Appendix E
Water Quality Management Plan

WATER QUALITY MANAGEMENT PLAN

Project Name:

2354 SAN CLEMENTE STREET, LAGUNA BEACH, CA

Prepared for:

Kevin Aaronson

2354 San Clemente Street
Laguna Beach, CA 92651
Tel: (949) 279-1644

Prepared by:

TOAL ENGINEERING, INC.

139 Avenida Navarro
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Registration No. 57587

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Engineer's Seal

Prepared on:

Date prepared: Dec 27, 2018

Date of revisions:

Date of Final revision:

Job Number**: 18156**

Project Owner's Certification			
Permit/Application No.	N/A	Grading Permit No.	N/A
Tract/Parcel Map No.	Lots 11-15, Blk 6, Loma Tract	Building Permit No.	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract)			APN: 656-122-04 +05

This Water Quality Management Plan (WQMP) has been prepared for Kevin Aaronson by Toal Engineering, Inc. The WQMP is intended to comply with the requirements of the local 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 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 (South Orange County). 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:			
Title	Kevin Aaronson		
Company	N/A		
Address	2354 San Clemente Street, Laguna Beach, CA		
Email			
Telephone #	(949) 279-1644		
Signature	DocuSigned by: F3F6AED2AD2C4A5... 4/14/2020	Date	

Contents

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Section 1 Discretionary Permit(s) and Water Quality Conditions

Project Infomation			
Permit/Application No.	N/A	Site Address or Tract/Parcel Map No.	Lots 11-15, Blk 6, Loma Tract
Additional Information/ Comments:	N/A		
Water Quality Conditions			
Water Quality Conditions from prior approvals or applicable watershed-based plans	Prior to the issuance of any grading or building permit, the applicant shall submit to the City a Water Quality Management Plan (WQMP) for review and approval that (Mitigation Measure 8-5): a. Fulfills all the requirements of the City's Standard Urban Stormwater Mitigation Plan (SUSMP, also known as the City's WQMP is Exhibit 7.V of the City's Local Implementation Plan); b. Addresses Site Design BMPs such as minimizing impervious areas, maximizing permeability, minimizing directly connected impervious areas, creating reduced or "Zero discharge" areas, and conserving natural areas; c. Incorporates the applicable Routine Source Control and Treatment Control BMPs as defined in the City's Standard Stormwater Manuals and the SUSMP; d. Generally, describes the long-term operation and maintenance requirements for the structural BMPs; e. Identifies the entity that will be responsible for long-term operation and maintenance of the structural BMPs; and, f. Describes the mechanism for funding the long-term operation and maintenance of the structural BMPs.		

Section 2 Project Description

2.1 General Description

Description of Proposed Project				
Site Location	Address: 2354 San Clemente Street, Laguna Beach, CA Location: The site is situated in a developed Residential area in the Laguna Coastal Stream Watershed, Located in the San Diego Region. See Figure 1. Legal: Lots 11-15, Block 6, Loma Tract			
Project Area (ft^2): **6,468**	Number of Dwelling Units: **1**		SIC Code: **1521**	
Narrative Project Description:	The project consists of the construction of a new single family residence with appurtenant hardscape, walls, driveway and landscape areas on the project. The project size is 6,468 sf (0.148 ac) with a rear descending slope which will remain untouched in its natural state.			
Project Area	Pervious		Impervious	
	Area (acres)	Percentage	Area (acres)	Percentage
Pre-Project Conditions	**0.088**	**59%**	**0.060**	**41%**
Post-Project Conditions	**0.032**	**22%**	**0.116**	**78%**

Figure 1. Project Location Map

2.2 Post Development Drainage Characteristics

The site drainage system is designed to treat and partially retain runoff via enclosed planter boxes (Bioretention with underdrain) prior to discharge in order to eliminate direct discharge into the Pacific Ocean. Drain inlets will be provided in site landscape areas to collect excess runoff and not allow surface water to accumulate and result in standing water/ponding situations. Drain lines will convey the collected runoff into enclosed planter boxes for treatment and storage prior to discharge.

Drainage from paved areas shall be directed to flow away from the building foundation and into turf or landscape areas, where possible prior to collection by the proposed area drain system.

The proposed planter boxes will remove sediment and pollutants through volume reduction before the runoff is discharged to the natural drainage course at the northerly end of the site. In large storm events runoff will overflow and bypass the enclosed planter boxes and flow to the drainage course that outlets directly to Glenneyre Street and into the City Drainage System. All project runoff will be

discharged directly to the natural drainage course (via an energy dissipator at the bottom of the slope) at the northerly end of the site. The lower portion of the aforementioned drainage course is concrete lined up to Glenneyre Street. Details of the drainage system are shown on the Site Plan and Drainage Plan in Section 4.

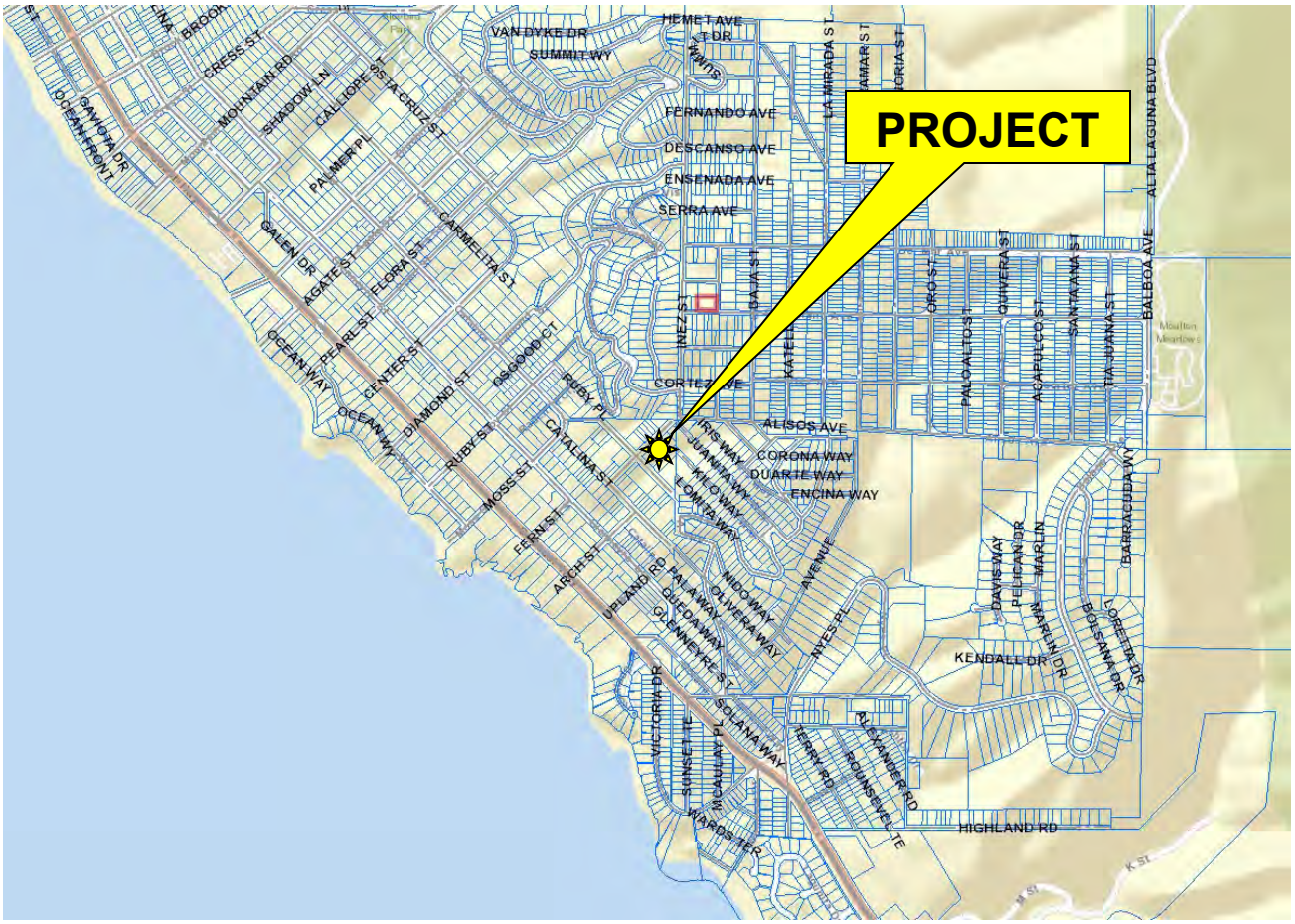


Figure 1

2.3 Property Ownership/Management

Kevin Aaronson
2354 San Clemente Street
Laguna Beach, CA 92651

Section 3 Site & Watershed Characterization

3.1 Site Conditions

3.1.1 Existing Site Conditions

Existing condition:
As shown in Figure 1 (Section 2.1), The project site is situated in a developed residential area and is located at the Northwesterly terminus of San Clemente Street. The site generally slopes from south to north and is bordered to the southwest by San Clemente Street, to the southeast by a similar residential development, to the northwest by a steep descending slope and to the east by an ascending slope. There is an east-west-trending natural swale at the bottom of the slope along northerly end of the site.

Topography:
The subject project is on a sloping site with a total area of 6,468 s.f. (0.148 acres). The maximum elevation change between property lines is roughly 82 feet, with the project sitting at an elevation between 292 to 314 feet above sea level. The site slopes away from San Clemente Street toward the rear yard with an average slope of 1.5:1 (H:V). A field shot survey was prepared by this office on 10/01/2018 and was used in preparation of plans and reports for this project.

Existing Drainage Patterns:
No drain inlets were discovered during the field shot survey. The site currently appears to sheet flow away from the building and towards the steep slope at the northerly end of the site where it enters an offsite natural drainage course. This natural drainage course descends and discharges directly to Glenneyre Street and into the City Storm drain system prior to entering the Pacific Ocean.

Environmentally Sensitive Features:
N/A - There are no environmentally sensitive features or areas within or near the site.

Existing Infrastructure:
The runoff will be conveyed (via an energy dissipator at the bottom of the slope) to the existing natural drainage course at the northerly end of the site. This natural drainage course descends and discharges to Glenneyre Street and into the City Storm drain system prior to entering Ocean. The lower portion of the swale is concrete lined up to Glenneyre Street. Public sewer, water, and dry utility facilities are located within San Clemente street.

Existing Land Uses				
Land Use Description	Total Area (acres)	Impervious Area (acres)	Pervious Area (acres)	Imperviousness (%)
Project Area	**0.148**	**0.060**	**0.088**	**41%**

Total	**0.148**	**0.060**	**0.088**	**41%**

3.1.2 Infiltration-Related Characteristics

A geotechnical report is not yet available for the project and will be incorporated into this report before WQMP approval.

Per Exhibit map XVI-2a in the TGD and the Orange County Hydrology Manual, the project is primarily comprised of HSG- C type soils. Surficial infiltration is possible, however it is not feasible due to the steep slope.

3.1.2.1 Hydrogeologic Conditions

Groundwater conditions will be added upon receipt of the project Soils Report.

3.1.2.2 Soil and Geologic Infiltration Characteristics

Site soils underlainment will be added upon receipt of the project Soils Report.

The site **is primarily comprised of HSG-C** type soils per Exhibit map XVI-2a in the TGD and the Orange County Hydrology Manual. Type C type soils are moderate for on-site infiltration. Infiltration is not feasible within 50' of the slope edge, nor within 8 feet of the building foundations, which represents the entire project area.

3.1.2.3 Geotechnical Conditions

Geotechnical conditions will be added upon receipt of the project Soils Report.

3.1.2.4 Summary of Infiltration Opportunities and Constraints of Existing Site

Although on-site areas comprised of Type C soils may support incidental infiltration, the steep slopes, shallow bedrock, and potential geotechnical hazards exclude the use of infiltration BMPs for this project.

3.2 Proposed Site Development Activities

3.2.1 Overview of Site Development Activities

The post-development drainage plan will eliminate direct discharge to the face of slope or Pacific Ocean by discharging directly to the natural drainage course (via an energy dissipator at the bottom of the slope) at the southerly end of the site. This natural drainage course descends and discharges directly to Glenneyre Street and into the City Storm drain system prior to entering the Pacific Ocean. Prior to discharge, the proposed drainage runoff will gravity flow to a bioretention area (Planter Box). Where possible, runoff is directed towards landscaped areas before being collected by the drain inlets. The Pacific Ocean is a known Environmentally Sensitive Area(ESA) and no runoff will be discharged directly into the water.

Details of the drainage system are shown on the Grading Plan prepared by Toal Engineering, Inc.

See Site Plan and Drainage Plan in Section 4.

3.2.2 Project Attributes Influencing Stormwater Management

Potential pollutant-generating activities:
The significant pollutant-generating activities anticipated for this residential development are Landscaping/Gardening, Pet care, Trash, and Automotive use. See Section 4.4 for applicable Site Design and Source Control BMPs.

Building Use:
The project is a single-family residential development; building use is residential.

Proposed landscaping:
On-slope areas within the project limits will be planted with native, drought-tolerant plant species, and will be temporarily irrigated to establish vegetation before disconnecting the irrigation system. Vegetation on the sloped areas beyond the project limits will remain untouched.

Drainage Patterns:
The post-development drainage pattern is intended to match the existing drainage pattern with the exception of not allowing the post-development drainage to outlet onto or over the slope. The post development drainage will be collected and treated by planter boxes that have been sized per the South Orange County Hydrology Module SOHM software that maintain runoff flow rates and durations to no more than 10% of the 2-year flowrate up to the 10 year flowrate. Please see SOHM reports in Attachment C. These planter boxes outlet directly to the bottom of the slope to reduce slope erosion. See the WQMP Site Plan and Drainage Plan in Section 4.1.

Proposed Slopes:
The on-site slopes outside of the project area will remain untouched. There are no proposed sloped areas within the project limts.

Environmentally Sensitive Features:
N/A - As noted in Section 3.1.1, there are no such areas within or near the site.

Proposed Land Uses				
Land Use Description	Total Area (acres)	Impervious Area (acres)	Pervious Area (acres)	Imperviousness (%)
Residential Project	**0.148**	**0.116**	**0.032**	**78%**
Total	**0.148**	**0.116**	**0.032**	**78%**

3.2.3 Effects on Infiltration and Harvest and Use Feasibility

As discussed in Section 3.1.2.4, there is no opportunity for on-site infiltration due to steep slopes and potential geotechnical hazards. Harvest and Use was considered for this project, but was also deemed infeasible due to lack of demand for irrigation water. The bulk of the pervious area within the project limits consist of planter areas that will be planted with native, drought-tolerant species and then temporarily irrigated until the vegetation is established; once established, the temporary irrigation will be turned off and disconnected.

3.3 Receiving Waterbodies

The project is located within the Laguna Coastal Streams Watershed. Storm runoff from the proposed development outlets into Glenneyre street for collection by the City storm drain system, which then conveys the runoff to the Pacific Ocean.

The Orange County Coast along with the Laguna Coastal Streams is 303(d) listed by the State Water Resources Board for the following impairments.

3.4 Stormwater Pollutants or Conditions of Concern

Pollutants or Conditions of Concern				
Pollutant	Expected from Proposed Land Uses/Activities (Yes or No)	Receiving Waterbody Impaired (Yes or No)	Priority Pollutant from WQIP or other Water Quality Condition? (Yes or No)	**Pollutant of Concern (Primary, Other, or No)**
Suspended-Solids	Yes	No	No	Other
Nutrients	Yes	No	No	Other
Heavy Metals	No	No	No	No
Bacteria/Virus/Pathogens	Yes	Yes	**Yes**	**Primary**
Pesticides	Yes	No	No	Other
Oil and Grease	Yes	No	No	Other
Toxic Organic Compounds	No	No	No	No
Trash and Debris	Yes	No	No	Other
Dry Weather Runoff	Yes	No	No	Other

3.5 Hydrologic Conditions of Concern

All PDPs must ensure that post-project runoff flow rates and durations for the PDF shall not exceed pre-development, naturally occuring, 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.Does a hydrologic condition of concern exist for this project?

– An HCOC does not exist for this receiving water because:

☐ Project discharges directly to a protected conveyance (bed and bank are concrete lined the entire way from the point(s) of discharge to a receiving lake, reservoir, embayment, or the Ocean

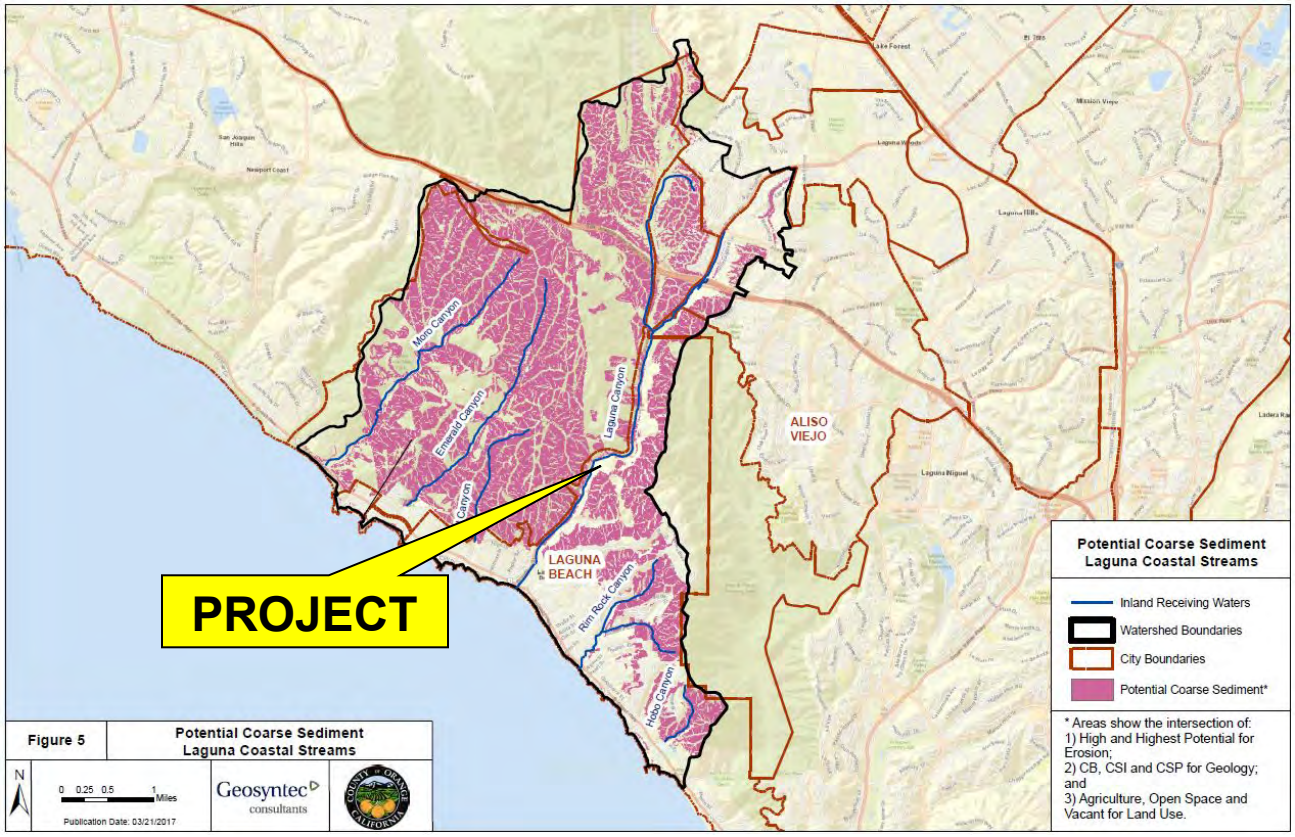
☐ Project discharges directly to storm drains which discharge directly to a reservoir, lake, embayment, ocean or protected conveyance (as described above)

☐ The project discharges to an area identified in the WMAA as exempt from hydromodification concerns

☒ Yes – An HCOC does exist for this receiving water because none of the above are applicable. Hydromofication control criteria applies because the project discharges to a natural drainage course and the project is not within the Hydromodification Exempt Areas per the TGD Appendix N.7 Hydromodification Susceptibility Maps by Jurisdiction. The natural swale descends and discharges directly to Glenneyre Street and into the City Storm drain system prior to entering the Pacific Ocean. The lower portion of the swale is concrete lined up to Glenneyre Street.

3.6 Critical Course Sediment Yield Areas

Per Figure 5 in Appendix N.8 of the TGD, the project is not located within a Potential critical coarse sediment area.



Section 4 Site Plan and Drainage Plan

4.1 Drainage Management Area Delineation

The project area includes two (2) DMAs as shown on the WQMP Site Plan on the following page, summarized as follows:

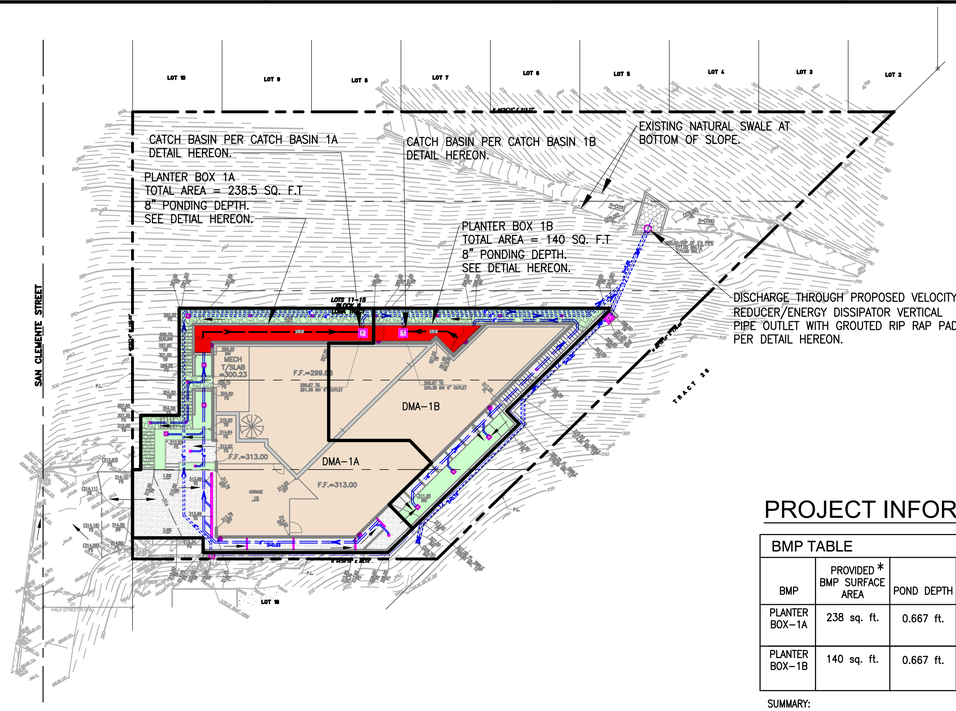
DMA-1A includes the driveway, portion of the residential building, and hardscape improvements. The runoff volume from DMA-1A is collected and conveyed to bioretention planter box 1A with underdrain unit for treatment prior to off-site discharge.

DMA-1B includes a portion of the residential building and hardscape improvements. The runoff volume from DMA-1B is collected and conveyed to bioretention planter box 1B with underdrain unit for treatment prior to off-site discharge.

GIS Coordinates of Planter Box 1A 33.526526, -117.764424

GIS Coordinates of Planter Box 1B 33.526574, -117.7644316

See DMA summary table in section 4.3.4



SCALE: 1"=20'

STRUCTURAL BMP
USE EFFICIENT IRRIGATION SYSTEMS, WATER CONSERVATION, SMART CONTROLLERS

NOT FOR CONSTRUCTION

WQMP LEGEND

- ENCLOSED PLANTER BOX
- PROPOSED BUILDING
- PROPOSED CONCRETE PAVING
- PROPOSED ONSITE LANDSCAPE / PERVIOUS AREA
- PROPOSED INFLOW DRAIN LINE
- PROPOSED OUTFLOW DRAIN LINE
- PROPOSED DOWNSPOUT
- FLOW DIRECTION IN DRAIN LINES
- PROPOSED DRAIN INLETS
- DRAINAGE BOUNDARY
- RUNOFF FLOW DIRECTION

PROJECT INFORMATION:

BMP TABLE

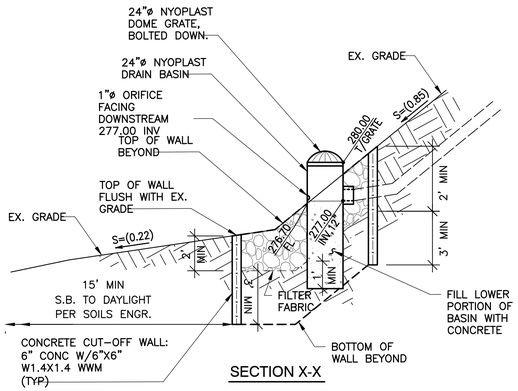
BMP	PROVIDED * BMP SURFACE AREA	POND DEPTH	PROVIDED ** BMP STORAGE VOLUME	DMA	DMA AREA	BIO-FILTRATION *** MIN REQUIRED STORAGE VOLUME	HYDROMOD **** MIN REQUIRED STORAGE VOLUME
PLANTER BOX-1A	238 sq. ft.	0.667 ft.	397 cu. ft.	DMA-1A	4,058 sq. ft. (0.093 ac)	148.4 cu. ft.	397 cu. ft.
PLANTER BOX-1B	140 sq. ft.	0.667 ft.	233 cu. ft.	DMA-1B	2,410 sq. ft. (0.055 ac)	87.4 cu. ft.	233 cu. ft.

