Hallmark-Barham Specific Plan EIR

Technical Appendices

Appendix J.2

SWQMP

City of San Marcos

PRIORITY DEVELOPMENT PROJECT (PDP)
STORM WATER QUALITY MANAGEMENT PLAN (SWQMP)
FOR

943 Barham Drive

[INSERT PERMIT APPLICATION NUMBERS]

943 Barham Drive
San Marcos, CA 92078

ASSESSOR'S PARCEL NUMBER(S):
228-310-01

ENGINEER OF WORK:

Allen L. Butcher, PE C47107

PREPARED FOR:

Hall Land Company, Inc.
740 Lomas Santa Fe Drive, Suite 204
Solana Beach, California 92075
(858) 481-3310

PDP SWQMP PREPARED BY:

SB&O, Inc.
3990 Ruffin Rd. Suite 120
San Diego, CA 92123
(858) 560-1141

DATE OF SWQMP:
19-June-2020

PLANS PREPARED BY:

SB&O INC.
PLANNING ENGINEERING SURVEYING

3990 Ruffin Rd. Suite 120
San Diego, CA 92123
(858) 560-1141
JN 75050.65

City of San Marcos PDP SWQMP Template Date: March 15, 2016
PDP SWQMP Preparation Date: 19-June-2020

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TABLE OF CONTENTS

ACRONYMS

APN	Assessor's Parcel Number
BMP	Best Management Practice
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NRCS	Natural Resources Conservation Service
PDP	Priority Development Project
PE	Professional Engineer
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWQMP	Storm Water Quality Management Plan

PDP SWQMP PREPARER'S CERTIFICATION PAGE

Project Name: 943 Barham Drive
Permit Application Number: [Insert Permit Application Number]

PREPARER'S CERTIFICATION

I hereby declare that I am the Engineer in Responsible Charge of design of storm water best management practices (BMPs) for this project, and that I have exercised responsible charge over the design of the BMPs as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the PDP requirements of the City of San Marcos BMP Design Manual, which is a design manual for compliance with local City of San Marcos and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2015-0100) requirements for storm water management.

I have read and understand that the [City Engineer] has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the BMP Design Manual. I certify that this PDP SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP SWQMP by the [City Engineer] is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

C47107 Exp 12/31/2021
Engineer of Work's Signature, PE Number & Expiration Date

Allen L. Butcher
Print Name

SB&O INC.
PLANNING ENGINEERING SURVEYING
3990 Ruffin Road, Suite 120
San Diego, Ca. 92123
858-560-1141
858-560-8157 Fax

REGISTERED PROFESSIONAL ENGINEER
ALLEN L. BUTCHER
No. 47107
CIVIL
STATE OF CALIFORNIA

19-June-2020
Date

Engineer's Seal:

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PDP SWQMP PROJECT OWNER'S CERTIFICATION PAGE

Project Name: 943 Barham Drive
Permit Application Number: [Insert Permit Application Number]

PROJECT OWNER'S CERTIFICATION

This PDP SWQMP has been prepared for **HALL LAND COMPANY, INC** by **SB&O, Inc**. PDP SWQMP is intended to comply with the PDP requirements of the City of San Marcos BMP Design Manual, which is a design manual for compliance with local City of San Marcos and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2015-0100) requirements for storm water management.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan. Once the undersigned transfers its interests in the property, its successor-in-interest shall bear the aforementioned responsibility to implement the best management practices (BMPs) described within this plan, including ensuring on-going operation and maintenance of structural BMPs. A signed copy of this document shall be available on the subject property into perpetuity.

_____
Project Owner's Signature

_____
Print Name

HALL LAND COMPANY, INC
Company

_____
Date

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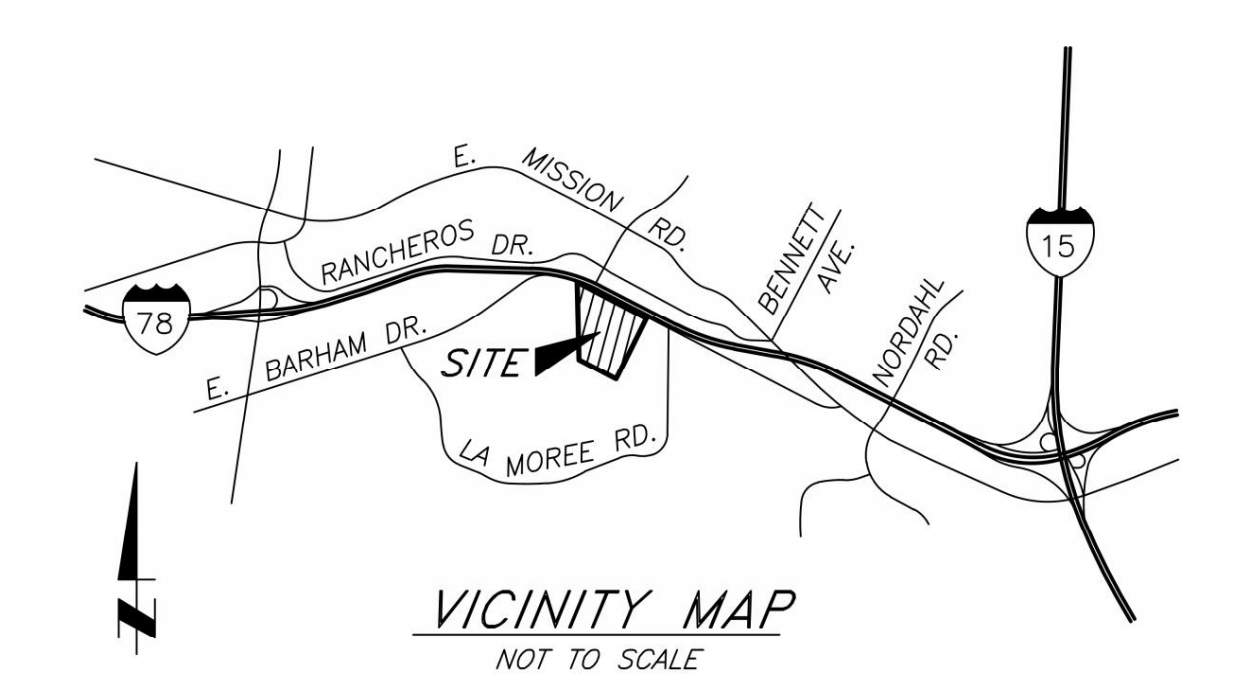
SUBMITTAL RECORD

Use this Table to keep a record of submittals of this PDP SWQMP. Each time the PDP SWQMP is re-submitted, provide the date and status of the project. In column 4 summarize the changes that have been made or indicate if response to plancheck comments is included. When applicable, insert response to plancheck comments behind this page.

Submittal Number	Date	Project Status	Summary of Changes
1	19-Jun-2020	☒ Preliminary Design/ Planning/ CEQA ☐ Final Design	Initial Submittal
2		☐ Preliminary Design/ Planning/ CEQA ☐ Final Design	
3		☐ Preliminary Design/ Planning/ CEQA ☐ Final Design	
4		☐ Preliminary Design/ Planning/ CEQA ☐ Final Design	

PROJECT VICINITY MAP

Project Name: 943 Barham Drive
Permit Application Number: [Insert Permit Application Number]



Applicability of Storm Water Best Management Practices (BMP) Requirements

(Storm Water Intake Form for all Development Permit Applications)
For detailed information please visit:
http://www.san-marcos.net/departments/development-services/stormwater/development-planning

Form I-1
[March 15, 2016]

Project Identification

Project Name: **943 Barham Drive**

Description: **Multifamily Residential buildings with approximately 150 attached units with garages and surface parking with Rec Building and Tot Lot.**

Permit Application Number (if applicable): **[Insert Permit Application Number]** | Date: **19-Jun-2020**

Project Address: **943 Barham Drive**

Determination of Requirements

This form is required as part of the City's application process. The purpose of this form is to identify potential land development planning storm water requirements that apply to development projects.

Development projects are defined as construction, rehabilitation, redevelopment, or reconstruction of any public or private projects. In addition, the identification of a development project, as it relates to storm water regulations, would truly apply to development and redevelopment activities that have the potential to contact storm water and contribute a source of pollutants, or reduce the natural absorption and infiltration abilities of the land.

To access the BMP Design Manual, Storm Water Quality Management Plan (SWQMP) templates, and other pertinent information related to this program please refer to:
http://www.san-marcos.net/departments/development-services/stormwater/development-planning

Please answer each of the following steps below, starting with Step 1 and progressing through each step until reaching "Stop".

Step	Answer	Progression
Step 1: Based on the above, Is the project a "development project" (See definition above)? See Section 1.3 of the BMP Design Manual for further guidance if necessary.	☒Yes	Go to Step 2.
	☐No	Permanent BMP requirements do not apply. No SWQMP will be required. Provide brief discussion below. **STOP.**
Discussion / justification if the project is not a "development project" (e.g., the project includes *only* interior remodels within an existing building):		
Step 2: Is the project a Standard Project, Priority Development Project (PDP), or exception to PDP definitions? **To answer this item, complete Form I-2, Project Type Determination. See Section 1.4 of the BMP Design Manual *in its entirety* for guidance.** **In addition to Section 1.4, please refer to the City's SWQMP Submittal Requirements form.**	☐Standard Project	Only Standard Project requirements apply, including Standard Project SWQMP. **STOP.**
	☒PDP	Standard and PDP requirements apply, including PDP SWQMP. **Go to Step 3 on the following page.**
	☐ Exception to PDP definitions	Standard Project requirements apply, and any additional requirements specific to the type of project. Provide discussion and list any additional requirements below. Prepare Standard Project SWQMP. **STOP.**
Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:		

Form I-1 Page 2, Form Date: March 15, 2016		
Step 3 (PDPs only). Please answer the list of questions in this section to determine if hydromodification requirements reply to the proposed PDP. Does the project:		
Step 3a. Discharge storm water runoff directly to the Pacific Ocean?	☐Yes	**STOP**. Hydromodification requirements do not apply.
	☒No	Continue to Step 3b.
Step 3b. Discharge storm water runoff directly to an enclosed embayment, not within protected areas?	☐Yes	**STOP**. Hydromodification requirements do not apply.
	☒No	Continue to Step 3c.
Step 3c. Discharge storm water runoff directly to a water storage reservoir or lake, below spillway or normal operating level?	☐Yes	**STOP**. Hydromodification requirements do not apply.
	☒No	Continue to Step 3d.
Step 3d. Discharge storm water runoff directly to an area identified in WMAA?	☐Yes	**STOP**. Hydromodification requirements do not apply.
	☒No	**Hydromodification requirements apply to the project. Go to Step 4.**
Discussion / justification if hydromodification control requirements do <u>not</u> apply:		
Step 4 (PDPs subject to hydromodification control requirements only). Does protection of critical coarse sediment yield areas apply based on review of WMAA Potential Critical Coarse Sediment Yield Area Map? See Section 6.2 of the BMP Design Manual for guidance.	☒Yes	Management measures required for protection of critical coarse sediment yield areas (Chapter 6.2). Stop.
	☐No	Management measures not required for protection of critical coarse sediment yield areas. Provide brief discussion below. Stop.

Project Type Determination Checklist			Form I-2 [March 15, 2016]
Project Information			
Project Name/Description: **943 Barham Drive**			
Permit Application Number (if applicable): **[Insert Permit Application Number]**			Date: **19-Jun-2020**
Project Address: **943 Barham Drive**			
Project Type Determination: Standard Project or Priority Development Project (PDP)			
The project is (select one): ☒ **New Development** ☐Redevelopment			
The total proposed newly created or replaced impervious area is: **265,617** ft^2 (**_6.098**) acres			
Is the project in any of the following categories, (a) through (f)?			
☒ **Yes**	☐ No	(a)	New development projects that create 10,000 square feet or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
☐ Yes	☒ No	(b)	Redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
☐ Yes	☒ No	(c)	New and redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site), and support one or more of the following uses: (i) Restaurants. This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification (SIC) code 5812). (ii) Hillside development projects. This category includes development on any natural slope that is twenty-five percent or greater. (iii) Parking lots. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce. (iv) Streets, roads, highways, freeways, and driveways. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.

Form I-2 Page 2, Form Date: March 15, 2016			
☐ Yes	☒ No	(d)	New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharging directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands). *Note: ESAs are areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Board and San Diego Water Board; State Water Quality Protected Areas; water bodies designated with the RARE beneficial use by the State Water Board and San Diego Water Board; and any other equivalent environmentally sensitive areas which have been identified by the Co-permittees. See BMP Design Manual Section 1.4.2 for additional guidance.*
☐ Yes	☒ No	(e)	New development projects, or redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface, that support one or more of the following uses: (i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following SIC codes: 5013, 5014, 5541, 7532-7534, or 7536-7539. (ii) Retail gasoline outlets (RGOs). This category includes RGOs that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.
☐ Yes	☒ No	(f)	New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction. *Note: See BMP Design Manual Section 1.4.2 for additional guidance.*

Does the project meet the definition of one or more of the Priority Development Project categories (a) through (f) listed above?

☐No – the project is not a Priority Development Project (Standard Project).

☒Yes – the project is a Priority Development Project (PDP).

The following is for ~~redevelopment PDPs only~~:

The area of existing (pre-project) impervious area at the project site is: _____ ft^2 (A)

The total proposed newly created or replaced impervious area is _____ ft^2 (B)

Percent impervious surface created or replaced (B/A)*100: _____%

The percent impervious surface created or replaced is (select one based on the above calculation):

less than or equal to fifty percent (50%) – only new impervious areas are considered PDP

OR

greater than fifty percent (50%) – the entire project site is a PDP

Site Information Checklist For PDPs	Form I-3B (PDPs) [March 15, 2016]
Project Summary Information	
Project Name:	**943 Barham Drive**
Project Address	**943 Barham Drive** **San Marcos CA 92078**
Assessor's Parcel Number(s) (APN(s))	**228-310-01**
Permit Application Number	**[Insert Permit Application Number]**
Project Hydrologic Unit	Select One: ☐ Santa Margarita 902 ☐ San Luis Rey 903 ☒ Carlsbad 904 ☐ San Dieguito 905 ☐ Penasquitos 906
Project Watershed (Complete Hydrologic Unit, Area, and Subarea Name with Numeric Identifier)	San Marcos 904.5
Parcel Area (total area of Assessor's Parcel(s) associated with the project)	__10.00__ Acres (_435,600 Square Feet)
Area to be Disturbed by the Project (Project Area)	__9.0884__ Acres (395,891 Square Feet)
Project Proposed Impervious Area (subset of Project Area)	__6.098_ Acres (265,617 Square Feet)
Project Proposed Pervious Area (subset of Project Area)	_2.9904_ Acres (130,274 Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area.	

Description of Existing Site Condition

Current Status of the Site (select all that apply):
☐Existing development ☐Previously graded but not built out
☐Agricultural or other non-impervious use
☒Vacant, undeveloped/natural

Description / Additional Information:

Existing Land Cover Includes (select all that apply):
☒Vegetative Cover
☐Non-Vegetated Pervious Areas
☒Impervious Areas

Description / Additional Information:

Underlying Soil belongs to Hydrologic Soil Group (select all that apply):
☐NRCS Type A
☐NRCS Type B
☐NRCS Type C
☒NRCS Type D

Approximate Depth to Groundwater:
☐Groundwater Depth < 5 feet
☐5 feet < Groundwater Depth < 10 feet
☐10 feet < Groundwater Depth < 20 feet
☒Groundwater Depth > 20 feet

Existing Natural Hydrologic Features (select all that apply):
☐ Watercourses
☐ Seeps
☐ Springs
☐ Wetlands
☒ None

Description / Additional Information:

Description of Existing Site Drainage Patterns

How is storm water runoff conveyed from the site? At a minimum, this description should answer:
(1) whether existing drainage conveyance is natural or urban;
(2) Is runoff from offsite conveyed through the site? if yes, quantify all offsite drainage areas, design flows, and locations where offsite flows enter the project site, and summarize how such flows are conveyed through the site;
(3)Provide details regarding existing project site drainage conveyance network, including any existing storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels; and
(4) Identify all discharge locations from the existing project site along with a summary of conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations.

Describe existing site drainage patterns:

1. The existing site is vacant and includes a hillside along the southern limits. Drainage is "natural" and generally overland toward the Barham Road frontage.
2. Drainage patterns are generally southeast to northwest and includes run-on from the hillside above the site.
3. No site drainage facilities. The majority of site runoff is directed overland to the Barham gutter. A small depression is near the northwest corner of the site.
4. An interim storm drain riser is located near the northeast corner of the site and is connected to the public storm drain in Barham Road (MS-4).

City of San Marcos storm drain plan IP 4729 Sheet 39B

Interim 18" RCP Storm Drain @ 0.39% Interim Capacity = 10.2 cfs

Ultimate Storm Drain 48" RCP @ 0.66% Q100 = 117.4 cfs

Description of Proposed Site Development

Project Description / Proposed Land Use and/or Activities:

Multifamily residential buildings with private streets and surface parking, with a recreation center and tot lot.

List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features):

Roof, private driveways and parking lots
Concrete walkways joining building and parking

List/describe proposed pervious features of the project (e.g., landscape areas):

Landscape areas
Manufactured slopes
Natural slopes located south of the development area

Does the project include grading and changes to site topography?

☒Yes

☐No

Description / Additional Information:

Site grading will include fill placement to raise the site above Barham Road, cut slopes along the rear slope limits.

Description of Proposed Site Drainage Patterns

Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)?

☒Yes

☐No

If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre- and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.

Describe proposed site drainage patterns::

Bypass ditches and storm drain inlets to intercept natural and manufactured slopes located southerly and westerly of the development area. A concrete ditch will convey flows along the westerly boundary to Barham.

Private driveways, swales and gutters will direct runoff to the onsite private storm drain system which is directed to the combination basin (treatment, HMP and detention) at the northwest corner of the project. Basin discharge will be to the existing storm drain.

Driveway entries and frontage slopes will discharge to the existing Barham gutter, which will continue westerly to the existing curb inlet near the adjacent driveway.

See Drainage Report for detention analysis and Existing vs Post Development discharge.

Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply):

☒ On-site storm drain inlets
☐ Interior floor drains and elevator shaft sump pumps
☐ Interior parking garages
☒ Need for future indoor & structural pest control
☒ Landscape/Outdoor Pesticide Use
☒ Pools, spas, ponds, decorative fountains, and other water features
☐ Food service
☒ Refuse areas
☐ Industrial processes
☐ Outdoor storage of equipment or materials
☐ Vehicle and Equipment Cleaning
☐ Vehicle/Equipment Repair and Maintenance
☐ Fuel Dispensing Areas
☐ Loading Docks
☒ Fire Sprinkler Test Water
☐ Miscellaneous Drain or Wash Water
☒ Plazas, sidewalks, and parking lots

Description / Additional Information:

Identification and Narrative of Receiving Water and Pollutants of Concern

Describe flow path of storm water from the project site discharge location(s), through urban storm conveyance systems as applicable, to receiving creeks, rivers, and lagoons as applicable, and ultimate discharge to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable):

Barham Drive Storm Drain (MS-4) to San Marcos Creek (passing through Lake San Marcos) to Batiquitos Lagoon (Inner).

List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:

303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs / WQIP Highest Priority Pollutant
San Marcos Creek	Benthic Community Effects, Indicator Bacteria, Nutrients & Metals	Nutrients Upper San Marcos Creek Table 8 of WQIP
San Marcos Lake	Nutrients, Metals	Nutrients Upper San Marcos Creek Table 8 of WQIP
Batiquitos Lagoon		

Identification of Project Site Pollutants*

***Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated)**

Identify pollutants expected from the project site based on all proposed use(s) of the site (see BMP Design Manual Appendix B.6):

Pollutant	Not Applicable to the Project Site	Expected from the Project Site	Also a Receiving Water Pollutant of Concern
Sediment			
Nutrients			
Heavy Metals			
Organic Compounds			
Trash & Debris			
Oxygen Demanding Substances			
Oil & Grease			
Bacteria & Viruses			
Pesticides			

Form I-3B Page 8 of 10, Form Date: March 15, 2016
Hydromodification Management Requirements
Do hydromodification management requirements apply (see Section 1.6 of the manual)? ☒Yes, hydromodification management flow control structural BMPs required. ☐No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides. Description / Additional Information (to be provided if a 'No' answer has been selected above): Project will discharge runoff to storm drains located on the south west corner of the site.
Critical Coarse Sediment Yield Areas* ***This Section only required if hydromodification management requirements apply**
Based on the maps provided within the WMAA, do potential critical coarse sediment yield areas exist within the project drainage boundaries? ☐Yes ☒No, no critical coarse sediment yield areas to be protected based on WMAA maps If yes, have any of the optional analyses presented in Section 6.2 of the manual been performed? ☐6.2.1 Verification of GLUs Onsite ☐6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite ☐No optional analyses were performed; the project will avoid critical coarse sediment yield areas identified based on WMAA maps If optional analyses were performed, what is the final result? ☐No critical coarse sediment yield areas to be protected based on verification of GLUs onsite. ☐Critical coarse sediment yield areas exist but additional analysis has determined that protection is not required. Documentation attached in Attachment 8 of the SWQMP. ☐Critical coarse sediment yield areas exist and require protection. The project will implement management measures described in Sections 6.2.4 and 6.2.5 as applicable, and the areas are identified on the SWQMP Exhibit. Discussion / Additional Information: PCCSYA area are plotted upstream of the site. A bypass system will intercept and convey runoff past the site basin.

Flow Control for Post-Project Runoff*

***This Section only required if hydromodification management requirements apply**

List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project's HMP Exhibit.

Single POC at the discharge of the water quality/HMP/Detention basin.

SEE DMA EXHIBIT

Has a geomorphic assessment been performed for the receiving channel(s)?

☒No, the low flow threshold is 0.1Q2 (default low flow threshold)

☐Yes, the result is the low flow threshold is 0.1Q2

☐Yes, the result is the low flow threshold is 0.3Q2

☐Yes, the result is the low flow threshold is 0.5Q2

If a geomorphic assessment has been performed, provide title, date, and preparer:

Discussion / Additional Information: (optional)

Other Site Requirements and Constraints

When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.

Limited downstream storm drain capacity & depth (interim condition).
Steep slopes south (uphill) of the development area.

Optional Additional Information or Continuation of Previous Sections As Needed

This space provided for additional information or continuation of information from previous sections as needed.

Source Control BMP Checklist for All Development Projects (Standard Projects and Priority Development Projects)	Form I-4 [March 15, 2016]

Project Identification

Project Name **943 Barham Drive**

Permit Application Number **[Insert Permit Application Number]**

Source Control BMPs

All development projects must implement source control BMPs SC-1 through SC-6 where applicable and feasible. See Chapter 4 and Appendix E of the Model BMP Design Manual for information to implement source control BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the Model BMP Design Manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification may be provided.

Source Control Requirement	Applied?		
SC-1 Prevention of Illicit Discharges into the MS4	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-1 not implemented:			
SC-2 Storm Drain Stenciling or Signage	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-2 not implemented:			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Discussion / justification if SC-3 not implemented:			
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Discussion / justification if SC-4 not implemented:			

Form I-4 Page 2 of 2, Form Date: March 15, 2016			
Source Control Requirement	**Applied?**		
SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-5 not implemented:			
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)			
☐ On-site storm drain inlets	Yes		
☐ Interior floor drains and elevator shaft sump pumps			N/A
☐ Interior parking garages			N/A
☐ Need for future indoor & structural pest control	Yes		
☐ Landscape/Outdoor Pesticide Use	Yes		
☐ Pools, spas, ponds, decorative fountains, and other water features	Yes		
☐ Food service			N/A
☐ Refuse areas			N/A
☐ Industrial processes			N/A
☐ Outdoor storage of equipment or materials			N/A
☐ Vehicle and Equipment Cleaning			N/A
☐ Vehicle/Equipment Repair and Maintenance			N/A
☐ Fuel Dispensing Areas			N/A
☐ Loading Docks			N/A
☐ Fire Sprinkler Test Water			N/A
☐ Miscellaneous Drain or Wash Water	Yes		
☐ Plazas, sidewalks, and parking lots			N/A
	Yes		
Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for all "No" answers shown above.			

Site Design BMP Checklist for All Development Projects (Standard Projects and Priority Development Projects)	Form I-5 [March 15, 2016]

Project Identification

Project Name **943 Barham Drive**

Permit Application Number **[Insert Permit Application Number]**

Site Design BMPs

All development projects must implement site design BMPs SD-1 through SD-8 where applicable and feasible. See Chapter 4 and Appendix E of the Model BMP Design Manual for information to implement site design BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the Model BMP Design Manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification may be provided.

Site Design Requirement	Applied?		
SD-1 Maintain Natural Drainage Pathways and Hydrologic Features	☐ Yes	☐ No	☒ N/A
Discussion / justification if SD-1 not implemented:			
SD-2 Conserve Natural Areas, Soils, and Vegetation	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-2 not implemented: **Preserve steep hillside**.			
SD-3 Minimize Impervious Area	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-3 not implemented: **Multi-story buildings with parking garages, minimum private improvement width.**			
SD-4 Minimize Soil Compaction	☐ Yes	☒ No	☐ N/A
Discussion / justification if SD-4 not implemented: **Not appropriate for pervious areas onsite.**			
SD-5 Impervious Area Dispersion	☐ Yes	☒ No	☐ N/A
Discussion / justification if SD-5 not implemented: **Limited pervious lengths or areas.**			

Form I-5 Page 2 of 2, Form Date: March 15, 2016			
Site Design Requirement	**Applied?**		
SD-6 Runoff Collection	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-6 not implemented: **Multiple private inlet to reduce length of runoff. Bypass storm drain.**			
SD-7 Landscaping with Native or Drought Tolerant Species	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-7 not implemented:			
SD-8 Harvesting and Using Precipitation	☐ Yes	☒ No	☐ N/A
Discussion / justification if SD-8 not implemented: **Not enough landscape area or toilet demand to justify rainwater harvesting**.			

Summary of PDP Structural BMPs	Form I-6 (PDPs) [March 15, 2016]

Project Identification

Project Name **943 Barham Drive**

Permit Application Number **[Insert Permit Application Number]**

PDP Structural BMPs

All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the BMP Design Manual). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the BMP Design Manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s).

PDP structural BMPs must be verified by the local jurisdiction at the completion of construction. This may include requiring the project owner or project owner's representative and engineer of record to certify construction of the structural BMPs (see Section 1.12 of the BMP Design Manual). PDP structural BMPs must be maintained into perpetuity, and the local jurisdiction must confirm the maintenance (see Section 7 of the BMP Design Manual).

Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the BMP Design Manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate.

Infiltration at the project site indicates poor infiltration rates, with a recommendation for No Infiltration Condition per Geocon, Inc report dated 6/17,2020. Harvest and re-use is not feasible.

Offsite and hillside flows are bypassed around the site to avoid the treatment/HMP/detention facility.

A combination treatment/HMP/detention facility will be used for the majority of the developed runoff. San Marcos Creek is a 303(d) listed water body impaired by nutrient pollutants sources. Nutrient Sensitive Media will be used in the Biofiltration (BF-2) basin with will be used to provide treatment.

The City of San Marcos does not allow treatment facilities in the public right-of-way. Runoff from the driveways, frontage slopes and the existing Barham Road improvements will continue westerly to the existing curb inlet at the church driveway. Street trees will be used at the driveway to intercept and provide treatment.

All 3 of the drainage system will discharge to the existing public storm drain (MS-4) in Barham Road.

(Continue on page 2 as necessary.)

Form I-6 Page 2 of X, Form Date: March 15, 2016
(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)
(Continued from page 1)

Form I-6 Page 3 of X (Copy as many as needed) Form Date: March 15, 2016
Structural BMP Summary Information **(Copy this page as needed to provide information for each individual proposed structural BMP)**
Structural BMP ID No. **BMP-1 & HMP-1**
Construction Plan Sheet No.
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☒ Biofiltration with Nutrient Sensitive Media Design (BF-2) ☐ Proprietary Biofiltration (BF-3) meeting all requirements of Appendix F ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☒ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)
Purpose: ☐ Pollutant control only ☐ Hydromodification control only ☒ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the [City Engineer] (See Section 1.12 of the BMP Design Manual)	**Engineer of Work**
Who will be the final owner of this BMP?	**HOA**
Who will maintain this BMP into perpetuity?	**HOA**
What is the funding mechanism for maintenance?	**HOA**

Form I-6 Page 4 of X (Copy as many as needed) , Form Date: March 15, 2016
Structural BMP ID No. **HMP-1 & BMP-1**
Construction Plan Sheet No. See DMA Exhibit
Discussion (as needed): Biofiltration basin (BF-2) with additional underground storage to provide HMP controls. Additional surface storage will provide attenuation for larger storm events.

