

# SANTA SUSANA FIELD LABORATORY



## PUBLIC MEETING SITE-WIDE SUMMARY OF ACTIVITIES

March 21, 2017

SSFL Surface Water Expert Panel

With support from  
**Geosyntec**  
consultants

# Outline

2

- Expert Panel Introduction
- NPDES Permit Overview
- BMP Strategies
- Questions of Interest:
  1. What has recent water quality been like?
  2. What is SSFL doing to improve water quality?
  3. How are the BMPs working?
  4. What's causing the remaining NPDES exceedances?

# Expert Panel Introduction

3

- Dr. Bob Gearheart, Humboldt State University
- Jon Jones, Wright Water Engineers
- Dr. Michael Josselyn, WRA Consultants
- Dr. Bob Pitt, University of Alabama
- Dr. Michael Stenstrom, Univ. California, Los Angeles
- *Panel consultant: Geosyntec (Brandon Steets, Megan Otto)*



# Expert Panel Introduction

4

- **Independent Expert Panel** was engaged with Regional Board consent to oversee stormwater BMP planning, as well as provide input on monitoring, source removal, and various NPDES permit issues
- **Mission:** Improve stormwater quality at outfalls site-wide
- **Additional responsibilities:** Oversee scientific studies and interface with the Regional Board and public on risk and science communication

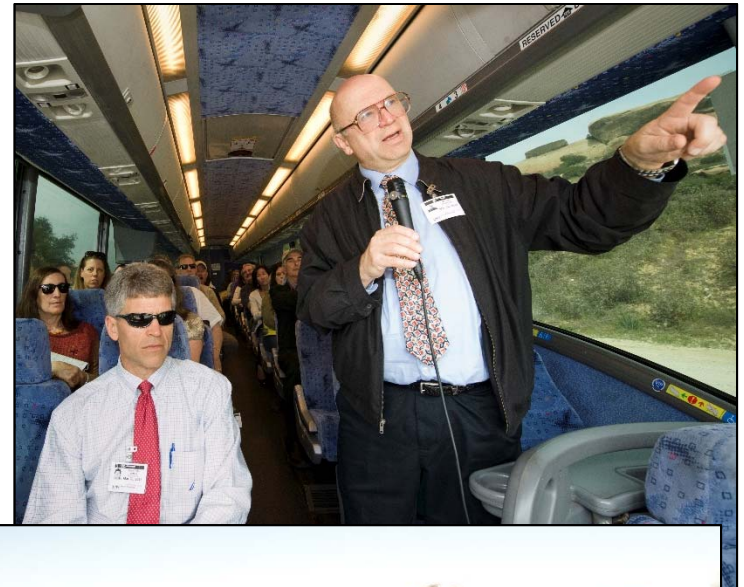




# Panel's On-Going Role and Scope

5

- Review NPDES compliance and BMP performance monitoring data
- Make recommendations for new BMPs or improvements to existing BMPs
- Review Stormwater Human Health Risk Assessment (HHRA)
- Investigate stormwater pollutant sources in OF009 watershed
- Public outreach



# NPDES Permit Overview

6

- Stormwater discharges at SSFL are regulated by the LARWQCB through an individual NPDES permit, which requires:
  - ▣ Composite sampling at outfalls during storms, and
  - ▣ Compliance with Numeric Effluent Limits (NELs) – protective of both human health and aquatic life
- NELs for a wide range of constituents, including:
  - ▣ Dioxins (TCDD TEQ): 0.000000028 µg/L (ppb)
  - ▣ Total Copper: 14 µg/L (ppb)
  - ▣ Total Lead: 5.2 µg/L (ppb)

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
LOS ANGELES REGION  
200 W. 4<sup>th</sup> Street, Suite 500, Los Angeles, California 90012  
Phone: 213.276.4600 • Fax: 213.276.4640  
http://www.cwrqcb.org

ORDER NO. RA-2010-0090  
NPDES NO. CA6001309

WASTE DISCHARGE REQUIREMENTS FOR THE BOEING COMPANY,  
SANTA SUSANA FIELD LABORATORY

The following Discharger is subject to waste discharge requirements as set forth in this Order:

**Table 1 Discharger Information**

Discharger	The Boeing Company
Name of Facility	Santa Susana Field Laboratory
Facility Address	5500 Woolsey Canyon Road Canoga Park, CA 91304-1143
	Ventura County

The U.S. Environmental Protection Agency (USEPA) and the Regional Water Quality Control Board have classified this discharge as a minor discharge.