SUMMARY:
* MINIMUM REQUIRED PLANTER AREA PER SOHM (ATTACHMENT C)
** STORAGE VOLUME = PONDING + PORE SPACE
*** MINIMUM REQUIRED STORAGE VOLUME PER WORKSHEET 8 IN ATTACHMENT E
**** MINIMUM REQUIRED STORAGE VOLUME PER SOHM (ATTACHMENT C) = PONDING + PORE SPACE

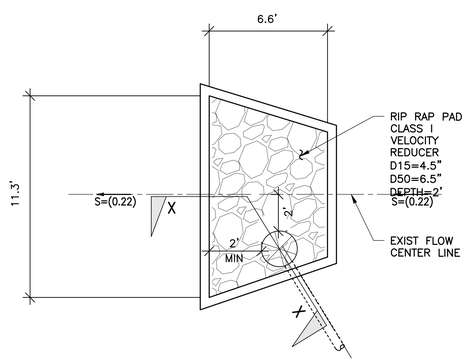
APPROXIMATE GIS COORDINATES FOR BMP'S

PLANTER BOX 1A: 33.526526, -117.764424

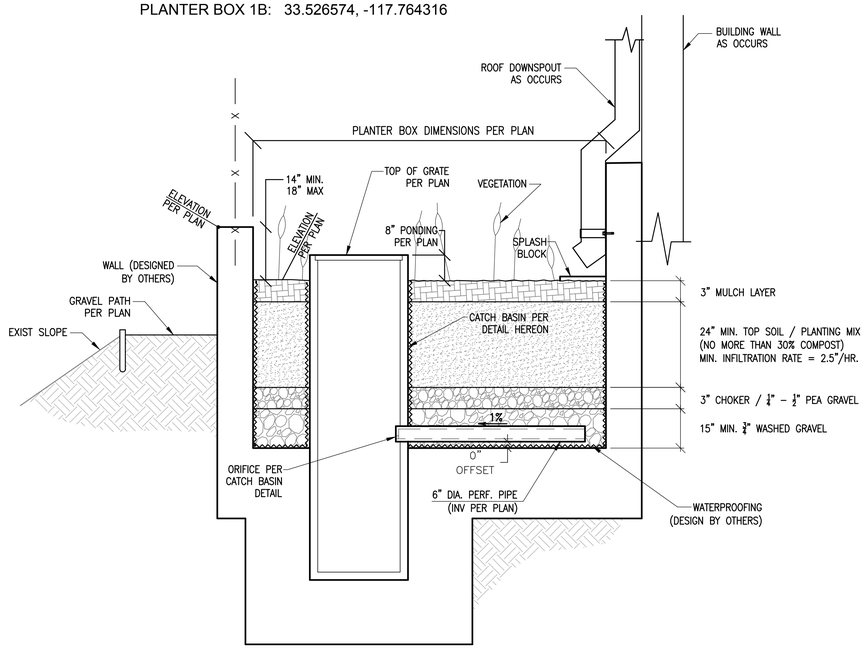
PLANTER BOX 1B: 33.526574, -117.764316



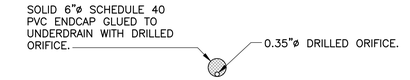
SECTION X-X



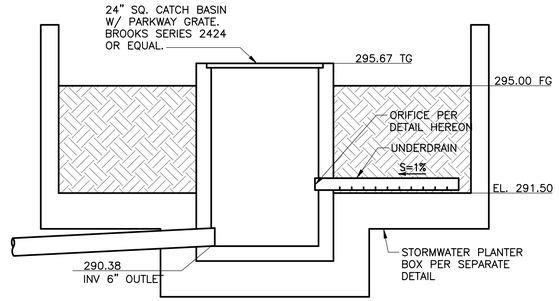
DETAIL
VERTICAL PIPE OUTLET WITH RIP RAP PAD
SCALE: 1/4" = 1'-0"



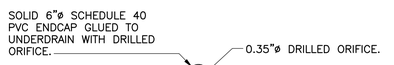
DETAIL PLANTER BOX
BIO-1: BIO-RETENTION PLANTER
NOT TO SCALE



ORIFICE DETAIL



DETAIL
1B FLOW CONTROL / DETENTION CATCH BASIN
NOT TO SCALE



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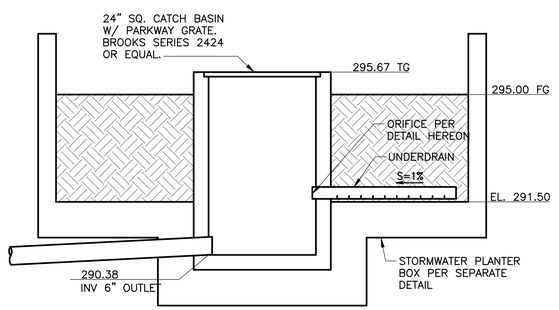

DETAIL
1B FLOW CONTROL / DETENTION CATCH BASIN
NOT TO SCALE

PLANS PREPARED BY:
TOAL ENGINEERING, INC.
CIVIL ENGINEERING
LAND SURVEYING
STORMWATER QUALITY
139 Avenida Navarro
San Clemente, CA 92672
949.492.8586
www.toalengineering.com

REGISTERED PROFESSIONAL ENGINEER
CALEB RIOS
No. 57587
CIVIL
STATE OF CALIFORNIA

CALEB RIOS
R.C.E. 57587
DATE:

PREPARED FOR:
KEVIN AARONSON

REVISIONS | BY | DATE | APP'D. | DATE

AARONSON RESIDENCE
WATER QUALITY MANAGEMENT PLAN (WQMP) SITE PLAN
LOTS 11-15, BLOCK 6, LOMA TRACT
2354 SAN CLEMENTE, LAGUNA BEACH CA

DATE: 12/27/18	H. SCALE: 1"=8'
SURVEY DATE: 10/01/18	V. SCALE: N/A
DRN.: O.R.	DWG. NO. 1
CHD.: C.R.	
APPD.: C.R.	
JOB NO. 18156	SHEET 1 OF 1

12/27/2018 3:01:44 PM N:\18\xx\18156\Reports\WQMP\18156-WQMP-SITE-PLAN.dwg

4.2 Overall Site Design BMPs

Minimize Impervious Area:
Driveway and walkways designed to minimum widths. Utilized multi-floor building to minimize building footprint.

Maximize Natural Infiltration Capacity:
N/A due to the steep topography and geotechnical hazards related to infiltration for the project site.

Preserve Existing Drainage Patterns and Time of Concentration:
The ultimate point of discharge is the same for the pre- and post-development conditions. Time of concentration is reduced by the project as a necessary consequence of proper drainage design on the steep slopes. Site discharge is limited to pre-development rates per SOHM requirements.

Disconnect Impervious Areas:
Pervious areas are distributed throughout the project. Hardscape areas are designed to drain to landscape areas where practicable; however, priority is given in the drainage design to protect foundations and other structures from the effects of runoff, including maintenance considerations.

Protect Existing Vegetation and Sensitive Areas:
Existing vegetation on sloped areas beyond the project limits shall remain untouched.

Revegetate Disturbed Areas:
There are no proposed sloped areas on the project. Any disturbed slope area shall be revegetated with native, drought-tolerant plant species in accordance with the project landscape plan. Vegetation shall comply with the City's Water Efficient Landscape Ordinance 9.55.020 (drought tolerant species with low water use).

Soil Stockpiling and Site Generated Organics:
Soils harvested during remedial grading shall be checked by the geotechnical engineer of record and designated for on-site use to the maximum extent feasible for revegetation purposes.

Firescaping:
Proposed landscape plant palette shall incorporate plants appropriate for the zone(s) around the development in an effort to mitigate fire risk to the maximum extent practicable.

Water Efficient Landscaping:
Plant materials on the disturbed slope areas shall consist of drought-tolerant species with limited irrigation requirements. Irrigation will be used only temporarily on the slopes to establish vegetation immediately after planting.

Slopes and Channel Buffers:

For planting, see Water Efficient Landscaping above. Additionally, drainage devices are proposed around the development area to capture storm runoff and avoid water flowing over slopes.

4.3 DMA Characteristics and Site Design BMPs

4.3.1 DMA-1A

Location:
DMA-1A includes the driveway, and portion of the residential building and hardscape improvements.

Area:
DMA-1A measures 4,058 sq. ft. (0.093 ac) with an impervious area of 78.5 percent.

Topographic Features and Drainage Pattern:
Runoff within DMA-1A is collected by a series of roof gutters and drain inlets, and conveyed via underground drain pipes to bioretention planter box 1A. Treated runoff is then discharged directly to the natural Drainage course at the bottom of the rear slope that discharges to Glenneyre Street.

BMP Locations/Placement:
The LID Bioretention planter box BMP is located along the northwesterly side of the project; this location was selected to avoid conflicts with footings, residential area and slope.

Land Uses and Pollutant-Generating Activities:
Residential development. See Table in Section 3.4 for expected project pollutants for this type of development.

Site Design BMPs:
HSCs were considered for this DMA, but were not implemented due to infiltration infeasibility, topography constraints related to the hillside and slopes, and architectural design considerations related to the roof.

Infiltration Feasibility:
See Worksheet 1 for the entire project in Attachment G. As shown thereon, and discussed earlier in Sections 3.1.2.4 and 3.2.3., infiltration is not feasible for this project.

Harvested Stormwater Demand and Feasibility:
As discussed earlier in Section 3.2.3, Harvest and Use is not feasible for this project. On-site pervious areas do not generate sufficient irrigation demand, as these areas are to be planted with native, drought tolerant species and will not be irrigated after vegetation has been initially established. A LID BMP that can fully address the runoff from this DMA was selected instead.

4.3.2 DMA-1B

Location:
DMA-1B includes portions of the residential building and hardscape improvements.

Area:
DMA-1B measures 2,410 sq. ft. (0.055 ac) with an impervious area of 78.2 percent.

Topographic Features and Drainage Pattern:
Runoff within DMA-1B is collected by a series of roof gutters and drain inlets, and conveyed via underground drain pipes to bioretention planter box 1B. Treated runoff is then discharged directly to the natural Drainage course at the bottom of the rear slope that discharges to Glenneyre Street.

BMP Locations/Placement:
The LID Bioretention planter box BMP is located along the northwesterly side of the project; this location was selected to avoid conflicts with footings, residential area and slope.

Land Uses and Pollutant-Generating Activities:
Residential development. See Table in Section 3.4 for expected project pollutants for this type of development.

Site Design BMPs:
HSCs were considered for this DMA, but were not implemented due to infiltration infeasibility, topography constraints related to the hillside and slopes, and architectural design considerations related to the roof.

Infiltration Feasibility:
See Worksheet 1 for the entire project in Attachment G. As shown thereon, and discussed earlier in Sections 3.1.2.4 and 3.2.3., infiltration is not feasible for this project.

Harvested Stormwater Demand and Feasibility:
As discussed earlier in Section 3.2.3, Harvest and Use is not feasible for this project. On-site pervious areas do not generate sufficient irrigation demand, as these areas are to be planted with native, drought tolerant species and will not be irrigated after vegetation has been initially established. A LID BMP that can fully address the runoff from this DMA was selected instead.

4.3.3 DMA Summary

Drainage Management Areas				
DMA (Number/Description)	Total Area (acres)	Imperviousness (%)	Infiltration Feasibility Category (Full, Partial, or No Infiltration)	Hydrologic Source Controls Used
DMA-1A: On-site Buildings, driveway, and hardscapes	0.093	78.5	No Infiltration	None
DMA-1B: On-site Buildings, and hardscapes	0.055	78.2	No infiltration	None

4.4 Source Control BMPs

Non-Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**Reason Source Control is Not Applicable**
		Included	**Not Applicable**	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No hazardous materials onsite.
N6	Local Industrial Permit Compliance	☐	☒	Not an industrial project.
N7	Spill Contingency Plan	☐	☒	No bulk storage of chemicals.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tanks.
N9	Hazardous Materials Disclosure Compliance	☐	☒	No bulk storage of hazardous materials on-site.
N10	Uniform Fire Code Implementation	☐	☒	No bulk storage of hazardous materials on-site.
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	
N13	Housekeeping of Loading Docks	☐	☒	N/A – residential development.
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☐	☒	N/A – single-family residential
N16	Retail Gasoline Outlets	☐	☒	Not a retail gasoline outlet.

N1 - Education for Property Owners, Tenants, and Occupants

Property owner(s) shall read and be familiar with this WQMP. The owner and occupants shall take an active role in promoting water quality (i.e. proper disposal of trash/waste, avoiding non-stormwater discharges, etc.). For more information, visit: http://ocwatersheds.com/publiced

N2 – Activity Restrictions

Outdoor activities are anticipated to be limited at this residential site, but the following items shall be taken into consideration:

- Avoid hosing down driveways and walkways; sweep the surfaces and properly dispose of collected debris, as needed.
- Wash water from any cleaning activities shall be contained and not directed to the storm drain.

N3 - Common Area Landscape Management

Property landscape management will be done under the supervision of the Owner. Plant material shall be selected with consideration taken for minimizing water and fertilizer requirements. Maintenance personnel shall be instructed to minimize irrigation, maintain the irrigation system in proper working condition, and keep inlet grates clear of debris. Maintenance shall be consistent with provisions of the Conservation Resolution and County Management Guidelines, EPA Preventing Pollution through Efficient Water Use, and Proper Use of Fertilizer and Pesticides.

N4-BMP Maintenance

See Inspection and Maintenance Responsibility & Frequency Plan in Attachment B.

N11 - Litter Control

Litter within the boundaries of the subject property will be cleaned up by the owner or contracted maintenance company under the supervision of the property owner. Collected debris shall be placed in the appropriate waste container for off-site disposal or recycling.

N12 – Employee Training

All contracted landscape and maintenance personnel shall read and be familiar with this WQMP. A copy should be made available at time of hire, and subsequently accessible for the duration of the service contract. Discussions between property owner and maintenance personnel, regarding onsite water quality expectations, shall take place on an annual basis. See also link in N1 above.

N14 - Catch Basin Inspection

Drain inlets, catch basins, surface gutters, and outlets shall be inspected and cleaned prior to the rainy season (October 1st) each year.

Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**Reason Source Control is Not Applicable**
		Included	**Not Applicable**	
S1	Provide storm drain system stenciling and signage	☐	☒	Private residence
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	No significant outdoor material storage areas.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	☒	☐	
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☐	☒	Drainage devices provided upstream of proposed improvements. No project runoff is discharged onto slopes.
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☐	
S6	Dock areas	☐	☒	No dock areas.
S7	Maintenance bays	☐	☒	No maintenance bays.
S8	Vehicle wash areas	☐	☒	No vehicle wash areas.
S9	Outdoor processing areas	☐	☒	No outdoor processing areas.
S10	Equipment wash areas	☐	☒	No equipment wash areas.
S11	Fueling areas	☐	☒	No fueling areas.
S12	Hillside landscaping	☒	☐	
S13	Wash water control for food preparation areas	☐	☒	Single-family residence.
S14	Community car wash racks	☐	☒	Not a commercial car wash.

S3

The trash area is located at the Southwest corner of the residence, adjacent to the parking garage entrance. The ground around the trash area shall be kept clear of loose debris, and the lids to all containers shall remain closed when not in use.

S4

The irrigation system is to be designed and constructed to facilitate irrigation and avoid over-watering. The use of an automated timer system will control valve run times, and low precipitation heads will minimize the amount of water entering the landscape areas. The system shall be equipped with a moisture detection system and/or rain shut-off trigger(s) to avoid unnecessary irrigation. The use of drought-tolerant plant materials, and the grouping of different species with similar watering requirements, will help to reduce the amount of irrigation needed to maintain

healthy vegetation on-site. The property owner shall refer to the "Water Quality Guidelines for Landscaping and Gardening" (see Educational Materials attachments) for additional information.

S12

The sloped areas within the limits of this project shall be revegetated with native, drought-tolerant plant material. Temporary irrigation will be used until the vegetation on the slope has been established, at which point the irrigation system will be turned off.

Section 5 Low Impact Development BMPs

5.1 LID BMPs in DMA-1A

Infiltration is not feasible for this project due to: 1) the close proximity of on-site slopes steeper than 15%; 2) the geotechnical hazards created by any proposed infiltration.

Harvest and Use is not feasible for this project due to insufficient irrigation demand from the conservation landscaping proposed throughout the development. The majority of the available landscape area will be planted with native, drought tolerant species and will not be irrigated. The total non-irrigated on-site landscape area = 750 sf (0.017 c). The irrigated on-site landscape area = 138 sf (0.003 ac). This irrigated area creates a negligible amount of daily demand as shown in the calculation below. A Harvest and Reuse Cistern for 2.1 Gallons/day is not feasible.

Per TGD Section F.2.5.3

Modified EAWU Daily Average Irrigation Demand in Laguna Beach= 680 gpd / Irrigated Acre x 0.003 Acre

EAWU = 2.1 Gallons/Day

This DMA will utilize a LID BMP with no infiltration. BMP selection is subject to space constraints resulting from the proposed residential buildings, the driveway, and the various site walls throughout which require footings, ect for design.

5.1.1 Hydrologic Source Controls for DMA-1A

Impervious area dispersion is a site design consideration for the drainage layout, however, priority is given to proper collection and conveyance of storm water away from buildings and structures. Use of this HSC BMP within DMA-1A does not qualify for a reduction toward control of the DCV, thus Worksheet 4 is not provided herewith.

5.1.2 Structural LID BMP for DMA-1A

BMP Type:

DMA-1A is categorized as "bioretention with underdrain." The selected LID BMP for this DMA is a Bio retention (bio infiltration with underdrain) BMP BIO-6. (see ATTACHMENT E for BIO-6 fact sheet)

BMP Sizing:

Sizing of "bioretention with underdrain" BMPs utilizes Worksheet 8 (see Attachment E).

BMP Design:

$DCV = C \times d \times A$

$C = (0.75 \times imp + 0.15)$ where: $imp = 0.785$

$d = 0.75\ inches$

$A = 0.093\ ac.$

$DCV = 0.74$ x 0.75 x 0.093 x 43,560 x $\left(1\ in. - 12\ ft.\right)$ → **DCV =187 c.f. "See Worksheet 8 for calculation"**

5.2 LID BMPs in DMA-1B

Infiltration is not feasible for this project due to: 1) the close proximity of on-site slopes steeper than 15%; 2) the geotechnical hazards created by any proposed infiltration.

Harvest and Use is not feasible for this project due to insufficient irrigation demand from the conservation landscaping proposed throughout the development. The majority of the available landscape area will be planted with native, drought tolerant species and will not be irrigated. The total non-irrigated on-site landscape area = 450 sf (0.010 c). The irrigated on-site landscape area = 76 sf (0.002 ac). This irrigated area creates a negligible amount of daily demand as shown in the calculation below. A Harvest and Reuse Cistern for 1.4 Gallons/day is not feasible.

Per TGD Section F.2.5.3

Modified EAWU Daily Average Irrigation Demand in Laguna Beach= 680 gpd / Irrigated Acre x 0.002 Acre

EAWU = 1.4 Gallons/Day

This DMA will utilize an LID BMP with no infiltration. BMP selection is subject to space constraints resulting from the proposed residential buildings, the driveway, and the various site walls throughout which require footings, ect for design.

5.2.1 Hydrologic Source Controls for DMA-1B

Impervious area dispersion is a site design consideration for the drainage layout, however, priority is given to proper collection and conveyance of storm water away from buildings and structures. Use of this HSC BMP within DMA-1A does not qualify for a reduction toward control of the DCV, thus Worksheet 4 is not provided herewith.

5.2.2 Structural LID BMP for DMA-1B

BMP Type:

DMA-1B is categorized as "bioretention with underdrain." The selected LID BMP for this DMA is a Bio retention (bio infiltration with underdrain) BMP BIO-6. (see ATTACHMENT E for BIO-6 fact sheet)

BMP Sizing:

Sizing of "bioretention with underdrain" BMPs utilizes Worksheet 8 (see Attachment E).

BMP Design:

$DCV = C \times d \times A$

$C = (0.75 \times imp + 0.15)$ where: $imp = 0.782$

$d = 0.75\ inches$

$A = 0.055\ ac.$

$DCV = 0.736$ x 0.75 x 0.055 x 43,560 x $\left(1\ in. - 12\ ft.\right)$ → **DCV =110.3 c.f. "See Worksheet 8 for calculation"**

5.3 Summary of LID BMPs

DMA	DMA-1A	DMA-1B
BMP Type	Bio retention planter box with underdrain	Bio retention planter box with underdrain
DCV	187 cu-ft	110.3 cu-ft
$A_{bmp\text{-}eff}$	89 sq-ft	52.5 sq-ft
$V_{media\text{-}retain}$	17.8 cu-ft	10.5 cu-ft
$V_{biofilter\text{-}storage\text{-}req}$	126.9 cu-ft	74.8 cu-ft
$V_{biofilter\text{-}storage}$	148.4 cu-f	87.4 cu-ft
Sizing Criteria Met	YES	YES

Section 6 Hydromodification BMPs

Hydromodification Control BMPs	
BMP Name	**BMP Description**
BIO-6 Bioretention Planter boxes with underdrain	Bioretention with underdrains (Flow through planter boxes). This BMP functions as a soil and plant-based filtration device and also as a stormwater retention device.

Per the SOHM software the required planter box sizes required to meet the hydromodification requirements are:

DMA-1A

Minimum planter box surface area required= 238 s.f.

Planter box surface area provided = 238 s.f. .... OK

Minimum Ponding Depth required= 8 inches = Ponding Depth provided .... OK

DMA-1B

Minimum planter box surface area required: 140 s.f.

Planter box surface area provided: 140 s.f. .... OK

Ponding Depth required: 8 inches = Ponding Depth provided ..... OK

(Please see Attachment C for the full SOHM report that contains all the hydromodification calculations and details)

Section 7 Educational Materials Index

Educational 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	☒	Compliance BMPs for Mobile Businesses	☐
Proper Disposal of Household Hazardous Waste	☒	**Other Material**	**Check If Attached**
Recycle at Your Local Used Oil Collection Center (North County)	☐		
Recycle at Your Local Used Oil Collection Center (Central County)	☐	Tips for Pool Maintenance	☒
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 Projects Using Paint	☐		☐

ATTACHMENT A
Educational Materials

Did You Know?

- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution is sometimes called "non-point source" pollution.
- There are two types of non-point source pollution: stormwater and urban runoff
- Stormwater runoff results from rainfall. When rainstorms cause large volumes of water to rinse the urban landscape, picking up pollutants along the way.
- Urban runoff can happen any time of the year when excessive water use from irrigation, vehicle washing and other sources carries trash, lawn clippings and other urban pollutants into storm drains.

Where Does It Go?

- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer systems; unlike water in sanitary sewers (from sinks or toilets), water in storm drains is not treated before entering our waterways.

Sources of Non-Point Source Pollution

- Automotive leaks and spills.
- Improper disposal of used oil and other engine fluids.
- Metals found in vehicle exhaust, weathered paint, rust, metal plating and tires.
- Pesticides and fertilizers from lawns, gardens and farms.
- Improper disposal of cleaners, paint and paint removers.
- Soil erosion and dust debris from landscape and construction activities.
- Litter, lawn clippings, animal waste, and other organic matter.
- Oil stains on parking lots and paved surfaces.

The Effect on the Ocean

Non-point source pollution can have a serious impact on water quality in Orange County. Pollutants from the storm drain system can harm marine life as well as coastal and wetland habitats. They can also degrade recreation areas such as beaches, harbors and bays.

Stormwater quality management programs have been developed throughout Orange County to educate and encourage the public to protect water quality, monitor runoff in the storm drain system, investigate illegal dumping and maintain storm drains.

Support from Orange County residents and businesses is needed to improve water quality and reduce urban runoff pollution. Proper use and disposal of materials will help stop pollution before it reaches the storm drain and the ocean.

The Ocean Begins at Your Front Door

Even if you live miles from the Pacific Ocean, you may be unknowingly polluting it.

Dumping one quart of motor oil into a storm drain can contaminate 250,000 gallons of water.

PROJECT Pollution PREVENTION

For More Information

California Environmental Protection Agency
www.calepa.ca.gov

- **Air Resources Board**
  www.arb.ca.gov
- **Department of Pesticide Regulation**
  www.cdpr.ca.gov
- **Department of Toxic Substances Control**
  www.dtsc.ca.gov
- **Integrated Waste Management Board**
  www.ciwmb.ca.gov
- **Office of Environmental Health Hazard Assessment**
  www.oehha.ca.gov
- **State Water Resources Control Board**
  www.waterboards.ca.gov

Earth 911 - Community-Specific Environmental Information 1-800-cleanup or visit www.1800cleanup.org

Health Care Agency's Ocean and Bay Water Closure and Posting Hotline
(714) 433-6400 or visit www.ocbeachinfo.com

Integrated Waste Management Dept. of Orange County (714) 834-6752 or visit www.oclandfills.com for information on household hazardous waste collection centers, recycling centers and solid waste collection

O.C. Agriculture Commissioner
(714) 447-7100 or visit www.ocagcomm.com

Stormwater Best Management Practice Handbook
Visit www.cabmphandbooks.com

UC Master Gardener Hotline
(714) 708-1646 or visit www.uccemg.com

The Orange County Stormwater Program has created and moderates an electronic mailing list to facilitate communications, take questions and exchange ideas among its users about issues and topics related to stormwater and urban runoff and the implementation of program elements. To join the list, please send an email to ocstormwaterinfo-join@list.ocwatersheds.com

Orange County Stormwater Program

Aliso Viejo	(949)	425-2535
Anaheim Public Works Operations	(714)	765-6860
Brea Engineering	(714)	990-7666
Buena Park Public Works	(714)	562-3655
Costa Mesa Public Services	(714)	754-5323
Cypress Public Works	(714)	229-6740
Dana Point Public Works	(949)	248-3584
Fountain Valley Public Works	(714)	593-4441
Fullerton Engineering Dept.	(714)	738-6853
Garden Grove Public Works	(714)	741-5956
Huntington Beach Public Works	(714)	536-5431
Irvine Public Works	(949)	724-6315
La Habra Public Services	(562)	905-9792
La Palma Public Works	(714)	690-3310
Laguna Beach Water Quality	(949)	497-0378
Laguna Hills Public Services	(949)	707-2650
Laguna Niguel Public Works	(949)	362-4337
Laguna Woods Public Works	(949)	639-0500
Lake Forest Public Works	(949)	461-3480
Los Alamitos Community Dev.	(562)	431-3538
Mission Viejo Public Works	(949)	470-3056
Newport Beach, Code & Water Quality Enforcement	(949)	644-3215
Orange Public Works	(714)	532-6480
Placentia Public Works	(714)	993-8245
Rancho Santa Margarita	**(949)**	**635-1800**
San Clemente Environmental Programs	**(949)**	**361-6143**
San Juan Capistrano Engineering	**(949)**	**234-4413**
Santa Ana Public Works	**(714)**	**647-3380**
Seal Beach Engineering	**(562)**	**431-2527 x317**
Stanton Public Works	**(714)**	**379-9222 x204**
Tustin Public Works/Engineering	**(714)**	**573-3150**
Villa Park Engineering	**(714)**	**998-1500**
Westminster Public Works/Engineering	**(714)**	**898-3311 x446**
Yorba Linda Engineering	**(714)**	**961-7138**
Orange County Stormwater Program	**(877)**	**897-7455**

Orange County 24-Hour Water Pollution Problem Reporting Hotline 1-877-89-SPILL (1-877-897-7455)

On-line Water Pollution Problem Reporting Form
www.ocwatersheds.com

Printed on Recycled Paper

The Ocean Begins at Your Front Door

Never allow pollutants to enter the street, gutter or storm drain!

