0.337-0.734)
10-min	**0.119** (0.099-0.145)	**0.171** (0.141-0.209)	**0.239** (0.197-0.293)	**0.295** (0.241-0.364)	**0.371** (0.293-0.474)	**0.430** (0.333-0.562)	**0.491** (0.371-0.657)	**0.554** (0.407-0.762)	**0.641** (0.452-0.919)	**0.709** (0.483-1.05)
15-min	**0.144** (0.119-0.176)	**0.207** (0.171-0.252)	**0.289** (0.238-0.354)	**0.356** (0.291-0.440)	**0.449** (0.355-0.573)	**0.521** (0.403-0.679)	**0.594** (0.449-0.794)	**0.670** (0.492-0.922)	**0.775** (0.546-1.11)	**0.857** (0.584-1.27)
30-min	**0.219** (0.181-0.268)	**0.314** (0.260-0.384)	**0.440** (0.362-0.539)	**0.542** (0.443-0.670)	**0.683** (0.540-0.873)	**0.792** (0.613-1.03)	**0.904** (0.683-1.21)	**1.02** (0.749-1.40)	**1.18** (0.831-1.69)	**1.31** (0.888-1.94)
60-min	**0.307** (0.254-0.375)	**0.441** (0.364-0.538)	**0.616** (0.508-0.755)	**0.760** (0.621-0.939)	**0.957** (0.757-1.22)	**1.11** (0.859-1.45)	**1.27** (0.957-1.69)	**1.43** (1.05-1.97)	**1.65** (1.16-2.37)	**1.83** (1.24-2.71)
2-hr	**0.444** (0.368-0.542)	**0.604** (0.499-0.738)	**0.820** (0.676-1.00)	**1.00** (0.819-1.24)	**1.26** (0.994-1.61)	**1.46** (1.13-1.91)	**1.67** (1.26-2.24)	**1.90** (1.39-2.61)	**2.22** (1.56-3.18)	**2.47** (1.68-3.67)
3-hr	**0.561** (0.464-0.685)	**0.750** (0.620-0.917)	**1.01** (0.832-1.24)	**1.23** (1.00-1.52)	**1.54** (1.22-1.97)	**1.80** (1.39-2.34)	**2.06** (1.56-2.76)	**2.35** (1.72-3.23)	**2.76** (1.94-3.95)	**3.09** (2.10-4.58)
6-hr	**0.788** (0.652-0.962)	**1.04** (0.863-1.28)	**1.40** (1.15-1.72)	**1.71** (1.40-2.11)	**2.15** (1.70-2.75)	**2.51** (1.94-3.28)	**2.90** (2.19-3.88)	**3.32** (2.44-4.57)	**3.94** (2.77-5.64)	**4.44** (3.02-6.60)
12-hr	**1.01** (0.839-1.24)	**1.39** (1.15-1.69)	**1.90** (1.57-2.33)	**2.35** (1.92-2.90)	**2.99** (2.36-3.82)	**3.52** (2.72-4.59)	**4.08** (3.08-5.46)	**4.70** (3.45-6.46)	**5.59** (3.94-8.02)	**6.34** (4.31-9.40)
24-hr	**1.38** (1.23-1.59)	**1.96** (1.73-2.26)	**2.76** (2.43-3.19)	**3.44** (3.02-4.01)	**4.44** (3.76-5.34)	**5.25** (4.36-6.45)	**6.12** (4.96-7.71)	**7.07** (5.57-9.15)	**8.43** (6.37-11.4)	**9.57** (6.99-13.4)
2-day	**1.56** (1.38-1.79)	**2.20** (1.95-2.53)	**3.09** (2.73-3.58)	**3.87** (3.39-4.51)	**5.01** (4.25-6.04)	**5.96** (4.94-7.32)	**6.97** (5.65-8.79)	**8.09** (6.37-10.5)	**9.72** (7.35-13.1)	**11.1** (8.10-15.5)
3-day	**1.67** (1.48-1.92)	**2.34** (2.08-2.70)	**3.29** (2.91-3.81)	**4.13** (3.61-4.81)	**5.35** (4.53-6.44)	**6.36** (5.28-7.82)	**7.47** (6.05-9.40)	**8.68** (6.84-11.2)	**10.5** (7.91-14.1)	**12.0** (8.74-16.7)
4-day	**1.80** (1.60-2.07)	**2.52** (2.23-2.91)	**3.54** (3.13-4.09)	**4.43** (3.88-5.16)	**5.74** (4.87-6.91)	**6.83** (5.67-8.40)	**8.02** (6.49-10.1)	**9.32** (7.34-12.1)	**11.2** (8.50-15.2)	**12.9** (9.39-18.0)
7-day	**2.01** (1.78-2.31)	**2.79** (2.47-3.21)	**3.88** (3.42-4.48)	**4.83** (4.23-5.62)	**6.22** (5.27-7.49)	**7.37** (6.12-9.06)	**8.63** (6.99-10.9)	**10.0** (7.88-13.0)	**12.0** (9.09-16.2)	**13.7** (10.0-19.2)
10-day	**2.15** (1.91-2.48)	**2.97** (2.63-3.42)	**4.11** (3.63-4.75)	**5.10** (4.47-5.94)	**6.54** (5.55-7.88)	**7.74** (6.42-9.52)	**9.03** (7.32-11.4)	**10.5** (8.24-13.5)	**12.5** (9.47-16.9)	**14.3** (10.4-19.9)
20-day	**2.61** (2.31-3.00)	**3.57** (3.16-4.11)	**4.90** (4.33-5.67)	**6.06** (5.31-7.06)	**7.73** (6.55-9.31)	**9.10** (7.56-11.2)	**10.6** (8.58-13.3)	**12.2** (9.63-15.8)	**14.6** (11.0-19.7)	**16.6** (12.1-23.2)
30-day	**3.08** (2.73-3.54)	**4.18** (3.71-4.82)	**5.71** (5.04-6.60)	**7.02** (6.15-8.18)	**8.92** (7.56-10.7)	**10.5** (8.71-12.9)	**12.2** (9.87-15.3)	**14.0** (11.1-18.2)	**16.8** (12.7-22.6)	**19.0** (13.9-26.6)
45-day	**3.66** (3.24-4.21)	**4.90** (4.34-5.65)	**6.62** (5.84-7.64)	**8.09** (7.09-9.43)	**10.2** (8.66-12.3)	**12.0** (9.93-14.7)	**13.9** (11.2-17.5)	**15.9** (12.6-20.7)	**19.0** (14.4-25.6)	**21.6** (15.8-30.1)
60-day	**4.16** (3.69-4.79)	**5.49** (4.86-6.33)	**7.32** (6.46-8.46)	**8.89** (7.78-10.4)	**11.2** (9.45-13.4)	**13.0** (10.8-16.0)	**15.0** (12.2-18.9)	**17.3** (13.6-22.4)	**20.6** (15.6-27.8)	**23.4** (17.1-32.6)

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

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

Please refer to NOAA Atlas 14 document for more information.

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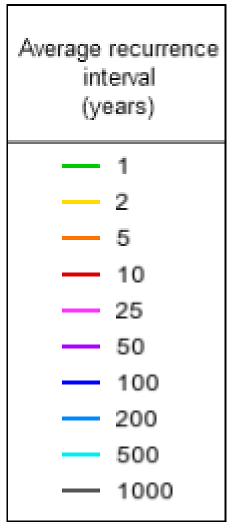
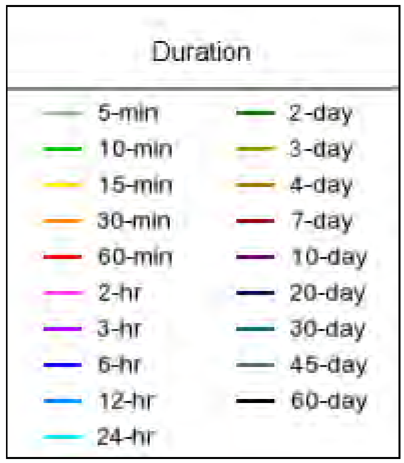
PF graphical

curve plots





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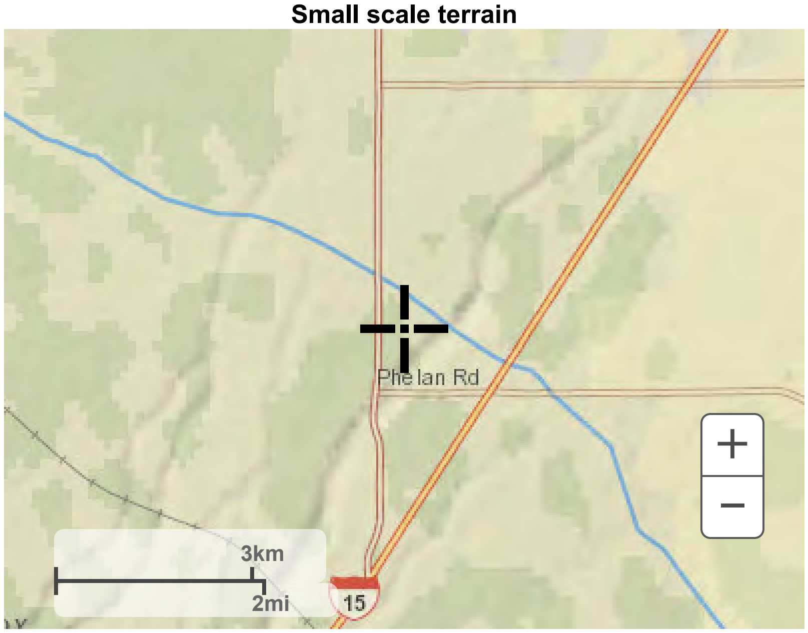
Maps & aerials

Small scale terrain



Large scale terrain

Large scale map

Large scale aerial

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Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	3	0.75
		Site soil variability	0.25	3	0.75
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			2.00
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.50
Combined Safety Factor, $S_{Total} = S_A \times S_B$					5.00
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					0.00
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					0.00

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

See Infiltration report in Appendix 6.4

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

SOILS SOUTHWEST, INC.
SOILS, MATERIALS AND ENVIRONMENTAL ENGINEERING CONSULTANTS

897 VIA LATA, SUITE N • COLTON, CA 92324 • (909) 370-0474 • (909) 370-0481 • FAX (909) 370-3156

Preliminary Evaluations

Due Diligence Report of WQMP-BMP Storm Water Disposal Design

Soil Infiltration Testing using 4-Double Ring and 1-Porchet Method
Proposed 80+ acre US Freezer/Cold Storage Distribution Center
NEC U.S. Highway 395 & Yucca Terrace Drive
City of Hesperia, San Bernardino County, California92344
A.P.N. 3064-421-01-0000,02 & 03

Project No. 19042-BMP1

March 19, 2020

Prepared for:

Fisher Construction Group
% Mr. Juan Ozuna, Project Manager
625 Fisher Lane
Burlington, WA 98233

soilssouthwest@aol.com
Established 1984

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March 19, 2020 Project No. 19042-BMP1

Fisher Construction Group
625 Fisher Lane
Burlington, WA 98233

Attention: Mr. Juan Ozuna, Project Manager

Subject: Preliminary Evaluations
Due Diligence Report of WQMP-BMP Storm Water Disposal Design
Soil Infiltration Testing using 4-Double Ring and 1-Porchet Method
Proposed 80+ acre US Freezer/Cold Storage Distribution Center
NEC U.S. Highway 395 & Yucca Terrace Drive
City of Hesperia, San Bernardino County, California 92344
A.P.N. 3064-421-01-0000,02,& 03

Reference: Site Plan by Bonadiman Engineers

Gentlemen:

Presented herewith are the results of preliminary soils infiltration testing performed for the for the site of the proposed U.S. Freezer/Cold Storage Distribution Center to be located at the northeast intersection of Highway 395 and Yucca Terrace Drive, City of Hesperia, San Bernardino County, California 92344.

It is understood that the stormwater disposal systems will be in form of in form of detention basin design and filtration trench or similar. As due diligence study, the test results included are for preliminary conceptual design purpose and may require additional evaluations once the project details are established.

For preliminary evaluations the infiltration testing includes four (4) shallow-depth testing using the standardized and well-documented constant head Double Ring (DR-1, DR-2, DR-3 and DR-4) test procedures performed in general conformance to the ASTM Standard D3385, along with an additional (1) deep testing using falling head test methods using Riverside County Environmental soil percolation test procedures with the percolation rates converted to infiltration rate using Porchet method. The infiltration test locations are selected within the general areas as designated in the referenced BMP layout plan as shown on the attached Plate A.

In general, the soils encountered primarily consist of slightly clayey, semi-cemented to cemented, fine to medium coarse silty gravely sands with traces of Caliche and minor fragmented rocks. Detailed descriptions of the soils encountered as shown on the attached test boring logs.

Based on the testing completed at the test locations as described, it is our opinion that for preliminary WQMP-BMP design, an average infiltration rate of 1.18 inch/hour maybe considered before using a factor of safety. Use of an appropriate factor of safety as selected by the project design engineer is suggested to account for long-term saturation, inconsistencies, potential for silting and lack of maintenance. Supplemental WQMP-BMP testing may be warranted.

We offer no other warranty, express or implied.

Respectfully submitted,
Soils Southwest, Inc.

Moloy Gupta, RCE 31708

John Flippin, Project Coordinator

REGISTERED PROFESSIONAL ENGINEER
MOLOY K. GUPTA
No. 31708
Exp. 12-31-20
CIVIL
STATE OF CALIFORNIA

1.0 Site Information

1.1 Proposed Development

No detailed development plan is available for review. However, based on the preliminary project information supplied it is understood that the subject site of about 80-acre will be developed primarily to include cold-storage freezer warehouse structures, along with WQMP-BMP detention basin/filtration trench disposal systems. Supplemental construction is anticipated to include truck paving, parking driveways and others. Moderate site preparations and grading should be anticipated with the development planned.

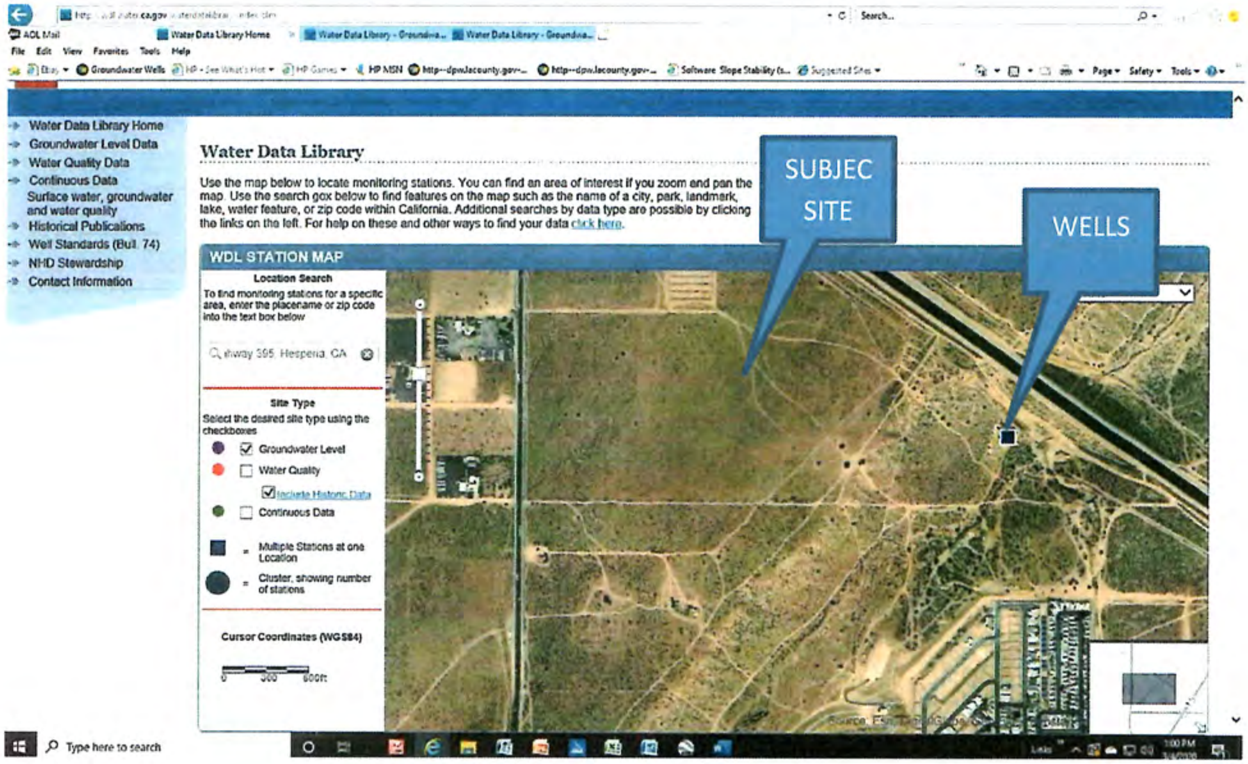
1.2 Infiltration Test Program

As suggested by the project design engineers, for shallow-depth testing (DR-1, DR-2, DR-3 and DR-4) using Double Ring Infiltrometer (ASTM Standard D3385) four (4) test trenches are made using a backhoe advanced to about five (5) feet below existing grade. For additional deep testing using Porchet Method, an exploratory test boring is made using a truck-mounted drilling rig advanced to about 12 feet below grade. The test locations are as described in the Plate A, attached.

Within the maximum exploratory depth of 31 feet associated the project geotechnical evaluations, it is our opinion that soils encountered consist, in general of, slightly clayey, semi-cemented to cemented, fine to medium coarse silty gravely sands with traces of Caliche and minor fragmented rocks. Detailed descriptions of the soils encountered as shown on the attached test boring logs.

1.3 Groundwater

No ground water was encountered in any of the test trenches explored and in during the geotechnical test borings advanced to maximum 31 feet depth grade, Based on review of the available water data from the nearest water well, it is estimated that the depth ground water within the site vicinity is in excess of 100 feet.


Water Data Library Home
Groundwater Level Data
Water Quality Data
Continuous Data
Surface water, groundwater and water quality
Historical Publications
Well Standards (Bull. 74)
NHD Stewardship
Contact Information
Water Data Library
Use the map below to locate monitoring stations. You can find an area of interest if you zoom and pan the map. Use the search gox below to find features on the map such as the name of a city, park, landmark, lake, water feature, or zip code within California. Additional searches by data type are possible by clicking the links on the left. For help on these and other ways to find your data click here.
WDL STATION MAP
Location Search
To find monitoring stations for a specific area, enter the placename or zip code into the text box below
Site Type
Select the desired site type using the checkboxes
Groundwater Level
Water Quality
Include Historic Data
Continuous Data
Multiple Stations at one Location
Cluster, showing number of stations
Cursor Coordinates (WGS84)
SUBJEC
SITE
WELLS

2.0 Shallow Depth Soil Percolation Testing

Prior shallow-depth infiltration testing using Double Ring Infiltrometer, following test excavations (+/- 5 feet), the excavated bottom loose soils were removed and leveled to expose the underlying undisturbed natural subgrades. Water used during percolation testing was supplied by using a potable water tank. Equipment used primarily include the following:

- Double Ring Infiltrometer with inner and outer rings of 12-inch and 24-inch (2 to 1 ratio) in diameter, respectively
- Shovel (flat head)
- Level
- Mallet-like small sledgehammer
- 2" x 4" timber (for protecting plate while hammering in rings)
- Plastic measuring rulers (30 cm/12-inc) with millimeter and centimeter scale ruler
- Watch
- Rubber plash guards
- (2) Marriotte Tubes
- Wood Measuring Rod with Styrofoam float attached at end (for Porchet perforated pvc pipe method Testing)

2.1 Methodology and Test Procedures

2.1.1 Shallow-Depth Double-Ring Infiltrometer Test Equipment Set-Up:

Soil infiltration test was performed using two described concentric rings established at the depth of the proposed infiltration design bottom as determined by the project civil engineer. During testing, the 12-inch diameter inner ring was centered inside the 24-inch diameter outer-ring. Prior to actual testing, both the rings were pushed into soil using a sledgehammer and driving plate with a 2" x 4" timber for protecting the driving plate. Water supplied by a portable water tank was used to fill the annular-space to about 4-inch, followed by the inner-ring to the same level described. A constant water head was maintained using Marriotte Tubes at 15,30, and 60-minute testing intervals.

ASTM Method D3385 describes the double ring test method as follows:

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

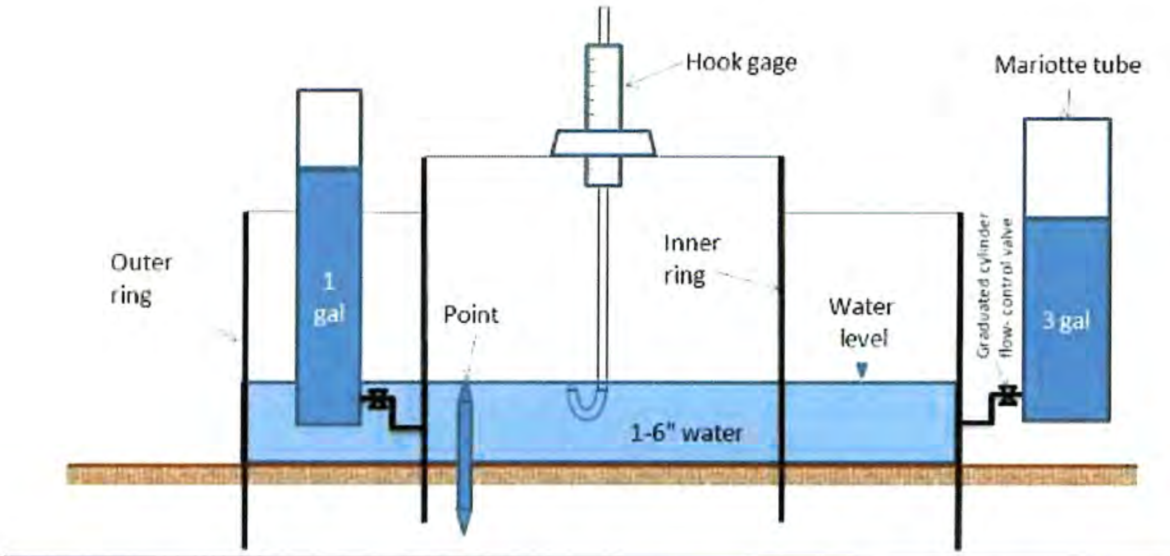


Figure 1-Typical Double Ring Installation with Mariotte Tubes

The purpose of the outer ring is to promote one-dimensional and vertical flow beneath the inner ring forcing the water contained in the inside ring to percolate straight downward and not to the sides. By measuring the vertical permeability, we have determined the most conservative infiltration rate.

The percolation/infiltration test pits were dug to depths of about 5 feet in the proposed infiltration areas. Then, by using an impact-absorbing hammer, we inserted the dual infiltration rings about 5 cm vertically into the soil.

The County Handbook states, "While there are two operational techniques used with double ring infiltrometers, the constant head method and the falling head method, ASTM D3385 mandates the use of the constant head method" **(Figure 1).**

Mariotte tubes, or 'bubblers' were used to maintain a constant head of water for both the inner and outer annular rings. As necessary, level of water to maintain constant heads were added manually. Actual measurements were taken by reading the calibration on the external Mariotte tubes to determine the constant head infiltration rate for each timed interval, 15,30, and 60-minutes respectively. For the inner and annular space rings, water levels were maintained about the same level in both rings throughout the testing to prevent flow of water from one ring to the other.

The volume of liquid used during each measured time interval was converted into an incremental infiltration velocity of the inner ring using the following equations:

For the inner ring calculated as follows: $V_{ir} = \Delta V_{ir} / (A_{ir} \Delta t)$

where: V_{ir} = inner ring incremental infiltration velocity, cm/hr

ΔV_{ir} = volume of liquid used during time interval to maintain constant head in the inner ring, cm^3

A_{ir} = internal area of the inner ring, cm^2

Δt = time interval, hr.

The outer ring is calculated in the same way using the outer ring values and data. Although the outer ring data has been included, typically it is not used for calculating infiltration rates.

2.1.2_Porchet Method Deep Test Set-up:

The test boring hole was drilled to the desired depth by using a 8-inch diameter hollow-stem auger drill rig. A perforated 3-inch diameter PVC pipe was installed in the test hole and presoaked the night before. A wooden rod with a Styrofoam float attachment was inserted inside the pipe to measure the rate (inches/minute) at which water infiltrated into the soil.

Considering that less than 6 inches seeped within the 25 -minute initial pre-saturation testing, subsequent test trials were performed at 30-minute intervals until soil conditions became saturated and constant in infiltrating rate.

Measurements continued until a relatively constant rate was reached. We used the last reading of a site as the design rate. The testing data sheets are attached in Appendix A and summarized in Table 1.

3.0 Observed Infiltration Test Results

Based on the soils infiltration testing completed, the following presents the infiltration rates for the test locations and test depth described. Actual field test data are attached.

Observed Infiltration Rate

Test No.	Method	Relative Site Location	Test Depth (ft.) Below Grade	Observed Rate (inch/hour.) (Inner Ring)
DR-1	Double Ring	Southwest	5.0	1.38
DR-2	Double Ring	Northwest	5.0	1.36
DR-3	Double Ring	Northeast	5.0	0.00
DR-4	Double Ring	Northeast	5.0	3.04
P-5	Porchet	Northeast	12.0	0.14

4.0 Conclusions

Based on the testing completed for the test locations and depths as described, it is our opinion that for preliminary design purposes, an average observed infiltration rate of 1.18 inch/hour maybe considered before using a factor of safety. it is suggested that, use of an appropriate factor of safety should considered to the observed rate as selected by design engineer to account for long-term saturation, inconsistencies in subsoil conditions, potential for silting and lack of maintenance.

The infiltration rate described is based on the in-situ testing completed at the locations and the depths as suggested by the project civil engineer. In event the final basin location and basin depth vary considerably from those as described herein, supplemental soils infiltration testing may be warranted.

It should be noted that over prolong use and lack of maintenance the detention/infiltration basin constructed based on the suggested design rate may experience much lower infiltration rate due to the accumulation of silts, fines, oils and others. Regular maintenance of the basins surfaces in form of removal of debris, oil and fines are strongly recommended. A maintenance record of such is suggested for future use, if any.

We offer no other warranty, express or implied.

<u>Suggested Site Requirements for Stormwater BMP installation</u>

The invert of stormwater infiltration shall be at least 10 feet above the groundwater elevation. Stormwater infiltration BMPs shall not be placed on steep slopes and shall not create the condition or potential for slopes instability.

Stormwater infiltration shall not increase the potential for static or seismic settlement of structures on or adjacent to the site. Potential geotechnical hazards that shall be addressed including potentials for collapsible and liquefaction, if any.

Stormwater infiltration shall not place an increased surcharge on structures or foundations on or its adjacent. The pore-water pressure shall not be increased on soil retaining structures on or adjacent to the site.

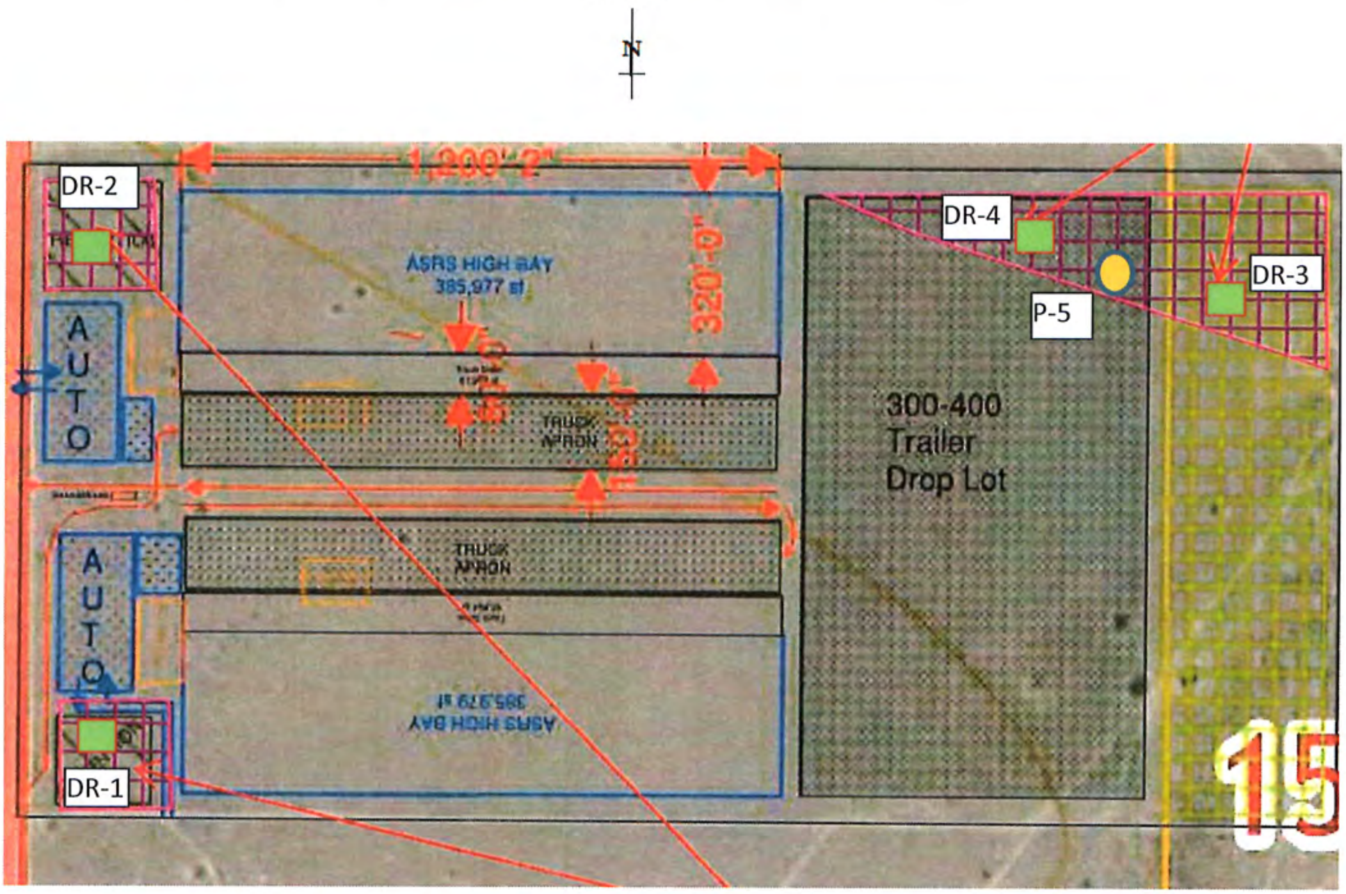
The invert of stormwater infiltration shall be set back at least 15 feet, and outside a 1:1 plan drawn up from the bottom of adjacent foundations.

Stormwater infiltration shall not be located near utility lines where the introduction of stormwater could cause damage to utilities or settlement of trench backfill.

Stormwater infiltration is not allowed within 100 feet of any potable groundwater production well.