ATTACHMENT 1
BACKUP FOR PDP POLLUTANT CONTROL BMPS

This is the cover sheet for Attachment 1.

Indicate which Items are Included behind this cover sheet:

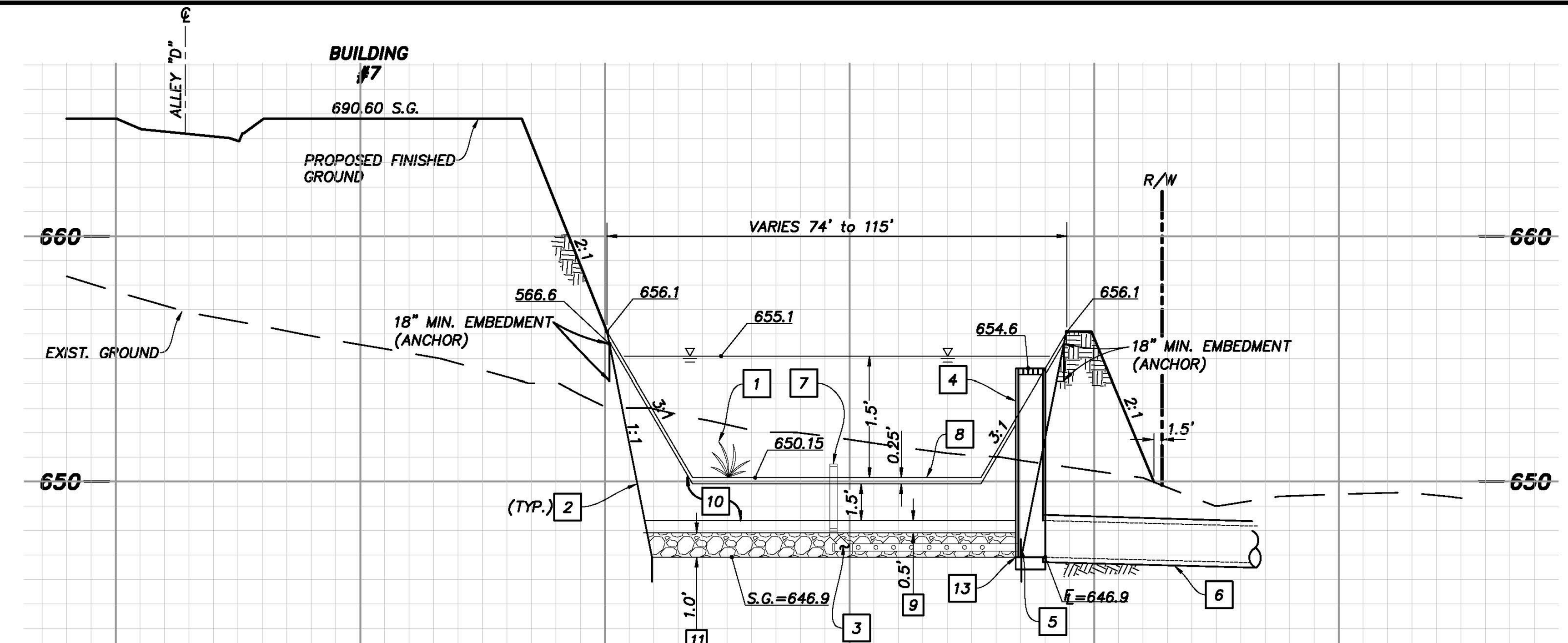
Attachment Sequence	Contents	Checklist
Attachment 1a	DMA Exhibit (Required) See DMA Exhibit Checklist on the back of this Attachment cover sheet.	**Included**
Attachment 1b	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type (Required)* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1a	☐ Included on DMA Exhibit in Attachment 1a ☒ Included as Attachment 1b, separate from DMA Exhibit
Attachment 1c	Form I-7, Harvest and Use Feasibility Screening Checklist (Required unless the entire project will use infiltration BMPs) Refer to Appendix B.3-1 of the BMP Design Manual to complete Form I-7.	☒ Included ☐ Not included because the entire project will use infiltration BMPs
Attachment 1d	Form I-8, Categorization of Infiltration Feasibility Condition (Required unless the project will use harvest and use BMPs) Refer to Appendices C and D of the BMP Design Manual to complete Form I-8.	☒ Included ☐ Not included because the entire project will use harvest and use BMPs
Attachment 1e	Pollutant Control BMP Design Worksheets / Calculations (Required) Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design guidelines	☒ Included

Use this checklist to ensure the required information has been included on the DMA Exhibit:

The DMA Exhibit must identify:

- ☐ Underlying hydrologic soil group
- ☐ Approximate depth to groundwater
- ☐ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
- ☐ Critical coarse sediment yield areas to be protected
- ☐ Existing topography and impervious areas
- ☐ Existing and proposed site drainage network and connections to drainage offsite
- ☐ Proposed demolition
- ☐ Proposed grading
- ☐ Proposed impervious features
- ☐ Proposed design features and surface treatments used to minimize imperviousness
- ☐ Drainage management area (DMA) boundaries, DMA ID numbers, and DMA areas (square footage or acreage), and DMA type (i.e., drains to BMP, self-retaining, or self-mitigating)
- ☐ Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Form I-3B)
- ☐ Structural BMPs (identify location, type of BMP, and size/detail)

DMA AND HMP EXHIBIT FOR:
BARHAM DRIVE



D/3 SITE SECTION ~ BIOFILTRATION BASIN (BF-2)
SCALE: 1" = 20'(H), 1" = 4'(V)
SEE SHEET 2

BIOFILTRATION DETAIL NOTES

1. PLANTING.
2. 30 MIL. P.V.C. LINER. ALL JOINTS TO BE SEALED WITH 12" MIN. OVERLAP. SEAL ALL PENETRATIONS.
3. 6" SLOTTED P.V.C. SUBDRAIN (ASTM D-3034), 3" MIN. FROM BOTTOM.
4. OUTLET CONTROL STRUCTURE WITH GRATED TOP.
5. ORIFICE PLATE.
6. OUTLET PIPE.
7. SUBDRAIN CLEANOUT PER SDRSD SC-01. RIM = F.G. + 0.6'
8. INSTALL WELL AGED SHREDDED HARDWOOD MULCH THAT HAS BEEN STOCKPILED OR STORED FOR AT LEAST 12 MONTHS. MULCH MUST BE NON-FLOATING.
9. FILTER COURSE TO BE 3" CLEAN AND WASHED SAND (ASTM NO. 33) OVER 3" LAYER OF ASTM NO. 8 STONE.
10. SOIL MEDIA, INFILTRATION = (BSM SPECIFICATION PER APPENDIX G OF COUNTY OF SAN DIEGO L.I.D. HANDBOOK JUNE 2014)

PER COUNTY OF SAN DIEGO L.I.D. HANDBOOK:

BSM COMPOSITION		SANDY LOAM			
	SAND	SAND	SILT	CLAY	COMPOST
VOLUME	65%	20%			15%
WEIGHT	75–80%		10% MAX.	3% MAX.	9% MAX.[1]

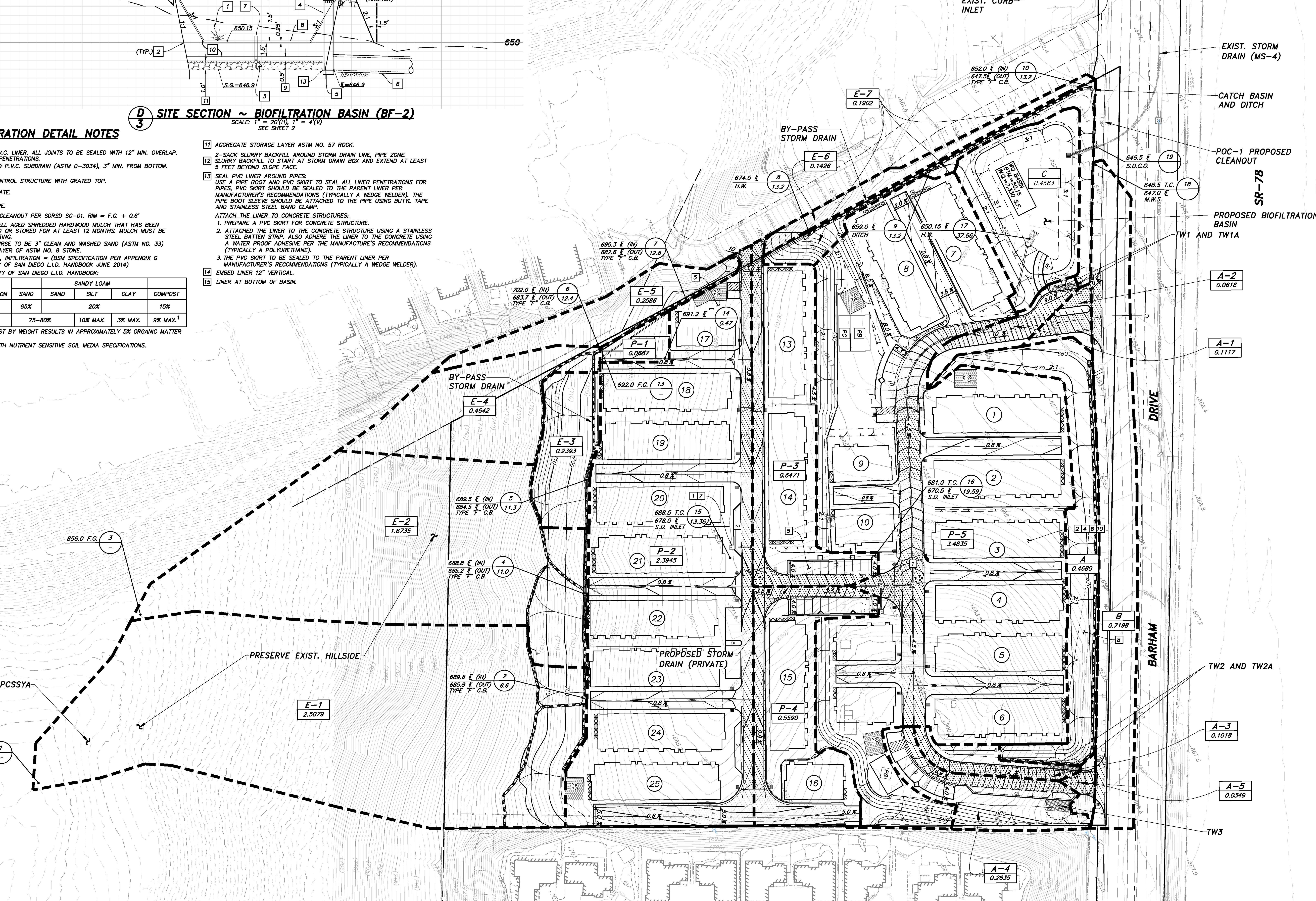
9% COMPOST BY WEIGHT RESULTS IN APPROXIMATELY 5% ORGANIC MATTER BY WEIGHT.

COMPLY WITH NUTRIENT SENSITIVE SOIL MEDIA SPECIFICATIONS.

11. AGGREGATE STORAGE LAYER ASTM NO. 57 ROCK.
12. 2-SACK SLURRY BACKFILL AROUND STORM DRAIN LINE, PIPE ZONE. SLURRY BACKFILL TO START AT STORM DRAIN BOX AND EXTEND AT LEAST 5 FEET BEYOND SLOPE FACE.
13. SEAL PVC LINER AROUND PIPES: USE A PIPE BOOT AND PVC SKIRT TO SEAL ALL LINER PENETRATIONS FOR PIPES, PVC SKIRT SHOULD BE SEALED TO THE PARENT LINER PER MANUFACTURER'S RECOMMENDATIONS (TYPICALLY A WEDGE WELDER). THE PIPE BOOT SLEEVE SHOULD BE ATTACHED TO THE PIPE USING BUTYL TAPE AND STAINLESS STEEL BAND CLAMP.

ATTACH THE LINER TO CONCRETE STRUCTURES:
1. PREPARE A PVC SKIRT FOR CONCRETE STRUCTURE.
2. ATTACHED THE LINER TO THE CONCRETE STRUCTURE USING A STAINLESS STEEL BATTEN STRIP. ALSO ADHERE THE LINER TO THE CONCRETE USING A WATER PROOF ADHESIVE PER THE MANUFACTURE'S RECOMMENDATIONS (TYPICALLY A POLYURETHANE).
3. THE PVC SKIRT TO BE SEALED TO THE PARENT LINER PER MANUFACTURER'S RECOMMENDATIONS (TYPICALLY A WEDGE WELDER).

14. EMBED LINER 12" VERTICAL.
15. LINER AT BOTTOM OF BASIN.



D.M.A. LEGEND

DESCRIPTION	SYMBOL
PROPERTY LINE/PROJECT BOUNDARY	
PROPOSED CURB AND GUTTER	
EXISTING CONTOUR	630
PROPOSED DMA LIMITS	
DIRECTION OF DRAINAGE	
STORM DRAIN PIPE SIZE PER PLAN	SD
TREE WELL	
NODE NUMBER / Q_{100} (C.F.S.)	1 / 17.29, ELEV.
BASIN IDENTIFIER / BASIN AREA (AC.)	E-5 / 1.9600

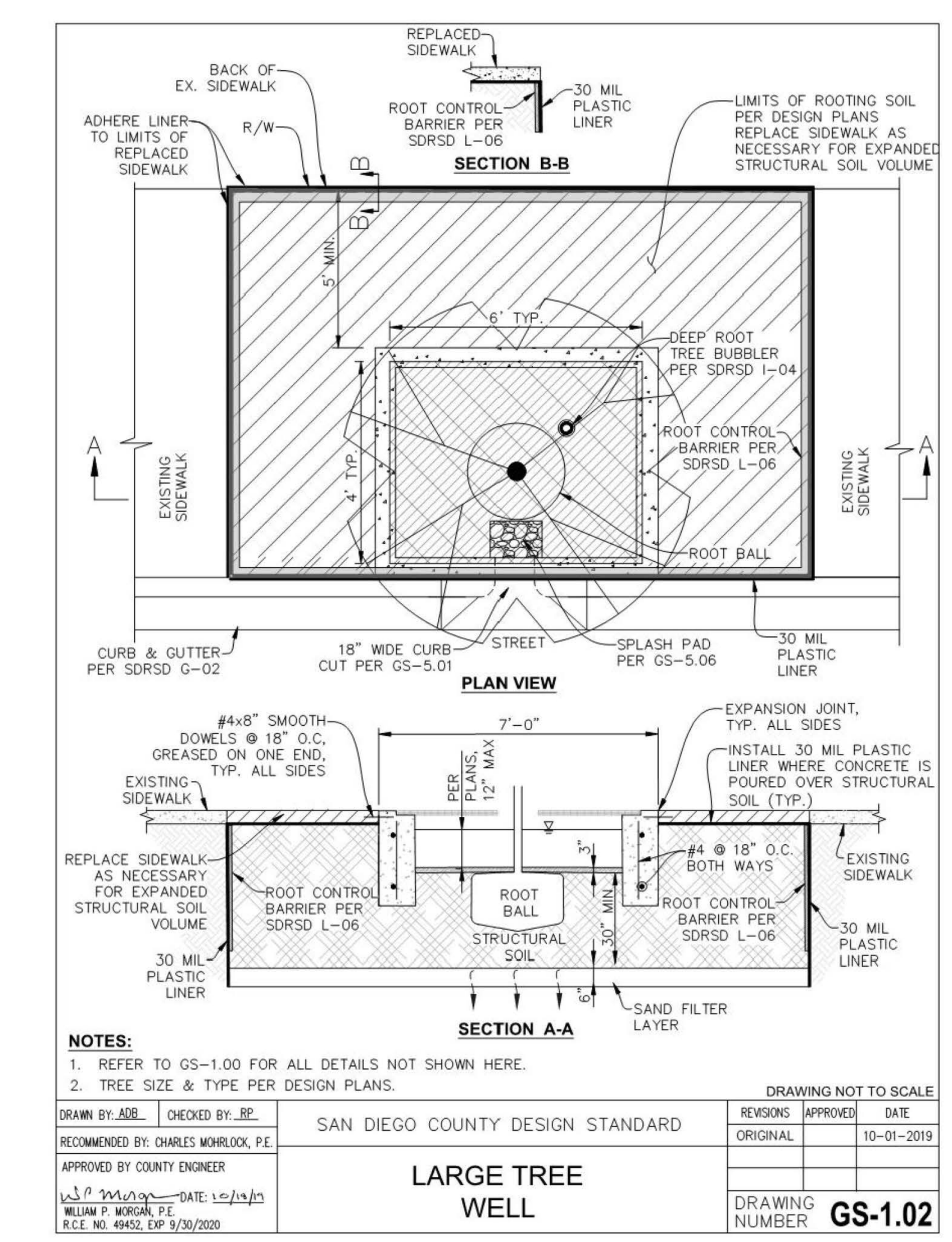
UNDERLYING HYDROLOGIC SOILS GROUP:	TYPE "D"
APPROXIMATE DEPTH TO GROUNDWATER:	GREATER THAN 20 FEET
EXISTING NATURAL HYDROLOGIC FEATURES:	N/A
POTENTIAL CRITICAL COARSE SEDIMENT YIELD AREAS:	N/A
EXISTING TOPOGRAPHY:	SHOWN
EXISTING IMPERVIOUS AREAS:	SHOWN
EXISTING DRAINAGE SYSTEM:	SHOWN
PROPOSED DRAINAGE SYSTEM:	SHOWN
PROPOSED DEMOLITION:	N/A
PROPOSED GRADING:	SHOWN
PROPOSED IMPERVIOUS SURFACES:	PAVING AND BUILDINGS
DMA AREAS:	SEE TABLE
POLLUTANT SOURCES:	PAVEMENT AND LANDSCAPE AREAS
STRUCTURAL SOURCE CONTROL:	SHOWN
INLET SIGNAGE:	N/A
TRASH ENCLOSURE CONTROLS:	PROVIDED
TREATMENT BMP:	SEE TABLE

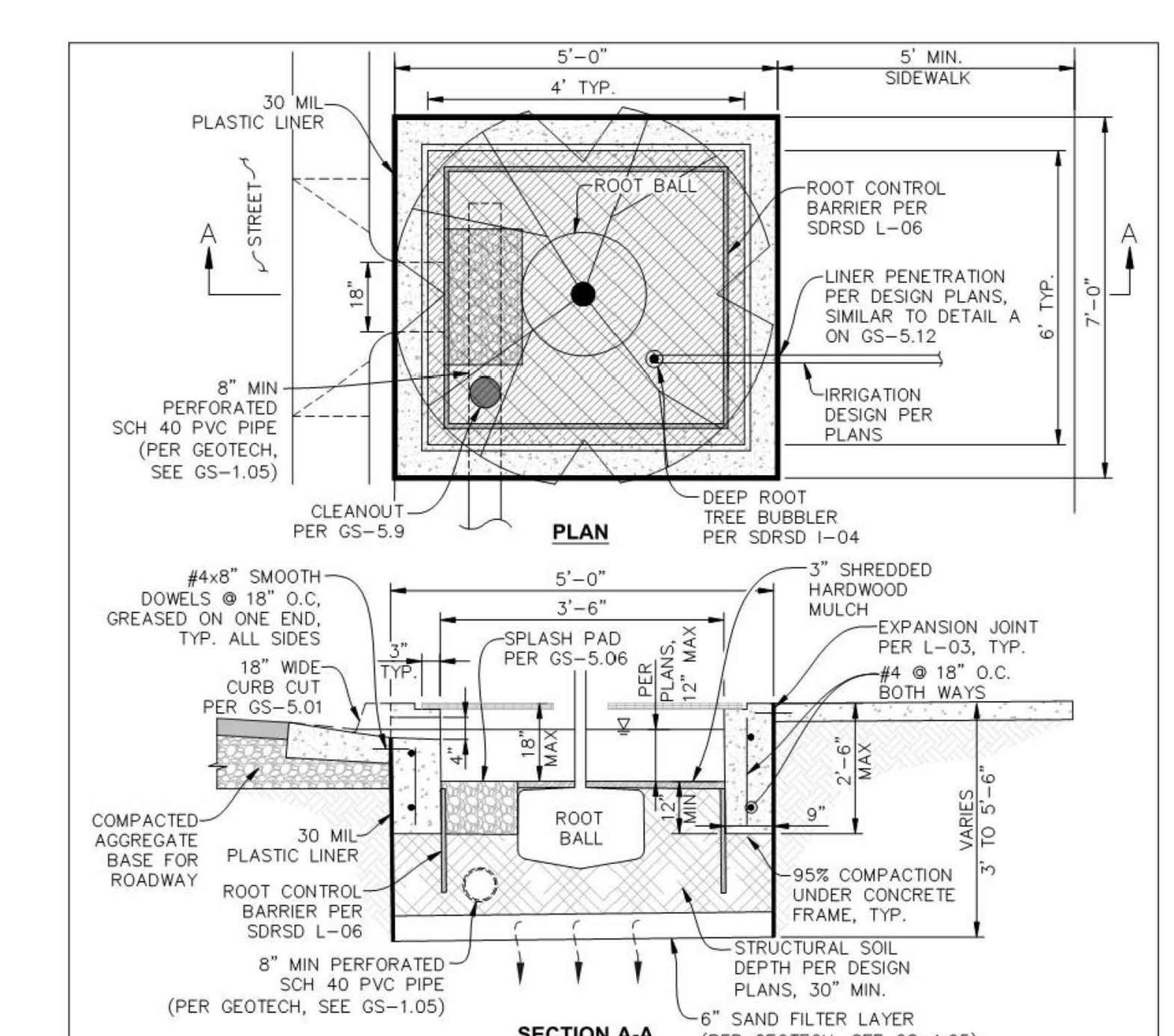
SOURCE CONTROL BMPS

1. STORM DRAIN INLETS.
2. LANDSCAPE/OUTDOOR PESTICIDE USE.
3. FIRE SPRINKLER TEST WATER.
4. MISCELLANEOUS DRAIN OR WASH WATER.
5. PLAZAS, SIDEWALKS, AND PARKING LOTS.
6. MINIMIZE IMPERVIOUS AREA.

SITE DESIGN BMPS

7. RUNOFF COLLECTION.
8. LANDSCAPE WITH NATIVE OR DRAUGHT TOLERANT SPECIES.
10. INDOOR/STRUCTURAL PEST CONTROL.





DESIGN NOTES:
1. STREET IMPROVEMENTS AND DRAINAGE STRUCTURES SHALL BE CONSTRUCTED ACCORDING TO THE LATEST SAN DIEGO REGIONAL STANDARD DRAWINGS AND CALTRANS STANDARD PLANS.
2. CONCRETE SHALL BE 520-C-2500 UNLESS OTHERWISE SPECIFIED.
3. SEE SDRSD DWG L-01 THROUGH L-06 FOR DETAILS NOT SPECIFIED HEREIN.
4. MINIMUM OPEN TREE PLANTING SPACE DIMENSION 4'x6'.
5. PROVIDE 30 MIL PLASTIC LINER WHERE CONCRETE WILL BE POURED ON TOP OF STRUCTURAL SOIL.
6. SEAL PLASTIC LINER TO ADJACENT IMPROVEMENTS AND EDGE RESTRAINTS PER GS-5.15.
7. WHEN SAND FILTER LAYER IS OMITTED, PROVIDE GEOTEXTILE BENEATH THE STRUCTURAL SOIL LAYER PER PROJECT-SPECIFIC GEOTECHNICAL RECOMMENDATIONS.
8. PROPOSED SIDEWALK LOCATIONS & INTENDED ADA ROUTES PER PROJECT-SPECIFIC DESIGN PLANS.
9. FOR TREE WELL SUBSURFACE DRAINAGE TYPES, SEE DWG GS-1.05.

DRAWING NOT TO SCALE

DRAWN BY: ADB	CHECKED BY: RP	SAN DIEGO COUNTY DESIGN STANDARD	REVISIONS	APPROVED	DATE
RECOMMENDED BY: CHARLES MOHRLOCK, P.E.			ORIGINAL		10-01-2019
APPROVED BY COUNTY ENGINEER DATE: 10/18/19 WILLIAM P. MORGAN, P.E. R.C.E. NO. 49452, EXP 9/30/2020		TREE WELL GENERAL DESIGN GUIDANCE	DRAWING NUMBER		GS-1.00

DMA & BMP SUMMARY TABLE

DMA NO	TOTAL AREA (SF)	IMPERVIOUS (SF)	IMPERVIOUS (%)	PERVIOUS (SF)	ADJUSTED AREA (SF)	DCV (CF)	SURFACE AREA REQUIRED * (SF)	SURFACE AREA PROVIDED (SF)	BMP TYPE / STANDARD	BMP ID
P-1	2,993	2,394	80%	599	2,334	121	70		BIOFILTRATION BF-2 / NUTRIENT SENSITIVE MEDIA	BMP1
P-2	104,304	83,444	80%	20,861	81,357	4,203	2,441		BIOFILTRATION BF-2 / NUTRIENT SENSITIVE MEDIA	BMP1
P-3	28,188	22,550	80%	5,638	21,986	1,136	660		BIOFILTRATION BF-2 / NUTRIENT SENSITIVE MEDIA	BMP1
P-4	24,350	19,480	80%	4,870	18,993	981	570		BIOFILTRATION BF-2 / NUTRIENT SENSITIVE MEDIA	BMP1
P-5	147,716	118,173	80%	29,543	115,219	5,953	3,457		BIOFILTRATION BF-2 / NUTRIENT SENSITIVE MEDIA	BMP1
C	19,863	-	0%	19,863			7,197	7,330	BIOFILTRATION BF-2 / NUTRIENT SENSITIVE MEDIA	BMP1
A1	2,433	2,190	90%	243	2,044	106	61	20' DIA	TW1	TREE WELL
A1A	2,433	2,190	90%	243	2,044	106	61	20' DIA	TW1 A	TREE WELL
A2	2,683	2,683	100%	-	2,415	125	72		WEST DRIVEWAY	DE MINIMIS
A3	2,217	1,774	80%	443	1,729	89	52	20' DIA	TW2	TREE WELL
A3A	2,217	1,774	80%	443	1,729	89	52	20' DIA	TW2 A	TREE WELL
A4	11,478	6,657	58%	4,821	7,438	384	223	30' DIA	TW3	TREE WELL
A5	1,289	1,289	100%	-	1,160	60	35		EAST DRIVEWAY	DE MINIMIS
A	20,388	1,019	5%	19,368	6,728	348	202		BARHAM SLOPE	SELF-TREATING
SITE	372,553	265,617	71%	106,936	265,177	13,701				
E-1	109,244	-	0%	109,244			-		BYPASS DITCH & STORM DRAIN	SELF-TREATING
E-2	72,898	-	0%	72,898			-		BYPASS DITCH & STORM DRAIN	SELF-TREATING
E-3	10,424	-	0%	10,424			-		BYPASS DITCH & STORM DRAIN	SELF-TREATING
E-4	20,221	-	0%	20,221			-		BYPASS DITCH & STORM DRAIN	SELF-TREATING
E-5	11,265	-	0%	11,265			-		BYPASS DITCH & STORM DRAIN	SELF-TREATING
E-6	6,212	-	0%	6,212			-		BYPASS DITCH & STORM DRAIN	SELF-TREATING
E-7	8,285	-	0%	8,285			-		BYPASS DITCH & STORM DRAIN	SELF-TREATING
B	31,354	28,219	90%	3,135			-		EXISTING BARHAM PAVING	SELF-TREATING
TOTALS	642,455	293,836	45.7%	348,619						

6-30-20

SCALE: 1" = 40'

GRAPHIC SCALE
40 0 40 80 120

SB&O INC.
PLANNING ENGINEERING SURVEYING
3990 Ruffin Road, Suite 120
San Diego, Ca. 92123
858-560-1141
858-560-8157 Fax

