

**PUBLIC**  
**VENTURA COUNTY**  
**WORKS**



# Training Workshop on Current Ventura County Stormwater Quality Post Construction Mitigation Requirements

Presented and  
Sponsored By:



*Ventura Countywide  
Stormwater Quality  
Management Program*



# Overview

**Session 1** – Site Planning, Conditioning & Annual Maintenance Tracking

Break (10 – 10:20 am)

**Session 2** – Engineering BMP Design (PART 1)

Lunch (11:45 – 1 pm)

**Session 3** – Engineering BMP Design (PART 2)

Break (2:40 – 3 pm)

**Session 4** – Design, Construction, Operations and Maintenance

# SESSION 1

## Site Planning, Conditioning & Annual Maintenance Tracking

# Background

## Federal Water Pollution Control Act

“Clean Water Act” - 1972



Federal Program to Regulate the Discharge of Pollutants  
into Waters of the United States

# Common Acronyms & Definitions

SQUIMP → Stormwater Quality Urban Impact Mitigation Plan

- Post-construction requirements of 2000 Permit

TGM → Technical Guidance Manual

- Detailed supplement to Permit outlining post-construction design

TMDL → Total Maximum Daily Load

- The defined maximum pollutant concentration in run-off discharging to a Water of the United States as to not adversely impact beneficial uses

PCSMP → Post-Construction Stormwater Management Plan

- Post-construction requirements of 2010 Permit

MS4 → Municipal Separate Storm Sewer System

- Municipal-owned conveyance for surface run-off (ie. storm drain pipes, streets, catch basins, curbs, gutters, ditches, channels, etc.)

# Ventura County MS4 Permitting History

1994 → 1<sup>st</sup> Term Ventura County MS4 Permit

- Program development permit

2000 → 2<sup>nd</sup> Term Ventura County MS4 Permit

- Program implementation permit
- SQUIIMP incorporated to address water pollution from new and redevelopment (Mirrored LA County's req's)

2010 → 3<sup>rd</sup> Term Ventura County MS4 Permit

- **Current** program implementation permit
- Includes TMDLs and stricter PCSMP requirements

STATE OF CALIFORNIA

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
LOS ANGELES REGION

ORDER R4-2010-0108  
NPDES PERMIT NO. CAS004002  
WASTE DISCHARGE REQUIREMENTS  
FOR

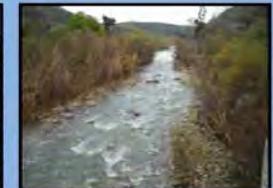
STORM WATER (WET WEATHER) AND NON-STORM WATER (DRY WEATHER)  
DISCHARGES FROM  
THE MUNICIPAL SEPARATE STORM SEWER SYSTEMS WITHIN THE VENTURA  
COUNTY WATERSHED PROTECTION DISTRICT, COUNTY OF VENTURA AND  
THE INCORPORATED CITIES THEREIN.

July 8, 2010



July 8, 2010

## Ventura County Technical Guidance Manual for Stormwater Quality Control Measures Manual Update 2011



Ventura Countywide  
Stormwater Quality  
Management Program

Geosyntec  
consultants



LARRY  
WALKER

ASSOCIATES

Prepared by

Larry Walker Associates    Geosyntec Consultants  
707 Fourth Street, Suite 200    1111 Broadway, 6<sup>th</sup> Floor  
Davis, CA 95616    Oakland, CA 94607

July 13, 2011

[http://pwaportal.ventura.org/WPD/onestop/  
stormwater/docs/2010%20Permit.pdf](http://pwaportal.ventura.org/WPD/onestop/stormwater/docs/2010%20Permit.pdf)

[http://pwaportal.ventura.org/WPD/onestop/  
stormwater/docs/2011%20TGM.pdf](http://pwaportal.ventura.org/WPD/onestop/stormwater/docs/2011%20TGM.pdf)

**PUBLIC**  
VENTURA COUNTY  
**WORKS**

Slide 7

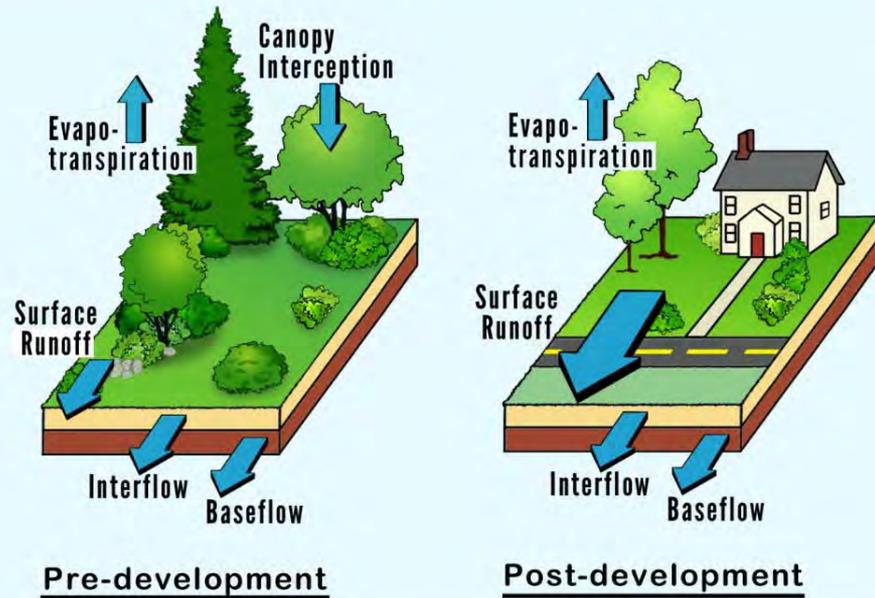
# 2010 MS4 Permit

Made up of 7 Parts and 9 Attachments

<b>PART 4</b>	<b>SPECIAL PROVISIONS (BASELINE)</b> -----	<b>41</b>
	A. General Requirements -----	41
	B. Watershed Initiative Participation -----	41
	C. Public Information and Participation Program -----	42
	D. Industrial/ Commercial Businesses Program -----	45
	E. Planning and Land Development Program -----	53
	F. Development Construction Program -----	68
	G. Public Agency Activities Program -----	77
	H. Illicit Connections and Illicit Discharges Elimination Program -----	85
	I. Reporting Program -----	87



Figure 1.1 Water Balance at a Developed and Underdeveloped Site  
(Source: Schueler, 1987)



Surface runoff is minimal in an undeveloped site, but dominates the water balance at a highly impervious site.



Table 3-2: Land Uses and Associated Pollutants

Class of Pollutant	Potential Land Use and Activities Sources
Sediment (TSS and Turbidity)	Streets, driveways, roads, landscaped areas, construction activities, soil erosion (channels and slopes)
Nutrients	Landscape fertilizers, atmospheric deposition, automobile exhaust, soil erosion, animal waste, detergents
Metals/Metalloids	Automobiles, bridges, atmospheric deposition, industrial areas, soil erosion, metal surfaces, combustion processes
Pesticides	Landscaped areas, roadsides, utility right-of-ways
Organic Materials/ Oxygen Demanding Substances	Landscaped areas, animal wastes, industrial wastes
Oil and Grease/ Organics Associated with Petroleum	Roads, driveways, parking lots, vehicle maintenance areas, gas stations, automobile emissions, restaurants
Bacteria and Viruses	Lawns, roads, leaky sanitary sewer lines, sanitary sewer cross-connections, animal waste (domestic and wild), septic systems, homeless encampments, sediments/biofilms in stormwater conveyance system
Trash and Debris (Gross Solids and Floatables)	Commercial areas, roadways, schools, trash receptacles/storage/disposal

Adapted from US EPA, 1999 (Preliminary Data Summary of Urban Stormwater BMPs)

2014 AND 2016 INTEGRATED REPORT — 303(D) LISTED WATERS

Zoom to county:  Zoom to Regional Board:   
 Show county  Show Regional Board

Map Help

Zoom to water body: (Filter: All)   
 Filter list by:  Reset list



Show all assessed waters  
 Show only impaired ("303(d)-listed") waters

Show water bodies by pollutant category:  
 All

Pollutant category:  
 All

Pollutant:  
 All

Reset filters

## 2010 MS4 Permit - TMDLs

TMDLs in effect and covered in this Order are the following:

1. TMDL for Nutrients for Malibu Creek Watershed (Effective date: March 21, 2003)
2. TMDL for Nitrogen Compounds and Related Effects in Calleguas Creek (Effective date: July 16, 2003)
3. TMDL for Nitrogen Compounds for the Santa Clara River (Effective date: March 23, 2004).
4. TMDL for Chloride in Santa Clara River, Reach 3 (Effective date: June 18, 2003)
5. TMDL for Chloride in Upper Santa Clara River (Effective date: May 4, 2005)
6. TMDL for Toxicity, Chlorpyrifos and Diazinon in the Calleguas Creek, its Tributaries and Mugu Lagoon - (Effective date: March 24, 2006).
7. TMDL for Organochlorine Pesticides, Polychlorinated Biphenyls, and Siltation in Calleguas Creek, its Tributaries and Mugu Lagoon (Effective date: March 24, 2006).
8. TMDL for Bacteria in Malibu Creek and Lagoon (Effective date: January 24, 2006).
9. TMDL for Metals and Selenium in the Calleguas Creek, its Tributaries and Mugu Lagoon (Effective date: March 26, 2007)
10. TMDL for Trash in Revolon Slough and Beardsley Wash (Effective date: March 6, 2008).
11. TMDL for Boron, Chloride, Sulfate, and TDS in Calleguas Creek Watershed (Effective date: December 2, 2008)
12. TMDL for Trash in the Ventura River Estuary (Effective date: March 6, 2008).
13. TMDL for Bacteria in Harbor Beaches of Ventura County (Effective date: September 23, 2008).

[https://www.waterboards.ca.gov/losangeles/water\\_issues/programs/303d/index.html](https://www.waterboards.ca.gov/losangeles/water_issues/programs/303d/index.html)

# New Development Triggers

1. **Projects disturbing > 1 acre & adding > 10,000 SF impervious area**
2. Industrial parks > 10,000 SF *total altered surface area*
3. Commercial strip mall > 10,000 SF impervious surface area
4. Retail gasoline outlets > 5,000 SF *total altered surface area*
5. Restaurants (SIC 5812) > 5,000 SF *total altered surface area*
6. Parking lots adding > 5,000 SF impervious area or 25 or more parking spaces
7. **Streets/roads/highways adding > 10,000 SF impervious area**
8. Automotive service facilities (SIC 5013, 5014, 5511, 5541, 7532-7534 & 7536-7539) > 5,000 SF *total altered surface area*
9. Projects in or directly adjacent to, or discharging directly to an ESA, where;
  - ▶ Discharge runoff is likely to impact sensitive biological species or habit; and
  - ▶ Creation of > 2,500 SF of impervious surface area
10. **Single-family hillside homes**

# New Development Triggers

## Single-family hillside homes

1. Includes grading of a natural slope > 20%
2. Doesn't meet thresholds of new development trigger #1:
  - ▶ ie. 0.8 acre lot developed with 20,000 SF (house, garage, driveway)
3. Must implement the following measures:
  - i. Conserve natural areas
  - ii. Protect slopes and channels
  - iii. Provide storm drain system stenciling and signage
  - iv. Direct roof runoff and surface flow to vegetated areas (unless results in slope instability)

Single-family hillside home projects have specific post-construction requirements separate from other new development and redevelopment project categories. The intent of these requirements is to minimize erosive conditions and stormwater pollution that may result from single-family hillside development.

**Applicability:** These guidelines apply to properties where a single-family hillside home is located in an area with known erosive soils conditions, where the development will result in grading on any slope that is 20% or greater or designated critical erosion areas.

These conditions do not apply to individual lots within a larger project. Larger projects (e.g., projects that consist of more than one home) should review Section 1.5 of the 2011 TGM to determine applicable post-construction requirements. The 2011 TGM may be found at: [www.vcstormwater.org](http://www.vcstormwater.org).

The following measures shall be applied to the entire lot during the construction of a single-family hillside home that meets the above applicability criteria.

### Conserve Natural Areas

1. Locate development on the least sensitive portion of the lot and leave the remaining land in a natural undisturbed state. Sensitive portion of the lot should include areas covered under Clean Water Act Section 404 such as riparian areas and wetlands.
2. Limit clearing and grading to the minimum needed to build the home, allow access, and provide fire protection.
3. Maximize trees and other vegetation at the site.

### Protect Slopes and Channels

#### Slopes

1. Adhere to erosion and sediment control standards.
2. Safely convey runoff from the tops of slopes, if necessary.
3. Vegetate slopes.

#### Channels

1. Minimize runoff.
2. Utilize natural drainage systems (i.e., natural topography).
3. Stabilize channel crossings.
4. Install energy dissipaters (e.g., rip rap) at the outlets of storm drains that discharge to unlined channels.

### Provide Storm Drain System Signage

Storm drain message markers or placards are required at all storm drain inlets within the project boundary.



### Divert Runoff to Vegetated Areas

1. Direct runoff from rooftops to vegetated pervious areas of the site or to a rainwater collection system (e.g., rain-barrel). Spread runoff to reduce erosion to landscaped areas using a splash block or other dispersion method.
2. Allow other impervious surfaces such as sidewalks, patios, and driveways to sheet flow to vegetated areas.
3. Runoff should be directed to well established vegetation that is at least 25 feet in length.
  - a. If less than 25 feet, a perforated stub-out connection may be used in lieu of rooftop runoff dispersion.
4. No erosion or flooding of downstream properties may result.
5. Runoff should not be directed to areas above slopes greater than 20% or above erosion hazard areas without evaluation by a geotechnical engineer or qualified geologist and County approval.

### For more information contact:

Ventura County Stormwater Program staff at (805) 662-6737 or (805) 645-1382 or visit Surface Water Quality Section at <http://onestoppermit.ventura.org>

Detailed information on post-construction requirements for new development and redevelopment projects can be obtained from: Ventura Countywide Stormwater Quality Management Program [www.vcstormwater.org](http://www.vcstormwater.org)

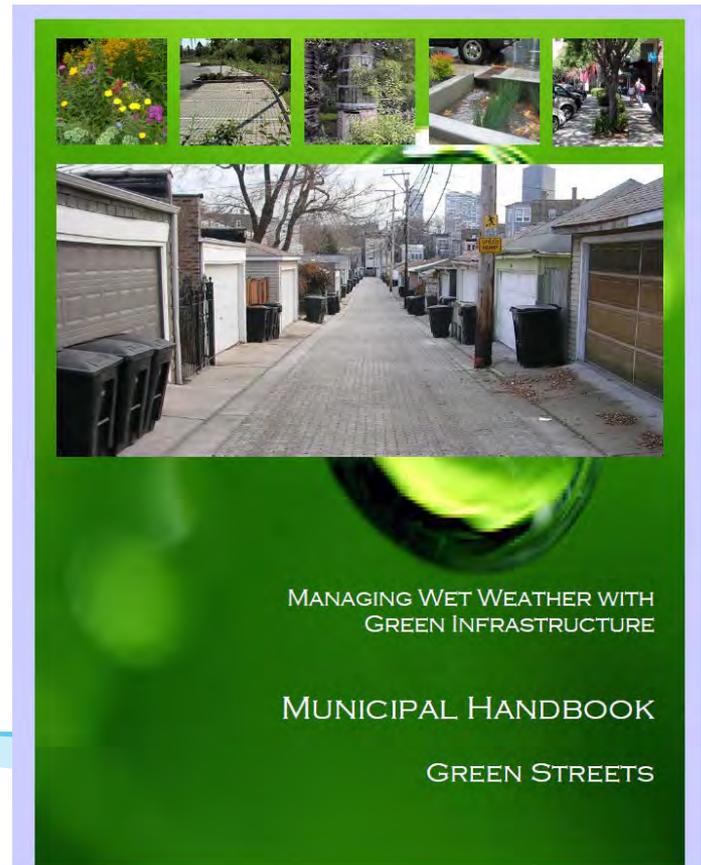


# New Development Triggers

Streets/roads/highways adding > 10,000 SF impervious area

- ▶ Section 4.E.II of the Permit requires these projects to incorporate USEPA guidance regarding *Managing Wet Weather with Green Infrastructure: Green Streets* to the maximum extent practicable.

<http://pwportal.ventura.org/WPD/onestop/stormwater/docs/EPA%20Green.pdf>



# Redevelopment Triggers

Projects in the same 10 new development categories that have:

- ▶ Land-disturbing activities resulting in creation, addition or replacement of 5,000 SF or more of impervious surface area on an already developed site.

Additionally:

- ▶ Project alters > 50% of impervious surfaces of an existing development that was not subject to post-construction requirements of the 2000 MS4 Permit shall mitigate the entire project area.
- ▶ Project alters > 50% of impervious surfaces of an existing development that was subject to post-construction requirements of the 2000 MS4 Permit only need to mitigate the altered portion of the redevelopment project area.
- ▶ Project alters < 50% of impervious surfaces of an existing development must mitigate only the altered portion of the redevelopment project area

# Redevelopment Triggers

Parcel is 8.3 acres and 50% impervious  
Built *prior to* 2000 MS4 Permit

Proposed redevelopment of north half

- > 5,000 SF impervious altered
- > 50% of existing impervious
- \* No existing post-construction controls



# Redevelopment Triggers

Parcel is 8.3 acres and 50% impervious

Built in 2004 → was subject to 2000 MS4 Permit (chose pervious pavement)

Proposed redevelopment of north half

- > **5,000 SF impervious altered**
- > **50% of existing impervious**
- \* **Existing pervious pavement post-construction BMP per 2000 MS4 Permit**



# Redevelopment Triggers

Parcel is 8.3 acres and 50% impervious

Proposed redevelopment of south half

- > 5,000 SF impervious altered
- < 50% of existing impervious



# Redevelopment Exemptions

## Single Family Dwellings

Existing single-family dwelling and accessory structure projects are exempt from the redevelopment requirements unless the project creates, adds, or replaces 10,000 SF of impervious surface area.

## Maintenance

Redevelopment does not include routine maintenance activities that are conducted to maintain the original line and grade, hydraulic capacity, or original purpose of the facility, such as the reconstruction of parking lots and roadways, that does not disturb additional area and maintains the original grade and alignment.

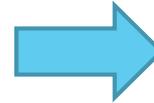
## Emergency

Redevelopment does not include emergency activities required to protect public health and safety.

# Grandfathering

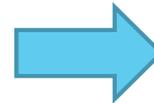
## Development & Redevelopment Projects

Deemed Complete prior to October 11, 2011



2000 Permit (SQUIMP)

Deemed Complete after October 11, 2011



2010 Permit (PCSMP)

## Projects that don't qualify for grandfathering

An project, or phase of a project, or individual lot within a larger previously approved project, where the application for such project has been "deemed complete," that does not have a final or substantially final drainage concept or a site layout that includes water quality treatment, as determined by the local permitting agency, must comply with PCSMP requirements of the 2010 Permit.

# Grandfathering Clauses

1. Projects or phases where the applications have been “deemed complete,” including projects with ministerial approval, by the applicable local permitting agency prior to 10/11/2011; or
2. Projects the subject of, or an application for, an approved Development Agreement and/or an adopted Specific Plan that have been “deemed complete” prior to 10/11/2011 and thereafter during the term of the agreement/plan unless earlier cancelled or terminated; or
3. All private projects which, prior to 10/11/2011, completed public improvements; commenced design, obtained financing, and/or participated in the financing of the public improvements; or which requires the private party to reimburse the local agency for public improvements upon the development of such private project; or
4. Local agency projects for which the governing body or their designee has approved initiation of the project design prior to 10/11/2011; or
5. A Tentative Map or Vesting Tentative Map was “deemed complete” or approved by the local permitting agency prior to 10/11/2011, and subsequent submittals of a Revised Map would be exempt from PCSMP as long the revisions substantially conform to original map design, consistent with Subdivision Map Act requirements

# Key Definitions

## Retention

Runoff volume reduction through designed infiltration, on-site reuse or evaporation. Less volume leaves a retention facility than entered.

## Detention

Temporary storage of runoff where full volume is released at a slower rate. Same volume enters and leaves a detention facility.

## Biofiltration

The process of filtration, adsorption, and biological uptake of pollutants in stormwater that takes place when runoff flows through vegetated areas. (ie. horizontal flow via swale or vertical flow via rain garden with underdrain)

# BMP Hierarchy – 2010 MS4 Permit

## Retention BMPs

### *Infiltration BMPs*

- [INF-1: Infiltration Basin](#)
- [INF-2: Infiltration Trench](#)
- [INF-3: Bioretention](#)
- [INF-4: Drywell](#)
- [INF-5: Permeable Pavement](#)
- [INF-6: Proprietary Infiltration](#)

### *Rainwater Harvesting BMPs*

- [RWH-1: Rainwater Harvesting](#)

### *Evapotranspiration BMPs*

- [ET-1: Green Roof](#)
- [ET-2: Hydrologic Source Controls](#)

## Biofiltration BMPs

- [BIO-1: Bioretention with Underdrain](#)
- [BIO-2: Planter Box](#)
- [BIO-3: Vegetated Swale](#)
- [BIO-4: Vegetated Filter Strip](#)
- [BIO-5: Proprietary Biotreatment](#)

## Treatment Control Measures

- [TCM-1: Dry Extended Detention Basin](#)
- [TCM-2: Wet Detention Basin](#)
- [TCM-3: Constructed Wetland](#)
- [TCM-4: Sand Filter](#) (if vegetated, this is considered a Biofiltration BMP)
- [TCM-5: Cartridge Media Filter](#)

## Pretreatment/Gross Solids Removal BMPs

- [PT-1: Hydrodynamic Device](#)
- [PT-2: Catch Basin Insert](#)

Must provide proof of technical infeasibility before bottom 3 BMP categories can be used



# Post-Construction BMPs

## Retention BMPs

### Infiltration BMPs

- INF-1: Infiltration Basin
- INF-2: Infiltration Trench
- INF-3: Bioretention
- INF-4: Drywell
- INF-5: Permeable Pavement
- INF-6: Proprietary Infiltration
- INF-7: Bioinfiltration



**Bioretention in Parkway and parking lots**

*Photo Credit: Geosyntec Consultants*



**Permeable pavement application**

*Photo Credit:  
Geosyntec Consultants*

# Post-Construction BMPs

## Retention BMPs

### Rainwater Harvesting BMPs

- RWH-1: Rainwater Harvesting

### Evapotranspiration BMPs

- ET-1: Green Roof
- ET-2: Hydrologic Source Control BMPs



### **Green Roof Example**

*Photo Credit: Geosyntec  
Consultants*

# Post-Construction BMPs

## Biofiltration BMPs

Only selectable for primary treatment if technical infeasibility established

- BIO-1: Bioretention with Underdrain
- BIO-2: Planter Box
- BIO-3: Vegetated Swale
- BIO-4: Vegetated Filter Strip
- BIO-5: Proprietary Biotreatment



**Proprietary  
Biotreatment Example**

*Photo Credit: Filterra®*



**Vegetated swale captures flow  
from a residential street**

*Photo Credit: Geosyntec Consultants*

# Post-Construction BMPs

## Treatment Control Measures

- TCM-1: Dry Extended Detention Basin
- TCM-2: Wet Detention Basin
- TCM-3: Constructed Wetland
- TCM-4: Sand Filter
- TCM-5: Cartridge Media Filter



**Wet Detention Basin**

*Photo Credit: Geosyntec  
Consultants*

# Project Conditioning

## Legal Authority requirement of MS4 Permit

Each Permittee has adopted a Storm Water Quality Ordinance based upon a countywide model. Each Permittee shall ensure, no later than [two years after Order adoption date], that its Storm Water Quality Ordinance authorizes the Permittee to enforce all requirements of this Order.

### ORDINANCE NO. 4450

#### AN ORDINANCE OF THE VENTURA COUNTY BOARD OF SUPERVISORS AMENDING DIVISION 6, CHAPTER 9, ARTICLES 1 THROUGH 9 TO THE VENTURA COUNTY ORDINANCE CODE RELATING TO STORMWATER QUALITY MANAGEMENT FOR UNINCORPORATED AREAS

j. "Development" shall mean any construction, rehabilitation, redevelopment or reconstruction of any public or private residential project (whether single-family, multi-unit or planned unit development); industrial, commercial, retail, and other non-residential projects, including public agency projects; or mass grading for future construction, for which either discretionary land use approval or ministerial permit is required.

# Project Conditioning

**Goal** → To ensure consistent and complete assessment of project related impacts to surface water quality. The surface water quality must be suitable to meet all surface water quality standards derived through the application of principles as outline Chapters 2 and 3 of the Basin Plans.

## Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties

Below is the first electronic version of the LARWQCB Basin Plan.

1. Chapter 1: Introduction
  2. Chapter 2: Beneficial Uses
    - Chapter 2: Beneficial Uses Tables
    - Chapter 2: Beneficial Uses Figures
  3. Chapter 3: Water Quality Objectives
  4. Chapter 4: Strategic Planning and Implementation
  5. Chapter 5: Plans and Policies
  6. Chapter 6: Monitoring and Assessment
  7. Chapter 7: TMDLs (Total Maximum Daily Loads)
  8. Chapter 8: Groundwater Quality Management
- References
  - Appendix 1
  - Appendix 2

**Water Contact Recreation (REC-1)**  
**Warm Freshwater Habitat (WARM)**  
**Cold Freshwater Habitat (COLD)**

Regional Objectives for Inland Surface Waters.....
Ammonia.....
Bacteria, Coliform.....
Bioaccumulation.....
Biochemical Oxygen Demand (BOD <sub>5</sub> ).....
Biostimulatory Substances.....
Chemical Constituents.....
Chlorine, Total Residual.....
Color.....
Exotic Vegetation.....
Floating Material.....
Methylene Blue Activated Substances (MBAS).....
Mineral Quality.....
Nitrogen (Nitrate, Nitrite).....
Oil and Grease.....
Oxygen, Dissolved (DO).....
Pesticides.....
pH.....
Polychlorinated Biphenyls (PCBs).....
Priority Pollutants.....
Radioactive Substances.....
Solid, Suspended, or Settleable Materials.....
Taste and Odor.....
Temperature.....
Toxicity.....
Turbidity.....

# Project Conditioning

## INITIAL STUDY ASSESSMENT GUIDELINES



### A. Definition of Issue

The purpose of this guideline is to ensure consistent and complete assessment of project related impacts to Surface Water quality. The Surface Water quality must be suitable to meet all water quality standards as derived through the application of principles as outlined in Chapters 2 and 3 of the *Basin Plans*.

### B. Definition of Technical Terms

*Basin Plans* - The *Water Quality Control Plans* for three California Regional Water Quality Control Boards covering the Ventura County area: Los Angeles Region (Region 4); the Central Coast Region (Region 3); and the Central Valley Region (Region 5), as amended from time to time.

*MS4 Permit* - NPDES Permit No. CAS004002, LARWQCB Order No. 09-0057, Waste Discharge Requirements (WDR) for Storm Water and Non-storm Water Discharges from the Municipal Separate Storm Sewer Systems (MS4) Within the Ventura County Watershed Protection District, County of Ventura, and the Incorporated Cities Therein, or the then-current MS4 Permit.

*NPDES Permit* - A water quality permit allowing a discrete discharge of water or wastes to "navigable waters" of the United States, as established under the federal Clean Water Act's National Pollutant Discharge Elimination System (NPDES).

*Surface Water* - All above-ground water bodies within Ventura County as identified in the *Basin Plans*.

*Water Quality Objectives* - The allowable limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area as outlined in the *Basin Plans*.

### C. Applicable General Plan Goals and Policies

1. Although the primary driving force for development oriented water quality guidelines are dictated by the federal *Clean Water Act*, the state *Porter-Cologne Water Quality Control Act*, and the *Basin Plans*, the Ventura County General Plan also provides several goals and policies that must be considered:

#### Countywide Goals, Policies and Programs:

- Goals 1.3.1-1, -2, -3, & -6
- Policies 1.3.2-1, 2, -4, -6, & -10

#### El Rio/Del Norte Area Plan:

- Goal 1.2.1-1
- Policies 1.2.2-3 & 4

#### Lake Sherwood/Hidden Valley Area Plan:

- Goals 2.4.1-1 through -4
- Policies 2.4.2-1 through -3 & -8

#### Oak Park Area Plan:

- Goals 1.2.1-1 through -4
- Policies 1.2.2-4 & -5

#### Ojai Valley Area Plan:

- Goal 1.2.1-1
- Policies 1.2.2-3 through -4

#### Piru Area Plan:

- Goals 1.9.1-1 through -3
- Policies 1.9.2-2

#### Saticoy Area Plan:

- Goals 1.2.1-1 & -2
- Policies 1.2.2-1

#### Thousand Oaks Area Plan:

- Goal 1.2.1

### D. Threshold of Significance Criteria

Threshold of significance criteria for determining if a land use or project activity has the potential to cause a significant adverse impact upon surface water quality individually or cumulatively when combined with recently approved, current, and/or reasonably foreseeable future projects, include, but are not limited to the following:

Condition	Requirement
<b>Compliance with PCSMP</b> (or SQUIMP if “deemed complete” prior to 10/11/2011)	Must show compliance with MS4 Permit post-construction requirements: <ul style="list-style-type: none"> <li>- Geotechnical Report</li> <li>- Drainage Study</li> <li>- Post-Construction BMP Worksheet</li> <li>- Design Plans and Details</li> </ul>
<b>PCSMP O&amp;M Plan</b> (or SQUIMP ...)	Must provide acceptable O&M Plan for long-term maintenance of post-construction BMPs: <ul style="list-style-type: none"> <li>- Covenant/Deed Restriction (if Private Parcel)</li> <li>- O&amp;M Plan included in CC&amp;Rs (if HOA proposed)</li> <li>- O&amp;M Plan (if County Project)</li> <li>- Flowage Easement (if multiple parcels drain to single lot containing post-construction device(s))</li> </ul>
<b>Compliance with MS4 Construction Program</b> <b>“Local SWPPP”</b>	Projects disturbing < 1 acre → SW-1 (13 BMPs to consider) Projects disturbing > 1 acre → SW-2 (28 BMPs to consider) Projects on High Risk Sites → SW-HR (33 BMPs to consider) County Projects → SWPCP (13 BMPs to consider + details)
<b>State Construction Permit Requirements</b>	Projects disturbing > 1 acre or “Common Plan of Development or Sale” clause → SWPPP (WDID# - Risk Level Calculations) <a href="https://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.html">https://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.html</a>
<b>State Industrial Permit Requirements</b>	Proposed industrial activities on-site per Attachment A of Permit <a href="https://www.waterboards.ca.gov/water_issues/programs/stormwater/industrial.html">https://www.waterboards.ca.gov/water_issues/programs/stormwater/industrial.html</a> Standard Industrial Classification (SIC) → <a href="https://www.osha.gov/pls/imis/sicsearch.html">https://www.osha.gov/pls/imis/sicsearch.html</a>

# Project Conditioning

## Compliance with PCSMP

**Purpose:** To ensure compliance with the Los Angeles Regional Water Quality Control Board NPDES Municipal Stormwater Permit No.CAS004002 (Permit) the proposed project will be subject to the post-construction requirements for surface water quality and stormwater runoff. In accordance with Part 4.E., “*Planning and Land Development Program*” of the *Permit*, the application must include performance criteria defined in Section III, Part 4.E of the *Permit* and the *Ventura County Technical Guidance Manual for Stormwater Quality Control Measures July 2011* (TGM).

**Requirement:** The proposed project shall meet performance criteria defined in Section III of Part 4.E of the Permit and the TGM.

**Documentation:** The Permittee shall submit the following items to the Watershed Protection District-County Stormwater Program Section (CSWP) for review and approval:

- i. A complete site plan prepared and stamped by a California licensed civil engineer or land surveyor that accurately delineates the location of the proposed project, existing and proposed impervious surfaces, storm drain system elements, general drainage pattern, and proposed site-specific Post-Construction Stormwater Management Plan (PCSMP). A drawing detail prepared and stamped by a California licensed civil engineer or architect verifying that the installation of the PCSMP will meet performance criteria defined in Section III of the Part 4.E of the Permit and the TGM.
- ii. Drainage Study or Hydrology Report prepared and stamped by a California licensed civil engineer including applicable calculations of stormwater quality design flow and volume to meet TGM requirements.

**Timing:** The above listed items shall be submitted to the CSWP for review and approval prior to (select appropriate) **issuance of zoning clearance for construction or issuance of grading permit.**

**Monitoring and Reporting:** CSWP staff will review the submitted materials for consistency with the Permit and TGM. **Grading or Building Inspectors (select appropriate)** will conduct inspections during construction to ensure that the installation is consistent with the approved plans. CSWP staff will conduct final inspection to verify that post-construction stormwater management controls were installed in compliance with PCSMP and other applicable standards, specifications, and regulations prior to **approving and/or signing off for occupancy and issuing the Certificate of Occupancy** for the proposed project (CSWP-1).

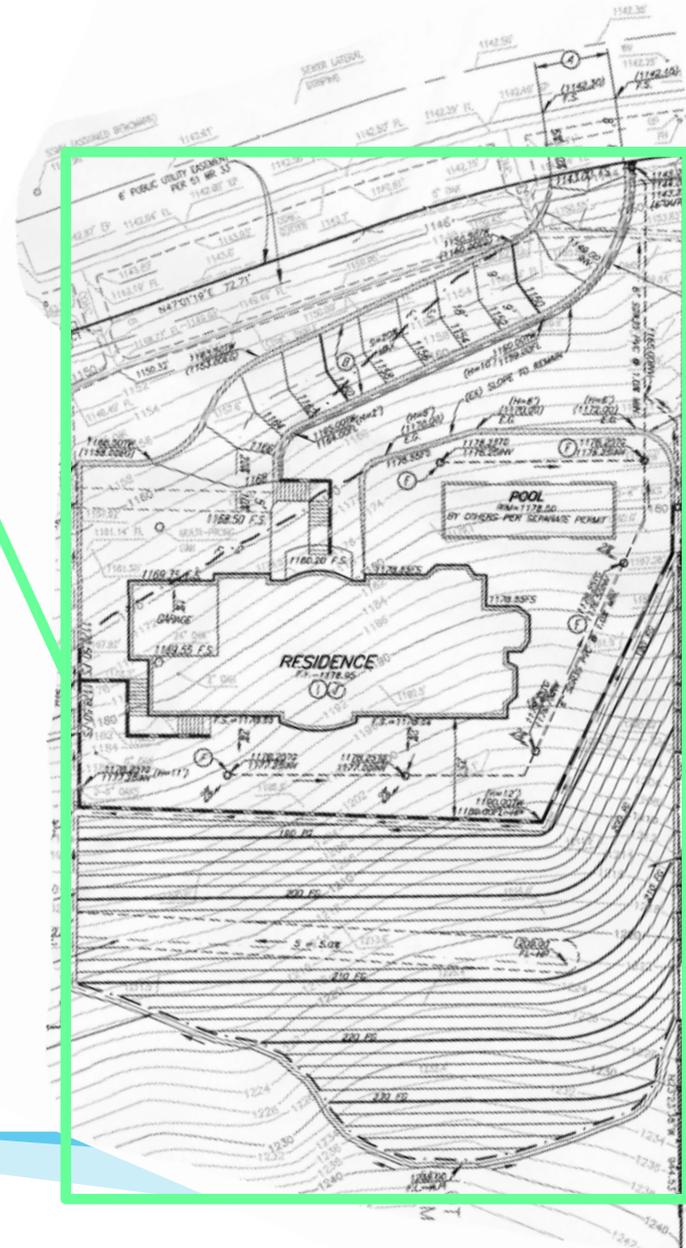
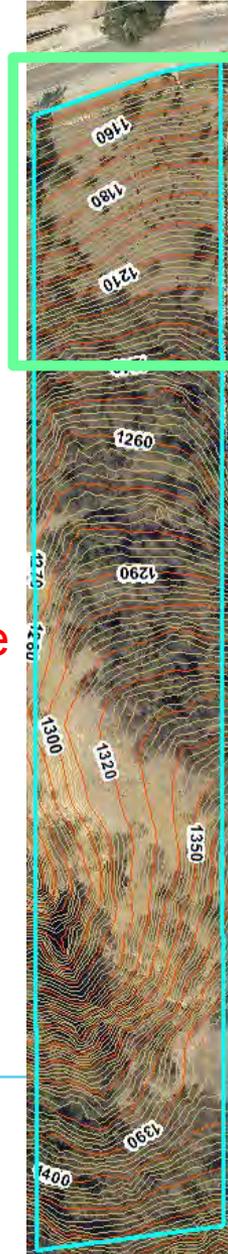


# Project Conditioning



3.22 Ac Parcel  
13,000 SF impervious

- Conditions Applied**
- 1) SW-HR
  - 2) < 1 ac Hillside Home



# Project Conditioning

## **Pepsi Plant Parking Lot Resurfacing**

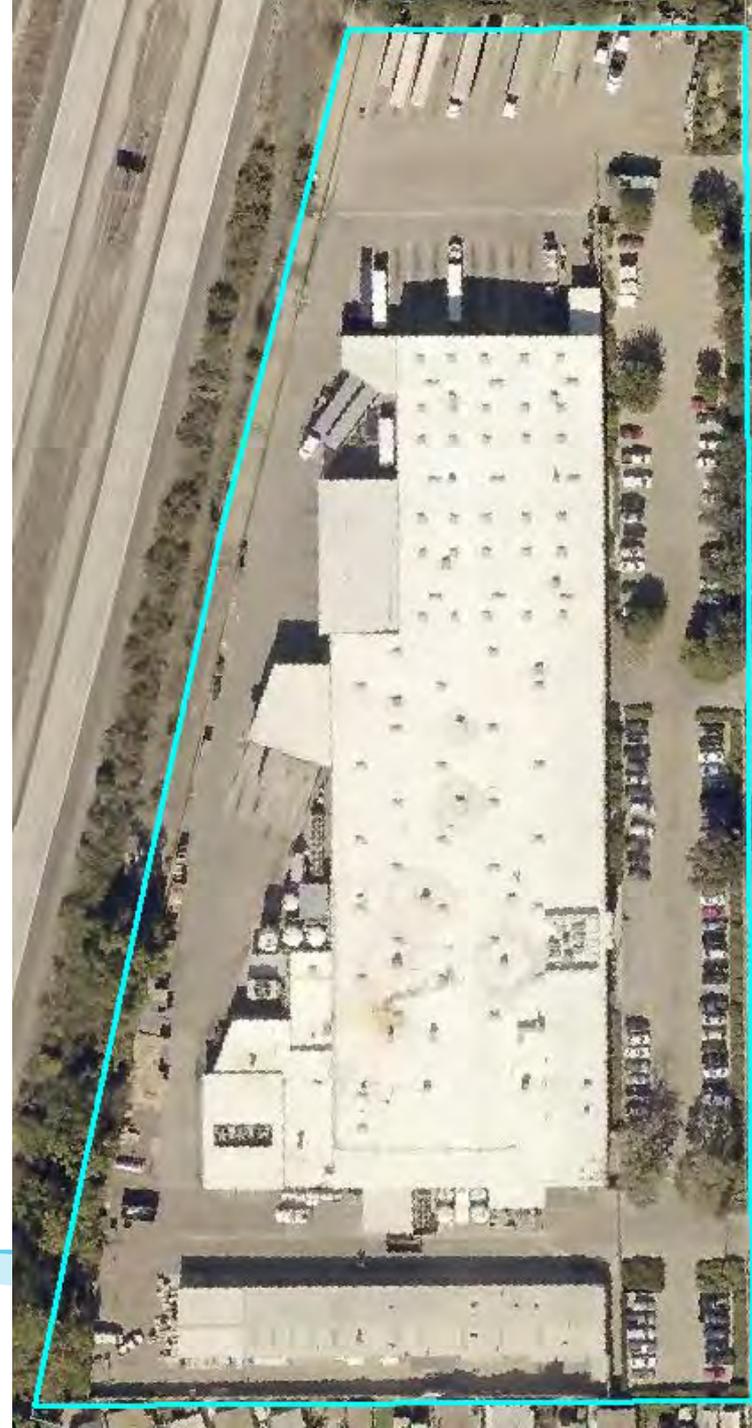
- Inquiry thru SW hotline

Asphalt in horrible shape at back of plant (~ 0.5 ac) due to loading/unloading traffic

Thinking of full section replacement from asphalt to concrete including base materials

### **Potential Condition**

- 1) SW-1 (ONLY)



# Project Conditioning

## Thomas Aquinas College

- 1) Campus Master Plan Approved thru CUP prior to 10/11/2011 (SQUIMP)

2015 Grading & Building Permit  
Application for 1 building  
< 1 acre disturbed  
> 5,000 SF impervious area

## Conditions Applied

- 1) SW-1
- 2) GCP (“Common Plan”)
- 3) SQUIMP
- 4) SQUIMP Covenant



# Ways of Attempted SW Req Avoidance

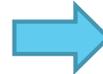


Stop Work Order (Grading Inspection)

- No BMPs implemented
- Disturbed area > approved grading
- < 10,000 SF impervious proposed

To Whom it may concern,

Per our construction staking hubs and the approved grading plan  
The on-site grading area calculates to be 1.0 acre.



The surveyor has determined that the disturbance is indeed 1.0 acre and regulations require a SWPPP for sites one acre or larger. This site will require a SWPPP be prepared and filed with the State Water Resources Control Board.



We did not survey the area of disturbance, your surveyor performed this work and you provided his signed and stamped letter stating the area of disturbance at this site is 1.0 acre.



We do not exceed 1 acre of grading !!!  
It's only a terminology !!!

- Please wave the requirement to get the SWPPP with the State
- The county as the jurisdiction for that scope of work (not to exceed 1 acre)
- I Can ask to the surveyor to be more specific and state 0.99 acre
- The different is one SF
- We need to complete that grading job ASAP

To Whom it may concern,

Per our construction staking hubs and the approved grading plans  
The on-site grading area calculates to be 0.999 acre.

# Ways of Attempted SW Req Avoidance



2 Separate Lots – 1.25 acres each

Each lots development < 1 acre disturbed and < 10,000 SF impervious

Same owner for both parcels with same civil engineer, and construction planned at same time for both lots

1 lot applied for individual Grading Permit

Within a week, 2<sup>nd</sup> lot applied for individual Grading Permit

Grading Ordinance allowed County to justify the two lots as a single contiguous project

SW-2, SW-HR, CGP, PCSMP & Covenant were conditioned accordingly

# Ways of Attempted SW Req Avoidance



Applicant submitted “Façade Improvement”

# Ways of Attempted SW Req Avoidance



# Some Applicants are Proactive

**Structural BMP Note:** This project does not trigger the MS4 Permit requirement for Post-Construction Stormwater Mitigation Plan (PCSMP) requirements because it does not meet the area thresholds for disturbed area or created impervious surfaces as outlined in the 2011 TGM. We encourage applicants to incorporate post-construction BMPs but if the applicant wishes to continue with implementation of water quality devices (currently proposing planter box for WQ treatment) additional items will need to be submitted. This includes appropriate sizing worksheet calculations (i.e worksheet from Appendix E of 2011 TGM) as well as PCSMP Covenant of Maintenance for long term functionality. Applicable templates can be found here: <http://onestop.vcpublicworks.org/stormwater-forms>

RECORDED AT THE REQUEST OF  
AND WHEN RECORDED MAIL TO:

20131230-00206229-0 1/11  
Ventura County Clerk and Recorder  
MARK R. LUBI  
12/30/2013 11:12:22 AM  
781328 5.00 PE

County Recorder  
County of Ventura  
800 S. Victoria Avenue  
Ventura, California 93009-1610

Recorded for the benefit of County of Ventura.  
No fee required (Government Code §27383)

# Bioswale

## COVENANT FOR MAINTENANCE OF STORMWATER TREATMENT DEVICE OR STORMWATER QUALITY URBAN IMPACT MITIGATION PLAN (SQUIMP)

**FOR PROJECT No** (Indicate as applicable):

Building Permit # \_\_\_\_\_ Grading Permit # \_\_\_\_\_

Conditional Use Permit # \_\_\_\_\_ Land Use # \_\_\_\_\_

Tract/Lot # \_\_\_\_\_ Subdivision # \_\_\_\_\_

OWNER: \_\_\_\_\_

PROPERTY ADDRESS: \_\_\_\_\_

ASSESSOR PARCEL NUMBER: \_\_\_\_\_

THIS COVENANT FOR MAINTENANCE  
STORMWATER MANAGEMENT CONTROL (P  
made and entered into this \_\_\_\_\_ day  
\_\_\_\_\_ ("Owner") for the  
Ventura County Watershed Protection District, ("C

### EXHIBIT C MAINTENANCE PLAN

#### General Site Information:

Address: \_\_\_\_\_

APN: \_\_\_\_\_

Owner: \_\_\_\_\_

#### Stormwater Treatment Device – Maintenance and Cleaning Activities:

At a minimum the following activities must occur to maintain the stormwater treatment device:

1. Inspect the device semiannually, and after each significant storm, or more as needed. The inspection checklist included as part of the maintenance plan should be used for each inspection to promote consistency and ensure required maintenance activities are not forgotten.
2. Remove litter and debris as required.
3. Damaged or dead areas of vegetation should be repaired immediately by reseeding (and applying mulch if applicable).
4. Remove all accumulated sediment that may obstruct flow into or through the device.
5. Plants are typically drought-tolerant. However, watering may be needed especially during prolonged dry periods to ensure vegetation growth and health.
6. If runoff is pooling rather than infiltrating and/or flowing through the device, make immediate repairs and control mosquitoes accordingly.

Lastly, annual verification of the Stormwater Treatment Device maintenance must be documented and provided to the Ventura County Watershed Protection District **by September 15** of each year. This is to be completed utilizing the Annual Maintenance Verification Report provided as Exhibit D herein.