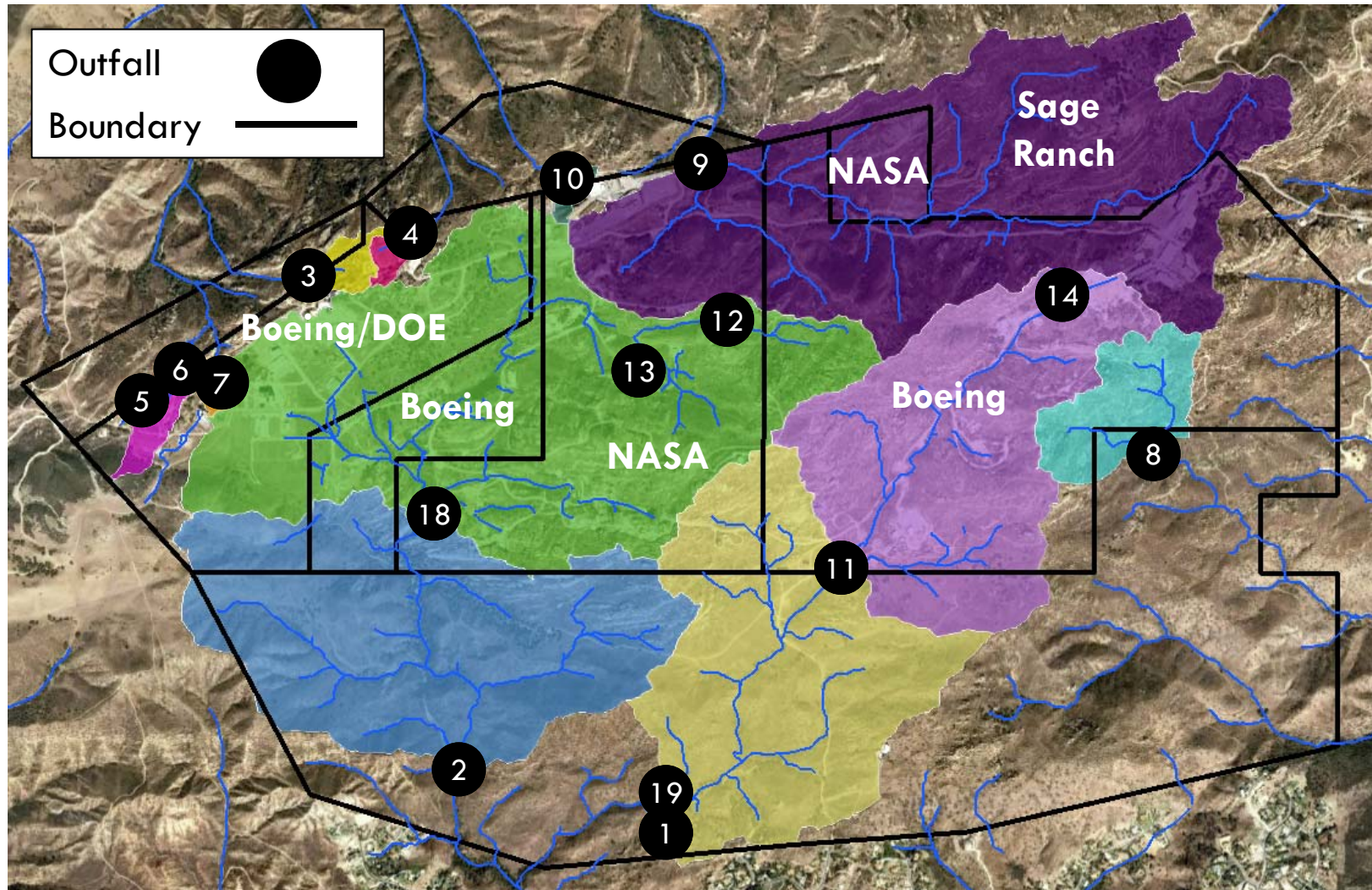
The discharge by the Owner from the discharge points identified below is subject to waste discharge requirements as set forth in this Order:

April 6, 2010  
Revised: May 20, 2010  
Revised: June 3, 2010



# SSFL NPDES Outfalls

7



# Monitored Parameters

**32-44** parameters are analyzed at **every** surface water outfall during **every** storm that produces runoff.

Over **250** parameters are analyzed at **every** outfall at least **once** annually.