FILE NAME: D:\75051 BARHAM DRIVE\03 DWG\DX\75051DX02-DMA HMP EXHIBIT.DWG, PLOTTED BY: MARIA GUARIN ON 6/30/2020 8:41 AM

75050.65

Barham Drive

Updated 20-Jun-2020

0.90 Impervious Coefficient
0.30 Pervious Coefficent Soil Type D
0.62 85th Percentile

DMA & BMP SUMMARY TABLE

DMA NO	*TOTAL AREA (SF)*	*IMPERVIOUS (SF)*	*IMPERVIOUS (%)*	*PERVIOUS (SF)*	*ADJUSTED AREA (SF)*	*DCV (CF)*	*SURFACE AREA REQUIRED * (SF)*	*SURFACE AREA PROVIDED (SF)*	*BMP TYPE / STANDARD*	*BMP ID*
P-1	*2,993*	*2,394*	*80%*	*599*	*2,334*	*121*	*70*		*BIOFILTRATION BF-2 / NUTRIENT SENSITIVE MEDIA*	*BMP1*
P-2	*104,304*	*83,444*	*80%*	*20,861*	*81,357*	*4,203*	*2,441*		*BIOFILTRATION BF-2 / NUTRIENT SENSITIVE MEDIA*	*BMP1*
P-3	*28,188*	*22,550*	*80%*	*5,638*	*21,986*	*1,136*	*660*		*BIOFILTRATION BF-2 / NUTRIENT SENSITIVE MEDIA*	*BMP1*
P-4	*24,350*	*19,480*	*80%*	*4,870*	*18,993*	*981*	*570*		*BIOFILTRATION BF-2 / NUTRIENT SENSITIVE MEDIA*	*BMP1*
P-5	*147,716*	*118,173*	*80%*	*29,543*	*115,219*	*5,953*	*3,457*		*BIOFILTRATION BF-2 / NUTRIENT SENSITIVE MEDIA*	*BMP1*
C	*19,863*	-	*0%*	*19,863*			*7,197*	*7,330*	*BIOFILTRATION BF-2 / NUTRIENT SENSITIVE MEDIA*	*BMP1*
A1	*2,433*	*2,190*	*90%*	*243*	*2,044*	*106*	*61*	*20' DIA*	*TW1*	*TREE WELL*
A1A	*2,433*	*2,190*	*90%*	*243*	*2,044*	*106*	*61*	*20' DIA*	*TW1 A*	*TREE WELL*
A2	*2,683*	*2,683*	*100%*	-	*2,415*	*125*	*72*		*WEST DRIVEWAY*	*DE MINIMIS*
A3	*2,217*	*1,774*	*80%*	*443*	*1,729*	*89*	*52*	*20' DIA*	*TW2*	*TREE WELL*
A3A	*2,217*	*1,774*	*80%*	*443*	*1,729*	*89*	*52*	*20' DIA*	*TW2 A*	*TREE WELL*
A4	*11,478*	*6,657*	*58%*	*4,821*	*7,438*	*384*	*223*	*30' DIA*	*TW3*	*TREE WELL*
A5	*1,289*	*1,289*	*100%*	-	*1,160*	*60*	*35*		*EAST DRIVEWAY*	*DE MINIMIS*
A	*20,388*	*1,019*	*5%*	*19,368*	*6,728*	*348*	*202*		*BARHAM SLOPE*	*SELF-TREATING*
SITE	*372,553*	*265,617*	*71%*	*106,936*	*265,177*	*13,701*				
E-1	*109,244*	-	*0%*	*109,244*			-		*BYPASS DITCH & STORM DRAIN*	*SELF-TREATING*
E-2	*72,898*	-	*0%*	*72,898*			-		*BYPASS DITCH & STORM DRAIN*	*SELF-TREATING*
E-3	*10,424*	-	*0%*	*10,424*			-		*BYPASS DITCH & STORM DRAIN*	*SELF-TREATING*
E-4	*20,221*	-	*0%*	*20,221*			-		*BYPASS DITCH & STORM DRAIN*	*SELF-TREATING*
E-5	*11,265*	-	*0%*	*11,265*			-		*BYPASS DITCH & STORM DRAIN*	*SELF-TREATING*
E-6	*6,212*	-	*0%*	*6,212*			-		*BYPASS DITCH & STORM DRAIN*	*SELF-TREATING*
E-7	*8,285*	-	*0%*	*8,285*			-		*BYPASS DITCH & STORM DRAIN*	*SELF-TREATING*
B	*31,354*	*28,219*	*90%*	*3,135*			-		*EXISTING BARHAM PAVING*	*SELF-TREATING*
TOTALS	*642,455*	*293,836*	*45.7%*	*348,619*						
	14.75	6.75		8.00						

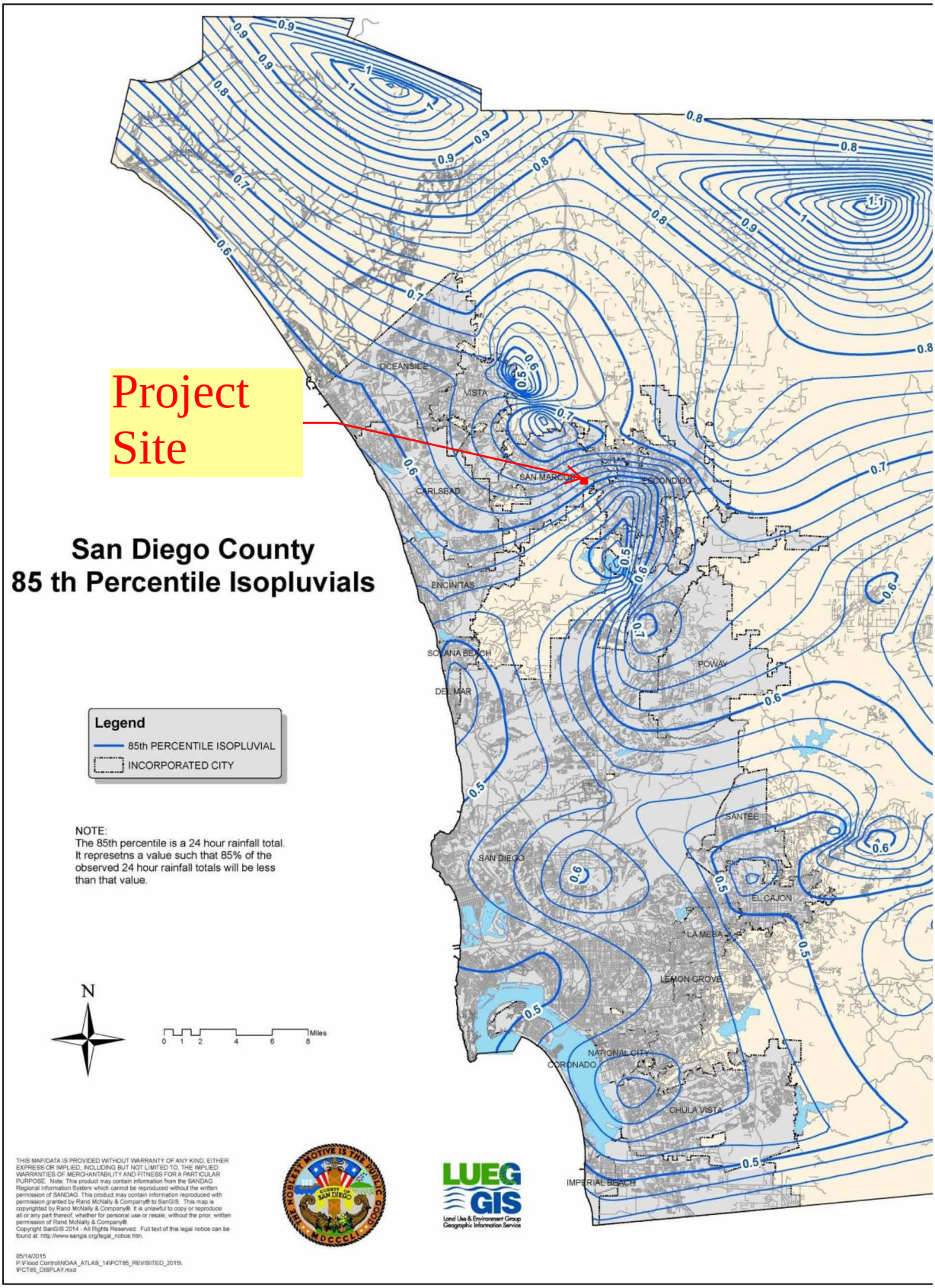


Figure B.1-1: 85th Percentile 2

Automated Worksheet B.3-1: Project-Scale BMP Feasibility Analysis (V1.3)

Category	#	Description	Value	Units
Capture & Use Inputs	0	Design Capture Volume for Entire Project Site	13,190	cubic-feet
	1	Proposed Development Type	Residential	unitless
	2	Number of Residents or Employees at Proposed Development	453	#
	3	Total Planted Area within Development	67,704	sq-ft
	4	Water Use Category for Proposed Planted Areas	Low	unitless
Infiltration Inputs	5	Is Average Site Design Infiltration Rate ≤0.500 Inches per Hour?	No	yes/no
	6	Is Average Site Design Infiltration Rate ≤0.010 Inches per Hour?	No	yes/no
	7	Is Infiltration of the Full DCV Anticipated to Produce Negative Impacts?	Yes	yes/no
	8	Is Infiltration of Any Volume Anticipated to Produce Negative Impacts?	Yes	yes/no
Calculations	9	36-Hour Toilet Use Per Resident or Employee	1.86	cubic-feet
	10	Subtotal: Anticipated 36 Hour Toilet Use	845	cubic-feet
	11	Anticipated 1 Acre Landscape Use Over 36 Hours	52.14	cubic-feet
	12	Subtotal: Anticipated Landscape Use Over 36 Hours	81	cubic-feet
	13	Total Anticipated Use Over 36 Hours	926	cubic-feet
	14	Total Anticipated Use / Design Capture Volume	0.07	cubic-feet
	15	Are Full Capture and Use Techniques Feasible for this Project?	No	unitless
	16	Is Full Retention Feasible for this Project?	No	yes/no
	17	Is Partial Retention Feasible for this Project?	No	yes/no
Result	18	Feasibility Category	5	1, 2, 3, 4, 5

Worksheet B.3-1 General Notes:

A. Applicants may use this worksheet to determine the types of structural BMPs that are acceptable for implementation at their project site (as required in Section 5 of the BMPDM). User input should be provided for yellow shaded cells, values for all other cells will be automatically generated. Projects demonstrating feasibility or potential feasibility via this worksheet are encouraged to incorporate capture and use features in their project.

B. Negative impacts associated with retention may include geotechnical, groundwater, water balance, or other issues identified by a geotechnical engineer and substantiated through completion of Form I-8.

C. Feasibility Category 1: Applicant must implement capture & use, retention, and/or infiltration elements for the entire DCV.

D. Feasibility Category 2: Applicant must implement capture & use elements for the entire DCV.

E. Feasibility Category 3: Applicant must implement retention and/or infiltration elements for all DMAs with Design Infiltration Rates greater than 0.50 in/hr.

F. Feasibility Category 4: Applicant must implement standard unlined biofiltration BMPs sized at ≥3% of the effective impervious tributary area for all DMAs with Design Infiltration Rates of 0.011 to 0.50 in/hr. Applicants may be permitted to implement lined BMPs, reduced size BMPs, and/or specialized biofiltration BMPs provided additional criteria identified in "Supplemental Retention Criteria for Non-Standard Biofiltration BMPs" are satisfied.

G. Feasibility Category 5: Applicant must implement standard lined biofiltration BMPs sized at ≥3% of the effective impervious tributary area for all DMAs with Design Infiltration Rates of 0.010 in/hr or less. Applicants may also be permitted to implement reduced size and/or specialized biofiltration BMPs provided additional criteria identified in "Supplemental Retention Criteria for Non-Standard Biofiltration BMPs" are satisfied.

H. PDPs participating in an offsite alternative compliance program are not held to the feasibility categories presented herein.

GEOTECHNICAL INVESTIGATION

943 BARHAM DRIVE
SAN MARCOS, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

HALLMARK COMMUNITIES
SOLANA BEACH, CALIFORNIA

JUNE 17, 2020
PROJECT NO. G2516-32-01

Worksheet C.4-1: Categorization of Infiltration Feasibility Condition

Categorization of Infiltration Feasibility Condition		Worksheet C.4-1	
Part 1 - Full Infiltration Feasibility Screening Criteria **Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?**			
Criteria	Screening Question	**Yes**	**No**
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X
Provide basis: We performed one infiltration test using our Aardvark constant head permeameter. The results indicate a design infiltration rate of 0.01 inches per hour (with an applied factor of safety of 2). Full infiltration is considered infeasible if the design rate is below 0.5 iph. Therefore, full infiltration is not considered feasible at the site.			
2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	X	
Provide basis: Infiltration at the proposed location may result in lateral water migration that could adversely impact adjacent utilities, roadways, and foundations. The adverse impacts of infiltration could be reasonably mitigated to accepted levels provided side liners and a subdrain are incorporated into the design. In addition, an overflow device should be added to prevent overtopping of the BMP slopes.			

Worksheet C.4-1 Page 2 of 4			
Criteria	Screening Question	Yes	No
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Groundwater is not located within 10 feet of the proposed BMP basin. The risk of storm water infiltration adversely impacting groundwater is considered negligible. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: We are not aware of any potential water balance issues or change of ephemeral stream flow as a result of infiltrating storm water. Researching downstream water rights and evaluating water balance issues to stream flows is beyond the scope of the geotechnical engineer. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 1 Result*	If all answers to rows 1 - 4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2	**NO**	

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X

Provide basis: An appreciable rate is typically defined as a factored rate of at least 0.05 inches per hour (using a factor of safety of 2). Based on our experience and field testing, we anticipate that the saturated hydraulic conductivity (Ksat) of the compacted fill will be less than 0.05 inches per hour. The in-situ infiltration test results on the underlying alluvium indicated a design rate of 0.01 iph. The colluvium and granitic rock are expected to be less permeable than the alluvium tested. Therefore, in our opinion the soil and geologic conditions do not allow for infiltration in any appreciable rate or volume based on infiltration rates.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

6	**Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	X	

Provide basis: Infiltration at the proposed location may result in lateral water migration that could adversely impact adjacent utilities, roadways, and foundations. The adverse impacts of infiltration could be reasonably mitigated to accepted levels provided side liners and a subdrain are incorporated into the design. In addition, an overflow device should be added to prevent overtopping of the BMP slopes.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

Worksheet C.4-1 Page 4 of 4			
Criteria	Screening Question	**Yes**	**No**
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Groundwater is not located within 10 feet of the proposed BMP basin. The risk of storm water infiltration adversely impacting groundwater is considered negligible. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
8	**Can infiltration be allowed without violating downstream water rights**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: We are not aware of any downstream water rights. Researching downstream water rights is beyond the scope of the geotechnical engineer. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
Part 2 Result*	If all answers from row 5-8 are yes then partial infiltration design is potentially feasible. The feasibility screening category is **Partial Infiltration.** If any answer from row 5-8 is no, then infiltration of any volume is considered to be **infeasible** within the drainage area. The feasibility screening category is **No Infiltration.**		**No Infiltration**

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings.

Automated Worksheet B.1-1: Calculation of Design Capture Volume (V1.3)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Standard Drainage Basin Inputs	0	Drainage Basin ID or Name	BMP1	TW1	TW1 A	TW2	TW2 A	TW3					unitless
	1	Basin Drains to the Following BMP Type	Biofiltration	n/a	n/a	n/a	n/a	n/a					unitless
	2	85th Percentile 24-hr Storm Depth	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	inches
	3	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	in/hr
	4	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	246,041	2,190	2,190	1,774	2,217	6,657					sq-ft
	5	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)	0	0									sq-ft
	6	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)	0	0									sq-ft
	7	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)	0	0									sq-ft
	8	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)	0	0									sq-ft
	9	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)	0	0									sq-ft
	10	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)	61,510	243	243	443	443	4,821					sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	11	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No	yes/no
	12	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)											sq-ft
	13	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	14	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	15	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	16	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)											sq-ft
	17	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)											sq-ft
	18	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	19	Number of Tree Wells Proposed per SD-A		1	1	1	1	1					#
	20	Average Mature Tree Canopy Diameter		20	20	20	20	30					ft
	21	Number of Rain Barrels Proposed per SD-E											#
	22	Average Rain Barrel Size											gal
Treatment Train Inputs & Calculations	23	Does BMP Overflow to Stormwater Features in Downstream Drainage?	No	No	No	No	No	No	No	No	No	No	unitless
	24	Identify Downstream Drainage Basin Providing Treatment in Series											unitless
	25	Percent of Upstream Flows Directed to Downstream Dispersion Areas											percent
	26	Upstream Impervious Surfaces Directed to Dispersion Area (Ci=0.90)	0	0	0	0	0	0	0	0	0	0	cubic-feet
	27	Upstream Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	0	0	0	0	0	0	0	0	0	0	cubic-feet
Initial Runoff Factor Calculation	28	Total Tributary Area	307,551	2,433	2,433	2,217	2,661	11,478	0	0	0	0	sq-ft
	29	Initial Runoff Factor for Standard Drainage Areas	0.78	0.84	0.84	0.78	0.80	0.65	0.00	0.00	0.00	0.00	unitless
	30	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	31	Initial Weighted Runoff Factor	0.78	0.84	0.84	0.78	0.80	0.65	0.00	0.00	0.00	0.00	unitless
	32	Initial Design Capture Volume	12,394	106	106	89	110	385	0	0	0	0	cubic-feet
Dispersion Area Adjustments	33	Total Impervious Area Dispersed to Pervious Surface	0	0	0	0	0	0	0	0	0	0	sq-ft
	34	Total Pervious Dispersion Area	0	0	0	0	0	0	0	0	0	0	sq-ft
	35	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	36	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	37	Runoff Factor After Dispersion Techniques	0.78	0.84	0.84	0.78	0.80	0.65	n/a	n/a	n/a	n/a	unitless
	38	Design Capture Volume After Dispersion Techniques	12,394	106	106	89	110	385	0	0	0	0	cubic-feet
Tree & Barrel Adjustments	39	Total Tree Well Volume Reduction	0	180	180	180	180	420	0	0	0	0	cubic-feet
	40	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	41	Final Adjusted Runoff Factor	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	42	Final Effective Tributary Area	239,890	0	0	0	0	0	0	0	0	0	sq-ft
	43	Initial Design Capture Volume Retained by Site Design Elements	0	180	180	180	180	420	0	0	0	0	cubic-feet
	44	Final Design Capture Volume Tributary to BMP	12,394	0	0	0	0	0	0	0	0	0	cubic-feet

Worksheet B.1-1 General Notes:

A. Applicants may use this worksheet to calculate design capture volumes for up to 10 drainage areas User input must be provided for yellow shaded cells, values for all other cells will be automatically generated, errors/notifications will be highlighted in red and summarized below. Upon completion of this worksheet, proceed to the appropriate BMP Sizing worksheet(s).

Automated Worksheet B.5-1: Sizing Lined or Unlined Biofiltration BMPs (V1.3)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	Units
BMP Inputs	0	Drainage Basin ID or Name	BMP1	-	-	-	-	sq-ft
	1	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	-	-	-	-	in/hr
	2	Effective Tributary Area	239,890	-	-	-	-	sq-ft
	3	Minimum Biofiltration Footprint Sizing Factor	0.030	-	-	-	-	ratio
	4	Design Capture Volume Tributary to BMP	12,394	-	-	-	-	cubic-feet
	5	Is Biofiltration Basin Impermeably Lined or Unlined?	Lined					unitless
	6	Provided Biofiltration BMP Surface Area	7,330					sq-ft
	7	Provided Surface Ponding Depth	12					inches
	8	Provided Soil Media Thickness	18					inches
	9	Provided Depth of Gravel Above Underdrain Invert	9					inches
	10	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	2.00					inches
	11	Provided Depth of Gravel Below the Underdrain	3					inches
Retention Calculations	12	Volume Infiltrated Over 6 Hour Storm	0	0	0	0	0	cubic-feet
	13	Soil Media Pore Space Available for Retention	0.05	0.05	0.05	0.05	0.05	unitless
	14	Gravel Pore Space Available for Retention	0.00	0.00	0.00	0.00	0.00	unitless
	15	Effective Retention Depth	0.90	0.00	0.00	0.00	0.00	inches
	16	Calculated Retention Storage Drawdown (Including 6 Hr Storm)	120	0	0	0	0	hours
	17	Volume Retained by BMP	550	0	0	0	0	cubic-feet
	18	Fraction of DCV Retained	0.04	0.00	0.00	0.00	0.00	ratio
	19	Portion of Retention Performance Standard Satisfied	0.05	0.00	0.00	0.00	0.00	ratio
	20	Fraction of DCV Retained (normalized to 36-hr drawdown)	0.02	0.00	0.00	0.00	0.00	ratio
	21	Design Capture Volume Remaining for Biofiltration	12,146	0	0	0	0	cubic-feet
Biofiltration Calculations	22	Max Hydromod Flow Rate through Underdrain	0.1869	n/a	n/a	n/a	n/a	CFS
	23	Max Soil Filtration Rate Allowed by Underdrain Orifice	1.10	n/a	n/a	n/a	n/a	in/hr
	24	Soil Media Filtration Rate per Specifications	5.00	5.00	5.00	5.00	5.00	in/hr
	25	Soil Media Filtration Rate to be used for Sizing	1.10	5.00	5.00	5.00	5.00	in/hr
	26	Depth Biofiltered Over 6 Hour Storm	6.61	30.00	30.00	30.00	30.00	inches
	27	Soil Media Pore Space Available for Biofiltration	0.20	0.20	0.20	0.20	0.20	unitless
	28	Effective Depth of Biofiltration Storage	19.20	0.00	0.00	0.00	0.00	inches
	29	Drawdown Time for Surface Ponding	11	0	0	0	0	hours
	30	Drawdown Time for Effective Biofiltration Depth	17	0	0	0	0	hours
	31	Total Depth Biofiltered	25.81	30.00	30.00	30.00	30.00	inches
	32	Option 1 - Biofilter 1.50 DCV: Target Volume	18,219	0	0	0	0	cubic-feet
	33	Option 1 - Provided Biofiltration Volume	15,766	0	0	0	0	cubic-feet
	34	Option 2 - Store 0.75 DCV: Target Volume	9,110	0	0	0	0	cubic-feet
	35	Option 2 - Provided Storage Volume	9,110	0	0	0	0	cubic-feet
	36	Portion of Biofiltration Performance Standard Satisfied	1.00	0.00	0.00	0.00	0.00	ratio
Result	37	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	-	-	-	-	yes/no
	38	Overall Portion of Performance Standard Satisfied	1.00	0.00	0.00	0.00	0.00	ratio
	39	This BMP Overflows to the Following Drainage Basin	-	-	-	-	-	unitless
	40	**Deficit of Effectively Treated Stormwater**	**0**	**n/a**	**n/a**	**n/a**	**n/a**	cubic-feet

Worksheet B.5-1 General Notes:

A. Applicants may use this worksheet to size Lined or Unlined Biofiltration BMPs (BF-1, PR-1) for up to 10 basins. User input must be provided for yellow shaded cells, values for blue cells are automatically populated based on user inputs from previous worksheets, values for all other cells will be automatically generated, errors/notifications will be highlighted in red/orange and summarized below. BMPs fully satisfying the pollutant control performance standards will have a deficit treated volume of zero and be highlighted in green.

Automated Worksheet B.5-3: Alternate Minimum Biofiltration Footprint Ratio (V1.3)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Drainage Basin Info	0	Drainage Basin ID or Name	BMP1	-	-	-	-	-	-	-	-	-	unitless
	1	Drains to following BMP Type	Biofiltration	-	-	-	-	-	-	-	-	-	unitless
	2	Final Effective Tributary Area	239,890	-	-	-	-	-	-	-	-	-	sq-ft
Biofiltration Clogging Inputs	3	Is Proposed Biofiltration BMP <3% of Effective Tributary Area Desired?			No	No	No	No	No	No	No	No	yes/no
	4	Average Annual Precipitation											inches
	5	Load to Clog (default =2.0)											lb/sq-ft
	6	Allowable Period to Accumulate Clogging Load (default =10)											years
	7	Pretreatment Measures Included?											yes/no
	8	Commercial: TSS=128 mg/L, C= 0.80											sq-ft
	9	Education: TSS=132 mg/L, C= 0.50											sq-ft
	10	Industrial: TSS=125 mg/L, C= 0.90											sq-ft
	11	Low Traffic Areas: TSS=50 mg/L, C= 0.50											sq-ft
	12	Multi-Family Residential: TSS=40 mg/L, C= 0.60											sq-ft
	13	Roof Areas: TSS=14 mg/L, C= 0.90											sq-ft
	14	Single Family Residential: TSS=123 mg/L, C= 0.40											sq-ft
	15	Transportation: TSS=78 mg/L, C= 0.90											sq-ft
	16	Vacant/Open Space: TSS=216 mg/L, C= 0.10											sq-ft
Minimum Footprint Calculations	17	Effective-Area Based on Specified Land Use Coefficients	0	0	0	0	0	0	0	0	0	0	sq-ft
	18	Average TSS Concentration for Tributary	0	0	0	0	0	0	0	0	0	0	mg/L
	19	Average Annual Runoff	0	0	0	0	0	0	0	0	0	0	cubic-feet
	20	Average Annual TSS Load	0	0	0	0	0	0	0	0	0	0	lb/yr
	21	Average Annual TSS Load After Pretreatment Measures	0	0	0	0	0	0	0	0	0	0	lb/yr
	22	Minimum Allowable Biofiltration Footprint Ratio	0.030	-	-	-	-	-	-	-	-	-	ratio

Worksheet B.5-3 General Notes:

A. Applicants may use this worksheet to calculate Alternate Minimum Biofiltration Footprint Ratios for up to 10 basins. User input must be provided for yellow shaded cells, values for blue cells are automatically populated based on user inputs from previous worksheets, values for all other cells will be automatically generated, errors/notifications will be highlighted in red and summarized below. Inputs for Lines 4-7 (precipitation, load to clog, clogging period, and pretreatment measures) must be supported through supplemental documentation.

Summary of Stormwater Pollutant Control Calculations (V1.3)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	Units
General Info	0	Drainage Basin ID or Name	BMP1	TW1	TW1 A	TW2	TW2 A	TW3	unitless
	1	85th Percentile Storm Depth	0.62	0.62	0.62	0.62	0.62	0.62	inches
	2	Design Infiltration Rate Recommended by Geotechnical Engineer	0.000	0.000	0.000	0.000	0.000	0.000	in/hr
	3	Total Tributary Area	307,551	2,433	2,433	2,217	2,661	11,478	sq-ft
	4	85th Percentile Storm Volume (Rainfall Volume)	15,890	126	126	115	137	593	cubic-feet
Initial DCV	5	Initial Weighted Runoff Factor	0.78	0.84	0.84	0.78	0.80	0.65	unitless
	6	Initial Design Capture Volume	12,394	106	106	89	110	385	cubic-feet
Site Design Volume Reductions	7	Dispersion Area Reductions	0	0	0	0	0	0	cubic-feet
	8	Tree Well and Rain Barrel Reductions	0	180	180	180	180	420	cubic-feet
BMP Volume Reductions	9	Effective Area Tributary to BMP	239,890	0	0	0	0	0	square feet
	10	Final Design Capture Volume Tributary to BMP	12,394	0	0	0	0	0	cubic-feet
	11	Basin Drains to the Following BMP Type	Biofiltration	n/a	n/a	n/a	n/a	n/a	unitless
	12	Volume Retained by BMP (normalized to 36 hour drawdown)	248	0	0	0	0	0	cubic-feet
Total Volume Reductions	13	Total Fraction of Initial DCV Retained within DMA	0.02	1.70	1.70	2.02	1.64	1.09	fraction
	14	Percent of Average Annual Runoff Retention Provided	3.0%	93.6%	93.6%	96.7%	93.0%	82.8%	%
	15	Percent of Average Annual Runoff Retention Required	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	%
Performance Standard	16	Percent of Pollution Control Standard Satisfied	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	%
Treatment Train	17	Discharges to Secondary Treatment in Drainage Basin	-	-	-	-	-	-	unitless
	18	Impervious Surface Area Still Requiring Treatment	0	0	0	0	0	0	square feet
	19	Impervious Surfaces Directed to Downstream Dispersion Area	-	-	-	-	-	-	square feet
	20	Impervious Surfaces Not Directed to Downstream Dispersion Area	-	-	-	-	-	-	square feet
Result	21	Deficit of Effectively Treated Stormwater	0	0	0	0	0	0	cubic-feet

Summary Notes:

All fields in this summary worksheet are populated based on previous user inputs. If applicable, drainage basin elements that require revisions and/or supplemental information outside the scope of these worksheets are highlighted in orange and summairzed in the red text below. If all drainage basins achieve full compliance without a need for supplemental information, a green message

-Congratulations, all specified drainage basins and BMPs are in compliance with stormwater pollutant control requirements. Include 11x17 color prints of this summary sheet and supporting worksheet calculations as part of the SWQMP submittal package.