PLOT PLAN AND TEST LOCATIONS

Proposed 80+ acre Freezer/Cold Storage Distribution Center
NEC U.S. Highway 395 & Yucca Terrace Drive
City of Hesperia, San Bernardino County, California92344
(NTS)



Legend: DR-1 Approximate Location of BMP-Double Ring (DR) Infiltrometer Test Pit

P-5 Approximate Location of BMP Test Boring and Testing using Porchet Method

Plate A

APPENDIX A

Field Data Test Sheets

DOUBLE RING INFILTRATION TEST - CONSTANT HEAD

Owner/Project	U.S Cold Storage/ Fischer Construction				TEST #	DRI-1
	NEC U.S. Hw. 395 and Yucca Terrace Dr. Hesperia					
Date Tested	2/18/20	Depth 5 ft	Comments		USCS	SP
Inner Ring	Diam. 30 cm	Area 729 cm2	Liquid of Depth	10.0cm	Bubbler Vol/Δ h	62.04 cm3/cm
Outer Ring	Diam. 60 cm	Area 2188 cm2	Liquid of Depth	10.0 cm	Bubbler Vol/Δ h	182.3 cm3/cm

	Time (hr/min)	Time Interval (min)	Cumulativ Time (min)	Inner Ring Reading (cm)	Inner Ring Change (cm)	Inner Ring Flow (cc)	Outer Ring Reading (cm)	Outer Ring Change (cm)	Outer Ring Flow (cc)	Inner Ring Inf Rate (cm/hr)	Outer Ring Inf Rate (cm/hr)	Inner Ring Inf Rate (in/hr)	Outer Ring Inf Rate (in/hr)
1	10:34			58.0			58.0						
	10:49	15	15	33.5	24.5	1520	32.8	25.3	4603	8.34	8.42	3.28	3.31
2	10:51			58.0			58.0						
	11:06	15	17	33.5	24.5	1520	33.0	25.0	4558	8.34	8.33	3.28	3.28
3	11:08			58.0			58.0						
	11:23	15	34	36.0	22.0	1365	35.5	22.5	4102	7.49	7.50	2.95	2.95
4	11:25			58.0			58.0						
	11:40	15	51	37.5	20.5	1272	35.0	23.0	4193	6.98	7.67	2.75	3.02
5	11:42			58.0			58.0						
	12:12	30	83	31.5	26.5	1644	30.8	27.3	4968	4.51	4.54	1.78	1.79
6	12:14			58.0			58.0						
	12:44	30	115	32.0	26.0	1613	31.3	26.8	4877	4.43	4.46	1.74	1.75
7	12:46			58.0			58.0						
	1:46	60	177	16.0	42.0	2606	14.8	43.3	7884	3.57	3.60	1.41	1.42
8	1:48			58.0			58.0						
	2:48	60	239	16.3	41.8	2590	14.8	43.3	7884	3.55	3.60	1.40	1.42
9	2:50			58.0			58.0						
	3:50	60	301	16.8	41.3	2559	15.0	43.0	7839	3.51	3.58	1.38	1.41
10	3:52			58.0			58.0						
	4:52	60	363	16.8	41.3	2559	15.0	43.0	7839	3.51	3.58	1.38	1.41
11	4:55			58.0			58.0						
	5:55	60	425	16.8	41.3	2559	15.0	43.0	7839	3.51	3.58	1.38	1.41

DOUBLE RING INFILTRATION TEST - CONSTANT HEAD

Owner/Project U.S Cold Storage/ Fischer Construction TEST # **DRI-2**

NEC U.S. Hw. 395 and Yucca Terrace Dr. Hesperia

Date Tested 2/18/20 Depth 5 ft **Comments** USCS SP

Inner Ring Diam. 30 cm Area 729 cm2 Liquid of Depth 10.0cm Bubbler Vol/Δ h 62.04 cm3/cm

Outer Ring Diam. 60 cm Area 2188 cm2 Liquid of Depth 10.0 cm Bubbler Vol/Δ h 182.3 cm3/cm

	Time (hr/min)	Time Interval (min)	Cumulativ Time (min)	Inner Ring Reading (cm)	Inner Ring Change (cm)	Inner Ring Flow (cc)	Outer Ring Reading (cm)	Outer Ring Change (cm)	Outer Ring Flow (cc)	Inner Ring Inf Rate (cm/hr)	Outer Ring Inf Rate (cm/hr)	Inner Ring Inf Rate (in/hr)	Outer Ring Inf Rate (in/hr)
1	10:40			58.0			58.0						
	10:55	15	15	42.5	15.5	962	42.0	16.0	2917	5.28	5.33	2.08	2.10
2	10:57			58.0			58.0						
	11:12	15	17	44.0	14.0	869	42.3	15.8	2871	4.77	5.25	1.88	2.07
3	11:14			58.0			58.0						
	11:29	15	34	44.5	13.5	838	42.5	15.5	2826	4.60	5.17	1.81	2.03
4	11:31			58.0			58.0						
	11:46	15	51	44.5	13.5	838	42.5	15.5	2826	4.60	5.17	1.81	2.03
5	11:48			58.0			58.0						
	12:18	30	83	34.0	24.0	1489	26.5	31.5	5742	4.08	5.25	1.61	2.07
6	12:20			58.0			58.0						
	12:50	30	115	35.5	22.5	1396	28.3	29.8	5423	3.83	4.96	1.51	1.95
7	12:52			58.0			58.0						
	1:52	60	177	17.0	41.0	2544	14.8	43.3	7884	3.49	3.60	1.37	1.42
8	1:54			58.0			58.0						
	2:54	60	239	17.0	41.0	2544	14.8	43.3	7884	3.49	3.60	1.37	1.42
9	2:56			58.0			58.0						
	3:56	60	301	17.5	40.5	2513	15.3	42.8	7793	3.45	3.56	1.36	1.40
10	3:58			58.0			58.0						
	4:58	60	363	17.5	40.5	2513	15.3	42.8	7793	3.45	3.56	1.36	1.40

DOUBLE RING INFILTRATION TEST - CONSTANT HEAD

Owner/Project U.S Cold Storage/ Fischer Construction — **TEST #** DRI-3

NEC U.S. Hw. 395 and Yucca Terrace Dr. Hesperia

Date Tested 2/28/20 — Depth 5 ft — **Comments** — USCS SM-SC cemented sands

Inner Ring Diam. 30 cm — Area 729 cm2 — Liquid of Depth 10.0cm — Bubbler Vol/Δ h 62.04 cm3/cm

Outer Ring Diam. 60 cm — Area 2188 cm2 — Liquid of Depth 10.0 cm — Bubbler Vol/Δ h 182.3 cm3/cm

	Time (hr/min)	Time Interval (min)	Cumulative Time (min)	Inner Ring Reading (cm)	Inner Ring Change (cm)	Inner Ring Flow (cc)	Outer Ring Reading (cm)	Outer Ring Change (cm)	Outer Ring Flow (cc)	Inner Ring Inf Rate (cm/hr)	Outer Ring Inf Rate (cm/hr)	Inner Ring Inf Rate (in/hr)	Outer Ring Inf Rate (in/hr)
1	10:15			58.0			58.0						
	10:30	15	15	56.8	1.3	78	42.8	15.3	2780	0.43	5.08	0.17	2.00
2	10:32			58.0			58.0						
	10:47	15	17	56.8	1.3	78	43.5	14.5	2643	0.43	4.83	0.17	1.90
3	10:49			58.0			58.0						
	11:04	15	34	57.0	1.0	62	44.0	14.0	2552	0.34	4.67	0.13	1.84
4	11:06			58.0			58.0						
	11:21	15	51	57.5	0.5	31	44.0	14.0	2552	0.17	4.67	0.07	1.84
5	11:23			58.0			58.0						
	11:53	30	83	57.0	1.0	62	43.3	14.8	2689	0.17	2.46	0.07	0.97
6	11:55			58.0			58.0						
	12:25	30	115	57.3	0.8	47	45.0	13.0	2370	0.13	2.17	0.05	0.85
7	12:27			58.0			58.0						
	1:27	60	177	57.8	0.3	16	41.5	16.5	3008	0.02	1.37	0.01	0.54
8	1:29			58.0			58.0						
	2:29	60	239	58.0	0.0	0	41.5	16.5	3008	0.00	1.37	0.00	0.54
9	2:31			58.0			58.0						
	3:01	60	301	58.0	0.0	0	41.8	16.3	2962	0.00	1.35	0.00	0.53

DOUBLE RING INFILTRATION TEST - CONSTANT HEAD

Owner/Project: U.S Cold Storage/ Fischer Construction
NEC U.S. Hw. 395 and Yucca Terrace Dr. Hesperia

TEST # DRI-4

Date Tested: 2/28/20 Depth 5 ft

Comments: USCS SP-SM Semi cemented sands

Inner Ring Diam. 30 cm Area 729 cm2 Liquid of Depth 10.0cm Bubbler Vol/Δ h 62.04 cm3/cm

Outer Ring Diam. 60 cm Area 2188 cm2 Liquid of Depth 10.0 cm Bubbler Vol/Δ h 182.3 cm3/cm

	Time (hr/min)	Time Interval (min)	Cumulativ Time (min)	Inner Ring Reading (cm)	Inner Ring Change (cm)	Inner Ring Flow (cc)	Outer Ring Reading (cm)	Outer Ring Change (cm)	Outer Ring Flow (cc)	Inner Ring Inf Rate (cm/hr)	Outer Ring Inf Rate (cm/hr)	Inner Ring Inf Rate (in/hr)	Outer Ring Inf Rate (in/hr)
1	10:25			91.5			107.0						
	10:40	15	15	0.0	91.5	5677	0.0	107.0	19506	31.15	35.66	12.26	14.04
2	10:42			91.3			106.8						
	10:57	15	17	0.0	91.3	5661	0.0	106.8	19461	31.06	35.58	12.23	14.01
3	11:00			90.8			106.0						
	11:15	15	35	0.0	90.8	5630	0.0	106.0	19324	30.89	35.33	12.16	13.91
4	11:17			90.3			105.5						
	11:32	15	52	0.0	90.3	5599	0.0	105.5	19233	30.72	35.16	12.10	13.84
5	11:34			90.3			107.3						
	12:04	30	84	0.0	90.3	5599	0.0	107.3	19552	15.36	17.87	6.05	7.04
6	12:06			89.0			107.0						
	12:36	30	116	0.0	89.0	5522	0.0	107.0	19506	15.15	17.83	5.96	7.02
7	12:38			91.0			108.0						
	1:38	60	178	0.0	91.0	5646	0.0	108.0	19688	7.74	9.00	3.05	3.54
8	1:40			90.8			108.0						
	2:40	60	240	0.0	90.8	5630	0.0	108.0	19688	7.72	9.00	3.04	3.54
9	2:42			90.8			107.5						
	3:42	60	302	0.0	90.8	5633	0.0	107.5	19597	7.73	8.96	3.04	3.53

Percolation Test Data Sheet

Project:	U.S. COLD STORAGE		Project No:	19042-BMP		Date:	2-28-20
Test Hole No:		P-5	Tested By:	JF, ALEX			
Depth of Test Hole, D_T:		144 INCH	USCS Soil Classification:		SP		
Test Hole Dimensions (inches)					Length	Width	
Diameter (if round)=		6 INCHES	Sides (if rectangular)=				

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	11:45	12:10	25	118	122.5	4.5	N
2							

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	12:15	12:45	30	118	121.5	3.5	8.57
2	12:47	1:17	30	118	120.5	2.5	12.00
3	1:20	1:50	30	118	120.5	2.5	12.00
4	1:52	2:22	30	118	120.0	2.0	15.00
5	2:25	2:55	30	118	119.5	1.5	20.00
6	2:57	3:27	30	118	119.5	1.5	20.00
7	3:30	4:00	30	118	119.0	1.0	30.00
8	4:01	4:31	30	118	119.0	1.0	30.00
9	4:32	5:02	30	118	119.0	1.0	30.00
10							
11							
12							
13							
14							
15							

COMMENTS:

APPENDIX B

Log of Test Pits (DR) and Test Boring (P)

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF TEST PIT DR-1

Project: U.S. Cold Storage/Fischer Construction		Job No.: 19042-BMP
Logged By: John F.	Boring Diam.: Backhoe	Date: 2-18-20

Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
				SP			Surface weeds and scattered desert brush
							SAND - Light brown, traces of silt, fine to medium coarse, pebbles, occasional rock fragments and scattered 1/2" to 1" rock
						5	- color change to light yellowish brown, gravely, fine to medium coarse, occasional rock fragments and rock, scattered cobbles
							- End of BMP Infiltration Test Pit @ 5.0 ft. - no bedrock - no groundwater
						10	
						15	
						20	
						25	
						30	

Groundwater: n/a Approx. Depth of Bedrock: n/a Datum: n/a Elevation: n/a	**Site Location** Proposed Industrial Commercial Warehouse NEC U.S. Hw 395 and Yucca Terrace Dr.Hesperia	**Plate #**

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF TEST PIT DR-2

Project: U.S. Cold Storage/Fischer Construction		Job No.: 19042-BMP
Logged By: John F.	Boring Diam.: Backhoe	Date: 2-18-20

Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
				SP			Surface weeds and scattered desert brush
							SAND - Light brown, traces of silt, fine to gravely, medium coarse, pebbles, occasional rock fragments, dry to dry to damp
						5	- color change to light yellowish brown, gravely, fine to medium coarse, occasional rock fragments and rock, scattered cobbles
							- End of BMP Infiltration Test Pit @ 5.0 ft. - no bedrock - no groundwater
						10	
						15	
						20	
						25	
						30	

Groundwater: n/a Approx. Depth of Bedrock: n/a Datum: n/a Elevation: n/a	**Site Location** Proposed Industrial Commercial Warehouse NEC U.S. Hw 395 and Yucca Terrace Dr.Hesperia	**Plate #**

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF TEST PIT DR-3

Project: U.S. Cold Storage/Fischer Construction		**Job No.:**	19042-BMP
Logged By: John F.	**Boring Diam.:** Backhoe	**Date:**	2-18-20

Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
				SP-SM			surface weeds and scattered desert brush SAND - light yellowish brown, slightly silty fine to medium, pebbles, occasional rock fragments
				SM-SC		5	- color change to reddish grayish brown, slightly silty and clayey, semi-cemented, fine to medium coarse, pebbles, rock,dry fragments
							- End of BMP Infiltration test pit @ 5.0 ft. - No bedrock - No groundwater
						10	
						15	
						20	
						25	
						30	

Groundwater: n/a **Approx. Depth of Bedrock:** n/a **Datum:** n/a **Elevation:** n/a	**Site Location** Proposed Industrial Commercial Warehouse NEC U.S. Hw 395 and Yucca Terrace Dr.Hesperia	**Plate #**

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF TEST PIT DR-4

Project: U.S. Cold Storage/Fischer Construction		**Job No.:**	19042-BMP
Logged By: John F.	**Boring Diam.:** Backhoe	**Date:**	2-18-20

Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
				SP-SM			surface weeds and scattered desert brush
							SAND - light yellowish brown, slightly silty fine to medium, pebbles, occasional rock fragments
				SP			- color change to reddish grayish brown, traces of silt and clay, gravely, semi-cemented, d.g origin materials, fine to medium coarse, pebbles, rock fragments, dry
						5	- End of BMP Infiltration test pit @ 5.0 ft. - No bedrock - No groundwater
						10	
						15	
						20	
						25	
						30	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: n/a
Elevation: n/a

Site Location
Proposed Industrial Commercial Warehouse
NEC U.S. Hw 395 and Yucca Terrace Dr.Hesperia

Plate #

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING P-5

Project: U.S. Cold Storage/Fischer Construction		**Job No.:** 19042-BMP
Logged By: John F.	**Boring Diam.:** Backhoe	**Date:** 2-18-20

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP-SM			surface weeds and scattered desert brush
								SAND - light yellowish brown, slightly silty fine to medium, pebble, scattered rock fragments and 1/2"-1" rock, dry
					SP			- color change to light brown, traces of silt, fine to medium, pebble, occasional rock fragments, scattered rock 1/2" to 1" rock
							5	
							10	
					GM-SM			- color change to gray-brown, silty with gravels, fine to medium coarse, rock fragments and occasional rock
							15	- End of infiltration test boring @ 12.0 ft. - no bedrock - no groundwater
							20	
							25	
							30	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: n/a
Elevation: n/a

Site Location
Proposed Industrial Commercial Warehouse
NEC U.S. Hw 395 and Yucca Terrace Dr.Hesperia

Plate #

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-1

Project:	Fisher Construction/U.S. Cold Storage	**Job No.:**	19042-F
Logged By: John F.	**Boring Diam.:** 6" HSA	**Date:**	March 13,2020

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SM			surface weeds and desert brush
								SAND - light brown, silty, fine to medium, pebbles, scattered rock fragments, dry to damp
					SP		5	- fine to medium coarse with occasional 1/2" - 1" rock, dry to damp
								- color change to light yellow brown, traces of silt, fine to medium coarse, pebble, rock fragments, scattered rock 1/2"-1"
							10	
23					SM-ML			- medium dense silty semi-cemented with white flecks, fine, pebbles
								- with rocks 1/2" -1" dry
							15	
					SP			- color change to light brown, gravely, medium coarse to coarse, rock fragments, rock
					SP-SC		20	- color change to light gray-brown, slightly clayey, fine to medium with pebble, rock fragments, damp to moist
26					SP			- gravely, medium to medium coarse, pebbles rock fragments, rock 1", dry to damp
							25	
								- gravely, medium coarse to coarse
							30	
40								
								- End of test boring @ 31.0 ft. - no bedrock - no groundwater

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: n/a
Elevation: n/a

Site Location
Proposed Freezer Warehouses and
Trailer Parking
NEC Yucca Terrace Drive and U.S.
Highway 395
Hesperia, California

Plate #

Standard penetration test

APPENDIX C

Photos of Double Ring Infiltrometer Test Pits Equipment Set-up and Testing

DR-2

DR-2

DR-3 Northeast Test Pit

Source Control/Site Design BMPs

BG-40 Landscape Maintenance

Photo Credit: Geoff Brosseau

Description

This category includes businesses that provide landscaping and landscape maintenance/gardening services.

Pollutant Sources

The following are sources of pollutants:

- Selecting plants or landscape design,
- Installing new landscaping,
- Maintaining landscapes,
- Using pesticides and fertilizers, and
- Using gas-powered equipment.

Pollutants can include:

- Nutrients (fertilizers, yard wastes),
- Pesticides,
- Heavy metals (copper, lead, and zinc),
- Hydrocarbons (fuels, oils and grease), and
- Sediments.

Approach

Minimize the potential for stormwater pollution and the need for resources/controls (water, pesticides, fertilizers) by creating and maintaining landscapes in a way that is compatible with the local soils, climate, and amount of rain and sun. Make stormwater pollution prevention BMPs a part of standard operating procedures and the employee training program.

CALIFORNIA STORMWATER QUALITY ASSOCIATION®

Provide employee education materials in the first language of employees, as necessary.

Source Control BMPs

The best management practices are listed by activity or area.

Landscape Design	☐ Specify native, low maintenance, and insectary (attract beneficial insects) plants and landscape designs. ☐ Design zoned, water-efficient irrigation systems using technologies such drip irrigation, soaker hoses, or microspray systems. Landscape design should be consistent with the local Water Efficient Landscape Ordinance. See the following website for a list of local ordinances: ftp://ftp.water.ca.gov/Model-Water-Efficient-Landscape-Ordinance/Local-Ordinances/ ☐ Do not landscape riparian areas, except to remove non-native plants and replace them with native riparian landscaping. ☐ Replant with native species where possible when landscaping or building an ornamental pond. Do not assume something is native because you have seen it in your area. Contact the local nursery for information or visit the California Exotic Pest Plant Council website (www.caleppc.org).
Landscape Installation	☐ Protect stockpiles and landscaping materials from wind and rain by storing them under tarps or secured plastic sheeting. ☐ Schedule grading and excavation projects during dry weather. ☐ Divert runoff from exposed soils or lower its velocity by leveling and terracing. ☐ Use temporary check dams or ditches to divert runoff away from storm drains. ☐ Protect storm drains with sandbags or other sediment controls. ☐ Revegetation is an excellent form of erosion control for any site. Keep soils covered with vegetation or temporary cover material (mulch) to control erosion. ☐ Check plant roots before buying a plant. Do not buy plants with roots are that kinked or circling around the container. Do not buy plants with soft, rotten, or deformed root crowns. ☐ Do not pile soil around the plant any higher than the root crown.
Landscape Maintenance	Yard Waste ☐ Allow leaf drop to become part of the mulch layer in tree, shrub, and groundcover areas. ☐ Keep lawn mower blades sharp, and grasscycle.

- Grasscycle – leave grass clippings on the lawn when mowing. Once cut, grass clippings first dehydrate, and then decompose, quickly disappearing from view. Proper mowing is required for successful grasscycling. Cut grass when the surface is dry, and keep mower blades sharp. Follow the "1/3 Rule": mow the lawn often enough so that no more than 1/3 of the length of the grass blade is cut in any one mowing. Frequent mowing will produce short clippings that will not cover up the grass surface. The lawn may have to be cut every seven days when the lawn is growing fast but only every 7 to 14 days when the lawn is growing slowly.
- Do not leave clippings on pavement or sidewalks where they can wash off into the street, gutter, or storm drain.
- Collect lawn and garden clippings, pruning waste, and tree trimmings. Chip if necessary, and compost or take to the local municipal yard waste recycling/composting facility.
- In communities with curbside pick-up of yard waste, place clippings and pruning waste at the curb in approved bags or containers. No curbside pickup of yard waste is available for commercial properties.
- Do not blow or rake leaves or other yard waste into the street, or place yard waste in gutters or on dirt shoulders, unless it is being piled up for recycling (allowed by some municipalities). After pick-up, sweep up any leaves, litter, or residue in gutters or on street.

Fertilizing and Pruning

- Perform soil analysis seasonally to determine actual fertilization need and application rates.
- Fertilize garden areas with a mulch of leaves, bark, or composted manure and/or garden waste.
- Apply chemical fertilizer only as needed, when plants can best use it, and when the potential for it being carried away by runoff is low. Make sure the fertilizer spreader is calibrated.
- Prune plants sparingly, if at all. A healthy plant – one that is native to the area and growing under the right conditions – should not need pruning, except when it is not in the right location (where safety or liability is a concern).

Watering

- Use soil probes to determine soil moisture depth, overall moisture levels, and the need to adjust irrigation schedules.
- Check sprinklers regularly. Adjust as needed to minimize or eliminate overspray onto impervious surfaces. Replace broken sprinklers or lines.

Pest and Weed Control

- Obtain appropriate licenses for pest control and pesticides. Contact the Department of Pesticide Regulation for more information.
- Become trained in and offer customers less-toxic pest control or Integrated Pest Management (IPM).
- The label on a pesticide container is a legal document. Use a pesticide only as instructed on the label.
- Store pesticides, fertilizers, and other chemicals indoors or in a shed or storage cabinet.
- Use pesticides sparingly, according to instructions on the label. Rinse empty containers, and use rinsewater as product.
- Dispose of rinsed, empty containers in the trash. Dispose of unused pesticides as hazardous waste.
- To control weeds, use drip irrigation and mulch. Hand-pull weeds including roots or cut down to ground. Repeat cutting before they flower, grow new leaves, or go to seed. Use herbicides containing pelargonic acid or herbicidal soap as a last resort.

Handling Gasoline

- Use only containers approved by a nationally recognized testing lab, such as Underwriters Laboratories (UL). Keep the container tightly sealed. Containers should be fitted with a spout to allow pouring without spilling and to minimize the generation of vapors.
- Fill cautiously. Always use a funnel and/or spout to prevent spilling or splashing when fueling power mowers, blowers, and all other gas-powered equipment.
- Avoid spilling gasoline on the ground, especially near wells. If a spill occurs use kitty litter, saw dust, or an absorbent towel to soak up the spill, then dispose of it properly.
- Store carefully. Gasoline moves quickly through soil and into groundwater, therefore, store and use gasoline and fuel equipment as far away from your drinking water well as possible. Be certain to keep a closed cap on the gasoline container. Store at ground level, not on a shelf to minimize the danger of falling and spilling.
- Do not dispose of gasoline down the drain, into surface water, onto the ground, or in the trash. Contact the local municipality for directions on proper disposal of excess or old gasoline. Transport old gas in an approved gasoline container.

Working Near Waterbodies

- Do not dump lawn clippings, other yard waste, or soil along creek banks or in creeks.

	◻ Do not store stockpiles of materials (soil, mulch) along creek banks. These piles can erode over time into a creek. ◻ Do not spray pesticides or fertilizers by creeks. ◻ Do not over water near streams. The excess water may carry pesticides, fertilizers, sediments, and anything else in its path directly into the creek.

Treatment Control BMPs

Not applicable.

More Information

Bay Area Stormwater Management Agencies Association, 1999. Start at the Source – Design Guidance Manual for Stormwater Quality Protection. Available on-line at: http://www.scvurppp-w2k.com/pdfs/0910/StartAtTheSource.pdf.

Bay Area Stormwater Management Agencies Association, Undated. *Landscape designs for Stormwater Management - Stormwater Control for Small Projects*. Available at: http://www.acterra.org/programs/stewardship/_doc/landscape_dispersion.pdf.

Bay Area Water Pollution Prevention Agencies, 2001. Less-Toxic Pest Management- Problem Pesticides. Available on-line at: http://www.sccgov.org/sites/iwm/hhw/Documents/505018Problem%20Pesticides.pdf.

California Invasive Plant Council, Undated Website. *Prevention BMPs for Land Managers*. Available on-line at: http://www.cal-ipc.org/ip/prevention/landmanagers.php.

California Department of Resources Recycling and Recovery (CalRecycle), 1999. *Grasscycle! Make the Most of Your Lawn. Make the Most of Your Time.* Available on-line at: http://www.calrecycle.ca.gov/publications/Documents/Organics/44399011.pdf .

California Department of Resources Recycling and Recovery (CalRecycle). *Capitol Park Training Manual Description and Guidelines for Horticultural Practices*. Available on-line at: http://www.calrecycle.ca.gov/organics/landscaping/Demos/Manual.pdf.

Southern Sonoma County Resource Conservation District, Undated pamphlet. *A Guide for Rural Landowners and Residents of Petaluma and Sonoma Creek Watersheds*. Available on-line at: http://www.conservation.ca.gov/dlrp/watershedportal/Documents/SSCRCD%20Creek%20Care%20Guide%20(southern%20sonoma%20rcd).pdf .

USEPA, Office of Water National Pollution Discharge Elimination System, Undated website. *Stormwater Menu of BMPs Municipal Landscaping*. Available on-line at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=1.

References

Bay Area Stormwater Management Agencies Association, 1999. Start at the Source – Design Guidance Manual for Stormwater Quality Protection. Available on-line at: http://www.scvurppp-w2k.com/pdfs/0910/StartAtTheSource.pdf.

Bay Area Stormwater Management Agencies Association, Undated. *Landscape designs for Stormwater Management - Stormwater Control for Small Projects*. Available at: http://www.acterra.org/programs/stewardship/_doc/landscape_dispersion.pdf.

City of San Diego, 2012. *Storm Water Standards*. Available on-line at: http://www.sandiego.gov/development-services/news/pdf/stormwatermanual.pdf.

City of San Francisco, 2009. *San Francisco Stormwater Design Guidelines*. Available on-line at: http://www.sfwater.org/modules/showdocument.aspx?documentid=2779.

County of Los Angeles Department of Public Works, 2009. *Stormwater Best Management Practice Design and Maintenance Manual For Publicly Maintained Storm Drain Systems*. Available on-line at: http://dpw.lacounty.gov/ldd/publications/Stormwater%20BMP%20Design%20and%20Maintenance%20Manual.pdf.

Spill Prevention, Control & Cleanup SC-11

Description

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

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

Approach

General Pollution Prevention Protocols

- ☐ Develop procedures to prevent/mitigate spills to storm drain systems.

- ☐ Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- ☐ Establish procedures and/or controls to minimize spills and leaks. The procedures should address:

  - ✓ Description of the facility, owner and address, activities, chemicals, and quantities present;

Objectives

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

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

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

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

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

Spill and Leak Prevention and Response

Spill Prevention

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

- ☐ If illegal dumping is observed at the facility:

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

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

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

Preventative Maintenance

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

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

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

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

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

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

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

- Identify key spill response personnel.

Spill Response

- Clean up leaks and spills immediately.

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

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

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

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

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

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

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

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

Reporting

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

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

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

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

  - ✓ Types and quantities (in some cases) of wastes;

  - ✓ Patterns in time of occurrence (time of day/night, month, or year);

  - ✓ Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills);

  - ✓ Clean-up procedures; and

  - ✓ Responsible parties.

Employee Training Program

- Educate employees about spill prevention and cleanup.

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

  - ✓ The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur; and

  - ✓ Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.

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

- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

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

Requirements

Costs (including capital and operation & maintenance)

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

Maintenance (including administrative and staffing)

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

Supplemental Information

Further Detail of the BMP

Reporting

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

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

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

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

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

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

Aboveground Tank Leak and Spill Control

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

The most common causes of unintentional releases are:

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

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

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

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

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

- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

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

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

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.

- Regularly inspect vehicles and equipment for leaks, and repair immediately.

- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.

- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.

- Immediately drain all fluids from wrecked vehicles.

- Store wrecked vehicles or damaged equipment under cover.

- Place drip pans or absorbent materials under heavy equipment when not in use.

- Use absorbent materials on small spills rather than hosing down the spill.

- Remove the adsorbent materials promptly and dispose of properly.

- Promptly transfer used fluids to the proper waste or recycling drums. Don’t leave full drip pans or other open containers lying around.

- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.

- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

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

  Cover fueling area if possible.

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

  Pave fueling area with concrete rather than asphalt.

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

Industrial Spill Prevention Response

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

The program should:

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

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

References and Resources

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

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

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

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

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

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

Waste Handling & Disposal SC-34

Description

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

Approach

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

General Pollution Prevention Protocols

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

Objectives

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

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

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

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- Use the entire product before disposing of the container.

- To the extent possible, store wastes under cover or indoors after ensuring all safety concerns such as fire hazard and ventilation are addressed.

- Provide containers for each waste stream at each work station. Allow time after shift to clean area.

Good Housekeeping

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run-on and runoff with a berm. The waste containers or piles must be covered except when in use.

- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.

- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain. Clean in a designated wash area that drains to a clarifier.

- Transfer waste from damaged containers into safe containers.

- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.

- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.

- Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.

- Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.

- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.

- If possible, move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.

Preventative Maintenance

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

- Prevent waste materials from directly contacting rain.

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

Spill Response and Prevention Procedures

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

Material Handling and Waste Management

Litter Control

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

Waste Collection

- ☐ Keep waste collection areas clean.

- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.

- Secure solid waste containers; containers must be closed tightly when not in use.

- Do not fill waste containers with washout water or any other liquid.

- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal. Affix labels to all waste containers.

Chemical/Hazardous Wastes

- Select designated hazardous waste collection areas on-site.

- Store hazardous materials and wastes in covered containers and protect them from vandalism.

- Place hazardous waste containers in secondary containment.

- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.

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

Employee Training Program

- Educate employees about pollution prevention measures and goals.

- Train employees how to properly handle and dispose of waste using the source control BMPs described above.

- Train employees and subcontractors in proper hazardous waste management.

- Use a training log or similar method to document training.

- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for waste handling and disposal, types and quantities of waste disposed of, and any improvement actions.

- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.

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

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital costs will vary substantially depending on the size of the facility and the types of waste handled. Significant capital costs may be associated with reducing wastes by modifying processes or implementing closed-loop recycling.

- Many facilities will already have indoor covered areas where waste materials will be stored and will require no additional capital expenditures for providing cover.

- If outdoor storage of wastes is required, construction of berms or other means to prevent stormwater run-on and runoff may require appropriate constructed systems for containment.

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

Maintenance

- Check waste containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.

- Sweep and clean the waste management area regularly. Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.

- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.

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

References and Resources

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

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

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

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

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

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

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

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

Building & Grounds Maintenance SC-41

Description

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

Approach

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

General Pollution Prevention Protocols

- ☐ Switch to non-toxic chemicals for maintenance to the maximum extent possible.
- ☐ Choose cleaning agents that can be recycled.
- ☐ Encourage proper lawn management and landscaping, including use of native vegetation.
- ☐ Encourage use of Integrated Pest Management techniques for pest control.
- ☐ Encourage proper onsite recycling of yard trimmings.
- ☐ Recycle residual paints, solvents, lumber, and other material as much as possible.

Objectives

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

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

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

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

Good Housekeeping

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.

- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.

- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures on exposed soils. See also SC-40, Contaminated and Erodible Areas, for more information.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.

- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.

- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.

- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.

- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.

- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures when soils are exposed.

- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.

- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Do not use pesticides if rain is expected.

- Do not mix or prepare pesticides for application near storm drains.

- Use the minimum amount needed for the job.

- Calibrate fertilizer distributors to avoid excessive application.

- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.

- Apply pesticides only when wind speeds are low.

- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.

- Irrigate slowly to prevent runoff and then only as much as is needed.

- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

Inspection

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

Spill Response and Prevention Procedures

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

Material Handling and Waste Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Dispose of empty pesticide containers according to the instructions on the container label.
- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Employee Training Program

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

Quality Assurance and Record Keeping

- Keep accurate logs that document maintenance activities performed and minimum BMP measures implemented.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

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

Maintenance

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

Supplemental Information

Fire Sprinkler Line Flushing

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

References and Resources

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

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

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

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at:

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

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

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

Building Repair and Construction SC-42

Description

Site modifications are common, particularly at large industrial sites. The activity may vary from minor and normal building repair to major remodeling, or the construction of new facilities. These activities can generate pollutants including solvents, paints, paint and varnish removers, finishing residues, spent thinners, soap cleaners, kerosene, asphalt and concrete materials, adhesive residues, and old asbestos installation. Protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants to stormwater from building repair, remodeling, and minor construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

This fact sheet is intended to be used for minor repairs and construction. If major construction is required, the guidelines in the Construction BMP Handbook should be followed.

Approach

The BMP approach is to reduce potential for pollutant discharges through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Recycle residual paints, solvents, lumber, and other materials to the maximum extent practicable.

- ☐ Avoid outdoor repairs and construction during periods of wet weather.

- ☐ Use safer alternative products to the maximum extent practicable. See also SC-35 Safer Alternative Products for more information.

Objectives

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

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

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

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- Buy recycled products to the maximum extent practicable.

- Inform on-site contractors of company policy on these matters and include appropriate provisions in their contract to ensure certain proper housekeeping and disposal practices are implemented.

- Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.

Good Housekeeping

Repair & Remodeling

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep and vacuum the area regularly to remove sediments and small debris.

- Cover raw materials of particular concern that must be left outside, particularly during the rainy season. See also SC-33 Outdoor Storage of Raw Materials for more information.

- Use equipment and tools such as bag sanders to reduce accumulation of debris.

- Limit/prohibit work on windy days; implement roll-down walls or other measures to reduce wind transport of pollutants.

- Do not dump waste liquids down the storm drain.

- Dispose of wash water, sweepings, and sediments properly.

- Store liquid materials properly that are normally used in repair and remodeling such as paints and solvents. See also SC-31 Outdoor Liquid Container Storage for more information.

- Sweep out rain gutters or wash the gutter and trap the particles at the outlet of the downspout. A sock or geofabric placed over the outlet may effectively trap the materials. If the downspout is tight lined, place a temporary plug at the first convenient point in the storm drain and pump out the water with a vactor truck, and clean the catch basin sump where you placed the plug.

- Clean the storm drain system in the immediate vicinity of the construction activity after it is completed. See also SC-44 Drainage System Maintenance for more information.

Painting

- Enclose painting operations consistent with local air quality regulations and OSHA.

- Local air pollution regulations may, in many areas of the state, specify painting procedures which if properly carried out are usually sufficient to protect water quality.

- Develop paint handling procedures for proper use, storage, and disposal of paints.

- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint containers.
- Mix paint indoors before using so that any spill will not be exposed to rain. Do so even during dry weather because cleanup of a spill will never be 100 percent effective.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.
- Do not transfer or load paint near storm drain inlets.
- Plug nearby storm drain inlets prior to starting painting and remove plugs when job is complete when there is risk of a spill reaching storm drains.
- Cover nearby storm drain inlets prior to starting work if sand blasting is used to remove paint.
- Use a ground cloth to collect the chips if painting requires scraping or sand blasting of the existing surface. Dispose of the residue properly.
- Cover or enclose painting operations properly to avoid drift.
- Clean the application equipment in a sink that is connected to the sanitary sewer if using water based paints.
- Capture all cleanup-water and dispose of properly.
- Dispose of paints containing lead or tributyl tin and considered a hazardous waste properly.
- Store leftover paints if they are to be kept for the next job properly, or dispose properly.
- Recycle paint when possible. Dispose of paint at an appropriate household hazardous waste facility.

Spill Response and Prevention Procedures

- Keep your spill prevention and control plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Clean up spills immediately.
- Excavate and remove the contaminated (stained) soil if a spill occurs on dirt.

Material Handling and Waste Management

- Post "No Littering" signs and enforce anti-litter laws.

- Provide a sufficient number of litter receptacles for the facility.

- Clean out and cover litter receptacles frequently to prevent spillage.

- Keep waste collection areas clean.

- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.

- Secure solid waste containers; containers must be closed tightly when not in use.

- Do not fill waste containers with washout water or any other liquid.

- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal. Affix labels to all waste containers.

- Make sure that hazardous waste is collected, removed, and disposed of properly. See also SC-34, Waste Handling and Disposal for more information.

Sediment and Erosion Controls

- Limit disturbance to bare soils and preserve natural vegetation whenever possible. See also EC-2, Preservation of Existing Vegetation, in the Construction BMP Handbook.

- Stabilize loose soils by re-vegetating whenever possible. See also EC-4 Hydroseeding, in the Construction BMP Handbook.

- Utilize non-vegetative stabilization methods for areas prone to erosion where vegetative options are not feasible. Examples include:

  - ✓ Areas of vehicular or pedestrian traffic such as roads or paths;

  - ✓ Arid environments where vegetation would not provide timely ground coverage, or would require excessive irrigation;

  - ✓ Rocky substrate, infertile or droughty soils where vegetation would be difficult to establish; and

  - ✓ Areas where vegetation will not grow adequately within the construction time frame.

  There are several non-vegetative stabilization methods and selection should be based on site-specific conditions. See also EC-16 Non-Vegetative Stabilization, in the Construction BMP Handbook.

- Utilize chemical stabilization when needed. See also EC-5 Soil Binders, in the Construction BMP Handbook.

- Use geosynthetic membranes to control erosion if feasible. See also EC-7 Geotextiles and Mats, in the Construction BMP Handbook.

- Stabilize all roadways, entrances, and exits to sufficiently control discharges of erodible materials from discharging or being tracked off the site. See also TC 1-3 Tracking Control, in the Construction BMP Handbook.

- Refer to the supplemental information provided below for projects that involve more extensive soil disturbance activities.

Employee Training Program

- Educate employees about pollution prevention measures and goals.

- Train employees how to properly implement the source control BMPs described above. Detailed information for Sediment and Erosion Control BMPs is provided in the Construction BMP Handbook.

- Proper education of off-site contractors is often overlooked. The conscientious efforts of well trained employees can be lost by unknowing off-site contractors, so make sure they are well informed about pollutant source control responsibilities.

- Use a training log or similar method to document training.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for building repair and construction, types and quantities of waste disposed of, and any improvement actions.

- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.

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

Potential Limitations and Work-Arounds

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

- This BMP is for minor construction only. The State's General Construction Activity Stormwater Permit has more extensive requirements for larger projects that would disturb one or more acres of surface.

  - ✓ Refer to the companion "Construction Best Management Practice Handbook" which contains specific guidance and best management practices for larger-scale projects.

- Time constraints may require some outdoor repairs and construction during wet weather.
  - ✓ Require employees to understand and follow good housekeeping and spill and leak prevention BMPs.
  - ✓ Inspect sediment and erosion control BMPs daily during periods of wet weather and repair or improve BMP implementation as necessary.
- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
  - ✓ Minimize use of hazardous materials to the maximum extent practicable.
- Be certain that actions to help stormwater quality are consistent with Cal- and Fed-OSHA and air quality regulations.
- Prices for recycled/safer alternative materials and fluids may be higher than those of conventional materials.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Limited capital investments may be required at some sites if adequate cover and containment facilities do not exist for construction materials and wastes.
- Purchase and installation of erosion and sediment controls, if needed will require additional capital investments, and this amount will vary depending on site characteristics and the types of BMPs being implemented.
- Minimize costs by maintaining existing vegetation and limiting construction operations on bare soils.

Maintenance

- The erosion and sediment control BMPs described above require periodic inspection and maintenance to remain effective. The cost of these actions will vary depending on site characteristics and the types of BMPs being implemented.
- Irrigation costs may be required to establish and maintain vegetation.

Supplemental Information

Soil/Erosion Control

If the work involves exposing large areas of soil, employ the appropriate soil erosion and control techniques. See the Construction Best Management Practice Handbook. If old buildings are being torn down and not replaced in the near future, stabilize the site using measures described in SC-40 Contaminated or Erodible Areas.

If a building is to be placed over an open area with a storm drainage system, make sure the storm inlets within the building are covered or removed, or the storm line is connected to the sanitary sewer. If because of the remodeling a new drainage system is to be installed or the existing system is to be modified, consider installing catch basins as they serve as effective "in-line" treatment devices. Include in the catch basin a "turn-down" elbow or similar device to trap floatables.

References and Resources

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

California Stormwater Quality Association, 2012. *Construction Stormwater Best Management Practice Handbook*. Available at http://www.casqa.org.

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

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

US EPA. *Construction Site Stormwater Runoff Control*. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=4.

Parking Area Maintenance SC-43

Description

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

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

Approach

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

General Pollution Prevention Protocols

- ◻ Encourage advanced designs and maintenance strategies for impervious parking lots. Refer to the treatment control BMP fact sheets in this manual for additional information.

- ◻ Keep accurate maintenance logs to evaluate BMP implementation.

Good Housekeeping

- ◻ Keep all parking areas clean and orderly. Remove debris, litter, and sediments in a timely fashion.

- ◻ Post "No Littering" signs and enforce anti-litter laws.

Objectives

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

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

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

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

Preventative Maintenance

Inspection

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

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

Surface Cleaning

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

Surface Repair

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

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

- Use only as much water as necessary for dust control during sweeping to avoid runoff.

- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Spill Response and Prevention Procedures

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.

- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.

- Clean up fluid spills immediately with absorbent rags or material.

- Dispose of spilled material and absorbents properly.

Employee Training Program

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.

- Train employees and contractors in proper techniques for spill containment and cleanup.

- Use a training log or similar method to document training.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for parking area maintenance, types and quantities of waste disposed of, and any improvement actions.

- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.

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

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

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

Maintenance

- Sweep and clean parking lots regularly to minimize pollutant transport into storm drains from stormwater runoff.

- Clean out oil/water/sand separators regularly, especially after heavy storms.

- Maintain advanced BMPs such as vegetated swales, infiltration trenches, or detention basins as appropriate. Refer to the treatment control fact sheets for more information.

Supplemental Information

Advanced BMPs

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

- When possible, direct sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.

- Utilize sand filters or oleophilic collectors for oily waste in low quantities.

- Arrange rooftop drains to prevent drainage directly onto paved surfaces.

- Design lot to include semi-permeable hardscape.

References and Resources

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

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

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

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

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

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

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

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

Description

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

Approach

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

General Pollution Prevention Protocols

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

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

Good Housekeeping

Illicit Connections and Discharges

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

Objectives

- *Cover*
- *Contain*
- *Educate*
- *Reduce/Minimize*

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

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

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- ✓ Identify evidence of spills such as paints, discoloring, odors, etc.

- ✓ Record locations of apparent illegal discharges/illicit connections.

- ✓ Track flows back to potential discharges and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.

- ✓ Eliminate the discharge once the origin of flow is established.

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

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

Illegal Dumping

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

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

  - ✓ Illegal dumping hot spots;

  - ✓ Types and quantities (in some cases) of wastes;

  - ✓ Patterns in time of occurrence (time of day/night, month, or year);

  - ✓ Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills); and

  - ✓ Responsible parties.

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

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

Preventative Maintenance

Catch Basins/Inlet Structures

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

  - ✓ Immediate repair of any deterioration threatening structural integrity.

  - ✓ Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.

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

Storm Drain Conveyance System

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

Pump Stations

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

Open Channel

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

Spill Response and Prevention Procedures

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

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

Employee Training Program

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

Quality Assurance and Record Keeping

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

Potential Limitations and Work-Arounds

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

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

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

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

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

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

  - ✓ Do not dump illegal materials anywhere onsite.

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

  - ✓ Cleanup spills immediately and properly dispose of wastes.

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

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

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

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

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

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

Maintenance

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

Supplemental Information

Storm Drain Flushing

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

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

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

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

References and Resources

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

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

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

Treatment Control BMPs

Biotreatment MP-20

General Description

Biotreatment systems are manufactured BMPs that mimic treatment provided by natural systems with a smaller footprint. Physical straining, biological and chemical reactions in the mulch, root zone, and soil matrix, and infiltration into the underlying subsoil are the main treatment processes. Biotreatment cells reduce peak discharge and runoff volume by detaining water through surface ponding, storage in soil and gravel layers, and evapotranspiration. They can be designed to incorporate infiltration to underlying soils and/or an underdrain system that collects treated stormwater and directs it to the storm drain.

Examples of biotreatment systems include manufactured wetlands and planter box biofilters that can incorporate a wide range of vegetation from grasses to trees.

Inspection / Maintenance Considerations

To maintain treatment performance longevity, pretreatment systems should be installed at sites with high loads of sediment, trash, and floatables. If pretreatment is provided then maintenance consideration must be given to remove accumulated materials.

Biotreatment systems require frequent landscaping maintenance, including harvesting of wetland vegetation and planter box irrigation in dry climates. Maintenance tasks may be conducted by a landscaping contractor, who may already be hired at the site. Refer to TC-21, Constructed Wetland, TC-32, Bioretention, and specific manufacturer recommendations for more information.

Advanced BMPs Covered

- ✓ Stormwater Containment and Discharge Reduction
- ✓ Treatment Control

Maintenance Concerns

- *Vegetation/Landscape Maintenance*
- *Mulch and Planting Media Replacement*
- *Clogged Soil or Outlet Structures*
- *Invasive/Exotic Plant Species*
- *Vector Control*

Targeted Constituents*

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

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

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Inspection Activities	Suggested Frequency
☐ Inspect during the dry season to determine if irrigation of plants is necessary.	As needed
☐ Inspect to ensure vegetation is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket if necessary. ☐ Check for debris and litter, and areas of sediment accumulation. ☐ Inspect health of trees and shrubs.	Semi-annual
☐ Inspect to verify that invasive species of wetland plants is not occurring.	Annual
Maintenance Activities	**Suggested Frequency**
☐ Water plants daily for at least 2 weeks.	At project completion
☐ Remove litter and debris.	Monthly
☐ Remove sediment. ☐ Remulch void areas. ☐ Treat diseased trees and shrubs. ☐ Mow turf areas. ☐ Repair erosion at inflow points. ☐ Repair outflow structures. ☐ Unclog underdrain. ☐ Regulate soil pH regulation. ☐ Repair undercut areas, erosion to banks, and bottom as required. ☐ Make structural changes or repairs as needed to eliminate pools of water that stand longer than 96 hrs to prevent mosquito production, particularly during the warmer months of the year. Identify and eliminate sources of non-stormwater runoff that feed standing water pools. Contact the local mosquito and vector control agency if mosquito breeding is observed or suspected.	As needed
☐ Remove and replace dead and diseased vegetation.	Semi-annual
☐ Add mulch. ☐ Replace tree stakes and wires. ☐ Supplement wetland plants if a significant portion have not established (at least 50% of the surface area). ☐ Remove nuisance plant species.	Annual
☐ Mulch should be replaced every 2 to 3 years or when bare spots appear or infiltration rates are reduced. Remulch prior to the wet season.	Every 2-3 years, or as needed
☐ Harvest plant species if vegetation becomes too thick causing flow backup and flooding. More frequent plant harvesting may be required by local vector control agencies.	5- to 7-year maintenance (or more frequently as required)

References

California Department of Transportation. *Treatment BMP Technology Report (CTSW-RT-09-239.06)*, April, 2010. http://www.dot.ca.gov/hq/env/stormwater/pdf/CTSW-RT-09-239-06.pdf.

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

Orange County Stormwater Program. Technical Guidance Document BMP Fact Sheets. http://media.ocgov.com/gov/pw/watersheds/documents/wqmp/tgd/technical_guidance_document_bmp_fact_sheets.asp.

Ventura Countywide Stormwater Quality Management Program. *Technical Guidance Manual for Stormwater Quality Control Measures*, May, 2010. http://www.vcstormwater.org/documents/workproducts/technicalguidancemanual/2010revisions/Ventura%20Technical%20Guidance%20Document_5-6-10.pdf.

Drain Inlet Insert MP-52

General Description

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

Inspection / Maintenance Considerations

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

Advanced BMPs Covered

Treatment Control

Maintenance Concerns

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

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

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

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

References

California Department of Transportation. *Treatment BMP Technology Report (CTSW-RT-09-239.06)*, April, 2010. http://www.dot.ca.gov/hq/env/stormwater/pdf/CTSW-RT-09-239-06.pdf.

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

Orange County Stormwater Program. Technical Guidance Document BMP Fact Sheets. http://media.ocgov.com/gov/pw/watersheds/documents/wqmp/tgd/technical_guidance_document_bmp_fact_sheets.asp.

San Francisco Public Utilities Commission, et al. San Francisco Stormwater Design Guidelines. Appendix A, Stormwater BMP Fact Sheets, June, 2010. http://www.sfwater.org/modules/showdocument.aspx?documentid=2778.

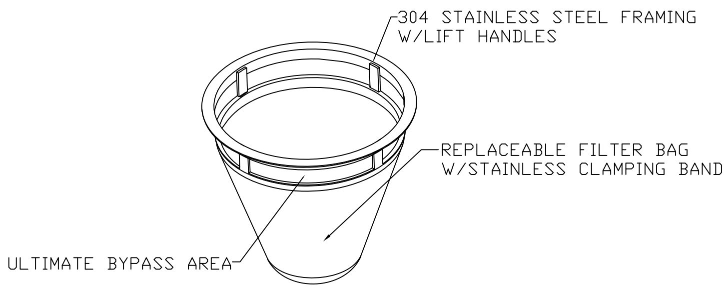
Tahoe Regional Planning Agency. Best Management Practices Handbook, 2012. http://www.tahoebmp.org/Documents/2012%20BMP%20Handbook.pdf.

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development and Redevelopment. BMP Fact Sheets. Available at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=5.

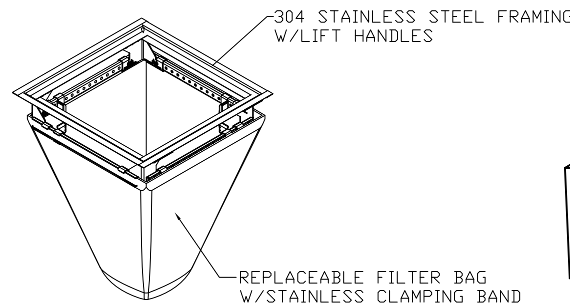
Ventura Countywide Stormwater Quality Management Program. *Technical Guidance Manual for Stormwater Quality Control Measures*, May, 2010. http://www.vcstormwater.org/documents/workproducts/technicalguidancemanual/2010revisions/Ventura%20Technical%20Guidance%20Document_5-6-10.pdf.

FLEXSTORM PURE FILTERS FOR PERMANENT INLET PROTECTION
PRODUCT SELECTION AND SPECIFICATION DRAWING

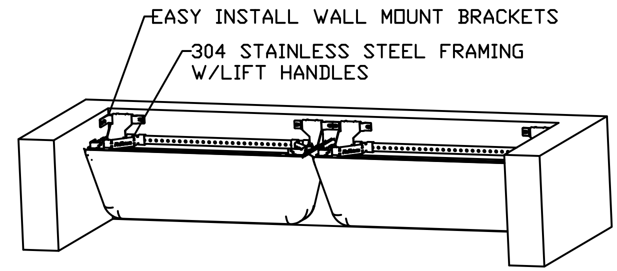
CALIFORNIA



FLEXSTORM PURE INLET FILTERS
FOR ROUND OPENINGS



FLEXSTORM PURE INLET FILTERS FOR
RECTANGULAR OPENINGS WITH GRATES

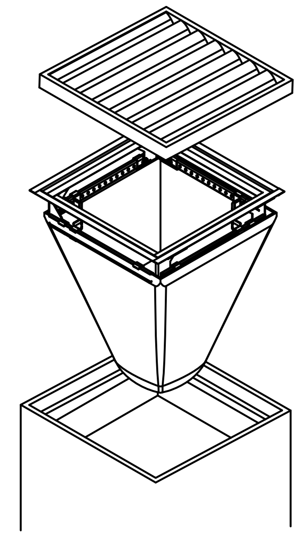


FLEXSTORM HDWM WALL MOUNT INLET
FILTERS FOR OPEN THROAT GUTTERS

Product selection for FLEXSTORM PURE Filters (Permanent Inlet Protection)

Standard	Inlet Type	Grate Size	Clear Opening Size	Bag Cap. (ft^3)	Flow Ratings (CFS) FX/FX+	PC/PC+	Bypass	PRICE FX	FX+	PC	PC+
36" Open Throat Inlet	Open Throat (WM)	N/A	**36**	2.5	1.9	1.4	N/A	62HDWM36FX	62HDWM36FXP	62HDWM36PC	62HDWM36PCP
42" Open Throat Inlet	Open Throat (WM)	N/A	**42**	3.0	2.5	1.7	N/A	62HDWM42FX	62HDWM42FXP	62HDWM42PC	62HDWM42PCP
48" Open Throat Inlet	Open Throat (WM)	N/A	**48**	3.3	2.5	1.7	N/A	62HDWM48FX	62HDWM48FXP	62HDWM48PC	62HDWM48PCP
60" Open Throat Inlet (2 piece)	Open Throat (WM)	N/A	**60**	4.2	2.5	1.7	N/A	62HDWM60FX	62HDWM60FXP	62HDWM60PC	62HDWM60PCP
84" Open Throat Inlet (2 piece)	Open Throat (WM)	N/A	**84**	5.8	2.5	1.7	N/A	62HDWM84FX	62HDWM84FXP	62HDWM84PC	62HDWM84PCP
48" Open Throat wiith Side Wings	Open Throat (WM)	N/A	**48 Winged**	5.1	2.7	1.7	N/A	62HDWM4818FX	62HDWM4818FXP	62HDWM4818PC	62HDWM4818PCP
12" x 12" precast	Concrete Box (HD)	15 x 15	**12 x 12**	0.9	1.0	0.7	2.4	62HD12FX	62HD12FXP	62HD12PC	62HD12PCP
18" x 18" precast	Concrete Box (HD)	21 x 18	**18 x 18**	2.0	1.5	1.0	3.7	62HD18FX	62HD18FXP	62HD18PC	62HD18PCP
21" Round Opening	Round (RD)	23	**21**	1.5	1.3	1.1	4.5	62HDR23FX	62HDR23FXP	62HDR23PC	62HDR23PCP
24" Round Opening	Round (RD)	26	**24**	1.9	1.5	1.3	4.9	62HDR21FX	62HDR21FXP	62HDR21PC	62HDR21PCP
24" x 24"	Concrete Box (HD)	27 x 24	**24 x 24**	3.2	1.9	0.8	6.1	62HD24FX	62HD24FXP	62HD24PC	62HD24PCP
24" x 24" (shallow)	Concrete Box (HD)	27 x 24	**24 x 24**	3.2	1.9	0.8	6.1	62HD24SFX	62HD24SFXP	62HD24SPC	62HD24SPCP
36" x 18" precast	Concrete Box (HD)	40 x 18	**36 x 18**	3.8	2.2	1.5	5.6	62HD3618FX	62HD3618FXP	62HD3618PC	62HD3618PC
36" x 18" precast	Combination	40 x 18	**36 x 18**	3.5	2.1	1.5	6.9	62HDFCB3618F	62HDFCB3618FXP	62HDFCB3618P	62HDFCB3618PCP
36" x 24" precast	Concrete Box (HD)	40 x 24	**36 x 24**	3.9	2.5	1.7	6.5	62HD3624FX	62HD3624FXP	62HD3624PC	62HD3624PCP
36" X 24" Combination Inlet	Concrete Box (HD)	40 x 24	**36 x 32**	4.3	2.3	2.0	5.8	62HDFCB3624FX	62HDFCB3624FXP	62HDFCB3624PC	62HDFCB3624PCP
36" X 36" precast +	Concrete Box (HD)	40 x 36	**36 x 36**	7.2	4.4	3.2	9.6	62HD36FX	62HD36FXP	62HD36PC	62HD36PCP
48" X 48" precast+	Concrete Box (HD)	48 x 48	**48 x 48**	13.0	5.4	4.2	11.4	62HD48FX	62HD48FXP	62HD48PC	62HD48PCP

*FLOW RATINGS SHOWN ARE 50% MAXIMUM



INSTALLATION:

1. REMOVE GRATE
2. DROP FLEXSTORM INLET FILTER ONTO LOAD BEARING LIP OF CASTING OR CONCRETE STRUCTURE
3. REPLACE GRATE

NOTES:

1. ALL FRAMING IS CONSTRUCTED OF 304 STAINLESS STEEL FOR 25 YEAR SERVICE LIFE RATING
2. TOTAL BYPASS CAPACITY WILL VARY WITH EACH SIZED DRAINAGE STRUCTURE. FLEXSTORM DESIGNS FRAMING BYPASS TO MEET OR EXCEED THE DESIGN FLOW OF THE PARTICULAR DRAINAGE STRUCTURE.
3. UPON ORDERING ADS P/N CONFIRMATION OF THE DOT CALLOUT, FLEXSTORM ITEM CODE, CASTING MAKE AND MODEL, OR DETAILED DIMENSIONAL FORMS MUST BE PROVIDED.
4. FOR WRITTEN SPECIFICATIONS AND MAINTENANCE GUIDELINES VISIT WWW.INLETFILTERS.COM

ALL PRODUCTS MANUFACTURED
BY INLET & PIPE PROTECTION, INC
A DIVISION OF ADS, INC.
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SIZE	DWG NO	REV
C	P-CA-SUBMIT	A
SCALE		SHEET 1 OF 1

FLEXSTORM® INLET FILTERS

FILTER BAG OPTIONS

FLEXSTORM offers seven different filter bag options for any of the framing styles. For complete test results visit www.inletfilters.com

FLEXSTORM FILTER BAGS	STANDARD BAG P/N (22" depth)	SHORT BAG P/N (12" depth)
FX: Standard Woven Bag	FX	FX-S
FX+: Woven w/ MyCelx	FXP	FXP-S
FXO: Woven w/ Oil Boom	FXO	FXO-S
PC: Post Construction Bag	PC	PC-S
PC+: PC Bag w/ MyCelx	PCP	PCP-S
LL: Litter and Leaf Bag	LL	LL-S
IL: IDOT NonWoven Bag	IL	IL-S

FILTER BAG TEST RESULTS

FX FILTRATION EFFICIENCY = 82% †

† Large scale, 3rd party testing per ASTM D 7351, Standard Test Method for Determination of Sediment Retention Device Effectiveness in Sheet Flow Application using 7% USDA Sandy Loam

PC/PC+ TSS = 99% TPH = 97% ‡

‡ Large scale testing at 90 GPM. 3rd party results using US Silica OK-110 sand at 1750 mg/L measuring TSS per SM 2540D. TPH tested at 243 mg/L used motor oil using EPA Method 1664A.

FILTER BAG SPECIFICATIONS & CAPABILITES

Bag Type (P/N)	Clean Water Flow Rate (GPM/SqFt)	Min A.O.S. (US Sieve)
Woven (FX)	200	40
Post Construction (PC)	137	140
NonWoven (IL)	145	70
Litter & Leaf Bag (LL)	High	3.5

Total Bypass Capacity: Bypass capacity will vary with each size drainage structure. Flexstorm designs filter bypass to meet the minimum design flow of the particular drainage structure.

Standard Bag Sizes (match frame sizes) §	Solids Storage Capacity (CuFt)	Filtered Flow Rate at 50% Max (CFS)			Oil Retention (Oz)		
		FX	PC	IL	PC*	PCP**	FX+
Small	1.6	1.2	0.8	0.9	66	155	89
Medium	2.1	1.8	1.2	1.3	96	185	89
Large	3.8	2.2	1.5	1.6	120	209	89
XL	4.2	3.6	2.4	2.6	192	370	178

* PC filter bag at 50% max adsorption capacity

** PC filter bag at 50% capacity and MyCelx skimmer at 100% capacity

§ Bag Sizes match the framing sizes based on clear opening dimensions. Standard bags are 22" in depth. Short bags are 12" in depth, reducing solids storage capacity by approximately 50%.

FLEXSTORM OPERATION AND MAINTENANCE PLAN

FLEXSTORM INLET FILTERS™

OPERATION & MAINTENANCE PLAN

Install on Instruc ons:

1. Remove grate from the drainage structure
2. Clean stone and dirt from ledge (lip) of drainage structure
3. Drop the FLEXSTORM inlet lter through the clear opening such that the hangers rest rmly on the lip of the structure.
4. Replace the grate and co rm it is not elevated more than 1/8", the thickness of the steel hangers.

Frequency of Inspections:

1. Inspec on should occur following any rain event >½".
2. Post construc on inspec ons should occur 4 mes per year. In snowfall a cted regions addi onal inspec ons should take place before and a er snowfall season.
3. Industrial applic on site inspec ons (loading ramps, wash racks, maintenance facili es) should occur on a regularly scheduled basis no less than mes/year.

Maintenance Guidelines:

1. Empty the sediment bag if more than half lled with sediment and debris, or as directed.
2. Remove the grate, engage the li ing bars with the FLEXSTORM Removal Tool, and li from drainage structure.
3. Dispose of sediment or debris as directed by the Engineer or Maintenance contract.
4. An industrial vacuum can be used to collect sediment.
5. Remove caked on silt from sediment bag and ush with Medium spray with o mal ltr on.
6. Replace bag if torn or punctured to >½" diameter on lower half of bag.

Post Construction PC Bag Maintenance:

1. At 50% satur on the average 2'x2' Adsorb-it lined PC lter will retain approximately 75 oz (4.2 lbs) of oil and should be serviced. To recover the oils the lter can be centrifuged or passed through a wringer.
2. Oil skimmer pouches start to turn black when saturated, indic ng me for replacement. Each ClearTec Rubberizer pouch will absorb ~62oz (4 lbs) of oil before needing replacement.
3. Dispose of all oil contaminated products in accordance with EPA guidelines. ClearTec Rubberizer, since a solidi er, will not leach under pressure and can be disposed of in most lan lls, recycled for industrial applic ons, or burned as fuel.

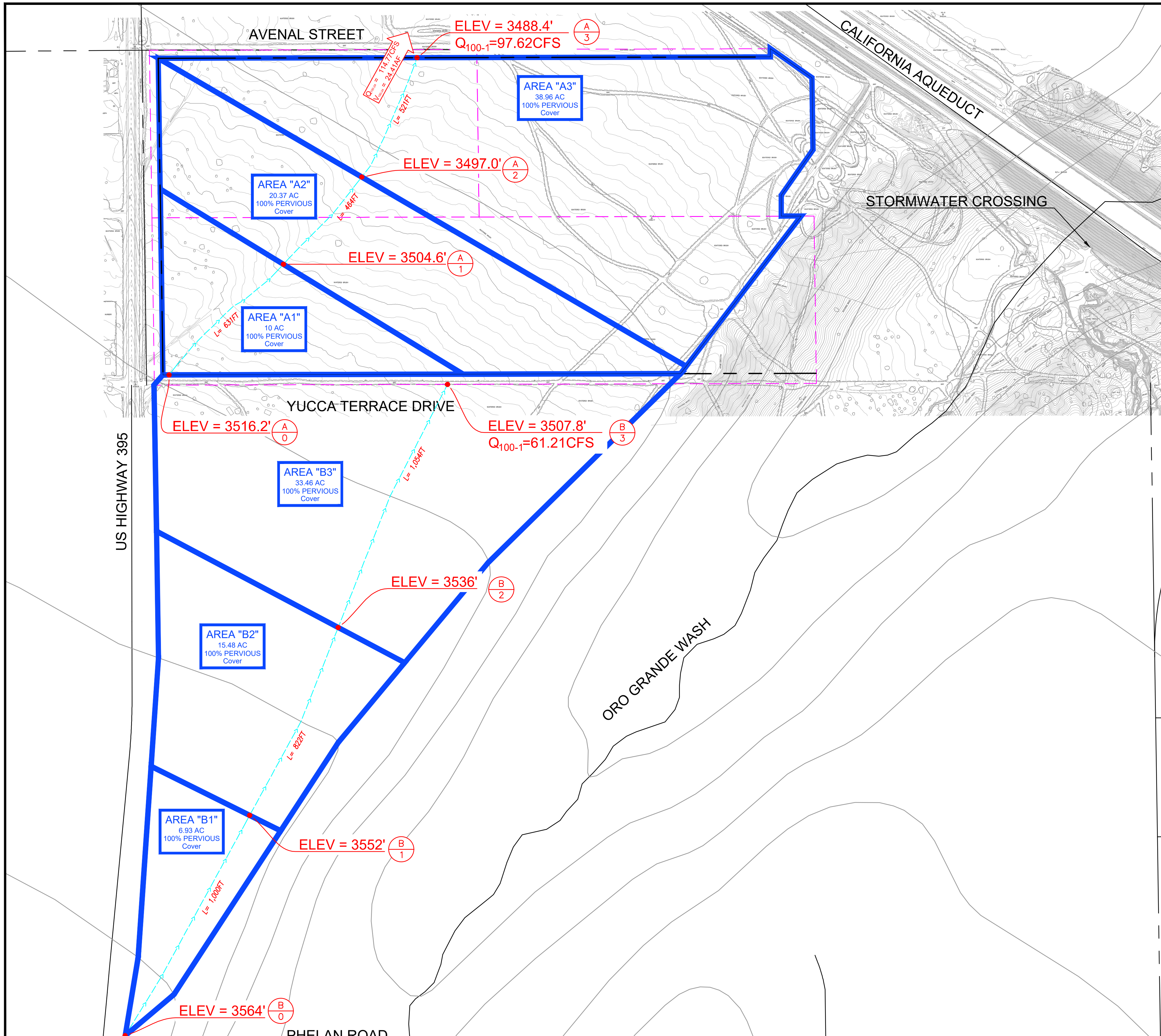
Sediment Bag Replacement:

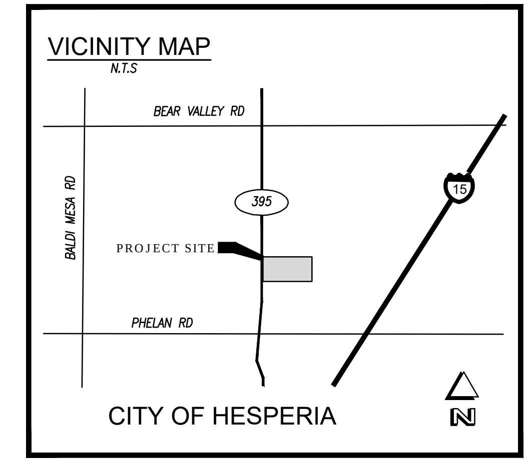
1. Remove the bag by loosening or cutting o clamping bag.
2. Take new sediment bag and secure worm drive clamping band to the frame channel.
3. Ensure Bag is secure and there is no slack around perimeter.