# Example – Bioswale

Constructed Bioswale



Lighting Project



## Condition

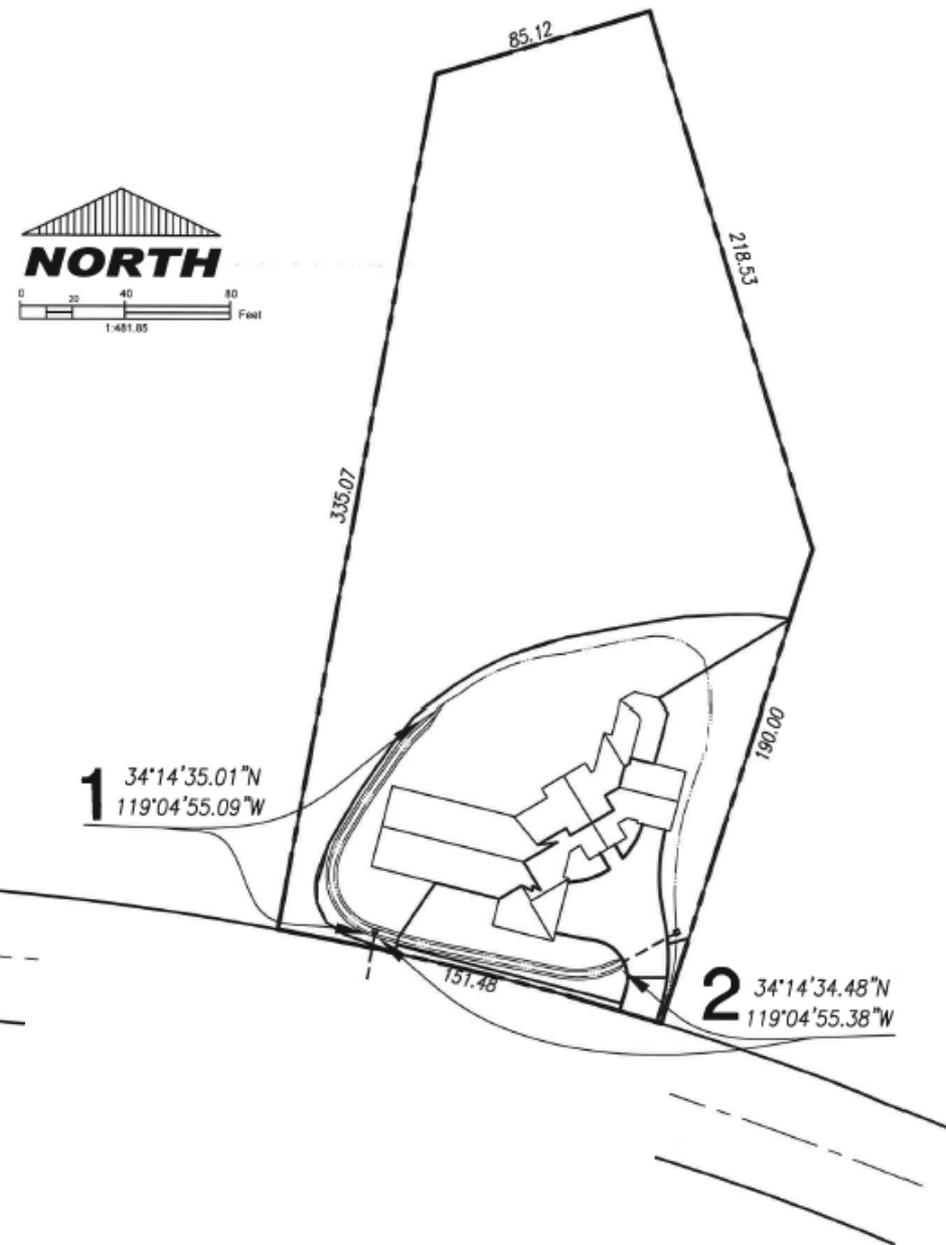
Notice - Post-construction stormwater requirements

## Comments Standard Comment

This APN is subject to post-construction stormwater requirements. Grading and Building Permits are not to be issued without prior approval by Watershed Protection District - Surface Water/Stormwater Quality Section.

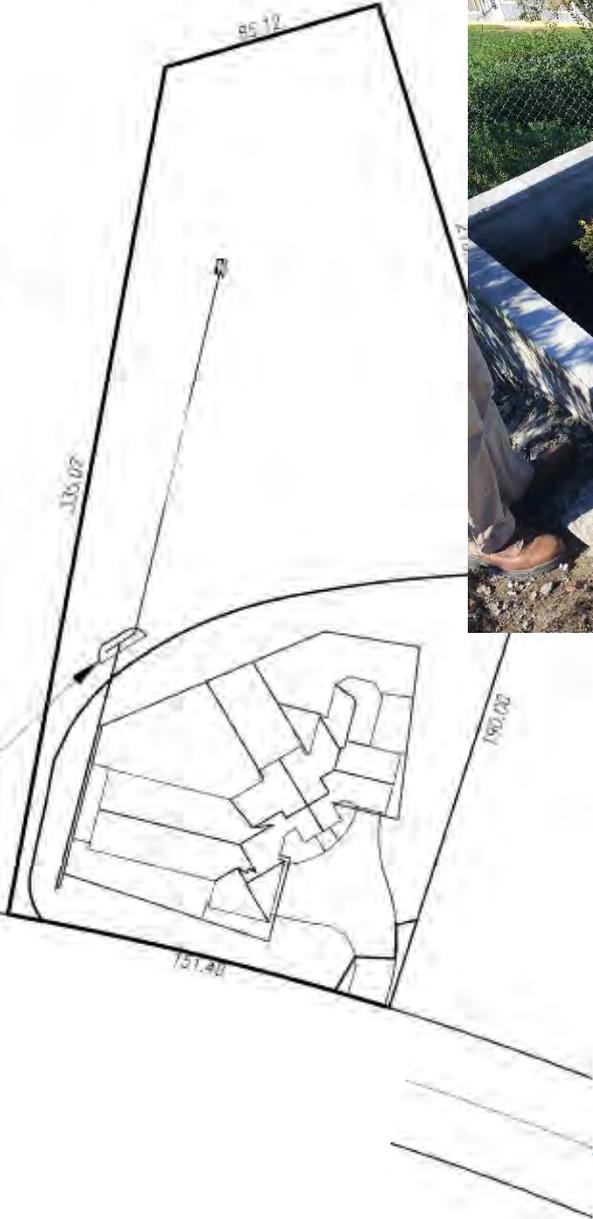


EXHIBIT 'B'



1-2. BIO-3 • VEGETATIVE SWALE

EXHIBIT 'B'



1. VEG-2 · PLANTER BOX

DO NOT PLACE RECORDING DATA ABOVE THIS LINE

RECORDING REQUESTED BY  
AND WHEN RECORDED RETURN TO:

City Clerk  
City of Thousand Oaks  
2100 Thousand Oaks Boulevard  
Thousand Oaks, CA 91362

**THOUSAND OAKS**

(SPACE ABOVE THIS LINE FOR RECORDER'S USE)

COVENANT AND DEED RESTRICTION

APN \_\_\_\_\_

Documentary Transfer Tax \$ -0-; No Apparent Value or Common Area

"No Fee Required" (Government Code Section 6103 & 27383)  
recorded for the benefit of: The City of Thousand Oaks

City of Thousand Oaks, by: (signature required above this line)

\*\*\*\*\*

This Covenant and Deed Restriction is made and executed on this \_\_\_\_ day of \_\_\_\_\_,  
20\_\_\_\_, by \_\_\_\_\_  
(print name and title / company)

The undersigned hereby certifies that it is the owner of fee title to the real property located at \_\_\_\_\_  
also known as Assessor's Parcel No. \_\_\_\_\_ and more  
particularly described in Exhibit "A", which is attached hereto and incorporated herein as set forth in full.

For valuable consideration, in compliance with the conditions of approval for City of Thousand  
Oaks Entitlement No. \_\_\_\_\_, the undersigned hereby covenants, acknowledges and  
agrees that it will:

1. Assume responsibility for proper maintenance of stormwater quality Best Management Practices as described in Exhibit "B", which is attached hereto and incorporated herein as though set forth in full.
2. Perform maintenance and inspection of Best Management Practices per the schedule specified within the Maintenance Plan (Exhibit "B"), not less than once annually.
3. Retain written proof that the inspection and maintenance were performed by the owner, with said proof being annually reported to the City and retained for a period of not less than five (5) calendar years.

The purpose of this Deed Restriction is to provide notice and disclosure to subsequent purchasers or transferees of limitations associated with the real property.

This covenant shall run with the land and shall be binding upon ourselves, our tenants and any future owners and tenants, their successors, heirs or assigns and shall continue in effect unless otherwise released by the authority of the City of Thousand Oaks in writing. Any lease of said specified parcels shall be subject to this restriction, which is made for the general benefit of the entire community. The covenant shall be enforceable by remedy of injunctive relief in addition to any other remedy in law or equity.

Covenants → Recorded by Owner Name Only

Deeds → Recorded by Owner Name and APN

Exhibit "A" → Legal Description

Having all three is recommended to maximize Title Report accuracy.



RECORDED AT THE REQUEST OF  
AND WHEN RECORDED MAIL TO:

Watershed Protection District  
County of Ventura  
800 S. Victoria Avenue  
Ventura, California 93009-1610

COUNTY

Recorded for the benefit of County of Ventura.  
No fee required (Government Code §27383)

**COVENANT FOR MAINTENANCE OF POST-CONSTRUCTION  
STORMWATER MANAGEMENT CONTROL SYSTEM**

<b>FOR PROJECT No</b> (indicate as applicable):			
Building Permit # _____	Grading Permit # _____	_____	_____
Conditional Use Permit # _____	Land Use # _____	_____	_____
Tract/Lot # _____	Subdivision # _____	_____	_____

**OWNER:** \_\_\_\_\_

**PROPERTY ADDRESS:** \_\_\_\_\_

**ASSESSOR PARCEL NUMBER:** \_\_\_\_\_

THIS COVENANT FOR MAINTENANCE OF POST-CONSTRUCTION  
STORMWATER MANAGEMENT CONTROL (PCSMC) SYSTEM ("Covenant") is  
made and entered into this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_, by  
\_\_\_\_\_ ("Owner") for the benefit of the County of Ventura and  
Ventura County Watershed Protection District, ("County").

Covenants → Recorded by Owner  
Name Only

~~Deeds → Recorded by Owner  
Name and APN~~

~~Exhibit "A" → Legal Description~~

~~**EXHIBIT "A"**  
**(Vicinity Map)**~~

## EXHIBIT C

### Minimum Maintenance Requirements For Post-Construction Treatment Devices

Maintenance logs will be required by the City of Camarillo in October of each year for all post-construction devices listed below. At a minimum, the maintenance log should include documentation identifying the device, its location, date of inspection, inspector's name and signature, type and quantity of material(s) removed, disposal destination, and other maintenance performed. The California Stormwater BMP Handbooks referred to below can be obtained at [www.cabmphandbooks.com](http://www.cabmphandbooks.com) and the Ventura County Technical Guidance Manual for Stormwater Quality Control Measures (TGM) can be obtained at [www.vcstormwater.org](http://www.vcstormwater.org). If device does not apply, write N/A.

Treatment Device	Minimum Maintenance Requirements/Schedule
<b>Onsite trash enclosures</b> constructed with solid roof that protects against stormwater entering refuse bins.	Inspect yearly prior to October 1 for leaks. Remove solids, stains and/or residue from floor and walls of trash enclosure with dry methods when possible. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer (check with local Sanitation Department before discharging to sewer). Do not hose down area to a storm drain. Refer also to Calif. Stormwater Municipal BMP Handbook – SC-34.
<b>Onsite storm drains &amp; catch basins</b>	All onsite catch basins to be inspected and cleaned at least twice a year. Once immediately prior to October 1 and once in January. Additional cleanings may be required if more than 40% full.
<b>Parking lots &amp; sidewalks</b>	Sidewalks and parking lots to be swept regularly to prevent accumulation of litter and debris. Litter, debris and any cleaning agents will be trapped and collected and disposed of properly to prevent entry into storm drain system. Refer also to Calif. Stormwater Municipal BMP Handbook – SC-43 & SC-71.
<b>TCM-1 Detention Basin</b> <i>See Ventura County Technical Guidance Manual (5/29/15) for further maint. guidelines</i>	Inspect basin semiannually, after each significant storm, or more frequently, if needed. Check/correct as required: differential settlement, cracking; erosion, leakage or tree growth on embankment; the condition of the riprap in the inlet, outlet and pilot channels; sediment accumulation in the basin; and the vigor and density of the grass turf on the basin side slopes and floor. Remove litter and debris from banks and basin bottom as required. Repair erosion to banks and bottom as required. Remove sediment when accumulation reaches 25% of original design depth, or if resuspension is observed. Clean in early Spring so vegetation damaged during cleaning has time to reestablish. Inspect outlet for clogging a minimum of twice a year, before and after the rainy season, after large storms, and more frequently if needed. Correct observed problems as necessary. Clean fore bay frequently to reduce frequency of main basin cleaning. Control mosquitoes, as necessary.
<b>BIO-3, 4 Biofilters (Swales Grass Strip Filters)</b> <i>See Ventura County Technical Guidance Manual (5/29/15) for further maint. guidelines</i>	Check annually for signs of erosion, vegetation loss, and channelization of the flow. The grass should be mowed when it reaches a height of 6 inches. Allowing the grass to grow taller may cause it to thin and become less effective. The clippings should be removed.

Directions for Exhibit "B": (do not include this page or verbiage on final recorded document).

Exhibit "B" shall contain:

- A summary list of the source control best management practices (BMPs) that are being provided, and a list of treatment control BMPs being provided with a count by type.
- A detailed description of the BMPs listed.
- A detailed description of the inspection and maintenance requirements, include schedule and factors that would require maintenance to be performed.
- A discussion addressing vector control issues and the required maintenance to prevent mosquito habitat.
- Procedures and equipment list for how the necessary maintenance is to be performed.
- If using proprietary devices, provide manufacturer's contact information, and recommended inspection and maintenance procedures.
- If using designed BMPs, reference the Ventura County Technical Guidance Manual for Stormwater Control Measures for inspection and maintenance procedures.
- A site diagram showing the location of all structural BMPs, each identified with a unique identification number. Must be on letter paper, multiple sheets ok.
- A functional inspection and maintenance form specific to the BMPs used. Identify each individual device on inspection form using the BMP identification numbers.

Example inspection and maintenance form, categories for your design may be different:

Catch Basin ID #	Inspection date and inspector initial	Evidence of Illegal Dumping (paint, oil)	Percent full of debris *	Signs of wear (rips, holes, broken parts)	Inlet and Outlet verification (clear of debris and obstructions)	Filter Replaced	Landscape Maintenance or Erosion Issues	Debris / Sediment Removal	Date of Maintenance Performed	Type of Maintenance Performed & Comments
CB #1							N/A			
Biofilter #1				N/A		N/A				
Detention Basin #1				N/A		N/A				
Porous Pavement #1		N/A	N/A	N/A	N/A	N/A	N/A			
Reshield Orifice #1		N/A	N/A	N/A		N/A	N/A	N/A		
Capture/Reuse facility #1			N/A	N/A		N/A	N/A	N/A		

\* Maintenance required when XXX% full

Criteria for inspection and maintenance will vary depending on BMP installed. See manufacturer's recommended inspection and maintenance requirements, or the Ventura County Technical Guidance Manual for Stormwater Control Measures for the specific criteria needed for the BMP installed. Inspection form should also list threshold criteria for when maintenance is required.

## EXHIBIT "C" (Maintenance Plan)

# COUNTY

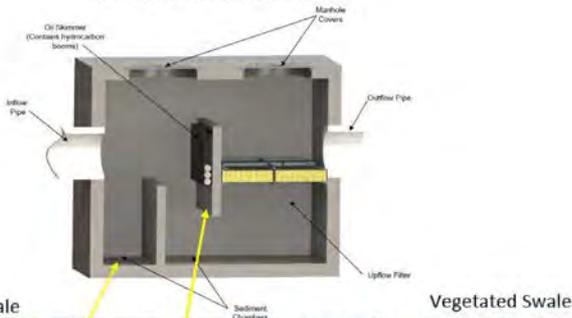
Owner shall complete and provide the applicable portion of Appendix I "Stormwater Control Measure Maintenance Plan Guidelines and Checklists" of the Technical Guidance Manual for Stormwater Quality Control Measures – Manual Update 2011\* available at [www.vcstormwater.org/technicalguidancemanual.html](http://www.vcstormwater.org/technicalguidancemanual.html) or [www.onestoppemitt.ventura.org](http://www.onestoppemitt.ventura.org) under "Surface Water Quality Section".

# Abbreviated O&M Plans

## POST-CONSTRUCTION STORMWATER QUALITY DEVICE OPERATIONS & MAINTENANCE

### Channel Islands Harbor Boat Launch Ramp Curlew Way, Oxnard

Devices On-Site:  
Two (2) Vegetated Swales  
Two (2) Water Polisher Units



## Operations & Maintenance Inspection Form

Date: \_\_\_\_\_ Inspector: \_\_\_\_\_

Inspection Type:  Pre-Wet Season (before Oct 1)  Post-Wet Season (after April 15)  After Storm  Routine

[2] Proprietary Stormwater Water Polisher Units			
Activity	O & M Needed	O & M Completed	Comments / Maintenance Performed
Remove Trash/Debris/Sediment from vault compartments and around/on top of cartridge media filters			
Clear Blockages on Inlet/Outlet Pipes			
Remove accumulated sediment from the first chamber when 75% full and when the secondary sediment chamber has accumulated 1 foot.			
Replace the upflow filter and media when it has become 75 % clogged or every 3 years			

\* Bio Clean Environmental Services, Inc. (<http://www.BioCleanEnvironmental.com>)

Vegetated Swale			
Activity	O & M Needed	O & M Completed	Comments / Maintenance Performed
Remove Trash/Debris/Sediment			
Assess for Poor Vegetative Health (i.e. Weeds, loss of ground cover, grass > 6" tall)			
Repair Erosion/Scouring			
Repair and clear blockages of inlet/outlets			
If Standing Water is present 4 days after rain event, maintenance is needed immediately to restore proper drainage. (See O & M details in 2011 Technical Guidance Manual Chapter 6 Page 152)			

\*2011 Technical Guidance Manual is available under Publications/Manuals @ <http://vcstormwater.org>

<http://vcpublishworks.org/stormwater-resources/county-stormwater-program>

# TGM O&M Guidelines

## TGM Section 6 – General O&M (Permeable Pavements)

### Operations and Maintenance

Permeable pavement mainly requires vacuuming and management of adjacent areas to limit sediment contamination and prevent clogging by fine sediment particles. Therefore, little special training is needed for maintenance crews. The following maintenance concerns and maintenance activities shall be considered and provided:

- 1) Trash tends to accumulate in paved areas, particularly in parking lots and along roadways. The need for litter removal should be determined through periodic inspection.
- 2) Regularly (e.g., monthly for a few months after initial installation, then quarterly) inspect pavement for pools of standing water after rain events, this could indicate surface clogging.
- 3) Actively (3 to 4 times per year, or more frequently depending onsite conditions) vacuum sweep the pavement to reduce the risk of clogging by frequently removing fine sediments before they can clog the pavement and subsurface layers. This also helps to prolong the functional period of the pavement.
- 4) Inspect for vegetation growth on pavement and remove when present.
- 5) Inspect for missing sand/gravel in spaces between pavers and replace as needed.
- 6) Activities that lead to ruts or depressions on the surface should be prevented or the integrity of the pavement should be restored by patching or repaving. Examples are vehicle tracks and utility maintenance.
- 7) Spot clogging of porous concrete may be remedied by drilling 0.5 inch holes every few feet in the concrete.
- 8) Interlocking pavers that are damaged should be replaced.
- 9) Maintain landscaped areas and reseed bare areas.

## TGM Appendix I – O&M Checklists (Permeable Pavements)

### I.6 Permeable Pavement Inspection and Maintenance Checklist

Date: \_\_\_\_\_ Work Order # \_\_\_\_\_

Type of Inspection:  post-storm  annual  routine  post-wet season  pre-wet season

Facility: \_\_\_\_\_ Inspector(s): \_\_\_\_\_

Defect	Conditions When Maintenance Is Needed	Inspection Result (0, 1, or 2) †	Date Maintenance Performed	Comments or Action(s) taken to resolve issue
Sediment Accumulation	Sediment is visible			
Missing gravel/sand fill	There are noticeable gaps in between pavers			
Weeds/mosses filling voids	Vegetation is growing in/on permeable pavement			
Trash and Debris Accumulation	Trash and debris accumulated on the permeable pavement.			
Dead or dying vegetation in adjacent landscaping	Vegetation is dead or dying leaving bare soil prone to erosion			
Surface clog	Clogging is evidenced by ponding on the surface			
Overflow clog	Excessive build up of water accompanied by observation of low flow in observation well (connected to underdrain system) If a surface overflow system is used, observation of an obvious clog			
Visual contaminants and pollution	Any visual evidence of oil, gasoline, contaminants or other pollutants.			
Erosion	Tributary area Exhibits signs of erosion Noticeably not completely stabilized			

# O&M Tracking

## COUNTY of VENTURA

### STORMWATER TREATMENT FACILITY MAINTENANCE RECORD VERIFICATION FORM

#### RECORD VERIFICATION

Property Address & Assessor's Parcel Number (APN):

No. & Street Name	City	Ca	ZIP Code	APN
-------------------	------	----	----------	-----

Property Owner/Responsible Party:

Name Code	Responsible Party/HOA (if applicable)	No. & Street Name	City	State	ZIP
--------------	---------------------------------------	-------------------	------	-------	-----

Type of SWTS on your property:

- |  |  |
|--|--|
| <input type="checkbox"/> Bioretention (with underdrain)    | <input type="checkbox"/> Infiltration Basin/ Trench                      |
| <input type="checkbox"/> Bioretention (without underdrain) | <input type="checkbox"/> Permeable Pavement                              |
| <input type="checkbox"/> Cartridge Media Filter            | <input type="checkbox"/> Planter Box                                     |
| <input type="checkbox"/> Catch Basin Insert                | <input type="checkbox"/> Proprietary Treatment Device (please list name) |
| <input type="checkbox"/> Constructed Wetland               | <input type="checkbox"/> Sand Filter                                     |
| <input type="checkbox"/> Dry Extended Detention Basin      | <input type="checkbox"/> Vegetated Swale/ Filter Strip                   |
| <input type="checkbox"/> Drywell                           | <input type="checkbox"/> Wet Detention Basin                             |
| <input type="checkbox"/> Green Roof                        |  |

#### CURRENT CONDITION OF SWTS (CHECK ALL THAT APPLY)

- |   |  |
|---|--|
| <input type="checkbox"/> Accumulation of trash and/or debris                          | <input type="checkbox"/> Signs of erosion and/or exposed dirt                                      |
| <input type="checkbox"/> Pipes or risers coming into BMP are damaged (e.g., cracked)  | <input type="checkbox"/> Odors and/or standing water (water should drain from BMP within 48 hours) |
| <input type="checkbox"/> Overflows (even during small rain storms - possibly clogged) | <input type="checkbox"/> Evidence of animal burrows  |
| <input type="checkbox"/> Overgrown or unhealthy vegetation                            | <input type="checkbox"/> Signs of vandalism  |
| <input type="checkbox"/> Excessive algae  | <input type="checkbox"/> None of the above   |

#### MAINTENANCE PERFORMED OVER THE PAST YEAR

Type of Service Performed (check  below as applicable to your device)

Note: Not all maintenance tasks will apply to your device.

Recommended inspection and maintenance for most BMPs is semiannually, after each significant storm, or more frequently, if needed.

- Manufacturer recommended maintenance performed (please list manufacturer and device model)
- Remove litter & debris as required
- Repair erosion
- Reseed and/or replant to damaged landscaped areas as needed
- Clean/repair inlet rip rap and pilot channels
- Clean/repair outlet to prevent/eliminate clogging
- Remove sediment when accumulation reach 25% of original design depth
- Remove accumulated sediment or tree/shrub growth that may obstruct flow through device
- Replace filter media (if applicable)
- Inspect perimeter fencing and repair as necessary
- Repairs to device needed  
*Please describe:* \_\_\_\_\_
- Date repair completed or scheduled for completion: \_\_\_\_\_
- Other Maintenance Performed  
*Please describe:* \_\_\_\_\_
- Device is clean and does not need service at this time

Date of Inspection: \_\_\_\_\_ Date Maintenance Performed: \_\_\_\_\_

#### CERTIFICATION

I, \_\_\_\_\_ herby certify that the above information is correct to the best of my knowledge.

Signature

Date

# SESSION 2

## Engineering BMP Design (PART 1)

# References

## SWRCB 303(d) Info & GIS/Excel Data Download

[https://www.waterboards.ca.gov/water\\_issues/programs/tmdl/integrated2014\\_2016.shtml](https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2014_2016.shtml)

### Final 2014/2016 California Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report)

[2014 and 2016 Integrated Report](#)

[Map](#)

[303\(d\) List](#)

[References](#)

[Data Download](#)

[Contact Us](#)

### 2014 AND 2016 CLEAN WATER ACT SECTION 303(d) AND 305(b) INTEGRATED REPORT — STATEWIDE

#### Downloadable Geographic Information System (GIS) Files

##### Disclaimer for 2014 and 2016 Integrated Report GIS Files

The GIS files for the 2014 and 2016 Integrated Report (all assessed waters) and 303(d) List of Water Quality Limited Segments (USEPA approved) were created for reporting purposes by the SWRCB and RWQCB. These GIS representations of the areal extent of assessed and 303(d) waters are estimated and should not be considered authoritative for the development of TMDLs (Total Maximum Daily Loads) or other regulatory actions. The TMDL effort may ultimately address more or less area. Mapping the all assessed and 303(d) listed waters is a work in progress and will be updated during each listing cycle to better define the affected areas.

- [INSTRUCTIONS FOR 2014 AND 2016 LIST FILES](#)
- **GIS Web Service**
  - [REST endpoint](#)
  - ArcGIS "GIS Server" connection string  
<http://gispublic.waterboards.ca.gov/ArcGIS/rest/services/>  
(service path is Water\_Quality/Impaired\_Waters\_2014\_2016)
- **GIS ArcGIS geodatabase**
  - [All assessed waters](#)
  - [303\(d\)-listed waters only](#)
- **GIS shapefiles**
  - **All assessed waters**
    - [Statewide lines](#)
    - [Statewide polygons](#)
  - **303(d) listed waters only**
    - [Statewide lines](#)
    - [Statewide polygons](#)
- **2014 and 2016 303(d) List to Associate/Relate with GIS shapefiles**
  - [303\(d\) list - Excel file \(without potential sources\)](#)
  - [303\(d\) list - Excel file \(includes potential sources\)](#)
- For questions about the data downloads please contact [Stephanie Bucknam](#) (email) or call (916) 558-1708.

# References

## State SMARTS System

<https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.xhtml>

**SMARTS LOGIN**

User ID:

Password:

[Login](#) [Create Account](#)

[Forgot User ID or Password](#)

**Browser Requirements:** SMARTS works best with Microsoft Edge. The use of other browsers may cause unexpected errors.

[Public User Menu](#) [Permit FAQs](#) [SMARTS Resources](#) [Email SMARTS Help](#)

[Stormwater Home](#)  
[Caltrans](#)  
[Construction](#)

[Contacts](#)  
[Databases](#)  
[Historical](#)

[Industrial](#)  
[Historical](#)  
[SMARTS Resources](#)

[STORMS](#)  
[Training](#)



# References

## LARWQCB TMDL Listings

[https://www.waterboards.ca.gov/losangeles/water\\_issues/programs/tmdl/](https://www.waterboards.ca.gov/losangeles/water_issues/programs/tmdl/)

### Total Maximum Daily Loads (TMDLs)

[Click here to go to the WQS List](#)

Click header row to order by specific field

Show  entries

Search:

No.	Resolution No.	Watershed	Pollutant	Resolution Name	Staff Contact	Last Updated	New Posting
7	<a href="#">R16-007</a>	Calleguas Creek	Metals	Reconsideration of the TMDLs for Metals and... <a href="#">more</a>	<a href="#">Thanhloan Nguyen</a> (213) 576-6689	In Effect on Jun 23, 2017	
38	<a href="#">2007-016</a>	Calleguas Creek	Salts	Calleguas Creek Watershed Salts TMDL	<a href="#">Thanhloan Nguyen</a> (213) 576-6689	In Effect on Jan 31, 2009	
42	<a href="#">2008-009</a>	Calleguas Creek	Nutrients	Revision of WLAs for Calleguas Creek... <a href="#">more</a>	<a href="#">Thanhloan Nguyen</a> (213) 576-6689	In Effect on Sep 29, 2008	
48	<a href="#">2007-007</a>	Calleguas Creek	Trash	Revolon Slough & Beardsley Wash Trash TMDL	<a href="#">Stefanie Hada</a> (213) 576-6804	In Effect on Mar 18, 2008	
52	<a href="#">2006-012</a>	Calleguas Creek	Metals	Calleguas Creek Watershed Metals TMDL	<a href="#">Thanhloan Nguyen</a> (213) 576-6689	In Effect on Mar 26, 2007	
60	<a href="#">2005-009</a>	Calleguas Creek	Toxicity	Calleguas Creek Toxicity TMDL	<a href="#">Kangshi Wang</a> (213) 576-6780	In Effect on Mar 24, 2006	
61	<a href="#">2005-010</a>	Calleguas Creek	Toxics	Calleguas Creek OC Pesticides & PCBs TMDL	<a href="#">Thanhloan Nguyen</a> (213) 576-6689	In Effect on Mar 24, 2006	

# References

## International BMP Database

<http://www.bmpdatabase.org/>

### International Stormwater BMP Database

Home

Get Data ▾

Submit Data ▾

Documents ▾

Guidance ▾

About ▾



UDFCD Rain Garden, Urban Drainage and Flood Control District

**Welcome!** The International Stormwater Best Management Practices (BMP) Database project website features a database of over 600 BMP studies, performance analysis results, tools for use in BMP performance studies, monitoring guidance and other study-related publications. **New to the site?** [Start Here](#)

#### **News**

- [2016 BMP Performance Summaries](#)
- [2016 Studies Now Available](#)
- [Stream Restoration Database](#)
- [Agricultural BMP Database Version 2.0 Now Available](#)
- [2014 BMP Database Release](#)
- [2014 BMP Performance Summaries](#)
- [2013 Advanced Analysis](#)
- [National Stormwater Quality Database Has A New Home](#)

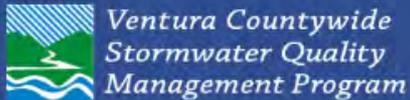
#### **Related Databases & Research**

- [Stream Restoration Database](#)
- [National Stormwater Quality Database](#)
- [Agricultural BMP Database](#)
- [Chesapeake Bay Research Portal](#)

# References

## VCSQMP TGM Page

<http://www.vcstormwater.org/index.php/publications/manuals/tech-guide-manual>



[HOME](#) • [PROGRAMS](#) • [PUBLICATIONS](#) • [REGULATIONS](#) • [LINKS](#) • [FAQ](#) • [CONTACT US](#) • [SEARCH](#)

## Technical Guidance Manual for Stormwater Quality Measures - New Development and Redevelopment Projects (TGM)

This page is to communicate information on the revisions to Technical Guidance Manual for Stormwater Control Measures. If you would like to be notified by email when this page is updated, please send a request to [Arne Anselm](#) with "Stakeholder Email" in the subject line.

### [NEW] TGM Errata Update 2015 Version

The 2011 TGM was updated in 2015 to correct minor errors and unintentional omissions. Due to the evolving nature of stormwater quality management, the 2011 TGM may continue to be updated to correct errors, to incorporate new and innovative control measures, or to add the Hydromodification Control Plan.

- ▶ [Errata TGM \(May 2015\)](#)
- ▶ [Errata Comments](#)

Ventura County Technical Guidance Manual for  
Stormwater Quality Control Measures

Manual Update 2011

Errata Update 2015

# References

## VCSQMP Countywide Mapping Data

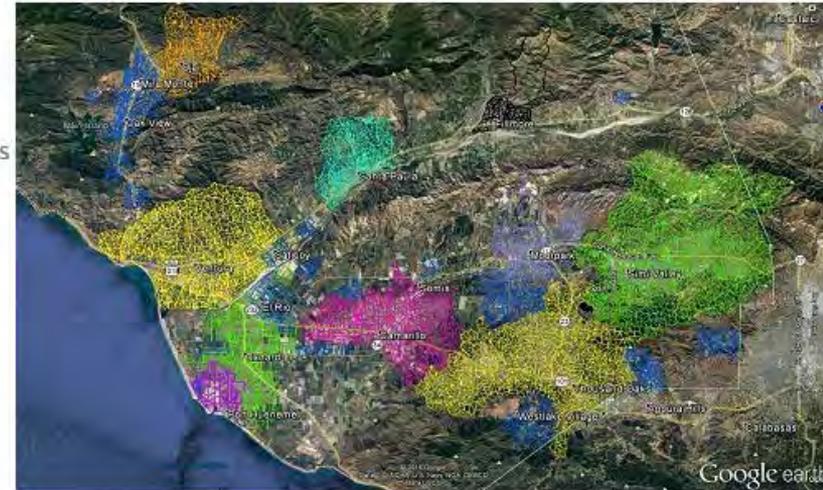
<http://www.vcstormwater.org/index.php/publications/maps/ventura-countywide-unified-storm-drain-map>

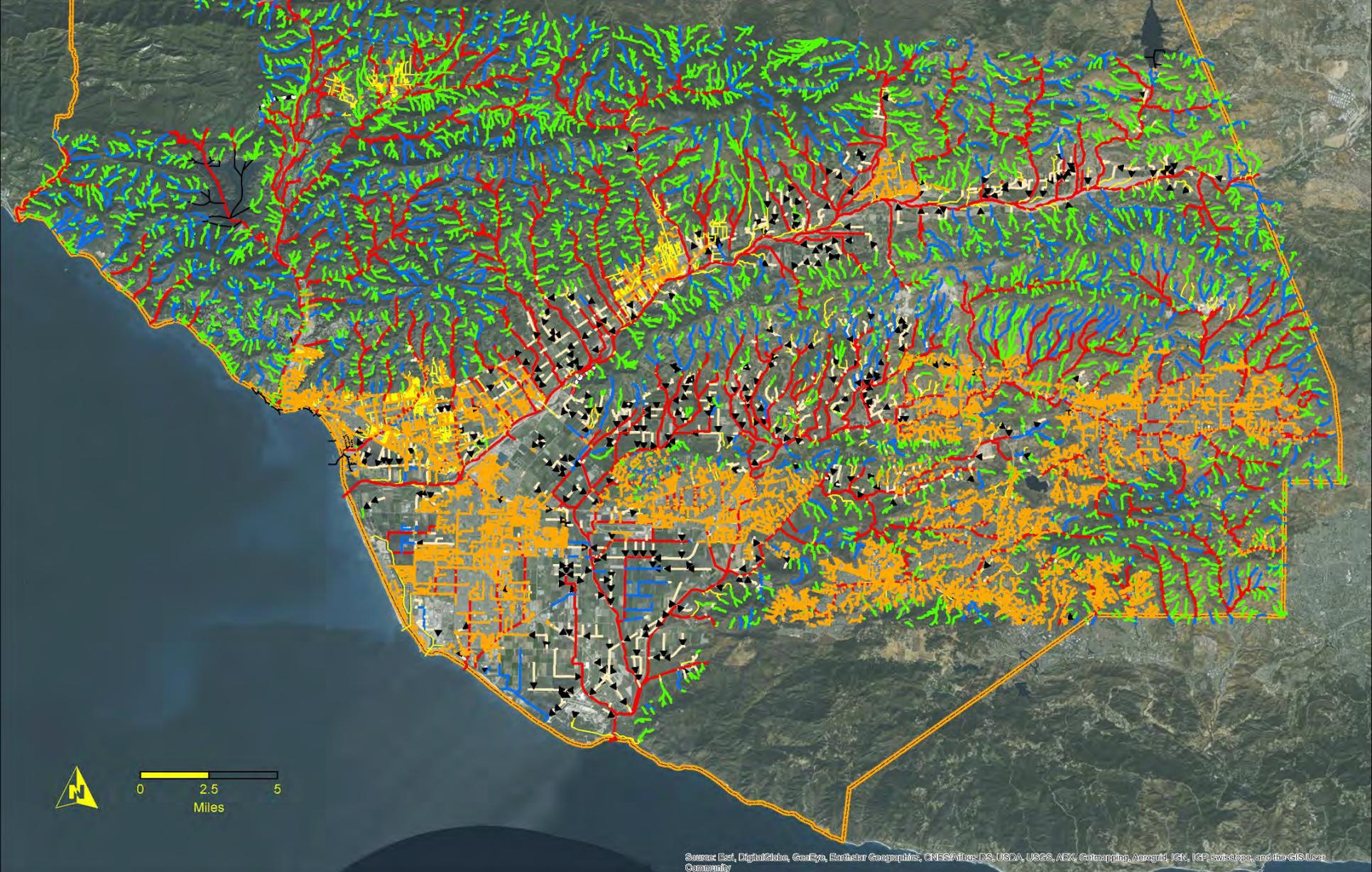
### Ventura Countywide Unified Storm Drain Map

The Ventura County Unified Storm Drain System Mapping project is a unified and seamless Countywide Storm Drain GIS. The project, completed in late 2015, consisted of the mapping of natural and engineered drainage system linkages using available topographic information, construction record drawings and other sources. New storm drain data was captured for the Cities of Fillmore, Moorpark, Ojai, Port Hueneme and Santa Paula and was seamlessly combined with the existing storm drain data from the Cities of Camarillo, Oxnard, Simi Valley, Thousand Oaks and Ventura and the County of Ventura Urban Unincorporated Areas.

### Ventura Countywide Unified Storm Drain Mapping Data Disclaimer

This data is being provided with the express understanding that there is no guarantee that the data is free of errors or omissions. There is no guarantee that any updates will be supplied as errors or omissions become apparent or if updates are available.



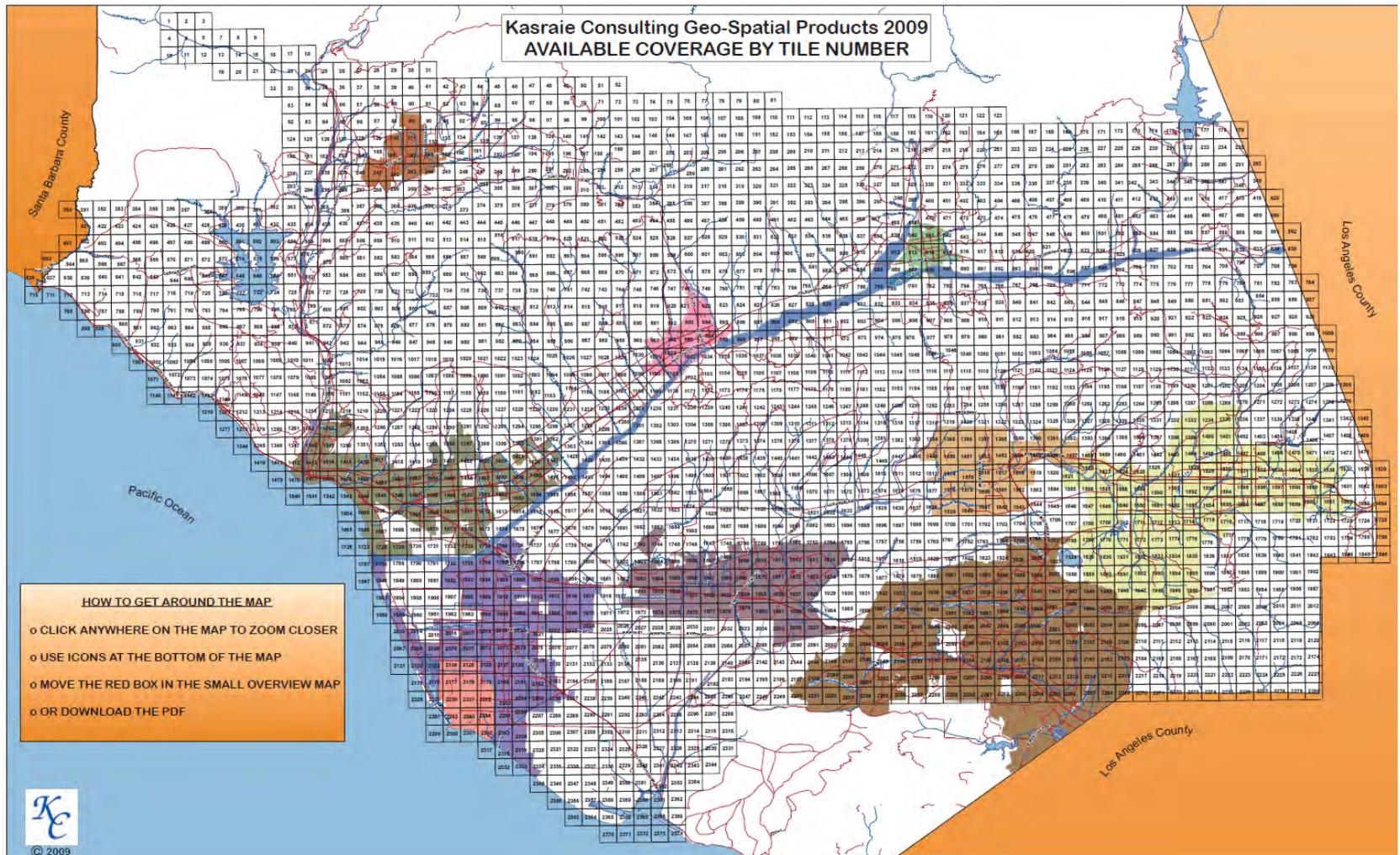


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroX, Geomatics, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community

# References

## Ventura County 2005 LiDAR Contours

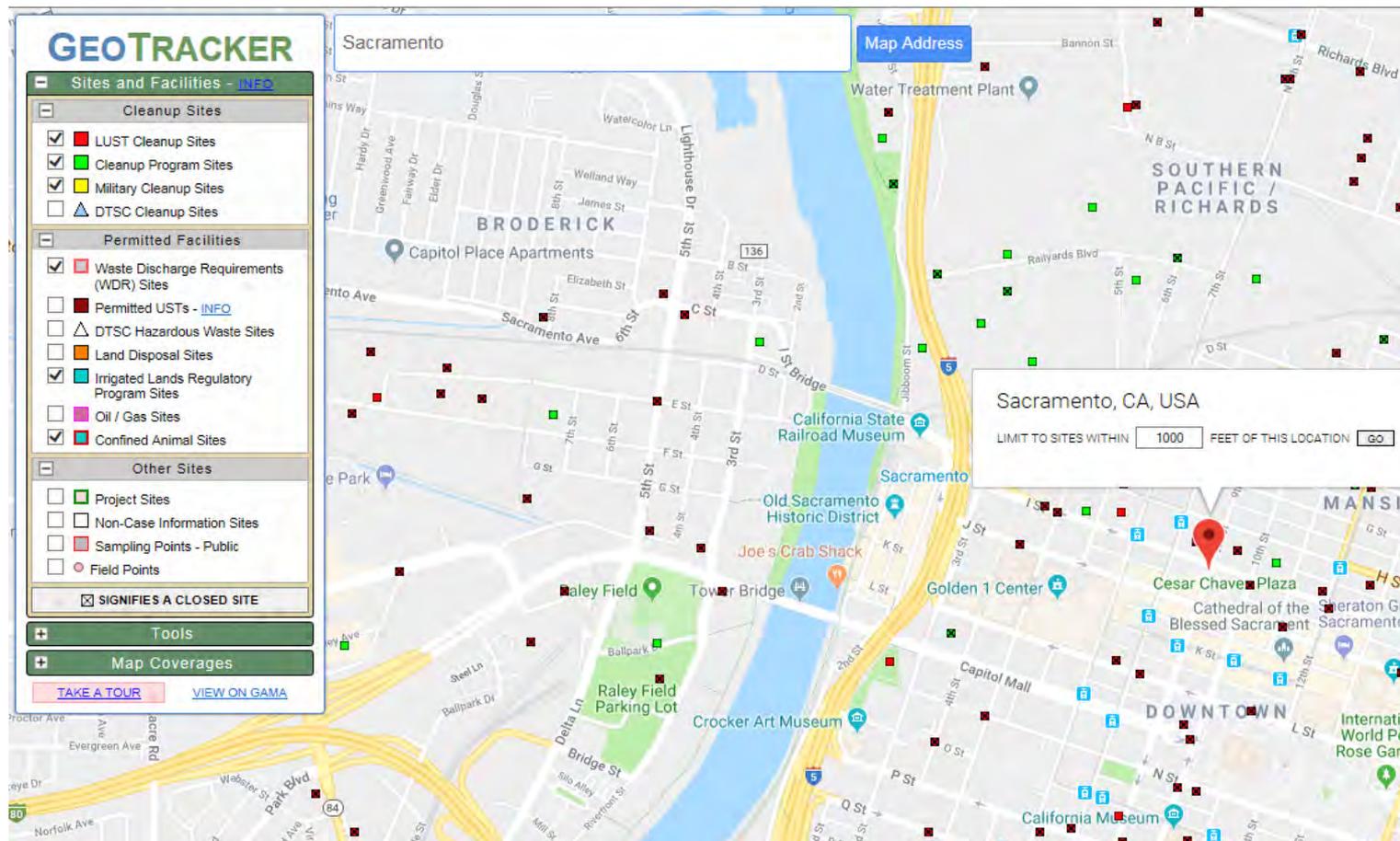
<http://kasraieconsulting.com/products#lidar>



# References

Geotracker → Groundwater Data & Spill/Cleanup Sites

<http://geotracker.waterboards.ca.gov/>



# References

## United Water Conservation District – Groundwater Reports <https://www.unitedwater.org/reports-5/groundwater-conditions>

The screenshot shows the United Water Conservation District website. The header includes the logo and the tagline "Protecting Resources. Balancing Needs." Below the header is a navigation menu with options: About Us, Board of Directors, Resource Conservation, News & Outreach, and Reports. The main content area is titled "Reports" and "Groundwater Conditions". It features a sidebar with links to Water Quality, Water Supply, Groundwater Conditions (highlighted), Financial Reports, FERC Compliance, CEQA Documents, and SB 272. The main text explains that monitoring water levels, quality, and other parameters is an integral part of the district's planning and conservation actions. It lists recent technical reports for three basins: Mound Basin, Santa Paula Basin, and Piru & Fillmore Basins.