False

Barham Drive TW1

Tree Well Credit Worksheet - VR / DCV / HMP

DMA	Total Area (sf)	Impervious (sf)	Pervious (sf)	Adjusted Area (sf)	
A1	2,433	2,190	243	2,044	
Total	2,433			2,044	sf AIA

Impervious C =	0.9	Gross	2,433	sf
Soil Type	D	BMP C'	0.84	
Pervious C =	0.3	85th %	0.62	in
Vol Retention Target		**DCV**	106	cf
Net Infiltration Rate	No			
Avg Annual Ret	4.50%	**HMP + Treatment**		
DCV Fraction	0.027	HMP Muliplier	3.70	
Vol Retention (cf)	**3**	**DCV x**	**391**	cf

Mature Tree Size	20	ft -dia
DCV Credit	180.0	cf
Mature Area	314.2	sf
Required Soil Vol	628.3	cf
Actual Surface Area	96	sf
Actual Depth	48	in
Actual Volume Provided	384	cf
Credit Ratio	61.1%	
Tree Credit Earned	**110**	cf
	Check DCV	
Tree Credit Satisfies;		
Vol Reduction =	3	Yes
DCV =	106	Yes
HMP =	391	No

Street Tree Options		Mature	Req'd Soil
Dia	Credit	Area	Volume
5	10	19.6	39.3
10	40	78.5	157.1
15	100	176.7	353.4
20	180	314.2	628.3
25	290	490.9	981.8
30	420	706.9	1,413.7

DCV Multiplier for Treatment HMP Compliance	
Soil Depth (in)	DCV Multiplier **Type D Soils**
30	2.90
31	2.94
32	2.99
33	3.03
34	3.08
35	3.12
36	3.17
37	3.21
38	3.26
39	3.30
40	3.34
41	3.39
42	3.43
43	3.48
44	3.52
45	3.57
46	3.61
47	3.66
48	3.70

Barham Drive TW1 A

Tree Well Credit Worksheet - VR / DCV / HMP

DMA	Total Area (sf)	Impervious (sf)	Pervious (sf)	Adjusted Area (sf)	
A1A	2,433	2,190	243	2,044	
Total	2,433			2,044	sf AIA

Impervious C =	0.9	Gross	2,433	sf
Soil Type	D	BMP C'	0.84	
Pervious C =	0.3	85th %	0.62	in
Vol Retention Target		**DCV**	106	cf
Net Infiltration Rate	No			
Avg Annual Ret	4.50%	**HMP + Treatment**		
DCV Fraction	0.027	HMP Muliplier	3.70	
Vol Retention (cf)	**3**	**DCV x**	**391**	cf

Mature Tree Size	20	ft -dia
DCV Credit	180.0	cf
Mature Area	314.2	sf
Required Soil Vol	628.3	cf
Actual Surface Area	96	sf
Actual Depth	48	in
Actual Volume Provided	384	cf
Credit Ratio	61.1%	
Tree Credit Earned	**110**	cf
	Check DCV	
Tree Credit Satisfies;		
Vol Reduction =	3	Yes
DCV =	106	Yes
HMP =	391	No

Street Tree Options		Mature	Req'd Soil
Dia	Credit	Area	Volume
5	10	19.6	39.3
10	40	78.5	157.1
15	100	176.7	353.4
20	180	314.2	628.3
25	290	490.9	981.8
30	420	706.9	1,413.7

DCV Multiplier for Treatment HMP Compliance	
Soil Depth (in)	DCV Multiplier **Type D Soils**
30	2.90
31	2.94
32	2.99
33	3.03
34	3.08
35	3.12
36	3.17
37	3.21
38	3.26
39	3.30
40	3.34
41	3.39
42	3.43
43	3.48
44	3.52
45	3.57
46	3.61
47	3.66
48	3.70

Barham Drive TW2

Tree Well Credit Worksheet - VR / DCV / HMP

DMA	Total Area (sf)	Impervious (sf)	Pervious (sf)	Adjusted Area (sf)	
A3	2,217	1,774	443	1,729	
Total	2,217			1,729	sf AIA

Impervious C =	0.9	Gross	2,217	sf
Soil Type	D	BMP C'	0.78	
Pervious C =	0.3	85th %	0.62	in
Vol Retention Target		**DCV**	89	cf
Net Infiltration Rate	No			
Avg Annual Ret	4.50%	**HMP + Treatment**		
DCV Fraction	0.027	HMP Muliplier	3.70	
Vol Retention (cf)	**2**	**DCV x**	**331**	cf

Mature Tree Size	20	ft -dia
DCV Credit	180.0	cf
Mature Area	314.2	sf
Required Soil Vol	628.3	cf
Actual Surface Area	80	sf
Actual Depth	48	in
Actual Volume Provided	320	cf
Credit Ratio	50.9%	
Tree Credit Earned	**92**	cf
	Check DCV	
Tree Credit Satisfies;		
Vol Reduction =	2	Yes
DCV =	89	Yes
HMP =	331	No

Street Tree Options		Mature	Req'd Soil
Dia	Credit	Area	Volume
5	10	19.6	39.3
10	40	78.5	157.1
15	100	176.7	353.4
20	180	314.2	628.3
25	290	490.9	981.8
30	420	706.9	1,413.7

DCV Multiplier for Treatment HMP Compliance	
Soil Depth (in)	DCV Multiplier **Type D Soils**
30	2.90
31	2.94
32	2.99
33	3.03
34	3.08
35	3.12
36	3.17
37	3.21
38	3.26
39	3.30
40	3.34
41	3.39
42	3.43
43	3.48
44	3.52
45	3.57
46	3.61
47	3.66
48	3.70

Barham Drive TW2 A

Tree Well Credit Worksheet - VR / DCV / HMP

DMA	Total Area (sf)	Impervious (sf)	Pervious (sf)	Adjusted Area (sf)	
A3A	2,217	1,774	443	1,729	
Total	2,217			1,729	sf AIA

Impervious C =	0.9	Gross	2,217	sf
Soil Type	D	BMP C'	0.78	
Pervious C =	0.3	85th %	0.62	in
Vol Retention Target		**DCV**	89	cf
Net Infiltration Rate	No			
Avg Annual Ret	4.50%	**HMP + Treatment**		
DCV Fraction	0.027	HMP Muliplier	3.70	
Vol Retention (cf)	**2**	**DCV x**	**331**	cf

Mature Tree Size	20	ft -dia
DCV Credit	180.0	cf
Mature Area	314.2	sf
Required Soil Vol	628.3	cf
Actual Surface Area	80	sf
Actual Depth	48	in
Actual Volume Provided	320	cf
Credit Ratio	50.9%	
Tree Credit Earned	**92**	cf
	Check DCV	
Tree Credit Satisfies;		
Vol Reduction =	2	Yes
DCV =	89	Yes
HMP =	331	No

Street Tree Options		Mature	Req'd Soil
Dia	Credit	Area	Volume
5	10	19.6	39.3
10	40	78.5	157.1
15	100	176.7	353.4
20	180	314.2	628.3
25	290	490.9	981.8
30	420	706.9	1,413.7

DCV Multiplier for Treatment HMP Compliance	
Soil Depth (in)	DCV Multiplier **Type D Soils**
30	2.90
31	2.94
32	2.99
33	3.03
34	3.08
35	3.12
36	3.17
37	3.21
38	3.26
39	3.30
40	3.34
41	3.39
42	3.43
43	3.48
44	3.52
45	3.57
46	3.61
47	3.66
48	3.70

Barham Drive TW3

Tree Well Credit Worksheet - VR / DCV / HMP

DMA	Total Area (sf)	Impervious (sf)	Pervious (sf)	Adjusted Area (sf)	
A4	11,478	6,657	4,821	7,438	
Total	11,478			7,438	sf AIA

Impervious C =	0.9	Gross	11,478	sf
Soil Type	D	BMP C'	0.65	
Pervious C =	0.3	85th %	0.62	in
Vol Retention Target		**DCV**	384	cf
Net Infiltration Rate	No			
Avg Annual Ret	4.50%	**HMP + Treatment**		
DCV Fraction	0.027	HMP Muliplier	3.70	
Vol Retention (cf)	**10**	**DCV x**	**1,422**	cf

Mature Tree Size	30	ft -dia
DCV Credit	420.0	cf
Mature Area	706.9	sf
Required Soil Vol	1,413.7	cf
Actual Surface Area	336	sf
Actual Depth	48	in
Actual Volume Provided	1344	cf
Credit Ratio	95.1%	
Tree Credit Earned	**399**	cf
	Check DCV	
Tree Credit Satisfies;		
Vol Reduction =	10	Yes
DCV =	384	Yes
HMP =	1,422	No

Street Tree Options		Mature	Req'd Soil
Dia	Credit	Area	Volume
5	10	19.6	39.3
10	40	78.5	157.1
15	100	176.7	353.4
20	180	314.2	628.3
25	290	490.9	981.8
30	420	706.9	1,413.7

DCV Multiplier for Treatment HMP Compliance	
Soil Depth (in)	DCV Multiplier **Type D Soils**
30	2.90
31	2.94
32	2.99
33	3.03
34	3.08
35	3.12
36	3.17
37	3.21
38	3.26
39	3.30
40	3.34
41	3.39
42	3.43
43	3.48
44	3.52
45	3.57
46	3.61
47	3.66
48	3.70

ATTACHMENT 2
BACKUP FOR PDP HYDROMODIFICATION CONTROL MEASURES

This is the cover sheet for Attachment 2.

☐ Mark this box if this attachment is empty because the project is exempt from PDP hydromodification management requirements.

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	**Contents**	**Checklist**
Attachment 2a	Hydromodification Management Exhibit (Required)	**See DMA Exhibit** See Hydromodification Management Exhibit Checklist on the back of this Attachment cover sheet.
Attachment 2b	Management of Critical Coarse Sediment Yield Areas (WMAA Exhibit is required, additional analyses are optional) See Section 6.2 of the BMP Design Manual.	☒ Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map (Required) Optional analyses for Critical Coarse Sediment Yield Area Determination ☐ 6.2.1 Verification of Geomorphic Landscape Units Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite
Attachment 2c	Geomorphic Assessment of Receiving Channels (Optional) See Section 6.3.4 of the BMP Design Manual.	☒ Not performed ☐ Included ☐ Submitted as separate stand-alone document
Attachment 2d	Flow Control Facility Design, including Structural BMP Drawdown Calculations and Overflow Design Summary (Required) See Chapter 6 and Appendix G of the BMP Design Manual	☒ Included ☐ Submitted as separate stand-alone document **See attached SWMM Report**
Attachment 2e	Vector Control Plan (Required when structural BMPs will not drain in 96 hours)	☐ Included ☒ Not required because BMPs will drain in less than 96 hours

Use this checklist to ensure the required information has been included on the Hydromodification Management Exhibit:

The Hydromodification Management Exhibit must identify:

- ☐ Underlying hydrologic soil group
- ☐ Approximate depth to groundwater
- ☐ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
- ☐ Critical coarse sediment yield areas to be protected
- ☐ Existing topography
- ☐ Existing and proposed site drainage network and connections to drainage offsite
- ☐ Proposed grading
- ☐ Proposed impervious features
- ☐ Proposed design features and surface treatments used to minimize imperviousness
- ☐ Point(s) of Compliance (POC) for Hydromodification Management
- ☐ Existing and proposed drainage boundary and drainage area to each POC (when necessary, create separate exhibits for pre-development and post-project conditions)
- ☐ Structural BMPs for hydromodification management (identify location, type of BMP, and size/detail)


Barham Drive
Potential CCSYA
Barham Dr
Potential
CCSYA
Google Earth
© 2019 Google
800 ft
N

ATTACHMENT

S.W.M.M. ~ HMP CONTINUOUS SIMULATION MODEL FOR:

943 BARHAM DRIVE

CITY OF SAN MARCOS, CA

July 2, 2020

PREPARED BY:

3990 RUFFIN ROAD, SUITE 120

SAN DIEGO, CA 92123

858-560-1141

TABLE OF CONTENTS

INTRODUCTION

This report, “S.W.M.M. ~ HMP CONTINUOUS SIMULATION MODELING FOR 943 BARHAM DRIVE”, is an attachment to the project Storm Water Quality Management Plan (SWQMP) and is not intended to be an independent document.

The San Diego County final Hydromodification Management Plan (HMP) became effective in January of 2011, and is applicable to all priority projects regardless of size. The HMP model seeks to limit post development increases in runoff (magnitude and duration) for runoff event ranging from a fraction of the Q2 up to Q10.

Hydromodification flow control is achieved for this project by routing runoff through the HMP control facility (basins). Outflow is restricted by using multiple control openings at each discharge. To determine the hydromodification controls and tank dimensions, Continuous Simulation Modeling was done using the EPA Storm Water Management Model (SWMM) software. Separate reports have been prepared to analyze the onsite 100-year storm capacity and to analyze the capacity of the downstream public drainage system.

STORM WATER MANAGEMENT MODEL SOFTWARE

EPA's Storm Water Management Model (SWMM) was first developed in 1971, and has since undergone several major upgrades. It continues to be widely used throughout the world for planning, analysis and design related to stormwater runoff, combined sewers, sanitary sewers, and other drainage systems in urban areas, with many applications in non-urban areas as well.

This general purpose urban hydrology and conveyance system hydraulics software is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas. The runoff component of SWMM operates on a collection of subcatchment areas that receive precipitation and generate runoff and pollutant loads. The routing portion of SWMM transports this runoff through a system of pipes, channels, storage/treatment devices, pumps, and regulators. SWMM tracks the quantity and quality of runoff generated within each subcatchment, and the flow rate, flow depth, and quality of water in each pipe and channel during a simulation period comprised of multiple time steps.

EPA has recently extended SWMM 5 to explicitly model the hydrologic performance of specific types of low impact development (LID) controls, such as porous pavement, bio-retention areas (e.g., rain gardens, green roofs, and street planters), rain barrels, infiltration trenches, and vegetative swales. The updated model allows engineers and planners to accurately represent any combination of LID controls within a study area to determine their effectiveness in managing stormwater and combined sewer overflows.

SWMM 5 was produced in a joint development effort with CDM, Inc., a global consulting, engineering, construction, and operations firm.

POINT OF COMPLIANCE (POC)

The majority of the developed runoff will be conveyed by the site private storm drain system to the northwest corner of the site for treatment and flow control (HMP & Detention). The proposed basin which will discharge to the existing storm drain system in Barham Road. Due to the hillside nature of the development, runoff from the steep driveway entries and frontage slopes will discharge to the Barham gutter. These flow will be intercepted by a proposed inlet on Barham Road near the northwest corner of the site.

The uphill section of the project will include manufactured cut slopes at the existing hillside. Runoff from the existing and proposed slopes will be intercepted in the bypass drainage ditches and storm drain, then directed to the westerly limits and then conveyed to a proposed inlet near the northwest corner of the property, which is connected to the existing Barham storm drain (MS-4).

Assuming the default low-flow threshold of 0.1 Q2, we have assigned one POC to the project, as shown on the DMA Exhibit. The location of the POC is consistent with the pre-development condition.

ANALYSIS

For each of the POCs, two models were simulated: pre-development and post-development mitigated. The pre-development condition simulation is a representation of the undeveloped site. The post-developed site adds BMPs and the detention facilities to reduce flows to meet the HMP requirements.

The performance standard requires the following:

1. For flow rates from 10% of the pre-project 2-year runoff event (0.1Q2) to the pre-project 10-year runoff event (Q10), the post-project discharge rates and durations shall not deviate above the pre-project rates and durations by more than 10% over more than 10% of the length of the flow duration curve.
2. For flow rates from 0.1 Q2 to Q5, the post-project peak flows shall not exceed pre-project peak flows. For flow rates from Q5 to Q10, post-project peak flows may exceed pre-project flows by up to 10% for a 1-year frequency interval. For example, post-project flows could exceed pre-project flows by up to 10% for the interval from Q9 to Q10 or from Q5.5 to Q6.5, but not from Q8 to Q10.

RAINFALL DATA

Precipitation is the principal driving variable in rainfall-runoff-quantity simulation. The volume and rate of stormwater runoff depends directly on the precipitation magnitude, and its spatial and temporal distribution over the catchment. Each subcatchment in SWMM is linked to a Rain Gage object that describes the format and source of the rainfall input for the subcatchment. The same rain gage and time series is applied to all scenarios for this project.

Long-term hourly rainfall records have been prepared for the San Diego rainfall stations. Sources of the rainfall data include ALERT data from the County of San Diego (which extend

back to 1982), the California Climatic Data Archive, National Oceanic and Atmospheric Administration (NOAA), the National Climatic Data Center, and the Western Regional Climate Center. In all cases, the length of the overall rainfall station record is 35 years or the overall length of the rainfall record, whichever is longer. The **ESCONDIDO** ALERT Station rainfall data was used for this project and can be found at, www.projectcleanwater.org.

ESCONDIDO RESERVOIR was chosen for this site due to its geographic proximity and similarity in elevation to this site.

EVAPORATION

Single event simulations are usually insensitive to the evaporation rate. Thus, evaporation is typically neglected when a single rainfall event or a synthetic storm is simulated. However, this process is more significant when a continuous simulation is performed because it is through evaporation that depression storage is recovered and water levels in extended detention and wet ponds are reduced; thus it becomes an important component of the overall water budget.

This project is located in the California Irrigation Management Information System (CIMIS) Zone 6. Monthly averages are applied to this site as provided by CIMIS.

SUBCATCHMENTS

SWMM is a distributed model, which means that a study area can be subdivided into any number of irregular subcatchments to best capture the effect that spatial variability in topography, drainage pathways, land cover, and soil characteristics have on runoff generation. Each subcatchment can be further divided into three subareas: an impervious area with depression (detention) storage, an impervious area without depression storage, and a pervious area with depression storage. Only the latter area allows for rainfall losses due to infiltration into the soil. Described below are some of the characteristics of a subcatchment.

Width/Length

W = AREA ÷ LENGTH OF OVERLAND FLOW

The width can be defined as the subcatchment area divided by the length of the longest un-concentrated overland flow path that water can travel. If there are several such paths, then one would use an average of their lengths to compute a width. In urbanized catchments, true overland flow can be very short before it is collected into channels or pipes.

Slope

This is the slope of the land surface over which runoff flows, and is the same for both the pervious and impervious surfaces. It is the slope of what one considers to be the overland flow path, or its area-weighted average, if there are several such paths in the subcatchment.

The existing site is vacant and includes a hillside along the southern limits. Drainage is "natural" and generally overland toward the Barham Road frontage with an approximate grade of 6%.

The proposed site has variable grades throughout the development. Area P1 is graded to an average slope of 2%, while area P-2 bypasses HMP treatment and is graded to an average of 10%.

Imperviousness

This is the percentage of the subcatchment area that is covered by impervious surfaces, such as roofs and roadways, through which rainfall cannot infiltrate. Imperviousness tends to be the most sensitive parameter in the hydrologic characterization of a catchment, and can range anywhere from 0% for undeveloped areas up to 100% for high-density areas.
The existing site is 100% pervious undeveloped site.

The developed condition for P-1 is approximately 80% impervious and the on-site bypass P-2 is approximately 30% impervious.

Roughness Coefficient

The roughness coefficient reflects the amount of resistance that overland flow encounters as it runs off of the subcatchment surface. Since SWMM uses the Manning equation to compute the overland flow rate, this coefficient is the same as Manning's roughness coefficient *n*. Separate values are required for the impervious and pervious fractions of a subcatchment since the pervious *n* is generally an order of magnitude higher than the impervious *n*.

N-imperv = 0.012
N-perv = 0.15

Depression Storage "Dstore"

Depression storage corresponds to a volume that must be filled prior to the occurrence of any runoff. Different values can be used for the pervious and impervious areas of a subcatchment. It represents initial abstractions such as surface ponding, interception by flat roofs and vegetation, and surface wetting.

Typical "D" values:

Surface	D (in)
Impervious surfaces (AC,PCC)	0.05
Proposed Landscaping	0.10
Existing Natural Terrain	0.15

Percent of Impervious Area without Depression Storage

This parameter accounts for immediate runoff that occurs at the beginning of rainfall before depression storage is satisfied. It represents pavement close to the gutters that has no surface storage, pitched rooftops that drain directly to street gutters, new pavement that may not have surface ponding, etc. By default the value of this variable is 25%, but it can be changed in each subcatchment. Unless special circumstances are known to exist, a percent imperviousness area without depression storage of 25% is recommended.

Subarea Routing

Choice of internal routing of runoff between pervious and impervious areas:
IMPERVIOUS: Runoff from pervious areas flow to impervious areas
PERVIOUS: Runoff from impervious areas flow to pervious areas.

OUTLET: Runoff from both areas flow directly to outlets.

This project utilizes only the OUTLET routing option, as recommended in the San Diego County BMP Design Manual.

Percent Routed
The percentage of runoff from the subcatchment that is to be routed. In all cases this is 100%.

Infiltration Model
Three different methods for computing infiltration loss on the pervious areas of a subcatchment are available in SWMM. They are the Horton, Green-Ampt and Curve Number models. There is no general agreement on which model is best. The Horton model has a long history of use in dynamic simulations, the Green-Ampt model is more physically-based, and the Curve Number model is derived from (but not the same as) the well-known SCS Curve Number method used in simplified runoff models.

We have chosen to use the Green-Ampt model for this project for type "D" soil:
Suction Head = 9.0 inches
Conductivity = 0.025
Initial Deficit = 0.3

Low Impact Development (LID) Controls
LID Controls are low impact development practices designed to capture surface runoff and provide some combination of detention, infiltration, and evapotranspiration. They are considered as properties of a given subcatchment, similar to how Aquifers and Snow Packs are treated. SWMM can explicitly model five different generic types of LID controls: Bio-retention Cells (with impermeable liner option), Infiltration Trenches, Continuous Porous Pavement Systems, Rain Barrels (or Cisterns) and Vegetative Swales.

Bio-retention cells, infiltration trenches, and porous pavement systems can all contain optional underdrain systems in their gravel storage beds to convey captured runoff off of the site rather than letting it all infiltrate. They can also have an impermeable floor or liner that prevents any infiltration into the native soil from occurring. Infiltration trenches and porous pavement systems can also be subject to a decrease in hydraulic conductivity over time due to clogging.

This project models BMPs as Bio-Retention Cells with a liner on the sides. The program is setup to route all flows from a Subcatchment into a smaller subcatchment that is fully occupied by the LID control. The project geotechnical engineer has found that infiltration is minimal, so the on-site BMP is lined on the sides.

STORAGE

SWMM routes runoff through storage units such as ponds and tanks with outlet orifices and weirs. Tanks can be modeled using either a storage curve function or a depth-area table. For this project we inputted a depth-area table and do allow for storage infiltration.

The project is required to provide water quality treatment and flow control for post development runoff. The project proposes a surface biofiltration basin with enhanced below grade storage to provide treatment and flow control. The surface basin has additional storage depth and an overflow structure with both a weir opening and grated top to provide attenuation of larger storm events. A concrete lined ramp provides an emergency overflow path to the driveway and then Barham Drive. In order to ensure that post development flows do not exceed existing peak flows, detention routing analyses were prepared to determine peak outflows, and to provide adjusted discharge estimate for comparison to the existing condition.
The project proposes two open bottom underground storage tanks to provide treatment and volume retention by allowing infiltration of the water quality volume (DCV) and to accomplish flow control (HMP) by eliminating the usual low flow orifice and using only an overflow weir.
Raw test results of the surficial soils indicate very poor rates (<0.05"/hr.). However, the bottom of the BMP has been left unlined to attain infiltration on the low flows

Main Basin Storage 54,724 cf. (1.26 ac-ft) @ 4.95' surface depth

Elevation	Description	Dimension/Size	Comment
647.15	Bottom of Crushed Rock	6,764 sf	40% Void Ratio
647.15	Low Flow Orifice	2" dia.	
648.15	Bottom of Soil Layer	6,764 sf	30% Void Ratio
650.15	Floor of Surface Basin	6,764 sf	
650.65	surface depth @ 6"	**7,330 sf**	Treatment Surface Area
653.90	3" overflow opening	11,027 sf	3.75' surface depth
654.60	Grated overflow 5' x5'	11,931 sf	4.45' surface depth
655.10	Surface Overflow	12,594 sf	4.95' surface depth
656.10	Top of Earth Berm	14,575 sf	5.95' surface depth

STATISTICS

SWMM computes peak flow frequency statistics by constructing a partial-duration series. This involves examining the entire runoff time series generated by the model, dividing the runoff time series into a set of discrete unrelated events, determining the peak flow for each event, ranking the peak flows for all events and then computing the recurrence interval or plotting position for each storm event. A separation event, defined as a time period in which runoff does not exceed a prescribed threshold, is required to parse the long-term flow records into discrete runoff events. The separation event corresponds to the required number of consecutive time intervals (24 hours in this case) with a flow value less than Flow Floor 1 (0.002 cfs/acre).

SWMM uses the Weibull method for construction of the partial-duration series, but the Final HMP gives preference to the Cunnane method. Both the Weibull and Cunnane methods result in very similar return periods and frequencies for events that occur below the Q10, and do not

begin significantly contrasting until the low frequency (high flow) ranges. We have converted the SWMM partial duration series to a Cunnane plotting for this report and have included a table at the end of this report.

AREA SUMMARY

	TOTAL	BMP	IMPERV	PERVIOUS	IMP. %
PRE-	*8.828*	*0.0000*	*0.0000*	*8.828*	*0*
POST-	*8.828*	*0.456*	*5.576*	*2.391*	*68%*

NOTE: ALL AREAS SHOWN IN ACRES

*Note: 1.40 Acres of the site does not flow through the BMP structure, however the overall combined storage is satisfied through the BMP.

