WQ XX-XXXX

County of Orange/San Diego Region Priority Project Conceptual Water Quality Management Plan (C-WQMP)

Project Name:

Oak Grove

23432 VISTA DEL VERDE,
COTO DE CAZA, CA 92679
APN: 804-261-12, 23, 24
Planning Application No. PA160056

Prepared for:

Oak Grove LLC and Silver-Bronze Corporation
One Upper Newport Plaza
Newport Beach, CA 92660

Prepared by:

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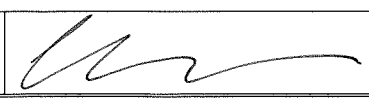
1st Submittal Prepared: 4/7/2016
2nd Submittal Prepared: 10/28/2016
3rd Submittal Prepared: 3/16/2017
4th Submittal Prepared: 8/14/2017
5th Submittal Prepared 12/7/2017
6th Submittal Prepared 2/11/2019
7th Submittal Prepared 5-14-2020
8th Submittal Prepared 4-27-2021 (rev 8-23-2021)
9th Submittal Prepared 3/31/2022

Project Owner's Certification			
Planning Application No. (If applicable)	PA160056	Grading Permit No.	N/A
Tract/Parcel Map and Lot(s) No.	Tract Map No. 17866	Building Permit No.	N/A
Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers)			23432 Vista Del Verde, Coto de Caza, CA 92679 APN: 804-261-12, 23, 24

This Conceptual Water Quality Management Plan (C-WQMP) has been prepared for Silver-Bronze Corporation by Land Strategies, LLC. The C-WQMP is intended to comply with the requirements of the County of Orange NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan , including the ongoing operation and maintenance of all best management practices (BMPs), and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the San Diego Region. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

Owner: Alain O'Connor			
Title	Chairman and Executive Director		
Company	Silver-Bronze Corporation and Oak Grove LLC		
Address	One Upper Newport Plaza, Newport Beach CA 92660		
Email	AO@OakGrovecoto.com		
Telephone #	949-251-2011		
I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein.			
Owner Signature		Date	3/31/2021

Preparer (Engineer): Roy Roberson			
Title	Managing Member	PE Registration #	44160
Company	Land Strategies, LLC		
Address	9241 Irvine Boulevard, Suite 100		
Email	roy@land-strategies.us		
Telephone #	(949) 580-3000		

I hereby certify that this Conceptual Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R9-2009-0002/NPDES No. CAS0108740, of the San Diego Regional Water Quality Control Board.

Preparer Signature		Date	03/31/2021
Place Stamp Here			

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Attachments

Section I Permit(s) and Water Quality Conditions of Approval or Issuance

Provide discretionary or grading/building permit information and water quality conditions of approval, or permit issuance, applied to the project. If conditions are unknown, please request applicable conditions from staff. *Refer to Section 2.1 in the Technical Guidance Document (TGD) available on the OC Planning website (www.ocplanning.net).*

Project Infomation			
Permit/Application No. (If applicable)	PA 160056	Grading or Building Permit No. (If applicable)	N/A
Address of Project Site (or Tract Map and Lot Number if no address) and APN	23432 Vista Del Verde, Coto de Caza, CA 92679 APN: 804-261-12, 23, 24		
Water Quality Conditions of Approval or Issuance			
Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.)	To be provided during the next submittal. Any conditions of approval applicable to NPDES requirements for this project will become a part of this WQMP.		
Conceptual WQMP			
Was a Conceptual Water Quality Management Plan previously approved for this project?	No. This is the Conceptual WQMP for this Project.		

Section II Project Description

II.1 Project Description

Provide a detailed project description including:

- Project areas;
- Land uses;
- Land cover;
- Design elements;
- A general description not broken down by drainage management areas (DMAs).

Include attributes relevant to determining applicable source controls. *Refer to Section 2.2 in the Technical Guidance Document (TGD) for information that must be included in the project description.*

Description of Proposed Project				
Development Category (From Model WQMP, Table 7.11-2; or -3):	Redevelopment project that creates, adds, or replaces at least 5,000 square feet of impervious surface on an already developed site and the existing development or redevelopment project falls under another Priority Development Project Category.			
Project Area (ft^2): 222,156	Number of Dwelling Units: 13		SIC Code: N/A	
Project Drainage Area (ft^2): 222,156 (5.1 Acres)	Pervious		Impervious	
	Area (acres or sq ft)	Percentage	Area (acres or sq ft)	Percentage
Pre-Project Conditions	4.1	80% (100% for Basin Design)	1.0	20% (0% for Basin Design)
Post-Project Conditions	2.0	40% (OC H Manual Allows 70% For 2.5 DU/Ac)	3.1	60% (OC H Manual Allows 30% For 2.5 DU/Ac)

Drainage Patterns/Connections	The site is in the within the Canada Gobernadora watershed of southern Orange County, which is tributary to San Juan Creek. Site drainage generally flows south to Via Pajaro. Currently on-site drainage sheet flows from impervious and pervious surfaces and is collected by various storm drain pipes that outlet into a small natural creek adjacent to Via Pajaro. The natural creek drains south eventually draining into Canada Gobernadora. Canada Gobernadora drains south into San Juan Creek which ultimately discharges into the Pacific Ocean.
Narrative Project Description: (Use as much space as necessary.)	The project site is the Oak Grove residential development and is bounded by Vista del Verde and Via Pajaro on the south and Coto Equestrian Preserve to the north, in the Coto de Caza community, an unincorporated portion of the County of Orange. This property lies within the Canada Gobendora Watershed. The current property is part of the Coto De Caza Equestrian Preserve which has been in existence for over 30 years. The proposed project will consist of 13 single family residential units. The project site will drain northwest towards the Coto Equestrian Preserve where it will be conveyed into a proposed underground infiltration reservoir. This reservoir will provide water quality treatment and flow attenuation for hydromodification purposes before discharging runoff into the natural creek adjacent to Via Pajaro.
Priority Project Category	Redevelopment project that creates, adds, or replaces at least 5,000 square feet of impervious surface on an already developed site and the existing development or redevelopment project falls under another Priority Development Project Category. The proposed improvements are anticipated to replace more than 50% of the sites total existing impervious surfaces so the entire site will be treated.

II.2 Potential Stormwater Pollutants

Determine and list expected stormwater pollutants based on land uses and site activities. *Refer to Section 2.2.2 and Table 2.1 in the Technical Guidance Document (TGD) for guidance.*

Pollutants of Concern			
Pollutant	Check One: E=Expected to be of concern N=Not Expected to be of concern		Additional Information and Comments
Bacteria and Viruses	E ☒	N ☐	
Metals	E ☐	N ☒	Not anticipated for residential developments.
Nutrients	E ☒	N ☐	
Pesticides	E ☒	N ☐	
Organic Compounds	E ☐	N ☒	Not anticipated for residential developments.
Sediments	E ☒	N ☐	
Trash and Debris	E ☒	N ☐	
Oxygen-Demanding Substances	E ☒	N ☐	
Oil and Grease	E ☒	N ☐	

II.3 Hydrologic Conditions of Concern

Determine if streams located downstream from the project area are potentially susceptible to hydromodification impacts. *Refer to Section 2.2.3.2 in the TGD and Appendix C of the Model WQMP for reference to applicable technical guidance for determining if downstream channels are susceptible to HCOCs.*

☐ No – Show map

☒ Yes – Describe applicable HCOCs below. *Refer to Section 2.2.3 in the TGD.*

The project discharges to a natural creek followed by Canada Gobendora, which is not a hydromodification exempt receiving water according to the South OC Hydromodfication Management Plan (HMP) dated April 1, 2015. Canada Gobernadora is therefore susceptible to HCOCs and the project is subject to the HMP requirements.

II.4 Post Development Drainage Characteristics

Describe post development drainage characteristics. *Refer to Section 2.2.4 in the TGD.*

Stormwater runoff from the site will sheet flow from each lot through pervious landscaped areas before being conveyed into the proposed Oak Grove Street. A proposed concrete swale located at the north east end of the site will convey runoff from the development into the water quality/hydromodification underground infiltration reservoir. The reservoir will then discharge into the adjacent natural creek through an existing storm drain culvert similar to the existing condition. The proposed drainage improvements will divert runoff from the development to the existing storm drain at a single discharge point as shown on the WQMP Exhibit. In the existing condition the site discharges to the natural creek through two discharge locations. The majority of the site drains to the existing storm drain, as discussed in the proposed condition, and a portion of the site (approximately 3.31 acres) drains to the natural creek at a point south of the single drainage point in the proposed condition. This increase in drainage area was included in the hydromodification model and is provided in Attachment C. Tributary drainage areas for the existing and proposed condition are provided in the stand alone Oak Grove and Coto Equestrian Preserve Master Drainage Plan. The proposed underground infiltration reservoir was designed to mimic the predeveloped condition to mitigate for increases in runoff into the natural creek. Currently the site partially sheet flows into the natural creek as well as into an existing storm drain system in Via Pajaro. The existing storm drain system in Via Pajaro discharges to the local stream adjacent to Via Pajaro just south of the project. The local stream adjacent Via Pajaro discharges into Canada Gobernadora which confluences downstream with San Juan Creek, which discharges to the Pacific Ocean.

II.5 Property Ownership/Management

Describe property ownership/management. *Refer to Section 2.2.5 in the TGD.*

The proposed improvements are owned by the Silver-Bronze Corporation and Oak Grove LLC, which is also responsible for the ongoing property ownership, management, and maintenance of the structure. Operation and maintenance of the BMPs and on-site storm drain facilities are the responsibility of the Owner until a Home Owner's Association (HOA) is formed. The Owner shall ensure that the WQMP is implemented and that the site is maintained by the HOA in perpetuity throughout the life of the facility. The WQMP and BMP maintenance records shall be kept on-site at the HOA management company office at all times and available upon request.

Section III Site Description

III.1 Physical Setting

Fill out table with relevant information. *Refer to Section 2.3.1 in the TGD.*

Name of Planned Community/Planning Area (if applicable)	Oak Grove
Location/Address	23432 Vista Del Verde Coto De Caza, CA 92679
General Plan Land Use Designation	Suburban Residential (1B)
Zoning	Coto de Caza Specific Plan, Planning Area 21, Community Center Commercial
Acreage of Project Site	5.1 acres
Predominant Soil Type	The on-site soils have been identified as a mix of Sandy Clays. These soils are identified in the Orange County Hydrology Manual as Hydrologic Soils Group A and C.

III.2 Site Characteristics

Fill out table with relevant information and include information as it relates to BMP sizing, suitability, and feasibility, as applicable. *Refer to Section 2.3.2 in the TGD.* Include additional narrative, as applicable, to summarize findings of site investigations. Include references to applicable studies/reports related to investigation of the site and evaluation of feasibility of LID BMPs.

Site Characteristics	
Precipitation Zone	The project is located in the 1.0-inch design capture storm depth rainfall zone.

Topography	The development is located on a gently sloping parcel that generally slopes 2% to the south. Adjacent to the property are slopes ranging from 2% to 50%.
Drainage Patterns/Connections	The site currently discharges to an existing storm drain system in Via Pajaro, that discharges into a local stream adjacent to Via Pajaro, which discharges into Canada Gobernadora which confluences downstream with San Juan Creek and ultimately discharges to the Pacific Ocean.
Soil Type, Geology, and Infiltration Properties	The on-site soils have been identified as Sandy Clays. These soils are identified in the Orange County Hydrology Manual as Hydrologic Soils Group A and C. Soils maps are provided in the stand alone Oak Grove and Coto Equestrian Preserve Master Drainage Plan
Hydrogeologic (Groundwater) Conditions	Shallow groundwater is not anticipated on the site however will be addressed during the Final WQMP once the geotechnical evaluation has been completed.
Geotechnical Conditions (relevant to infiltration)	Sandy clays present on site could potentially reduce infiltration rates. Infiltration testing will occur during the Final WQMP.
Off-Site Drainage	Drainage improvements adjacent to the site will eliminate any run on from off-site residential/equestrian areas.
Utility and Infrastructure Information	Typical utilities related to residential and commercial land use are present within the property.

III.3 Watershed Description

Fill out table with relevant information and include information regarding BMP sizing, suitability, and feasibility, as applicable. *Refer to Section 2.3.3 in the TGD.*

Receiving Waters	Local stream adjacent to Via Pajaro, Canada Gobernadora, San Juan Creek and the Pacific Ocean
303(d) Listed Impairments	Indicator Bacteria, Phosphorus, Metals, Total Nitrogen as N, and Toxicity
Applicable TMDLs	Total Maximum Daily Loads for Indicator Bacteria

Pollutants of Concern for the Project	Sediment, nutrients, heavy metals, pathogens, pesticides, nutrients, organic compounds, oils, grease, and trash
Environmentally Sensitive and Special Biological Significant Areas	2010 303(d) list of impaired water bodies; The confluence of San Juan Creek with the Pacific Ocean is located four miles south from Heisler Park ASBS (ASBS No. 30).

Section IV Best Management Practices (BMPs)

IV. 1 Project Performance Criteria

Describe project performance criteria. Several steps must be followed in order to determine what performance criteria will apply to a project. These steps include:

- Determine applicable hydromodification control performance criteria. *Refer to Section 7.II-2.4.2.2 and Appendix C of the Model WQMP.*
- Determine applicable LID performance criteria. *Refer to Section 7.II-2.4.3 of the Model WQMP.*
- Calculate the LID DCV for the project. *Refer to Section 7.II-2.4.3 of the Model WQMP.*

Project Performance Criteria	
If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP)	According to Section 3.1 - HMP Criteria and Performance Standard, of the South Orange County Hydromodification Management Plan dated April 1, 2015 the HMP criteria for all PDPs is: All PDPs must ensure that post-project runoff flow rates and durations for the PDP shall not exceed pre-development, naturally occurring, runoff flow rates and durations by more than 10% of the time, from 10% of the 2-year runoff event up to the 10-year runoff event.
List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP)	According to Section 7.II-2.4.3 of the Model WQMP the following is the LID performance criteria: • Priority Development Projects must infiltrate, harvest and use, evapotranspire, or biofilter, the 85th percentile, 24-hour storm event DCV. • A properly designed biofiltration system may only be considered if infiltration, harvest and use, and evapotranspiration (ET) cannot be feasibly implemented for the full design capture volume. In this case, infiltration, harvest and use, and ET practices must be implemented to the greatest extent feasible and biofiltration may be provided for the remaining DCV.
Calculate LID design storm capture volume for Project.	Total Tributary Drainage Area = 5.1 acres Precipitation Depth = 1.0 inches Impervious % = 60% Runoff Coefficient = 0.87 unitless Total DCV = (5.1x43560)x(1.0/12)x(0.87) = 16,106 cubic feet

IV.2. Site Design and Drainage

Describe site design and drainage including

- A narrative of site design practices utilized or rationale for not using practices;
- A narrative of how site is designed to allow BMPs to be incorporated to the MEP
- A table of DMA characteristics and list of LID BMPs proposed in each DMA.
- Reference to the WQMP "BMP Exhibit."
- Calculation of Design Capture Volume (DCV) for each drainage area.
- A listing of GIS coordinates for LID and Treatment Control BMPs (if applicable).

Refer to Section 2.4.2 in the Technical Guidance Document (TGD).

The project is located within the Canada Gobernadora watershed of southern Orange County, which is tributary to San Juan Creek. The vicinity map on the WQMP Exhibit in Attachment B shows the location of the development from a regional perspective. The project site is bounded by Vista del Verde and Via Pajaro on the south and Coto Equestrian Preserve to the north, in the Coto de Caza community, an unincorporated portion of the County of Orange.

The site planning principles integrated into the site design include minimization of impervious surfaces and disconnection of impervious surfaces. The site was planned to minimize the impervious surfaces to be integrated into the site to the maximum extent practicable by including only the structural features to make the site function for the intended purpose.