**United Water Conservation District**  
Protecting Resources. Balancing Needs.

Reports

### Groundwater Conditions

Monitoring of water levels, water quality and other key parameters are an integral part of United's successful planning and water conservation actions. Recent technical reports include, but are not limited to, the following:

**Mound Basin:**

- Mound Basin Stakeholder Meeting (June 1, 2015)
- Mound Basin Hydrogeological Assessment Report (May 2012) UPDATE

**Santa Paula Basin:**

- Santa Paula Basin Hydrogeologic Characterization and Safe Yield Study (May 2017)
- 2016 Santa Paula Basin Annual Report (September 2017)
- 2015 Santa Paula Basin Annual Report (March 2017)
- Combined 2013 and 2014 Santa Paula Basin Annual Report (January 2016)
- Percolation of Santa Clara River Flow within the Santa Paula Basin (February 2013)
- Santa Paula Creek Percolation: An Update (February 2013)
- Santa Paula Basin Groundwater Elevation Trend Assessment (February 2013)
- Santa Paula Basin Pumping Trend Effects and Assessment (December 2010)
- Santa Paula Basin Yield Report 2003 (July 2003)

**Piru & Fillmore Basins:**

- 2014-2015 Piru & Fillmore Basins Biennial Groundwater Conditions Report - Final (June 2016)
- 2012-2013 Piru Fillmore Basins AB3030 Biennial Groundwater Conditions Report FINAL (February 2015)
- 2013 Piru/Fillmore Basins AB 3030 Groundwater Management Plan DRAFT (May 2013)
- Fillmore-Piru Pumpers Association Stakeholder Meeting January 12, 2016

## VCWPD - Groundwater Reports & Info

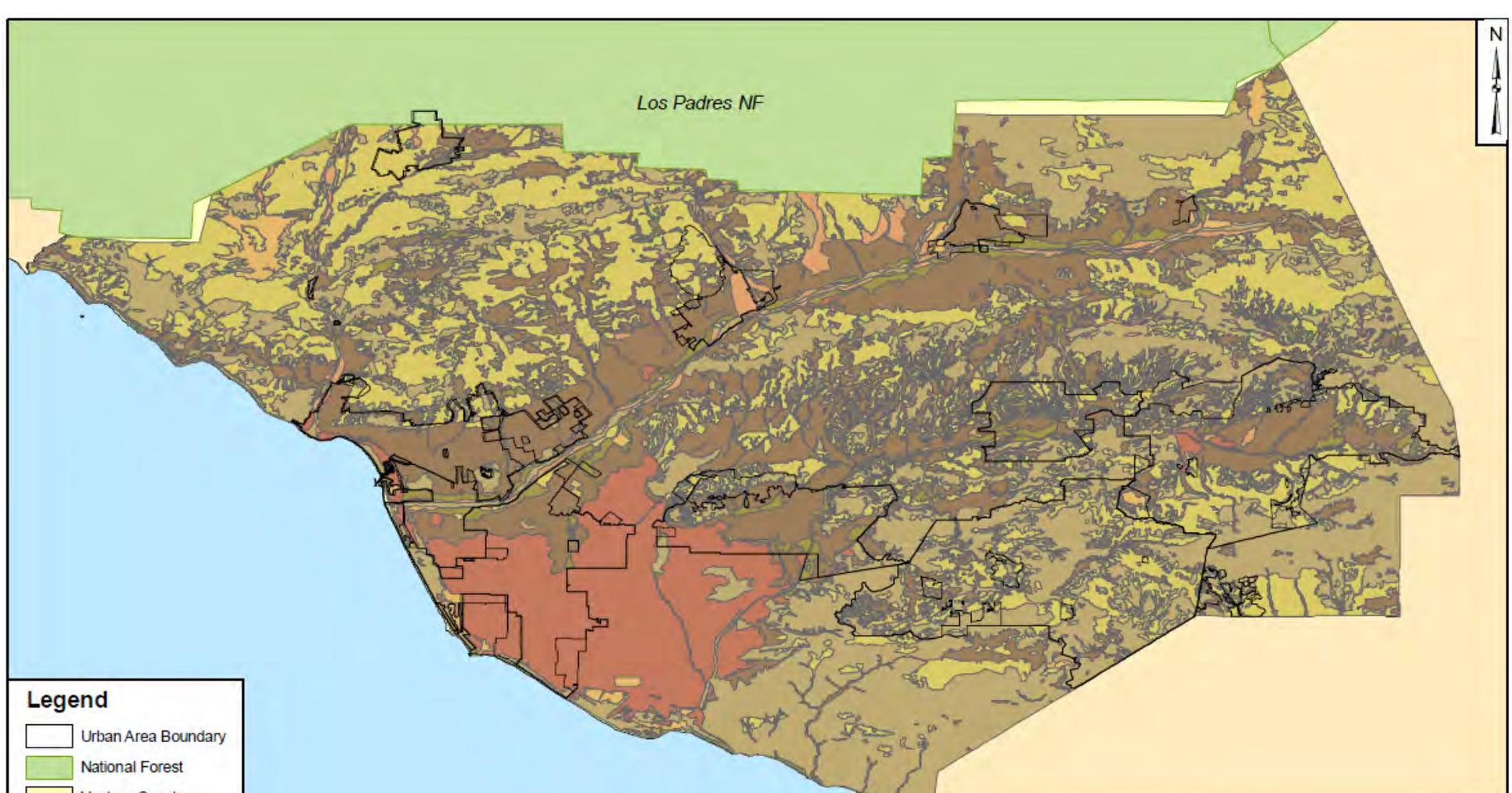
<http://vcpublicworks.org/pwa/groundwater-resources>

### General Questions

Phone: (805) 654-2088

### Groundwater Data

- » 2015 Groundwater Report
- » 2014 Groundwater Report
- » 2013 Groundwater Report
- » 2012 Groundwater Report
- » 2011 Groundwater Report
- » 2010 Groundwater Report
- » Basin Map (PDF, 678 KB)



Los Padres NF



**Legend**

- Urban Area Boundary
- National Forest
- Ventura County
- Adjacent County

**Ventura County Soil Number**

- 1
- 2
- 3
- 4
- 5
- 6
- 7

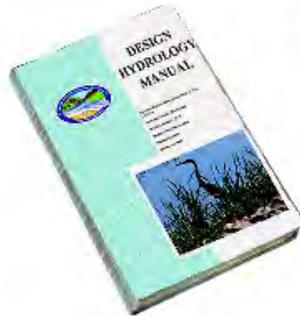


<p><b>Southern Ventura County Soil Classification</b> Ventura County, CA</p>	
<p><b>Geosyntec</b><sup>®</sup> consultants</p>	
Oakland Office	April 2010
<p><b>Figure</b> <b>B-15</b></p>	

# References

## 2017 Ventura County Hydrology Manual (SOILS GIS Data & More)

<http://vcpublishworks.org/watershed-resources-and-technology/hydrology-manual-2>



### **Updated Manual Includes:**

- Revised Rainfall Zones using NOAA 2011 Design Intensity Data
- Updated C Coefficients
- VCRat2.64 Program to run on 64-bit machines with Windows 7 and 10
- VCRat2.64 can use revised rainfall and C coefficients or legacy rainfall and C coefficients
- Tc Calculator Excel Spreadsheet (Appendix E-27)
- VCRat Single Subarea Runoff and Detention Basin Routing Excel Spreadsheet (Appendix E-28)

### **Coming Soon:**

Updated Tc Calculator program to use revised NOAA rainfall zones.

### **2017 Hydrology Manual Appendix E Files**

- E-1 10-Yr Rainfall PDF Map ([pdf, 14mb,download](#))
- E-2 25-Yr Rainfall PDF Map ([pdf, 14mb,download](#))
- E-3 50-Yr Rainfall PDF Map ([pdf, 14mb,download](#))
- E-4 100-Yr Rainfall PDF Map ([pdf, 14mb,download](#))
- E-5 10-Yr Rainfall Shapefiles NAD83 ([zip,download](#))
- E-6 25-Yr Rainfall Shapefiles NAD83 ([zip,download](#))
- E-7 50-Yr Rainfall Shapefiles NAD83 ([zip,download](#))
- E-8 100-Yr Rainfall Shapefiles NAD83 ([zip,download](#))
- E-9 NOAA Rain Zones Map and Shapefiles NAD83 ([zip,download](#))
- E-10 Updated Soils Map Shapefiles ([zip,download](#))
- E-11 Example VCRat2.64, 2.6, and 2.2 Files ([zip,download](#))
- E-12 Design Rainfall Frequency and Hyetograph Files ([zip,download](#))



# References



# References

## Web Soil Survey

<https://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>

**Search**

**Map Unit Legend**

**Ventura Area, California (CA674)**

Ventura Area, California (CA674)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
MoA	Mocho loam, 0 to 2 percent slopes, warm MAAT, MLRA 19	42.0	43.1%
SwC	Sorrento loam, 2 to 9 percent slopes, warm MAAT, MLRA 19	9.4	9.7%
SxA	Sorrento silty clay loam, 0 to 2 percent slopes, warm MAAT, MLRA 19	45.2	46.4%
SxC	Sorrento silty clay loam, 2 to 9 percent slopes, warm MAAT, MLRA 19	0.8	0.8%
<b>Totals for Area of Interest</b>		<b>97.5</b>	<b>100.0%</b>

**Soil Map**

**Report — Map Unit Description**

**Ventura Area, California**  
**SxA—Sorrento silty clay loam, 0 to 2 percent slopes, warm MAAT, MLRA 19**

**Map Unit Setting**

National map unit symbol: 2tyzr  
 Elevation: 20 to 540 feet  
 Mean annual precipitation: 14 to 18 inches  
 Mean annual air temperature: 61 to 62 degrees F  
 Frost-free period: 330 to 360 days  
 Farmland classification: Prime farmland if irrigated

**Map Unit Composition**

Sorrento and similar soils: 85 percent  
 Minor components: 15 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Sorrento**

**Setting**

Landform: Alluvial fans  
 Landform position (two-dimensional): Footslope  
 Landform position (three-dimensional): Tread  
 Down-slope shape: Linear  
 Across-slope shape: Linear  
 Parent material: Alluvium derived from sedimentary rock

**Typical profile**

A - 0 to 19 inches: silty clay loam  
 C - 19 to 79 inches: silty clay loam

**Properties and qualities**

Slope: 0 to 2 percent  
 Depth to restrictive feature: More than 80 inches  
 Natural drainage class: Well drained  
 Runoff class: Medium  
 Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)  
 Depth to water table: More than 80 inches  
 Frequency of flooding: None  
 Frequency of ponding: None  
 Calcium carbonate, maximum in profile: 10 percent  
 Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)  
 Available water storage in profile: High (about 10.8 inches)

**Interpretive groups**

Land capability classification (irrigated): 1  
 Land capability classification (nonirrigated): 3c  
 Hydrologic Soil Group: C  
 Hydric soil rating: No

# Technical Infeasibility

- Seasonal high groundwater (< 5 FT below BMP bottom surface)
- Ventura Hydrology Manual Soil Numbers 1 or 2
- Site specific infiltration testing showing < 0.5 in/hr
- Various Setbacks:
  - i. 100 FT of groundwater well used for drinking water, non-potable wells, drain fields, and springs
  - ii. 50 FT from slopes > 15% or alternate setback established by Geotech
  - iii. 8 FT from building foundations or alternate setback established by Geotech
- Sites with documented potential for groundwater pollutant mobilization (landfills, mines, brownfield development sites, etc.)
- Cannot provide sufficient demand for harvested stormwater

16 different conditions that could potentially demonstrate technical infeasibility of retention for a project site (TGM Section 3.2)

Table 3-4: Treatment Control Measures for Addressing Pollutants of Concern

Class of Pollutant	Recommended BMPs (in Order of Performance)
Sediment	<ol style="list-style-type: none"> <li>1. Retention BMPs (Infiltration, Rainwater Harvesting, and Evapotranspiration BMPs)</li> <li>2. Any of the following BMPs (equivalent performance):                             <ol style="list-style-type: none"> <li>a. Biofiltration BMPs</li> <li>b. Wet Detention Basin</li> <li>c. Constructed Wetland</li> <li>d. Sand Filter/Cartridge Media Filter</li> </ol> </li> <li>3. Dry Extended Detention Basin</li> </ol>
Metals / Metalloids	<ol style="list-style-type: none"> <li>1. Retention BMPs (Infiltration, Rainwater Harvesting, and Evapotranspiration BMPs)</li> <li>2. Any of the following BMPs (equivalent performance):                             <ol style="list-style-type: none"> <li>a. Constructed Wetland</li> <li>b. Biofiltration BMPs</li> <li>c. Wet Detention Basin</li> <li>d. Sand Filter/Cartridge Media Filter</li> </ol> </li> <li>3. Dry Extended Detention Basin</li> </ol>
Nutrients <sup>1</sup>	<ol style="list-style-type: none"> <li>1. Retention BMPs (Infiltration, Rainwater Harvesting, and Evapotranspiration BMPs)</li> <li>2. Any of the following BMPs (equivalent performance):                             <ol style="list-style-type: none"> <li>a. Bioinfiltration</li> <li>b. Wet Detention Basin</li> <li>c. Constructed Wetland</li> </ol> </li> <li>3. Any of the following BMPs (equivalent performance):                             <ol style="list-style-type: none"> <li>a. Biofiltration BMPs</li> </ol> </li> <li>4. Any of the following (equivalent performance):                             <ol style="list-style-type: none"> <li>a. Sand Filter/Cartridge Media Filter</li> <li>b. Dry Extended Detention Basin</li> </ol> </li> </ol>
Pesticides <sup>2</sup>	<ol style="list-style-type: none"> <li>1. Source controls, erosion controls</li> <li>2. Retention BMPs (Infiltration, Rainwater Harvesting, and Evapotranspiration BMPs)</li> <li>3. Any of the following BMPs (equivalent performance):                             <ol style="list-style-type: none"> <li>a. Biofiltration BMPs</li> <li>b. Wet Detention Basin</li> <li>c. Constructed Wetland</li> <li>d. Sand Filter/Cartridge Media Filter</li> </ol> </li> <li>4. Dry Extended Detention Basin</li> </ol>

Class of Pollutant	Recommended BMPs (in Order of Performance)
Pathogens	<ol style="list-style-type: none"> <li>1. Retention BMPs (Infiltration, Rainwater Harvesting, and Evapotranspiration BMPs)</li> <li>2. Any of the following BMPs (equivalent performance):                             <ol style="list-style-type: none"> <li>a. Bioretention with Underdrain</li> <li>b. Wet Detention Basins</li> <li>c. Proprietary Biofiltration</li> </ol> </li> <li>3. Sand Filter/Cartridge Media Filter</li> </ol>
Trash and Debris	<ol style="list-style-type: none"> <li>1. Gross Solids Removal BMPs (should be combined with a Retention BMP, Biofiltration BMP, or Treatment Control Measure)</li> <li>2. Any Retention BMP, Biofiltration BMP, or Treatment Control Measure designed to incorporate a trash capture device (e.g., a trash screen)</li> </ol>

<sup>1</sup>Performance is based on removal of nitrogen compounds. For performance of BMPs in removing phosphorous, see sediment pollutant class as they are largely associated with particulates.

<sup>2</sup>Performance data is not available for this pollutant class, but as they are largely associated with particulates, BMP selection should be similar to the sediment pollutant class.

**Table 3-4 of TGM**

# Proprietary BMP Selection

Proprietary BMPs must meet or exceed the performance standards listed in TGM Appendix D → 4 Step process for comparison

Effluent Concentrations as Median Values

BMP Category	Total Suspended Solids (mg/L)	Total Nitrate-Nitrogen (mg/L)	Total Copper (µg/L)	Total Lead (µg/L)	Total Zinc (µg/L)
Detention Pond	27	0.48	15.9	14.6	58.7
Wet Pond	10	0.2	5.8	3.4	21.6
Wetland Basin	13	0.13	3.3	2.5	29.2
Biofilter	18	0.36	9.6	5.4	27.9
Media Filter	11	0.66	7.6	2.6	32.2
Hydrodynamic Device	23	0.29	11.8	5	75.1

Expected BMP pollutant performance for effluent quality was developed from the WERF-ASCE/U.S. EPA International BMP Database, 2007

BIO-5: Proprietary Biofiltration (allowed if retention infeasibility shown)

- ▶ Fact Sheet (pg 6-164 of TGM) has list of potential options (List was created in 2011, there are a lot more options available now)

# BMPs - Planning

Table 4-1: Rule of Thumb Space Requirements

BMP Type	% of Contributing Drainage Area
Infiltration	3 to 10
Rainwater Harvesting (Cistern)	0 to 10
Evapotranspiration (Green Roof)	1 to 1 ratio of impervious cover treated
Biofiltration	3 to 5
Dry Extended Detention Basin	1 to 3
Wet Detention Basin	1 to 3
Sand Filters	0 to 5
Cartridge Media Filter	0 to 5

# BMPs - Planning

## Table 3-1: Space Requirements per Land Use

Project Type		Percent of Site <sup>1</sup>
New Development	SF/MF Residential < 7 du/ac	10
	SF/MF Residential 7 - 18 du/ac	7
	SF/MF Residential > 18 du/ac	5
	Mixed Use, Commercial, Institutional/Industrial w/ FAR < 1.0	10
	Mixed Use, Commercial, Institutional/Industrial w/ FAR 1.0 - 2.0	7
	Mixed Use, Commercial, Institutional/Industrial w/ FAR > 2.0	5
	Podium (parking under > 75% of project)	3
	Projects with zoning allowing development to lot lines	2
	Transit Oriented Development	5
Parking	5	

Project Type		Percent of Site <sup>1</sup>
Redevelopment	SF/MF Residential < 7 du/ac	5
	SF/MF Residential 7 - 18 du/ac	4
	SF/MF Residential > 18 du/ac	3
	Mixed Use, Commercial, Institutional/Industrial w/ FAR < 1.0	5
	Mixed Use, Commercial, Institutional/Industrial w/ FAR 1.0 - 2.0	4
	Mixed Use, Commercial, Institutional/Industrial w/ FAR > 2.0	3
	Podium (parking under > 75% of project)	2
	Projects with zoning allowing development to lot lines	1
	Transit Oriented Development	3
Projects in Historic Districts	3	

Key: SF = Single Family, MF = Multi Family, du/ac = dwelling units per acre, FAR = Floor Area Ratio = ratio of gross floor area of building to gross lot area.

<sup>1</sup> If subsurface BMPs are used, dedicated area may have other surface land uses which do not structurally impact the subsurface BMP (see INF-6: Proprietary Infiltration).

# BMPs – Planning

<http://www.vcstormwater.org/index.php/publications/manuals/tech-guide-manual>



## Technical Guidance Manual for Stormwater Quality Measures - New Development and Redevelopment Projects (TGM)

This page is to communicate information on the revisions to Technical Guidance Manual for Stormwater Control Measures. If you would like to be notified by email when this page is updated, please send a request to Arne Anselm with "Stakeholder Email" in the subject line.

### [NEW] TGM Errata Update 2015 Version

The 2011 TGM was updated in 2015 to correct minor errors and unintentional omissions. Due to the evolving nature of stormwater quality management, the 2011 TGM may continue to be updated to correct errors, to incorporate new and innovative control measures, or to add the Hydromodification Control Plan.

- ▶ Errata TGM (May 2015)
- ▶ Errata Comments

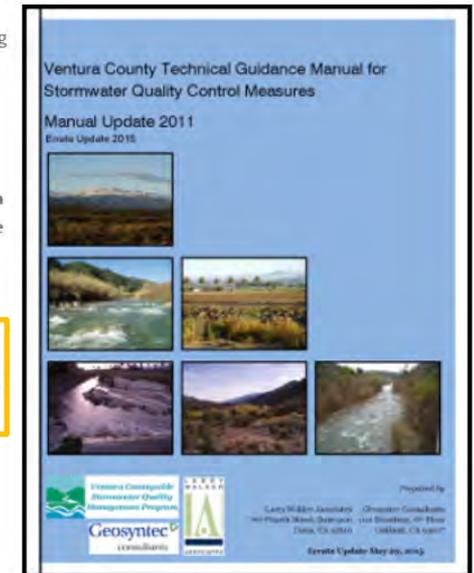
The Technical Guidance Manual was approved by the Executive Officer of the LA Regional Board on July 13, 2011. The new rules became effective on October 11, 2011. For more information on how the effective date applies to projects see page 1-8 of the TGM.

- ▶ Final 2011 Technical Guidance Manual (July 2011)
- ▶ An electronic tool to assist land development project applicants in meeting the new LID requirements under the new Permit. *[To ensure you use the correct version of this tool always check with the agency that has jurisdiction over your project before starting. Links are provided at the bottom of this page.]*
- ▶ Ventura Stormwater Permit LID Alternative Compliance Stakeholder Meeting Announcement
- ▶ July 13, 2011 Approval Letter from Regional Board

Training Materials from June 21st, 2011, Seminar

- ▶ Morning Presentation (June 2011)
- ▶ Afternoon Presentation (June 2011)
- ▶ Flow Charts (June 2011)

## TGM Tool Spreadsheet



# TGM Tool (7 Step Process)

## Step 1 - Applicability

<b>Project Name:</b> [Insert Project Name in General Info.]	
<b>STEP 1: DETERMINE PROJECT APPLICABILITY</b>	
<i>Instructions:</i> For <u>new development projects</u> , answer yes, no, or NA to questions (1) - (10) below. For <u>redevelopment projects</u> , answer yes, no, or NA to questions (11) - (13) below.	
<b>NEW DEVELOPMENT PROJECTS</b>	
Does the new development project fall within categories (1) - (10) below?	
<b>Project Type and/or Characteristics</b>	<b>Y/N/NA</b>
1) Development projects equal to 1 acre or greater of disturbed area that adds more than 10,000 square feet of impervious surface area →go to Step 2	
2) Industrial parks with 10,000 square feet or more of total altered surface area →go to Step 2	
3) Commercial strip malls with 10,000 square feet or more of impervious surface area →go to Step 2	
4) Retail gasoline outlets with 5,000 square feet or more of total altered surface area →go to Step 2	
5) Restaurants (Standard Industrial Classification (SIC) of 5812) with 5,000 square feet or more of total altered surface area →go to Step 2	
6) Parking lots with 5,000 square feet or more of impervious surface area, or with 25 or more parking spaces →go to Step 2	
7) Streets, roads, highways, and freeway construction of 10,000 square feet or more of impervious surface area → go to Roadway Projects	
8) Automotive service facilities (Standard Industrial Classification (SIC) of 5013, 5014, 5511, 5541, 7532-7534 and 7536-7539) of 5,000 square feet or more of total altered surface area →go to Step 2	
9) Projects located in or directly adjacent to, or discharging directly to an Environmentally Sensitive Area (ESA), where the development will: a. Discharge stormwater runoff that is likely to impact a sensitive biological species or habitat; and b. Create 2,500 square feet or more of impervious surface area →go to Step 2	
10) Single-family hillside homes (see Section 2 of the TGM for specific requirements) →go to SF Hillside	

## Step 2 – Assess Site Conditions

<b>Project Name:</b> [Insert Project Name in General Info.]	
<b>STEP 2: ASSESS SITE CONDITIONS</b>	
Provide an assessment of the project site using the following tables	
<b>New Development Project General Characteristics</b>	
<b>General Project Characteristics</b>	<b>Area (acres)</b>
Total Project Site Area	
Total Disturbed Area	
Total Existing (Pre-Project) Impervious Area	
Post-Project Impervious Area [1]	
Area of Green Roof (ET-1) [1]	
Area Draining to Hydrologic Source Controls (ET-2) [1]	
Revised Post-Project Impervious Area	0.00
Project Imperviousness (%)	
<b>Redevelopment Project General Characteristics</b>	
<b>General Project Characteristics</b>	<b>Area (acres)</b>
Total Project Site Area	
Total Altered Area [6]	
Total Existing (Pre-Project) Impervious Area	
Was existing (pre-project) impervious area subject to post-development stormwater quality control requirements? [2]	
Amount of Existing Impervious Area Altered [3]	
Amount of Impervious Area Added	
% Alteration of Existing Impervious Area [4]	N/A
Post-Project Impervious Area (Impervious Area to be Mitigated) [1], [4]	0.00
Area of Green Roof (ET-1) [1]	
Area Draining to Hydrologic Source Controls (ET-2) [1]	
Revised Post-Project Impervious Area	0.00
Project Imperviousness (%) [5]	

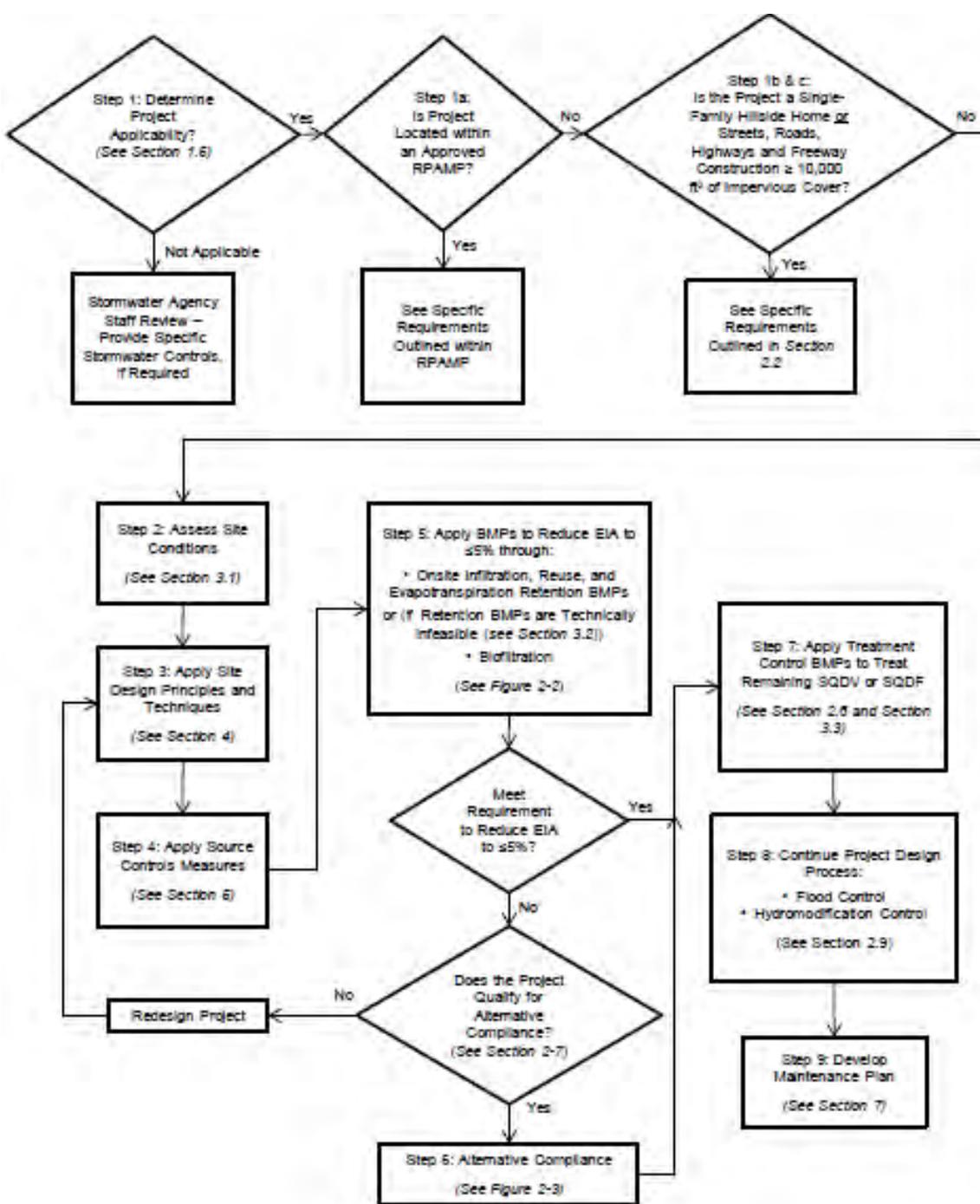
# Appendix E

## BMP Sizing Worksheets

- ▶ Sizing Criteria
- ▶ Step by Step sizing instructions for BMPs
- ▶ Blank Worksheet Form
- ▶ Worksheet Form Example

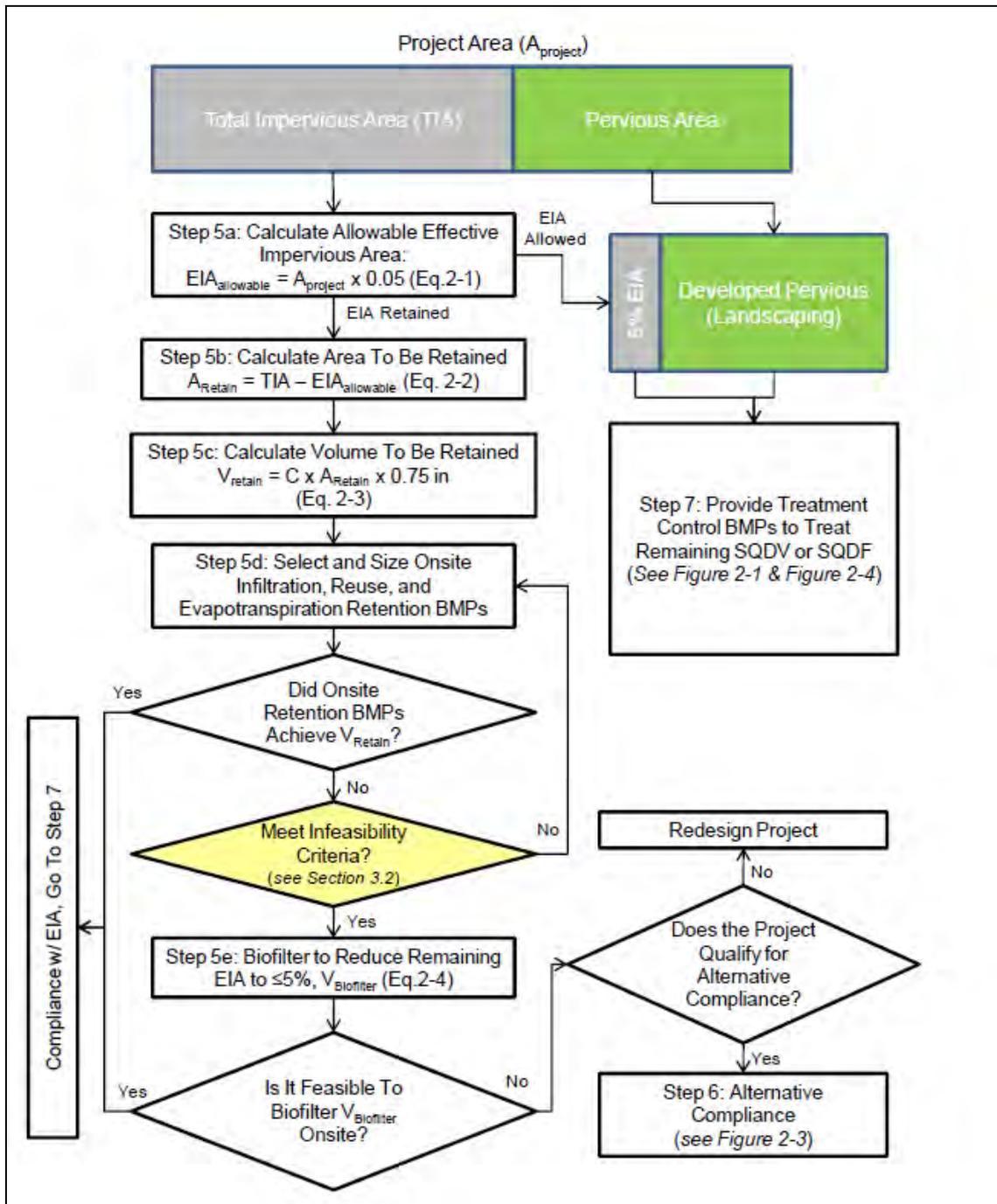
### Sizing Worksheet

Step 1: Determine water quality design volume	
1-1. Enter Project area (acres), $A_{\text{project}}$	$A_{\text{project}} =$ acres
1-2. Enter the maximum allowable percent of the Project area that may be effective impervious area (%) (refer to permit), ranges from 5-30%, $\%_{\text{allowable}}$	$\%_{\text{allowable}} =$ %
1-3. Determine the maximum allowable effective impervious area (acres), $EIA_{\text{allowable}} = (A_{\text{project}}) * (\%_{\text{allowable}})$	$EIA_{\text{allowable}} =$ acres
1-4. Enter Project impervious fraction, $Imp$ (eg, 60% = 0.60)	$Imp =$
1-5. Determine the Project Total Impervious area (acres), $TIA = A_{\text{project}} * Imp$	$TIA =$ acres
1-6. Determine the total area from which runoff must be retained (acres), $A_{\text{retain}} = TIA - EIA_{\text{allowable}}$	$A_{\text{retain}} =$ acres
1-7. Determine pervious runoff coefficient using Table E-1, $C_p$	$C_p =$
1-8. Calculate runoff coefficient, $C = 0.95 * imp + C_p (1 - imp)$	$C =$
1-9. Enter design rainfall depth of the storm (in), $P_i$ (see Table D-3)	$P_i =$ in
1-10. Calculate rainfall depth (ft), $P = P_i / 12$	$P =$ ft
1-11. Calculate water quality design volume (ft <sup>3</sup> ), $SQDV = 43560 \times C * P * A_{\text{retain}}$	$SQDV =$ ft <sup>3</sup>
Step 2: Determine the design percolation rate	
2-1. Enter measured soil percolation rate (in/hr, 0.5 in/hr min.), $P_{\text{measured}}$	$P_{\text{measured}} =$ in/hr



Step by step flowchart for site specific post-construction BMP design TGM Figure 2-1



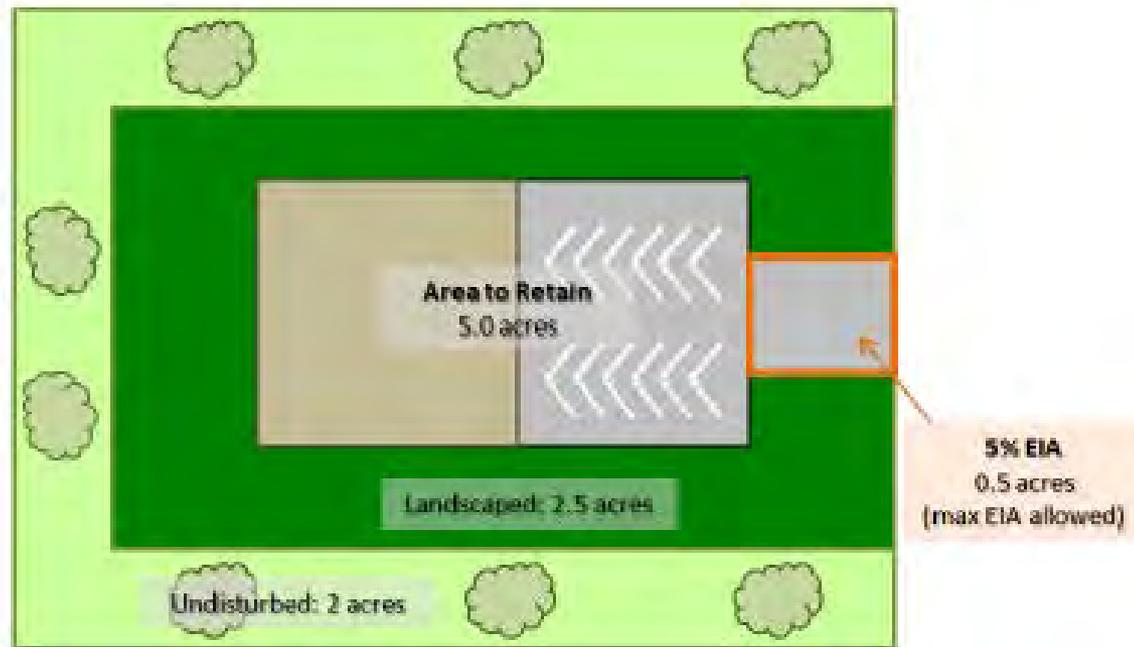


Apply BMPs to reduce EIA to < 5% flowchart TGM Figure 2-2

# Effective Impervious Area (EIA)

- ▶ Portion of the surface area that is hydrologically connected via sheet flow over a hardened conveyance or impervious surface **without any intervening medium to mitigate volume.**
- ▶ Impervious surfaces are rendered “ineffective” if the design storm volume is fully retained onsite using retention BMPs.
- ▶ Biofiltration BMPs may be used to achieve the 5% EIA standard if Retention BMPs are technically infeasible. But, 150% of the volume not retained onsite must be treated.

# Effective Impervious Area (EIA)



Total Project Area:  $A_{total} = 10$  acres

Maximum allowed EIA =  $A_{total} * 0.05 = 0.5$  acres

$A_{impervious} = 5.5$  acres (building, parking lot, driveway)

$A_{pervious} = 4.5$  acres (surrounding landscaping)

$A_{retained} = 5.5 - 0.5 = 5$  acres retained onsite (minimum)

$A_{treated} = 0.5 + 2.5 = 5$  acres treated

# Site Design Example

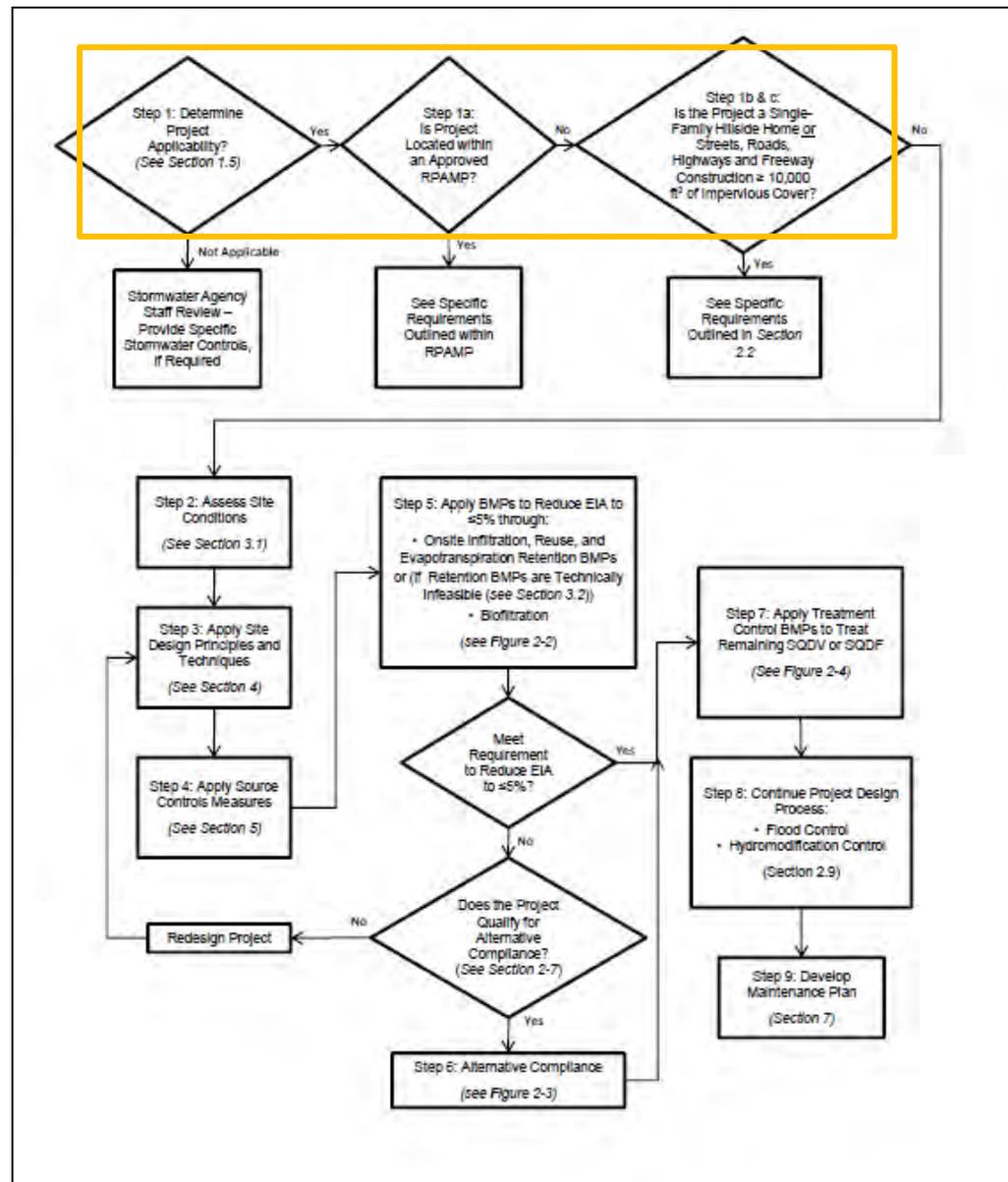
## Project Information:

- ▶ Redevelopment of a commercial center
- ▶ Highly urbanized area
- ▶ Site is covered by building roof and parking lot, with some vegetation (curbed off trees) within the main parking lot.
- ▶ 12.2 Acres
- ▶ 95% Impervious



# Step 1: Project Applicability

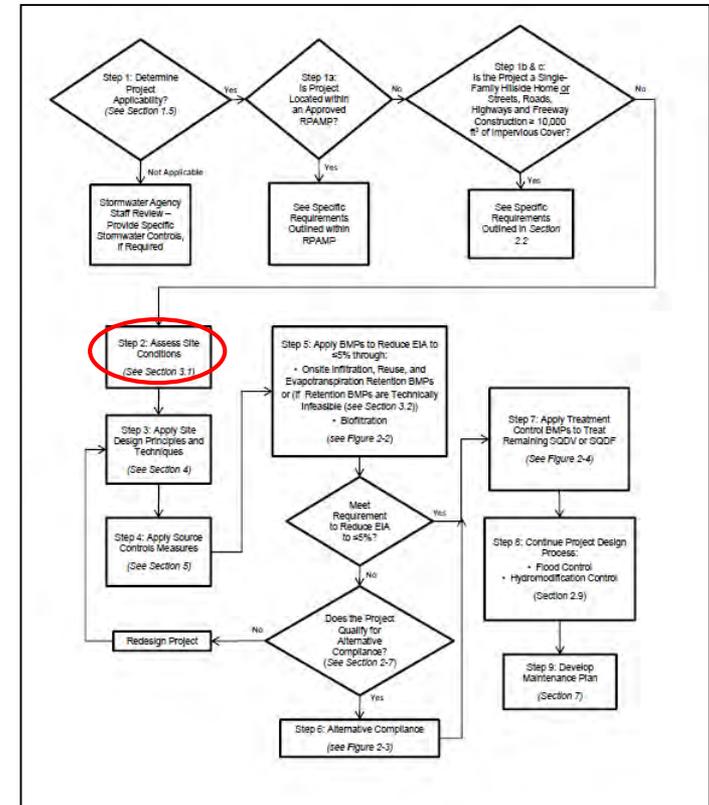
- ▶ Project is Subject to Requirements
- ▶ Project not located within approved RPAMP
- ▶ Project does not require specifications indicated for Step 1b & 1c



# Step 2: Assess Site Conditions

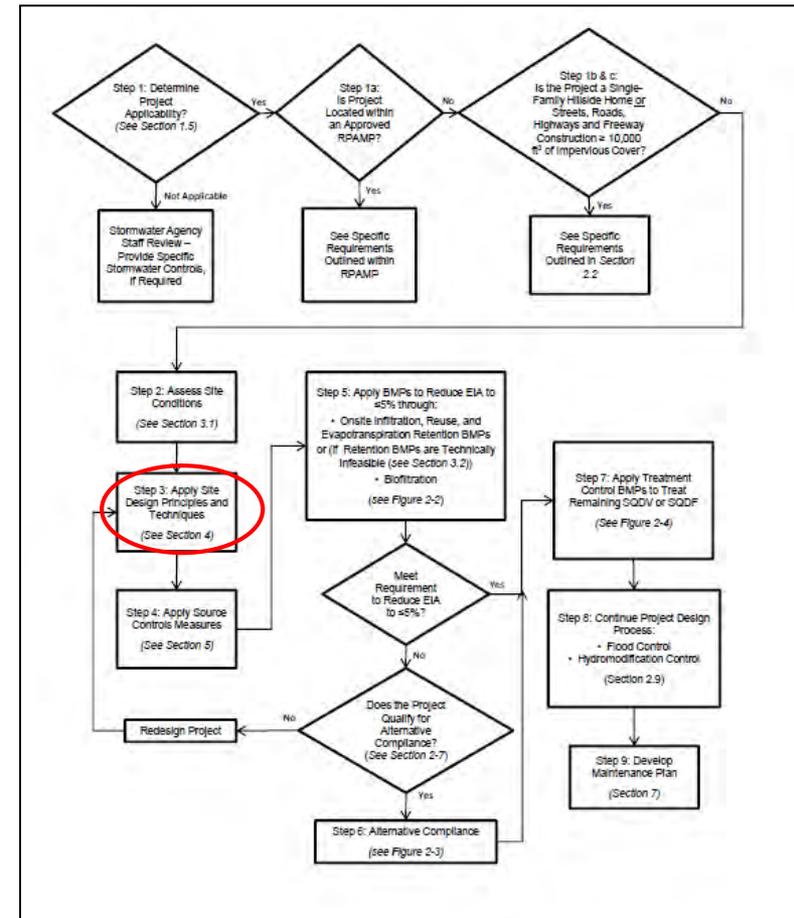
## Collect Site Information (Section 3.1):