RESULTS

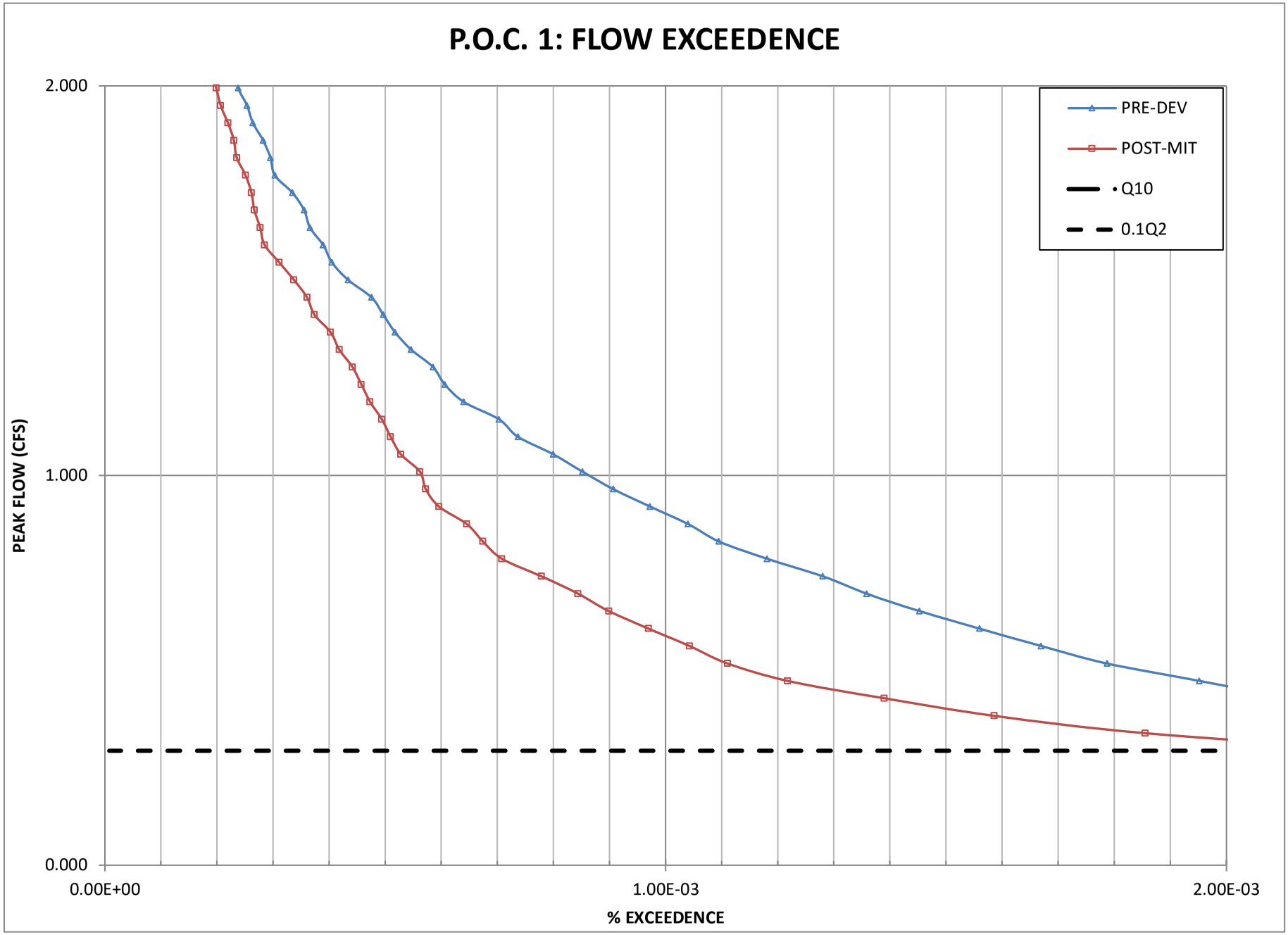
For each HMP facility (each POC) the results are included at the end of this report and are summarized as follows:

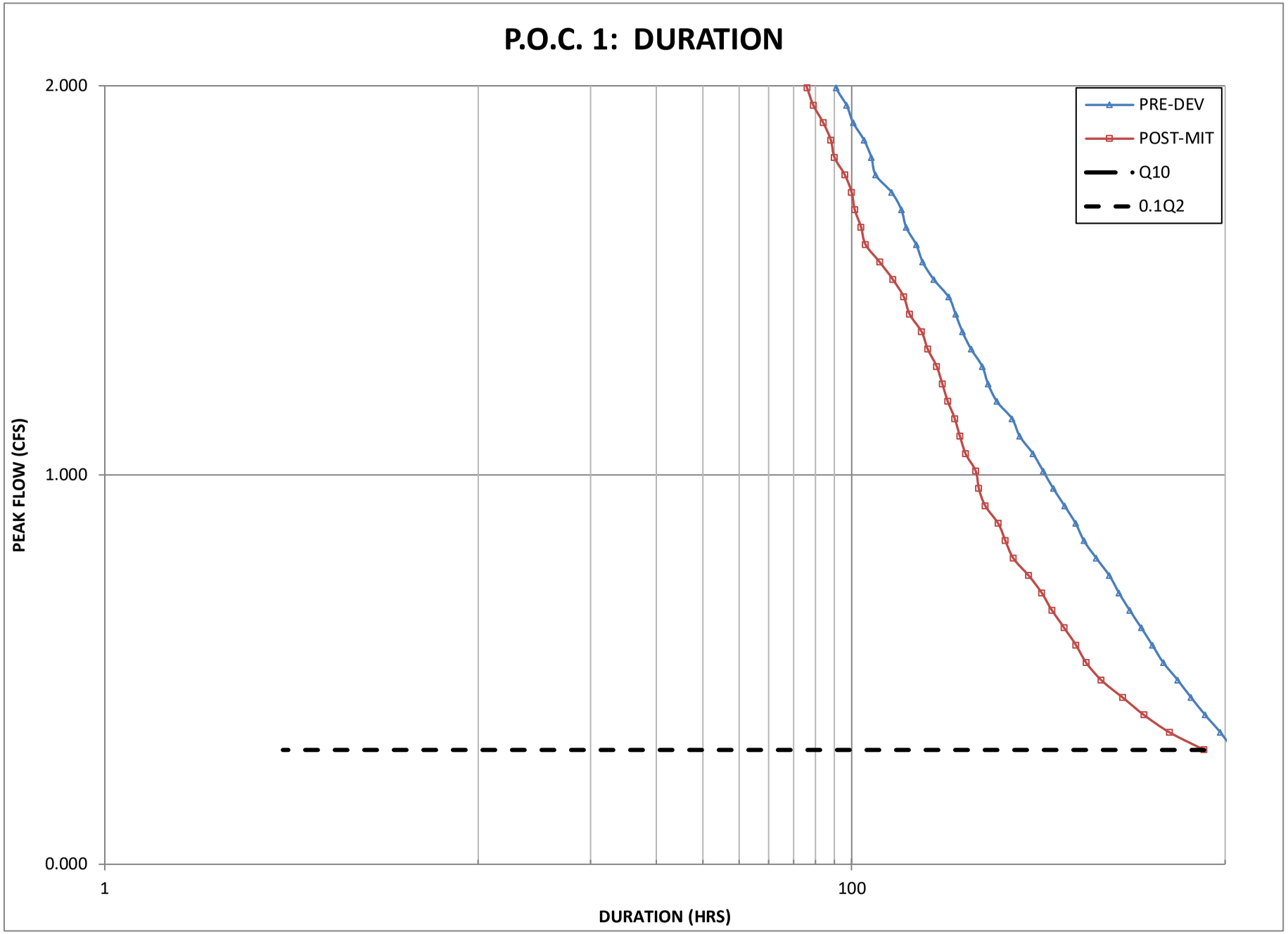
A. PEAK FLOW-EXCEEDANCE CURVE
B. RUNOFF-DURATION CURVE (LOGARITHMIC)
C. FLOW-DURATION DATA TABLE
D. PEAK EVENT TABLE – EXISTING (INCLUDES Q2-Q10 THRESHOLDS)
E. PEAK EVENT TABLE – POST-MITIGATED

Observing flows between 0.1Q2 and Q10, each of these charts or tables show the flow control openings for the project HMP facility reduces the runoff from the site to below the pre-developed condition, and meets the performance standard requirements described above.

APPENDIX I: POC #1 SWMM RESULTS

A. PEAK FLOW-EXCEEDANCE CURVE
B. RUNOFF-DURATION CURVE (LOGARITHMIC)
C. FLOW-DURATION DATA TABLE
D. PEAK EVENT TABLE – EXISTING (INCLUDES Q2-Q10 THRESHOLDS)
E. PEAK EVENT TABLE – POST-MITIGATED
F. POND STAGE-STORAGE-DISCHARGE TABLE


P.O.C. 1: FLOW EXCEEDENCE
2.000
1.000
0.000
PEAK FLOW (CFS)
0.00E+00
1.00E-03
2.00E-03
% EXCEEDENCE
PRE-DEV
POST-MIT
Q10
0.1Q2


P.O.C. 1: DURATION
2.000
1.000
0.000
PEAK FLOW (CFS)
1
100
DURATION (HRS)
PRE-DEV
POST-MIT
Q10
0.1Q2

POC. #1: FLOW-DURATION TABLE

Q2 = 2.941 CFS FRACTION = 1.0%
0.1Q2= 0.2941 CFS
Q10 = 4.768 CFS
STEP = 0.045 CFS

	EXISTING			POST-MITIGATED		PERCENT	PASS OR
INTERVAL	Q (CFS)	HRS>Q	% EXCEEDED	HRS>Q	% EXCEEDED	POST/PRE	FAIL
0	0.294	1054	2.75E-03	879	2.30E-03	83%	PASS
1	0.339	971	2.54E-03	710	1.86E-03	73%	PASS
2	0.384	885	2.31E-03	607	1.59E-03	69%	PASS
3	0.428	811	2.12E-03	532	1.39E-03	66%	PASS
4	0.473	747	1.95E-03	466	1.22E-03	62%	PASS
5	0.518	684	1.79E-03	425	1.11E-03	62%	PASS
6	0.563	639	1.67E-03	399	1.04E-03	62%	PASS
7	0.607	597	1.56E-03	371	9.69E-04	62%	PASS
8	0.652	556	1.45E-03	344	8.99E-04	62%	PASS
9	0.697	520	1.36E-03	323	8.44E-04	62%	PASS
10	0.742	490	1.28E-03	298	7.79E-04	61%	PASS
11	0.786	452	1.18E-03	271	7.08E-04	60%	PASS
12	0.831	419	1.09E-03	258	6.74E-04	62%	PASS
13	0.876	398	1.04E-03	247	6.45E-04	62%	PASS
14	0.920	372	9.72E-04	228	5.96E-04	61%	PASS
15	0.965	347	9.07E-04	219	5.72E-04	63%	PASS
16	1.010	326	8.52E-04	215	5.62E-04	66%	PASS
17	1.055	306	8.00E-04	202	5.28E-04	66%	PASS
18	1.099	282	7.37E-04	195	5.09E-04	69%	PASS
19	1.144	269	7.03E-04	189	4.94E-04	70%	PASS
20	1.189	245	6.40E-04	181	4.73E-04	74%	PASS
21	1.234	232	6.06E-04	175	4.57E-04	75%	PASS
22	1.278	224	5.85E-04	169	4.42E-04	75%	PASS
23	1.323	209	5.46E-04	160	4.18E-04	77%	PASS
24	1.368	198	5.17E-04	154	4.02E-04	78%	PASS
25	1.413	190	4.96E-04	143	3.74E-04	75%	PASS
26	1.457	182	4.76E-04	138	3.61E-04	76%	PASS
27	1.502	166	4.34E-04	129	3.37E-04	78%	PASS
28	1.547	155	4.05E-04	119	3.11E-04	77%	PASS
29	1.592	149	3.89E-04	109	2.85E-04	73%	PASS
30	1.636	140	3.66E-04	106	2.77E-04	76%	PASS
31	1.681	136	3.55E-04	102	2.67E-04	75%	PASS
32	1.726	128	3.34E-04	100	2.61E-04	78%	PASS
33	1.771	116	3.03E-04	96	2.51E-04	83%	PASS
34	1.815	113	2.95E-04	90	2.35E-04	80%	PASS
35	1.860	108	2.82E-04	88	2.30E-04	81%	PASS
36	1.905	101	2.64E-04	84	2.19E-04	83%	PASS
37	1.950	97	2.53E-04	79	2.06E-04	81%	PASS
38	1.994	91	2.38E-04	76	1.99E-04	84%	PASS
39	2.039	89	2.33E-04	73	1.91E-04	82%	PASS
40	2.084	84	2.19E-04	70	1.83E-04	83%	PASS
41	2.129	79	2.06E-04	66	1.72E-04	84%	PASS
42	2.173	76	1.99E-04	62	1.62E-04	82%	PASS
43	2.218	72	1.88E-04	61	1.59E-04	85%	PASS
44	2.263	71	1.86E-04	60	1.57E-04	85%	PASS
45	2.307	68	1.78E-04	58	1.52E-04	85%	PASS
46	2.352	67	1.75E-04	57	1.49E-04	85%	PASS
47	2.397	66	1.72E-04	54	1.41E-04	82%	PASS
48	2.442	63	1.65E-04	50	1.31E-04	79%	PASS

49	2.486	60	1.57E-04	49	1.28E-04	82%	PASS
50	2.531	56	1.46E-04	48	1.25E-04	86%	PASS
51	2.576	52	1.36E-04	47	1.23E-04	90%	PASS
52	2.621	51	1.33E-04	46	1.20E-04	90%	PASS
53	2.665	50	1.31E-04	43	1.12E-04	86%	PASS
54	2.710	47	1.23E-04	42	1.10E-04	89%	PASS
55	2.755	46	1.20E-04	37	9.67E-05	80%	PASS
56	2.800	42	1.10E-04	35	9.14E-05	83%	PASS
57	2.844	40	1.05E-04	34	8.88E-05	85%	PASS
58	2.889	40	1.05E-04	30	7.84E-05	75%	PASS
59	2.934	37	9.67E-05	29	7.58E-05	78%	PASS
60	2.979	34	8.88E-05	29	7.58E-05	85%	PASS
61	3.023	32	8.36E-05	29	7.58E-05	91%	PASS
62	3.068	31	8.10E-05	29	7.58E-05	94%	PASS
63	3.113	29	7.58E-05	27	7.05E-05	93%	PASS
64	3.158	29	7.58E-05	23	6.01E-05	79%	PASS
65	3.202	28	7.32E-05	22	5.75E-05	79%	PASS
66	3.247	28	7.32E-05	19	4.96E-05	68%	PASS
67	3.292	28	7.32E-05	19	4.96E-05	68%	PASS
68	3.337	26	6.79E-05	19	4.96E-05	73%	PASS
69	3.381	25	6.53E-05	18	4.70E-05	72%	PASS
70	3.426	23	6.01E-05	18	4.70E-05	78%	PASS
71	3.471	23	6.01E-05	17	4.44E-05	74%	PASS
72	3.516	22	5.75E-05	17	4.44E-05	77%	PASS
73	3.560	21	5.49E-05	17	4.44E-05	81%	PASS
74	3.605	19	4.96E-05	17	4.44E-05	89%	PASS
75	3.650	19	4.96E-05	17	4.44E-05	89%	PASS
76	3.694	19	4.96E-05	16	4.18E-05	84%	PASS
77	3.739	19	4.96E-05	15	3.92E-05	79%	PASS
78	3.784	18	4.70E-05	15	3.92E-05	83%	PASS
79	3.829	18	4.70E-05	15	3.92E-05	83%	PASS
80	3.873	17	4.44E-05	13	3.40E-05	76%	PASS
81	3.918	16	4.18E-05	13	3.40E-05	81%	PASS
82	3.963	16	4.18E-05	13	3.40E-05	81%	PASS
83	4.008	15	3.92E-05	11	2.87E-05	73%	PASS
84	4.052	14	3.66E-05	9	2.35E-05	64%	PASS
85	4.097	13	3.40E-05	9	2.35E-05	69%	PASS
86	4.142	13	3.40E-05	9	2.35E-05	69%	PASS
87	4.187	13	3.40E-05	9	2.35E-05	69%	PASS
88	4.231	13	3.40E-05	9	2.35E-05	69%	PASS
89	4.276	12	3.14E-05	8	2.09E-05	67%	PASS
90	4.321	10	2.61E-05	7	1.83E-05	70%	PASS
91	4.366	9	2.35E-05	6	1.57E-05	67%	PASS
92	4.410	9	2.35E-05	5	1.31E-05	56%	PASS
93	4.455	9	2.35E-05	5	1.31E-05	56%	PASS
94	4.500	8	2.09E-05	4	1.05E-05	50%	PASS
95	4.545	7	1.83E-05	4	1.05E-05	57%	PASS
96	4.589	7	1.83E-05	4	1.05E-05	57%	PASS
97	4.634	7	1.83E-05	4	1.05E-05	57%	PASS
98	4.679	6	1.57E-05	3	7.84E-06	50%	PASS
99	4.724	6	1.57E-05	3	7.84E-06	50%	PASS
100	4.768	4	1.05E-05	3	7.84E-06	75%	PASS

P.O.C. #1: PEAK EVENTS - EXISTING

WEIBULL (SWMM)

F = m/(nr+1) where F = frequency
m = event rank
nr = total number of event
n = number of year anlayzed

CUNNANE

F = (i-0.4)/(n+0.2)
i = rank
n = sample size = # of storms

Number of Years Analyzed (n): 43.69
Total number of events (nr) 246

	Weibull		Cunnane		
m or i	F	Return (yrs)	F	Return	Q
1	0.40%	44.69	0.24%	73.15	6.164
2	0.81%	22.35	0.65%	27.43	5.419
3	1.21%	14.90	1.06%	16.88	4.867
4	1.62%	11.17	1.46%	12.19	4.781
5	2.02%	8.94	1.87%	9.54	4.765
6	2.43%	7.45	2.27%	7.84	4.736
7	2.83%	6.38	2.68%	6.65	4.528
8	3.24%	5.59	3.09%	5.78	4.330
9	3.64%	4.97	3.49%	5.10	4.282
10	4.05%	4.47	3.90%	4.57	3.893
11	4.45%	4.06	4.31%	4.14	3.863
12	4.86%	3.72	4.71%	3.78	3.759
13	5.26%	3.44	5.12%	3.48	3.537
14	5.67%	3.19	5.52%	3.23	3.383
15	6.07%	2.98	5.93%	3.01	3.382
16	6.48%	2.79	6.34%	2.81	3.299
17	6.88%	2.63	6.74%	2.64	3.298
18	7.29%	2.48	7.15%	2.49	3.111
19	7.69%	2.35	7.55%	2.36	3.088
20	8.10%	2.23	7.96%	2.24	2.996
21	8.50%	2.13	8.37%	2.13	2.974
22	8.91%	2.03	8.77%	2.03	2.941
23	9.31%	1.94	9.18%	1.94	2.930
24	9.72%	1.86	9.59%	1.86	2.899
25	10.12%	1.79	9.99%	1.78	2.787
26	10.53%	1.72	10.40%	1.71	2.772
27	10.93%	1.66	10.80%	1.65	2.758
28	11.34%	1.60	11.21%	1.59	2.676
29	11.74%	1.54	11.62%	1.53	2.630
30	12.15%	1.49	12.02%	1.48	2.565
31	12.55%	1.44	12.43%	1.43	2.552
32	12.96%	1.40	12.84%	1.39	2.538
33	13.36%	1.35	13.24%	1.35	2.493
34	13.77%	1.31	13.65%	1.31	2.468
35	14.17%	1.28	14.05%	1.27	2.415
36	14.57%	1.24	14.46%	1.23	2.411
37	14.98%	1.21	14.87%	1.20	2.311
38	15.38%	1.18	15.27%	1.17	2.242
39	15.79%	1.15	15.68%	1.14	2.211
40	16.19%	1.12	16.08%	1.11	2.153
41	16.60%	1.09	16.49%	1.08	2.128
42	17.00%	1.06	16.90%	1.06	2.114
43	17.41%	1.04	17.30%	1.03	2.112
44	17.81%	1.02	17.71%	1.01	2.053

SUMMARY OF PEAK EVENTS

Q2	**2.941**
Q3	**3.382**
Q4	**3.825**
Q5	**4.228**
Q6	**4.386**
Q7	**4.596**
Q8	**4.739**
Q9	**4.759**
Q10	**4.768**

START	9/24/1964 13:00
END	5/23/2008 22:00
TOTAL YRS	43.69
TOTAL HRS	382737

45	18.22%	0.99	18.12%	0.98	1.975
46	18.62%	0.97	18.52%	0.96	1.886
47	19.03%	0.95	18.93%	0.94	1.857
48	19.43%	0.93	19.33%	0.92	1.842
49	19.84%	0.91	19.74%	0.90	1.790
50	20.24%	0.89	20.15%	0.88	1.745
51	20.65%	0.88	20.55%	0.87	1.743
52	21.05%	0.86	20.96%	0.85	1.737
53	21.46%	0.84	21.36%	0.83	1.734
54	21.86%	0.83	21.77%	0.82	1.704
55	22.27%	0.81	22.18%	0.80	1.686
56	22.67%	0.80	22.58%	0.79	1.674
57	23.08%	0.78	22.99%	0.78	1.632
58	23.48%	0.77	23.40%	0.76	1.612
59	23.89%	0.76	23.80%	0.75	1.610
60	24.29%	0.74	24.21%	0.74	1.568
61	24.70%	0.73	24.61%	0.72	1.561
62	25.10%	0.72	25.02%	0.71	1.542
63	25.51%	0.71	25.43%	0.70	1.540
64	25.91%	0.70	25.83%	0.69	1.539
65	26.32%	0.69	26.24%	0.68	1.526
66	26.72%	0.68	26.65%	0.67	1.507
67	27.13%	0.67	27.05%	0.66	1.492
68	27.53%	0.66	27.46%	0.65	1.489
69	27.94%	0.65	27.86%	0.64	1.469
70	28.34%	0.64	28.27%	0.63	1.466
71	28.74%	0.63	28.68%	0.62	1.462
72	29.15%	0.62	29.08%	0.61	1.438
73	29.55%	0.61	29.49%	0.60	1.438
74	29.96%	0.60	29.89%	0.60	1.437
75	30.36%	0.60	30.30%	0.59	1.432
76	30.77%	0.59	30.71%	0.58	1.382
77	31.17%	0.58	31.11%	0.57	1.357
78	31.58%	0.57	31.52%	0.57	1.353
79	31.98%	0.57	31.93%	0.56	1.325
80	32.39%	0.56	32.33%	0.55	1.311
81	32.79%	0.55	32.74%	0.54	1.303
82	33.20%	0.55	33.14%	0.54	1.287
83	33.60%	0.54	33.55%	0.53	1.252
84	34.01%	0.53	33.96%	0.53	1.211
85	34.41%	0.53	34.36%	0.52	1.208
86	34.82%	0.52	34.77%	0.51	1.206
87	35.22%	0.51	35.17%	0.51	1.197
88	35.63%	0.51	35.58%	0.50	1.187
89	36.03%	0.50	35.99%	0.50	1.182
90	36.44%	0.50	36.39%	0.49	1.179
91	36.84%	0.49	36.80%	0.48	1.177
92	37.25%	0.49	37.21%	0.48	1.172
93	37.65%	0.48	37.61%	0.47	1.172
94	38.06%	0.48	38.02%	0.47	1.170
95	38.46%	0.47	38.42%	0.46	1.166
96	38.87%	0.47	38.83%	0.46	1.161
97	39.27%	0.46	39.24%	0.45	1.142
98	39.68%	0.46	39.64%	0.45	1.100
99	40.08%	0.45	40.05%	0.45	1.097
100	40.49%	0.45	40.45%	0.44	1.089
101	40.89%	0.44	40.86%	0.44	1.084
102	41.30%	0.44	41.27%	0.43	1.075
103	41.70%	0.43	41.67%	0.43	1.060

104	42.11%	0.43	42.08%	0.42	1.054
105	42.51%	0.43	42.49%	0.42	1.052
106	42.91%	0.42	42.89%	0.42	1.047
107	43.32%	0.42	43.30%	0.41	1.041
108	43.72%	0.41	43.70%	0.41	1.036
109	44.13%	0.41	44.11%	0.40	1.028
110	44.53%	0.41	44.52%	0.40	1.028
111	44.94%	0.40	44.92%	0.40	1.028
112	45.34%	0.40	45.33%	0.39	1.003
113	45.75%	0.40	45.74%	0.39	0.998
114	46.15%	0.39	46.14%	0.39	0.992
115	46.56%	0.39	46.55%	0.38	0.991
116	46.96%	0.39	46.95%	0.38	0.990
117	47.37%	0.38	47.36%	0.38	0.977
118	47.77%	0.38	47.77%	0.37	0.962
119	48.18%	0.38	48.17%	0.37	0.957
120	48.58%	0.37	48.58%	0.37	0.931
121	48.99%	0.37	48.98%	0.36	0.926
122	49.39%	0.37	49.39%	0.36	0.924
123	49.80%	0.36	49.80%	0.36	0.920
124	50.20%	0.36	50.20%	0.36	0.918
125	50.61%	0.36	50.61%	0.35	0.914
126	51.01%	0.35	51.02%	0.35	0.886
127	51.42%	0.35	51.42%	0.35	0.886
128	51.82%	0.35	51.83%	0.34	0.882
129	52.23%	0.35	52.23%	0.34	0.875
130	52.63%	0.34	52.64%	0.34	0.862
131	53.04%	0.34	53.05%	0.34	0.862
132	53.44%	0.34	53.45%	0.33	0.852
133	53.85%	0.34	53.86%	0.33	0.840
134	54.25%	0.33	54.26%	0.33	0.839
135	54.66%	0.33	54.67%	0.33	0.836
136	55.06%	0.33	55.08%	0.32	0.829
137	55.47%	0.33	55.48%	0.32	0.816
138	55.87%	0.32	55.89%	0.32	0.810
139	56.28%	0.32	56.30%	0.32	0.805
140	56.68%	0.32	56.70%	0.31	0.804
141	57.09%	0.32	57.11%	0.31	0.804
142	57.49%	0.31	57.51%	0.31	0.801
143	57.89%	0.31	57.92%	0.31	0.794
144	58.30%	0.31	58.33%	0.31	0.785
145	58.70%	0.31	58.73%	0.30	0.772
146	59.11%	0.31	59.14%	0.30	0.761
147	59.51%	0.30	59.55%	0.30	0.755
148	59.92%	0.30	59.95%	0.30	0.747
149	60.32%	0.30	60.36%	0.30	0.713
150	60.73%	0.30	60.76%	0.29	0.713
151	61.13%	0.30	61.17%	0.29	0.710
152	61.54%	0.29	61.58%	0.29	0.708
153	61.94%	0.29	61.98%	0.29	0.706
154	62.35%	0.29	62.39%	0.29	0.705
155	62.75%	0.29	62.79%	0.28	0.703
156	63.16%	0.29	63.20%	0.28	0.693
157	63.56%	0.28	63.61%	0.28	0.675
158	63.97%	0.28	64.01%	0.28	0.672
159	64.37%	0.28	64.42%	0.28	0.666
160	64.78%	0.28	64.83%	0.28	0.662
161	65.18%	0.28	65.23%	0.27	0.640
162	65.59%	0.28	65.64%	0.27	0.630

163	65.99%	0.27	66.04%	0.27	0.620
164	66.40%	0.27	66.45%	0.27	0.617
165	66.80%	0.27	66.86%	0.27	0.614
166	67.21%	0.27	67.26%	0.27	0.613
167	67.61%	0.27	67.67%	0.26	0.584
168	68.02%	0.27	68.07%	0.26	0.581
169	68.42%	0.26	68.48%	0.26	0.580
170	68.83%	0.26	68.89%	0.26	0.575
171	69.23%	0.26	69.29%	0.26	0.575
172	69.64%	0.26	69.70%	0.26	0.573
173	70.04%	0.26	70.11%	0.25	0.571
174	70.45%	0.26	70.51%	0.25	0.569
175	70.85%	0.26	70.92%	0.25	0.562
176	71.26%	0.25	71.32%	0.25	0.549
177	71.66%	0.25	71.73%	0.25	0.534
178	72.06%	0.25	72.14%	0.25	0.531
179	72.47%	0.25	72.54%	0.25	0.528
180	72.87%	0.25	72.95%	0.24	0.527
181	73.28%	0.25	73.35%	0.24	0.527
182	73.68%	0.25	73.76%	0.24	0.523
183	74.09%	0.24	74.17%	0.24	0.521
184	74.49%	0.24	74.57%	0.24	0.515
185	74.90%	0.24	74.98%	0.24	0.507
186	75.30%	0.24	75.39%	0.24	0.503
187	75.71%	0.24	75.79%	0.24	0.502
188	76.11%	0.24	76.20%	0.23	0.497
189	76.52%	0.24	76.60%	0.23	0.493
190	76.92%	0.24	77.01%	0.23	0.492
191	77.33%	0.23	77.42%	0.23	0.479
192	77.73%	0.23	77.82%	0.23	0.464
193	78.14%	0.23	78.23%	0.23	0.460
194	78.54%	0.23	78.64%	0.23	0.434
195	78.95%	0.23	79.04%	0.23	0.433
196	79.35%	0.23	79.45%	0.22	0.429
197	79.76%	0.23	79.85%	0.22	0.411
198	80.16%	0.23	80.26%	0.22	0.405
199	80.57%	0.22	80.67%	0.22	0.398
200	80.97%	0.22	81.07%	0.22	0.396
201	81.38%	0.22	81.48%	0.22	0.392
202	81.78%	0.22	81.88%	0.22	0.390
203	82.19%	0.22	82.29%	0.22	0.387
204	82.59%	0.22	82.70%	0.22	0.384
205	83.00%	0.22	83.10%	0.21	0.383
206	83.40%	0.22	83.51%	0.21	0.374
207	83.81%	0.22	83.92%	0.21	0.374
208	84.21%	0.21	84.32%	0.21	0.371
209	84.62%	0.21	84.73%	0.21	0.361
210	85.02%	0.21	85.13%	0.21	0.358
211	85.43%	0.21	85.54%	0.21	0.356
212	85.83%	0.21	85.95%	0.21	0.355
213	86.23%	0.21	86.35%	0.21	0.353
214	86.64%	0.21	86.76%	0.21	0.349
215	87.04%	0.21	87.16%	0.20	0.347
216	87.45%	0.21	87.57%	0.20	0.346
217	87.85%	0.21	87.98%	0.20	0.339
218	88.26%	0.21	88.38%	0.20	0.295
219	88.66%	0.20	88.79%	0.20	0.295
220	89.07%	0.20	89.20%	0.20	0.284
221	89.47%	0.20	89.60%	0.20	0.280

