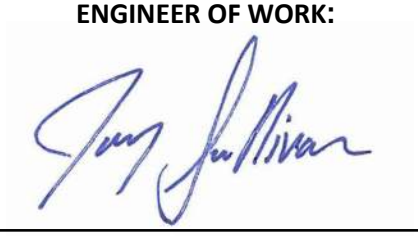
County of San Diego
PRIORITY DEVELOPMENT PROJECT (PDP) SWQMP

SWEETWATER PLACE
PDS2014-TM-5588 RPL-1; STP-14-015 RPL-1;
GPA-14-003; REZ-14-003; ER-14-19-005

2657 Sweetwater Springs Boulevard
Spring Valley, CA 91978

ASSESSOR'S PARCEL NUMBER(S): 505-231-36

ENGINEER OF WORK:



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DATE OF SWQMP:
May 24, 2016
Revised June 15, 2016

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APPROVAL DATE:

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Table of Contents

Table of Contents i
Attachments ii
Acronyms ii
PDP SWQMP Preparer's Certification Page 1
Submittal Record 3
Project Vicinity Map 4
Step 1: Project type determination (Standard or Priority Development Project) 5
Step 1.1: Storm Water Quality Management Plan requirements 7
Step 1.2: Exemption to PDP definitions 7
Step 2: Construction Storm Water BMP Checklist 8
Step 3: County of San Diego PDP SWQMP Site Information Checklist 11
Step 3.1: Description of Existing Site Condition 11
Step 3.2: Description of Existing Site Drainage Patterns 12
Step 3.3: Description of Proposed Site Development 13
Step 3.4: Description of Proposed Site Drainage Patterns 17
Step 3.5: Potential Pollutant Source Areas 18
Step 3.6: Identification and Narrative of Receiving Water and Pollutants of Concern 19
Step 3.7: Hydromodification Management Requirements 21
Step 3.7.1: Critical Coarse Sediment Yield Areas* 22
Step 3.7.2: Flow Control for Post-Project Runoff* 23
Step 3.8: Other Site Requirements and Constraints 24
Step 4: Source Control BMP Checklist 25
Step 5: Site Design BMP Checklist 27
Step 6: PDP Structural BMPs 29
Step 6.1: Description of structural BMP strategy 29
Step 6.2: Structural BMP Checklist 31
Step 6.3: Offsite Alternative Compliance Participation Form 34
ATTACHMENT 1 35

Attachments

Attachment 1: Backup for PDP Pollutant Control BMPs
- Attachment 1a: Storm Water Pollutant Control Worksheet Calculations
- Attachment 1b: DMA Exhibit
- Attachment 1c: Individual Structural BMP DMA Mapbook

Attachment 2: Backup for PDP Hydromodification Control Measures
- Attachment 2a: Flow Control Facility Design
- Attachment 2b: Hydromodification Management Exhibit
- Attachment 2c: Management of Critical Coarse Sediment Yield Areas
- Attachment 2d: Geomorphic Assessment of Receiving Channels (optional)
- Attachment 2e: Vector Control Plan (if applicable)

Attachment 3: Structural BMP Maintenance Plan
- Attachment 3a: Structural BMP Maintenance Thresholds and Actions
- Attachment 3b: Draft Maintenance Agreements / Notifications(when applicable)

Attachment 4: County of San Diego PDP Structural BMP Verification for DPW Permitted Land Development Projects

Attachment 5: Copy of Plan Sheets Showing Permanent Storm Water BMPs

Attachment 6: Copy of Project's Drainage Report

Attachment 7: Copy of Project's Geotechnical and Groundwater Investigation Report

Acronyms

ACP	Alternative Compliance Project
APN	Assessor's Parcel Number
BMP	Best Management Practice
BMP DM	Best Management Practice Design Manual
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NRCS	Natural Resources Conservation Service
PDCI	Private Development Construction Inspection Section
PDP	Priority Development Project
PDS	Planning and Development Services
PE	Professional Engineer
RPO	Resource Protection Ordinance
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWQMP	Storm Water Quality Management Plan
WMAA	Watershed Management Area Analysis
WPO	Watershed Protection Ordinance
WQIP	Water Quality Improvement Plan

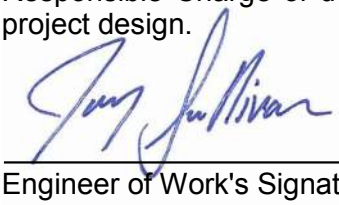
PDP SWQMP Preparer's Certification Page

Project Name: Sweetwater Place
Permit Application Number: TBD

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 County of San Diego BMP Design Manual, which is a design manual for compliance with local County of San Diego Watershed Protection Ordinance (Sections 67.801 et seq.) and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100) requirements for storm water management.

I have read and understand that the County of San Diego 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 County staff 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.



Engineer of Work's Signature, PE Number & Expiration Date

Jay Sullivan, PE, CFM
Print Name

Michael Baker International
Company

May 24th 2016
Date

Engineer's Seal:

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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.

Preliminary Design / Planning / CEQA

Submittal Number	Date	Summary of Changes
1	January 2015	Initial Submittal
2	March 2015	Park Relocation
3	June 2015	Site layout changes
4	May 2016	New SWQMP template used
5	June 2016	Comments addressed for Discretionary Approval

Final Design

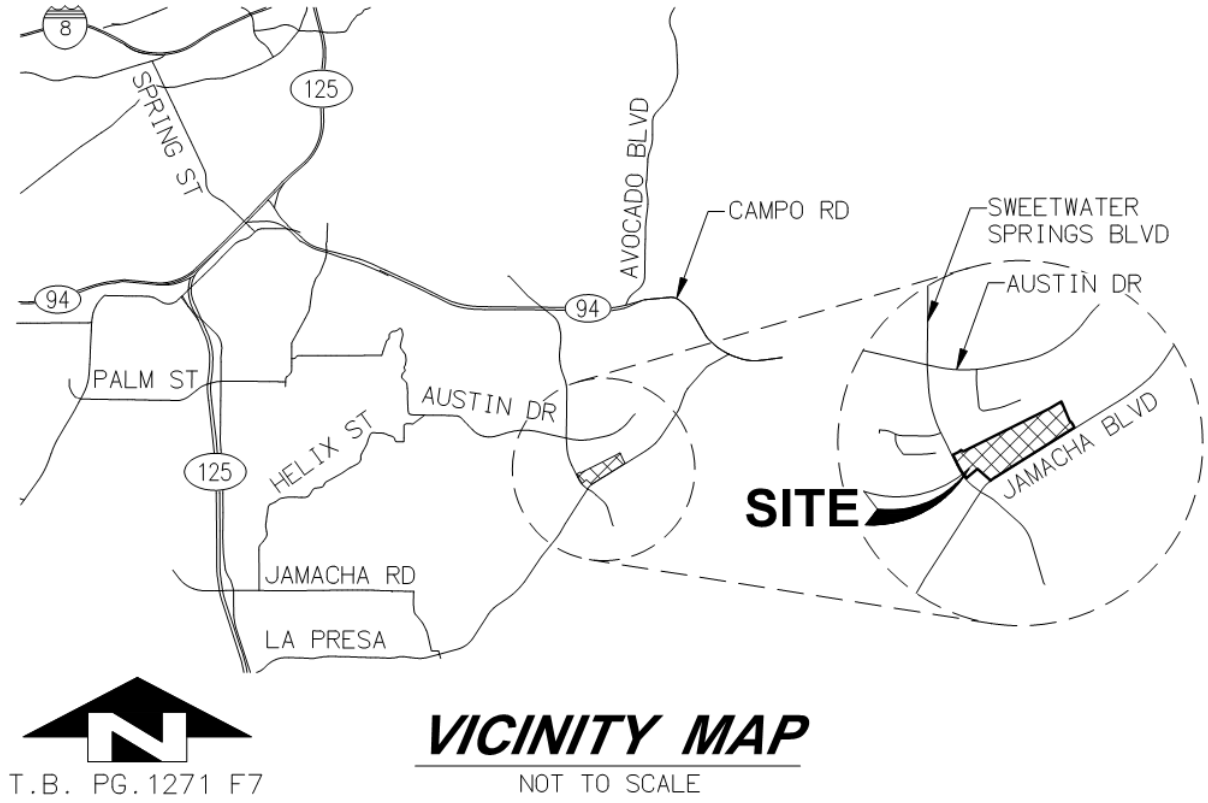
Submittal Number	Date	Summary of Changes
1		
2		
3		
4		

Plan Changes

Submittal Number	Date	Summary of Changes
1		
2		
3		
4		

Project Vicinity Map

Project Name: Sweetwater Place
Record ID: TBD



Step 1: Project type determination (Standard or Priority Development Project)

Is the project part of another Priority Development Project (PDP)? If so, a PDP SWQMP is required. Go to Step 2.			☐ Yes X No
The project is (select one): X New Development ☐ Redevelopment[1]			
The total proposed newly created or replaced impervious area is:			365,033 ft^2
The total existing (pre-project) impervious area is:			196,020 ft^2
The total area disturbed by the project is:			779,724 ft^2
If the total area disturbed by the project is 1 acre (43,560 sq. ft.) or more OR the project is part of a larger common plan of development disturbing 1 acre or more, a Waste Discharger Identification (WDID) number must be obtained from the State Water Resources Control Board. WDID: *forthcoming*			
Is the project in any of the following categories, (a) through (f)?[2]			
Yes ☐	No X	(a)	New development projects that create 10,000 square feet or more of impervious surfaces [3](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 X	(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.

1 Redevelopment is defined as: The creation and/or replacement of impervious surface on an already developed site. Examples include the expansion of a building footprint, road widening, the addition to or replacement of a structure, and creation or addition of impervious surfaces. Replacement of impervious surfaces includes any activity that is not part of a routine maintenance activity where impervious material(s) are removed, exposing underlying soil during construction. Redevelopment does not include routine maintenance activities, such as trenching and resurfacing associated with utility work; pavement grinding; resurfacing existing roadways; new sidewalks construction; pedestrian ramps; or bike lanes on existing roads; and routine replacement of damaged pavement, such as pothole repair.

2 Applicants should note that any development project that will create and/or replace 10,000 square feet or more of impervious surface (collectively over the entire project site) is considered a new development.

3 For solar energy farm projects, the area of the solar panels does not count toward the total impervious area of the site.

Project type determination (continued)

Yes	No		
X	☐	(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 Copermittees. See BMP Design Manual Section 1.4.2 for additional guidance.*
Yes	No		
☐	X	(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		
☐	X	(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).

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

Further guidance may be found in Chapter 1 and Table 1-2 of the BMP Design Manual.

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

The area of existing (pre-project) impervious area at the project site is:	196,020	ft^2 (A)
The total proposed newly created or replaced impervious area is	365,033	ft^2 (B)
Percent impervious surface created or replaced (B/A)*100:	>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 newly created or replaced impervious areas are considered a PDP and subject to stormwater requirements**

OR

X greater than fifty percent (50%) – **the entire project site is considered a PDP and subject to stormwater requirements**

Step 1.1: Storm Water Quality Management Plan requirements

Step	Answer	Progression
Is the project a Standard Project, Priority Development Project (PDP), or exception to PDP definitions? To answer this item, complete Step 1 Project Type Determination Checklist on Pages 1 and 2, and see PDP exemption information below. For further guidance, see Section 1.4 of the BMP Design Manual *in its entirety*.	☐ Standard Project	Standard Project requirements apply, including Standard Project SWQMP. **Complete Standard Project SWQMP.**
	X PDP ☐ PDP with ACP	Standard and PDP requirements apply, including PDP SWQMP. **Complete PDP SWQMP.** If participating in offsite alternative compliance, **complete Step 6.3 and an ACP SWQMP.**
	☐ PDP Exemption	**Go to Step 1.2 below.**

Step 1.2: Exemption to PDP definitions

Is the project exempt from PDP definitions based on either of the following: ☐ Projects that are only new or retrofit paved sidewalks, bicycle lanes, or trails that meet the following criteria: (i) Designed and constructed to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas; OR (ii) Designed and constructed to be hydraulically disconnected from paved streets or roads [i.e., runoff from the new improvement does not drain directly onto paved streets or roads]; OR (iii) Designed and constructed with permeable pavements or surfaces in accordance with County of San Diego Guidance on Green Infrastructure;	If so: Standard Project requirements apply, AND any additional requirements specific to the type of project. County concurrence with the exemption is required. *Provide discussion and list any additional requirements below in this form.* **Complete Standard Project SWQMP**
☐ Projects that are only retrofitting or redeveloping existing paved alleys, streets or roads that are designed and constructed in accordance with the County of San Diego Guidance on Green Infrastructure.	**Complete Green Streets PDP Exempt SWQMP.**
Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable: Intentionally left blank, no PDP exemption for this project.	

Step 2: Construction Storm Water BMP Checklist

Minimum Required Standard Construction Storm Water BMPs		
If you answer "Yes" to any of the questions below, your project is subject to Table 1 on the following page (Minimum Required Standard Construction Stormwater BMPs). As noted in Table 1, please select at least the minimum number of required BMPs, or as many as are feasible for your project. If no BMP is selected, an explanation must be given in the box provided. The following questions are intended to aid in determining construction BMP requirements for your project. **Note: All selected BMPs below must be included on the BMP plan incorporated into the construction plan sets.**		
1. Will there be soil disturbing activities that will result in exposed soil areas? (This includes minor grading and trenching.) **Reference Table 1 Items A, B, D, and E** Note: Soil disturbances NOT considered significant include, but are not limited to, change in use, mechanical/electrical/plumbing activities, signs, temporary trailers, interior remodeling, and minor tenant improvement.	X Yes	☐No
2. Will there be asphalt paving, including patching? **Reference Table 1 Items D and F**	X Yes	☐No
3. Will there be slurries from mortar mixing, coring, or concrete saw cutting? **Reference Table 1 Items D and F**	X Yes	☐No
4. Will there be solid wastes from concrete demolition and removal, wall construction, or form work? **Reference Table 1 Items D and F**	X Yes	☐No
5. Will there be stockpiling (soil, compost, asphalt, concrete, solid waste) for over 24 hours? **Reference Table 1 Items D and F**	X Yes	☐No
6. Will there be dewatering operations? **Reference Table 1 Items C and D**	☐Yes	X No
7. Will there be temporary on-site storage of construction materials, including mortar mix, raw landscaping and soil stabilization materials, treated lumber, rebar, and plated metal fencing materials? **Reference Table 1 Items E and F**	X Yes	☐No
8. Will trash or solid waste product be generated from this project? **Reference Table 1 Item F**	X Yes	☐No
9. Will construction equipment be stored on site (e.g.: fuels, oils, trucks, etc.?) **Reference Table 1 Item F**	X Yes	☐No
10. Will Portable Sanitary Services ("Porta-potty") be used on the site? **Reference Table 1 Item F**	X Yes	☐No

Table 1. Construction Storm Water BMP Checklist

Minimum Required Best Management Practices (BMPs)	CALTRANS SW Handbook[4] Detail or County Std. Detail	BMP Selected	Reference sheet No.'s where each selected BMP is shown on the plans. If no BMP is selected, an explanation must be provided.
A. Select Erosion Control Method for Disturbed Slopes (choose at least one for the appropriate season)			
Vegetation Stabilization Planting[5] (Summer)	SS-2, SS-4	☐	Reference to the Sheet No. where each selected BMP is shown will be provided once available.
Hydraulic Stabilization Hydroseeding[2] (Summer)	SS-4	☐	
Bonded Fiber Matrix or Stabilized Fiber Matrix[6] (Winter)	SS-3	☐	
Physical Stabilization Erosion Control Blanket[3] (Winter)	SS-7	X	
B. Select erosion control method for disturbed flat areas (slope < 5%) (choose at least one)			
County Standard Lot Perimeter Protection Detail	PDS 659[7], SC-2	☐	Reference to the Sheet No. where each selected BMP is shown will be provided once available.
Will use erosion control measures from Item A on flat areas also	SS-3, 4, 7	X	
County Standard Desilting Basin (must treat all site runoff)	PDS 660[8], SC-2	☐	
Mulch, straw, wood chips, soil application	SS-6, SS-8	☐	

4 State of California Department of Transportation (Caltrans). 2003. Storm Water Quality Handbooks, Construction Site Best Management Practices (BMPs) Manual. March. Available online at: http://www.dot.ca.gov/hq/construc/stormwater/manuals.htm.

5 If Vegetation Stabilization (Planting or Hydroseeding) is proposed for erosion control it may be installed between May 1st and August 15th. Slope irrigation is in place and needs to be operable for slopes >3 feet. Vegetation must be watered and established prior to October 1st. The owner must implement a contingency physical BMP by August 15th if vegetation establishment does not occur by that date. If landscaping is proposed, erosion control measures must also be used while landscaping is being established. Established vegetation must have a subsurface mat of intertwined mature roots with a uniform vegetative coverage of 70 percent of the natural vegetative coverage or more on all disturbed areas.

6 All slopes over three feet must have established vegetative cover prior to final permit approval.

7 County of San Diego, Planning & Development Services. 2012. Standard Lot Perimeter Protection Design System. Building Division. PDS 659. Available online at http://www.sandiegocounty.gov/pds/docs/pds659.pdf.

8 County of San Diego, Planning & Development Services. 2012. County Standard Desilting Basin for Disturbed Areas of 1 Acre or Less Building Division. PDS 659. Available online at http://www.sandiegocounty.gov/pds/docs/pds660.pdf.

Table 1. Construction Storm Water BMP Checklist (continued)

Minimum Required Best Management Practices (BMPs)	CALTRANS SW Handbook Detail or County Std. Detail	BMP Selected	Reference sheet No.'s where each selected BMP is shown on the plans. If no BMP is selected, an explanation must be provided.
C. If runoff or dewatering operation is concentrated, velocity must be controlled using an energy dissipater			
Energy Dissipater Outlet Protection[9]	SS-10	X	Reference to the Sheet No. where each selected BMP is shown will be provided once available.
D. Select sediment control method for all disturbed areas (choose at least one)			
Silt Fence	SC-1	X	Reference to the Sheet No. where each selected BMP is shown will be provided once available.
Fiber Rolls (Straw Wattles)	SC-5	X	
Gravel & Sand Bags	SC-6 & 8	X	
Dewatering Filtration	NS-2	☐	
Storm Drain Inlet Protection	SC-10	X	
Engineered Desilting Basin (sized for 10-year flow)	SC-2	☐	
E. Select method for preventing offsite tracking of sediment (choose at least one)			
Stabilized Construction Entrance	TC-1	X	Reference to the Sheet No. where each selected BMP is shown will be provided once available.
Construction Road Stabilization	TC-2	☐	
Entrance/Exit Tire Wash	TC-3	☐	
Entrance/Exit Inspection & Cleaning Facility	TC-1	☐	
Street Sweeping and Vacuuming	SC-7	X	
F. Select the general site management BMPs			
F.1 Materials Management			
Material Delivery & Storage	WM-1	X	Reference to the Sheet No. where each selected BMP is shown will be provided once available.
Spill Prevention and Control	WM-4	X	
F.2 Waste Management[10]			
Waste Management Concrete Waste Management	WM-8	X	Reference to the Sheet No. where each selected BMP is shown will be provided once available.
Solid Waste Management	WM-5	X	
Sanitary Waste Management	WM-9	X	
Hazardous Waste Management	WM-6	X	

Note: The Construction General Permit (Order No. 2009-0009-DWQ) also requires all projects not subject to the BMP Design Manual to comply with runoff reduction requirements through the implementation of post-construction BMPs as described in Section XIII of the order.

[9] Regional Standard Drawing D-40 – Rip Rap Energy Dissipater is also acceptable for velocity reduction.

[10] Not all projects will have every waste identified. The applicant is responsible for identifying wastes that will be onsite and applying the appropriate BMP. For example, if concrete will be used, BMP WM-8 must be selected.

Step 3: County of San Diego PDP SWQMP Site Information Checklist

Step 3.1: Description of Existing Site Condition

Project Watershed (Complete Hydrologic Unit, Area, and Subarea Name with Numeric Identifier)	Sweetwater HU (909); Middle Sweetwater HA (909.20); Jamacha HSA (909.21)

Current Status of the Site (select all that apply):

- ☐ Existing development
- X Previously graded but not built out
- ☐ Demolition completed without new construction
- ☐ Agricultural or other non-impervious use
- ☐ Vacant, undeveloped/natural

Description / Additional Information:

Existing Land Cover Includes (select all that apply and provide each area on site):

- X Vegetative Cover 8.71 Acres (379,408 Square Feet)
- X Non-Vegetated Pervious Areas 4.69 Acres (204,296 Square Feet)
- X Impervious Areas 4.5 Acres (196,020 Square Feet)

Description / Additional Information:

Underlying Soil belongs to Hydrologic Soil Group (select all that apply):

- ☐ NRCS Type A
- ☐ NRCS Type B
- ☐ NRCS Type C
- X NRCS Type D

Approximate Depth to Groundwater (GW) (or N/A if no infiltration is used):

- ☐ GW Depth < 5 feet
- ☐ 5 feet < GW Depth < 10 feet
- ☐ 10 feet < GW Depth < 20 feet
- X GW Depth > 20 feet

Existing Natural Hydrologic Features (select all that apply):

- X Watercourse
- ☐ Seeps
- ☐ Springs
- ☐ Wetlands
- ☐ None
- ☐ Other

Description / Additional Information:
An existing rock-lined channel convey's off-site runoff southwesterly across the site under existing conditions. The project proposed to hardline this conveyance with a new 54-inch RCP.

Step 3.2: 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:

The 17.9-acre project site contains approximately 4.5 acres of impervious cover under existing conditions. This existing impervious area consists of several concrete pads and drive aisles. The site was previously used as a landscape and gardening nursery. No buildings or other vertical construction currently remains. Runoff drains southwesterly via a combination of sheet flow and open channel flow (rock-lined flood control channel).

An existing commercial development is located immediately north of the project site. A 54-inch RCP storm drain discharges runoff from this commercial development onto the project site approximately midway along the northerly project boundary. Project site run-on from the 54-inch RCP is conveyed southwesterly across the project site via open channel flow (rock-lined flood control channel).

An existing 60-inch RCP with headwall is located in the southwesterly corner of the site. This pipe and headwall represent the primary project outfall location under pre and post development conditions. This 60-inch pipe transitions to dual 36-inch RCPs at the road right-of-way and conveys runoff southerly beneath Jamacha Boulevard, discharging to a regional detention facility located south of the Jamacha Boulevard. A small portion of the site drains to Sweetwater Springs Boulevard (westerly project boundary) as sheet flow.

An existing concrete lined channel is located on-site, along the easterly project boundary. This concrete channel conveys off-site runoff southerly to an existing F-Type inlet, which discharges runoff to Jamacha Boulevard via a curb outlet. Alterations to this existing concrete channel or its tributary drainage area (northerly storage facility) are not proposed.

A regional detention facility is located immediately adjacent to the southeast corner of the Jamacha Boulevard, Sweetwater Springs Boulevard intersection. Storm water runoff from the project site drains to this detention facility via existing storm drain pipes beneath Jamacha Boulevard (dual 36-inch RCP) and via overland flow under pre and post development conditions. This regional detention facility receives runoff from approximately 590 acres, of which the 17.9-acre project site represents approximately 3-percent.

Step 3.3: Description of Proposed Site Development

Project Description / Proposed Land Use and/or Activities:
The Project site is located in the community of Spring Valley within the unincorporated area of southwestern San Diego County. The approximately 20-acre (gross)/17.1-acre (net) Project site is located at the northwestern corner of Sweetwater Springs Boulevard and Jamacha Boulevard. The site address is 2657 Sweetwater Springs Boulevard; the County Assessor Parcel Number (APN) is 505-231-36.

The site was originally designated as future right-of-way (ROW) for extension of State Highway 54 (SR 54). The California Department of Transportation (Caltrans) has since abandoned the SR 54 extension and sold the property at auction as excess right-of-way. The new (current) owner of the Project site is SAM Sweetwater, LLC. The Project site was previously utilized as a retail nursery (Evergreen Nursery), which has since ceased operation and vacated the site. The site is currently 100% disturbed due to the previous use.

Existing land uses in the Project area include undeveloped land to the west/southwest across Sweetwater Springs Boulevard, which is planned for a residential development known as "The Pointe;" however, a number of homes associated with this development have already been constructed. Other uses include a commercial strip mall and gas station to the southeast; a vegetated County detention basin further to the southeast; a self-storage facility, Mardi Gras Café and Market building, and Sweetwater Lodge mobile-home park to the south across Jamacha Boulevard; a vacant lot adjacent to northwest; and, a business park adjacent to the north. Single-family residential uses also exist further to the north and northeast/east.

The Project proposes a 122-unit residential condominium development with exclusive backyards, attached two-car garages, 2.08-acre public community park, private and group useable open space, a riding and hiking trail, pedestrian pathways, and a series of greenbelt open areas. The units will be accessed by a series of 24-foot wide access drives within the interior of the property. Conceptual architectural design for the Project has been prepared, offering various housing styles and sizes. Additionally, ornamental landscaping will be provided within the onsite common areas, along Project roadways, and at the Project entryways to visually enhance the proposed development and blend the site into the existing surrounding setting. A Tentative Map/Condominium, Site Plan, and Grading Plan will be required to implement the proposed development.

Open Space: Integrated into the development will be private useable open space areas [minimum 350 square feet (s.f.) per unit] adjoining each unit, along with group useable open space areas located within the public park (minimum of 150 s.f. per unit). Each unit will have a fenced exclusive use backyard area.

The Project proposes an 8-foot wide public riding and hiking trail (within a 12-foot wide graded easement) along the northern side of Jamacha Boulevard to enhance the existing public pedestrian network. A series of pedestrian pathways connect and circulate throughout the project site and Public Park. Access from the Jamacha Road public trail to the residential portion of the project and Public Park has been provided. A 10-foot wide existing (cleared) trail easement is also proposed along the eastern Project boundary for future construction of a public trail by others; no physical trail improvements are proposed with the Project along this easement.

Public Street Improvements: Main access will occur from Jamacha Boulevard at the intersection of Folex Way. The intersection will be signalized, and a project entrance will be constructed to extend into the site from the intersection with Jamacha Boulevard that will terminate in a cul-de-sac. An exclusive eastbound left-turn lane is proposed on Jamacha Boulevard, and the existing exclusive northbound left-turn lane will be restriped to a shared thru/left-turn lane.

Project site and Public Park. Access from the Jamacha Road public trail to the residential portion of the project and Public Park has been provided. A 10-foot wide existing (cleared) trail easement is also proposed along the eastern Project boundary for future construction of a public trail by others; no physical trail improvements are proposed with the Project along this easement.

Public Street Improvements: Main access will occur from Jamacha Boulevard at the intersection of Folex Way. The intersection will be signalized, and a project entrance will be constructed to extend into the site from the intersection with Jamacha Boulevard that will terminate in a cul-de-sac. An exclusive eastbound left-turn lane is proposed on Jamacha Boulevard, and the existing exclusive northbound left-turn lane will be restriped to a shared thru/left-turn lane.

Secondary access is proposed off of Sweetwater Springs Boulevard via extension of an onsite public roadway terminating in a cul-de-sac. This road will provide access to the proposed public park and associated parking area (29 spaces total). Improvements to Sweetwater Springs Boulevard will include construction of a southbound left-turn pocket, median, and installation of stop signs at the intersection to facilitate ingress to and egress from the site. Additionally, the Project proposes to improve Jamacha Boulevard and Sweetwater Springs Boulevard to a 55-foot half-width with curb, gutter, and sidewalks, and a bike lane.

Fire, Water, Sewer, Storm Drain: The site will be served by the San Miguel Fire Protection District for fire service. The site will be served by the Otay Water District for public water service and the San Diego County (Spring Valley) Sanitation District will provide public sewer service. The Project proposes improvements to capture storm water flows from offsite properties that currently flow aboveground across the site within a proposed underground 54-inch pipe for outflow to an existing storm drain at the southwest corner of the site near Jamacha Boulevard. Onsite stormwater flows will discharge from the Project site in two locations. The majority of the site will discharge to the existing storm drain system within Jamacha Boulevard, consistent with pre-development conditions. The westerly portion of the site will discharge to Sweetwater Springs Boulevard, and flows will continue southwesterly via curb and gutter, consistent with pre-development conditions.

The Project site is identified in the Spring Valley Community Plan as a “Special Study Area (SSA) – Sweetwater Springs Boulevard and Jamacha Boulevard.” The SSA totals approximately 34 acres, extending northward of the Project site across Calavo Drive (two non-contiguous sites); however, the proposed Project site represents approximately 20.35 acres of the overall SSA. The remaining land within the SSA is not part of the proposed Project. The SSA designation requires that additional analysis be prepared to determine an appropriate land use. Additionally, the County provides specific goals and policies intended to guide future development of properties designated as SSA.

The existing County of San Diego General Plan land use designation is Public/Semi-Public with an underlying land use designation of RL-80 (Rural Lands). A General Plan Amendment is required to change the current General Plan designator from RL-80 to a Village Residential (VR-7.3) designator. The Regional Category of Village applies to the property; no change to the Regional Category is proposed with the Project. The Project site is currently zoned as S-90 (Holding Zone). A Rezone is requested to change the zone from S-90 to a RV-Variable Family Use Regulation to allow for the proposed condominium units.

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

The Project proposes a 122-unit residential condominium development with exclusive backyards, attached two-car garages, 2.08-acre public community park, private and group useable open space, a riding and hiking trail, pedestrian pathways, and a series of greenbelt open areas. The units will be accessed by a series of 24-foot wide access drives within the interior of the property.

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

The Sweetwater Place project will include partial bioretention along the westerly and southerly boundaries. Heavy construction equipment should avoid excessive use within the bioretention and park areas to avoid over compaction. Soils within the identified areas may need to be re-tilled from construction vehicles/equipment compaction.

On-site storm drain pipes and inlets will be included to direct on-site runoff to the proposed partial bioretention areas.

Retaining walls to the north will reduce slope length and steepness of slopes. Run-off from the northern boundary (vegetated slopes) will be collected in a stabilized concrete ditch behind the retaining wall to avoid comingling. The off-site 54-inch RCP will be extended through the project site as bypass flow. Project site runoff will comingle with runoff within this 54-inch RCP downstream of the project site.

Does the project include grading and changes to site topography?
X Yes
□No

Description / Additional Information:

Elevations on site range from approximately 492 feet above mean sea level (MSL) near the northeast property corner to 441 feet above MSL near the southwest property corner. Runoff drains overland southwesterly at an approximate slope of four percent (S=0.04 ft/ft). The project site receives run-on along the entire northerly boundary. Towards the westerly edge, off-site slopes are on the order of 50 percent (S=0.5 ft/ft) and 20 feet high; along the easterly edge, off-site slopes are closer to 20 percent (S=0.2 ft/ft) and five feet high.

The proposed site topography will continue to direct flows southwesterly. The site will be flattened, as compared to existing conditions, in order to facilitate construction of residential pads and drive aisles. The northerly portion of the site will be lowered while the southerly portion will be raised, as compared to existing conditions.

A retaining wall on the order of five feet high will be installed along the northerly boundary. Concrete brow ditches will direct off-site slope run-on westerly, as opposed to cascading over the proposed retaining wall.

Insert acreage or square feet for the different land cover types in the table below:

Change in Land Cover Type Summary			
Land Cover Type	Existing (acres or ft^2)	Proposed (acres or ft^2)	Percent Change
Vegetation	8.71	9.52	109%
Pervious (non-vegetated)	4.69	0	100%
Impervious	4.5	8.38	186%

Step 3.4: Description of Proposed Site Drainage Patterns

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

X 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:

The Sweetwater Place project will include partial bioretention along the westerly and southerly boundaries. Heavy construction equipment should avoid excessive use within the bioretention and park areas to avoid over compaction. Soils within the identified areas may need to be re-tilled from construction vehicles/equipment compaction.

On-site storm drain pipes and inlets will be included to direct on-site runoff to the proposed partial bioretention areas.

Retaining walls to the north will reduce slope length and steepness of slopes. Run-off from the northern boundary (vegetated slopes) will be collected in a stabilized concrete ditch behind the retaining wall to avoid comingling. The off-site 54-inch RCP will be extended through the project site as bypass flow. Project site runoff will comingle with runoff within this 54-inch RCP downstream of the project site.

Step 3.5: Potential Pollutant Source Areas

Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply). Select "Other" if the project is a phased development and provide a description:

X On-site storm drain inlets
☐ Interior floor drains and elevator shaft sump pumps
☐ Interior parking garages
☐ Need for future indoor & structural pest control
X 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
X Plazas, sidewalks, and parking lots
☐ Other (provide description)

Description / Additional Information:

Step 3.6: 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):

Partial bioretention basins will be strategically located along the southerly and westerly project boundary. As such, all project site runoff is disconnected prior to discharge from the site.

All proposed partial bioretention basins will consist of a 12-inch rock section (33-percent voids), an 18-inch soil matrix layer (38-percent voids), and 12 inches of available surface ponding (100-percent voids). Passive infiltration at a conservative rate of 0.1 inches per hour has been accounted for in the San Diego Hydrology Model (SDHM). The basins will be fitted with perforated sub-drains and impermeable side-wall liners will be extended into the sub-grade to prevent the potential for lateral migration of flow.

The partial bioretention basins located along the southerly project boundary (Jamacha Blvd.) will utilize a cascading grading plan such that weir flow occurs from one basin to the next should the rainfall intensity exceed the hydraulic conductivity of the soil and rock matrices. These partial bioretention areas are on the order of 15 feet below the adjacent homes; as such, potential residential flooding is not anticipated.

The partial bioretention area located along the westerly project boundary servicing the public park and public roadway (adjacent to Sweetwater Springs Blvd.) will utilize weir flow discharge as the secondary mechanism; however overflow discharge will convey directly to Sweetwater Springs Blvd., as opposed to a downstream bioretention area. This bioretention area will be fitted with a sub-drain that connects to the system location along Jamacha Blvd.

Runoff discharged from the site conveys southerly to the regional detention facility located at the southeast corner of Jamacha and Sweetwater Springs. From this facility, runoff is conveyed southerly 1.3 miles to the Sweetwater Reservoir, then another 7.5 miles to the San Diego Bay.

List any 303(d) impaired water bodies[11] 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)IStressor(s)	TMDLs I WQIP Highest Priority Pollutant
Sweetwater Reservoir	Dissolved Oxygen	Est. TMDL completion: 2019
Sweetwater River	Enterococcus, Fecal Coliform, Phosphorus, Selenium, Total Dissolved Solids, Total Nitrogen as N., Toxicity	Est. TMDL completion: 2021
San Diego Bay	Bacteria, Dissolved Copper, Lead, Zinc	Est. TMDL completion: 2019

Identification of Project Site Pollutants*

*Identification of project site pollutants below 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):

Intentionally Blank, no Flow-Through BMPs proposed

Pollutant	Not Applicable to the Project Site	Anticipated 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	☐	☐	☐

[11] The current list of Section 303(d) impaired water bodies can be found at http://www.waterboards.ca.gov/water_issues/programs/water_quality_assessment/#impaired

Step 3.7: Hydromodification Management Requirements

Do hydromodification management requirements apply (see Section 1.6 of the BMP Design Manual)?

X Yes, hydromodification management requirements for flow control and preservation of critical coarse sediment yield areas are applicable.

☐ 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[12] for the watershed in which the project resides.

Description / Additional Information (to be provided if a 'No' answer has been selected above):

[12] The Watershed Management Area Analysis (WMAA) is an optional element for inclusion in the Water Quality Improvement Plans (WQIPs) described in the 2013 MS4 Permit [Provision B.3.b.(4)]. It is available online at the Project Clean Water website: http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=248

Step 3.7.1: Critical Coarse Sediment Yield Areas*

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

Projects must satisfy critical coarse sediment yield area (CCSYA) requirements by characterizing the project as one of the scenario-types presented below and satisfying associated criteria. Projects must appropriately satisfy all requirements for identification, avoidance, and bypass, OR may alternatively elect to demonstrate no net impact.

Scenario 1: Project is subject to and in compliance with RPO requirements *(without utilization of RPO exemptions 86.604(e)(2)(cc) or 86.604(e)(3) that result in impacts to more than 15% of the project-scale CCSYAs)*.

Identify: Project has identified both onsite and upstream CCSYAs as areas that are coarse, Š25% slope, and Š50' tall. *(Optional refinement methods may be performed per guidance in Section H.1.2). AND,*

☐ Avoid: Project has avoided onsite CCSYAs per existing RPO steep slope encroachment criteria. AND,

☐ Bypass: Project has demonstrated that both onsite and upstream CCSYAs are bypassed through or around the project site with a 2 year peak storm velocity of 3 feet per second or greater. OR,

No Net Impact: Project does not satisfy all Scenario 1 criteria above and must alternatively demonstrate no net impact to the receiving water.

X Scenario 2: Project is entirely exempt/not subject to RPO requirements without utilization of RPO exemptions 86.604(e)(2)(cc) or 86.604(e)(3).

X Identify: Project has identified upstream CCSYAs that are coarse, Š25% slope, and Š50' tall. *(Optional refinement methods may be performed per guidance in Section H.1.2). AND,*

X Avoid: Project is not required to avoid onsite CCSYAs as none were identified in the previous step. AND,

X Bypass: Project has demonstrated that upstream CCSYAs are bypassed through or around the project site with a 2 year peak storm velocity of 3 feet per second or greater. OR,

☐ No Net Impact: Project does not satisfy all Scenario 2 criteria above and must alternatively demonstrate no net impact to the receiving water. *(Skip to next row).*

☐ **Scenario 3**: Project utilizes exemption(s) via RPO Section 86.604(e)(2)(cc) or 86.604(e)(3) and impacts more than 15% of the project-scale CCSYAs.

☐ No Net Impact: Project is not eligible for traditional methods of identification, avoidance, and bypass. Project must demonstrate no net impact to the receiving water.

Critical Coarse Sediment Yield Areas Continued
Demonstrate No Net Impact
If the project elects to satisfy CCSYA criteria through demonstration of no net impact to the receiving water. Applicants must identify the methods utilized from the list below and provide supporting documentation in Attachment 2c of the SWQMP. Check all that are applicable. **X** N/A, the project appropriately identifies, avoids, and bypasses CCSYAs. ☐ Project has performed additional analysis to demonstrate that impacts to CCSYAs satisfy the no net impact standard of Ep/SpŠ1.1. ☐ Project has provided alternate mapping of CCSYAs. Project has implemented additional onsite hydromodification flow control measures. ☐ Project has implemented an offsite stream rehabilitation project to offset impacts. ☐ Project has implemented other applicant-proposed mitigation measures.

Step 3.7.2: 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.f One Point of Compliance (POC-1) has been modeled using the San Diego Hydrology Model (SDHM) version 3.0.
Has a geomorphic assessment been performed for the receiving channel(s)? X 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:* *N/A* *Discussion / Additional Information: (optional)*

Step 3.8: 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.

The Project site is identified in the Spring Valley Community Plan as a "Special Study Area (SSA) – Sweetwater Springs Boulevard and Jamacha Boulevard." The SSA totals approximately 34 acres, extending northward of the Project site across Calavo Drive (two non-contiguous sites); however, the proposed Project site represents approximately 20.35 acres of the overall SSA. The remaining land within the SSA is not part of the proposed Project. The SSA designation requires that additional analysis be prepared to determine an appropriate land use. Additionally, the County provides specific goals and policies intended to guide future development of properties designated as SSA.

The existing County of San Diego General Plan land use designation is Public/Semi-Public with an underlying land use designation of RL-80 (Rural Lands). A General Plan Amendment is required to change the current General Plan designator from RL-80 to a Village Residential (VR-7.3) designator. The Regional Category of Village applies to the property; no change to the Regional Category is proposed with the Project. The Project site is currently zoned as S-90 (Holding Zone). A Rezone is requested to change the zone from S-90 to a RV-Variable Family Use Regulation to allow for the proposed condominium units.