- ▶ Topography
  - ▶ Slopes < 15%
- ▶ No Geological/Geotechnical Hazards
- ▶ Ventura Soil Type 4 from (Fig B-15, App B)
- ▶ Seasonal High Groundwater is greater than 10 feet below ground surface (BGS)
- ▶ No nearby groundwater wells



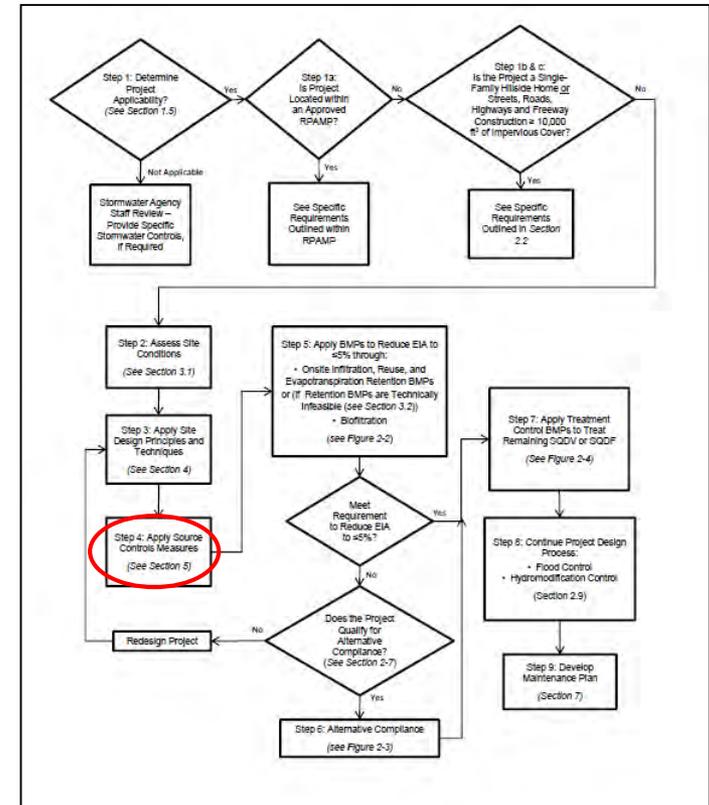
# Step 3: Apply Site Design Principles and Techniques

Design Principle	Yes	N/A	Notes
Site Planning (4.2)		X	<i>Redevelopment Site</i>
Conservation of Natural Areas (4.3)		X	<i>Redevelopment Site</i>
Minimizing Land Disturbance (4.4)		X	<i>Redevelopment Site</i>
Minimizing Impervious Cover (4.5)	X		Pervious areas and BMPs provide minimization of impervious areas
Applying LID at Various Scales (4.6)		X	<i>Redevelopment Site</i>
Implementing IWRMP (4.7)	X		Use of LID BMPs promotes IWRM

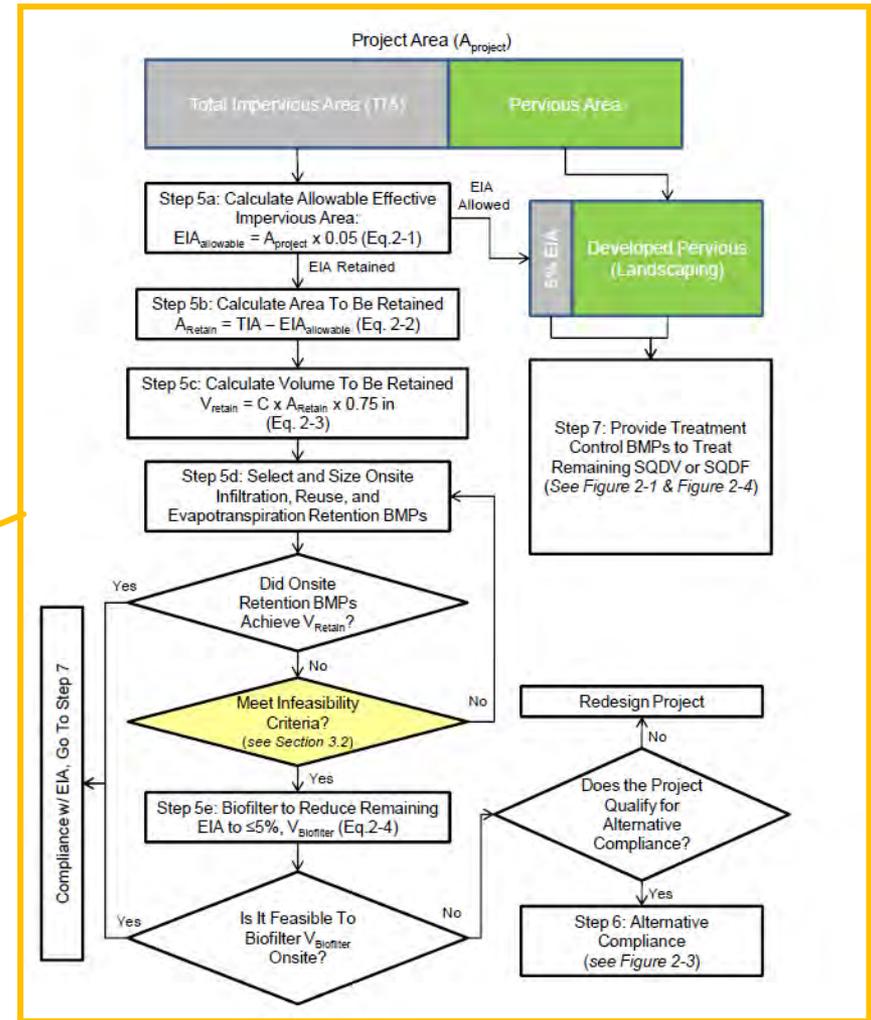
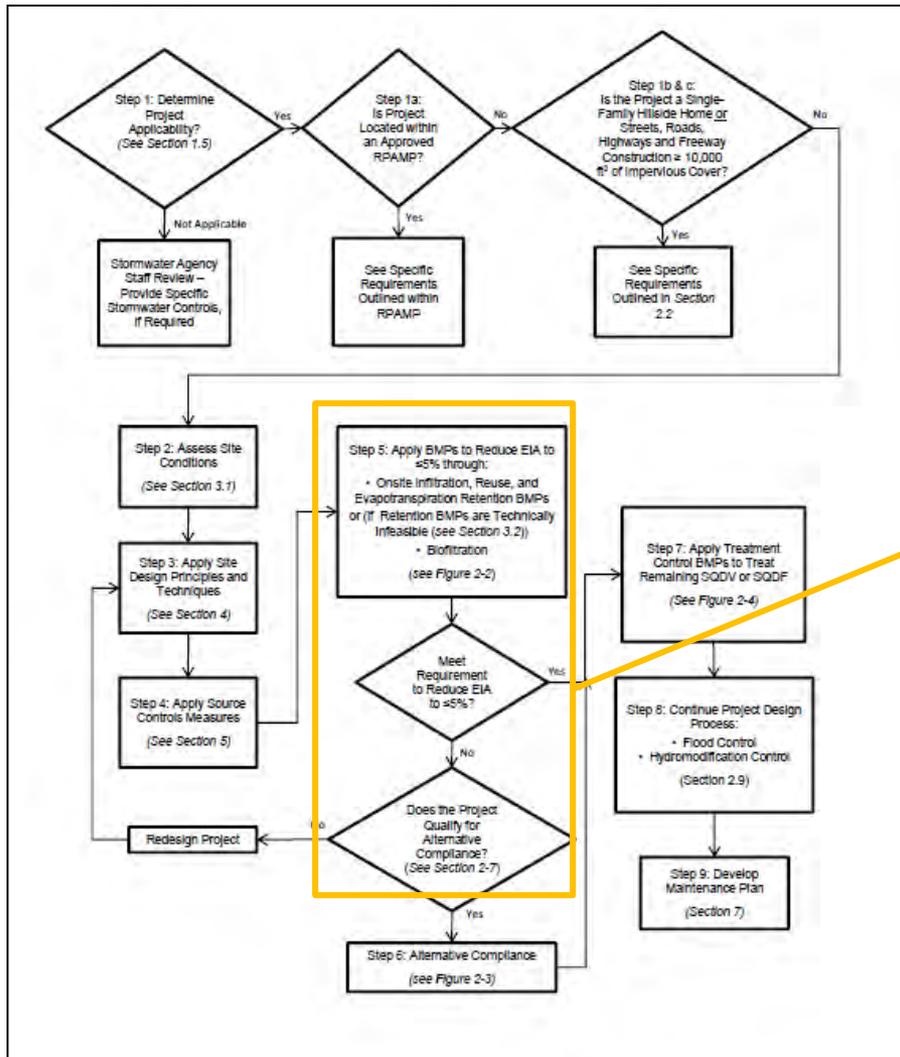


# Step 4: Apply Source Controls

Source Control	Yes	N/A	Notes
S-1: Storm Drain Message/Signage	X		Storm drains expected on-site
S-2: Outdoor Material Storage Area Design		X	No outdoor material storage
S-3: Outdoor Trash Storage Area Design	X		Outdoor trash area on-site should be properly contained
S-4: Outdoor Loading/ Unloading Dock Area	X		Outdoor loading dock on-site
S-5: Outdoor Repair/ Maintenance Bay Design		X	No outdoor repair/ maintenance bay on-site
S-6: Outdoor Vehicle Washing Area Design		X	No outdoor vehicle washing allowed on-site
S-7: Fueling Area Design		X	No vehicle fueling area on-site
S-8: Proof of Control Measure Maintenance	X		Required for all sites



# Step 5: Apply BMPs to Reduce EIA to $\leq 5\%$



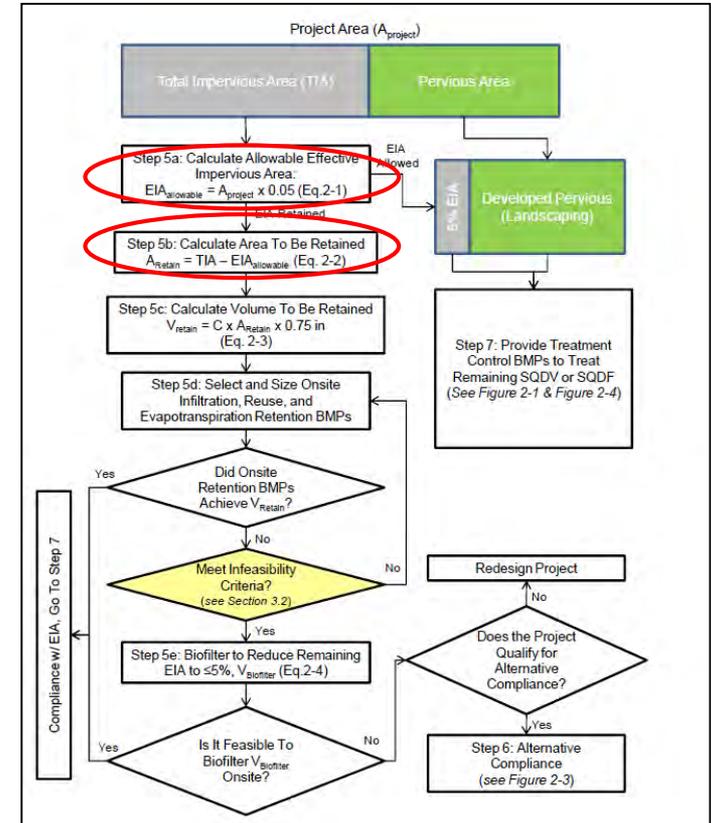
# Step 5: Apply BMPs to Reduce EIA to $\leq 5\%$

**Step 5a:** Calculate Allowable Effective Impervious Area (Equation 2-1)

▶  $EIA_{\text{allowable}} = (12.2 \text{ ac}) * (0.05) = 0.6 \text{ ac}$

**Step 5b:** Calculate Area to be retained (Equation 2-2)

▶  $A_{\text{retain}} = (12.2 \text{ ac} * 0.95) - 0.6 \text{ ac} = 11 \text{ ac}$



# Step 5: Apply BMPs to Reduce EIA to $\leq 5\%$

## Step 5c: Calculate Volume to be Retained

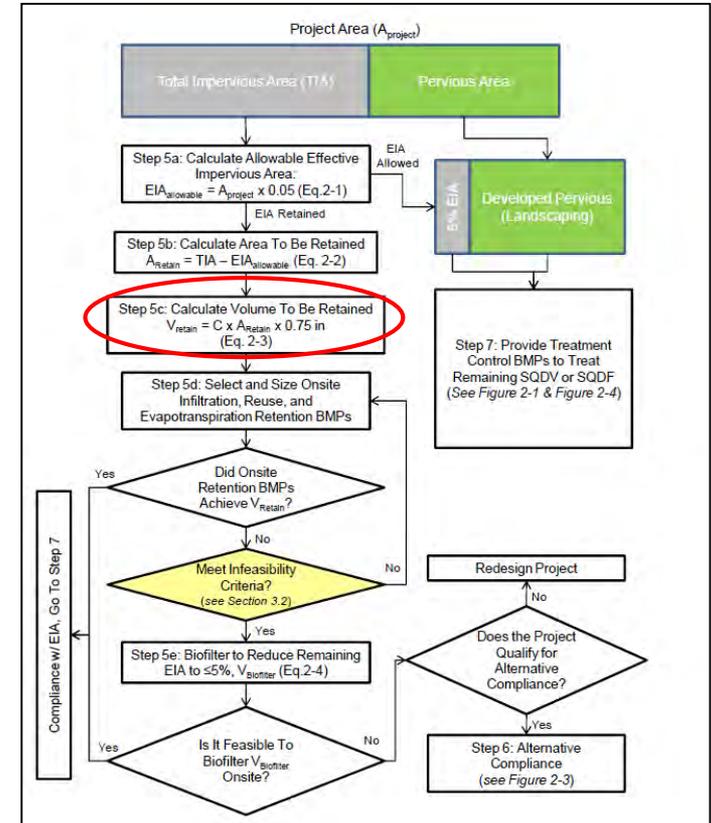
- 1) The 85th percentile 24-hour runoff event determined as the maximized capture stormwater volume for the area using a 48 to 72-hour draw down time, from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87, (1998); or
- 2) The volume of annual runoff based on unit basin storage water quality volume to achieve 80 percent or more volume treatment; or
-  3) The volume of runoff produced from a 0.75 inch storm event; or
- 4) Eighty (80) percent of the average annual runoff volume using an appropriate public domain continuous flow model [such as Storm Water Management Model (SWMM) or Hydrologic Engineering Center – Hydrologic Simulation Program – Fortran (HEC-HSPF)], using the local rainfall record and relevant BMP sizing and design data.

# Step 5: Apply BMPs to Reduce EIA to $\leq 5\%$

Step 5c: Calculate Volume to be Retained  
(Equation 2-3)

▶  $V_{\text{retain}} = 0.95 * 11 \text{ ac} * (0.75 \text{ in}/12 \text{ in}/\text{ft})$

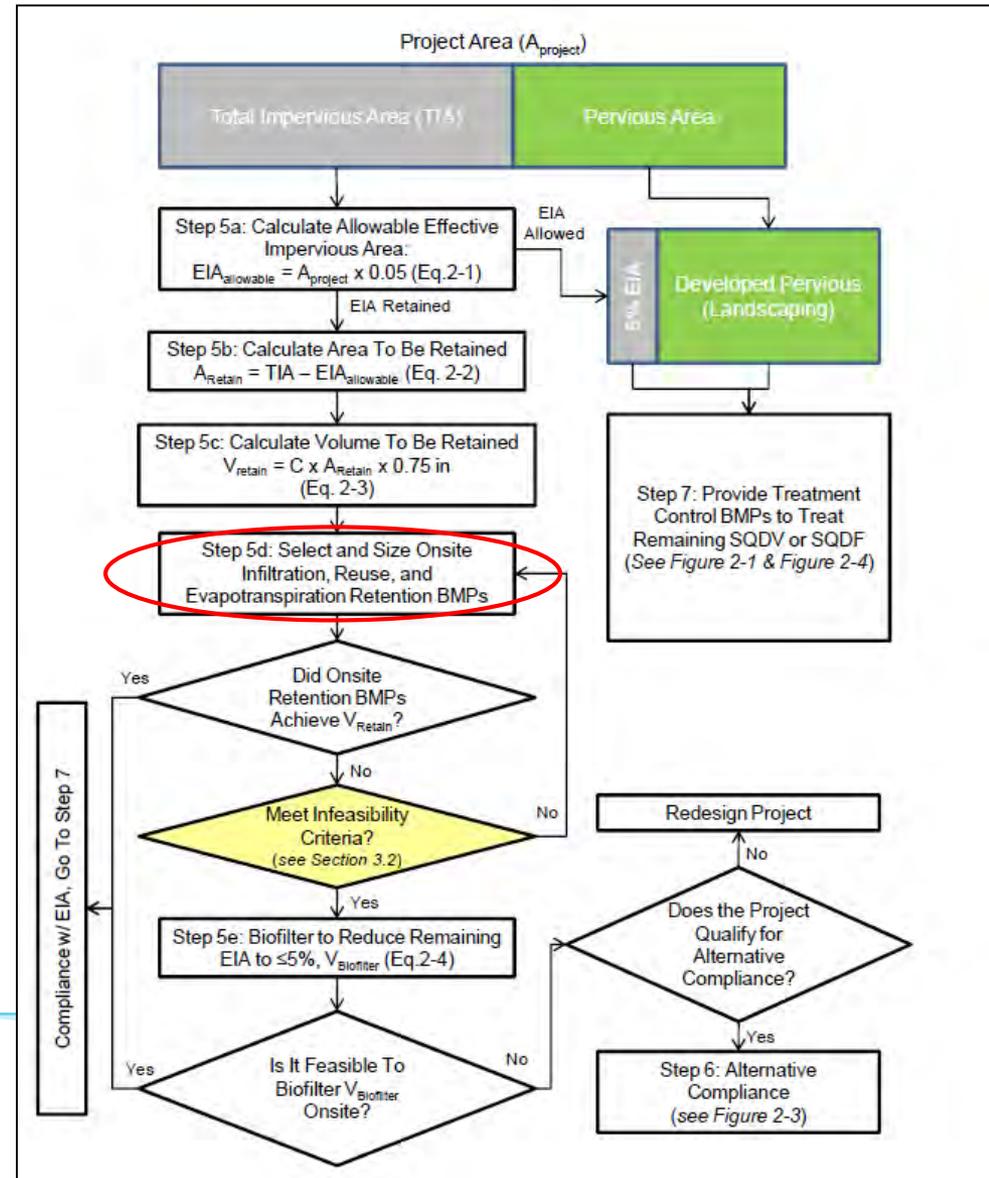
- $V_{\text{retain}} = 0.65 \text{ ac-ft}$



# Step 5: Apply BMPs to Reduce EIA to $\leq 5\%$

## Step 5d: Select and Size on-site Infiltration BMPs

- Infiltration considered 1st

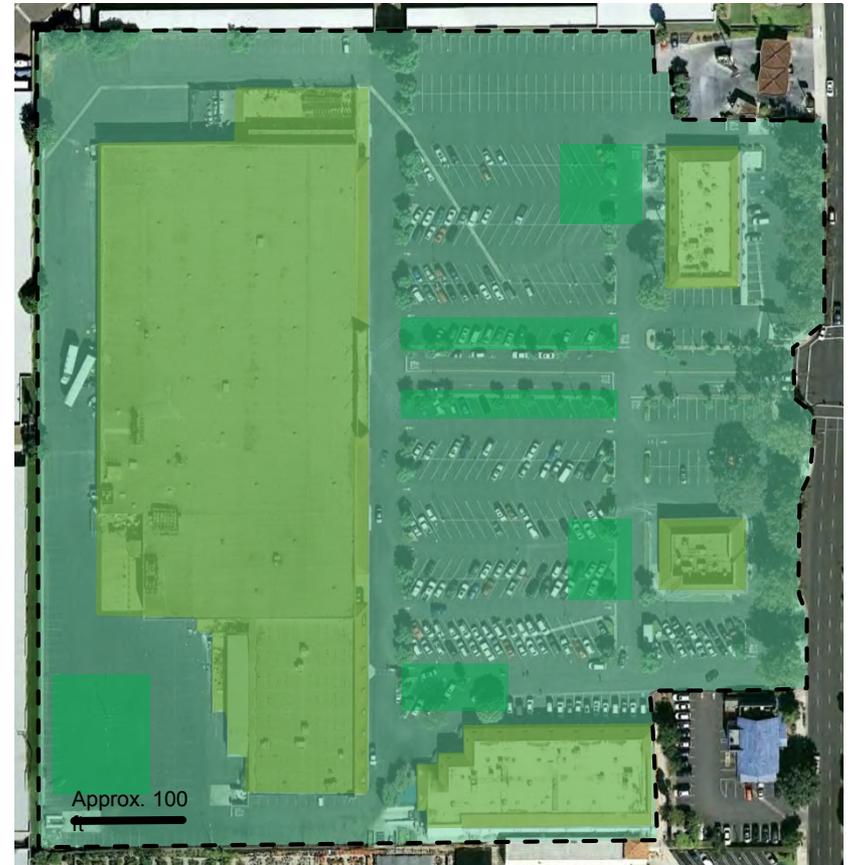


# Step 5d: Selecting and Sizing BMPs

BMP	Recommended	Possible	Not Recommended	Notes
INF-1: Infiltration Basin			X	Infiltration basin generally not practical for parking lot site as takes useable area
INF-2: Infiltration Trench		X		Infiltration trench could be applied with biofiltration pretreatment
INF-3: Bioretention	X			Bioretention can be applied to parking lot land uses and can treat smaller or larger tributary areas
INF-4: Drywell		X		Drywells could be installed with adequate pretreatment
INF-5: Permeable Pavement	X			Permeable pavement is a good option for parking stalls and other low traffic areas
INF-6: Proprietary Infiltration		X		Underground vaults could be installed below grade to capture and infiltrate runoff

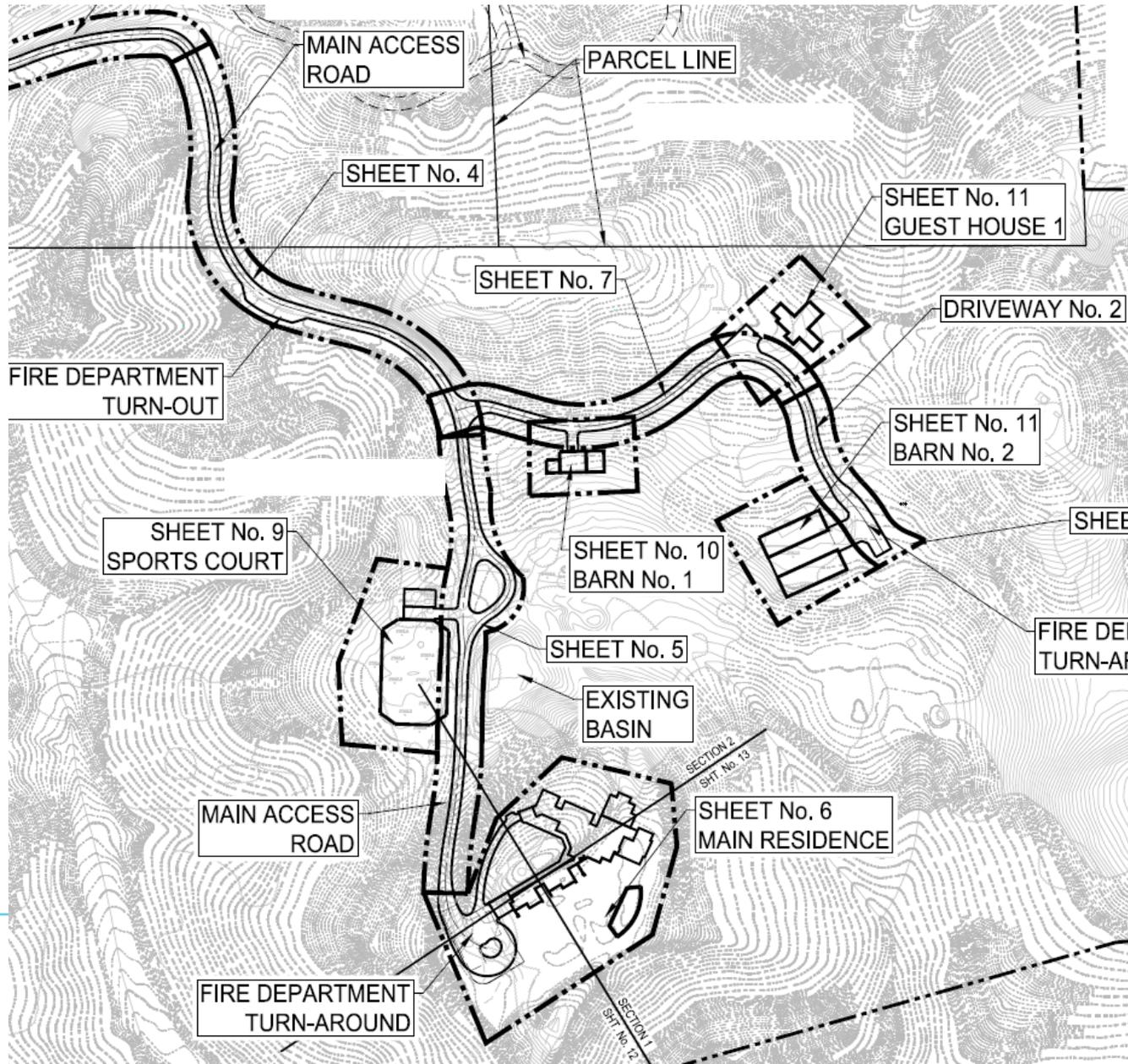
# Step 5d: Selecting and Sizing BMPs

Proposed: Distributed Bioretention

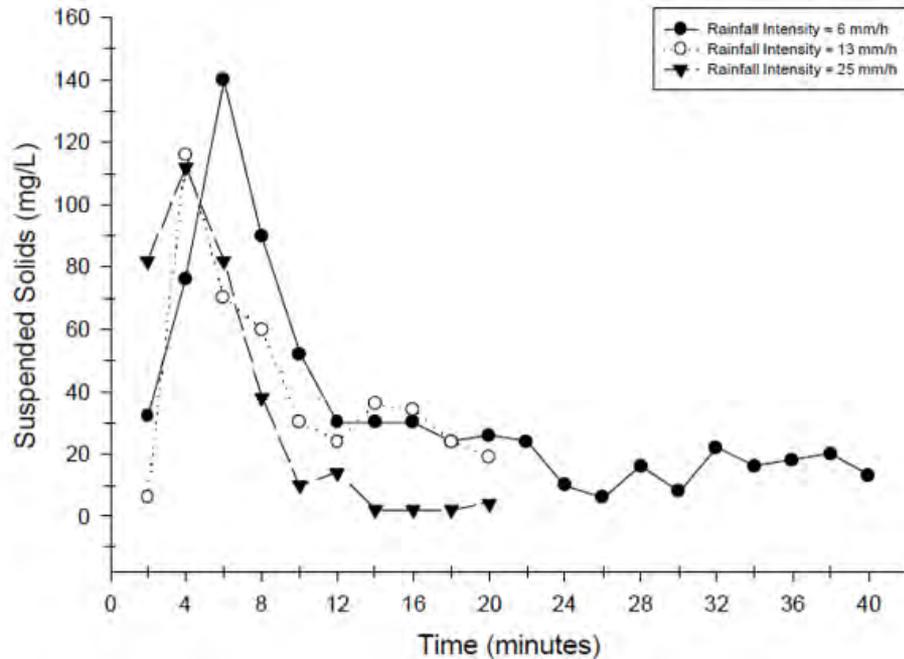


-  Buildings
-  Asphalt
-  Bioretention Areas

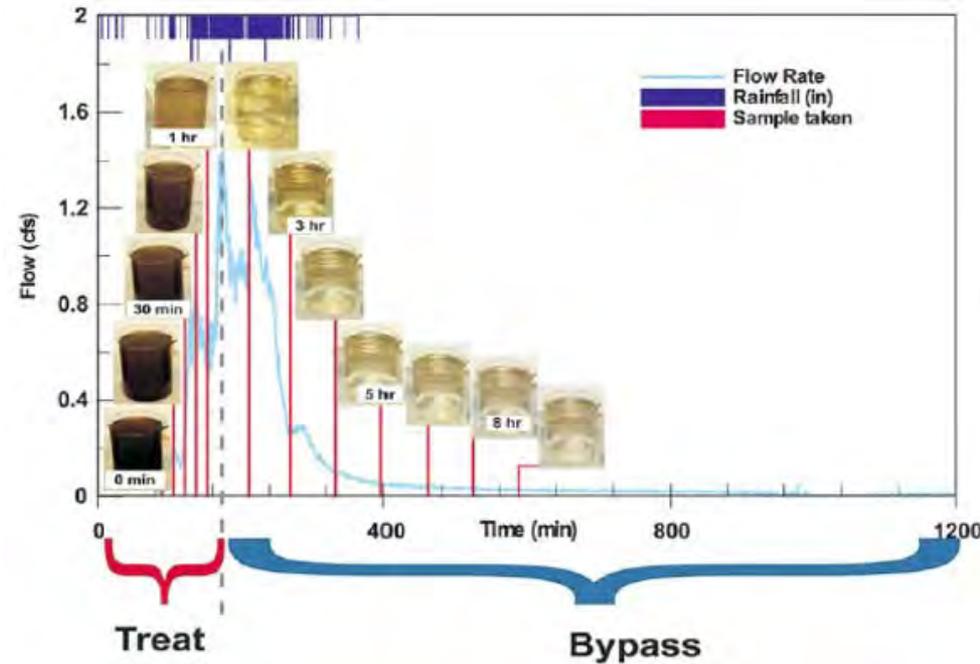
# Example – Must Treat all Developed Areas



# TGM Goal - Retain/Treat 1<sup>st</sup> Part of All Storms



Southern California Coastal Research Project (SCCWRP)  
 Technical Report 343



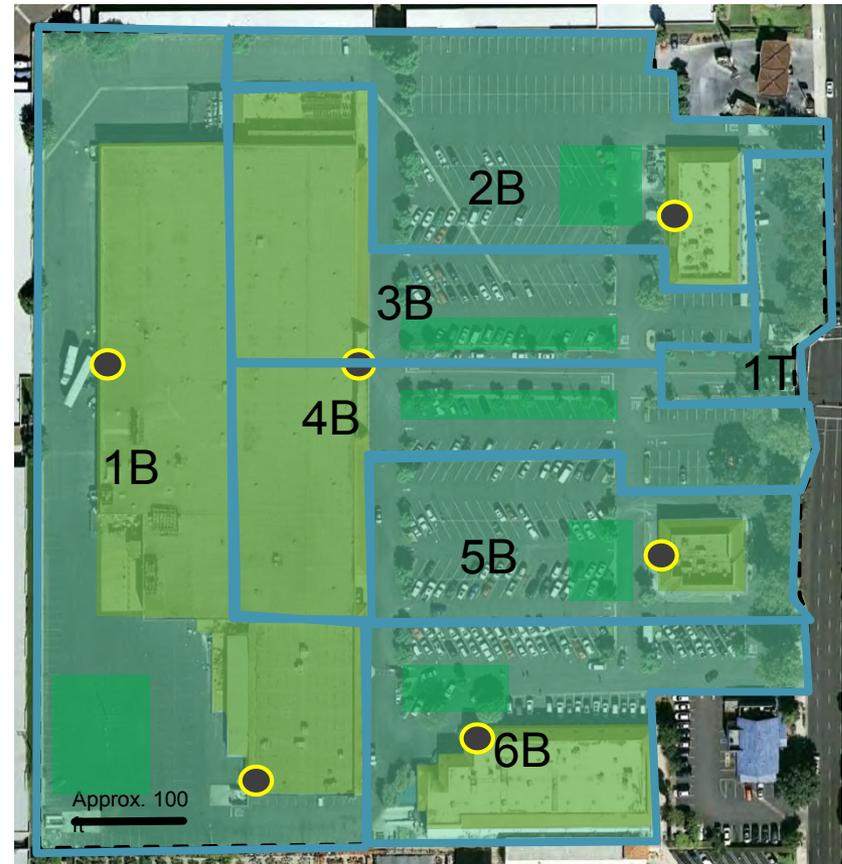
Caltrans, First Flush Phenomenon Characterization,  
 prepared by M.K. Stenstrom and M. Kayhanian

“First flush” = higher pollutant concentrations at start of storms

# Step 5d: Selecting and Sizing BMPs

Determine BMP drainage areas

- ▶ Sub-areas 1B – 6B: Treated by bioretention (INF-3)
- ▶ Sub-area 1T:
  - i. Difficult to find space for bioretention
  - ii. Treatment Control Measure will be used **(Step 7)**
  - iii. This area will count towards Project EIA

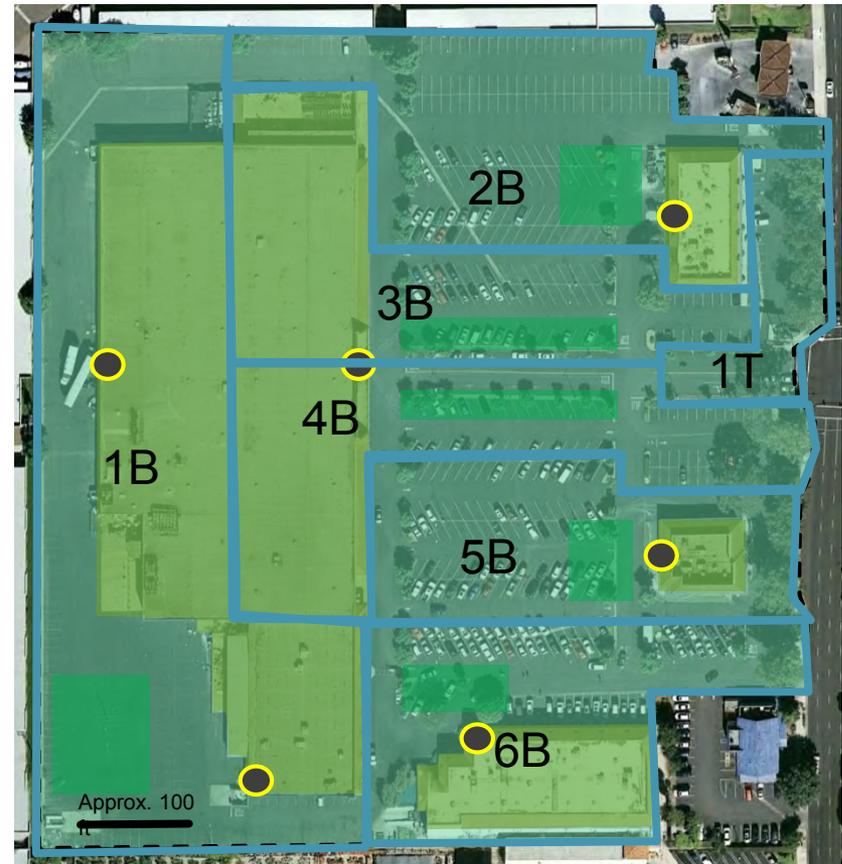


# Step 5d: Selecting and Sizing BMPs

Also consider drainage infrastructure and pretreatment needed

- ▶ Conveyance system
- ▶ Include pretreatment BMPs
  - i. Catch Basin Inserts Recommended (PT-2)
  - ii. Could also use Hydrodynamic Separators (PT-1)

Next Step: Size BMPs for tributary area → **3B**



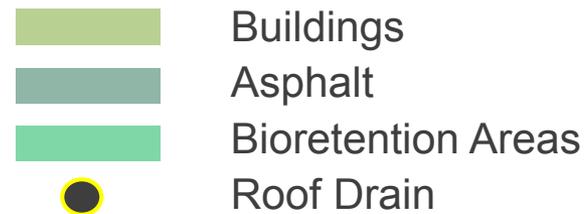
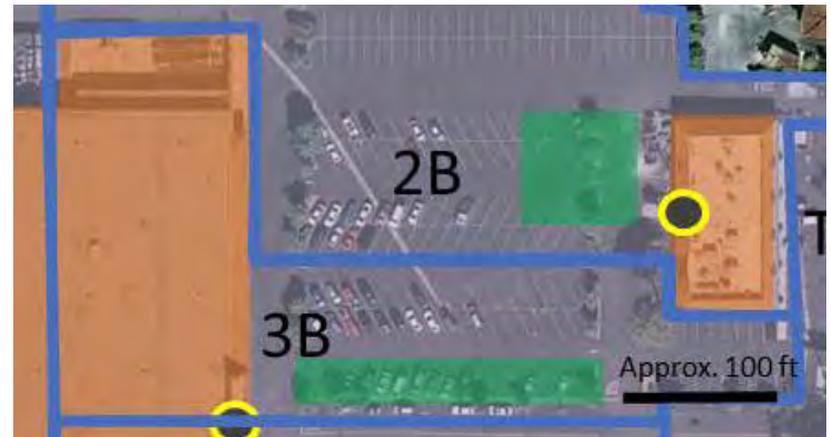
## Sizing Worksheet

Step 1: Determine water quality design volume	
1-1. Enter Project area (acres), $A_{project}$	$A_{project} =$ acres
1-2. Enter the maximum allowable percent of the Project area that may be effective impervious area (%) (refer to permit), ranges from 5-30%, $\%_{allowable}$	$\%_{allowable} =$ %
1-3. Determine the maximum allowable effective impervious area (acres),  $EIA_{allowable} = (A_{project}) * (\%_{allowable})$	$EIA_{allowable} =$ acres
1-4. Enter Project impervious fraction, $Imp$ (e.g. 60% = 0.60)	$Imp =$
1-5. Determine the Project Total Impervious area (acres), $TIA = A_{project} * Imp$	$TIA =$ acres
1-6. Determine the total area from which runoff must be retained (acres), $A_{retain} = TIA - EIA_{allowable}$	<b>Area = 56,600 ft<sup>2</sup></b>
1-7. Determine pervious runoff coefficient using <u>Table E-1</u> , $C_p$	$C_p =$ <b>0.05</b>
1-8. Calculate runoff coefficient,  $C = 0.95 * imp + C_p (1 - imp)$	$C =$ <b>0.91</b>
1-9. Enter design rainfall depth of the storm (in), $P_i$	$P_i =$ <b>0.75 in</b>
1-10. Calculate rainfall depth (ft), $P = P_i / 12$	$P =$ <b>0.0625 ft</b>
1-11. Calculate water quality design volume (ft <sup>3</sup> ),  $SQDV = 43560 * C * P * A_{retain}$	$SQDV =$ <b>3,200 ft<sup>3</sup></b>

# Step 5d: Selecting and Sizing BMPs

## Sub-Drainage 3B

- ▶ From Ventura County GIS Soils (Soil #4: Typically Silty loams or Loams)
- ▶ Web Soil Survey Data:
  - Hydraulic Conductivity ranges from 1.4 – 4.0 in/hr

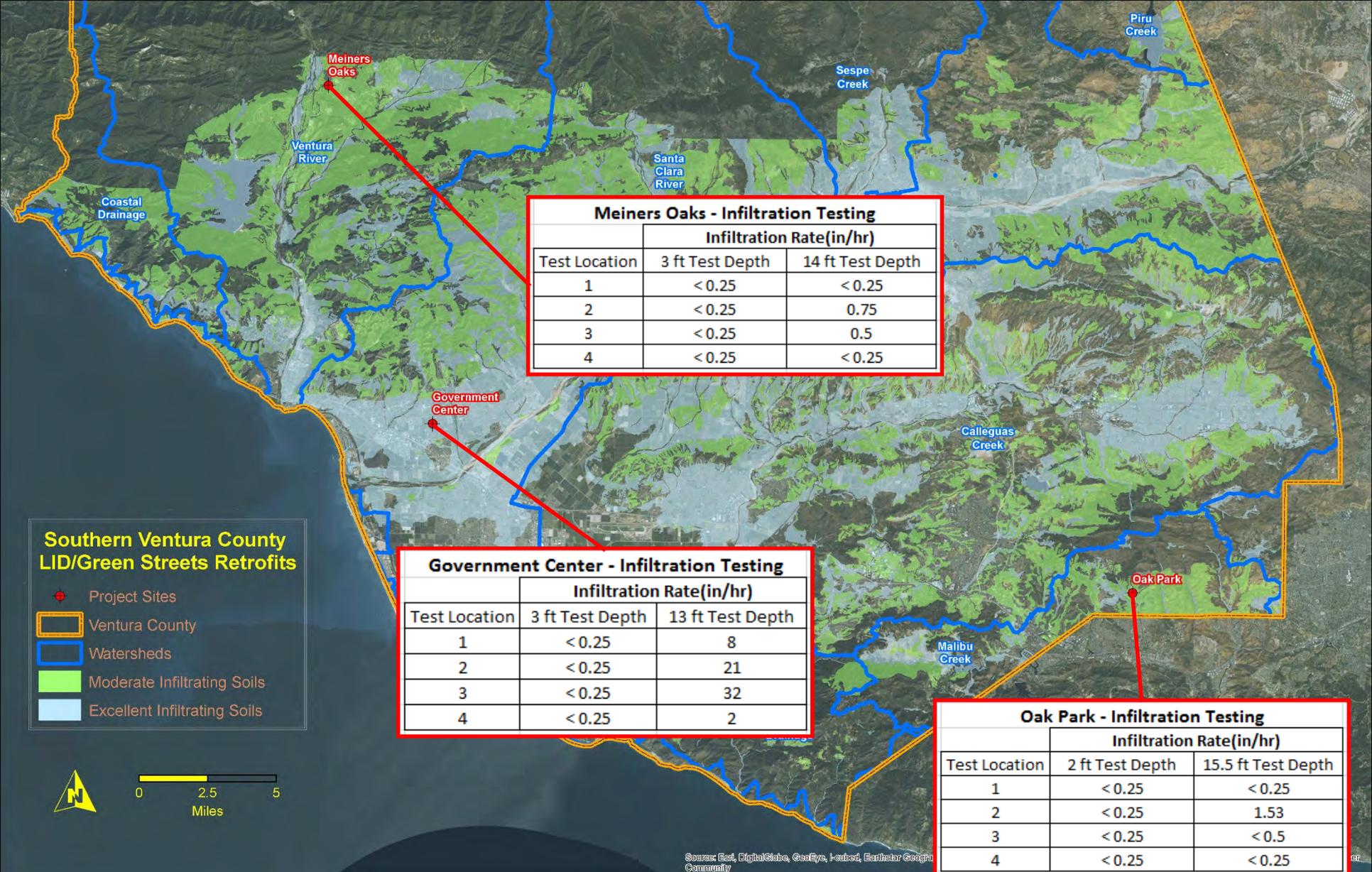


# Step 5d: Selecting and Sizing BMPs

**Table 6-9: Infiltration Facility Safety Factor Determination Worksheet**

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) $p = w \times v$
A	Suitability Assessment	Soil assessment methods	0.25	3	0.75
		Predominant soil texture	0.25	2	0.5
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	2	0.5
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			
B	Design	Tributary area size	0.25	1	0.25
		Level of pre-treatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	2	0.5
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			
<b>Combined Safety Factor = <math>S_A \times S_B</math></b>				<b>4</b>	

**Note:** The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.



**Southern Ventura County LID/Green Streets Retrofits**

- Project Sites
- Ventura County
- Watersheds
- Moderate Infiltrating Soils
- Excellent Infiltrating Soils

Meiners Oaks - Infiltration Testing		
Test Location	Infiltration Rate(in/hr)	
	3 ft Test Depth	14 ft Test Depth
1	< 0.25	< 0.25
2	< 0.25	0.75
3	< 0.25	0.5
4	< 0.25	< 0.25

Government Center - Infiltration Testing		
Test Location	Infiltration Rate(in/hr)	
	3 ft Test Depth	13 ft Test Depth
1	< 0.25	8
2	< 0.25	21
3	< 0.25	32
4	< 0.25	2

Oak Park - Infiltration Testing		
Test Location	Infiltration Rate(in/hr)	
	2 ft Test Depth	15.5 ft Test Depth
1	< 0.25	< 0.25
2	< 0.25	1.53
3	< 0.25	< 0.5
4	< 0.25	< 0.25

Source: Esri, DigitalGlobe, GeoEye, iSat, Earthstar Geogra Community

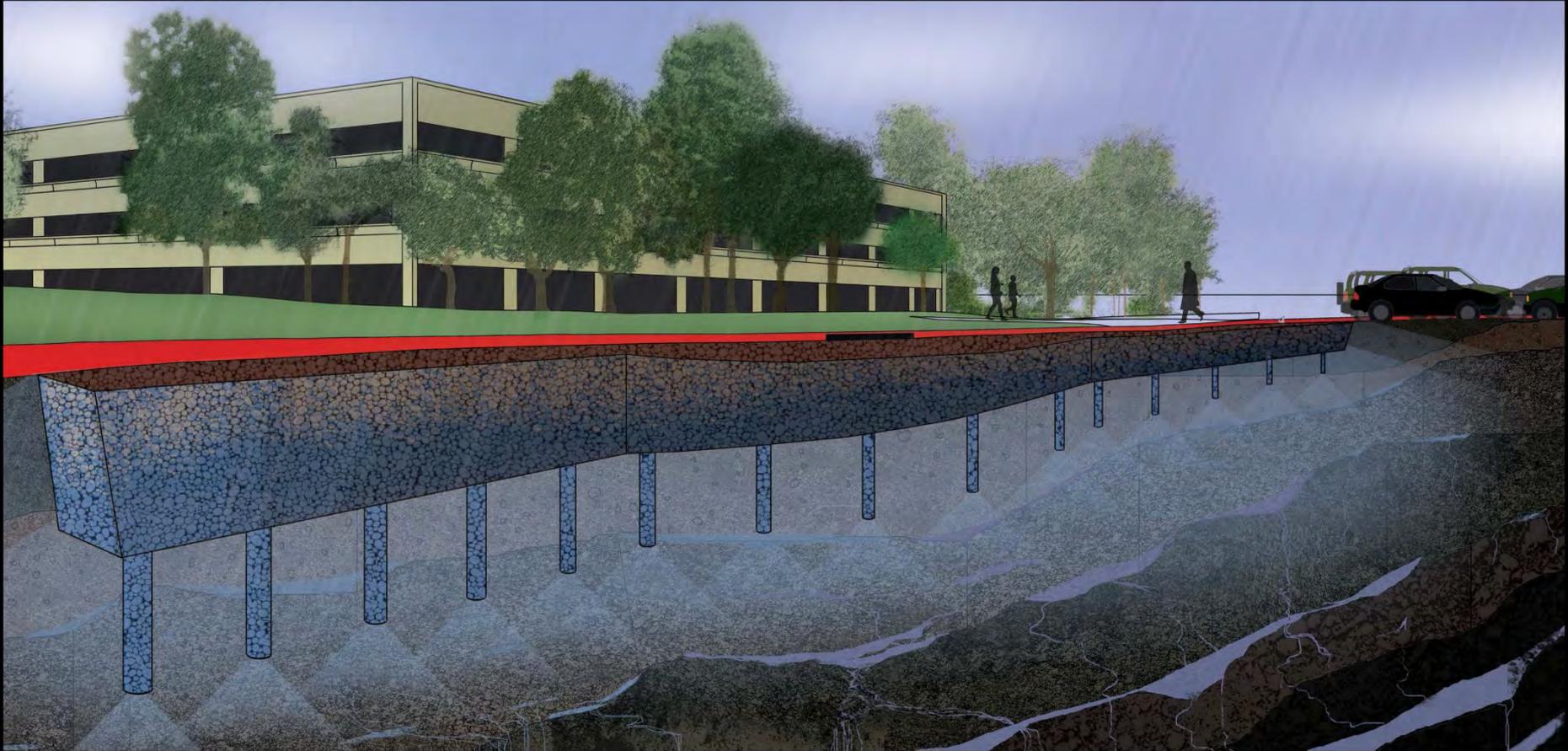


Illustration: MGM Design Studio

# Step 5d: Selecting and Sizing BMPs

Step 2: Determine the design percolation rate	
2-1. Enter measured soil percolation rate (in/hr) (0.5 in/hr minimum), $P_{\text{measured}}$	$P_{\text{measured}} = 1.4 \text{ in/hr}$
2-2. Determine percolation rate correction factor, $S_A$ based on suitability assessment (see Section 6 INF-3)	$S_A = 2$
2-3. Determine percolation rate correction factor, $S_B$ based on design (see Section 6 INF-3)	$S_B = 2$
2-4. Calculate combined safety factor, $S = S_A \times S_B$	$S = 4$
2-5. Calculate the design percolation rate (in/hr), $P_{\text{design}} = P_{\text{measured}}/S$	$P_{\text{design}} = 0.35 \text{ in/hr}$

Next Step: Calculate required infiltrating area

<b>Step 3: Calculate Bioretention Infiltrating surface area</b>	
3-1. Enter water quality design volume (ft <sup>3</sup> ), $SQDV$	$SQDV = 3,200 \text{ ft}^3$
3-2. Enter design percolation rate (in/hr), $P_{design}$	$P_{design} = 0.35 \text{ in/hr}$
3.3 Enter the required drain time (48 hours), $t_{ponding}$	$t_{ponding} = 48 \text{ hours}$
3-3. Calculate the maximum depth of surface ponding that can be infiltrated within the required drain time (ft):  $d_{max} = (P_{design} \times t_{ponding})/12$	$d_{max} = 1.4 \text{ ft}$
3-4. Select surface ponding depth (ft), $d_p$ , such that $d_p \leq d_{max}$	$d_p = 1.3 \text{ ft}$
3-5. Select thickness of amended media (ft, 2 feet minimum, 3 preferred), $l_{media}$	$l_{media} = 3 \text{ ft}$
3-6. Enter porosity of amended media (roughly 25% or 0.25 ft/ft), $n_{media}$	$n_{media} = 0.25$
3-7. Select thickness of optional gravel layer (ft), $l_{gravel}$	$l_{gravel} = \text{N/A}$
3-8. Enter porosity of gravel (roughly 30% or 0.3 ft/ft), $n_{gravel}$	$n_{gravel} = \text{N/A}$
3-9. Calculate the total effective storage depth of bioretention facility (ft):  $d_{effective} \leq (d_p + n_{media}l_{media} + n_{gravel}l_{gravel})$	$d_{effective} = 2.05 \text{ ft}$

# Step 5d: Selecting and Sizing BMPs

3-10. Check that the entire effective depth infiltrates in required drainage time, 96 hours:

$$t_{total} = (d_{effective}/P_{design}) \times 12$$

If  $t_{total} > 96$  hours, reduce surface ponding depth and/or amended media thickness and/or gravel thickness and return to 3-4.