1,1,1-Trichloroethane	Acrolein	Chlordane	Lindane (gamma-BHC)
1,1,2,2-Tetrachloroethane	Acrylonitrile	Chlorobenzene	Magnesium
1,1,2-Trichloroethane	Aldrin	Chloroethane	Magnesium, Dissolved
1,1-Dichloroethane	alpha-BHC	Chloroform	Mercury, dissolved
1,1-Dichloroethene	Aluminum	Chloroform (Trichloromethane)	Methoxychlor
1,2,3,4-Tetrachloroethane	beta-BHC	Chloroform (Trichloromethane)	beta-BHC
1,2,3,4-Tetrachloroethane	bis (2-Chloroethyl) ether	Fluoranthene	Fluoranthene
1,2,3,4-Tetrachloroethane	bis (2-ethylhexyl) Phthalate	Fluorene	Fluorene
1,2,3,4-Tetrachloroethane	bis(2-Chloroethoxy) methane	gamma-BHC (Lindane)	gamma-BHC (Lindane)
1,2,3,4-Tetrachloroethane	bis(2-Chloroethoxy)methane	Gross Alpha Analytes	Gross Alpha Analytes
1,2,3,4-Tetrachloroethane	bis(2-Chloroethyl)ether	Gross Beta Analytes	Gross Beta Analytes
1,2-D	bis(2-Chloroisopropyl) ether	Hardness	Hardness
1,2-D	bis(2-Ethylhexyl)phthalate	Hardness as CaCO3	Hardness as CaCO3
1,2-D	Boron, dissolved	Hardness as CaCO3, dissolved	Hardness as CaCO3, dissolved
1,3-D	Bromodichloromethane	Hardness, dissolved	Hardness, dissolved
1,4-D	Bromoform	Heptachlor	Heptachlor
2,2'-d	Bromomethane	Heptachlor epoxide	Heptachlor epoxide
2,3,4,	Bromomethane (Methyl Bromide)	Hexachlorobenzene	Hexachlorobenzene
2,3,4,	Butyl benzylphthalate	Hexachlorobutadiene	Hexachlorobutadiene
2,3,7,	Butylbenzylphthalate	Hexachlorocyclopentadiene	Hexachlorocyclopentadiene
2,4,5-	Cadmium, dissolved	Hexachloroethane	Hexachloroethane
2,4,6-	Calcium	Indeno(1,2,3-cd)pyrene	Indeno(1,2,3-cd)pyrene
2,4-D	Calcium, Dissolved	Iron	Iron
2,4-D	Carbon Tetrachloride	Iron, dissolved	Iron, dissolved
2,4-D	Cesium 137	Isophorone	Isophorone
2,6-D	Cesium-137	Lead, dissolved	Lead, dissolved
2-But	4-Chloroaniline	Vinyl chloride	Vinyl chloride
2-Chl	4-Chlorophenyl phenyl ether	Xylene (total)	Xylene (total)
2-Chl	4-Chlorophenylphenylether	Xylenes (Total)	Xylenes (Total)
2-Chl	4-Nitrophenol	Zinc	Zinc
2-Met	Acenaphthene	Zinc, Dissolved	Zinc, Dissolved
2-Met	Acenaphthylene		
2-Nitr			
3,3'-d			
3,3'-d			
4,4'-d			
4,4'-d			
4,4'-d			
4,4'-d			
4,4'-d			
4,6-D			
4-Bro			
4-Chl			
4-Chloroaniline	Cadmium, dissolved	Hexachloroethane	Vinyl chloride
4-Chlorophenyl phenyl ether	Calcium	Indeno(1,2,3-cd)pyrene	Xylene (total)
4-Chlorophenylphenylether	Calcium, Dissolved	Iron	Xylenes (Total)
4-Nitrophenol	Carbon Tetrachloride	Iron, dissolved	Zinc
Acenaphthene	Cesium 137	Isophorone	Zinc, Dissolved
Acenaphthylene	Cesium-137	Lead, dissolved	