Step 4: Source Control BMP Checklist

Source Control BMPs			
All development projects must implement source control BMPs 4.2.1 through 4.2.6 where applicable and feasible. See Chapter 4.2 and Appendix E of the County 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 4.2 and/or Appendix E of the County 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 must be provided.			
Source Control Requirement	**Applied?**		
4.2.1 Prevention of Illicit Discharges into the MS4	X Yes	☐No	☐N/A
Discussion / justification if 4.2.1 not implemented:			
4.2.2 Storm Drain Stenciling or Signage	X Yes	☐No	☐N/A
Discussion / justification if 4.2.2 not implemented:			
4.2.3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	X Yes	☐No	☐N/A
Discussion / justification if 4.2.3 not implemented:			
4.2.4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	X Yes	☐No	☐N/A
Discussion / justification if 4.2.4 not implemented:			

Source Control Requirement	Applied?		
4.2.5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	X Yes	☐No	☐N/A
Discussion / justification if 4.2.5 not implemented:			
4.2.6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below):			
☐ A. On-site storm drain inlets	X Yes	☐No	☐N/A
☐ B. Interior floor drains and elevator shaft sump pumps	☐Yes	☐No	X N/A
☐ C. Interior parking garages	☐Yes	☐No	X N/A
☐ D. Need for future indoor & structural pest control	X Yes	☐No	☐N/A
☐ E. Landscape/outdoor pesticide use	X Yes	☐No	☐N/A
☐ F. Pools, spas, ponds, fountains, and other water features	☐Yes	☐No	X N/A
☐ G. Food service	☐Yes	☐No	X N/A
☐ H. Refuse areas	☐Yes	☐No	X N/A
☐ I. Industrial processes	☐Yes	☐No	X N/A
☐ J. Outdoor storage of equipment or materials	☐Yes	☐No	X N/A
☐ K. Vehicle and equipment cleaning	☐Yes	☐No	X N/A
☐ L. Vehicle/equipment repair and maintenance	☐Yes	☐No	X N/A
☐ M. Fuel dispensing areas	☐Yes	☐No	X N/A
☐ N. Loading docks	☐Yes	☐No	X N/A
☐ O. Fire sprinkler test water	☐Yes	☐No	X N/A
☐ P. Miscellaneous drain or wash water	☐Yes	☐No	X N/A
☐ Q. Plazas, sidewalks, and parking lots	X Yes	☐No	☐N/A
Discussion / justification if 4.2.6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for all "No" answers shown above.			

Note: Show all source control measures described above that are included in design capture volume calculations in the plan sheets of Attachment 5.

Step 5: Site Design BMP Checklist

Site Design BMPs
All development projects must implement site design BMPs SD-A through SD-H where applicable and feasible. See Chapter 4.3 and Appendix E of the County 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 4.3 and/or Appendix E of the County 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 must be provided.

Site Design Requirement	Applied?		
4.3.1 Maintain Natural Drainage Pathways and Hydrologic Features	☐ Yes	X No	☐N/A
Discussion / justification if 4.3.1 not implemented: An existing rock-lined channel convey's off-site runoff southwesterly across the site under existing conditions. The project proposed to hardline this conveyance with a new 54-inch RCP. The proposed project will not result in a diversion of flow, as compared to existing conditions.			
4.3.2 Conserve Natural Areas, Soils, and Vegetation	X Yes	☐No	☐N/A
Discussion / justification if 4.3.2 not implemented:			
4.3.3 Minimize Impervious Area	X Yes	☐No	☐N/A
Discussion / justification if 4.3.3 not implemented:			
4.3.4 Minimize Soil Compaction	X Yes	☐No	☐N/A
Discussion / justification if 4.3.4 not implemented:			
4.3.5 Impervious Area Dispersion	X Yes	☐No	☐N/A
Discussion / justification if 4.3.5 not implemented:			

Site Design Requirement	Applied?		
4.3.6 Runoff Collection	X Yes	☐No	☐N/A
Discussion / justification if 4.3.6 not implemented:			
4.3.7 Landscaping with Native or Drought Tolerant Species	X Yes	☐No	☐N/A
Discussion / justification if 4.3.7 not implemented:			
4.3.8 Harvesting and Using Precipitation	☐Yes	☐No	X N/A
Discussion / justification if 4.3.8 not implemented: The use of rain barrels will be evaluated in more detail during final engineering. As a conservative approach to determining the Design Capture Volume (DCV) and subsequent BMP design, rail barrels have been intentionally omitted at this preliminary stage of the project.			

Note: Show all site design measures described above that are included in design capture volume calculations in the plan sheets of Attachment 5.

Step 6: 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 County 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 County must confirm the maintenance (see Section 7 of the BMP Design Manual).

Use this section 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 (Step 6.2) for each structural BMP within the project (copy the BMP summary information sheet [Step 6.2] as many times as needed to provide summary information for each individual structural BMP).

Step 6.1: Description of structural BMP strategy

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. At the end of this discussion provide a summary of all the structural BMPs within the project including the type and number.

The BMP selection process has been developed in accordance with the new MS4 Permit (R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100). Harvest and re-use is considered impractical for use on the project site due to it being a proposed residential area with low water usage. Full infiltration is considered infeasible due to the entire site consisting of type D soils with high runoff rates and slow infiltration rates. Partial infiltration is considered feasible due a low infiltration rate for proposed project site and lack of geotechnical hazards. These statements will be verified by site specific infiltrometer testing which is currently on-going at the time of the preliminary report. Partial Bioretention infiltration basins will be strategically located along the southerly and westerly project boundary. As such, all project site runoff is disconnected prior to discharge from the site.

All proposed bioretention basins will consist of a 12-inch rock section (33-percent voids), an 18-inch soil matrix layer (38-percent voids), and 12 inches of available surface ponding (100-percent voids). Passive infiltration at a conservative rate of 0.02 inches per hour, in accordance with Table G.1-5 in Appendix G of the San Diego County BMP Design Manual, has been accounted for in the San Diego Hydrology Model (SDHM). The basins will be fitted with perforated sub-drains and impermeable side-wall liners will be extended into the sub-grade to prevent the potential for lateral migration of flow.

Description of structural BMP strategy continued
(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)

(Continued from previous page)

DMA 1-3 and DMA 4's DCV will utilize the partial infiltration bioretention basins located along the southerly project boundary (Jamacha Blvd.) The basins along Jamacha Blvd. will utilize a cascading grading plan such that weir flow occurs from one basin to the next should the rainfall intensity exceed the hydraulic conductivity of the soil and rock matrices. These bioretention areas are on the order of 15 feet below the adjacent homes; as such, potential residential flooding is not anticipated.

DMA 2's DCV will utilize the partial infiltration bioretention area located along the westerly project boundary (Sweetwater Springs Blvd.) This basin will utilize weir flow discharge as the secondary mechanism; however discharge will convey directly to Sweetwater Springs Blvd., as opposed to a downstream bioretention area. This bioretention area will be fitted with a sub-drain that discharges to the curb and gutter of Sweetwater Springs Boulevard.

Step 6.2: Structural BMP Checklist

DMA 1-3	
Structural BMP ID No. DMA 1-3	
Construction Plan Sheet No. *forthcoming*	
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) X 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 X 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 (See Section 1.12 of the BMP Design Manual)	Jay Sullivan, PE, CFM 9755 Clairemont Mesa Blvd San Diego, CA 92124 858.614.5000 RCE 77445
Who will be the final owner of this BMP?	☐ HOA X Property Owner ☐ County ☐ Other (describe)
Who will maintain this BMP into perpetuity?	X HOA ☐Property Owner ☐ County ☐ Other (describe)
What Category (1-4) is the Structural BMP? Refer to the Category definitions in Section 7.3 of the BMP DM. Attach the appropriate maintenance agreement in Attachment 3.	Category 2
Discussion (as needed): The HOA will be responsible for BMP maintenance; however, an easement covering the bioretention areas will be granted to the County of San Diego.	

DMA 2	
Structural BMP ID No. DMA-2	
Construction Plan Sheet No. *forthcoming*	
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) X 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 X 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 (See Section 1.12 of the BMP Design Manual)	Jay Sullivan, PE, CFM 9755 Clairemont Mesa Blvd San Diego, CA 92124 858.614.5000 RCE 77445
Who will be the final owner of this BMP?	☐ HOA X Property Owner ☐ County ☐ Other (describe)
Who will maintain this BMP into perpetuity?	X HOA ☐Property Owner ☐ County ☐ Other (describe)
What Category (1-4) is the Structural BMP? Refer to the Category definitions in Section 7.3 of the BMP DM. Attach the appropriate maintenance agreement in Attachment 3.	Category 2
Discussion (as needed): The HOA will be responsible for BMP maintenance; however, an easement covering the bioretention areas will be granted to the County of San Diego.	

DMA 4	
Structural BMP ID No. DMA-4	
Construction Plan Sheet No. *forthcoming*	
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) X 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 X 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 (See Section 1.12 of the BMP Design Manual)	Jay Sullivan, PE, CFM 9755 Clairemont Mesa Blvd San Diego, CA 92124 858.614.5000 RCE 77445
Who will be the final owner of this BMP?	☐ HOA X Property Owner ☐ County ☐ Other (describe)
Who will maintain this BMP into perpetuity?	X HOA ☐Property Owner ☐ County ☐ Other (describe)
What Category (1-4) is the Structural BMP? Refer to the Category definitions in Section 7.3 of the BMP DM. Attach the appropriate maintenance agreement in Attachment 3.	Category 2
Discussion (as needed): The HOA will be responsible for BMP maintenance; however, an easement covering the bioretention areas will be granted to the County of San Diego.	

Step 6.3: Offsite Alternative Compliance Participation Form

PDP INFORMATION	
Record ID:	*Alternative Compliance not used in this project.*
Assessor's Parcel Number(s) [APN(s)]	
What are your PDP Pollutant Control Debits? *See Attachment 1 of the PDP SWQMP	
What are your PDP HMP Debits? (if applicable) *See Attachment 2 of the PDP SWQMP	
ACP Information	
Record ID:	
Assessor's Parcel Number(s) [APN(s)]	
Project Owner/Address	
What are your ACP Pollutant Control Credits? *See Attachment 1 of the ACP SWQMP	
What are your ACP HMP Debits? (if applicable) *See Attachment 2 of the ACP SWQMP	
Is your ACP in the same watershed as your PDP? ☐ Yes ☐ No	Will your ACP project be completed prior to the completion of the PDP? ☐ Yes ☐ No
Does your ACP account for all Deficits generated by the PDP? ☐ Yes ☐ No (PDP and/or ACP must be redesigned to account for all deficits generated by the PDP.	What is the difference between your PDP debits and ACP Credits? *(ACP Credits -Total PDP Debits = Total Earned Credits)

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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	Storm Water Pollutant Control Worksheet Calculations -Worksheet B.3-1 (Required) -Worksheet B.1-1 (Required) -Worksheet B.4-1 (if applicable) -Worksheet B.4-2 (if applicable) -Worksheet B.5-1 (if applicable) -Worksheet B.5-2 (if applicable) -Worksheet B.5-3 (if applicable) -Worksheet B.6-1 (if applicable) -Summary Worksheet (optional)	X Included
Attachment 1b	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.	X Included ☐ Not included because the entire project will use harvest and use BMPs
Attachment 1c	DMA Exhibit (Required) See DMA Exhibit Checklist on the back of this Attachment cover sheet.	X Included
Attachment 1d	Individual Structural BMP DMA Mapbook (Required) -Place each map on 8.5”x11” paper. -Show at a minimum the DMA, Structural BMP, and any existing hydrologic features within the DMA.	X Included

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

The DMA Exhibit must identify:

X Underlying hydrologic soil group
X Approximate depth to groundwater
X Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
X Critical coarse sediment yield areas to be protected
X Existing topography and impervious areas
X Existing and proposed site drainage network and connections to drainage offsite
X Proposed demolition
X Proposed grading
X Proposed impervious features
X Proposed design features and surface treatments used to minimize imperviousness
X 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)
X Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Step 3.5)
X Structural BMPs (identify location, structural BMP ID#, type of BMP, and size/detail)

Categorization of Infiltration Feasibility Condition	Form I-8

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?

Note that it is not necessary to investigate each and every criterion in the worksheet if infiltration is precluded. Instead a letter of justification from a geotechnical professional familiar with the local conditions substantiating any geotechnical issues will be required.

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 must be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		✕

Provide basis:

Based on the Geotechnical Report and a NRCS Soil Survey, the entire project site is comprised of type D soils which have a very high surface runoff rate and slow infiltration rate.

Infiltration testing is currently being performed. This SWQMP will be updated to reflect results once available.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

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 must be based on a comprehensive evaluation of the factors presented in Appendix C.2.	✕	

Provide basis:

Pending on-going geotechnical investigation, consistent with the County's BMP Design Manual.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

Form I-8 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 must be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Per the preliminary Geotechnical report, the groundwater level is not considered an issue on this site and it was not encountered during any testing done. The project site is residential which does not propose a high emittance of pollutants. 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 must be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Infiltration would not cause any water balance issues or change of seasonality of ephemeral streams. 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 Agency/Jurisdictions to substantiate findings

Form I-8 Page 3 of 4

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 must be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	✕	

Provide basis:

Infiltration is still allowed although based on the Geotechnical Report and a NRCS Soil Survey, the entire project site is comprised of type D soils which have a very high surface runoff rate and slow infiltration rate.

This statement will be substantiated with results from the on-going investigation.

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 must be based on a comprehensive evaluation of the factors presented in Appendix C.2.	✕	

Provide basis:

Infiltration would not cause any water balance issues or change of seasonality of ephemeral streams.

This statement will be substantiated with results from the on-going investigation.

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.

Form I-8 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 must be based on a comprehensive evaluation of the factors presented in Appendix C.3.	✕	
Provide basis: According to the preliminary Geotechnical report, the groundwater level is not considered an issue on this site and it was not encountered during any testing done. The project site is residential which does not propose a high emittance of pollutants. This statement will be substantiated with results from the on-going investigation. 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 must be based on a comprehensive evaluation of the factors presented in Appendix C.3.	✕	
Provide basis: Infiltration would not violate any downstream water rights. This statement will be substantiated with results from the on-going investigation. 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 1-4 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.**		Partial 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.3-1: Project-Scale BMP Feasibility Analysis (V1.1)

Category	#	Description	Value	Units
Capture & Use Inputs	0	Design Capture Volume for Entire Project Site	16,453	cubic-feet
	1	Proposed Development Type	Residential	unitless
	2	Number of Residents or Employees at Proposed Development	122	#
	3	Total Planted Area within Development	33,933	sq-ft
	4	Water Use Category for Proposed Planted Areas	Moderate	unitless
Infiltration Inputs	5	Is Average Site Infiltration Rate Less than 0.5 Inches per Hour?	Yes	yes/no
	6	Is Retention of the Full DCV Anticipated to Produce Negative Impacts?	No	yes/no
	7	Is Retention of Any Volume Anticipated to Produce Negative Impacts?	No	yes/no
Calculations	8	36-Hour Toilet Use Per Resident or Employee	0.37	cubic-feet
	9	Subtotal: Anticipated 36 Hour Toilet Use	46	cubic-feet
	10	Anticipated 1 Acre Landscape Use Over 36 Hours	196.52	cubic-feet
	11	Subtotal: Anticipated Landscape Use Over 36 Hours	153	cubic-feet
	12	Total Anticipated Use Over 36 Hours	199	cubic-feet
	13	Total Anticipated Use / Design Capture Volume	0.01	cubic-feet
	14	Are Full Capture and Use Techniques Feasible for this Project?	No	unitless
	15	Is Full Retention Feasible for this Project?	No	yes/no
	16	Is Partial Retention Feasible for this Project?	Yes	yes/no
Result	17	Feasibility Category	4	1, 2, 3, 4, 5

Worksheet B.3-1 General Notes:

A. Applicants may use this optional worksheet to gauge the feasibility of implementing capture and use techniques on their project site. 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.

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

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Standard Drainage Basin Inputs	0	Drainage Basin ID or Name	DMA 1-3	DMA 2	DMA 4								unitless
	1	Basin Drains to the Following BMP Type	Partial Ret.	Partial Ret.	Partial Ret.								unitless
	2	85th Percentile 24-hr Storm Depth	0.52	0.52	0.52								inches
	3	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	188,615	15,246	161,172								sq-ft
	4	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)											sq-ft
	5	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)											sq-ft
	6	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)											sq-ft
	7	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)											sq-ft
	8	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)											sq-ft
	9	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)	175,547	94,090	145,055								sq-ft
Dispersion, Tree Well, & Rain Barrel Inputs (Optional)	10	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	Yes	Yes	Yes	No	No	No	No	No	No	No	yes/no
	11	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)	0	0	0								sq-ft
	12	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)	0	0	0								sq-ft
	13	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)	0	0	0								sq-ft
	14	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)	0	0	0								sq-ft
	15	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)	0	0	0								sq-ft
	16	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)	0	0	0								sq-ft
	17	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)	0	0	0								sq-ft
	18	Number of Tree Wells Proposed per SD-A	12	10	10								#
	19	Average Mature Tree Canopy Diameter	15	15	15								ft
	20	Number of Rain Barrels Proposed per SD-E	0	0	0								#
	21	Average Rain Barrel Size	0	0	0								gal
Final Adjusted Runoff Factor Calculations	22	Total Area Tributary to BMP	364,162	109,336	306,227	0	0	0	0	0	0	0	sq-ft
	23	Composite Runoff Factor for Standard Drainage Areas	0.61	0.38	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	24	Initial Composite Runoff 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	unitless
	25	Total Impervious Area Dispersed to Pervious Surface	0	0	0	0	0	0	0	0	0	0	sq-ft
	26	Total Pervious Dispersion Area	0	0	0	0	0	0	0	0	0	0	sq-ft
	27	Dispersed Impervious Area / Pervious Dispersion Area	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	28	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
	29	Final Adjusted Tributary Runoff Factor	0.61	0.38	0.62	n/a	n/a	n/a	n/a	n/a	n/a	n/a	unitless
Volume Reduction Calculations	30	Final Effective Tributary Area	222,139	41,548	189,861	0	0	0	0	0	0	0	sq-ft
	31	Initial Design Capture Volume	9,626	1,800	8,227	0	0	0	0	0	0	0	cubic-feet
	32	Volume Reduction per Tree Well	100	100	100	0	0	0	0	0	0	0	cubic-feet
	33	Total Tree Well Volume Reduction	1,200	1,000	1,000	0	0	0	0	0	0	0	cubic-feet
	34	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Result	35	Design Capture Volume Tributary to BMP	8,426	800	7,227	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).

B. Impervious surfaces include roofs, concrete, asphalt, or pervious pavements with an impervious liner. Semi-pervious surfaces include decomposed granite, cobbles, crushed aggregate, or compacted soils such as unpaved parking. Engineered pervious surfaces include pervious pavements providing full retention of the 85th percentile rainfall depth, or areas with soils that have been amended and mulched per Section 86.709 of the Landscape Ordinance. Dispersion areas are pervious or semi-pervious surfaces that receive runoff from impervious surfaces (C=0.90) and reduce stormwater runoff as outlined in Fact Sheet SD-B.

Automated Worksheet B.5-2: Sizing Partial Retention BMPs (V1.1)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
BMP Inputs	0	Drainage Basin ID or Name	DMA 1-3	DMA 2	DMA 4	-	-	-	-	-	-	-	sq-ft
	1	Effective Tributary Area	222,139	41,548	189,861	-	-	-	-	-	-	-	sq-ft
	2	Minimum Biofiltration Footprint Sizing Factor	0.030	0.030	0.030	-	-	-	-	-	-	-	ratio
	3	Design Capture Volume Tributary to BMP	8,426	800	7,227	-	-	-	-	-	-	-	cubic-feet
	4	Provided Partial Retention BMP Surface Area	12,321	3,136	19,321								sq-ft
	5	Provided Surface Ponding Depth	7.2	12	12								inches
	6	Provided Soil Media Thickness	18	18	18								inches
	7	Provided Depth of Gravel Above Underdrain Invert	6.5	6.5	6.5								inches
	8	Hydromodification Orifice Diameter of Underdrain	1.40	1.00	2.20								inches
	9	Provided Depth of Gravel Below the Underdrain	5.5	5.5	5.5								inches
	10	Native Soil Infiltration Rate	0.02	0.02	0.02								in/hr
Retention Calculations	11	Volume Infiltrated Over 6 Hour Storm	123	31	193	0	0	0	0	0	0	0	cubic-feet
	12	Soil Media Pore Space Available for Retention	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	unitless
	13	Gravel Pore Space Available for Retention	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	14	Effective Retention Depth	4.00	4.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	15	Calculated Drawdown for Gravel Below Underdrain (Including 6 Hr Storm)	116	116	116	36	36	36	36	36	36	36	hours
	16	Volume Retained by BMP	4,230	1,077	6,634	0	0	0	0	0	0	0	cubic-feet
	17	Fraction of DCV Retained	0.50	1.35	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	18	Portion of Retention Performance Standard Satisfied	0.47	0.89	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	19	Equivalent Fraction of DCV Retained with 36-hr Drawdown	0.30	0.77	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	20	Design Capture Volume Remaining for Biofiltration	5,898	184	3,324	0	0	0	0	0	0	0	cubic-feet
Biofiltration Calculations	21	Max Hydromod Flow Rate through Underdrain	0.0827	0.0455	0.2183	n/a	n/a	n/a	n/a	n/a	n/a	n/a	CFS
	22	Max Soil Filtration Rate Allowed by Underdrain Orifice	0.29	0.63	0.49	n/a	n/a	n/a	n/a	n/a	n/a	n/a	in/hr
	23	Soil Media Filtration Rate per Specifications	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	in/hr
	24	Soil Media Filtration Rate to be used for Sizing	0.29	0.63	0.49	5.00	5.00	5.00	5.00	5.00	5.00	5.00	in/hr
	25	Depth Biofiltered Over 6 Hour Storm	1.74	3.76	2.93	30.00	30.00	30.00	30.00	30.00	30.00	30.00	inches
	26	Soil Media Pore Space Available for Biofiltration	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	unitless
	27	Effective Depth of Biofiltration Storage	13.40	18.20	18.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	28	Drawdown Time for Surface Ponding	23	19	24	0	0	0	0	0	0	0	hours
	29	Drawdown Time for Effective Biofiltration Depth	43	28	36	0	0	0	0	0	0	0	hours
	30	Total Depth Biofiltered	15.14	21.96	21.13	30.00	30.00	30.00	30.00	30.00	30.00	30.00	inches
	31	Option 1 - Biofilter 1.50 DCV: Target Volume	8,847	276	4,986	0	0	0	0	0	0	0	cubic-feet
	32	Option 1 - Provided Biofiltration Volume	8,847	276	4,986	0	0	0	0	0	0	0	cubic-feet
	33	Option 2 - Store 0.75 DCV: Target Volume	4,424	138	2,493	0	0	0	0	0	0	0	cubic-feet
	34	Option 2 - Provided Storage Volume	4,424	138	2,493	0	0	0	0	0	0	0	cubic-feet
	35	Portion of Biofiltration Performance Standard Satisfied	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
Result	36	Overall Portion of Performance Standard Satisfied	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	37	**Deficit of Effectively Treated Stormwater**	**0**	**0**	**0**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	cubic-feet

Worksheet B.5-2 General Notes:

A. Applicants may use this worksheet to size Partial Retention BMPs (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 and summarized below. BMPs fully satisfying the pollutant control performance standards will have a deficit treated volume of zero and be highlighted in green.

Summary of Stormwater Pollutant Control Calculations (V1.1)

Category	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Drainage Basin Inputs	Drainage Basin ID or Name	DMA 1-3	DMA 2	DMA 4	-	-	-	-	-	-	-	unitless
	Total Area Tributary to BMP	364,162	109,336	306,227	-	-	-	-	-	-	-	sq-ft
	Composite Runoff Factor for Standard Drainage Areas	0.61	0.38	0.62	-	-	-	-	-	-	-	unitless
	85th Percentile 24-hr Storm Depth	0.52	0.52	0.52	-	-	-	-	-	-	-	inches
	Initial Design Capture Volume	9,626	1,800	8,227	-	-	-	-	-	-	-	cubic-feet
Volume Reductions	Final Adjusted Tributary Runoff Factor	0.61	0.38	0.62	-	-	-	-	-	-	-	unitless
	Final Effective Tributary Area	222,139	41,548	189,861	-	-	-	-	-	-	-	sq-ft
	Tree Well and Rain Barrel Reductions	1,200	1,000	1,000	-	-	-	-	-	-	-	cubic-feet
	Design Capture Volume Tributary to BMP	8,426	800	7,227	-	-	-	-	-	-	-	cubic-feet
BMP Sizing	Basin Drains to the Following BMP Type	Partial Ret.	Partial Ret.	Partial Ret.	-	-	-	-	-	-	-	unitless
	Deficit of Effectively Treated Stormwater	0	0	0	-	-	-	-	-	-	-	cubic-feet

Summary Notes:

All fields in this summary worksheet are populated based on previous user inputs. Drainage basins achieving full compliance with performance requirements for onsite pollutant control are highlighted in green. Drainage basins not achieving full compliance are highlighted in red and summarized below. Please note that drainage areas using De Minimis, Self-Mitigating, and/or Self-Retaining classifications may be required to provide additional supporting information.

-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.

SCALE: 1"=150'

LEGEND:

- PARTIAL BIORETENTION
- PUBLIC PARK
- EX. CONCRETE CHANNEL
- DRAINAGE MANAGEMENT AREA (DMA1)
- PUBLIC IMPROVEMENT PAVEMENT
- PUBLIC IMPROVEMENT SIDEWALK
- FLOW PATH

DRAINAGE MANAGEMENT AREA					
DMA	AREA AC	IMP (AC)	PER (AC)	BMP TYPE	BMP AREA
DMA-1-3*	8.36	4.33	4.03	PARTIAL BIORETENTION	12,321 FT^2
DMA-2*	2.51	0.35	2.16	PARTIAL BIORETENTION	3,136 FT^2
DMA-4	7.03	3.70	3.33	PARTIAL BIORETENTION	19,321 FT^2
TOTAL	17.90*	8.38	9.52	–	34,778 FT^2

*ON-SITE BIORETENTION HAS BEEN SIZED TO TREAT AND ATTENUATION AN ADDITIONAL AREA EQUIVALENT TO THE MINOR OFF-SITE IMPROVEMENTS ASSOCIATED WITH JAMACHA BLVD. AND SWEETWATER SPRINGS BLVD.

SOURCE CONTROL BMPS		
SOURCE OF POLLUTANT	PERMANENT SOURCE CONTROL BMP	OPERATIONAL SOURCE CONTROL BMP
ON-SITE STORM DRAIN INLETS	PROVIDE INLET MARKERS INDICATING NO DUMPING	MAINTAIN INLET MARKERS AS NECESSARY
FUTURE PEST CONTROL	SELECT BUILDING DESIGN FEATURES THAT DISCOURAGE PEST ENTRY	PROVIDE PEST MANAGEMENT INFORMATION TO OWNERS
LANDSCAPE/OUTDOOR PESTICIDE USE	SELECT DROUGHT TOLERANT PLANTS THAT WILL ALSO SURVIVE SATURATED SOILS	MINIMIZE USE OF PESTICIDES IN LANDSCAPING
MISC. DRAIN OR WASH WATER – ROOFING, GUTTERS, AND TRIM	AVOID USING MATERIALS MADE OF UNPROTECTED METAL THAT MAY LEACH INTO RUNOFF	N/A

NOTES:
1. THE UNDERLYING HYDROLOGIC SOIL GROUP IS D
2. APPROXIMATE DEPTH TO GROUNDWATER IS >19.5 FT
3. EXISTING NATURAL HYDROLOGIC FEATURES: AN EXISTING ROCK LINED CHANNEL WILL BE REMOVED AND REPLACED WITH A 54-INCH RCP
4. CRITICAL COARSE SEDIMENT YIELD AREAS TO BE PROTECTED: N/A

SWEETWATER PLACE DRAINAGE MANAGEMENT AREA EXHIBIT

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San Diego, CA 92124
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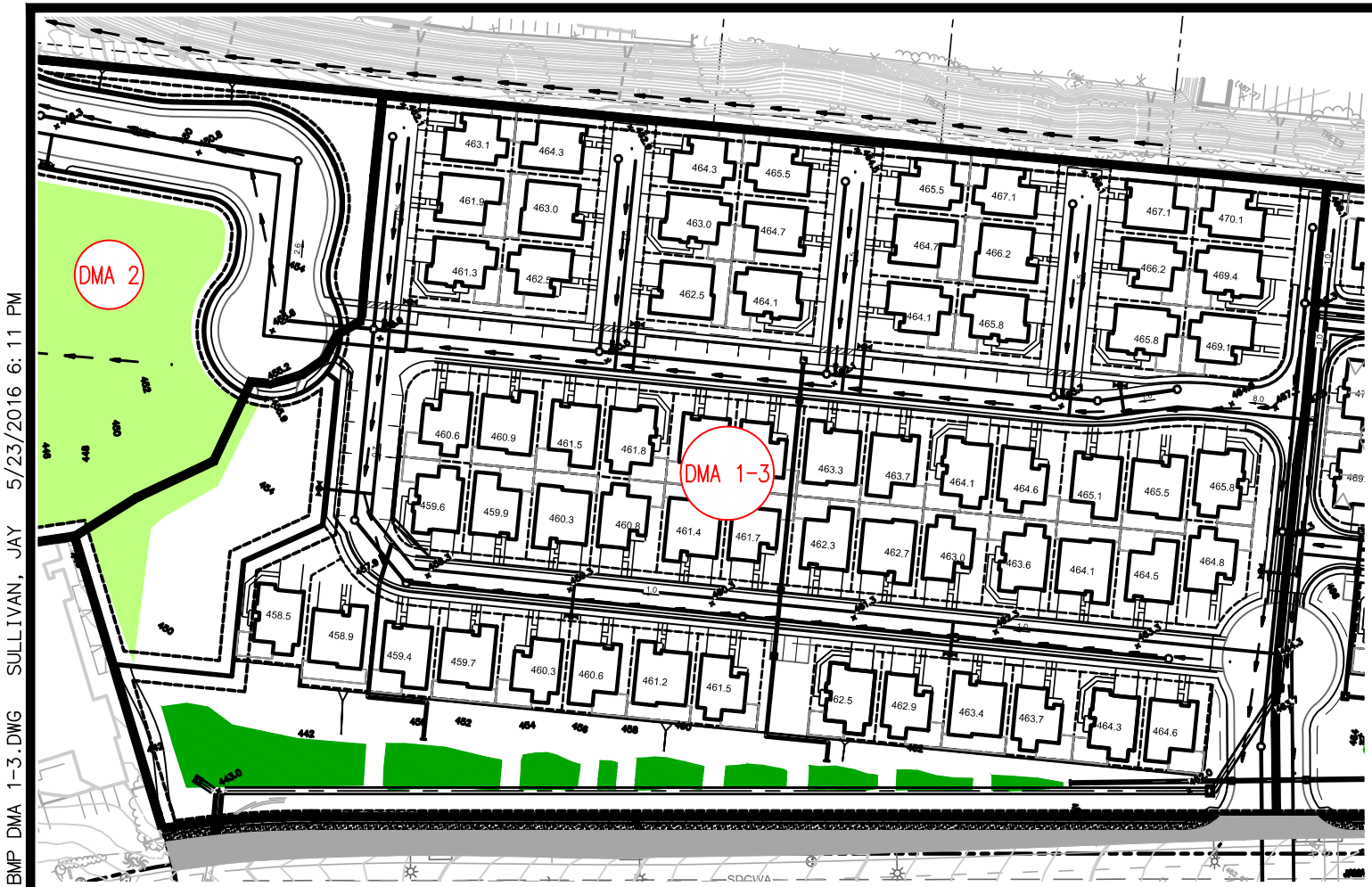

NOTES:

1. DMA 1-3 CONSISTS OF PARTIAL BIORETENTION BMPS
2. NO EXISTING HYDROLOGIC FEATURES

LEGEND:

PARTIAL BIORETENTION

PUBLIC PARK

EX. CONCRETE CHANNEL

DRAINAGE MANAGEMENT AREA — DMA 1

PUBLIC IMPROVEMENT PAVEMENT

PUBLIC IMPROVEMENT SIDEWALK

FLOW PATH

SWEETWATER PLACE POST DEVELOPMENT DMA 1-3 MAP

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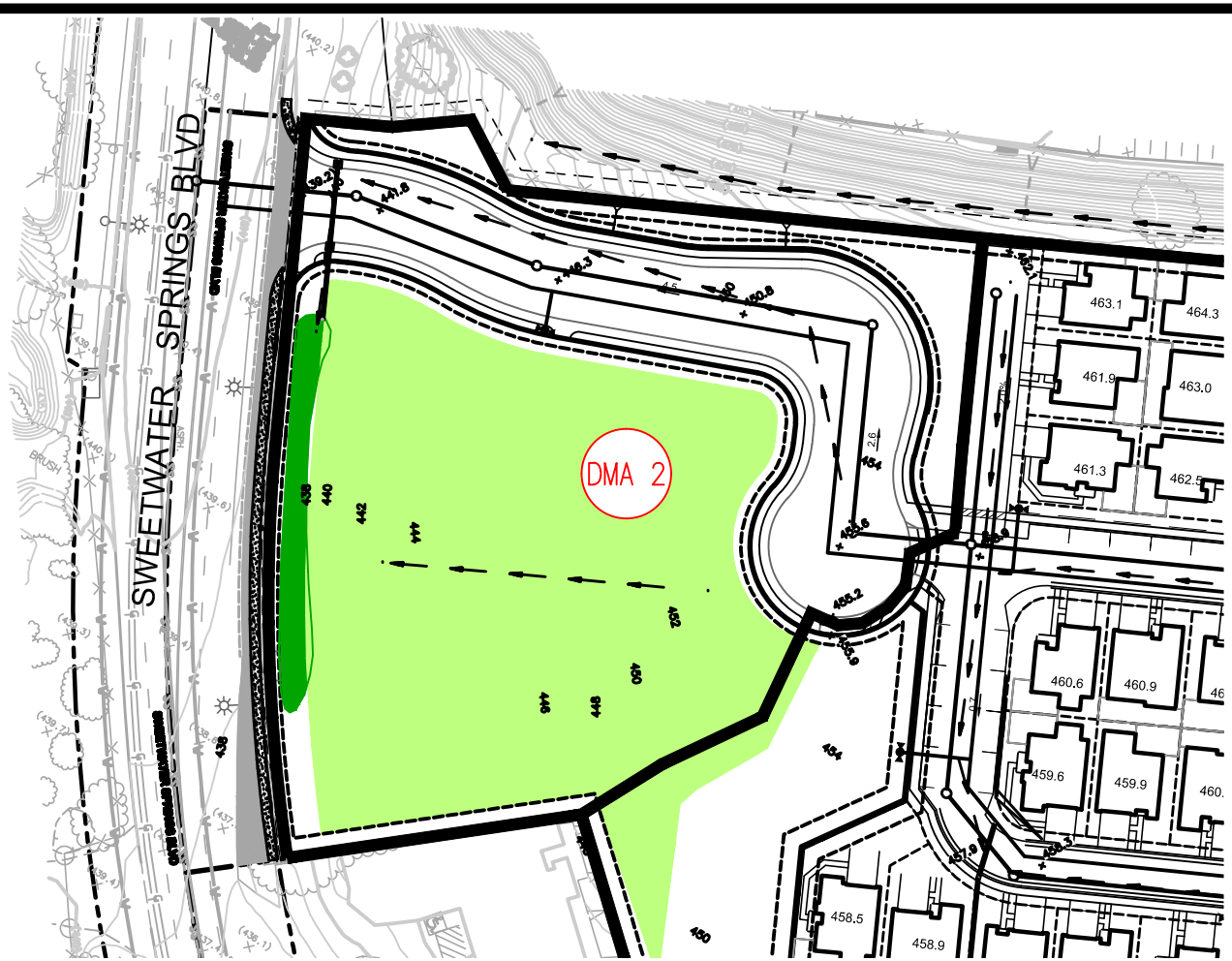

NOTES:

1. DMA 2 CONSISTS OF PARTIAL BIORETENTION BMPS
2. NO EXISTING HYDROLOGIC FEATURES

SCALE: 1"=100'

LEGEND:

PARTIAL BIORETENTION

PUBLIC PARK

EX. CONCRETE CHANNEL

DRAINAGE MANAGEMENT AREA — DMA 1

PUBLIC IMPROVEMENT PAVEMENT

PUBLIC IMPROVEMENT SIDEWALK

FLOW PATH

SWEETWATER PLACE POST DEVELOPMENT DMA 2 MAP

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NOTES:

1. DMA 1-3 CONSISTS OF PARTIAL BIORETENTION BMPS
2. THE EXISTING ROCK-LINED CHANNEL WILL BE REPLACED WITH A 54-INCH RCP

SCALE: 1"=120'

LEGEND:

PARTIAL BIORETENTION

PUBLIC PARK

EX. CONCRETE CHANNEL

DRAINAGE MANAGEMENT AREA — DMA 1

PUBLIC IMPROVEMENT PAVEMENT

PUBLIC IMPROVEMENT SIDEWALK

FLOW PATH

SWEETWATER PLACE POST DEVELOPMENT DMA 4 MAP

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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	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	X Included X Submitted as separate stand- alone document
Attachment 2b	Hydromodification Management Exhibit (Required)	X Included See Hydromodification Management Exhibit Checklist on the back of this Attachment cover sheet.
Attachment 2c	Management of Critical Coarse Sediment Yield Areas See Section 6.2 and Appendix H of the BMP Design Manual.	☐ Exhibit depicting onsite and/or upstream sources of critical coarse sediment as mapped by Regional or Jurisdictional approaches outlined in Appendix H.1 AND, X Demonstration that the project effectively avoids and bypasses sources of mapped critical coarse sediment per approaches outlined in Appendix H.2 and H.3. OR, ☐ Demonstration that project does not generate a net impact on the receiving water per approaches outlined in Appendix H.4.
Attachment 2d	Geomorphic Assessment of Receiving Channels (Optional) See Section 6.3.4 of the BMP Design Manual.	X Not performed ☐ Included ☐ Submitted as separate stand-alone document
Attachment 2e	Vector Control Plan (Required when structural BMPs will not drain in 96 hours)	☐ Included X Not required because BMPs will drain in less than 96 hours

PRIORITY DEVELOPMENT PROJECT (PDP) SWQMP

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

The Hydromodification Management Exhibit must identify:

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

SDHM 3.0

PROJECT REPORT

General Model Information

Project Name:	Sweetwater Place 5-23-16
Site Name:	Sweetwater Place
Site Address:	
City:	
Report Date:	6/15/2016
Gage:	BONITA
Data Start:	10/01/1971
Data End:	09/30/2004
Timestep:	Hourly
Precip Scale:	1.000
Version Date:	2016/05/13

POC Thresholds

Low Flow Threshold for POC1:	10 Percent of the 2 Year
High Flow Threshold for POC1:	10 Year

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Landuse Basin Data

Predeveloped Land Use

Sweetwater Place EX Condition

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
D,Dirt,Moderate	17.9
Pervious Total	17.9
Impervious Land Use	acre
Impervious Total	0
Basin Total	17.9

Element Flows To:

Surface	Interflow	Groundwater

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Mitigated Land Use

DMA 1-3

Bypass:	No
Impervious Land Use	acre
IMPERVIOUS-FLAT LAT	3.1

Element Flows To:

Outlet 1	Outlet 2
Lateral Basin 1	

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Lateral Basin 1

Bypass: No

GroundWater: No

Pervious Land Use	acre
D,NatVeg,Flat	4.23

Element Flows To:

Surface	Interflow	Groundwater
Surface Bioretention		

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DMA 4

Bypass:	No
Impervious Land Use	acre
IMPERVIOUS-FLAT LAT	2.6

Element Flows To:

Outlet 1	Outlet 2
Lateral Basin 2	

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Lateral Basin 2

Bypass: No

GroundWater: No

Pervious Land Use	acre
D,NatVeg,Flat	3.53

Element Flows To:

Surface	Interflow	Groundwater
Surface Bioretention		

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DMA-2 (Public Park and Road)

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
D,Urban,Moderate	2.16
Pervious Total	2.16
Impervious Land Use	acre
IMPERVIOUS-MOD	0.35
Impervious Total	0.35
Basin Total	2.51

Element Flows To:

Surface	Interflow	Groundwater
Surface Bioretention		

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DMA 1-3 Roads

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
IMPERVIOUS-FLAT	1.03
Impervious Total	1.03
Basin Total	1.03

Element Flows To:

Surface	Interflow	Groundwater
Surface Bioretention		

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DMA 4 Roads

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
IMPERVIOUS-FLAT	0.9
Impervious Total	0.9
Basin Total	0.9

Element Flows To:

Surface	Interflow	Groundwater
Surface Bioretention		

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Routing Elements
Predeveloped Routing

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Mitigated Routing

DMA 1-3 Partial Bioretention

Bottom Length:	112.00 ft.
Bottom Width:	112.00 ft.
Material thickness of first layer:	1.5
Material type for first layer:	Amended 5 in/hr
Material thickness of second layer:	1
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Infiltration On	
Infiltration rate:	0.02
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	15.425
Total Volume Through Riser (ac-ft.):	2.989
Total Volume Through Facility (ac-ft.):	31.441
Percent Infiltrated:	49.06
Total Precip Applied to Facility:	4.038
Total Evap From Facility:	4.849
Underdrain used	
Underdrain Diameter (feet):	0.5
Orifice Diameter (in.):	1.4
Offset (in.):	5.5
Flow Through Underdrain (ac-ft.):	13.027
Total Outflow (ac-ft.):	31.441
Percent Through Underdrain:	41.43
Discharge Structure	
Riser Height:	0.6 ft.
Riser Diameter:	12 in.
Notch Type:	Rectangular
Notch Width:	0.000 ft.
Notch Height:	0.000 ft.
Element Flows To:	
Outlet 1	Outlet 2