Follow these simple steps to help reduce water pollution:

Household Activities

- Do not rinse spills with water. Use dry cleanup methods such as applying cat litter or another absorbent material, sweep and dispose of in the trash. Take items such as used or excess batteries, oven cleaners, automotive fluids, painting products and cathode ray tubes, like TVs and computer monitors, to a Household Hazardous Waste Collection Center (HHWCC).
- For a HHWCC near you call (714) 834-6752 or visit www.oclandfills.com.
- Do not hose down your driveway, sidewalk or patio to the street, gutter or storm drain. Sweep up debris and dispose of it in the trash.

Automotive

- Take your vehicle to a commercial car wash whenever possible. If you wash your vehicle at home, choose soaps, cleaners, or detergents labeled non-toxic, phosphate- free or biodegradable. Vegetable and citrus-based products are typically safest for the environment.
- Do not allow washwater from vehicle washing to drain into the street, gutter or storm drain. Excess washwater should be disposed of in the sanitary sewer (through a sink or toilet) or onto an absorbent surface like your lawn.
- Monitor your vehicles for leaks and place a pan under leaks. Keep your vehicles well maintained to stop and prevent leaks.
- Never pour oil or antifreeze in the street, gutter or storm drain. Recycle these substances at a service station, a waste oil collection center or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.1800cleanup.org.

Pool Maintenance

- Pool and spa water must be dechlorinated and free of excess acid, alkali or color to be allowed in the street, gutter or storm drain.
- When it is not raining, drain dechlorinated pool and spa water directly into the sanitary sewer.
- Some cities may have ordinances that do not allow pool water to be disposed of in the storm drain. Check with your city.

Landscape and Gardening

- Do not over-water. Water your lawn and garden by hand to control the amount of water you use or set irrigation systems to reflect seasonal water needs. If water flows off your yard onto your driveway or sidewalk, your system is over-watering. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of waste by composting, hauling it to a permitted landfill, or as green waste through your city's recycling program.
- Follow directions on pesticides and fertilizer, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Take unwanted pesticides to a HHWCC to be recycled. For locations and hours of HHWCC, call (714) 834-6752 or visit www.oclandfills.com.

Trash

- Place trash and litter that cannot be recycled in securely covered trash cans.
- Whenever possible, buy recycled products.
- Remember: Reduce, Reuse, Recycle.

Pet Care

- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash. Pet waste, if left outdoors, can wash into the street, gutter or storm drain.
- If possible, bathe your pets indoors. If you must bathe your pet outside, wash it on your lawn or another absorbent/permeable surface to keep the washwater from entering the street, gutter or storm drain.
- Follow directions for use of pet care products and dispose of any unused products at a HHWCC.

Common Pollutants

Home Maintenance

- Detergents, cleaners and solvents
- Oil and latex paint
- Swimming pool chemicals
- Outdoor trash and litter

Lawn and Garden

- Pet and animal waste
- Pesticides
- Clippings, leaves and soil
- Fertilizer

Automobile

- Oil and grease
- Radiator fluids and antifreeze
- Cleaning chemicals
- Brake pad dust

Do your part to prevent water pollution in our creeks, rivers, bays and ocean.

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, not properly disposing of household hazardous waste can lead to water pollution. Batteries, electronics, paint, oil, gardening chemicals, cleaners and other hazardous materials cannot be thrown in the trash. They also must never be poured or thrown into yards, sidewalks, driveways, gutters or streets. Rain or other water could wash the materials into the storm drain and eventually into our waterways and the ocean. In addition, hazardous waste must not be poured in the sanitary sewers (sinks and toilets).

NEVER DISPOSE OF HOUSEHOLD HAZARDOUS WASTE IN THE TRASH, STREET, GUTTER, STORM DRAIN OR SEWER.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

To Report Illegal Dumping of Household Hazardous Waste call 1-800-69-TOXIC

To report a spill, call the **Orange County 24-Hour Water Pollution Problem Reporting Hotline 1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

RECYCLE USED OIL

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Proper Disposal of Household Hazardous Waste

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

ORANGE COUNTY

Pollution Prevention

Leftover household products that contain corrosive, toxic, ignitable, or reactive ingredients are considered to be "household hazardous waste" or "HHW." HHW can be found throughout your home, including the bathroom, kitchen, laundry room and garage.

WHEN POSSIBLE, USE NON-HAZARDOUS OR LESS-HAZARDOUS PRODUCTS.

Disposal of HHW down the drain, on the ground, into storm drains, or in the trash is illegal and unsafe.

Proper disposal of HHW is actually easy. Simply drop them off at a Household Hazardous Waste Collection Center (HHWCC) for free disposal and recycling. Many materials including anti-freeze, latex-based paint, motor oil and batteries can be recycled. Some centers have a "Stop & Swap" program that lets you take partially used home, garden, and automobile products free of charge. There are four HHWCCs in Orange County:

Anaheim:.....1071 N. Blue Gum St
Huntington Beach:.....17121 Nichols St
Irvine:..... 6411 Oak Canyon
San Juan Capistrano:... 32250 La Pata Ave

Centers are open Tuesday-Saturday, 9 a.m.-3 p.m. Centers are closed on rainy days and major holidays. For more information, call **(714) 834-6752** or visit **www.oclandfills.com.**

Common household hazardous wastes

- Batteries
- Paint and paint products
- Adhesives
- Drain openers
- Household cleaning products
- Wood and metal cleaners and polishes
- Pesticides
- Fungicides/wood preservatives
- Automotive products (antifreeze, motor oil, fluids)
- Grease and rust solvents
- Fluorescent lamps
- Mercury (thermometers & thermostats)
- All forms of electronic waste including computers and microwaves
- Pool & spa chemicals
- Cleaners
- Medications
- Propane (camping & BBQ)
- Mercury-containing lamps
- Television & monitors (CRTs, flatscreens)

Tips for household hazardous waste

- Never dispose of HHW in the trash, street, gutter, storm drain or sewer.
- Keep these materials in closed, labeled containers and store materials indoors or under a cover.
- When possible, use non-hazardous products.
- Reuse products whenever possible or share with family and friends.
- Purchase only as much of a product as you'll need. Empty containers may be disposed of in the trash.
- HHW can be harmful to humans, pets and the environment. Report emergencies to 911.

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Fertilizers, pesticides and other chemicals that are left on yards or driveways can be blown or washed into storm drains that flow to the ocean. Overwatering lawns can also send materials into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour gardening products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

UCCE Master Gardener Hotline: (714) 708-1646

To report a spill, call the **Orange County 24-Hour Water Pollution Problem Reporting Hotline 1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while landscaping or gardening. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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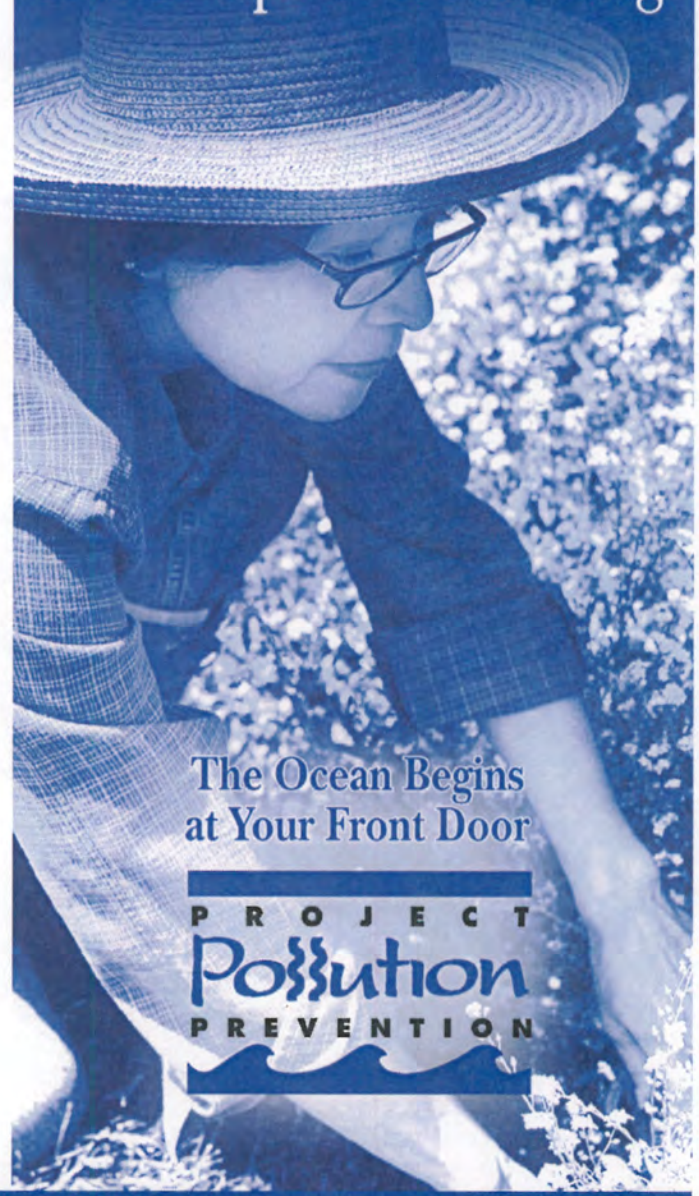
Help Prevent Ocean Pollution:

Tips for Landscape & Gardening



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Landscape & Gardening

Never allow gardening products or polluted water to enter the street, gutter or storm drain.

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.
- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.

- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro spray systems. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.

- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.

- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit **www.ipm.ucdavis.edu**.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

Household Hazardous Waste Collection Centers

Anaheim:	1071 N. Blue Gum St.
Huntington Beach:	17121 Nichols St.
Irvine:	6411 Oak Canyon
San Juan Capistrano:	32250 La Pata Ave.

For more information, call (714) 834-6752 or visit www.oclandfills.com

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Swimming pools and spas are common in Orange County, but they must be maintained properly to guarantee that chemicals aren't allowed to enter the street, where they can flow into the storm drains and then into the waterways. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump pool chemicals into the ocean, so don't let it enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

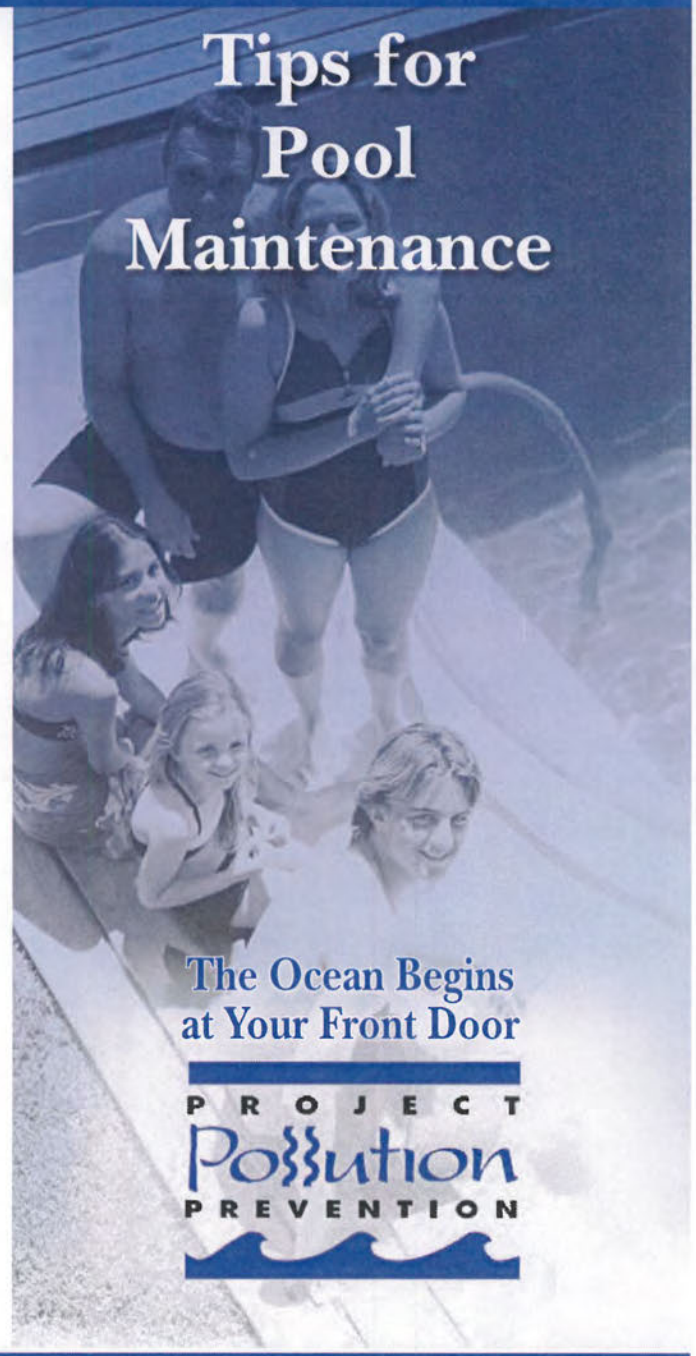
To report a spill, call the **Orange County 24-Hour Water Pollution Reporting Hotline 1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while maintaining your pool. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

Help Prevent Ocean Pollution:

Tips for Pool Maintenance



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Pool Maintenance

Many pools are plumbed to allow the pool to drain directly to the sanitary sewer. If yours is not, follow these instructions for disposing of pool and spa water.

Acceptable and Preferred Method of Disposal

When you cannot dispose of pool water in the sanitary sewer, the release of dechlorinated swimming pool water is allowed if all of these tips are followed:

- The residual chlorine does not exceed 0.1 mg/l (parts per million).
- The pH is between 6.5 and 8.5.
- The water is free of any unusual coloration, dirt or algae.
- There is no discharge of filter media.
- There is no discharge of acid cleaning wastes.
- Some cities may have ordinances that do not allow pool water to be disposed into a storm drain. Check with your city.

How to Know if You're Following the Standards

You can find out how much chlorine is in your water by using a pool testing kit. Excess chlorine can be removed by discontinuing the use of chlorine for a few days prior to discharge or by purchasing dechlorinating chemicals from a local pool supply company. Always make sure to follow the instructions that come with any products you use.

Doing Your Part

By complying with these guidelines, you will make a significant contribution toward keeping pollutants out of Orange County's creeks, streams, rivers, bays and the ocean. This helps to protect organisms that are sensitive to pool chemicals, and helps to maintain the health of our environment.

PROJECT Pollution PREVENTION

Do your part to prevent water pollution in our creeks, rivers, bays and ocean.

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common household activities can lead to water pollution if you're not careful.

Remember the Water in Your Storm Drain is Not Treated BEFORE It Enters Our Waterways

Litter, oil, chemicals and other substances that are left on your yard or driveway can be blown or washed into storm drains that flow to the ocean. Over-watering your lawn and washing your car can also flush materials into the storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated.

You would never pour soap, fertilizers or oil into the ocean, so don't let them enter streets, gutters or storm drains. Follow the easy tips in this brochure to help prevent water pollution.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

To report a spill, call the **Orange County 24-Hour Water Pollution Problem Reporting Hotline 1-877-89-SPILL** (1-877-897-7455)**.**

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while performing everyday household activities. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

GENUINE RECYCLED PAPER
50% PRE-CONSUMER AND 15% POST-CONSUMER

RECYCLE USED OIL

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Pollution Prevention

Household Activities

- **Do not rinse spills with water!** Sweep outdoor spills and dispose of in the trash. For wet spills like oil, apply cat litter or another absorbent material, then sweep and bring to a household hazardous waste collection center (HHWCC).
- Securely cover trash cans.
- Take household hazardous waste to a household hazardous waste collection center.
- Store household hazardous waste in closed, labeled containers inside or under a cover.
- Do not hose down your driveway, sidewalk or patio. Sweep up debris and dispose of in trash.
- Always pick up after your pet. Flush waste down the toilet or dispose of in the trash.
- Bathe pets indoors or have them professionally groomed.

Household Hazardous Wastes include:

- ▲ **Batteries**
- ▲ **Paint thinners, paint strippers and removers**
- ▲ **Adhesives**
- ▲ **Drain openers**
- ▲ **Oven cleaners**
- ▲ **Wood and metal cleaners and polishes**
- ▲ **Herbicides and pesticides**
- ▲ **Fungicides/wood preservatives**
- ▲ **Automotive fluids and products**
- ▲ **Grease and rust solvents**
- ▲ **Thermometers and other products containing mercury**
- ▲ **Fluorescent lamps**
- ▲ **Cathode ray tubes, e.g. TVs, computer monitors**
- ▲ **Pool and spa chemicals**

Gardening Activities

- Follow directions on pesticides and fertilizers, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Water your lawn and garden by hand to control the amount of water you use. Set irrigation systems to reflect seasonal water needs. If water flows off your yard and onto your driveway or sidewalk, your system is over-watering.
- Mulch clippings or leave them on the lawn. If necessary, dispose in a green waste container.
- Cultivate your garden often to control weeds.

Washing and Maintaining Your Car

- Take your car to a commercial car wash whenever possible.
- Choose soaps, cleaners, or detergents labeled "non-toxic," "phosphate free" or "biodegradable." Vegetable and citrus-based products are typically safest for the environment, **but even these should not be allowed into the storm drain.**
- Shake floor mats into a trash can or vacuum to clean.
- Do not use acid-based wheel cleaners and "hose off" engine degreasers at home. They can be used at a commercial facility, which can properly process the washwater.
- **Do not dump washwater onto your driveway, sidewalk, street, gutter or storm drain.** Excess washwater should be disposed of in the sanitary sewers (through a sink, or toilet) or onto an absorbent surface like your lawn.
- Use a nozzle to turn off water when not actively washing down automobile.
- Monitor vehicles for leaks and place pans under leaks. Keep your car well maintained to stop and prevent leaks.
- Use cat litter or other absorbents and sweep to remove any materials deposited by vehicles. Contain sweepings and dispose of at a HHWCC.
- Perform automobile repair and maintenance under a covered area and use drip pans or plastic sheeting to keep spills and waste material from reaching storm drains.
- **Never pour oil or antifreeze in the street, gutter or storm drains.** Recycle these substances at a service station, HHWCC, or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.ciwmb.ca.gov/UsedOil.

For locations and hours of Household Hazardous Waste Collection Centers in Anaheim, Huntington Beach, Irvine and San Juan Capistrano, call (714)834-6752 or visit www.oclandfills.com.

Did you know that just one quart of oil can pollute 250,000 gallons of water?

A clean ocean and healthy creeks, rivers, bays and beaches are important to Orange County. However, not properly disposing of used oil can lead to water pollution. If you pour or drain oil onto driveways, sidewalks or streets, it can be washed into the storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering the ocean. Help prevent water pollution by taking your used oil to a used oil collection center.

Included in this brochure is a list of locations that will accept up to five gallons of used motor oil at no cost. Many also accept used oil filters. Please contact the facility before delivering your used oil. This listing of companies is for your reference and does not constitute a recommendation or endorsement of the company.

Please note that used oil filters may not be disposed of with regular household trash. They must be taken to a household hazardous waste collection or recycling center in Anaheim, Huntington Beach, Irvine or San Juan Capistrano. For information about these centers, visit www.oclandfills.com.

Please do not mix your oil with other substances!

For more information, please call the Orange County Stormwater Program at 1-877-89-SPILL (1-877-897-7455) **or visit www.watersheds.com.**

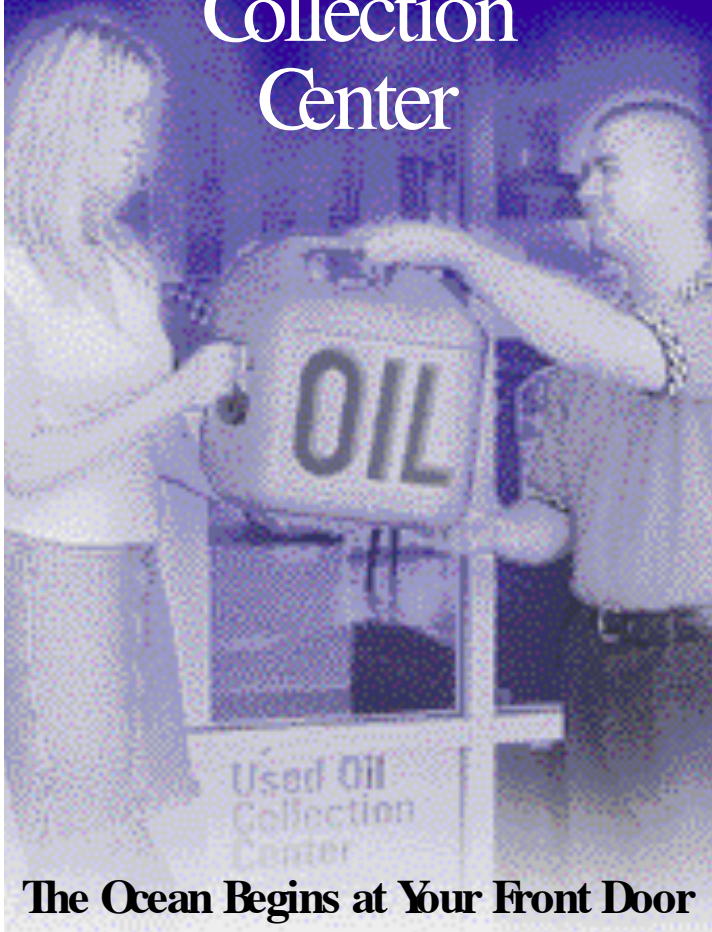
For information about the proper disposal of household hazardous waste, call the Household Waste Hotline at (714) 834-6752 or visit www.oclandfills.com.

RECYCLE USED OIL

For additional information about the nearest oil recycling center, call the Used Oil Program at 1-800-CLEANUP or visit www.cleanup.org.

Help Prevent Ocean Pollution:

Recycle at Your Local Used Oil Collection Center



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

SOUTH COUNTY

Used Oil Collection Centers

ALISO VIEJO

Big O Tires
27812 Aliso Creek Rd, Suite E-100
(949) 362-4225

Econo Lube N' Tune
22932 Glenwood Dr.
(949) 643-9667

Jiffy Lube
27832 Aliso Creek Road
(949) 362-0005

Pep Boys
26881 Aliso Creek Road
(949) 362-9254

DANA POINT

Dana Point Fuel Dock
34661 Puerto Pl. (949) 496-6113

EZ Lube Inc.
34242 Doheny Park Rd.
(949) 477-1223

FOOTHILL RANCH

USA Express Tire & Service
26492 Town Center Dr.
(714) 826-1001

LAGUNA BEACH

USA Express Tire & Service Inc.
350 Broadway (949) 494-7111

LAKE FOREST

Big O Tires
20742 Lake Forest Dr.
(949) 443-4155

EZ Lube
26731 Rancho Parkway
(949) 465-9912

Firestone Store
24421 Rockfield Blvd.
(949) 581-2660

Jiffy Lube
20781 Lake Forest Dr.
(949) 583-0470

Kragen Auto Parts
24601 Raymond Way
(949) 829-8292

Pep Boys
22671 Lake Forest Dr.
(949) 855-9593

Ryan's Foothill Ranch Transmission
20622 Pascal Way (949) 770-6888

USA Express Tire & Service
24561 Trabuco Rd (949) 454-8001

LAGUNA NIGUEL

Econo Lube N Tune
27912 Forbes Rd. (949) 364-5833

Laguna Niguel Auto Center
26042 Cape Dr. #12
(949) 582-2191

LAGUNA HILLS

David J Phillips Buick
24888 Alicia Pkwy.
(949) 831-0434

EZ Lube
24281 Moulton Pkwy.
(949) 830-9840

EZ Lube
26921 Moulton Pkwy.
(949) 751-3436

Kragen Auto Parts
26562 Moulton Ave.
(949) 831-0434

Firestone Store
24196 Laguna Hills Mall
(949) 581-4700

MISSION VIEJO

AAA Complete Auto Care & Tire
27913 Center Street
(949) 347-8200

Autobahn West
25800 Jeronimo Rd. Suite 401
(949) 770-2312

Auto Zone
22942 Los Alisos (949) 830-8181

Econo Lube & Tune
25902 El Paseo (949) 582-5483

Jiffy Lube
27240 La Paz Rd. (949) 455-0470

Kragen Auto Parts
24510 Alicia Pkwy. (949) 951-9175

Mission Viejo Chevron
27742 Crown Vly. Pkwy.
(949) 364-0137

Oilmax 10 Minute Lube
25800 Jeronimo Rd. #300
(949) 859-9271

Ramona Auto Service
27210 La Paz Rd. (949) 583-1233

RANCHO SANTA MARGARITA

Jiffy Lube
23401 Antonio Parkway
(949) 589-7447

SAN CLEMENTE

EZ Lube
525 Avenida Pico (949) 940-1850

Kragen Auto Parts
1113 S. El Camino Real
(949) 492-9850

Kragen Auto Parts
400 Camino de Estrella
(949) 240-9195

San Clemente Car Wash & Oil
1731 N. El Camino Real
(949) 847-4924

SAN JUAN CAPISTRANO

Saturn of San Juan Capistrano
33033 Camino Capistrano
(949) 248-5411

Texaco Xpress Lube
27201 Ortega Hwy.
(949) 489-8008

This information was provided by the County of Orange Integrated Waste Management Department and the California Integrated Waste Management Board (CIWMB).