# BMP Strategy for 008/009 Watersheds

9

Unlike other outfalls, “end of pipe” stormwater treatment was not possible here without constructing environmentally-intrusive dams. So instead a **distributed, watershed-based approach** was implemented. Emphases were:

- **008:** source removal, erosion control, and restoration
- **009:** the same, plus distributed treatment controls

## **Additional elements of this approach:**

- **Iterative & adaptive** – Each year new recommendations are made based on evaluation of new monitoring data
- **Low Maintenance** – Prioritized solutions that require minimal long-term maintenance
- **Redundancy** – Multipronged approach provides redundancy and is expected to be more effective

# 008/009 Multi-Pronged Approach

10

## □ **Source Controls**

- ISRA soil removal
- Pavement and building removal

## □ **Erosion/Sediment Controls and Restoration**

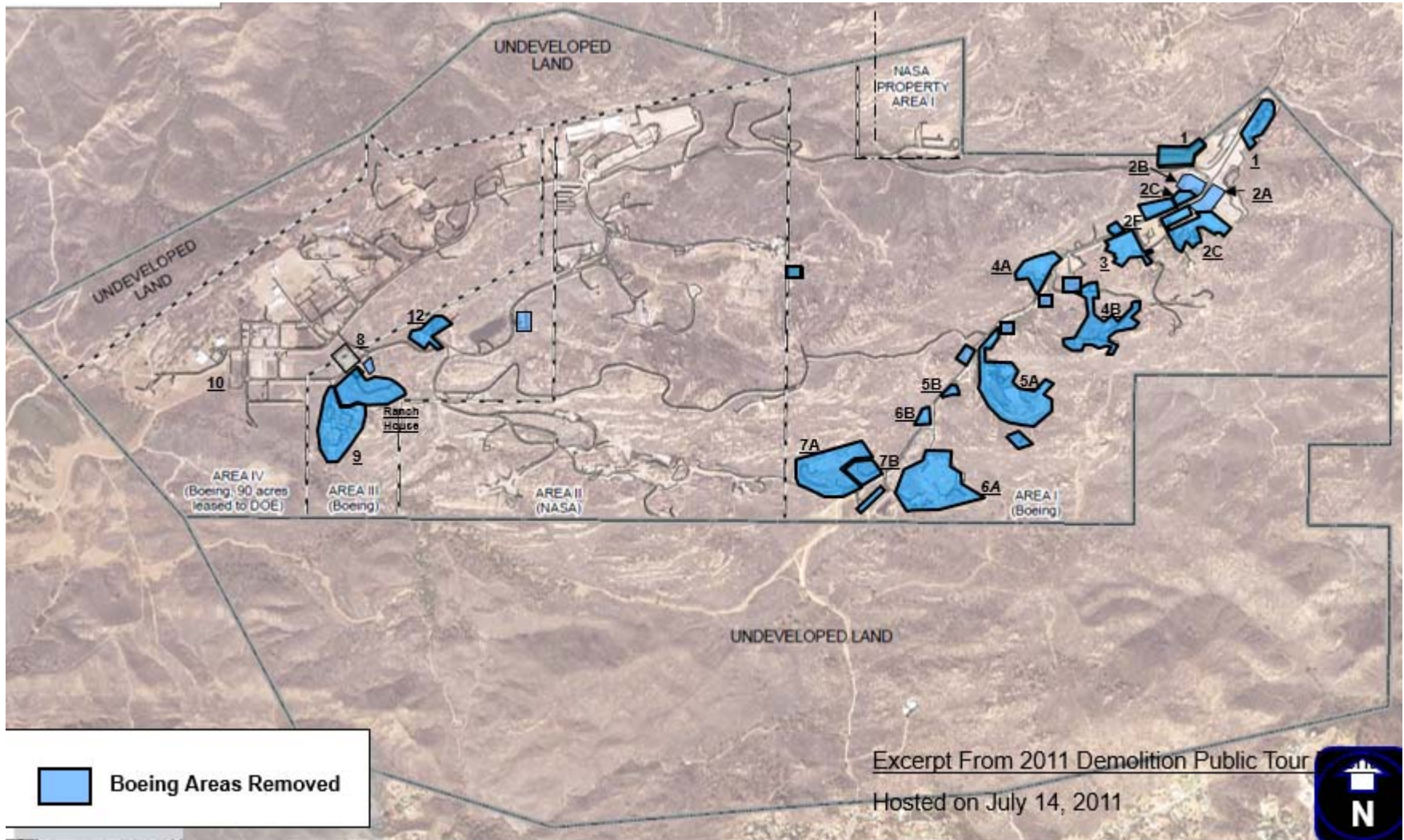
- Hydroseed/mulch, plantings, etc.
- Dirt road controls
- Channel stabilization controls