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Landscape Swale Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
100.00	0.3703	0.0000	0.0000	0.0000
100.05	0.3695	0.0031	0.0000	0.0000
100.10	0.3677	0.0061	0.0000	0.0000
100.15	0.3659	0.0123	0.0000	0.0000
100.20	0.3642	0.0186	0.0058	0.0058
100.25	0.3624	0.0248	0.0058	0.0058
100.30	0.3607	0.0311	0.0058	0.0058
100.35	0.3589	0.0375	0.0058	0.0058
100.40	0.3572	0.0438	0.0058	0.0058
100.45	0.3555	0.0502	0.0058	0.0058
100.51	0.3537	0.0567	0.0058	0.0058
100.56	0.3520	0.0631	0.0058	0.0058
100.61	0.3503	0.0696	0.0058	0.0058
100.66	0.3486	0.0762	0.0058	0.0058
100.71	0.3469	0.0827	0.0058	0.0058
100.76	0.3451	0.0893	0.0058	0.0058
100.81	0.3434	0.0960	0.0058	0.0058

100.86	0.3417	0.1026	0.0058	0.0058
100.91	0.3400	0.1094	0.0058	0.0058
100.96	0.3383	0.1161	0.0058	0.0058
101.01	0.3367	0.1229	0.0058	0.0058
101.06	0.3350	0.1297	0.0058	0.0058
101.11	0.3333	0.1365	0.0058	0.0058
101.16	0.3316	0.1434	0.0058	0.0058
101.21	0.3299	0.1503	0.0058	0.0058
101.26	0.3283	0.1573	0.0058	0.0058
101.31	0.3266	0.1643	0.0058	0.0058
101.36	0.3250	0.1713	0.0058	0.0058
101.42	0.3233	0.1783	0.0058	0.0058
101.47	0.3217	0.1854	0.0058	0.0058
101.52	0.3200	0.1925	0.0058	0.0058
101.57	0.3184	0.1996	0.0058	0.0058
101.62	0.3167	0.2067	0.0058	0.0058
101.67	0.3151	0.2138	0.0058	0.0058
101.72	0.3135	0.2210	0.0058	0.0058
101.77	0.3118	0.2282	0.0058	0.0058
101.82	0.3102	0.2355	0.0058	0.0058
101.87	0.3086	0.2428	0.0058	0.0058
101.92	0.3070	0.2501	0.0058	0.0058
101.97	0.3054	0.2575	0.0058	0.0058
102.02	0.3038	0.2649	0.0058	0.0058
102.07	0.3022	0.2723	0.0058	0.0058
102.12	0.3006	0.2798	0.0058	0.0058
102.17	0.2990	0.2873	0.0058	0.0058
102.22	0.2974	0.2949	0.0058	0.0058
102.27	0.2958	0.3025	0.0058	0.0058
102.33	0.2942	0.3101	0.0058	0.0058
102.38	0.2927	0.3177	0.0058	0.0058
102.43	0.2911	0.3254	0.0058	0.0058
102.48	0.2895	0.3332	0.0058	0.0058
102.50	0.2880	0.3367	0.0058	0.0058

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Landscape Swale Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.5000	0.3703	0.3367	0.0000	1.5362	0.0000
2.5505	0.3720	0.3555	0.0000	1.5362	0.0000
2.6011	0.3738	0.3743	0.0000	1.5863	0.0000
2.6516	0.3756	0.3933	0.0000	1.6364	0.0000
2.7022	0.3774	0.4123	0.0000	1.6865	0.0000
2.7527	0.3792	0.4314	0.0000	1.7366	0.0000
2.8033	0.3810	0.4506	0.0000	1.7866	0.0000
2.8538	0.3828	0.4699	0.0000	1.8367	0.0000
2.9044	0.3846	0.4893	0.0000	1.8868	0.0000
2.9549	0.3864	0.5088	0.0000	1.9369	0.0000
3.0055	0.3882	0.5284	0.0000	1.9870	0.0000
3.0560	0.3900	0.5480	0.0000	2.0371	0.0000
3.1066	0.3918	0.5678	0.0000	2.0871	0.0000
3.1571	0.3936	0.5877	0.0000	2.1372	0.0000
3.2077	0.3954	0.6076	0.0000	2.1873	0.0000
3.2582	0.3973	0.6276	0.0000	2.2374	0.0000
3.3088	0.3991	0.6478	0.0000	2.2875	0.0000
3.3593	0.4009	0.6680	0.0000	2.3376	0.0000
3.4099	0.4028	0.6883	0.0000	2.3876	0.0000
3.4604	0.4046	0.7087	0.0000	2.4377	0.0000
3.5110	0.4065	0.7292	0.0040	2.4878	0.0000

3.5615	0.4083	0.7498	0.0094	2.5379	0.0000
3.6121	0.4102	0.7705	0.0127	2.5880	0.0000
3.6626	0.4121	0.7913	0.0153	2.6381	0.0000
3.7132	0.4139	0.8122	0.0175	2.6881	0.0000
3.7637	0.4158	0.8331	0.0195	2.7382	0.0000
3.8143	0.4177	0.8542	0.0213	2.7883	0.0000
3.8648	0.4196	0.8753	0.0229	2.8384	0.0000
3.9154	0.4214	0.8966	0.0245	2.8885	0.0000
3.9659	0.4233	0.9180	0.0259	2.9385	0.0000
4.0165	0.4252	0.9394	0.0273	2.9886	0.0000
4.0670	0.4271	0.9609	0.0286	3.0387	0.0000
4.1176	0.4290	0.9826	0.0298	3.0888	0.0000
4.1681	0.4309	1.0043	0.0310	3.1389	0.0000
4.2187	0.4328	1.0262	0.0322	3.1890	0.0000
4.2692	0.4348	1.0481	0.0333	3.2390	0.0000
4.3198	0.4367	1.0701	0.0344	3.2891	0.0000
4.3703	0.4386	1.0922	0.0355	3.3392	0.0000
4.4209	0.4405	1.1144	0.0365	3.3893	0.0000
4.4714	0.4425	1.1368	0.0376	3.4394	0.0000
4.5220	0.4444	1.1592	0.0395	3.4895	0.0000
4.5725	0.4463	1.1817	0.0404	3.5395	0.0000
4.6000	0.4474	1.1940	0.0413	3.5668	0.0000

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Surface Bioretention

Element Flows To:

Outlet 1	Outlet 2
	DMA 1-3 Partial Bioretention

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DMA-4 Partial Bioretention

Bottom Length:	140.00 ft.
Bottom Width:	140.00 ft.
Material thickness of first layer:	1.5
Material type for first layer:	Amended 5 in/hr
Material thickness of second layer:	1
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Infiltration On	
Infiltration rate:	0.02
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	18.002
Total Volume Through Riser (ac-ft.):	0.444
Total Volume Through Facility (ac-ft.):	27.013
Percent Infiltrated:	66.64
Total Precip Applied to Facility:	5.95
Total Evap From Facility:	6.667
Underdrain used	
Underdrain Diameter (feet):	0.5
Orifice Diameter (in.):	2.2
Offset (in.):	5.5
Flow Through Underdrain (ac-ft.):	8.567
Total Outflow (ac-ft.):	27.013
Percent Through Underdrain:	31.71
Discharge Structure	
Riser Height:	1 ft.
Riser Diameter:	12 in.
Notch Type:	Rectangular
Notch Width:	0.000 ft.
Notch Height:	0.000 ft.
Element Flows To:	
Outlet 1	Outlet 2

DRAFT

Landscape Swale Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
100.00	0.5515	0.0000	0.0000	0.0000
100.05	0.5504	0.0052	0.0000	0.0000
100.11	0.5480	0.0104	0.0000	0.0000
100.16	0.5457	0.0209	0.0000	0.0000
100.22	0.5434	0.0315	0.0091	0.0091
100.27	0.5410	0.0421	0.0091	0.0091
100.33	0.5387	0.0528	0.0091	0.0091
100.38	0.5364	0.0635	0.0091	0.0091
100.44	0.5341	0.0742	0.0091	0.0091
100.49	0.5318	0.0850	0.0091	0.0091
100.55	0.5295	0.0959	0.0091	0.0091
100.60	0.5272	0.1068	0.0091	0.0091
100.66	0.5249	0.1177	0.0091	0.0091
100.71	0.5226	0.1287	0.0091	0.0091
100.77	0.5203	0.1398	0.0091	0.0091
100.82	0.5180	0.1509	0.0091	0.0091
100.88	0.5158	0.1620	0.0091	0.0091
100.93	0.5135	0.1732	0.0091	0.0091
100.99	0.5112	0.1845	0.0091	0.0091

101.04	0.5090	0.1958	0.0091	0.0091
101.10	0.5067	0.2072	0.0091	0.0091
101.15	0.5045	0.2186	0.0091	0.0091
101.21	0.5022	0.2300	0.0091	0.0091
101.26	0.5000	0.2416	0.0091	0.0091
101.32	0.4978	0.2531	0.0091	0.0091
101.37	0.4956	0.2647	0.0091	0.0091
101.43	0.4933	0.2764	0.0091	0.0091
101.48	0.4911	0.2881	0.0091	0.0091
101.54	0.4889	0.2998	0.0091	0.0091
101.59	0.4867	0.3114	0.0091	0.0091
101.65	0.4845	0.3232	0.0091	0.0091
101.70	0.4823	0.3350	0.0091	0.0091
101.76	0.4801	0.3468	0.0091	0.0091
101.81	0.4779	0.3587	0.0091	0.0091
101.87	0.4757	0.3706	0.0091	0.0091
101.92	0.4736	0.3826	0.0091	0.0091
101.98	0.4714	0.3947	0.0091	0.0091
102.03	0.4692	0.4068	0.0091	0.0091
102.09	0.4671	0.4189	0.0091	0.0091
102.14	0.4649	0.4311	0.0091	0.0091
102.20	0.4628	0.4434	0.0091	0.0091
102.25	0.4606	0.4557	0.0091	0.0091
102.31	0.4585	0.4681	0.0091	0.0091
102.36	0.4563	0.4805	0.0091	0.0091
102.42	0.4542	0.4929	0.0091	0.0091
102.47	0.4521	0.5055	0.0091	0.0091
102.50	0.4500	0.5118	0.0091	0.0091

Landscape Swale Hydraulic Table

DRAFT

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.5000	0.5515	0.5118	0.0000	2.4072	0.0000
2.5549	0.5539	0.5421	0.0000	2.4072	0.0000
2.6099	0.5562	0.5726	0.0000	2.4922	0.0000
2.6648	0.5586	0.6032	0.0000	2.5773	0.0000
2.7198	0.5610	0.6340	0.0000	2.6623	0.0000
2.7747	0.5633	0.6649	0.0000	2.7474	0.0000
2.8297	0.5657	0.6959	0.0000	2.8325	0.0000
2.8846	0.5681	0.7271	0.0000	2.9175	0.0000
2.9396	0.5705	0.7583	0.0000	3.0026	0.0000
2.9945	0.5729	0.7897	0.0000	3.0876	0.0000
3.0495	0.5752	0.8213	0.0000	3.1727	0.0000
3.1044	0.5776	0.8530	0.0000	3.2578	0.0000
3.1593	0.5801	0.8848	0.0000	3.3428	0.0000
3.2143	0.5825	0.9167	0.0000	3.4279	0.0000
3.2692	0.5849	0.9488	0.0000	3.5129	0.0000
3.3242	0.5873	0.9810	0.0000	3.5980	0.0000
3.3791	0.5897	1.0133	0.0000	3.6830	0.0000
3.4341	0.5921	1.0458	0.0000	3.7681	0.0000
3.4890	0.5946	1.0784	0.0000	3.8532	0.0000
3.5440	0.5970	1.1111	0.0049	3.9382	0.0000
3.5989	0.5995	1.1440	0.0074	4.0233	0.0000
3.6538	0.6019	1.1770	0.0092	4.1083	0.0000
3.7088	0.6044	1.2101	0.0107	4.1934	0.0000
3.7637	0.6068	1.2434	0.0120	4.2785	0.0000
3.8187	0.6093	1.2768	0.0132	4.3635	0.0000
3.8736	0.6118	1.3104	0.0143	4.4486	0.0000
3.9286	0.6142	1.3440	0.0153	4.5336	0.0000

3.9835	0.6167	1.3779	0.0163	4.6187	0.0000
4.0385	0.6192	1.4118	0.0172	4.7038	0.0000
4.0934	0.6217	1.4459	0.0180	4.7888	0.0000
4.1484	0.6242	1.4801	0.0189	4.8739	0.0000
4.2033	0.6267	1.5145	0.0197	4.9589	0.0000
4.2582	0.6292	1.5490	0.0204	5.0440	0.0000
4.3132	0.6317	1.5836	0.0212	5.1291	0.0000
4.3681	0.6342	1.6184	0.0219	5.2141	0.0000
4.4231	0.6367	1.6533	0.0226	5.2992	0.0000
4.4780	0.6392	1.6884	0.0233	5.3842	0.0000
4.5330	0.6418	1.7236	0.0245	5.4693	0.0000
4.5879	0.6443	1.7589	0.0251	5.5543	0.0000
4.6429	0.6468	1.7944	0.0257	5.6394	0.0000
4.6978	0.6494	1.8300	0.0263	5.7245	0.0000
4.7527	0.6519	1.8657	0.0268	5.8095	0.0000
4.8077	0.6545	1.9016	0.0274	5.8946	0.0000
4.8626	0.6570	1.9376	0.0279	5.9796	0.0000
4.9176	0.6596	1.9738	0.0284	6.0647	0.0000
4.9725	0.6622	2.0101	0.0290	6.1498	0.0000
5.0000	0.6635	2.0283	0.0292	6.1923	0.0000

DRAFT

Surface Bioretention

Element Flows To:

Outlet 1	Outlet 2
	DMA-4 Partial Bioretention

DRAFT

DMA-2 Partial Bioretention

Bottom Length:	56.00 ft.
Bottom Width:	56.00 ft.
Material thickness of first layer:	1.5
Material type for first layer:	Amended 5 in/hr
Material thickness of second layer:	1
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Infiltration On	
Infiltration rate:	0.02
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	4.508
Total Volume Through Riser (ac-ft.):	0.338
Total Volume Through Facility (ac-ft.):	10.051
Percent Infiltrated:	44.85
Total Precip Applied to Facility:	1.192
Total Evap From Facility:	1.89
Underdrain used	
Underdrain Diameter (feet):	0.5
Orifice Diameter (in.):	1
Offset (in.):	5.5
Flow Through Underdrain (ac-ft.):	5.205
Total Outflow (ac-ft.):	10.051
Percent Through Underdrain:	51.79
Discharge Structure	
Riser Height:	1 ft.
Riser Diameter:	12 in.
Notch Type:	Rectangular
Notch Width:	0.000 ft.
Notch Height:	0.000 ft.
Element Flows To:	
Outlet 1	Outlet 2

DRAFT

Landscape Swale Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
100.00	0.1157	0.0000	0.0000	0.0000
100.05	0.1152	0.0008	0.0000	0.0000
100.11	0.1141	0.0025	0.0000	0.0000
100.16	0.1131	0.0042	0.0000	0.0000
100.22	0.1120	0.0060	0.0015	0.0015
100.27	0.1109	0.0077	0.0015	0.0015
100.33	0.1099	0.0095	0.0015	0.0015
100.38	0.1088	0.0113	0.0015	0.0015
100.44	0.1078	0.0131	0.0015	0.0015
100.49	0.1068	0.0149	0.0015	0.0015
100.55	0.1057	0.0168	0.0015	0.0015
100.60	0.1047	0.0186	0.0015	0.0015
100.66	0.1037	0.0205	0.0015	0.0015
100.71	0.1027	0.0225	0.0015	0.0015
100.77	0.1017	0.0244	0.0015	0.0015
100.82	0.1007	0.0264	0.0015	0.0015
100.88	0.0997	0.0283	0.0015	0.0015
100.93	0.0987	0.0303	0.0015	0.0015
100.99	0.0977	0.0324	0.0015	0.0015

101.04	0.0967	0.0344	0.0015	0.0015
101.10	0.0957	0.0365	0.0015	0.0015
101.15	0.0947	0.0385	0.0015	0.0015
101.21	0.0938	0.0407	0.0015	0.0015
101.26	0.0928	0.0428	0.0015	0.0015
101.32	0.0918	0.0449	0.0015	0.0015
101.37	0.0909	0.0471	0.0015	0.0015
101.43	0.0899	0.0493	0.0015	0.0015
101.48	0.0890	0.0515	0.0015	0.0015
101.54	0.0881	0.0537	0.0015	0.0015
101.59	0.0871	0.0560	0.0015	0.0015
101.65	0.0862	0.0582	0.0015	0.0015
101.70	0.0853	0.0605	0.0015	0.0015
101.76	0.0843	0.0628	0.0015	0.0015
101.81	0.0834	0.0652	0.0015	0.0015
101.87	0.0825	0.0675	0.0015	0.0015
101.92	0.0816	0.0699	0.0015	0.0015
101.98	0.0807	0.0723	0.0015	0.0015
102.03	0.0798	0.0747	0.0015	0.0015
102.09	0.0789	0.0772	0.0015	0.0015
102.14	0.0780	0.0796	0.0015	0.0015
102.20	0.0772	0.0821	0.0015	0.0015
102.25	0.0763	0.0846	0.0015	0.0015
102.31	0.0754	0.0872	0.0015	0.0015
102.36	0.0746	0.0898	0.0015	0.0015
102.42	0.0737	0.0923	0.0015	0.0015
102.47	0.0728	0.0950	0.0015	0.0015
102.50	0.0720	0.0963	0.0015	0.0015

Landscape Swale Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.5000	0.1157	0.0963	0.0000	0.3851	0.0000
2.5549	0.1168	0.1027	0.0000	0.3851	0.0000
2.6099	0.1179	0.1091	0.0000	0.3988	0.0000
2.6648	0.1190	0.1156	0.0000	0.4124	0.0000
2.7198	0.1201	0.1222	0.0000	0.4260	0.0000
2.7747	0.1212	0.1288	0.0000	0.4396	0.0000
2.8297	0.1223	0.1355	0.0000	0.4532	0.0000
2.8846	0.1234	0.1422	0.0000	0.4668	0.0000
2.9396	0.1245	0.1491	0.0000	0.4804	0.0000
2.9945	0.1256	0.1559	0.0000	0.4940	0.0000
3.0495	0.1267	0.1629	0.0000	0.5076	0.0000
3.1044	0.1278	0.1699	0.0000	0.5212	0.0000
3.1593	0.1290	0.1769	0.0000	0.5349	0.0000
3.2143	0.1301	0.1840	0.0000	0.5485	0.0000
3.2692	0.1313	0.1912	0.0000	0.5621	0.0000
3.3242	0.1324	0.1984	0.0000	0.5757	0.0000
3.3791	0.1336	0.2058	0.0000	0.5893	0.0000
3.4341	0.1347	0.2131	0.0000	0.6029	0.0000
3.4890	0.1359	0.2206	0.0000	0.6165	0.0000
3.5440	0.1370	0.2281	0.0041	0.6301	0.0000
3.5989	0.1382	0.2356	0.0061	0.6437	0.0000
3.6538	0.1394	0.2432	0.0076	0.6573	0.0000
3.7088	0.1406	0.2509	0.0088	0.6709	0.0000
3.7637	0.1418	0.2587	0.0099	0.6846	0.0000
3.8187	0.1430	0.2665	0.0109	0.6982	0.0000
3.8736	0.1442	0.2744	0.0118	0.7118	0.0000
3.9286	0.1454	0.2824	0.0127	0.7254	0.0000

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3.9835	0.1466	0.2904	0.0135	0.7390	0.0000
4.0385	0.1478	0.2985	0.0142	0.7526	0.0000
4.0934	0.1490	0.3066	0.0149	0.7662	0.0000
4.1484	0.1502	0.3148	0.0156	0.7798	0.0000
4.2033	0.1514	0.3231	0.0162	0.7934	0.0000
4.2582	0.1527	0.3315	0.0169	0.8070	0.0000
4.3132	0.1539	0.3399	0.0175	0.8206	0.0000
4.3681	0.1551	0.3484	0.0181	0.8343	0.0000
4.4231	0.1564	0.3569	0.0187	0.8479	0.0000
4.4780	0.1576	0.3656	0.0193	0.8615	0.0000
4.5330	0.1589	0.3743	0.0203	0.8751	0.0000
4.5879	0.1602	0.3830	0.0208	0.8887	0.0000
4.6429	0.1614	0.3919	0.0212	0.9023	0.0000
4.6978	0.1627	0.4008	0.0217	0.9159	0.0000
4.7527	0.1640	0.4098	0.0222	0.9295	0.0000
4.8077	0.1653	0.4188	0.0226	0.9431	0.0000
4.8626	0.1666	0.4279	0.0231	0.9567	0.0000
4.9176	0.1678	0.4371	0.0235	0.9704	0.0000
4.9725	0.1691	0.4464	0.0239	0.9840	0.0000
5.0000	0.1698	0.4510	0.0241	0.9908	0.0000

DRAFT

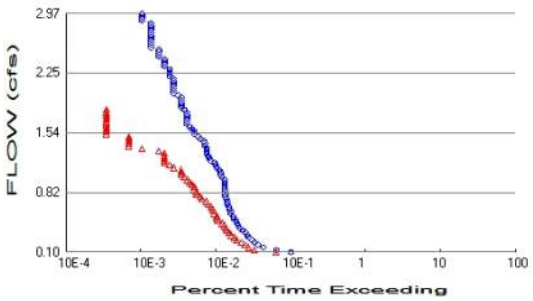
Surface Bioretention

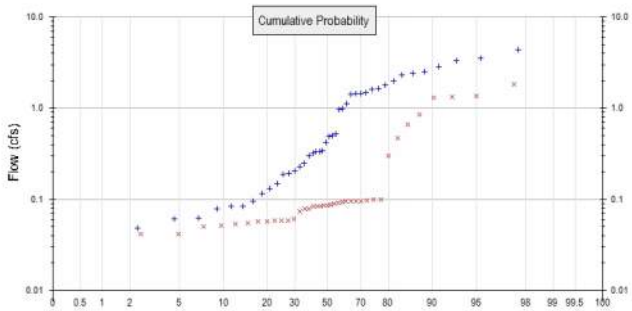
Element Flows To:

Outlet 1	Outlet 2
	DMA-2 Partial Bioretention

DRAFT

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 17.9
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 9.92
Total Impervious Area: 7.98

Flow Frequency Method: Weibull

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.993716
5 year	2.300398
10 year	2.971769
25 year	3.615624

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.091439
5 year	0.463651
10 year	1.304813
25 year	1.422692

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Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0994	293	184	62	Pass
0.1284	186	95	51	Pass
0.1574	127	80	62	Pass
0.1864	106	71	66	Pass
0.2154	95	64	67	Pass
0.2444	88	55	62	Pass
0.2735	80	52	65	Pass
0.3025	77	47	61	Pass
0.3315	72	44	61	Pass
0.3605	66	41	62	Pass
0.3895	61	39	63	Pass
0.4185	58	38	65	Pass
0.4475	56	35	62	Pass
0.4766	54	31	57	Pass
0.5056	50	30	60	Pass
0.5346	49	30	61	Pass
0.5636	46	28	60	Pass
0.5926	46	27	58	Pass
0.6216	44	26	59	Pass
0.6506	43	25	58	Pass
0.6797	42	23	54	Pass
0.7087	42	22	52	Pass
0.7377	40	19	47	Pass
0.7667	39	18	46	Pass
0.7957	39	16	41	Pass
0.8247	39	16	41	Pass
0.8537	39	15	38	Pass
0.8828	38	15	39	Pass
0.9118	38	14	36	Pass
0.9408	38	13	34	Pass
0.9698	38	12	31	Pass
0.9988	35	11	31	Pass
1.0278	34	10	29	Pass
1.0568	34	10	29	Pass
1.0859	33	10	30	Pass
1.1149	30	8	26	Pass
1.1439	29	7	24	Pass
1.1729	28	6	21	Pass
1.2019	25	6	24	Pass
1.2309	24	6	25	Pass
1.2599	23	6	26	Pass
1.2890	22	6	27	Pass
1.3180	22	5	22	Pass
1.3470	22	3	13	Pass
1.3760	21	2	9	Pass
1.4050	21	2	9	Pass
1.4340	20	2	10	Pass
1.4630	18	2	11	Pass
1.4920	17	2	11	Pass
1.5211	15	1	6	Pass
1.5501	15	1	6	Pass
1.5791	14	1	7	Pass
1.6081	13	1	7	Pass

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1.6371	12	1	8	Pass
1.6661	12	1	8	Pass
1.6951	12	1	8	Pass
1.7242	12	1	8	Pass
1.7532	12	1	8	Pass
1.7822	12	1	8	Pass
1.8112	11	1	9	Pass
1.8402	10	0	0	Pass
1.8692	10	0	0	Pass
1.8982	10	0	0	Pass
1.9273	10	0	0	Pass
1.9563	10	0	0	Pass
1.9853	9	0	0	Pass
2.0143	8	0	0	Pass
2.0433	8	0	0	Pass
2.0723	8	0	0	Pass
2.1013	8	0	0	Pass
2.1304	8	0	0	Pass
2.1594	8	0	0	Pass
2.1884	8	0	0	Pass
2.2174	7	0	0	Pass
2.2464	7	0	0	Pass
2.2754	7	0	0	Pass
2.3044	7	0	0	Pass
2.3335	6	0	0	Pass
2.3625	6	0	0	Pass
2.3915	6	0	0	Pass
2.4205	6	0	0	Pass
2.4495	5	0	0	Pass
2.4785	5	0	0	Pass
2.5075	5	0	0	Pass
2.5366	5	0	0	Pass
2.5656	4	0	0	Pass
2.5946	4	0	0	Pass
2.6236	4	0	0	Pass
2.6526	4	0	0	Pass
2.6816	4	0	0	Pass
2.7106	4	0	0	Pass
2.7397	4	0	0	Pass
2.7687	4	0	0	Pass
2.7977	4	0	0	Pass
2.8267	4	0	0	Pass
2.8557	4	0	0	Pass
2.8847	3	0	0	Pass
2.9137	3	0	0	Pass
2.9428	3	0	0	Pass
2.9718	3	0	0	Pass

DRAFT

Water Quality

DRAFT

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

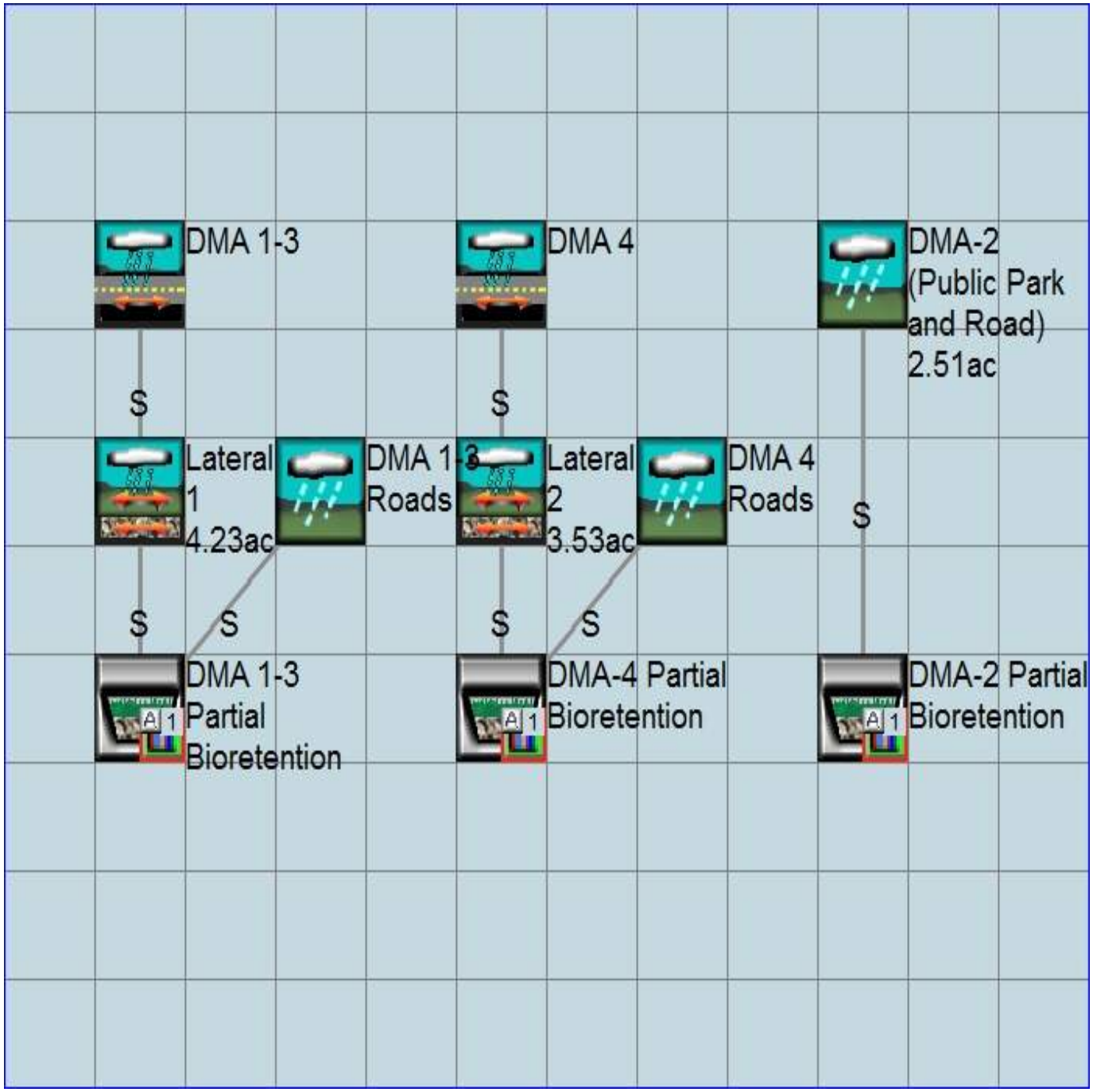
No IMPLND changes have been made.

DRAFT

Appendix

Predeveloped Schematic

Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1971 10 01        END    2004 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
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<-ID->                                                               ***
WDM        26   Sweetwater Place 5-23-16.wdm
MESSU      25   PreSweetwater Place 5-23-16.MES
           27   PreSweetwater Place 5-23-16.L61
           28   PreSweetwater Place 5-23-16.L62
           30   POCSweetwater Place 5-23-161.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:60
      PERLND      32
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Sweetwater Place EX Condi   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                           in  out           ***
   32      D,Dirt,Moderate        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   32         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   32         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

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```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   32         0    1    1    1    0    0    0    0    1    1    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   32              0       4.5      0.04       175       0.1       2.5     0.915
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   32              0         0         2         2         0      0.05      0.05
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   32              0       0.6       0.2       1.5       0.7         0
  END PWAT-PARM4
  MON-LZETPARM
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   32       0.4  0.4  0.4  0.4  0.6  0.6  0.6  0.6  0.6  0.4  0.4  0.4
  END MON-LZETPARM
  MON-INTERCEP
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   32       0.1  0.1  0.1  0.1 0.06 0.06 0.06 0.06 0.06  0.1  0.1  0.1
  END MON-INTERCEP

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   32              0         0      0.01         0       0.4      0.01         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                       in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2
```

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```
  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Sweetwater Place EX Condition***
PERLND  32                        17.9     COPY   501     12
PERLND  32                        17.9     COPY   501     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   12.1        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                        in  out                               ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                   ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                      ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES
```

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```
SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     12.1      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13


END MASS-LINK

END RUN
```

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Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1971 10 01        END    2004 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                               ***
WDM        26   Sweetwater Place 5-23-16.wdm
MESSU      25   MitSweetwater Place 5-23-16.MES
           27   MitSweetwater Place 5-23-16.L61
           28   MitSweetwater Place 5-23-16.L62
           30   POCSweetwater Place 5-23-161.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:60
      IMPLND       6
      IMPLND       7
      PERLND      47
      IMPLND       2
      IMPLND       1
      PERLND      63
      PERLND      64
      GENER        2
      RCHRES       1
      RCHRES       2
      GENER        4
      RCHRES       3
      RCHRES       4
      GENER        6
      RCHRES       5
      RCHRES       6
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        DMA-2 Partial Bioretentio   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
    2        24
    4        24
    6        24
  END OPCODE
  PARM
    #    #         K ***
    2             0.
    4             0.
    6             0.
  END PARM
```

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```
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -   #                          User  t-series Engl Metr ***
                                            in  out            ***
   47      D,Urban,Moderate       1    1    1    1   27    0
   63     D,NatVeg,Flat           1    1    1    1   27    0
   64     D,NatVeg,Flat           1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -   # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   47         0    0    1    0    0    0    0    0    0    0    0    0
   63         0    0    1    0    0    0    0    0    0    0    0    0
   64         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -   # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   47         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   63         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   64         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -   # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   47         0    1    1    1    0    0    0    0    1    1    0
   63         0    1    1    1    0    0    0    0    1    1    0
   64         0    1    1    1    0    0    0    0    1    1    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -   # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   47              0       4.5      0.03       175       0.1       2.5     0.915
   63              0       4.8      0.04       200      0.05       2.5     0.915
   64              0       4.8      0.04       200      0.05       2.5     0.915
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -   # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   47              0         0         2         2         0      0.05      0.05
   63              0         0         2         2         0      0.05      0.05
   64              0         0         2         2         0      0.05      0.05
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                  ***
    # -   #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   47              0       0.6       0.2       1.5       0.7         0
   63              0       0.6       0.2       1.5       0.7         0
   64              0       0.6       0.2       1.5       0.7         0
  END PWAT-PARM4
  MON-LZETPARM
    <PLS >      PWATER input info: Part 3         ***
    # -   #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   47       0.4  0.4  0.4  0.4  0.6  0.6  0.6  0.6  0.6  0.4  0.4  0.4
   63       0.4  0.4  0.4  0.4  0.6  0.6  0.6  0.6  0.6  0.4  0.4  0.4
   64       0.4  0.4  0.4  0.4  0.6  0.6  0.6  0.6  0.6  0.4  0.4  0.4
  END MON-LZETPARM
  MON-INTERCEP
    <PLS >      PWATER input info: Part 3         ***
    # -   #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   47       0.1  0.1  0.1  0.1 0.06 0.06 0.06 0.06 0.06  0.1  0.1  0.1
   63       0.1  0.1  0.1  0.1 0.06 0.06 0.06 0.06 0.06  0.1  0.1  0.1
```

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```
   64       0.1  0.1  0.1  0.1 0.06 0.06 0.06 0.06 0.06  0.1  0.1  0.1
  END MON-INTERCEP

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -   # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   47              0         0      0.15         0         1      0.05         0
   63              0         0      0.01         0       0.4      0.01         0
   64              0         0      0.01         0       0.4      0.01         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -   #                     User  t-series Engl Metr ***
                                       in  out           ***
    6     IMPERVIOUS-FLAT LAT     1    1    1   27    0
    7     IMPERVIOUS-FLAT LAT     1    1    1   27    0
    2      IMPERVIOUS-MOD         1    1    1   27    0
    1      IMPERVIOUS-FLAT        1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -   # ATMP SNOW IWAT  SLD  IWG IQAL    ***
    6         0    0    1    0    0    0
    7         0    0    1    0    0    0
    2         0    0    1    0    0    0
    1         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -   # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    6         0    0    4    0    0    0    1    9
    7         0    0    4    0    0    0    1    9
    2         0    0    4    0    0    0    1    9
    1         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -   # CSNO RTOP  VRS  VNN RTLI     ***
    6         0    0    0    0    1
    7         0    0    0    0    1
    2         0    0    0    0    1
    1         0    0    0    0    1
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -   # ***  LSUR     SLSUR      NSUR     RETSC
    6            100      0.05      0.05       0.1
    7            100      0.05      0.05       0.1
    2            100       0.1      0.05      0.08
    1            100      0.05      0.05       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -   # ***PETMAX    PETMIN
    6              0         0
    7              0         0
    2              0         0
    1              0         0
  END IWAT-PARM3
```

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```
  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    6             0         0
    7             0         0
    2             0         0
    1             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
DMA 1-3***
IMPLND   6                      0.7329     PERLND  63     50
Lateral Basin  1***
PERLND  63                        4.23     RCHRES   3      2
DMA-2 (Public Park and Road)***
PERLND  47                        2.16     RCHRES   1      2
IMPLND   2                        0.35     RCHRES   1      5
DMA 1-3 Roads***
IMPLND   1                        1.03     RCHRES   3      5
DMA 4 Roads***
IMPLND   1                         0.9     RCHRES   5      5
DMA 4***
IMPLND   7                      0.7365     PERLND  64     50
Lateral Basin  2***
PERLND  64                        3.53     RCHRES   5      2

******Routing******
RCHRES   3                           1     RCHRES   4      8
PERLND  63                        4.23     COPY     1     12
RCHRES   5                           1     RCHRES   6      8
RCHRES   5                                 COPY     1     18
RCHRES   1                           1     RCHRES   2      8
RCHRES   1                                 COPY     1     18
IMPLND   1                        1.03     COPY     1     15
RCHRES   4                           1     COPY   501     17
RCHRES   3                           1     COPY   501     17
RCHRES   6                           1     COPY   501     17
RCHRES   2                           1     COPY   501     17
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   12.1        DISPLY   1     INPUT  TIMSER 1
GENER    2 OUTPUT TIMSER      .0002778     RCHRES   1     EXTNL  OUTDGT 1
GENER    4 OUTPUT TIMSER      .0002778     RCHRES   3     EXTNL  OUTDGT 1
GENER    6 OUTPUT TIMSER      .0002778     RCHRES   5     EXTNL  OUTDGT 1


<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                          in  out                            ***
    1     Surface Bioreten-021    3    1    1    1   28    0    1
    2     DMA-2 Partial Bi-020    2    1    1    1   28    0    1
    3     Surface Bioreten-008    3    1    1    1   28    0    1
    4     DMA 1-3 Partial -007    2    1    1    1   28    0    1
    5     Surface Bioreten-018    3    1    1    1   28    0    1
    6     DMA-4 Partial Bi-017    2    1    1    1   28    0    1
```

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```
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
    2         1    0    0    0    0    0    0    0    0    0
    3         1    0    0    0    0    0    0    0    0    0
    4         1    0    0    0    0    0    0    0    0    0
    5         1    0    0    0    0    0    0    0    0    0
    6         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
    2         4    0    0    0    0    0    0    0    0    0    1    9
    3         4    0    0    0    0    0    0    0    0    0    1    9
    4         4    0    0    0    0    0    0    0    0    0    1    9
    5         4    0    0    0    0    0    0    0    0    0    1    9
    6         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                        ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
           FG FG FG FG  possible  exit  *** possible  exit      possible  exit
            *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
    1       0  1  0  0    4  5  6  0  0       0  1  0  0  0        2  1  2  2  2
    2       0  1  0  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
    3       0  1  0  0    4  5  6  0  0       0  1  0  0  0        2  1  2  2  2
    4       0  1  0  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
    5       0  1  0  0    4  5  6  0  0       0  1  0  0  0        2  1  2  2  2
    6       0  1  0  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1             1      0.01       0.0     100.0       0.5       0.0
    2             2      0.01       0.0     100.0       0.5       0.0
    3             3      0.01       0.0     100.0       0.5       0.0
    4             4      0.02       0.0     100.0       0.5       0.0
    5             5      0.01       0.0     100.0       0.5       0.0
    6             6      0.03       0.0     100.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                           ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1           0         4.0  5.0  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2           0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    3           0         4.0  5.0  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    4           0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    5           0         4.0  5.0  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    6           0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
*** User-Defined Variable Quantity Lines
***                          addr
***                        <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><--------> <><-> <><-> <--> ***
  UVQUAN vol2   RCHRES   2 VOL              4
  UVQUAN v2m2   GLOBAL     WORKSP  1        3
```