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as pest control can lead to water pollution if you're not careful. Pesticide treatments must be planned and applied properly to ensure that pesticides do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump pesticides into the ocean, so don't let it enter the storm drains. Pesticides can cause significant damage to our environment if used improperly. If you are thinking of using a pesticide to control a pest, there are some important things to consider.

For more information,
please call
University of California Cooperative
Extension Master Gardeners at
(714) 708-1646
or visit these Web sites:
www.uccemg.org
www.ipm.ucdavis.edu

For instructions on collecting a specimen sample visit the Orange County Agriculture Commissioner's website at:
http://www.ocagcomm.com/ser_lab.asp

To report a spill, call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline at 1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

Information From:
Cheryl Wilen, Area IPM Advisor; Darren Haver, Watershed Management Advisor; Mary Louise Flint, IPM Education and Publication Director; Pamela M. Geisel, Environmental Horticulture Advisor; Carolyn L. Unruh, University of California Cooperative Extension staff writer. Photos courtesy of the UC Statewide IPM Program and Darren Haver.

Funding for this brochure has been provided in full or in part through an agreement with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Prop. 13).

Printed on Recycled Paper

Help Prevent Ocean Pollution:

Responsible Pest Control

Tips for Pest Control

Key Steps to Follow:

Step 1: Correctly identify the pest (insect, weed, rodent, or disease) and verify that it is actually causing the problem.

Three life stages of the common lady beetle, a beneficial insect.

This is important because beneficial insects are often mistaken for pests and sprayed with pesticides needlessly.

Consult with a Certified Nursery Professional at a local nursery or garden center or send a sample of the pest to the Orange County Agricultural Commissioner's Office.

Determine if the pest is still present – even though you see damage, the pest may have left.

Step 2: Determine how many pests are present and causing damage.

Small pest populations may be controlled more safely using non-pesticide techniques. These include removing food sources, washing off leaves with a strong stream of water, blocking entry into the home using caulking and replacing problem plants with ones less susceptible to pests.

Integrated Pest Management (IPM) usually combines several least toxic pest control methods for long-term prevention and management of pest problems without harming you, your family, or the environment.

UC CE University of California Cooperative Extension

Step 3: If a pesticide must be used, choose the least toxic chemical.

Obtain information on the least toxic pesticides that are effective at controlling the target pest from the UC Statewide Integrated Pest Management (IPM) Program's Web site at www.ipm.ucdavis.edu.

Seek out the assistance of a Certified Nursery Professional at a local nursery or garden center when selecting a pesticide. Purchase the smallest amount of pesticide available.

Apply the pesticide to the pest during its most vulnerable life stage. This information can be found on the pesticide label.

Step 4: Wear appropriate protective clothing.

Follow pesticide labels regarding specific types of protective equipment you should wear. Protective clothing should always be washed separately from other clothing.

Step 5: Continuously monitor external conditions when applying pesticides such as weather, irrigation, and the presence of children and animals.

Never apply pesticides when rain is predicted within the next 48 hours. Also, do not water after applying pesticides unless the directions say it is necessary.

Apply pesticides when the air is still; breezy conditions may cause the spray or dust to drift away from your targeted area.

In case of an emergency call 911 and/or the regional poison control number at (714) 634-5988 or (800) 544-4404 (CA only).

For general questions you may also visit www.calpoison.org.

Step 6: In the event of accidental spills, sweep up or use an absorbent agent to remove any excess pesticides. Avoid the use of water.

Be prepared. Have a broom, dust pan, or dry absorbent material, such as cat litter, newspapers or paper towels, ready to assist in cleaning up spills.

Contain and clean up the spill right away. Place contaminated materials in a doubled plastic bag. All materials used to clean up the spill should be properly disposed of according to your local Household Hazardous Waste Disposal site.

Step 7: Properly store and dispose of unused pesticides.

Purchase Ready-To-Use (RTU) products to avoid storing large concentrated quantities of pesticides.

Store unused chemicals in a locked cabinet.

Unused pesticide chemicals may be disposed of at a Household Hazardous Waste Collection Center.

Empty pesticide containers should be triple rinsed prior to disposing of them in the trash.

Household Hazardous Waste Collection Center
(714) 834-6752
www.oclandfills.com

PROJECT Pollution PREVENTION

The Pollution Solution

Several residential activities can result in water pollution. Among these activities are car washing and hosing off driveways and sidewalks. Both activities can waste water and result in excess runoff. Water conservation methods described in this pamphlet can prevent considerable amounts of runoff and conserve water. By taking your car to a commercial car wash and by sweeping driveways and sidewalks, you can further prevent the transport of pollutants to Orange County waterways. Here are some of the common pollutants for which you can be part of the solution:

1 Pesticides and Fertilizer

- **Pollution:** The same pesticides that are designed to be toxic to pests can have an equally lethal impact on our marine life. The same fertilizer that promotes plant growth in lawns and gardens can also create nuisance algae blooms, which remove oxygen from the water and clog waterways when it decomposes.

- **Solution:** Never use pesticides or fertilizer within 48 hours of an anticipated rainstorm. Use only as much as is directed on the label and keep it off driveways and sidewalks.

2 Dirt and Sediment

- **Pollution:** Dirt or sediment can impede the flow of the stormwater and negatively impact stream habitat as it travels through waterways and deposits downstream. Pollutants can attach to sediment, which can then be transported through our waterways.

- **Solution:** Protect dirt stockpiles by covering them with tarps or secure plastic sheets to prevent wind or rain from allowing dirt or sediment to enter the storm drain system.

3 Metals

- **Pollution:** Metals and other toxins present in car wash water can harm important plankton, which forms the base of the aquatic food chain.

- **Solution:** Take your car to a commercial car wash where the wash water is captured and treated at a local wastewater treatment plant.

DID YOU KNOW?

Did you know that most of the pollution found in our waterways is not from a single source, but from a "non-point" source meaning the accumulation of pollution from residents and businesses throughout the community

4 Pet Waste

- **Pollution:** Pet waste carries bacteria through our watersheds and eventually will be washed out to the ocean. This can pose a health risk to swimmers and surfers.

- **Solution:** Pick up after your pets!

5 Trash and Debris

- **Pollution:** Trash and debris can enter waterways by wind, littering and careless maintenance of trash receptacles. Street sweeping collects some of this trash; however, much of what isn't captured ends up in our storm drain system where it flows untreated out to the ocean.

- **Solution:** Don't litter and make sure trash containers are properly covered. It is far more expensive to clean up the litter and trash that ends up in our waterways than it is to prevent it in the first place. Come out to one of Orange County's many locations for Coastal and Inner-Coastal Cleanup Day, which is held in September.

6 Motor Oil / Vehicle Fluids

- **Pollution:** Oil and petroleum products from our vehicles are toxic to people, wildlife and plants.

- **Solution:** Fix any leaks from your vehicle and keep the maintenance up on your car. Use absorbent material such as cat litter on oil spills, then sweep it up and dispose of it in the trash. Recycle used motor oil at a local Household Hazardous Waste Collection Center.

A TEAM EFFORT

The Orange County Stormwater Program has teamed with the Municipal Water District of Orange County (MWDOC) and the University of California Cooperative Extension Program (UCCE) to develop this pamphlet.

Low Impact Development (LID) and sustainable water use prevents water pollution and conserves water for drinking and reuse. Reducing your water use and the amount of water flowing from your home protects the environment and saves you money.

Thank you for making water protection a priority!

For more information, please visit www.ocwatersheds.com/publiced/

www.mwdoc.com

www.uccemg.com

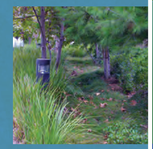
To report a spill, call the Orange County 24-Hour Water Pollution Prevention Reporting Hotline at 1-877-89-SPILL \(1-877-897-7455)

Special Thanks to
The City of Los Angeles Stormwater Program for the use of its artwork

The Metropolitan Water District of Southern California for the use of the California-Friendly Plant and Native Habitat photos

Homeowners Guide for Sustainable Water Use

Low Impact Development, Water Conservation & Pollution Prevention



The Ocean Begins at Your Front Door

RUNOFF, RAINWATER AND REUSE

Where Does Water Runoff Go?

Stormwater, or water from rainfall events, and runoff from outdoor water use such as sprinklers and hoses flows from homes directly into catch basins and the storm drain system. After entering the storm drain, the water flows untreated into streams, rivers, bays and ultimately the Pacific Ocean. Runoff can come from lawns, gardens, driveways, sidewalks and roofs. As it flows over hard, impervious surfaces, it picks up pollutants. Some pollutants carried by the water runoff include trash, pet waste, pesticides, fertilizer, motor oil and more.

Water Conservation

Pollution not only impairs the water quality for habitat and recreation, it can also reduce the water available for reuse. Runoff allowed to soak into the ground is cleaned as it percolates through the soil, replenishing depleted groundwater supplies. Groundwater provides at least 50% of the total water for drinking and other indoor household activities in north and central Orange County. When land is covered with roads, parking lots, homes, etc., there is less land to take in the water and more hard surfaces over which the water can flow.

In Orange County, 60-70% of water used by residents and businesses goes to irrigation and other outdoor uses. Reusing rainwater to irrigate our lawn not only reduces the impact of water pollution from runoff, but it also is a great way to conserve our precious water resources and replenish our groundwater basin.

What is Low Impact Development (LID)?

Low Impact Development (LID) is a method of development that seeks to maintain the natural hydrologic character of an area. LID provides a more sustainable and pollution-preventative approach to water management.

New water quality regulations require implementation of LID in larger new developments and encourage implementation of LID and other sustainable practices in existing residential areas. Implementing modifications to your lawn or garden can reduce pollution in our environment, conserve water and reduce your water bill.

Permeable pavement allows water runoff to infiltrate through the soil and prevents most pollutants from reaching the storm drain system.

OPTIONS FOR RAINWATER HARVESTING AND REUSE

Rainwater harvesting is a great way to save money, prevent pollution and reduce potable water use. To harvest your rainwater, simply redirect the runoff from roofs and downspouts to rain barrels. Rain gardens are another option; these reduce runoff as well as encourage infiltration.

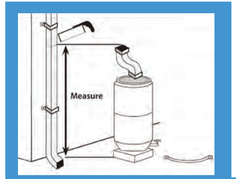
Downspout Disconnection/Redirection

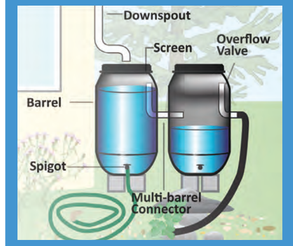
Disconnecting downspouts from pipes running to the gutter prevents runoff from transporting pollutants to the storm drain. Once disconnected, downspouts can be redirected to rain gardens or other vegetated areas, or be connected to a rain barrel.

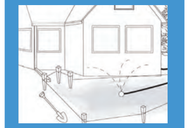
Rain Barrels

Rain barrels capture rainwater flow from roofs for reuse in landscape irrigation. Capacity of rain barrels needed for your home will depend on the amount of roof area and rainfall received. When purchasing your rain barrel, make sure it includes a screen, a spigot to siphon water for use, an overflow tube to allow for excess water to run out and a connector if you wish to connect multiple barrels to add capacity of water storage.

Mosquito growth prevention is very important when installing a rain barrel. The best way to prevent mosquito breeding is to eliminate entry points by ensuring all openings are sealed tightly. If these methods are unsuccessful, products are available to kill mosquito larvae, but that are harmless to animals and humans. Regular application of these products is essential. Please visit the Orange County Vector Control website for more information at www.ocvcd.org/mosquitoes3.php.



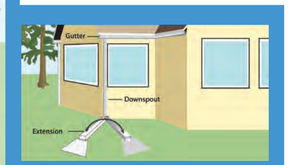




Rain Gardens

Rain gardens allow runoff to be directed from your roof downspout into a landscaped area. Vegetation and rocks in the garden will slow the flow of water to allow for infiltration into the soil. Plants and soil particles will absorb pollutants from the roof runoff. By utilizing a native plant palate, rain gardens can be maintained all year with minimal additional irrigation. These plants are adapted to the semi-arid climate of Southern California, require less water and can reduce your water bill.

Before modifying your yard to install a rain garden, please consult your local building and/or planning departments to ensure your garden plan follows pertinent building codes and ordinances. Besides codes and ordinances, some home owner associations also have guidelines for yard modifications. If your property is in hill areas or includes engineered slopes, please seek professional advice before proceeding with changes.



For information on how to disconnect a downspout or to install and maintain a rain barrel or rain garden at your home, please see the Los Angeles Rainwater Harvesting Program, A Homeowner's "How-To" Guide, November 2009 at www.larainwaterharvesting.org/

OTHER WATER CONSERVATION AND POLLUTION PREVENTION TECHNIQUES

Native Vegetation and Maintenance

"California Friendly" plants or native vegetation can significantly reduce water use. These plants often require far less fertilizers and pesticides, which are two significant pollutants found in Orange County waterways. Replacing water "thirsty" plants and grass types with water efficient natives is a great way to save water and reduce the need for potentially harmful pesticides and fertilizer.

Please see the California Friendly Garden Guide produced by the Metropolitan Water District of Southern California and associated Southern California Water Agencies for a catalog of California friendly plants and other garden resources at www.bewaterwise.com/Gardensoft.

Weed Free Yards

Weeds are water thieves. They often reproduce quickly and rob your yard of both water and nutrients. Weed your yard by hand if possible. If you use herbicides to control the weeds, use only the amount recommended on the label and never use it if rain is forecast within the next 48 hours.

Soil Amendments

Soil amendments such as green waste (e.g. grass clippings, compost, etc.) can be a significant source of nutrients and can help keep the soil near the roots of plants moist. However, they can cause algal booms if they get into our waterways, which reduces the amount of oxygen in the water and impacts most aquatic organisms. It is important to apply soil amendments more than 48 hours prior to predicted rainfall.

IRRIGATE EFFICIENTLY

Water runoff from sprinklers left on too long will carry pollutants into our waterways.

Smart Irrigation Controllers

Smart Irrigation Controllers have internal clocks as well as sensors that will turn off the sprinklers in response to environmental changes. If it is raining, too windy or too cold, the smart irrigation control sprinklers will automatically shut off.

Check with your local water agency for available rebates on irrigation controllers and smart timers.

- Aim your sprinklers at your lawn, not the sidewalk – By simply adjusting the direction of your sprinklers you can save water, prevent water pollution from runoff, keep your lawn healthy and save money.
- **Set a timer for your sprinklers** – lawns absorb the water they need to stay healthy within a few minutes of turning on the sprinklers. Time your sprinklers; when water begins running off your lawn, you can turn them off. Your timer can be set to water your lawn for this duration every time.
- **Water at Sunrise** – Watering early in the morning will reduce water loss due to evaporation. Additionally, winds tend to die down in the early morning so the water will get to the lawn as intended.
- **Water by hand** – Instead of using sprinklers, consider watering your yard by hand. Hand-watering ensures that all plants get the proper amount of water and you will prevent any water runoff, which wastes water and carries pollutants into our waterways.
- **Fix leaks** - Nationwide, households waste one trillion gallons of water a year to leaks – that is enough water to serve the entire state of Texas for a year. If your garden hose is leaking, replace the nylon or rubber hose washer and ensure a tight connection. Fix broken sprinklers immediately.

ATTACHMENT B Operation & Maintenance Plan

Operations and Maintenance (O&M) Plan

Water Quality Management Plan
for
AARONSON RESIDENCE
2354 San Clemente Street
Laguna Beach, California 92651
APN 656-122-04+05

LOTS 11-15, BLK 6, LOMA TRACT

Overall Responsible Party/Owner:
KEVIN AARONSON
2354 San Clemente Street
Laguna Beach, California 92651

BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Non-Structural Source Control BMPs			
Yes	**N1. Education for Property Owners, Tenants and Occupants** Practical information materials will be provided to the first residents/occupants/tenants on general housekeeping practices that contribute to the protection of stormwater quality. These materials will be initially developed and provided to first residents/occupants/tenants by the developer.	Owner shall keep up to date with BMP requirements, and be responsible for educating maintenance personnel; As required.	*Owner*
No	**N2. Activity Restrictions**		
Yes	**N3. Common Area Landscape Management** Identify on-going landscape maintenance requirements that are consistent with those in the County Water Conservation Resolution (or city equivalent) that include fertilizer and/or pesticide usage consistent with Management Guidelines for Use of Fertilizers (DAMP Section 5.5). Statements regarding the specific applicable guidelines must be included in the project WQMP.	Keep garden areas clean, planted, and weed free. Weekly.	*Owner or contracted maintenance personnel*
Yes	**N4. BMP Maintenance** The project WQMP shall identify responsibility for implementation of each non-structural BMP and scheduled cleaning and/or maintenance of all structural BMP facilities.	Visual Inspection, perform more thorough inspection if ponding water sits for more than 48 hours. Twice yearly and immediately following each storm event.	*Owner or contracted maintenance personnel*
No	**N5. Title 22 CCR Compliance**		
No	**N6. Local Water Quality Permit Compliance**		
No	**N7. Spill Contingency Plan**		
No	**N8. Underground Storage Tank Compliance**		
No	**N9. Hazardous Materials Disclosure Compliance**		
No	**N10. Uniform Fire Code Implementation**		

BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Yes	**N11. Common Area Litter Control** The owner may contract with their landscape maintenance firms to provide this service during regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposal violations by tenants/homeowners or businesses and reporting the violations to the owner/POA for investigation.	Keep site clean of litter. Weekly.	*Owner or contracted maintenance personnel*
No	**N12. Employee Training**		
No	**N13. Housekeeping of Loading Docks**		
Yes	**N14. Common Area Catch Basin Inspection** The owner is required to have at least 80 percent of drainage facilities inspected, cleaned and maintained on an annual basis with 100 percent of the facilities included in a two year period. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. Drainage facilities include catch basins (storm drain inlets), detention basins, retention basins, sediment basins, open drainage channels and lift stations. Records should be kept to document the annual maintenance.	Inspect drain inlets and catch basins. Keep inlet covers clean. Weekly.	*Owner or contracted maintenance personnel*
No	**N15. Street Sweeping Private Streets and Parking Lots**		
	Structural Source Control BMPs		
Yes	**S1. Provide Storm Drain System Stenciling and Signage** Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language and/or graphical icons, which discourage illegal dumping.	Ensure that all catch basins are stencilled "No Dumping – Drains To Ocean."	*Owner or contracted maintenance personnel*
No	**S2. Design Outdoor Hazardous Material Storage Areas to Reduce Pollutant Introduction**		

BMP Applicable? Yes/No	BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Yes	**S3. Design Trash Enclosures to Reduce Pollutant Introduction** Design trash storage areas to reduce pollutant introduction. All trash container areas shall be paved with an impervious surface, designed not to allow run-on, screened or walled to prevent off-site transport of trash, and be provided with a roof or awning to prevent direct precipitation.	Keep trash storage areas clean and orderly. Weekly.	*Owner or contracted maintenance personnel*
Yes	**S4. Use Efficient Irrigation Systems and Landscape Design** Projects shall design the timing and application methods of irrigation water to minimize the runoff of excessive irrigation water into the municipal storm drain system. Additionally, permittee shall: Employ rain shutoff devices, design irrigation systems to each landscape areas specific requirements, use flow reducers, group plants with similar water requirements together.	Ensure that sprinklers are working properly and minimize unnecessary irrigation. Weekly.	*Owner or contracted maintenance personnel*
Yes	**S5. Protect Slopes and Channels**	Ensure that drainage system is in proper working order to prevent stormwater from flowing over the top of slopes. Monthly	*Owner or contracted maintenance personnel*
No	**S6. Loading Dock Areas**		
No	**S7. Maintenance Bays and Docks**		
No	**S8. Vehicle Wash Areas**		
No	**S9. Outdoor Processing Areas**		
No	**S10. Equipment Wash Areas**		
No	**S11. Fueling Areas**		
No	**S12. Site Design and Landscape Planning**		
No	**S13. Wash Water Controls for Food Preparation Areas**		
No	**S14. Community Car Wash Racks**		

BMP Name and BMP Implementation, Maintenance and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Person or Entity with Operation & Maintenance Responsibility
Low Impact Development BMPs		
Enclosed Planter Box (Biotreatment). BIO-1 • Media (gravel, soil mixtures, etc.) replacement • Confirm that the planter box is infiltrating water by checking the ground surface 48 hours after major storm events. • Add 1" – 2" of Mulch	• Every 5 – 10 years • On-going, during the rainy season; and, periodically during the summer months • Annually	*Owner via maintenance contractors*

Required Permits

This section must list any permits required for the implementation, operation, and maintenance of the BMPs. Possible examples are:

- Permits for connection to sanitary sewer
- Permits from California Department of Fish and Game
- Encroachment permits

If no permits are required, a statement to that effect should be made.

Forms to Record BMP Implementation, Maintenance, and Inspection

The form that will be used to record implementation, maintenance, and inspection of BMPs is attached.

Recordkeeping

All operations and maintenance (O&M) records must be maintained and available to the city upon request. Records must be maintained for at least the last five (5) consecutive years.

RECORD OF BMP IMPLEMENTATION, MAINTENANCE, AND INSPECTION

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

ATTACHMENT C
SOHM Reports

SOHM

PROJECT REPORT

General Model Information

Project Name:	DMA-1
Site Name:	Aaronson
Site Address:	2354 San Clemente Street
City:	Laguna Beach
Report Date:	12/27/2018
Gage:	Laguna Beach
Data Start:	10/01/1949
Data End:	09/30/2006
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2018/11/27

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

DMA-1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C,Scrub,VSteep(>15%)	0.148
Pervious Total	0.148
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.148

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

DMA-1A

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C,Urban,Flat(0-5%)	0.02
Pervious Total	0.02

Impervious Land Use	acre
Impervious,Flat(0-5)	0.073
Impervious Total	0.073
Basin Total	0.093

Element Flows To:

Surface	Interflow	Groundwater
PLANT BOX Surface1A	PLANT BOX Surface1A	

DMA-1B

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C,Urban,Flat(0-5%)	0.012
Pervious Total	0.012

Impervious Land Use	acre
Impervious,Flat(0-5)	0.043
Impervious Total	0.043
Basin Total	0.055

Element Flows To:

Surface		Interflow		Groundwater	
PLANT BOX	Surface1B	PLANT BOX	Surface1B		

Routing Elements
Predeveloped Routing

Mitigated Routing

PLANT BOX 1A

Bottom Length:	53.00 ft.
Bottom Width:	4.50 ft.
Material thickness of first layer:	2
Material type for first layer:	Amended 2.5 in/hr
Material thickness of second layer:	1.5
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Underdrain used	
Underdrain Diameter (feet):	0.5
Orifice Diameter (in.):	0.45
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	3.525
Total Outflow (ac-ft.):	3.902
Percent Through Underdrain:	90.34
Discharge Structure	
Riser Height:	0.667 ft.
Riser Diameter:	8 in.
Element Flows To:	
Outlet 1	Outlet 2

Flow Through Planter Box Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0055	0.0000	0.0000	0.0000
0.0513	0.0055	0.0001	0.0000	0.0000
0.1026	0.0055	0.0002	0.0000	0.0000
0.1539	0.0055	0.0003	0.0000	0.0000
0.2051	0.0055	0.0004	0.0000	0.0000
0.2564	0.0055	0.0005	0.0000	0.0000
0.3077	0.0055	0.0007	0.0000	0.0000
0.3590	0.0055	0.0008	0.0000	0.0000
0.4103	0.0055	0.0009	0.0000	0.0000
0.4616	0.0055	0.0010	0.0000	0.0000
0.5129	0.0055	0.0011	0.0000	0.0000
0.5641	0.0055	0.0012	0.0000	0.0000
0.6154	0.0055	0.0013	0.0000	0.0000
0.6667	0.0055	0.0014	0.0000	0.0000
0.7180	0.0055	0.0015	0.0000	0.0000
0.7693	0.0055	0.0016	0.0000	0.0000
0.8206	0.0055	0.0018	0.0000	0.0000
0.8719	0.0055	0.0019	0.0000	0.0000
0.9231	0.0055	0.0020	0.0000	0.0000
0.9744	0.0055	0.0021	0.0000	0.0000
1.0257	0.0055	0.0022	0.0000	0.0000
1.0770	0.0055	0.0023	0.0000	0.0000
1.1283	0.0055	0.0024	0.0000	0.0000
1.1796	0.0055	0.0025	0.0000	0.0000
1.2309	0.0055	0.0026	0.0000	0.0000
1.2821	0.0055	0.0027	0.0000	0.0000
1.3334	0.0055	0.0028	0.0000	0.0000
1.3847	0.0055	0.0030	0.0000	0.0000
1.4360	0.0055	0.0031	0.0000	0.0000