The project area is divided up into one main Drainage Management Area (DMA) which contains one underground infiltration reservoir located at the downstream end of the development. The drainage boundary, flow patterns, discharge location, and underground infiltration reservoir for the project site are shown in the C-WQMP Exhibit in Attachment B.

The coordinates for the underground infiltration reservoir are as follows:

Lat: 33°37'23.1"N, Long: 117°34'53.6"W

DCV = Drainage Area (square feet) x Precipitation Depth (inches) x Runoff Coefficient
Total Tributary Drainage Area = 5.1 acres
Precipitation Depth = 1.0 inches
Impervious % = 60%
Runoff Coefficient = 0.87 unit less

Total DCV = (5.1x43560)x(1.0/12)x(0.87) = 16,106 cubic feet

IV.3 LID BMP Selection and Project Conformance Analysis

Each sub-section below documents that the proposed design features conform to the applicable project performance criteria via check boxes, tables, calculations, narratives, and/or references to worksheets. *Refer to Section 2.4.2.3 in the Technical Guidance Document (TGD) for selecting LID BMPs and Section 2.4.3 in the TGD for conducting conformance analysis with project performance criteria. Refer to Appendix C of the Model WQMP for hydromodification criteria and analysis methods.*

IV.3.1 Hydrologic Source Controls (HSCs)

If required HSCs are included, fill out applicable check box forms. If the retention criteria are otherwise met with other LID BMPs, include a statement indicating HSCs not required.

Name	Included
Localized on-lot infiltration	☐
Impervious area dispersion (e.g. roof top disconnection)	☒
Street trees (canopy interception)	☒
Residential rain barrels (not actively managed)	☐
Green roofs/Brown roofs	☐
Impervious area reduction (e.g. permeable pavers, site design)	☐
Other:	☐

IV.3.2 Infiltration BMPs

Identify infiltration BMPs to be used in project. Include sections for selection, suitability, sizing, and infeasibility, as applicable.

Name	Included
Bioretention without underdrains	☐
Rain gardens	☐
Porous landscaping	☐
Infiltration planters	☐
Retention swales	☐
Infiltration trenches	☐
Infiltration basins	☐

Drywells	☐
Subsurface infiltration galleries	☒
French drains	☐
Permeable asphalt	☐
Permeable concrete	☐
Permeable concrete pavers	☐
Other:	☐
Other:	☐

Show calculations below to demonstrate if the LID Design Strom Capture Volume can be met with infiltration BMPs. If not, document how much can be met with infiltration and document why it is not feasible to meet the full volume with infiltration BMPs.

Infiltration BMPs were used on site as the onsite soils are very sandy. An infiltration rate of 2.5 in/hr was used as an estimate during this conceptual stage. Infiltration tests will be performed during the final design for the project. The current underground infiltration reservoir has been designed with a 2.5 in/hr rate that is to be verified once infiltration tests are completed. A geotechnical report will be provided with the final WQMP.

The underground infiltration reservoir has been designed with an invert surface area of 4,060 sf. Using a 2.5 in/hr infiltration rate and a ponding depth of 2.5 feet, the drawdown is 20 hours. A 4.5' depth and 4,060 sf surface area provides capacity for 18,270 cf which exceeds the DCV of 16,106 cf.

IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

If the full DCV cannot be met with infiltration BMPs, describe any evapotranspiration and/or rainwater harvesting BMPs. Include sections for selection, suitability, sizing, and infeasibility, as applicable.

Name	Included
All HSCs; *See Section IV.3.1*	☐
Surface-based infiltration BMPs	☐
Biotreatment BMPs	☐
Above-ground cisterns and basins	☐
Underground detention	☐
Other:	☐

Show calculations and provide narrative below to demonstrate if the LID DCV can be met with evapotranspiration, rainwater harvesting BMPs in combination with infiltration BMPs. If not document how much can be met with either infiltration BMPs, evapotranspiration, rainwater harvesting BMPs, or a combination, and document why it is not feasible to meet the full volume with either of these BMPs categories. Included reference to applicable findings from site assessment activities, including references to studies prepared to substantiate findings of feasibility or infeasibility, as applicable.

Evapotranspiration was not evaluated because the DCV is met using an infiltration BMP.

IV.3.4 Biofiltration BMPs

If the full DCV cannot be met with infiltration BMPs, and/or evapotranspiration and rainwater harvesting BMPs, describe the biofiltration BMPs use to address the remainder of the DCV. Include sections for selection, suitability, sizing, and infeasibility, as applicable.

Name	Included
Bioretention with underdrains	☐
Stormwater planter boxes with underdrains	☐
Rain gardens with underdrains	☐
Proprietary vegetated biotreatment systems	☐
Other:	☐

Show calculations below to demonstrate if the LID DCV can be met with a combination of infiltration, evapotranspiration, rainwater harvesting and/or biotreatment BMPs. Show calculations to demonstrate that the "pre-filter detention volume plus pore volume" in biofiltration BMPs is at least 0.75 of the remaining DCV (after accounting for retention achieved before using biofiltration BMPs). If it is not feasible to meet the DCV with a combination of either infiltration BMPs, evapotranspiration, rainwater harvesting BMPs, document why it is not feasible to meet the full volume with either of these BMPs categories and document how much can be feasibily retained plus biofiltered.

Biofiltration BMPs were not evaluated because the DCV is met using an infiltration BMP.

IV.3.5 Hydromodification Control BMPs

Describe hydromodification control BMPs. Include sections for selection, suitability, sizing, and infeasibility, as applicable. Detail compliance with Prior Conditions of Approval (if applicable).

*See Appendix C – HCOC Guidance Memorandum of the South Orange County Model WQMP (12/20/2013) and Section 5 of the Technical Guidance Document (TGD) for details.*The sizing tool for hydromodification utilizes SOCHM to confirm the mitigation on peak and flow duration of 10% Q2 to Q10, with continuous modeling, per TGD. The proposed BMP shall meet the HMP requirements of the San Diego Water Quality Control Board. Download "South Orange County Hydromodification Requirements (effective October 25, 2012)" and the SOCHM computer program from www.ocplanning.net/water .

Hydromodification Control BMPs	
BMP Name	**BMP Description**
Underground infiltration reservoir	Underground infiltration reservoir was sized using SOCHM to meet the hydromodification criteria will be implemented for the project. Calculations and results are provided in Attachment C. The type of underground infiltration reservoir will be designed in detail during the final design. Potential BMP types are dry wells, precast concrete units, cast in place concrete reservoir, or CMP/HDPE chambers.

Attach the sketches of engineeing sections /details of the proposed Hydromodification BMPs for references.

IV.3.6 Non-structural Source Control BMPs

Fill out non-structural source control check box forms or provide a brief narrative explaining if non-structural source controls were not used.

Non-Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☐	☒	NA – Not a Part of Project
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	NA – Not Required for the site.
N6	Local Industrial Permit Compliance	☐	☒	NA – Not Required for the site.
N7	Spill Contingency Plan	☐	☒	NA – Not Required for the site.
N8	Underground Storage Tank Compliance	☐	☒	NA – Not a Part of Project
N9	Hazardous Materials Disclosure Compliance	☐	☒	NA – Not a Part of Project
N10	Uniform Fire Code Implementation	☐	☒	NA – Not a Part of Project
N11	Common Area Litter Control	☐	☒	NA – Not a Part of Project
N12	Employee Training	☐	☒	NA – Not a Part of Project
N13	Housekeeping of Loading Docks	☐	☒	NA – Not a Part of Project
N14	Common Area Catch Basin Inspection	☐	☒	NA – Not a Part of Project
N15	Street Sweeping Private Streets and Parking Lots	☐	☒	NA – Not a Part of Project
N16	Retail Gasoline Outlets	☐	☒	NA – Not a Part of Project

IV.3.7 Structural Source Control BMPs

Fill out structural source control check box forms or provide a brief narrative explaining if structural source controls were not used.

Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**If not applicable, state brief reason**
		Included	**Not Applicable**	
S1	Provide storm drain system stenciling and signage	☐	☒	Catch basins are not included in the project.
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	NA – Not a Part of Project
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☐	☒	NA – Not a Part of Project
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☐	☒	NA – Not a Part of Project
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☒	☐	
S6	Dock areas	☐	☒	NA – Not a Part of Project
S7	Maintenance bays	☐	☒	NA – Not a Part of Project
S8	Vehicle wash areas	☐	☒	NA – Not a Part of Project
S9	Outdoor processing areas	☐	☒	NA – Not a Part of Project
S10	Equipment wash areas	☐	☒	NA – Not a Part of Project
S11	Fueling areas	☐	☒	NA – Not a Part of Project
S12	Hillside landscaping	☐	☒	NA – Not a Part of Project
S13	Wash water control for food preparation areas	☐	☒	NA – Not a Part of Project
S14	Community car wash racks	☐	☒	NA – Not a Part of Project

IV.4 Alternative Compliance Plan (If Applicable)

IV.4.1 Request of Waiver of LID BMPs

Provide documentation of feasibility analysis if implementation of LID BMPs is technically infeasible. *Refer to Section 7.II-3.1 in the Model WQMP.* Calculate the amount of remaining obligation that must be met with alternative compliance *(See TGD Appendix VI).*

IV.4.2 Water Quality Credits

Determine if water quality credits are applicable for the project. *Refer to Section 7.II-3.2.2 of the SOC Model WQMP for description of credits and Appendix VI of the Technical Guidance Document (TGD) for calculation methods for applying water quality credits.*

<table>
<tr><th colspan="5">Description of Proposed Project</th></tr>
<tr><td colspan="5">Project Types that Qualify for Water Quality Credits (Select all that apply):</td></tr>
<tr><td>☐Redevelopment projects that reduce the overall impervious footprint of the project site.</td><td colspan="2">☐Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface WQ if not redeveloped.</td><td colspan="2">☐ Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance).</td></tr>
<tr><td colspan="2">☐ Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution).</td><td colspan="2">☐ Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned</td><td>☐ Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping).</td></tr>
<tr><td>☐Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.</td><td>☐ Developments in a city center area.</td><td>☐ Developments in historic districts or historic preservation areas.</td><td>☐ Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories.</td><td>☐In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas.</td></tr>
<tr><td colspan="2">Calculation of Water Quality Credits</td><td colspan="3">Not Applicable</td></tr>
</table>

IV.4.3 Treatment Control BMPs

Treatment control BMPs can only be considered if the project conformance analysis indicates that it is not feasible to retain and/or biofilter the full DCV with LID BMPs. Describe treatment control BMPs used as part of an alternative compliance program, including sections for selection and sizing, as applicable. *Refer to Section 7.II-3.3 in the Model WQMP.*

Treatment Control BMPs			
Technique	**Included?**		**If not applicable, state brief reason**
	Yes	**No**	
Vegetated (Grass) Strips	☐	☒	DCV is being treated with infiltration.
Vegetated (Grass) Swales	☐	☒	DCV is being treated with infiltration.
Proprietary Control Measures	☐	☒	DCV is being treated with infiltration.
Dry Detention Basin	☐	☒	DCV is being treated with infiltration.
Wet Detention Basin	☐	☒	DCV is being treated with infiltration.
Constructed Wetland	☐	☒	DCV is being treated with infiltration.
Detention Basin/Sand Filter	☐	☒	DCV is being treated with infiltration.
Porous Pavement Detention	☐	☒	DCV is being treated with infiltration.
Porous Landscape Detention	☐	☒	DCV is being treated with infiltration.
Infiltration Basin	☐	☒	DCV is being treated with infiltration.
Infiltration Trench	☐	☒	DCV is being treated with infiltration.
Media Filter (Please describe and provide brand name and model)	☐	☒	DCV is being treated with infiltration.
Proprietary Control Measures (Please describe and provide brand name and model)	☐	☒	DCV is being treated with infiltration.

IV.4.4 Regional/Sub-Regional LID BMPs

Describe regional/sub-regional LID BMPs in which the project will participate as part of alternative compliance. Include references to applicable reports or prior approvals of regional/sub-regional BMPs, as applicable, to demonstrate that use of regional/sub-regional BMPs are consistent with Model WQMP requirements. *Refer to Section 7.II-3.5 of the Model WQMP.*

Regional/Sub-Regional LID BMPs
Not Applicable

IV.4.5 Other Alternative Compliance Measures

Describe additional alternative compliance measures that will fully or partially meet the remaining LID obligations in association with treatment control BMP use (i.e., off-site mitigation project and/or stormwater mitigation fund). Include calculations to demonstrate how remaining alternative compliance. *Refer to Section 7.II-3.4 in the Model WQMP.*

Not Applicable

Section V Inspection/Maintenance Responsibility for BMPs

Fill out information in table below. Prepare and attach an Operation and Maintenance Plan. Identify the funding mechanism through which BMPs will be maintained. Inspection and maintenance records must be kept for a minimum of five years for inspection by the regulatory agencies. *Refer to Section 7.II 4.0 in the Model WQMP.*

BMP Inspection/Maintenance			
BMP	**Reponsible Party(s)**	**Inspection/ Maintenance Activities Required**	**Minimum Frequency of Activities**
Underground infiltration reservoir	Oak Grove HOA	Details provided in Attachment D	Biannual (Before and after the wet season)
Storm Drains	Oak Grove HOA	Details provided in Attachment D	Biannual (Before and after the wet season)

Section VI BMP Exhibit (Site Plan)

VI.1 BMP Exhibit (Site Plan)

Include a BMP Exhibit (Site Plan), at a size no less than 24" by 36," which includes the following minimum information:

- Insert in the title block (lower right hand corner) of BMP Exhibit: the WQMP Number (assigned by staff) and the grading/building or Planning Application permit numbers
- Project location (address, tract/lot number(s), etc.)
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural BMP locations
- Drainage delineations and flow information
- Delineate the area being treated by each structural BMP
- GIS coordinates for LID and Treatment Control BMPs
- Drainage connections
- BMP details
- Preparer name and stamp

Please do not include any areas outside of the project area or any information not related to drainage or water quality. The approved BMP Exhibit (Site Plan) shall be submitted as a plan sheet on all grading and building plan sets submitted for plan check review and approval. The BMP Exhibit shall be at the same size as the rest of the plan sheets in the submittal and shall have an approval stamp and signature prior to plan check submittal.

VI.2 Submittal and Recordation of Water Quality Management Plan

Following approval of the Final Project-Specific WQMP, three copies of the approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be submitted. In addition, these documents shall be submitted in a PDF format.

Each approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be recorded in the Orange County Clerk-Recorder's Office, prior to close-out of grading and/or building permit. Educational Materials are not required to be included.

Section VII Educational Materials

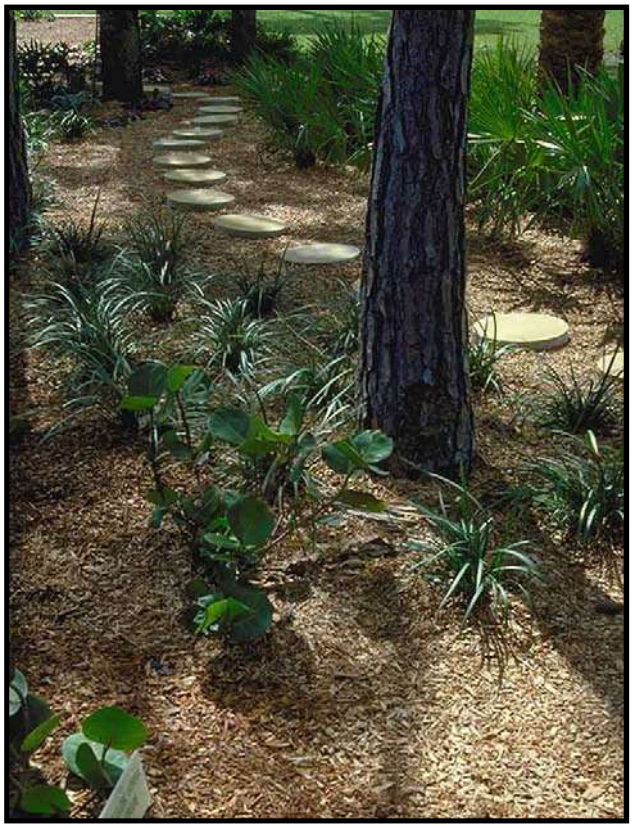
Refer to the Orange County Stormwater Program (ocwatersheds.com) for a library of materials available. Please only attach the educational materials specifically applicable to this project. Other materials specific to the project may be included as well and must be attached.