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```
  UVQUAN vpo2   GLOBAL     WORKSP  2        3
  UVQUAN v2d2   GENER    2 K       1        3
*** User-Defined Variable Quantity Lines
***                          addr
***                         <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><--------> <><-> <><-> <--> ***
  UVQUAN vol4   RCHRES   4 VOL              4
  UVQUAN v2m4   GLOBAL     WORKSP  3        3
  UVQUAN vpo4   GLOBAL     WORKSP  4        3
  UVQUAN v2d4   GENER    4 K       1        3
*** User-Defined Variable Quantity Lines
***                          addr
***                         <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><--------> <><-> <><-> <--> ***
  UVQUAN vol6   RCHRES   6 VOL              4
  UVQUAN v2m6   GLOBAL     WORKSP  5        3
  UVQUAN vpo6   GLOBAL     WORKSP  6        3
  UVQUAN v2d6   GENER    6 K       1        3
*** User-Defined Target Variable Names
***                  addr or                      addr or
***                 <------>                     <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m2    1 WORKSP  1         1.0 QUAN
  UVNAME  vpo2    1 WORKSP  2         1.0 QUAN
  UVNAME  v2d2    1 K       1         1.0 QUAN
*** User-Defined Target Variable Names
***                  addr or                      addr or
***                 <------>                     <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m4    1 WORKSP  3         1.0 QUAN
  UVNAME  vpo4    1 WORKSP  4         1.0 QUAN
  UVNAME  v2d4    1 K       1         1.0 QUAN
*** User-Defined Target Variable Names
***                  addr or                      addr or
***                 <------>                     <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m6    1 WORKSP  5         1.0 QUAN
  UVNAME  vpo6    1 WORKSP  6         1.0 QUAN
  UVNAME  v2d6    1 K       1         1.0 QUAN
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  GENER   2                               v2m2            =  3929.
*** Compute remaining available pore space
  GENER   2                               vpo2            =  v2m2
  GENER   2                               vpo2           -=  vol2
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo2 < 0.0) THEN
  GENER   2                               vpo2            =  0.0
END IF
*** Infiltration volume
  GENER   2                               v2d2            =  vpo2
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  GENER   4                               v2m4            =  13786.
*** Compute remaining available pore space
  GENER   4                               vpo4            =  v2m4
  GENER   4                               vpo4           -=  vol4
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo4 < 0.0) THEN
  GENER   4                               vpo4            =  0.0
END IF
*** Infiltration volume
  GENER   4                               v2d4            =  vpo4
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
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  GENER   6                                  v2m6            =  20917.
*** Compute remaining available pore space
  GENER   6                                  vpo6            =  v2m6
  GENER   6                                  vpo6           -=  vol6
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo6 < 0.0) THEN
  GENER   6                                  vpo6            =  0.0
END IF
*** Infiltration volume
  GENER   6                                  v2d6            =  vpo6
END SPEC-ACTIONS
FTABLES
  FTABLE      4
   51    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.370271  0.000000  0.000000  0.000000
  0.050549  0.369464  0.003065  0.000000  0.000000
  0.101099  0.367699  0.006147  0.000000  0.000000
  0.151648  0.365939  0.012344  0.000000  0.000000
  0.202198  0.364183  0.018574  0.000000  0.005807
  0.252747  0.362431  0.024838  0.000000  0.005807
  0.303297  0.360684  0.031135  0.000000  0.005807
  0.353846  0.358940  0.037466  0.000000  0.005807
  0.404396  0.357201  0.043831  0.000000  0.005807
  0.454945  0.355466  0.050230  0.000000  0.005807
  0.505495  0.353736  0.056662  0.000000  0.005807
  0.556044  0.352009  0.063128  0.000000  0.005807
  0.606593  0.350287  0.069629  0.000000  0.005807
  0.657143  0.348569  0.076164  0.000000  0.005807
  0.707692  0.346855  0.082733  0.000000  0.005807
  0.758242  0.345145  0.089336  0.000000  0.005807
  0.808791  0.343440  0.095974  0.000000  0.005807
  0.859341  0.341739  0.102647  0.000000  0.005807
  0.909890  0.340042  0.109354  0.000000  0.005807
  0.960440  0.338349  0.116095  0.000000  0.005807
  1.010989  0.336661  0.122872  0.003991  0.005807
  1.061538  0.334977  0.129683  0.009416  0.005807
  1.112088  0.333297  0.136530  0.012703  0.005807
  1.162637  0.331621  0.143412  0.015300  0.005807
  1.213187  0.329949  0.150328  0.017516  0.005807
  1.263736  0.328282  0.157280  0.019482  0.005807
  1.314286  0.326619  0.164268  0.021267  0.005807
  1.364835  0.324960  0.171291  0.022914  0.005807
  1.415385  0.323305  0.178349  0.024452  0.005807
  1.465934  0.321655  0.185443  0.025899  0.005807
  1.516484  0.320008  0.192488  0.027271  0.005807
  1.567033  0.318366  0.199568  0.028578  0.005807
  1.617582  0.316729  0.206683  0.029830  0.005807
  1.668132  0.315095  0.213835  0.031033  0.005807
  1.718681  0.313466  0.221022  0.032195  0.005807
  1.769231  0.311841  0.228244  0.033320  0.005807
  1.819780  0.310220  0.235503  0.034414  0.005807
  1.870330  0.308603  0.242797  0.035484  0.005807
  1.920879  0.306991  0.250127  0.036540  0.005807
  1.971429  0.305382  0.257494  0.037619  0.005807
  2.021978  0.303778  0.264896  0.039540  0.005807
  2.072527  0.302179  0.272335  0.040435  0.005807
  2.123077  0.300583  0.279810  0.041309  0.005807
  2.173626  0.298992  0.287322  0.042166  0.005807
  2.224176  0.297405  0.294870  0.043005  0.005807
  2.274725  0.295822  0.302455  0.043829  0.005807
  2.325275  0.294243  0.310076  0.044637  0.005807
  2.375824  0.292669  0.317734  0.045431  0.005807
  2.426374  0.291098  0.325429  0.046211  0.005807
  2.476923  0.289532  0.333162  0.046978  0.005807
  2.500000  0.287971  0.673408  0.047324  0.005807
  END FTABLE  4
  FTABLE      3
   43    6
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     Depth      Area    Volume  Outflow1  Outflow2  outflow 3 Velocity  Travel
Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.287971  0.000000  0.000000  0.000000  0.000000
  0.050549  0.372042  0.018762  0.000000  1.536231  0.000000
  0.101099  0.373816  0.037613  0.000000  1.586314  0.000000
  0.151648  0.375596  0.056554  0.000000  1.636397  0.000000
  0.202198  0.377379  0.075585  0.000000  1.686479  0.000000
  0.252747  0.379166  0.094707  0.000000  1.736562  0.000000
  0.303297  0.380958  0.113919  0.000000  1.786645  0.000000
  0.353846  0.382754  0.133222  0.000000  1.836727  0.000000
  0.404396  0.384554  0.152615  0.000000  1.886810  0.000000
  0.454945  0.386359  0.172100  0.000000  1.936893  0.000000
  0.505495  0.388167  0.191676  0.000000  1.986975  0.000000
  0.556044  0.389980  0.211343  0.000000  2.037058  0.000000
  0.606593  0.391797  0.231102  0.005685  2.087141  0.000000
  0.657143  0.393619  0.250953  0.144704  2.137223  0.000000
  0.707692  0.395444  0.270897  0.372233  2.187306  0.000000
  0.758242  0.397274  0.290933  0.653182  2.237389  0.000000
  0.808791  0.399108  0.311061  0.962367  2.287471  0.000000
  0.859341  0.400946  0.331282  1.274196  2.337554  0.000000
  0.909890  0.402789  0.351596  1.563350  2.387637  0.000000
  0.960440  0.404635  0.372004  1.808202  2.437719  0.000000
  1.010989  0.406486  0.392505  1.995719  2.487802  0.000000
  1.061538  0.408341  0.413099  2.127417  2.537885  0.000000
  1.112088  0.410201  0.433787  2.253885  2.587967  0.000000
  1.162637  0.412064  0.454570  2.362511  2.638050  0.000000
  1.213187  0.413932  0.475447  2.466357  2.688133  0.000000
  1.263736  0.415804  0.496418  2.566004  2.738215  0.000000
  1.314286  0.417680  0.517484  2.661923  2.788298  0.000000
  1.364835  0.419561  0.538645  2.754504  2.838381  0.000000
  1.415385  0.421445  0.559902  2.844073  2.888463  0.000000
  1.465934  0.423334  0.581253  2.930906  2.938546  0.000000
  1.516484  0.425228  0.602700  3.015240  2.988629  0.000000
  1.567033  0.427125  0.624243  3.097278  3.038711  0.000000
  1.617582  0.429026  0.645882  3.177198  3.088794  0.000000
  1.668132  0.430932  0.667617  3.255157  3.138877  0.000000
  1.718681  0.432842  0.689449  3.331292  3.188959  0.000000
  1.769231  0.434757  0.711377  3.405726  3.239042  0.000000
  1.819780  0.436675  0.733403  3.478567  3.289125  0.000000
  1.870330  0.438598  0.755525  3.549913  3.339207  0.000000
  1.920879  0.440525  0.777744  3.619854  3.389290  0.000000
  1.971429  0.442456  0.800062  3.688469  3.439373  0.000000
  2.021978  0.444391  0.822476  3.755831  3.489455  0.000000
  2.072527  0.446331  0.844989  3.822005  3.539538  0.000000
  2.100000  0.447387  0.857265  3.887053  3.566757  0.000000
  END FTABLE  3
  FTABLE      6
   47    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.551538  0.000000  0.000000  0.000000
  0.054945  0.550366  0.005204  0.000000  0.000000
  0.109890  0.548025  0.010433  0.000000  0.000000
  0.164835  0.545688  0.020939  0.000000  0.000000
  0.219780  0.543357  0.031494  0.000000  0.009074
  0.274725  0.541031  0.042099  0.000000  0.009074
  0.329670  0.538710  0.052753  0.000000  0.009074
  0.384615  0.536394  0.063457  0.000000  0.009074
  0.439560  0.534082  0.074211  0.000000  0.009074
  0.494505  0.531776  0.085014  0.000000  0.009074
  0.549451  0.529475  0.095867  0.000000  0.009074
  0.604396  0.527179  0.106771  0.000000  0.009074
  0.659341  0.524887  0.117724  0.000000  0.009074
  0.714286  0.522601  0.128728  0.000000  0.009074
  0.769231  0.520320  0.139782  0.000000  0.009074
  0.824176  0.518044  0.150887  0.000000  0.009074
  0.879121  0.515772  0.162043  0.000000  0.009074
  0.934066  0.513506  0.173249  0.000000  0.009074
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  0.989011  0.511245  0.184506  0.000000  0.009074
  1.043956  0.508988  0.195814  0.004914  0.009074
  1.098901  0.506737  0.207173  0.007367  0.009074
  1.153846  0.504491  0.218583  0.009187  0.009074
  1.208791  0.502249  0.230045  0.010701  0.009074
  1.263736  0.500013  0.241558  0.012027  0.009074
  1.318681  0.497782  0.253122  0.013221  0.009074
  1.373626  0.495555  0.264738  0.014316  0.009074
  1.428571  0.493334  0.276406  0.015333  0.009074
  1.483516  0.491118  0.288126  0.016288  0.009074
  1.538462  0.488906  0.299758  0.017191  0.009074
  1.593407  0.486700  0.311441  0.018050  0.009074
  1.648352  0.484498  0.323176  0.018871  0.009074
  1.703297  0.482302  0.334963  0.019660  0.009074
  1.758242  0.480110  0.346801  0.020421  0.009074
  1.813187  0.477924  0.358692  0.021158  0.009074
  1.868132  0.475742  0.370634  0.021878  0.009074
  1.923077  0.473566  0.382629  0.022586  0.009074
  1.978022  0.471395  0.394676  0.023317  0.009074
  2.032967  0.469228  0.406776  0.024531  0.009074
  2.087912  0.467067  0.418927  0.025128  0.009074
  2.142857  0.464910  0.431132  0.025710  0.009074
  2.197802  0.462758  0.443389  0.026280  0.009074
  2.252747  0.460612  0.455700  0.026838  0.009074
  2.307692  0.458470  0.468063  0.027384  0.009074
  2.362637  0.456334  0.480479  0.027920  0.009074
  2.417582  0.454202  0.492949  0.028445  0.009074
  2.472527  0.452076  0.505472  0.028961  0.009074
  2.500000  0.449954  1.074681  0.029216  0.009074
  END FTABLE  6
  FTABLE      5
   47    6
     Depth       Area    Volume  Outflow1  Outflow2  outflow 3 Velocity  Travel
Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.449954  0.000000  0.000000  0.000000  0.000000
  0.054945  0.553887  0.030369  0.000000  2.407166  0.000000
  0.109890  0.556240  0.060867  0.000000  2.492225  0.000000
  0.164835  0.558599  0.091494  0.000000  2.577284  0.000000
  0.219780  0.560963  0.122251  0.000000  2.662343  0.000000
  0.274725  0.563331  0.153139  0.000000  2.747402  0.000000
  0.329670  0.565705  0.184156  0.000000  2.832461  0.000000
  0.384615  0.568083  0.215304  0.000000  2.917520  0.000000
  0.439560  0.570467  0.246583  0.000000  3.002578  0.000000
  0.494505  0.572855  0.277993  0.000000  3.087637  0.000000
  0.549451  0.575249  0.309534  0.000000  3.172696  0.000000
  0.604396  0.577648  0.341207  0.000000  3.257755  0.000000
  0.659341  0.580051  0.373012  0.000000  3.342814  0.000000
  0.714286  0.582460  0.404949  0.000000  3.427873  0.000000
  0.769231  0.584873  0.437019  0.000000  3.512932  0.000000
  0.824176  0.587292  0.469221  0.000000  3.597991  0.000000
  0.879121  0.589715  0.501557  0.000000  3.683050  0.000000
  0.934066  0.592144  0.534025  0.000000  3.768108  0.000000
  0.989011  0.594577  0.566627  0.000000  3.853167  0.000000
  1.043956  0.597015  0.599363  0.097690  3.938226  0.000000
  1.098901  0.599459  0.632234  0.328096  4.023285  0.000000
  1.153846  0.601907  0.665238  0.627270  4.108344  0.000000
  1.208791  0.604361  0.698377  0.962367  4.193403  0.000000
  1.263736  0.606819  0.731652  1.300589  4.278462  0.000000
  1.318681  0.609283  0.765061  1.609623  4.363521  0.000000
  1.373626  0.611751  0.798606  1.862893  4.448579  0.000000
  1.428571  0.614224  0.832286  2.047214  4.533638  0.000000
  1.483516  0.616703  0.866103  2.172110  4.618697  0.000000
  1.538462  0.619186  0.900056  2.311197  4.703756  0.000000
  1.593407  0.621674  0.934146  2.426251  4.788815  0.000000
  1.648352  0.624168  0.968372  2.536091  4.873874  0.000000
  1.703297  0.626666  1.002736  2.641368  4.958933  0.000000
  1.758242  0.629169  1.037237  2.742606  5.043992  0.000000
  1.813187  0.631678  1.071875  2.840238  5.129050  0.000000
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  1.868132  0.634191  1.106652  2.934624  5.214109  0.000000
  1.923077  0.636709  1.141567  3.026067  5.299168  0.000000
  1.978022  0.639233  1.176620  3.114826  5.384227  0.000000
  2.032967  0.641761  1.211812  3.201126  5.469286  0.000000
  2.087912  0.644294  1.247143  3.285159  5.554345  0.000000
  2.142857  0.646832  1.282614  3.367096  5.639404  0.000000
  2.197802  0.649376  1.318224  3.447086  5.724463  0.000000
  2.252747  0.651924  1.353974  3.525261  5.809522  0.000000
  2.307692  0.654477  1.389864  3.601740  5.894580  0.000000
  2.362637  0.657035  1.425895  3.676628  5.979639  0.000000
  2.417582  0.659599  1.462066  3.750021  6.064698  0.000000
  2.472527  0.662167  1.498378  3.822005  6.149757  0.000000
  2.500000  0.663453  1.516587  3.892658  6.192286  0.000000
  END FTABLE  5
  FTABLE      2
   47    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.115725  0.000000  0.000000  0.000000
  0.054945  0.115189  0.000836  0.000000  0.000000
  0.109890  0.114119  0.002526  0.000000  0.000000
  0.164835  0.113054  0.004237  0.000000  0.000000
  0.219780  0.111995  0.005968  0.000000  0.001452
  0.274725  0.110940  0.007718  0.000000  0.001452
  0.329670  0.109890  0.009489  0.000000  0.001452
  0.384615  0.108845  0.011280  0.000000  0.001452
  0.439560  0.107806  0.013091  0.000000  0.001452
  0.494505  0.106771  0.014923  0.000000  0.001452
  0.549451  0.105741  0.016775  0.000000  0.001452
  0.604396  0.104716  0.018649  0.000000  0.001452
  0.659341  0.103697  0.020542  0.000000  0.001452
  0.714286  0.102682  0.022457  0.000000  0.001452
  0.769231  0.101672  0.024393  0.000000  0.001452
  0.824176  0.100667  0.026350  0.000000  0.001452
  0.879121  0.099667  0.028329  0.000000  0.001452
  0.934066  0.098672  0.030329  0.000000  0.001452
  0.989011  0.097683  0.032350  0.000000  0.001452
  1.043956  0.096698  0.034393  0.004061  0.001452
  1.098901  0.095718  0.036458  0.006088  0.001452
  1.153846  0.094743  0.038544  0.007592  0.001452
  1.208791  0.093773  0.040653  0.008844  0.001452
  1.263736  0.092808  0.042783  0.009940  0.001452
  1.318681  0.091848  0.044936  0.010926  0.001452
  1.373626  0.090893  0.047112  0.011831  0.001452
  1.428571  0.089943  0.049309  0.012672  0.001452
  1.483516  0.088998  0.051529  0.013461  0.001452
  1.538462  0.088059  0.053745  0.014207  0.001452
  1.593407  0.087124  0.055984  0.014917  0.001452
  1.648352  0.086194  0.058245  0.015596  0.001452
  1.703297  0.085269  0.060529  0.016248  0.001452
  1.758242  0.084349  0.062836  0.016877  0.001452
  1.813187  0.083434  0.065166  0.017486  0.001452
  1.868132  0.082524  0.067519  0.018081  0.001452
  1.923077  0.081619  0.069895  0.018666  0.001452
  1.978022  0.080719  0.072295  0.019270  0.001452
  2.032967  0.079823  0.074718  0.020274  0.001452
  2.087912  0.078933  0.077164  0.020767  0.001452
  2.142857  0.078048  0.079634  0.021248  0.001452
  2.197802  0.077168  0.082128  0.021719  0.001452
  2.252747  0.076293  0.084646  0.022180  0.001452
  2.307692  0.075423  0.087187  0.022631  0.001452
  2.362637  0.074558  0.089753  0.023074  0.001452
  2.417582  0.073698  0.092343  0.023508  0.001452
  2.472527  0.072843  0.094957  0.023935  0.001452
  2.500000  0.071993  0.327331  0.024145  0.001452
  END FTABLE  2
  FTABLE      1
   47    6
     Depth      Area    Volume  Outflow1  Outflow2  outflow 3 Velocity  Travel
Time***
```

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```
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.071993  0.000000  0.000000  0.000000  0.000000
  0.054945  0.116803  0.006388  0.000000  0.385147  0.000000
  0.109890  0.117885  0.012836  0.000000  0.398756  0.000000
  0.164835  0.118972  0.019343  0.000000  0.412365  0.000000
  0.219780  0.120064  0.025910  0.000000  0.425975  0.000000
  0.274725  0.121161  0.032537  0.000000  0.439584  0.000000
  0.329670  0.122263  0.039224  0.000000  0.453194  0.000000
  0.384615  0.123370  0.045972  0.000000  0.466803  0.000000
  0.439560  0.124483  0.052781  0.000000  0.480413  0.000000
  0.494505  0.125600  0.059652  0.000000  0.494022  0.000000
  0.549451  0.126722  0.066584  0.000000  0.507631  0.000000
  0.604396  0.127849  0.073577  0.000000  0.521241  0.000000
  0.659341  0.128981  0.080633  0.000000  0.534850  0.000000
  0.714286  0.130118  0.087751  0.000000  0.548460  0.000000
  0.769231  0.131260  0.094932  0.000000  0.562069  0.000000
  0.824176  0.132407  0.102176  0.000000  0.575679  0.000000
  0.879121  0.133559  0.109482  0.000000  0.589288  0.000000
  0.934066  0.134716  0.116853  0.000000  0.602897  0.000000
  0.989011  0.135878  0.124286  0.000000  0.616507  0.000000
  1.043956  0.137045  0.131784  0.097690  0.630116  0.000000
  1.098901  0.138217  0.139347  0.328096  0.643726  0.000000
  1.153846  0.139394  0.146973  0.627270  0.657335  0.000000
  1.208791  0.140576  0.154665  0.962367  0.670944  0.000000
  1.263736  0.141763  0.162421  1.300589  0.684554  0.000000
  1.318681  0.142955  0.170243  1.609623  0.698163  0.000000
  1.373626  0.144152  0.178131  1.862893  0.711773  0.000000
  1.428571  0.145354  0.186084  2.047214  0.725382  0.000000
  1.483516  0.146561  0.194104  2.172110  0.738992  0.000000
  1.538462  0.147773  0.202190  2.311197  0.752601  0.000000
  1.593407  0.148990  0.210343  2.426251  0.766210  0.000000
  1.648352  0.150211  0.218563  2.536091  0.779820  0.000000
  1.703297  0.151438  0.226850  2.641368  0.793429  0.000000
  1.758242  0.152670  0.235204  2.742606  0.807039  0.000000
  1.813187  0.153907  0.243627  2.840238  0.820648  0.000000
  1.868132  0.155149  0.252117  2.934624  0.834257  0.000000
  1.923077  0.156396  0.260676  3.026067  0.847867  0.000000
  1.978022  0.157648  0.269304  3.114826  0.861476  0.000000
  2.032967  0.158904  0.278000  3.201126  0.875086  0.000000
  2.087912  0.160166  0.286766  3.285159  0.888695  0.000000
  2.142857  0.161433  0.295601  3.367096  0.902305  0.000000
  2.197802  0.162705  0.304506  3.447086  0.915914  0.000000
  2.252747  0.163982  0.313481  3.525261  0.929523  0.000000
  2.307692  0.165263  0.322526  3.601740  0.943133  0.000000
  2.362637  0.166550  0.331642  3.676628  0.956742  0.000000
  2.417582  0.167842  0.340828  3.750021  0.970352  0.000000
  2.472527  0.169139  0.350086  3.822005  0.983961  0.000000
  2.500000  0.169789  0.354742  3.892658  0.990766  0.000000
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP
WDM     22 IRRG     ENGL    0.7       SAME PERLND  47     EXTNL  SURLI
WDM      2 PREC     ENGL    1              RCHRES   1     EXTNL  PREC
WDM      2 PREC     ENGL    1              RCHRES   3     EXTNL  PREC
WDM      2 PREC     ENGL    1              RCHRES   5     EXTNL  PREC
WDM      1 EVAP     ENGL    0.5            RCHRES   1     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.7            RCHRES   2     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.5            RCHRES   3     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.7            RCHRES   4     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.5            RCHRES   5     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.7            RCHRES   6     EXTNL  POTEV
```

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```
END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   4 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   4 HYDR   O      1 1        1      WDM   1001 FLOW     ENGL      REPL
RCHRES   4 HYDR   O      2 1        1      WDM   1002 FLOW     ENGL      REPL
RCHRES   4 HYDR   STAGE  1 1        1      WDM   1003 STAG     ENGL      REPL
RCHRES   3 HYDR   STAGE  1 1        1      WDM   1004 STAG     ENGL      REPL
RCHRES   3 HYDR   O      1 1        1      WDM   1005 FLOW     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     12.1      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     12.1      WDM    801 FLOW     ENGL      REPL
RCHRES   6 HYDR   RO     1 1        1      WDM   1006 FLOW     ENGL      REPL
RCHRES   6 HYDR   O      1 1        1      WDM   1007 FLOW     ENGL      REPL
RCHRES   6 HYDR   O      2 1        1      WDM   1008 FLOW     ENGL      REPL
RCHRES   6 HYDR   STAGE  1 1        1      WDM   1009 STAG     ENGL      REPL
RCHRES   5 HYDR   STAGE  1 1        1      WDM   1010 STAG     ENGL      REPL
RCHRES   5 HYDR   O      1 1        1      WDM   1011 FLOW     ENGL      REPL
RCHRES   2 HYDR   RO     1 1        1      WDM   1012 FLOW     ENGL      REPL
RCHRES   2 HYDR   O      1 1        1      WDM   1013 FLOW     ENGL      REPL
RCHRES   2 HYDR   O      2 1        1      WDM   1014 FLOW     ENGL      REPL
RCHRES   2 HYDR   STAGE  1 1        1      WDM   1015 STAG     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1016 STAG     ENGL      REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1017 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        8
RCHRES     OFLOW  OVOL   2                 RCHRES         INFLOW IVOL
  END MASS-LINK    8