1.4873	0.0055	0.0032	0.0000	0.0000
1.5386	0.0055	0.0033	0.0000	0.0000
1.5899	0.0055	0.0034	0.0000	0.0000
1.6411	0.0055	0.0035	0.0000	0.0000
1.6924	0.0055	0.0036	0.0000	0.0000
1.7437	0.0055	0.0037	0.0000	0.0000
1.7950	0.0055	0.0038	0.0000	0.0000
1.8463	0.0055	0.0039	0.0000	0.0000
1.8976	0.0055	0.0041	0.0000	0.0000
1.9489	0.0055	0.0042	0.0000	0.0000
2.0001	0.0055	0.0043	0.0000	0.0000
2.0514	0.0055	0.0044	0.0000	0.0000
2.1027	0.0055	0.0045	0.0000	0.0000
2.1540	0.0055	0.0046	0.0000	0.0000
2.2053	0.0055	0.0047	0.0000	0.0000
2.2566	0.0055	0.0049	0.0000	0.0000
2.3079	0.0055	0.0050	0.0000	0.0000
2.3591	0.0055	0.0051	0.0000	0.0000
2.4104	0.0055	0.0052	0.0000	0.0000
2.4617	0.0055	0.0053	0.0000	0.0000
2.5130	0.0055	0.0054	0.0000	0.0000
2.5643	0.0055	0.0056	0.0000	0.0000
2.6156	0.0055	0.0057	0.0000	0.0000
2.6669	0.0055	0.0058	0.0000	0.0000
2.7181	0.0055	0.0059	0.0000	0.0000
2.7694	0.0055	0.0060	0.0000	0.0000
2.8207	0.0055	0.0061	0.0000	0.0000
2.8720	0.0055	0.0063	0.0000	0.0000
2.9233	0.0055	0.0064	0.0000	0.0000
2.9746	0.0055	0.0065	0.0000	0.0000
3.0259	0.0055	0.0066	0.0000	0.0000
3.0771	0.0055	0.0067	0.0000	0.0000
3.1284	0.0055	0.0068	0.0000	0.0000
3.1797	0.0055	0.0070	0.0000	0.0000
3.2310	0.0055	0.0071	0.0000	0.0000
3.2823	0.0055	0.0072	0.0000	0.0000
3.3336	0.0055	0.0073	0.0000	0.0000
3.3849	0.0055	0.0074	0.0000	0.0000
3.4361	0.0055	0.0075	0.0000	0.0000
3.4874	0.0055	0.0077	0.0000	0.0000
3.5000	0.0055	0.0077	0.0000	0.0000

Flow Through Planter Box Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
3.5000	0.0055	0.0077	0.0000	0.0068	0.0000
3.5513	0.0055	0.0080	0.0000	0.0068	0.0000
3.6026	0.0055	0.0082	0.0000	0.0068	0.0000
3.6539	0.0055	0.0085	0.0000	0.0068	0.0000
3.7051	0.0055	0.0088	0.0000	0.0068	0.0000
3.7564	0.0055	0.0091	0.0000	0.0068	0.0000
3.8077	0.0055	0.0094	0.0000	0.0068	0.0000
3.8590	0.0055	0.0097	0.0000	0.0068	0.0000
3.9103	0.0055	0.0099	0.0000	0.0068	0.0000
3.9616	0.0055	0.0102	0.0000	0.0068	0.0000
4.0129	0.0055	0.0105	0.0000	0.0068	0.0000
4.0641	0.0055	0.0108	0.0003	0.0068	0.0000
4.1154	0.0055	0.0111	0.0010	0.0068	0.0000
4.1667	0.0055	0.0113	0.0011	0.0068	0.0000

4.2180	0.0055	0.0116	0.0012	0.0068	0.0000
4.2693	0.0055	0.0119	0.0013	0.0068	0.0000
4.3206	0.0055	0.0122	0.0013	0.0068	0.0000
4.3719	0.0055	0.0125	0.0016	0.0068	0.0000
4.4231	0.0055	0.0127	0.0018	0.0068	0.0000
4.4744	0.0055	0.0130	0.0018	0.0068	0.0000
4.5257	0.0055	0.0133	0.0020	0.0068	0.0000
4.5770	0.0055	0.0136	0.0022	0.0068	0.0000
4.6283	0.0055	0.0139	0.0024	0.0068	0.0000
4.6670	0.0055	0.0141	0.0024	0.0068	0.0000

PLANT BOX Surface1A

Element Flows To:

Outlet 1	Outlet 2
	PLANT BOX 1A

PLANT BOX 1B

Bottom Length:	31.11 ft.
Bottom Width:	4.50 ft.
Material thickness of first layer:	2
Material type for first layer:	Amended 2.5 in/hr
Material thickness of second layer:	1.5
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Underdrain used	
Underdrain Diameter (feet):	0.5
Orifice Diameter (in.):	0.35
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	2.081
Total Outflow (ac-ft.):	2.296
Percent Through Underdrain:	90.62
Discharge Structure	
Riser Height:	0.667 ft.
Riser Diameter:	8 in.
Element Flows To:	
Outlet 1	Outlet 2

Flow Through Planter Box Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0032	0.0000	0.0000	0.0000
0.0513	0.0032	0.0001	0.0000	0.0000
0.1026	0.0032	0.0001	0.0000	0.0000
0.1539	0.0032	0.0002	0.0000	0.0000
0.2051	0.0032	0.0003	0.0000	0.0000
0.2564	0.0032	0.0003	0.0000	0.0000
0.3077	0.0032	0.0004	0.0000	0.0000
0.3590	0.0032	0.0004	0.0000	0.0000
0.4103	0.0032	0.0005	0.0000	0.0000
0.4616	0.0032	0.0006	0.0000	0.0000
0.5129	0.0032	0.0006	0.0000	0.0000
0.5641	0.0032	0.0007	0.0000	0.0000
0.6154	0.0032	0.0008	0.0000	0.0000
0.6667	0.0032	0.0008	0.0000	0.0000
0.7180	0.0032	0.0009	0.0000	0.0000
0.7693	0.0032	0.0010	0.0000	0.0000
0.8206	0.0032	0.0010	0.0000	0.0000
0.8719	0.0032	0.0011	0.0000	0.0000
0.9231	0.0032	0.0012	0.0000	0.0000
0.9744	0.0032	0.0012	0.0000	0.0000
1.0257	0.0032	0.0013	0.0000	0.0000
1.0770	0.0032	0.0013	0.0000	0.0000
1.1283	0.0032	0.0014	0.0000	0.0000
1.1796	0.0032	0.0015	0.0000	0.0000
1.2309	0.0032	0.0015	0.0000	0.0000
1.2821	0.0032	0.0016	0.0000	0.0000
1.3334	0.0032	0.0017	0.0000	0.0000
1.3847	0.0032	0.0017	0.0000	0.0000
1.4360	0.0032	0.0018	0.0000	0.0000
1.4873	0.0032	0.0019	0.0000	0.0000
1.5386	0.0032	0.0019	0.0000	0.0000

1.5899	0.0032	0.0020	0.0000	0.0000
1.6411	0.0032	0.0021	0.0000	0.0000
1.6924	0.0032	0.0021	0.0000	0.0000
1.7437	0.0032	0.0022	0.0000	0.0000
1.7950	0.0032	0.0022	0.0000	0.0000
1.8463	0.0032	0.0023	0.0000	0.0000
1.8976	0.0032	0.0024	0.0000	0.0000
1.9489	0.0032	0.0024	0.0000	0.0000
2.0001	0.0032	0.0025	0.0000	0.0000
2.0514	0.0032	0.0026	0.0000	0.0000
2.1027	0.0032	0.0026	0.0000	0.0000
2.1540	0.0032	0.0027	0.0000	0.0000
2.2053	0.0032	0.0028	0.0000	0.0000
2.2566	0.0032	0.0029	0.0000	0.0000
2.3079	0.0032	0.0029	0.0000	0.0000
2.3591	0.0032	0.0030	0.0000	0.0000
2.4104	0.0032	0.0031	0.0000	0.0000
2.4617	0.0032	0.0031	0.0000	0.0000
2.5130	0.0032	0.0032	0.0000	0.0000
2.5643	0.0032	0.0033	0.0000	0.0000
2.6156	0.0032	0.0033	0.0000	0.0000
2.6669	0.0032	0.0034	0.0000	0.0000
2.7181	0.0032	0.0035	0.0000	0.0000
2.7694	0.0032	0.0035	0.0000	0.0000
2.8207	0.0032	0.0036	0.0000	0.0000
2.8720	0.0032	0.0037	0.0000	0.0000
2.9233	0.0032	0.0037	0.0000	0.0000
2.9746	0.0032	0.0038	0.0000	0.0000
3.0259	0.0032	0.0039	0.0000	0.0000
3.0771	0.0032	0.0039	0.0000	0.0000
3.1284	0.0032	0.0040	0.0000	0.0000
3.1797	0.0032	0.0041	0.0000	0.0000
3.2310	0.0032	0.0042	0.0000	0.0000
3.2823	0.0032	0.0042	0.0000	0.0000
3.3336	0.0032	0.0043	0.0000	0.0000
3.3849	0.0032	0.0044	0.0000	0.0000
3.4361	0.0032	0.0044	0.0000	0.0000
3.4874	0.0032	0.0045	0.0000	0.0000
3.5000	0.0032	0.0045	0.0000	0.0000

Flow Through Planter Box Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
3.5000	0.0032	0.0045	0.0000	0.0041	0.0000
3.5513	0.0032	0.0047	0.0000	0.0041	0.0000
3.6026	0.0032	0.0048	0.0000	0.0041	0.0000
3.6539	0.0032	0.0050	0.0000	0.0041	0.0000
3.7051	0.0032	0.0052	0.0000	0.0041	0.0000
3.7564	0.0032	0.0053	0.0000	0.0041	0.0000
3.8077	0.0032	0.0055	0.0000	0.0041	0.0000
3.8590	0.0032	0.0057	0.0000	0.0041	0.0000
3.9103	0.0032	0.0058	0.0000	0.0041	0.0000
3.9616	0.0032	0.0060	0.0000	0.0041	0.0000
4.0129	0.0032	0.0062	0.0000	0.0041	0.0000
4.0641	0.0032	0.0063	0.0002	0.0041	0.0000
4.1154	0.0032	0.0065	0.0006	0.0041	0.0000
4.1667	0.0032	0.0067	0.0006	0.0041	0.0000
4.2180	0.0032	0.0068	0.0007	0.0041	0.0000
4.2693	0.0032	0.0070	0.0008	0.0041	0.0000

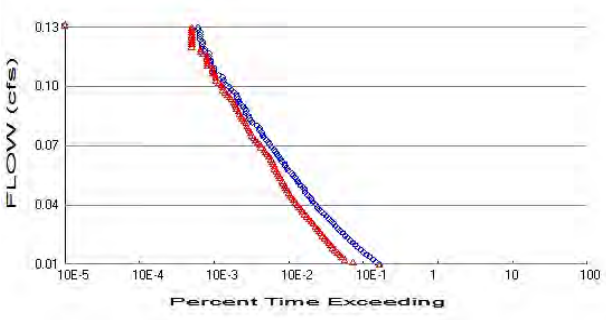
4.3206	0.0032	0.0071	0.0008	0.0041	0.0000
4.3719	0.0032	0.0073	0.0010	0.0041	0.0000
4.4231	0.0032	0.0075	0.0010	0.0041	0.0000
4.4744	0.0032	0.0076	0.0011	0.0041	0.0000
4.5257	0.0032	0.0078	0.0011	0.0041	0.0000
4.5770	0.0032	0.0080	0.0012	0.0041	0.0000
4.6283	0.0032	0.0081	0.0013	0.0041	0.0000
4.6670	0.0032	0.0083	0.0015	0.0041	0.0000

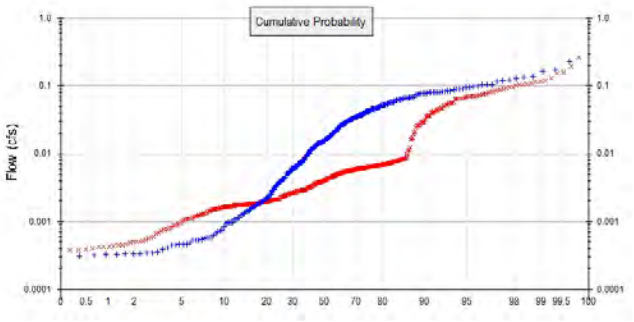
PLANT BOX Surface1B

Element Flows To:

Outlet 1	Outlet 2
	PLANT BOX 1B

Analysis Results
POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.148
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.032
Total Impervious Area: 0.116

Flow Frequency Method: Cunnane

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.079819
5 year	0.102733
10 year	0.129077
25 year	0.16741

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.071649
5 year	0.105324
10 year	0.118384
25 year	0.165433

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0080	3284	3264	99	Pass
0.0092	2962	1448	48	Pass
0.0104	2690	1120	41	Pass
0.0117	2436	1029	42	Pass
0.0129	2204	965	43	Pass
0.0141	2021	894	44	Pass
0.0153	1843	827	44	Pass
0.0165	1703	777	45	Pass
0.0178	1558	729	46	Pass
0.0190	1443	688	47	Pass
0.0202	1330	653	49	Pass
0.0214	1242	610	49	Pass
0.0227	1141	570	49	Pass
0.0239	1057	541	51	Pass
0.0251	976	513	52	Pass
0.0263	911	482	52	Pass
0.0276	843	452	53	Pass
0.0288	787	422	53	Pass
0.0300	735	398	54	Pass
0.0312	682	373	54	Pass
0.0324	641	347	54	Pass
0.0337	595	325	54	Pass
0.0349	546	307	56	Pass
0.0361	509	291	57	Pass
0.0373	482	274	56	Pass
0.0386	452	260	57	Pass
0.0398	429	242	56	Pass
0.0410	403	232	57	Pass
0.0422	379	219	57	Pass
0.0435	356	209	58	Pass
0.0447	337	200	59	Pass
0.0459	327	189	57	Pass
0.0471	310	183	59	Pass
0.0483	285	176	61	Pass
0.0496	271	171	63	Pass
0.0508	259	164	63	Pass
0.0520	245	153	62	Pass
0.0532	226	146	64	Pass
0.0545	218	143	65	Pass
0.0557	201	137	68	Pass
0.0569	190	129	67	Pass
0.0581	179	127	70	Pass
0.0594	176	125	71	Pass
0.0606	161	121	75	Pass
0.0618	155	116	74	Pass
0.0630	144	108	75	Pass
0.0642	138	103	74	Pass
0.0655	131	97	74	Pass
0.0667	126	93	73	Pass
0.0679	119	85	71	Pass
0.0691	111	82	73	Pass
0.0704	107	76	71	Pass
0.0716	100	71	71	Pass

0.0728	93	68	73	Pass
0.0740	89	65	73	Pass
0.0753	86	62	72	Pass
0.0765	81	59	72	Pass
0.0777	81	57	70	Pass
0.0789	74	55	74	Pass
0.0801	65	53	81	Pass
0.0814	62	51	82	Pass
0.0826	59	47	79	Pass
0.0838	58	46	79	Pass
0.0850	54	43	79	Pass
0.0863	53	42	79	Pass
0.0875	52	40	76	Pass
0.0887	49	39	79	Pass
0.0899	45	38	84	Pass
0.0912	43	37	86	Pass
0.0924	42	34	80	Pass
0.0936	41	32	78	Pass
0.0948	40	30	75	Pass
0.0961	37	28	75	Pass
0.0973	34	26	76	Pass
0.0985	32	26	81	Pass
0.0997	29	25	86	Pass
0.1009	27	23	85	Pass
0.1022	27	21	77	Pass
0.1034	26	21	80	Pass
0.1046	23	21	91	Pass
0.1058	20	19	95	Pass
0.1071	20	19	95	Pass
0.1083	20	19	95	Pass
0.1095	18	16	88	Pass
0.1107	18	16	88	Pass
0.1120	18	16	88	Pass
0.1132	17	16	94	Pass
0.1144	17	16	94	Pass
0.1156	17	14	82	Pass
0.1168	15	13	86	Pass
0.1181	15	13	86	Pass
0.1193	14	10	71	Pass
0.1205	14	10	71	Pass
0.1217	14	10	71	Pass
0.1230	13	10	76	Pass
0.1242	13	10	76	Pass
0.1254	13	10	76	Pass
0.1266	13	10	76	Pass
0.1279	12	10	83	Pass
0.1291	12	10	83	Pass

Water Quality

Model Default Modifications

Total of 0 changes have been made.

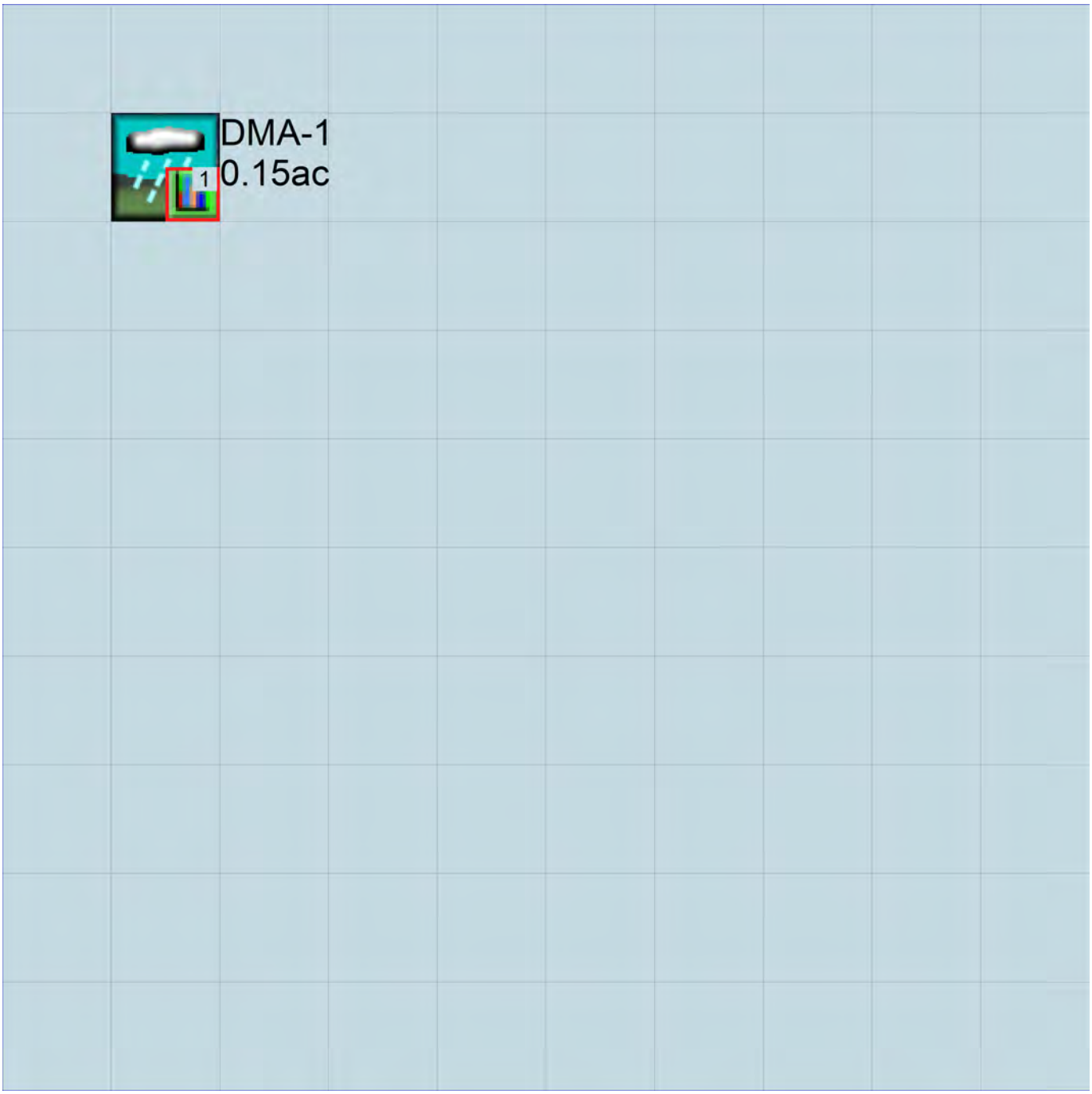
PERLND Changes

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       1949 10 01        END    2006 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   DMA-1.wdm
MESSU       25   PreDMA-1.MES
            27   PreDMA-1.L61
            28   PreDMA-1.L62
            30   POCDMA-11.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      28
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        DMA-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           ***
   28     C,Scrub,VSteep(>15%)    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 ***
   28         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  *********
   28         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 ***
   28         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
   28             0       3.9     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
   28            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 ***
   28             0       0.3       0.3       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  ***
   28       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  ***
   28      0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13 0.13
  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
   28             0         0      0.03         0      0.78       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#   ***
DMA-1***
PERLND  28                       0.148     COPY   501     12
PERLND  28                       0.148     COPY   501     13

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

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   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                            ***
  END GEN-INFO
  *** Section RCHRES***

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

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

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

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

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

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

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     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       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1949 10 01         END    2006 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   DMA-1.wdm
MESSU       25   MitDMA-1.MES
            27   MitDMA-1.L61
            28   MitDMA-1.L62
            30   POCDMA-11.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      57
      IMPLND       1
      RCHRES       1
      RCHRES       2
      RCHRES       3
      RCHRES       4
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        PLANT BOX  Surface1A        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           ***
   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 ***
   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  *********
   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 ***
   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
   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
   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 ***
   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  ***
   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  ***
   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
   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#   ***
DMA-1A***
PERLND  57                       0.02     RCHRES   1      2
PERLND  57                       0.02     RCHRES   1      3
IMPLND   1                      0.073     RCHRES   1      5
DMA-1B***
PERLND  57                      0.012     RCHRES   3      2
PERLND  57                      0.012     RCHRES   3      3
IMPLND   1                      0.043     RCHRES   3      5

******Routing******
PERLND  57                       0.02     COPY     1     12
IMPLND   1                      0.073     COPY     1     15
PERLND  57                       0.02     COPY     1     13
RCHRES   1                          1     RCHRES   2      8
PERLND  57                      0.012     COPY     1     12
IMPLND   1                      0.043     COPY     1     15
PERLND  57                      0.012     COPY     1     13
RCHRES   3                          1     RCHRES   4      8
RCHRES   2                          1     COPY   501     16
RCHRES   1                          1     COPY   501     17
RCHRES   4                          1     COPY   501     16
RCHRES   3                          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     PLANT BOX  Surfa-012    3    1    1    1   28    0    1
    2     PLANT BOX 1A            1    1    1    1   28    0    1
```

```
    3     PLANT BOX  Surfa-015    3    1    1    1   28    0    1
    4     PLANT BOX 1B            1    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
    3         1    0    0    0    0    0    0    0    0    0
    4         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

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

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                  ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
          FG FG FG FG  possible  exit  *** possible  exit      possible  exit
           *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
    1     0  1  0  0    4  5  6  0  0       0  0  0  0  0       2  2  2  2  2
    2     0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
    3     0  1  0  0    4  5  6  0  0       0  0  0  0  0       2  2  2  2  2
    4     0  1  0  0    4  0  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       0.0       0.0
    2              2      0.01       0.0       0.0       0.5       0.0
    3              3      0.01       0.0       0.0       0.0       0.0
    4              4      0.01       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  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0  0.0
    2            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0  0.0
    3            0         4.0  5.0  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0  0.0
    4            0         4.0  0.0  0.0  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      2
   70    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.005475  0.000000  0.000000
  0.051286  0.005475  0.000110  0.000000
  0.102571  0.005475  0.000219  0.000000
  0.153857  0.005475  0.000329  0.000000
  0.205143  0.005475  0.000438  0.000000
  0.256429  0.005475  0.000548  0.000000
  0.307714  0.005475  0.000657  0.000000
  0.359000  0.005475  0.000767  0.000000
  0.410286  0.005475  0.000876  0.000000
```

```
  0.461571  0.005475  0.000986  0.000000
  0.512857  0.005475  0.001095  0.000000
  0.564143  0.005475  0.001205  0.000332
  0.615429  0.005475  0.001314  0.000975
  0.666714  0.005475  0.001424  0.001087
  0.718000  0.005475  0.001533  0.001152
  0.769286  0.005475  0.001643  0.001298
  0.820571  0.005475  0.001752  0.001330
  0.871857  0.005475  0.001862  0.001606
  0.923143  0.005475  0.001971  0.001759
  0.974429  0.005475  0.002081  0.001839
  1.025714  0.005475  0.002190  0.002044
  1.077000  0.005475  0.002300  0.002230
  1.128286  0.005475  0.002409  0.002363
  1.179571  0.005475  0.002519  0.002401
  1.230857  0.005475  0.002628  0.002560
  1.282143  0.005475  0.002738  0.002710
  1.333429  0.005475  0.002847  0.002852
  1.384714  0.005475  0.002957  0.002987
  1.436000  0.005475  0.003066  0.003115
  1.487286  0.005475  0.003176  0.003239
  1.538571  0.005475  0.003285  0.003358
  1.589857  0.005475  0.003395  0.003473
  1.641143  0.005475  0.003504  0.003584
  1.692429  0.005475  0.003614  0.003692
  1.743714  0.005475  0.003723  0.003796
  1.795000  0.005475  0.003833  0.003898
  1.846286  0.005475  0.003942  0.003997
  1.897571  0.005475  0.004052  0.004094
  1.948857  0.005475  0.004161  0.004188
  2.000143  0.005475  0.004278  0.004280
  2.051429  0.005475  0.004395  0.004371
  2.102714  0.005475  0.004511  0.004459
  2.154000  0.005475  0.004628  0.004546
  2.205286  0.005475  0.004744  0.004631
  2.256571  0.005475  0.004861  0.004715
  2.307857  0.005475  0.004977  0.004797
  2.359143  0.005475  0.005094  0.004878
  2.410429  0.005475  0.005210  0.004957
  2.461714  0.005475  0.005327  0.005035
  2.513000  0.005475  0.005443  0.005112
  2.564286  0.005475  0.005560  0.005188
  2.615571  0.005475  0.005676  0.005263
  2.666857  0.005475  0.005793  0.005337
  2.718143  0.005475  0.005909  0.005410
  2.769429  0.005475  0.006026  0.005481
  2.820714  0.005475  0.006142  0.005552
  2.872000  0.005475  0.006259  0.005622
  2.923286  0.005475  0.006376  0.005691
  2.974571  0.005475  0.006492  0.005760
  3.025857  0.005475  0.006609  0.005827
  3.077143  0.005475  0.006725  0.005894
  3.128429  0.005475  0.006842  0.005960
  3.179714  0.005475  0.006958  0.006026
  3.231000  0.005475  0.007075  0.006091
  3.282286  0.005475  0.007191  0.006218
  3.333571  0.005475  0.007308  0.006344
  3.384857  0.005475  0.007424  0.006468
  3.436143  0.005475  0.007541  0.006591
  3.487429  0.005475  0.007657  0.006759
  3.500000  0.005475  0.007826  0.006774
  END FTABLE  2
  FTABLE      1
   24    6
     Depth      Area    Volume  Outflow1  Outflow2  outflow 3 Velocity  Travel
Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.005475  0.000000  0.000000  0.000000  0.000000
  0.051286  0.005475  0.000281  0.000000  0.006774  0.000000
```