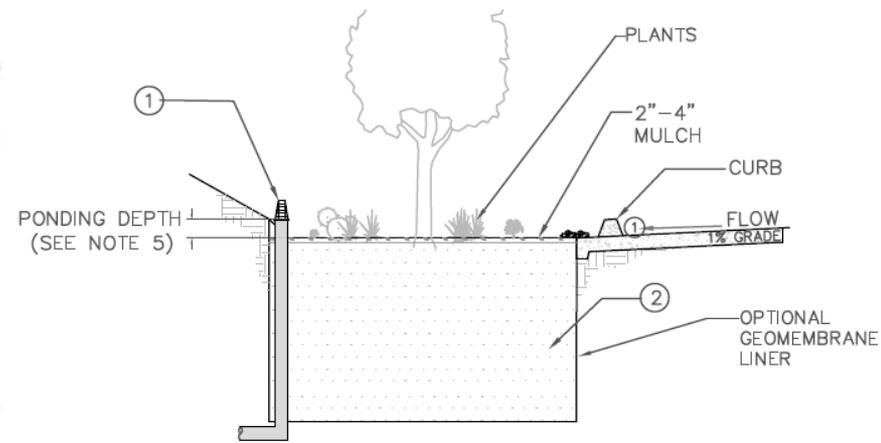
If  $t_{total} \leq 96$  hours, proceed to 3-11.

3-11. Calculate the required infiltrating surface area (ft<sup>2</sup>):

$$A_{req} = SQDV/d_{effective}$$

$$t_{total} = 70 \text{ hours}$$

$$A_{req} = 1,561 \text{ ft}^2$$



## NOTES:

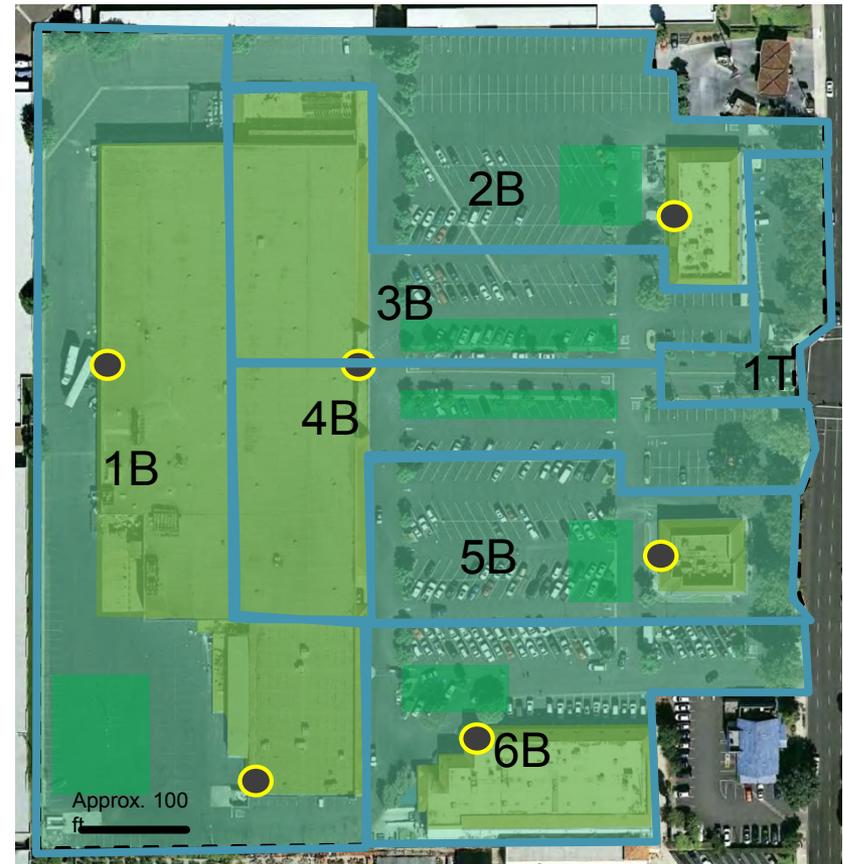
- ① OVERFLOW DEVICE: VERTICAL RISER OR EQUIVALENT.
- ② 2' MIN PLANTING MIX; 3' PREFERRED.
- ③ PONDING DEPTH 18" WITH FENCE; 6" WITHOUT FENCE.

- Buildings
- Asphalt
- Bioretention Areas
- Roof Drain



# Step 5d: Selecting and Sizing BMPs

- ▶ Repeat sizing procedure for sub-areas 1B, 2B, 4B, 5B, and 6B
- ▶ Ensure that  $(SQDV_{1B} + SQDV_{2B} + SQDV_{3B} + SQDV_{4B} + SQDV_{5B} + SQDV_{6B}) \geq V_{retain}$



-  Buildings
-  Asphalt
-  Bioretention Areas
-  Roof Drain

# Step 7: Apply Treatment Control BMPs to Treat Remaining SQDV

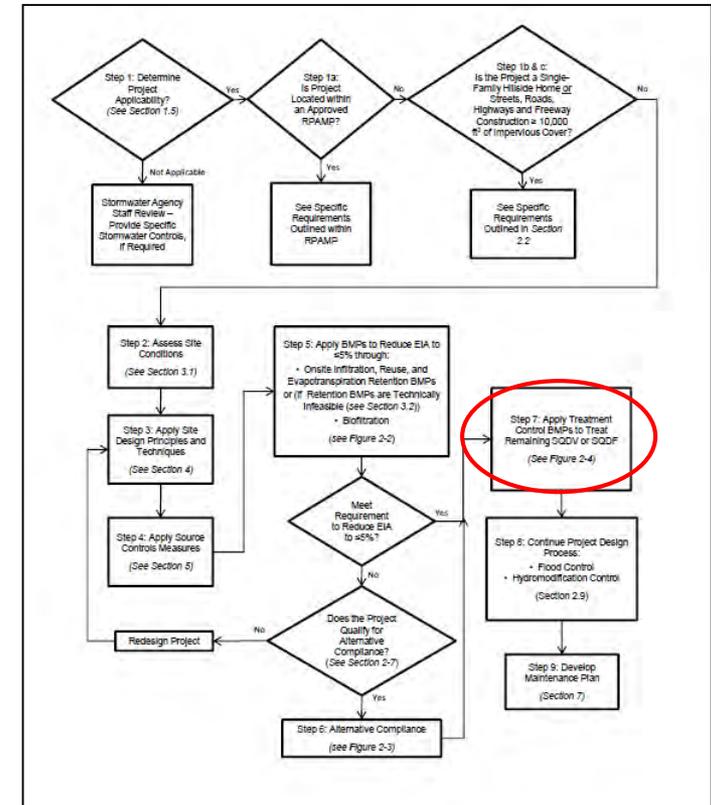
For projects that discharge to **an impaired waterbody** and whose discharges contain the pollutant causing impairment, the project shall select Treatment Control Measures from **the top three performing BMP categories**, or alternative BMPs that are designed to meet or exceed the performance of the highest performing BMP, for the pollutant causing impairment

- i. See Table 3-2 of TGM → lists typical pollutants from land uses
- ii. See Table 3-4 of TGM → lists most effective BMPs per pollutant

# Step 7: Apply Treatment Control BMPs to Treat Remaining SQDVs

Continue to **Step 7** to size treatment control measure for 1T – remaining tributary area runoff volume

- ▶ Selection of appropriate TCM (Section 3.3 of TGM)
- ▶ Determine Primary POCs
  - i. Sediment, Oil & Grease, and Trash
- ▶ Discharge to an Impaired Waterbody?
  - i. SWRCB Mapper (303(d) listed receiving waters)
  - ii. GIS layers and impairment spreadsheets also available online
  - iii. SCR Reach 1 Impaired for Toxicity



# Step 7: Apply Treatment Control BMPs to Treat Remaining SQDV

Select TCM that addresses pollutant causing impairment

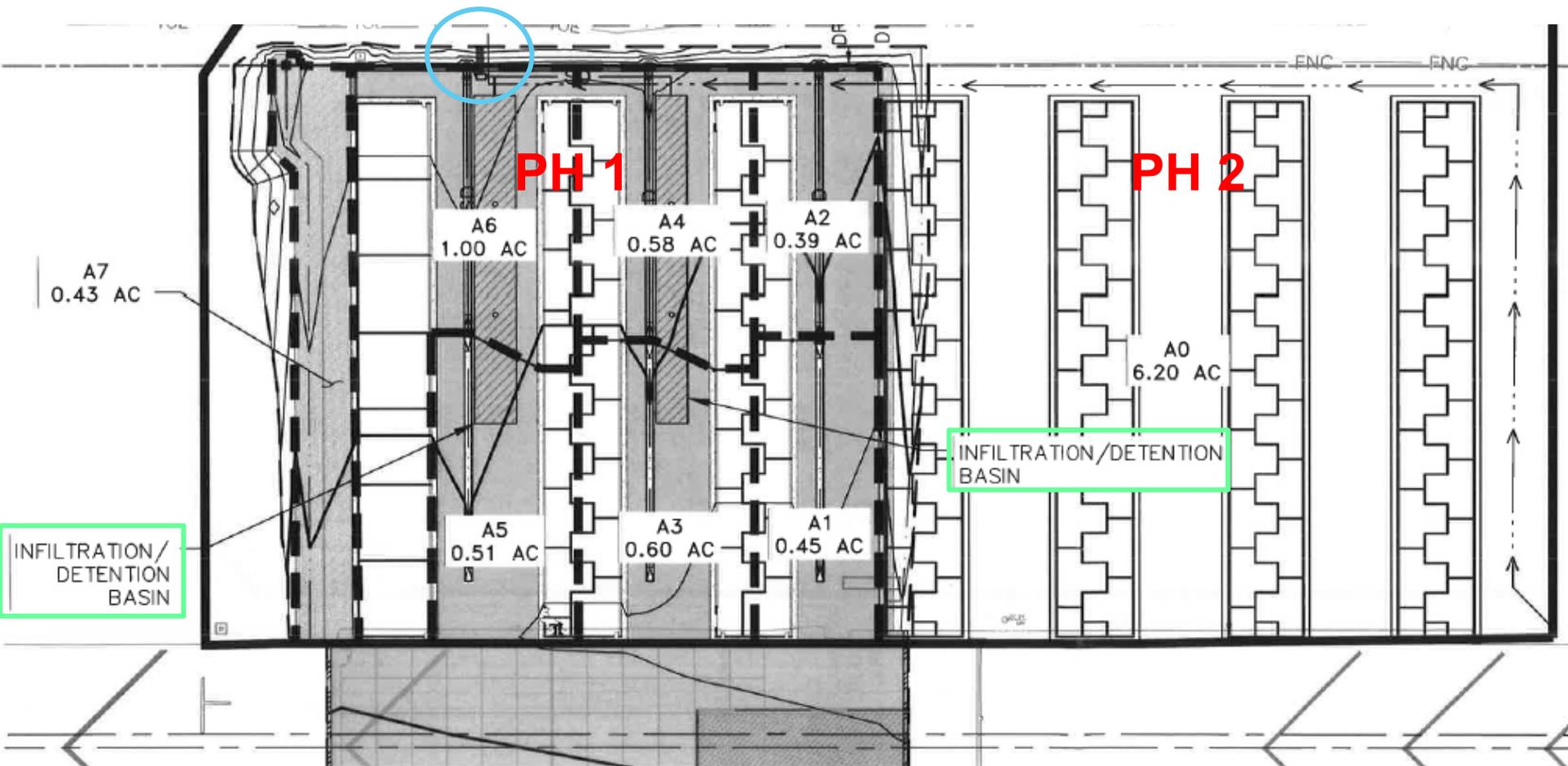
- ▶ Table 3-4 of TGM (a portion is shown ->)
- ▶ Toxicity not listed
- ▶ Surrogates: Metals, Pesticides
- ▶ Cartridge Media Filter (TCM-5) acceptable for these POCs

Table 3-4: Treatment Control Measures for Addressing Pollutants of Concern

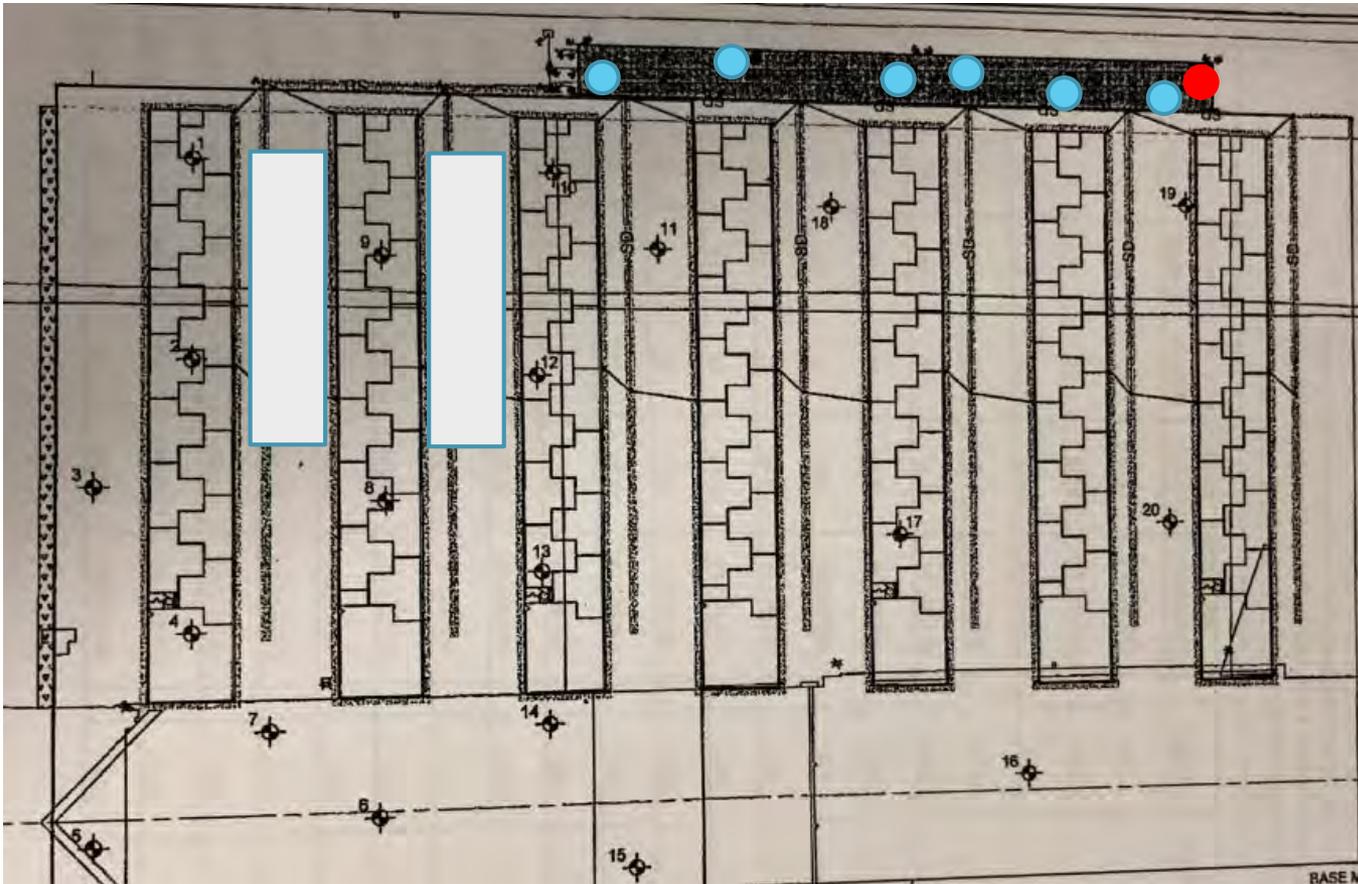
Class of Pollutant	Recommended BMPs (in Order of Performance)
Sediment	<ol style="list-style-type: none"> <li>1. Retention BMPs (Infiltration, Rainwater Harvesting, and Evapotranspiration BMPs)</li> <li>2. Any of the following BMPs (equivalent performance):               <ol style="list-style-type: none"> <li>a. Biofiltration BMPs</li> <li>b. Wet Detention Basin</li> <li>c. Constructed Wetland</li> <li>d. Sand Filter/Cartridge Media Filter</li> </ol> </li> <li>3. Dry Extended Detention Basin</li> </ol>
Metals / Metalloids	<ol style="list-style-type: none"> <li>1. Retention BMPs (Infiltration, Rainwater Harvesting, and Evapotranspiration BMPs)</li> <li>2. Any of the following BMPs (equivalent performance):               <ol style="list-style-type: none"> <li>a. Constructed Wetland</li> <li>b. Biofiltration BMPs</li> <li>c. Wet Detention Basin</li> <li>d. Sand Filter/Cartridge Media Filter</li> </ol> </li> <li>3. Dry Extended Detention Basin</li> </ol>
Nutrients <sup>1</sup>	<ol style="list-style-type: none"> <li>1. Retention BMPs (Infiltration, Rainwater Harvesting, and Evapotranspiration BMPs)</li> <li>2. Any of the following BMPs (equivalent performance):               <ol style="list-style-type: none"> <li>a. Biofiltration</li> <li>b. Wet Detention Basin</li> <li>c. Constructed Wetland</li> </ol> </li> <li>3. Any of the following BMPs (equivalent performance):               <ol style="list-style-type: none"> <li>a. Biofiltration BMPs</li> </ol> </li> <li>4. Any of the following (equivalent performance):               <ol style="list-style-type: none"> <li>a. Sand Filter/Cartridge Media Filter</li> <li>b. Dry Extended Detention Basin</li> </ol> </li> </ol>
Pesticides <sup>2</sup>	<ol style="list-style-type: none"> <li>1. Source controls, erosion controls</li> <li>2. Retention BMPs (Infiltration, Rainwater Harvesting, and Evapotranspiration BMPs)</li> <li>3. Any of the following BMPs (equivalent performance):               <ol style="list-style-type: none"> <li>a. Biofiltration BMPs</li> <li>b. Wet Detention Basin</li> <li>c. Constructed Wetland</li> <li>d. Sand Filter/Cartridge Media Filter</li> </ol> </li> <li>4. Dry Extended Detention Basin</li> </ol>

# Example - BMPs for Phased Projects

- 1) BMPs to be constructed in PH 1 are sized for PH 1 & 2
- 2) Pretreatment filter inserts proposed in all drop inlets & catch basins
- 3) Single diversion structure for low flow retention and hi-flow bypass



# Example - Design Infiltration Testing

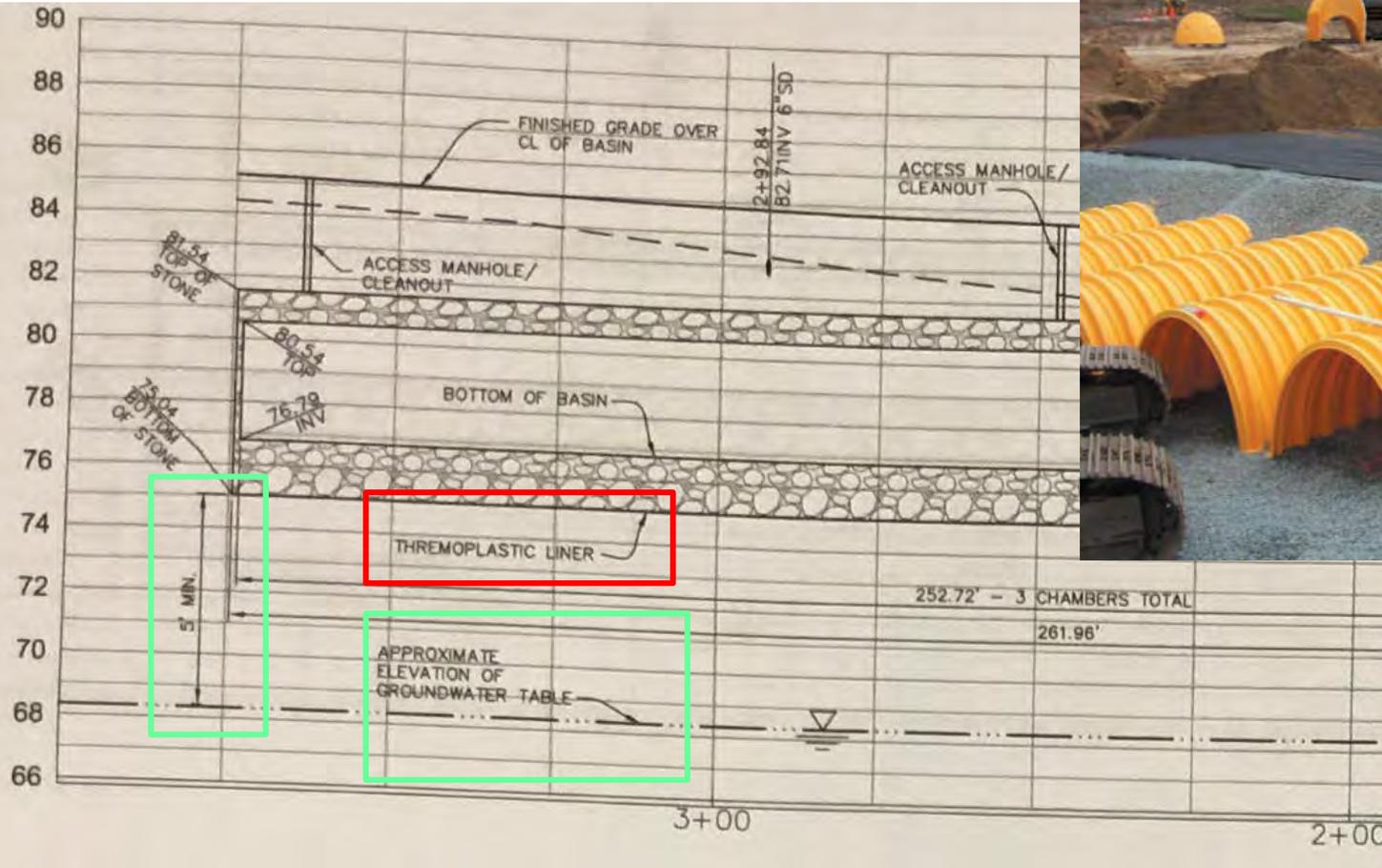


- 6 infiltration test areas
- 1 pilot boring for GW



Locations of proposed BMPs

# Example - BMPs Design



# Plant Lists (2002 TGM)

Table F-1. Sample List of Appropriate Vegetative Covers

<i>Plant Name Common (Latin)</i>	<i>Appropriate Species</i>	<i>Map Zones*</i>	<i>Maintenance and Usage Notes**</i>
Bermuda Grass (Cynodon)	Santa Ana hybrid	A	Moderate maintenance. Dormant (brown) in winter. Heat tolerant. Erosion control, swales.
Fescue (Festuca)	Red fescue (F. rubra)	A, B	Low to moderate maintenance. Tolerates some shade and poor soil. Lawns, swales, erosion control.
	"Kentucky 31" Tall Fescue (F. elatior)	A, B	Low maintenance. Tolerate shade and compacted soils. Rapid germination. Lawns, swales, erosion control. Useful as overseed for Bermuda grass during dormant (winter) season.
Ryegrass (Lolium)	Perennial (L. perenne)	A, B	Moderate maintenance. Heat intolerant. Fast sprouting. Useful as overseed for Bermuda grass during dormant (winter) season. Swales.
	Annual (L. multiflorum)	A, B	Annual (may live several seasons in mild climate). Moderate maintenance. Heat intolerant. Fast growing. Useful as overseed for winter-dormant species. Swales.

\*See Figure F-1  
 \*\*Generally, these species will require supplemental irrigation.  
 Sources: ASCE, MWCG, Sunset

Table F-2. Additional Suggested Vegetative Covers

<i>Plant Name Common (Latin)</i>	<i>Appropriate Species</i>	<i>Usage Notes</i>
Orchard grass (Dactylis)	"Akaroa" or "Berber" (D. glomerata)	Irrigated and Non-irrigated Sites
Wheatgrass (Agropyron)	"Luna" or "Topar" pubescent (A. intermedium trichophorum)	Irrigated and Non-irrigated Sites
Zorro Fescue (Vulpia)	(V. myuros)	Irrigated and Non-irrigated Sites
Creeping wild Rye (Leymus)	(L. triticoides)	Nonirrigated Sites
Brome (Bromus)	Blando (B. mollis)	Nonirrigated Sites
	California or "Cucamonga" (B. carinatus)	Nonirrigated Sites

Source: NRCS-FOTG



Figure F-1. Vegetation Suitability Zones

# Plant Lists (City of Camarillo)

## Appendix A: Lists of Plants Suitable for Southern California

The plant lists included in this manual are intended to serve as a general guide for identifying plants likely to be suitable for use in LID. The lists and associated references are not exhaustive, and are not a substitute for the planting recommendations of a qualified landscape professional with knowledge of LID and following a site and design specific evaluation.

Table 31. Master Plant List.

Master Plant List				Region <sup>2</sup>			Light Level <sup>4</sup>			Moisture <sup>5</sup>				Uses				
	Latin Name <sup>1</sup>	Common Name	Form	Sunset Zone	Coastal	Intermediate	Inland	Native Community <sup>3</sup>	H	M	L	VL	L	M	H	General	Bioretention	Roof
<i>Acalypha californica</i>	California Copperleaf	evergreen shrub		✓	✓	✓	chaparral, scrub	✓	✓		✓✓				✓			
<i>Achillea millefolium</i> *	Yarrow	herbaceous perennial	1-24	✓	✓	✓	Many	✓	✓	✓	✓✓	✓	✓	✓	✓	✓	✓	
<i>Adenostoma fasciculatum</i> 'Nicolas'	Prostrate Chamise	groundcover	14-16, 18-24	✓	✓	✓	Chaparral	✓	✓	✓	✓✓			✓	✓	✓		
<i>Aesculus californica</i>	California Buckeye	deciduous tree	4-10,12,14-24	✓	✓	✓	Woodland	✓	✓	✓	✓✓			✓	✓	✓		
<i>Agave deserti</i>	Desert Century Plant	succulent	12-24	✓	✓	✓	Scrub	✓		✓	✓✓			✓	✓	✓		
<i>Agave shawii</i>	Shaw's Century Plant	succulent		✓	✓		css	✓		✓	✓✓			✓	✓	✓		
<i>Ambrosia chamissonis</i>	Sand Bur	sprawling perennial		✓			dunes	✓			✓✓					✓		
<i>Ambrosia pumila</i>								✓			✓✓	✓				✓		
<i>Amorpha fruticosa</i>								✓	✓	✓			✓	✓	✓	✓		
<i>Antigonon leptopus</i>								✓				✓	✓			✓		
<i>Arbutus menziesii</i>								✓	✓	✓		✓	✓	✓	✓	✓		
<i>Arctostaphylos catalinae</i>								✓	✓	✓✓				✓	✓	✓		
<i>Arctostaphylos densiflora</i> 'Howard McMinn'								✓	✓	✓✓				✓	✓	✓		
<i>Arctostaphylos edmundsii</i> 'Carmel Sur'								✓	✓	✓	✓			✓	✓	✓		
<i>Arctostaphylos glauca</i>								✓	✓	✓✓				✓	✓	✓		

### Low Impact Development Manual for Southern California:

### Technical Guidance and Site Planning Strategies

Prepared for

the Southern California Stormwater Monitoring Coalition

in cooperation with the State Water Resources Control Board

By

The Low Impact Development Center Inc

# LID Plant Guidance for Bioretention

## Low Impact Development



# Plant Lists (Others)

**Table 1. Plants for Bioretention Areas<sup>1</sup>**

Zone A: Periodic inundation, area ponds following storm events (24 - 72 hours).

Zone B: Above area of ponding, side slope areas receive runoff, but are never inundated.

Common Name	Scientific Name	Zone(s)	Height/ Width	Light	Notes:	Climate Zones <sup>2</sup>
<b>Trees</b>						
Western Redbud	<i>Cercis occidentalis</i>	B	20/20'	sun	small tree or large shrub, tolerates clay, winter wet, drought, flowers stronger with frost	all but coastal
Desert Willow	<i>Chilopsis linearis</i>	B	25/30'	sun	tolerates alkaline soil, sand, clay, seasonal flooding and drought, not coastal condition	all, but 1A-3A
Western Sycamore	<i>Platanus racemosa</i>	B	40-80/40-70'	sun	tolerates sand and clay soils, seasonal flooding, needs space to grow, avoid underground water/sewer pipes	all, but 1A-3A
Coast Live Oak	<i>Quercus agrifolia</i>	B	25-60/40-70'	sun - shade	tolerates drought and winter wet conditions, mature trees produce significant litter limiting understory plantings, need space to grow	all, but 1A-3A
<b>Large Shrubs</b>						
Toyon, Christmas Berry	<i>Heteromeles arbutifolia</i>	B	8'-20'/8'-20'	sun-pt shade	tolerates sand, clay and serpentine soils, seasonal water with good drainage	all, but 1A-3A
Pacific Wax Myrtle	<i>Myrica californica</i>	B	10'-30'/10'-30'	sun-pt shade	large shrub or small tree, tolerates coastal conditions, sand, clay and seasonal inundation	all, but 1A-3A
Western Elderberry	<i>Sambucus mexicana</i>	B	10'-30'/8'-20'	sun-pt shade	large shrub to tree, tolerates clay, seasonal flooding and drought, good wildlife food source	all, but 1A-3A
<b>Shrubs and Subshrubs</b>						
Coyote Brush	<i>Baccharis pilularis</i>	B	wide variation	sun	adaptable evergreen shrub, provides quick cover and bank stabilization, tolerant of coastal conditions, alkaline soil, sand, clay and seasonal wet	all, but 1A-3A
California Wild Rose	<i>Rosa californica</i>	A,B	3'-6'/spreads	sun-pt shade	tolerates a wide variety of soils, seasonal flooding and some drought, spreads aggressively, avoid edges of walkways because of thorns	all
<b>Perennials</b>						
Yarrow	<i>Achillea millefolium</i>	B	1'-3/2'	sun-pt shade	tolerates alkaline soil, sand, clay, seasonal wet conditions, foot traffic and deer, will self sow	all
Beach Strawberry	<i>Fragaria chiloensis</i>	B	2'-4'/spreads	sun-pt shade	vigorous spreading groundcover, tolerates sand, clay, wet conditions, prefers good drainage	all, but 1A-3A
Douglas Iris	<i>Iris douglasiana</i>	B	1.5'-3'/spreads	sun - shade	tolerates sand, clay and serpentine soils, seasonal wet (but not soggy) soils and drought	all, but 1A-3A
Hummingbird Sage	<i>Salvia spathochea</i>	B	1'-3'/4'-6'	pt sun-pt shade	low growing perennial, tolerates clay, winter wet, summer drought, prefers light shade, provides nectar for birds and insects, does well under oaks	all, but 1A-3A
Bog Sage	<i>Salvia uliginosa</i> *	B	3'-6'/spreads	sun	quick growing, spreading perennial, tolerates wet to dry, cut back winter, divide rhizomes	all, but 1A-3A
Blue-eyed Grass	<i>Sisyrinchium bellum</i>	B	6'-11'/6'-11'	sun	a semi-evergreen perennial, tolerates sand, clay, seasonal wet soils and deer dormant in summer, but can be delayed with supplemental irrigation	all, but 1A-3A
California Goldenrod	<i>Solidago californica</i>	B	1'-4'/1'-4'	sun-pt shade	tolerates poor soils, seasonal wet and drought, can spread aggressively if over irrigated	all, but 24
<b>Grasses and Grass-like Plants</b>						
Berkeley Sedge, Grey Sedge	<i>Carex divulsa</i> *	A,B	12"-18"/12"-18"	sun-pt shade	tolerates foot traffic, some drought and boggy soils	all, but 1A-3A
California Meadow Sedge	<i>Carex pansa</i>	A,B	6"-12'/spreads	sun - shade	good lawn substitute, tolerates wide range of growing conditions, seasonal inundation, drought, foot traffic and mowing	all, but 1A-3A
Clustered Field Sedge	<i>Carex proterocallis</i>	A	1'/spreads	sun-pt shade	useful lawn substitute and bank stabilizer, good planted in masses, tolerates wide range of growing conditions, foot traffic and mowing, may look weedy when mixed with other plants	all, but 1A-3A
San Diego Sedge	<i>Carex spisa</i>	A	3'-6'/2'-5'	pt sun-shade	a large grass, tolerates alkaline soil, clay, serpentine, seasonal inundation, and deer	all, but 1A-3A
Small Cape Rush	<i>Chondropetalum leucorum</i> *	A,B	2'-3'/3'-4'	sun-pt shade	A tough, attractive reed-like plant, tolerates boggy or clay soils and drought once established, <i>Chondropetalum elephantinum</i> is a much larger species	all, but 1A, 2A, 3A, 7
Molate Red Fescue	<i>Festuca rubra</i> 'Molate'	A,B	8'-12' /spreads	pt sun-shade	a tufted, spreading bunchgrass, good lawn substitute, provides erosion control, tolerates wet conditions, but looks best with regular water, tolerates drought once established	all
Soft Rush	<i>Juncus effusus</i>	A	2'-3'/2'-3'	sun-pt shade	tolerates poor drainage, heavy soil, needs more supplemental water than <i>Juncus patens</i>	all
Wire Grass, Blue Rush	<i>Juncus patens</i>	A	1'-2'/1'-2'	sun - shade	strong performance in bioretention areas, tolerates poor drainage, seasonal inundation, drought, shade	all, but 1A-3A
Canyon Prince Wild Rye	<i>Leymus condensatus</i> 'Canyon Prince'	B	2'-3'/spreads	sun-pt shade	tolerates drought, wet, but not soggy soils, looks best with supplemental irrigation, spreads by rhizomes	all, but 1A-3A
Deer Grass	<i>Muhlenbergia rigens</i>	B	4'-5'/4'-6'	sun-pt shade	a large grass, tolerates sandy and clay soils, seasonal inundation, best when cut back annually to remove old thatch	all, but 1A-3A

<sup>1</sup> See: [www.centralcoastlidi.org](http://www.centralcoastlidi.org) for a photo gallery of the plants in this list.

<sup>2</sup> Refers to Sunset Western Garden Book Climate Zones. The Central Coast includes Zones 1A, 2A, 3A, 7, 9, and 14-24. [www.sunset.com/garden/climate-zones](http://www.sunset.com/garden/climate-zones)

\* Indicates non native species. Non natives are only recommended for use in urbanized settings and should not be used on sites in proximity to natural areas.

# Plant Establishment



# Plant Establishment

2016-03-21



(First Bend in Swale After Baffle Box – Facing East)

2017-02-24



(First Bend in Swale After Baffle Box – Facing East)

2018-03-15



(First Bend in Swale After Baffle Box – Facing East)



(Center of Swale w/ Access Road – Facing North)



(Center of Swale w/ Access Road – Facing North)



(Center of Swale w/ Access Road – Facing North)



# Questions?

Presented and  
Sponsored By:



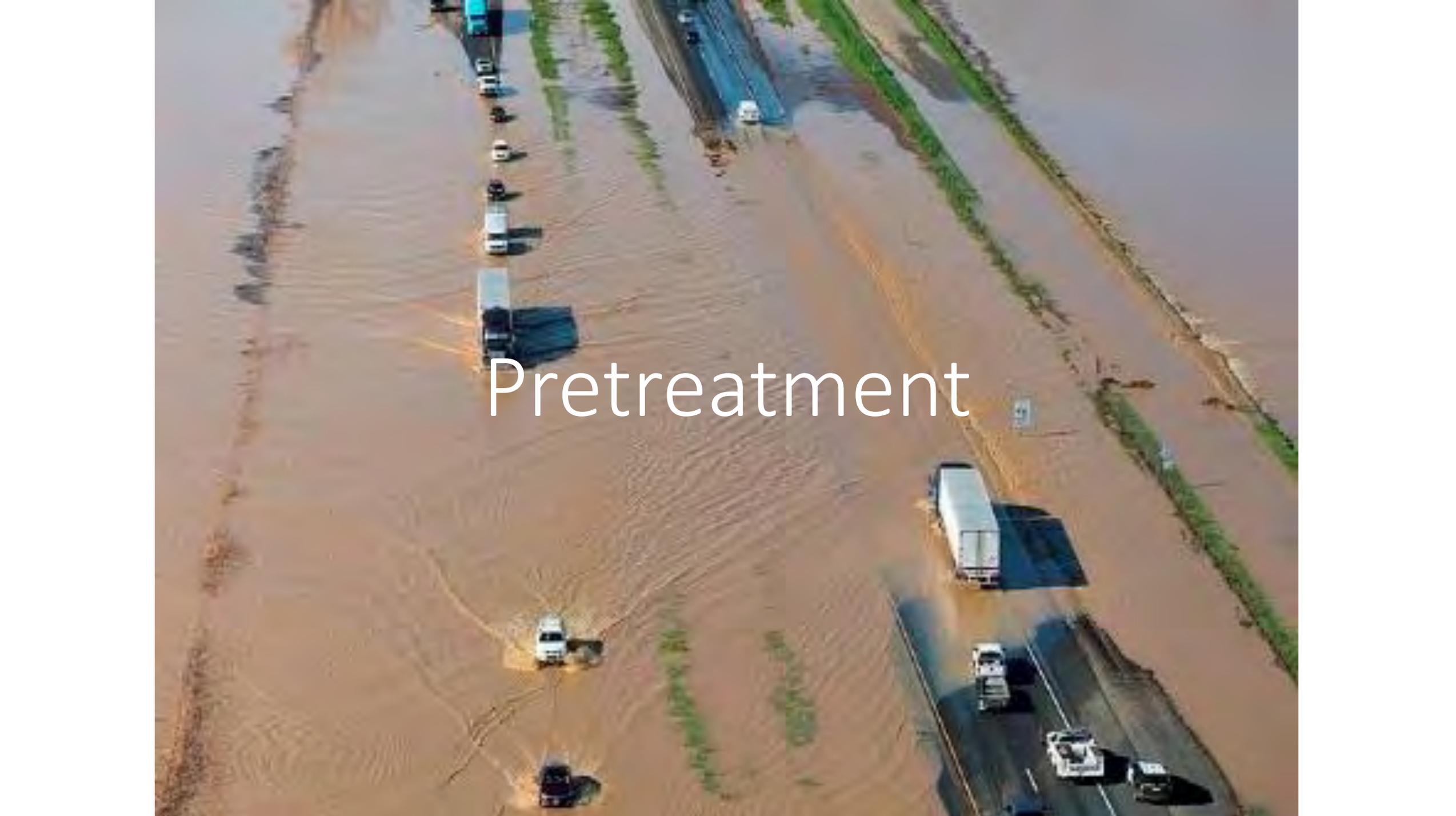
*Ventura Countywide  
Stormwater Quality  
Management Program*





# Engineering BMP Design

Part 2

An aerial photograph showing a multi-lane highway completely inundated with muddy brown floodwater. Several vehicles, including large semi-trucks and smaller cars, are driving through the water, creating large splashes and ripples. The surrounding landscape is also flooded, with green grassy areas and some buildings visible in the distance. The word "Pretreatment" is overlaid in white text in the center of the image.