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15

  MASS-LINK       17
RCHRES     OFLOW  OVOL   1                 COPY           INPUT  MEAN
  END MASS-LINK   17

  MASS-LINK       18
RCHRES     OFLOW  OVOL   2                 COPY           INPUT  MEAN
  END MASS-LINK   18

  MASS-LINK       50
IMPLND     IWATER SURO                     PERLND         EXTNL  SURLI
  END MASS-LINK   50


END MASS-LINK

END RUN
```

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Disclaimer

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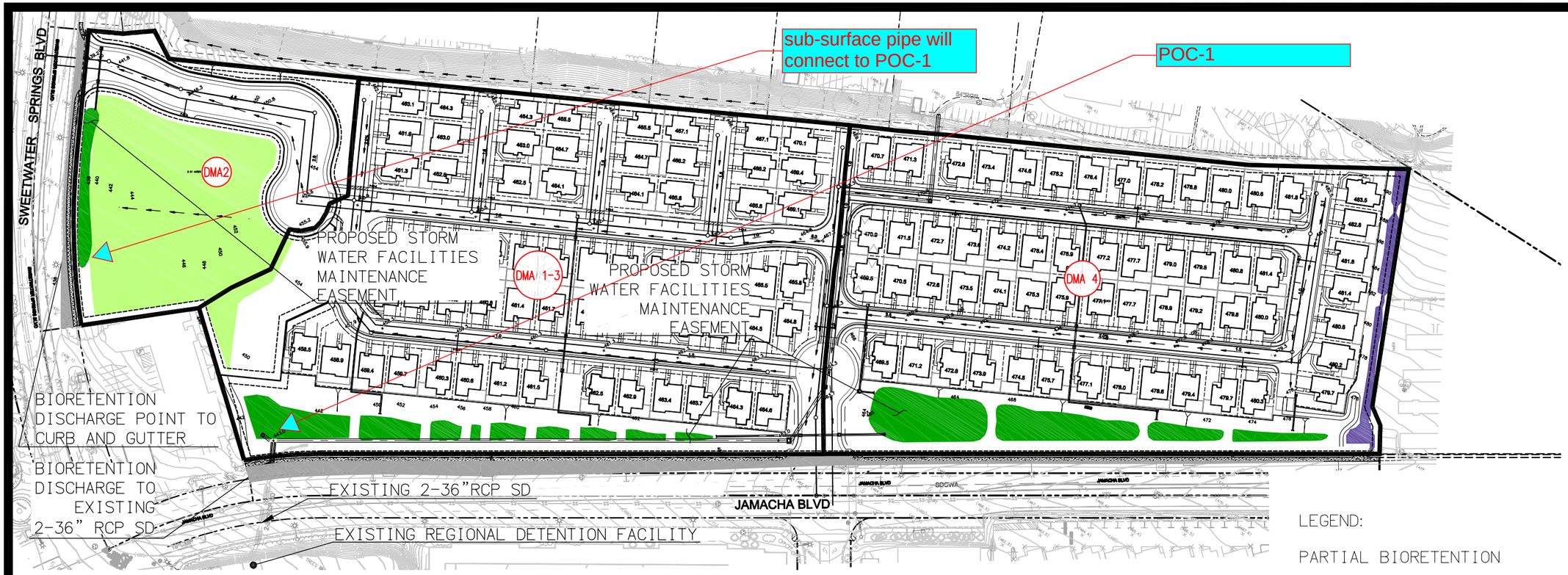


SCALE: 1"=150'

DRAINAGE MANAGEMENT AREA					
DMA	AREA AC	IMP (AC)	PER (AC)	BMP TYPE	BMP AREA
DMA-1-3*	8.36	4.33	4.03	PARTIAL BIORETENTION	12,321 FT²
DMA-2*	2.51	0.35	2.16	PARTIAL BIORETENTION	3,136 FT²
DMA-4	7.03	3.70	3.33	PARTIAL BIORETENTION	19,321 FT²
TOTAL	17.90*	8.38	9.52	–	34,778 FT²

*ON-SITE BIORETENTION HAS BEEN SIZED TO TREAT AND ATTENUATION AN ADDITIONAL AREA EQUIVALENT TO THE MINOR OFF-SITE IMPROVEMENTS ASSOCIATED WITH JAMACHA BLVD. AND SWEETWATER SPRINGS BLVD.

LEGEND:

- PARTIAL BIORETENTION
- PUBLIC PARK
- EX. CONCRETE CHANNEL
- DRAINAGE MANAGEMENT AREA (DMA 1)
- PUBLIC IMPROVEMENT PAVEMENT
- PUBLIC IMPROVEMENT SIDEWALK
- FLOW PATH

SOURCE CONTROL BMPS		
SOURCE OF POLLUTANT	PERMANENT SOURCE CONTROL BMP	OPERATIONAL SOURCE CONTROL BMP
ON-SITE STORM DRAIN INLETS	PROVIDE INLET MARKERS INDICATING NO DUMPING	MAINTAIN INLET MARKERS AS NECESSARY
FUTURE PEST CONTROL	SELECT BUILDING DESIGN FEATURES THAT DISCOURAGE PEST ENTRY	PROVIDE PEST MANAGEMENT INFORMATION TO OWNERS
LANDSCAPE/OUTDOOR PESTICIDE USE	SELECT DROUGHT TOLERANT PLANTS THAT WILL ALSO SURVIVE SATURATED SOILS	MINIMIZE USE OF PESTICIDES IN LANDSCAPING
MISC. DRAIN OR WASH WATER – ROOFING, GUTTERS, AND TRIM	AVOID USING MATERIALS MADE OF UNPROTECTED METAL THAT MAY LEACH INTO RUNOFF	N/A

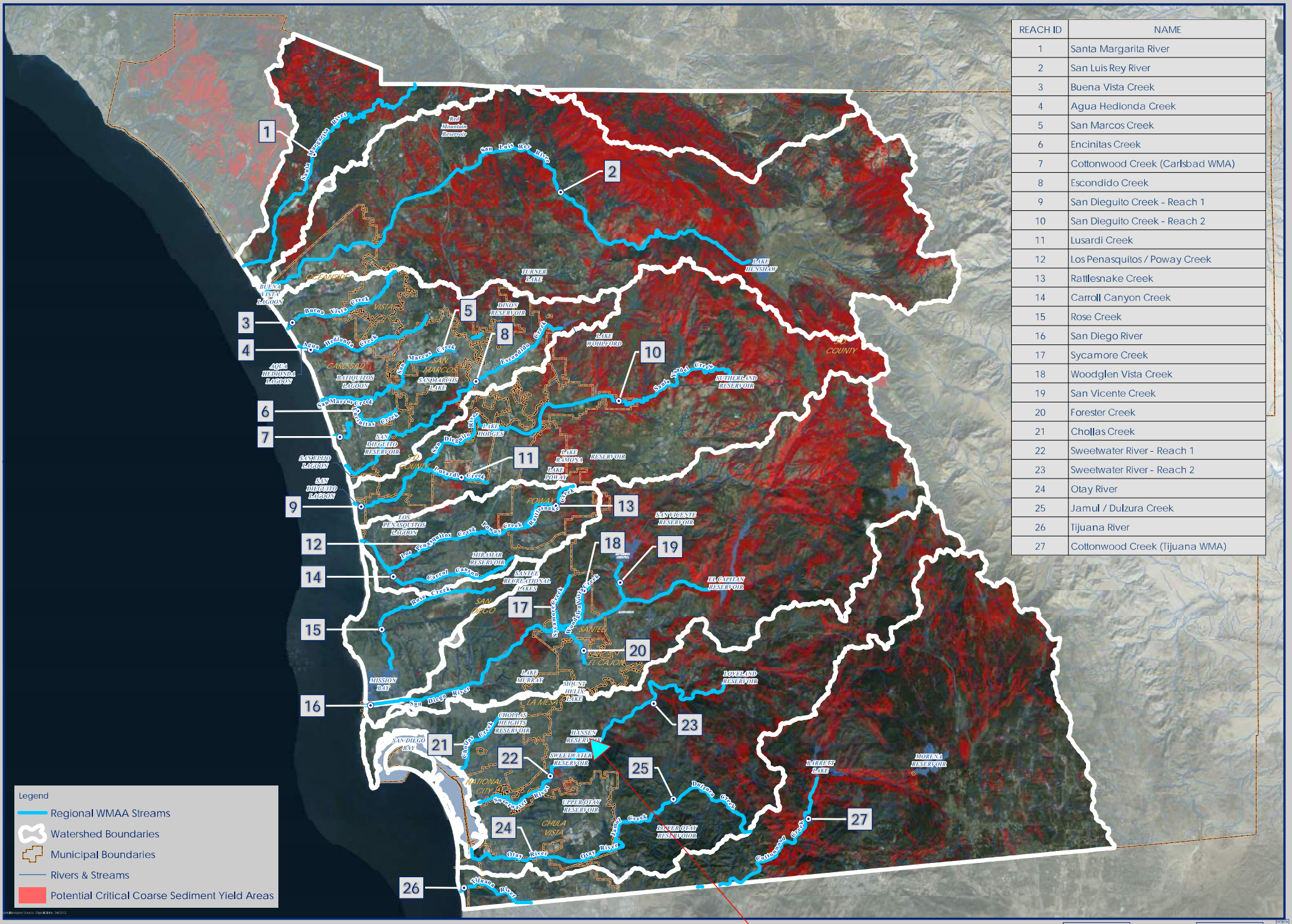
NOTES:

1. THE UNDERLYING HYDROLOGIC SOIL GROUP IS D
2. APPROXIMATE DEPTH TO GROUNDWATER IS >19.5 FT
3. EXISTING NATURAL HYDROLOGIC FEATURES: AN EXISTING ROCK LINED CHANNEL WILL BE REMOVED AND REPLACED WITH A 54-INCH RCP
4. CRITICAL COARSE SEDIMENT YIELD AREAS TO BE PROTECTED: N/A

SWEETWATER PLACE HYDROMODIFICATION MANAGEMENT EXHIBIT

Michael Baker INTERNATIONAL
9755 Clairemont Mesa Blvd., Suite 100
San Diego, CA 92124
Phone: (858) 614-5000 · MBAKERINTL.COM

H:\PDATA\152741\CADD\Strmwater\DLV\152741 HYDROMOD Exhibit.dwg 05/23/16 – 6:07pm jsullivan



REACH ID	NAME
1	Santa Margarita River
2	San Luis Rey River
3	Buena Vista Creek
4	Agua Hedionda Creek
5	San Marcos Creek
6	Encinitas Creek
7	Cottonwood Creek (Carlsbad WMA)
8	Escondido Creek
9	San Dieguito Creek - Reach 1
10	San Dieguito Creek - Reach 2
11	Lusardi Creek
12	Los Penasquitos / Poway Creek
13	Rattlesnake Creek
14	Carroll Canyon Creek
15	Rose Creek
16	San Diego River
17	Sycamore Creek
18	Woodglen Vista Creek
19	San Vicente Creek
20	Forester Creek
21	Chollas Creek
22	Sweetwater River - Reach 1
23	Sweetwater River - Reach 2
24	Otay River
25	Jamul / Dulzura Creek
26	Tijuana River
27	Cottonwood Creek (Tijuana WMA)

Potential Critical Coarse Sediment Yield Areas

Regional San Diego County Watersheds

Exhibit Date: Sept. 8, 2014

Geosyntec consultants

RICK ENGINEERING COMPANY

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 Plan (Required)	X Included See Structural BMP Maintenance Information Checklist on the back of this Attachment cover sheet.
Attachment 3b	Draft Stormwater Maintenance Notification / Agreement (when applicable)	X Included ☐ Not Applicable

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

Attachment 3a must identify:

X Specific maintenance indicators and actions for proposed structural BMP(s). This must be based on Section 7.7 of the BMP Design Manual and enhanced to reflect actual proposed components of the structural BMP(s)

X How to access the structural BMP(s) to inspect and perform maintenance

X 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)

X Manufacturer and part number for proprietary parts of structural BMP(s) when applicable

X 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)

X Recommended equipment to perform maintenance

X 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 all Structural BMPs, Attachment 3b must include a draft maintenance agreement in the County's standard format depending on the Category (PDP applicant to contact County staff to obtain the current maintenance agreement forms). Refer to Section 7.3 in the BMP Design Manual for a description of the different categories.

Note: The maintenance program found in Attachment 3a has been designed to be compatible with the County of San Diego's standard BMP maintenance agreement.

BMP Maintenance Program

The following inspection and maintenance activities shall be performed and completed as indicated. Question should be directed to the San Diego County Department of Public Works at (858) 694-3810.

Maintenance Program for Bioretention Area

Inspection Frequency/Indications:	Regular Inspections ❑ Before wet season begins (September); ❑ Every 60 days during wet season (September-April); ❑ After wet season (April). Performance Inspections ❑ After rainfall events greater than 0.5 inch
Maintenance Indications Connections	**Maintenance Activities Connections**
❑ Damage to inlet/outlet, sideslopes, headwall, or other structures	❑ Repair inlet/outlet structures, side slopes, fences, or other structural elements as needed to maintain performance of the facility.
❑ Over-grown vegetation, emergent woody vegetation and/or weeds	❑ Trim vegetation to average height of 12 inches and remove trimmings. ❑ Remove emergent trees and other vegetation that are not part of bioretention basin plan and weeds ❑ Re-seed and re-plan barren areas prior to rainy season ❑ Install erosion blanket on barrent spots if re-vegetation is not successful
❑ Sediment accumulation over 3 inches	❑ Remove sediment accumulation at or near plant height
❑ Trash, debris, and vegetative litter	❑ Remove trash, debris, and vegetative litter
❑ Rodents or other vectors	❑ Abate and control rodents as necessary to maintain performance of the facility ❑ Drain standing water
Waste Disposal	Sediment, other pollutants, and all other waste shall be properly disposed of in a licensed landfill or by another appropriate disposal method in accordance with local, state, and federal regulations.

ATTACHMENT 4

County of San Diego PDP Structural BMP Verification for Permitted Land Development Projects

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PRIORITY DEVELOPMENT PROJECT (PDP) SWQMP

County of San Diego BMP Design Manual Verification Form	
Project Summary Information	
Project Name	Sweetwater Place
Record ID (e.g., grading/improvement plan number)	
Project Address	2657 SWEETWATER SPRINGS BOULEVARD SPRING VALLEY, CA 91978
Assessor's Parcel Number(s) (APN(s))	505-231-36
Project Watershed (Complete Hydrologic Unit, Area, and Subarea Name with Numeric Identifier)	Sweetwater HU (909); Middle Sweetwater HA (909.20); Jamacha HSA (909.21)
Responsible Party for Construction Phase	
Developer's Name	
Address	
Email Address	
Phone Number	
Engineer of Work	
Engineer's Phone Number	
Responsible Party for Ongoing Maintenance	
Owner's Name(s)*	
Address	
Email Address	
Phone Number	
*Note: If a corporation or LLC, provide information for principal partner or Agent for Service of Process. If an HOA, provide information for the Board or property manager at time of project closeout.	

County of San Diego BMP Design Manual Verification Form Page 2 of 4					
Stormwater Structural Pollutant Control & Hydromodification Control BMPs* (List all from SWQMP)					
Description of Type of Structural BMP	**Plan Sheet #**	**STRUCT-URAL BMP ID#**	**Maint-enance Category**	**Maintenance Agreement Recorded Doc #**	**Revisions**
Partial Biofiltration (DMA 1-3)		DMA 1-3	2		
Partial Biofiltration (DMA 2)		DMA-2	2		
Partial Biofiltration (DMA 4)		DMA-4	2		
*All Priority Development Projects (PDPs) require a Structural BMP					

Note: If this is a partial verification of Structural BMPs, provide a list and map denoting Structural BMPs that have already been submitted, those for this submission, and those anticipated in future submissions.

Checklist for Applicant to submit to PDCI:

- ☐ Copy of the final accepted SWQMP and any accepted addendum.
- ☐ Copy of the most current plan showing the Stormwater Structural BMP Table, plans/cross-section sheets of the Structural BMPs and the location of each verified as-built Structural BMP.
- ☐ Photograph of each Structural BMP.
- ☐ Photograph(s) of each Structural BMP during the construction process to illustrate proper construction.
- ☐ Copy of the approved Structural BMP maintenance agreement and associated security

By signing below, I certify that the Structural BMP(s) for this project have been constructed and all BMPs are in substantial conformance with the approved plans and applicable regulations. I understand the County reserves the right to inspect the above BMPs to verify compliance with the approved plans and Watershed Protection Ordinance (WPO). Should it be determined that the BMPs were not constructed to plan or code, corrective actions may be necessary before permits can be closed.

Please sign your name and seal.

Professional Engineer's Printed Name:

_____

Professional Engineer's Signed Name:

_____

Date:_____

[SEAL]

COUNTY - OFFICIAL USE ONLY:

For PDCI: Verification Package #: _____

PDCI Inspector: _____

Date Project has/expects to close: _____

Date verification received from EOW: _____

By signing below, PDCI Inspector concurs that every noted Structural BMP has been installed per plan.

PDCI Inspector's Signature:_____Date: _____

FOR WPP:

Date Received from PDCI: _____

WPP Submittal Reviewer: _____

WPP Reviewer concurs that the information provided for the following Structural BMPs is acceptable to enter into the Structural BMP Maintenance verification inventory:

List **acceptable** Structural BMPs:

WPP Reviewer's Signature:_____Date: _____

ATTACHMENT 5

Copy of Plan Sheets Showing Permanent Storm Water BMPs, Source Control, and Site Design

This is the cover sheet for Attachment 5.

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 Step 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 County staff
- ☐ 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 must be provided. Photocopies of general brochures are not acceptable.
- ☐ Include all source control and site design measures described in Steps 4 and 5 of the SWQMP. Can be included as a separate exhibit as necessary.

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ATTACHMENT 6

Copy of Project's Drainage Report

This is the cover sheet for Attachment 6.

If hardcopy or CD is not attached, the following information should be provided:

Title:
Prepared By:
Date:

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.

Preliminary CEQA Drainage Study

Sweetwater Place
San Diego, California

June 2014
January 2015
March 2015

PDS2014-TM-5588 RPL-1; STP-14-015 RPL-1;
GPA-14-003; REZ-14-003; ER-14-19-005

Prepared for:

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Jay Sullivan, R.C.E. 77445

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Declaration of Responsible Charge

I, hereby declare that I am the Civil Engineer for this Drainage Study, that I have exercised responsible charge over this Drainage Study as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with current design. I attest to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based. The plans and specifications in this Drainage Study are not for construction purposes; the contractor shall refer to final approved construction documents for plans and specifications.

Jay Sullivan
RCE 77445

March 20, 2014

Table of Contents

Section 1. Project Location and Scope 1

1.1. Project Location 1
1.2. Scope of Report 1

Section 2. Study Objectives 2

Section 3. Project Description 3

3.1. Project Site Information 3
3.2. Pre Development Conditions 3
3.3. Post Development Conditions 5

Section 4. Methodology 8

4.1. Hydrology 8
4.2. Runoff Volume 8
4.3. Hydraulics 8

Section 5. Results and Conclusions 10

5.1. Hydrologic Results 10
5.2. Hydraulic Results 12
5.3. Conclusions 14

Section 6. CEQA Guidelines for Determining Significance 15

Section 7. References 17

List of Tables

Table 5-1 Summary of Pre vs. Post Development Peak Flow Rates: Project Site 10
Table 5-2 Summary of Pre vs. Post Development Runoff Volume 11
Table 5-3 Hydraulic Summary 12

Table of Appendices

Appendix A: Project Information
Appendix B: Existing Hydrology
Appendix C: Proposed Hydrology
Appendix D: Hydraulics

Section 1. Project Location and Scope

1.1. Project Location

The Project site is located in the community of Spring Valley within the unincorporated area of southwestern San Diego County. The approximately 20-acre (gross)/17.1-acre (net) Project site is located at the northwestern corner of Sweetwater Springs Boulevard and Jamacha Boulevard. The site address is 2657 Sweetwater Springs Boulevard; the County Assessor Parcel Number (APN) is 505-231-36. A vicinity map is found Appendix A.

The site was originally designated as future right-of-way (ROW) for extension of State Highway 54 (SR 54). The California Department of Transportation (Caltrans) has since abandoned the SR 54 extension and sold the property at auction as excess right-of-way. The new (current) owner of the Project site is SAM Sweetwater, LLC. The Project site was previously utilized as a retail nursery (Evergreen Nursery), which has since ceased operation and vacated the site. The site is currently 100% disturbed due to the previous use.

Existing land uses in the Project area include undeveloped land to the west/southwest across Sweetwater Springs Boulevard, which is planned for a residential development known as "The Pointe;" however, a number of homes associated with this development have already been constructed. Other uses include a commercial strip mall and gas station to the southeast; a vegetated County detention basin further to the southeast; a self-storage facility, Mardi Gras Café and Market building, and Sweetwater Lodge mobile-home park to the south across Jamacha Boulevard; a vacant lot adjacent to northwest; and, a business park adjacent to the north. Single-family residential uses also exist further to the north and northeast/east.

1.2. Scope of Report

This report will deal specifically with proposed improvements associated with the Sweetwater Place residential development. This study develops 100-year storm peak flows and volumes for the pre and post development conditions to identify the hydrologic and hydraulic effect of the proposed project. The proposed BMPs (bioretention and permeable pavement) are discussed within this report in the context of 100-year peak flow attenuation.

This report does not discuss required water quality measures to be taken on an interim level during construction, or those necessary to be implemented on a permanent basis. That discussion can be found under separate cover in the project "Storm Water Management Plan" (SWMP). Additionally, this report does not discuss hydromodification mitigation requirements and/or exemptions. That discussion can be found in the SWMP as well.

Section 2. Study Objectives

The specific objectives of this study are as follows:

- Quantify the pre and post development 100-year peak flow rates and flow volumes for the project site,
- Quantify the 100-year peak flow rate for project site run-on from the northerly commercial development,
- Quantify the hydraulic capacity of all existing and proposed storm drain infrastructure, as it compares to the 100-year storm event,
- Quantify the proposed on-site peak flow attenuation provided by permeable pavement and bioretention areas for the project site,
- Address CEQA's guidelines for determining significance.

Section 3. Project Description

3.1. Project Site Information

The Project site is identified in the Spring Valley Community Plan as a "Special Study Area (SSA) – Sweetwater Springs Boulevard and Jamacha Boulevard." The SSA totals approximately 34 acres, extending northward of the Project site across Calavo Drive (two non-contiguous sites); however, the proposed Project site represents approximately 20.35 acres of the overall SSA. The remaining land within the SSA is not part of the proposed Project. The SSA designation requires that additional analysis be prepared to determine an appropriate land use. Additionally, the County provides specific goals and policies intended to guide future development of properties designated as SSA.

The existing County of San Diego General Plan land use designation is Public/Semi-Public with an underlying land use designation of RL-80 (Rural Lands). A General Plan Amendment is required to change the current General Plan designator from RL-80 to a Village Residential (VR-7.3) designator. The Regional Category of Village applies to the property; no change to the Regional Category is proposed with the Project. The Project site is currently zoned as S-90 (Holding Zone). A Rezone is requested to change the zone from S-90 to a RV-Variable Family Use Regulation to allow for the proposed condominium units.

Elevations on site range from approximately 492 feet above mean sea level (MSL) near the northeast property corner to 441 feet above MSL near the southwest property corner. Access to the site will be provided off Jamacha Boulevard, at Folex Way; and off Sweetwater Springs Boulevard. Refer to Appendix A for an aerial exhibit.

Based on the Natural Resources Conservation Service's (NRCS) Websoil Survey, the project site is comprised of approximately 90-percent Diablo clay (DaE), with slopes ranging from 15 to 30 percent (hydrologic soil type D); and approximately 10-percent Huerhuero loam (HrD2), with slopes ranging from nine to 15 percent (hydrologic soil type D).

The Federal Emergency Management Agency (FEMA) has not mapped any Special Flood Hazard Areas (SFHAs) for the project site. The entire project site lies within un-shaded Zone X, which correlates with areas determined to be outside the 500-year floodplain. An exhibit is provided in Appendix A of this report.

3.2. Pre Development Conditions

The 17.9-acre project site contains approximately 4.5 acres of impervious cover under existing conditions. This existing impervious area consists of several concrete pads and drive aisles. The site was previously used as a landscape and gardening nursery. No buildings or other vertical construction currently remains. Runoff drains southwesterly via a combination of sheet flow and open channel flow (rock-lined flood control channel).

3.2.1 Project Site Run-On

An existing commercial development is located immediately north of the project site. A 54-inch reinforced concrete pipe (RCP) storm drain discharges runoff from this commercial development onto the project site approximately midway along the northerly project boundary. Project site run-on from the 54-inch RCP is conveyed southwesterly across the project site via open channel flow (rock-lined flood control channel).

The northerly commercial area is topographically higher than the project site. As such, the project site receives sheet flow run-on from the vegetated slope separating the properties, in addition to the concentrated run-on from the 54-inch RCP.

A storm water field inspection was performed on October 11, 2013 to investigate the upstream tributary area. Refer to the Off-Site Hydrologic Work Map found in Appendix B for graphical representation of the upstream tributary area.

3.2.2 Discharge Locations

A majority of the site (15.6 acres, 77 percent) drains to the southwesterly corner of the project site, where a 60-inch reinforced concrete pipe (RCP) and headwall convey runoff off-site. A small portion of the site (2.3 acres, 13 percent) drains southwesterly to Sweetwater Springs Boulevard (westerly project boundary), where runoff discharges as sheet flow. See below for a discussion on the regional detention facility to which project site runoff drains into.

3.2.3 Storm Water Infrastructure

An existing 60-inch RCP with headwall is located in the southwesterly corner of the site. This pipe and headwall represent the project outfall location under pre and post development conditions. This 60-inch pipe transitions to dual 36-inch RCPs at the road right-of-way and conveys runoff southerly beneath Jamacha Boulevard, discharging to a regional detention facility located south of the Jamacha Boulevard. Refer to Section 3.3 for further discussion pertaining to the proposed improvements in this area.

An existing concrete lined channel is located on-site, along the easterly project boundary. This concrete channel conveys runoff southerly to an existing F-Type inlet, which discharges runoff to Jamacha Boulevard via a curb outlet. Alterations to this existing concrete channel or its tributary drainage area (northerly storage facility) are not proposed.

A regional detention facility is located immediately adjacent to the southeast corner of the Jamacha Boulevard, Sweetwater Springs Boulevard intersection. Storm water runoff from the project site drains to this detention facility via existing storm drain pipes beneath Jamacha Boulevard (dual 36-inch RCP) and via overland flow under pre and post development conditions. This regional detention facility receives runoff from approximately 590 acres, of which the 17.9-acre project site represents 3-percent.

3.3. Post Development Conditions

The Project proposes a 122-unit residential condominium development with exclusive backyards, attached two-car garages, 2.08-acre public community park, private and group useable open space, a riding and hiking trail, pedestrian pathways, and a series of greenbelt open areas. The units will be accessed by a series of 24-foot wide access drives within the interior of the property. Conceptual architectural design for the Project has been prepared, offering various housing styles and sizes. Additionally, ornamental landscaping will be provided within the onsite common areas, along Project roadways, and at the Project entryways to visually enhance the proposed development and blend the site into the existing surrounding setting. A Tentative Map/Condominium, Site Plan, and Grading Plan will be required to implement the proposed development.

Open Space: Integrated into the development will be private useable open space areas [minimum 350 square feet (s.f.) per unit] adjoining each unit, along with group useable open space areas located within the public park (minimum of 150 s.f. per unit). Each unit will have a fenced exclusive use backyard area.

Internal Drives: Private internal drives will be improved to 24 feet in width to enable circulation and fire protection service. The maximum length of the dead-end drives will be 150 feet; no cul-de-sacs are proposed at these locations. A five-foot wide sidewalk is proposed along one side of the main interior roadway, ultimately providing a pedestrian link between Jamacha and Sweetwater Springs Boulevards.

Parks and Trails: The Project proposes to dedicate, improve, and maintain a 2.08-acre public community park for use by both Sweetwater Place residents and the general public. The public park will be a major focal area for Community gathering. Access to the Public Park and 29- parking spaces is provided via a proposed public road extending easterly from Sweetwater Springs Boulevard. The public park will satisfy County Park Land Dedication Ordinance (PLDO) requirements of the project, plus the group useable open space acreage requirement per the site's zoning regulations. Private useable open space will also be provided within the exclusive back yard areas of the residents.

The Project proposes an 8-foot wide public riding and hiking trail (within a 12-foot wide graded easement) along the northern side of Jamacha Boulevard to enhance the existing public pedestrian network. A series of pedestrian pathways connect and circulate throughout the project site and Public Park. Access from the Jamacha Road public trail to the residential portion of the project and Public Park has been provided. A 10-foot wide existing (cleared) trail easement is also proposed along the eastern Project boundary for future construction of a public trail by others; no physical trail improvements are proposed with the Project along this easement.

Public Street Improvements: Main access will occur from Jamacha Boulevard at the intersection of Folex Way. The intersection will be signalized, and a project entrance will be constructed to extend into the site from the intersection with Jamacha Boulevard that will terminate in a cul-de-sac. An exclusive eastbound left-turn lane is proposed on

Jamacha Boulevard, and the existing exclusive northbound left-turn lane will be restriped to a shared thru/left-turn lane.

Secondary access is proposed off of Sweetwater Springs Boulevard via extension of an onsite public roadway terminating in a cul-de-sac. This road will provide access to the proposed public park and associated parking area (29 spaces total). Improvements to Sweetwater Springs Boulevard will include construction of a southbound left-turn pocket, median, and installation of stop signs at the intersection to facilitate ingress to and egress from the site. Additionally, the Project proposes to improve Jamacha Boulevard and Sweetwater Springs Boulevard to a 55-foot half-width with curb, gutter, and sidewalks, and a bike lane.

Fire, Water, Sewer, Storm Drain: The site will be served by the San Miguel Fire Protection District for fire service. The site will be served by the Otay Water District for public water service and the San Diego County (Spring Valley) Sanitation District will provide public sewer service. The Project proposes improvements to capture storm water flows from offsite properties that currently flow aboveground across the site within a proposed underground 54-inch pipe for outflow to an existing storm drain at the southwest corner of the site near Jamacha Boulevard. Onsite stormwater flows will discharge from the Project site in two locations. The majority of the site will discharge to the existing storm drain system within Jamacha Boulevard, consistent with pre-development conditions. The westerly portion of the site will discharge to Sweetwater Springs Boulevard, and flows will continue southwesterly via curb and gutter, consistent with pre-development conditions.

3.3.1 Project Site Run-On

The existing off-site 54-inch RCP will be extended through the project site and connected to the 60-inch RCP located in the southwesterly corner. A proposed concrete ditch will intercept slope run-on from the area immediately north of the project site and convey this off-site flow to Sweetwater Springs Road.

3.3.2 Discharge Locations

Under post development conditions, runoff will discharge from the site as pipe flow in the southwesterly corner and as overland flow to Sweetwater Springs Boulevard (westerly project boundary), consistent with pre development conditions. Peak flow attenuation will be provided via proposed bioretention areas and permeable pavement sections. Under proposed conditions, discharge from the project site will not be increased at either location, as compared to existing conditions.

3.3.3 Storm Water Infrastructure

The rock-lined flood control channel conveying runoff southwesterly across the project site will be replaced with a pipe to accommodate proposed improvements. The existing off-site 54-inch RCP storm drain that discharges into the rock-lined channel will be extended through the site such that off-site runoff is not co-mingled with on-site runoff. The new, on-site 54-inch RCP will directly connect to the existing 60-inch RCP located

in the southwesterly corner of the site. A 36-inch RCP with headwall will be installed immediately adjacent to this connection such that overland release is provided for project site runoff draining to the bioretention areas located in the southwest corner (adjacent to Jamacha Boulevard.

An on-site storm drain system consisting of inlets and pipes is proposed to convey project site runoff into the proposed bioretention areas. Refer to the Proposed Hydrologic Work Map found in Appendix C. Sub-drains will be included in the bioretention areas and permeable pavement sections. These perforated sub-drains will connect directly, via hard-lined pipes, to the project outfall at Jamacha Boulevard. The proposed bioretention area adjacent to Sweetwater Springs Boulevard will be fitted with a sub-drain that discharges to the street curb and gutter, consistent with pre development conditions (in terms of discharge location).

A proposed 24-inch RCP culvert will be extended beneath the project site entrance off Jamacha Boulevard. This culvert is sized and located (diameter and invert elevation) for 100-year conditions. The intent of this culvert is to provide flood control conveyance of flow from the easterly bioretention areas to the westerly bioretention areas (adjacent to Jamacha Boulevard) and on to the southwesterly project outfall (the primary conveyance mechanism is the bioretention sub-drains).

As mentioned in Section 3.2.3, no alterations to the concrete channel or area contributing flow to the concrete channel along the easterly project boundary are proposed. Under post development conditions, this existing concrete channel will continue to convey off-site runoff to Jamacha Boulevard, consistent with pre development conditions.

The proposed project will continue to discharge runoff to the regional detention facility located at the southeast corner of the Jamacha Boulevard, Sweetwater Springs Boulevard intersection, consistent with pre development conditions. Post development project site flows will be attenuated to pre development levels so as not to disrupt the current functionality of this regional detention facility.

Section 4. Methodology

4.1. Hydrology

Advanced Engineering Solutions (AES – HydroWIN 2013) was used to model the hydrologic characteristics of the project site under pre and post development conditions. This software utilizes the Rational Method and conforms to the hydrologic methodologies outlined in the San Diego County Hydrology Manual (SDCHM, June 2003). The Rational Method is a physically-based model that calculates peak flow rates (Q) as a function of runoff coefficients (c), rainfall intensities (I), and drainage areas (A):

$$Q = c * I * A$$

Runoff coefficients (c) where established based upon Table 3-1 from the SDCHM (page 3-6). Given the amount of imperious cover under existing conditions, weighted runoff coefficient calculations were developed and are included in Appendix B. Under proposed conditions, Table 3-1 from the SDCHM has been referenced using 10.9 dwelling units per acre (DU/ac) and hydrologic soil type D. This represents a conservative approach, as the proposed development includes 122 units on 15.4 acres (7.9 DU/ac.).

Time of concentration and rainfall intensities were developed internally within the AES software. The 'San Diego' AES module was used for this analysis and conforms to the methodologies described in the SDCHM. Refer to Appendices B and C for existing and proposed condition calculations, respectively.

Area delineations were developed using project specific 1-foot contour topography. Off-site delineations were developed using a combination of field survey and USGS topography. Refer to the hydrologic work maps found in Appendices B and C.

4.2. Runoff Volume

Pre and post development runoff volumes have been calculated using the standard volume equation:

$$VOL = (P_6)_{100} * C * A$$

The difference between pre and post development runoff volume has been compared to the provided storage volume under post development conditions.

4.3. Hydraulics

Hydraulic modeling has been performed in accordance with the San Diego County Drainage Design Manual (July 2005).

Bentley's Culvert Master has been used for design of the proposed headwalls located at Nodes 203 and 205. Culvert Master solves for inlet and outlet control using built in FHWA Hydraulic Design of Highway Culverts (HDS-5) methodology.

The Manning's equation has been used to size the proposed RCP storm drain conveying off-site flow through the project site, as well as on-site storm drain conveying project runoff to the proposed bioretention areas. Allowances have been made in the permitted depth of flow within the proposed pipes to account for junction losses.

Section 5. Results and Conclusions

5.1. Hydrologic Results

The tables below summarize the hydrologic results under existing and proposed conditions for the project site's contribution to the watershed. The storage volume associated with the proposed bioretention areas and permeable pavement sections far exceeds the delta runoff volume between existing and proposed conditions. Calculations are included in Appendices B and C.

Table 5-1 Summary of Pre vs. Post Development Peak Flow Rates: Project Site

Discharge Location	C	I	A	Q_{100}	Mitigated Q_{100}	Velocity
-	-	(in/hr)	(ac)	(cfs)	(cfs)	(ft/sec)
Pre Development Condition						
Sweetwater Springs Blvd. Node 103	0.64	3.51	2.3	5.1	-	1.7
Jamacha Blvd. Node 204	0.47	3.52	15.6	25.6	-	13.2
Total	**-**	**-**	**17.9**	**30.7**	**-**	**-**
Post Development Condition						
Sweetwater Springs Blvd. Node 103	0.60	3.61	2.9	6.5*	5.1	1.7
Jamacha Blvd. Node 130	0.60	3.70	15.0	40.0*	25.6	13.2
Total	**-**	**-**	**17.9**	**46.5***	**30.7**	**-**

**Un-mitigated peak flow rate*
Discharge velocities will not be impacted by the proposed development. At Jamacha, discharge is via the 60" pipe and post development peak flows are not increased. At Sweetwater Springs, discharge will occur was weir flow (from the bioretention basins) in the event the sub-drains clog. Under normal operation, runoff will discharge from the bioretention sub-drain to the curb and gutter of Sweetwater Springs Boulevard, consistent with pre development conditions.

The un-mitigated values above do not account for the storage volume provided by the proposed bioretention and permeable pavement. Refer to Table 5-2 for a comparison of pre development, post development, and proposed storage volumes.

Table 5-2 Summary of Pre vs. Post Development Runoff Volume

	100-year Runoff Volume (ft^3)
Pre Development Condition	95,876
Post Development Condition	116,959
Delta Runoff Volume	**18,083**
Proposed Storage via Bioretention and Permeable Pavement	**57,377**

The pre and post development runoff values tabulated above were determined using a weighted runoff coefficient, the 100-year, 6-hour rainfall depth (3 inches), and the project site area. Table 5-2 above shows the extensive storage volume provided by the proposed BMPs, relative to difference in runoff volume between pre and post development conditions.

As shown in the project specific Hydromodification Mitigation report, found under separate cover, the proposed BMP's dramatically reduce the peak flow discharge from the site during the 2-, 5-, 10-, and 25-year storm events (on the order of 90-percent).

The continuous simulation results show that peak flow discharge for the 25-year event is reduced almost 90-percent when compared to pre development conditions. The provided storage volume on-site under post development conditions is approximately three times the delta runoff volume under pre and post development conditions. Based on these results and design, the assertion that 100-year peak flow rates have been mitigated to pre development conditions is valid and warranted.

5.2. Hydraulic Results

The table below summarizes the hydraulic results. Proposed storm drains have been sized to avoid pressure flow during 100-year, peak flow conditions. The two proposed headwalls have been sized to convey post development 100-year peak flow rate without overtopping.

Table 5-3 Hydraulic Summary

Location	Facility	HW/D (ft)	Q100 (cfs)	Velocity (ft/sec)
Pre Development Condition				
S.W. Corner	60" RCP w/HDWL	1.31	172.8	13.2
Post Development Condition				
Culvert Beneath Access Road off Jamacha Blvd.	24" RCP w/HDWL	1.17	16.9	11.8
On-site Storm Drains	24" RCP	1.5*	20.6 [1]	8.2 [1]
S.W. Corner (adjacent to 60" RCP)	36" RCP w/HDWL	0.79	24.9	8.6
Northerly Project Boundary	V-Ditch	0.62*	3.2	4.2**
Southwesterly through the site	54" RCP	2.93*	149.3	13.6

**Normal depth in v-ditch or pipe*

***Discharges to Sweetwater Springs Blvd. via an under sidewalk drain (no diversion of flow as compared to pre development conditions).*

[1] Conservative Q100 & V: detailed HGL calculations will be developed during final engineering

The proposed 54-inch RCP conveying off-site flow through the project site has been sized using Manning's equation. Hydraulic results indicate this pipe is approximately 65-percent full, prior to accounting for junction losses. Based on a proposed alignment that includes only three 90-degree bends, junction losses are not anticipated to warrant a larger pipe such that pressure flow is avoided. A hydraulic analysis that accounts for junction losses, per Table 3-7 of the San Diego County Drainage Design Manual, will be

provided during final engineering. Riprap energy dissipaters will be located downstream of all proposed on-site storm drain outfalls.

5.3. Conclusions

Through the installation of bioretention areas and permeable pavement; the proposed project will mitigate any potential adverse impact associated with hydrology and hydraulics.

The proposed project will not substantially alter the existing drainage pattern of the site, nor will it have any adverse impact on the potential for erosion. Proposed conditions will reduce the amount of concentrated flow throughout the site through the strategic placement of permeable pavement and bioretention areas, as compared to predevelopment conditions. Along Jamacha Boulevard, the proposed bioretention areas are tiered such that weir flow is achieved as runoff conveys westerly overland. Riprap (or similar) energy dissipaters will be utilized along the weirs to prevent scour. Riprap energy dissipaters, or similar, will be included downstream of all proposed on-site storm drain outfalls to protect against scour and erosion.

Under post development conditions, runoff will discharge from the site as pipe flow in two locations. (1) In the southwesterly corner, adjacent to Jamacha Boulevard, on-site runoff will discharge to the existing storm drain system (dual 36-inch RCP) conveying flow southerly beneath Jamacha Boulevard to the regional detention facility. (2) Along the westerly project boundary, on-site runoff will discharge to the curb and gutter of Sweetwater Springs Boulevard via the proposed bioretention area sub-drain. As such, discharge from the project site is not anticipated to have any adverse impact on the potential for erosion.

A proposed 54-inch RCP will be installed to convey off-site flow to the existing 60-inch RCP located in the southwest corner of the site. This does not result in the diversion of flow as compared to pre development conditions. The proposed 54-inch RCP will prevent the comingling of off-site runoff with on-site runoff. At the point of connection with the existing 60-inch RCP (southwest corner), a proposed 36-inch RCP lateral with headwall will be included for secondary project site discharge (primary discharge being the perforated sub-drains associated with the bioretention area).

The regional detention facility located across Jamacha Boulevard from the project site will not be adversely impacted as a result of the proposed development.

Minor surface improvements are proposed along Jamacha Boulevard and Sweetwater Springs Boulevard. The proposed on-site bioretention areas have been sized to treat the equivalent area of off-site improvements. Refer to the project specific Storm Water Management Plan (SWMP), found under separate cover, for detailed calculations.

Section 6. CEQA Guidelines for Determining Significance

1. **Will the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?**

   The project will not alter the existing drainage pattern across the site. Upon completion of the project, runoff will continue to flow southwesterly towards Sweetwater Springs Boulevard and Jamacha Boulevard. Runoff will discharge from the project site as either pipe flow directly connected to existing storm drains (at Jamacha Boulevard) or as pipe flow directly to the curb and gutter (Sweetwater Springs Boulevard).

2. **Will the project increase water surface elevation in a watercourse within a watershed equal to or greater than 1 square mile, by 1 foot or more in height and in the case of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River and Otay River, 2/10 of a foot or more?**

   The project will not increase water surface elevations across the site or downstream. Proposed improvements will not alter the existing hydrologic and hydraulic properties of the site. No increase in peak flow discharge is anticipated as a result of the proposed project.

3. **Will the project result in increased velocities and peak flow rates exiting the project site that could cause flooding downstream or exceed the storm water drainage system capacity serving the site?**

   The project will not increase runoff velocities or peak flow rates leaving the site. Runoff will continue to flow as it does under existing conditions. The project will not cause flooding downstream, nor will it hydraulically impact on-site or downstream storm water infrastructure.

4. **Will the project result in placing housing, habitable structures, or unanchored impediments to flow in a 100-year floodplain area or other special flood hazard area, as shown on a FIRM, a County Flood Plain Map or County Alluvial Fan Map, which would subsequently endanger health, safety and property due to flooding?**

   The project will not result in placing housing within a 100-year floodplain or other special flood hazard area.

5. **Will the project place structures within a 100-year flood hazard or alter the floodway in a manner that would redirect or impede flow resulting in any of the following:**

   a) **Alter the line of inundation resulting in the placement of other housing in a 100 year flood hazard**

b) Increase water surface elevation in a watercourse with a watershed equal to or greater than 1 square mile by 1 foot or more in height and in the case of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River and Otay River, 2/10 of a foot or more?

No, the project will not place housing within a 100-year floodplain. Nor will the project increase water surface elevations downstream.

Section 7. References

County of San Diego, 2003. County of San Diego. (June 2003). Hydrology Manual

County of San Diego, 2005. County of San Diego. (July 2005). Drainage Design Manual.

FEMA, 1997. FEMA. (June 17, 1997). Flood Insurance Study, San Diego County.

Appendix A: Project Information

Vicinity Map

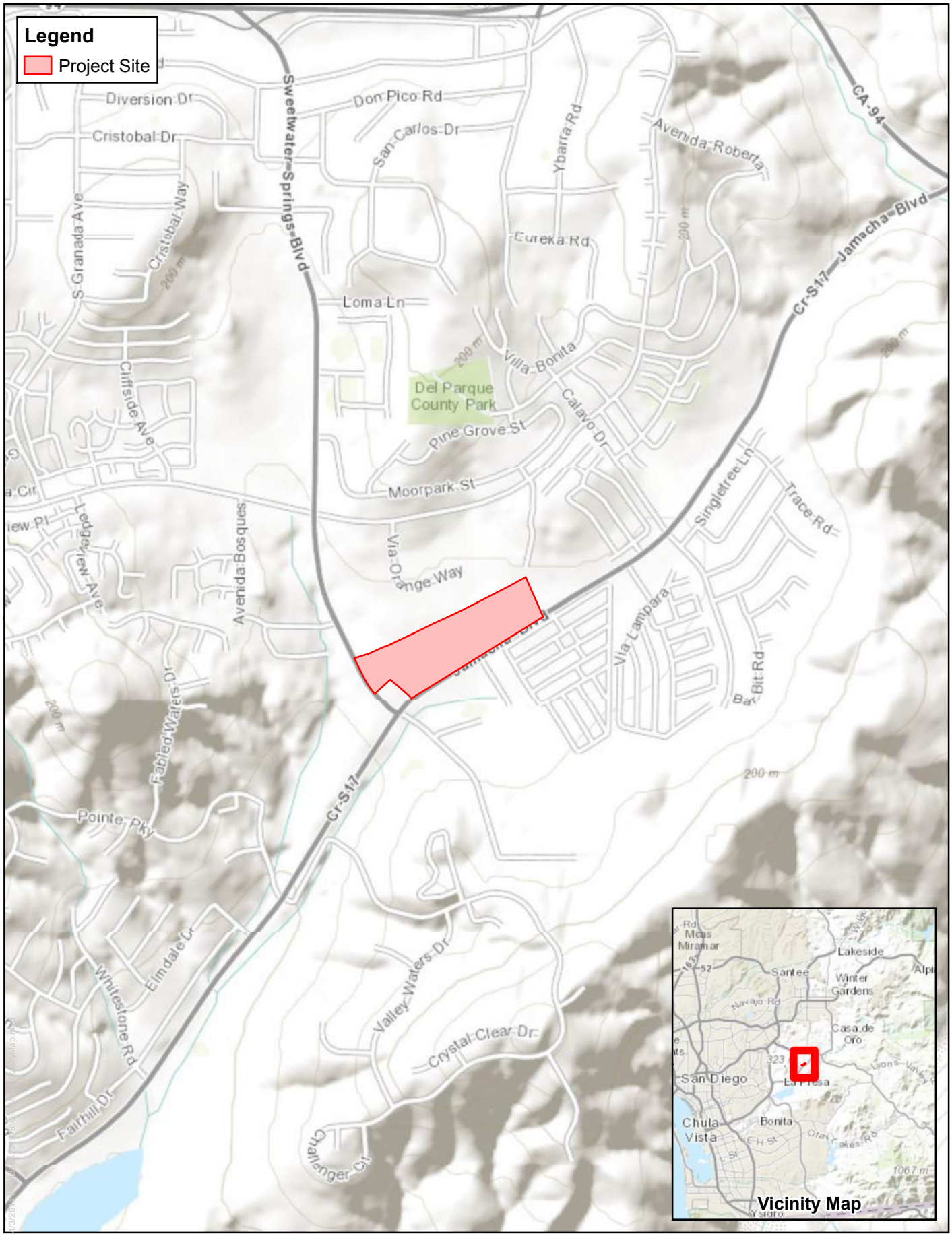
Rainfall Isopluvials

Runoff Coefficients for Urban Areas: Table 3-1 in SDCHM

Intensity-Duration Design Chart: Figure 3-1 in SDCHM

NRCS Soils Information

FEMA Information

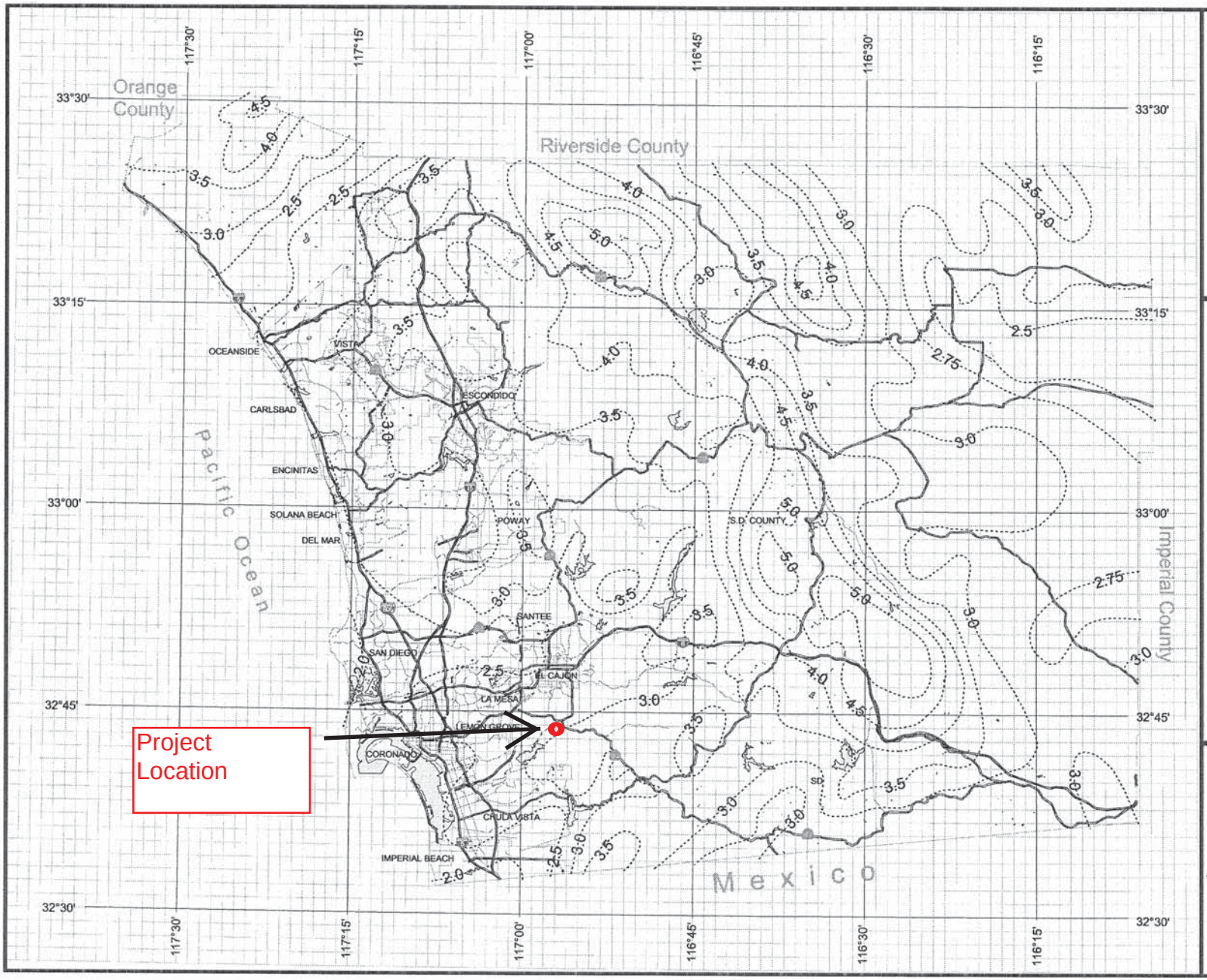


0 500 1,000 2,000 Feet

Source: ESRI, RBF

Spring Valley, California

Sweetwater Village



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

P6(100) = 3.0"

DPW GIS
Department of Public Works Geographic Information Services

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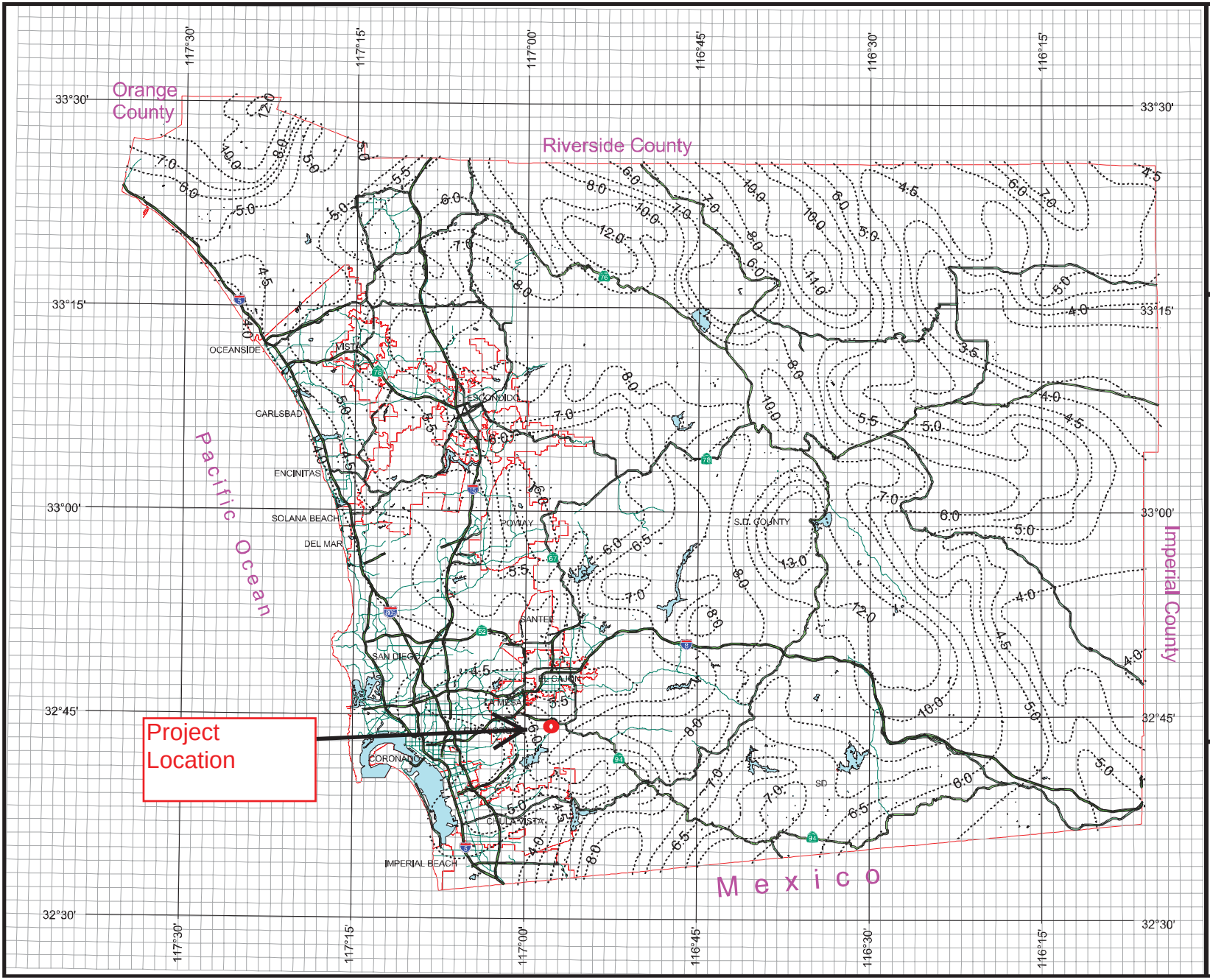
N W E S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

P24(100) = 6.0"

DPW GIS
Department of Public Works Geographic Information Services

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N
W E
S

3 0 3 Miles

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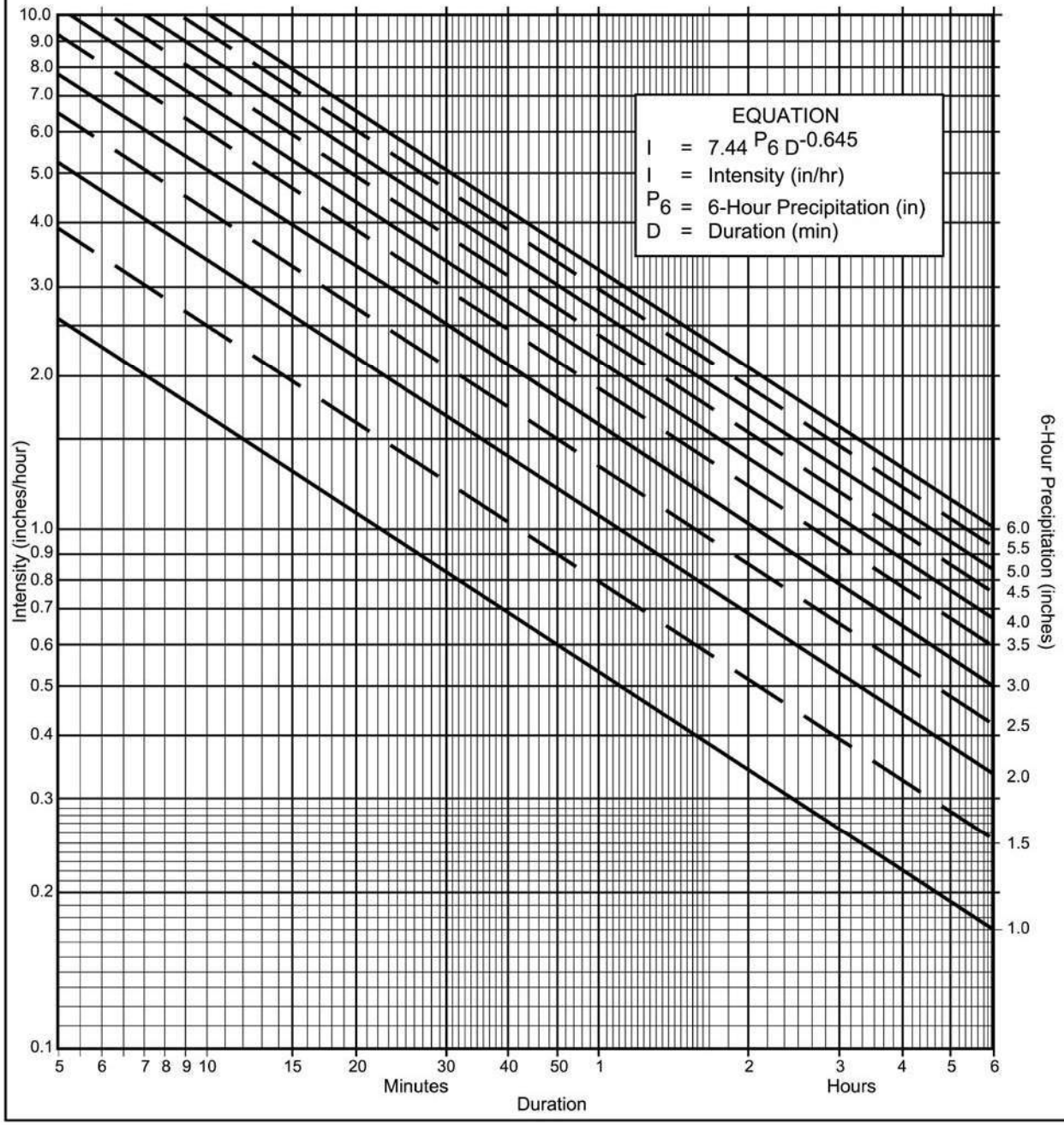
Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 3 in., P_{24} = 6 , $\frac{P_6}{P_{24}}$ = 50 %(2)

(c) Adjusted P_6(2) = N/A in.

(d) t_x = SEE AES OUTPUT min.

(e) I = SEE AES OUTPUT in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1

Hydrologic Soil Group—San Diego County Area, California

Map Scale: 1:2,940 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 40 80 160 240

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 7, Nov 15, 2013

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

Date(s) aerial images were photographed: May 2, 2010—May 6, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
DaE	Diablo clay, 15 to 30 percent slopes	D	16.0	90.4%
HrD2	Huerhuero loam, 9 to 15 percent slopes, eroded	D	1.7	9.6%
Totals for Area of Interest			**17.7**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

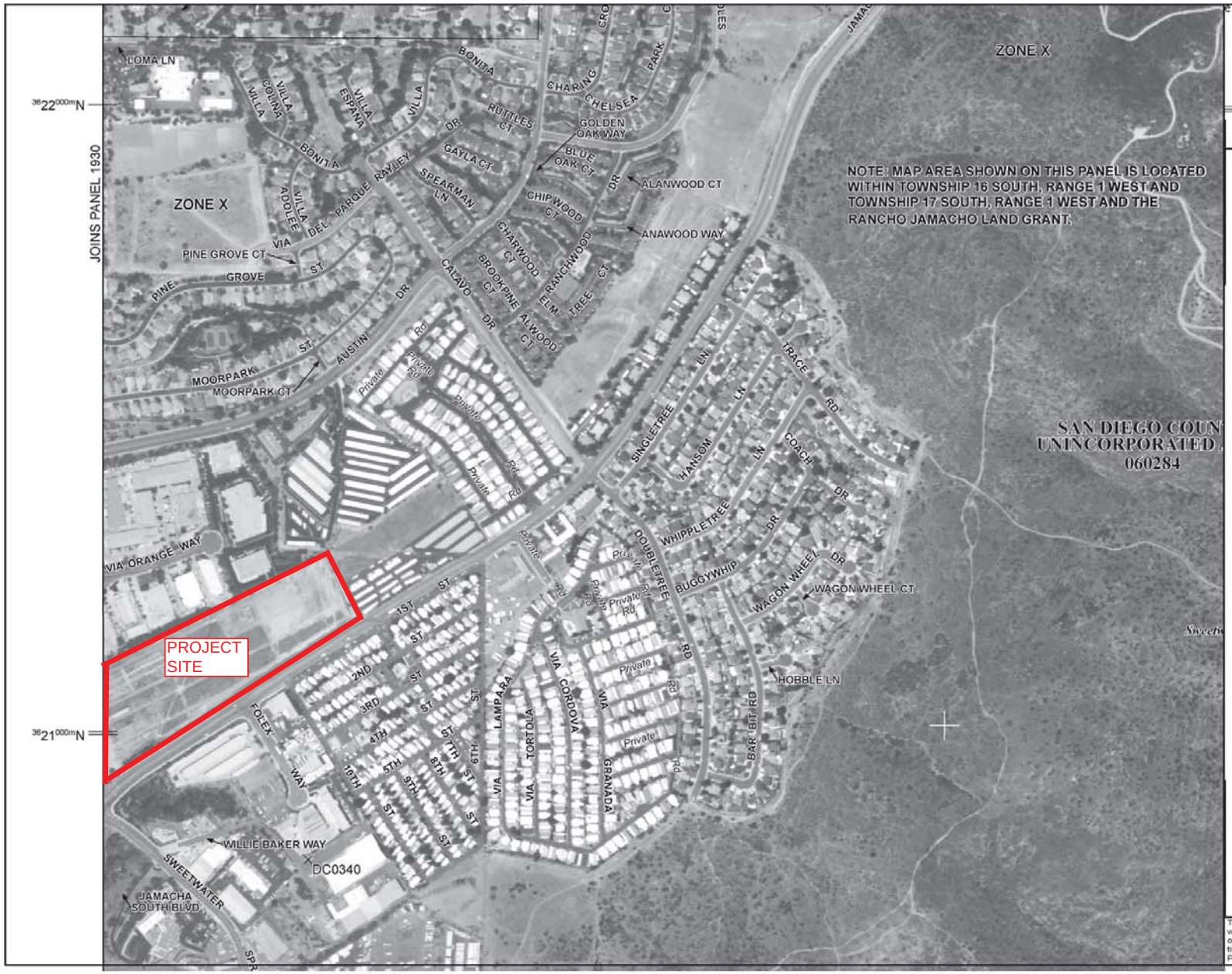
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.



e Program at 1-800-638-6620.

MAP SCALE 1" = 500'

0 250 500 750 1,000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1927G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 1927 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SAN DIEGO COUNTY	060284	1927	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06073C1927G

MAP REVISED
MAY 16, 2012

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

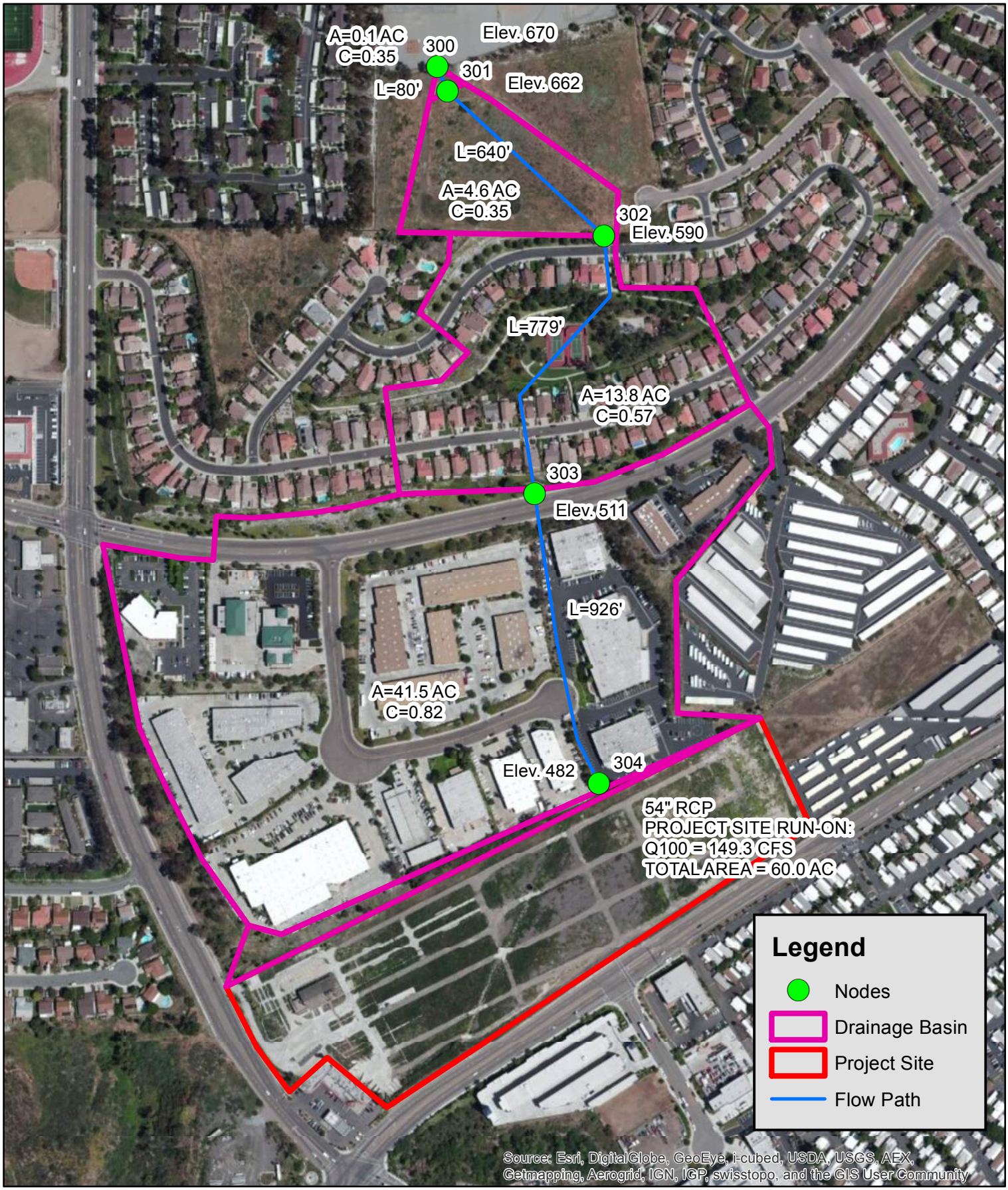
Appendix B: Existing Hydrology

Off-Site Hydrologic Work Map

Existing Condition On-Site Hydrologic Work Map

Existing Condition AES (Off-Site Flow Included)

Weighted Runoff Coefficients



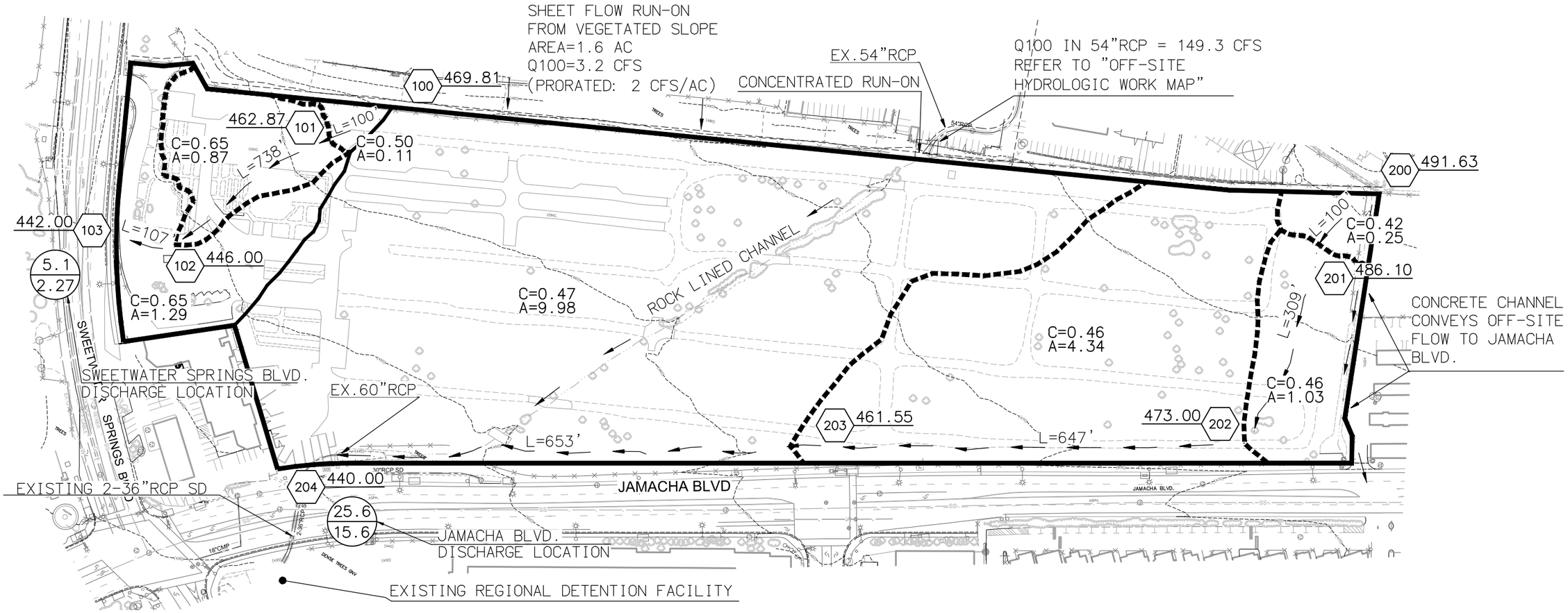
RBF CONSULTING A Baker Company

GIS

N

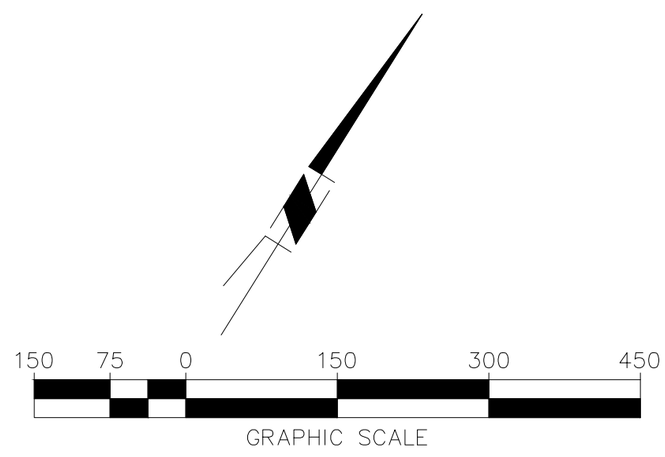
0 250 500 1,000 Feet

Sweetwater Town Center
Off-Site
Hydology Exhibit



LEGEND

- DRAINAGE BOUNDARY
- SUBAREA BOUNDARY
- FLOW PATH
- 0.00 / 0.00 — PROJECT OUTFALL: Q100 (CFS) / TOTAL AREA (ACRES)
- C=0.00 A=0.00 — RUN-OFF COEFFICIENT AREA (ACRES)
- 100 — HYDROLOGY NODE
- 442 — NODE ELEVATION



SWEETWATER VILLAGE EXISTING CONDITION HYDROLOGY EXHIBIT

RBF CONSULTING
A Baker Company
5050 AVENIDA ENCINAS, SUITE 260
CARLSBAD, CALIFORNIA 92008-4386
760.476.9193 ▪ FAX 760.476.9198 ▪ www.RBF.com

H:\PDATA\134978\CADD\Strmwater\134978_Ex_Hydor_Exhibit.dwg 01/14/15 - 5:15pm eric.edge

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                          2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2013 Advanced Engineering Software (aes)
            Ver. 20.0 Release Date: 06/01/2013  License ID 1264

                           Analysis prepared by:

                               RBF Consulting
                            14257 Alton Parkway
                                 Irvine, CA
                                   92618

 ************************* DESCRIPTION OF STUDY *************************
* Existing Condition 100 Year                                              *
* Sweetwater Town Center                                                   *
* 134978                                                                   *
 ****************************************************************************

  FILE NAME: EX100SW.DAT
  TIME/DATE OF STUDY: 12:10 06/05/2014
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.000
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.01
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

+---------------------------------------------------------------------------+
| Begin Basin 100                                                           |
| Northwesterly portion of project site                                     |
| Discharges to Sweeatwater Springs Road                                    |
+---------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    469.81
  DOWNSTREAM ELEVATION(FEET) =    462.87
  ELEVATION DIFFERENCE(FEET) =      6.94
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.662
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.295
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    462.87  DOWNSTREAM(FEET) =    446.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   738.00   CHANNEL SLOPE =  0.0229
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.660
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.50
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.14
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =  10.83
  Tc(MIN.) =   16.49
  SUBAREA AREA(ACRES) =     0.87       SUBAREA RUNOFF(CFS) =    2.07
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.633
  TOTAL AREA(ACRES) =        1.0         PEAK FLOW RATE(CFS) =       2.27

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   1.35
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     838.00 FEET.
```



```
****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    446.00  DOWNSTREAM(FEET) =    442.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   107.00   CHANNEL SLOPE =  0.0374
  CHANNEL BASE(FEET) =   30.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.514
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.74
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.66
  AVERAGE FLOW DEPTH(FEET) =   0.07   TRAVEL TIME(MIN.) =   1.07
  Tc(MIN.) =   17.57
  SUBAREA AREA(ACRES) =     1.29       SUBAREA RUNOFF(CFS) =    2.95
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.643
  TOTAL AREA(ACRES) =        2.3         PEAK FLOW RATE(CFS) =       5.13

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.09   FLOW VELOCITY(FEET/SEC.) =   1.87
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     945.00 FEET.

+---------------------------------------------------------------------------+
| Begin Basin 200                                                           |
| Majority of the project site                                              |
| Discharges to EX. 60" RCP located in SW corner of the site                |
+---------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .4200
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    491.63
  DOWNSTREAM ELEVATION(FEET) =    486.10
  ELEVATION DIFFERENCE(FEET) =      5.53
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.922
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.408
  SUBAREA RUNOFF(CFS) =      0.67
  TOTAL AREA(ACRES) =      0.25   TOTAL RUNOFF(CFS) =      0.67

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    486.10  DOWNSTREAM(FEET) =    473.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   309.00   CHANNEL SLOPE =  0.0424
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.975
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.85
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.55
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   3.33
  Tc(MIN.) =   10.25
  SUBAREA AREA(ACRES) =     1.03       SUBAREA RUNOFF(CFS) =    2.36
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.452
  TOTAL AREA(ACRES) =        1.3         PEAK FLOW RATE(CFS) =       2.88

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   1.75
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     409.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    473.00  DOWNSTREAM(FEET) =    461.55
  CHANNEL LENGTH THRU SUBAREA(FEET) =   647.00   CHANNEL SLOPE =  0.0177
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   8.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.904
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.82
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.30
  AVERAGE FLOW DEPTH(FEET) =   0.25   TRAVEL TIME(MIN.) =   4.68
  Tc(MIN.) =   14.93
  SUBAREA AREA(ACRES) =     4.34       SUBAREA RUNOFF(CFS) =    7.79
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.458
  TOTAL AREA(ACRES) =        5.6         PEAK FLOW RATE(CFS) =      10.05

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.31   FLOW VELOCITY(FEET/SEC.) =   2.62
```

```
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    1056.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    461.55  DOWNSTREAM(FEET) =    440.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   653.00   CHANNEL SLOPE =  0.0330
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.520
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .4700
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      18.32
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.19
  AVERAGE FLOW DEPTH(FEET) =   0.37   TRAVEL TIME(MIN.) =   2.60
  Tc(MIN.) =   17.53
  SUBAREA AREA(ACRES) =     9.98       SUBAREA RUNOFF(CFS) =   16.51
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.466
  TOTAL AREA(ACRES) =       15.6         PEAK FLOW RATE(CFS) =      25.57

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.45   FLOW VELOCITY(FEET/SEC.) =   4.67
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =    1709.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| Off-Site Flow                                                            |
| Run-on Location: Midway along northerly boundary                         |
| 54" RCP discharges onto the project site                                 |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    670.00
  DOWNSTREAM ELEVATION(FEET) =    662.00
  ELEVATION DIFFERENCE(FEET) =      8.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.605
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.343
  SUBAREA RUNOFF(CFS) =      0.26
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.26

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    662.00  DOWNSTREAM(FEET) =    590.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   640.00   CHANNEL SLOPE =  0.1125
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.682
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.92
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.90
  AVERAGE FLOW DEPTH(FEET) =   0.12   TRAVEL TIME(MIN.) =   2.74
  Tc(MIN.) =    8.34
  SUBAREA AREA(ACRES) =     4.60       SUBAREA RUNOFF(CFS) =    9.15
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        4.7         PEAK FLOW RATE(CFS) =       9.35

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.17   FLOW VELOCITY(FEET/SEC.) =   4.98
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   590.00  DOWNSTREAM(FEET) =   511.00
  FLOW LENGTH(FEET) =   779.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  15.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.21
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.35
  PIPE TRAVEL TIME(MIN.) =   4.05    Tc(MIN.) =   12.39
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    1499.00 FEET.
```



```
****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.402
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  87
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5141
  SUBAREA AREA(ACRES) =   13.80   SUBAREA RUNOFF(CFS) =   34.62
  TOTAL AREA(ACRES) =       18.5   TOTAL RUNOFF(CFS) =      41.87
  TC(MIN.) =   12.39

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    304.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   511.00  DOWNSTREAM(FEET) =   482.00
  FLOW LENGTH(FEET) =   926.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.63
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      41.87
  PIPE TRAVEL TIME(MIN.) =   5.86    Tc(MIN.) =   18.25
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    304.00 =    2425.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    304.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.429
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  95
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7257
  SUBAREA AREA(ACRES) =   41.50   SUBAREA RUNOFF(CFS) =  116.67
  TOTAL AREA(ACRES) =       60.0   TOTAL RUNOFF(CFS) =     149.28
  TC(MIN.) =   18.25

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    482.00  DOWNSTREAM(FEET) =    440.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   945.00   CHANNEL SLOPE =  0.0444
  CHANNEL BASE(FEET) =   15.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.231
  URBAN NEWLY GRADED AREAS RUNOFF COEFFICIENT = .7100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     149.29
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   8.96
  AVERAGE FLOW DEPTH(FEET) =   0.94   TRAVEL TIME(MIN.) =   1.76
  Tc(MIN.) =   20.01
  SUBAREA AREA(ACRES) =     0.01       SUBAREA RUNOFF(CFS) =    0.02
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.726
  TOTAL AREA(ACRES) =       60.0         PEAK FLOW RATE(CFS) =     149.28

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.94   FLOW VELOCITY(FEET/SEC.) =   8.96
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    204.00 =    3370.00 FEET.

+--------------------------------------------------------------------------+
| Total Q100 at Node 204                                                   |
| Includes Off-site Area                                                   |
| Discharge from site in a 60" RCP                                         |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      149.28    20.01       3.231       60.01
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    204.00 =    3370.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       25.57    17.53       3.520       15.60
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =    1709.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     156.31      17.53       3.520
      2     172.76      20.01       3.231
```