```
0.102571  0.005475  0.000562  0.000000  0.006774  0.000000
0.153857  0.005475  0.000842  0.000000  0.006774  0.000000
0.205143  0.005475  0.001123  0.000000  0.006774  0.000000
0.256429  0.005475  0.001404  0.000000  0.006774  0.000000
0.307714  0.005475  0.001685  0.000000  0.006774  0.000000
0.359000  0.005475  0.001966  0.000000  0.006774  0.000000
0.410286  0.005475  0.002246  0.000000  0.006774  0.000000
0.461571  0.005475  0.002527  0.000000  0.006774  0.000000
0.512857  0.005475  0.002808  0.000000  0.006774  0.000000
0.564143  0.005475  0.003089  0.000000  0.006774  0.000000
0.615429  0.005475  0.003370  0.000000  0.006774  0.000000
0.666714  0.005475  0.003650  0.000000  0.006774  0.000000
0.718000  0.005475  0.003931  0.081222  0.006774  0.000000
0.769286  0.005475  0.004212  0.226740  0.006774  0.000000
0.820571  0.005475  0.004493  0.397938  0.006774  0.000000
0.871857  0.005475  0.004774  0.562249  0.006774  0.000000
0.923143  0.005475  0.005054  0.690887  0.006774  0.000000
0.974429  0.005475  0.005335  0.771702  0.006774  0.000000
1.025714  0.005475  0.005616  0.838400  0.006774  0.000000
1.077000  0.005475  0.005897  0.896332  0.006774  0.000000
1.128286  0.005475  0.006178  0.950741  0.006774  0.000000
1.167000  0.005475  0.006390  1.002200  0.006774  0.000000
END FTABLE  1
FTABLE      4
 70    4
   Depth      Area    Volume  Outflow1 Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
0.000000  0.003214  0.000000  0.000000
0.051286  0.003214  0.000064  0.000000
0.102571  0.003214  0.000129  0.000000
0.153857  0.003214  0.000193  0.000000
0.205143  0.003214  0.000257  0.000000
0.256429  0.003214  0.000321  0.000000
0.307714  0.003214  0.000386  0.000000
0.359000  0.003214  0.000450  0.000000
0.410286  0.003214  0.000514  0.000000
0.461571  0.003214  0.000579  0.000000
0.512857  0.003214  0.000643  0.000000
0.564143  0.003214  0.000707  0.000201
0.615429  0.003214  0.000771  0.000590
0.666714  0.003214  0.000836  0.000638
0.718000  0.003214  0.000900  0.000676
0.769286  0.003214  0.000964  0.000762
0.820571  0.003214  0.001029  0.000805
0.871857  0.003214  0.001093  0.000971
0.923143  0.003214  0.001157  0.001033
0.974429  0.003214  0.001221  0.001097
1.025714  0.003214  0.001286  0.001112
1.077000  0.003214  0.001350  0.001237
1.128286  0.003214  0.001414  0.001349
1.179571  0.003214  0.001478  0.001453
1.230857  0.003214  0.001543  0.001549
1.282143  0.003214  0.001607  0.001639
1.333429  0.003214  0.001671  0.001725
1.384714  0.003214  0.001736  0.001807
1.436000  0.003214  0.001800  0.001885
1.487286  0.003214  0.001864  0.001959
1.538571  0.003214  0.001928  0.002031
1.589857  0.003214  0.001993  0.002101
1.641143  0.003214  0.002057  0.002168
1.692429  0.003214  0.002121  0.002233
1.743714  0.003214  0.002186  0.002296
1.795000  0.003214  0.002250  0.002358
1.846286  0.003214  0.002314  0.002418
1.897571  0.003214  0.002378  0.002476
1.948857  0.003214  0.002443  0.002534
2.000143  0.003214  0.002511  0.002589
2.051429  0.003214  0.002579  0.002644
2.102714  0.003214  0.002648  0.002698
2.154000  0.003214  0.002716  0.002750
```

```
  2.205286  0.003214  0.002785  0.002802
  2.256571  0.003214  0.002853  0.002852
  2.307857  0.003214  0.002922  0.002902
  2.359143  0.003214  0.002990  0.002951
  2.410429  0.003214  0.003058  0.002999
  2.461714  0.003214  0.003127  0.003046
  2.513000  0.003214  0.003195  0.003093
  2.564286  0.003214  0.003264  0.003139
  2.615571  0.003214  0.003332  0.003184
  2.666857  0.003214  0.003400  0.003228
  2.718143  0.003214  0.003469  0.003272
  2.769429  0.003214  0.003537  0.003316
  2.820714  0.003214  0.003606  0.003359
  2.872000  0.003214  0.003674  0.003401
  2.923286  0.003214  0.003742  0.003443
  2.974571  0.003214  0.003811  0.003484
  3.025857  0.003214  0.003879  0.003525
  3.077143  0.003214  0.003948  0.003566
  3.128429  0.003214  0.004016  0.003606
  3.179714  0.003214  0.004084  0.003645
  3.231000  0.003214  0.004153  0.003684
  3.282286  0.003214  0.004221  0.003762
  3.333571  0.003214  0.004290  0.003838
  3.384857  0.003214  0.004358  0.003913
  3.436143  0.003214  0.004426  0.003987
  3.487429  0.003214  0.004495  0.004089
  3.500000  0.003214  0.004596  0.004098
  END FTABLE  4
  FTABLE      3
   24    6
     Depth      Area    Volume  Outflow1  Outflow2  outflow 3 Velocity  Travel
Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.003214  0.000000  0.000000  0.000000  0.000000
  0.051286  0.003214  0.000165  0.000000  0.004098  0.000000
  0.102571  0.003214  0.000330  0.000000  0.004098  0.000000
  0.153857  0.003214  0.000494  0.000000  0.004098  0.000000
  0.205143  0.003214  0.000659  0.000000  0.004098  0.000000
  0.256429  0.003214  0.000824  0.000000  0.004098  0.000000
  0.307714  0.003214  0.000989  0.000000  0.004098  0.000000
  0.359000  0.003214  0.001154  0.000000  0.004098  0.000000
  0.410286  0.003214  0.001319  0.000000  0.004098  0.000000
  0.461571  0.003214  0.001483  0.000000  0.004098  0.000000
  0.512857  0.003214  0.001648  0.000000  0.004098  0.000000
  0.564143  0.003214  0.001813  0.000000  0.004098  0.000000
  0.615429  0.003214  0.001978  0.000000  0.004098  0.000000
  0.666714  0.003214  0.002143  0.000000  0.004098  0.000000
  0.718000  0.003214  0.002308  0.081222  0.004098  0.000000
  0.769286  0.003214  0.002472  0.226740  0.004098  0.000000
  0.820571  0.003214  0.002637  0.397938  0.004098  0.000000
  0.871857  0.003214  0.002802  0.562249  0.004098  0.000000
  0.923143  0.003214  0.002967  0.690887  0.004098  0.000000
  0.974429  0.003214  0.003132  0.771702  0.004098  0.000000
  1.025714  0.003214  0.003296  0.838400  0.004098  0.000000
  1.077000  0.003214  0.003461  0.896332  0.004098  0.000000
  1.128286  0.003214  0.003626  0.950741  0.004098  0.000000
  1.167000  0.003214  0.003751  1.002200  0.004098  0.000000
  END FTABLE  3
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  57     EXTNL  SURLI
WDM      2 PREC     ENGL    1              RCHRES   1     EXTNL  PREC
```

```
WDM      2 PREC     ENGL    1              RCHRES   3     EXTNL  PREC
WDM      1 EVAP     ENGL    0.5            RCHRES   1     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.7            RCHRES   2     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.5            RCHRES   3     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.7            RCHRES   4     EXTNL  POTEV

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   1000 FLOW     ENGL       REPL
RCHRES   2 HYDR   STAGE  1 1         1      WDM   1001 STAG     ENGL       REPL
RCHRES   1 HYDR   STAGE  1 1         1      WDM   1002 STAG     ENGL       REPL
RCHRES   1 HYDR   O      1 1         1      WDM   1003 FLOW     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
RCHRES   4 HYDR   RO     1 1         1      WDM   1004 FLOW     ENGL       REPL
RCHRES   4 HYDR   STAGE  1 1         1      WDM   1005 STAG     ENGL       REPL
RCHRES   3 HYDR   STAGE  1 1         1      WDM   1006 STAG     ENGL       REPL
RCHRES   3 HYDR   O      1 1         1      WDM   1007 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         8
RCHRES     OFLOW  OVOL   2                 RCHRES         INFLOW IVOL
  END MASS-LINK     8

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

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

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

  MASS-LINK        16
RCHRES     ROFLOW                          COPY           INPUT  MEAN
  END MASS-LINK    16

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

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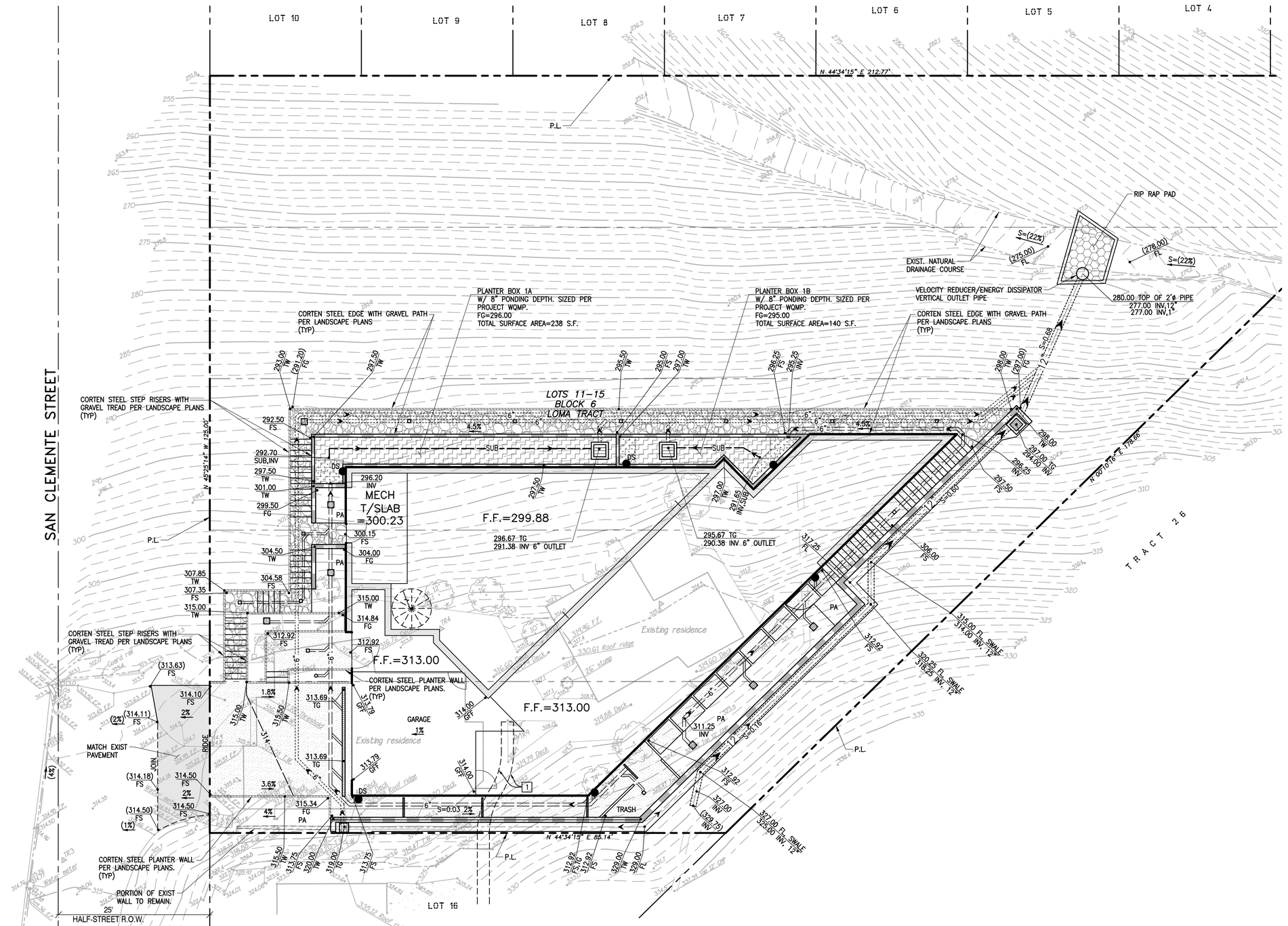
ATTACHMENT D
Grading Plan



BENCHMARK NOTE:
OCSBM 3Z-29-71
ELEV=290.867
NAVD88 DATUM, 1991 ADJ.

EASEMENT NOTE:
ALL EASEMENTS SHOWN ON THIS TOPOGRAPHIC AND BOUNDARY SURVEY ARE PER A PRELIMINARY TITLE REPORT PREPARED BY CALIFORNIA TITLE COMPANY, ORDER NO. NB-1906169-12 DATED JUNE 18, 2018 UNLESS NOTED OTHERWISE.

[1] ITEM 5 OF THE PRELIMINARY TITLE REPORT, A 2' WIDE EASEMENT FOR INGRESS AND EGRESS TO AND FROM A SEWER LINE AND INCIDENTAL PURPOSES RECORDED IN BOOK 13859, PAGE 2 O.R. THE LOCATION AS SHOWN ON THIS TOPOGRAPHIC SURVEY IS APPROXIMATE. THE ACTUAL LOCATION IS SUBJECT TO THE FIELD LOCATION OF THE SEWER LINE.

LOT LINE ADJUSTMENT NOTE:

[1] ITEM 6 OF THE PRELIMINARY TITLE REPORT, AN APPLICATION FOR LOT LINE ADJUSTMENT LLA 10-2 RECORDED AUGUST 9, 2010 AS INSTRUMENT NO. 2010-404481 O.R. WAS RESCINDED BY RESOLUTION 15.085, RECORDED DECEMBER 4, 2015 AS INSTRUMENT NO. 2015-617907.

0 8 16
SCALE: 1/8"= 1'-0"

LEGEND

100	EXISTING CONTOUR
100	PROPOSED CONTOUR
100.00	SPOT ELEVATION
	PROPOSED CONCRETE PAVING
	PROPOSED GRAVEL
	PROPOSED RIP RAP PAD
	PROPOSED BIORETENTION AREA
	PROPOSED SPLASH BLOCK
	EXIST WALL TO REMAIN
4"	PROPOSED STORM DRAIN LINE TO PLANTER BOX
4"	PROPOSED STORM DRAIN LINE TO DRAINAGE COURSE
	BEARING/RETAINING WALL
	EXISTING SCREEN WALL
	PROPOSED RETAINING WALL
	PROPOSED CORTEN STEEL EDGE
	PROPOSED GUARD RAILING
SUB	PROPOSED SUBDRAIN
PAD	PROPOSED PAD ELEVATION
FF	PROPOSED FINISHED FLOOR
FS	PROPOSED FINISHED SURFACE
FG	PROPOSED FINISHED GROUND
T/S	PROPOSED TOP OF SLAB
INV	INVERT OF PIPE
TG	TOP OF GRATE
P.L.	PROPERTY LINE
TW	TOP OF WALL
TF	TOP OF FOOTING
DS	DOWNSPOUT

PLANS PREPARED BY:
TOAL ENGINEERING, INC.
CIVIL ENGINEERING
LAND SURVEYING
STORMWATER QUALITY
139 Avenida Navarro
San Clemente, CA 92672
949.492.8586
www.toalengineering.com

REGISTERED PROFESSIONAL ENGINEER
CALEB RIOS
No. 57587
CIVIL
STATE OF CALIFORNIA

CALEB RIOS
R.C.E. 57587
DATE:

PREPARED FOR:
KEVIN AARONSON

REVISIONS	BY	DATE	APP'D.	DATE

AARONSON RESIDENCE

PRELIMINARY GRADING PLAN

LOTS 11-15, BLOCK 6, LOMA TRACT
2354 SAN CLEMENTE, LAGUNA BEACH CA

DATE: 12/26/18	H. SCALE: 1"=8'
SURVEY DATE: 10/01/18	V. SCALE: N/A
DRN.: O.R.	DWG. NO. C-01
CHD.: C.R.	
APPD.: C.R.	
JOB NO. 18156	SHEET 1 OF 2

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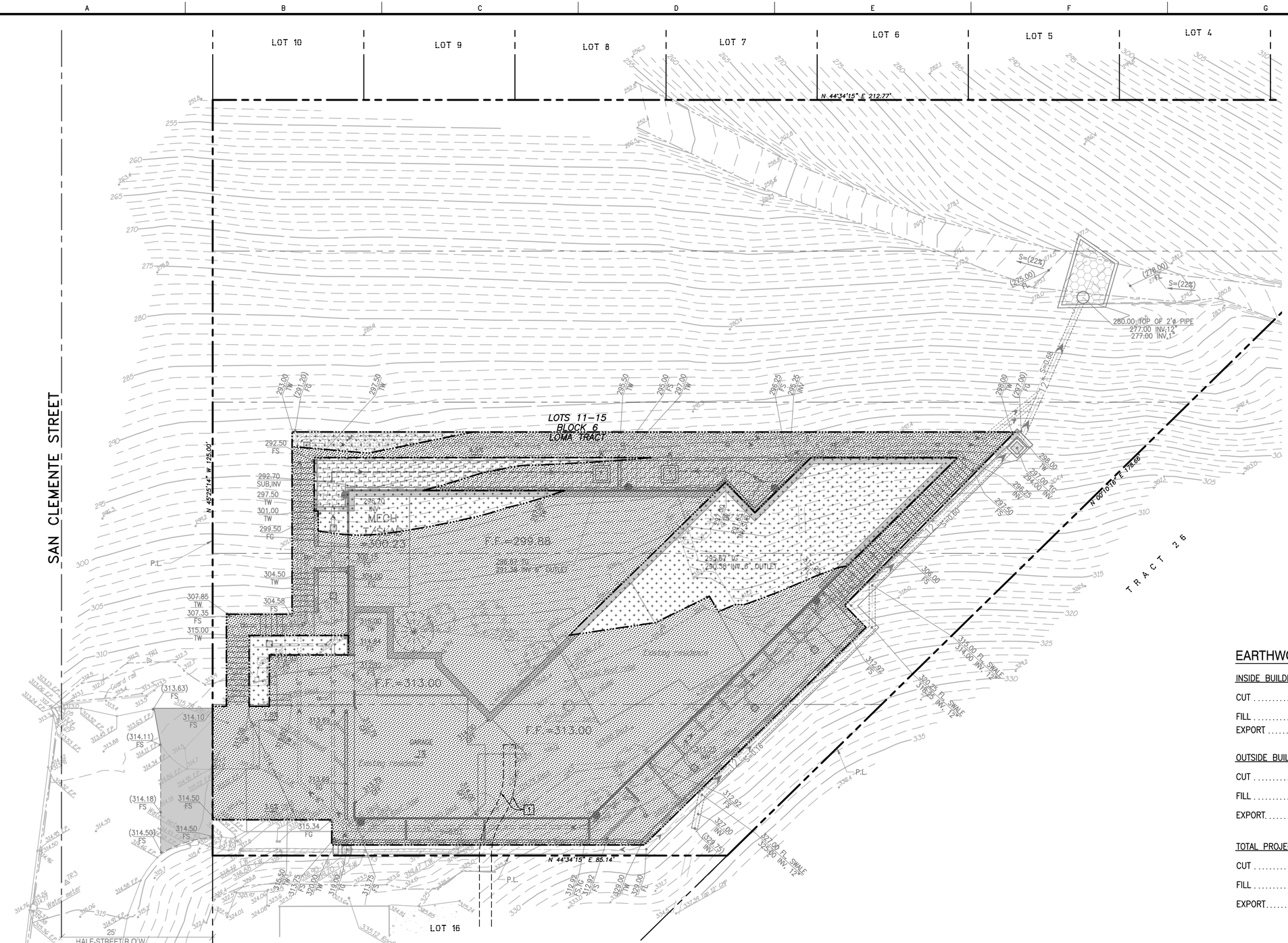

EARTHWORK QUANTITIES:

INSIDE BUILDING FOOTPRINT:

CUT ..... 601 CY

FILL ..... 164 CY

EXPORT ..... 437 CY

OUTSIDE BUILDING FOOTPRINT:

CUT ..... 347 CY

FILL ..... 24 CY

EXPORT ..... 323 CY

TOTAL PROJECT

CUT ..... 948 CY

FILL ..... 188 CY

EXPORT ..... 760 CY

LEGEND:

AREA OF CUT

AREA OF FILL

PLANS PREPARED BY:

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CALEB RIOS
R.C.E. 57587
DATE: _____

PREPARED FOR:

KEVIN AARONSON

REVISIONS	BY	DATE	APP'D.	DATE

AARONSON RESIDENCE

CUT FILL EXHIBIT

LOTS 11-15, BLOCK 6, LOMA TRACT
2354 SAN CLEMENTE, LAGUNA BEACH CA

DATE: 12/26/18	H. SCALE: 1"=8'
SURVEY DATE: 10/01/18	V. SCALE: N/A
DRN.: O.R.	DWG. NO.
CHD.: C.R.	C-02
APPD.: C.R.	
JOB NO. 18156	SHEET 2 OF 2

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ATTACHMENT E
Worksheets, Fact sheets and Product information

Worksheet 1: Infiltration Feasibility Categorization

Categorization of Infiltration Feasibility Condition			*Page 1 of 5*
Part 1: Physical Limitations of Infiltration Based on the criteria for physical limitations of infiltration described in Section 4.2.2.2, what level of physical feasibility of infiltration is the maximum that the BMP location will support?			
	Physical Infiltration Feasibility Category	**Mark applicable category**	**Next step**
1	Full Infiltration of the DCV		Continue to Part 2
	Biotreatment with Partial Infiltration	**X**	Continue to Part 3
	Biotreatment with No Infiltration		Select and Utilize Biotreatment without Infiltration
Provide summary of basis: The project area is located within Type C soils. Type C soils may allow incidental infiltration.			

Categorization of Infiltration Feasibility Condition		*Page 2 of 5*	
Part 2: Risks Limiting Full Infiltration of the DCV –*Would infiltration of the full DCV introduce risks of undesirable consequences that cannot reasonably be mitigated?*		***Yes***	***No***
2	**Would infiltration of the DCV pose significant risk for groundwater related concerns?** Use criteria described in Section 4.2.2.3 and results from **Worksheet 2** (Appendix C) to describe groundwater-related infiltration feasibility criteria.		
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
3	**Would infiltration of the full DCV pose significant risk of increasing risk of geotechnical hazards that cannot be mitigated to an acceptable level**? Use criteria described in Section 4.2.2.4.		
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	Would infiltration of the DCV cause an increase in groundwater flow or decrease in surface runoff over predevelopment conditions that would cause **impairment to downstream beneficial uses, such as change of seasonality of ephemeral washes or increased discharge of contaminated groundwater to surface waters?** Use criteria in Section 4.2.2.5		
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Categorization of Infiltration Feasibility Condition		***Page 3 of 5***	
Part 2 (continued): Risks Limiting Full Infiltration of the DCV –*Would infiltration of the full DCV introduce risks of undesirable consequences that cannot reasonably be mitigated?*		***Yes***	***No***
5	Is there substantial evidence that infiltration of the DCV would **result in a significant increase in I&I to the sanitary sewer** that cannot be sufficiently mitigated?		
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
6	Would infiltration of the DCV **violate downstream water rights**?		
Provide basis: Summarize findings of studies provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 2 Result	If the answer to all questions 2-6 are “No”, then the DMA is categorized as “Full Infiltration” for the purposes of LID BMP type selection. Describe finding. At the Preliminary/Conceptual WQMP phase, describe the additional design-phase testing required to confirm this determination and identify contingencies for final design. At the Final Project WQMP phase, identify any required construction-phase testing and identify the design contingencies that should result based on construction-phase testing. If the answer to any of questions 2-6 is “Yes” then the site cannot be categorized as “Full Infiltration”. Continue to Part 3: Partial Infiltration Feasibility		
Categorization of Infiltration Feasibility Condition		***Page 4 of 5***	
Part 3: Partial Infiltration Feasibility Criteria –*Would infiltration of any appreciable volume of stormwater result in risks of undesirable consequences that cannot reasonably be mitigated?*		***Yes***	***No***

8	**Would use of biotreatment BMPs with partial infiltration pose significant risk for groundwater related concerns?** Refer to criteria in Section 4.2.2.3 and Worksheet 1 (Appendix C) for guidance on groundwater-related infiltration feasibility criteria.		
Provide basis: Groundwater information will be included upon receipt of the Project Soils Report.			
9	**Would the use of biotreatment BMPs with partial infiltration pose elevated risks of geotechnical hazards that cannot be mitigated to an acceptable level**? Refer to Section 4.2.2.4.	**X**	
Provide basis: Infiltration cannot be located on-site in areas more than 50' from slopes greater than 15%, nor can it be placed beyond 8' from building foundations. See WQMP Site Plan in Section 4.1			
10	**Would the use of biotreatment BMPs with partial infiltration elevate risks or introduced conflicts related to groundwater balance, inflow and infiltration, or water rights?** Refer to Section 4.2.2.5. Note: this is uncommon and must be supported by site-specific analysis if it is used as a basis to reject biotreatment with partial infiltration.		
Provide basis: Groundwater information will be included upon receipt of the Project Soils Report. The quantity and quality of the stormwater from the site has not been diminished. A review of the Orange County Geomatics website and the Orange County Public Works Drainage Facilities Map does not reveal any potential downstream water right issues or violations.			