222	89.88%	0.20	90.01%	0.20	0.266
223	90.28%	0.20	90.41%	0.20	0.261
224	90.69%	0.20	90.82%	0.20	0.259
225	91.09%	0.20	91.23%	0.20	0.258
226	91.50%	0.20	91.63%	0.19	0.251
227	91.90%	0.20	92.04%	0.19	0.246
228	92.31%	0.20	92.45%	0.19	0.246
229	92.71%	0.20	92.85%	0.19	0.244
230	93.12%	0.19	93.26%	0.19	0.241
231	93.52%	0.19	93.66%	0.19	0.236
232	93.93%	0.19	94.07%	0.19	0.234
233	94.33%	0.19	94.48%	0.19	0.227
234	94.74%	0.19	94.88%	0.19	0.223
235	95.14%	0.19	95.29%	0.19	0.219
236	95.55%	0.19	95.69%	0.19	0.218
237	95.95%	0.19	96.10%	0.19	0.210
238	96.36%	0.19	96.51%	0.18	0.208
239	96.76%	0.19	96.91%	0.18	0.204
240	97.17%	0.19	97.32%	0.18	0.200
241	97.57%	0.19	97.73%	0.18	0.197
242	97.98%	0.18	98.13%	0.18	0.192
243	98.38%	0.18	98.54%	0.18	0.185
244	98.79%	0.18	98.94%	0.18	0.185
245	99.19%	0.18	99.35%	0.18	0.183
246	99.60%	0.18	99.76%	0.18	0.183

POC #1: PEAK EVENTS - POST MITIGATED

WEIBULL (SWMM)

F = m/(nr+1) where F = frequency
m = event rank
nr = total number of event
n = number of year anlayzed

CUNNANE

F = (i-0.4)/(n+0.2)
i = rank
n = sample size = # of storms

Number of Years Analyzed (n): 43.69
Total number of events (nr) 627

	Weibull		Cunnane			SUMMARY OF PEAK EVENTS	
m or i	F	Return (yrs)	F	Return	Q		
1	0.16%	44.69	0.10%	73.15	5.036	**Q2**	**2.414**
2	0.32%	22.35	0.26%	27.43	5.007	**Q3**	**2.746**
3	0.48%	14.90	0.41%	16.88	4.650	**Q4**	**3.194**
4	0.64%	11.17	0.57%	12.19	4.323	**Q5**	**3.645**
5	0.80%	8.94	0.73%	9.54	4.312	**Q6**	**3.991**
6	0.96%	7.45	0.89%	7.84	4.233	**Q7**	**4.104**
7	1.11%	6.38	1.05%	6.65	4.041	**Q8**	**4.242**
8	1.27%	5.59	1.21%	5.78	3.971	**Q9**	**4.295**
9	1.43%	4.97	1.37%	5.10	3.712	**Q10**	**4.314**
10	1.59%	4.47	1.53%	4.57	3.228		
11	1.75%	4.06	1.69%	4.14	3.217		
12	1.91%	3.72	1.85%	3.78	3.152		
13	2.07%	3.44	2.01%	3.48	3.119		
14	2.23%	3.19	2.17%	3.23	2.851		
15	2.39%	2.98	2.33%	3.01	2.746		
16	2.55%	2.79	2.49%	2.81	2.728		
17	2.71%	2.63	2.65%	2.64	2.681		
18	2.87%	2.48	2.81%	2.49	2.621		
19	3.03%	2.35	2.97%	2.36	2.580		
20	3.18%	2.23	3.13%	2.24	2.460		
21	3.34%	2.13	3.28%	2.13	2.416		
22	3.50%	2.03	3.44%	2.03	2.414		
23	3.66%	1.94	3.60%	1.94	2.241		
24	3.82%	1.86	3.76%	1.86	2.173		
25	3.98%	1.79	3.92%	1.78	1.930		
26	4.14%	1.72	4.08%	1.71	1.905		
27	4.30%	1.66	4.24%	1.65	1.902		
28	4.46%	1.60	4.40%	1.59	1.764		
29	4.62%	1.54	4.56%	1.53	1.571		
30	4.78%	1.49	4.72%	1.48	1.519		
31	4.94%	1.44	4.88%	1.43	1.509		
32	5.10%	1.40	5.04%	1.39	1.437		
33	5.25%	1.35	5.20%	1.35	1.408		
34	5.41%	1.31	5.36%	1.31	1.312		
35	5.57%	1.28	5.52%	1.27	1.311		
36	5.73%	1.24	5.68%	1.23	1.308		
37	5.89%	1.21	5.84%	1.20	1.289		
38	6.05%	1.18	5.99%	1.17	1.128		
39	6.21%	1.15	6.15%	1.14	1.084		

40	6.37%	1.12	6.31%	1.11	1.034
41	6.53%	1.09	6.47%	1.08	0.944
42	6.69%	1.06	6.63%	1.06	0.881
43	6.85%	1.04	6.79%	1.03	0.869
44	7.01%	1.02	6.95%	1.01	0.862
45	7.17%	0.99	7.11%	0.98	0.854
46	7.32%	0.97	7.27%	0.96	0.846
47	7.48%	0.95	7.43%	0.94	0.800
48	7.64%	0.93	7.59%	0.92	0.769
49	7.80%	0.91	7.75%	0.90	0.762
50	7.96%	0.89	7.91%	0.88	0.738
51	8.12%	0.88	8.07%	0.87	0.733
52	8.28%	0.86	8.23%	0.85	0.709
53	8.44%	0.84	8.39%	0.83	0.687
54	8.60%	0.83	8.55%	0.82	0.642
55	8.76%	0.81	8.71%	0.80	0.640
56	8.92%	0.80	8.86%	0.79	0.613
57	9.08%	0.78	9.02%	0.78	0.601
58	9.24%	0.77	9.18%	0.76	0.588
59	9.39%	0.76	9.34%	0.75	0.579
60	9.55%	0.74	9.50%	0.74	0.566
61	9.71%	0.73	9.66%	0.72	0.566
62	9.87%	0.72	9.82%	0.71	0.564
63	10.03%	0.71	9.98%	0.70	0.556
64	10.19%	0.70	10.14%	0.69	0.554
65	10.35%	0.69	10.30%	0.68	0.549
66	10.51%	0.68	10.46%	0.67	0.546
67	10.67%	0.67	10.62%	0.66	0.541
68	10.83%	0.66	10.78%	0.65	0.537
69	10.99%	0.65	10.94%	0.64	0.536
70	11.15%	0.64	11.10%	0.63	0.521
71	11.31%	0.63	11.26%	0.62	0.513
72	11.46%	0.62	11.42%	0.61	0.497
73	11.62%	0.61	11.58%	0.60	0.491
74	11.78%	0.60	11.73%	0.60	0.490
75	11.94%	0.60	11.89%	0.59	0.482
76	12.10%	0.59	12.05%	0.58	0.479
77	12.26%	0.58	12.21%	0.57	0.476
78	12.42%	0.57	12.37%	0.57	0.473
79	12.58%	0.57	12.53%	0.56	0.453
80	12.74%	0.56	12.69%	0.55	0.450
81	12.90%	0.55	12.85%	0.54	0.449
82	13.06%	0.55	13.01%	0.54	0.444
83	13.22%	0.54	13.17%	0.53	0.434
84	13.38%	0.53	13.33%	0.53	0.433
85	13.54%	0.53	13.49%	0.52	0.429
86	13.69%	0.52	13.65%	0.51	0.416
87	13.85%	0.51	13.81%	0.51	0.411
88	14.01%	0.51	13.97%	0.50	0.410
89	14.17%	0.50	14.13%	0.50	0.410
90	14.33%	0.50	14.29%	0.49	0.410
91	14.49%	0.49	14.45%	0.48	0.403
92	14.65%	0.49	14.60%	0.48	0.396
93	14.81%	0.48	14.76%	0.47	0.393
94	14.97%	0.48	14.92%	0.47	0.389

95	15.13%	0.47	15.08%	0.46	0.385
96	15.29%	0.47	15.24%	0.46	0.385
97	15.45%	0.46	15.40%	0.45	0.383
98	15.61%	0.46	15.56%	0.45	0.377
99	15.76%	0.45	15.72%	0.45	0.375
100	15.92%	0.45	15.88%	0.44	0.370
101	16.08%	0.44	16.04%	0.44	0.370
102	16.24%	0.44	16.20%	0.43	0.370
103	16.40%	0.43	16.36%	0.43	0.368
104	16.56%	0.43	16.52%	0.42	0.366
105	16.72%	0.43	16.68%	0.42	0.365
106	16.88%	0.42	16.84%	0.42	0.365
107	17.04%	0.42	17.00%	0.41	0.363
108	17.20%	0.41	17.16%	0.41	0.361
109	17.36%	0.41	17.32%	0.40	0.359
110	17.52%	0.41	17.47%	0.40	0.356
111	17.68%	0.40	17.63%	0.40	0.351
112	17.83%	0.40	17.79%	0.39	0.350
113	17.99%	0.40	17.95%	0.39	0.350
114	18.15%	0.39	18.11%	0.39	0.345
115	18.31%	0.39	18.27%	0.38	0.344
116	18.47%	0.39	18.43%	0.38	0.341
117	18.63%	0.38	18.59%	0.38	0.338
118	18.79%	0.38	18.75%	0.37	0.337
119	18.95%	0.38	18.91%	0.37	0.336
120	19.11%	0.37	19.07%	0.37	0.335
121	19.27%	0.37	19.23%	0.36	0.329
122	19.43%	0.37	19.39%	0.36	0.327
123	19.59%	0.36	19.55%	0.36	0.327
124	19.75%	0.36	19.71%	0.36	0.324
125	19.90%	0.36	19.87%	0.35	0.319
126	20.06%	0.35	20.03%	0.35	0.316
127	20.22%	0.35	20.18%	0.35	0.310
128	20.38%	0.35	20.34%	0.34	0.309
129	20.54%	0.35	20.50%	0.34	0.309
130	20.70%	0.34	20.66%	0.34	0.308
131	20.86%	0.34	20.82%	0.34	0.308
132	21.02%	0.34	20.98%	0.33	0.307
133	21.18%	0.34	21.14%	0.33	0.307
134	21.34%	0.33	21.30%	0.33	0.305
135	21.50%	0.33	21.46%	0.33	0.304
136	21.66%	0.33	21.62%	0.32	0.303
137	21.82%	0.33	21.78%	0.32	0.290
138	21.97%	0.32	21.94%	0.32	0.287
139	22.13%	0.32	22.10%	0.32	0.287
140	22.29%	0.32	22.26%	0.31	0.285
141	22.45%	0.32	22.42%	0.31	0.280
doubt	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.280
143	22.77%	0.31	22.74%	0.31	0.279
144	22.93%	0.31	22.90%	0.31	0.279
145	23.09%	0.31	23.05%	0.30	0.274
146	23.25%	0.31	23.21%	0.30	0.273
147	23.41%	0.30	23.37%	0.30	0.271
148	23.57%	0.30	23.53%	0.30	0.262
149	23.73%	0.30	23.69%	0.30	0.259

150	23.89%	0.30	23.85%	0.29	0.259
151	24.04%	0.30	24.01%	0.29	0.256
152	24.20%	0.29	24.17%	0.29	0.254
153	24.36%	0.29	24.33%	0.29	0.252
154	24.52%	0.29	24.49%	0.29	0.252
155	24.68%	0.29	24.65%	0.28	0.251
156	24.84%	0.29	24.81%	0.28	0.247
157	25.00%	0.28	24.97%	0.28	0.245
158	25.16%	0.28	25.13%	0.28	0.244
159	25.32%	0.28	25.29%	0.28	0.242
160	25.48%	0.28	25.45%	0.28	0.236
161	25.64%	0.28	25.61%	0.27	0.235
162	25.80%	0.28	25.77%	0.27	0.230
163	25.96%	0.27	25.92%	0.27	0.228
164	26.11%	0.27	26.08%	0.27	0.228
165	26.27%	0.27	26.24%	0.27	0.228
166	26.43%	0.27	26.40%	0.27	0.228
167	26.59%	0.27	26.56%	0.26	0.222
168	26.75%	0.27	26.72%	0.26	0.221
169	26.91%	0.26	26.88%	0.26	0.220
170	27.07%	0.26	27.04%	0.26	0.218
171	27.23%	0.26	27.20%	0.26	0.216
172	27.39%	0.26	27.36%	0.26	0.212
173	27.55%	0.26	27.52%	0.25	0.209
174	27.71%	0.26	27.68%	0.25	0.208
175	27.87%	0.26	27.84%	0.25	0.205
176	28.03%	0.25	28.00%	0.25	0.199
177	28.18%	0.25	28.16%	0.25	0.196
178	28.34%	0.25	28.32%	0.25	0.194
179	28.50%	0.25	28.48%	0.25	0.187
180	28.66%	0.25	28.64%	0.24	0.185
181	28.82%	0.25	28.79%	0.24	0.184
182	28.98%	0.25	28.95%	0.24	0.182
183	29.14%	0.24	29.11%	0.24	0.181
184	29.30%	0.24	29.27%	0.24	0.181
185	29.46%	0.24	29.43%	0.24	0.180
186	29.62%	0.24	29.59%	0.24	0.177
187	29.78%	0.24	29.75%	0.24	0.177
188	29.94%	0.24	29.91%	0.23	0.175
189	30.10%	0.24	30.07%	0.23	0.175
190	30.25%	0.24	30.23%	0.23	0.174
191	30.41%	0.23	30.39%	0.23	0.172
192	30.57%	0.23	30.55%	0.23	0.167
193	30.73%	0.23	30.71%	0.23	0.166
194	30.89%	0.23	30.87%	0.23	0.162
195	31.05%	0.23	31.03%	0.23	0.161
196	31.21%	0.23	31.19%	0.22	0.159
197	31.37%	0.23	31.35%	0.22	0.157
198	31.53%	0.23	31.51%	0.22	0.154
199	31.69%	0.22	31.66%	0.22	0.154
200	31.85%	0.22	31.82%	0.22	0.153
201	32.01%	0.22	31.98%	0.22	0.153
202	32.17%	0.22	32.14%	0.22	0.149
203	32.32%	0.22	32.30%	0.22	0.148
204	32.48%	0.22	32.46%	0.22	0.148

205	32.64%	0.22	32.62%	0.21	0.147
206	32.80%	0.22	32.78%	0.21	0.147
207	32.96%	0.22	32.94%	0.21	0.145
208	33.12%	0.21	33.10%	0.21	0.144
209	33.28%	0.21	33.26%	0.21	0.143
210	33.44%	0.21	33.42%	0.21	0.141
211	33.60%	0.21	33.58%	0.21	0.141
212	33.76%	0.21	33.74%	0.21	0.141
213	33.92%	0.21	33.90%	0.21	0.134
214	34.08%	0.21	34.06%	0.21	0.134
215	34.24%	0.21	34.22%	0.20	0.133
216	34.39%	0.21	34.38%	0.20	0.133
217	34.55%	0.21	34.53%	0.20	0.133
218	34.71%	0.21	34.69%	0.20	0.133
219	34.87%	0.20	34.85%	0.20	0.133
220	35.03%	0.20	35.01%	0.20	0.133
221	35.19%	0.20	35.17%	0.20	0.132
222	35.35%	0.20	35.33%	0.20	0.130
223	35.51%	0.20	35.49%	0.20	0.128
224	35.67%	0.20	35.65%	0.20	0.125
225	35.83%	0.20	35.81%	0.20	0.125
226	35.99%	0.20	35.97%	0.19	0.124
227	36.15%	0.20	36.13%	0.19	0.124
228	36.31%	0.20	36.29%	0.19	0.123
229	36.46%	0.20	36.45%	0.19	0.120
230	36.62%	0.19	36.61%	0.19	0.119
231	36.78%	0.19	36.77%	0.19	0.119
232	36.94%	0.19	36.93%	0.19	0.119
233	37.10%	0.19	37.09%	0.19	0.118
234	37.26%	0.19	37.24%	0.19	0.117
235	37.42%	0.19	37.40%	0.19	0.116
236	37.58%	0.19	37.56%	0.19	0.116
237	37.74%	0.19	37.72%	0.19	0.116
238	37.90%	0.19	37.88%	0.18	0.114
239	38.06%	0.19	38.04%	0.18	0.114
240	38.22%	0.19	38.20%	0.18	0.114
241	38.38%	0.19	38.36%	0.18	0.111
242	38.54%	0.18	38.52%	0.18	0.111
243	38.69%	0.18	38.68%	0.18	0.111
244	38.85%	0.18	38.84%	0.18	0.110
245	39.01%	0.18	39.00%	0.18	0.110
246	39.17%	0.18	39.16%	0.18	0.110
247	39.33%	0.18	39.32%	0.18	0.109
248	39.49%	0.18	39.48%	0.18	0.109
249	39.65%	0.18	39.64%	0.18	0.109
250	39.81%	0.18	39.80%	0.18	0.108
251	39.97%	0.18	39.96%	0.18	0.108
252	40.13%	0.18	40.11%	0.17	0.108
253	40.29%	0.18	40.27%	0.17	0.108
254	40.45%	0.18	40.43%	0.17	0.107
255	40.61%	0.18	40.59%	0.17	0.107
256	40.76%	0.17	40.75%	0.17	0.106
257	40.92%	0.17	40.91%	0.17	0.106
258	41.08%	0.17	41.07%	0.17	0.105
259	41.24%	0.17	41.23%	0.17	0.105

260	41.40%	0.17	41.39%	0.17	0.104
261	41.56%	0.17	41.55%	0.17	0.102
262	41.72%	0.17	41.71%	0.17	0.102
263	41.88%	0.17	41.87%	0.17	0.100
264	42.04%	0.17	42.03%	0.17	0.100
265	42.20%	0.17	42.19%	0.17	0.100
266	42.36%	0.17	42.35%	0.17	0.100
267	42.52%	0.17	42.51%	0.16	0.100
268	42.68%	0.17	42.67%	0.16	0.099
269	42.83%	0.17	42.83%	0.16	0.099
270	42.99%	0.17	42.98%	0.16	0.099
271	43.15%	0.16	43.14%	0.16	0.099
272	43.31%	0.16	43.30%	0.16	0.099
273	43.47%	0.16	43.46%	0.16	0.098
274	43.63%	0.16	43.62%	0.16	0.098
275	43.79%	0.16	43.78%	0.16	0.098
276	43.95%	0.16	43.94%	0.16	0.098
277	44.11%	0.16	44.10%	0.16	0.097
278	44.27%	0.16	44.26%	0.16	0.097
279	44.43%	0.16	44.42%	0.16	0.097
280	44.59%	0.16	44.58%	0.16	0.096
281	44.75%	0.16	44.74%	0.16	0.095
282	44.90%	0.16	44.90%	0.16	0.094
283	45.06%	0.16	45.06%	0.16	0.094
284	45.22%	0.16	45.22%	0.15	0.094
285	45.38%	0.16	45.38%	0.15	0.092
286	45.54%	0.16	45.54%	0.15	0.091
287	45.70%	0.16	45.70%	0.15	0.091
288	45.86%	0.16	45.85%	0.15	0.090
289	46.02%	0.15	46.01%	0.15	0.089
290	46.18%	0.15	46.17%	0.15	0.089
291	46.34%	0.15	46.33%	0.15	0.085
292	46.50%	0.15	46.49%	0.15	0.085
293	46.66%	0.15	46.65%	0.15	0.084
294	46.82%	0.15	46.81%	0.15	0.084
295	46.97%	0.15	46.97%	0.15	0.084
296	47.13%	0.15	47.13%	0.15	0.084
297	47.29%	0.15	47.29%	0.15	0.084
298	47.45%	0.15	47.45%	0.15	0.084
299	47.61%	0.15	47.61%	0.15	0.084
300	47.77%	0.15	47.77%	0.15	0.084
301	47.93%	0.15	47.93%	0.15	0.083
302	48.09%	0.15	48.09%	0.15	0.083
303	48.25%	0.15	48.25%	0.15	0.083
304	48.41%	0.15	48.41%	0.14	0.083
305	48.57%	0.15	48.57%	0.14	0.083
306	48.73%	0.15	48.72%	0.14	0.083
307	48.89%	0.15	48.88%	0.14	0.083
308	49.04%	0.15	49.04%	0.14	0.083
309	49.20%	0.14	49.20%	0.14	0.083
310	49.36%	0.14	49.36%	0.14	0.083
311	49.52%	0.14	49.52%	0.14	0.083
312	49.68%	0.14	49.68%	0.14	0.083
313	49.84%	0.14	49.84%	0.14	0.083
314	50.00%	0.14	50.00%	0.14	0.083

315	50.16%	0.14	50.16%	0.14	0.082
316	50.32%	0.14	50.32%	0.14	0.082
317	50.48%	0.14	50.48%	0.14	0.082
318	50.64%	0.14	50.64%	0.14	0.082
319	50.80%	0.14	50.80%	0.14	0.082
320	50.96%	0.14	50.96%	0.14	0.082
321	51.11%	0.14	51.12%	0.14	0.082
322	51.27%	0.14	51.28%	0.14	0.082
323	51.43%	0.14	51.43%	0.14	0.081
324	51.59%	0.14	51.59%	0.14	0.081
325	51.75%	0.14	51.75%	0.14	0.081
326	51.91%	0.14	51.91%	0.13	0.080
327	52.07%	0.14	52.07%	0.13	0.078
328	52.23%	0.14	52.23%	0.13	0.077
329	52.39%	0.14	52.39%	0.13	0.077
330	52.55%	0.14	52.55%	0.13	0.077
331	52.71%	0.14	52.71%	0.13	0.075
332	52.87%	0.13	52.87%	0.13	0.075
333	53.03%	0.13	53.03%	0.13	0.074
334	53.18%	0.13	53.19%	0.13	0.073
335	53.34%	0.13	53.35%	0.13	0.072
336	53.50%	0.13	53.51%	0.13	0.072
337	53.66%	0.13	53.67%	0.13	0.071
338	53.82%	0.13	53.83%	0.13	0.071
339	53.98%	0.13	53.99%	0.13	0.071
340	54.14%	0.13	54.15%	0.13	0.071
341	54.30%	0.13	54.30%	0.13	0.070
342	54.46%	0.13	54.46%	0.13	0.070
343	54.62%	0.13	54.62%	0.13	0.070
344	54.78%	0.13	54.78%	0.13	0.067
345	54.94%	0.13	54.94%	0.13	0.067
346	55.10%	0.13	55.10%	0.13	0.067
347	55.25%	0.13	55.26%	0.13	0.067
348	55.41%	0.13	55.42%	0.13	0.067
349	55.57%	0.13	55.58%	0.13	0.067
350	55.73%	0.13	55.74%	0.13	0.067
351	55.89%	0.13	55.90%	0.13	0.067
352	56.05%	0.13	56.06%	0.12	0.067
353	56.21%	0.13	56.22%	0.12	0.067
354	56.37%	0.13	56.38%	0.12	0.067
355	56.53%	0.13	56.54%	0.12	0.067
356	56.69%	0.13	56.70%	0.12	0.067
357	56.85%	0.13	56.86%	0.12	0.067
358	57.01%	0.12	57.02%	0.12	0.066
359	57.17%	0.12	57.17%	0.12	0.066
360	57.32%	0.12	57.33%	0.12	0.066
361	57.48%	0.12	57.49%	0.12	0.066
362	57.64%	0.12	57.65%	0.12	0.066
363	57.80%	0.12	57.81%	0.12	0.065
364	57.96%	0.12	57.97%	0.12	0.065
365	58.12%	0.12	58.13%	0.12	0.065
366	58.28%	0.12	58.29%	0.12	0.065
367	58.44%	0.12	58.45%	0.12	0.065
368	58.60%	0.12	58.61%	0.12	0.065
369	58.76%	0.12	58.77%	0.12	0.065

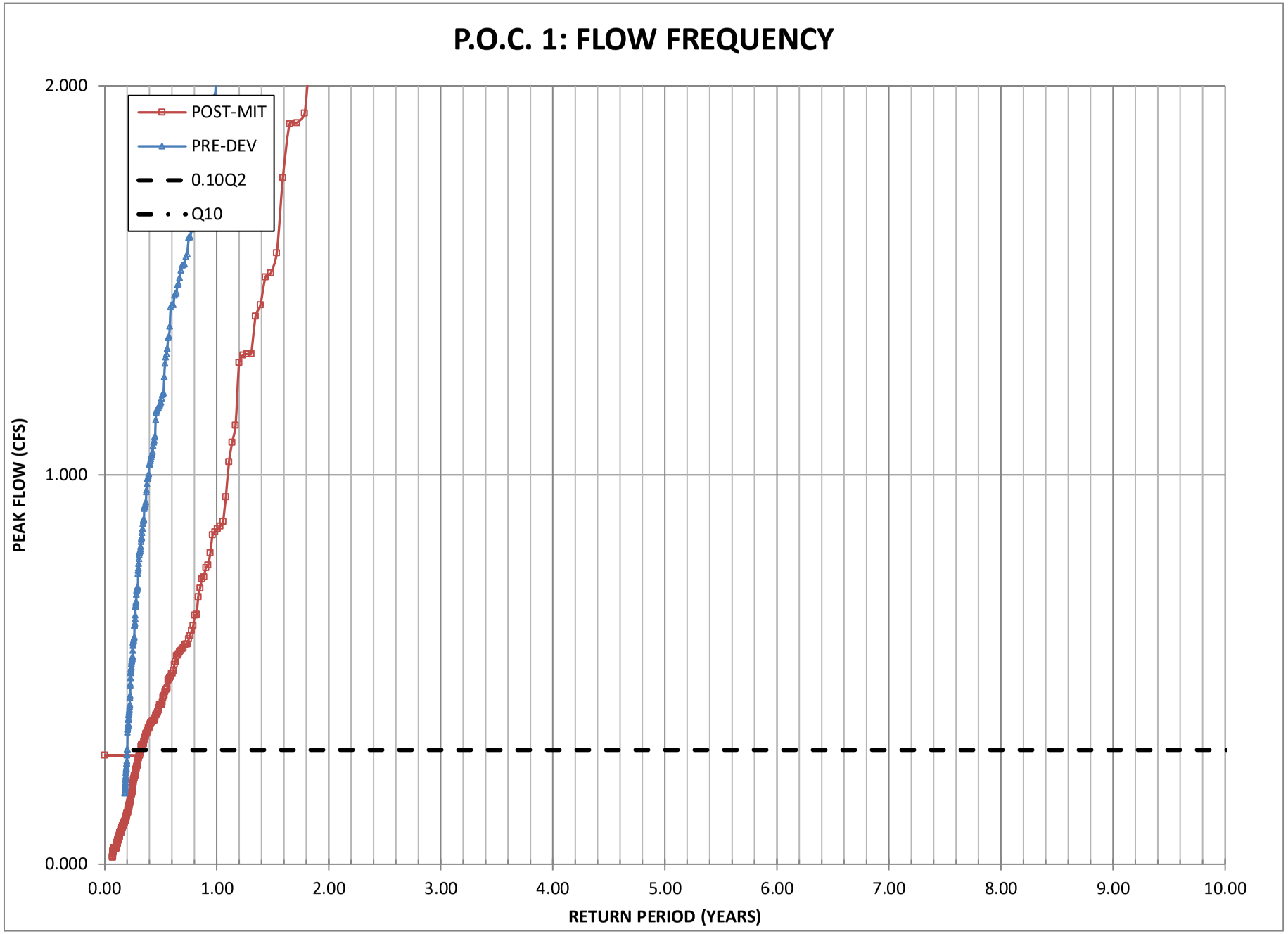
370	58.92%	0.12	58.93%	0.12	0.063
371	59.08%	0.12	59.09%	0.12	0.063
372	59.24%	0.12	59.25%	0.12	0.063
373	59.39%	0.12	59.41%	0.12	0.063
374	59.55%	0.12	59.57%	0.12	0.062
375	59.71%	0.12	59.73%	0.12	0.062
376	59.87%	0.12	59.89%	0.12	0.061
377	60.03%	0.12	60.04%	0.12	0.061
378	60.19%	0.12	60.20%	0.12	0.060
379	60.35%	0.12	60.36%	0.12	0.060
380	60.51%	0.12	60.52%	0.12	0.059
381	60.67%	0.12	60.68%	0.12	0.058
382	60.83%	0.12	60.84%	0.12	0.058
383	60.99%	0.12	61.00%	0.11	0.058
384	61.15%	0.12	61.16%	0.11	0.058
385	61.31%	0.12	61.32%	0.11	0.057
386	61.46%	0.12	61.48%	0.11	0.057
387	61.62%	0.12	61.64%	0.11	0.057
388	61.78%	0.12	61.80%	0.11	0.056
389	61.94%	0.11	61.96%	0.11	0.056
390	62.10%	0.11	62.12%	0.11	0.056
391	62.26%	0.11	62.28%	0.11	0.056
392	62.42%	0.11	62.44%	0.11	0.054
393	62.58%	0.11	62.60%	0.11	0.054
394	62.74%	0.11	62.76%	0.11	0.054
395	62.90%	0.11	62.91%	0.11	0.053
396	63.06%	0.11	63.07%	0.11	0.052
397	63.22%	0.11	63.23%	0.11	0.052
398	63.38%	0.11	63.39%	0.11	0.052
399	63.54%	0.11	63.55%	0.11	0.052
400	63.69%	0.11	63.71%	0.11	0.051
401	63.85%	0.11	63.87%	0.11	0.051
402	64.01%	0.11	64.03%	0.11	0.050
403	64.17%	0.11	64.19%	0.11	0.050
404	64.33%	0.11	64.35%	0.11	0.050
405	64.49%	0.11	64.51%	0.11	0.050
406	64.65%	0.11	64.67%	0.11	0.050
407	64.81%	0.11	64.83%	0.11	0.050
408	64.97%	0.11	64.99%	0.11	0.050
409	65.13%	0.11	65.15%	0.11	0.050
410	65.29%	0.11	65.31%	0.11	0.050
411	65.45%	0.11	65.47%	0.11	0.050
412	65.61%	0.11	65.63%	0.11	0.049
413	65.76%	0.11	65.78%	0.11	0.049
414	65.92%	0.11	65.94%	0.11	0.049
415	66.08%	0.11	66.10%	0.11	0.048
416	66.24%	0.11	66.26%	0.11	0.048
417	66.40%	0.11	66.42%	0.11	0.048
418	66.56%	0.11	66.58%	0.11	0.048
419	66.72%	0.11	66.74%	0.10	0.048
420	66.88%	0.11	66.90%	0.10	0.048
421	67.04%	0.11	67.06%	0.10	0.047
422	67.20%	0.11	67.22%	0.10	0.047
423	67.36%	0.11	67.38%	0.10	0.047
424	67.52%	0.11	67.54%	0.10	0.046