Education Materials			
Residential Material (http://www.ocwatersheds.com)	**Check If Applicable**	**Business Material (http://www.ocwatersheds.com)**	**Check If Applicable**
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete and Mortar	☐
Tips for the Home Mechanic	☐	Tips for the Food Service Industry	☐
Homeowners Guide for Sustainable Water Use	☐	Proper Maintenance Practices for Your Business	☐
Household Tips	☐	**Other Material**	**Check If Attached**
Proper Disposal of Household Hazardous Waste	☐		
Recycle at Your Local Used Oil Collection Center (North County)	☐		☐
Recycle at Your Local Used Oil Collection Center (Central County)	☐		☐
Recycle at Your Local Used Oil Collection Center (South County)	☐		☐
Tips for Maintaining a Septic Tank System	☐		☐
Responsible Pest Control	☐		☐
Sewer Spill	☐		☐
Tips for the Home Improvement Projects	☐		☐
Tips for Horse Care	☒		☐
Tips for Landscaping and Gardening	☒		☐
Tips for Pet Care	☐		☐
Tips for Pool Maintenance	☐		☐
Tips for Residential Pool, Landscape and Hardscape Drains	☐		☐
Tips for Projects Using Paint	☐		☐

Attachment A

BMP Fact Sheets and Educational Materials

Site Design & Landscape Planning SD-10



Design Objectives

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

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

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

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

CASQA California Stormwater Quality Association

Designing New Installations

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

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

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

Conserve Natural Areas during Landscape Planning

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

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

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

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

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

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

Protection of Slopes and Channels during Landscape Design

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

Redeveloping Existing Installations

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

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

Other Resources

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

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

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

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

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

R-1
AUTOMOBILE REPAIR AND MAINTENANCE

Automobile repair and maintenance activities have the potential to contribute directly to storm drain systems primarily through spills or the dumping of waste fluids being conveyed to the storm drain. Automotive fluids, such as oils, greases, and solvents, are hydrocarbon based, and may contain metals, chlorinated hydrocarbons, and other toxic compounds. Removal of caked dirt and grime from an automobile increases the sediment load to the storm drain system. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	
Bacteria	
Foaming Agents	
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	
Other	

Think before conducting automobile repair and maintenance activities. Remember - The ocean starts at your front door.

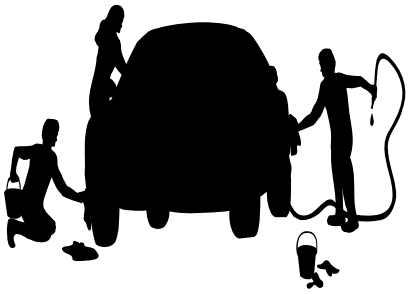
Required Activities

- Recycle used oil and antifreeze by taking them to service stations and other recycling centers. Never pour oil in storm drains or other areas.
- Do not perform repair and maintenance activities during rain events.
- Immediately clean up and contain any spills. Dispose of all waste and adsorbent materials properly.
- Store hazardous materials and wastes (including, but not limited to, fluids, solvents, parts containing fluids, batteries) indoors, under cover, or in watertight containers.
- Perform automobile maintenance and repairs over impervious surfaces such as concrete, so spills and waste material should be readily cleaned up. Use drip pans, plastic sheeting, etc. to contain spills and waste material.
- Dispose of cleaning solvents at the designated hazardous waste center.

Recommended Activities

- Conduct auto repair activities at a commercial repair facility
- Perform automobile repair and maintenance activities under a covered area.
- Do not buy fluids containing target pollutants (e.g. degreasers containing PERC).
- Monitor parked or stored vehicles and equipment for leaks and place pans under leaks to collect fluids for proper disposal or recycling.

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600 Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com



R-2
AUTOMOBILE WASHING

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	X
Bacteria	
Foaming Agents	X
Metals	X
Hydrocarbons	X
Hazardous Materials	x
Pesticides and Herbicides	
Other	

Automobile washing activities have the potential to contribute pollutants because road dust washed from vehicles may contain metals and hydrocarbons. Any leaking fluids washed from the automobile may be carried to the storm drain by the wash water. Detergents used for automobile washing may also contain phosphorus and foaming agents, which contribute to the eutrophication of receiving waterbodies. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before conducting automobile washing activities. Remember - The ocean starts at your front door.

Required Activities

- Shake floor mats into trashcan or vacuum to clean. Do not shake over ground.
- If using cleaners (such as acid based wheel cleaners) use a rag to wipe them on and off, do not rinse them off with water.
- If possible, divert runoff from automobile washing to a grassy surface large enough to contain and allow complete infiltration
- Dispose of excess wash water into the sanitary sewer (i.e. via sink, or toilet) or onto a landscaped area that will allow for complete infiltration.
- Conduct engine degreasing at a commercial facility that is set up to handle that type of waste.

Recommended Activities

- When possible, use commercial wash facilities
- Wash vehicles over pervious surfaces such as lawns and gravel areas
- Choose soaps, cleaners, or detergents labeled "non-toxic", "phosphate free", or "biodegradable". Vegetable and citrus-based products are typically safest for the environment.
- Turn off water when not actively washing down automobile.
- If available, use established neighborhood wash areas, where runoff is properly controlled and managed.

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com

R-4
HOME AND GARDEN CARE ACTIVITIES

HOME CARE

Many hazardous materials may be used in and around residences during routine maintenance activities (such as: oils, paints, cleaners, bleaches, pesticides, glues, solvents, and other products). Improper or excessive use of these products can increase the potential for pollutants to be transported to the storm drain by runoff. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before conducting home care activities. Remember - The ocean starts at your front door.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	
Bacteria	x
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	
Other	x

Required Activities

- Clean out painting equipment in an area where the waste can be contained and properly disposed of (latex – sewer, oil based – household hazardous waste center).
- Rinse off cement mixers and cement laden tools in a contained washout area. Dispose of dried concrete waste in household trash.
- If safe, contain, clean up, and properly dispose all household hazardous waste spills. If an unsafe condition exists, call 911 to activate the proper response team.
- Household hazardous materials must be stored indoors or under cover, and in closed and labeled containers. Dispose of them at a household hazardous waste center.
- Household wash waters (e.g. washer machine effluent, mop water, etc.) must be disposed of in the sanitary sewer.
- Pool and spa water may be discharged to the storm drain if residual chlorine is less than 0.1 mg/L, the pH is between 6.5 and 8.5, and the water is free from any unusual coloration. (Call 714-834-6107 to obtain information on a pool drain permit). Pool filter media must be contained and disposed of properly.

Recommended Activities

- Only purchase the types and amounts of materials needed.
- Share unused portions of products with neighbors or community programs (latex paint)

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com

GARDEN CARE

Garden activities may contribute pollutants via soil erosion, green waste, fertilizer and pesticide use. Plant and garden care activities such as landscape maintenance, fertilization, and pesticide application have the potential to discharge significant quantities of pollutants to the storm drain system. Nonvegetated surfaces may allow for significant erosion leading to high sediment loads. Other pollutants such as pesticides may adsorb onto the soil particles and be transported off site. Excess fertilizer and pesticide pollutants from over application may be carried to the storm drain by dissolving in irrigation runoff or rainwater. Green wastes may also contain organic matter and may have adsorbed fertilizers and pesticides.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	
Metals	
Hydrocarbons	
Hazardous Materials	
Pesticides and Herbicides	x
Other	x

Excessive irrigation is often the most significant factor in home and garden care activities. Pollutants may dissolve in irrigation water and then be transported to the storm drain, or particles and materials coated with fertilizers and pesticides may be suspended in the irrigation flow and carried to the storm drain. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before conducting garden care activities. Remember - The ocean starts at your front door.

Required Activities

- Irrigation systems must be properly adjusted to reflect seasonal water needs.
- Minimize the use of pesticides and fertilizers. Read the labels and follow directions to avoid improper use. Do not apply chemicals if it is windy or about to rain.
- Properly clean up and dispose of spills of gardening chemicals, fertilizes, or soils. If possible, return the spilled material to the container for future use.
- Lawn and garden care products must be stored in closed labeled containers, in covered areas, or off-ground and under protective tarps.
- Household hazardous waste must be properly disposed at a household hazardous waste center.
- Cover nonvegetated surfaces to prevent erosion.

Recommended Activities

- Utilize xeroscaping and use of drought and insect resistant landscaping.
- Cultivate garden often to control weeds
- Use integrated pest management (IPM). Planting pest repelling plants (e.g. Marigolds) or using pest eating insects (e.g. ladybugs) may reduce the need for pesticides.
- Do not leave food (human or pet) outside overnight
- Remove fruit and garden waste

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com

R-5
DISPOSAL OF PET WASTES

Pet wastes left in the environment may introduce solids, bacteria, and nutrients to the storm drain. The type and quantity of waste will dictate the proper disposal method. Small quantities of waste are best disposed with regular trash or flushed down a toilet. Large quantities of wastes from herbivore animals may be composted for subsequent use or disposal to landfill.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	
Metals	
Hydrocarbons	
Hazardous Materials	
Pesticides and Herbicides	
Other	

Pick up after your pet! It's as easy as 1-2-3. 1) Bring a bag. 2) Clean it up. 3) Dispose of it properly (toilet or trash). The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before you dispose of any pet wastes. Remember - The ocean starts at your front door.

Required Activities

- All pet wastes must be picked up and properly disposed of. Pet waste should be disposed of in the regular trash, flushed down a toilet, or composted as type and quantities dictate.
- Properly dispose of unused flea control products (shampoo, sprays, or collars).
- Manure produced by livestock in uncovered areas should be removed at least daily for composting, or storage in water-tight container prior to disposal. Never hose down to stream or storm drain. Composting or storage areas should be configured and maintained so as not to allow contact with runoff. Compost may be donated to greenhouses, nurseries, and botanical parks. Topsoil companies and composting centers may also accept composted manure.
- Line waste pits or trenches with an impermeable layer, such as thick plastic sheeting.
- When possible, allow wash water to infiltrate into the ground, or collect in an area that is routed to the sanitary sewer.
- Confine livestock in fenced in areas except during exercise and grazing times. Restrict animal access to creeks and streams, preferably by fencing.

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com

- Install gutters that will divert roof runoff away from livestock areas.

Recommended Activities

- In order to properly dispose of pet waste, carry bags, pooper-scooper, or equivalent to safely pick up pet wastes while walking with pets.

- Bathe pets indoors and use less toxic shampoos. When possible, have pets professionally groomed.

- Properly inoculate your pet in order to maintain their health and reduce the possibility of pathogens in pet wastes.

- Maintain healthy and vigorous pastures with at least three inches of leafy material.

- Consider indoor feeding of livestock during heavy rainfall, to minimize manure exposed to potential runoff.

- Locate barns, corrals, and other high use areas on portions of property that either drain away from or are located distant form nearby creeks or storm drains.

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com

R-6
DISPOSAL OF GREEN WASTES

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	
Metals	
Hydrocarbons	
Hazardous Materials	x
Pesticides and Herbicides	x
Other	

Green wastes entering the storm drain may clog the system creating flooding problems. Green wastes washed into receiving waters create an oxygen demand as they are decomposed, reducing the available oxygen for aquatic life. Pesticide and nutrient residues may be carried to the receiving water with the green wastes. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before disposing of any green wastes – Remember - The ocean starts at your front door.

Required Activities

- Green wastes can not be disposed of in the street, gutter, public right-of-way, storm drain, or receiving water. Dispose of green wastes as a part of the household trash. If the quantities are too large, arrange a pick up with the local waste hauler.

- After conducting yard or garden activities sweep the area and properly dispose of the clippings and waste. Do not sweep or blow out into the street or gutter.

Recommended Activities

- Utilize a commercial landscape company to conduct the landscape activities and waste disposal.

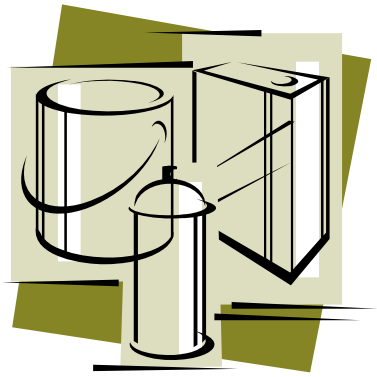
- Utilize native plants and drought tolerant species to reduce the water use and green waste produced.

- Use a lawn mower that has a mulcher so that the grass clippings remain on the lawn and do not have to be collected and disposed of.

- Compost materials in a designated area within the yard.

- Recycle lawn clippings and greenery waste through local programs if available.

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com



R-7
HOUSEHOLD HAZARDOUS WASTE

Household hazardous wastes (HHW) are defined as waste materials which are typically found in homes or similar sources, which exhibit characteristics such as: corrosivity, ignitability, reactivity, and/or toxicity, or are listed as hazardous materials by EPA.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	
Nutrients	
Bacteria	
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x

List of most common HHW products:

Drain openers
Oven cleaners
Wood and metal cleaners and polishes
Automotive oil and fuel additives
Grease and rust solvents
Carburetor and fuel injection cleaners
Starter fluids
Batteries
Paint Thinners
Paint strippers and removers
Adhesives
Herbicides
Pesticides
Fungicides/wood preservatives

Many types of waste can be recycled, however options for each waste type are limited. Recycling is always preferable to disposal of unwanted materials. All gasoline, antifreeze, waste oil, and lead-acid batteries can be recycled. Latex and oil-based paint can be reused, as well as recycled. Materials that cannot be reused or recycled should be disposed of at a properly permitted landfill.

Think before disposing of any household hazardous waste. Remember - The ocean starts at your front door.

RECYCLE USED OIL

Required Activities

- Dispose of HHW at a local collection facility. Call (714) 834-6752 for the household hazardous waste center closest to your area.
- Household hazardous materials must be stored indoors or under cover, and in closed and labeled containers.
- If safe, contain, clean up, and properly dispose all household hazardous waste spills. If an unsafe condition exists, call 911 to activate the proper response team.

Recommended Activities

- Use non-hazardous or less-hazardous products.
- Participate in HHW reuse and recycling. Call (714) 834-6752 for the participating household hazardous waste centers.

The California Integrated Waste Management Board has a Recycling Hotline (800) 553-2962, that provides information and recycling locations for used oil.

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com

R-8
WATER CONSERVATION

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x

Excessive irrigation and/or the overuse of water is often the most significant factor in transporting pollutants to the storm drain system. Pollutants from a wide variety of sources including automobile repair and maintenance, automobile washing, automobile parking, home and garden care activities and pet care may dissolve in the water and be transported to the storm drain. In addition, particles and materials coated with fertilizers and pesticides may be suspended in the flow and be transported to the storm drain.

Hosing off outside areas to wash them down not only consumes large quantities of water, but also transports any pollutants, sediments, and waste to the storm drain system. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before using water. Remember - The ocean starts at your front door.

Required Activities

- Irrigation systems must be properly adjusted to reflect seasonal water needs.
- Do not hose off outside surfaces to clean, sweep with a broom instead.

Recommended Activities

- Fix any leaking faucets and eliminate unnecessary water sources.
- Use xeroscaping and drought tolerant landscaping to reduce the watering needs.
- Do not over watering lawns or gardens. Over watering wastes water and promotes diseases.
- Use a bucket to re-soak sponges/rags while washing automobiles and other items outdoors. Use hose only for rinsing.
- Wash automobiles at a commercial car wash employing water recycling.