Categorization of Infiltration Feasibility Condition		***Page 5 of 5***
Part 3 Result	If the answer to all questions 8-10 are "No", then the DMA is categorized as "Biotreatment with Partial Infiltration" for the purposes of LID BMP type selection. If the answer to any of questions 8-10 is "Yes" then the site is categorized as "Biotreatment with No Infiltration" for the purposes of LID BMP type selection.	**Biotreatment with No Infiltration**

Worksheet 8: Static Volume Method for Sizing Bioretention BMPs with Underdrains in SOC

DMA-1A, PLANTER BOX 1A

Part 1: Calculate Design Storm Volume				
1	Enter design capture storm depth, *d* (inches)	d=	0.75	inches
2a	Enter the combined effect of provided HSCs, d_{HSC} (inches) (based on Worksheet 4)	d_{HSC}=	0	inches
2b	Calculate the remainder of the design capture storm depth, dremainder = d - d_{HSC}	$d_{remainder}$=	0.75	inches
3a	Enter DMA area tributary to BMP(s), A (acres) excluding any self-retaining areas	A=	0.093	acres
3b	Enter DMA Imperviousness, imp (unitless) after removal of self-retaining areas	imp=	0.785	
3c	Calculate runoff coefficient, C= (0.75 x imp) + 0.15	C=	0.74	
3d	Calculate runoff volume, DCV = (C x $d_{remainder}$ x A x 43560 x (1/12)) (See Section E.2.2)	DCV=	187.0	cu-ft
Part 2: Select Initial BMP Effective Footprint Area (can be iterative)				
4a	Calculate minimum area required for BMP to avoid premature clogging from Section E.4.1 (as percent of impervious tributary area)	$\%A_{min,clog}$=	2.8	%
4b	Calculate minimum area required for BMP to meet volume reduction requirements (Partial Infiltration category only) using Section E.4.2	$\%A_{min,vol}$=	1.9	%
4c	Effective footprint of BMP as percent of tributary impervious area, must be equal to or greater than both $\%A_{min,clos}$ and $\%A_{min,vol}$ (as applicable)	$\%A_{BMP\_EFF}$	2.8	%
4d	Effective footprint of BMP ($\%A_{BMP\_EFF}$ * A * imp)	A_{BMP_EFF}	89.0	sq-ft
Part 3: Calculate Retention Volume in BMP				
5a	Determine gravel layer depth (18 inches or an alternative depth that will infiltrate within 48 hours)	D_{gravel}	18	inches
5b	Calculate effective retention storage depth of gravel layer $D_{eff,gravel}$ = 0.4 porosity * Dgravel (Partial Infiltration Category only)	$D_{eff,gravel}$	-	inches
6	Calculate volume retained in gravel layer (Partial Infiltration Category only) V_{gravel} = $D_{eff,gravel}$ * A_{BMP_EFF} * (1 ft/12 inches)	V_{gravel_retain}	-	cu-ft
7a	Media depth D_{media} (24 inches typical) See BMP fact sheet (Appendix G)	D_{media}	24	inches
8b	Calculate volume retained in soil media layer, Vmedia =0.1*D_{media}*A_{BMP_EFF} * (1 ft/12 inches)	V_{media_retain}	17.8	cu-ft
Part 4: Calculate Required and Provided Biofiltered Volume				
9	Calculate the remaining DCV by subtracting the retained volume in the gravel layer and media layer from the initial design volume, DCV_{remain}= DCV-V_{gravel}-V_{media}	DCV_{remain}	169.2	cu-ft

9	Calculate the required static biofiltration volume to be provided in the pores of the media and surface ponded storage above the underdrain, $V_{biofilter\_storage\_req} = 0.75 * DCV_{remain}$	$V_{biofilter\_storage\_req}$	126.9	cu-ft
10a	Surface storage ponding depth (6-12 inches typical) See BMP fact sheet (Appendix G)	$D_{ponding}$	8	inches
10b	Calculate effective depth of the biofiltration storage above the underdrain, $D_{effective\_biotreat} = 0.2 * D_{media} + D_{ponding} + 0.4*D_{gravel}$	$D_{effective\_biotreat}$	20	in
11	Calculate static biofiltration storage volume provided in pores of media, and surface ponded storage above the underdrain Vbiofilter_storage = $(D_{effective\_biotreat}) * A_{BMP\_EFF} * (1 ft/12 in)$	$V_{biofilter\_storage}$	148.4	cu-ft
12	The $V_{biofilter\_storage} > V_{biofilter\_storage\_req}$. ……. OK.	**148.4**	>	**126.9**

Worksheet 8: Static Volume Method for Sizing Bioretention BMPs with Underdrains in SOC

DMA-1B, PLANTER BOX 1B

Part 1: Calculate Design Storm Volume				
1	Enter design capture storm depth, *d* (inches)	d=	0.75	inches
2a	Enter the combined effect of provided HSCs, d_{HSC} (inches) (based on Worksheet 4)	d_{HSC}=	0	inches
2b	Calculate the remainder of the design capture storm depth, dremainder = d - d_{HSC}	$d_{remainder}$=	0.75	inches
3a	Enter DMA area tributary to BMP(s), A (acres) excluding any self-retaining areas	A=	0.055	acres
3b	Enter DMA Imperviousness, imp (unitless) after removal of self-retaining areas	imp=	0.782	
3c	Calculate runoff coefficient, C= (0.75 x imp) + 0.15	C=	0.74	
3d	Calculate runoff volume, DCV = (C x $d_{remainder}$ x A x 43560 x (1/12)) (See Section E.2.2)	DCV=	110.3	cu-ft
Part 2: Select Initial BMP Effective Footprint Area (can be iterative)				
4a	Calculate minimum area required for BMP to avoid premature clogging from Section E.4.1 (as percent of impervious tributary area)	$\%A_{min,clog}$=	2.8	%
4b	Calculate minimum area required for BMP to meet volume reduction requirements (Partial Infiltration category only) using Section E.4.2	$\%A_{min,vol}$=	1.9	%
4c	Effective footprint of BMP as percent of tributary impervious area, must be equal to or greater than both $\%A_{min,clos}$ and $\%A_{min,vol}$ (as applicable)	$\%A_{BMP\_EFF}$	2.8	%
4d	Effective footprint of BMP ($\%A_{BMP\_EFF}$ * A * imp)	A_{BMP_EFF}	52.5	sq-ft
Part 3: Calculate Retention Volume in BMP				
5a	Determine gravel layer depth (18 inches or an alternative depth that will infiltrate within 48 hours)	D_{gravel}	18	inches
5b	Calculate effective retention storage depth of gravel layer $D_{eff,gravel}$ = 0.4 porosity * Dgravel (Partial Infiltration Category only)	$D_{eff,gravel}$	-	inches
6	Calculate volume retained in gravel layer (Partial Infiltration Category only) V_{gravel} = $D_{eff,gravel}$ * A_{BMP_EFF} * (1 ft/12 inches)	V_{gravel_retain}	-	cu-ft
7a	Media depth D_{media} (24 inches typical) See BMP fact sheet (Appendix G)	D_{media}	24	inches
8b	Calculate volume retained in soil media layer, Vmedia =0.1*D_{media}*A_{BMP_EFF} * (1 ft/12 inches)	V_{media_retain}	10.5	cu-ft
Part 4: Calculate Required and Provided Biofiltered Volume				
9	Calculate the remaining DCV by subtracting the retained volume in the gravel layer and media layer from the initial design volume, DCV_{remain}= DCV-V_{gravel}-V_{media}	DCV_{remain}	99.8	cu-ft

9	Calculate the required static biofiltration volume to be provided in the pores of the media and surface ponded storage above the underdrain, $V_{biofilter\_storage\_req} = 0.75 * DCV_{remain}$	$V_{biofilter\_storage\_req}$	74.8	cu-ft
10a	Surface storage ponding depth (6-12 inches typical) See BMP fact sheet (Appendix G)	$D_{ponding}$	8	inches
10b	Calculate effective depth of the biofiltration storage above the underdrain, $D_{effective\_biotreat} = 0.2 * D_{media} + D_{ponding} + 0.4*D_{gravel}$	$D_{effective\_biotreat}$	20	in
11	Calculate static biofiltration storage volume provided in pores of media, and surface ponded storage above the underdrain Vbiofilter_storage = $(D_{effective\_biotreat}) * A_{BMP\_EFF}$ * (1 ft/12 in)	$V_{biofilter\_storage}$	87.4	cu-ft
12	The $V_{biofilter\_storage} > V_{biofilter\_storage\_req}$. ……. OK.	**87.4**	>	**74.8**

MISC-1: BIORETENTION SOIL MEDIA

Also known as:

- *Bioretention media*
- *Biofiltration media*

Street-end biofiltration with planting/storage media
Source: City of Portland

Bioretention soil media is a critical design element for bioretention BMPs, including INF-3, BIO-1, and BIO-6. It is also part of the design of some configurations of swales (BIO-2) and filter strips (BIO-3). Finally, it can be used as a filtering layer below infiltration systems to augment treatment and protect groundwater quality.

All bioretention soil media must provide appropriate properties for filtering stormwater and supporting vegetation.

In addition, for systems that filter water through BSM into an underdrain (BIO-1, BIO-6), additional criteria apply for media infiltration rate and chemical suitability to avoid pollutant leaching or premature clogging.

Applicability of BSM Specification Elements

The model specifications described in this fact sheet include elements that do not apply to all BMP types. The following table identifies the elements of the model specifications that apply to the different types of BMPs.

BMP Type	Composition and Material Specifications	Basic Testing of Combined Mix	Infiltration Testing of Combined Mix	Chemical Suitability Testing of Combined Mix (leaching potential)
Bioretention with Underdrains (BIO-1, BIO-6)	X	X	X	X
BIO-1 or BIO-6 draining to nutrient-sensitive water bodies	X	X	X	X
Bioretention without Underdrains (INF-3)	X	X		
Amended Soils as Treatment Layer in Other Infiltration BMPs	X	X		
Swales (BIO-2) with Amended Soil Layer	X	X		
Filter Strips (BIO-3)	X	X		

General Criteria and Composition

- BSM should consist of 70 to 80% fine sand and 20 to 30% stable, well aged compost **by volume**, each meeting the quality standards described in the following sections. Alternative mix designs may be developed and tested to demonstrate suitability. Deviations from these ranges and material types may also be needed to achieve low nutrient leaching designs, where necessary. [*Note: The unit weight of compost is typically less than half of the unit weight of sand. Therefore, the percentage by mass is different.]*
- BSM should be designed to achieve the long term hydraulic design requirements associated with the design of the facility (i.e., design infiltration rate).
    - For BIO-1 and BIO-6 (systems with underdrains), the hydraulic conductivity should be evaluated via testing and conform to an acceptable range due to the importance of this value in sizing and performance of systems. Selection of an appropriate infiltration rate and evaluation of mix acceptability is described in "Infiltration Rate Evaluation" section of this Fact Sheet.
    - For other applications of BSM, infiltration rate of media is not as critical in design and can be assured via simpler checks on particle size information obtained as part of "Basic Whole Mix Testing Recommendations" part of this Fact Sheet.
- BSM should support the growth of hardy native plants suited to a well drained sandy soil. However BSM should not be excessively enriched, which can lead to excessive weeds and leaching of nutrients. Agronomic suitability and avoidance of excessive nutrient leaching is evaluated as part of "Basic Whole Mix Testing Recommendations" part of this Fact Sheet.
- BSM for use in BIO-1 or BIO-6 (systems with underdrains) should be more carefully evaluated for nutrient and other pollutant leaching potential as described in "Chemical Suitability Evaluation" part of this Fact Sheet.
- Blending should be conducted at a soil blending facility using an appropriate mechanical method to achieve complete and uniform mixing, such as a drum mixer. Moving piles of material around with a loader and/or transferring back and forth between bins to mix components is typically not adequate to achieve uniform mixing.
- Testing of the actual whole BSM mix to be delivered to the project is strongly recommended; prior testing conducted by the manufacturer may be used in place of project-specific testing provided that it is recent (within 6 months) and represents the actual mix proportions and compontents that are proposed for the project.
- Procurement, handling, and placement of BSM should adhere to guidelines in "Construction Guidelines" part of this Fact Sheet.

Sand for Bioretention Soil Media

- Sand should be free of wood, waste, coating such as clay, stone dust, carbonate, etc., or any other deleterious material.
- Sand should be washed.
- All aggregate passing the No. 200 sieve size should be non-plastic.
- Sand for bioretention should be analyzed by an accredited lab using #200, #100, #40, #30, #16, #8, #4, and 3/8 sieves (ASTM D 422 or as approved by the local permitting authority) and meet

the following gradation (Note: all sands complying with ASTM C33 for "fine aggregate concrete sand" comply with the gradation requirements below):

Sieve Size (ASTM D422)	Sieve Size (mm)	% Passing (by weight)	
		Minimum	Maximum
3/8 inch	9.5	100	100
#4	4.8	90	100
#8	2.4	70	100
#16	1.2	40	95
#30	0.60	15	70
#40	0.42	5	55
#100	0.15	0	15
#200	0.075	0	5

- Coefficient of Uniformity (Cu = D60/D10) should be equal to or equal to or greater than 4
- Note: the gradation of the sand component of the media an important major factor in the infiltration rate of the media mix. If the desired infiltration rate of the media cannot be achieved within the specified proportions of sand and compost), then it may be necessary to utilize sand at the coarser end of the range specified in the table above ("minimum" column) with more uniform particle size (i.e., poorly graded). Sand products such as "filter sand" and "top dressing sand" tend to meet the C33 specification and support higher infiltration rates.

Compost for Bioretention Soil Media

Compost should be a well decomposed, stable, weed free organic matter source derived from waste materials including yard debris, wood wastes, or other organic materials not including manure or biosolids meeting standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program). **It is expected that only select compost products will meet this specification**. Compost quality should be verified via a lab analysis to be:

- Feedstock materials shall be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
- Organic matter: 35-75% dry weight basis.
- Carbon and Nitrogen Ratio: 15:1 < C:N < 40:1; preferably above 20:1 to reduce the potential for nitrogen leaching/washout.
- Nitrogen between 0.6 and 3% by dry weight.
- Physical contaminants (manmade inert materials) not exceeding 1% by dry weight.
- Maturity/Stability (qualitative):Compost shall have dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120 F) upon delivery or rewetting is not acceptable.
- Maturity (seed emergence and seedling vigor): greater than 80% relative to positive control (Method TMECC 5.05-A, USDA and U.S. Composting Council)

- Stability (Carbon Dioxide evolution rate): less than 2.5 mg CO2-C per g compost organic matter (OM) per day or less than 5 mg CO2-C per g compost carbon per day, whichever unit is reported. (Method TMECC 5.08-B, USDA and U.S. Composting Council). Alternatively a Solvita rating of 6 or higher is acceptable.
- Toxicity: any one of the following measures is sufficient to indicate non-toxicity:
    - NH4:NH3 < 3
    - Ammonium < 500 ppm, dry weight basis
    - Seed Germination > 80% of control
    - Plant trials > 80% of control
    - Total Boron should be <80 ppm, soluble boron < 2.5 ppm
- Salinity: < 6.0 mmhos/cm or Soluble Salt Concentration less than 10 dS/m (Method TMECC 4.10-A, USDA and U.S. Composting Council).
- pH between 6.5 and 7.5 (may vary with plant palette)
- Compost for bioretention should be analyzed by an accredited lab using #200, ¼ inch, ½ inch, and 1 inch sieves (ASTM D 422 or as approved by the local permitting authority) and meet the following gradation:

Sieve Size (ASTM D422)	% Passing (by weight)	
	Minimum	Maximum
1 inch	99	100
½ inch	90	100
¼ inch	40	90
#200	0	10

- Tests should be sufficiently recent to represent the actual material that is anticipated to be delivered to the site. If processes or sources used by the supplier have changed significantly since the most recent testing, new tests should be requested. Compost quality can vary significanly by season and by batch.
- Note: the gradation of compost used in bioretention media can have an important influence on the saturated hydraulic conductivity of the media. To achieve a higher saturated hydraulic conductivity, it may be necessary to utilize compost at the coarser end of this range (“minimum” column). The percent passing the #200 sieve (fines) is believed to be the most important factor in hydraulic conductivity. In addition, a coarser compost mix provides more heterogeneity of the bioretention media, which is believed to be advantageous for more rapid development of soil structure needed to support health biological processes. This may be an advantage for plant establishment with lower nutrient and water input.

Mulch for Bioretention Soil Media

- The bioretention panting area should generally be covered with 2 to 4 inches (average 3 inches) of well aged, double or triple shredded mulch at the time of construction and an additional placement of 1 to 2 inches of mulch should be added annually. Mulch should be stockpiled and stored at least 12 months prior to application to the BMP and must be non-

floating to avoid clogging of overflow structures.*The intention is to help sustain the nutrient levels, suppress weeds, retain moisture, and maintain infiltration capacity*.

- Inorganic mulch such as rock, may be used.

Basic Whole Mix Testing Recommendations

Basic whole mix testing should be done for any application of BSM in stormwater BMPs. The blended BSM should be submitted to an agronomic laboratory for a standard "Agronomic Soil Suitability Test" with texture class and organic matter analyses included (estimated $110 to $150).

- Organic Matter: between 2 and 5 percent by dry weight

  [Note: This range is not incompatible with the organic content requirements of compost. If compost is 20 percent of the mix by volume, this represents about 7.5 percent of the mix by dry weight. If compost has an organic fraction of 35 percent to 75 percent by dry weight, then the total mix organic content would be 2.5 to 5.5 percent]

- Total Nitrogen: 0.1 to 0.25% by dry weight (100 to 250 mg/kg)

  [Note: Similar to the explanation above, this is not incompatible with the compost nitrogen requirements]

- Plant Available Phosphorus (also known as "P Index") (based on weak acid extraction: ammonium Bicarbonate/DTPA soil analysis or similar): 10 to 50 mg/kg (P Index 10 to 50)
- Percent Sand/Silt/Clay: Less than 2 percent clay; 5 to 20 percent silt or infiltration testing showing greater than 10 inches per hour
- pH range: 6.0-7.5
- Salinity less than 3.0 millimho/cm (as measured by electrical conductivity)
- Sodium adsorption ration (SAR) less than 3.0
- Chloride less than 150 ppm
- An assessment of agricultural suitability for hearty, well-suited plants based on test results should be conducted, including recommendations for adding amendments, chemical corrections, or both.

Testing reports should include:

- Date of Testing
- Project Name
- The Contractor's Name
- Source of Materials and Supplier's Name
- Adequate information to demonstration conformance with the criteria above.

Rationale: A BSM that aheres to the general guidelines for mix composition, sand properties, and compost properties should provide acceptable properties for most applications. However, due to ranges of physical and chemcial properties that exist in sand and compost specifications and variability in supply stocks, basic testing of the specific whole BSM proposed for the project is strongly recommended. The ranges of criteria are intended to avoid mixes that have clear material quality issues.

Infiltration Rate Evaluation

This section appiles to BIO-1 or BIO-6 where a specific range of media infiltration rates is established in design and is critical for sizing.

- The saturated hydraulic conductivity or infiltration rate of the whole BSM shall be measured by one of the following methods:
    - Measurement of hydraulic conductivity (USDA Handbook 60, method 34b) (commonly available as part of standard agronomic soil evaluation – estimated $30 to 50 per sample), or
    - ASTM D2434 Permeability of Granular Soils (at approximately 85 percent relative compaction Standard Proctor, ASTM D698)
- BSM should conform to hydraulic criteria associated with the BMP design configuration that best applies to the facility where the BSM will be installed (options describe below).
    - **Systems with hydraulic control on the outlet of the underdrain system** (i.e., outlet control). For systems in which the flowrate of water through the media is controlled via an outlet control device (e.g., orifice or valve) affixed to the outlet of the underdrain system, the infiltration rate or hydraulic conductivity of the media should be at least 20 inches per hour and not more than 40 inches per hour. The outlet control device should control the flowrate to between 5 and 12 inches per hour. This configuration reduces the sensitivity of system performance to the permeability of the material, reduces the likelihood of short circuiting through media, and allows more precise design and control of system flow rates. For these reasons, outlet control should be considered the preferred design option.
    - **Systems with free-flowing underdrain system** (i.e., flowrate is controlled by the permeability of the BSM). For systems with underdrains that are not restricted, the BSM should have minimum measured hydraulic conductivity of 8 inches per hour to ensure adequate flow rate through the BMP and longevity of the system. This results in a recommended design infiltration rate of 2 to 4 inches per hour to account for potential compaction and clogging. The BSM should have a maximum measured hydraulic conductivity of no more than 20 inches per hour to provide adequate contact time and treatment. Where this limit cannot be achieved, an outlet controlled configuration should be considered. In all cases, an upturned elbow system on the underdrain, measuring 6 to 12 inches above the invert of the underdrain, should be used to control velocities in the underdrain pipe and reduce potential for solid migration through the system.

Rationale: The media infiltration rate is a critical parameter in sizing and design of BIO-1 and BIO-6. It is necessary to confirm that the infiltration rate is reasonably consistent with what has been used in sizing and design and is capable of providing adequate treatment. Infiltration rates that are too slow may not provide long term capture performance adequate to meet sizing criteria. Infiltration rates that are too high may not provide adequate treatment or can be susceptible to short-circuiting unless used in an outlet controlled configuration.

Chemical Suitability Evaluation

This section appiles to BIO-1 or BIO-6 (systems with underdrains). In these systems, it is more critical to ensure that significant increases in pollutants will not occur as a result of filtration of water through the media (i.e., pollutant leaching). Nutrients are the most common form of leached pollutants. However, metals have also been observed.

The basic testing described above is adequate where nutrients or metals are not identified as impairments or TMDLs.

Where nutrients or metals are identified as impairments or TMDLs in any receiving water, the standard “Agronomic Soil Suitability Test” should be augmented with Saturated Media Extract Method (aka “saturation extract”) testing that covers at least the following parameters.

- Nitrate as N: < 3 mg/L

- Plant Available Phosphorus (P Index): 10 to 30 mg/kg (this is a tighter range than specified for basic evaluation above)
- Zinc < 0.1 mg/L (100 ppb)
- Copper < 0.025 mg/L (25 ppb)
- Lead < 0.025 mg/L
- Arsenic < 0.02 mg/L
- Cadmium < 0.01 mg/L
- Mercury < 0.01 mg/L
- Selenium < 0.01 mg/L

The Synthetic Precipitation Leaching Procedure (SPLP) (EPA SW-846, Method 1312) may also be used.

Criteria should be met as stated where a pollutant is associated with a water quality impairment or Total Maximum Daily Load (TMDL) in any downstream receiving water. Criteria may be waived or modified, at the discretion of the reviewer, where a pollutant does not have a nexus to a water quality impairment or TMDL of downstream receiving water(s).

Note that Saturation Extract and SPLP tests are expected to result in somewhat more leaching than would be experienced with real stormwater; therefore a direct comparison to water quality standards or effluent limitations is not appropriate.

Alternative Mix Components and Proportions

Alternative mix components and proportions may be utilized, provided that the whole blended mix conforms to the criteria identified in the Basic Whole Mix Testing, Infiltration Rate Evaluation, and Chemical Suitability Evaluation, as applicable. Alternative mix designs may include alternative proportions, alternative organic amendments (e.g., peat, coco coir pith) and/or use of natural soils. Alternative mixes are subject to approval by the reviewer. Alternative mixtures may be particularly applicable for systems with underdrains in areas where phosphorus is associated with a water quality impairment or a Total Maximum Daily Load (TMDL) in a downstream receiving water.

Construction Guidelines

- The Contractor should not deliver or place soils in wet or muddy conditions. The Contractor should protect soils and mixes from absorbing excess water and from erosion at all times. The Contractor should not store materials unprotected from rainfall events (>0.25 inches). If water is introduced into the material while it is stockpiled, the Contractor should allow material to drain prior to placement
- BSM should be thoroughly mixed prior to delivery using mechanical mixing methods such as a drum mixer.
- BSM should be lightly compacted and placed in loose lifts approximately 12 inches (300 mm) to ensure reasonable settlement without excessive compaction, such as via a rolling landscaping compaction drum (hand operated). Compaction within the BSM area should not exceed 75 to 85% standard proctor within the designed depth of the BSM. Machinery shouldl not be used in the bioretention facility to place the BSM. A conveyor or spray system should be used for media placement in large facilities. Low ground pressure equipment may be authorized for large facilities at the discretion of the reviewer.

- Placement methods and BSM quantities should account for approximately 10 percent reduction in media volume due to settling. Planting methods and timing should account for settling of media without exposing plant root systems.
- The Permittee construction inspector may request up to three double ring infiltrometer tests (ASTM D3385) or approved alternate tests to confirm that the placed material meets applicable infiltration rate range. In the event that the infiltration rate of placed material does not meet applicable criteria, the Permittee may require replacement and/or decompaction of materials.
- Close adherence to the material quality controls herein are necessary in order to assure sufficient permeability to infiltrate/filter runoff during the life of the facility, support healthy vegetation, and minimize pollutant leaching.
- Acceptance of the material should be based on test results conducted no more than 120 days prior to delivery of the blended BSM to the project site and certified to be representative of the mix composition that is actually used. For projects installing more than 100 cubic yards of BSM, batch-specific tests of the blended mix should be provided to the Permittee inspector for every 100 cubic yards of BSM along with a site plan showing the placement locations of each BSM batch within the facility.

Integration with Other Specifications

BSM specifications are related to, and may depend or have dependency on other specifications, including but not limited to:

- Filter course and drainage layer (See MISC-3)
- Plantings and Hydroseed (See MISC-4)
- Underdrains (See BIO-1)
- Outlet control structures (See BIO-1)

Narrative Guidance for Balancing Plant Growth with Nutrient Leaching

Where the BMP discharges to receiving waters with nutrient impairments or nutrient TMDLs, there is a particular balance that needs to be maintained between providing enough nutrients for plant growth while avoiding chronic leaching of nutrients from the media.