425	67.68%	0.11	67.70%	0.10	0.046
426	67.83%	0.10	67.86%	0.10	0.046
427	67.99%	0.10	68.02%	0.10	0.045
428	68.15%	0.10	68.18%	0.10	0.045
429	68.31%	0.10	68.34%	0.10	0.044
430	68.47%	0.10	68.49%	0.10	0.042
431	68.63%	0.10	68.65%	0.10	0.042
432	68.79%	0.10	68.81%	0.10	0.042
433	68.95%	0.10	68.97%	0.10	0.042
434	69.11%	0.10	69.13%	0.10	0.042
435	69.27%	0.10	69.29%	0.10	0.042
436	69.43%	0.10	69.45%	0.10	0.042
437	69.59%	0.10	69.61%	0.10	0.042
438	69.75%	0.10	69.77%	0.10	0.042
439	69.90%	0.10	69.93%	0.10	0.042
440	70.06%	0.10	70.09%	0.10	0.042
441	70.22%	0.10	70.25%	0.10	0.042
442	70.38%	0.10	70.41%	0.10	0.042
443	70.54%	0.10	70.57%	0.10	0.042
444	70.70%	0.10	70.73%	0.10	0.042
445	70.86%	0.10	70.89%	0.10	0.042
446	71.02%	0.10	71.05%	0.10	0.042
447	71.18%	0.10	71.21%	0.10	0.042
448	71.34%	0.10	71.36%	0.10	0.042
449	71.50%	0.10	71.52%	0.10	0.042
450	71.66%	0.10	71.68%	0.10	0.042
451	71.82%	0.10	71.84%	0.10	0.042
452	71.97%	0.10	72.00%	0.10	0.042
453	72.13%	0.10	72.16%	0.10	0.042
454	72.29%	0.10	72.32%	0.10	0.042
455	72.45%	0.10	72.48%	0.10	0.042
456	72.61%	0.10	72.64%	0.10	0.042
457	72.77%	0.10	72.80%	0.10	0.042
458	72.93%	0.10	72.96%	0.10	0.042
459	73.09%	0.10	73.12%	0.10	0.042
460	73.25%	0.10	73.28%	0.10	0.042
461	73.41%	0.10	73.44%	0.10	0.042
462	73.57%	0.10	73.60%	0.10	0.042
463	73.73%	0.10	73.76%	0.09	0.042
464	73.89%	0.10	73.92%	0.09	0.042
465	74.04%	0.10	74.08%	0.09	0.042
466	74.20%	0.10	74.23%	0.09	0.042
467	74.36%	0.10	74.39%	0.09	0.042
468	74.52%	0.10	74.55%	0.09	0.042
469	74.68%	0.10	74.71%	0.09	0.042
470	74.84%	0.10	74.87%	0.09	0.042
471	75.00%	0.09	75.03%	0.09	0.042
472	75.16%	0.09	75.19%	0.09	0.042
473	75.32%	0.09	75.35%	0.09	0.042
474	75.48%	0.09	75.51%	0.09	0.042
475	75.64%	0.09	75.67%	0.09	0.042
476	75.80%	0.09	75.83%	0.09	0.042
477	75.96%	0.09	75.99%	0.09	0.042
478	76.11%	0.09	76.15%	0.09	0.042
479	76.27%	0.09	76.31%	0.09	0.042

480	76.43%	0.09	76.47%	0.09	0.042
481	76.59%	0.09	76.63%	0.09	0.042
482	76.75%	0.09	76.79%	0.09	0.042
483	76.91%	0.09	76.95%	0.09	0.042
484	77.07%	0.09	77.10%	0.09	0.042
485	77.23%	0.09	77.26%	0.09	0.042
486	77.39%	0.09	77.42%	0.09	0.042
487	77.55%	0.09	77.58%	0.09	0.042
488	77.71%	0.09	77.74%	0.09	0.042
489	77.87%	0.09	77.90%	0.09	0.042
490	78.03%	0.09	78.06%	0.09	0.042
491	78.18%	0.09	78.22%	0.09	0.042
492	78.34%	0.09	78.38%	0.09	0.042
493	78.50%	0.09	78.54%	0.09	0.042
494	78.66%	0.09	78.70%	0.09	0.042
495	78.82%	0.09	78.86%	0.09	0.042
496	78.98%	0.09	79.02%	0.09	0.042
497	79.14%	0.09	79.18%	0.09	0.042
498	79.30%	0.09	79.34%	0.09	0.042
499	79.46%	0.09	79.50%	0.09	0.042
500	79.62%	0.09	79.66%	0.09	0.042
501	79.78%	0.09	79.82%	0.09	0.042
502	79.94%	0.09	79.97%	0.09	0.042
503	80.10%	0.09	80.13%	0.09	0.042
504	80.25%	0.09	80.29%	0.09	0.042
505	80.41%	0.09	80.45%	0.09	0.042
506	80.57%	0.09	80.61%	0.09	0.042
507	80.73%	0.09	80.77%	0.09	0.042
508	80.89%	0.09	80.93%	0.09	0.042
509	81.05%	0.09	81.09%	0.09	0.042
510	81.21%	0.09	81.25%	0.09	0.042
511	81.37%	0.09	81.41%	0.09	0.042
512	81.53%	0.09	81.57%	0.09	0.042
513	81.69%	0.09	81.73%	0.09	0.042
514	81.85%	0.09	81.89%	0.09	0.042
515	82.01%	0.09	82.05%	0.09	0.042
516	82.17%	0.09	82.21%	0.09	0.042
517	82.32%	0.09	82.37%	0.08	0.042
518	82.48%	0.09	82.53%	0.08	0.042
519	82.64%	0.09	82.68%	0.08	0.042
520	82.80%	0.09	82.84%	0.08	0.042
521	82.96%	0.09	83.00%	0.08	0.042
522	83.12%	0.09	83.16%	0.08	0.042
523	83.28%	0.09	83.32%	0.08	0.042
524	83.44%	0.09	83.48%	0.08	0.042
525	83.60%	0.09	83.64%	0.08	0.042
526	83.76%	0.08	83.80%	0.08	0.042
527	83.92%	0.08	83.96%	0.08	0.042
528	84.08%	0.08	84.12%	0.08	0.042
529	84.24%	0.08	84.28%	0.08	0.042
530	84.39%	0.08	84.44%	0.08	0.042
531	84.55%	0.08	84.60%	0.08	0.042
532	84.71%	0.08	84.76%	0.08	0.042
533	84.87%	0.08	84.92%	0.08	0.042
534	85.03%	0.08	85.08%	0.08	0.042

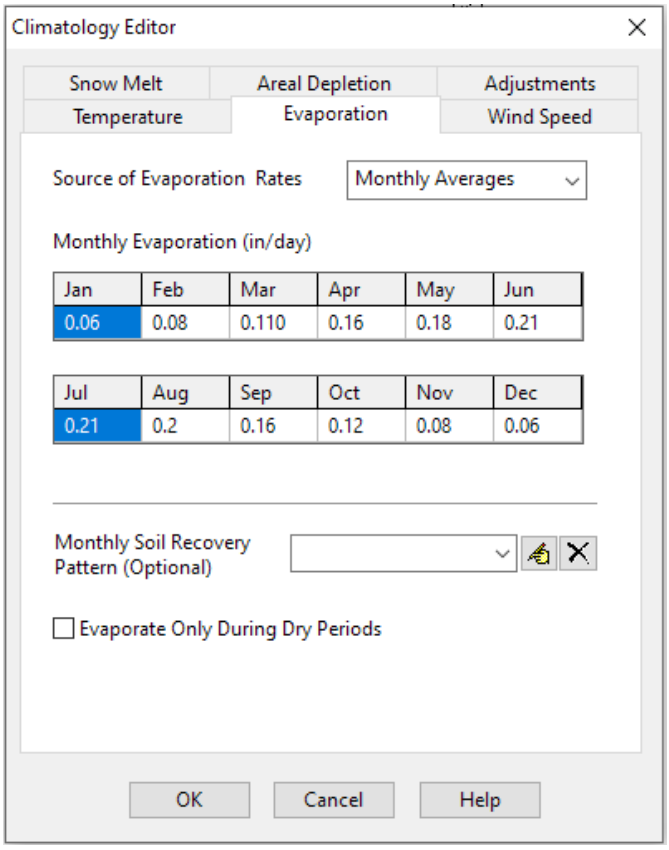
535	85.19%	0.08	85.24%	0.08	0.042
536	85.35%	0.08	85.40%	0.08	0.042
537	85.51%	0.08	85.55%	0.08	0.042
538	85.67%	0.08	85.71%	0.08	0.042
539	85.83%	0.08	85.87%	0.08	0.042
540	85.99%	0.08	86.03%	0.08	0.042
541	86.15%	0.08	86.19%	0.08	0.042
542	86.31%	0.08	86.35%	0.08	0.042
543	86.46%	0.08	86.51%	0.08	0.042
544	86.62%	0.08	86.67%	0.08	0.042
545	86.78%	0.08	86.83%	0.08	0.042
546	86.94%	0.08	86.99%	0.08	0.042
547	87.10%	0.08	87.15%	0.08	0.042
548	87.26%	0.08	87.31%	0.08	0.042
549	87.42%	0.08	87.47%	0.08	0.042
550	87.58%	0.08	87.63%	0.08	0.042
551	87.74%	0.08	87.79%	0.08	0.042
552	87.90%	0.08	87.95%	0.08	0.042
553	88.06%	0.08	88.11%	0.08	0.042
554	88.22%	0.08	88.27%	0.08	0.042
555	88.38%	0.08	88.42%	0.08	0.042
556	88.54%	0.08	88.58%	0.08	0.042
557	88.69%	0.08	88.74%	0.08	0.042
558	88.85%	0.08	88.90%	0.08	0.042
559	89.01%	0.08	89.06%	0.08	0.042
560	89.17%	0.08	89.22%	0.08	0.042
561	89.33%	0.08	89.38%	0.08	0.042
562	89.49%	0.08	89.54%	0.08	0.042
563	89.65%	0.08	89.70%	0.08	0.041
564	89.81%	0.08	89.86%	0.08	0.041
565	89.97%	0.08	90.02%	0.08	0.040
566	90.13%	0.08	90.18%	0.08	0.038
567	90.29%	0.08	90.34%	0.08	0.038
568	90.45%	0.08	90.50%	0.08	0.037
569	90.61%	0.08	90.66%	0.08	0.037
570	90.76%	0.08	90.82%	0.08	0.037
571	90.92%	0.08	90.98%	0.08	0.037
572	91.08%	0.08	91.14%	0.08	0.037
573	91.24%	0.08	91.29%	0.08	0.035
574	91.40%	0.08	91.45%	0.08	0.034
575	91.56%	0.08	91.61%	0.08	0.034
576	91.72%	0.08	91.77%	0.08	0.033
577	91.88%	0.08	91.93%	0.08	0.033
578	92.04%	0.08	92.09%	0.08	0.033
579	92.20%	0.08	92.25%	0.08	0.033
580	92.36%	0.08	92.41%	0.08	0.033
581	92.52%	0.08	92.57%	0.08	0.033
582	92.68%	0.08	92.73%	0.08	0.033
583	92.83%	0.08	92.89%	0.08	0.033
584	92.99%	0.08	93.05%	0.08	0.033
585	93.15%	0.08	93.21%	0.08	0.033
586	93.31%	0.08	93.37%	0.07	0.033
587	93.47%	0.08	93.53%	0.07	0.033
588	93.63%	0.08	93.69%	0.07	0.033
589	93.79%	0.08	93.85%	0.07	0.033

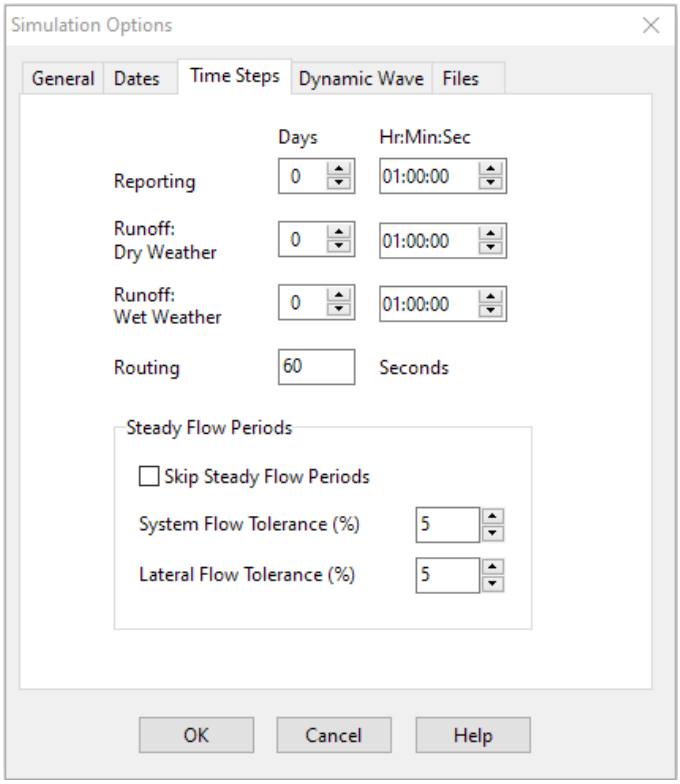
590	93.95%	0.08	94.01%	0.07	0.033
591	94.11%	0.08	94.16%	0.07	0.033
592	94.27%	0.08	94.32%	0.07	0.033
593	94.43%	0.08	94.48%	0.07	0.033
594	94.59%	0.08	94.64%	0.07	0.033
595	94.75%	0.08	94.80%	0.07	0.033
596	94.90%	0.07	94.96%	0.07	0.033
597	95.06%	0.07	95.12%	0.07	0.032
598	95.22%	0.07	95.28%	0.07	0.032
599	95.38%	0.07	95.44%	0.07	0.032
600	95.54%	0.07	95.60%	0.07	0.032
601	95.70%	0.07	95.76%	0.07	0.032
602	95.86%	0.07	95.92%	0.07	0.032
603	96.02%	0.07	96.08%	0.07	0.032
604	96.18%	0.07	96.24%	0.07	0.032
605	96.34%	0.07	96.40%	0.07	0.032
606	96.50%	0.07	96.56%	0.07	0.032
607	96.66%	0.07	96.72%	0.07	0.031
608	96.82%	0.07	96.88%	0.07	0.031
609	96.97%	0.07	97.03%	0.07	0.031
610	97.13%	0.07	97.19%	0.07	0.031
611	97.29%	0.07	97.35%	0.07	0.031
612	97.45%	0.07	97.51%	0.07	0.029
613	97.61%	0.07	97.67%	0.07	0.028
614	97.77%	0.07	97.83%	0.07	0.028
615	97.93%	0.07	97.99%	0.07	0.028
616	98.09%	0.07	98.15%	0.07	0.027
617	98.25%	0.07	98.31%	0.07	0.026
618	98.41%	0.07	98.47%	0.07	0.025
619	98.57%	0.07	98.63%	0.07	0.021
620	98.73%	0.07	98.79%	0.07	0.020
621	98.89%	0.07	98.95%	0.07	0.020
622	99.04%	0.07	99.11%	0.07	0.020
623	99.20%	0.07	99.27%	0.07	0.020
624	99.36%	0.07	99.43%	0.07	0.020
625	99.52%	0.07	99.59%	0.07	0.019
626	99.68%	0.07	99.74%	0.07	0.019
627	99.84%	0.07	99.90%	0.07	0.018


P.O.C. 1: FLOW FREQUENCY
POST-MIT
PRE-DEV
0.10Q2
Q10
2.000
1.000
0.000
PEAK FLOW (CFS)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
RETURN PERIOD (YEARS)

APPENDIX II: SUMMARY OF INPUT DATA/PARAMETERS

GENERAL OPTIONS & CLIMATOLOGY





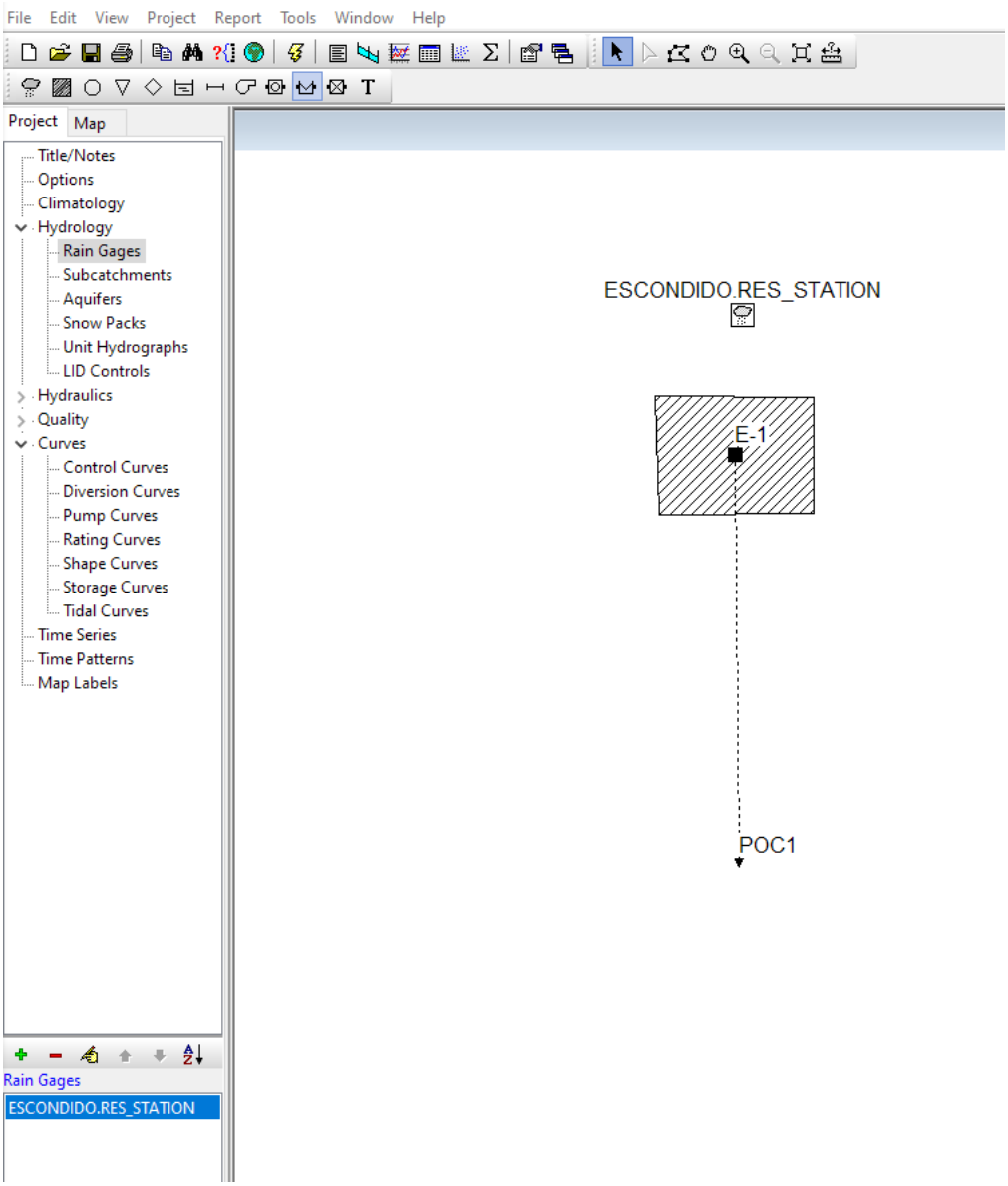
RAIN GAGES

Rain Gage ESCONDIDO.RES_STATION

Property	Value
Name	ESCONDIDO.RES_STATION
X-Coordinate	4725.275
Y-Coordinate	8538.462
Description	
Tag	
Rain Format	INTENSITY
Time Interval	1:00
Snow Catch Factor	1.0
Data Source	TIMESERIES
TIME SERIES:	
- Series Name	TS2
DATA FILE:	
- File Name	*
- Station ID	*
- Rain Units	IN

User-assigned name of rain gage

EXISTING CONDITION



Subcatchment E-1

Property	Value
Name	E-1
X-Coordinate	4644.309
Y-Coordinate	7337.398
Description	PRE-DEV
Tag	
Rain Gage	ESCONDIDO.RES_STATION
Outlet	POC1
Area	8.82
Width	415
% Slope	6
% Imperv	0
N-Imperv	0.012
N-Perv	.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT

User-assigned name of subcatchment

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	.025
Initial Deficit	.3

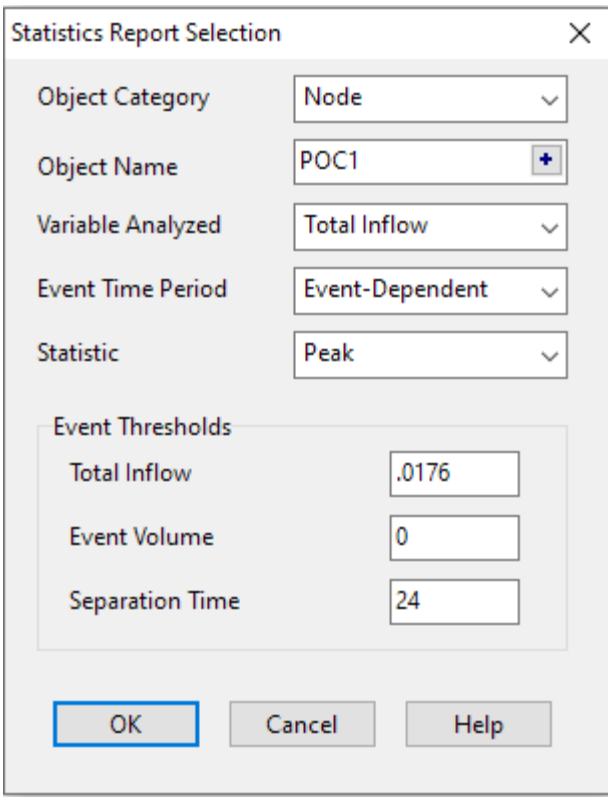
Soil capillary suction head (inches or mm)

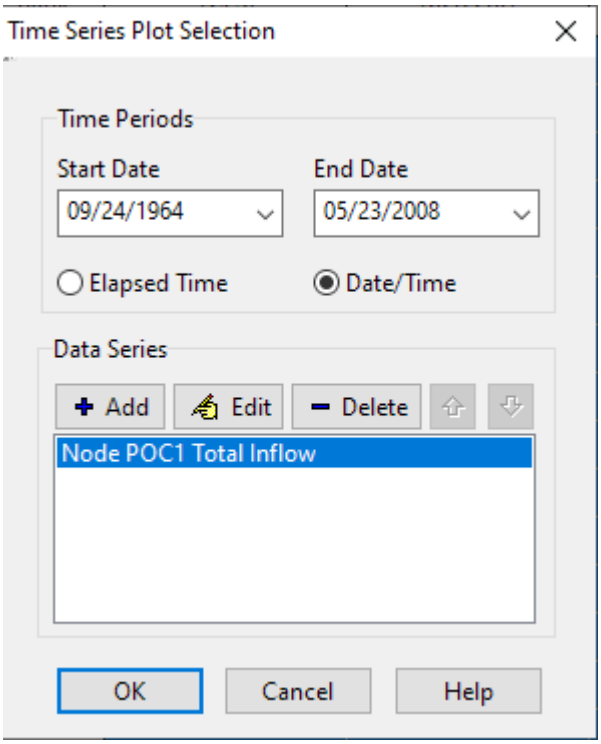
OK Cancel Help

Outfall POC1

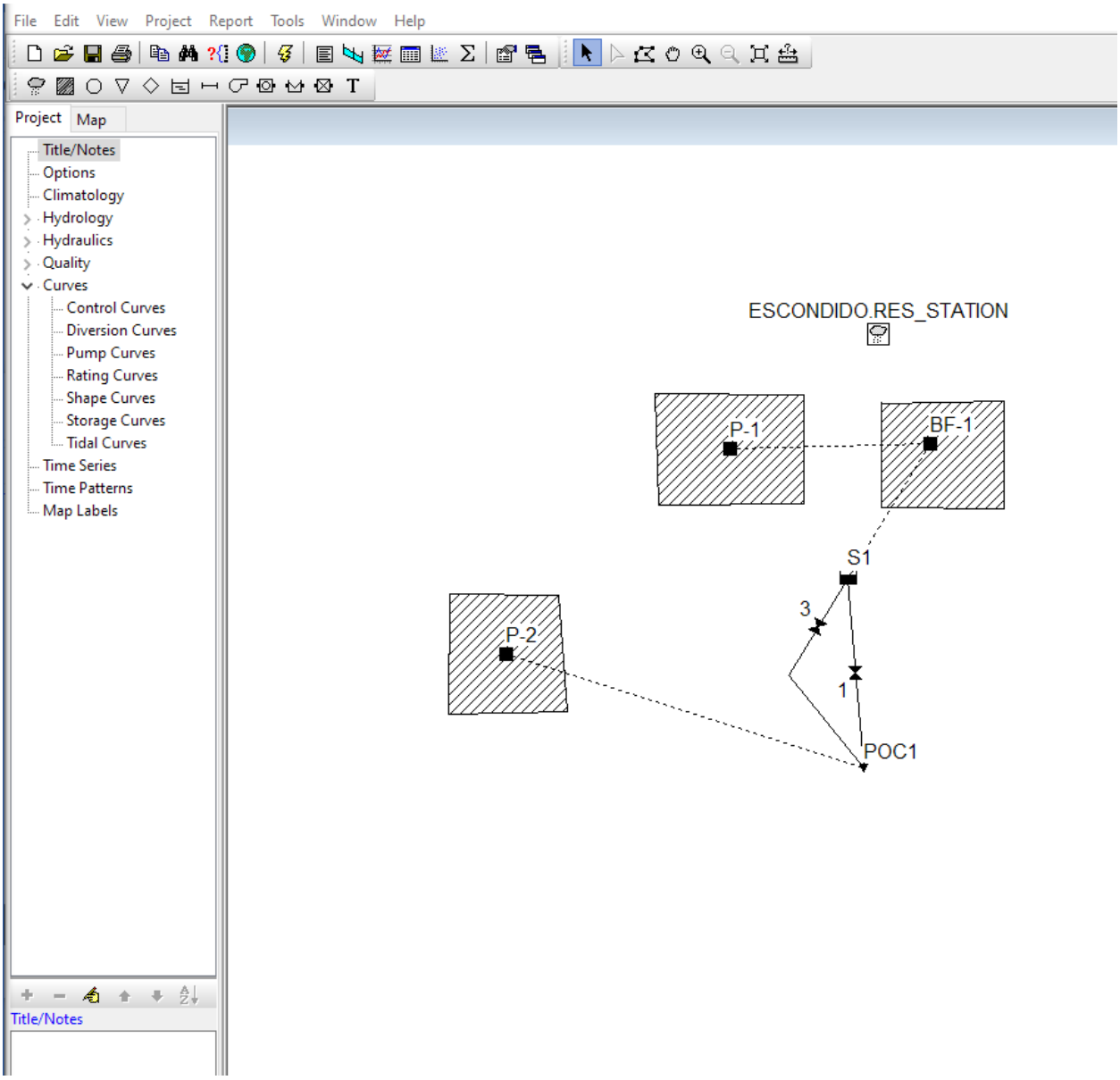
Property	Value
Name	POC1
X-Coordinate	4670.330
Y-Coordinate	3780.220
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Tide Gate	NO
Route To	
Type	FREE
Fixed Outfall	
Fixed Stage	0
Tidal Outfall	
Curve Name	*
Time Series Outfall	
Series Name	*