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

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

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

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

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

Dry wells and Infiltration Trenches

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

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

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

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

Pop-up Drainage Emitter

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

Foundation Planting

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

Redeveloping Existing Installations

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

Supplemental Information

Examples

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

Other Resources

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

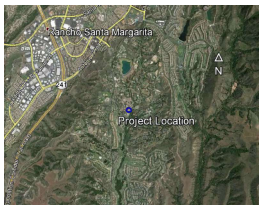
Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

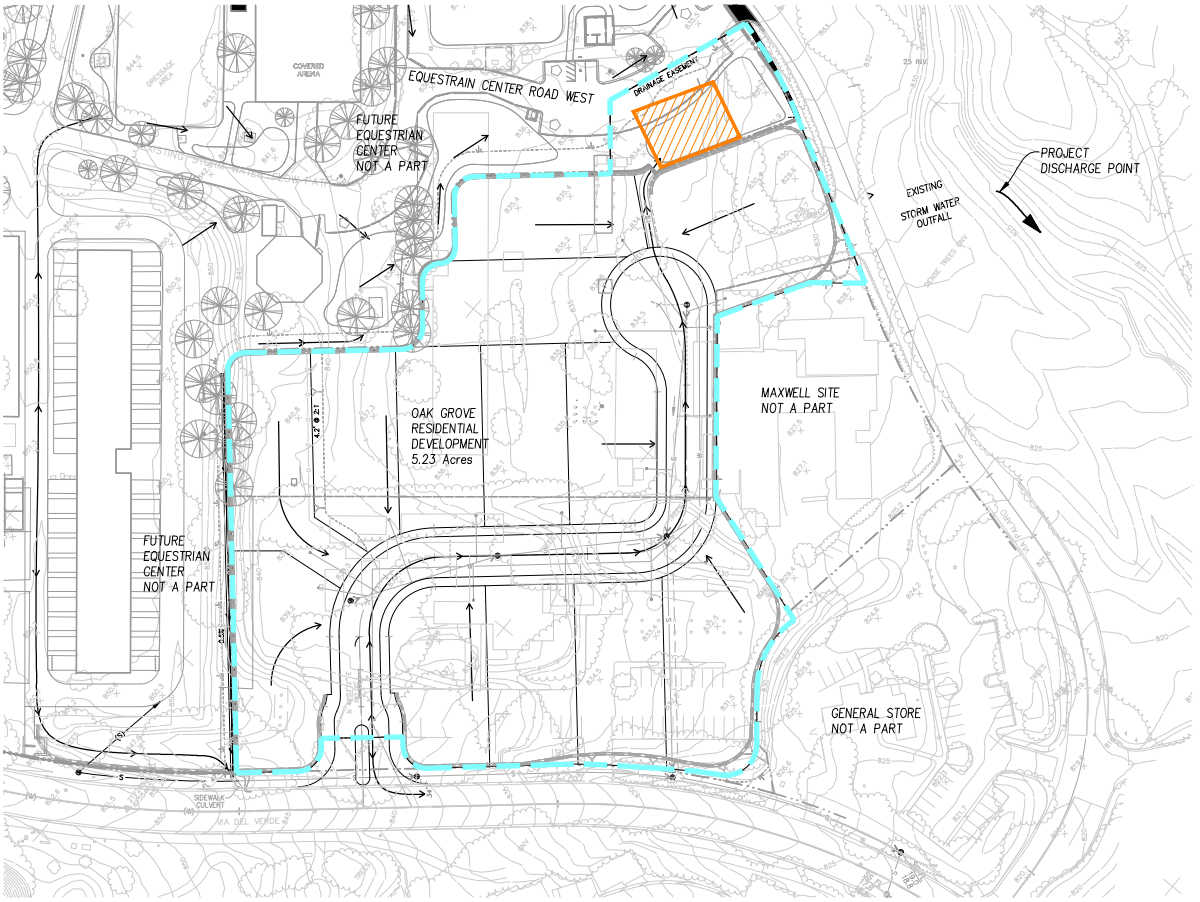
Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Attachment B

WQMP Exhibit

VICINITY MAP





SCALE: 1"=40'

40 20 0 40 80 120

SCALE: 1"=40'

LEGEND

- TRIBUTARY AREA BOUNDARY
- DRAINAGE DISCHARGE POINT
- SURFACE FLOW
- UNDERGROUND INFILTRATION

NO.	DATE	DESCRIPTION
		REVISIONS

PREPARED FOR:

SILVER - BRONZE CORPORATION AND OAK GROVE LLC
***ONE UPPER NEWPORT** PLAZA*
NEWPORT BEACH, CA 92660

REGISTERED PROFESSIONAL ENGINEER ROY L. ROBERSON No. RCE 44160 (EXP. 06/30/2017) STATE OF CALIFORNIA

PREPARED BY:

LAND STRATEGIES, LLC
9241 IRVINE BLVD, SUITE 100
IRVINE, CA 92618
(949) 580-3000

ROY L. ROBERSON R.C.E. 44160 — 4/4/2016 DATE

WQMP EXHIBIT

OAK GROVE RESIDENTIAL DEVELOPMENT
23432 VISTA DEL VERDE
COTO DE CAZA, CA 92679

SHEET **1** *OF 3*

Attachment C

HCOC Calculations

Predeveloped										
Area		Slope		Soil %		Area				
Number	(acre)	Slope	%	A	C	A		C		Total
A-1	1.22	0 to 5	30%	20%	80%	0.07	2.77	0.29	10.64	1.22
		5 to10	30%			0.07	0.46	0.29	3.45	
		10 to 15	20%			0.05	0.82	0.20	2.99	
		15 and up	20%			0.05	1.31	0.20	2.51	
A-2	2.18	0 to 5	25%	10%	90%	0.05		0.49		2.18
		5 to10	20%			0.04		0.39		
		10 to 15	15%			0.03		0.29		
		15 and up	40%			0.09		0.78		
A-3	4.22	0 to 5	50%	70%	30%	1.48		0.63		4.22
		5 to10	5%			0.15		0.06		
		10 to 15	15%			0.44		0.19		
		15 and up	30%			0.89		0.38		
A-4	7.17	0 to 5	60%	20%	80%	0.86		3.44		7.17
		5 to10	5%			0.07		0.29		
		10 to 15	15%			0.22		0.86		
		15 and up	20%			0.29		1.15		
A-5	10.15	0 to 5	60%	5%	95%	0.30		5.79		10.15
		5 to10	25%			0.13		2.41		
		10 to 15	15%			0.08		1.45		
		15 and up	0%			0.00		0.00		
									Total =	**24.94**

Developed										
Area		Slope		Soil %		Area				
Number	(acre)	Slope	%	A	C	A		C		Total
A-1	1.22	0 to 5	30%	20%	80%	0.07	2.71	0.29	9.55	1.22
		5 to10	30%			0.07	0.44	0.29	2.99	
		10 to 15	20%			0.05	0.80	0.20	2.71	
		15 and up	20%			0.05	1.31	0.20	2.51	
A-2	2.18	0 to 5	25%	10%	90%	0.05		0.49		2.18
		5 to10	20%			0.04		0.39		
		10 to 15	15%			0.03		0.29		
		15 and up	40%			0.09		0.78		
A-3	4.22	0 to 5	50%	70%	30%	1.48		0.63		4.22
		5 to10	5%			0.15		0.06		
		10 to 15	15%			0.44		0.19		
		15 and up	30%			0.89		0.38		
A-4	7.17	0 to 5	60%	20%	80%	0.86		3.44		7.17
		5 to10	5%			0.07		0.29		
		10 to 15	15%			0.22		0.86		
		15 and up	20%			0.29		1.15		
A-5	8.23	0 to 5	60%	5%	95%	0.25		4.69		8.23
		5 to10	25%			0.10		1.95		
		10 to 15	15%			0.06		1.17		
		15 and up	0%			0.00		0.00		
B	5.23	0 to 5 Imp	41%	15%	85%	0.32		1.82		5.23
		0 to 5 Perv	59%			0.46		2.62		
						0.00		0.00		
						0.00		0.00		
									Total =	28.25

SOHM

PROJECT REPORT

General Model Information

Project Name:	Groves 11292017
Site Name:	CEP
Site Address:	Coto OC
City:	Coto De Caza
Report Date:	12/2/2017
Gage:	Trabuco Canyon
Data Start:	10/01/1958
Data End:	09/30/2005
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2017/03/20

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A,Open Brush,Flat	2.71
A,Open Brush,Mod	0.46
A,Open Brush,Steep	0.82
A,Open Brush,VSteep	1.31
C,Open Brush,Flat	10.64
C,Open Brush,Mod	3.45
C,Open Brush,Steep	2.99
C,Open Brush,VSteep	2.56
Pervious Total	24.94

Impervious Land Use	acre
Impervious Total	0
Basin Total	24.94

Element Flows To:

Surface	Interflow	Groundwater
Channel 1	Channel 1	

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A,Open Brush,Flat	2.71
A,Open Brush,Mod	0.44
A,Open Brush,Steep	0.8
A,Open Brush,VSteep	1.31
C,Open Brush,Flat	9.55
C,Open Brush,Mod	2.99
C,Open Brush,Steep	2.71
C,Open Brush,VSteep	2.51
A,Urban,Flat(0-5%)	0.46
C,Urban,Flat(0-5%)	2.63
Pervious Total	26.11

Impervious Land Use	acre
Impervious,Flat(0-5)	2.14
Impervious Total	2.14
Basin Total	28.25

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Routing Elements
Predeveloped Routing

Channel 1

Bottom Length:	100.00 ft.	
Bottom Width:	10.00 ft.	
Manning's n:	0.03	
Channel bottom slope 1:	0.03 To 1	
Channel Left side slope 0:	3 To 1	
Channel right side slope 2:	3 To 1	
Infiltration On		
Infiltration rate:	0.5	
Infiltration safety factor:	1	
Total Volume Infiltrated (ac-ft.):		2.36
Total Volume Through Riser (ac-ft.):		438.465
Total Volume Through Facility (ac-ft.):		440.825
Percent Infiltrated:		0.54
Total Precip Applied to Facility:		0
Total Evap From Facility:		0
Discharge Structure		
Riser Height:	0 ft.	
Riser Diameter:	0 in.	
Element Flows To:		
Outlet 1	Outlet 2	

Channel Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.023	0.000	0.000	0.000
0.0889	0.024	0.002	1.534	0.011
0.1778	0.025	0.004	4.911	0.011
0.2667	0.026	0.006	9.738	0.011
0.3556	0.027	0.009	15.87	0.011
0.4444	0.029	0.011	23.25	0.011
0.5333	0.030	0.014	31.83	0.011
0.6222	0.031	0.017	41.59	0.011
0.7111	0.032	0.019	52.51	0.011
0.8000	0.034	0.022	64.60	0.011
0.8889	0.035	0.025	77.86	0.011
0.9778	0.036	0.029	92.29	0.011
1.0667	0.037	0.032	107.9	0.011
1.1556	0.038	0.035	124.7	0.011
1.2444	0.040	0.039	142.7	0.011
1.3333	0.041	0.042	161.9	0.011
1.4222	0.042	0.046	182.4	0.011
1.5111	0.043	0.050	204.1	0.011
1.6000	0.045	0.054	227.0	0.011
1.6889	0.046	0.058	251.3	0.011
1.7778	0.047	0.062	276.9	0.011
1.8667	0.048	0.066	303.7	0.011
1.9556	0.050	0.071	332.0	0.011
2.0444	0.051	0.075	361.5	0.011
2.1333	0.052	0.080	392.5	0.011
2.2222	0.053	0.085	424.8	0.011
2.3111	0.054	0.089	458.5	0.011

2.4000	0.056	0.094	493.7	0.011
2.4889	0.057	0.099	530.3	0.011
2.5778	0.058	0.105	568.4	0.011
2.6667	0.059	0.110	607.9	0.011
2.7556	0.061	0.115	649.0	0.011
2.8444	0.062	0.121	691.6	0.011
2.9333	0.063	0.126	735.7	0.011
3.0222	0.064	0.132	781.4	0.011
3.1111	0.065	0.138	828.6	0.011
3.2000	0.067	0.144	877.5	0.011
3.2889	0.068	0.150	927.9	0.011
3.3778	0.069	0.156	980.0	0.011
3.4667	0.070	0.162	1033.	0.011
3.5556	0.072	0.168	1089.	0.011
3.6444	0.073	0.175	1146.	0.011
3.7333	0.074	0.181	1205.	0.011
3.8222	0.075	0.188	1265.	0.011
3.9111	0.077	0.195	1327.	0.011
4.0000	0.078	0.202	1391.	0.011
4.0889	0.079	0.209	1457.	0.011
4.1778	0.080	0.216	1525.	0.011
4.2667	0.081	0.223	1594.	0.011
4.3556	0.083	0.231	1665.	0.011
4.4444	0.084	0.238	1738.	0.011
4.5333	0.085	0.246	1813.	0.011
4.6222	0.086	0.253	1890.	0.011
4.7111	0.088	0.261	1969.	0.011
4.8000	0.089	0.269	2049.	0.011
4.8889	0.090	0.277	2132.	0.011
4.9778	0.091	0.285	2216.	0.011
5.0667	0.093	0.293	2303.	0.011
5.1556	0.094	0.302	2391.	0.011
5.2444	0.095	0.310	2482.	0.011
5.3333	0.096	0.318	2574.	0.011
5.4222	0.098	0.327	2669.	0.011
5.5111	0.099	0.336	2765.	0.011
5.6000	0.100	0.345	2864.	0.011
5.6889	0.101	0.354	2964.	0.011
5.7778	0.102	0.363	3067.	0.011
5.8667	0.104	0.372	3172.	0.011
5.9556	0.105	0.381	3279.	0.011
6.0444	0.106	0.391	3388.	0.011
6.1333	0.107	0.400	3500.	0.011
6.2222	0.109	0.410	3613.	0.011
6.3111	0.110	0.420	3729.	0.011
6.4000	0.111	0.430	3847.	0.011
6.4889	0.112	0.440	3967.	0.011
6.5778	0.114	0.450	4089.	0.011
6.6667	0.115	0.460	4214.	0.011
6.7556	0.116	0.470	4341.	0.011
6.8444	0.117	0.481	4470.	0.011
6.9333	0.119	0.491	4602.	0.011
7.0222	0.120	0.502	4736.	0.011
7.1111	0.121	0.512	4872.	0.011
7.2000	0.122	0.523	5011.	0.011
7.2889	0.123	0.534	5152.	0.011
7.3778	0.125	0.545	5295.	0.011
7.4667	0.126	0.556	5441.	0.011

7.5556	0.127	0.568	5589.	0.011
7.6444	0.128	0.579	5740.	0.011
7.7333	0.130	0.591	5893.	0.011
7.8222	0.131	0.602	6048.	0.011
7.9111	0.132	0.614	6206.	0.011
8.0000	0.133	0.626	6367.	0.011
8.0889	0.135	0.638	6530.	0.011

Mitigated Routing

Vault 1

Width: 58 ft.
Length: 70 ft.
Depth: 14.5 ft.
Infiltration On
Infiltration rate: 1.5
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 289.12
Total Volume Through Riser (ac-ft.): 330.148
Total Volume Through Facility (ac-ft.): 619.268
Percent Infiltrated: 46.69
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 12 ft.
Riser Diameter: 20 in.
Notch Type: Rectangular
Notch Width: 0.280 ft.
Notch Height: 7.000 ft.
Orifice 1 Diameter: 5 in. Elevation:2 ft.
Orifice 2 Diameter: 5 in. Elevation:3 ft.
Orifice 3 Diameter: 6 in. Elevation:4 ft.
Element Flows To:
Outlet 1 Outlet 2
Channel 1

Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.093	0.000	0.000	0.000
0.1611	0.093	0.015	0.000	0.141
0.3222	0.093	0.030	0.000	0.141
0.4833	0.093	0.045	0.000	0.141
0.6444	0.093	0.060	0.000	0.141
0.8056	0.093	0.075	0.000	0.141
0.9667	0.093	0.090	0.000	0.141
1.1278	0.093	0.105	0.000	0.141
1.2889	0.093	0.120	0.000	0.141
1.4500	0.093	0.135	0.000	0.141
1.6111	0.093	0.150	0.000	0.141
1.7722	0.093	0.165	0.000	0.141
1.9333	0.093	0.180	0.000	0.141
2.0944	0.093	0.195	0.208	0.141
2.2556	0.093	0.210	0.343	0.141
2.4167	0.093	0.225	0.437	0.141
2.5778	0.093	0.240	0.515	0.141
2.7389	0.093	0.255	0.583	0.141
2.9000	0.093	0.270	0.643	0.141
3.0611	0.093	0.285	0.866	0.141
3.2222	0.093	0.300	1.069	0.141
3.3833	0.093	0.315	1.218	0.141
3.5444	0.093	0.330	1.343	0.141
3.7056	0.093	0.345	1.455	0.141
3.8667	0.093	0.360	1.558	0.141
4.0278	0.093	0.375	1.816	0.141

4.1889	0.093	0.390	2.168	0.141
4.3500	0.093	0.405	2.406	0.141
4.5111	0.093	0.420	2.607	0.141
4.6722	0.093	0.435	2.787	0.141
4.8333	0.093	0.450	2.952	0.141
4.9944	0.093	0.465	3.106	0.141
5.1556	0.093	0.480	3.306	0.141
5.3167	0.093	0.495	3.544	0.141
5.4778	0.093	0.510	3.799	0.141
5.6389	0.093	0.525	4.062	0.141
5.8000	0.093	0.540	4.328	0.141
5.9611	0.093	0.555	4.595	0.141
6.1222	0.093	0.570	4.886	0.141
6.2833	0.093	0.585	5.194	0.141
6.4444	0.093	0.600	5.926	0.141
6.6056	0.093	0.615	6.324	0.141
6.7667	0.093	0.630	6.735	0.141
6.9278	0.093	0.645	7.158	0.141
7.0889	0.093	0.660	7.592	0.141
7.2500	0.093	0.675	8.037	0.141
7.4111	0.093	0.690	8.494	0.141
7.5722	0.093	0.705	8.961	0.141
7.7333	0.093	0.720	9.438	0.141
7.8944	0.093	0.735	9.925	0.141
8.0556	0.093	0.750	10.42	0.141
8.2167	0.093	0.765	10.92	0.141
8.3778	0.093	0.780	11.44	0.141
8.5389	0.093	0.795	11.96	0.141
8.7000	0.093	0.810	12.50	0.141
8.8611	0.093	0.825	13.04	0.141
9.0222	0.093	0.840	13.59	0.141
9.1833	0.093	0.855	14.15	0.141
9.3444	0.093	0.870	14.72	0.141
9.5056	0.093	0.886	15.29	0.141
9.6667	0.093	0.901	15.88	0.141
9.8278	0.093	0.916	16.47	0.141
9.9889	0.093	0.931	17.07	0.141
10.150	0.093	0.946	17.68	0.141
10.311	0.093	0.961	18.29	0.141
10.472	0.093	0.976	18.92	0.141
10.633	0.093	0.991	19.55	0.141
10.794	0.093	1.006	20.18	0.141
10.956	0.093	1.021	20.83	0.141
11.117	0.093	1.036	21.48	0.141
11.278	0.093	1.051	22.14	0.141
11.439	0.093	1.066	22.81	0.141
11.600	0.093	1.081	23.48	0.141
11.761	0.093	1.096	24.16	0.141
11.922	0.093	1.111	24.84	0.141
12.083	0.093	1.126	25.64	0.141
12.244	0.093	1.141	27.37	0.141
12.406	0.093	1.156	29.56	0.141
12.567	0.093	1.171	31.55	0.141
12.728	0.093	1.186	32.88	0.141
12.889	0.093	1.201	33.77	0.141
13.050	0.093	1.216	34.54	0.141
13.211	0.093	1.231	35.27	0.141
13.372	0.093	1.246	35.95	0.141

13.533	0.093	1.261	36.59	0.141
13.694	0.093	1.276	37.20	0.141
13.856	0.093	1.291	37.79	0.141
14.017	0.093	1.306	38.35	0.141
14.178	0.093	1.321	38.90	0.141
14.339	0.093	1.336	39.42	0.141
14.500	0.093	1.351	39.93	0.141
14.661	0.096	1.364	40.43	0.194

Channel 1

Bottom Length:	100.00 ft.
Bottom Width:	10.00 ft.
Manning's n:	0.03
Channel bottom slope 1:	0.03 To 1
Channel Left side slope 0:	3 To 1
Channel right side slope 2:	3 To 1
Infiltration On	
Infiltration rate:	0.5
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	1.626
Total Volume Through Riser (ac-ft.):	328.345
Total Volume Through Facility (ac-ft.):	329.97
Percent Infiltrated:	0.49
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	0 ft.
Riser Diameter:	0 in.
Element Flows To:	
Outlet 1	Outlet 2

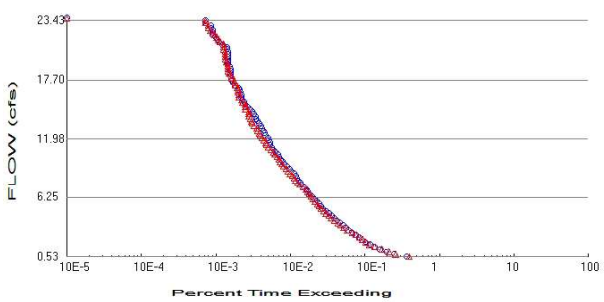
Channel Hydraulic Table

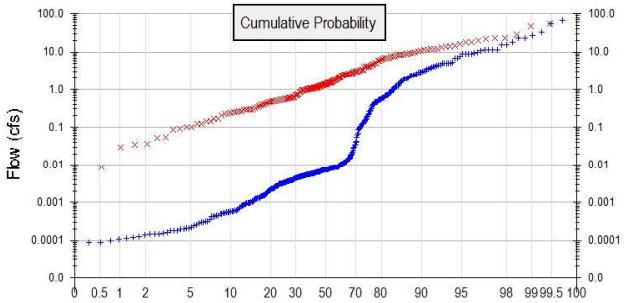
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.023	0.000	0.000	0.000
0.0889	0.024	0.002	1.534	0.011
0.1778	0.025	0.004	4.911	0.011
0.2667	0.026	0.006	9.738	0.011
0.3556	0.027	0.009	15.87	0.011
0.4444	0.029	0.011	23.25	0.011
0.5333	0.030	0.014	31.83	0.011
0.6222	0.031	0.017	41.59	0.011
0.7111	0.032	0.019	52.51	0.011
0.8000	0.034	0.022	64.60	0.011
0.8889	0.035	0.025	77.86	0.011
0.9778	0.036	0.029	92.29	0.011
1.0667	0.037	0.032	107.9	0.011
1.1556	0.038	0.035	124.7	0.011
1.2444	0.040	0.039	142.7	0.011
1.3333	0.041	0.042	161.9	0.011
1.4222	0.042	0.046	182.4	0.011
1.5111	0.043	0.050	204.1	0.011
1.6000	0.045	0.054	227.0	0.011
1.6889	0.046	0.058	251.3	0.011
1.7778	0.047	0.062	276.9	0.011
1.8667	0.048	0.066	303.7	0.011
1.9556	0.050	0.071	332.0	0.011
2.0444	0.051	0.075	361.5	0.011
2.1333	0.052	0.080	392.5	0.011
2.2222	0.053	0.085	424.8	0.011
2.3111	0.054	0.089	458.5	0.011
2.4000	0.056	0.094	493.7	0.011
2.4889	0.057	0.099	530.3	0.011
2.5778	0.058	0.105	568.4	0.011
2.6667	0.059	0.110	607.9	0.011

2.7556	0.061	0.115	649.0	0.011
2.8444	0.062	0.121	691.6	0.011
2.9333	0.063	0.126	735.7	0.011
3.0222	0.064	0.132	781.4	0.011
3.1111	0.065	0.138	828.6	0.011
3.2000	0.067	0.144	877.5	0.011
3.2889	0.068	0.150	927.9	0.011
3.3778	0.069	0.156	980.0	0.011
3.4667	0.070	0.162	1033.	0.011
3.5556	0.072	0.168	1089.	0.011
3.6444	0.073	0.175	1146.	0.011
3.7333	0.074	0.181	1205.	0.011
3.8222	0.075	0.188	1265.	0.011
3.9111	0.077	0.195	1327.	0.011
4.0000	0.078	0.202	1391.	0.011
4.0889	0.079	0.209	1457.	0.011
4.1778	0.080	0.216	1525.	0.011
4.2667	0.081	0.223	1594.	0.011
4.3556	0.083	0.231	1665.	0.011
4.4444	0.084	0.238	1738.	0.011
4.5333	0.085	0.246	1813.	0.011
4.6222	0.086	0.253	1890.	0.011
4.7111	0.088	0.261	1969.	0.011
4.8000	0.089	0.269	2049.	0.011
4.8889	0.090	0.277	2132.	0.011
4.9778	0.091	0.285	2216.	0.011
5.0667	0.093	0.293	2303.	0.011
5.1556	0.094	0.302	2391.	0.011
5.2444	0.095	0.310	2482.	0.011
5.3333	0.096	0.318	2574.	0.011
5.4222	0.098	0.327	2669.	0.011
5.5111	0.099	0.336	2765.	0.011
5.6000	0.100	0.345	2864.	0.011
5.6889	0.101	0.354	2964.	0.011
5.7778	0.102	0.363	3067.	0.011
5.8667	0.104	0.372	3172.	0.011
5.9556	0.105	0.381	3279.	0.011
6.0444	0.106	0.391	3388.	0.011
6.1333	0.107	0.400	3500.	0.011
6.2222	0.109	0.410	3613.	0.011
6.3111	0.110	0.420	3729.	0.011
6.4000	0.111	0.430	3847.	0.011
6.4889	0.112	0.440	3967.	0.011
6.5778	0.114	0.450	4089.	0.011
6.6667	0.115	0.460	4214.	0.011
6.7556	0.116	0.470	4341.	0.011
6.8444	0.117	0.481	4470.	0.011
6.9333	0.119	0.491	4602.	0.011
7.0222	0.120	0.502	4736.	0.011
7.1111	0.121	0.512	4872.	0.011
7.2000	0.122	0.523	5011.	0.011
7.2889	0.123	0.534	5152.	0.011
7.3778	0.125	0.545	5295.	0.011
7.4667	0.126	0.556	5441.	0.011
7.5556	0.127	0.568	5589.	0.011
7.6444	0.128	0.579	5740.	0.011
7.7333	0.130	0.591	5893.	0.011
7.8222	0.131	0.602	6048.	0.011

7.9111	0.132	0.614	6206.	0.011
8.0000	0.133	0.626	6367.	0.011
8.0889	0.135	0.638	6530.	0.011

Analysis Results
POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 24.94
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 26.11
Total Impervious Area: 2.14

Flow Frequency Method: Cunnane

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	5.258344
5 year	12.215375
10 year	23.430243
25 year	46.493653

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	9.248281
5 year	16.19486
10 year	22.617314
25 year	40.307498

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.5258	5959	6506	109	Pass
0.7572	4102	4272	104	Pass
0.9885	3205	3487	108	Pass
1.2199	2635	2802	106	Pass
1.4513	2235	2235	100	Pass
1.6826	1928	1902	98	Pass
1.9140	1679	1702	101	Pass
2.1453	1504	1542	102	Pass
2.3767	1374	1403	102	Pass
2.6081	1233	1259	102	Pass
2.8394	1099	1115	101	Pass
3.0708	988	964	97	Pass
3.3021	914	862	94	Pass
3.5335	839	779	92	Pass
3.7648	756	714	94	Pass
3.9962	700	647	92	Pass
4.2276	642	582	90	Pass
4.4589	596	541	90	Pass
4.6903	542	497	91	Pass
4.9216	498	463	92	Pass
5.1530	452	423	93	Pass
5.3843	426	399	93	Pass
5.6157	398	379	95	Pass
5.8471	374	354	94	Pass
6.0784	345	330	95	Pass
6.3098	320	315	98	Pass
6.5411	299	296	98	Pass
6.7725	280	280	100	Pass
7.0038	269	270	100	Pass
7.2352	251	243	96	Pass
7.4666	234	222	94	Pass
7.6979	223	207	92	Pass
7.9293	211	194	91	Pass
8.1606	203	185	91	Pass
8.3920	193	176	91	Pass
8.6234	183	164	89	Pass
8.8547	171	152	88	Pass
9.0861	160	145	90	Pass
9.3174	149	134	89	Pass
9.5488	138	128	92	Pass
9.7801	128	121	94	Pass
10.0115	121	116	95	Pass
10.2429	117	109	93	Pass
10.4742	113	102	90	Pass
10.7056	104	99	95	Pass
10.9369	97	91	93	Pass
11.1683	94	83	88	Pass
11.3996	89	79	88	Pass
11.6310	87	78	89	Pass
11.8624	85	73	85	Pass
12.0937	82	68	82	Pass
12.3251	77	65	84	Pass
12.5564	75	63	84	Pass

12.7878	72	60	83	Pass
13.0191	69	59	85	Pass
13.2505	66	54	81	Pass
13.4819	63	51	80	Pass
13.7132	60	50	83	Pass
13.9446	57	48	84	Pass
14.1759	56	46	82	Pass
14.4073	53	46	86	Pass
14.6387	51	46	90	Pass
14.8700	48	41	85	Pass
15.1014	44	41	93	Pass
15.3327	41	41	100	Pass
15.5641	39	38	97	Pass
15.7954	37	37	100	Pass
16.0268	36	34	94	Pass
16.2582	36	34	94	Pass
16.4895	35	33	94	Pass
16.7209	34	33	97	Pass
16.9522	33	32	96	Pass
17.1836	30	30	100	Pass
17.4149	28	30	107	Pass
17.6463	27	29	107	Pass
17.8777	27	27	100	Pass
18.1090	26	27	103	Pass
18.3404	26	25	96	Pass
18.5717	26	24	92	Pass
18.8031	26	24	92	Pass
19.0344	25	24	96	Pass
19.2658	24	24	100	Pass
19.4972	24	23	95	Pass
19.7285	24	22	91	Pass
19.9599	24	22	91	Pass
20.1912	24	22	91	Pass
20.4226	24	22	91	Pass
20.6540	23	21	91	Pass
20.8853	23	21	91	Pass
21.1167	20	21	104	Pass
21.3480	18	19	105	Pass
21.5794	17	18	105	Pass
21.8107	16	17	106	Pass
22.0421	15	16	106	Pass
22.2735	15	15	100	Pass
22.5048	15	14	93	Pass
22.7362	14	13	92	Pass
22.9675	14	13	92	Pass
23.1989	12	12	100	Pass
23.4302	12	12	100	Pass

Water Quality

Model Default Modifications

Total of 0 changes have been made.