- In general, the potential for leaching of nutrients can be minimized by:
  - Utilizing stable, aged compost (as required of media mixes under all conditions).
  - Utilizing other sources of organic matter, as appropriate, that are safe, non-toxic, and have lower potential for nutrient leaching than compost (e.g., wood compost, peat, coco coir pith).
  - Reducing the content of compost or other organic material in the media mix to the minimum amount necessary to support plant growth and healthy biological processes.
- A botanist, agronomist, and/or landscape architect can be consulted to assist in balancing the interests of plant establishment, water retention capacity (irrigation demand), and the potential for nutrient leaching. The following practices should be considered in developing the media mix design:
  - The actual nutrient content and organic content of the selected compost source should be considered when specifying the proportions of compost and sand. The compost specification allows a range of organic content over approximately a factor of 2 and nutrient content may vary more widely. Therefore determining the actual organic content

and nutrient content of the compost expected to be supplied is important in determining the proportion to be used for amendment.

- A commitment to periodic soil testing for nutrient content and a commitment to adaptive management of nutrient levels can help reduce the amount of organic amendment that must be provided initially. Generally, nutrients can be added planting areas through the addition of organic mulch, but cannot be removed.
- Plant palettes and the associated planting mix should be designed with native plants where possible. Native plants generally have a broader tolerance for nutrient content, and can be longer lived in leaner/lower nutrient soils. An additional benefit of lower nutrient levels is that native plants will generally have less competition from weeds.
- Nutrients are better retained in soils with higher cation exchange capacity (CEC). CEC can be increased through selection of organic material with naturally high CEC, such as peat, and/or selection of inorganic material with high CEC such as some sands or engineered minerals (e.g., low P-index sands, zeolites, rhyolites, etc). Including higher CEC materials would tend to reduce the net leaching of nutrients.
- Soil structure can be more important than nutrient content in plant survival and biologic health of the system. If a good soil structure can be created with very low amounts of compost, plants survivability should still be provided. Soil structure is loosely defined as the ability of the soil to conduct and store water and nutrients as well as the degree of aeration of the soil. While soil structure generally develops with time, planting/storage media can be designed to promote earlier development of soil structure. Soil structure is enhanced by the use of amendments with high hummus content (as found in well-aged organic material). In addition, soil structure can be enhanced through the use of compost/organic material with a distribution of particle sizes (i.e., a more heterogeneous mix).
- Younger plants are generally more tolerant of lower nutrient levels and tend to help develop soil structure as they grow. Starting plants from smaller transplants can help reduce the need for organic amendments and improve soil structure. The project should be able to accept a plant mortality rate that is somewhat higher than starting from larger plants and providing high organic content.

- With these considerations, it is anticipated that less than 20 percent compost amendment could be used, while still balancing plant survivability and water retention.

We wish to express our gratitude to following individuals for their feedback on the design of planting/storage media for nutrient sensitive receiving waters in Southern California.

Deborah Deets, City of Los Angeles Bureau of Sanitation

Drew Ready, LA and San Gabriel Rivers Watershed Council

Rick Fisher, ASLA, City of Los Angeles Bureau of Engineering

Dr. Garn Wallace, Wallace Laboratories

Glen Dake, GDML

Jason Schmidt, Tree People

The guidance provided herein does not reflect the individual opinions of any individual listed above and should not be cited or otherwise attributed to those listed.

BIO-1: BIOINFILTRATION

Category: Biotreatment with Partial Infiltration

[This fact sheet also serves as the base fact sheet for INF-3 and BIO-6.]

Also known as:
- Rain Gardens
- Bioretention with Internal Water Storage
- Bioretention with Elevated Underdrain

Source: Geosyntec Consultants

Bioinfiltration facilities are designed for biotreatment with partial infiltration of runoff. Water is biotreated via filtering through a vegetated bed of engineered media. Water is infiltrated via an aggregate storage layer that is designed to discharge only when the storage layer is full. Bioinfiltration facilities are commonly incorporated into parking lot islands, cul-de-sacs, traffic circles, road shoulders, and road medians. These facilities can be used in areas where there are no hazards associated with partial infiltration but infiltrating the full DCV is infeasible. These facilities may not result in retention of the full DCV, but they can be used to achieve the maximum feasible volume reduction through infiltration and ET while providing biotreatment of the remaining portion of the required treatment volume.

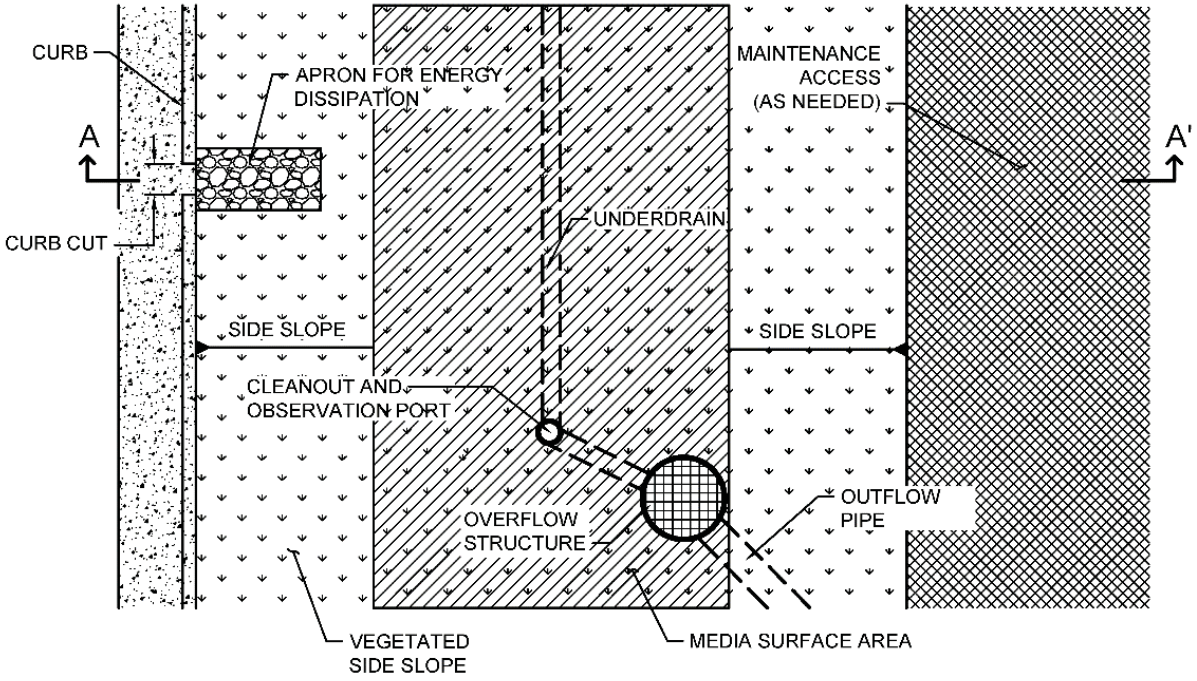
Pollutant Removal Considerations

TSS	Phosphorus	Nitrogen	Metals	Bacteria	Oil & Grease	Organics	Trash
H	M	M	H	M	H	M	H

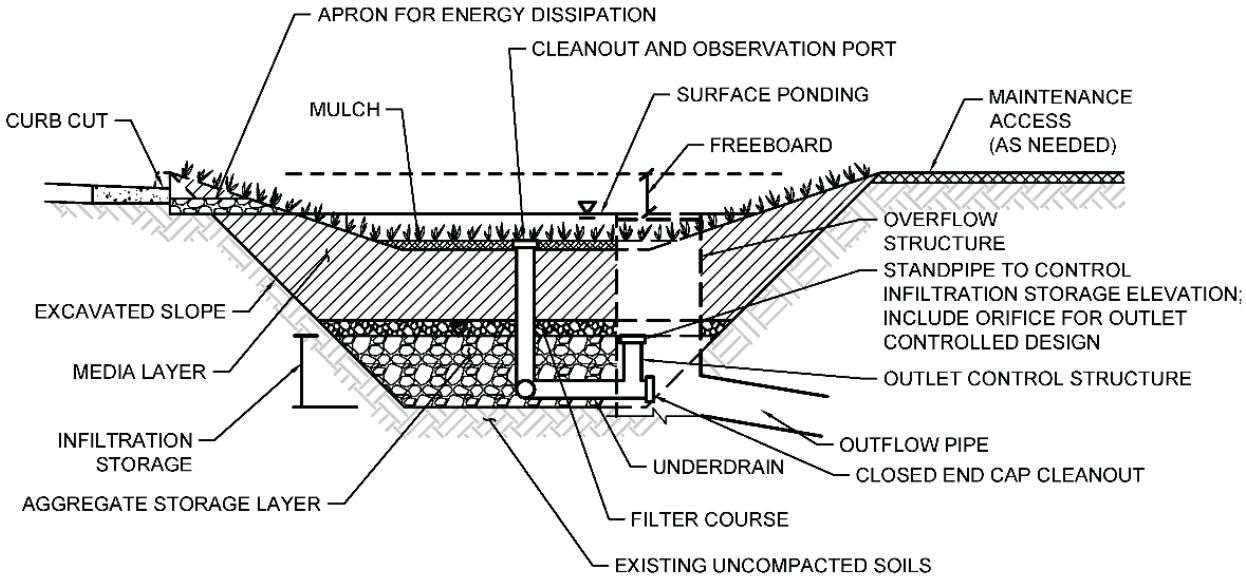
Recommended Siting Criteria

	Siting Criteria	Intent/Rationale
☐	BMP placement adheres to geotechnical recommendations with respect to geological hazards and setbacks.	Must not negatively impact existing site geotechnical concerns.
☐	BMP is located in an area of the site most suitable for partial infiltration.	To the extent practicable, BMPs must be sited to take advantage of areas where infiltration is likely to be highest.
☐	Tributary area is ≤ 5 acres, preferably ≤ 1 acre.	Larger biofiltration facilities have a higher potential for scour and short circuiting and may require more specific construction methods. **Section 4.4.7** provides specific design considerations for larger facilities.
☐	Sediment sources are controlled prior to operation of the system.	Facility should not be used in areas that will continue to receive elevated sediment loading following construction, such as from open space area.

Example Schematic Design - Plan and Section View



PLAN
NOT TO SCALE



SECTION A-A'
NOT TO SCALE

Recommended BMP Component Dimensions

BMP Component	Dimension	Intent/Rationale
Freeboard	≥ 6 inches if system has internal overflow Freeboard not required if offline with acceptable bypass	Freeboard provides for water to enter overflow structures and minimizes risk of uncontrolled surface discharge. Lower freeboard (or no freeboard) is allowable if there is an acceptable bypass pathway when the WQ storage is full, such as flow along the curb line to a storm inlet downstream.
Surface Ponding	≥ 3 inches	A lower limit is needed to provide enough surface storage for water to be able to enter the media. Also, very shallow depths are more susceptible to construction error and change over time with O&M activities.
Surface Ponding	≤ 18 inches	Deeper surface ponding depths may require demonstration that premature clogging is not likely and may require fencing.
Ponding Area Side Slopes	3H:1V or shallower	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain. Vertical walls may be acceptable with appropriate considerations for safety.
Mulch	2-4 inches (average 3 inches)	Mulch is intended to suppress weeds and maintain moisture for plant growth. Mulch also retains sediment and allows sediment to be removed before it clogs the media bed.
Media Layer	≥ 18 inches (24 to 36 inches preferred)	A deeper media layer provides additional filtration and supports plants with deeper roots. The media layer must extend across the BMP to the waterline to ensure no infiltrated water bypasses the media.
Filter Course	4-6 inches	Typically made up of 2 to 3 inches of coarse sand and 2 to 3 inches of pea gravel, both washed. Thinner layers are less effective and may be more challenging to accurately construct.
Infiltration Storage	≥ 18 inches	Provides enhanced volume control. May include the pea gravel portion of the filter course and the full depth of the aggregate storage layer, depending on the outlet control elevation and design.
Underdrain Diameter	≥ 6 inches	Facilitates simpler cleaning.
Cleanout Diameter	≥ 6 inches	Facilitates simpler cleaning.

Recommended Design Criteria and Considerations

Design Criteria	Intent/Rationale
Pretreatment	
☐ Select pretreatment to provide acceptable clogging timeframe per guidance in Fact Sheet MISC-5 and **Appendix E.4.1**.	BMP performance and longevity is increased. Premature clogging is avoided.
Surface Ponding	
☐ Finish grade of the facility has ≤3 inches of elevation difference across the bottom of the facility.	Flatter surfaces reduce erosion and channelization within the facility and reduce the potential for development of preferential pathways.
☐ Surface ponding is limited to a 24-hour drawdown time.	24-hour drawdown time is recommended for plant health.
Vegetation	
☐ An irrigation system with a connection to water supply should be provided, as needed.	Seasonal irrigation may be needed to ensure robust vegetative processes in relatively coarse-grained media material.
☐ Plant materials should be tolerant of summer drought (unless irrigated), ponding fluctuations, and saturated soil conditions for up to 48 hours; native plant species and/or hardy cultivars that are not invasive and do not require chemical fertilizers or pesticides should be used to the maximum extent feasible. See recommended plant list in **Fact Sheet MISC-4.**	Plants suited to the climate and ponding depth are more likely to survive.
☐ In right of way areas, plant selection should not impair traffic sightlines or vehicle access.	Vegetation should be selected to be compatible with operation of the system and support adjacent uses.
Mulch	
☐ Well-aged, double or triple shredded hardwood mulch that has been stockpiled or stored for at least 12 months. Mulch must be non-floating to avoid clogging of overflow structure.	Mulch provides moisture retention and captures some sediment before it enters the media. Aged hardwood mulch will not rob the soil of nitrogen needed for new plants and will decompose slowly.
Media Layer	
☐ Planting/storage media shall conform to the criteria in **Fact Sheet MISC-1.**	Media is one of the most critical elements of the system and must be specified carefully to avoid pollutant export issues, plant health issues, or premature clogging.
Filter Course Layer	
☐ A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.
☐ Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility and produce turbidity

Design Criteria	Intent/Rationale
	washout events. For infiltration and partial infiltration systems, washing shall not occur in situ as it could clog the underlying infiltration surface.
☐ Filter course should adhere to guidance provided in **Fact Sheet MISC-3.**	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.
Aggregate Storage Layer	
☐ The aggregate storage layer depth below the underdrain invert is determined based on a minimum of 18 inches of stone or the depth, which can include the pea gravel portion of the filter course, that will drain within 48 hours at the design infiltration rate of the underlying soil.	The intent of this layer is to maximize incidental volume reduction.
☐ Washed river rock or open-graded, crushed rock.	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.
Inflow, Underdrain and Outflow Structures	
☐ Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance access is essential to ensure long-term performance.
☐ Inflow velocities are held to less than 1 ft/s. Dispersed flow or energy dissipation (e.g., riprap, level spreader, curb cut drop and apron) for piped inlets should be provided at inlet to prevent erosion.	High inflow velocities can cause erosion, scour and/or channeling.
☐ An underdrain cleanout with a lockable cap is placed every 100 to 200 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.
☐ At least one observation port is provided in each cell to allow inspection of subsurface water level.	This feature is necessary to facilitate inspection and performance confirmation (i.e., the infiltration storage is draining and providing the volume reduction anticipated).
☐ Underdrain is placed 3 inches above the bottom elevation of the aggregate storage layer.	Separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked. This configuration allows the system to be fully drained, if needed. Under normal conditions, the water level is controlled via an elbow or standpipe configuration such that the sump storage depth can be adjusted without excavation of the media bed, if needed.
☐ An outlet control approach to maintain subsurface water level and manage flow rates through the media is strongly preferred. To maintain the subsurface water level, an upturned	Outlet control helps prevent preferential pathways and media loss. It also reduces the sensitivity of system performance on the hydraulic conductivity of the media, allowing

	Design Criteria	Intent/Rationale
	elbow/standpipe system or equivalent is used in the receiving outlet structure. To control flow rates through the media, an orifice is used, if possible. Orifice size should not be less than 0.5 inches.	media to be specified with a greater factor of safety against clogging.
☐	The outlet control is provided in the catch basin or manhole where the underdrain connects and is accessible for observation and maintenance.	Using outlet control in the receiving catch basin or manhole allows the system to be adapted without requiring excavation.
☐	Underdrains made of are slotted pipe per **MISC-3**.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☐	An overflow device is required at the top of the ponding depth to safely convey overflow to the downstream receiving system unless the system is offline and will bypass externally to the facility.	Planning for controlled overflow lessens the risk of property damage due to flooding.

Calculations and Sizing Method

See **Appendix E** for acceptable sizing methods. Checks on footprints associated with clogging risk and volume reduction should be conducted as part of sizing. Retention volume is the volume within the stone reservoir below the underdrain elevation and up to 0.1 inch per inch of pores within the soil (suction/ET storage). Biotreatment volume is the volume in ponded water and soil pores.

Construction Guidance

	Construction Guidance	Intent/Rationale
☐	Plans should include a construction sequence for the BMP. Revisions proposed by the contractor should be reviewed by the engineer. The construction sequence should address erosion control, utilities, BMP installation, inspections, testing and certifications, final grading, vegetation, stabilization, and post-construction monitoring.	Construction sequencing is critical to avoid issues/damage and allow appropriate inspections, testing, and certifications to be performed.
☐	Excavate and place media in dry weather, or at least 48 hours after the end of rainfall.	Wetter soil is typically more susceptible to compaction.
☐	Avoid compaction of the base and sidewalls of facilities. Alleviate compaction as needed using mechanical tilling equipment (e.g., rototiller).	Infiltration rates are typically very susceptible to compaction. Infiltration should be maximized.
☐	Keep sediment out of the facility during construction as much as practicable using sediment and erosion control measures (e.g., silt fence, filter logs, check dams). Remove any confining layer that accumulates as a result of sedimentation. If the location of BMP is used as a temporary erosion and sediment control facility, it	Sediment accumulation can impair infiltration rates.

	Construction Guidance	Intent/Rationale
	should be completely rehabilitated via over excavation, before being placed into service as a post-construction BMP.	
☐	Traffic within the BMP should be avoided unless impractical. If traffic within the system is allowed, only wide track and low-ground pressure equipment is allowed.	Compaction of the system must be avoided as much as possible.
☐	Account for settlement of media when setting finished grades and planting depths.	Media will tend to settle approximately 10 percent. Failure to account for this can result in dimensions different than intended and/or exposure of plant roots.
☐	Use staking, surveying, or other methods to confirm thickness of filter course and media layers.	A uniform thickness of layers is important for effectiveness and to reduce preferential pathways.
☐	Establish the construction sequence to allow for inspection of buried infrastructure (e.g., underdrain, filter course) before it is buried.	It is impractical to inspect buried elements once they are covered.
☐	Fully stabilize sources of sediment within the tributary area (i.e., no exposed soil) prior to placing the finished BMP into service.	Erosion and sedimentation can seriously impair the hydraulic conductivity of the media bed and require restoration and revegetation of the surface of the media bed.
☐	Allow plants and mulch to stabilize for as long as practicable (preferably several months) prior to placing the finished BMP into service.	Stabilization of the system allows plants to mature and mulch to settle and "knit" before stressing the system with stormwater loading.

Adaptability Considerations

This type of BMP provides a high degree of adaptability. Adjustments to the design and/or operation of the system may be needed if observations from more detailed investigation, construction, or operation are different than what was estimated in design and permitting.

Adjust standpipe elevation and/or uncap lower underdrain (pre- or post-construction) – this can be done to reduce the amount of infiltrated volume and make the system act as bioretention with underdrains (BIO-6). This adaptation could take place between the Preliminary/Conceptual WQMP and the Final Project WQMP should issues with infiltration be identified or following construction should infiltration rates be determined to be lower than estimated.

Add a liner as part of detailed design (prior to construction) – this can be done to further limit infiltration if issues with any level of infiltration are identified as part of detailed design. This adaptation could take place between the Preliminary/Conceptual WQMP and the Final Project WQMP.

To allow for these adaptations, calculations in the WQMP should demonstrate that the system will still be adequately sized if the retention compartment is converted to biofiltration.

O&M Activities and Frequencies

Activity	Frequency
GENERAL INSPECTIONS	
Remove trash and debris	Four times per year during wet season, including inspection just before the wet season and within 24 hours after at least two storm events ≥ 0.5 inches.
Repair eroded facility areas	
Inspect and maintain access roads	
Inspect and resolve areas of standing water	
Remove minor sediment in facility bottom	
Provide vector control if needed	
Identify any needed corrective maintenance that will require site-specific planning or design	
ROUTINE MAINTENANCE	
Vegetation	
Irrigate as recommended by a landscape professional, typically for the first 3 years to establish vegetation	As needed
Remove undesirable vegetation	Four times per year during wet season, including inspection just before the wet season.
Reseed or replant areas of thin or missing vegetation	Annually
Mulch	
Remove and replace mulch in areas where significant sediment (>1 inch) has accumulated	Annually
Add an additional 1-2 inches of mulch; replace any mulch that is removed	Annually
Media Layer	
Scarify media to promote infiltration while removing mulch	Annually
Replace top 3-6 inches of media layer and replace vegetation	Estimated every 10 years (highly site specific)
Replace full depth of media and replace vegetation	Estimated every 30 years (highly site specific)
Inflow, Underdrain and Outflow Structures	
Check energy dissipation function and add riprap	Four times per year during wet season, including inspection just before the wet season.
Inspect inlets and outlets and remove accumulated sediment	Four times per year during wet season, including

Activity	Frequency
	inspection just before the wet season.
Flush underdrain	As needed
Repair structural damage to inlets, outlets, and underdrain	As needed
CORRECTIVE (MAJOR) MAINTENANCE	
Prepare documentation of issues and resolutions for review by appropriate parties; modify WQMP if needed.	Before major maintenance
Document major maintenance activities; record modified WQMP and as-built plan set if needed	After major maintenance
Take photographs before and after from the same vantage point	Before and after

BIO-6: BIORETENTION WITH UNDERDRAIN

Category: Biotreatment

Also known as:
Biofiltration
Planter Box

This BMP is very similar to BIO-1, but is tailored to be located in conditions that do not support a significant level of infiltration or where infiltration must be avoided.


Source: Geosyntec Consultants

Fact Sheet BIO-1 should be the primary resource for guidelines about this BMP. Fact Sheet BIO-6 does not repeat this guidance; it only presents the specific differences that should be considered in design, construction, and O&M in cases where there is not appreciable infiltration.

There are three primary options for adapting the guidance from BIO-1 to serve in conditions where no appreciable level of infiltration is feasible.

No changes to BIO-1 - Where minor incidental infiltration is permissible from the perspective of risks, but does not occur in a significant rate, it is acceptable to simply design the system following the guidance in BIO-1. Standing water in the underdrains for an extended period is an acceptable design variation known as "Internal Water Storage." This configuration improves nutrient and bacteria removal. It can also result in minor volume reduction even in very tight soils.

Add liner to BIO-1 – Where infiltration must be avoided due to risk of impacts, an impermeable liner of some sort should be used. Continuing to provide aggregate storage layer and internal water storage, as included in BIO-1 is preferred due to pollutant removal benefits.

Eliminate internal water storage – In conditions not suitable for partial infiltration and that do not have nutrients as a pollutant of concern, is is acceptable to eliminate the internal water storage zone. This can reduce the thickness of the gravel storage layer compared to BIO-1. It reduces the effectiveness of the BMP to remove nutrients (from M to L) and bacteria (from H to M).

Pollutant Removal Considerations

Config	Sediment	Phosphorus	Nitrogen	Metals	Bacteria	Oil & Grease	Organics	Trash
With Internal Water Storage	H	M	M	H	H	H	M	H

Without Internal Water Storage	H	L	L	H	M	H	M	H

Recommended Design Criteria and Considerations (only differences from BIO-1 are listed)

Aggregate Storage Layer – Internal Water Storage Configuration Only	
☐ The aggregate storage layer depth below the underdrain invert is a minimum of 18 inches of stone.	The intent of this layer is to provide treatment processes associated with an internal water storage zone.
Underdrain Aggregate Layer –No Internal Water Storage Configuration Only	
☐ The aggregate underdrain layer must provide at least 6 inches of cover on the top and sides of the underdrain pipe and 3 inches below the pipe	The intent of this layer is to provide treatment processes associated with an internal water storage zone.
☐ Underdrains, aggregate, and filter course material maybe located in trenches rather than over the entire bottom of the BMP.	Because volume reduction and/or internal water storage is not a goal, it is not necessary to provide a storage layer.
Impermeable Liner	
☐ Liner has a minimum thickness of 30 mils.	Minimizes tearing and penetration by aggregate or other protrusions.
☐ Liner is free of holes, blisters, undispersed raw materials, contamination by foreign matter, and other defects.	Minimizes facility stormwater loss and contamination.
☐ Liner withstands the range of temperature encountered by open exposure at the site without degradation or deterioration of the lining system.	Minimizes liner deterioration.
☐ Liner, and all other parts of the lining system in contact with liquid is resistant to stormwater pollutants including small concentrations of floating hydrocarbons such as hydraulic oil, diesel fuel, and gasoline.	Minimizes liner deterioration.
☐ Liner is bedded between appropriate material at least 6 inches above and below liner, or greater subject to manufacturer recommendations.	Appropriate bedding materials should be free of sharp objects and any objects larger than 1 inch in dimension. Sand, clean soil, and/or rounded pea gravel are typically appropriate bedding materials.
Observation Port	
☐ An observation port is not necessary for BIO-6.	It is not necessary to inspect the rate of drawdown of infiltration storage.

Calculations and Sizing Method

See **Appendix E** for acceptable sizing methods. Sizing calculations should not take credit for any amount of infiltration. The internal water storage zone should be assumed to be full and not included in sizing calculations.

Construction Guidance (only differences from BIO-1 are listed)

Construction Guidance	Intent/Rationale
☐ Same as BIO-1, except it is not necessary to protect the BMP location from compaction or construction-phase sedimentation. All other provisions from BIO-1 apply.	It is not necessary preserve infiltration capacity of underlying soils.

O&M Activities and Frequencies

No differences in O&M activities compared to BIO-1.