## □ **Treatment Controls**

- Flow-through media filters
  - Culvert modifications
  - B1, Upper Lot media filters
  - Sedimentation basin and biofilter
  - ELV treatment BMP
- Detention bioswales
- Temporary sedimentation areas (LOX, helipad)

# Boeing Demo Areas

11





# CTL3 - Before and After



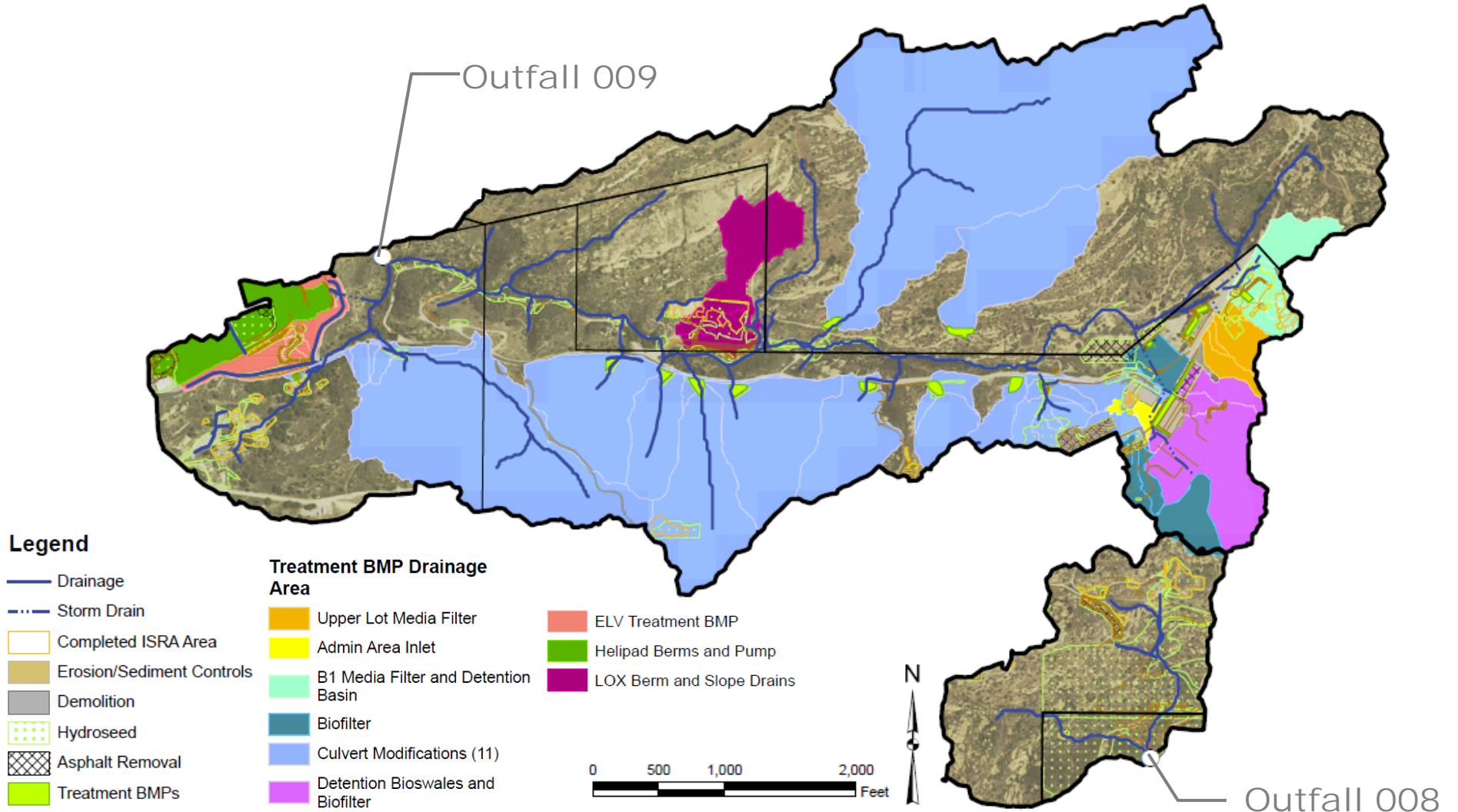


# CTL3 - Yesterday (3/20/17)

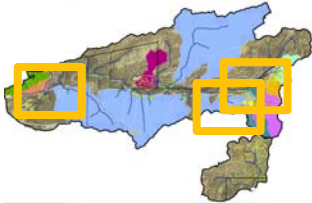