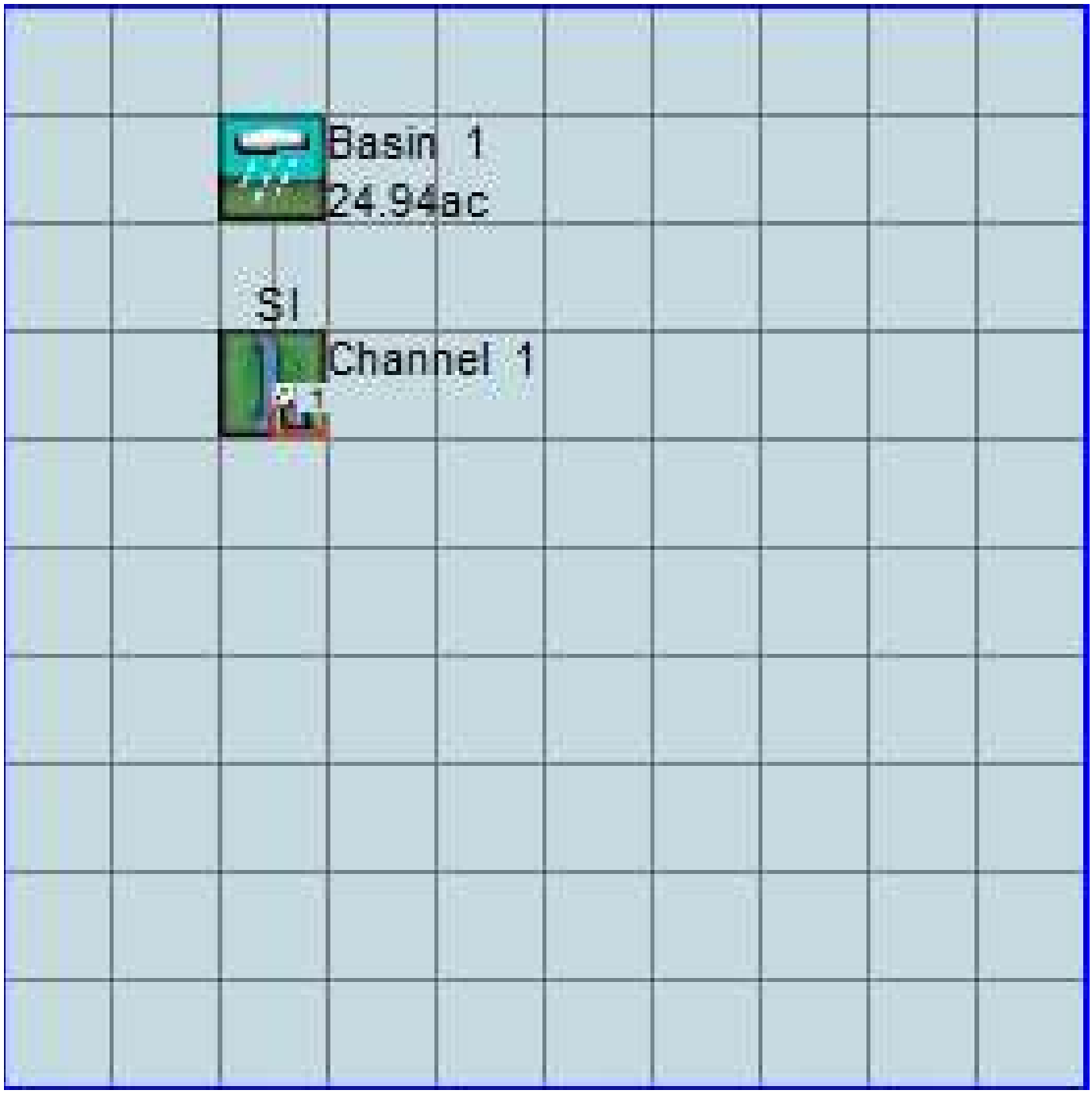
PERLND Changes

No PERLND changes have been made.

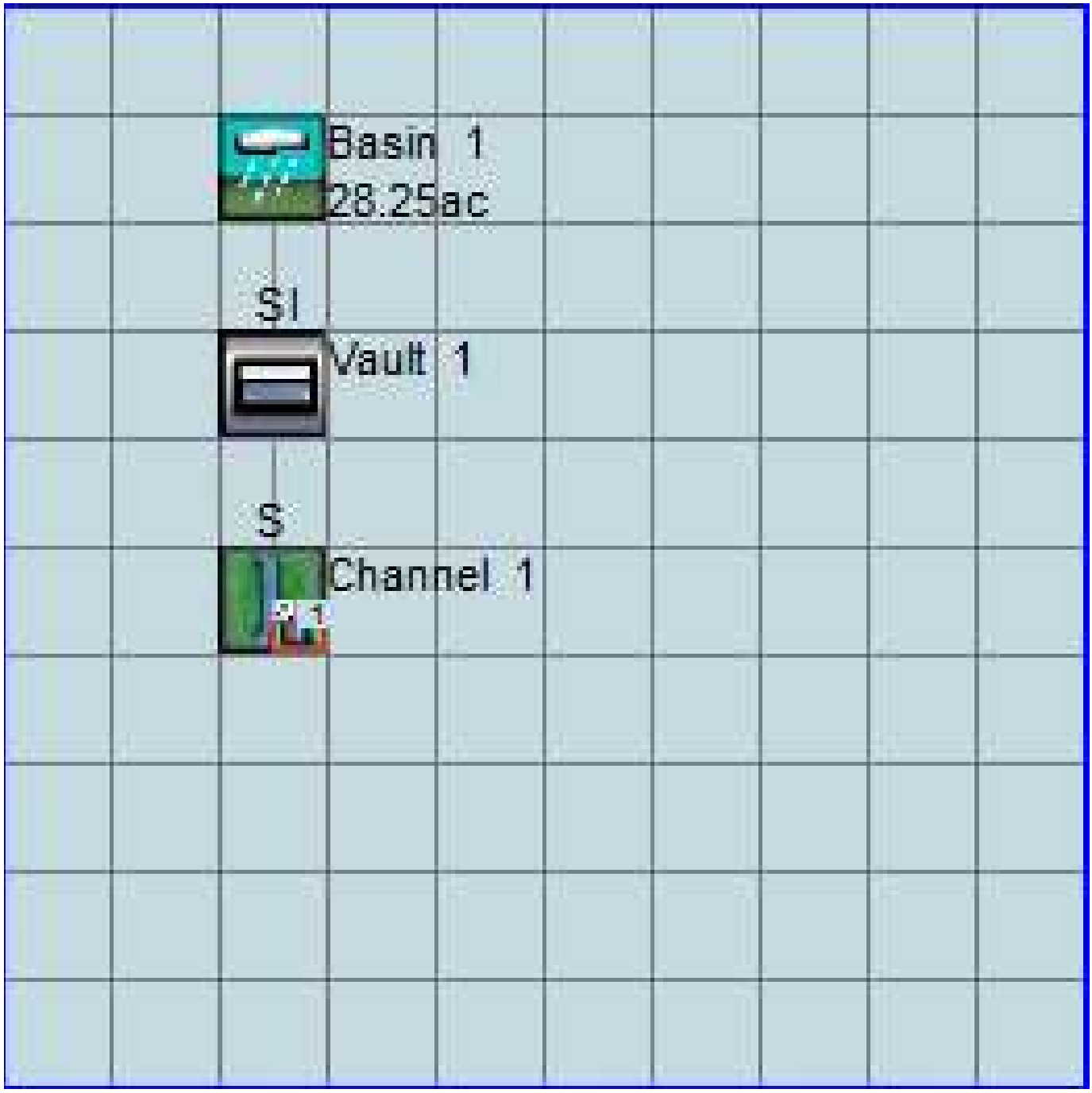
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1958 10 01         END    2005 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   Groves 11292017.wdm
MESSU       25   PreGroves 11292017.MES
            27   PreGroves 11292017.L61
            28   PreGroves 11292017.L62
            30   POCGroves 112920171.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND        5
      PERLND        6
      PERLND        7
      PERLND        8
      PERLND       29
      PERLND       30
      PERLND       31
      PERLND       32
      RCHRES        1
      COPY        501
      DISPLY        1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Channel  1                  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             ***
    5     A,Open Brush,Flat       1    1    1    1   27    0
    6     A,Open Brush,Mod        1    1    1    1   27    0
    7     A,Open Brush,Steep      1    1    1    1   27    0
    8     A,Open Brush,VSteep     1    1    1    1   27    0
   29     C,Open Brush,Flat       1    1    1    1   27    0
   30     C,Open Brush,Mod        1    1    1    1   27    0
   31     C,Open Brush,Steep      1    1    1    1   27    0
   32     C,Open Brush,VSteep     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 ***
  5         0    0    1    0    0    0    0    0    0    0    0    0
  6         0    0    1    0    0    0    0    0    0    0    0    0
  7         0    0    1    0    0    0    0    0    0    0    0    0
  8         0    0    1    0    0    0    0    0    0    0    0    0
 29         0    0    1    0    0    0    0    0    0    0    0    0
 30         0    0    1    0    0    0    0    0    0    0    0    0
 31         0    0    1    0    0    0    0    0    0    0    0    0
 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  *********
  5         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  6         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  7         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  8         0    0    4    0    0    0    0    0    0    0    0    0    1    9
 29         0    0    4    0    0    0    0    0    0    0    0    0    1    9
 30         0    0    4    0    0    0    0    0    0    0    0    0    1    9
 31         0    0    4    0    0    0    0    0    0    0    0    0    1    9
 32         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 ***
  5         0    0    0    1    0    0    0    0    1    0    0
  6         0    0    0    1    0    0    0    0    1    0    0
  7         0    0    0    1    0    0    0    0    1    0    0
  8         0    0    0    1    0    0    0    0    1    0    0
 29         0    0    0    1    0    0    0    0    1    0    0
 30         0    0    0    1    0    0    0    0    1    0    0
 31         0    0    0    1    0    0    0    0    1    0    0
 32         0    0    0    1    0    0    0    0    1    0    0
END PWAT-PARM1

PWAT-PARM2
  <PLS >      PWATER input info: Part 2          ***
  # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR      KVARY      AGWRC
  5              0       5.2      0.09       400      0.05        0.8      0.955
  6              0       4.8      0.07       350       0.1        0.8      0.955
  7              0       4.5     0.045       300      0.15        0.8      0.955
  8              0       4.2      0.03       250       0.2        0.8      0.955
 29              0       4.8     0.045       400      0.05        0.8      0.955
 30              0       4.5      0.04       350       0.1        0.8      0.955
 31              0       4.2      0.03       300      0.15        0.8      0.955
 32              0         4     0.015       250       0.2        0.8      0.955
END PWAT-PARM2

PWAT-PARM3
  <PLS >      PWATER input info: Part 3          ***
  # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  5             40        35         2         2         0      0.03         0
  6             40        35         2         2         0      0.03         0
  7             40        35         2         2         0      0.03         0
  8             40        35         2         2         0      0.03         0
 29             40        35         3         2         0      0.03         0
 30             40        35         3         2         0      0.03         0
 31             40        35         3         2         0      0.03         0
 32             40        35         3         2         0      0.03         0
END PWAT-PARM3
PWAT-PARM4
  <PLS >     PWATER input info: Part 4                              ***
  # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
```

```
    5              0       0.8      0.25         4       0.7         0
    6              0      0.65      0.25       3.2      0.45         0
    7              0      0.45      0.25       2.6       0.4         0
    8              0      0.25      0.25       1.3       0.3         0
   29              0       0.8      0.25         2       0.7         0
   30              0      0.65      0.25       1.2      0.45         0
   31              0      0.45      0.25       0.8       0.4         0
   32              0      0.25      0.25       0.4       0.3         0
  END PWAT-PARM4
  MON-LZETPARM
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
    5       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
    6       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
    7       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
    8       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
   29       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
   30       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
   31       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
   32       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  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  ***
    5      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
    6      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
    7      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
    8      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
   29      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
   30      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
   31      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
   32      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
  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
    5              0         0      0.08         0      1.04       0.3      0.01
    6              0         0     0.065         0      0.96       0.3      0.01
    7              0         0     0.045         0       0.9       0.3      0.01
    8              0         0     0.025         0      0.84       0.3      0.01
   29              0         0      0.08         0      0.96       0.3      0.01
   30              0         0     0.065         0       0.9       0.3      0.01
   31              0         0     0.045         0      0.84       0.3      0.01
   32              0         0     0.025         0       0.8       0.3      0.01
  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

  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#   ***
Basin  1***
PERLND   5                        2.71     RCHRES   1      2
PERLND   5                        2.71     RCHRES   1      3
PERLND   6                        0.46     RCHRES   1      2
PERLND   6                        0.46     RCHRES   1      3
PERLND   7                        0.82     RCHRES   1      2
PERLND   7                        0.82     RCHRES   1      3
PERLND   8                        1.31     RCHRES   1      2
PERLND   8                        1.31     RCHRES   1      3
PERLND  29                       10.64     RCHRES   1      2
PERLND  29                       10.64     RCHRES   1      3
PERLND  30                        3.45     RCHRES   1      2
PERLND  30                        3.45     RCHRES   1      3
PERLND  31                        2.99     RCHRES   1      2
PERLND  31                        2.99     RCHRES   1      3
PERLND  32                        2.56     RCHRES   1      2
PERLND  32                        2.56     RCHRES   1      3

******Routing******
RCHRES   1                           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   48.4        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                              ***
    1     Channel  1              2    1    1    1   28    0    1
  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
  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
  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  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      0.02       0.0       0.0       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  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.022957  0.000000  0.000000  0.000000
  0.088889  0.024182  0.002095  1.534328  0.011574
  0.177778  0.025408  0.004299  4.911125  0.011574
  0.266667  0.026634  0.006612  9.738430  0.011574
  0.355556  0.027860  0.009034  15.87713  0.011574
  0.444444  0.029086  0.011565  23.25577  0.011574
  0.533333  0.030313  0.014205  31.83456  0.011574
  0.622222  0.031539  0.016954  41.59160  0.011574
  0.711111  0.032766  0.019812  52.51624  0.011574
  0.800000  0.033992  0.022779  64.60537  0.011574
  0.888889  0.035219  0.025855  77.86115  0.011574
  0.977778  0.036446  0.029040  92.28957  0.011574
  1.066667  0.037673  0.032334  107.8995  0.011574
  1.155556  0.038901  0.035738  124.7019  0.011574
  1.244444  0.040128  0.039250  142.7094  0.011574
  1.333333  0.041355  0.042872  161.9361  0.011574
  1.422222  0.042583  0.046602  182.3968  0.011574
  1.511111  0.043811  0.050442  204.1073  0.011574
  1.600000  0.045039  0.054391  227.0841  0.011574
  1.688889  0.046267  0.058449  251.3440  0.011574
  1.777778  0.047495  0.062616  276.9042  0.011574
  1.866667  0.048723  0.066892  303.7825  0.011574
  1.955556  0.049951  0.071278  331.9967  0.011574
  2.044444  0.051180  0.075773  361.5648  0.011574
  2.133333  0.052409  0.080376  392.5050  0.011574
  2.222222  0.053637  0.085090  424.8357  0.011574
  2.311111  0.054866  0.089912  458.5753  0.011574
  2.400000  0.056095  0.094844  493.7422  0.011574
  2.488889  0.057325  0.099885  530.3550  0.011574
  2.577778  0.058554  0.105035  568.4321  0.011574
  2.666667  0.059783  0.110294  607.9921  0.011574
  2.755556  0.061013  0.115663  649.0536  0.011574
  2.844444  0.062243  0.121141  691.6350  0.011574
  2.933333  0.063472  0.126728  735.7548  0.011574
```