STRUCTURE ID#/LOCATION:

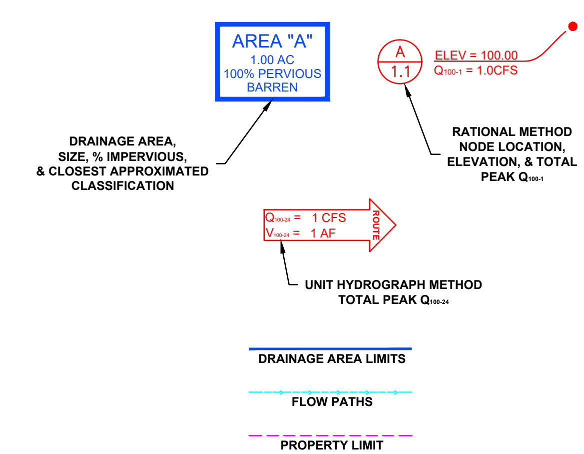
DATE	TASK PERFORMED	INSPECTOR

EXHIBIT "F"
EXISTING CONDITION EXHIBIT
US COLD STORAGE
IN THE CITY OF HESPERIA CA





MAP LEGEND



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SCALE: 1"=200'

EXISTING OFF-SITE TRIBUTARY
US COLD STORAGE
IN THE CITY OF HESPERIA CA

PREPARED BY:
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CONSTRUCTION GROUP

BY	MARK	REVISION DESCRIPTION	DATE

PREPARED FOR:	FISHER CONSTRUCTION GROUP
JOB NO:	204728
PREPARED BY:	SG
CHECKED BY:	JTS

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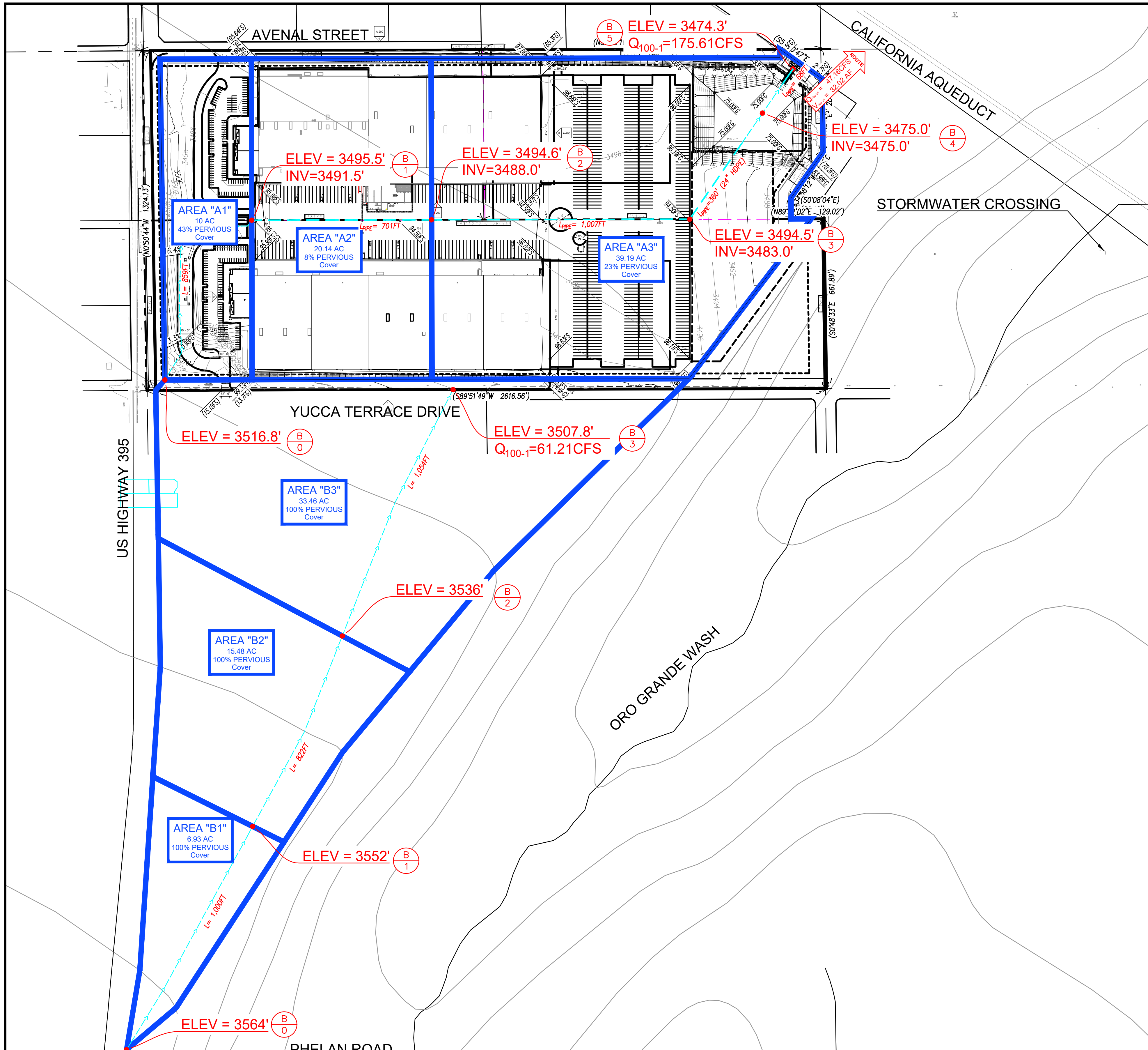
EXISTING OFF-SITE TRIBUTARY
US COLD STORAGE
IN THE CITY OF HESPERIA CA

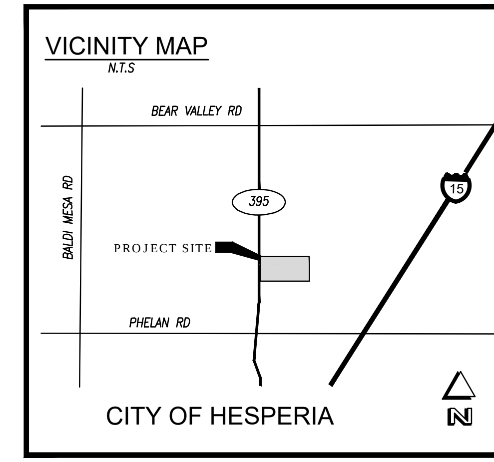
DISREGARD PRINTS BEARING EARLIER REVISION DATES 05-08-2020

F

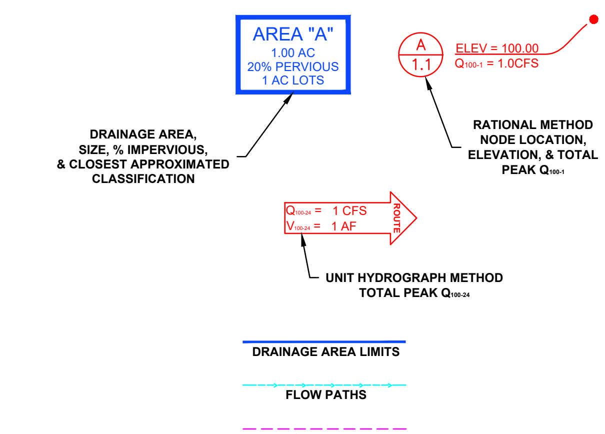
SHEET 1 OF 1

EXHIBIT "G"
PROPOSED CONDITION EXHIBIT
US COLD STORAGE
IN THE CITY OF HESPERIA CA





MAP LEGEND



200 0 200 400 600

SCALE: 1"=200'

PROPOSED CONDITION EXHIBIT
US COLD STORAGE
IN THE CITY OF HESPERIA CA

PREPARED BY:

BONADIMAN
JOSEPH E. BONADIMAN & ASSOCIATES, INC.
TEL (909) 885-3806

CIVILDESIGN

PREPARED FOR:

FISHER CONSTRUCTION GROUP

BY	MARK	REVISION DESCRIPTION	DATE

PREPARED FOR:	FISHER CONSTRUCTION GROUP
JOB NO:	204728
PREPARED BY:	SG
CHECKED BY:	JTS

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PROPOSED CONDITION EXHIBIT
US COLD STORAGE
IN THE CITY OF HESPERIA CA

DISREGARD PRINTS BEARING EARLIER REVISION DATES 05-08-2020

G

SHEET 1 OF 1

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

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Study date 05/06/20

++

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

Program License Serial Number 6320

204728 - US Cold Storage
EXISTING CONDITIONS - AREA A
10-YEAR, 24- HOUR STORM
BY: SG DATE: 05-06-20

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	69.33	1	0.76
Rainfall data for year 2	69.33	6	1.04
Rainfall data for year 2	69.33	24	1.96
Rainfall data for year 100	69.33	1	1.27
Rainfall data for year 100	69.33	6	2.90
Rainfall data for year 100	69.33	24	6.12

```
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 63.0      63.0         69.33      1.000     0.637    1.000    0.637

Area-averaged adjusted loss rate Fm (In/Hr) =  0.637

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
    69.33   1.000         63.0      63.0       5.87     0.203

Area-averaged catchment yield fraction, Y =  0.203
Area-averaged low loss fraction, Yb =  0.797
User entry of time of concentration  =   0.506 (hours)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      69.33(Ac.)
Catchment Lag time =   0.405 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 20.5863
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.637(In/Hr)
Average low loss rate fraction (Yb) = 0.797 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.361(In)
Computed peak 30-minute rainfall =  0.617(In)
Specified peak 1-hour rainfall =  0.760(In)
Computed peak 3-hour rainfall =  1.292(In)
Specified peak 6-hour rainfall =  1.805(In)
Specified peak 24-hour rainfall =  3.671(In)


Rainfall depth area reduction factors:
Using a total area of      69.33(Ac.) (Ref: fig. E-4)

5-minute factor = 0.997     Adjusted rainfall =  0.359(In)
30-minute factor = 0.997    Adjusted rainfall =  0.615(In)
1-hour factor = 0.997       Adjusted rainfall =  0.758(In)
3-hour factor = 1.000       Adjusted rainfall =  1.291(In)
6-hour factor = 1.000       Adjusted rainfall =  1.805(In)
24-hour factor = 1.000      Adjusted rainfall =  3.671(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 =       838.46 (CFS))

  1               1.033                   8.660
  2               4.725                  30.955
  3              12.013                  61.112
```

4	28.066	134.597
5	45.124	143.023
6	56.476	95.180
7	63.994	63.040
8	69.530	46.418
9	73.935	36.932
10	77.525	30.097
11	80.431	24.371
12	82.868	20.432
13	85.001	17.883
14	86.912	16.023
15	88.543	13.671
16	89.843	10.907
17	91.022	9.880
18	92.092	8.978
19	93.055	8.073
20	93.930	7.331
21	94.649	6.029
22	95.347	5.855
23	95.943	4.997
24	96.478	4.488
25	96.972	4.138
26	97.349	3.164
27	97.713	3.052
28	97.961	2.081
29	98.167	1.726
30	98.388	1.852
31	98.635	2.068
32	98.882	2.071
33	99.129	2.071
34	99.376	2.071
35	99.564	1.578
36	99.693	1.079
37	99.821	1.079
38	100.000	0.539

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3595	0.3595
2	0.4425	0.0831
3	0.4998	0.0572
4	0.5448	0.0450
5	0.5826	0.0377
6	0.6153	0.0328
7	0.6444	0.0291
8	0.6708	0.0263
9	0.6949	0.0241
10	0.7172	0.0223
11	0.7380	0.0208
12	0.7575	0.0195
13	0.7875	0.0300
14	0.8164	0.0288
15	0.8442	0.0278
16	0.8711	0.0269
17	0.8971	0.0260
18	0.9223	0.0252
19	0.9468	0.0245
20	0.9707	0.0239

21	0.9940	0.0233
22	1.0167	0.0227
23	1.0389	0.0222
24	1.0605	0.0217
25	1.0818	0.0212
26	1.1026	0.0208
27	1.1229	0.0204
28	1.1429	0.0200
29	1.1626	0.0196
30	1.1819	0.0193
31	1.2008	0.0190
32	1.2195	0.0186
33	1.2378	0.0184
34	1.2559	0.0181
35	1.2737	0.0178
36	1.2912	0.0175
37	1.3084	0.0172
38	1.3254	0.0170
39	1.3421	0.0167
40	1.3587	0.0165
41	1.3750	0.0163
42	1.3911	0.0161
43	1.4070	0.0159
44	1.4227	0.0157
45	1.4382	0.0155
46	1.4536	0.0154
47	1.4687	0.0152
48	1.4838	0.0150
49	1.4986	0.0149
50	1.5133	0.0147
51	1.5279	0.0145
52	1.5423	0.0144
53	1.5565	0.0143
54	1.5706	0.0141
55	1.5846	0.0140
56	1.5985	0.0139
57	1.6122	0.0137
58	1.6258	0.0136
59	1.6393	0.0135
60	1.6527	0.0134
61	1.6659	0.0133
62	1.6790	0.0131
63	1.6921	0.0130
64	1.7050	0.0129
65	1.7178	0.0128
66	1.7305	0.0127
67	1.7432	0.0126
68	1.7557	0.0125
69	1.7681	0.0124
70	1.7804	0.0123
71	1.7927	0.0122
72	1.8048	0.0122
73	1.8176	0.0128
74	1.8303	0.0127
75	1.8430	0.0126
76	1.8555	0.0125
77	1.8680	0.0125
78	1.8804	0.0124

79	1.8927	0.0123
80	1.9049	0.0122
81	1.9171	0.0122
82	1.9291	0.0121
83	1.9412	0.0120
84	1.9531	0.0119
85	1.9650	0.0119
86	1.9768	0.0118
87	1.9885	0.0117
88	2.0002	0.0117
89	2.0118	0.0116
90	2.0234	0.0115
91	2.0348	0.0115
92	2.0463	0.0114
93	2.0576	0.0114
94	2.0689	0.0113
95	2.0802	0.0112
96	2.0914	0.0112
97	2.1025	0.0111
98	2.1136	0.0111
99	2.1246	0.0110
100	2.1355	0.0110
101	2.1465	0.0109
102	2.1573	0.0109
103	2.1681	0.0108
104	2.1789	0.0108
105	2.1896	0.0107
106	2.2002	0.0107
107	2.2108	0.0106
108	2.2214	0.0106
109	2.2319	0.0105
110	2.2424	0.0105
111	2.2528	0.0104
112	2.2632	0.0104
113	2.2735	0.0103
114	2.2838	0.0103
115	2.2940	0.0102
116	2.3042	0.0102
117	2.3144	0.0102
118	2.3245	0.0101
119	2.3345	0.0101
120	2.3446	0.0100
121	2.3546	0.0100
122	2.3645	0.0099
123	2.3744	0.0099
124	2.3843	0.0099
125	2.3941	0.0098
126	2.4039	0.0098
127	2.4136	0.0098
128	2.4234	0.0097
129	2.4330	0.0097
130	2.4427	0.0096
131	2.4523	0.0096
132	2.4619	0.0096
133	2.4714	0.0095
134	2.4809	0.0095
135	2.4904	0.0095
136	2.4998	0.0094

137	2.5092	0.0094
138	2.5186	0.0094
139	2.5279	0.0093
140	2.5372	0.0093
141	2.5465	0.0093
142	2.5557	0.0092
143	2.5649	0.0092
144	2.5741	0.0092
145	2.5832	0.0091
146	2.5923	0.0091
147	2.6014	0.0091
148	2.6104	0.0090
149	2.6195	0.0090
150	2.6284	0.0090
151	2.6374	0.0090
152	2.6463	0.0089
153	2.6552	0.0089
154	2.6641	0.0089
155	2.6730	0.0088
156	2.6818	0.0088
157	2.6906	0.0088
158	2.6993	0.0088
159	2.7081	0.0087
160	2.7168	0.0087
161	2.7255	0.0087
162	2.7341	0.0087
163	2.7428	0.0086
164	2.7514	0.0086
165	2.7599	0.0086
166	2.7685	0.0086
167	2.7770	0.0085
168	2.7855	0.0085
169	2.7940	0.0085
170	2.8025	0.0085
171	2.8109	0.0084
172	2.8193	0.0084
173	2.8277	0.0084
174	2.8360	0.0084
175	2.8444	0.0083
176	2.8527	0.0083
177	2.8610	0.0083
178	2.8693	0.0083
179	2.8775	0.0082
180	2.8857	0.0082
181	2.8939	0.0082
182	2.9021	0.0082
183	2.9103	0.0082
184	2.9184	0.0081
185	2.9265	0.0081
186	2.9346	0.0081
187	2.9427	0.0081
188	2.9507	0.0080
189	2.9587	0.0080
190	2.9667	0.0080
191	2.9747	0.0080
192	2.9827	0.0080
193	2.9906	0.0079
194	2.9986	0.0079

195	3.0065	0.0079
196	3.0144	0.0079
197	3.0222	0.0079
198	3.0301	0.0078
199	3.0379	0.0078
200	3.0457	0.0078
201	3.0535	0.0078
202	3.0613	0.0078
203	3.0690	0.0078
204	3.0768	0.0077
205	3.0845	0.0077
206	3.0922	0.0077
207	3.0999	0.0077
208	3.1075	0.0077
209	3.1152	0.0076
210	3.1228	0.0076
211	3.1304	0.0076
212	3.1380	0.0076
213	3.1456	0.0076
214	3.1531	0.0076
215	3.1607	0.0075
216	3.1682	0.0075
217	3.1757	0.0075
218	3.1832	0.0075
219	3.1906	0.0075
220	3.1981	0.0075
221	3.2055	0.0074
222	3.2129	0.0074
223	3.2204	0.0074
224	3.2277	0.0074
225	3.2351	0.0074
226	3.2425	0.0074
227	3.2498	0.0073
228	3.2571	0.0073
229	3.2644	0.0073
230	3.2717	0.0073
231	3.2790	0.0073
232	3.2863	0.0073
233	3.2935	0.0072
234	3.3008	0.0072
235	3.3080	0.0072
236	3.3152	0.0072
237	3.3224	0.0072
238	3.3295	0.0072
239	3.3367	0.0072
240	3.3438	0.0071
241	3.3510	0.0071
242	3.3581	0.0071
243	3.3652	0.0071
244	3.3723	0.0071
245	3.3793	0.0071
246	3.3864	0.0071
247	3.3934	0.0070
248	3.4005	0.0070
249	3.4075	0.0070
250	3.4145	0.0070
251	3.4215	0.0070
252	3.4285	0.0070

253	3.4354	0.0070
254	3.4424	0.0069
255	3.4493	0.0069
256	3.4562	0.0069
257	3.4631	0.0069
258	3.4700	0.0069
259	3.4769	0.0069
260	3.4838	0.0069
261	3.4906	0.0069
262	3.4975	0.0068
263	3.5043	0.0068
264	3.5111	0.0068
265	3.5179	0.0068
266	3.5247	0.0068
267	3.5315	0.0068
268	3.5383	0.0068
269	3.5450	0.0068
270	3.5518	0.0067
271	3.5585	0.0067
272	3.5652	0.0067
273	3.5719	0.0067
274	3.5786	0.0067
275	3.5853	0.0067
276	3.5920	0.0067
277	3.5986	0.0067
278	3.6053	0.0066
279	3.6119	0.0066
280	3.6186	0.0066
281	3.6252	0.0066
282	3.6318	0.0066
283	3.6384	0.0066
284	3.6449	0.0066
285	3.6515	0.0066
286	3.6581	0.0066
287	3.6646	0.0065
288	3.6711	0.0065

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0065	0.0052	0.0013
2	0.0065	0.0052	0.0013
3	0.0066	0.0052	0.0013
4	0.0066	0.0052	0.0013
5	0.0066	0.0053	0.0013
6	0.0066	0.0053	0.0013
7	0.0066	0.0053	0.0013
8	0.0066	0.0053	0.0013
9	0.0067	0.0053	0.0014
10	0.0067	0.0053	0.0014
11	0.0067	0.0053	0.0014
12	0.0067	0.0054	0.0014
13	0.0067	0.0054	0.0014
14	0.0068	0.0054	0.0014
15	0.0068	0.0054	0.0014
16	0.0068	0.0054	0.0014
17	0.0068	0.0054	0.0014

18	0.0068	0.0054	0.0014
19	0.0069	0.0055	0.0014
20	0.0069	0.0055	0.0014
21	0.0069	0.0055	0.0014
22	0.0069	0.0055	0.0014
23	0.0069	0.0055	0.0014
24	0.0069	0.0055	0.0014
25	0.0070	0.0056	0.0014
26	0.0070	0.0056	0.0014
27	0.0070	0.0056	0.0014
28	0.0070	0.0056	0.0014
29	0.0071	0.0056	0.0014
30	0.0071	0.0056	0.0014
31	0.0071	0.0057	0.0014
32	0.0071	0.0057	0.0014
33	0.0071	0.0057	0.0014
34	0.0072	0.0057	0.0015
35	0.0072	0.0057	0.0015
36	0.0072	0.0057	0.0015
37	0.0072	0.0058	0.0015
38	0.0072	0.0058	0.0015
39	0.0073	0.0058	0.0015
40	0.0073	0.0058	0.0015
41	0.0073	0.0058	0.0015
42	0.0073	0.0059	0.0015
43	0.0074	0.0059	0.0015
44	0.0074	0.0059	0.0015
45	0.0074	0.0059	0.0015
46	0.0074	0.0059	0.0015
47	0.0075	0.0060	0.0015
48	0.0075	0.0060	0.0015
49	0.0075	0.0060	0.0015
50	0.0075	0.0060	0.0015
51	0.0076	0.0060	0.0015
52	0.0076	0.0061	0.0015
53	0.0076	0.0061	0.0015
54	0.0076	0.0061	0.0016
55	0.0077	0.0061	0.0016
56	0.0077	0.0061	0.0016
57	0.0077	0.0062	0.0016
58	0.0078	0.0062	0.0016
59	0.0078	0.0062	0.0016
60	0.0078	0.0062	0.0016
61	0.0078	0.0063	0.0016
62	0.0079	0.0063	0.0016
63	0.0079	0.0063	0.0016
64	0.0079	0.0063	0.0016
65	0.0080	0.0064	0.0016
66	0.0080	0.0064	0.0016
67	0.0080	0.0064	0.0016
68	0.0080	0.0064	0.0016
69	0.0081	0.0064	0.0016
70	0.0081	0.0065	0.0016
71	0.0082	0.0065	0.0017
72	0.0082	0.0065	0.0017
73	0.0082	0.0066	0.0017
74	0.0082	0.0066	0.0017
75	0.0083	0.0066	0.0017

76	0.0083	0.0066	0.0017
77	0.0084	0.0067	0.0017
78	0.0084	0.0067	0.0017
79	0.0084	0.0067	0.0017
80	0.0085	0.0067	0.0017
81	0.0085	0.0068	0.0017
82	0.0085	0.0068	0.0017
83	0.0086	0.0068	0.0017
84	0.0086	0.0069	0.0017
85	0.0087	0.0069	0.0018
86	0.0087	0.0069	0.0018
87	0.0087	0.0070	0.0018
88	0.0088	0.0070	0.0018
89	0.0088	0.0070	0.0018
90	0.0088	0.0071	0.0018
91	0.0089	0.0071	0.0018
92	0.0089	0.0071	0.0018
93	0.0090	0.0072	0.0018
94	0.0090	0.0072	0.0018
95	0.0091	0.0072	0.0018
96	0.0091	0.0073	0.0018
97	0.0092	0.0073	0.0019
98	0.0092	0.0073	0.0019
99	0.0093	0.0074	0.0019
100	0.0093	0.0074	0.0019
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103	0.0095	0.0075	0.0019
104	0.0095	0.0076	0.0019
105	0.0096	0.0076	0.0019
106	0.0096	0.0077	0.0019
107	0.0097	0.0077	0.0020
108	0.0097	0.0077	0.0020
109	0.0098	0.0078	0.0020
110	0.0098	0.0078	0.0020
111	0.0099	0.0079	0.0020
112	0.0099	0.0079	0.0020
113	0.0100	0.0080	0.0020
114	0.0101	0.0080	0.0020
115	0.0102	0.0081	0.0021
116	0.0102	0.0081	0.0021
117	0.0103	0.0082	0.0021
118	0.0103	0.0082	0.0021
119	0.0104	0.0083	0.0021
120	0.0105	0.0083	0.0021
121	0.0106	0.0084	0.0021
122	0.0106	0.0085	0.0022
123	0.0107	0.0085	0.0022
124	0.0108	0.0086	0.0022
125	0.0109	0.0087	0.0022
126	0.0109	0.0087	0.0022
127	0.0110	0.0088	0.0022
128	0.0111	0.0088	0.0022
129	0.0112	0.0089	0.0023
130	0.0112	0.0090	0.0023
131	0.0114	0.0091	0.0023
132	0.0114	0.0091	0.0023
133	0.0115	0.0092	0.0023

134	0.0116	0.0093	0.0024
135	0.0117	0.0094	0.0024
136	0.0118	0.0094	0.0024
137	0.0119	0.0095	0.0024
138	0.0120	0.0096	0.0024
139	0.0122	0.0097	0.0025
140	0.0122	0.0098	0.0025
141	0.0124	0.0099	0.0025
142	0.0125	0.0099	0.0025
143	0.0126	0.0101	0.0026
144	0.0127	0.0101	0.0026
145	0.0122	0.0097	0.0025
146	0.0122	0.0098	0.0025
147	0.0124	0.0099	0.0025
148	0.0125	0.0100	0.0025
149	0.0127	0.0101	0.0026
150	0.0128	0.0102	0.0026
151	0.0130	0.0104	0.0026
152	0.0131	0.0105	0.0027
153	0.0134	0.0107	0.0027
154	0.0135	0.0107	0.0027
155	0.0137	0.0109	0.0028
156	0.0139	0.0110	0.0028
157	0.0141	0.0113	0.0029
158	0.0143	0.0114	0.0029
159	0.0145	0.0116	0.0030
160	0.0147	0.0117	0.0030
161	0.0150	0.0120	0.0030
162	0.0152	0.0121	0.0031
163	0.0155	0.0124	0.0032
164	0.0157	0.0125	0.0032
165	0.0161	0.0128	0.0033
166	0.0163	0.0130	0.0033
167	0.0167	0.0133	0.0034
168	0.0170	0.0135	0.0034
169	0.0175	0.0140	0.0036
170	0.0178	0.0142	0.0036
171	0.0184	0.0146	0.0037
172	0.0186	0.0149	0.0038
173	0.0193	0.0154	0.0039
174	0.0196	0.0157	0.0040
175	0.0204	0.0162	0.0041
176	0.0208	0.0166	0.0042
177	0.0217	0.0173	0.0044
178	0.0222	0.0177	0.0045
179	0.0233	0.0185	0.0047
180	0.0239	0.0190	0.0048
181	0.0252	0.0201	0.0051
182	0.0260	0.0207	0.0053
183	0.0278	0.0222	0.0056
184	0.0288	0.0230	0.0059
185	0.0195	0.0156	0.0040
186	0.0208	0.0166	0.0042
187	0.0241	0.0192	0.0049
188	0.0263	0.0210	0.0053
189	0.0328	0.0261	0.0066
190	0.0377	0.0301	0.0077
191	0.0572	0.0456	0.0116