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     172.76   Tc(MIN.) =   20.01
  TOTAL AREA(ACRES) =       75.6
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       75.6  TC(MIN.) =     20.01
  PEAK FLOW RATE(CFS)   =     172.76
  *** PEAK FLOW RATE TABLE ***
         Q(CFS)   Tc(MIN.)
  1      156.31      17.53
  2      172.76      20.01
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

ON-SITE Runoff Coefficients

EXISTING Condition

Land Use	Area A1	
	Area	C
Type D Natural	0.08	0.35
EX. Impervious	0.03	0.90
Total	**0.11**	

Weighted C = 0.50

Land Use	Area B4	
	Area	C
Type D Natural	7.79	0.35
EX. Impervious (pavement)	2.19	0.90
Total	**9.98**	

Weighted C = 0.47

Land Use	Area A2	
	Area	C
Type D Natural	0.39	0.35
EX. Impervious (pavement)	0.48	0.90
Total	**0.87**	

Weighted C = 0.65

Total Area =	**17.87**	**ac**
Total Impervious =	**4.50**	**ac**

Land Use	Area A3	
	Area	C
Type D Natural	0.58	0.35
EX. Impervious (pavement)	0.70	0.90
Total	**1.29**	

Weighted C = 0.65

Land Use	Area B1	
	Area	C
Type D Natural	0.22	0.35
EX. Impervious (pavement)	0.03	0.90
Total	**0.25**	

Weighted C = 0.42

Land Use	Area B2	
	Area	C
Type D Natural	0.83	0.35
EX. Impervious (pavement)	0.20	0.90
Total	**1.03**	

Weighted C = 0.46

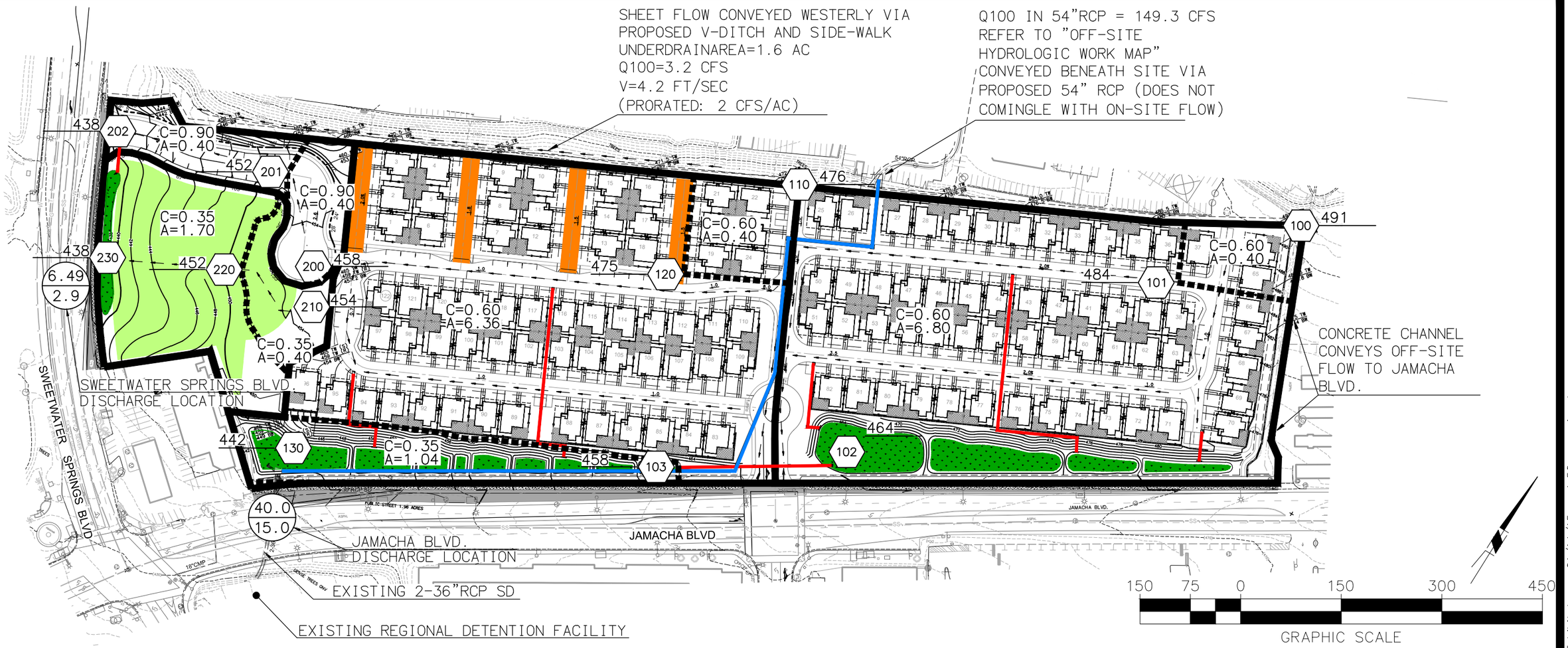
Land Use	Area B3	
	Area	C
Type D Natural	3.47	0.35
EX. Impervious (pavement)	0.87	0.90
Total	**4.34**	

Weighted C = 0.46

Appendix C: Proposed Hydrology

Proposed Condition On-Site Hydrologic Work Map

Proposed Condition AES (Off-Site Flow Included)



LEGEND

	DRAINAGE BOUNDARY	PERVIOUS PAVEMENT	
	SUBAREA BOUNDARY	BIORETENTION	
	FLOW PATH	PUBLIC PARK	
0.00 / 0.00	PROJECT OUTFALL: UNMITIGATED Q100 (CFS) / TOTAL OUFALL AREA (ACRES)	PUBLIC IMPROVEMENT PAVEMENT	
C=0.00 A=0.00	RUN-OFF COEFFICIENT AREA (ACRES)	PUBLIC IMPROVEMENT SIDEWALK	
100	HYDROLOGY NODE	24" ON-SITE STORM DRAIN	
442	NODE ELEVATION	54" RCP (OFF-SITE FLOW)	

PUBLIC IMPROVEMENTS:

	SWEETWATER SPRINGS BLVD	JAMACHA BLVD.	TOTAL
NEW PAVEMENT	0.06 AC	0.33 AC	0.39 AC
NEW SIDEWALK	0.04 AC	0.19 AC	0.23 AC
	0.10 AC	0.52 AC	0.62 AC

PROJECT OUTFALL DESCRIPTION:

1) SWEETWATER SPRINGS BLVD - BIORETENTION SUB-DRAIN DISCHARGE TO CURB AND GUTTER

2) JAMACHA BLVD - EXISTING DUAL 36-INCH RCP DISCHARGE TO REGIONAL DETENTION FACILITY

SWEETWATER VILLAGE PROPOSED CONDITION HYDROLOGY EXHIBIT

RBF CONSULTING
A Baker Company
5050 AVENIDA ENCINAS, SUITE 260
CARLSBAD, CALIFORNIA 92008-4386
760.476.9193 ▪ FAX 760.476.9198 ▪ www.RBF.com

H:\PDATA\134978\CADD\Strmwater\134978 Prop_Hydro Exhibit.dwg 01/14/15 - 4:50pm eric.edge

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****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2013 Advanced Engineering Software (aes)
             Ver. 20.0 Release Date: 06/01/2013  License ID 1264

                           Analysis prepared by:

                              RBF Consulting
                            14257 Alton Parkway
                                 Irvine, CA
                                   92618

 ************************** DESCRIPTION OF STUDY **************************
* UN-MITIGATED PROPOSED CONDITION:100-YEAR                                 *
* SWEETWATER VILLAGE                                                       *
* 134978                                                                   *
 ***************************************************************************

  FILE NAME: SWTPR100.DAT
  TIME/DATE OF STUDY: 16:31 01/14/2015
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.000
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.01
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

+---------------------------------------------------------------------------+
| BEGIN BASIN 100                                                           |
| CONFLUENCES WITH BASIN 110                                                |
| DISCHARGES TO EXISTING DUAL 36" RCP                                       |
+---------------------------------------------------------------------------+

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

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   192.00
  UPSTREAM ELEVATION(FEET) =    491.00
  DOWNSTREAM ELEVATION(FEET) =    486.00
  ELEVATION DIFFERENCE(FEET) =      5.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.068
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    86.04
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.976
  SUBAREA RUNOFF(CFS) =      1.67
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.67

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  486.00  DOWNSTREAM ELEVATION(FEET) =  464.00
  STREET LENGTH(FEET) =   840.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   7.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      12.53
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   11.96
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.05
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.48
  STREET FLOW TRAVEL TIME(MIN.) =   3.46   Tc(MIN.) =    9.53
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.215
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    6.80      SUBAREA RUNOFF(CFS) =   21.28
  TOTAL AREA(ACRES) =        7.2        PEAK FLOW RATE(CFS) =      22.53

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.42   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  5.06   DEPTH*VELOCITY(FT*FT/SEC.) =   2.14
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =    1032.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  41
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   464.00  DOWNSTREAM(FEET) =   458.00
  FLOW LENGTH(FEET) =   231.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.17
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      22.53
  PIPE TRAVEL TIME(MIN.) =   0.54    Tc(MIN.) =   10.07
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    1263.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    130.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    458.00  DOWNSTREAM(FEET) =    442.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   565.00   CHANNEL SLOPE =  0.0283
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.311
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      23.31
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.45
  AVERAGE FLOW DEPTH(FEET) =   0.29   TRAVEL TIME(MIN.) =   2.73
  Tc(MIN.) =   12.80
  SUBAREA AREA(ACRES) =     1.04       SUBAREA RUNOFF(CFS) =    1.57
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.568
  TOTAL AREA(ACRES) =        8.2         PEAK FLOW RATE(CFS) =      22.53

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.29   FLOW VELOCITY(FEET/SEC.) =   3.36
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =    1828.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| BEGIN BASIN 110                                                          |
| CONFLUENCES WITH BASIN 100                                               |
| DISCHARGES TO EXISTING DUAL 36" RCP                                      |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    120.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
```

```
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   208.00
  UPSTREAM ELEVATION(FEET) =    476.00
  DOWNSTREAM ELEVATION(FEET) =    475.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.018
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.829
  SUBAREA RUNOFF(CFS) =      1.40
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.40

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    130.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  475.00  DOWNSTREAM ELEVATION(FEET) =  442.00
  STREET LENGTH(FEET) =   660.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   7.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.95
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.91
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.98
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.61
  STREET FLOW TRAVEL TIME(MIN.) =   2.21   Tc(MIN.) =   10.23
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.982
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .6000
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.600
  SUBAREA AREA(ACRES) =    6.36      SUBAREA RUNOFF(CFS) =   19.01
  TOTAL AREA(ACRES) =        6.8        PEAK FLOW RATE(CFS) =      20.21

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.00
  FLOW VELOCITY(FEET/SEC.) =  5.90   DEPTH*VELOCITY(FT*FT/SEC.) =   2.24
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    130.00 =     868.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================
```

```
  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       20.21    10.23       4.982        6.76
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    130.00 =     868.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       22.53    12.80       4.311        8.24
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    130.00 =    1828.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      38.21      10.23        4.982
      2      40.01      12.80        4.311

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      40.01   Tc(MIN.) =   12.80
  TOTAL AREA(ACRES) =       15.0

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| BEGIN BASIN 200                                                          |
| CONFLUENCES WITH BASIN 210                                               |
| DISCHARGES TO CURB AND GUTTER ALONG SWEETWATER SPRINGS BLVD              |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   150.00
  UPSTREAM ELEVATION(FEET) =    458.00
  DOWNSTREAM ELEVATION(FEET) =    452.00
  ELEVATION DIFFERENCE(FEET) =      6.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.211
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    95.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.904
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      2.85
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      2.85

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  61
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  452.00  DOWNSTREAM ELEVATION(FEET) =  438.00
  STREET LENGTH(FEET) =   262.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 12.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   7.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.27
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.30
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.14
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.05
  STREET FLOW TRAVEL TIME(MIN.) =   1.05   Tc(MIN.) =    3.26
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.904
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.900
  SUBAREA AREA(ACRES) =    0.40      SUBAREA RUNOFF(CFS) =    2.85
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       5.69

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   7.20
  FLOW VELOCITY(FEET/SEC.) =  4.47   DEPTH*VELOCITY(FT*FT/SEC.) =   1.21
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     412.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    230.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   438.00  DOWNSTREAM(FEET) =   437.00
  FLOW LENGTH(FEET) =    62.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   1.81
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.69
  PIPE TRAVEL TIME(MIN.) =   0.57    Tc(MIN.) =    3.83
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    230.00 =     474.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    220.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   150.00
  UPSTREAM ELEVATION(FEET) =    454.00
  DOWNSTREAM ELEVATION(FEET) =    452.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.622
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    75.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.862
  SUBAREA RUNOFF(CFS) =      0.68
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      0.68

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    230.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    452.00  DOWNSTREAM(FEET) =    438.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   203.00   CHANNEL SLOPE =  0.0690
  CHANNEL BASE(FEET) =  100.00   "Z" FACTOR =  20.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.031
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.90
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.95
  AVERAGE FLOW DEPTH(FEET) =   0.02   TRAVEL TIME(MIN.) =   3.58
  Tc(MIN.) =   14.20
  SUBAREA AREA(ACRES) =     1.70       SUBAREA RUNOFF(CFS) =    2.40
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        2.1         PEAK FLOW RATE(CFS) =       2.96

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.03   FLOW VELOCITY(FEET/SEC.) =   1.14
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    230.00 =     353.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        2.96    14.20       4.031        2.10
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    230.00 =     353.00 FEET.
```

```
  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        5.69     3.83       7.904        0.80
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    230.00 =     474.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1       6.49       3.83        7.904
      2       5.87      14.20        4.031

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       6.49   Tc(MIN.) =    3.83
  TOTAL AREA(ACRES) =        2.9

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    230.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| Off-Site Flow                                                            |
| Run-on Location: Midway along northerly boundary                         |
| 54" RCP discharges onto the project site                                 |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    670.00
  DOWNSTREAM ELEVATION(FEET) =    662.00
  ELEVATION DIFFERENCE(FEET) =      8.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.605
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.343
  SUBAREA RUNOFF(CFS) =      0.26
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.26

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    662.00  DOWNSTREAM(FEET) =    590.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   640.00   CHANNEL SLOPE =  0.1125
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.682
```

```
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  88
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.92
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.90
  AVERAGE FLOW DEPTH(FEET) =   0.12   TRAVEL TIME(MIN.) =   2.74
  Tc(MIN.) =    8.34
  SUBAREA AREA(ACRES) =     4.60       SUBAREA RUNOFF(CFS) =    9.15
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        4.7         PEAK FLOW RATE(CFS) =       9.35

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.17   FLOW VELOCITY(FEET/SEC.) =   4.98
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   590.00  DOWNSTREAM(FEET) =   511.00
  FLOW LENGTH(FEET) =   779.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  15.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.21
  GIVEN PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.35
  PIPE TRAVEL TIME(MIN.) =   4.05    Tc(MIN.) =   12.39
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    1499.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.402
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  87
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5141
  SUBAREA AREA(ACRES) =   13.80   SUBAREA RUNOFF(CFS) =   34.62
  TOTAL AREA(ACRES) =       18.5   TOTAL RUNOFF(CFS) =      41.87
  TC(MIN.) =   12.39

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    304.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   511.00  DOWNSTREAM(FEET) =   482.00
  FLOW LENGTH(FEET) =   926.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.63
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      41.87
  PIPE TRAVEL TIME(MIN.) =   5.86    Tc(MIN.) =   18.25
```

```
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    304.00 =    2425.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    304.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.429
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  95
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7257
  SUBAREA AREA(ACRES) =   41.50   SUBAREA RUNOFF(CFS) =  116.67
  TOTAL AREA(ACRES) =       60.0   TOTAL RUNOFF(CFS) =     149.28
  TC(MIN.) =   18.25

+--------------------------------------------------------------------------+
| Total Q100 at Node 205                                                   |
| Un-Mitigated Condition: Includes Off-Site Area                           |
| Discharge from site in a 60" RCP                                         |
+--------------------------------------------------------------------------+
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       60.0  TC(MIN.) =     18.25
  PEAK FLOW RATE(CFS)   =     149.28
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Appendix D: Hydraulics

Existing 60” RCP On-site Storm Drain (EX. Outfall in S.W. Corner)

Proposed On-site Storm Drain (Off-site Flow Conveyance)

Proposed On-Site Culvert (Access off Jamacha Blvd.)