Pretreatment





LAT: 34.222244 LON: -119.078300 ±16.4ft



City of Camarillo

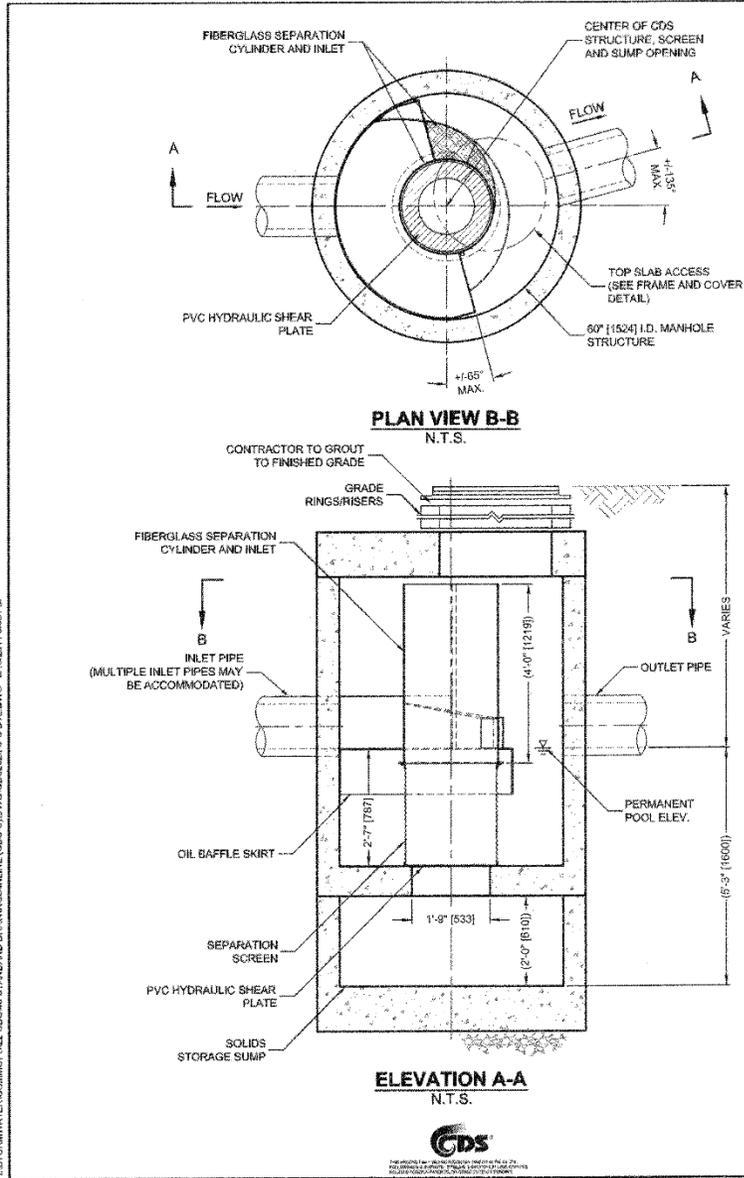
Elacora  
26 Feb 2018, 10:48 AM



PLOT DATE: 10/4/2017 2:05:25 PM

SAVE DATE: 9/27/2017 11:07:04 AM PLOT BY: Zaretsky, Alex

L:\STANDARD\DRAWINGS\CDS\CDSDR STANDARD DRAWINGS\CDS-CDS\CONTECH\CDSDR-CDS-CDS.DWG 5/13/2014 4:58 PM



**PLAN VIEW B-B**  
N.T.S.

**ELEVATION A-A**  
N.T.S.



CONTECH ENGINEERED SOLUTIONS LLC  
2023 Centre Pointe Dr., Suite 400, West Chester, OH 45389  
800-338-1122 513-645-7000 513-645-7993 FAX

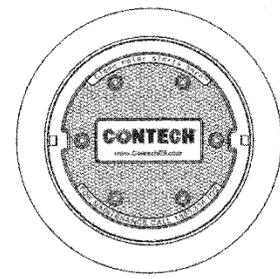
**CDS2020-5-C DESIGN NOTES**

CDS2020-5-C RATED TREATMENT CAPACITY IS 1.1 CFS [31.2 L/s], OR PER LOCAL REGULATIONS. MAXIMUM HYDRAULIC INTERNAL BYPASS CAPACITY IS 14.0 CFS [396 L/s]. IF THE SITE CONDITIONS EXCEED 14.0 CFS [396 L/s], AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

THE STANDARD CDS2020-5-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

**CONFIGURATION DESCRIPTION**

- GRATED INLET ONLY (NO INLET PIPE)
- GRATED INLET WITH INLET PIPE OR PIPES
- CURB INLET ONLY (NO INLET PIPE)
- CURB INLET WITH INLET PIPE OR PIPES
- SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
- SEDIMENT WEIR FOR NUDEP / HUCAT CONFORMING UNITS



**FRAME AND COVER**  
(DIAMETER VARIES)  
N.T.S.

**SITE SPECIFIC DATA REQUIREMENTS**

STRUCTURE ID	-		
WATER QUALITY FLOW RATE (CFS OR L/s)	0.88 cfs		
PEAK FLOW RATE (CFS OR L/s)	11.01 cfs		
RETURN PERIOD OF PEAK FLOW (YRS)	50-yr		
SCREEN APERTURE (2400 OR 4700)	4700		
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	115.24	HDPE	24-inch
INLET PIPE 2	-	-	-
OUTLET PIPE	115.22	HDPE	24-inch
RIM ELEVATION	121.6		
ANTI-FLOTATION BALLAST	WIDTH	HEIGHT	
	-	-	
NOTES/SPECIAL REQUIREMENTS:			
* PER ENGINEER OF RECORD			

**GENERAL NOTES**

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. [www.ContechES.com](http://www.ContechES.com)
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO H20 AND CASTINGS SHALL MEET H20 (AASHTO M 305) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

**INSTALLATION NOTES**

- A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
- C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
- D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
- E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

**CONTECH**  
ENGINEERED SOLUTIONS LLC  
[www.ContechES.com](http://www.ContechES.com)  
2023 Centre Pointe Dr., Suite 400, West Chester, OH 45389  
800-338-1122 513-645-7000 513-645-7993 FAX

CDS2020-5-C  
INLINE CDS  
STANDARD DETAIL

**CONTECH INLINE CDS STANDARD DETAIL**

SCALE: N.T.S.





PROVIDES

**SIGNIFICANT SAVINGS**

LAT: 34.213806 LON: -119.004913 ±213.3ft



City of Camarillo

Teso Robles  
20 Mar 2017, 8:58 AM

LAT: 34.213894 LON: -119.005013 ±213.3ft

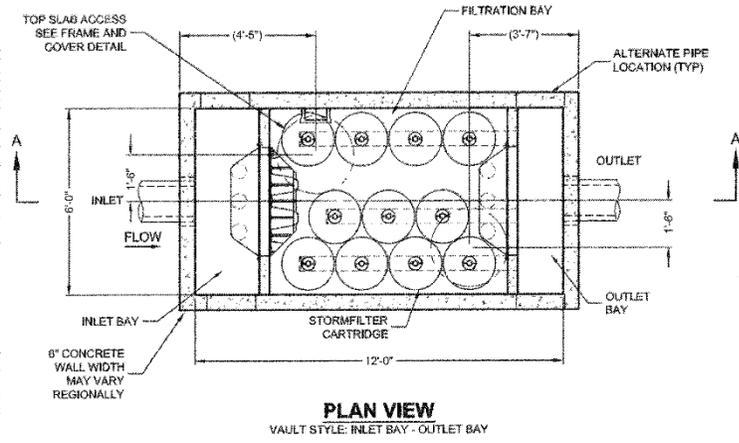


City of Camarillo

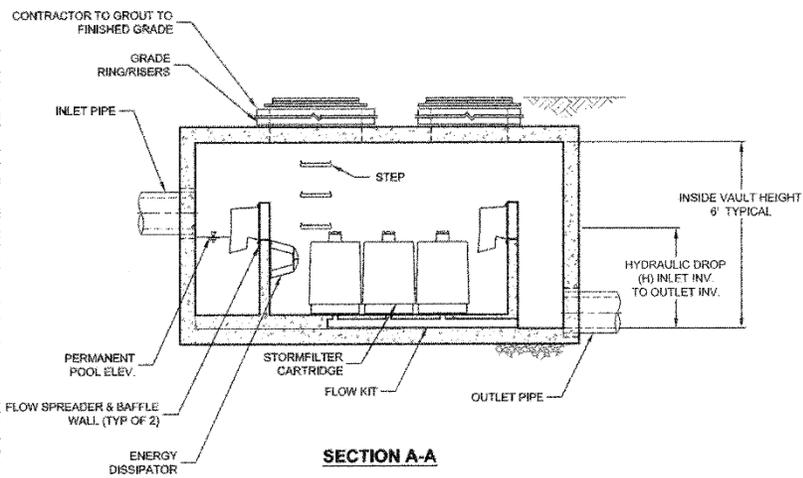
Teso Robles  
20 Mar 2017, 8:58 AM



I:\STORMWATER\COMMON\010 STORMFILT\STANDARD DRAWINGS\VAULT\SF0612.DTL.DWG 12/29/2014 10:14 AM



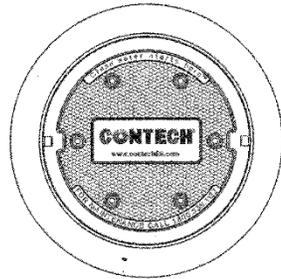
**PLAN VIEW**  
VAULT STYLE: INLET BAY - OUTLET BAY



**SECTION A-A**



STORMFILTER DESIGN NOTES						
STORMFILTER TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD VAULT STYLE IS SHOWN WITH THE MAXIMUM NUMBER OF CARTRIDGES (11). VAULT STYLE OPTIONS INCLUDE: OUTLET BAY (11), FULL HEIGHT BAFFLE WALL (12).						
STORMFILTER 6X12 PEAK HYDRAULIC CAPACITY IS 1.6 CFS. IF THE SITE CONDITIONS EXCEED 1.6 CFS AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.						
CARTRIDGE SELECTION						
CARTRIDGE HEIGHT	27"		18"		LOW DROP	
RECOMMENDED HYDRAULIC DROP (ft)	3.05'		2.3'		1.8'	
SPECIFIC FLOW RATE (gpm/ft <sup>2</sup> )	2 gpm/ft <sup>2</sup>	1 gpm/ft <sup>2</sup>	2 gpm/ft <sup>2</sup>	1 gpm/ft <sup>2</sup>	2 gpm/ft <sup>2</sup>	1 gpm/ft <sup>2</sup>
CARTRIDGE FLOW RATE (gpm)	22.5	11.25	16	7.5	10	5



**FRAME AND COVER**  
(DIAMETER VARIES)  
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS	
STRUCTURE ID	-
WATER QUALITY FLOW RATE (cfs)	0.23 cfs
PEAK FLOW RATE (cfs)	15.81 cfs
RETURN PERIOD OF PEAK FLOW (yrs)	50-yr
# OF CARTRIDGES REQUIRED	11
CARTRIDGE FLOW RATE	10
MEDIA TYPE (CSF, PERLITE, ZPG, GAC, PHS)	TBD
PIPE DATA:	I.E. MATERIAL DIAMETER
INLET PIPE #1	114.82 PVC 8-inch
INLET PIPE #2	- - -
OUTLET PIPE	113.02 PVC 8-inch
UPSTREAM RIM ELEVATION	121.16
DOWNSTREAM RIM ELEVATION	121.24
ANTI-FLOTATION BALLAST	WIDTH HEIGHT
	- - -
NOTES/SPECIAL REQUIREMENTS:	
* PER ENGINEER OF RECORD	

- GENERAL NOTES**
- CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
  - DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
  - FOR SITE SPECIFIC DRAWINGS WITH DETAILED VAULT DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. [www.ContechES.com](http://www.ContechES.com)
  - STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
  - STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M503 AND BE CAST WITH THE CONTECH LOGO.
  - FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 39 SECONDS.
  - SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).

- INSTALLATION NOTES**
- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
  - CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER VAULT (LIFTING CLUTCHES PROVIDED).
  - CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL VAULT SECTIONS AND ASSEMBLE VAULT.
  - CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
  - CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

**CONTECH**  
ENGINEERED SOLUTIONS LLC  
[www.ContechES.com](http://www.ContechES.com)  
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45389  
800-338-1122 513-845-7000 513-845-7883 FAX

SF0612  
STORMFILTER  
STANDARD DETAIL

**CONTECH STORMFILTER (MODEL SF0612) STANDARD DETAIL**

SCALE: N.T.S.





## **PhosphoSorb® Filter Media**

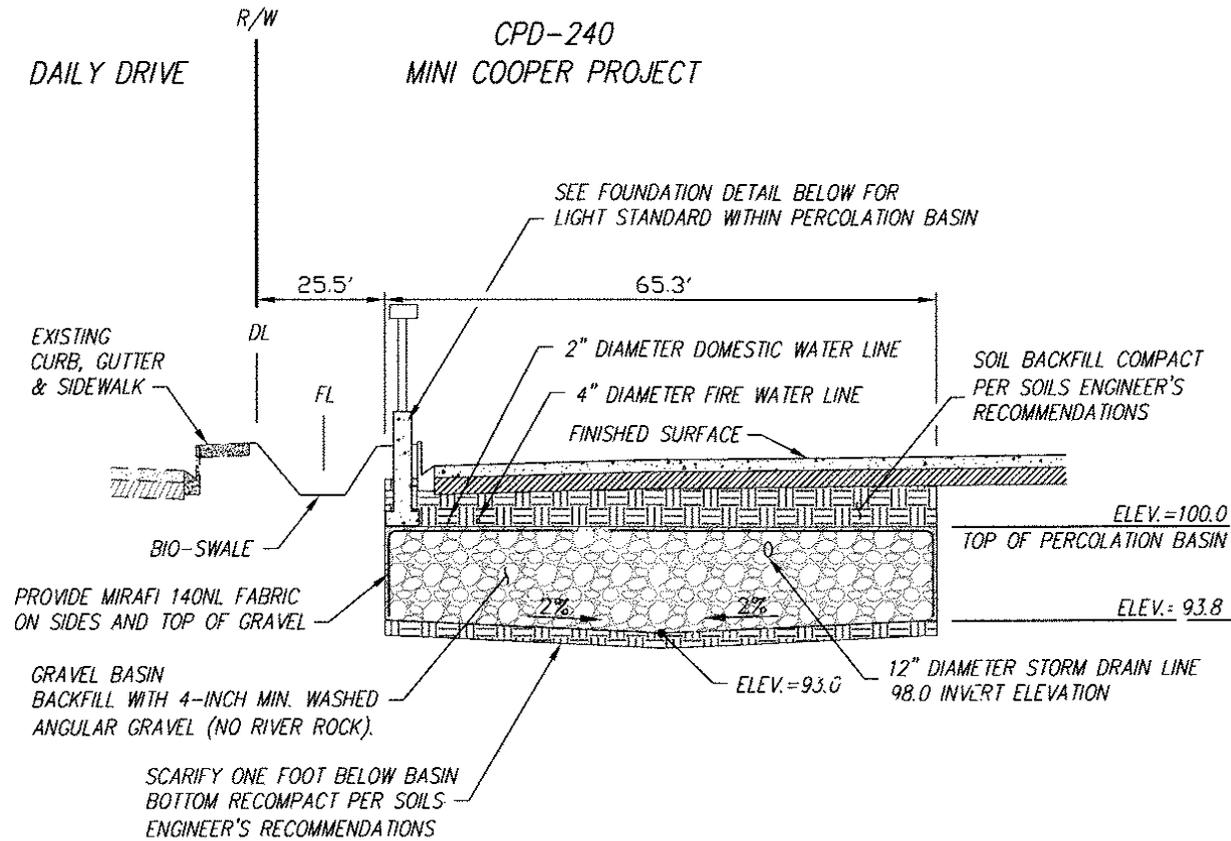
Designed for targeting  
high levels of phosphorus





CONSTRUCTION NOTES

- ① STORM DRAIN MANHOLE PER SPPWC STANDARD PLAN PLATE 321-1 (MODIFIED)  
SEE OUTLET MANHOLE DETAIL "B" ON SHEET 7.
- ② OBSERVATION WELL PER DETAIL "C" ON SHEET 7.

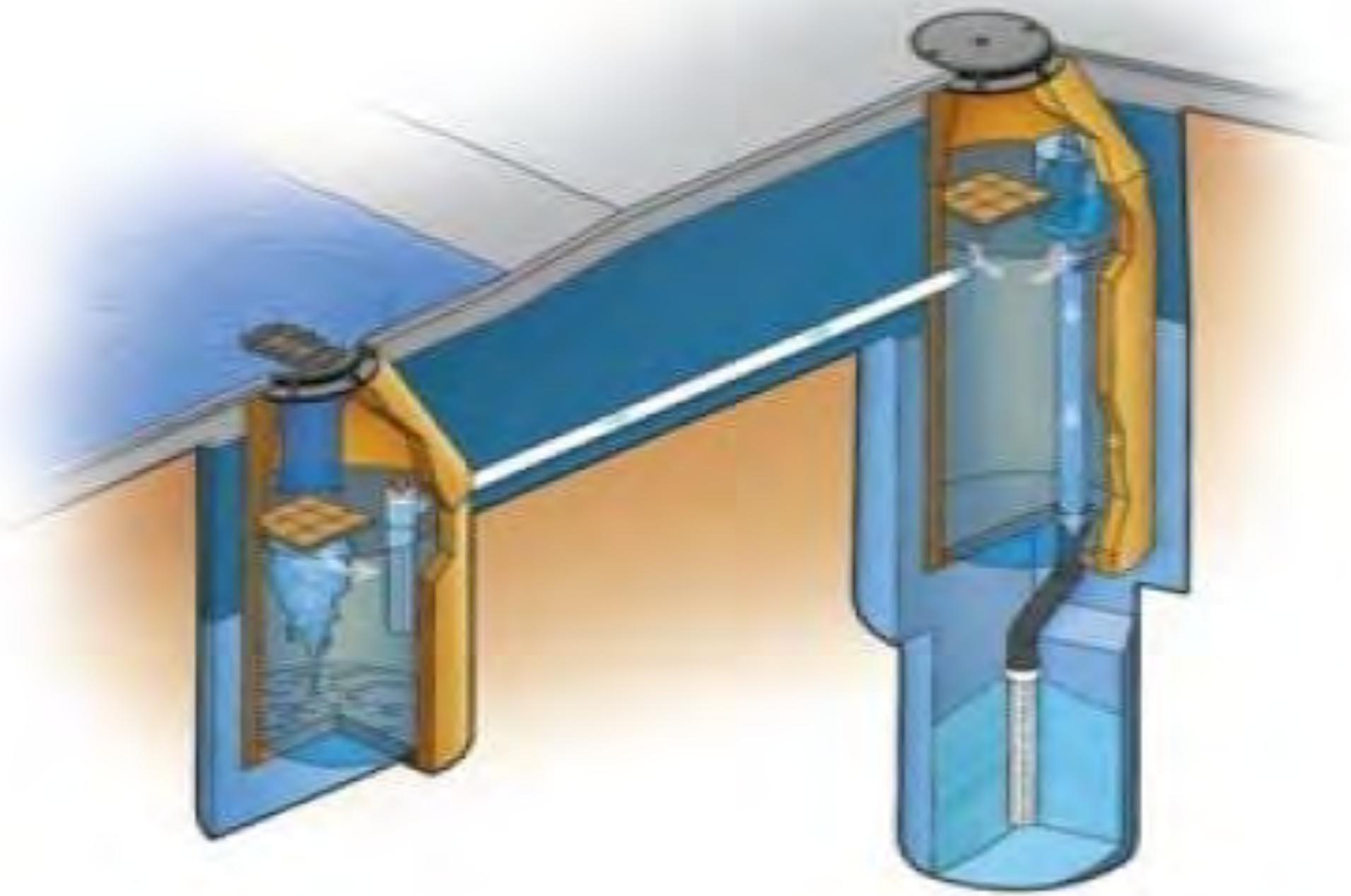


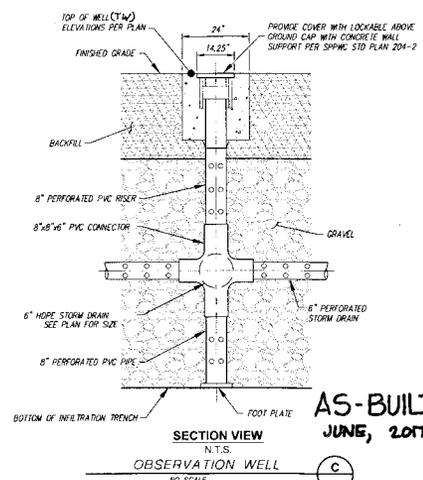
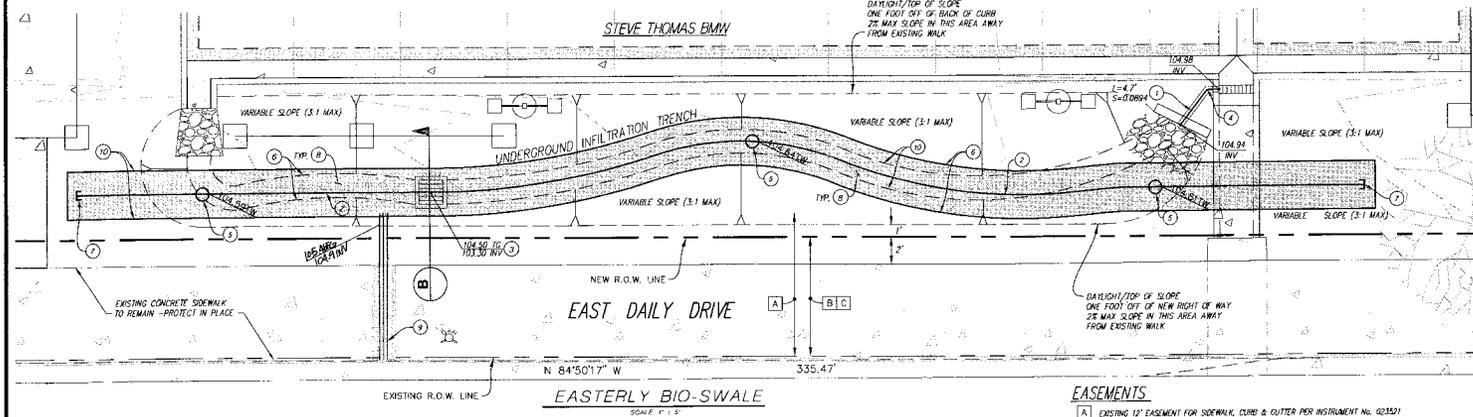
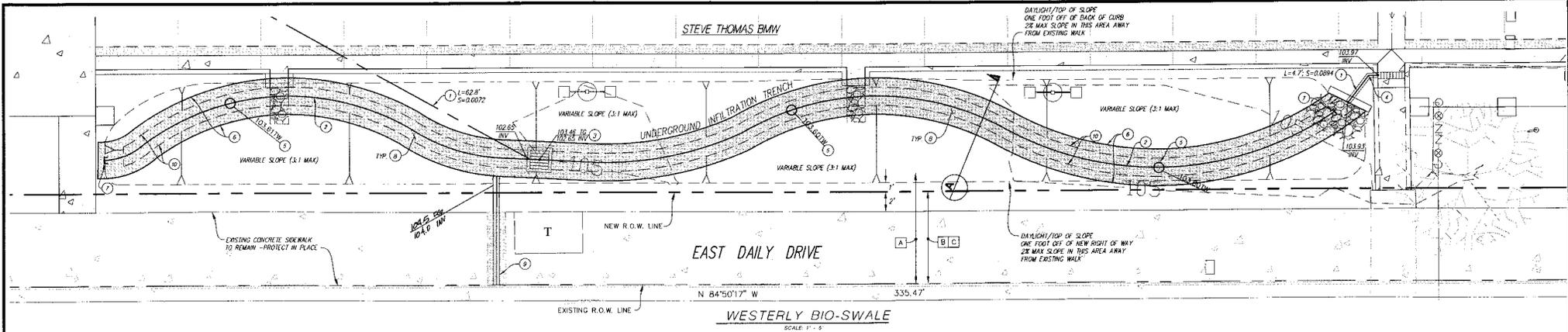
PERCOLATION BASIN SECTION

NO SCALE

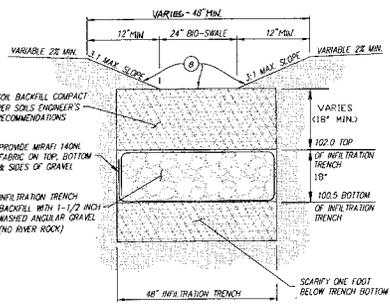
A  
4



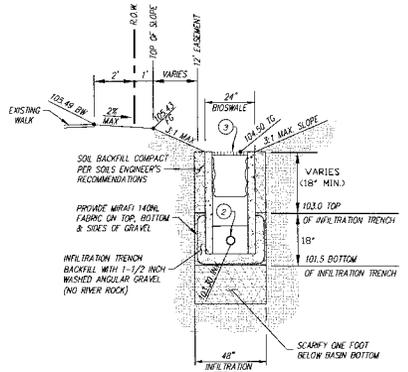




**AS-BUILT**  
JUNE, 2017



BIO-SWALE AND INFILTRATION TRENCH SECTION A-A  
NO SCALE



INFILTRATION TRENCH SECTION B-B  
NO SCALE

**EASEMENTS**

- A EXISTING 12' EASEMENT FOR SIDEWALK, CURB & CUTTER PER INSTRUMENT NO. 023521
- B EXISTING 10' EASEMENT FOR ROAD AND PUBLIC UTILITY PER INSTRUMENT NO. 69353
- C PROPOSED 10' RIGHT-OF-WAY DEDICATION TO THE CITY OF CAMARILLO.

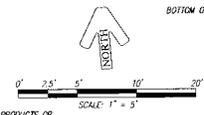
**STORMDRAIN CONSTRUCTION NOTES**

1. INSTALL 6" DIAMETER SOLID PVC 30# 35 STORM DRAIN.
2. INSTALL 6" DIAMETER PERFORATED PVC 30# 35 STORM DRAIN.
3. INSTALL 24" SQUARE GRATED CONCRETE CATCH BASIN WITH C1 GRATE PER BROOKS PRODUCTS OR APPROVED EQUAL. PROVIDE FLOODGATE MEDIA FILTER INSERT PER CULCASTLE STORMWATER SOLUTIONS.
4. INSTALL 6" PVC 45' ELBOW.
5. INSTALL 6" DIAMETER OBSERVATION WELL - SEE OBSERVATION WELL PER DETAIL "C" HEREIN.
6. CONSTRUCT UNDERGROUND INFILTRATION TRENCH (INF-T) SEE SECTION DETAILS "A" & "B", HEREIN TO BE PRIVATELY MAINTAINED UNDER SEPARATE MAINTENANCE AGREEMENT.
7. INSTALL 6" DIAMETER PVC CAP PER MANUFACTURER'S RECOMMENDATIONS.
8. BIOSWALE BOTTOM AND SUE SLOPES SHALL BE PLANTED WITH NASSELLA TENUESIMA (MEXICAN FEATHER GRASS). REFER TO INTALQIO STUDIO LANDSCAPE PLANNING PLAN L-30 FOR FURTHER DETAIL.
9. INSTALL CURB DRAIN (3-3" PVC PIPES) PER SPWPC STANDARD PLAN 100-3.
10. LIMITS OF BIO-SWALE. SEE GRADING AND DRAINAGE PLAN - SHEET J.

**NOTE**  
PROJECT GEOTECHNICAL ENGINEER SHALL INSPECT THE BOTTOM OF INFILTRATION FACILITIES AND PROVIDE A WRITTEN OPINION THAT THE EXPOSED SOIL LAYER IS SUITABLE FOR THE BOTTOM OF A STORMWATER INFILTRATION FACILITY BASED ON REVIEW OF THE EXISTING SITE GEOTECHNICAL REPORTS, PERCOLATION TESTS, AND CHARACTERISTICS OF THE EXPOSED SOIL LAYER.

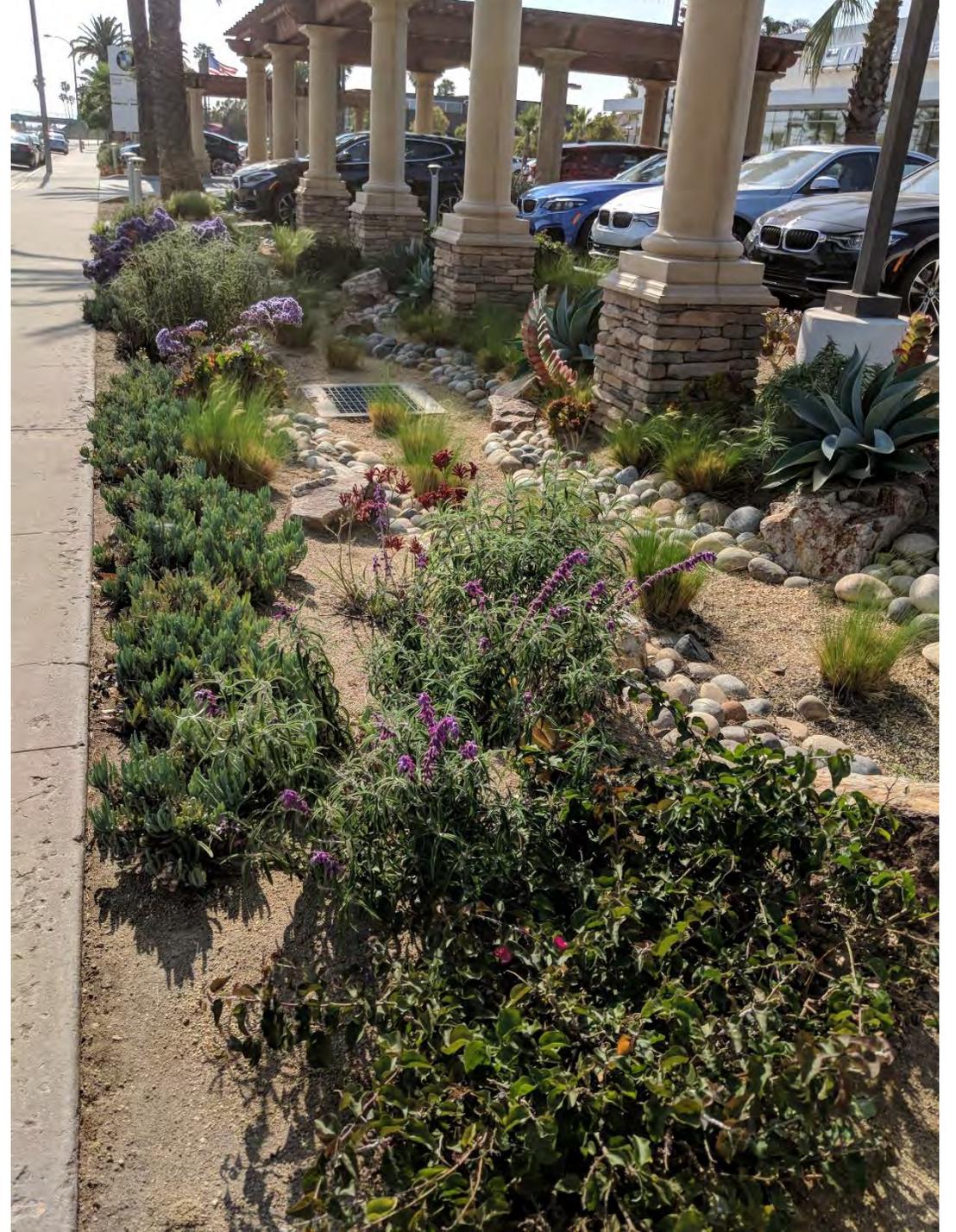
HATCH J.F.G.F.N.D. PLAN CHECK CONSULTANT

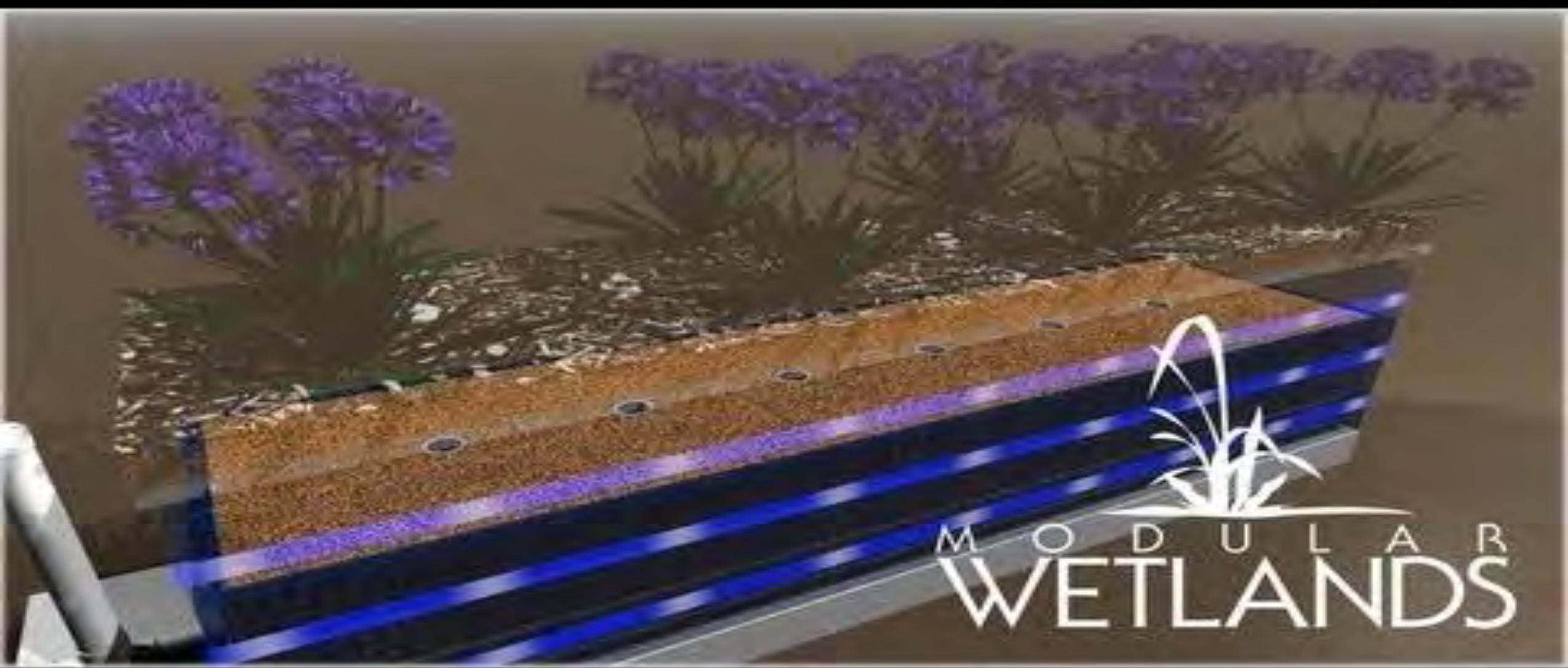
**SAMPLE**



REVIEWED:	DATE	REV	DESCRIPTION	APP'D	DATE
N/A					
TRAFFIC ENGINEER					
REVIEWED:	DATE	REV	DESCRIPTION	APP'D	DATE
N/A					
DIRECTOR, COMMUNITY DEVELOPMENT					
REVIEWED:	DATE	REV	DESCRIPTION	APP'D	DATE
Autu	4/19/15				
STORMWATER PROGRAM MANAGER					
REVIEWED:	DATE	REV	DESCRIPTION	APP'D	DATE
N/A					
WATER SUPERINTENDENT					
REVIEWED:	DATE	REV	DESCRIPTION	APP'D	DATE
N/A					
WATER RECLAMATION SUPERINTENDENT					
RECOMMENDED BY:	SPEC NUMBER	PROJ NUMBER			
N/A					
PUBLIC WORKS MAINTENANCE SUPERINTENDENT	DATE	P.B.	P.C.	SHEET 4 OF 4	C-16059

DEPARTMENT OF PUBLIC WORKS					
CITY OF CAMARILLO					
CPD - 21M(8)					
STORMWATER, UNDERGROUND PERCOLATION & BIOSWALE SECTIONS & DETAIL PLAN					
STEVE THOMAS BMW					
DRN BY:	DES BY:	CHK'D BY:			
N/A					
APPROVED:	DATE	REV	DESCRIPTION	APP'D	DATE
Adelle Tucker	5/16/15				
CITY ENGINEER					
DEPARTMENT OF PUBLIC WORKS					
ICE 1081/B	EXPIRES: 9/30/2015				
RECOMMENDED BY:	SPEC NUMBER	PROJ NUMBER			
N/A					
PUBLIC WORKS MAINTENANCE SUPERINTENDENT	DATE	P.B.	P.C.	SHEET 4 OF 4	C-16059





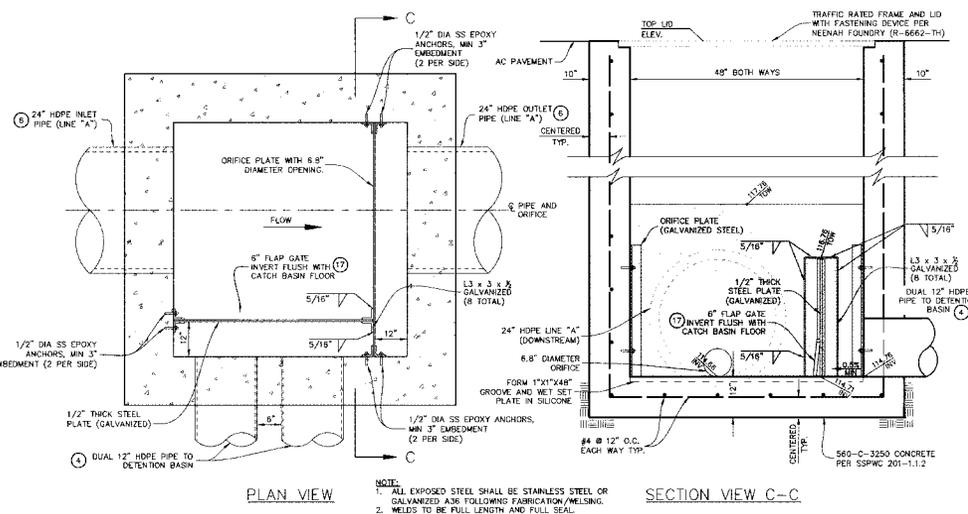
MODULAR  
WETLANDS

# Post Treatment Infiltration

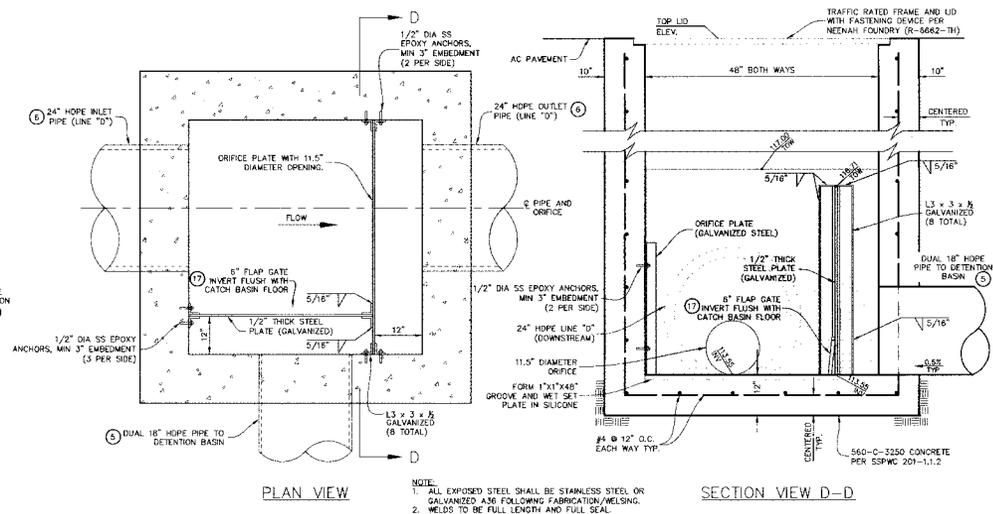
City of Camarillo

Carl's Jr  
21 Aug 2017, 12:15

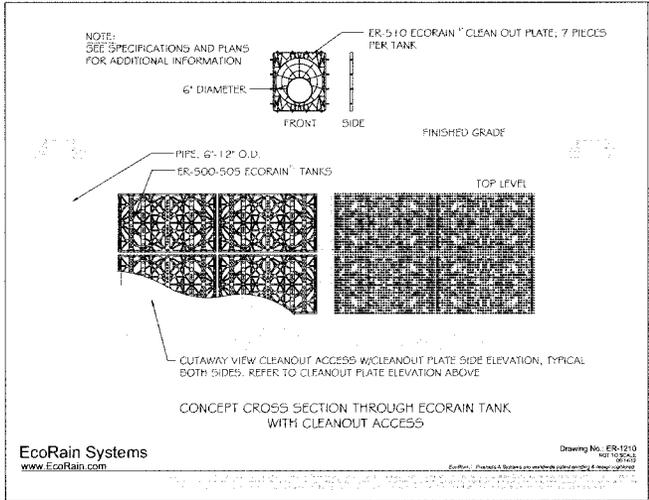
DRAWING: \\h1379-01\workgroup\2084\active\2064020589\0399\locat\Final Design\Improvements\210895\_S0\_PLAN.dwg  
 PLOT DATE: 4/7/2017 11:20:33 AM PLOT BY: Lopez, Daniel  
 SCALE: N.T.S.  
 2/15/2012



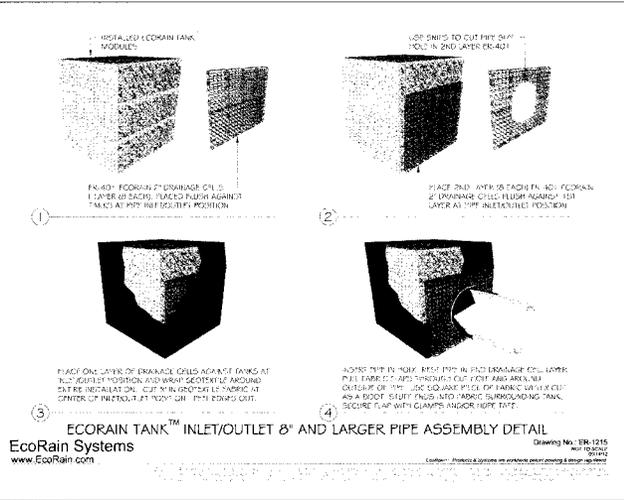
**CAST-IN-PLACE ORIFICE AND WEIR STRUCTURE-1 (C)**  
 SCALE: N.T.S.



**CAST-IN-PLACE ORIFICE AND WEIR STRUCTURE-2 (D)**  
 SCALE: N.T.S.



EcoRain Systems  
 www.EcoRain.com



EcoRain Systems  
 www.EcoRain.com

**CONSTRUCTION NOTES**

1. CONSTRUCT 12" HDPE (N-12 WT) STORM DRAIN PIPE WITH RUBBER GASKET PER TRENCH DETAIL "A", SHEET 29.
2. CONSTRUCT 18" HDPE (N-12 WT) STORM DRAIN PIPE WITH RUBBER GASKET PER TRENCH DETAIL "A", SHEET 29.
3. CONSTRUCT 24" HDPE (N-12 WT) STORM DRAIN PIPE WITH RUBBER GASKET PER TRENCH DETAIL "A", SHEET 29.
4. CONSTRUCT 6" FLAP GATE, RODNEY HUNT SERIES FG-SFR OR EQUAL, WALL MOUNTED WITH STAINLESS STEEL ANCHOR BOLTS AND FLANGE INSULATING GASKET KIT.