192	0.0831	0.0531	0.0300
193	0.3595	0.0531	0.3064
194	0.0450	0.0359	0.0091
195	0.0291	0.0232	0.0059
196	0.0223	0.0178	0.0045
197	0.0300	0.0239	0.0061
198	0.0269	0.0214	0.0055
199	0.0245	0.0196	0.0050
200	0.0227	0.0181	0.0046
201	0.0212	0.0169	0.0043
202	0.0200	0.0159	0.0041
203	0.0190	0.0151	0.0038
204	0.0181	0.0144	0.0037
205	0.0172	0.0137	0.0035
206	0.0165	0.0132	0.0034
207	0.0159	0.0127	0.0032
208	0.0154	0.0122	0.0031
209	0.0149	0.0118	0.0030
210	0.0144	0.0115	0.0029
211	0.0140	0.0111	0.0028
212	0.0136	0.0108	0.0028
213	0.0133	0.0106	0.0027
214	0.0129	0.0103	0.0026
215	0.0126	0.0101	0.0026
216	0.0123	0.0098	0.0025
217	0.0128	0.0102	0.0026
218	0.0125	0.0100	0.0025
219	0.0123	0.0098	0.0025
220	0.0121	0.0096	0.0025
221	0.0119	0.0095	0.0024
222	0.0117	0.0093	0.0024
223	0.0115	0.0092	0.0023
224	0.0113	0.0090	0.0023
225	0.0111	0.0089	0.0023
226	0.0110	0.0087	0.0022
227	0.0108	0.0086	0.0022
228	0.0107	0.0085	0.0022
229	0.0105	0.0084	0.0021
230	0.0104	0.0083	0.0021
231	0.0102	0.0082	0.0021
232	0.0101	0.0081	0.0021
233	0.0100	0.0080	0.0020
234	0.0099	0.0079	0.0020
235	0.0098	0.0078	0.0020
236	0.0096	0.0077	0.0020
237	0.0095	0.0076	0.0019
238	0.0094	0.0075	0.0019
239	0.0093	0.0074	0.0019
240	0.0092	0.0074	0.0019
241	0.0091	0.0073	0.0019
242	0.0090	0.0072	0.0018
243	0.0090	0.0071	0.0018
244	0.0089	0.0071	0.0018
245	0.0088	0.0070	0.0018
246	0.0087	0.0069	0.0018
247	0.0086	0.0069	0.0018
248	0.0086	0.0068	0.0017
249	0.0085	0.0068	0.0017

```
      250              0.0084           0.0067             0.0017
      251              0.0083           0.0066             0.0017
      252              0.0083           0.0066             0.0017
      253              0.0082           0.0065             0.0017
      254              0.0081           0.0065             0.0017
      255              0.0081           0.0064             0.0016
      256              0.0080           0.0064             0.0016
      257              0.0079           0.0063             0.0016
      258              0.0079           0.0063             0.0016
      259              0.0078           0.0062             0.0016
      260              0.0078           0.0062             0.0016
      261              0.0077           0.0062             0.0016
      262              0.0077           0.0061             0.0016
      263              0.0076           0.0061             0.0015
      264              0.0076           0.0060             0.0015
      265              0.0075           0.0060             0.0015
      266              0.0075           0.0059             0.0015
      267              0.0074           0.0059             0.0015
      268              0.0074           0.0059             0.0015
      269              0.0073           0.0058             0.0015
      270              0.0073           0.0058             0.0015
      271              0.0072           0.0058             0.0015
      272              0.0072           0.0057             0.0015
      273              0.0071           0.0057             0.0014
      274              0.0071           0.0056             0.0014
      275              0.0070           0.0056             0.0014
      276              0.0070           0.0056             0.0014
      277              0.0070           0.0055             0.0014
      278              0.0069           0.0055             0.0014
      279              0.0069           0.0055             0.0014
      280              0.0068           0.0055             0.0014
      281              0.0068           0.0054             0.0014
      282              0.0068           0.0054             0.0014
      283              0.0067           0.0054             0.0014
      284              0.0067           0.0053             0.0014
      285              0.0067           0.0053             0.0014
      286              0.0066           0.0053             0.0013
      287              0.0066           0.0053             0.0013
      288              0.0066           0.0052             0.0013
      --------------------------------------------------------------------
      --------------------------------------------------------------------
      Total soil rain loss =      2.68(In)
      Total effective rainfall =      0.99(In)
      Peak flow rate in flood hydrograph =     50.81(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       15.0      30.0      45.0      60.0
-----------------------------------------------------------------------
  0+ 5       0.0001      0.01  Q       |         |         |         |
  0+10       0.0004      0.05  Q       |         |         |         |
  0+15       0.0014      0.13  Q       |         |         |         |
  0+20       0.0035      0.31  Q       |         |         |         |
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 0+25        0.0070       0.50  Q          |         |         |         |
 0+30        0.0113       0.63  Q          |         |         |         |
 0+35        0.0162       0.72  Q          |         |         |         |
 0+40        0.0216       0.78  Q          |         |         |         |
 0+45        0.0273       0.83  Q          |         |         |         |
 0+50        0.0333       0.87  Q          |         |         |         |
 0+55        0.0396       0.91  Q          |         |         |         |
 1+ 0        0.0460       0.94  Q          |         |         |         |
 1+ 5        0.0526       0.96  Q          |         |         |         |
 1+10        0.0594       0.99  Q          |         |         |         |
 1+15        0.0663       1.01  Q          |         |         |         |
 1+20        0.0734       1.02  Q          |         |         |         |
 1+25        0.0806       1.04  Q          |         |         |         |
 1+30        0.0878       1.05  Q          |         |         |         |
 1+35        0.0952       1.07  Q          |         |         |         |
 1+40        0.1026       1.08  Q          |         |         |         |
 1+45        0.1101       1.09  Q          |         |         |         |
 1+50        0.1177       1.10  Q          |         |         |         |
 1+55        0.1254       1.11  Q          |         |         |         |
 2+ 0        0.1331       1.12  Q          |         |         |         |
 2+ 5        0.1409       1.13  Q          |         |         |         |
 2+10        0.1487       1.14  QV         |         |         |         |
 2+15        0.1566       1.14  QV         |         |         |         |
 2+20        0.1645       1.15  QV         |         |         |         |
 2+25        0.1724       1.16  QV         |         |         |         |
 2+30        0.1804       1.16  QV         |         |         |         |
 2+35        0.1885       1.17  QV         |         |         |         |
 2+40        0.1966       1.17  QV         |         |         |         |
 2+45        0.2047       1.18  QV         |         |         |         |
 2+50        0.2128       1.19  QV         |         |         |         |
 2+55        0.2211       1.19  QV         |         |         |         |
 3+ 0        0.2293       1.20  QV         |         |         |         |
 3+ 5        0.2376       1.20  QV         |         |         |         |
 3+10        0.2459       1.21  QV         |         |         |         |
 3+15        0.2542       1.21  QV         |         |         |         |
 3+20        0.2626       1.21  QV         |         |         |         |
 3+25        0.2709       1.22  QV         |         |         |         |
 3+30        0.2793       1.22  QV         |         |         |         |
 3+35        0.2878       1.22  Q V        |         |         |         |
 3+40        0.2962       1.23  Q V        |         |         |         |
 3+45        0.3047       1.23  Q V        |         |         |         |
 3+50        0.3132       1.24  Q V        |         |         |         |
 3+55        0.3218       1.24  Q V        |         |         |         |
 4+ 0        0.3303       1.24  Q V        |         |         |         |
 4+ 5        0.3389       1.25  Q V        |         |         |         |
 4+10        0.3476       1.25  Q V        |         |         |         |
 4+15        0.3562       1.26  Q V        |         |         |         |
 4+20        0.3649       1.26  Q V        |         |         |         |
 4+25        0.3736       1.26  Q V        |         |         |         |
 4+30        0.3823       1.27  Q V        |         |         |         |
 4+35        0.3911       1.27  Q V        |         |         |         |
 4+40        0.3999       1.28  Q V        |         |         |         |
 4+45        0.4087       1.28  Q V        |         |         |         |
 4+50        0.4176       1.29  Q V        |         |         |         |
 4+55        0.4265       1.29  Q V        |         |         |         |
 5+ 0        0.4354       1.29  Q  V       |         |         |         |
 5+ 5        0.4443       1.30  Q  V       |         |         |         |
 5+10        0.4533       1.30  Q  V       |         |         |         |
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 5+15       0.4623      1.31  Q  V      |         |         |         |
 5+20       0.4714      1.31  Q  V      |         |         |         |
 5+25       0.4805      1.32  Q  V      |         |         |         |
 5+30       0.4896      1.32  Q  V      |         |         |         |
 5+35       0.4987      1.33  Q  V      |         |         |         |
 5+40       0.5079      1.33  Q  V      |         |         |         |
 5+45       0.5171      1.34  Q  V      |         |         |         |
 5+50       0.5263      1.34  Q  V      |         |         |         |
 5+55       0.5356      1.35  Q  V      |         |         |         |
 6+ 0       0.5449      1.35  Q  V      |         |         |         |
 6+ 5       0.5543      1.36  Q  V      |         |         |         |
 6+10       0.5637      1.36  Q  V      |         |         |         |
 6+15       0.5731      1.37  Q   V     |         |         |         |
 6+20       0.5826      1.37  Q   V     |         |         |         |
 6+25       0.5921      1.38  Q   V     |         |         |         |
 6+30       0.6016      1.39  Q   V     |         |         |         |
 6+35       0.6112      1.39  Q   V     |         |         |         |
 6+40       0.6208      1.40  Q   V     |         |         |         |
 6+45       0.6305      1.40  Q   V     |         |         |         |
 6+50       0.6402      1.41  Q   V     |         |         |         |
 6+55       0.6499      1.41  Q   V     |         |         |         |
 7+ 0       0.6597      1.42  Q   V     |         |         |         |
 7+ 5       0.6695      1.43  Q   V     |         |         |         |
 7+10       0.6794      1.43  Q   V     |         |         |         |
 7+15       0.6893      1.44  Q   V     |         |         |         |
 7+20       0.6992      1.44  Q   V     |         |         |         |
 7+25       0.7092      1.45  Q   V     |         |         |         |
 7+30       0.7193      1.46  Q    V    |         |         |         |
 7+35       0.7293      1.46  Q    V    |         |         |         |
 7+40       0.7395      1.47  Q    V    |         |         |         |
 7+45       0.7496      1.48  Q    V    |         |         |         |
 7+50       0.7599      1.48  Q    V    |         |         |         |
 7+55       0.7701      1.49  Q    V    |         |         |         |
 8+ 0       0.7804      1.50  Q    V    |         |         |         |
 8+ 5       0.7908      1.50  |Q   V    |         |         |         |
 8+10       0.8012      1.51  |Q   V    |         |         |         |
 8+15       0.8117      1.52  |Q   V    |         |         |         |
 8+20       0.8222      1.53  |Q   V    |         |         |         |
 8+25       0.8328      1.53  |Q   V    |         |         |         |
 8+30       0.8434      1.54  |Q   V    |         |         |         |
 8+35       0.8541      1.55  |Q   V    |         |         |         |
 8+40       0.8648      1.56  |Q    V   |         |         |         |
 8+45       0.8756      1.57  |Q    V   |         |         |         |
 8+50       0.8864      1.57  |Q    V   |         |         |         |
 8+55       0.8973      1.58  |Q    V   |         |         |         |
 9+ 0       0.9083      1.59  |Q    V   |         |         |         |
 9+ 5       0.9193      1.60  |Q    V   |         |         |         |
 9+10       0.9303      1.61  |Q    V   |         |         |         |
 9+15       0.9415      1.62  |Q    V   |         |         |         |
 9+20       0.9527      1.63  |Q    V   |         |         |         |
 9+25       0.9639      1.63  |Q    V   |         |         |         |
 9+30       0.9753      1.64  |Q    V   |         |         |         |
 9+35       0.9866      1.65  |Q    V   |         |         |         |
 9+40       0.9981      1.66  |Q    V   |         |         |         |
 9+45       1.0096      1.67  |Q     V  |         |         |         |
 9+50       1.0212      1.68  |Q     V  |         |         |         |
 9+55       1.0329      1.69  |Q     V  |         |         |         |
10+ 0       1.0446      1.70  |Q     V  |         |         |         |
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10+ 5       1.0564      1.71  |Q     V  |         |         |         |
10+10       1.0683      1.73  |Q     V  |         |         |         |
10+15       1.0803      1.74  |Q     V  |         |         |         |
10+20       1.0923      1.75  |Q     V  |         |         |         |
10+25       1.1044      1.76  |Q     V  |         |         |         |
10+30       1.1166      1.77  |Q     V  |         |         |         |
10+35       1.1289      1.78  |Q     V  |         |         |         |
10+40       1.1412      1.79  |Q     V  |         |         |         |
10+45       1.1537      1.81  |Q      V |         |         |         |
10+50       1.1662      1.82  |Q      V |         |         |         |
10+55       1.1788      1.83  |Q      V |         |         |         |
11+ 0       1.1915      1.85  |Q      V |         |         |         |
11+ 5       1.2043      1.86  |Q      V |         |         |         |
11+10       1.2172      1.87  |Q      V |         |         |         |
11+15       1.2302      1.89  |Q      V |         |         |         |
11+20       1.2433      1.90  |Q      V |         |         |         |
11+25       1.2565      1.92  |Q      V |         |         |         |
11+30       1.2698      1.93  |Q      V |         |         |         |
11+35       1.2832      1.95  |Q      V |         |         |         |
11+40       1.2968      1.96  |Q       V|         |         |         |
11+45       1.3104      1.98  |Q       V|         |         |         |
11+50       1.3241      2.00  |Q       V|         |         |         |
11+55       1.3380      2.01  |Q       V|         |         |         |
12+ 0       1.3520      2.03  |Q       V|         |         |         |
12+ 5       1.3661      2.05  |Q       V|         |         |         |
12+10       1.3803      2.06  |Q       V|         |         |         |
12+15       1.3946      2.07  |Q       V|         |         |         |
12+20       1.4088      2.07  |Q       V|         |         |         |
12+25       1.4231      2.07  |Q       V|         |         |         |
12+30       1.4374      2.08  |Q        V         |         |         |
12+35       1.4518      2.09  |Q        V         |         |         |
12+40       1.4663      2.11  |Q        V         |         |         |
12+45       1.4810      2.12  |Q        V         |         |         |
12+50       1.4957      2.14  |Q        V         |         |         |
12+55       1.5106      2.16  |Q        V         |         |         |
13+ 0       1.5257      2.19  |Q        V         |         |         |
13+ 5       1.5409      2.21  |Q        V         |         |         |
13+10       1.5563      2.24  |Q        V         |         |         |
13+15       1.5719      2.26  |Q        V         |         |         |
13+20       1.5877      2.29  |Q        |V        |         |         |
13+25       1.6037      2.32  |Q        |V        |         |         |
13+30       1.6199      2.35  |Q        |V        |         |         |
13+35       1.6363      2.38  |Q        |V        |         |         |
13+40       1.6530      2.42  |Q        |V        |         |         |
13+45       1.6699      2.45  |Q        |V        |         |         |
13+50       1.6870      2.49  |Q        |V        |         |         |
13+55       1.7044      2.53  |Q        |V        |         |         |
14+ 0       1.7221      2.57  |Q        | V       |         |         |
14+ 5       1.7402      2.62  |Q        | V       |         |         |
14+10       1.7585      2.66  |Q        | V       |         |         |
14+15       1.7772      2.71  |Q        | V       |         |         |
14+20       1.7962      2.77  |Q        | V       |         |         |
14+25       1.8157      2.82  |Q        | V       |         |         |
14+30       1.8355      2.88  |Q        | V       |         |         |
14+35       1.8558      2.95  |Q        | V       |         |         |
14+40       1.8766      3.02  | Q       |  V      |         |         |
14+45       1.8979      3.09  | Q       |  V      |         |         |
14+50       1.9197      3.16  | Q       |  V      |         |         |
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14+55       1.9420      3.25  | Q       |  V      |         |         |
15+ 0       1.9650      3.34  | Q       |  V      |         |         |
15+ 5       1.9887      3.44  | Q       |  V      |         |         |
15+10       2.0131      3.55  | Q       |   V     |         |         |
15+15       2.0384      3.67  | Q       |   V     |         |         |
15+20       2.0646      3.80  | Q       |   V     |         |         |
15+25       2.0916      3.93  | Q       |   V     |         |         |
15+30       2.1194      4.03  | Q       |   V     |         |         |
15+35       2.1474      4.07  | Q       |    V    |         |         |
15+40       2.1748      3.97  | Q       |    V    |         |         |
15+45       2.2016      3.89  | Q       |    V    |         |         |
15+50       2.2290      3.98  | Q       |    V    |         |         |
15+55       2.2582      4.24  | Q       |    V    |         |         |
16+ 0       2.2917      4.86  |  Q      |     V   |         |         |
16+ 5       2.3499      8.45  |    Q    |     V   |         |         |
16+10       2.4628     16.40  |         Q      V  |         |         |
16+15       2.6509     27.31  |         |       Q |         |         |
16+20       2.9911     49.39  |         |         V         | Q       |
16+25       3.3410     50.81  |         |         |  V      |  Q      |
16+30       3.5859     35.56  |         |         |  Q V    |         |
16+35       3.7595     25.20  |         |     Q   |      V  |         |
16+40       3.8958     19.80  |         |  Q      |       V |         |
16+45       4.0107     16.68  |         |Q        |        V|         |
16+50       4.1093     14.32  |        Q|         |        V|         |
16+55       4.1941     12.31  |       Q |         |         V         |
17+ 0       4.2689     10.86  |      Q  |         |         V         |
17+ 5       4.3368      9.86  |     Q   |         |         V         |
17+10       4.3992      9.06  |     Q   |         |         V         |
17+15       4.4551      8.13  |    Q    |         |         |V        |
17+20       4.5041      7.12  |   Q     |         |         |V        |
17+25       4.5498      6.64  |   Q     |         |         |V        |
17+30       4.5926      6.21  |   Q     |         |         | V       |
17+35       4.6326      5.80  |  Q      |         |         | V       |
17+40       4.6700      5.44  |  Q      |         |         | V       |
17+45       4.7040      4.93  |  Q      |         |         | V       |
17+50       4.7368      4.76  |  Q      |         |         |  V      |
17+55       4.7671      4.40  | Q       |         |         |  V      |
18+ 0       4.7957      4.15  | Q       |         |         |  V      |
18+ 5       4.8228      3.94  | Q       |         |         |  V      |
18+10       4.8473      3.57  | Q       |         |         |  V      |
18+15       4.8710      3.44  | Q       |         |         |   V     |
18+20       4.8924      3.10  | Q       |         |         |   V     |
18+25       4.9127      2.96  |Q        |         |         |   V     |
18+30       4.9331      2.95  |Q        |         |         |   V     |
18+35       4.9536      2.98  |Q        |         |         |   V     |
18+40       4.9738      2.93  |Q        |         |         |   V     |
18+45       4.9937      2.89  |Q        |         |         |   V     |
18+50       5.0131      2.83  |Q        |         |         |    V    |
18+55       5.0312      2.63  |Q        |         |         |    V    |
19+ 0       5.0480      2.43  |Q        |         |         |    V    |
19+ 5       5.0644      2.38  |Q        |         |         |    V    |
19+10       5.0793      2.17  |Q        |         |         |    V    |
19+15       5.0928      1.97  |Q        |         |         |    V    |
19+20       5.1062      1.93  |Q        |         |         |    V    |
19+25       5.1193      1.90  |Q        |         |         |    V    |
19+30       5.1322      1.87  |Q        |         |         |    V    |
19+35       5.1449      1.84  |Q        |         |         |    V    |
19+40       5.1574      1.82  |Q        |         |         |     V   |
```

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19+45       5.1697      1.79  |Q        |         |         |     V   |
19+50       5.1818      1.77  |Q        |         |         |     V   |
19+55       5.1938      1.74  |Q        |         |         |     V   |
20+ 0       5.2057      1.72  |Q        |         |         |     V   |
20+ 5       5.2174      1.70  |Q        |         |         |     V   |
20+10       5.2289      1.68  |Q        |         |         |     V   |
20+15       5.2403      1.66  |Q        |         |         |     V   |
20+20       5.2516      1.64  |Q        |         |         |     V   |
20+25       5.2628      1.62  |Q        |         |         |     V   |
20+30       5.2738      1.60  |Q        |         |         |     V   |
20+35       5.2847      1.58  |Q        |         |         |     V   |
20+40       5.2955      1.57  |Q        |         |         |      V  |
20+45       5.3062      1.55  |Q        |         |         |      V  |
20+50       5.3167      1.54  |Q        |         |         |      V  |
20+55       5.3272      1.52  |Q        |         |         |      V  |
21+ 0       5.3376      1.51  |Q        |         |         |      V  |
21+ 5       5.3479      1.49  Q         |         |         |      V  |
21+10       5.3580      1.48  Q         |         |         |      V  |
21+15       5.3681      1.46  Q         |         |         |      V  |
21+20       5.3781      1.45  Q         |         |         |      V  |
21+25       5.3880      1.44  Q         |         |         |      V  |
21+30       5.3979      1.43  Q         |         |         |      V  |
21+35       5.4076      1.41  Q         |         |         |      V  |
21+40       5.4172      1.40  Q         |         |         |      V  |
21+45       5.4268      1.39  Q         |         |         |      V  |
21+50       5.4363      1.38  Q         |         |         |       V |
21+55       5.4457      1.37  Q         |         |         |       V |
22+ 0       5.4551      1.36  Q         |         |         |       V |
22+ 5       5.4644      1.35  Q         |         |         |       V |
22+10       5.4736      1.34  Q         |         |         |       V |
22+15       5.4827      1.33  Q         |         |         |       V |
22+20       5.4918      1.32  Q         |         |         |       V |
22+25       5.5008      1.31  Q         |         |         |       V |
22+30       5.5097      1.30  Q         |         |         |       V |
22+35       5.5186      1.29  Q         |         |         |       V |
22+40       5.5274      1.28  Q         |         |         |       V |
22+45       5.5362      1.27  Q         |         |         |       V |
22+50       5.5449      1.26  Q         |         |         |       V |
22+55       5.5535      1.25  Q         |         |         |       V |
23+ 0       5.5621      1.25  Q         |         |         |       V |
23+ 5       5.5707      1.24  Q         |         |         |       V |
23+10       5.5791      1.23  Q         |         |         |        V|
23+15       5.5876      1.22  Q         |         |         |        V|
23+20       5.5959      1.22  Q         |         |         |        V|
23+25       5.6043      1.21  Q         |         |         |        V|
23+30       5.6125      1.20  Q         |         |         |        V|
23+35       5.6207      1.19  Q         |         |         |        V|
23+40       5.6289      1.19  Q         |         |         |        V|
23+45       5.6370      1.18  Q         |         |         |        V|
23+50       5.6451      1.17  Q         |         |         |        V|
23+55       5.6532      1.17  Q         |         |         |        V|
24+ 0       5.6611      1.16  Q         |         |         |        V|
24+ 5       5.6690      1.14  Q         |         |         |        V|
24+10       5.6765      1.09  Q         |         |         |        V|
24+15       5.6835      1.01  Q         |         |         |        V|
24+20       5.6892      0.82  Q         |         |         |        V|
24+25       5.6935      0.63  Q         |         |         |        V|
24+30       5.6970      0.50  Q         |         |         |        V|
```

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  24+35       5.6998      0.41  Q          |         |         |        V|
  24+40       5.7022      0.35  Q          |         |         |        V|
  24+45       5.7043      0.30  Q          |         |         |        V|
  24+50       5.7061      0.26  Q          |         |         |        V|
  24+55       5.7076      0.23  Q          |         |         |        V|
  25+ 0       5.7090      0.20  Q          |         |         |        V|
  25+ 5       5.7102      0.17  Q          |         |         |        V|
  25+10       5.7112      0.15  Q          |         |         |        V|
  25+15       5.7121      0.13  Q          |         |         |        V|
  25+20       5.7129      0.12  Q          |         |         |        V|
  25+25       5.7136      0.10  Q          |         |         |        V|
  25+30       5.7142      0.09  Q          |         |         |        V|
  25+35       5.7148      0.08  Q          |         |         |        V|
  25+40       5.7153      0.07  Q          |         |         |        V|
  25+45       5.7157      0.06  Q          |         |         |        V|
  25+50       5.7160      0.05  Q          |         |         |        V|
  25+55       5.7163      0.05  Q          |         |         |        V|
  26+ 0       5.7166      0.04  Q          |         |         |        V|
  26+ 5       5.7168      0.03  Q          |         |         |        V|
  26+10       5.7170      0.03  Q          |         |         |        V|
  26+15       5.7172      0.02  Q          |         |         |        V|
  26+20       5.7174      0.02  Q          |         |         |        V|
  26+25       5.7175      0.02  Q          |         |         |        V|
  26+30       5.7176      0.02  Q          |         |         |        V|
  26+35       5.7177      0.01  Q          |         |         |        V|
  26+40       5.7178      0.01  Q          |         |         |        V|
  26+45       5.7178      0.01  Q          |         |         |        V|
  26+50       5.7179      0.01  Q          |         |         |        V|
  26+55       5.7179      0.00  Q          |         |         |        V|
  27+ 0       5.7179      0.00  Q          |         |         |        V|
  27+ 5       5.7179      0.00  Q          |         |         |         V
-----------------------------------------------------------------------
```

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

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014, Version 9.0

                Study date  05/06/20

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


Program License Serial Number 6320

---------------------------------------------------------------------
204728 - US Cold Storage
PROPOSED CONDITIONS - AREA A
10-YEAR, 1- HOUR STORM
BY: SG  DATE: 05-06-20
--------------------------------------------------------------------

        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        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
            69.33           1           0.76
--------------------------------------------------------------------
Rainfall data for year 2
            69.33           6           1.04
--------------------------------------------------------------------
Rainfall data for year 2
            69.33          24           1.96
--------------------------------------------------------------------
Rainfall data for year 100
            69.33           1           1.27
--------------------------------------------------------------------
Rainfall data for year 100
            69.33           6           2.90
--------------------------------------------------------------------
Rainfall data for year 100
            69.33          24           6.12
--------------------------------------------------------------------
```

```
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 63.0      63.0         69.33      1.000     0.637    0.220    0.140

Area-averaged adjusted loss rate Fm (In/Hr) =  0.140

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
    15.25   0.220         63.0      63.0       5.87     0.203
    54.08   0.780         98.0      98.0       0.20     0.936

Area-averaged catchment yield fraction, Y =  0.775
Area-averaged low loss fraction, Yb =  0.225
User entry of time of concentration  =   0.259 (hours)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      69.33(Ac.)
Catchment Lag time =   0.207 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 40.2188
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.140(In/Hr)
Average low loss rate fraction (Yb) = 0.225 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.361(In)
Computed peak 30-minute rainfall =  0.617(In)
Specified peak 1-hour rainfall =  0.760(In)
Computed peak 3-hour rainfall =  1.292(In)
Specified peak 6-hour rainfall =  1.805(In)
Specified peak 24-hour rainfall =  3.671(In)


Rainfall depth area reduction factors:
Using a total area of      69.33(Ac.) (Ref: fig. E-4)

5-minute factor = 0.997     Adjusted rainfall =  0.359(In)
30-minute factor = 0.997    Adjusted rainfall =  0.615(In)
1-hour factor = 0.997       Adjusted rainfall =  0.758(In)
3-hour factor = 1.000       Adjusted rainfall =  1.291(In)
6-hour factor = 1.000       Adjusted rainfall =  1.805(In)
24-hour factor = 1.000      Adjusted rainfall =  3.671(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 =       838.46 (CFS))