Proposed On-Site Culvert (PR. Outfall in S.W. Corner)

Proposed Concrete Ditch (Northerly Project Boundary)

Proposed 24” RCP – On-site Storm Drains

Culvert Designer/Analyzer Report
EX 60" RCP

Analysis Component			
Storm Event	Design	Discharge	172.80 cfs

Peak Discharge Method: User-Specified			
Design Discharge	172.80 cfs	Check Discharge	0.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-60 inch Circular	172.80 cfs	452.53 ft	13.23 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
EX 60" RCP

Component:Culvert-1

Culvert Summary					
Computed Headwater Eleva	452.53	ft	Discharge	172.80	cfs
Inlet Control HW Elev.	452.41	ft	Tailwater Elevation	N/A	ft
Outlet Control HW Elev.	452.53	ft	Control Type	Entrance Control	
Headwater Depth/Height	1.31				

Grades					
Upstream Invert	446.00	ft	Downstream Invert	445.00	ft
Length	100.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	3.16	ft
Slope Type	Steep		Normal Depth	2.98	ft
Flow Regime	Supercritical		Critical Depth	3.77	ft
Velocity Downstream	13.23	ft/s	Critical Slope	0.005238	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	5.00	ft
Section Size	60 inch		Rise	5.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	452.53	ft	Upstream Velocity Head	1.84	ft
Ke	0.50		Entrance Loss	0.92	ft

Inlet Control Properties					
Inlet Control HW Elev.	452.41	ft	Flow Control	Transition	
Inlet Type	Square edge w/headwall		Area Full	19.6	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Proposed 54" RCP (to convey off-site flow)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	4.50	ft
Discharge	149.30	ft^3/s

Results

Normal Depth	2.93	ft
Flow Area	10.98	ft^2
Wetted Perimeter	8.46	ft
Hydraulic Radius	1.30	ft
Top Width	4.29	ft
Critical Depth	3.59	ft
Percent Full	65.2	%
Critical Slope	0.00608	ft/ft
Velocity	13.60	ft/s
Velocity Head	2.88	ft
Specific Energy	5.81	ft
Froude Number	1.50	
Maximum Discharge	211.53	ft^3/s
Discharge Full	196.64	ft^3/s
Slope Full	0.00576	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	65.17	%
Downstream Velocity	Infinity	ft/s

Proposed 54" RCP (to convey off-site flow)

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.93	ft
Critical Depth	3.59	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00608	ft/ft

Culvert Designer/Analyzer Report
PR 24" RCP

Analysis Component			
Storm Event	Design	Discharge	16.90 cfs

Peak Discharge Method: User-Specified			
Design Discharge	16.90 cfs	Check Discharge	0.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-24 inch Circular	16.90 cfs	468.34 ft	11.67 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
PR 24" RCP

Component:Culvert-1

Culvert Summary					
Computed Headwater Eleva	468.34	ft	Discharge	16.90	cfs
Inlet Control HW Elev.	468.30	ft	Tailwater Elevation	N/A	ft
Outlet Control HW Elev.	468.34	ft	Control Type	Entrance Control	
Headwater Depth/Height	1.17				

Grades					
Upstream Invert	466.00	ft	Downstream Invert	458.00	ft
Length	288.00	ft	Constructed Slope	0.027778	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.94	ft
Slope Type	Steep		Normal Depth	0.94	ft
Flow Regime	Supercritical		Critical Depth	1.48	ft
Velocity Downstream	11.67	ft/s	Critical Slope	0.006907	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	468.34	ft	Upstream Velocity Head	0.71	ft
Ke	0.20		Entrance Loss	0.14	ft

Inlet Control Properties					
Inlet Control HW Elev.	468.30	ft	Flow Control	Transition	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	3.1	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Designer/Analyzer Report
PR 36" RCP SW Corner

Analysis Component			
Storm Event	Design	Discharge	24.90 cfs

Peak Discharge Method: User-Specified			
Design Discharge	24.90 cfs	Check Discharge	0.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-36 inch Circular	24.90 cfs	442.38 ft	8.61 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Designer/Analyzer Report
PR 36" RCP SW Corner

Component:Culvert-1

Culvert Summary					
Computed Headwater Eleva	442.38	ft	Discharge	24.90	cfs
Inlet Control HW Elev.	442.27	ft	Tailwater Elevation	N/A	ft
Outlet Control HW Elev.	442.38	ft	Control Type	Entrance Control	
Headwater Depth/Height	0.79				

Grades					
Upstream Invert	440.00	ft	Downstream Invert	439.00	ft
Length	100.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.28	ft
Slope Type	Steep		Normal Depth	1.27	ft
Flow Regime	Supercritical		Critical Depth	1.61	ft
Velocity Downstream	8.61	ft/s	Critical Slope	0.004405	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	442.38	ft	Upstream Velocity Head	0.65	ft
Ke	0.20		Entrance Loss	0.13	ft

Inlet Control Properties					
Inlet Control HW Elev.	442.27	ft	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	7.1	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

PR V-Ditch Along Northerly Boundary

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.01000	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Discharge	3.20	ft^3/s

Results

Normal Depth	0.62	ft
Flow Area	0.76	ft^2
Wetted Perimeter	2.76	ft
Hydraulic Radius	0.28	ft
Top Width	2.47	ft
Critical Depth	0.69	ft
Critical Slope	0.00542	ft/ft
Velocity	4.20	ft/s
Velocity Head	0.27	ft
Specific Energy	0.89	ft
Froude Number	1.33	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.62	ft
Critical Depth	0.69	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00542	ft/ft

Proposed 24" RCP - On-Site Storm Drains

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Normal Depth	1.50	ft
Diameter	2.00	ft

Results

Discharge	20.63	ft^3/s
Flow Area	2.53	ft^2
Wetted Perimeter	4.19	ft
Hydraulic Radius	0.60	ft
Top Width	1.73	ft
Critical Depth	1.63	ft
Percent Full	75.0	%
Critical Slope	0.00841	ft/ft
Velocity	8.16	ft/s
Velocity Head	1.04	ft
Specific Energy	2.54	ft
Froude Number	1.19	
Maximum Discharge	24.33	ft^3/s
Discharge Full	22.62	ft^3/s
Slope Full	0.00832	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	75.00	%
Downstream Velocity	Infinity	ft/s

Proposed 24" RCP - On-Site Storm Drains

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.63	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00841	ft/ft

ATTACHMENT 7

Copy of Project's Geotechnical and Groundwater Investigation Report

This is the cover sheet for Attachment 7.

If hardcopy or CD is not attached, the following information should be provided:

Title:
Prepared By:
Date:

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PETRA

REVISED FEASIBILITY/DUE-DILIGENCE GEOTECHNICAL INVESTIGATION, PROPOSED RESIDENTIAL DEVELOPMENT, SWEETWATER VILLAGE PROJECT, APN 760-128-54-00, 2657 SWEETWATER SPRINGS BOULEVARD, SPRING VALLEY, SAN DIEGO COUNTY, CALIFORNIA

SAM-SWEETWATER, LLC

SEPTEMBER 18, 2013
J.N. 13-357

Riverside County / Environmental

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PETRA

past + present + futu
it's in our scien

Engineers, Geologis
Environmental Scientis

September 18, 2013
J.N. 13-357

Mr. Ray Dorame
SAM-SWEETWATER, LLC
20201 SW Birch Street, Suite 100
Newport Beach, CA 92660

Subject: Revised Feasibility/Due-diligence Geotechnical Investigation, Proposed Residential Development, *Sweetwater Village Project*, APN 760-128-54-00, 2657 Sweetwater Springs Boulevard, Spring Valley, San Diego County, California

Dear Mr. Dorame:

In accordance with your request and authorization, **Petra Geotechnical, Inc. (Petra)** is pleased to submit herewith our revised feasibility/due-diligence geotechnical investigation report for the proposed residential development (*Sweetwater Village Project)*, located at 2657 Sweetwater Springs Boulevard in Spring Valley, San Diego County, California. This work was performed in general accordance with the scope of work outlined in our Proposal No. 13-357-P dated June 24, 2013. This revised report presents the results of our field exploration, laboratory testing, and our engineering judgment, opinions, conclusions and recommendations pertaining to preliminary geotechnical design aspects for the proposed residential development.

It has been a pleasure to be of service to you on this project. Should you have questions regarding the contents of this report or should you require additional information, please contact this office.

Respectfully submitted,

PETRA GEOTECHNICAL, INC.

Todd A. Greer, CEG
Senior Project Geologist

Grayson R. Walker, GE
Vice President

TAG/GRW/jma
Distribution: (4) Addressee

TABLE OF CONTENTS

Page

Purpose and Scope of Services 1
Location and Site Description 2
Proposed Construction 2
Literature Review 3
Subsurface Exploration 3
Laboratory Testing 3
FINDINGS 4
Regional Geologic Setting 4
Local Geology and Subsurface Soil Conditions 4
Groundwater 4
Faulting 5
CONCLUSIONS AND RECOMMENDATIONS 5
General 5
Geologic Considerations 5
Groundwater 5
Fault Rupture 5
Seismic Shaking 6
Secondary Effects of Seismic Activity 6
Landslides and Slope Instability 6
Surface Flooding 6
Expansive Soils 7
Areal Subsidence 7
Liquefaction and Seismically-Induced Settlement 7
Earthwork 8
General Earthwork Recommendations 8
Clearing and Grubbing 8
Geotechnical Observations and Testing 9
Ground Preparation – Foundation Areas 9
Ground Preparation – Cut Areas 10
Ground Preparation – Roadways and Sheet-Graded Areas 10
Fill Placement and Testing 10
Geotechnical Observations 10
Shrinkage and Subsidence 11
Foundation Systems 11
General 11
Allowable Soil Bearing Capacities 11
Footing Settlement 12
Lateral Resistance 12
Conventional Slab-on-Ground Foundations 12
Post-Tensioned Slab-on-Ground Foundations 14
General Corrosivity Screening 17
Concrete in Contact with Site Soils 17
Metals Encased in Concrete 18
Metallic Elements in Contact with Site Soils 19
Post-Grading Recommendations 19
Site Drainage 19

TABLE OF CONTENTS

Page

Utility Trenches 19
PLAN REVIEW AND CONSTRUCTION SERVICES 20
LIMITATIONS 21
REFERENCES 17

Attachments
References
Figure 1 – Site Location Map
Figure 2 – Boring Location Map

Appendices
Appendix A – Boring Logs
Appendix B – Laboratory Test Criteria/Laboratory Test Data

FEASIBILITY/DUE-DILIGENCE GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
***SWEETWATER VILLAGE PROJECT*, APN 760-128-54-00**
2657 SWEETWATER SPRINGS BOULEVARD
SPRING VALLEY, SAN DIEGO COUNTY, CALIFORNIA

This revised report presents the results of Petra Geotechnical, Inc.'s (Petra) feasibility/due-diligence geotechnical investigation for the proposed residential development of the Sweetwater Village Project (APN 760-128-54-00) located at 2657 Sweetwater Springs Boulevard in Spring Valley, San Diego County, California. This investigation included a review of published and unpublished literature, site reconnaissance and subsurface exploration, as well as a review of geotechnical maps pertaining to geologic hazards which may have an impact on the proposed residential construction.

Purpose and Scope of Services

The purposes of this study were to obtain preliminary information on the subsurface geologic and soil conditions within the project area, evaluate the field and laboratory data and provide conclusions and preliminary geotechnical recommendations for design and construction of the proposed site improvements as influenced by the subsurface conditions encountered.

The scope of our evaluation consisted of the following.

- Provide review of available published and unpublished geologic data, maps, available online aerial imagery and geotechnical documents concerning geologic and soil conditions within, and adjacent to the site which could have an impact on the proposed improvements.
- Perform a site reconnaissance and conduct geologic mapping of the property to evaluate existing onsite conditions.
- The advancement of ten (10) exploratory borings, utilizing a hollow-stem auger drill rig, to evaluate the stratigraphy of the subsurface earth materials and collect representative undisturbed and bulk samples for subsequent laboratory testing.
- Log and visually classify soil materials encountered in the hollow-stem auger borings in accordance with the Unified Soil Classification System.
- Conduct appropriate laboratory testing of representative samples (bulk and undisturbed) obtained from the hollow-stem auger borings to determine their engineering properties.
- Perform appropriate engineering and geologic analysis of the data with respect to the proposed improvements.
- Preparation of this report, including pertinent figures and appendices presenting the results of our evaluation and recommendations for the proposed improvements, in general conformance with the

requirements of the 2010 California Building Code (CBC), as well as in accordance with applicable local jurisdictional requirements.

Location and Site Description

The subject site is an irregularly shaped parcel of unoccupied land. The site is located at 2657 Sweetwater Springs Boulevard northeast of the intersection of Sweetwater Springs Boulevard and Jamacha Road in Spring Valley, San Diego County, California. The associated Assessors Parcel Number (APN) is 760-128-54-00. The site has a gently ascending gradient from the southwest to the northeast portion of the site. Topographically, elevations within the property range from approximately 489± Mean Sea Level (MSL) within the northeast portion of the site to 441± MSL in the southwest portion of the site. Thus, overall relief is on the order of 48± feet. A Chevron gas station and several commercial buildings are located adjacent to the site on the north corner of the intersection of Sweetwater Springs Boulevard and Jamacha Road. At the time of this investigation the site was unoccupied land, with a light to heavy growth of vegetation covering the central and northeastern portion of the site and sporadic, light vegetation in the southwestern portion of the site. Several concrete driveways and rock pathways traverse the site. The property is enclosed by metal and chain link fencing. A small drainage ditch transects the site from the northeast to the southwest.

Based on our review the site was previously occupied by the Evergreen Nursery. All above-ground structures previously located on the property have been subsequently demolished and removed from the site; however, it is assumed that the previous subsurface utility improvements (i.e., sewer, water, gas utilities, and/or onsite sewage disposal systems) associated with the former nursery still exist onsite. The location of the site is shown on Figure 1.

Proposed Construction

Based on conversations with the Client, it is our understanding that the site will be developed as a residential tract. At this time, no specific development plans have been provided for our review. However, it is assumed the structures will utilize typical wood-frame or masonry block construction with either conventional or post-tension slab-on-ground foundation systems. Building loads are assumed to be typical for this type of relatively light residential construction.

Literature Review

Petra researched and reviewed available published and unpublished geologic data, maps and aerial imagery pertaining to regional geology, faulting and geologic hazards that may affect the site. The results of this review are discussed under Findings presented in a following section of this report.

Subsurface Exploration

A subsurface exploration program was performed under the direction of an engineering geologist from Petra on July 30, and August 1, 2013. The exploration involved the advancement of ten (10) exploratory borings (B-1 through B-10) to a maximum depth of approximately 19.5 feet below existing grades, and/or practical refusal. The borings were advanced utilizing rubber-tired and track-mounted drill rigs equipped with 8- and 6-inch diameter hollow-stem augers, respectively. Earth materials encountered within the exploratory borings were classified and logged by an engineering geologist in accordance with the visual-manual procedures of the Unified Soil Classification System (USCS), ASTM Test Standard D2488. The approximate locations of the exploratory borings are shown on Figure 2. The logs for the borings are presented in Appendix A.

Relatively undisturbed ring and disturbed bulk samples of representative earth materials were collected from the exploratory borings for classification, laboratory testing and engineering analyses. Undisturbed samples were obtained using a 3-inch outside diameter modified California split-spoon soil sampler lined with brass rings. The soil sampler was driven with successive 30-inch drops of a free-fall, 140-pound automatic trip hammer. The central portions of the driven-core samples were placed in sealed containers and transported to our laboratory for testing. The number of blows required to drive the split-spoon sampler 18 inches into the soil were recorded for each 6-inch driving increment; however, the number of blows required to drive the sampler for the final 12 inches was noted in the boring logs as Blows per Foot.

Laboratory Testing

The laboratory testing program included the determination of in-situ dry density and moisture content, maximum dry density and optimum moisture content, expansion index, direct shear strength, and preliminary soil corrosivity screening (soluble sulfate and chloride content, pH and minimum resistivity). A description of laboratory test methods and summaries of the laboratory test data are presented in Appendix B and the in-situ dry density and moisture content results are presented on the boring logs (Appendix A).

FINDINGS

Regional Geologic Setting

The proposed residential development is located within the Peninsular Ranges Geomorphic Provence (PRGP). The Peninsular Ranges is characterized by steep, elongated ranges and valleys that trend northwesterly. This province is typified by plutonic and metamorphic rocks (bedrock) which comprise the majority of the mountain masses, with relatively thin volcanic and sedimentary deposits discontinuously overlying the bedrock, and with Plio/Pleistocene-age (Quaternary-age) alluvial fan deposits filling in the valleys and younger alluvium infilling the incised drainages. The alluvial deposits are derived from the water-borne deposition of the products of weathering and erosion of the bedrock materials.

Local Geology and Subsurface Soil Conditions

More specifically, the subject site lies near the margin of the San Diego Embayment, which is a downdropped structural block, encompassing the western portion of San Diego County from south of Carlsbad, east to Rancho Bernardo and south into the northern portion of the Republic of Mexico. The site is mapped as being underlain by Cretaceous age medium-grained and dark-colored gabbro rock (Tan, 2002). However, based on our recent subsurface field investigations, the site is underlain by Cretaceous age fine-grained and light-colored granodiorite rock. These granitic rocks are locally mantled by a relatively thin layer of undocumented artificial fill (believed to be associated with minor grading of the previous Evergreen Nursery) and near surface colluvium/topsoil materials. In general, the artificial fill, colluvial/topsoil, and granitic bedrock deposits were generally found to be dry to slightly moist, loose/soft near the surface, becoming moderately hard with depth.

Groundwater

The site is located within the Otay Groundwater Basin, (California Department of Water Resources, [CDWR], 2010). Groundwater depth varies within the area and though flow direction beneath the subject site is unknown, however, it is believed to be toward the Sweetwater Reservoir to the southwest. Based on our review, of the CDWR water data library (2013), historic data from nearby wells indicate groundwater levels range between 8± and 72± feet below the ground surface. No indication of surface water was observed on the site at the time of this investigation. However, based on our review, the "Sweetwater Spring" is located down gradient (approximate elevation of 427± MSL) across Sweetwater Springs Boulevard, approximately 470± feet west of the subject site.

Faulting

San Diego County is a seismically active area and several northwest-trending active faults have been documented within the area. The Rose Canyon and Elsinore fault zones are the most prominent faults within the San Diego County area. These faults are considered to be "active". An "active" fault is defined as a fault that has had displacement within the Holocene epoch, or last ±11,000 years. Based on our review, the site is not located within an Earthquake Fault Zone, as defined by the state of California in the Alquist-Priolo Earthquake Fault Zoning Act (Bryant and Hart, 2007).

CONCLUSIONS AND RECOMMENDATIONS

General

From a geotechnical engineering and engineering geologic point of view, the subject property is considered suitable for the proposed residential and commercial development provided the following conclusions and recommendations are incorporated into the design criteria and project specifications.

Geologic Considerations

Groundwater

Based on our review, adverse effects on the proposed development due to shallow regional groundwater conditions are currently not anticipated. However, seepage and perched groundwater conditions may occur onsite due to excess irrigation, migration from adjacent springs and/or drainage areas and developments during and/or after periods of above normal or heavy precipitation. Thus, seepage and perched water conditions may occur in the future, and should be anticipated. Should manifestations of seepage and/or perched water conditions develop in the future, Petra could assess the conditions and provide mitigative recommendations, as necessary.

Fault Rupture

As discussed previously, the site is not located within a currently designated State of California Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007). In addition, no known active faults have been identified on the site. While fault rupture would most likely occur along established fault traces, fault rupture could occur at other locations. However, the potential for active fault rupture at the site is considered to be very low.

Seismic Shaking

The site is located within an active tectonic area with several significant faults capable of producing moderate to strong earthquakes. The Rose Canyon, Elsinore, San Jacinto, and San Andreas faults are all in close proximity to the site and capable of producing strong ground motions.

Secondary Effects of Seismic Activity

Secondary effects of seismic activity normally considered as possible hazards to a site include several types of ground failure, as well as earthquake-induced flooding. Various general types of ground failures, which might occur as a consequence of severe ground shaking at the site, include ground subsidence, ground lurching and lateral spreading. The probability of occurrence of each type of ground failure depends on the severity of the earthquake, distance from faults, topography, subsoil and groundwater conditions, in addition to other factors. Based on the shallow bedrock materials, site conditions, and relatively flat topography, ground subsidence ground lurching and lateral spreading is considered unlikely at the site.

Seismically induced flooding that might be considered a potential hazard to a site normally includes flooding due to tsunami or seiche (i.e., a wave-like oscillation of the surface of water in an enclosed basin that may be initiated by a strong earthquake) or failure of a major reservoir or retention structure upstream of the site. No major reservoir is located upstream of the site. The Sweetwater Reservoir is situated approximately 1 mile southwest of the site, with an elevation differential greater than approximately 200 feet. Therefore, the potential for seiche or inundation is considered negligible. Because of the inland location of the site, flooding due to a tsunami is also considered negligible at the site.

Landslides and Slope Instability

The site exhibits a generally flat topography and no mapped landslides exist within or near the site. Based on the topography across the site, the potential for landsliding is considered low.

Surface Flooding

Based on our review, storm water in the form of localized sheet flooding and/or channelized flows from adjacent properties has the potential to affect the site. Based on current site configurations (i.e., drainage channel crossing the site), it is anticipated a drainage study will be performed by the project civil engineer. As such, the potential for localized surface flooding is considered low.

Expansive Soils

Based on the laboratory testing conducted (Appendix B), the Expansion Index (E.I.) of the surface and subsurface soils across the site are considered to have Medium to Very High expansion potential (i.e., E.I. between 51 and above 130). Such expansive soils can affect the performance of concrete slabs or structures with shallow foundations if not properly designed. Therefore, on a preliminary basis recommendations to mitigate the potential effects of expansive soils will be required during the foundation design process. Based on the above, post-tension foundations will likely be required since the Plasticity Index (P.I.) of the onsite soils is greater than >20. Supplemental E.I. and P.I. testing should be conducted at the conclusion of earthwork to provide final foundation design recommendations, based on as-graded site soil conditions. Preliminary recommendations for conventional slab-on-ground foundation in highly expansive soils are also included.

Areal Subsidence

The effects of areal subsidence generally occur at the transition or boundaries between low-lying areas and adjacent hillside terrain, where materials of substantially different engineering properties (i.e., alluvium vs. bedrock) are present. Our review of aerial photographs for the site and vicinity indicated no readily discernable features (i.e., ground fissures, linearity of depressions associated with mountain fronts, etc.) that would indicate subsidence is occurring at this time. Ground fissures are generally associated with excessive groundwater withdrawal and associated subsidence, or active faulting. Our review did not reveal any information that active faulting, ground fissures, or hydro-consolidation in the specific site vicinity, is occurring at this time. Therefore based on the above, and the moderately hard bedrock that underlies the site, the potential for areal subsidence to affect the site is considered low and would generally be no greater than that for other existing structures and improvements in the immediate vicinity.

Liquefaction and Seismically-Induced Settlement

Assessment of liquefaction potential for a particular site requires knowledge of a number of regional as well as site-specific parameters, including the estimated design earthquake magnitude, the distance to the assumed causative fault and the associated probable peak horizontal ground acceleration at the site, subsurface stratigraphy and soil characteristics. Parameters such as distance to causative faults and estimated probable peak horizontal ground acceleration can readily be determined using published references, or by utilizing a commercially available computer program specifically designed to perform a probabilistic analysis. On the other hand, stratigraphy and soil characteristics can only be accurately

determined by means of a site-specific subsurface investigation combined with appropriate laboratory analysis of representative samples of onsite soils.

Liquefaction occurs when dynamic loading of a saturated sand or silt causes pore-water pressures to increase to levels where grain-to-grain contact is lost and material temporarily behaves as a viscous fluid. Liquefaction can cause settlement of the ground surface, settlement and tilting of engineered structures, flotation of buoyant buried structures and fissuring of the ground surface. A common manifestation of liquefaction is the formation of sand boils – short-lived fountains of soil and water that emerge from fissures or vents and leave freshly deposited conical mounds of sand or silt on the ground surface.

In light of the moderately hard bedrock materials that underlie the site, the potential for manifestation of liquefaction induced features or settlement is considered nil.

Earthwork

General Earthwork Recommendations

Prior to the start of onsite grubbing and earthwork, a meeting should be held at the project with the owner, contractor, and geotechnical consultant to discuss the work schedule and geotechnical aspects of site grading. Earthwork should be performed in accordance with the applicable provisions of the 2010 CBC. Grading should also be performed in accordance with the following site-specific recommendations prepared by Petra based on the proposed residential and commercial development of the site.

Clearing and Grubbing

All remaining concrete structures (i.e., foundations, driveways, block walls, etc.), onsite vegetation and/or mulch (from previous nursery operations), and any trash or debris in areas to be graded should be removed from the site. During site grading, fill soils should be cleared of any remaining deleterious materials that were missed during the initial clearing and grubbing operations. Any cavities or excavations created upon removal of subsurface structures and foundations should be cleared of loose soil, shaped to provide access for backfilling and compaction equipment, and then backfilled with properly compacted fill.

The project geotechnical consultant should provide periodic observation and testing services during clearing and grubbing operations to document compliance with the above recommendations. In addition, should any unusual or adverse soil conditions be encountered during grading that are not described herein,

these conditions should be brought to the immediate attention of the project geotechnical consultant for corrective recommendations, as warranted.

Geotechnical Observations and Testing

Grading earthwork, which in this instance will generally entail overexcavation and re-compaction of low density near surface earth materials for structures supported by shallow foundations, should be accomplished under full-time observation and testing of the geotechnical consultant. A representative of the project geotechnical consultant should be present onsite during all earthwork operations to document proper placement and adequate moisture and compaction of fill materials, as well as to document compliance with the other geotechnical recommendations presented herein.

Ground Preparation – Foundation Areas

Based on the earth materials encountered within the exploratory borings, surficial soils (i.e., artificial fill, colluvium/topsoil, and near surface weathered bedrock) over a majority of the site are loose/very soft to medium dense/firm, porous, or extremely weathered. Therese materials are considered unsuitable for support of structures in their existing state, and therefore should be removed and recompacted, in areas proposed for settlement sensitive improvements. In areas where structures are to be supported by conventional shallow slab-on-grade foundations, spread footings, and/or post-tension foundations the existing ground should be over-excavated to depths that expose competent bedrock materials exhibiting an in-place relative compaction of 85 percent or more, based on ASTM Test Method D 1557.

Therefore, the required depths of remedial removals (unsuitable soils) are anticipated to vary from approximately 2± to 8½± feet. A minimum of three feet of compacted fill should underlie all foundation elements. The horizontal limits of over-excavation should extend to a minimum distance of 5 feet beyond the proposed perimeter foundation lines or to a horizontal distance equal to the depth of remedial removals, whichever is greater.

Due to the variability of the near surface earth materials that underlie the project site, the required depths of over-excavation will have to be determined during grading on a case-by-case basis. Therefore, prior to placing compacted fill, the exposed bottom surfaces in all over-excavated areas should be observed and approved by the project geotechnical consultant. Following this approval, the exposed bottom surfaces should be scarified to a depth of approximately 6 to 8 inches, watered as necessary to achieve a moisture

content that is equal to or slightly above optimum moisture content, and then processed to a minimum relative compaction of 90 percent (ASTM D 1557).

Ground Preparation – Cut Areas

Cuts that extend to depths greater than approximately 2± to 8½± feet below existing grade are anticipated to expose competent bedrock materials. However, due to variability in moisture content and the extremely weathered nature of the bedrock materials encountered across the site, cuts in structural areas should be overexcavated to a minimum depth of 5 feet, or 3 feet below foundation elements, and replaced with fill processed to a minimum relative compaction of 90 percent. Shallower removals for roadways and sheet-graded areas may be appropriate where exposed bedrock materials, following the cut, are deemed to be suitable as determined by the project engineering geologist and/or geotechnical engineer.

Ground Preparation – Roadways and Sheet-Graded Areas

The existing ground in proposed roadway areas to be paved with asphaltic concrete should be over-excavated and recompacted in a similar manner as recommended above. In areas to be graded to a sheet flow condition for drainage purposes and where no structures are planned, all existing undocumented artificial fills should be removed, the exposed native earth materials should be scarified to a depth of 8 to 12 inches, watered as necessary to achieve a moisture content that is equal to or slightly above optimum moisture content, and then compacted in-place to a minimum relative compaction of 90 percent.

Fill Placement and Testing

All fill should be placed in lifts not exceeding 6 inches in thickness, watered as necessary to achieve moisture contents that are equal to, or slightly above optimum moisture content, and then processed to a minimum relative compaction of 90 percent. Each fill lift should be treated in a similar manner. Subsequent lifts should not be placed until the preceding lift has been tested and approved by the project geotechnical consultant. The laboratory maximum dry density and optimum moisture content for each change in soil type should be determined in accordance with Test Method ASTM D 1557.

Geotechnical Observations

The project geotechnical consultant should be present on site during grading operations to observe proper placement, adequate moisture, and compaction of fill, as well as to document compliance with the other recommendations presented herein.

Shrinkage and Subsidence

Volumetric changes in earth quantities will occur when excavated onsite soils are replaced as properly compacted fill. Accordingly, it is estimated that a shrinkage factor on the order of approximately 15± to 20± percent will occur when near surface onsite earth materials are excavated and placed as compacted fill.

Subsidence from scarification and re-compaction of exposed bottom surfaces in over-excavated areas is expected to be on the order of approximately 0.05 to 0.10 feet.

The above estimates of shrinkage and subsidence are intended as aids for the civil engineer and project planners in determining earthwork quantities. However, these values should not be considered as absolute values and some contingencies should be made for balancing earthwork quantities on the basis of actual shrinkage and subsidence that occur during grading.

Foundation Systems

General

It is our understanding that no project design or grading plans are currently available for the project at this time. However, building loads are assumed to be typical for this type of relatively light residential and commercial construction. Therefore, based on the weathered and expansive nature of the bedrock materials that underlie the site, the proposed residential and commercial structures will likely be founded on post-tension slab-on-grade foundations systems, although general recommendations for conventional slab-on-ground foundation are also included. Specific preliminary geotechnical foundation design recommendations can be provided when actual building loads, site configurations, and rough grading plans are provided for our review.

Allowable Soil Bearing Capacities

A basic allowable soil bearing capacity of 1,500 pounds per square foot, including dead and live loads, may be utilized for design of 24-inch square pad footing and 12-inch-wide continuous footings founded at a minimum depth of 12 inches below the lowest adjacent final grade. This value may be increased by 20 percent for each additional foot of depth and by 10 percent for each additional foot of width to a maximum value of 2,500 pounds per square foot. Recommended allowable bearing values include both dead and live loads, and may be increased by one-third for short duration wind and seismic forces.

Footing Settlement

Based on the allowable bearing values provided above, total settlement of the footings is anticipated to be less than 1 inch. Differential settlement is expected to be less than 1 inch over a horizontal span of 40 feet. The majority of settlement is likely to take place as footing loads are applied or shortly thereafter.

Lateral Resistance

A passive earth pressure of 250 pounds per square foot per foot of depth, to a maximum value of 2,500 pounds per square foot, may be used to determine lateral bearing resistance for footings. In addition, a coefficient of friction of 0.30 times the dead load forces may be used between concrete and the supporting soils to determine lateral sliding resistance. The above values may be increased by one-third when designing for transient wind or seismic forces. It should be noted that the above values are based on the condition where footings are cast in direct contact with compacted fill or competent native soils. In cases where the footing sides are formed, all backfill placed against the footings upon removal of forms should be compacted to at least 90 percent of the applicable maximum dry density.

Conventional Slab-on-Ground Foundations

As stated above, onsite soils within the subject site should be considered to be expansive per Section 1803.5.3 of the 2010 CBC. Section 1808.6.2 of the 2010 CBC specifies that non-prestressed slab-on-ground foundations (floor slabs) constructed on expansive materials should be designed in accordance with the latest edition of the Wire Reinforcement Institute (WRI) publication "Design of Slab-on-Ground Foundations." The design procedures outlined in the WRI publication are based on the weighted plasticity index of the various soil layers existing within the upper 15 feet of the building site. *The recommendations presented herein are to be considered preliminary in nature and subject to modification following further analysis.*

Footings

1. Exterior continuous footings supporting one- and two-story structures should be founded at a minimum depth of 24 inches below the lowest adjacent final grade. Interior continuous footings may be founded at a minimum depth of 18 inches below the tops of the adjacent floor slabs.

2. All continuous footings should have minimum widths of 12 and 15 inches for one-story and two-story construction, respectively. All continuous footings should be reinforced with a minimum of four No. 4 bars, two top and two bottom.

3. A 12-inch wide grade beam founded at the same depth as adjacent footings should be provided across garage entrances. The grade beam should be reinforced in a similar manner as provided above.

4. Interior isolated pad footings, if required, should be a minimum of 24 inches square and founded at a minimum depth of 18 inches below the top of the adjacent floor slabs. Pad footings should be reinforced with No. 4 bars spaced a maximum of 18 inches on centers, both ways, placed near the bottoms of the footings.

5. Exterior isolated pad footings intended for support of roof overhangs such as second-story decks, patio covers and similar construction should be a minimum of 24 inches square, and founded at a minimum depth of 24 inches below the lowest adjacent final grade. The pad footings should be reinforced with No. 4 bars spaced a maximum of 18 inches on centers, both ways, placed near the bottoms of the footings. Exterior isolated pad footings may need to be connected to adjacent pad and/or continuous footings via tie beams at the discretion of the project structural engineer.

6. The spacing and layout of the interior concrete grade beam system required below floor slabs should be determined by the project architect or structural engineer in accordance with the WRI publication using the effective plasticity index value provided previously.

7. The minimum footing dimensions and reinforcement recommended herein may be modified (increased or decreased) by the structural engineer responsible for foundation design based on his/her calculations and engineering experience and judgment.

<u>Building Floor Slabs</u>

1. The building pad should be graded such that it accommodates placement of 4 inches of non-expansive sand and gravel below the slab underlayment system as explained below.

2. Concrete floor slabs should be a minimum 5 inches thick and reinforced with No. 3 bars spaced a maximum of 15 inches on centers (both ways) for subgrade soils with an effective plasticity index (PI) of less than 20, and with No. 4 bars spaced at a maximum spacing of 20 inches on centers (both ways) for subgrade soils with an effective plasticity index (PI) of 20 or greater. All slab reinforcement should be supported on concrete chairs or brick to ensure the desired placement near mid-depth.

3. Living area concrete floor slabs should be underlain with a moisture vapor retarder consisting of a minimum 10-mil-thick polyethylene or polyolefin membrane that meets the minimum requirements of ASTM E96 and ASTM E1745 for vapor retarders (such as Husky Orange Guard®, Stego® Wrap, or equivalent). All laps within the membrane should be sealed, and at least 2 inches of clean sand should be placed over the membrane to promote uniform curing of the concrete. To reduce the adverse impact of highly expansive soils on slab performance, a 4-inch non-expansive layer of sand and gravel should be placed below the moisture vapor retarder membrane.

   At the present time, some slab designers, geotechnical professionals and concrete experts view the sand layer below the slab (blotting sand) as a place for entrapment of excess moisture that could adversely impact moisture-sensitive floor coverings. As a preventive measure, the potential for moisture intrusion into the concrete slab could be reduced if the concrete is placed directly on the vapor retarder. However, if this sand layer is omitted,

appropriate curing methods must be implemented to ensure that the concrete slab cures uniformly. A qualified materials engineer with experience in slab design and construction should provide recommendations for alternative methods of curing and supervise the construction process to ensure uniform slab curing. Additional steps would also need to be taken to prevent puncturing of the vapor retarder during concrete placement.

4. Garage floor slabs should be a minimum 5 inches thick and reinforced in a similar manner as living area floor slabs. Garage slabs should also be poured separately from adjacent wall footings with a positive separation maintained using ¾-inch-minimum felt expansion joint materials. To control the propagation of shrinkage cracks, garage floor slabs should be quartered with weakened plane joints.

5. Prior to placing concrete, the subgrade soils below living area floor slabs should be pre-watered to achieve a moisture content that is at least 1.4 times the optimum moisture content. This moisture should penetrate to a depth of approximately 24 inches into the subgrade.

6. The minimum dimensions and reinforcement recommended herein for building floor slabs may be modified (increased or decreased) by the structural engineer responsible for foundation design based on his/her calculations, engineering experience and judgment.

Post-Tensioned Slab-on-Ground Foundations

As stated above, onsite soils within the subject site should be considered to be expansive per Section 1803.5.3 of the 2010 CBC. Section 1808.6.2 of the 2010 CBC specifies that post-tensioned slab-on-ground foundations (floor slabs) resting on expansive materials should be designed in accordance with the latest edition of the Post-Tensioning Institute (PTI) publication "Standard Requirements for Design of Shallow Post-Tensioned Concrete Foundations on Expansive Soils."

To comply with Section 1808.6.2 of the 2010 CBC and the PTI publication, in addition to performing appropriate tests on preliminary samples of site soils, certain assumptions regarding the site environmental condition and the composition of the subsurface soils were made. The following table provides preliminary soil and environmental parameters for design of post-tensioned slabs-on-grade based on our laboratory testing, engineering analysis as well as our engineering judgment and experience on similar sites. *The recommendations presented herein are to be considered preliminary in nature and subject to modification following further analysis.*

Design Parameters for PTI Procedure

Soil Information	
Liquid Limit (LL)	55
Plastic Limit (PL)	16
Plasticity Index (PI)	39
Percent Passing No. 200 Sieve (% < #200)	90
Percent Less than 2 Microns (% < 0.002 mm)	80
Expansion Index (EI)	138
Summary of Design Parameters	
Approximate Depth of Constant Suction, feet	9
Approximate Soil Suction, pF	3.9
Thornthwaite Index:	-20
Average Edge Moisture Variation Distance, e_m in feet:	
Center Lift	7.6
Edge Lift	4.0
Anticipated Swell, y_m in inches:	
Center Lift	0.441
Edge Lift	1.071

Modulus of Subgrade Reaction

The modulus of subgrade reaction for design of load bearing partitions may be assumed to be 80 pounds per cubic inch.

Minimum Design Recommendations

The soil values provided above may be utilized by the project structural engineer to design post-tensioned slabs-on-ground in accordance with Section 1808.6.2 of the 2010 CBC and the PTI publication. Thicker floor slabs and larger footing sizes may be required for structural reasons and should govern the design if more restrictive than the minimum recommendations provided below:

1. Perimeter footings for both one-story and two-story structures should be founded at a minimum depth of 21 inches below the lowest adjacent finished ground surface. Interior footings may be founded at a minimum depth of 15 inches below the tops of the finish floor slabs. All continuous footings should be reinforced with a minimum of four No. 4 bars, two top and two bottom.

2. A minimum 12-inch-wide grade beam founded at the same depth as adjacent footings should be provided across the garage entrances. The grade beam should be reinforced in a similar manner as provided above.

3. Exterior isolated pad footings intended for support of roof overhangs such as second-story decks, patio covers and similar construction should be a minimum of 24 inches square, and founded at a minimum depth of 24 inches below the lowest adjacent final grade. The pad footings should be reinforced with No. 4 bars spaced a maximum of 18 inches on centers, both ways, placed near the bottoms of the footings. Exterior isolated pad footings may need to be connected to adjacent pad and/or continuous footings via tie beams at the discretion of the project structural engineer.

4. The thickness of the floor slabs should be determined by the project structural engineer with consideration given to the expansion potential of the on-site soils, however; we recommend that a minimum slab thickness of 5 inches be considered.

5. As an alternative to designing 5-inch-thick post-tensioned slabs with perimeter footings as described in Items 1 and 2 above, the structural engineer may design the foundation system using a thickened slab design. The minimum thickness of this uniformly thick slab should be 12 inches. The engineer in charge of post-tensioned slab design may also opt to use any combination of slab thickness and footing embedment depth as deemed appropriate based on their engineering experience and judgment. .

6. Living area concrete floor slabs should be underlain with a moisture vapor retarder consisting of a minimum 10-mil-thick polyethylene or polyolefin membrane that meets the minimum requirements of ASTM E96 and ASTM E1745 for vapor retarders (such as Husky Orange Guard®, Stego® Wrap, or equivalent). All laps within the membrane should be sealed, and at least 2 inches of clean sand should be placed over the membrane to promote uniform curing of the concrete. To reduce the potential for punctures, the membrane should be placed on a pad surface that has been graded smooth without any sharp protrusions. If a smooth surface cannot be achieved by grading, consideration should be given to lowering the pad finished grade an additional inch and then placing a 1-inch-thick leveling course of sand across the pad surface prior to the placement of the membrane.

   At the present time, some slab designers, geotechnical professionals and concrete experts view the sand layer below the slab (blotting sand) as a place for entrapment of excess moisture that could adversely impact moisture-sensitive floor coverings. As a preventive measure, the potential for moisture intrusion into the concrete slab could be reduced if the concrete is placed directly on the vapor retarder. However, if this sand layer is omitted, appropriate curing methods must be implemented to ensure that the concrete slab cures uniformly. A qualified materials engineer with experience in slab design and construction should provide recommendations for alternative methods of curing and supervise the construction process to ensure uniform slab curing. Additional steps would also need to be taken to prevent puncturing of the vapor retarder during concrete placement.

7. Presaturation of the subgrade below floor slabs will not be required; however, prior to placing concrete, the subgrade below all dwelling and garage floor slab areas should be thoroughly moistened to achieve a moisture content that is at least equal to or slightly greater than optimum moisture content to a minimum depth of 24 inches below the bottoms of the slabs.

General Corrosivity Screening

The following sections represent an interpretation of current codes and specifications that are commonly used in our industry as they relate to the adverse impact of chemical components of the site soils on various components of the proposed structures. As a screening level study, limited chemical testing was performed on representative samples of onsite soils to identify potential corrosive characteristics of these soils. A variety of test methods are available to quantify the corrosive potential of soils. The testing procedures referred to herein are considered to be typical for our industry and have been adopted and/or approved by many public or private agencies.

Petra does not practice corrosion engineering; therefore, the opinion and engineering judgment provided herein should be considered as general guidelines only. Further analyses would be warranted for cases where buried metallic building materials such as copper and ductile iron are planned for the project. For these conditions, we recommend that the project design professionals (i.e., the architect and/or structural engineer) consider recommending a qualified corrosion engineer to conduct additional sampling and testing of near-surface soils during the final stages of site grading to provide a complete assessment of soil corrosivity. Recommendations to mitigate the detrimental effects of corrosive soils on buried metallic and other building materials that may be exposed to corrosive soils should be provided by the corrosion engineer, as deemed appropriate.

Concrete in Contact with Site Soils

Soils containing soluble sulfates beyond certain threshold levels as well as acidic soils are considered to be detrimental to integrity of concrete placed in contact with such soils. For the purpose of this study, soluble sulfates concentration in soils determined in accordance with California Test Method No. 417. Soil acidity, as indicated by hydrogen-ion concentration (pH), was determined in accordance with California Test Method No. 643.