**ECORAIN TANK SYSTEM BASIN-1 STANDARD DETAILS (E)**  
 SCALE: N.T.S.

PLAN CHECK CONSULTANT



REVIEWED:	N/A	DATE:	
TRAFFIC ENGINEER		DATE	
REVIEWED:	N/A	DATE:	
DIRECTOR, COMMUNITY DEVELOPMENT		DATE	
REVIEWED:	<i>Auty</i>	DATE:	4-19-17
STORMWATER PROGRAM MANAGER		DATE	

REPLACEMENT SHEET C.O. 17-12	DATE	4/18/17	
REV.	DESCRIPTION	APP'D	DATE
DEPARTMENT OF PUBLIC WORKS CITY OF CAMARILLO			
TRACT 5956 / RPD-194 STORM DRAIN IMPROVEMENTS (PRIVATE) DETAILS SHEET			
DRN BY: TJS	DES BY: TJS	CK'D BY: APZ	
APPROVED:			
<i>Heather Tucke</i> 4/18/17			
CITY ENGINEER DEPARTMENT OF PUBLIC WORKS RCE 50678 EXPIRES: 9/30/2017			
RECOMMENDED BY:			
SPEC. NUMBER:	PROJ. NUMBER:		
F.B. PG.	SHEET 30 OF 49	C-16414	



FOR REDUCED PLANS  
 ORIGINAL SCALE IN INCHES

SCALE: 1"=20'

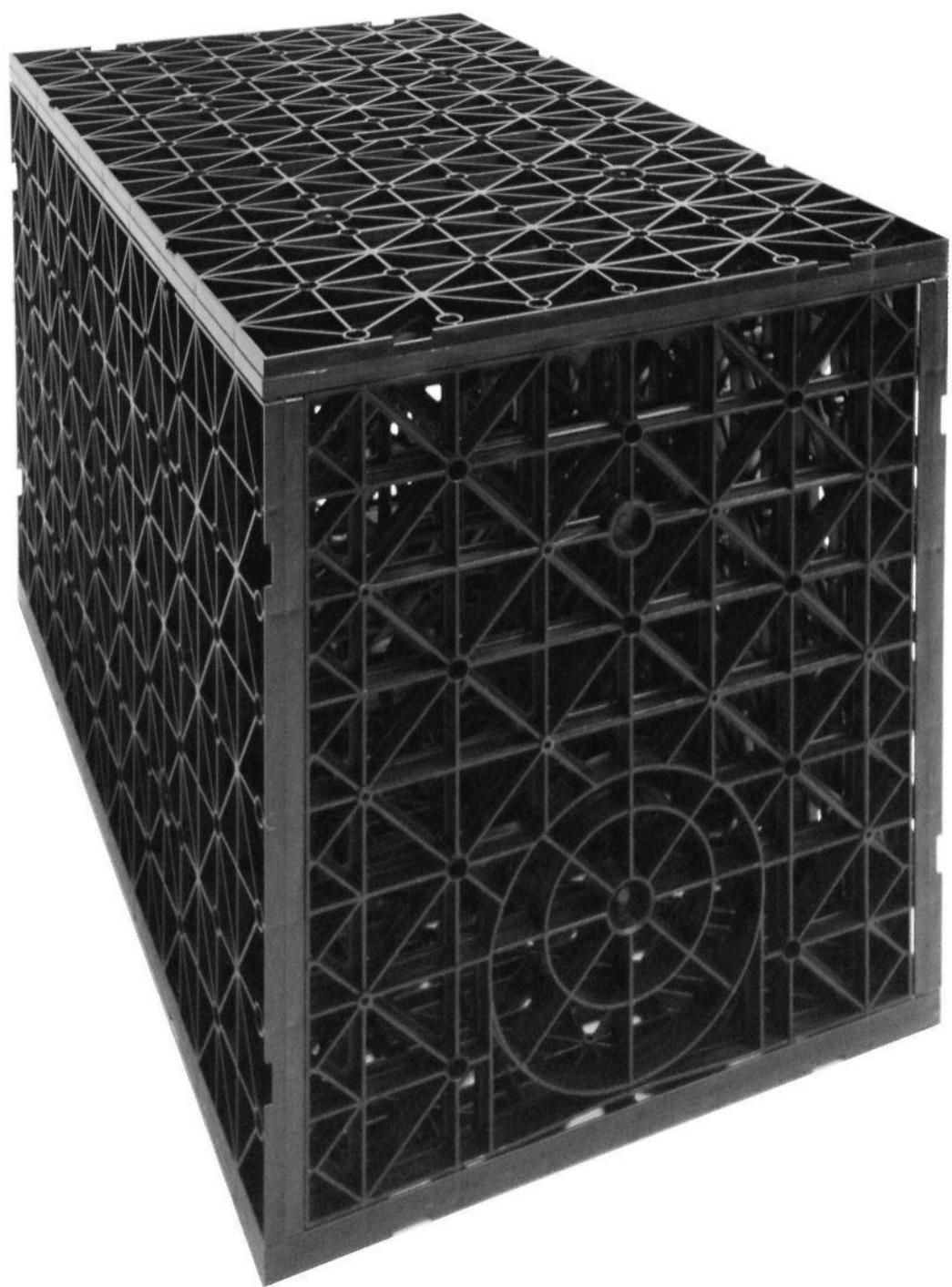
04-11-2017











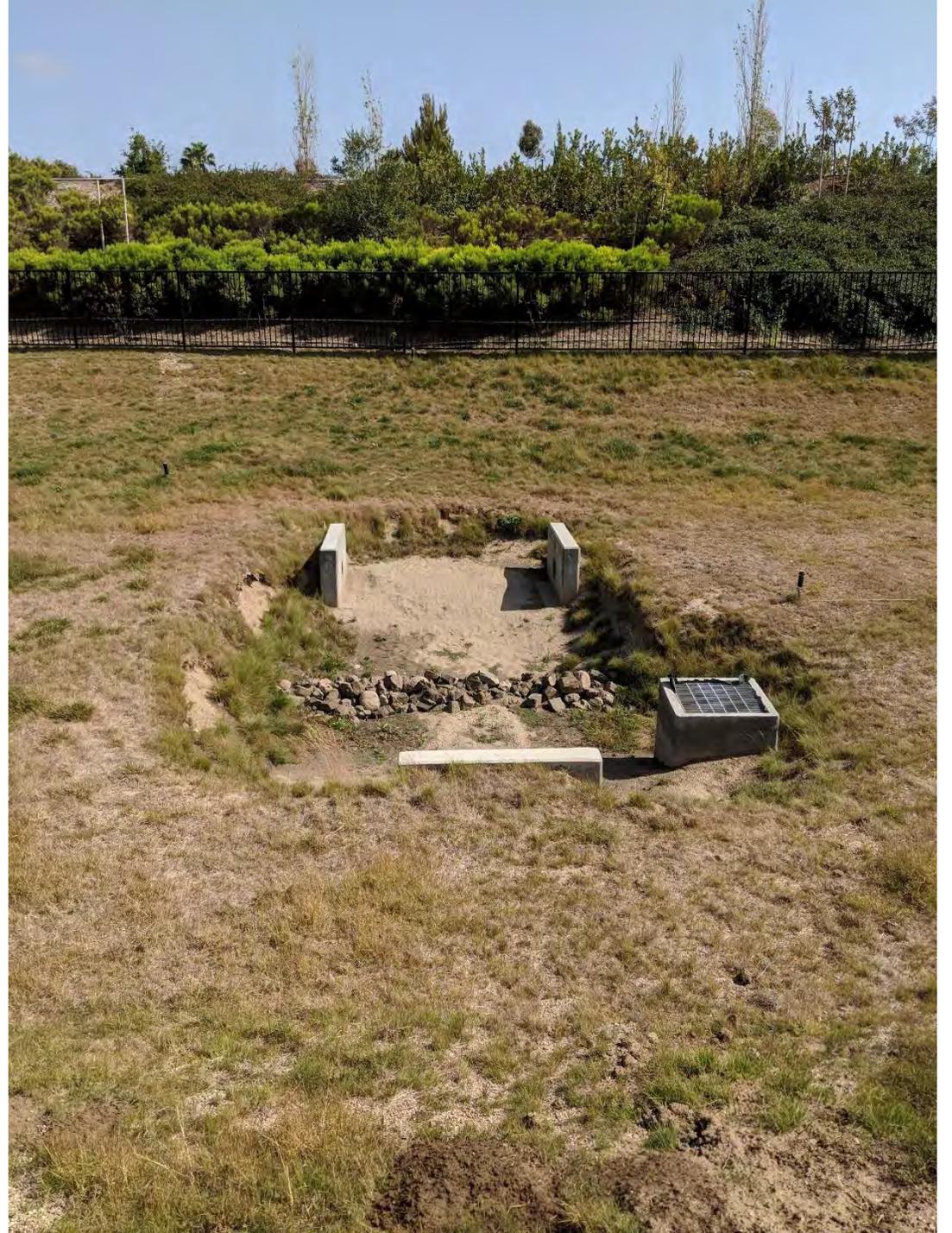


# Sand Filter











# Some Learning Experiences

For Real

LAT: 34.220341 LON: -119.076546 ±16.4ft



City of Camarillo

Elacora  
26 Jan 2017, 11:14 AM

LAT: 34.220367 LON: -119.076416 ±16.4ft



City of Camarillo

Elacora  
26 Jan 2017, 11:14 AM

LAT: 34.220371 LON: -119.076302 ±16.4ft



City of Camarillo

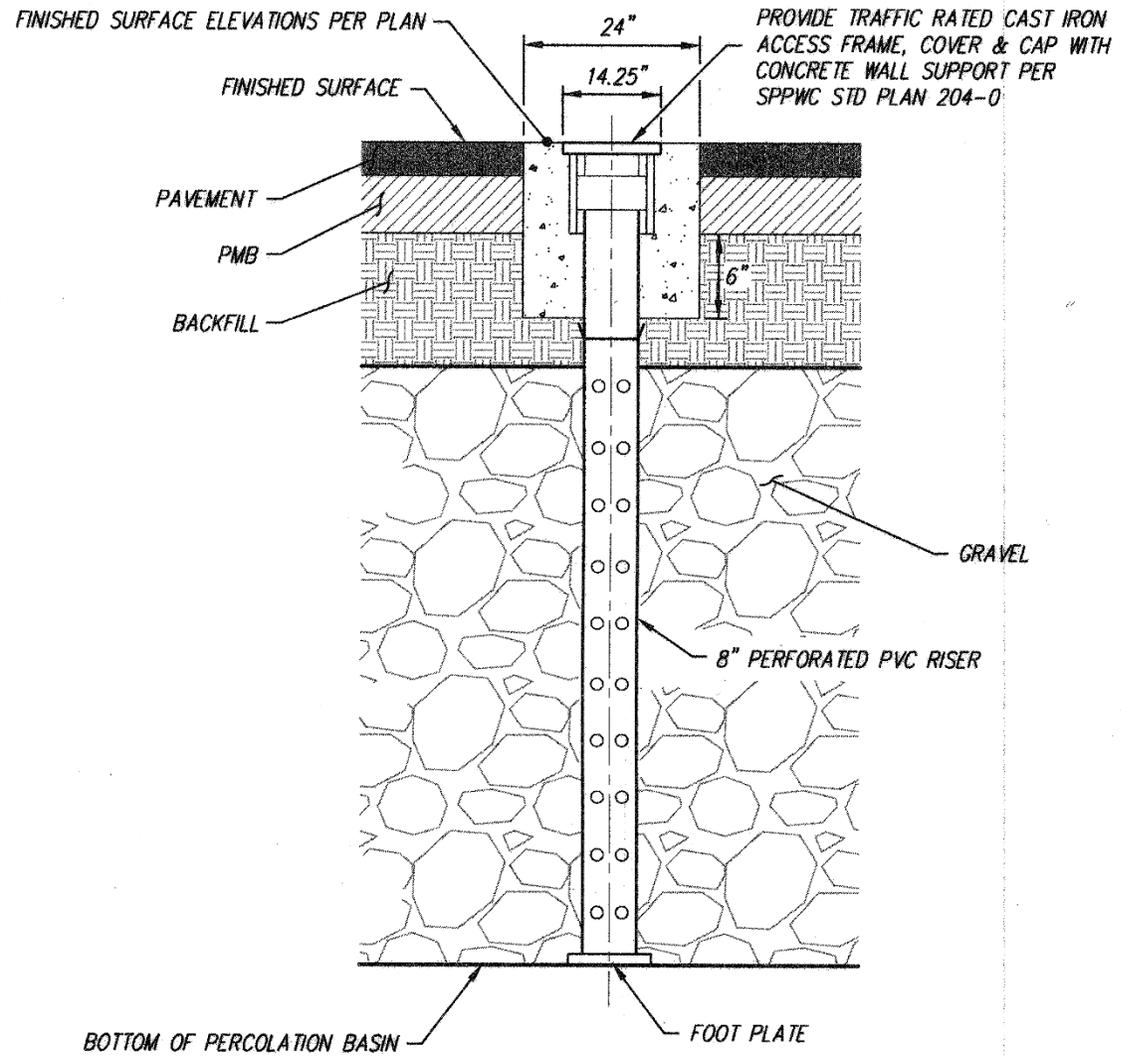
Elacora  
26 Jan 2017, 11:14 AM



04/28/2014



04/28/2014



**SECTION VIEW**  
N.T.S.

**OBSERVATION WELL DETAIL**

NO SCALE

**AS - BUILT**  
**NOV. 2013**

4080 Villamonte Ct, Camarillo, CA 93010

LAT: 34.244148 LON: -119.015862 ±32.8ft



City of Camarillo

Rancho Campana HS  
27 Jan 2016, 10:55



4080 Villamonte Ct, Camarillo, CA 93010

LAT: 34.244190 LON: -119.015854 ±16.4ft



City of Camarillo

Rancho Campana HS  
27 Jan 2016, 10:55







04/29/2014



04/29/2014



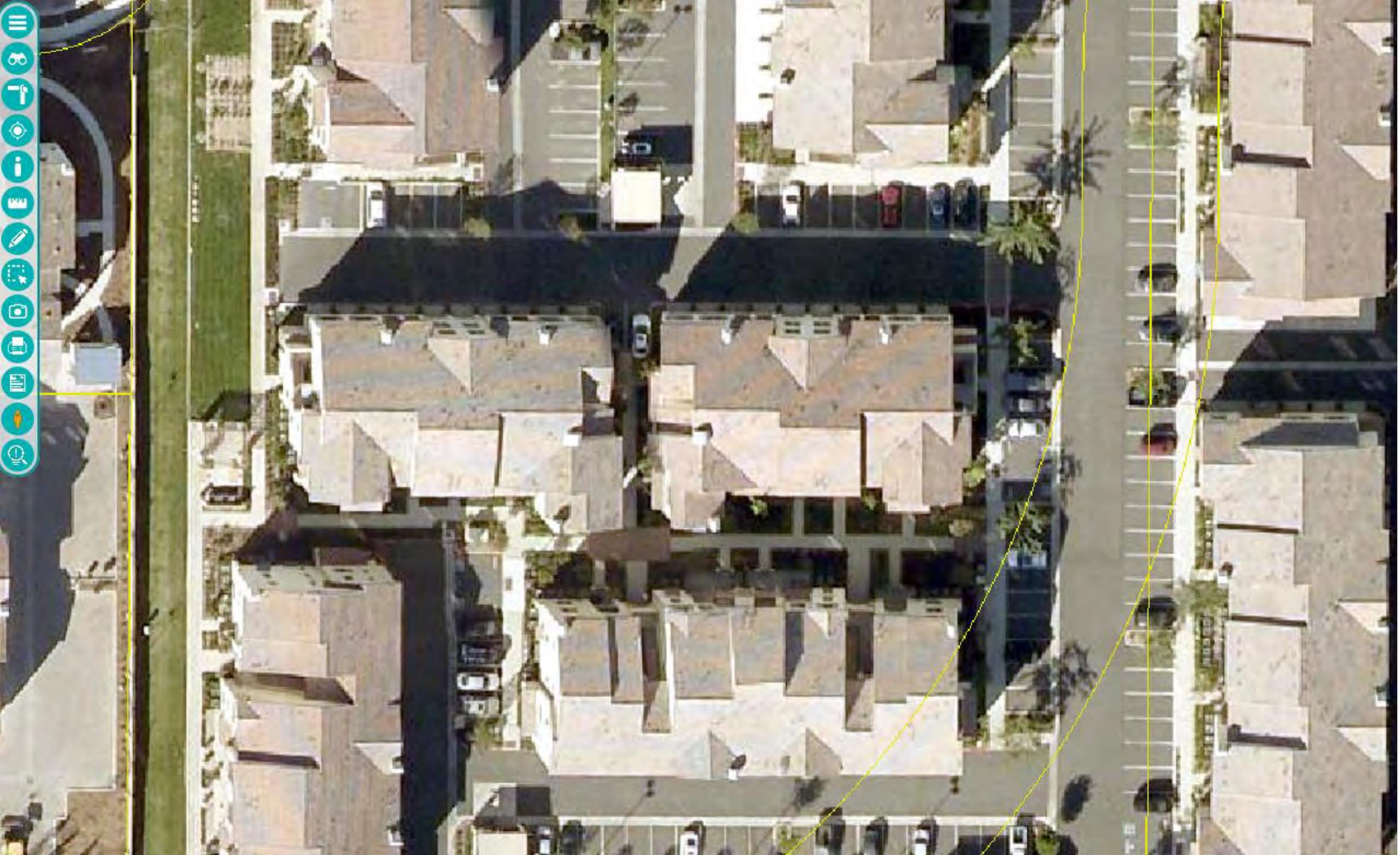
04/29/2014

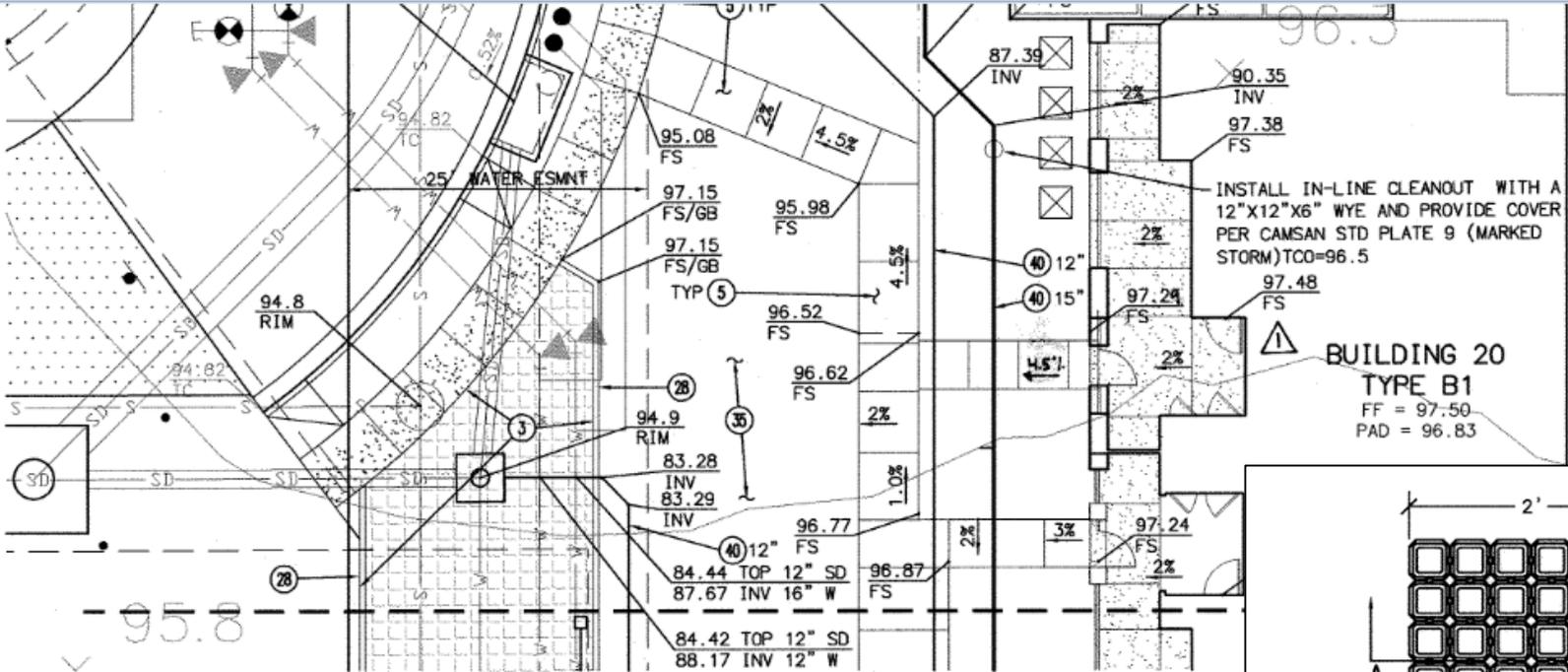


04/29/2014



09.29.2014 07:23

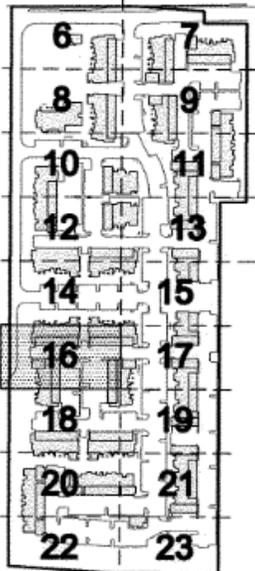




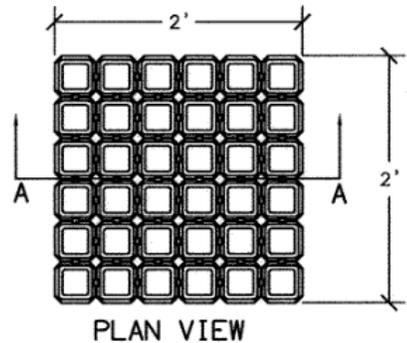
**BUILDING 20**  
**TYPE B1**  
 FF = 97.50  
 PAD = 96.83

**CONSTRUCTION NOTES**

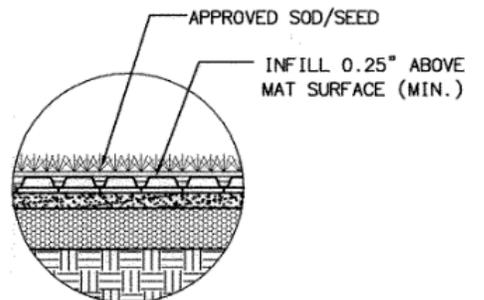
- ① CONSTRUCT 3" MIN AC OVER 9" MIN AB ACTUAL SECTION TO BE DETERMINED BY THE SO ENGINEER BASED ON R-VALUE ANALYSIS AND APPROVED BY CITY ENGINEER, PARKING ST SECTION CAN BE REDUCED TO 6" MIN AB.
- ③ CONSTRUCT 20' WIDE DRIVABLE GRASS ACCESS ROAD FROM SPRING OAK ROAD TO EXIST WELL FACILITY, SEE COMMERCIAL DRIVABLE GRASS DETAIL 4, SHEET 5.
- ④ CONSTRUCT 6" DRIVEWAY OVER 4" AB AND 12" OF SCARIFIED AND RECOMPACTED SOIL. TO BE 520-C-2500
- ⑤ CONSTRUCT 4" THICK SIDEWALK, EXPANSION AND CONTROL JOINTS PER LANDSCAPE ARCH PLANS AND DETAILS.
- ⑦ CONSTRUCT PCC RIBBON GUTTER PER SPPWC 122-2, LONGITUDINAL GUTTER, W=3'.
- ⑨ CONSTRUCT 6" CONCRETE CURB PER CITY OF CAMARILLO STD PLATE E-4.1(REV D), TYPE
- ⑩ CONSTRUCT TRASH ENCLOSURE PER ARCHITECTUAL PLANS AND AS SHOWN PER PLAN
- ⑬ CONSTRUCT ACCESS RAMP PER SPPWC 111-4, CASE D, TYPE 1 AND AS MODIFIED PER PLAN NOTE 2 SHEET 56 FOR TRUNCATED DOMES.
- ⑮ TRANSITION CURB FROM 0" CF TO 6" CF OVER 1.5 LF, BEG AT DRIVEWAY EDGE
- ⑳ CONSTRUCT 0" MOW CURB PER LANDSCAPE ARCH PLANS
- ㉓ LANDSCAPING/PLANTING PER LANDSCAPE ARCHITECTURAL PLANS, MAINTAIN 5% MIN FOR ALL BUILDINGS, 2% MIN SLOPE BEYOND 5' AND 1% MIN EARTHEN FLOWLINE.
- ④① INSTALL PVC (SDR 35) STORM DRAIN PIPE AND FITTINGS (EL, WYE, TEE) PER MANUFACTURER RECOMMENDATION, SIZE PER PLAN, S=0.010 UNLESS OTHERWISE NOTED. UPSTREAM PIPE CONNECTION TO MAIN AT OR ABOVE SPRINGLINE
- ④② INSTALL 4" ATRIUM GRATE INLET, NDS 75
- ④⑤ INSTALL 24"x36" DROP INLET, JENSEN PRECAST OR APPROVED EQUIVALENT, INSTALL PER "DON'T DUMP-DRAINS TO CREEK" FOR PURCHASE FROM CITY.
- ⑥④ CONSTRUCT JUNCTION STRUCTURE PER SPPWC 332-2, CASE 1
- ⑥⑤ INSTALL BIO CLEAN BAFFLE BOX PER DETAILS ON SHEET 28A (PRIVATE).



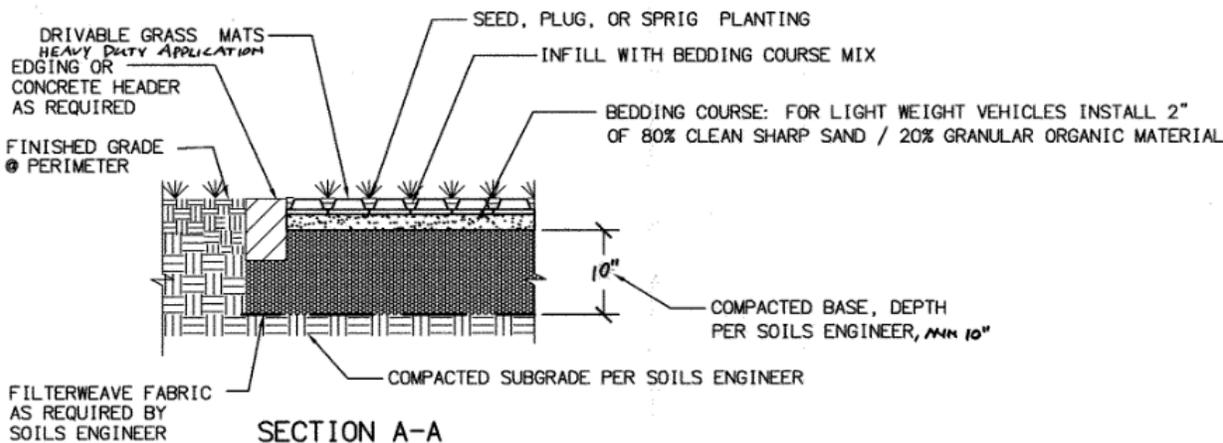
**KEY MAP**  
 NTS



PLAN VIEW



OPTIONAL SOD PLANTING



SECTION A-A

**TYPICAL COMMERCIAL DRIVABLE GRASS DETAIL**

NTS



**SYSTEM-1 ASSEMBLY**  
SCALE: 1" = 10'

**PROJECT SUMMARY SYSTEM-1**

**CALCULATION DETAILS**

- LENGTH PER BARREL = 30 FT
- LENGTH PER HEAD = 18 FT
- LOADING = 100 & 800
- APPROX. COMP. FOOTAGE = 121 FT

**STORAGE SUMMARY**

- STORAGE VOLUME REQUIRED = 1800 CF
- PIPE STORAGE = 1383 CF
- STRUCTURAL BACKFILL STORAGE = 416 CF
- TOTAL STORAGE PROVIDED = 9193 CF

**PIPE DETAILS**

- DIAMETER = 36 IN
- CORROSION = 8" X 1" OR 7" X 1"
- GAGE = 16
- COATING = ALUMINIZED STEEL
- TYPE 2 (A1)
- WALL TYPE = PERFORATED
- BARREL SPACING = 36 IN

**BACKFILL DETAILS**

- WIDTH AT TOP = 36 IN
- WIDTH AT BASE = 36 IN
- WIDTH AT SIDES = 36 IN
- BELOW PIPE = 6 IN

**SYSTEM-2 ASSEMBLY**  
SCALE: 1" = 10'

**PROJECT SUMMARY SYSTEM-2**

**CALCULATION DETAILS**

- LENGTH PER BARREL = 30 FT
- LENGTH PER HEAD = 18 FT
- LOADING = 100 & 800
- APPROX. COMP. FOOTAGE = 79 FT

**STORAGE SUMMARY**

- STORAGE VOLUME REQUIRED = 1367 CF
- PIPE STORAGE = 1039 CF
- STRUCTURAL BACKFILL STORAGE = 327 CF
- TOTAL STORAGE PROVIDED = 4322 CF

**PIPE DETAILS**

- DIAMETER = 36 IN
- CORROSION = 8" X 1" OR 7" X 1"
- GAGE = 16
- COATING = ALUMINIZED STEEL
- TYPE 2 (A1)
- WALL TYPE = PERFORATED
- BARREL SPACING = 36 IN

**BACKFILL DETAILS**

- WIDTH AT TOP = 36 IN
- WIDTH AT BASE = 36 IN
- WIDTH AT SIDES = 36 IN
- BELOW PIPE = 6 IN

**CONTECH ENGINEERED SOLUTIONS LLC**

3000 D Street, Camarillo, CA 93015  
805.488.1100

**CONTECH CAP DETENTION SYSTEMS**

PROJECT NAME: TRACT 5945 / RPD-188  
City of Camarillo, CA 93035  
DESCRIPTION: UNDERGROUND INFILTRATION SYSTEM

**CONSTRUCTION LOADING DIAGRAM**  
SCALE: N.T.S.

**REINFORCING TABLE**

Ø CMP RISER	A	Ø B	REINFORCING	BEARING PRESSURE (PSF)
24"	Ø 4"	Ø 6"	Ø 5 @ 10" OC/Ø 5 @ 10" OC/Ø 5 @ 10" OC	2140
30"	Ø 4 1/2"	Ø 7"	Ø 5 @ 10" OC/Ø 5 @ 10" OC	2120
36"	Ø 5"	Ø 8"	Ø 5 @ 10" OC/Ø 5 @ 10" OC	1900
42"	Ø 5 1/2"	Ø 9"	Ø 5 @ 10" OC/Ø 5 @ 10" OC	1700
48"	Ø 6"	Ø 10"	Ø 5 @ 10" OC/Ø 5 @ 10" OC	1500

**CONSTRUCTION LOADING TABLE**

PIPE SPAN INCHES	AXLE LOADS (KIPS)	MINIMUM COVER (FT)
13-50	30/15	10/10
14-40	24/12	10/10
48-72	3/6	3/3
72-120	3/6	3/3

**ROUND OPTION PLAN VIEW**

**SQUARE OPTION PLAN VIEW**

**CONTECH ENGINEERED SOLUTIONS LLC**

3000 D Street, Camarillo, CA 93015  
805.488.1100

**CONTECH CAP DETENTION SYSTEMS**

PROJECT NAME: DYODS - 2567-3-0 & DYODS-2569-2-0  
PROJECT NAME: Village Gateway  
City of Camarillo, CA 93035  
DESCRIPTION: UNDERGROUND INFILTRATION SYSTEMS 1 & 2

**TYPICAL MANWAY DETAIL**  
SCALE: N.T.S.

**TYPICAL RISER DETAIL**

**TYPICAL SECTION VIEW**

**BACKFILL DETAIL**

SCALE: N.T.S.

**TYPICAL PERFORATION DETAIL**

SCALE: N.T.S.

**CONTECH ENGINEERED SOLUTIONS LLC**

3000 D Street, Camarillo, CA 93015  
805.488.1100

**CONTECH CAP DETENTION SYSTEMS**

DYODS - 2567-3-0 & DYODS-2569-2-0  
PROJECT NAME: Village Gateway  
City of Camarillo, CA 93035  
DESCRIPTION: UNDERGROUND INFILTRATION SYSTEMS 1 & 2

**CONTECH ENGINEERED SOLUTIONS LLC**

3000 D Street, Camarillo, CA 93015  
805.488.1100

**CONTECH CAP DETENTION SYSTEMS**

DYODS - 2567-3-0 & DYODS-2569-2-0  
PROJECT NAME: Village Gateway  
City of Camarillo, CA 93035  
DESCRIPTION: UNDERGROUND INFILTRATION SYSTEMS 1 & 2

**REVIEW:**

TRAFFIC ENGINEER: N/A

REVIEWED: N/A

DIRECTOR, COMMUNITY DEVELOPMENT: DATE

STORMWATER PROGRAM MANAGER: DATE

REVIEWED: N/A

WATER SUPERINTENDENT: DATE

WATER RECLAMATION SUPERINTENDENT: DATE

PUBLIC WORKS MAINTENANCE SUPERINTENDENT: DATE

**REVISIONS**

REV.	DESCRIPTION	APP'D	DATE
1			

DEPARTMENT OF PUBLIC WORKS  
**CITY OF CAMARILLO**  
TRACT-5945/ RPD-188  
UNDERGROUND INFILTRATION DETAILS

APPROVED: *[Signature]* 7/10/17

APPROVED: *[Signature]* 8/1/17

RECOMMENDED BY: *[Signature]*

SPEC. NUMBER: PROJ. NUMBER

F.B. PG. SHEET 19 OF 32 C-16628



LAT: 34.210125 LON: -119.033195 ±16.4ft



City of Camarillo

Aldersgate

17 Jan 2018, 11:18 AM

LAT: 34.209938 LON: -119.034210 ±16.4ft



City of Camarillo

Aldersgate  
17 Jan 2018, 4:23 PM

LAT: 34.209602 LON: -119.033279 ±16.4ft



City of Camarillo

Aldersgate  
18 Jan 2018, 1:48 PM

LAT: 34.209686 LON: -119.033844 ±16.4ft



City of Camarillo

Aldersgate  
19 Jan 2018, 7:53 AM

LAT: 34.209885 LON: -119.034172 ±16.4ft



City of Camarillo

Aldersgate  
19 Jan 2018, 7:57 AM

LAT: 34.210052 LON: -119.034180 ±16.4ft



City of Camarillo

Aldersgate  
17 Jan 2018, 11:20 AM

2/8/17





5/1/18

# Questions?





# Ventura County NPDES MS4 Workshop

June 12, 2018

Design of BMPs: Lessons Learned

Xiaoyu Zhang  
Southern California – Stormwater Consultant

# Overview and Agenda



## Overview and Agenda

- BMP Selection
- LID Design
- Stormwater Quality Design
  - Pretreatment
  - Treatment
- Stormwater Quantity Storage

# Design Considerations

## Items to consider before selecting BMP

- Calculations and Regulations
- Target Pollutants
- Available space and foot print
- Existing conditions and grading design
- Budget \$
- Lifespan of the project
- Maintenance requirements

Ventura County Technical Guidance Manual for  
Stormwater Quality Control Measures

Manual Update 2011

Errata Update 2015



Geosyntec  
consultants



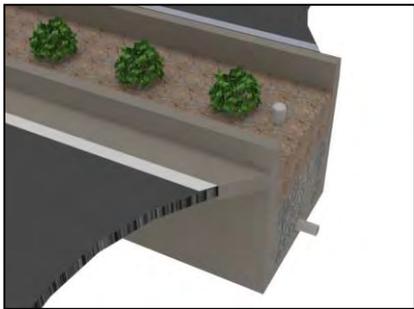
Prepared by  
Larry Walker Associates Geosyntec Consultants  
707 Fourth Street, Suite 200 1111 Broadway, 6<sup>th</sup> Floor  
Davis, CA 95616 Oakland, CA 94607

Errata Update May 29, 2015

# Stormwater Quality Design

## Low Impact Design

- Mitigate impact to historical natural conditions of site.
- Should be considered early in the planning phase.
- Possible solutions are bio-filtration, infiltration, and hydro-modification by storing water.



*Modular Biofiltration*



*Biofiltration Planter*

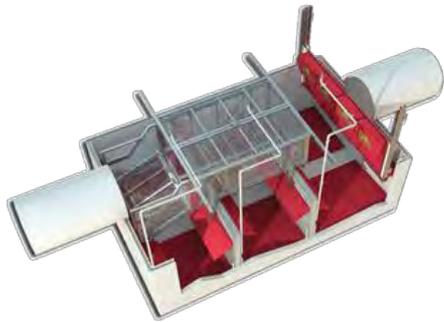


*Precast Storage*

# Stormwater Quality Design

## Stormwater Quality Design - Pre-treatment

- Typically used with infiltration and storage.
- Decreased maintenance for biofiltration or filtration system.
- California Waterboards Trash capture approval list – (2019).



*Baffle Box*



*Inlet Filtration*



*Hydrodynamic  
Separators*

# Stormwater Quality Design

## Options for Quality Design - Treatment

- Biofiltration, infiltration (biological component that will meet the pollutant removal levels of their project).
- Based on calculations and regulations.
- Proprietary or non-proprietary solutions.



*Media Filtration*



*Biofiltration Planter*



*Engineered Biofiltration*

# Storage and Hydromodification

## Stormwater – Storage and Hydromodification

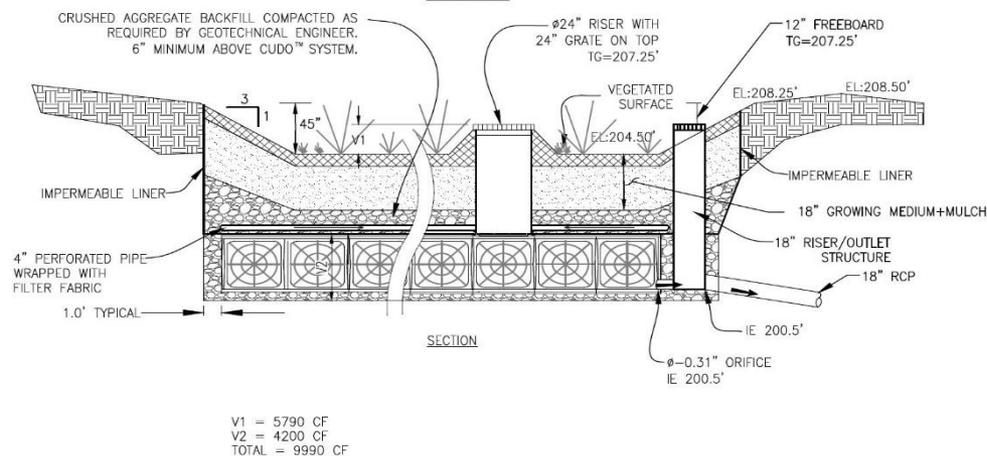
- Is storage a requirement?
  - How much needs to be stored?
  - Do you need hydromodification and flow control?
- Space requirements?
  - Where does your site allow storage to occur?
  - Given these constraints, what type of storage is best for your project?



# Storage and Hydromodification

## Stormwater – Storage and Hydromodification

- Storage should near the discharge site.
  - Located between treatment and discharge location.
  - Consider LID.
- Storage and Infiltration.
- Iterative design process involving input.



# Cost and Project Life

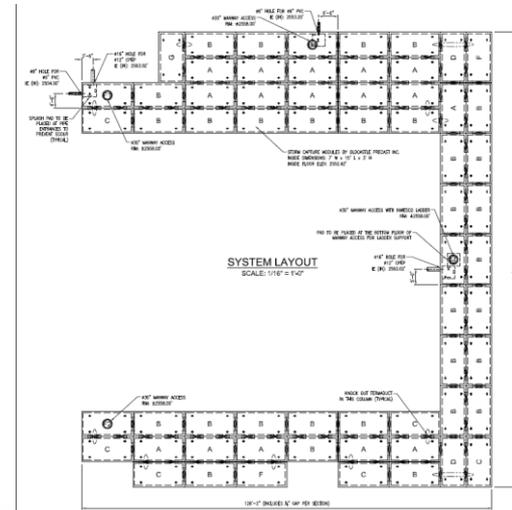
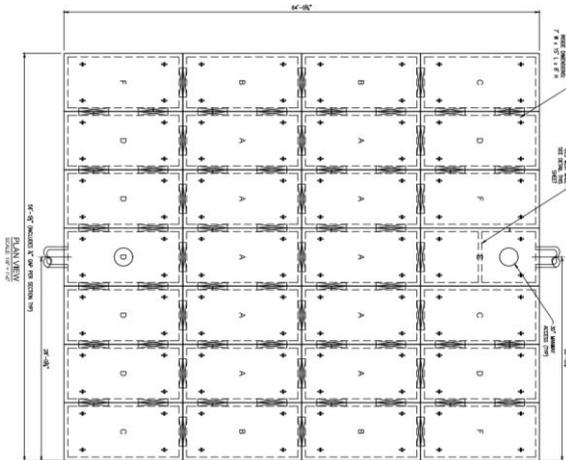
## Cost Considerations

- Iterative process, multiple options and solutions.
- Standard sizes and constraints when designing with manufactured products.
- Consider total install cost and maintenance rather than material costs alone.
- Life span of the BMP and Maintenance requirements.



# Space, Surroundings, and Existing Conditions

- Allowable footprint or space?
- Are there surrounding buildings or existing conditions that will affect the structural design of the BMP?
  - Building Footings.
  - Groundwater Table.
  - Which codes you are designing to?
- Consider installation requirements during design process.



# Other Items to Consider

Considering “Common Sense Items” will help save money in the long Run

- Considerations for treatment and storage should be in the early planning phases
- Drainage pattern, BMPs should be at low points,
  - Reworking sites can be avoided
- It is never too early to bring in manufacturers to get their insight when choosing solutions.



**Xiaoyu Zhang, EIT**

Stormwater Consultant

(323) 430-3138

Oldcastle Precast Stormwater

[Xiaoyu.Zhang@oldcastle.com](mailto:Xiaoyu.Zhang@oldcastle.com)

**Tamara Mamon, EIT**

Stormwater Consultant

Contech Engineered Solutions

Cell: 818-519-1781

[TMamon@conteches.com](mailto:TMamon@conteches.com)

**Shelby Hull**

Director – SW Region

(619) 599-6316

Oldcastle Precast Stormwater

[Shelby.hull@oldcastle.com](mailto:Shelby.hull@oldcastle.com)

**Mark R. Baker**

Contech Engineered Solutions LLC

Area Director, Stormwater West

909-797-1367

[MBaker@conteches.com](mailto:MBaker@conteches.com)



# **Ventura County NPDES MS4 Workshop – June 12, 2018**

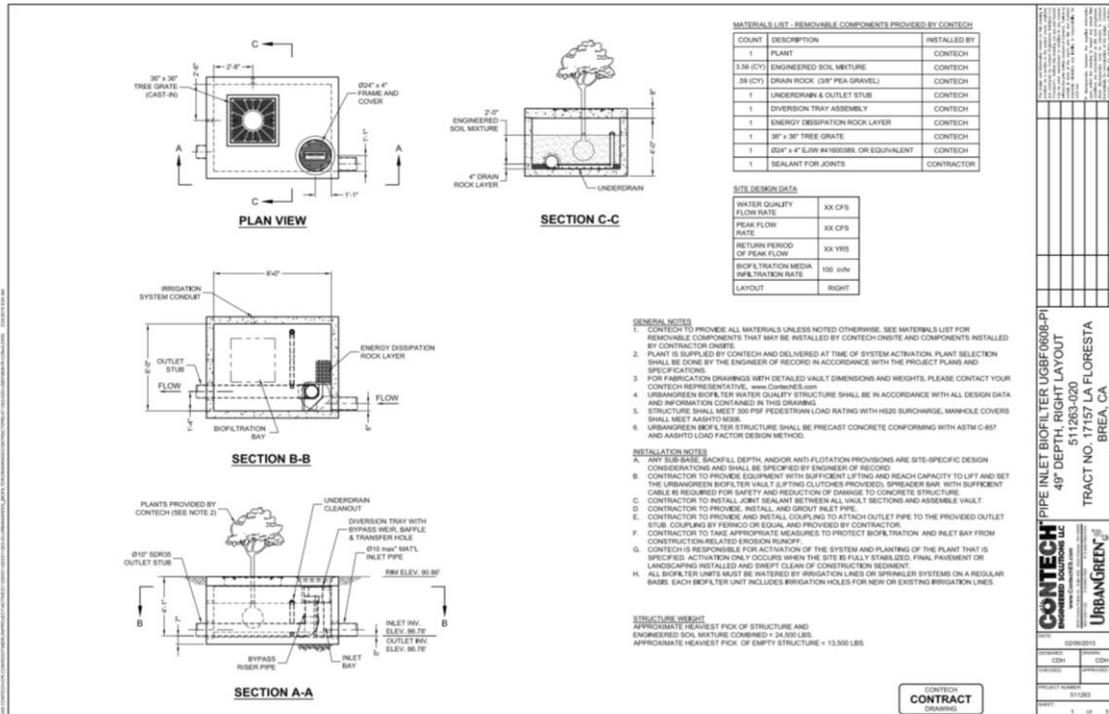
## **Installation and Maintenance: Lessons Learned**



- **Pick weights, points and rigging**
  - **Called out in submittals**
  - **Use of Spreader Bars**
  - **Chains not typically recommended**
  - **Know equipment's capabilities**



- Outside dimensions versus inside dimensions. Make certain to look at plans not product nomenclature
  - Overall Height as well



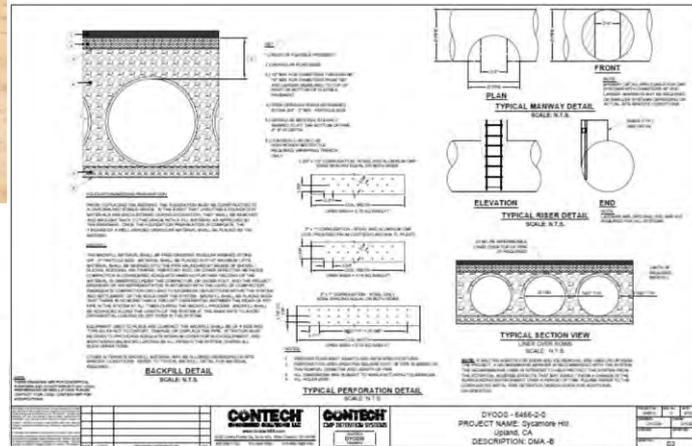


- **Bedding**
  - Settling problems can arise if proper bedding (typically 6") is not used



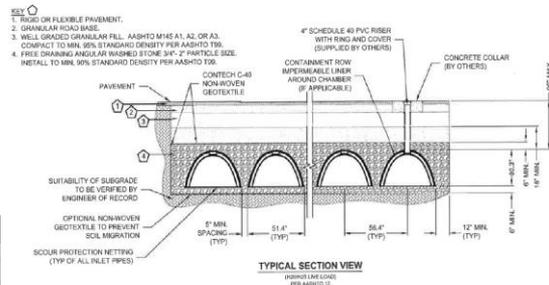
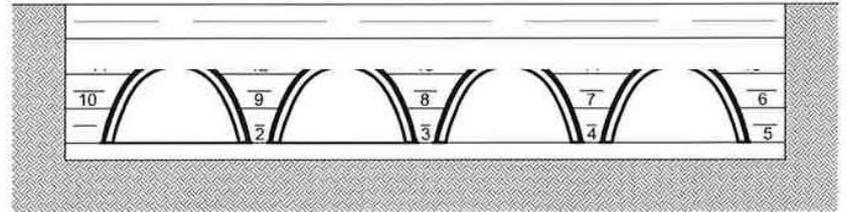
## HDPE / Chambers / Corrugated Steel Pipe (CSP)

- Bedding, backfilling material and process
- Starting point
- Non-woven Geotextile



## Chambers

- Additional Materials
- Backfill; Sequence
- Top-loading Equip Restrictions



CHAMBERMaxx

CHAMBERMAXX STORMWATER RETENTION SYSTEM  
STANDARD INSTALLATION DETAILS

REVISION	DATE	BY	CHKD
DESIGNED	12/4/15	MAH	
CHECKED		MAH	
APPROVED			

1 OF 2

## Corrugated Metal Pipe (CMP) Detention

- **\$\$ Considerations – Conveyor versus backhoe for backfilling**
- **All Other Points Previous Mentioned**



## Precast Concrete Detention

- **Various manufacturers with various design configurations and efficiencies**
- **Some require foundations others do not**
- **If foundation is required it is extremely important that the keyway is poured correctly**



## Hydrodynamic Manufactured Devices - HDS

### COMMENTS

- HDS systems are not considered maintenance-intensive products
- Site conditions influence maintenance: street/lot sweeping, catch basin cleaning, landscaping, site use, etc.