  1               2.772                  23.244
  2              18.946                 135.610
```

3	49.467	255.908
4	65.841	137.286
5	74.974	76.575
6	81.019	50.693
7	85.377	36.535
8	88.714	27.978
9	91.129	20.255
10	93.102	16.543
11	94.658	13.044
12	95.920	10.578
13	96.919	8.381
14	97.656	6.179
15	98.132	3.989
16	98.581	3.762
17	99.063	4.047
18	99.505	3.703
19	99.775	2.266
20	100.000	1.884

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3595	0.3595
2	0.4425	0.0831
3	0.4998	0.0572
4	0.5448	0.0450
5	0.5826	0.0377
6	0.6153	0.0328
7	0.6444	0.0291
8	0.6708	0.0263
9	0.6949	0.0241
10	0.7172	0.0223
11	0.7380	0.0208
12	0.7575	0.0195
13	0.7875	0.0300
14	0.8164	0.0288
15	0.8442	0.0278
16	0.8711	0.0269
17	0.8971	0.0260
18	0.9223	0.0252
19	0.9468	0.0245
20	0.9707	0.0239
21	0.9940	0.0233
22	1.0167	0.0227
23	1.0389	0.0222
24	1.0605	0.0217
25	1.0818	0.0212
26	1.1026	0.0208
27	1.1229	0.0204
28	1.1429	0.0200
29	1.1626	0.0196
30	1.1819	0.0193
31	1.2008	0.0190
32	1.2195	0.0186
33	1.2378	0.0184
34	1.2559	0.0181
35	1.2737	0.0178
36	1.2912	0.0175
37	1.3084	0.0172

38	1.3254	0.0170
39	1.3421	0.0167
40	1.3587	0.0165
41	1.3750	0.0163
42	1.3911	0.0161
43	1.4070	0.0159
44	1.4227	0.0157
45	1.4382	0.0155
46	1.4536	0.0154
47	1.4687	0.0152
48	1.4838	0.0150
49	1.4986	0.0149
50	1.5133	0.0147
51	1.5279	0.0145
52	1.5423	0.0144
53	1.5565	0.0143
54	1.5706	0.0141
55	1.5846	0.0140
56	1.5985	0.0139
57	1.6122	0.0137
58	1.6258	0.0136
59	1.6393	0.0135
60	1.6527	0.0134
61	1.6659	0.0133
62	1.6790	0.0131
63	1.6921	0.0130
64	1.7050	0.0129
65	1.7178	0.0128
66	1.7305	0.0127
67	1.7432	0.0126
68	1.7557	0.0125
69	1.7681	0.0124
70	1.7804	0.0123
71	1.7927	0.0122
72	1.8048	0.0122
73	1.8176	0.0128
74	1.8303	0.0127
75	1.8430	0.0126
76	1.8555	0.0125
77	1.8680	0.0125
78	1.8804	0.0124
79	1.8927	0.0123
80	1.9049	0.0122
81	1.9171	0.0122
82	1.9291	0.0121
83	1.9412	0.0120
84	1.9531	0.0119
85	1.9650	0.0119
86	1.9768	0.0118
87	1.9885	0.0117
88	2.0002	0.0117
89	2.0118	0.0116
90	2.0234	0.0115
91	2.0348	0.0115
92	2.0463	0.0114
93	2.0576	0.0114
94	2.0689	0.0113
95	2.0802	0.0112

96	2.0914	0.0112
97	2.1025	0.0111
98	2.1136	0.0111
99	2.1246	0.0110
100	2.1355	0.0110
101	2.1465	0.0109
102	2.1573	0.0109
103	2.1681	0.0108
104	2.1789	0.0108
105	2.1896	0.0107
106	2.2002	0.0107
107	2.2108	0.0106
108	2.2214	0.0106
109	2.2319	0.0105
110	2.2424	0.0105
111	2.2528	0.0104
112	2.2632	0.0104
113	2.2735	0.0103
114	2.2838	0.0103
115	2.2940	0.0102
116	2.3042	0.0102
117	2.3144	0.0102
118	2.3245	0.0101
119	2.3345	0.0101
120	2.3446	0.0100
121	2.3546	0.0100
122	2.3645	0.0099
123	2.3744	0.0099
124	2.3843	0.0099
125	2.3941	0.0098
126	2.4039	0.0098
127	2.4136	0.0098
128	2.4234	0.0097
129	2.4330	0.0097
130	2.4427	0.0096
131	2.4523	0.0096
132	2.4619	0.0096
133	2.4714	0.0095
134	2.4809	0.0095
135	2.4904	0.0095
136	2.4998	0.0094
137	2.5092	0.0094
138	2.5186	0.0094
139	2.5279	0.0093
140	2.5372	0.0093
141	2.5465	0.0093
142	2.5557	0.0092
143	2.5649	0.0092
144	2.5741	0.0092
145	2.5832	0.0091
146	2.5923	0.0091
147	2.6014	0.0091
148	2.6104	0.0090
149	2.6195	0.0090
150	2.6284	0.0090
151	2.6374	0.0090
152	2.6463	0.0089
153	2.6552	0.0089

154	2.6641	0.0089
155	2.6730	0.0088
156	2.6818	0.0088
157	2.6906	0.0088
158	2.6993	0.0088
159	2.7081	0.0087
160	2.7168	0.0087
161	2.7255	0.0087
162	2.7341	0.0087
163	2.7428	0.0086
164	2.7514	0.0086
165	2.7599	0.0086
166	2.7685	0.0086
167	2.7770	0.0085
168	2.7855	0.0085
169	2.7940	0.0085
170	2.8025	0.0085
171	2.8109	0.0084
172	2.8193	0.0084
173	2.8277	0.0084
174	2.8360	0.0084
175	2.8444	0.0083
176	2.8527	0.0083
177	2.8610	0.0083
178	2.8693	0.0083
179	2.8775	0.0082
180	2.8857	0.0082
181	2.8939	0.0082
182	2.9021	0.0082
183	2.9103	0.0082
184	2.9184	0.0081
185	2.9265	0.0081
186	2.9346	0.0081
187	2.9427	0.0081
188	2.9507	0.0080
189	2.9587	0.0080
190	2.9667	0.0080
191	2.9747	0.0080
192	2.9827	0.0080
193	2.9906	0.0079
194	2.9986	0.0079
195	3.0065	0.0079
196	3.0144	0.0079
197	3.0222	0.0079
198	3.0301	0.0078
199	3.0379	0.0078
200	3.0457	0.0078
201	3.0535	0.0078
202	3.0613	0.0078
203	3.0690	0.0078
204	3.0768	0.0077
205	3.0845	0.0077
206	3.0922	0.0077
207	3.0999	0.0077
208	3.1075	0.0077
209	3.1152	0.0076
210	3.1228	0.0076
211	3.1304	0.0076

212	3.1380	0.0076
213	3.1456	0.0076
214	3.1531	0.0076
215	3.1607	0.0075
216	3.1682	0.0075
217	3.1757	0.0075
218	3.1832	0.0075
219	3.1906	0.0075
220	3.1981	0.0075
221	3.2055	0.0074
222	3.2129	0.0074
223	3.2204	0.0074
224	3.2277	0.0074
225	3.2351	0.0074
226	3.2425	0.0074
227	3.2498	0.0073
228	3.2571	0.0073
229	3.2644	0.0073
230	3.2717	0.0073
231	3.2790	0.0073
232	3.2863	0.0073
233	3.2935	0.0072
234	3.3008	0.0072
235	3.3080	0.0072
236	3.3152	0.0072
237	3.3224	0.0072
238	3.3295	0.0072
239	3.3367	0.0072
240	3.3438	0.0071
241	3.3510	0.0071
242	3.3581	0.0071
243	3.3652	0.0071
244	3.3723	0.0071
245	3.3793	0.0071
246	3.3864	0.0071
247	3.3934	0.0070
248	3.4005	0.0070
249	3.4075	0.0070
250	3.4145	0.0070
251	3.4215	0.0070
252	3.4285	0.0070
253	3.4354	0.0070
254	3.4424	0.0069
255	3.4493	0.0069
256	3.4562	0.0069
257	3.4631	0.0069
258	3.4700	0.0069
259	3.4769	0.0069
260	3.4838	0.0069
261	3.4906	0.0069
262	3.4975	0.0068
263	3.5043	0.0068
264	3.5111	0.0068
265	3.5179	0.0068
266	3.5247	0.0068
267	3.5315	0.0068
268	3.5383	0.0068
269	3.5450	0.0068

270	3.5518	0.0067
271	3.5585	0.0067
272	3.5652	0.0067
273	3.5719	0.0067
274	3.5786	0.0067
275	3.5853	0.0067
276	3.5920	0.0067
277	3.5986	0.0067
278	3.6053	0.0066
279	3.6119	0.0066
280	3.6186	0.0066
281	3.6252	0.0066
282	3.6318	0.0066
283	3.6384	0.0066
284	3.6449	0.0066
285	3.6515	0.0066
286	3.6581	0.0066
287	3.6646	0.0065
288	3.6711	0.0065

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0065	0.0015	0.0051
2	0.0065	0.0015	0.0051
3	0.0066	0.0015	0.0051
4	0.0066	0.0015	0.0051
5	0.0066	0.0015	0.0051
6	0.0066	0.0015	0.0051
7	0.0066	0.0015	0.0051
8	0.0066	0.0015	0.0052
9	0.0067	0.0015	0.0052
10	0.0067	0.0015	0.0052
11	0.0067	0.0015	0.0052
12	0.0067	0.0015	0.0052
13	0.0067	0.0015	0.0052
14	0.0068	0.0015	0.0052
15	0.0068	0.0015	0.0053
16	0.0068	0.0015	0.0053
17	0.0068	0.0015	0.0053
18	0.0068	0.0015	0.0053
19	0.0069	0.0015	0.0053
20	0.0069	0.0015	0.0053
21	0.0069	0.0016	0.0053
22	0.0069	0.0016	0.0054
23	0.0069	0.0016	0.0054
24	0.0069	0.0016	0.0054
25	0.0070	0.0016	0.0054
26	0.0070	0.0016	0.0054
27	0.0070	0.0016	0.0054
28	0.0070	0.0016	0.0054
29	0.0071	0.0016	0.0055
30	0.0071	0.0016	0.0055
31	0.0071	0.0016	0.0055
32	0.0071	0.0016	0.0055
33	0.0071	0.0016	0.0055
34	0.0072	0.0016	0.0055

35	0.0072	0.0016	0.0056
36	0.0072	0.0016	0.0056
37	0.0072	0.0016	0.0056
38	0.0072	0.0016	0.0056
39	0.0073	0.0016	0.0056
40	0.0073	0.0016	0.0057
41	0.0073	0.0016	0.0057
42	0.0073	0.0017	0.0057
43	0.0074	0.0017	0.0057
44	0.0074	0.0017	0.0057
45	0.0074	0.0017	0.0058
46	0.0074	0.0017	0.0058
47	0.0075	0.0017	0.0058
48	0.0075	0.0017	0.0058
49	0.0075	0.0017	0.0058
50	0.0075	0.0017	0.0058
51	0.0076	0.0017	0.0059
52	0.0076	0.0017	0.0059
53	0.0076	0.0017	0.0059
54	0.0076	0.0017	0.0059
55	0.0077	0.0017	0.0060
56	0.0077	0.0017	0.0060
57	0.0077	0.0017	0.0060
58	0.0078	0.0017	0.0060
59	0.0078	0.0018	0.0060
60	0.0078	0.0018	0.0061
61	0.0078	0.0018	0.0061
62	0.0079	0.0018	0.0061
63	0.0079	0.0018	0.0061
64	0.0079	0.0018	0.0061
65	0.0080	0.0018	0.0062
66	0.0080	0.0018	0.0062
67	0.0080	0.0018	0.0062
68	0.0080	0.0018	0.0062
69	0.0081	0.0018	0.0063
70	0.0081	0.0018	0.0063
71	0.0082	0.0018	0.0063
72	0.0082	0.0018	0.0063
73	0.0082	0.0019	0.0064
74	0.0082	0.0019	0.0064
75	0.0083	0.0019	0.0064
76	0.0083	0.0019	0.0064
77	0.0084	0.0019	0.0065
78	0.0084	0.0019	0.0065
79	0.0084	0.0019	0.0065
80	0.0085	0.0019	0.0066
81	0.0085	0.0019	0.0066
82	0.0085	0.0019	0.0066
83	0.0086	0.0019	0.0066
84	0.0086	0.0019	0.0067
85	0.0087	0.0019	0.0067
86	0.0087	0.0020	0.0067
87	0.0087	0.0020	0.0068
88	0.0088	0.0020	0.0068
89	0.0088	0.0020	0.0068
90	0.0088	0.0020	0.0069
91	0.0089	0.0020	0.0069
92	0.0089	0.0020	0.0069

93	0.0090	0.0020	0.0070
94	0.0090	0.0020	0.0070
95	0.0091	0.0020	0.0070
96	0.0091	0.0021	0.0071
97	0.0092	0.0021	0.0071
98	0.0092	0.0021	0.0071
99	0.0093	0.0021	0.0072
100	0.0093	0.0021	0.0072
101	0.0094	0.0021	0.0073
102	0.0094	0.0021	0.0073
103	0.0095	0.0021	0.0073
104	0.0095	0.0021	0.0074
105	0.0096	0.0022	0.0074
106	0.0096	0.0022	0.0074
107	0.0097	0.0022	0.0075
108	0.0097	0.0022	0.0075
109	0.0098	0.0022	0.0076
110	0.0098	0.0022	0.0076
111	0.0099	0.0022	0.0077
112	0.0099	0.0022	0.0077
113	0.0100	0.0023	0.0078
114	0.0101	0.0023	0.0078
115	0.0102	0.0023	0.0079
116	0.0102	0.0023	0.0079
117	0.0103	0.0023	0.0080
118	0.0103	0.0023	0.0080
119	0.0104	0.0023	0.0081
120	0.0105	0.0024	0.0081
121	0.0106	0.0024	0.0082
122	0.0106	0.0024	0.0082
123	0.0107	0.0024	0.0083
124	0.0108	0.0024	0.0083
125	0.0109	0.0024	0.0084
126	0.0109	0.0025	0.0085
127	0.0110	0.0025	0.0085
128	0.0111	0.0025	0.0086
129	0.0112	0.0025	0.0087
130	0.0112	0.0025	0.0087
131	0.0114	0.0026	0.0088
132	0.0114	0.0026	0.0089
133	0.0115	0.0026	0.0089
134	0.0116	0.0026	0.0090
135	0.0117	0.0026	0.0091
136	0.0118	0.0027	0.0091
137	0.0119	0.0027	0.0093
138	0.0120	0.0027	0.0093
139	0.0122	0.0027	0.0094
140	0.0122	0.0028	0.0095
141	0.0124	0.0028	0.0096
142	0.0125	0.0028	0.0097
143	0.0126	0.0028	0.0098
144	0.0127	0.0029	0.0098
145	0.0122	0.0027	0.0094
146	0.0122	0.0028	0.0095
147	0.0124	0.0028	0.0096
148	0.0125	0.0028	0.0097
149	0.0127	0.0029	0.0099
150	0.0128	0.0029	0.0099

151	0.0130	0.0029	0.0101
152	0.0131	0.0030	0.0102
153	0.0134	0.0030	0.0104
154	0.0135	0.0030	0.0104
155	0.0137	0.0031	0.0106
156	0.0139	0.0031	0.0107
157	0.0141	0.0032	0.0109
158	0.0143	0.0032	0.0110
159	0.0145	0.0033	0.0113
160	0.0147	0.0033	0.0114
161	0.0150	0.0034	0.0116
162	0.0152	0.0034	0.0118
163	0.0155	0.0035	0.0120
164	0.0157	0.0035	0.0122
165	0.0161	0.0036	0.0125
166	0.0163	0.0037	0.0126
167	0.0167	0.0038	0.0130
168	0.0170	0.0038	0.0131
169	0.0175	0.0039	0.0136
170	0.0178	0.0040	0.0138
171	0.0184	0.0041	0.0142
172	0.0186	0.0042	0.0145
173	0.0193	0.0043	0.0149
174	0.0196	0.0044	0.0152
175	0.0204	0.0046	0.0158
176	0.0208	0.0047	0.0161
177	0.0217	0.0049	0.0168
178	0.0222	0.0050	0.0172
179	0.0233	0.0052	0.0180
180	0.0239	0.0054	0.0185
181	0.0252	0.0057	0.0196
182	0.0260	0.0059	0.0202
183	0.0278	0.0063	0.0215
184	0.0288	0.0065	0.0224
185	0.0195	0.0044	0.0151
186	0.0208	0.0047	0.0161
187	0.0241	0.0054	0.0187
188	0.0263	0.0059	0.0204
189	0.0328	0.0074	0.0254
190	0.0377	0.0085	0.0292
191	0.0572	0.0117	0.0456
192	0.0831	0.0117	0.0714
193	0.3595	0.0117	0.3478
194	0.0450	0.0101	0.0349
195	0.0291	0.0066	0.0226
196	0.0223	0.0050	0.0173
197	0.0300	0.0068	0.0233
198	0.0269	0.0060	0.0208
199	0.0245	0.0055	0.0190
200	0.0227	0.0051	0.0176
201	0.0212	0.0048	0.0164
202	0.0200	0.0045	0.0155
203	0.0190	0.0043	0.0147
204	0.0181	0.0041	0.0140
205	0.0172	0.0039	0.0133
206	0.0165	0.0037	0.0128
207	0.0159	0.0036	0.0123
208	0.0154	0.0035	0.0119

209	0.0149	0.0033	0.0115
210	0.0144	0.0032	0.0112
211	0.0140	0.0031	0.0108
212	0.0136	0.0031	0.0105
213	0.0133	0.0030	0.0103
214	0.0129	0.0029	0.0100
215	0.0126	0.0028	0.0098
216	0.0123	0.0028	0.0096
217	0.0128	0.0029	0.0099
218	0.0125	0.0028	0.0097
219	0.0123	0.0028	0.0095
220	0.0121	0.0027	0.0094
221	0.0119	0.0027	0.0092
222	0.0117	0.0026	0.0090
223	0.0115	0.0026	0.0089
224	0.0113	0.0025	0.0088
225	0.0111	0.0025	0.0086
226	0.0110	0.0025	0.0085
227	0.0108	0.0024	0.0084
228	0.0107	0.0024	0.0083
229	0.0105	0.0024	0.0081
230	0.0104	0.0023	0.0080
231	0.0102	0.0023	0.0079
232	0.0101	0.0023	0.0078
233	0.0100	0.0022	0.0077
234	0.0099	0.0022	0.0076
235	0.0098	0.0022	0.0076
236	0.0096	0.0022	0.0075
237	0.0095	0.0021	0.0074
238	0.0094	0.0021	0.0073
239	0.0093	0.0021	0.0072
240	0.0092	0.0021	0.0072
241	0.0091	0.0021	0.0071
242	0.0090	0.0020	0.0070
243	0.0090	0.0020	0.0069
244	0.0089	0.0020	0.0069
245	0.0088	0.0020	0.0068
246	0.0087	0.0020	0.0067
247	0.0086	0.0019	0.0067
248	0.0086	0.0019	0.0066
249	0.0085	0.0019	0.0066
250	0.0084	0.0019	0.0065
251	0.0083	0.0019	0.0065
252	0.0083	0.0019	0.0064
253	0.0082	0.0018	0.0064
254	0.0081	0.0018	0.0063
255	0.0081	0.0018	0.0063
256	0.0080	0.0018	0.0062
257	0.0079	0.0018	0.0062
258	0.0079	0.0018	0.0061
259	0.0078	0.0018	0.0061
260	0.0078	0.0017	0.0060
261	0.0077	0.0017	0.0060
262	0.0077	0.0017	0.0059
263	0.0076	0.0017	0.0059
264	0.0076	0.0017	0.0059
265	0.0075	0.0017	0.0058
266	0.0075	0.0017	0.0058

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     267          0.0074          0.0017            0.0057
     268          0.0074          0.0017            0.0057
     269          0.0073          0.0016            0.0057
     270          0.0073          0.0016            0.0056
     271          0.0072          0.0016            0.0056
     272          0.0072          0.0016            0.0056
     273          0.0071          0.0016            0.0055
     274          0.0071          0.0016            0.0055
     275          0.0070          0.0016            0.0055
     276          0.0070          0.0016            0.0054
     277          0.0070          0.0016            0.0054
     278          0.0069          0.0016            0.0054
     279          0.0069          0.0015            0.0053
     280          0.0068          0.0015            0.0053
     281          0.0068          0.0015            0.0053
     282          0.0068          0.0015            0.0052
     283          0.0067          0.0015            0.0052
     284          0.0067          0.0015            0.0052
     285          0.0067          0.0015            0.0052
     286          0.0066          0.0015            0.0051
     287          0.0066          0.0015            0.0051
     288          0.0066          0.0015            0.0051
     --------------------------------------------------------------------
     --------------------------------------------------------------------
     Total soil rain loss =      0.75(In)
     Total effective rainfall =      2.92(In)
     Peak flow rate in flood hydrograph =    112.26(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       50.0     100.0     150.0     200.0
-----------------------------------------------------------------------
  0+ 5       0.0008      0.12  Q         |         |         |         |
  0+10       0.0064      0.80  Q         |         |         |         |
  0+15       0.0208      2.10  Q         |         |         |         |
  0+20       0.0401      2.80  Q         |         |         |         |
  0+25       0.0621      3.20  Q         |         |         |         |
  0+30       0.0860      3.46  Q         |         |         |         |
  0+35       0.1112      3.66  Q         |         |         |         |
  0+40       0.1374      3.81  Q         |         |         |         |
  0+45       0.1644      3.92  Q         |         |         |         |
  0+50       0.1920      4.01  Q         |         |         |         |
  0+55       0.2202      4.09  Q         |         |         |         |
  1+ 0       0.2488      4.15  Q         |         |         |         |
  1+ 5       0.2777      4.21  Q         |         |         |         |
  1+10       0.3070      4.25  Q         |         |         |         |
  1+15       0.3365      4.28  Q         |         |         |         |
  1+20       0.3662      4.31  Q         |         |         |         |
  1+25       0.3961      4.34  Q         |         |         |         |
  1+30       0.4262      4.37  QV        |         |         |         |
  1+35       0.4565      4.40  QV        |         |         |         |
  1+40       0.4870      4.42  QV        |         |         |         |
  1+45       0.5175      4.43  QV        |         |         |         |
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1+50       0.5481      4.44  QV         |         |         |         |
1+55       0.5788      4.46  QV         |         |         |         |
2+ 0       0.6096      4.47  QV         |         |         |         |
2+ 5       0.6405      4.48  QV         |         |         |         |
2+10       0.6714      4.50  QV         |         |         |         |
2+15       0.7025      4.51  QV         |         |         |         |
2+20       0.7336      4.52  QV         |         |         |         |
2+25       0.7648      4.53  QV         |         |         |         |
2+30       0.7962      4.55  QV         |         |         |         |
2+35       0.8276      4.56  QV         |         |         |         |
2+40       0.8591      4.57  Q V        |         |         |         |
2+45       0.8907      4.59  Q V        |         |         |         |
2+50       0.9224      4.60  Q V        |         |         |         |
2+55       0.9542      4.62  Q V        |         |         |         |
3+ 0       0.9861      4.63  Q V        |         |         |         |
3+ 5       1.0180      4.64  Q V        |         |         |         |
3+10       1.0501      4.66  Q V        |         |         |         |
3+15       1.0823      4.67  Q V        |         |         |         |
3+20       1.1146      4.69  Q V        |         |         |         |
3+25       1.1470      4.70  Q V        |         |         |         |
3+30       1.1795      4.72  Q V        |         |         |         |
3+35       1.2120      4.73  Q V        |         |         |         |
3+40       1.2447      4.75  Q V        |         |         |         |
3+45       1.2775      4.76  Q  V       |         |         |         |
3+50       1.3104      4.78  Q  V       |         |         |         |
3+55       1.3434      4.79  Q  V       |         |         |         |
4+ 0       1.3766      4.81  Q  V       |         |         |         |
4+ 5       1.4098      4.82  Q  V       |         |         |         |
4+10       1.4431      4.84  Q  V       |         |         |         |
4+15       1.4766      4.86  Q  V       |         |         |         |
4+20       1.5101      4.87  Q  V       |         |         |         |
4+25       1.5438      4.89  Q  V       |         |         |         |
4+30       1.5776      4.91  Q  V       |         |         |         |
4+35       1.6115      4.92  Q  V       |         |         |         |
4+40       1.6455      4.94  Q  V       |         |         |         |
4+45       1.6797      4.96  Q  V       |         |         |         |
4+50       1.7140      4.98  Q   V      |         |         |         |
4+55       1.7483      4.99  Q   V      |         |         |         |
5+ 0       1.7829      5.01  |Q  V      |         |         |         |
5+ 5       1.8175      5.03  |Q  V      |         |         |         |
5+10       1.8522      5.05  |Q  V      |         |         |         |
5+15       1.8871      5.07  |Q  V      |         |         |         |
5+20       1.9221      5.08  |Q  V      |         |         |         |
5+25       1.9573      5.10  |Q  V      |         |         |         |
5+30       1.9926      5.12  |Q  V      |         |         |         |
5+35       2.0280      5.14  |Q  V      |         |         |         |
5+40       2.0635      5.16  |Q  V      |         |         |         |
5+45       2.0992      5.18  |Q  V      |         |         |         |
5+50       2.1350      5.20  |Q   V     |         |         |         |
5+55       2.1710      5.22  |Q   V     |         |         |         |
6+ 0       2.2071      5.24  |Q   V     |         |         |         |
6+ 5       2.2433      5.26  |Q   V     |         |         |         |
6+10       2.2797      5.28  |Q   V     |         |         |         |
6+15       2.3162      5.30  |Q   V     |         |         |         |
6+20       2.3529      5.33  |Q   V     |         |         |         |
6+25       2.3897      5.35  |Q   V     |         |         |         |
6+30       2.4267      5.37  |Q   V     |         |         |         |
6+35       2.4638      5.39  |Q   V     |         |         |         |
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 6+40       2.5011      5.41  |Q   V    |         |         |         |
 6+45       2.5385      5.44  |Q    V   |         |         |         |
 6+50       2.5761      5.46  |Q    V   |         |         |         |
 6+55       2.6139      5.48  |Q    V   |         |         |         |
 7+ 0       2.6518      5.51  |Q    V   |         |         |         |
 7+ 5       2.6899      5.53  |Q    V   |         |         |         |
 7+10       2.7282      5.56  |Q    V   |         |         |         |
 7+15       2.7666      5.58  |Q    V   |         |         |         |
 7+20       2.8052      5.60  |Q    V   |         |         |         |
 7+25       2.8440      5.63  |Q    V   |         |         |         |
 7+30       2.8829      5.66  |Q    V   |         |         |         |
 7+35       2.9221      5.68  |Q    V   |         |         |         |
 7+40       2.9614      5.71  |Q     V  |         |         |         |
 7+45       3.0009      5.74  |Q     V  |         |         |         |
 7+50       3.0406      5.76  |Q     V  |         |         |         |
 7+55       3.0805      5.79  |Q     V  |         |         |         |
 8+ 0       3.1205      5.82  |Q     V  |         |         |         |
 8+ 5       3.1608      5.85  |Q     V  |         |         |         |
 8+10       3.2013      5.88  |Q     V  |         |         |         |
 8+15       3.2420      5.91  |Q     V  |         |         |         |
 8+20       3.2828      5.94  |Q     V  |         |         |         |
 8+25       3.3239      5.97  |Q     V  |         |         |         |
 8+30       3.3652      6.00  |Q     V  |         |         |         |
 8+35       3.4067      6.03  |Q      V |         |         |         |
 8+40       3.4485      6.06  |Q      V |         |         |         |
 8+45       3.4904      6.09  |Q      V |         |         |         |
 8+50       3.5326      6.12  |Q      V |         |         |         |
 8+55       3.5750      6.16  |Q      V |         |         |         |
 9+ 0       3.6176      6.19  |Q      V |         |         |         |
 9+ 5       3.6605      6.23  |Q      V |         |         |         |
 9+10       3.7036      6.26  |Q      V |         |         |         |
 9+15       3.7470      6.30  |Q      V |         |         |         |
 9+20       3.7906      6.33  |Q      V |         |         |         |
 9+25       3.8345      6.37  |Q       V|         |         |         |
 9+30       3.8786      6.41  |Q       V|         |         |         |
 9+35       3.9230      6.45  |Q       V|         |         |         |
 9+40       3.9677      6.48  |Q       V|         |         |         |
 9+45       4.0126      6.53  |Q       V|         |         |         |
 9+50       4.0578      6.56  |Q       V|         |         |         |
 9+55       4.1033      6.61  |Q       V|         |         |         |
10+ 0       4.1491      6.65  |Q       V|         |         |         |
10+ 5       4.1952      6.69  |Q       V|         |         |         |
10+10       4.2416      6.73  |Q        V         |         |         |
10+15       4.2883      6.78  |Q        V         |         |         |
10+20       4.3353      6.83  |Q        V         |         |         |
10+25       4.3826      6.87  |Q        V         |         |         |
10+30       4.4303      6.92  |Q        V         |         |         |
10+35       4.4783      6.97  |Q        V         |         |         |
10+40       4.5266      7.02  |Q        V         |         |         |
10+45       4.5753      7.07  |Q        V         |         |         |
10+50       4.6243      7.12  |Q        V         |         |         |
10+55       4.6737      7.17  |Q        |V        |         |         |
11+ 0       4.7235      7.23  |Q        |V        |         |         |
11+ 5       4.7737      7.28  |Q        |V        |         |         |
11+10       4.8242      7.34  |Q        |V        |         |         |
11+15       4.8752      7.40  |Q        |V        |         |         |
11+20       4.9265      7.46  |Q        |V        |         |         |
11+25       4.9783      7.52  |Q        |V        |         |         |
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11+30       5.0305      7.58  |Q        |V        |         |         |
11+35       5.0832      7.65  |Q        | V       |         |         |
11+40       5.1363      7.71  |Q        | V       |         |         |
11+45       5.1899      7.78  |Q        | V       |         |         |
11+50       5.2439      7.85  |Q        | V       |         |         |
11+55       5.2985      7.92  |Q        | V       |         |         |
12+ 0       5.3535      7.99  |Q        | V       |         |         |
12+ 5       5.4090      8.06  |Q        | V       |         |         |
12+10       5.4645      8.06  |Q        | V       |         |         |
12+15       5.5195      7.99  |Q        |  V      |         |         |
12+20       5.5746      8.00  |Q        |  V      |         |         |
12+25       5.6300      8.04  |Q        |  V      |         |         |
12+30       5.6858      8.10  |Q        |  V      |         |         |
12+35       5.7421      8.17  |Q        |  V      |         |         |
12+40       5.7989      8.25  |Q        |  V      |         |         |
12+45       5.8563      8.34  |Q        |  V      |         |         |
12+50       5.9143      8.43  |Q        |   V     |         |         |
12+55       5.9731      8.53  |Q        |   V     |         |         |
13+ 0       6.0325      8.63  |Q        |   V     |         |         |
13+ 5       6.0926      8.74  |Q        |   V     |         |         |
13+10       6.1536      8.85  |Q        |   V     |         |         |
13+15       6.2154      8.97  |Q        |   V     |         |         |
13+20       6.2780      9.09  |Q        |   V     |         |         |
13+25       6.3415      9.23  |Q        |    V    |         |         |
13+30       6.4060      9.36  |Q        |    V    |         |         |
13+35       6.4715      9.51  |Q        |    V    |         |         |
13+40       6.5379      9.65  |Q        |    V    |         |         |
13+45       6.6055      9.82  |Q        |    V    |         |         |
13+50       6.6743      9.98  |Q        |    V    |         |         |
13+55       6.7443     10.16  | Q       |    V    |         |         |
14+ 0       6.8155     10.34  | Q       |     V   |         |         |
14+ 5       6.8881     10.54  | Q       |     V   |         |         |
14+10       6.9622     10.75  | Q       |     V   |         |         |
14+15       7.0379     11.00  | Q       |     V   |         |         |
14+20       7.1152     11.23  | Q       |     V   |         |         |
14+25       7.1944     11.49  | Q       |      V  |         |         |
14+30       7.2754     11.76  | Q       |      V  |         |         |
14+35       7.3583     12.05  | Q       |      V  |         |         |
14+40       7.4434     12.35  | Q       |      V  |         |         |
14+45       7.5308     12.69  | Q       |      V  |         |         |
14+50       7.6207     13.05  | Q       |       V |         |         |
14+55       7.7133     13.45  | Q       |       V |         |         |
15+ 0       7.8088     13.87  | Q       |       V |         |         |
15+ 5       7.9077     14.35  | Q       |       V |         |         |
15+10       8.0101     14.87  | Q       |       V |         |         |
15+15       8.1167     15.47  |  Q      |        V|         |         |
15+20       8.2277     16.13  |  Q      |        V|         |         |
15+25       8.3427     16.69  |  Q      |        V|         |         |
15+30       8.4551     16.31  |  Q      |         V         |         |
15+35       8.5584     15.01  |  Q      |         V         |         |
15+40       8.6610     14.89  | Q       |         V         |         |
15+45       8.7688     15.65  |  Q      |         V         |         |
15+50       8.8861     17.04  |  Q      |         |V        |         |
15+55       9.0207     19.53  |  Q      |         |V        |         |
16+ 0       9.1873     24.19  |   Q     |         |V        |         |
16+ 5       9.4581     39.33  |      Q  |         | V       |         |
16+10      10.0023     79.02  |         |    Q    |  V      |         |
16+15      10.7755    112.26  |         |         | Q  V    |         |
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16+20      11.2677     71.48  |         |   Q     |     V   |         |
16+25      11.5990     48.10  |        Q|         |      V  |         |
16+30      11.8569     37.45  |      Q  |         |       V |         |
16+35      12.0800     32.39  |     Q   |         |       V |         |
16+40      12.2762     28.49  |    Q    |         |        V|         |
16+45      12.4469     24.78  |   Q     |         |        V|         |
16+50      12.6010     22.38  |   Q     |         |        V|         |
16+55      12.7401     20.19  |   Q     |         |         V         |
17+ 0      12.8670     18.43  |  Q      |         |         V         |
17+ 5      12.9830     16.84  |  Q      |         |         V         |
17+10      13.0888     15.36  |  Q      |         |         |V        |
17+15      13.1854     14.03  | Q       |         |         |V        |
17+20      13.2776     13.39  | Q       |         |         |V        |
17+25      13.3667     12.94  | Q       |         |         |V        |
17+30      13.4514     12.30  | Q       |         |         |V        |
17+35      13.5297     11.36  | Q       |         |         | V       |
17+40      13.6037     10.75  | Q       |         |         | V       |
17+45      13.6712      9.80  |Q        |         |         | V       |
17+50      13.7364      9.47  |Q        |         |         | V       |
17+55      13.7997      9.18  |Q        |         |         | V       |
18+ 0      13.8611      8.92  |Q        |         |         | V       |
18+ 5      13.9210      8.69  |Q        |         |         | V       |
18+10      13.9798      8.54  |Q        |         |         |  V      |
18+15      14.0381      8.47  |Q        |         |         |  V      |
18+20      14.0956      8.36  |Q        |         |         |  V      |
18+25      14.1522      8.22  |Q        |         |         |  V      |
18+30      14.2079      8.08  |Q        |         |         |  V      |
18+35      14.2626      7.94  |Q        |         |         |  V      |
18+40      14.3163      7.81  |Q        |         |         |  V      |
18+45      14.3692      7.68  |Q        |         |         |   V     |
18+50      14.4212      7.56  |Q        |         |         |   V     |
18+55      14.4725      7.44  |Q        |         |         |   V     |
19+ 0      14.5229      7.32  |Q        |         |         |   V     |
19+ 5      14.5726      7.21  |Q        |         |         |   V     |
19+10      14.6216      7.11  |Q        |         |         |   V     |
19+15      14.6698      7.01  |Q        |         |         |   V     |
19+20      14.7174      6.91  |Q        |         |         |   V     |
19+25      14.7644      6.82  |Q        |         |         |   V     |
19+30      14.8108      6.73  |Q        |         |         |    V    |
19+35      14.8565      6.65  |Q        |         |         |    V    |
19+40      14.9017      6.56  |Q        |         |         |    V    |
19+45      14.9464      6.48  |Q        |         |         |    V    |
19+50      14.9905      6.40  |Q        |         |         |    V    |
19+55      15.0341      6.33  |Q        |         |         |    V    |
20+ 0      15.0772      6.26  |Q        |         |         |    V    |
20+ 5      15.1198      6.19  |Q        |         |         |    V    |
20+10      15.1619      6.12  |Q        |         |         |    V    |
20+15      15.2036      6.05  |Q        |         |         |     V   |
20+20      15.2449      5.99  |Q        |         |         |     V   |
20+25      15.2857      5.93  |Q        |         |         |     V   |
20+30      15.3262      5.87  |Q        |         |         |     V   |
20+35      15.3662      5.81  |Q        |         |         |     V   |
20+40      15.4059      5.76  |Q        |         |         |     V   |
20+45      15.4451      5.70  |Q        |         |         |     V   |
20+50      15.4841      5.65  |Q        |         |         |     V   |
20+55      15.5226      5.60  |Q        |         |         |     V   |
21+ 0      15.5609      5.55  |Q        |         |         |     V   |
21+ 5      15.5988      5.50  |Q        |         |         |     V   |
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   21+10      15.6363      5.45  |Q        |         |         |      V  |
   21+15      15.6736      5.41  |Q        |         |         |      V  |
   21+20      15.7105      5.36  |Q        |         |         |      V  |
   21+25      15.7472      5.32  |Q        |         |         |      V  |
   21+30      15.7835      5.28  |Q        |         |         |      V  |
   21+35      15.8196      5.24  |Q        |         |         |      V  |
   21+40      15.8554      5.20  |Q        |         |         |      V  |
   21+45      15.8909      5.16  |Q        |         |         |      V  |
   21+50      15.9261      5.12  |Q        |         |         |      V  |
   21+55      15.9611      5.08  |Q        |         |         |      V  |
   22+ 0      15.9958      5.04  |Q        |         |         |      V  |
   22+ 5      16.0303      5.01  |Q        |         |         |      V  |
   22+10      16.0645      4.97  Q         |         |         |       V |
   22+15      16.0985      4.94  Q         |         |         |       V |
   22+20      16.1323      4.90  Q         |         |         |       V |
   22+25      16.1658      4.87  Q         |         |         |       V |
   22+30      16.1991      4.84  Q         |         |         |       V |
   22+35      16.2322      4.80  Q         |         |         |       V |
   22+40      16.2651      4.77  Q         |         |         |       V |
   22+45      16.2978      4.74  Q         |         |         |       V |
   22+50      16.3302      4.71  Q         |         |         |       V |
   22+55      16.3625      4.68  Q         |         |         |       V |
   23+ 0      16.3945      4.65  Q         |         |         |       V |
   23+ 5      16.4264      4.63  Q         |         |         |       V |
   23+10      16.4580      4.60  Q         |         |         |        V|
   23+15      16.4895      4.57  Q         |         |         |        V|
   23+20      16.5208      4.54  Q         |         |         |        V|
   23+25      16.5519      4.52  Q         |         |         |        V|
   23+30      16.5829      4.49  Q         |         |         |        V|
   23+35      16.6136      4.47  Q         |         |         |        V|
   23+40      16.6442      4.44  Q         |         |         |        V|
   23+45      16.6746      4.42  Q         |         |         |        V|
   23+50      16.7049      4.39  Q         |         |         |        V|
   23+55      16.7350      4.37  Q         |         |         |        V|
   24+ 0      16.7649      4.35  Q         |         |         |        V|
   24+ 5      16.7938      4.20  Q         |         |         |        V|
   24+10      16.8179      3.50  Q         |         |         |        V|
   24+15      16.8330      2.19  Q         |         |         |        V|
   24+20      16.8432      1.48  Q         |         |         |        V|
   24+25      16.8506      1.08  Q         |         |         |        V|
   24+30      16.8563      0.82  Q         |         |         |        V|
   24+35      16.8607      0.63  Q         |         |         |        V|
   24+40      16.8640      0.49  Q         |         |         |        V|
   24+45      16.8667      0.38  Q         |         |         |        V|
   24+50      16.8687      0.30  Q         |         |         |        V|
   24+55      16.8703      0.23  Q         |         |         |        V|
   25+ 0      16.8715      0.18  Q         |         |         |        V|
   25+ 5      16.8724      0.13  Q         |         |         |        V|
   25+10      16.8731      0.10  Q         |         |         |        V|
   25+15      16.8737      0.08  Q         |         |         |        V|
   25+20      16.8741      0.06  Q         |         |         |        V|
   25+25      16.8744      0.04  Q         |         |         |        V|
   25+30      16.8745      0.02  Q         |         |         |        V|
   25+35      16.8746      0.01  Q         |         |         |         V
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```
                  FLOOD HYDROGRAPH ROUTING PROGRAM
         Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014
                     Study date: 05/08/20

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 204728 - US Cold Storage
 PROPOSED BASIN - AREA A
 10-YEAR, 24- HOUR STORM
 BY: SG  DATE: 05-08-20
 --------------------------------------------------------------------


 Program License Serial Number 6320

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 ********************* HYDROGRAPH INFORMATION **********************

                 From study/file name: PROPA10.rte
 ****************************HYDROGRAPH DATA***************************
                 Number of intervals =   307
                 Time interval =    5.0 (Min.)
                 Maximum/Peak flow rate =      112.265 (CFS)
                 Total volume =      16.875 (Ac.Ft)
         Status of hydrographs being held in storage
                    Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
         Peak (CFS)      0.000     0.000     0.000     0.000     0.000
         Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
 *********************************************************************



 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 Process from Point/Station       4.000 to Point/Station       5.000
 **** RETARDING BASIN ROUTING ****
 ______________________________________________________________________

 Program computation of outflow v. depth





 CALCULATED OUTFLOW DATA AT DEPTH =    0.50(Ft.))
 Total outflow at this depth =      0.00(CFS)


 CALCULATED OUTFLOW DATA AT DEPTH =    1.00(Ft.))
 Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
 Manning's N = 0.013   No. of pipes = 1
 Given pipe size =      8.00(In.)
 Calculated individual pipe flow  =     1.112(CFS)
 Normal flow depth in pipe =    4.38(In.)
 Flow top width inside pipe =    7.96(In.)
 Critical Depth =    0.50(Ft.)
```

```
Calculated flow rate through pipe(s) =      1.112(CFS)

Total outflow at this depth =      1.11(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    1.50(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      2.000(Ft.)
Pipe friction loss =      1.178(Ft.)
Minor friction loss =      0.822(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      2.074(CFS)

Total outflow at this depth =      2.07(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    2.00(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      2.500(Ft.)
Pipe friction loss =      1.472(Ft.)
Minor friction loss =      1.027(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      2.318(CFS)

Total outflow at this depth =      2.32(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    2.50(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      3.000(Ft.)
Pipe friction loss =      1.767(Ft.)
Minor friction loss =      1.233(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      2.540(CFS)

Total outflow at this depth =      2.54(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    2.99(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      3.490(Ft.)
Pipe friction loss =      2.055(Ft.)
Minor friction loss =      1.434(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      2.739(CFS)
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```
Total outflow at this depth =      2.74(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    3.00(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      3.500(Ft.)
Pipe friction loss =      2.061(Ft.)
Minor friction loss =      1.438(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      2.743(CFS)

Total outflow at this depth =      2.74(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    3.50(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      4.000(Ft.)
Pipe friction loss =      2.355(Ft.)
Minor friction loss =      1.644(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      2.932(CFS)

Total outflow at this depth =      2.93(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    4.00(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      4.500(Ft.)
Pipe friction loss =      2.650(Ft.)
Minor friction loss =      1.849(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      3.110(CFS)

Total outflow at this depth =      3.11(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    4.50(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      5.000(Ft.)
Pipe friction loss =      2.944(Ft.)
Minor friction loss =      2.055(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      3.279(CFS)

Total outflow at this depth =      3.28(CFS)
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```
CALCULATED OUTFLOW DATA AT DEPTH =    5.00(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      5.500(Ft.)
Pipe friction loss =      3.239(Ft.)
Minor friction loss =      2.260(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      3.439(CFS)

Pipe length  =    40.00(Ft.)   Elevation difference =   2.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     1.768(CFS)
Normal flow depth in pipe =    3.34(In.)
Flow top width inside pipe =   14.00(In.)
Critical Depth =    0.50(Ft.)
Calculated flow rate through pipe(s) =      1.768(CFS)

Total outflow at this depth =      5.21(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    5.50(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      6.000(Ft.)
Pipe friction loss =      3.533(Ft.)
Minor friction loss =      2.466(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      3.591(CFS)

Pipe length  =    40.00(Ft.)   Elevation difference =   2.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     6.687(CFS)
Normal flow depth in pipe =    6.57(In.)
Flow top width inside pipe =   17.33(In.)
Critical Depth =    1.00(Ft.)
Calculated flow rate through pipe(s) =      6.687(CFS)

Total outflow at this depth =     10.28(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    6.00(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      6.500(Ft.)
Pipe friction loss =      3.828(Ft.)
Minor friction loss =      2.671(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      3.738(CFS)
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```
Pipe length  =    40.00(Ft.)   Elevation difference =   2.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =     18.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      3.500(Ft.)
Pipe friction loss =      1.145(Ft.)
Minor friction loss =      2.356(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =     17.772(CFS)

Total outflow at this depth =     21.51(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    6.50(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      7.000(Ft.)
Pipe friction loss =      4.122(Ft.)
Minor friction loss =      2.877(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      3.879(CFS)

Pipe length  =    40.00(Ft.)   Elevation difference =   2.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =     18.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      4.000(Ft.)
Pipe friction loss =      1.309(Ft.)
Minor friction loss =      2.692(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =     18.999(CFS)

Pipe length  =    40.00(Ft.)   Elevation difference =   2.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     1.768(CFS)
Normal flow depth in pipe =    3.34(In.)
Flow top width inside pipe =   14.00(In.)
Critical Depth =    0.50(Ft.)
Calculated flow rate through pipe(s) =      1.768(CFS)

Total outflow at this depth =     24.65(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    7.00(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      7.500(Ft.)
Pipe friction loss =      4.417(Ft.)
Minor friction loss =      3.082(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      4.015(CFS)

Pipe length  =    40.00(Ft.)   Elevation difference =   2.00(Ft.)
```

```
Manning's N = 0.013   No. of pipes = 1
Given pipe size =     18.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      4.500(Ft.)
Pipe friction loss =      1.472(Ft.)
Minor friction loss =      3.029(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =     20.152(CFS)

Pipe length  =    40.00(Ft.)   Elevation difference =   2.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     6.687(CFS)
Normal flow depth in pipe =    6.57(In.)
Flow top width inside pipe =   17.33(In.)
Critical Depth =    1.00(Ft.)
Calculated flow rate through pipe(s) =      6.687(CFS)

Total outflow at this depth =     30.85(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    7.50(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      8.000(Ft.)
Pipe friction loss =      4.711(Ft.)
Minor friction loss =      3.288(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      4.147(CFS)

Pipe length  =    40.00(Ft.)   Elevation difference =   2.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =     18.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      5.000(Ft.)
Pipe friction loss =      1.636(Ft.)
Minor friction loss =      3.366(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =     21.242(CFS)

Pipe length  =    40.00(Ft.)   Elevation difference =   2.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =     18.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      3.500(Ft.)
Pipe friction loss =      1.145(Ft.)
Minor friction loss =      2.356(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =     17.772(CFS)

Total outflow at this depth =     43.16(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    8.00(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
```

```
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      8.500(Ft.)
Pipe friction loss =      5.005(Ft.)
Minor friction loss =      3.493(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      4.275(CFS)

Pipe length  =    40.00(Ft.)   Elevation difference =   2.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =     18.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      5.500(Ft.)
Pipe friction loss =      1.799(Ft.)
Minor friction loss =      3.702(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =     22.279(CFS)

Pipe length  =    40.00(Ft.)   Elevation difference =   2.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =     18.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      4.000(Ft.)
Pipe friction loss =      1.309(Ft.)
Minor friction loss =      2.692(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =     18.999(CFS)


Weir capacity using equation Q = CLH^Exp(Using Feet as units)
Weir Length =   3.00(Ft.)   C value =   2.63   Exp =   1.50
Weir flow:      Depth = H =    0.50(Ft.)   Flow =      2.79 (CFS)

Total outflow at this depth =     48.34(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    8.50(Ft.))
Pipe length  =    40.00(Ft.)   Elevation difference =   1.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =      8.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      9.000(Ft.)
Pipe friction loss =      5.300(Ft.)
Minor friction loss =      3.698(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =      4.399(CFS)

Pipe length  =    40.00(Ft.)   Elevation difference =   2.00(Ft.)
Manning's N = 0.013   No. of pipes = 1
Given pipe size =     18.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      6.000(Ft.)
Pipe friction loss =      1.963(Ft.)
Minor friction loss =      4.039(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =     23.269(CFS)

Pipe length  =    40.00(Ft.)   Elevation difference =   2.00(Ft.)
```

```
Manning's N = 0.013   No. of pipes = 1
Given pipe size =     18.00(In.)
 NOTE: Assuming free outlet flow.
NOTE: Normal flow is pressure flow.
The total friction loss through the pipe is      4.500(Ft.)
Pipe friction loss =      1.472(Ft.)
Minor friction loss =      3.029(Ft.)     K-factor =   1.50
Calculated flow rate through pipe(s) =     20.152(CFS)


Weir capacity using equation Q = CLH^Exp(Using Feet as units)
Weir Length =   3.00(Ft.)   C value =   2.63   Exp =   1.50
Weir flow:      Depth = H =    1.00(Ft.)   Flow =      7.89 (CFS)

Total outflow at this depth =     55.71(CFS)

--------------------------------------------------------------------
Total number of inflow hydrograph intervals = 307
Hydrograph time unit =  5.000 (Min.)
Initial depth in storage basin =   0.00(Ft.)
--------------------------------------------------------------------
--------------------------------------------------------------------
Initial basin depth =   0.00 (Ft.)
Initial basin storage =      0.00 (Ac.Ft)
Initial basin outflow =   0.00 (CFS)
---------------------------------------------------------------------
--------------------------------------------------------------------
Depth vs. Storage and Depth vs. Discharge data:
 Basin Depth  Storage    Outflow   (S-O*dt/2)   (S+O*dt/2)
     (Ft.)    (Ac.Ft)    (CFS)     (Ac.Ft)    (Ac.Ft)
---------------------------------------------------------------------
  0.000      0.000      0.000      0.000        0.000
  0.500      0.341      0.000      0.341        0.341
  1.000      0.682      1.112      0.678        0.686
  1.500      1.023      2.074      1.016        1.030
  2.000      1.150      2.318      1.142        1.158
  2.500      1.278      2.540      1.269        1.287
  2.990      1.403      2.739      1.394        1.412
  3.000      1.404      2.743      1.395        1.413
  3.500      2.268      2.932      2.258        2.278
  4.000      3.157      3.110      3.146        3.168
  4.500      4.071      3.279      4.060        4.082
  5.000      5.010      5.207      4.992        5.028
  5.500      5.980     10.278      5.945        6.015
  6.000      6.971     21.510      6.897        7.045
  6.500      7.990     24.647      7.905        8.075
  7.000      9.038     30.854      8.932        9.144
  7.500     10.113     43.161      9.964       10.262
  8.000     11.216     48.343     11.050       11.382
  8.500     12.349     55.710     12.157       12.541
--------------------------------------------------------------------
                Hydrograph Detention Basin Routing
---------------------------------------------------------------------

Graph values: 'I'= unit inflow; 'O'=outflow at time shown
---------------------------------------------------------------------
  Time   Inflow  Outflow    Storage                                Depth
(Hours)  (CFS)   (CFS)     (Ac.Ft) .0      28.1   56.13   84.20  112.26 (Ft.)
```