User-assigned name of outfall


Statistics Report Selection
Object Category
Node
Object Name
POC1
Variable Analyzed
Total Inflow
Event Time Period
Event-Dependent
Statistic
Peak
Event Thresholds
Total Inflow
.0176
Event Volume
0
Separation Time
24
OK
Cancel
Help


Time Series Plot Selection
Time Periods
Start Date
09/24/1964
End Date
05/23/2008
Elapsed Time
Date/Time
Data Series
Add
Edit
Delete
Node POC1 Total Inflow
OK
Cancel
Help

POST-DEVELOPMENT CONDITION



Subcatchment P-1

Property	Value
Name	P-1
X-Coordinate	4939.560
Y-Coordinate	7175.825
Description	POST-DEV
Tag	
Rain Gage	ESCONDIDO.RES_STATION
Outlet	BF-1
Area	7.273
Width	640
% Slope	2.3
% Imperv	80
N-Imperv	0.012
N-Perv	.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

User-assigned name of subcatchment

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	.025
Initial Deficit	.3

Soil capillary suction head (inches or mm)

OK Cancel Help

Subcatchment BF-1

Property	Value
Name	BF-1
X-Coordinate	6810.842
Y-Coordinate	7220.300
Description	
Tag	
Rain Gage	ESCONDIDO.RES_STATION
Outlet	S1
Area	.153
Width	140
% Slope	0
% Imperv	0
N-Imperv	0.012
N-Perv	0.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT ...
Groundwater	NO
Snow Pack	
LID Controls	1
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Infiltration parameters (click to edit)

Subcatchment P-2

Property	Value
Name	P-2
X-Coordinate	2860.438
Y-Coordinate	5268.166
Description	
Tag	
Rain Gage	ESCONDIDO.RES_STATION
Outlet	POC1
Area	1.402
Width	360
% Slope	10
% Imperv	30
N-Imperv	0.012
N-Perv	.15
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT ...
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Infiltration parameters (click to edit)

Storage Unit S1

Property	Value
Name	S1
X-Coordinate	6035.422
Y-Coordinate	5967.302
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Max. Depth	5.45
Initial Depth	0
Ponded Area	0
Evap. Factor	1
Seepage Loss	YES
Storage Curve	TABULAR
Functional Curve	
Coefficient	1000
Exponent	0
Constant	0
Tabular Curve	
Curve Name	BF

Storage Curve Editor

Curve Name: BF

Description:

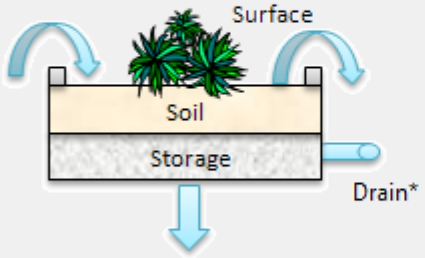
	Depth (ft)	Area (ft2)
1	0	7191
2	5.45	13962
3		
4		
5		
6		
7		
8		
9		
10		
11		

View... Load... Save... OK Cancel Help

LID Control Editor

Control Name: BF-3

LID Type: Bio-Retention Cell



*Optional

OK Cancel Help

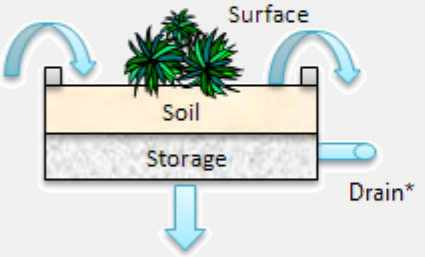
Surface | Soil | Storage | Drain

Berm Height (in. or mm)	6
Vegetation Volume Fraction	0.0
Surface Roughness (Mannings n)	0
Surface Slope (percent)	0

LID Control Editor

Control Name: BF-3

LID Type: Bio-Retention Cell



*Optional

OK Cancel Help

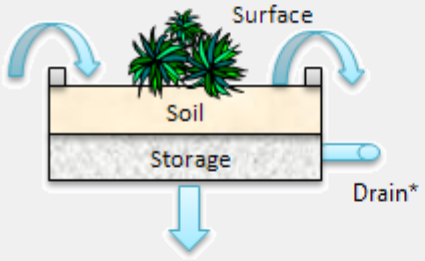
Surface | Soil | Storage | Drain

Thickness (in. or mm)	21
Porosity (volume fraction)	.4
Field Capacity (volume fraction)	0.2
Wilting Point (volume fraction)	0.1
Conductivity (in/hr or mm/hr)	5
Conductivity Slope	5
Suction Head (in. or mm)	1.5

LID Control Editor

Control Name: BF-3

LID Type: Bio-Retention Cell



*Optional

OK Cancel Help

Surface | Soil | Storage | Drain

Thickness (in. or mm): 18

Void Ratio (Voids / Solids): .6

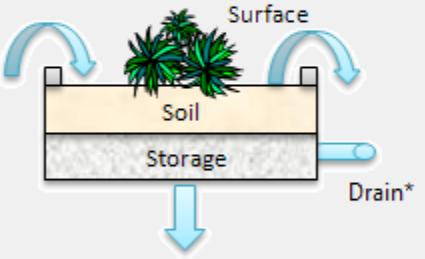
Seepage Rate (in/hr or mm/hr): .02

Clogging Factor: 0

LID Control Editor

Control Name: BF-3

LID Type: Bio-Retention Cell



*Optional

OK Cancel Help

Surface | Soil | Storage | Drain

Flow Coefficient*: .07

Flow Exponent: 0.5

Offset Height (in. or mm): 3

Drain Advisor

*Units are for flow in either in/hr or mm/hr; use 0 if there is no drain.

Orifice 3

Property	Value
Name	3
Inlet Node	S1
Outlet Node	POC1
Description	
Tag	
Type	SIDE
Shape	CIRCULAR
Height	.25
Width	0
Inlet Offset	3.25
Discharge Coeff.	0.65
Flap Gate	NO
Time to Open/Close	0

User-assigned name of orifice

Weir 1

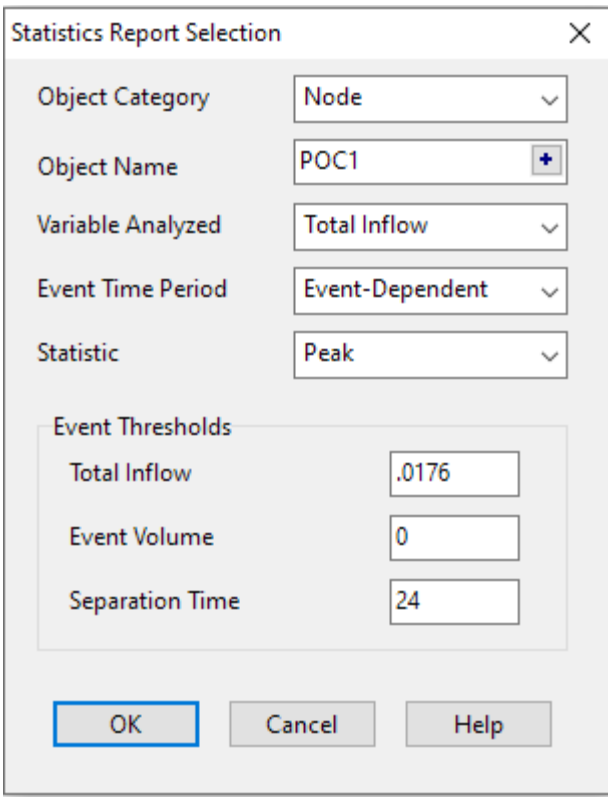
Property	Value
Name	1
Inlet Node	S1
Outlet Node	POC1
Description	
Tag	
Type	TRANSVERSE
Height	.1
Length	20
Side Slope	0
Inlet Offset	3.95
Discharge Coeff.	3.33
Flap Gate	NO
End Contractions	0

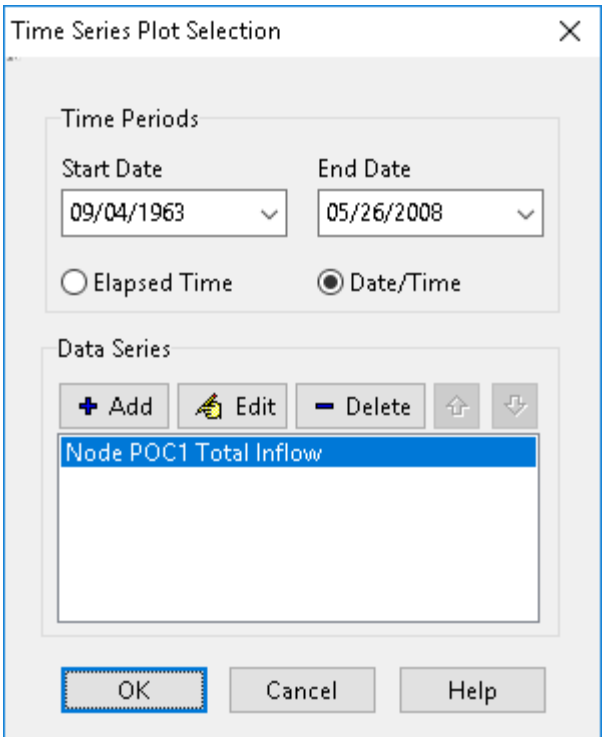
User-assigned name of weir

Outfall POC1

Property	Value
Name	POC1
X-Coordinate	6185.286
Y-Coordinate	4209.809
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Tide Gate	NO
Route To	
Type	FREE
Fixed Outfall	
Fixed Stage	0
Tidal Outfall	
Curve Name	*
Time Series Outfall	
Series Name	*

User-assigned name of outfall


Statistics Report Selection
Object Category
Node
Object Name
POC1
Variable Analyzed
Total Inflow
Event Time Period
Event-Dependent
Statistic
Peak
Event Thresholds
Total Inflow
.0176
Event Volume
0
Separation Time
24
OK
Cancel
Help


Time Series Plot Selection
Time Periods
Start Date
09/04/1963
End Date
05/26/2008
Elapsed Time
Date/Time
Data Series
Add
Edit
Delete
Node POC1 Total Inflow
OK
Cancel
Help

APPENDIX III: DRAIN COEFFICIENT CALCULATION SUMMARY

PA-12 APARTMENTS

SWMM MODEL - DRAIN ORIFICE CALULCATION SUMM

BASIN ID	**BF-1**	
DRAIN COEFF, C	0.07	
T, DRAIN TIME (HRS)	72	HR
D, DEPTH (IN)	39	IN

cg	0.6
ALID	19863.4
D	2
g	32.2

ATTACHMENT 3
Structural BMP Maintenance Information

This is the cover sheet for Attachment 3.

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	Contents	Checklist
Attachment 3a	Structural BMP Maintenance Thresholds and Actions (Required)	☒ Included See Structural BMP Maintenance Information Checklist on the back of this Attachment cover sheet.
Attachment 3b	Draft Maintenance Agreement (when applicable)	☐ Included ☒ Not Applicable for discretionary phase.

Use this checklist to ensure the required information has been included in the Structural BMP Maintenance Information Attachment:

☒ **Preliminary Design / Planning / CEQA level submittal:**

Attachment 3a must identify:

☒ Typical maintenance indicators and actions for proposed structural BMP(s) based on Section 7.7 of the BMP Design Manual

Attachment 3b is not required for preliminary design / planning / CEQA level submittal.

☐ **Final Design level submittal:**

Attachment 3a must identify:

- ☐ Specific maintenance indicators and actions for proposed structural BMP(s). This shall be based on Section 7.7 of the BMP Design Manual and enhanced to reflect actual proposed components of the structural BMP(s)
- ☐ How to access the structural BMP(s) to inspect and perform maintenance
- ☐ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
- ☐ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
- ☐ Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
- ☐ Recommended equipment to perform maintenance
- ☐ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management

Attachment 3b: For private entity operation and maintenance, Attachment 3b shall include a draft maintenance agreement in the local jurisdiction's standard format (PDP applicant to contact the [City Engineer] to obtain the current maintenance agreement forms).

BF-1
Biofiltration

BMP MAINTENANCE FACT SHEET
FOR
STRUCTURAL BMP BF-1 BIOFILTRATION

Biofiltration facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Biofiltration facilities have limited or no infiltration. They are typically designed to provide enough hydraulic head to move flows through the underdrain connection to the storm drain system. Typical biofiltration components include:

- Inflow distribution mechanisms (e.g., perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Impermeable liner or uncompacted native soils at the bottom of the facility
- Overflow structure

Normal Expected Maintenance

Biofiltration requires routine maintenance to: remove accumulated materials such as sediment, trash or debris; maintain vegetation health; maintain infiltration capacity of the media layer; replenish mulch; and maintain integrity of side slopes, inlets, energy dissipators, and outlets. A summary table of standard inspection and maintenance indicators is provided within this Fact Sheet.

Non-Standard Maintenance or BMP Failure

If any of the following scenarios are observed, the BMP is not performing as intended to protect downstream waterways from pollution and/or erosion. Corrective maintenance, increased inspection and maintenance, BMP replacement, or a different BMP type will be required.

- The BMP is not drained between storm events. Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health, and surface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Poor drainage can result from clogging of the media layer, filter course, aggregate storage layer, underdrain, or outlet structure. The specific cause of the drainage issue must be determined and corrected.
- Sediment, trash, or debris accumulation greater than 25% of the surface ponding volume within one month. This means the load from the tributary drainage area is too high, reducing BMP function or clogging the BMP. This would require pretreatment measures within the tributary area draining to the BMP to intercept the materials. Pretreatment components, especially for sediment, will extend the life of components that are more expensive to replace such as media, filter course, and aggregate layers.
- Erosion due to concentrated storm water runoff flow that is not readily corrected by adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.

Other Special Considerations

Biofiltration is a vegetated structural BMP. Vegetated structural BMPs that are constructed in the vicinity of, or connected to, an existing jurisdictional water or wetland could inadvertently result in creation of expanded waters or wetlands. As such, vegetated structural BMPs have the potential to come under the jurisdiction of the United States Army Corps of Engineers, SDRWQCB, California Department of Fish and Wildlife, or the United States Fish and Wildlife Service. This could result in the need for specific resource agency permits and costly mitigation to perform maintenance of the structural BMP. Along with proper placement of a structural BMP, **routine maintenance is key to preventing this scenario**.

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR BF-1 BIOFILTRATION		
The property owner is responsible to ensure inspection, operation and maintenance of permanent BMPs on their property unless responsibility has been formally transferred to an agency, community facilities district, homeowners association, property owners association, or other special district. Maintenance frequencies listed in this table are average/typical frequencies. Actual maintenance needs are site-specific, and maintenance may be required more frequently. Maintenance must be performed whenever needed, based on maintenance indicators presented in this table. The BMP owner is responsible for conducting regular inspections to see when maintenance is needed based on the maintenance indicators. During the first year of operation of a structural BMP, inspection is recommended at least once prior to August 31 and then monthly from September through May. Inspection during a storm event is also recommended. After the initial period of frequent inspections, the minimum inspection and maintenance frequency can be determined based on the results of the first year inspections.		
Threshold/Indicator	**Maintenance Action**	**Typical Maintenance Frequency**
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation or compaction of the media layer.	• Inspect monthly. If the BMP is 25% full* or more in one month, increase inspection frequency to monthly plus after every 0.1-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Obstructed inlet or outlet structure	Clear blockage.	• Inspect monthly and after every 0.5-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable	• Inspect annually. • Maintenance when needed.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintenance when needed.
Dead or diseased vegetation	Remove dead or diseased vegetation, re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintenance when needed.
Overgrown vegetation	Mow or trim as appropriate.	• Inspect monthly. • Maintenance when needed.
2/3 of mulch has decomposed, or mulch has been removed	Remove decomposed fraction and top off with fresh mulch to a total depth of 3 inches.	• Inspect monthly. • Replenish mulch annually, or more frequently when needed based on inspection.

*"25% full" is defined as ¼ of the depth from the design bottom elevation to the crest of the outflow structure (e.g., if the height to the outflow opening is 12 inches from the bottom elevation, then the materials must be removed when there is 3 inches of accumulation – this should be marked on the outflow structure).

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR BF-1 BIOFILTRATION (Continued from previous page)		
Threshold/Indicator	**Maintenance Action**	**Typical Maintenance Frequency**
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.	• Inspect monthly. • Maintenance when needed.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.	• Inspect after every 0.5-inch or larger storm event. If erosion due to storm water flow has been observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.
Standing water in BMP for longer than 24 hours following a storm event Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils.	• Inspect monthly and after every 0.5-inch or larger storm event. If standing water is observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology	If mosquitos/larvae are observed: first, immediately remove any standing water by dispersing to nearby landscaping; second, make corrective measures as applicable to restore BMP drainage to prevent standing water. If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria due to release rates controlled by an orifice installed on the underdrain, the [City Engineer] shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.	• Inspect monthly and after every 0.5-inch or larger storm event. If mosquitos are observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Underdrain clogged	Clear blockage.	• Inspect if standing water is observed for longer than 24-96 hours following a storm event. • Maintenance when needed.

BF-1
Biofiltration

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	
Property / Development Name:	Responsible Party Name and Phone Number:	
Property Address of BMP:	Responsible Party Address:	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 1 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Accumulation of sediment, litter, or debris Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove and properly dispose of accumulated materials, without damage to the vegetation ☐ If sediment, litter, or debris accumulation exceeds 25% of the surface ponding volume within one month (25% full*), add a forebay or other pre-treatment measures within the tributary area draining to the BMP to intercept the materials. ☐ Other / Comments:		
Poor vegetation establishment Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Re-seed, re-plant, or re-establish vegetation per original plans ☐ Other / Comments:		

*"25% full" is defined as ¼ of the depth from the design bottom elevation to the crest of the outflow structure (e.g., if the height to the outflow opening is 12 inches from the bottom elevation, then the materials must be removed when there is 3 inches of accumulation – this should be marked on the outflow structure).

BF-1
Biofiltration

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 2 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Dead or diseased vegetation Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove dead or diseased vegetation, re-seed, re-plant, or re-establish vegetation per original plans ☐ Other / Comments:		
Overgrown vegetation Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Mow or trim as appropriate ☐ Other / Comments:		
2/3 of mulch has decomposed, or mulch has been removed Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove decomposed fraction and top off with fresh mulch to a total depth of 3 inches ☐ Other / Comments:		

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 3 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Erosion due to concentrated irrigation flow Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair/re-seed/re-plant eroded areas and adjust the irrigation system ☐ Other / Comments:		
Erosion due to concentrated storm water runoff flow Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan ☐ If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction ☐ Other / Comments:		

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 4 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Obstructed inlet or outlet structure Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Clear blockage ☐ Other / Comments:		
Underdrain clogged (inspect underdrain if standing water is observed for longer than 24-96 hours following a storm event) Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Clear blockage ☐ Other / Comments:		
Damage to structural components such as weirs, inlet or outlet structures Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair or replace as applicable ☐ Other / Comments:		

BF-1
Biofiltration

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 5 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Standing water in BMP for longer than 24-96 hours following a storm event* Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils ☐ Other / Comments:		
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Apply corrective measures to remove standing water in BMP when standing water occurs for longer than 24-96 hours following a storm event.** ☐ Other / Comments:		

*Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health, and surface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Poor drainage can result from clogging of the media layer, filter course, aggregate storage layer, underdrain, or outlet structure. The specific cause of the drainage issue must be determined and corrected.

**If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria due to release rates controlled by an orifice installed on the underdrain, the [City Engineer] shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.

SD-1
Tree Wells

BMP MAINTENANCE FACT SHEET
FOR
SITE DESIGN BMP SD-1 TREE WELLS

Tree wells as site design BMPs are trees planted in configurations that allow storm water runoff to be directed into the soil immediately surrounding the tree. The tree may be contained within a planter box or structural cells. The surrounding area will be graded to direct runoff to the tree well. There may be features such as tree grates, suspended pavement design, or shallow surface depressions designed to allow runoff into the tree well. Typical tree well components include:

- Trees of the appropriate species for site conditions and constraints
- Available growing space based on tree species, soil type, water availability, surrounding land uses, and project goals
- Entrance/opening that allows storm water runoff to flow into the tree well (e.g., a curb opening, tree grate, or surface depression)
- Optional suspended pavement design to provide structural support for adjacent pavement without requiring compaction of underlying layers
- Optional root barrier devices as needed; a root barrier is a device installed in the ground, between a tree and the sidewalk, intended to guide roots down and away from the sidewalk in order to prevent sidewalk lifting from tree roots
- Optional tree grates; to be considered to maximize available space for pedestrian circulation and to protect tree roots from compaction related to pedestrian circulation; tree grates are typically made up of porous material that will allow the runoff to soak through
- Optional shallow surface depression for ponding of excess runoff
- Optional planter box drain

Normal Expected Maintenance

Tree health shall be maintained as part of normal landscape maintenance. Additionally, ensure that storm water runoff can be conveyed into the tree well as designed. That is, the opening that allows storm water runoff to flow into the tree well (e.g., a curb opening, tree grate, or surface depression) shall not be blocked, filled, re-graded, or otherwise changed in a manner that prevents storm water from draining into the tree well. A summary table of standard inspection and maintenance indicators is provided within this Fact Sheet.

Non-Standard Maintenance or BMP Failure

Tree wells are site design BMPs that normally do not require maintenance actions beyond routine landscape maintenance. The normal expected maintenance described above ensures the BMP functionality. If changes have been made to the tree well entrance / opening such that runoff is prevented from draining into the tree well (e.g., a curb inlet opening is blocked by debris or a grate is clogged causing runoff to flow around instead of into the tree well, or a surface depression has been filled so runoff flows away from the tree well), the BMP is not performing as intended to protect downstream waterways from pollution and/or erosion. Corrective maintenance will be required to restore drainage into the tree well as designed.

Surface ponding of runoff directed into tree wells is expected to infiltrate/evapotranspirate within 24-96 hours following a storm event. Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health, and surface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Poor drainage can result from clogging or compaction of the soils surrounding the tree. Loosen or replace the soils to restore drainage.

Other Special Considerations

Site design BMPs, such as tree wells, installed within a new development or redevelopment project are components of an overall storm water management strategy for the project. The presence of site design BMPs within a project is usually a factor in the determination of the amount of runoff to be managed with structural BMPs (i.e., the amount of runoff expected to reach downstream retention or biofiltration basins that process storm water runoff from the project as a whole). When site design BMPs are not maintained or are removed, this can lead to clogging or failure of downstream structural BMPs due to greater delivery of runoff and pollutants than intended for the structural BMP. Therefore, the [City Engineer] may require confirmation of maintenance of site design BMPs as part of their structural BMP maintenance documentation requirements. Site design BMPs that have been installed as part of the project should not be removed, nor should they be bypassed by re-routing roof drains or re-grading surfaces within the project. If changes are necessary, consult the [City Engineer] to determine requirements.

SD-1
Tree Wells

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR SD-1 TREE WELLS		
The property owner is responsible to ensure inspection, operation and maintenance of permanent BMPs on their property unless responsibility has been formally transferred to an agency, community facilities district, homeowners association, property owners association, or other special district. Maintenance frequencies listed in this table are average/typical frequencies. Actual maintenance needs are site-specific, and maintenance may be required more frequently. Maintenance must be performed whenever needed, based on maintenance indicators presented in this table. The BMP owner is responsible for conducting regular inspections to see when maintenance is needed based on the maintenance indicators. During the first year of operation of a structural BMP, inspection is recommended at least once prior to August 31 and then monthly from September through May. Inspection during a storm event is also recommended. After the initial period of frequent inspections, the minimum inspection and maintenance frequency can be determined based on the results of the first year inspections.		
Threshold/Indicator	**Maintenance Action**	**Typical Maintenance Frequency**
Tree health	Routine actions as necessary to maintain tree health.	• Inspect monthly. • Maintenance when needed.
Dead or diseased tree	Remove dead or diseased tree. Replace per original plans.	• Inspect monthly. • Maintenance when needed.
Standing water in tree well for longer than 24 hours following a storm event Surface ponding longer than approximately 24 hours following a storm event may be detrimental to tree health	Loosen or replace soils surrounding the tree to restore drainage.	• Inspect monthly and after every 0.5-inch or larger storm event. If standing water is observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology	Disperse any standing water from the tree well to nearby landscaping. Loosen or replace soils surrounding the tree to restore drainage (and prevent standing water).	• Inspect monthly and after every 0.5-inch or larger storm event. If mosquitos are observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed
Entrance / opening to the tree well is blocked such that storm water will not drain into the tree well (e.g., a curb inlet opening is blocked by debris or a grate is clogged causing runoff to flow around instead of into the tree well; or a surface depression is filled such that runoff drains away from the tree well)	Make repairs as appropriate to restore drainage into the tree well.	• Inspect monthly. • Maintenance when needed.

References

American Mosquito Control Association.
http://www.mosquito.org/
County of San Diego. 2014. Low Impact Development Handbook.
http://www.sandiegocounty.gov/content/sdc/dpw/watersheds/susmp/lid.html
San Diego County Copermittees. 2016. Model BMP Design Manual, Appendix E, Fact Sheet SD-1.
http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=250&Itemid=220

SD-1
Tree Wells

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	
Property / Development Name:	Responsible Party Name and Phone Number:	
Property Address of BMP:	Responsible Party Address:	

INSPECTION AND MAINTENANCE CHECKLIST FOR SD-1 TREE WELLS PAGE 1 of 2			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Dead or diseased tree Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove dead or diseased tree ☐ Replace per original plans ☐ Other / Comments:		
Standing water in tree well for longer than 24 hours following a storm event Surface ponding longer than approximately 24 hours following a storm event may be detrimental to tree health Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Loosen or replace soils surrounding the tree to restore drainage ☐ Other / Comments:		

SD-1
Tree Wells

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR SD-1 TREE WELLS PAGE 2 of 2			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Disperse any standing water from the tree well to nearby landscaping ☐ Loosen or replace soils surrounding the tree to restore drainage (and prevent standing water) ☐ Other / Comments:		
Entrance / opening to the tree well is blocked such that storm water will not drain into the tree well (e.g., a curb inlet opening is blocked by debris or a grate is clogged causing runoff to flow around instead of into the tree well; or a surface depression is filled such that runoff drains away from the tree well) Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Make repairs as appropriate to restore drainage into the tree well ☐ Other / Comments:		

ATTACHMENT 4
Copy of Plan Sheets Showing Permanent Storm Water BMPs

This is the cover sheet for Attachment 4.

See DMA Exhibit

Use this checklist to ensure the required information has been included on the plans:

The plans must identify:

- ☐ Structural BMP(s) with ID numbers matching Form I-6 Summary of PDP Structural BMPs
- ☐ The grading and drainage design shown on the plans must be consistent with the delineation of DMAs shown on the DMA exhibit
- ☐ Details and specifications for construction of structural BMP(s)
- ☐ Signage indicating the location and boundary of structural BMP(s) as required by the [City Engineer]
- ☐ How to access the structural BMP(s) to inspect and perform maintenance
- ☐ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
- ☐ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
- ☐ Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
- ☐ Recommended equipment to perform maintenance
- ☐ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management
- ☐ Include landscaping plan sheets showing vegetation requirements for vegetated structural BMP(s)
- ☐ All BMPs must be fully dimensioned on the plans
- ☐ When proprietary BMPs are used, site-specific cross section with outflow, inflow, and model number shall be provided. Photocopies of general brochures are not acceptable.