### INSPECTION :

- Frequency: Range from 1 - 4 times per year
- Process:
  - Should be able to be accomplished without entering system
  - Typical tools are rod, measuring tape and inspection log
  - Record sediment loading

### MAINTENANCE:

- Use vacuum truck to remove floatables (trash, debris, oil), sediment and standing water
- Clean interior



## Filtering Manufactured Devices

### COMMENTS

- Filter systems capture finer materials thus requiring more intense maintenance procedures
- Membrane or media based filters

### INSPECTION :

- Frequency: Typically range from 1 - 2 times per year
- Process:
  - Most systems can be inspected without entering system
  - Typical tools are rod, measuring tape and inspection log
  - Visual indicators determine condition of Filters

### MAINTENANCE:

- Confined Space is typically required to conduct maintenance
- Use vacuum truck to remove floatables (trash, debris, oil), sediment and standing water
- Remove / Replace Filters
- Clean interior



## Biofiltration / Bioretention Manufactured Devices

### COMMENTS

- Media types: Low Flow and High Flow
- High flow media systems require more frequent / routine maintenance visits to maintain flow rates



### INSPECTION :

- Inspection every 1 – 4 times per year.

### MAINTENANCE:

- Routine maintenance every 6 - 12 months (2 visits per year)
- Some site may require more frequent visits
- Typically considered the easiest MTD systems to maintain





# Questions

**Xiaoyu Zhang**

Stormwater Consultant – Los Angeles  
Region | Oldcastle Precast, Inc. Tel:  
323-430-3138

**Tamara Mamon, EIT**

Stormwater Consultant  
Contech Engineered Solutions  
Cell: 818-519-1781

**Shelby Hull**

Director – SW Region | Oldcastle Precast,  
Inc. Tel: 619-599-6316 |

**Mark R. Baker**

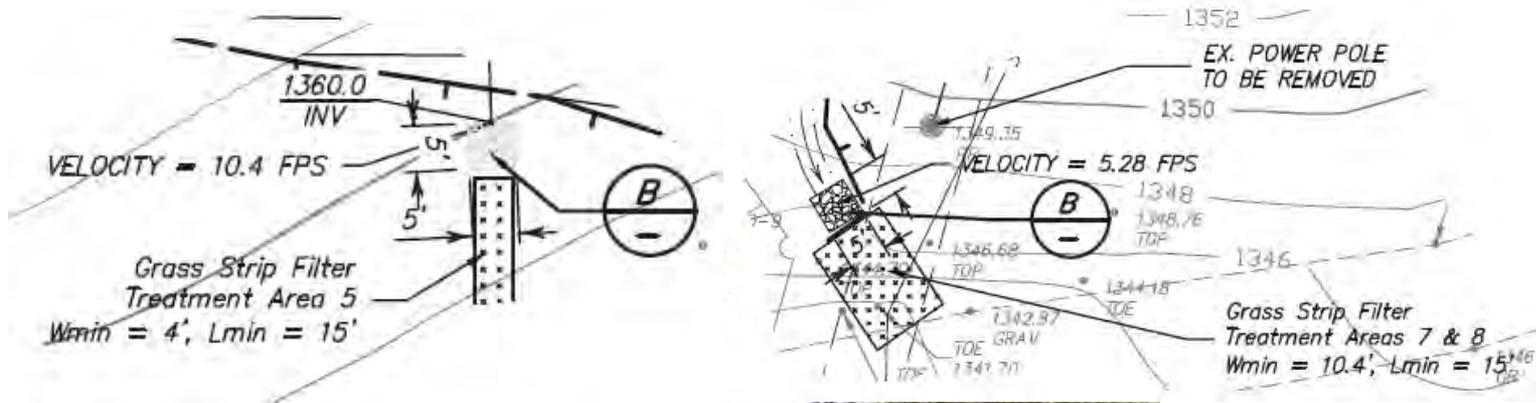
Contech Engineered Solutions LLC  
Area Director, Stormwater West  
909-797-1367

# SESSION 4

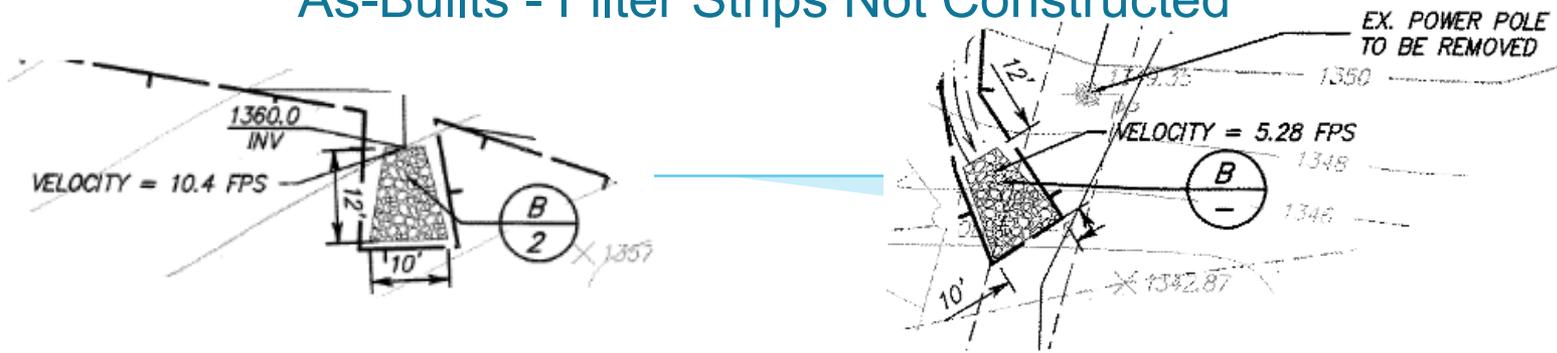
## Design, Construction, Operations and Maintenance

# Filter Strips Example

Proposed and Approved for Construction

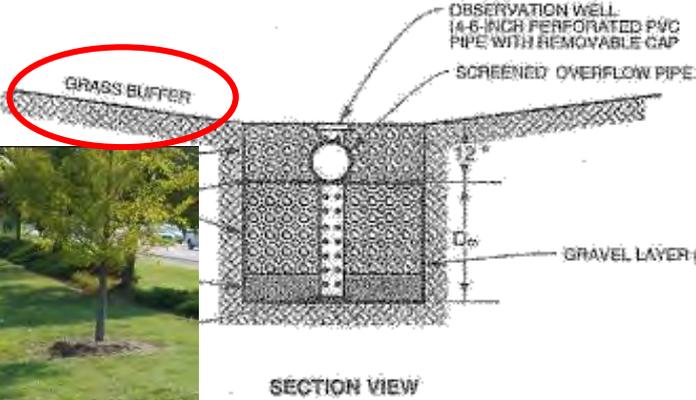
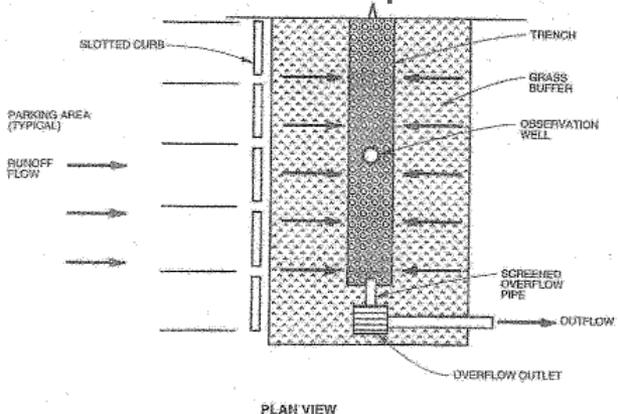


## As-Builts - Filter Strips Not Constructed



# Infiltration Trench Example

Proposed and Approved for Construction



## What was Actually Constructed



# Infiltration Testing (TGM)

## APPENDIX C: SITE SOIL TYPE AND INFILTRATION TESTING



Figure C-2: Double Ring Infiltrometer

Photo Credit: Geosyntec Consultants (Braga and Fitsik, 2008)



Figure C-3: Guelph Permeameter for Shallow Borehole Permeability

Photo Credit: USDA, 2005

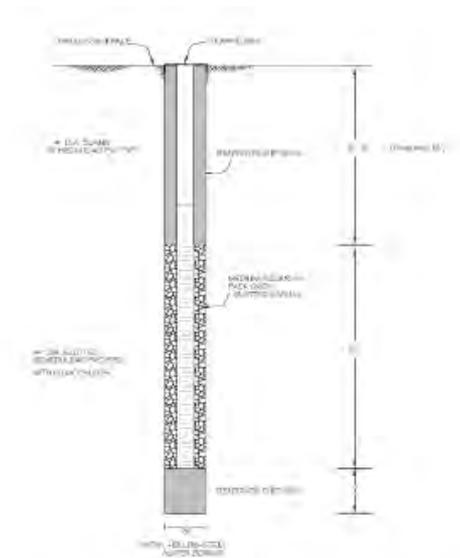


Figure C-4: Falling-Head Permeameter for Deep Borehole Permeability

Diagram Credit: Group Delta Consultants, 2008

# Infiltration Testing

Insufficient infiltration rates  
required redesign

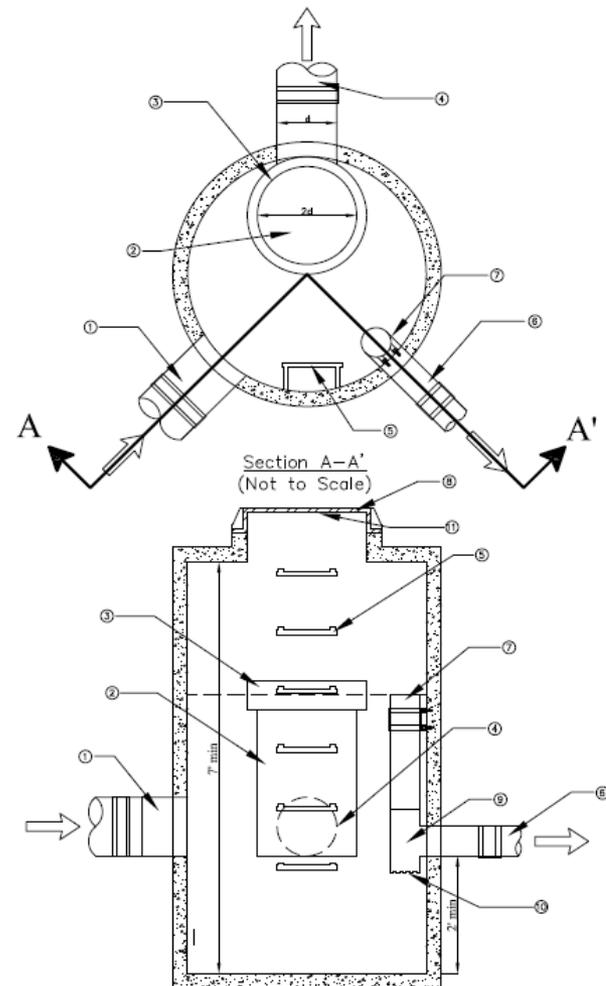
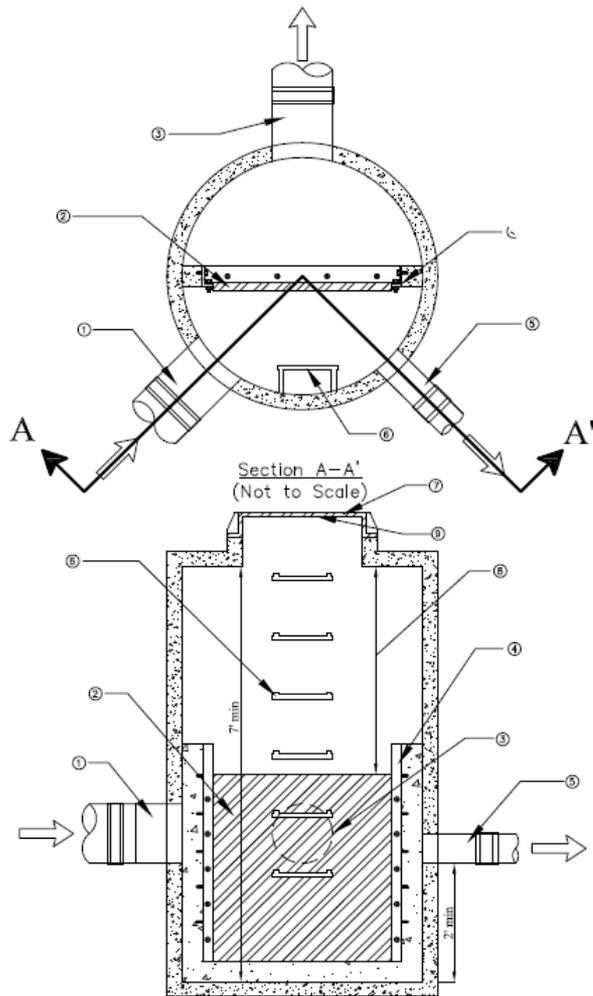


**Table 2. Field Percolation Testing Results**

Site Name	Location	Test Interval (feet bgs)	Stabilized Field Test Percolation Rate (in/hr)	
			Corrected (for open, uncased hole)	Uncorrected (Field Data)
OVLG	Ojai Valley Land Conservancy parcel	DH-01B, 2-5	<1/4	<1/4
		DH-01A, 9-14	<1/4	<1/4
El Camino	Ventura County access road	DH-02B, 2-5	<1/4	<1/4
		DH-02A, 9-14	3/4	1
El Roblar	Ventura County ROW (dirt shoulder of road)	DH-03B, 2-5	<1/4	<1/4
		DH-03A, 10-14	1/2	3/4
Lomita	Ventura County ROW (dirt shoulder of road)	DH-04B, 3-5	<1/4	<1/4
		DH-04A, 6-9	<1/4	<1/4

# High Flow Bypass (TGM)

## APPENDIX F : FLOW SPLITTER DESIGN SPECIFICATIONS



# High Flow Bypass – Offline BMP Configs

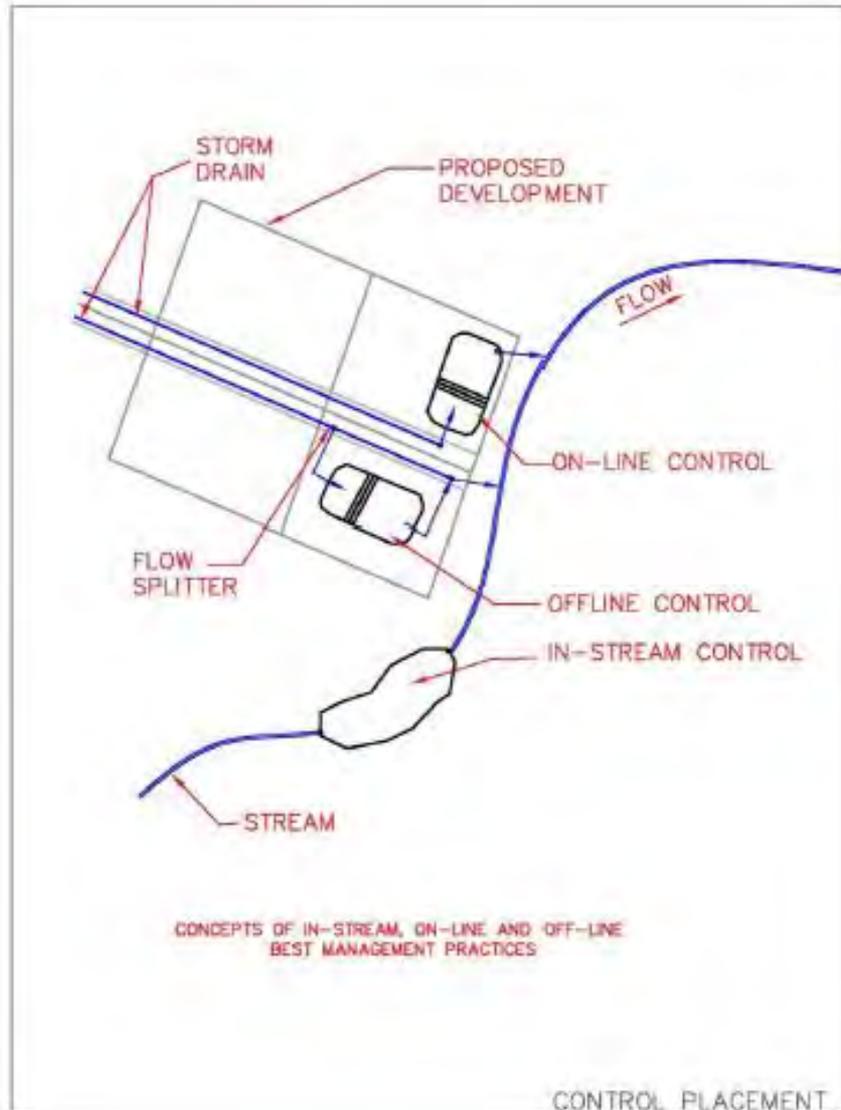


Figure 6-1: Differences between On-line, Off-line, and In-stream Control Measures



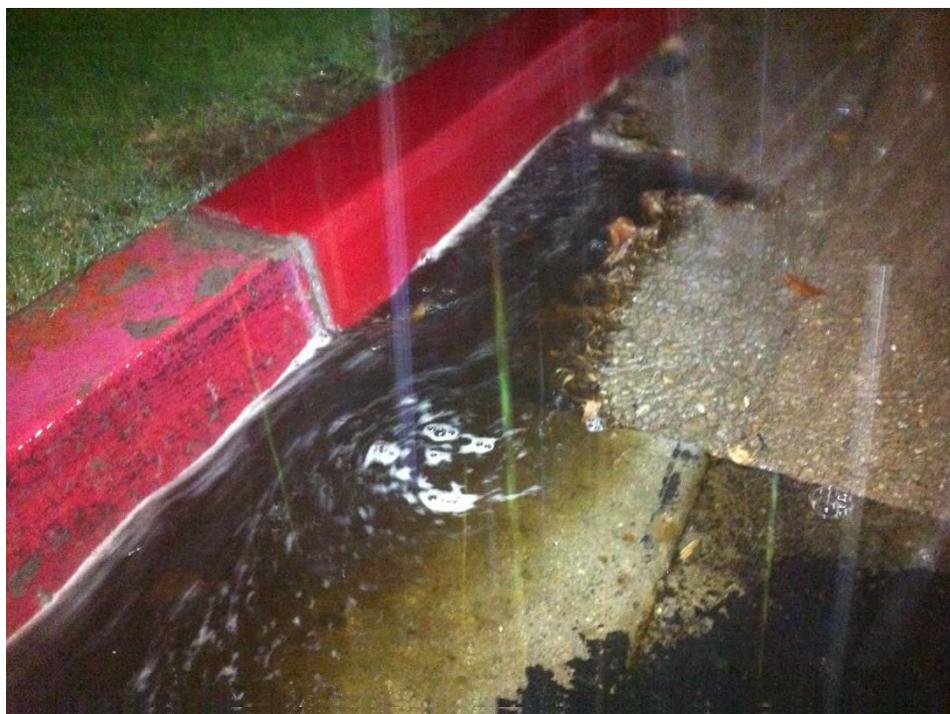
# Inspection, Maintenance and Operability are Required by the Countywide MS4 Permit

## Publicly-Owned BMPs – Inspections Every 2 years (min)

Verify proper maintenance and operation of post-construction BMPs previously approved for new development and redevelopment and operated by the Permittees. The post construction BMP maintenance inspection program shall incorporate the following elements:

- (1) Post-construction BMP Maintenance Inspection checklist.
- (2) Inspection at least once every 2 years, beginning (Order adoption date), of post-construction BMPs to assess operation conditions with particular attention to:
- (3) Criteria and procedures for post construction Treatment Control and Hydromodification Control BMP repair, replacement, or re-vegetation.

## Privately-Owned BMPs – Annual O&M Verification



# PCBMP Inspection Checklist (Good Example)



## COUNTY OF VENTURA – PUBLIC WORKS AGENCY STORMWATER POST-CONSTRUCTION TRE INSPECTION CHECKLIST

Type of Device: Biofiltration With Underdrain Location of \_\_\_\_\_  
Date of Inspection: 12-13-2017 Inspector: Darin Yant  
Photos Taken:  Yes  No Quantity: 01

### Service Information:

#### **Biofiltration with Underdrain**

- Needs removal of litter and debris \_\_\_\_\_
- Needs to be swept \_\_\_\_\_
- Removal of accumulated sediment \_\_\_\_\_
- Reseed and/or apply mulch to damaged grass areas \_\_\_\_\_
- No Maintenance is needed at this time

Other repairs/maintenance necessary: \_\_\_\_\_

Additional Notes: \_\_\_\_\_

Is follow-up inspection needed?

- Yes  No

Darin Yant  
Inspector Signature

12-13-2017  
Date



# PCBMP Inspection Checklist (Bad Example)



**COUNTY OF VENTURA – PUBLIC WORKS AGENCY**  
**STORMWATER POST-CONSTRUCTION TREATMENT DEVICE**  
**INSPECTION CHECKLIST**

Type of Inspection:  Regular  Follow-up

Type of Device: Vortechs Model 5000, Infiltration Basin, Vegetated Swale Location of Device: S/E Corner of Facility

Date of Inspection: 12/22/2017 Inspector: Darin Yant

Photos Taken:  Yes  No Quantity: 06

**Vortech Model 5000 Service Information:**

- Provide documentation that trash and debris have been removed from vault compartments.
- Provide documentation that sediment in swirl chamber is less than 12 inches of accumulation.

**Infiltration Basin**

- Needs removal of vegetation from basin and banks at RCP inlets.
- Repair erosion to banks and bottom \_\_\_\_\_
- Clean/repair inlet ntrap and pilot channels \_\_\_\_\_
- Clean/repair outlet to prevent clogging \_\_\_\_\_
- Sediment accumulation of 25% or more of original depth (should be cleaned) \_\_\_\_\_
- Apply Mosquito abatement procedure \_\_\_\_\_

**Vegetated Swale**

- Needs removal of litter, debris and leaves \_\_\_\_\_ throughout \_\_\_\_\_
- Repair Erosion / Scouring \_\_\_\_\_
- Removal of accumulated sediment and debris \_\_\_\_\_ from manhole catch basins \_\_\_\_\_

**Other repairs/maintenance necessary:** Approximately 95% of the Vegetated Swale has died off and must be replanted or hydroseeded

**Outreach Material Given to Facility:** Contech Engineered Solutions Vortechs Guide- Operation, Design, Performance and Maintenance, VC Stormwater Post-Construction Treatment Device Operations & Maintenance

Is follow-up inspection needed?

Yes  No

Darin Yant  
Inspector Signature

1/4/2018  
Date



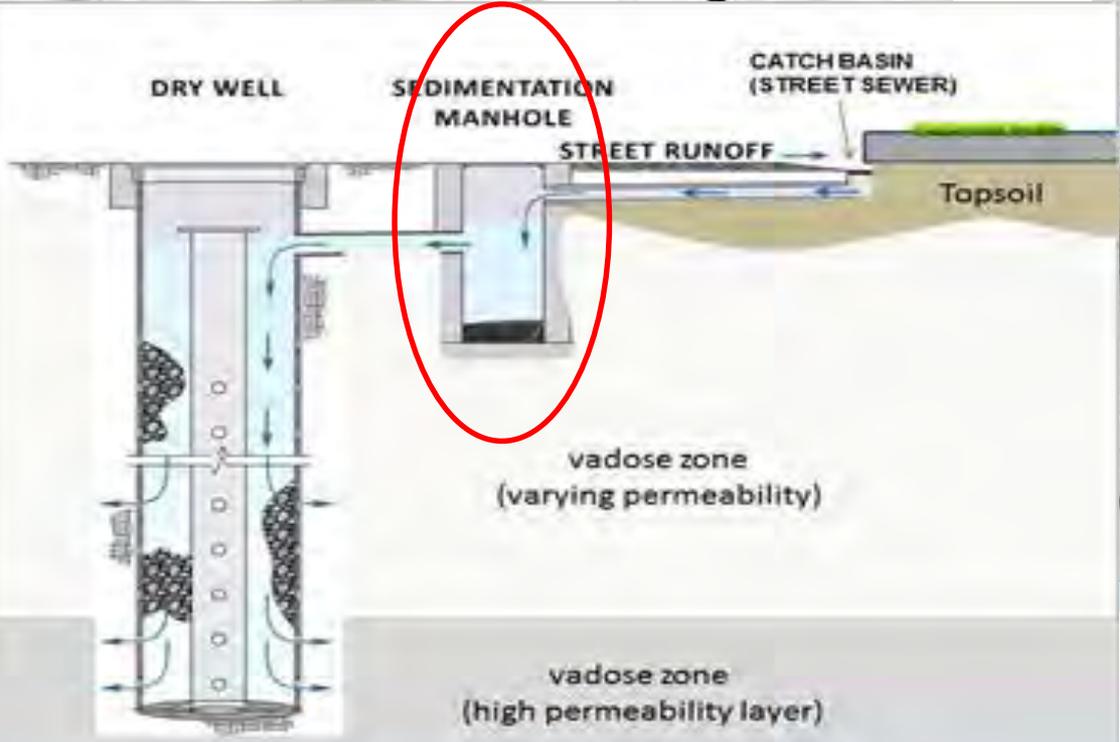
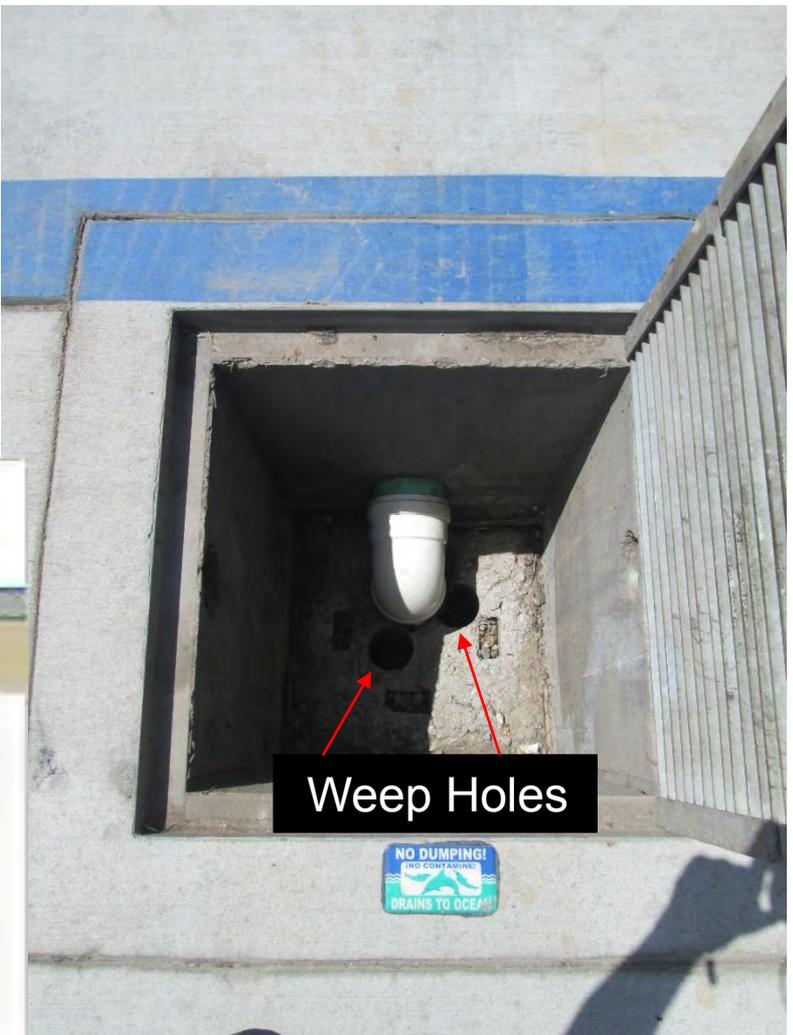
# Poor Maintenance

Vegetation Overgrown



Routine Trash Collection  
Not Occurring

# Poor Maintenance



# Poor Maintenance



# Initial Inspection vs Follow-up Inspection





# Construction vs O&M Costs

Project	Construction Cost	Impervious Acres Treated	Annual Maintenance Cost			Annual Cost per Impervious Acre	20-yr Project Life O&M Cost	20-yr Project Life Cost Avoidance for County
			County	Partner	Total			
Happy Valley Bioswale	\$378,089	20 Acres	-	\$15,000	\$26,280	\$1,314	\$525,600	\$300,000
			\$11,280	-				
Piru Stormwater Capture for Groundwater Recharge	\$289,700 (estimate)	25 Acres	-	\$14,400	\$34,400	\$1,376	\$688,000	\$288,000
			\$20,000	-				
Saticoy Subsurface Infiltration	\$750,000 (estimate)	32 Acres	-	\$3,000	\$23,000	\$719	\$460,000	\$810,000
			\$20,000	-				
Government Center Pervious Concrete	\$1,425,224	39 Acres	\$12,000	-	\$67,358	\$1,727	\$1,347,164	\$0 (no teaming)
			\$55,358	-				
Full Capture Trash Screens	\$92,023	665 Acres	\$55,237	-	\$55,237	\$83	\$1,104,740	\$0 (no teaming)
<b>TOTALS</b>	<b>\$2,935,036</b>	<b>781 Acres</b>			<b>\$206,275</b>		<b>\$4,125,504</b>	<b>\$1,398,000</b>

## Comparisons:

- Estimated \$1.4M cost avoidance due to partnerships
- Bioswale, Piru, & Pervious Concrete were grant funded → Additional \$2.67M cost avoidance
- Int'l BMP Database → O&M is \$400 - \$3,000 annually per impervious acre. Our projects are at the bottom end of that range

# Cost of Maintaining Green Infrastructure



ASCE

Edited by  
Jane Clary  
Holly Piza, P.E.



**PUBLIC**  
VENTURA COUNTY  
**WORKS**

Table 3-1. Summary of GI Maintenance Cost Estimates for Bioretention from 2016 Survey

Data source	Orig. year	BMP ID	Location	Normalized cost estimate			
				Area (sq ft)	\$ per BMP per year	\$ per sq ft per year	
Capitol Region WD	2009	Ar-McK	Saint Paul	MN	769	\$431	\$ 0.56
Capitol Region WD	2010	Ar-McK	Saint Paul	MN	769	\$765	\$ 1.00
Capitol Region WD	2009	Asbury N	Saint Paul	MN	945	\$383	\$ 0.41
Capitol Region WD	2010	Asbury N	Saint Paul	MN	945	\$903	\$ 0.96
Capitol Region WD	2009	Asbury S	Saint Paul	MN	1,719	\$713	\$ 0.41
Capitol Region WD	2010	Asbury S	Saint Paul	MN	1,719	\$997	\$ 0.58
Capitol Region WD	2009	Fr-McK	Saint Paul	MN	2,076	\$939	\$ 0.45
Capitol Region WD	2010	Fr-McK	Saint Paul	MN	2,076	\$890	\$ 0.43
Capitol Region WD	2009	Ham-Mid	Saint Paul	MN	10,756	\$456	\$ 0.04
Capitol Region WD	2010	Ham-Mid	Saint Paul	MN	10,756	\$2,332	\$ 0.22
Capitol Region WD	2009	Pascal C	Saint Paul	MN	534	\$792	\$ 1.48
Capitol Region WD	2010	Pascal C	Saint Paul	MN	534	\$906	\$ 1.70
Capitol Region WD	2009	Pascal N	Saint Paul	MN	357	\$469	\$ 1.31
Capitol Region WD	2010	Pascal N	Saint Paul	MN	357	\$224	\$ 0.63
Capitol Region WD	2009	Pascal S	Saint Paul	MN	706	\$582	\$ 0.82
Capitol Region WD	2010	Pascal S	Saint Paul	MN	706	\$348	\$ 0.49
Charlotte-Meck.	2006	Freedom	Charlotte	NC	6,300	\$180	\$ 0.03
Charlotte-Meck.	2007	Freedom	Charlotte	NC	6,300	\$1,911	\$ 0.30
Charlotte-Meck.	2009	Freedom	Charlotte	NC	6,300	\$1,319	\$ 0.21
Charlotte-Meck.	2010	Freedom	Charlotte	NC	6,300	\$306	\$ 0.05

Table 6-5. Normalized UNHSC Installation and Maintenance Cost Data

Parameter	Vegetated swale	Wet pond	Dry pond	Sand filter	Gravel wetland	Bioretention (3 sites)	Porous asphalt
Surface area (m <sup>2</sup> )	260	299	299	15	179	25 (2 sites) 218 (1 site)	523
WQ volume (m <sup>3</sup> )	97.7	97.7	97.7	97.7	97.7	97.7	13.3
Inflated 2012 capital cost	\$36,200	\$40,700	\$40,700	\$37,700	\$67,800	\$63,200	\$65,700
Maintenance-capital cost comparison (years) <sup>a</sup>	16	5	7	5	12	13	25
Personnel (h/year)	24	69	59	70	54	51	15
Personnel (\$/year)	\$2,030	\$7,560	\$5,880	\$6,940	\$5,280	\$4,670	\$939
Materials (\$/year)	\$247	\$272	\$272	\$272	\$272	\$272	\$-
Subcontractor cost (\$/year)	\$-	\$-	\$-	\$-	\$-	\$-	\$1,730
Annual O&M cost (\$/year)	\$2,280	\$7,830	\$6,150	\$7,210	\$5,550	\$4,940	\$2,670
Annual maintenance/capital cost (%)	6	19	15	19	8	8	4

<sup>a</sup>Number of years at which amortized maintenance costs equal capital construction costs

# Green Infrastructure Cost-Benefit Resources

<https://www.epa.gov/green-infrastructure/green-infrastructure-cost-benefit-resources>

## Cost Analysis

Cost comparison is the most common method for assessing the economic impacts of green infrastructure. The two basic approaches to cost analysis address:

- only initial construction costs; and
- life cycle costs, including planning, design, installation, operation and maintenance, and replacement.

Both approaches ignore the differences in performance between green infrastructure and gray infrastructure. As a result, they provide an incomplete basis for decision-making.

[Low Impact Design vs. Conventional Development \(PDF\)](#) (46 pp, 92 K, [About PDF](#)) [EXIT](#) —This report compares the construction costs of conventional and low impact development (LID) approaches for nine subdivisions in the United States and Auckland, New Zealand.

[Pembroke Woods: Lessons Learned in the Design and Construction of an LID Subdivision \(PDF\)](#) (9 pp, 285 K, [About PDF](#)) [EXIT](#) —This case study of a 43-acre residential subdivision in Frederick County, Maryland, documents the cost savings achieved by adopting a green infrastructure approach. Cost savings were realized by:

- eliminating the need for stormwater management ponds;
- reducing the extent of clearing, grubbing, and paving; and
- adding two additional lots.

[Changing Cost Perceptions: An Analysis of Conservation Development \(PDF\)](#) (6 pp, 130 K, [About PDF](#)) [EXIT](#) —This report prepared for the Illinois Conservation Foundation and Chicago Wilderness compares the stormwater management costs of conservation development with those of conventional development. It defines conservation development as an approach that "addresses stormwater on-site by distributing water across the landscape."

[Low Impact Development at the Local Level: Developers' Experiences and City and County Support \(PDF\)](#) (22 pp, 233 K, [About PDF](#)) [EXIT](#) —This report by ECONorthwest focuses on two aspects of LID adoption at the local level: the experiences that developers have had with LID, and actions that local jurisdictions can take to increase LID use.

## Cost-Benefit Analysis

Cost-benefit analysis is more complicated than cost analysis, but also provides a more complete basis for decision-making. It considers costs as well as environmental, social, and public health outcomes of alternative management approaches. The result is more complete information on the benefits associated with different stormwater control options.

Review this sampling of cost-benefit analyses conducted by cities and research institutions to identify a methodology that could be applied to your community.

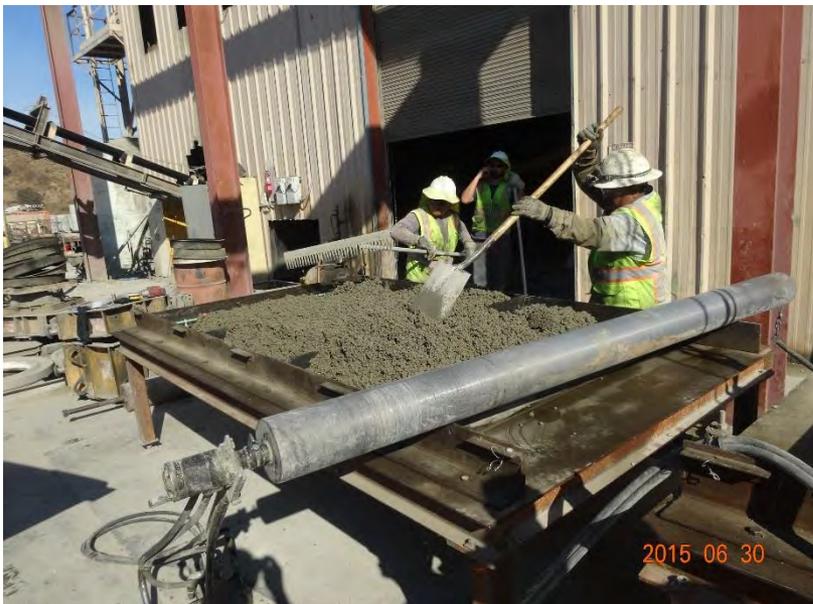
[The Economic Benefits of Green Infrastructure: A Case Study of Lancaster, PA](#)—This case study estimates the value of several of the cost benefits of Lancaster's Green Infrastructure Plan. It highlights the importance of including the multiple benefits of green infrastructure in cost-benefit assessments and adding green infrastructure into planned improvement projects.

[Case Studies Analyzing the Economic Benefits of Low Impact Development and Green Infrastructure Programs](#)—This EPA report summarizes 13 economic benefit analyses conducted by public entities across the country to assess the effectiveness of their green infrastructure programs. The case studies represent a range of methodologies, geographic contexts, and municipal program types.

[The Economics of Low Impact Development: A Literature Review \(PDF\)](#) (40 pp, 429 K, [About PDF](#)) [EXIT](#) —This literature review summarizes the benefits of LID, methodologies for assessing the economic impact of LID, and results of more than 50 studies.

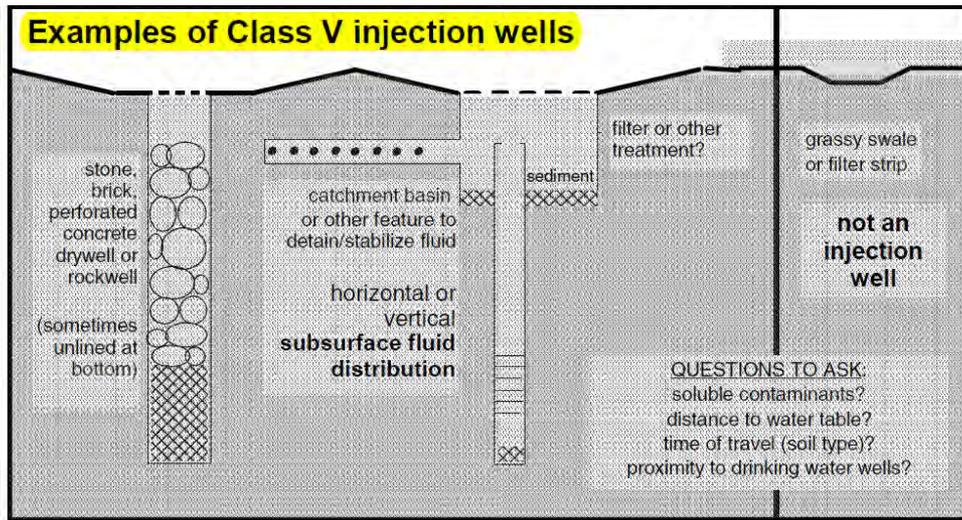
[NYC Green Infrastructure Plan: A Sustainable Strategy for Clean Waterways \(PDF\)](#) (16 pp, 2.7 MB, [About PDF](#)) —In this plan released by New York City, the modeling results indicate that a combined sewer overflow (CSO) reduction strategy that combines green and gray infrastructure can yield greater reductions in CSO volumes at a lower cost than an all-gray strategy while providing more community benefits.

# Pervious Concrete Construction



# Other Regs – BMPs as Class V Injection Wells

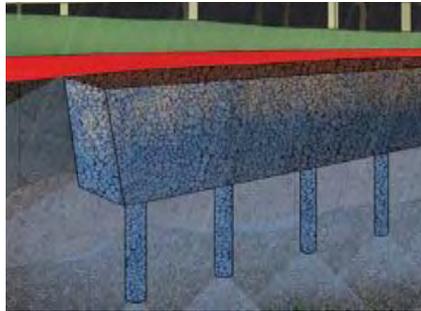
<https://www.epa.gov/uic/underground-injection-control-region-9-az-ca-hi-nv-mp-gu>



**What are the requirements in California for owners and operators of Class V injection wells?**

- 1. Submit an Inventory Form** to EPA for all Class V injection wells. The inventory form registers the ownership and liability for the wells and notes their approximate location. **Complying with the inventory requirement means you are "authorized by rule" to continue injecting unless EPA requires more information, a permit, or closure of your well(s).** For a copy of the inventory form, contact EPA Region 9. *40 CFR 144.26*

## U.S. Environmental Protection Agency, Region 9 Underground Injection Control Program (WTR-9)



*Infiltration Trenches*

**...FROM THE REGULATIONS**

(Injection) Well means: A bored, drilled, or driven shaft whose depth is greater than the largest surface dimension; or, a dug hole whose depth is greater than the largest surface dimension; or, an improved sinkhole; or, a subsurface fluid distribution system.

Subsurface fluid distribution system means an assemblage of perforated pipes, drain tiles, or other similar mechanisms intended to distribute fluids below the surface of the ground. *40 CFR 144.3*

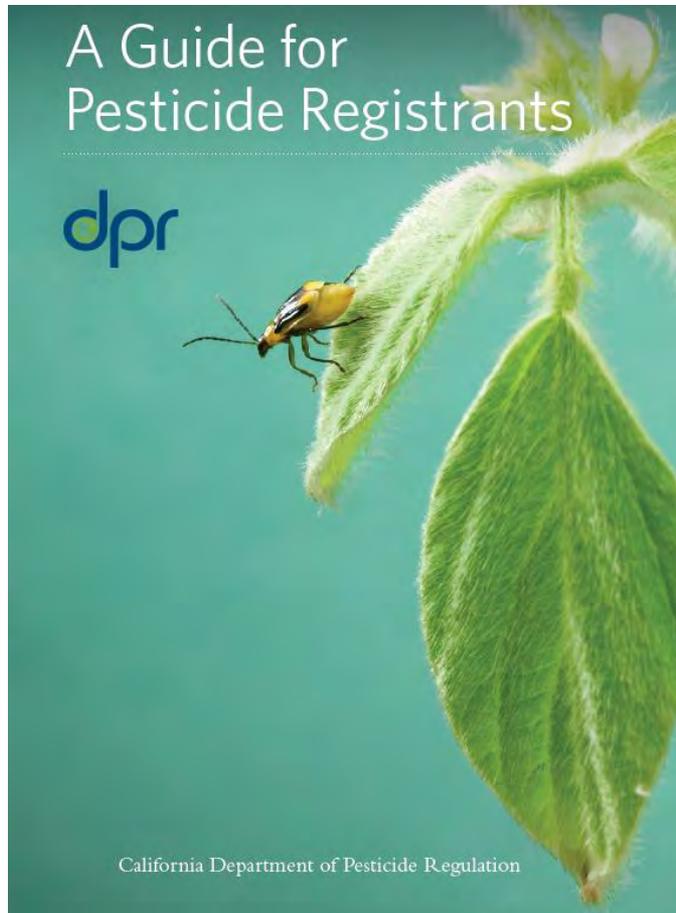
Infiltration trenches are shallow excavated trenches backfilled with gravel to create an underground reservoir (see Figure 5). Most infiltration trenches are wider at their largest surface dimension than they are deep, **and thus are not classified as Class V injection wells.** They are discussed here simply for completeness. **Variations in infiltration trench design may include vertical fluid distribution pipes placed in the bottom of the trench (so called "infiltration galleries").** Because these vertical pipes meet the criterion of being deeper than they are wide, an infiltration trench with this configuration **would** be classified as a Class V injection well.



# Other Regulations - Antimicrobials

Products claiming to **KILL** bacteria in stormwater are illegal unless certified by CalDPR

An **antimicrobial** is an agent that kills microorganisms or stops their growth.



## Does My Product/Device Require California Registration?

### What is a Pesticide?

[California Food and Agricultural Code \(FAC\) section 12753](#) defines a pesticide as any of the following:

- (1) Any substance or mixture of substances which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest, as defined in FAC Section 12754.5, which may infest or be detrimental to vegetation, man, animals, or households, or be present in any agricultural or nonagricultural environment whatsoever.
- (2) Any spray adjuvant.

Further, a "pest" is defined in [FAC section 12754.5](#) as any of the following that is, or is liable to become, dangerous or detrimental to the agricultural or nonagricultural environment of the state:

- Any insect, predatory animal, rodent, nematode, or weed.
- Any form of terrestrial, aquatic, or aerial plant or animal, virus, fungus, bacteria, or other microorganism (except viruses, fungi, bacteria, or other microorganisms on or in living man or other living animals).
- Anything that the director, by regulation, declares to be a pest.

A product requires registration in California if:

- (1) The U.S. Environmental Protection Agency (U.S. EPA) Office of Pesticide Programs requires registration of the product (excluding [Plant Incorporated Protectants](#)) and the product is sold, distributed, or used in California.
- (2) California law requires registration of the product even if U.S. EPA does not (e.g., [spray adjuvants](#), [structural pest control devices](#), certain [FIFRA 25\(b\) products](#)).



# Questions?

Presented and  
Sponsored By:



*Ventura Countywide  
Stormwater Quality  
Management Program*



# Thank you for Participating!