0.083	0.12	0.00	0.000	O				0.00
0.167	0.80	0.00	0.004	O				0.01
0.250	2.10	0.00	0.014	O				0.02
0.333	2.80	0.00	0.030	O				0.04
0.417	3.20	0.00	0.051	O				0.07
0.500	3.46	0.00	0.074	O				0.11
0.583	3.66	0.00	0.099	OI				0.14
0.667	3.81	0.00	0.124	OI				0.18
0.750	3.92	0.00	0.151	OI				0.22
0.833	4.01	0.00	0.178	OI				0.26
0.917	4.09	0.00	0.206	OI				0.30
1.000	4.15	0.00	0.234	OI				0.34
1.083	4.21	0.00	0.263	OI				0.39
1.167	4.25	0.00	0.292	OI				0.43
1.250	4.28	0.00	0.322	OI				0.47
1.333	4.31	0.03	0.351	OI				0.52
1.417	4.34	0.13	0.380	OI				0.56
1.500	4.37	0.22	0.409	OI				0.60
1.583	4.40	0.32	0.438	OI				0.64
1.667	4.42	0.41	0.466	OI				0.68
1.750	4.43	0.50	0.493	OI				0.72
1.833	4.44	0.58	0.520	OI				0.76
1.917	4.46	0.67	0.546	OI				0.80
2.000	4.47	0.75	0.572	OI				0.84
2.083	4.48	0.84	0.597	OI				0.88
2.167	4.50	0.92	0.622	OI				0.91
2.250	4.51	1.00	0.647	OI				0.95
2.333	4.52	1.08	0.671	OI				0.98
2.417	4.53	1.15	0.694	OI				1.02
2.500	4.55	1.21	0.717	OI				1.05
2.583	4.56	1.28	0.740	OI				1.09
2.667	4.57	1.34	0.763	OI				1.12
2.750	4.59	1.40	0.785	OI				1.15
2.833	4.60	1.46	0.806	OI				1.18
2.917	4.62	1.52	0.828	OI				1.21
3.000	4.63	1.58	0.849	OI				1.24
3.083	4.64	1.64	0.870	OI				1.28
3.167	4.66	1.70	0.890	OI				1.31
3.250	4.67	1.76	0.911	OI				1.34
3.333	4.69	1.81	0.931	OI				1.36
3.417	4.70	1.87	0.950	OI				1.39
3.500	4.72	1.92	0.970	OI				1.42
3.583	4.73	1.98	0.989	OI				1.45
3.667	4.75	2.03	1.008	OI				1.48
3.750	4.76	2.08	1.026	OI				1.51
3.833	4.78	2.11	1.045	OI				1.58
3.917	4.79	2.15	1.063	OI				1.66
4.000	4.81	2.19	1.081	OI				1.73
4.083	4.82	2.22	1.099	OI				1.80
4.167	4.84	2.25	1.117	OI				1.87
4.250	4.86	2.29	1.135	OI				1.94
4.333	4.87	2.32	1.152	OI				2.01
4.417	4.89	2.35	1.170	OI				2.08
4.500	4.91	2.38	1.187	OI				2.15
4.583	4.92	2.41	1.204	OI				2.21
4.667	4.94	2.44	1.222	OI				2.28
4.750	4.96	2.47	1.239	OI				2.35
4.833	4.98	2.50	1.256	OI				2.41

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4.917    4.99    2.53     1.273  OI    |        |        |        |      2.48
5.000    5.01    2.56     1.290  OI    |        |        |        |      2.55
5.083    5.03    2.59     1.307  OI    |        |        |        |      2.61
5.167    5.05    2.61     1.324  OI    |        |        |        |      2.68
5.250    5.07    2.64     1.340  OI    |        |        |        |      2.74
5.333    5.08    2.67     1.357  OI    |        |        |        |      2.81
5.417    5.10    2.69     1.374  OI    |        |        |        |      2.87
5.500    5.12    2.72     1.390  OI    |        |        |        |      2.94
5.583    5.14    2.74     1.407  OI    |        |        |        |      3.00
5.667    5.16    2.75     1.423  OI    |        |        |        |      3.01
5.750    5.18    2.75     1.440  OI    |        |        |        |      3.02
5.833    5.20    2.75     1.457  OI    |        |        |        |      3.03
5.917    5.22    2.76     1.474  OI    |        |        |        |      3.04
6.000    5.24    2.76     1.491  OI    |        |        |        |      3.05
6.083    5.26    2.77     1.508  OI    |        |        |        |      3.06
6.167    5.28    2.77     1.525  OI    |        |        |        |      3.07
6.250    5.30    2.77     1.542  OI    |        |        |        |      3.08
6.333    5.33    2.78     1.560  OI    |        |        |        |      3.09
6.417    5.35    2.78     1.578  OI    |        |        |        |      3.10
6.500    5.37    2.78     1.595  OI    |        |        |        |      3.11
6.583    5.39    2.79     1.613  OI    |        |        |        |      3.12
6.667    5.41    2.79     1.631  OI    |        |        |        |      3.13
6.750    5.44    2.80     1.649  OI    |        |        |        |      3.14
6.833    5.46    2.80     1.667  OI    |        |        |        |      3.15
6.917    5.48    2.80     1.686  OI    |        |        |        |      3.16
7.000    5.51    2.81     1.704  OI    |        |        |        |      3.17
7.083    5.53    2.81     1.723  OI    |        |        |        |      3.18
7.167    5.56    2.82     1.742  OI    |        |        |        |      3.20
7.250    5.58    2.82     1.761  OI    |        |        |        |      3.21
7.333    5.60    2.83     1.780  OI    |        |        |        |      3.22
7.417    5.63    2.83     1.799  OI    |        |        |        |      3.23
7.500    5.66    2.83     1.818  OI    |        |        |        |      3.24
7.583    5.68    2.84     1.838  OI    |        |        |        |      3.25
7.667    5.71    2.84     1.858  OI    |        |        |        |      3.26
7.750    5.74    2.85     1.877  OI    |        |        |        |      3.27
7.833    5.76    2.85     1.897  OI    |        |        |        |      3.29
7.917    5.79    2.86     1.917  OI    |        |        |        |      3.30
8.000    5.82    2.86     1.938  OI    |        |        |        |      3.31
8.083    5.85    2.86     1.958  OI    |        |        |        |      3.32
8.167    5.88    2.87     1.979  OI    |        |        |        |      3.33
8.250    5.91    2.87     2.000  OI    |        |        |        |      3.34
8.333    5.94    2.88     2.021  OI    |        |        |        |      3.36
8.417    5.97    2.88     2.042  OI    |        |        |        |      3.37
8.500    6.00    2.89     2.063  OI    |        |        |        |      3.38
8.583    6.03    2.89     2.085  OI    |        |        |        |      3.39
8.667    6.06    2.90     2.106  OI    |        |        |        |      3.41
8.750    6.09    2.90     2.128  OI    |        |        |        |      3.42
8.833    6.12    2.91     2.150  OI    |        |        |        |      3.43
8.917    6.16    2.91     2.172  OI    |        |        |        |      3.44
9.000    6.19    2.92     2.195  OI    |        |        |        |      3.46
9.083    6.23    2.92     2.218  OI    |        |        |        |      3.47
9.167    6.26    2.93     2.240  OI    |        |        |        |      3.48
9.250    6.30    2.93     2.264  OI    |        |        |        |      3.50
9.333    6.33    2.94     2.287  OI    |        |        |        |      3.51
9.417    6.37    2.94     2.310  OI    |        |        |        |      3.52
9.500    6.41    2.95     2.334  OI    |        |        |        |      3.54
9.583    6.45    2.95     2.358  OI    |        |        |        |      3.55
9.667    6.48    2.96     2.382  OI    |        |        |        |      3.56
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9.750	6.53	2.96	2.407	OI	3.58
9.833	6.56	2.97	2.431	OI	3.59
9.917	6.61	2.97	2.456	OI	3.61
10.000	6.65	2.98	2.481	OI	3.62
10.083	6.69	2.98	2.507	OI	3.63
10.167	6.73	2.99	2.533	OI	3.65
10.250	6.78	2.99	2.558	OI	3.66
10.333	6.83	3.00	2.585	OI	3.68
10.417	6.87	3.00	2.611	OI	3.69
10.500	6.92	3.01	2.638	OI	3.71
10.583	6.97	3.01	2.665	OI	3.72
10.667	7.02	3.02	2.693	O I	3.74
10.750	7.07	3.02	2.720	O I	3.75
10.833	7.12	3.03	2.748	O I	3.77
10.917	7.17	3.03	2.777	O I	3.79
11.000	7.23	3.04	2.805	O I	3.80
11.083	7.28	3.05	2.834	O I	3.82
11.167	7.34	3.05	2.864	O I	3.84
11.250	7.40	3.06	2.893	O I	3.85
11.333	7.46	3.06	2.923	O I	3.87
11.417	7.52	3.07	2.954	O I	3.89
11.500	7.58	3.08	2.985	O I	3.90
11.583	7.65	3.08	3.016	O I	3.92
11.667	7.71	3.09	3.048	O I	3.94
11.750	7.78	3.09	3.080	O I	3.96
11.833	7.85	3.10	3.112	O I	3.97
11.917	7.92	3.11	3.145	O I	3.99
12.000	7.99	3.11	3.178	O I	4.01
12.083	8.06	3.12	3.212	O I	4.03
12.167	8.06	3.13	3.246	O I	4.05
12.250	7.99	3.13	3.280	O I	4.07
12.333	8.00	3.14	3.313	O I	4.09
12.417	8.04	3.15	3.347	O I	4.10
12.500	8.10	3.15	3.381	O I	4.12
12.583	8.17	3.16	3.415	O I	4.14
12.667	8.25	3.16	3.450	O I	4.16
12.750	8.34	3.17	3.485	O I	4.18
12.833	8.43	3.18	3.521	O I	4.20
12.917	8.53	3.18	3.558	O I	4.22
13.000	8.63	3.19	3.595	O I	4.24
13.083	8.74	3.20	3.632	O I	4.26
13.167	8.85	3.20	3.671	O I	4.28
13.250	8.97	3.21	3.710	O I	4.30
13.333	9.09	3.22	3.750	O I	4.32
13.417	9.23	3.23	3.791	O I	4.35
13.500	9.36	3.23	3.833	O I	4.37
13.583	9.51	3.24	3.876	O I	4.39
13.667	9.65	3.25	3.919	O I	4.42
13.750	9.82	3.26	3.964	O I	4.44
13.833	9.98	3.27	4.010	O I	4.47
13.917	10.16	3.28	4.056	O I	4.49
14.000	10.34	3.35	4.104	O I	4.52
14.083	10.54	3.45	4.153	O I	4.54
14.167	10.75	3.55	4.202	|O I	4.57
14.250	11.00	3.65	4.252	|O I	4.60
14.333	11.23	3.76	4.303	|O I	4.62
14.417	11.49	3.86	4.355	|O I	4.65
14.500	11.76	3.97	4.408	|O I	4.68

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14.583   12.05    4.08      4.462  |O I    |       |       |       |     4.71
14.667   12.35    4.20      4.518  |O I    |       |       |       |     4.74
14.750   12.69    4.31      4.575  |O I    |       |       |       |     4.77
14.833   13.05    4.43      4.633  |O I    |       |       |       |     4.80
14.917   13.45    4.56      4.694  |O I    |       |       |       |     4.83
15.000   13.87    4.69      4.756  |O I    |       |       |       |     4.86
15.083   14.35    4.82      4.820  |O  I   |       |       |       |     4.90
15.167   14.87    4.96      4.887  |O  I   |       |       |       |     4.93
15.250   15.47    5.10      4.957  |O  I   |       |       |       |     4.97
15.333   16.13    5.31      5.030  |O  I   |       |       |       |     5.01
15.417   16.69    5.71      5.105  |O  I   |       |       |       |     5.05
15.500   16.31    6.09      5.178  |O  I   |       |       |       |     5.09
15.583   15.01    6.43      5.243  |O  I   |       |       |       |     5.12
15.667   14.89    6.73      5.301  |O  I   |       |       |       |     5.15
15.750   15.65    7.03      5.359  | O I   |       |       |       |     5.18
15.833   17.04    7.36      5.422  | O I   |       |       |       |     5.21
15.917   19.53    7.75      5.496  | O  I  |       |       |       |     5.25
16.000   24.19    8.24      5.591  | O   I |       |       |       |     5.30
16.083   39.33    9.08      5.750  | O     |  I    |       |       |     5.38
16.167   79.02   11.49      6.087  |  O    |       |     I |       |     5.55
16.250  112.26   17.81      6.645  |    O  |       |       |       I     5.84
16.333   71.48   22.03      7.140  |     O |       |   I   |       |     6.08
16.417   48.10   22.82      7.397  |     O |    I  |       |       |     6.21
16.500   37.45   23.24      7.533  |     O | I     |       |       |     6.28
16.583   32.39   23.49      7.613  |     O |I      |       |       |     6.32
16.667   28.49   23.63      7.660  |     O I       |       |       |     6.34
16.750   24.78   23.70      7.681  |     OI|       |       |       |     6.35
16.833   22.38   23.69      7.680  |     O |       |       |       |     6.35
16.917   20.19   23.64      7.664  |    IO |       |       |       |     6.34
17.000   18.43   23.55      7.634  |    IO |       |       |       |     6.33
17.083   16.84   23.43      7.594  |   I O |       |       |       |     6.31
17.167   15.36   23.27      7.544  |   I O |       |       |       |     6.28
17.250   14.03   23.09      7.485  |  I  O |       |       |       |     6.25
17.333   13.39   22.90      7.421  |  I  O |       |       |       |     6.22
17.417   12.94   22.69      7.355  |  I  O |       |       |       |     6.19
17.500   12.30   22.48      7.287  |  I  O |       |       |       |     6.15
17.583   11.36   22.26      7.214  |  I  O |       |       |       |     6.12
17.667   10.75   22.02      7.138  |  I  O |       |       |       |     6.08
17.750    9.80   21.78      7.058  | I   O |       |       |       |     6.04
17.833    9.47   21.52      6.975  | I   O |       |       |       |     6.00
17.917    9.18   20.64      6.894  | I  O  |       |       |       |     5.96
18.000    8.92   19.77      6.817  | I  O  |       |       |       |     5.92
18.083    8.69   18.94      6.744  | I  O  |       |       |       |     5.89
18.167    8.54   18.17      6.676  | I  O  |       |       |       |     5.85
18.250    8.47   17.44      6.612  | I O   |       |       |       |     5.82
18.333    8.36   16.76      6.552  | I O   |       |       |       |     5.79
18.417    8.22   16.13      6.496  | I O   |       |       |       |     5.76
18.500    8.08   15.53      6.443  | I O   |       |       |       |     5.73
18.583    7.94   14.96      6.393  | I O   |       |       |       |     5.71
18.667    7.81   14.43      6.346  | I O   |       |       |       |     5.68
18.750    7.68   13.93      6.302  | IO    |       |       |       |     5.66
18.833    7.56   13.45      6.260  | IO    |       |       |       |     5.64
18.917    7.44   13.01      6.221  | IO    |       |       |       |     5.62
19.000    7.32   12.58      6.183  | IO    |       |       |       |     5.60
19.083    7.21   12.18      6.148  | IO    |       |       |       |     5.58
19.167    7.11   11.81      6.115  | IO    |       |       |       |     5.57
19.250    7.01   11.45      6.083  |I O    |       |       |       |     5.55
19.333    6.91   11.11      6.054  |I O    |       |       |       |     5.54
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19.417	6.82	10.79	6.025	I O					5.52
19.500	6.73	10.49	5.999	IO					5.51
19.583	6.65	10.24	5.973	IO					5.50
19.667	6.56	10.12	5.949	IO					5.48
19.750	6.48	9.99	5.925	IO					5.47
19.833	6.40	9.86	5.901	IO					5.46
19.917	6.33	9.74	5.877	IO					5.45
20.000	6.26	9.62	5.854	IO					5.43
20.083	6.19	9.50	5.831	IO					5.42
20.167	6.12	9.38	5.808	IO					5.41
20.250	6.05	9.26	5.786	IO					5.40
20.333	5.99	9.15	5.764	IO					5.39
20.417	5.93	9.04	5.742	IO					5.38
20.500	5.87	8.92	5.721	IO					5.37
20.583	5.81	8.82	5.700	IO					5.36
20.667	5.76	8.71	5.680	IO					5.35
20.750	5.70	8.60	5.660	IO					5.33
20.833	5.65	8.50	5.640	IO					5.32
20.917	5.60	8.40	5.620	IO					5.31
21.000	5.55	8.30	5.601	IO					5.30
21.083	5.50	8.20	5.583	IO					5.30
21.167	5.45	8.10	5.564	IO					5.29
21.250	5.41	8.01	5.546	IO					5.28
21.333	5.36	7.92	5.528	IO					5.27
21.417	5.32	7.83	5.511	IO					5.26
21.500	5.28	7.74	5.494	IO					5.25
21.583	5.24	7.65	5.477	IO					5.24
21.667	5.20	7.56	5.461	IO					5.23
21.750	5.16	7.48	5.444	IO					5.22
21.833	5.12	7.40	5.429	IO					5.22
21.917	5.08	7.31	5.413	IO					5.21
22.000	5.04	7.23	5.398	IO					5.20
22.083	5.01	7.16	5.383	IO					5.19
22.167	4.97	7.08	5.368	IO					5.18
22.250	4.94	7.00	5.354	O					5.18
22.333	4.90	6.93	5.340	O					5.17
22.417	4.87	6.86	5.326	O					5.16
22.500	4.84	6.79	5.312	O					5.16
22.583	4.80	6.72	5.299	O					5.15
22.667	4.77	6.65	5.286	O					5.14
22.750	4.74	6.58	5.273	O					5.14
22.833	4.71	6.52	5.261	O					5.13
22.917	4.68	6.45	5.248	O					5.12
23.000	4.65	6.39	5.236	O					5.12
23.083	4.63	6.33	5.224	O					5.11
23.167	4.60	6.27	5.213	O					5.10
23.250	4.57	6.21	5.201	O					5.10
23.333	4.54	6.15	5.190	O					5.09
23.417	4.52	6.09	5.179	O					5.09
23.500	4.49	6.04	5.169	O					5.08
23.583	4.47	5.98	5.158	O					5.08
23.667	4.44	5.93	5.148	O					5.07
23.750	4.42	5.87	5.138	O					5.07
23.833	4.39	5.82	5.128	O					5.06
23.917	4.37	5.77	5.118	O					5.06
24.000	4.35	5.72	5.108	O					5.05
24.083	4.20	5.67	5.098	O					5.05
24.167	3.50	5.61	5.086	IO					5.04