# 008/009 Treated Areas



# Example 009 BMPs



**11 Culvert Modifications**



**Sedimentation Basin and Biofilter**



**Expendable Launch Vehicle (ELV) Treatment BMP**



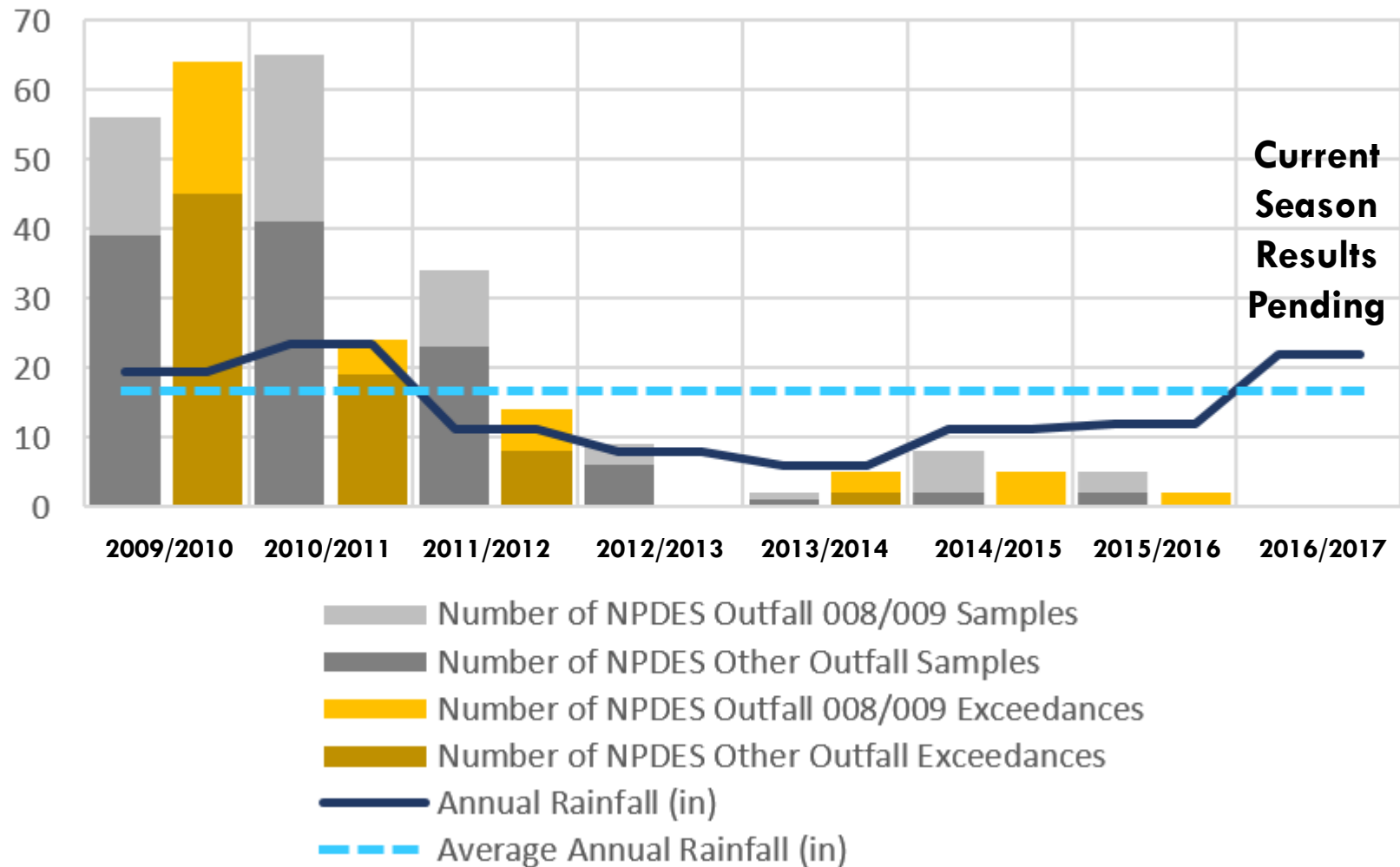


# Recent Stormwater Quality



# Historical Overview – NPDES Sampling: All SSFL Outfalls

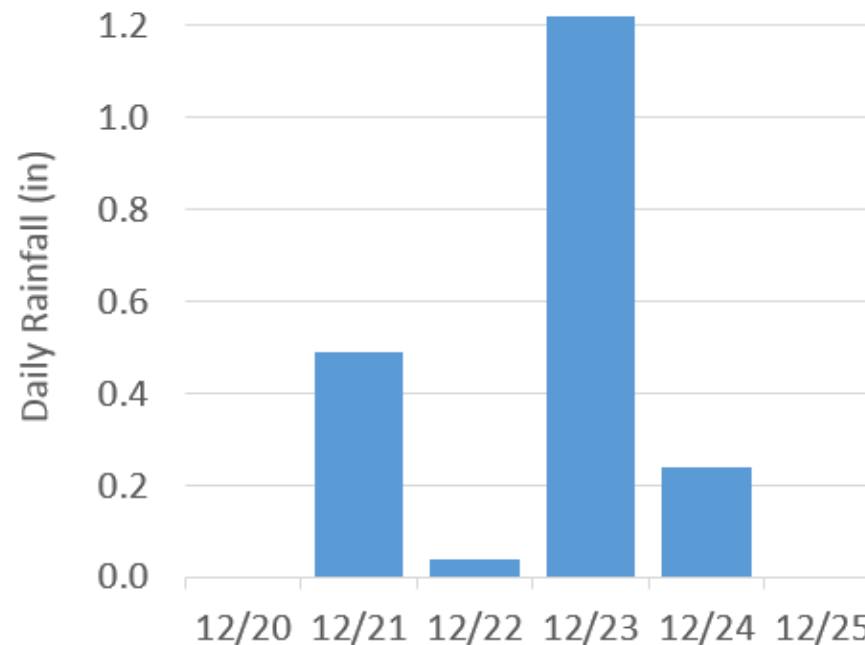
17



# December 22-27, 2016

18