```
  3.022222  0.064702  0.132425  781.4315  0.011574
  3.111111  0.065932  0.138231  828.6834  0.011574
  3.200000  0.067163  0.144146  877.5290  0.011574
  3.288889  0.068393  0.150171  927.9866  0.011574
  3.377778  0.069624  0.156305  980.0744  0.011574
  3.466667  0.070854  0.162548  1033.811  0.011574
  3.555556  0.072085  0.168901  1089.213  0.011574
  3.644444  0.073316  0.175363  1146.301  0.011574
  3.733333  0.074547  0.181935  1205.091  0.011574
  3.822222  0.075778  0.188616  1265.602  0.011574
  3.911111  0.077009  0.195407  1327.852  0.011574
  4.000000  0.078241  0.202307  1391.858  0.011574
  4.088889  0.079472  0.209316  1457.638  0.011574
  4.177778  0.080704  0.216435  1525.210  0.011574
  4.266667  0.081936  0.223664  1594.592  0.011574
  4.355556  0.083167  0.231001  1665.801  0.011574
  4.444444  0.084400  0.238449  1738.855  0.011574
  4.533333  0.085632  0.246006  1813.771  0.011574
  4.622222  0.086864  0.253672  1890.566  0.011574
  4.711111  0.088096  0.261448  1969.259  0.011574
  4.800000  0.089329  0.269334  2049.865  0.011574
  4.888889  0.090562  0.277329  2132.403  0.011574
  4.977778  0.091795  0.285434  2216.889  0.011574
  5.066667  0.093028  0.293648  2303.341  0.011574
  5.155556  0.094261  0.301972  2391.775  0.011574
  5.244444  0.095494  0.310406  2482.209  0.011574
  5.333333  0.096727  0.318949  2574.659  0.011574
  5.422222  0.097961  0.327602  2669.142  0.011574
  5.511111  0.099194  0.336364  2765.676  0.011574
  5.600000  0.100428  0.345236  2864.276  0.011574
  5.688889  0.101662  0.354218  2964.959  0.011574
  5.777778  0.102896  0.363309  3067.742  0.011574
  5.866667  0.104130  0.372511  3172.641  0.011574
  5.955556  0.105364  0.381821  3279.673  0.011574
  6.044444  0.106599  0.391242  3388.854  0.011574
  6.133333  0.107833  0.400772  3500.201  0.011574
  6.222222  0.109068  0.410412  3613.730  0.011574
  6.311111  0.110303  0.420162  3729.457  0.011574
  6.400000  0.111538  0.430022  3847.398  0.011574
  6.488889  0.112773  0.439991  3967.569  0.011574
  6.577778  0.114008  0.450070  4089.987  0.011574
  6.666667  0.115243  0.460259  4214.668  0.011574
  6.755556  0.116479  0.470558  4341.627  0.011574
  6.844444  0.117714  0.480967  4470.880  0.011574
  6.933333  0.118950  0.491485  4602.444  0.011574
  7.022222  0.120186  0.502113  4736.333  0.011574
  7.111111  0.121422  0.512851  4872.565  0.011574
  7.200000  0.122658  0.523699  5011.154  0.011574
  7.288889  0.123894  0.534657  5152.116  0.011574
  7.377778  0.125131  0.545725  5295.467  0.011574
  7.466667  0.126367  0.556903  5441.222  0.011574
  7.555556  0.127604  0.568190  5589.397  0.011574
  7.644444  0.128840  0.579588  5740.007  0.011574
  7.733333  0.130077  0.591095  5893.069  0.011574
  7.822222  0.131314  0.602713  6048.596  0.011574
  7.911111  0.132552  0.614440  6206.605  0.011574
  8.000000  0.133789  0.626277  6367.111  0.011574
  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

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   1 HYDR   RO     1 1         1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      1 1         1      WDM   1001 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      2 1         1      WDM   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1         1      WDM   1003 STAG     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1      48.4      WDM    501 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         3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK     3

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1958 10 01         END    2005 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   Groves 11292017.wdm
MESSU       25   MitGroves 11292017.MES
            27   MitGroves 11292017.L61
            28   MitGroves 11292017.L62
            30   POCGroves 112920171.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND        5
      PERLND        6
      PERLND        7
      PERLND        8
      PERLND       29
      PERLND       30
      PERLND       31
      PERLND       32
      PERLND       49
      PERLND       57
      IMPLND        1
      RCHRES        1
      RCHRES        2
      COPY          1
      COPY        501
      DISPLY        1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Channel  1                  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           ***
    5     A,Open Brush,Flat       1    1    1    1   27    0
    6     A,Open Brush,Mod        1    1    1    1   27    0
    7     A,Open Brush,Steep      1    1    1    1   27    0
```

```
  8     A,Open Brush,VSteep      1    1    1    1   27    0
 29     C,Open Brush,Flat        1    1    1    1   27    0
 30     C,Open Brush,Mod         1    1    1    1   27    0
 31     C,Open Brush,Steep       1    1    1    1   27    0
 32     C,Open Brush,VSteep      1    1    1    1   27    0
 49     A,Urban,Flat(0-5%)       1    1    1    1   27    0
 57     C,Urban,Flat(0-5%)       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 ***
  5         0    0    1    0    0    0    0    0    0    0    0    0
  6         0    0    1    0    0    0    0    0    0    0    0    0
  7         0    0    1    0    0    0    0    0    0    0    0    0
  8         0    0    1    0    0    0    0    0    0    0    0    0
 29         0    0    1    0    0    0    0    0    0    0    0    0
 30         0    0    1    0    0    0    0    0    0    0    0    0
 31         0    0    1    0    0    0    0    0    0    0    0    0
 32         0    0    1    0    0    0    0    0    0    0    0    0
 49         0    0    1    0    0    0    0    0    0    0    0    0
 57         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  *********
  5         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  6         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  7         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  8         0    0    4    0    0    0    0    0    0    0    0    0    1    9
 29         0    0    4    0    0    0    0    0    0    0    0    0    1    9
 30         0    0    4    0    0    0    0    0    0    0    0    0    1    9
 31         0    0    4    0    0    0    0    0    0    0    0    0    1    9
 32         0    0    4    0    0    0    0    0    0    0    0    0    1    9
 49         0    0    4    0    0    0    0    0    0    0    0    0    1    9
 57         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 ***
  5         0    0    0    1    0    0    0    0    1    0    0
  6         0    0    0    1    0    0    0    0    1    0    0
  7         0    0    0    1    0    0    0    0    1    0    0
  8         0    0    0    1    0    0    0    0    1    0    0
 29         0    0    0    1    0    0    0    0    1    0    0
 30         0    0    0    1    0    0    0    0    1    0    0
 31         0    0    0    1    0    0    0    0    1    0    0
 32         0    0    0    1    0    0    0    0    1    0    0
 49         0    0    0    1    0    0    0    0    1    0    0
 57         0    0    0    1    0    0    0    0    1    0    0
END PWAT-PARM1

PWAT-PARM2
  <PLS >      PWATER input info: Part 2          ***
  # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  5               0       5.2      0.09       400      0.05       0.8     0.955
  6               0       4.8      0.07       350       0.1       0.8     0.955
  7               0       4.5     0.045       300      0.15       0.8     0.955
  8               0       4.2      0.03       250       0.2       0.8     0.955
 29               0       4.8     0.045       400      0.05       0.8     0.955
 30               0       4.5      0.04       350       0.1       0.8     0.955
 31               0       4.2      0.03       300      0.15       0.8     0.955
 32               0         4     0.015       250       0.2       0.8     0.955
 49               0         5      0.07       400      0.05       0.8     0.955
 57               0       4.6     0.045       400      0.05       0.8     0.955
END PWAT-PARM2
```

```
PWAT-PARM3
  <PLS >       PWATER input info: Part 3          ***
  # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  5             40        35         2         2         0      0.03         0
  6             40        35         2         2         0      0.03         0
  7             40        35         2         2         0      0.03         0
  8             40        35         2         2         0      0.03         0
 29             40        35         3         2         0      0.03         0
 30             40        35         3         2         0      0.03         0
 31             40        35         3         2         0      0.03         0
 32             40        35         3         2         0      0.03         0
 49             40        35         2         2         0      0.03         0
 57             40        35         3         2         0      0.03         0
END PWAT-PARM3
PWAT-PARM4
  <PLS >     PWATER input info: Part 4                              ***
  # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  5             0       0.8      0.25         4       0.7         0
  6             0      0.65      0.25       3.2      0.45         0
  7             0      0.45      0.25       2.6       0.4         0
  8             0      0.25      0.25       1.3       0.3         0
 29             0       0.8      0.25         2       0.7         0
 30             0      0.65      0.25       1.2      0.45         0
 31             0      0.45      0.25       0.8       0.4         0
 32             0      0.25      0.25       0.4       0.3         0
 49             0       0.7      0.25         3       0.7         0
 57             0       0.7      0.25         3       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  ***
  5       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
  6       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
  7       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
  8       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
 29       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
 30       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
 31       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
 32       0.4  0.4  0.4  0.5 0.55 0.55 0.55 0.55 0.55 0.55 0.45  0.4
 49       0.5  0.5  0.5  0.6 0.65 0.65 0.65 0.65 0.65 0.65 0.55  0.5
 57       0.5  0.5  0.5  0.6 0.65 0.65 0.65 0.65 0.65 0.65 0.55  0.5
END MON-LZETPARM
MON-INTERCEP
  <PLS >       PWATER input info: Part 3          ***
  # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
  5      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
  6      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
  7      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
  8      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
 29      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
 30      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
 31      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
 32      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
 49      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
 57      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
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
  5             0         0      0.08         0      1.04       0.3      0.01
  6             0         0     0.065         0      0.96       0.3      0.01
  7             0         0     0.045         0       0.9       0.3      0.01
  8             0         0     0.025         0      0.84       0.3      0.01
 29             0         0      0.08         0      0.96       0.3      0.01
 30             0         0     0.065         0       0.9       0.3      0.01
 31             0         0     0.045         0      0.84       0.3      0.01
 32             0         0     0.025         0       0.8       0.3      0.01
 49             0         0      0.07         0         1       0.3      0.01
```

```
   57              0         0      0.07         0      0.92       0.3      0.01
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                    in  out           ***
    1     Impervious,Flat(0-5)    1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

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

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    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     ***
    1         0    0    0    0    0
  END IWAT-PARM1

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

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

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

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND   5                       2.71     RCHRES   1      2
PERLND   5                       2.71     RCHRES   1      3
PERLND   6                       0.44     RCHRES   1      2
PERLND   6                       0.44     RCHRES   1      3
PERLND   7                        0.8     RCHRES   1      2
PERLND   7                        0.8     RCHRES   1      3
PERLND   8                       1.31     RCHRES   1      2
PERLND   8                       1.31     RCHRES   1      3
PERLND  29                       9.55     RCHRES   1      2
PERLND  29                       9.55     RCHRES   1      3
PERLND  30                       2.99     RCHRES   1      2
PERLND  30                       2.99     RCHRES   1      3
PERLND  31                       2.71     RCHRES   1      2
PERLND  31                       2.71     RCHRES   1      3
```

```
PERLND  32                          2.51     RCHRES   1      2
PERLND  32                          2.51     RCHRES   1      3
PERLND  49                          0.46     RCHRES   1      2
PERLND  49                          0.46     RCHRES   1      3
PERLND  57                          2.63     RCHRES   1      2
PERLND  57                          2.63     RCHRES   1      3
IMPLND   1                          2.14     RCHRES   1      5

******Routing******
RCHRES   1                             1     RCHRES   2      7
RCHRES   1                                   COPY     1     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   48.4        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                               ***
    1     Vault  1               2    1    1    1   28    0    1
    2     Channel  1             2    1    1    1   28    0    1
  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
  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
  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  0  0  0       0  0  0  0  0       2  2  2  2  2
    2        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       0.0       0.5       0.0
    2              2      0.02       0.0       0.0       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  0.0  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
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)    (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.093205  0.000000  0.000000  0.000000
  0.161111  0.093205  0.015016  0.000000  0.140972
  0.322222  0.093205  0.030033  0.000000  0.140972
  0.483333  0.093205  0.045049  0.000000  0.140972
  0.644444  0.093205  0.060065  0.000000  0.140972
  0.805556  0.093205  0.075082  0.000000  0.140972
  0.966667  0.093205  0.090098  0.000000  0.140972
  1.127778  0.093205  0.105114  0.000000  0.140972
  1.288889  0.093205  0.120131  0.000000  0.140972
  1.450000  0.093205  0.135147  0.000000  0.140972
  1.611111  0.093205  0.150163  0.000000  0.140972
  1.772222  0.093205  0.165180  0.000000  0.140972
  1.933333  0.093205  0.180196  0.000000  0.140972
  2.094444  0.093205  0.195212  0.208491  0.140972
  2.255556  0.093205  0.210229  0.342958  0.140972
  2.416667  0.093205  0.225245  0.437918  0.140972
  2.577778  0.093205  0.240261  0.515679  0.140972
  2.738889  0.093205  0.255278  0.583161  0.140972
  2.900000  0.093205  0.270294  0.643606  0.140972
  3.061111  0.093205  0.285310  0.866552  0.140972
  3.222222  0.093205  0.300326  1.069832  0.140972
  3.383333  0.093205  0.315343  1.217962  0.140972
  3.544444  0.093205  0.330359  1.343694  0.140972
  3.705556  0.093205  0.345375  1.455851  0.140972
  3.866667  0.093205  0.360392  1.558473  0.140972
  4.027778  0.093205  0.375408  1.816670  0.140972
  4.188889  0.093205  0.390424  2.168024  0.140972
  4.350000  0.093205  0.405441  2.406208  0.140972
  4.511111  0.093205  0.420457  2.607444  0.140972
  4.672222  0.093205  0.435473  2.787277  0.140972
  4.833333  0.093205  0.450490  2.952343  0.140972
  4.994444  0.093205  0.465506  3.106275  0.140972
  5.155556  0.093205  0.480522  3.306769  0.140972
  5.316667  0.093205  0.495539  3.544728  0.140972
  5.477778  0.093205  0.510555  3.799157  0.140972
  5.638889  0.093205  0.525571  4.062172  0.140972
  5.800000  0.093205  0.540588  4.328805  0.140972
  5.961111  0.093205  0.555604  4.595395  0.140972
  6.122222  0.093205  0.570620  4.886108  0.140972
  6.283333  0.093205  0.585637  5.194000  0.140972
  6.444444  0.093205  0.600653  5.926323  0.140972
  6.605556  0.093205  0.615669  6.324519  0.140972
  6.766667  0.093205  0.630686  6.735256  0.140972
  6.927778  0.093205  0.645702  7.158020  0.140972
  7.088889  0.093205  0.660718  7.592363  0.140972
  7.250000  0.093205  0.675735  8.037891  0.140972
  7.411111  0.093205  0.690751  8.494252  0.140972
  7.572222  0.093205  0.705767  8.961131  0.140972
  7.733333  0.093205  0.720784  9.438241  0.140972
  7.894444  0.093205  0.735800  9.925322  0.140972
  8.055556  0.093205  0.750816  10.42213  0.140972
  8.216667  0.093205  0.765833  10.92846  0.140972
  8.377778  0.093205  0.780849  11.44408  0.140972
  8.538889  0.093205  0.795865  11.96883  0.140972
  8.700000  0.093205  0.810882  12.50250  0.140972
  8.861111  0.093205  0.825898  13.04495  0.140972
  9.022222  0.093205  0.840914  13.59600  0.140972
  9.183333  0.093205  0.855931  14.15552  0.140972
  9.344444  0.093205  0.870947  14.72336  0.140972
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9.505556  0.093205  0.885963  15.29939  0.140972
9.666667  0.093205  0.900979  15.88348  0.140972
9.827778  0.093205  0.915996  16.47551  0.140972
9.988889  0.093205  0.931012  17.07537  0.140972
10.15000  0.093205  0.946028  17.68295  0.140972
10.31111  0.093205  0.961045  18.29814  0.140972
10.47222  0.093205  0.976061  18.92084  0.140972
10.63333  0.093205  0.991077  19.55096  0.140972
10.79444  0.093205  1.006094  20.18841  0.140972
10.95556  0.093205  1.021110  20.83309  0.140972
11.11667  0.093205  1.036126  21.48492  0.140972
11.27778  0.093205  1.051143  22.14381  0.140972
11.43889  0.093205  1.066159  22.80970  0.140972
11.60000  0.093205  1.081175  23.48250  0.140972
11.76111  0.093205  1.096192  24.16213  0.140972
11.92222  0.093205  1.111208  24.84854  0.140972
12.08333  0.093205  1.126224  25.63987  0.140972
12.24444  0.093205  1.141241  27.37720  0.140972
12.40556  0.093205  1.156257  29.55979  0.140972
12.56667  0.093205  1.171273  31.55393  0.140972
12.72778  0.093205  1.186290  32.88135  0.140972
12.88889  0.093205  1.201306  33.77184  0.140972
13.05000  0.093205  1.216322  34.54834  0.140972
13.21111  0.093205  1.231339  35.27120  0.140972
13.37222  0.093205  1.246355  35.95074  0.140972
13.53333  0.093205  1.261371  36.59434  0.140972
13.69444  0.093205  1.276388  37.20748  0.140972
13.85556  0.093205  1.291404  37.79436  0.140972
14.01667  0.093205  1.306420  38.35829  0.140972
14.17778  0.093205  1.321437  38.90193  0.140972
14.33889  0.093205  1.336453  39.42746  0.140972
14.50000  0.093205  1.351469  39.93668  0.140972
END FTABLE  1
FTABLE      2
 91    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
0.000000  0.022957  0.000000  0.000000  0.000000
0.088889  0.024182  0.002095  1.534328  0.011574
0.177778  0.025408  0.004299  4.911125  0.011574
0.266667  0.026634  0.006612  9.738430  0.011574
0.355556  0.027860  0.009034  15.87713  0.011574
0.444444  0.029086  0.011565  23.25577  0.011574
0.533333  0.030313  0.014205  31.83456  0.011574
0.622222  0.031539  0.016954  41.59160  0.011574
0.711111  0.032766  0.019812  52.51624  0.011574
0.800000  0.033992  0.022779  64.60537  0.011574
0.888889  0.035219  0.025855  77.86115  0.011574
0.977778  0.036446  0.029040  92.28957  0.011574
1.066667  0.037673  0.032334  107.8995  0.011574
1.155556  0.038901  0.035738  124.7019  0.011574
1.244444  0.040128  0.039250  142.7094  0.011574
1.333333  0.041355  0.042872  161.9361  0.011574
1.422222  0.042583  0.046602  182.3968  0.011574
1.511111  0.043811  0.050442  204.1073  0.011574
1.600000  0.045039  0.054391  227.0841  0.011574
1.688889  0.046267  0.058449  251.3440  0.011574
1.777778  0.047495  0.062616  276.9042  0.011574
1.866667  0.048723  0.066892  303.7825  0.011574
1.955556  0.049951  0.071278  331.9967  0.011574
2.044444  0.051180  0.075773  361.5648  0.011574
2.133333  0.052409  0.080376  392.5050  0.011574
2.222222  0.053637  0.085090  424.8357  0.011574
2.311111  0.054866  0.089912  458.5753  0.011574
2.400000  0.056095  0.094844  493.7422  0.011574
2.488889  0.057325  0.099885  530.3550  0.011574
2.577778  0.058554  0.105035  568.4321  0.011574
2.666667  0.059783  0.110294  607.9921  0.011574
2.755556  0.061013  0.115663  649.0536  0.011574
2.844444  0.062243  0.121141  691.6350  0.011574
```