The results of our laboratory tests indicate that on-site soils within the subject site contain a water soluble sulfate contents of between 0.06 and 0.12 percent by weight. Based on Section 1904.3 of the 2010 CBC, concrete that will be exposed to sulfate-containing soils should comply with the provisions of Section 4.3 of ACI 318.

According to Table 4.2.1 of ACI 318-08 (a precursor to Section 4.3), an exposure class of **S0 to S1** is considered appropriate for onsite soils. As such, a range of **Not Applicable to Moderate** exposure to

sulfate may be expected for concrete placed in contact with the onsite soil materials. As directed by Table 4.3.1 of ACI 318-08, no restriction for cement or maximum water-cement ratio for the fresh concrete would be required for an exposure class of **S0**. For this exposure class, the concrete minimum unconfined compressive strength should not be less than 2,500 psi. Per Table 4.3.1, a maximum water-cement ratio of 0.50 for the fresh concrete would be required for an exposure class of **S1**. For this exposure class the concrete minimum unconfined compressive strength should not be less than 4,000 psi. The **S1** exposure class should be considered for design purposes.

The results of limited in-house testing of representative samples indicate that soils within the subject site are neutral with respect to pH (pH of 7.1 and 7.2). Based on this finding and according to Section 8.22.2 of Caltrans' 2003 Bridge Design Specifications (2003 BDS) requirements (which consider the combined effects of soluble sulfates and soil pH), a commercially available Type II Modified cement may be used.

These recommendations should be verified by the project structural engineer and the contractor responsible for concrete placement for concrete used in footings and interior slabs-on-ground, foundation walls and concrete exposed to weather.

Metals Encased in Concrete

Soils containing a soluble chloride concentration beyond a certain threshold level are considered corrosive to metallic elements such as reinforcement bars, cables, bolts, etc. that are encased in concrete that, in turn, is in contact with such soils. For the purpose of this study, soluble chlorides in soils were determined in accordance with California Test Method No. 422.

The results of limited screening tests performed indicate that onsite soils contain a water-soluble chloride concentrations of between 83 and 122 parts per million (ppm). Section 1904.4 of CBC 2010 requires that reinforcement in concrete be protected from the corrosive effects of chloride exposure in accordance with Section 4.4 of ACI 318. It should be noted that Section 4.4 of ACI 318-08 pertains to freeze-and-thaw conditions that are not applicable to the subject project; however, regardless of the level of chlorides in soils in contact with concrete, Table 4.2.1 of ACI 318-08 assigns an exposure class of C1 for concrete that will be exposed to moisture but not necessarily to external sources of chlorides. As such, a **Moderate** exposure to chloride may be expected for metallic elements encased in concrete, which is, in turn, placed in contact with the onsite soil materials.

One method of protecting reinforcement in concrete where moderate chloride concentrations are present in the soils is to increase the thickness of the concrete cover over the reinforcement. However, Table 8.22.1 of Caltrans BDS 2003 provides no minimum concrete cover when chloride concentration is less than 500 ppm (as is the case for the subject site). This recommendation should be verified by the project structural engineer.

Metallic Elements in Contact with Site Soils

Elevated concentrations of soluble salts in soils tend to induce low level electrical currents in metallic objects in contact with such soils. This process promotes metal corrosion and can lead to distress to building components that are in contact with site soils. The minimum electrical resistivity indicates the relative concentration of soluble salts in the soil and, therefore, can be used to estimate soil corrosivity with regard to metals. For the purpose of this investigation, the minimum resistivity in soils is measured in accordance with California Test Method No. 643.

The minimum electrical resistivity for onsite soils was found to be between 640 and 1,000 ohm-cm based on limited testing. This result indicates that on-site soils are **Severely Corrosive to Corrosive** to ferrous metals and copper. As such, any ferrous metal or copper components of the subject buildings or panel foundations that are expected to be placed in direct contact with site soils should be protected against detrimental effects of the corrosive soils.

Post-Grading Recommendations

Site Drainage

Positive-drainage devices, such as sloping flatwork, graded-swales and/or area drains, should be provided around buildings to collect and direct water away from the structures. Neither rain nor excess irrigation water should be allowed to collect or pond against building foundations. Drainage should be directed to an appropriate discharge area. The ground surface adjacent to the structures should also be sloped at a gradient of 2 percent or more away from the foundations for a horizontal distance of 5 feet or more.

Utility Trenches

Utility-trench backfill materials to be placed within access roads, utility easements, cable raceways, and under building-floor slabs should be compacted to a relative compaction of 90 percent or more. Where onsite soils are utilized as backfill, mechanical compaction methods should be utilized. Density testing,

along with probing, should be performed by the project geotechnical consultant or his representative to document adequate compaction.

Utility-trench sidewalls deeper than about 3 feet should be laid back at a ratio of 1:1 horizontal to vertical (h:v) or flatter, or shored. A trench box may be used in lieu of shoring. If shoring is anticipated, the project geotechnical consultant should be contacted to provide appropriate design parameters.

For trenches with vertical walls, backfill should be placed in approximately 1- to 2-foot thick loose lifts and then mechanically compacted with a hydra-hammer, pneumatic tampers, sheepsfoot roller, or similar compaction equipment. For deep trenches with sloped walls, backfill materials should be placed in approximately 8- to 12-inch-thick loose lifts and then compacted by rolling with a sheepsfoot tamper, a full rubber-tired loader, or similar compaction equipment.

Where utility trenches are proposed in a direction that parallels any structural footing (interior and/or exterior trenches), the bottom of the trench should not be located within a 1:1 (h:v) plane projected downward from the outside bottom edge of the adjacent footing.

PLAN REVIEW AND CONSTRUCTION SERVICES

This report has been prepared for the exclusive use of SAM-Sweetwater, LLC to assist the project team in the design of the proposed development. It is recommended that Petra be engaged to review the final-design drawings and specifications prior to construction. This is to document that the recommendations contained in this report have been properly interpreted and are incorporated into the project grading plans and specifications. If Petra is not accorded the opportunity to review these documents, we can take no responsibility for misinterpretation of our recommendations.

We recommend that Petra be retained to provide soil-engineering services during grading and construction of the excavation and foundation preparation phases of the work. This is to observe compliance with the design, specifications, or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

If the project design concept changes significantly (e.g., structural loads or types), we should be retained to review our original design recommendations and their applicability to the revised construction concept. If conditions are encountered during construction that appears to be different than those indicated in this

report, this office should be notified immediately. If this is the case, design and construction revisions may be required.

LIMITATIONS

This report is based on the project, as described, and the preliminary geologic/geotechnical field data obtained from the limited field tests performed at the locations shown. The materials encountered on the project site and utilized in our laboratory evaluation are believed representative of the total area, and the conclusions and recommendations contained in this report are presented on that basis. However, soil materials and groundwater levels can vary in characteristics between points of excavation, both laterally and vertically.

The conclusions and opinions contained in this report are based on the results of the described geotechnical evaluations and represent our professional judgment. The contents of this report are professional opinions and as such, are not to be considered a guaranty or warranty. The findings, conclusions and opinions contained in this report are to be considered tentative only and subject to confirmation by the undersigned during the construction process. Without this confirmation, this report is to be considered incomplete and Petra or the undersigned professionals assume no responsibility for its use. In addition, this report should be reviewed and updated after a period of 1 year or if the site ownership or project concept changes from that described herein.

The professional opinions contained herein have been derived in accordance with current standards of practice and no warranty is expressed or implied. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

We sincerely appreciate this opportunity to be of service. Please do not hesitate to call the undersigned if you have any questions regarding this report.

Respectfully submitted,

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FIGURES

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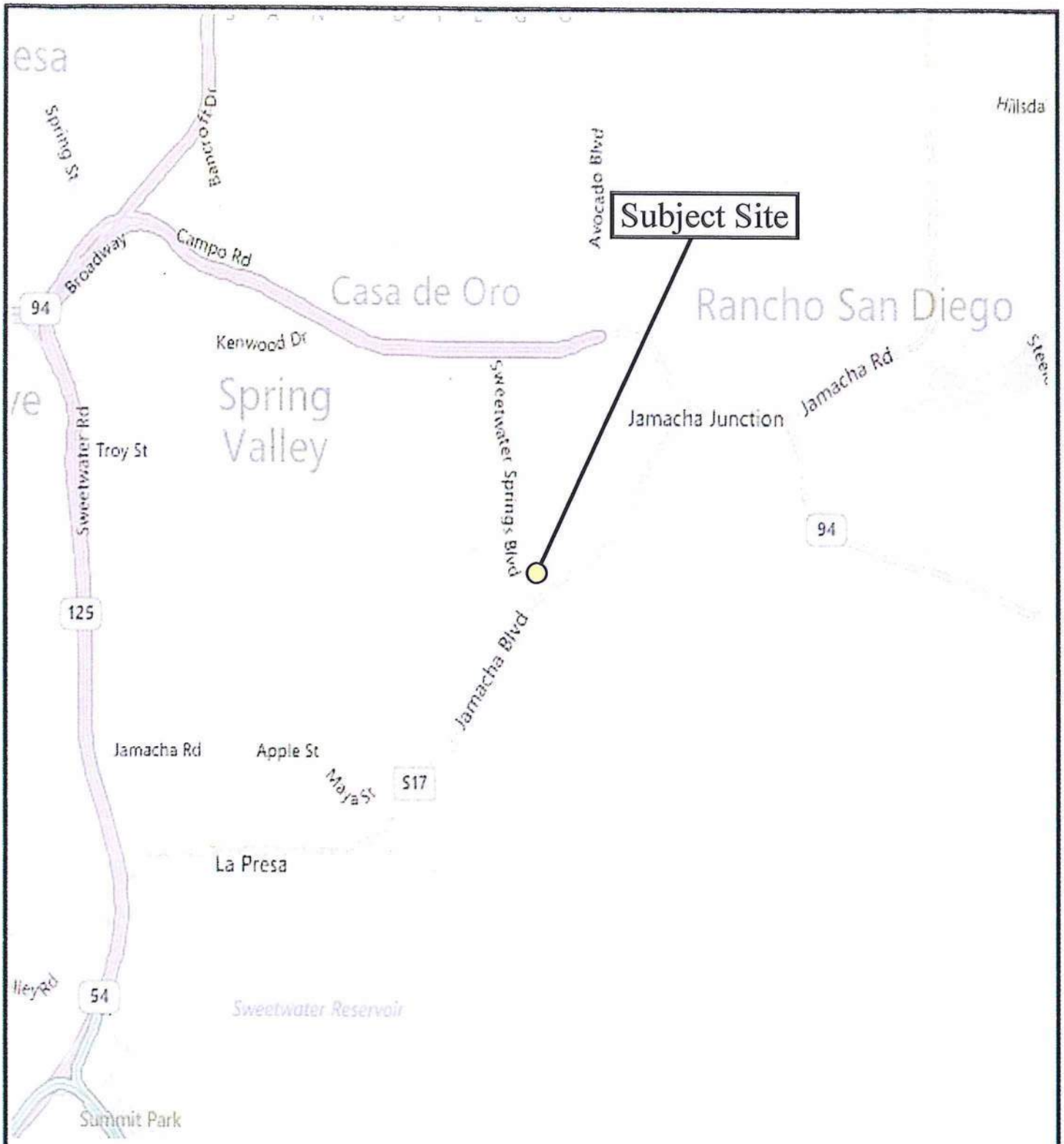

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COSTA MESA TEMECULA PALM DESERT SAN DIEGO SANTA CLARITA

SITE LOCATION MAP

SAM-Sweetwater, LLC
Sweetwater Springs Project
Spring Valley, CA

DATE: September 2013	J.N.: 13--357	Figure 1
DWG BY: LH	SCALE: None	

Reference: Bing Maps

EXPLANATION

Approximate Project Boundary

B-10 Approximate Location of Exploratory Boring

N
W
E
S

Reference: Google Earth

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BORING LOCATION MAP

SAM-Sweetwater,LLC Project
Sweetwater Spring Project
Spring Valley, California

DATE: September 2013	J.N.: 13-357	Figure 2
DWG BY: LH	SCALE: NTS	

APPENDIX A

BORING LOGS

PETRA

Key to Soil and Bedrock Symbols and Terms

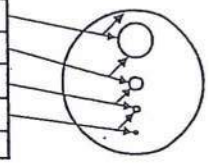
PETRA

Unified Soil Classification System

Coarse-grained Soils > 1/2 of materials is larger than #200 sieve	The No. 200 U.S. Standard Sieve is about the smallest particle visible to the naked eye	GRAVELS more than half of coarse fraction is larger than #4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
				GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
			Gravels with fines	GM	Silty Gravels, poorly-graded gravel-sand-silt mixtures
				GC	Clayey Gravels, poorly-graded gravel-sand-clay mixtures
		SANDS more than half of coarse fraction is smaller than #4 sieve	Clean Sands (less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
				SP	Poorly-graded sands, gravelly sands, little or no fines
			Sands with fines	SM	Silty Sands, poorly-graded sand-gravel-silt mixtures
				SC	Clayey Sands, poorly-graded sand-gravel-clay mixtures
Fine-grained Soils > 1/2 of materials is smaller than #200 sieve		SILTS & CLAYS Liquid Limit Less Than 50		ML	Inorganic silts & very fine sands, silty or clayey fine sands, clayey silts with slight plasticity
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
				OL	Organic silts & clays of low plasticity
		SILTS & CLAYS Liquid Limit Greater Than 50		MH	Inorganic silts, micaceous or diatomaceous fine sand or silt
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic silts and clays of medium-to-high plasticity
Highly Organic Soils				PT	Peat, humus swamp soils with high organic content

Grain Size

Description		Sieve Size	Grain Size	Approximate Size
Boulders		>12"	>12"	Larger than basketball-sized
Cobbles		3 - 12"	3 - 12"	Fist-sized to basketball-sized
Gravel	coarse	3/4 - 3"	3/4 - 3"	Thumb-sized to fist-sized
	fine	#4 - 3/4"	0.19 - 0.75"	Pea-sized to thumb-sized
Sand	coarse	#10 - #4	0.079 - 0.19"	Rock salt-sized to pea-sized
	medium	#40 - #10	0.017 - 0.079"	Sugar-sized to rock salt-sized
	fine	#200 - #40	0.0029 - 0.017"	Flour-sized to sugar-sized to
Fines		Passing #200	<0.0029"	Flour-sized and smaller



Laboratory Test Abbreviations

MAX	Maximum Dry Density	MA	Mechanical (Partical Size) Analysis
EXP	Expansion Potential	AT	Atterberg Limits
SO4	Soluble Sulfate Content	#200	#200 Screen Wash
RES	Resistivity	DSU	Direct Shear (Undisturbed Sample)
pH	Acidity	DSR	Direct Shear (Remolded Sample)
CON	Consolidation	HYD	Hydrometer Analysis
SW	Swell	SE	Sand Equivalent

Modifiers

Trace	< 1 %
Few	1 - 5%
Some	5 - 12 %
Numerous	12 - 20 %

Sampler and Symbol Descriptions

- Approximate Depth of Seepage
- Approximate Depth of Standing Groundwater
- Modified California Split Spoon Sample
- Standard Penetration Test
- Bulk Sample
- No Recovery in Sampler

Bedrock Hardness

Soft	Can be crushed and granulated by hand; "soil like" and structureless
Moderately Hard	Can be grooved with fingernails; gouged easily with butter knife; crumbles under light hammer blows
Hard	Cannot break by hand; can be grooved with a sharp knife; breaks with a moderate hammer blow
Very Hard	Sharp knife leaves scratch; chips with repeated hammer blows

Notes:

Blows Per Foot: Number of blows required to advance sampler 1 foot (unless a lesser distance is specified). Samplers in general were driven into the soil or bedrock at the bottom of the hole with a standard (140 lb.) hammer dropping a standard 30 inches. Drive samples collected in bucket auger borings may be obtained by dropping non-standard weight from variable heights. When a SPT sampler is used the blow count conforms to ASTM D-1586

EXPLORATION LOG

Project: Sweetwater Springs		Boring No.: B-1	
Location: Spring Valley		Elevation: 470	
Job No.: 13-357	Client: SAM-Sweetwater, LLC	Date: 7/30/13	
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: TAG	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		ARTIFICIAL FILL - Undocumented (Af)							
1		Mulch and organic matter.							
		Clayey SAND (SC): light brown, dry, very loose.		10			18.7	113.9	
2		Sandy CLAY (CL): very dark brown to black to light brown, slightly moist, medium dense; fine to coarse grained.		16					
3		No Recovery.		84					
4									
5		**BEDROCK - Cretaceous Granitics (Kgr)**		44			21.7	89.1	
6		Excavates as Clayey SAND (SC): Granodiorite, yellowish brown, moist, moderately hard; very fine to fine grained, highly weathered and fractured.							
7									
8		Excavates as Clayey SAND (SC): Granodiorite, very light gray to white, moist, moderately hard.		32			32.8	86.4	
9									
10		Excavates as Clayey SAND (SC): Granodiorite, gray, slightly moist, moderately hard; very fine to fine grained.		24			35.9	76.7	
11									
12									
13									
14									
15		Excavates as Clayey SAND (SC): Granodiorite, white, moist, moderately hard; very fine to fine grained, highly weathered.		19			35.4		
16				50-5"					
17									
18		Excavates as Clayey SAND (SC): Granodiorite, gray, moist, moderately hard.		43			32.9	88.4	
19									
		T.D. = 19.5 Feet No Groundwater No Caving Backfilled w/ Cutlines and Bentonite 7/30/13.							

EXPLORATION LOG - V2 13-357.GPJ PETRA.GDT 9/4/13

PLATE A-1

Petra Geotechnical, Inc.

EXPLORATION LOG

Project: Sweetwater Springs		Boring No.: B-2	
Location: Spring Valley		Elevation: 482	
Job No.: 13-357	Client: SAM-Sweetwater, LLC	Date: 7/30/13	
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: TAG	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		ARTIFICIAL FILL - Undocumented (Af)							
1		Clayey SAND (SC): dark brown, dry, loose.							
2		**BEDROCK - Cretaceous Granitics (Kgr)**		38	■		27.6	82.5	
3		Excavates as Clayey SAND (SC): Granodiorite, greenish gray, moist, moderately hard; fine grained.			■				
4		Excavates as Clayey SAND (SC): Granodiorite, greenish gray, moist, moderately hard; fine grained.		72	■		31.2	89.1	
5					■				
6									
7		As per 4' - white, sample disturbed.		39	■				
8				50-4"	■				
9									
10		Excavates as Clayey SAND (SC): Granodiorite, greenish gray to white, moist, moderately hard; very fine to fine grained.		46	▨		27.1		
		T.D. = 10.5 Feet							
		No Groundwater							
		No Caving							
		Backfilled w/ Cuttings 7/30/13.							

EXPLORATION LOG - V2 13-357.GPJ PETRA.GDT 9/4/13

PLATE A-3

Petra Geotechnical, Inc.

EXPLORATION LOG

Project: Sweetwater Springs		Boring No.: B-3	
Location: Spring Valley		Elevation: 484	
Job No.: 13-357	Client: SAM-Sweetwater, LLC	Date: 7/30/13	
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: TAG	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
1		**ARTIFICIAL FILL - Undocumented (Af)** Clayey SAND (SC): white, slightly moist, loose; fine to coarse grained.		12	■		15.5	76.2	
2					■				
3		**COLLUVIUM/TOPSOIL (Qcol)** CLAY (CL): dark brown, moist, very stiff; trace grained, very fine to fine grained, trace coarse graned sand.		33	■		18.6	105.0	
4					■				
5									
6									
7		**BEDROCK - Cretaceous Granitics (Kgr)** Excavates as Clayey SAND (SC): Granodiorite, gray, dry, moderately hard; fine grained.		25	■		8.0	106.2	
8				50-6"	■				
9									
10		Excavates as Clayey SAND (SC): Granodiorite, greenish gray, slightly moist, moderately hard; fine grained.		80	▨		16.7		
11					▨				
		T.D. = 11.5 Feet No Groundwater No Caving Backfilled w/ Cuttings and Bentonite 7/30/13.							

EXPLORATION LOG - V2 13-357.GPJ PETRA.GDT 9/4/13

PLATE A-4

Petra Geotechnical, Inc.

EXPLORATION LOG

Project: **Sweetwater Springs**		Boring No.: **B-4**	
Location: **Spring Valley**		Elevation: **478**	
Job No.: **13-357**	Client: **SAM-Sweetwater, LLC**	Date: **7/30/13**	
Drill Method: **Hollow-Stem Auger**	Driving Weight: **140 lbs / 30 in**	Logged By: **TAG**	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
1		**ARTIFICIAL FILL - Undocumented (Af)** Silty SAND (SM): light brown, dry, loose; some gravel.							
2		**COLLUVIUM/TOPSOIL (Qcol)** CLAY (CL): dark brown, moist, stiff; very fine to fine grained sand.		16			30.2	82.7	
3									
4									
5		**BEDROCK - Cretaceous Granitics (Kgr)** Excavates as Clayey SAND (SC): Granodiorite, yellowish brown, moist, moderately hard; fine grained.		13 50-6"			25.7	87.3	
6									
7									
8		Drill chatter							
9		Practical Refusal @ 9 1/2' on Hard Bedrock Materials.							

T.D. = 9.5 Feet
No Groundwater
No Caving
Backfilled w/ Cuttings 7/30/13.

EXPLORATION LOG - V2 13-357.GPJ PETRA.GDT 9/4/13

PLATE A-5

Petra Geotechnical, Inc.

EXPLORATION LOG

Project: **Sweetwater Springs**		Boring No.: **B-5**	
Location: **Spring Valley**		Elevation: **483**	
Job No.: **13-357**	Client: **SAM-Sweetwater, LLC**	Date: **8/1/13**	
Drill Method: **Hollow-Stem Auger**	Driving Weight: **140 lbs / 30 in**	Logged By: **TAG**	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
1		**ARTIFICIAL FILL - Undocumented (Af)** Silty SAND (SM): light gray, dry, loose.							
2		**BEDROCK - Cretaceous Granitics (Kgr)** Excavates as Clayey SAND (SC): Granodiorite, very light gray to white, slightly moist, moderately hard; very fine to fine grained, highly weathered.		47	■		10.1	99.5	
3					■				
4									
5		As per 2'.		35	■		12.1	102.4	
6				50-6"	■				

T.D. = 6.5 Feet
No Groundwater
No Caving
Backfilled w/ Cuttings 8/1/13.

EXPLORATION LOG - V2 13-357.GPJ PETRA.GDT 9/4/13

PLATE A-6

EXPLORATION LOG

Project: **Sweetwater Springs**		Boring No.: **B-6**	
Location: **Spring Valley**		Elevation: **475**	
Job No.: **13-357**	Client: **SAM-Sweetwater, LLC**	Date: **8/1/13**	
Drill Method: **Hollow-Stem Auger**	Driving Weight: **140 lbs / 30 in**	Logged By: **TAG**	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
1		**ARTIFICIAL FILL - Undocumented (Af)** CLayey SAND (SC): light gray, slightly moist, loose.							
2		**BEDROCK - Cretaceous Granitics (Kgr)** Excavates as Clayey SAND (SC): Granodiorite, very light gray to gray, moist, moderately hard; very fine to fine grained, highly weathered and fractured.		45 50-5"	■		23.7	99.4	
3									
4									
5		Excavates as Clayey SAND (SC): Granodiorite, light gray, moist, moderately hard.		72	■		26.5	96.5	
6									
		T.D. = 6.5 Feet No Groundwater No Caving Backfilled w/ Cuttings 8/1/13.							

EXPLORATION LOG - V2 13-357.GPJ PETRA.GDT 9/4/13

PLATE A-7

Petra Geotechnical, Inc.

EXPLORATION LOG

Project: **Sweetwater Springs**		Boring No.: **B-7**	
Location: **Spring Valley**		Elevation: **462**	
Job No.: **13-357**	Client: **SAM-Sweetwater, LLC**	Date: **8/1/13**	
Drill Method: **Hollow-Stem Auger**	Driving Weight: **140 lbs / 30 in**	Logged By: **TAG**	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		COLLUVIUM/TOPSOIL (Qcol)							
1		Sandy CLAY (CL): dark brown, moist, soft.							
2		Sandy CLAY (CL): very dark brown, moist, very stiff; very fine to trace coarse grained sand.		27	■	■	15.6	106.9	
3									
4		Sandy CLAY (CL): very light gray to dark brown, moist, very stiff; very fine to fine grained, trace coarse grained sand.		43	■		27.1	93.3	
5									
6		**BEDROCK - Cretaceous Granitics (Kgr)**		59	■		31.5	83.3	
7		Excavates as Clayey SAND (SC): Granodiorite, very light gray, moist, moderately hard; very fine to grained sand, highly weathered and fractured.							

T.D. = 7.5 Feet
No Groundwater
No Caving
Backfilled w/ Cuttings 8/1/13.

EXPLORATION LOG - V2 13-357.GPJ PETRA.GDT 9/4/13

PLATE A-8

EXPLORATION LOG

Project: **Sweetwater Springs**		Boring No.: **B-8**	
Location: **Spring Valley**		Elevation: **455**	
Job No.: **13-357**	Client: **SAM-Sweetwater, LLC**	Date: **8/1/13**	
Drill Method: **Hollow-Stem Auger**	Driving Weight: **140 lbs / 30 in**	Logged By: **TAG**	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		COLLUVIUM/TOPSOIL (Qcol)							
1		GRAVEL (GM): gray, dry, loose.							
		Clayey SAND to Sandy CLAY (SC/CL): dark brown, moist, stiff.		20	■		19.5	84.0	
2		Clayey SAND to Sandy CLAY (SC/CL): dark brown, moist, stiff; very fine to trace coarse grained sand.			■				
3		**BEDROCK - Cretaceous Granitics (Kgr)**		25	■		23.8	83.5	
4		Excavates as Clayey SAND (SC): Granodiorite, very light gray to white, moist, moderately hard; highly weathered and fractured.			■				
5									
6		As per 3' greenish gray.		50	■		28.6	86.3	
		T.D. = 6.5 Feet No Groundwater No Caving Backfilled w/ Cuttings 8/1/13.							

EXPLORATION LOG - V2 13-357.GPJ PETRA.GDT 9/4/13

PLATE A-9

Petra Geotechnical, Inc.

EXPLORATION LOG

Project: **Sweetwater Springs**		Boring No.: **B-9**	
Location: **Spring Valley**		Elevation: **469**	
Job No.: **13-357**	Client: **SAM-Sweetwater, LLC**	Date: **8/1/13**	
Drill Method: **Hollow-Stem Auger**	Driving Weight: **140 lbs / 30 in**	Logged By: **TAG**	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		COLLUVIUM/TOPSOIL (Qcol)							
1		Clayey SAND (SC): light gray, dry, loose to medium dense.							
		Sandy CLAY (CL): very dark brown, moist, very stiff; very fine to trace coarse grained sand.		38	■		19.7	99.1	
2					■				
3									
4		**BEDROCK - Cretaceous Grantics (Kgr)**							
5		Excavaes as Clayey SAND (SC): Granodiorite, white, moist, moderately hard; very fine to fine grained.		45	■		23.9	83.4	
6		As per 4'.			■				
		T.D. = 6.5 Feet No Groundwater No Caving Backfilled w/ Cuttings 8/1/13.							

EXPLORATION LOG - V2 13-357.GPJ PETRA.GDT 9/4/13

PLATE A-10

Petra Geotechnical, Inc.

EXPLORATION LOG

Project: **Sweetwater Springs**		Boring No.: **B-10**	
Location: **Spring Valley**		Elevation: **456**	
Job No.: **13-357**	Client: **SAM-Sweetwater, LLC**	Date: **8/1/13**	
Drill Method: **Hollow-Stem Auger**	Driving Weight: **140 lbs / 30 in**	Logged By: **TAG**	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		ARTIFICIAL FILL - Undocumented (Af)							
1		Clayey SAND (SC): light gray, dry, loose.							
2		Sandy CLAY and Clayey SAND (SC): very dark brown (clay) to gray (clayey sand), moist, stiff to medium dense; very fine to fine grained sand.		22			18.2	75.5	
3									
4									
5		**COLLUVIUM/TOPSOIL (Qcol)**		65			24.6	94.2	
6		Sandy CLAY (CL): dark brown, moist, hard; very fine to trace coarse grained.							
7		**BEDROCK - Cretaceous Granitics (Kgr)**							
8		Excavates as Clayey SAND (SC): Granodiorite, white to very light gray, moist, moderately hard; highly weathered and fractured.		33			22.7		
9		Excavates as Clayey SAND (SC): Granodiorite, very light gray, moist, moderately hard.							

T.D. = 9.5 Feet
No Groundwater
No Caving
Backfilled w/ Cuttings 8/1/13.

EXPLORATION LOG - V2 13-357.GPJ PETRA.GDT 9/4/13

PLATE A-2

APPENDIX B

LABORATORY TEST CRITERIA / LABORATORY TEST DATA

PETRA

APPENDIX B

Laboratory Test Criteria

Soil Classification

Soils encountered within the exploratory borings were initially classified in the field in general accordance with the visual-manual procedures of the Unified Soil Classification System (ASTM D2488). The samples were re-examined in the laboratory and the classifications reviewed and then revised where appropriate. The assigned group symbols are presented in the Boring Logs (Appendix A).

In-Situ Moisture and Density

Moisture content and unit dry density of in-place soils were determined in representative strata. Test data are summarized in the Boring Logs (Appendix A).

Maximum Dry Density

Maximum dry density and optimum moisture content were determined for selected samples of the onsite soils in general accordance with ASTM D1557. The test results are presented on Plate B-1.

Expansion Index

Expansion Index (E.I.) testing was performed on a selected bulk samples of the onsite soils in general accordance with ASTM D4829. The expansion potential classification was determined from 2010 CBC Section 1802.3.2 on the basis of the E.I. value. The test results and expansion potentials are presented on Plate B-1.

Atterberg Limits

Atterberg limit tests (Liquid Limit, Plastic Limit and Plasticity Index) were performed on selected samples to verify visual classifications. These tests were performed in accordance with ASTM D4318. Test results are presented on Plate B-1.

Corrosivity

Chemical analyses were performed on a selected sample of the onsite soils to determine concentrations of soluble sulfate and chloride, as well as pH and resistivity. The tests were performed in general accordance with California Test Method Nos. 417 (sulfate), 422 (chloride) and 643 (pH and resistivity). Test results are included on Plate B-2.

Direct Shear

The Coulomb shear strength parameters, angle of internal friction and cohesion, were determined for disturbed (bulk) samples remolded to approximately 90 percent of maximum dry density. These tests were performed in general accordance with ASTM D3080. Three specimens were prepared for each test. The test specimens were artificially saturated, and then sheared under varied normal loads at a maximum constant rate of strain of 0.01 inches per minute. Results are graphically presented on Plates B-3 and B-4.

APPENDIX B

MAXIMUM DRY DENSITY

Boring/Depth (feet)	Soil Type	Maximum Dry Density[1] (pcf)	Optimum Moisture[1] (%)
B-4 @ 0-5	Clayey SAND (SC)	111.0	16.0
B-7 @ 0-4	Clayey SAND (SC)	115.0	16.0

EXPANSION INDEX

Boring/Depth (feet)	Soil Type	Expansion Index[2]	Expansion Potential[3]
B-1 @ 1-5	Sandy Clay (CL)	84	Medium
B-4 @ 0-5	Clayey Sand (SC)	57	Medium
B-7 @ 0-4	Clay (CH)	138	Very High

ATTERBURG LIMITS TEST DATA

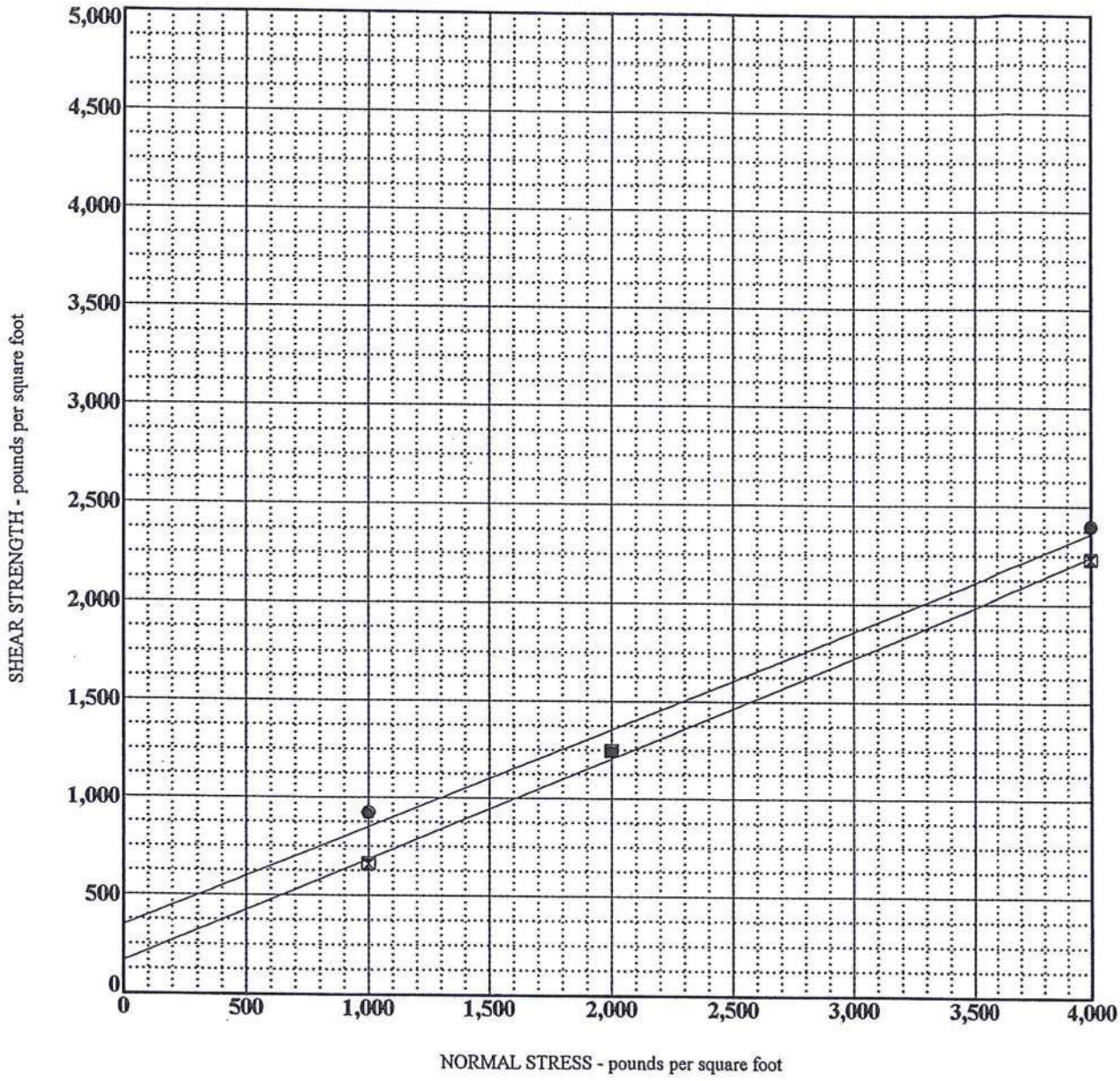
Boring/Depth (feet)	Liquid Limit[4]	Plastic Limit[4]	Plasticity Index[4]	USCS Classification
B-1 @ 1-5	52	16	36	CH (High-Plasticity Clay)
B-4 @ 0-5	48	16	32	CL (Low-Plasticity Sandy Clay)
B-7 @ 0-4	55	16	39	CH (High-Plasticity Clay)

APPENDIX B

CORROSIVITY

Boring/Depth (feet)	Sulfate[5] (%)	Chloride[6] (ppm)	pH[7]	Resistivity[7] (ohm-cm)	Corrosivity Potential
B-4 @ 1-5	0.12	122	7.1	640	Concrete: Negligible Steel: Severely Corrosive
B-10 @ 4-8	0.06	83	7.2	1,000	Concrete: Negligible Steel: Corrosive

(1) PER ASTM D 1557
(2) PER ASTM D 4829
(3) PER 2010 CBC SECTION 1802.3.2
(4) PER ASTM D 4318
(5) PER CALIFORNIA TEST METHOD NO. 417
(6) PER CALIFORNIA TEST METHOD NO. 422
(7) PER CALIFORNIA TEST METHOD NO. 643

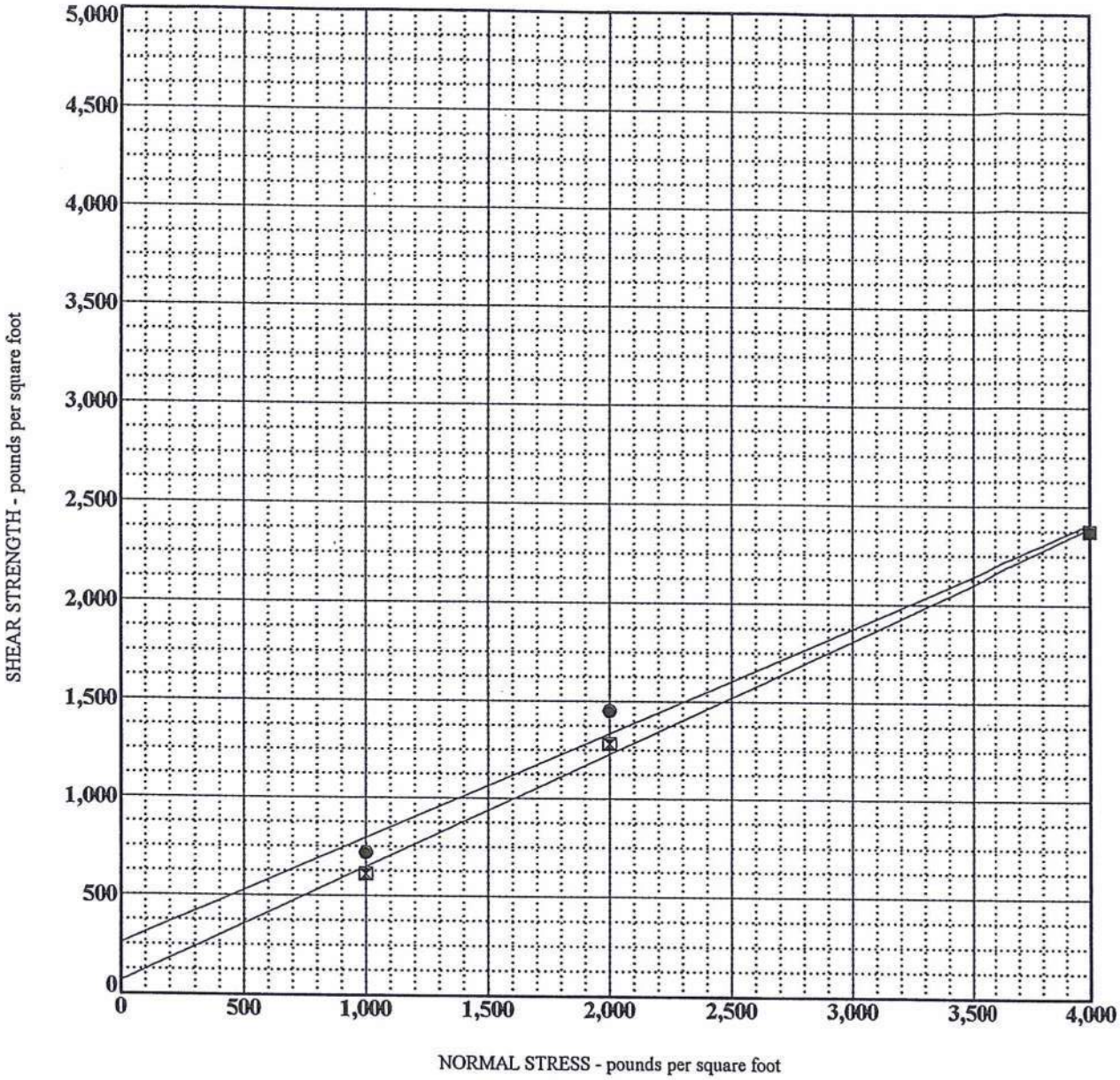


SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-4 @ 1-5'	Peak	27	348
⊠ B-4 @ 1-5'	Ultimate	27	168

NOTES:

Samples Remolded to 90% of Maximum Dry Density
All Samples Were Presoaked 24 Hours Minimum Prior to Shearing

J.N. 13-357	**DIRECT SHEAR TEST DATA**	**September, 2013**
PETRA GEOTECHNICAL, INC.		**PLATE B-3**



SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-7 @ 0-4'	Peak	28	258
⊠ B-7 @ 0-4'	Ultimate	30	66

NOTES:

Samples Remolded to 90% of Maximum Dry Density
All Samples Were Presoaked 24 Hours Minimum Prior to Shearing

J.N. 13-357	**DIRECT SHEAR TEST DATA**	**September, 2013**
PETRA GEOTECHNICAL, INC.		**PLATE B-4**

PETRA

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