24.250	2.19	5.51	5.067	IO	5.03
24.333	1.48	5.38	5.043	IO	5.02
24.417	1.08	5.23	5.015	IO	5.00
24.500	0.82	5.16	4.986	IO	4.99
24.583	0.63	5.09	4.955	IO	4.97
24.667	0.49	5.03	4.924	IO	4.95
24.750	0.38	4.97	4.893	IO	4.94
24.833	0.30	4.90	4.861	IO	4.92
24.917	0.23	4.84	4.830	IO	4.90
25.000	0.18	4.77	4.798	IO	4.89
25.083	0.13	4.71	4.766	IO	4.87
25.167	0.10	4.64	4.735	IO	4.85
25.250	0.08	4.58	4.704	IO	4.84
25.333	0.06	4.51	4.673	IO	4.82
25.417	0.04	4.45	4.643	IO	4.80
25.500	0.02	4.39	4.612	IO	4.79
25.583	0.01	4.33	4.582	IO	4.77
25.667	0.00	4.27	4.553	IO	4.76
25.750	0.00	4.21	4.524	IO	4.74
25.833	0.00	4.15	4.495	IO	4.73
25.917	0.00	4.09	4.466	IO	4.71
26.000	0.00	4.03	4.438	IO	4.70
26.083	0.00	3.98	4.411	IO	4.68
26.167	0.00	3.92	4.384	IO	4.67
26.250	0.00	3.87	4.357	IO	4.65
26.333	0.00	3.81	4.330	IO	4.64
26.417	0.00	3.76	4.304	IO	4.62
26.500	0.00	3.71	4.279	IO	4.61
26.583	0.00	3.65	4.253	IO	4.60
26.667	0.00	3.60	4.228	IO	4.58
26.750	0.00	3.55	4.204	IO	4.57
26.833	0.00	3.50	4.179	O	4.56
26.917	0.00	3.45	4.156	O	4.55
27.000	0.00	3.40	4.132	O	4.53
27.083	0.00	3.36	4.109	O	4.52
27.167	0.00	3.31	4.086	O	4.51
27.250	0.00	3.28	4.063	O	4.50
27.333	0.00	3.27	4.040	O	4.48
27.417	0.00	3.27	4.018	O	4.47
27.500	0.00	3.26	3.995	O	4.46
27.583	0.00	3.26	3.973	O	4.45
27.667	0.00	3.26	3.951	O	4.43
27.750	0.00	3.25	3.928	O	4.42
27.833	0.00	3.25	3.906	O	4.41
27.917	0.00	3.24	3.883	O	4.40
28.000	0.00	3.24	3.861	O	4.39
28.083	0.00	3.24	3.839	O	4.37
28.167	0.00	3.23	3.816	O	4.36
28.250	0.00	3.23	3.794	O	4.35
28.333	0.00	3.22	3.772	O	4.34
28.417	0.00	3.22	3.750	O	4.32
28.500	0.00	3.22	3.728	O	4.31
28.583	0.00	3.21	3.706	O	4.30
28.667	0.00	3.21	3.683	O	4.29
28.750	0.00	3.20	3.661	O	4.28
28.833	0.00	3.20	3.639	O	4.26
28.917	0.00	3.20	3.617	O	4.25
29.000	0.00	3.19	3.595	O	4.24

29.083	0.00	3.19	3.573	O	4.23
29.167	0.00	3.18	3.551	O	4.22
29.250	0.00	3.18	3.530	O	4.20
29.333	0.00	3.17	3.508	O	4.19
29.417	0.00	3.17	3.486	O	4.18
29.500	0.00	3.17	3.464	O	4.17
29.583	0.00	3.16	3.442	O	4.16
29.667	0.00	3.16	3.420	O	4.14
29.750	0.00	3.15	3.399	O	4.13
29.833	0.00	3.15	3.377	O	4.12
29.917	0.00	3.15	3.355	O	4.11
30.000	0.00	3.14	3.334	O	4.10
30.083	0.00	3.14	3.312	O	4.08
30.167	0.00	3.13	3.290	O	4.07
30.250	0.00	3.13	3.269	O	4.06
30.333	0.00	3.13	3.247	O	4.05
30.417	0.00	3.12	3.226	O	4.04
30.500	0.00	3.12	3.204	O	4.03
30.583	0.00	3.12	3.183	O	4.01
30.667	0.00	3.11	3.161	O	4.00
30.750	0.00	3.11	3.140	O	3.99
30.833	0.00	3.10	3.119	O	3.98
30.917	0.00	3.10	3.097	O	3.97
31.000	0.00	3.09	3.076	O	3.95
31.083	0.00	3.09	3.055	O	3.94
31.167	0.00	3.09	3.033	O	3.93
31.250	0.00	3.08	3.012	O	3.92
31.333	0.00	3.08	2.991	O	3.91
31.417	0.00	3.07	2.970	O	3.89
31.500	0.00	3.07	2.949	O	3.88
31.583	0.00	3.06	2.927	O	3.87
31.667	0.00	3.06	2.906	O	3.86
31.750	0.00	3.06	2.885	O	3.85
31.833	0.00	3.05	2.864	O	3.84
31.917	0.00	3.05	2.843	O	3.82
32.000	0.00	3.04	2.822	O	3.81
32.083	0.00	3.04	2.801	O	3.80
32.167	0.00	3.03	2.780	O	3.79
32.250	0.00	3.03	2.759	O	3.78
32.333	0.00	3.03	2.739	O	3.76
32.417	0.00	3.02	2.718	O	3.75
32.500	0.00	3.02	2.697	O	3.74
32.583	0.00	3.01	2.676	O	3.73
32.667	0.00	3.01	2.655	O	3.72
32.750	0.00	3.01	2.635	O	3.71
32.833	0.00	3.00	2.614	O	3.69
32.917	0.00	3.00	2.593	O	3.68
33.000	0.00	2.99	2.573	O	3.67
33.083	0.00	2.99	2.552	O	3.66
33.167	0.00	2.99	2.532	O	3.65
33.250	0.00	2.98	2.511	O	3.64
33.333	0.00	2.98	2.491	O	3.63
33.417	0.00	2.97	2.470	O	3.61
33.500	0.00	2.97	2.450	O	3.60
33.583	0.00	2.96	2.429	O	3.59
33.667	0.00	2.96	2.409	O	3.58
33.750	0.00	2.96	2.388	O	3.57
33.833	0.00	2.95	2.368	O	3.56

33.917	0.00	2.95	2.348	O	3.54
34.000	0.00	2.94	2.327	O	3.53
34.083	0.00	2.94	2.307	O	3.52
34.167	0.00	2.94	2.287	O	3.51
34.250	0.00	2.93	2.267	O	3.50
34.333	0.00	2.93	2.247	O	3.49
34.417	0.00	2.92	2.226	O	3.48
34.500	0.00	2.92	2.206	O	3.46
34.583	0.00	2.91	2.186	O	3.45
34.667	0.00	2.91	2.166	O	3.44
34.750	0.00	2.91	2.146	O	3.43
34.833	0.00	2.90	2.126	O	3.42
34.917	0.00	2.90	2.106	O	3.41
35.000	0.00	2.89	2.086	O	3.39
35.083	0.00	2.89	2.066	O	3.38
35.167	0.00	2.88	2.046	O	3.37
35.250	0.00	2.88	2.027	O	3.36
35.333	0.00	2.88	2.007	O	3.35
35.417	0.00	2.87	1.987	O	3.34
35.500	0.00	2.87	1.967	O	3.33
35.583	0.00	2.86	1.947	O	3.31
35.667	0.00	2.86	1.928	O	3.30
35.750	0.00	2.85	1.908	O	3.29
35.833	0.00	2.85	1.888	O	3.28
35.917	0.00	2.84	1.869	O	3.27
36.000	0.00	2.84	1.849	O	3.26
36.083	0.00	2.84	1.830	O	3.25
36.167	0.00	2.83	1.810	O	3.24
36.250	0.00	2.83	1.791	O	3.22
36.333	0.00	2.82	1.771	O	3.21
36.417	0.00	2.82	1.752	O	3.20
36.500	0.00	2.82	1.732	O	3.19
36.583	0.00	2.81	1.713	O	3.18
36.667	0.00	2.81	1.694	O	3.17
36.750	0.00	2.80	1.674	O	3.16
36.833	0.00	2.80	1.655	O	3.15
36.917	0.00	2.79	1.636	O	3.13
37.000	0.00	2.79	1.617	O	3.12
37.083	0.00	2.79	1.597	O	3.11
37.167	0.00	2.78	1.578	O	3.10
37.250	0.00	2.78	1.559	O	3.09
37.333	0.00	2.77	1.540	O	3.08
37.417	0.00	2.77	1.521	O	3.07
37.500	0.00	2.76	1.502	O	3.06
37.583	0.00	2.76	1.483	O	3.05
37.667	0.00	2.76	1.464	O	3.03
37.750	0.00	2.75	1.445	O	3.02
37.833	0.00	2.75	1.426	O	3.01
37.917	0.00	2.74	1.407	O	3.00
38.000	0.00	2.72	1.388	O	2.93
38.083	0.00	2.69	1.370	O	2.86
38.167	0.00	2.66	1.351	O	2.79
38.250	0.00	2.63	1.333	O	2.72
38.333	0.00	2.60	1.315	O	2.65
38.417	0.00	2.57	1.297	O	2.58
38.500	0.00	2.54	1.280	O	2.51
38.583	0.00	2.51	1.262	O	2.44
38.667	0.00	2.48	1.245	O	2.37

38.750	0.00	2.45	1.228	O	2.30
38.833	0.00	2.42	1.211	O	2.24
38.917	0.00	2.40	1.195	O	2.17
39.000	0.00	2.37	1.178	O	2.11
39.083	0.00	2.34	1.162	O	2.05
39.167	0.00	2.31	1.146	O	1.98
39.250	0.00	2.28	1.130	O	1.92
39.333	0.00	2.25	1.115	O	1.86
39.417	0.00	2.22	1.099	O	1.80
39.500	0.00	2.19	1.084	O	1.74
39.583	0.00	2.16	1.069	O	1.68
39.667	0.00	2.13	1.054	O	1.62
39.750	0.00	2.11	1.040	O	1.57
39.833	0.00	2.08	1.025	O	1.51
39.917	0.00	2.04	1.011	O	1.48
40.000	0.00	2.00	0.997	O	1.46
40.083	0.00	1.96	0.984	O	1.44
40.167	0.00	1.92	0.970	O	1.42
40.250	0.00	1.89	0.957	O	1.40
40.333	0.00	1.85	0.944	O	1.38
40.417	0.00	1.82	0.932	O	1.37
40.500	0.00	1.78	0.919	O	1.35
40.583	0.00	1.75	0.907	O	1.33
40.667	0.00	1.71	0.895	O	1.31
40.750	0.00	1.68	0.883	O	1.30
40.833	0.00	1.65	0.872	O	1.28
40.917	0.00	1.62	0.861	O	1.26
41.000	0.00	1.58	0.850	O	1.25
41.083	0.00	1.55	0.839	O	1.23
41.167	0.00	1.52	0.828	O	1.21
41.250	0.00	1.50	0.818	O	1.20
41.333	0.00	1.47	0.808	O	1.18
41.417	0.00	1.44	0.798	O	1.17
41.500	0.00	1.41	0.788	O	1.16
41.583	0.00	1.38	0.778	O	1.14
41.667	0.00	1.36	0.769	O	1.13
41.750	0.00	1.33	0.760	O	1.11
41.833	0.00	1.31	0.750	O	1.10
41.917	0.00	1.28	0.742	O	1.09
42.000	0.00	1.26	0.733	O	1.07
42.083	0.00	1.23	0.724	O	1.06
42.167	0.00	1.21	0.716	O	1.05
42.250	0.00	1.18	0.708	O	1.04
42.333	0.00	1.16	0.700	O	1.03
42.417	0.00	1.14	0.692	O	1.01
42.500	0.00	1.12	0.684	O	1.00
42.583	0.00	1.09	0.676	O	0.99
42.667	0.00	1.07	0.669	O	0.98
42.750	0.00	1.05	0.661	O	0.97
42.833	0.00	1.02	0.654	O	0.96
42.917	0.00	1.00	0.647	O	0.95
43.000	0.00	0.98	0.641	O	0.94
43.083	0.00	0.96	0.634	O	0.93
43.167	0.00	0.93	0.627	O	0.92
43.250	0.00	0.91	0.621	O	0.91
43.333	0.00	0.89	0.615	O	0.90
43.417	0.00	0.87	0.609	O	0.89
43.500	0.00	0.85	0.603	O	0.88

43.583	0.00	0.84	0.597	O	0.88
43.667	0.00	0.82	0.591	O	0.87
43.750	0.00	0.80	0.586	O	0.86
43.833	0.00	0.78	0.580	O	0.85
43.917	0.00	0.76	0.575	O	0.84
44.000	0.00	0.75	0.570	O	0.84
44.083	0.00	0.73	0.565	O	0.83
44.167	0.00	0.71	0.560	O	0.82
44.250	0.00	0.70	0.555	O	0.81
44.333	0.00	0.68	0.550	O	0.81
44.417	0.00	0.67	0.545	O	0.80
44.500	0.00	0.65	0.541	O	0.79
44.583	0.00	0.64	0.537	O	0.79
44.667	0.00	0.62	0.532	O	0.78
44.750	0.00	0.61	0.528	O	0.77
44.833	0.00	0.60	0.524	O	0.77
44.917	0.00	0.58	0.520	O	0.76
45.000	0.00	0.57	0.516	O	0.76
45.083	0.00	0.56	0.512	O	0.75
45.167	0.00	0.54	0.508	O	0.74
45.250	0.00	0.53	0.504	O	0.74
45.333	0.00	0.52	0.501	O	0.73
45.417	0.00	0.51	0.497	O	0.73
45.500	0.00	0.50	0.494	O	0.72
45.583	0.00	0.49	0.490	O	0.72
45.667	0.00	0.48	0.487	O	0.71
45.750	0.00	0.47	0.484	O	0.71
45.833	0.00	0.46	0.481	O	0.70
45.917	0.00	0.45	0.477	O	0.70
46.000	0.00	0.44	0.474	O	0.70
46.083	0.00	0.43	0.471	O	0.69
46.167	0.00	0.42	0.469	O	0.69
46.250	0.00	0.41	0.466	O	0.68
46.333	0.00	0.40	0.463	O	0.68
46.417	0.00	0.39	0.460	O	0.67
46.500	0.00	0.38	0.458	O	0.67
46.583	0.00	0.37	0.455	O	0.67
46.667	0.00	0.36	0.452	O	0.66
46.750	0.00	0.36	0.450	O	0.66
46.833	0.00	0.35	0.448	O	0.66
46.917	0.00	0.34	0.445	O	0.65
47.000	0.00	0.33	0.443	O	0.65
47.083	0.00	0.33	0.441	O	0.65
47.167	0.00	0.32	0.438	O	0.64
47.250	0.00	0.31	0.436	O	0.64
47.333	0.00	0.30	0.434	O	0.64
47.417	0.00	0.30	0.432	O	0.63
47.500	0.00	0.29	0.430	O	0.63
47.583	0.00	0.28	0.428	O	0.63
47.667	0.00	0.28	0.426	O	0.62
47.750	0.00	0.27	0.424	O	0.62
47.833	0.00	0.27	0.422	O	0.62
47.917	0.00	0.26	0.421	O	0.62
48.000	0.00	0.25	0.419	O	0.61
48.083	0.00	0.25	0.417	O	0.61
48.167	0.00	0.24	0.415	O	0.61
48.250	0.00	0.24	0.414	O	0.61
48.333	0.00	0.23	0.412	O	0.60

48.417	0.00	0.23	0.411	O	|	|	|	|	0.60
48.500	0.00	0.22	0.409	O	|	|	|	|	0.60
48.583	0.00	0.22	0.408	O	|	|	|	|	0.60
48.667	0.00	0.21	0.406	O	|	|	|	|	0.60
48.750	0.00	0.21	0.405	O	|	|	|	|	0.59
48.833	0.00	0.20	0.403	O	|	|	|	|	0.59
48.917	0.00	0.20	0.402	O	|	|	|	|	0.59
49.000	0.00	0.19	0.400	O	|	|	|	|	0.59
49.083	0.00	0.19	0.399	O	|	|	|	|	0.59
49.167	0.00	0.19	0.398	O	|	|	|	|	0.58
49.250	0.00	0.18	0.397	O	|	|	|	|	0.58
49.333	0.00	0.18	0.395	O	|	|	|	|	0.58
49.417	0.00	0.17	0.394	O	|	|	|	|	0.58
49.500	0.00	0.17	0.393	O	|	|	|	|	0.58
49.583	0.00	0.17	0.392	O	|	|	|	|	0.57
49.667	0.00	0.16	0.391	O	|	|	|	|	0.57
49.750	0.00	0.16	0.390	O	|	|	|	|	0.57
49.833	0.00	0.15	0.388	O	|	|	|	|	0.57
49.917	0.00	0.15	0.387	O	|	|	|	|	0.57
50.000	0.00	0.15	0.386	O	|	|	|	|	0.57
50.083	0.00	0.14	0.385	O	|	|	|	|	0.57
50.167	0.00	0.14	0.384	O	|	|	|	|	0.56
50.250	0.00	0.14	0.383	O	|	|	|	|	0.56
50.333	0.00	0.14	0.382	O	|	|	|	|	0.56
50.417	0.00	0.13	0.382	O	|	|	|	|	0.56
50.500	0.00	0.13	0.381	O	|	|	|	|	0.56
50.583	0.00	0.13	0.380	O	|	|	|	|	0.56
50.667	0.00	0.12	0.379	O	|	|	|	|	0.56
50.750	0.00	0.12	0.378	O	|	|	|	|	0.55
50.833	0.00	0.12	0.377	O	|	|	|	|	0.55
50.917	0.00	0.12	0.376	O	|	|	|	|	0.55
51.000	0.00	0.11	0.376	O	|	|	|	|	0.55
51.083	0.00	0.11	0.375	O	|	|	|	|	0.55
51.167	0.00	0.11	0.374	O	|	|	|	|	0.55
51.250	0.00	0.11	0.373	O	|	|	|	|	0.55
51.333	0.00	0.10	0.373	O	|	|	|	|	0.55
51.417	0.00	0.10	0.372	O	|	|	|	|	0.55
51.500	0.00	0.10	0.371	O	|	|	|	|	0.54
51.583	0.00	0.10	0.371	O	|	|	|	|	0.54
51.667	0.00	0.09	0.370	O	|	|	|	|	0.54
51.750	0.00	0.09	0.369	O	|	|	|	|	0.54
51.833	0.00	0.09	0.369	O	|	|	|	|	0.54
51.917	0.00	0.09	0.368	O	|	|	|	|	0.54
52.000	0.00	0.09	0.367	O	|	|	|	|	0.54
52.083	0.00	0.08	0.367	O	|	|	|	|	0.54
52.167	0.00	0.08	0.366	O	|	|	|	|	0.54
52.250	0.00	0.08	0.366	O	|	|	|	|	0.54
52.333	0.00	0.08	0.365	O	|	|	|	|	0.54
52.417	0.00	0.08	0.365	O	|	|	|	|	0.53
52.500	0.00	0.08	0.364	O	|	|	|	|	0.53
52.583	0.00	0.07	0.364	O	|	|	|	|	0.53
52.667	0.00	0.07	0.363	O	|	|	|	|	0.53
52.750	0.00	0.07	0.363	O	|	|	|	|	0.53
52.833	0.00	0.07	0.362	O	|	|	|	|	0.53
52.917	0.00	0.07	0.362	O	|	|	|	|	0.53
53.000	0.00	0.07	0.361	O	|	|	|	|	0.53
53.083	0.00	0.06	0.361	O	|	|	|	|	0.53
53.167	0.00	0.06	0.360	O	|	|	|	|	0.53

53.250	0.00	0.06	0.360	O	|	|	|	|	0.53
53.333	0.00	0.06	0.359	O	|	|	|	|	0.53
53.417	0.00	0.06	0.359	O	|	|	|	|	0.53
53.500	0.00	0.06	0.359	O	|	|	|	|	0.53
53.583	0.00	0.06	0.358	O	|	|	|	|	0.53
53.667	0.00	0.06	0.358	O	|	|	|	|	0.52
53.750	0.00	0.05	0.358	O	|	|	|	|	0.52
53.833	0.00	0.05	0.357	O	|	|	|	|	0.52
53.917	0.00	0.05	0.357	O	|	|	|	|	0.52
54.000	0.00	0.05	0.356	O	|	|	|	|	0.52
54.083	0.00	0.05	0.356	O	|	|	|	|	0.52
54.167	0.00	0.05	0.356	O	|	|	|	|	0.52
54.250	0.00	0.05	0.355	O	|	|	|	|	0.52
54.333	0.00	0.05	0.355	O	|	|	|	|	0.52
54.417	0.00	0.05	0.355	O	|	|	|	|	0.52
54.500	0.00	0.04	0.354	O	|	|	|	|	0.52
54.583	0.00	0.04	0.354	O	|	|	|	|	0.52
54.667	0.00	0.04	0.354	O	|	|	|	|	0.52
54.750	0.00	0.04	0.354	O	|	|	|	|	0.52
54.833	0.00	0.04	0.353	O	|	|	|	|	0.52
54.917	0.00	0.04	0.353	O	|	|	|	|	0.52
55.000	0.00	0.04	0.353	O	|	|	|	|	0.52
55.083	0.00	0.04	0.353	O	|	|	|	|	0.52
55.167	0.00	0.04	0.352	O	|	|	|	|	0.52
55.250	0.00	0.04	0.352	O	|	|	|	|	0.52
55.333	0.00	0.04	0.352	O	|	|	|	|	0.52
55.417	0.00	0.03	0.352	O	|	|	|	|	0.52
55.500	0.00	0.03	0.351	O	|	|	|	|	0.52
55.583	0.00	0.03	0.351	O	|	|	|	|	0.51
55.667	0.00	0.03	0.351	O	|	|	|	|	0.51
55.750	0.00	0.03	0.351	O	|	|	|	|	0.51
55.833	0.00	0.03	0.350	O	|	|	|	|	0.51
55.917	0.00	0.03	0.350	O	|	|	|	|	0.51
56.000	0.00	0.03	0.350	O	|	|	|	|	0.51
56.083	0.00	0.03	0.350	O	|	|	|	|	0.51
56.167	0.00	0.03	0.350	O	|	|	|	|	0.51
56.250	0.00	0.03	0.349	O	|	|	|	|	0.51
56.333	0.00	0.03	0.349	O	|	|	|	|	0.51
56.417	0.00	0.03	0.349	O	|	|	|	|	0.51
56.500	0.00	0.03	0.349	O	|	|	|	|	0.51
56.583	0.00	0.03	0.349	O	|	|	|	|	0.51
56.667	0.00	0.02	0.349	O	|	|	|	|	0.51
56.750	0.00	0.02	0.348	O	|	|	|	|	0.51
56.833	0.00	0.02	0.348	O	|	|	|	|	0.51
56.917	0.00	0.02	0.348	O	|	|	|	|	0.51
57.000	0.00	0.02	0.348	O	|	|	|	|	0.51
57.083	0.00	0.02	0.348	O	|	|	|	|	0.51
57.167	0.00	0.02	0.348	O	|	|	|	|	0.51
57.250	0.00	0.02	0.347	O	|	|	|	|	0.51
57.333	0.00	0.02	0.347	O	|	|	|	|	0.51
57.417	0.00	0.02	0.347	O	|	|	|	|	0.51
57.500	0.00	0.02	0.347	O	|	|	|	|	0.51
57.583	0.00	0.02	0.347	O	|	|	|	|	0.51
57.667	0.00	0.02	0.347	O	|	|	|	|	0.51
57.750	0.00	0.02	0.347	O	|	|	|	|	0.51
57.833	0.00	0.02	0.346	O	|	|	|	|	0.51
57.917	0.00	0.02	0.346	O	|	|	|	|	0.51
58.000	0.00	0.02	0.346	O	|	|	|	|	0.51

58.083	0.00	0.02	0.346	O	|	|	|	|	0.51
58.167	0.00	0.02	0.346	O	|	|	|	|	0.51
58.250	0.00	0.02	0.346	O	|	|	|	|	0.51
58.333	0.00	0.02	0.346	O	|	|	|	|	0.51
58.417	0.00	0.02	0.346	O	|	|	|	|	0.51
58.500	0.00	0.01	0.346	O	|	|	|	|	0.51
58.583	0.00	0.01	0.345	O	|	|	|	|	0.51
58.667	0.00	0.01	0.345	O	|	|	|	|	0.51
58.750	0.00	0.01	0.345	O	|	|	|	|	0.51
58.833	0.00	0.01	0.345	O	|	|	|	|	0.51
58.917	0.00	0.01	0.345	O	|	|	|	|	0.51
59.000	0.00	0.01	0.345	O	|	|	|	|	0.51
59.083	0.00	0.01	0.345	O	|	|	|	|	0.51
59.167	0.00	0.01	0.345	O	|	|	|	|	0.51
59.250	0.00	0.01	0.345	O	|	|	|	|	0.51
59.333	0.00	0.01	0.345	O	|	|	|	|	0.51
59.417	0.00	0.01	0.345	O	|	|	|	|	0.51
59.500	0.00	0.01	0.345	O	|	|	|	|	0.51
59.583	0.00	0.01	0.344	O	|	|	|	|	0.51
59.667	0.00	0.01	0.344	O	|	|	|	|	0.50
59.750	0.00	0.01	0.344	O	|	|	|	|	0.50
59.833	0.00	0.01	0.344	O	|	|	|	|	0.50
59.917	0.00	0.01	0.344	O	|	|	|	|	0.50
60.000	0.00	0.01	0.344	O	|	|	|	|	0.50
60.083	0.00	0.01	0.344	O	|	|	|	|	0.50
60.167	0.00	0.01	0.344	O	|	|	|	|	0.50
60.250	0.00	0.01	0.344	O	|	|	|	|	0.50
60.333	0.00	0.01	0.344	O	|	|	|	|	0.50
60.417	0.00	0.01	0.344	O	|	|	|	|	0.50
60.500	0.00	0.01	0.344	O	|	|	|	|	0.50
60.583	0.00	0.01	0.344	O	|	|	|	|	0.50
60.667	0.00	0.01	0.344	O	|	|	|	|	0.50
60.750	0.00	0.01	0.344	O	|	|	|	|	0.50
60.833	0.00	0.01	0.343	O	|	|	|	|	0.50
60.917	0.00	0.01	0.343	O	|	|	|	|	0.50
61.000	0.00	0.01	0.343	O	|	|	|	|	0.50
61.083	0.00	0.01	0.343	O	|	|	|	|	0.50
61.167	0.00	0.01	0.343	O	|	|	|	|	0.50
61.250	0.00	0.01	0.343	O	|	|	|	|	0.50
61.333	0.00	0.01	0.343	O	|	|	|	|	0.50
61.417	0.00	0.01	0.343	O	|	|	|	|	0.50
61.500	0.00	0.01	0.343	O	|	|	|	|	0.50
61.583	0.00	0.01	0.343	O	|	|	|	|	0.50
61.667	0.00	0.01	0.343	O	|	|	|	|	0.50
61.750	0.00	0.01	0.343	O	|	|	|	|	0.50
61.833	0.00	0.01	0.343	O	|	|	|	|	0.50
61.917	0.00	0.01	0.343	O	|	|	|	|	0.50
62.000	0.00	0.01	0.343	O	|	|	|	|	0.50
62.083	0.00	0.01	0.343	O	|	|	|	|	0.50
62.167	0.00	0.01	0.343	O	|	|	|	|	0.50
62.250	0.00	0.01	0.343	O	|	|	|	|	0.50
62.333	0.00	0.01	0.343	O	|	|	|	|	0.50
62.417	0.00	0.01	0.343	O	|	|	|	|	0.50
62.500	0.00	0.01	0.343	O	|	|	|	|	0.50
62.583	0.00	0.00	0.343	O	|	|	|	|	0.50
62.667	0.00	0.00	0.342	O	|	|	|	|	0.50
62.750	0.00	0.00	0.342	O	|	|	|	|	0.50
62.833	0.00	0.00	0.342	O	|	|	|	|	0.50

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62.917    0.00    0.00      0.342  O        |       |       |       |      0.50
63.000    0.00    0.00      0.342  O        |       |       |       |      0.50
63.083    0.00    0.00      0.342  O        |       |       |       |      0.50
63.167    0.00    0.00      0.342  O        |       |       |       |      0.50
63.250    0.00    0.00      0.342  O        |       |       |       |      0.50
63.333    0.00    0.00      0.342  O        |       |       |       |      0.50
63.417    0.00    0.00      0.342  O        |       |       |       |      0.50
63.500    0.00    0.00      0.342  O        |       |       |       |      0.50
63.583    0.00    0.00      0.342  O        |       |       |       |      0.50
63.667    0.00    0.00      0.342  O        |       |       |       |      0.50
63.750    0.00    0.00      0.342  O        |       |       |       |      0.50
63.833    0.00    0.00      0.342  O        |       |       |       |      0.50
63.917    0.00    0.00      0.342  O        |       |       |       |      0.50
64.000    0.00    0.00      0.342  O        |       |       |       |      0.50
64.083    0.00    0.00      0.342  O        |       |       |       |      0.50
64.167    0.00    0.00      0.342  O        |       |       |       |      0.50
64.250    0.00    0.00      0.342  O        |       |       |       |      0.50
64.333    0.00    0.00      0.342  O        |       |       |       |      0.50
64.417    0.00    0.00      0.342  O        |       |       |       |      0.50
64.500    0.00    0.00      0.342  O        |       |       |       |      0.50
64.583    0.00    0.00      0.342  O        |       |       |       |      0.50
64.667    0.00    0.00      0.342  O        |       |       |       |      0.50
64.750    0.00    0.00      0.342  O        |       |       |       |      0.50
64.833    0.00    0.00      0.342  O        |       |       |       |      0.50
64.917    0.00    0.00      0.342  O        |       |       |       |      0.50
65.000    0.00    0.00      0.342  O        |       |       |       |      0.50
65.083    0.00    0.00      0.342  O        |       |       |       |      0.50
65.167    0.00    0.00      0.342  O        |       |       |       |      0.50
65.250    0.00    0.00      0.342  O        |       |       |       |      0.50
65.333    0.00    0.00      0.342  O        |       |       |       |      0.50
65.417    0.00    0.00      0.342  O        |       |       |       |      0.50
65.500    0.00    0.00      0.342  O        |       |       |       |      0.50
65.583    0.00    0.00      0.342  O        |       |       |       |      0.50
65.667    0.00    0.00      0.342  O        |       |       |       |      0.50
65.750    0.00    0.00      0.342  O        |       |       |       |      0.50
65.833    0.00    0.00      0.342  O        |       |       |       |      0.50
65.917    0.00    0.00      0.342  O        |       |       |       |      0.50
66.000    0.00    0.00      0.342  O        |       |       |       |      0.50
66.083    0.00    0.00      0.342  O        |       |       |       |      0.50
66.167    0.00    0.00      0.342  O        |       |       |       |      0.50
66.250    0.00    0.00      0.342  O        |       |       |       |      0.50
66.333    0.00    0.00      0.342  O        |       |       |       |      0.50
66.417    0.00    0.00      0.342  O        |       |       |       |      0.50
66.500    0.00    0.00      0.342  O        |       |       |       |      0.50
66.583    0.00    0.00      0.342  O        |       |       |       |      0.50
66.667    0.00    0.00      0.342  O        |       |       |       |      0.50
66.750    0.00    0.00      0.341  O        |       |       |       |      0.50
66.833    0.00    0.00      0.341  O        |       |       |       |      0.50
66.917    0.00    0.00      0.341  O        |       |       |       |      0.50
67.000    0.00    0.00      0.341  O        |       |       |       |      0.50
67.083    0.00    0.00      0.341  O        |       |       |       |      0.50
67.167    0.00    0.00      0.341  O        |       |       |       |      0.50
67.250    0.00    0.00      0.341  O        |       |       |       |      0.50
67.333    0.00    0.00      0.341  O        |       |       |       |      0.50
67.417    0.00    0.00      0.341  O        |       |       |       |      0.50
67.500    0.00    0.00      0.341  O        |       |       |       |      0.50
67.583    0.00    0.00      0.341  O        |       |       |       |      0.50
67.667    0.00    0.00      0.341  O        |       |       |       |      0.50
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67.750    0.00    0.00      0.341  O       |       |       |       |     0.50
67.833    0.00    0.00      0.341  O       |       |       |       |     0.50
67.917    0.00    0.00      0.341  O       |       |       |       |     0.50
68.000    0.00    0.00      0.341  O       |       |       |       |     0.50
68.083    0.00    0.00      0.341  O       |       |       |       |     0.50
68.167    0.00    0.00      0.341  O       |       |       |       |     0.50
68.250    0.00    0.00      0.341  O       |       |       |       |     0.50
68.333    0.00    0.00      0.341  O       |       |       |       |     0.50
68.417    0.00    0.00      0.341  O       |       |       |       |     0.50
68.500    0.00    0.00      0.341  O       |       |       |       |     0.50
68.583    0.00    0.00      0.341  O       |       |       |       |     0.50

       Remaining water in basin =    0.34 (Ac.Ft)

       ****************************HYDROGRAPH DATA****************************
                       Number of intervals =   823
                       Time interval =    5.0 (Min.)
                       Maximum/Peak flow rate =       23.696 (CFS)
                       Total volume =      16.533 (Ac.Ft)
               Status of hydrographs being held in storage
                          Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
               Peak (CFS)      0.000     0.000     0.000     0.000     0.000
               Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
       ***********************************************************************

       --------------------------------------------------------------------
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