```
  2.933333  0.063472  0.126728  735.7548  0.011574
  3.022222  0.064702  0.132425  781.4315  0.011574
  3.111111  0.065932  0.138231  828.6834  0.011574
  3.200000  0.067163  0.144146  877.5290  0.011574
  3.288889  0.068393  0.150171  927.9866  0.011574
  3.377778  0.069624  0.156305  980.0744  0.011574
  3.466667  0.070854  0.162548  1033.811  0.011574
  3.555556  0.072085  0.168901  1089.213  0.011574
  3.644444  0.073316  0.175363  1146.301  0.011574
  3.733333  0.074547  0.181935  1205.091  0.011574
  3.822222  0.075778  0.188616  1265.602  0.011574
  3.911111  0.077009  0.195407  1327.852  0.011574
  4.000000  0.078241  0.202307  1391.858  0.011574
  4.088889  0.079472  0.209316  1457.638  0.011574
  4.177778  0.080704  0.216435  1525.210  0.011574
  4.266667  0.081936  0.223664  1594.592  0.011574
  4.355556  0.083167  0.231001  1665.801  0.011574
  4.444444  0.084400  0.238449  1738.855  0.011574
  4.533333  0.085632  0.246006  1813.771  0.011574
  4.622222  0.086864  0.253672  1890.566  0.011574
  4.711111  0.088096  0.261448  1969.259  0.011574
  4.800000  0.089329  0.269334  2049.865  0.011574
  4.888889  0.090562  0.277329  2132.403  0.011574
  4.977778  0.091795  0.285434  2216.889  0.011574
  5.066667  0.093028  0.293648  2303.341  0.011574
  5.155556  0.094261  0.301972  2391.775  0.011574
  5.244444  0.095494  0.310406  2482.209  0.011574
  5.333333  0.096727  0.318949  2574.659  0.011574
  5.422222  0.097961  0.327602  2669.142  0.011574
  5.511111  0.099194  0.336364  2765.676  0.011574
  5.600000  0.100428  0.345236  2864.276  0.011574
  5.688889  0.101662  0.354218  2964.959  0.011574
  5.777778  0.102896  0.363309  3067.742  0.011574
  5.866667  0.104130  0.372511  3172.641  0.011574
  5.955556  0.105364  0.381821  3279.673  0.011574
  6.044444  0.106599  0.391242  3388.854  0.011574
  6.133333  0.107833  0.400772  3500.201  0.011574
  6.222222  0.109068  0.410412  3613.730  0.011574
  6.311111  0.110303  0.420162  3729.457  0.011574
  6.400000  0.111538  0.430022  3847.398  0.011574
  6.488889  0.112773  0.439991  3967.569  0.011574
  6.577778  0.114008  0.450070  4089.987  0.011574
  6.666667  0.115243  0.460259  4214.668  0.011574
  6.755556  0.116479  0.470558  4341.627  0.011574
  6.844444  0.117714  0.480967  4470.880  0.011574
  6.933333  0.118950  0.491485  4602.444  0.011574
  7.022222  0.120186  0.502113  4736.333  0.011574
  7.111111  0.121422  0.512851  4872.565  0.011574
  7.200000  0.122658  0.523699  5011.154  0.011574
  7.288889  0.123894  0.534657  5152.116  0.011574
  7.377778  0.125131  0.545725  5295.467  0.011574
  7.466667  0.126367  0.556903  5441.222  0.011574
  7.555556  0.127604  0.568190  5589.397  0.011574
  7.644444  0.128840  0.579588  5740.007  0.011574
  7.733333  0.130077  0.591095  5893.069  0.011574
  7.822222  0.131314  0.602713  6048.596  0.011574
  7.911111  0.132552  0.614440  6206.605  0.011574
  8.000000  0.133789  0.626277  6367.111  0.011574
  END FTABLE  2
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  49     EXTNL  SURLI
WDM     22  IRRG     ENGL    0.7       SAME PERLND  57     EXTNL  SURLI
```

```
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   2 HYDR   RO     1 1         1      WDM   1004 FLOW     ENGL      REPL
RCHRES   2 HYDR   O      1 1         1      WDM   1005 FLOW     ENGL      REPL
RCHRES   2 HYDR   O      2 1         1      WDM   1006 FLOW     ENGL      REPL
RCHRES   2 HYDR   STAGE  1 1         1      WDM   1007 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1      48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1      48.4      WDM    801 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        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

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

  MASS-LINK        7
RCHRES     OFLOW  OVOL   1                 RCHRES         INFLOW IVOL
  END MASS-LINK    7

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

```
ERROR/WARNING ID:   341   6

DATE/TIME: 1978/ 3/ 4 14:15

RCHRES:     1

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB().  To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows.  This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS         V1         V2         VOL
91 5.8216E+04 5.8870E+04 7.8740E+04
```

```
ERROR/WARNING ID:   341   5

DATE/TIME: 1978/ 3/ 4 14:15

RCHRES:     1

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated.  If extrapolation was small, no problem.
Remedy; extend ftable.  Relevant data are:

A          B          C      RDEP1      RDEP2  COUNT
0.0000E+00 8120.0     -2.548E+05   31.378   3.1378E+01      2
```

```
ERROR/WARNING ID:   341   6

DATE/TIME: 1978/ 3/ 4 14:30

RCHRES:     1

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB().  To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows.  This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS         V1         V2         VOL
91 5.8216E+04 5.8870E+04 8.1419E+04
```

```
ERROR/WARNING ID:   341   5

DATE/TIME: 1978/ 3/ 4 14:30

RCHRES:     1

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated.  If extrapolation was small, no problem.
Remedy; extend ftable.  Relevant data are:

A          B          C      RDEP1      RDEP2  COUNT
0.0000E+00 8120.0     -2.880E+05   35.473   3.5473E+01      2
```

```
ERROR/WARNING ID:   341   6

DATE/TIME: 1978/ 3/ 4 14:45

RCHRES:     1
```

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB(). To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows. This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS	V1	V2	VOL
91	5.8216E+04	5.8870E+04	6.3916E+04

ERROR/WARNING ID: 341 5

DATE/TIME: 1978/ 3/ 4 14:45

RCHRES: 1

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	8120.0	-7.077E+04	8.7149	8.7149E+00	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1980/ 1/30 17: 0

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB(). To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows. This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS	V1	V2	VOL
91	5.8216E+04	5.8870E+04	7.2102E+04

ERROR/WARNING ID: 341 5

DATE/TIME: 1980/ 1/30 17: 0

RCHRES: 1

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	8120.0	-1.724E+05	21.229	2.1229E+01	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1980/ 1/30 17:15

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB(). To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows. This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS	V1	V2	VOL
91	5.8216E+04	5.8870E+04	6.5788E+04

ERROR/WARNING ID: 341   5

DATE/TIME: 1980/ 1/30 17:15

RCHRES: 1

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	8120.0	-9.400E+04	11.576	1.1576E+01	2

Disclaimer

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Attachment D

Operations & Maintenance

DF-1
DRAINAGE FACILITY OPERATION AND MAINTENANCE

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and storm water that may contain certain pollutants. Consequently these pollutants may accumulate in the system and must be removed periodically. In addition, the systems must also be maintained to function properly hydraulically to avoid flooding. Maintaining the system may involve the following activities:

1. Inspection and Cleaning of Stormwater Conveyance Structures
2. Controlling Illicit Connections and Discharges
3. Controlling Illegal Dumping

This list of Model Maintenance Procedures can be utilized as an inspection checklist to determine where better compliance with Designated Minimum Best Management Practices (notated with checkmarks and capital letters) is needed, and to recommend Additional Best Management Practices (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. BMPs applicable to certain constituents are notated as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G)* *Pesticides (PEST)*
OtherToxic Compounds (TOX) *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General (ANY)*

Program/Facility Being Inspected: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

MAINTENANCE PROCEDURES:

1. Inspection and Cleaning of Drainage Facilities

Unsatisfactory	OK
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐

General Guidelines

T 1A. Annually inspect and clean drainage structures as needed.

T 1B. Maintain appropriate records of cleaning and inspections.

T 1C. Properly dispose of removed materials at a landfill or recycling facility.

T 1D. Conduct intermittent supplemental visual inspections during the wet season to determine if there are problem inlets where sediment/trash or other pollutants accumulate, and provide for additional cleanouts as appropriate.

T 1E. Prevent or clean up any discharges that may occur during the course of maintenance and cleaning procedures.

T 1F. Verify that appropriate employees or subcontractors are trained in proper conductance of maintenance activities, including record keeping and disposal.

T 1G. Annually inspect and clean v-ditches as needed, prior to the wet season. On shrub-covered slopes, vegetative debris may be placed on the downhill side of the ditch. Trash should be bagged and disposed at a landfill.

Unsatisfactory	OK
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐

General Guidelines (cont.)

- 1a. Remove trash or debris as needed from open channels. It should be noted that major vegetative debris removal may require other regulatory permits prior to completing the work. (TRASH)
- 1b. Consider retrofitting energy dissipaters (e.g. riprap) below culvert outfalls to minimize potential for erosion. (SED)
- 1c. Repair any v-ditches that have cracked or displaced in a manner that accelerates erosion. (SED)
- 1d. If suspicious conditions appear to exist, test selected samples of the removed wastes for compliance with hazardous waste regulations prior to disposal. (TOX)
- 1e. Consider more frequent regular cleaning of selected drainage structures to help address ongoing specific impairments. (SED, BACT, NUT, TRASH)
- 1f. Consider structural retrofits to the MS4 to help address ongoing specific impairments (SED, BACT, NUT, TRASH, O&G)
- 1g. Consider cleaning out pipes at gradient breaks or other in-pipe debris accumulation points as identified/needed. (ANY, BACT, NUT, TRASH)

Storm Drain Flushing

- 1h. Flushing of storm drains or storm drain inlets should only be done when critically necessary and no other solution is practical. (SED, BACT, TRASH).
- 1i. If flushed, to the extent practical the material should be collected (vacuumed), treated with an appropriate filtering device to remove sand and debris and disposed of properly. (SED)

Waste Management

T 1H. Store wastes collected from cleaning activities of the drainage facilities in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.

- 1j. Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device to remove the sand and debris prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not permitted, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream. (SED, TRASH)
- 1k. Provide for laboratory analysis of at least one randomly collected sediment (less the debris) sample per year from the storm drain inlet leaning program to ensure that it does not meet the EPA criteria for hazardous waste. If the sample is determined to be hazardous, the sediment must be disposed of as hazardous waste and the source should be investigated. (TOX).

2. Controlling Illicit Connections and Discharges

Unsatisfactory	OK	General Guidelines
☐	☐	T 2A. Report prohibited discharges such as dumping, paint spills, abandoned oil containers, etc. observed during the course of normal daily activities so they can be investigated, contained, and cleaned up.
☐	☐	T 2B. Where field observations and/or monitoring data indicate significant problems, conduct field investigations to detect and eliminate existing illicit connections and improper disposal of pollutants into the storm drain (i.e. identify problem areas where discharges or illegal connections may occur and follow up stream to determine the source(s)). (Refer to Appendices A-10 and A-11.)
☐	☐	T 2C. Report all observed illicit connections and discharges to the 24-hour water pollution problem reporting hotline (714) 567-6363.
☐	☐	T 2D. Encourage public reporting of improper waste disposal by distributing public education materials and advertising the 24-hour water pollution problem reporting hotline.
		Storm Drain Stenciling ("No Dumping—Drains to Ocean")
☐	☐	T 2E. Implement and maintain a storm drain stenciling program.
☐	☐	• 2a. Consider adding the hotline number to the storm drain stencils (BACT, TOX, TRASH).

3. Controlling Illegal Dumping

		Field Investigation
☐	☐	T 3A. Report prohibited discharges such as dumpings observed during the course of normal daily activities so they can be investigated, contained and cleaned up.
☐	☐	T 3B. Conduct field investigations to detect and eliminate improper disposal of pollutants into the storm drain (i.e. identify problem areas where discharges or illegal connections may occur and follow up stream to determine the source(s)).
☐	☐	T 3C. Report all observed illegal dumping to the 24-hour water pollution problem reporting hotline (714) 567-6363.
☐	☐	T 3D. Encourage public reporting of improper waste disposal by distributing public education materials and advertising the 24-hour water pollution problem reporting hotline.
☐	☐	T 3E. If perpetrator can be identified, take appropriate enforcement action.
☐	☐	• 3a. Consider posting "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs could also indicate fines and penalties for illegal dumping. (ANY)

Unsatisfactory	OK	Training/Education/Outreach
☐ _____	☐	T 3F. Verify that appropriate employees and subcontractors are trained to recognize and report illegal dumping. T 3G. Encourage public reporting of illegal dumping by advertising the 24-hour water pollution problem reporting hotline (714) 567-6363. • 3b. Take extra steps to educate the public in neighborhoods where illegal dumping has occurred to inform them why illegal dumping is a problem, and that illegal dumping carries a significant financial penalty. (ANY)
☐ _____	☐	
☐ _____	☐	

LIMITATIONS:

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