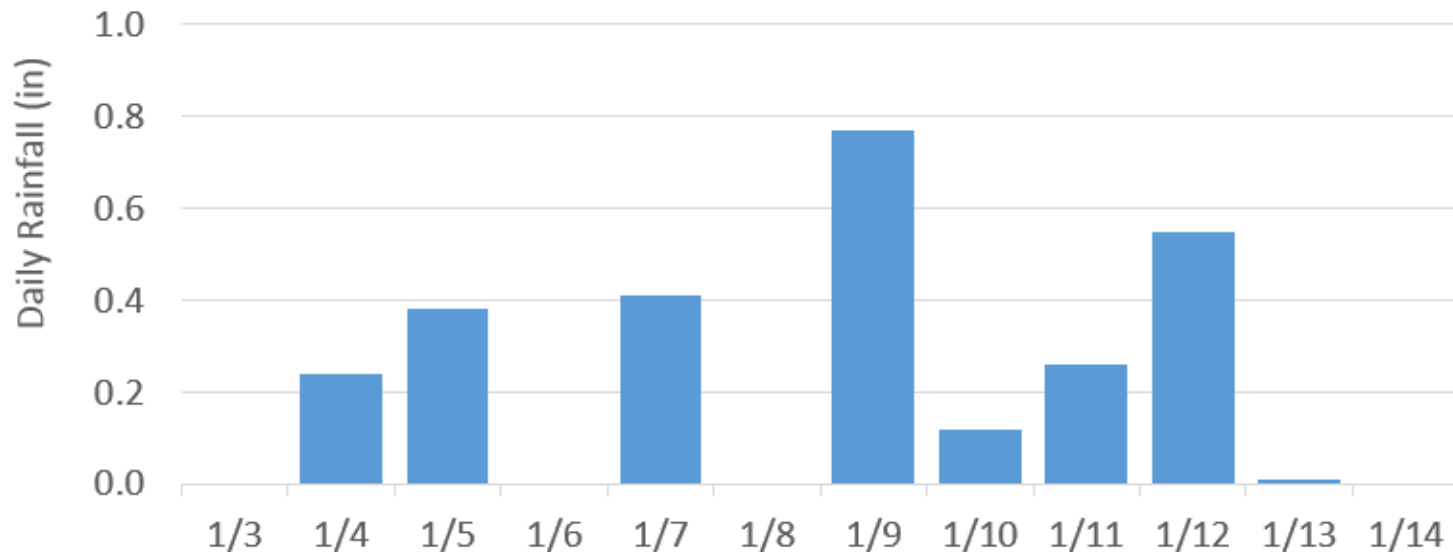
- Total rainfall = 1.99-in
- Outfall 009 only flowed
  - ▣ Sampled December 24<sup>th</sup> and 25<sup>th</sup> (grab and composite)
  - ▣ **No exceedances**



# January 4-13, 2017

19

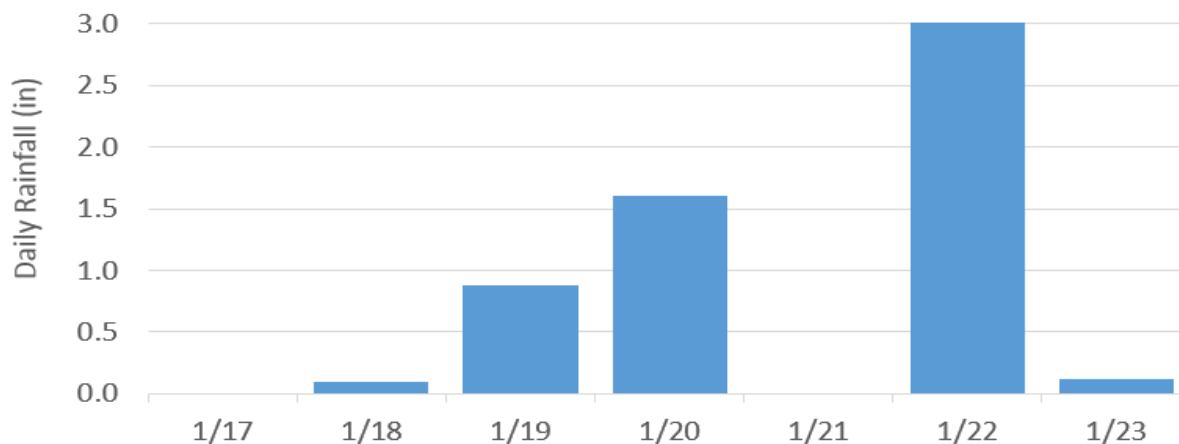
- Total rainfall = 2.74-in
- Outfall 009 only flowed
  - ▣ Sampled January 9<sup>th</sup> and 10<sup>th</sup> (grab and composite)
  - ▣ **No exceedances**



# January 18-23, 2017

20

- Total rainfall = 5.70-in
- Outfalls 001, 002, 006, 008, 009, 011, and 018 flowed
- Only Outfall 008 and 009 results available/validated
- Outfall 009
  - ▣ Sampled January 19-21 (grab and composite)
  - ▣ **No exceedances**
- Outfall 008
  - ▣ Sampled January 20-21 (grab and composite)
  - ▣ One exceedance: Field pH = 6.2

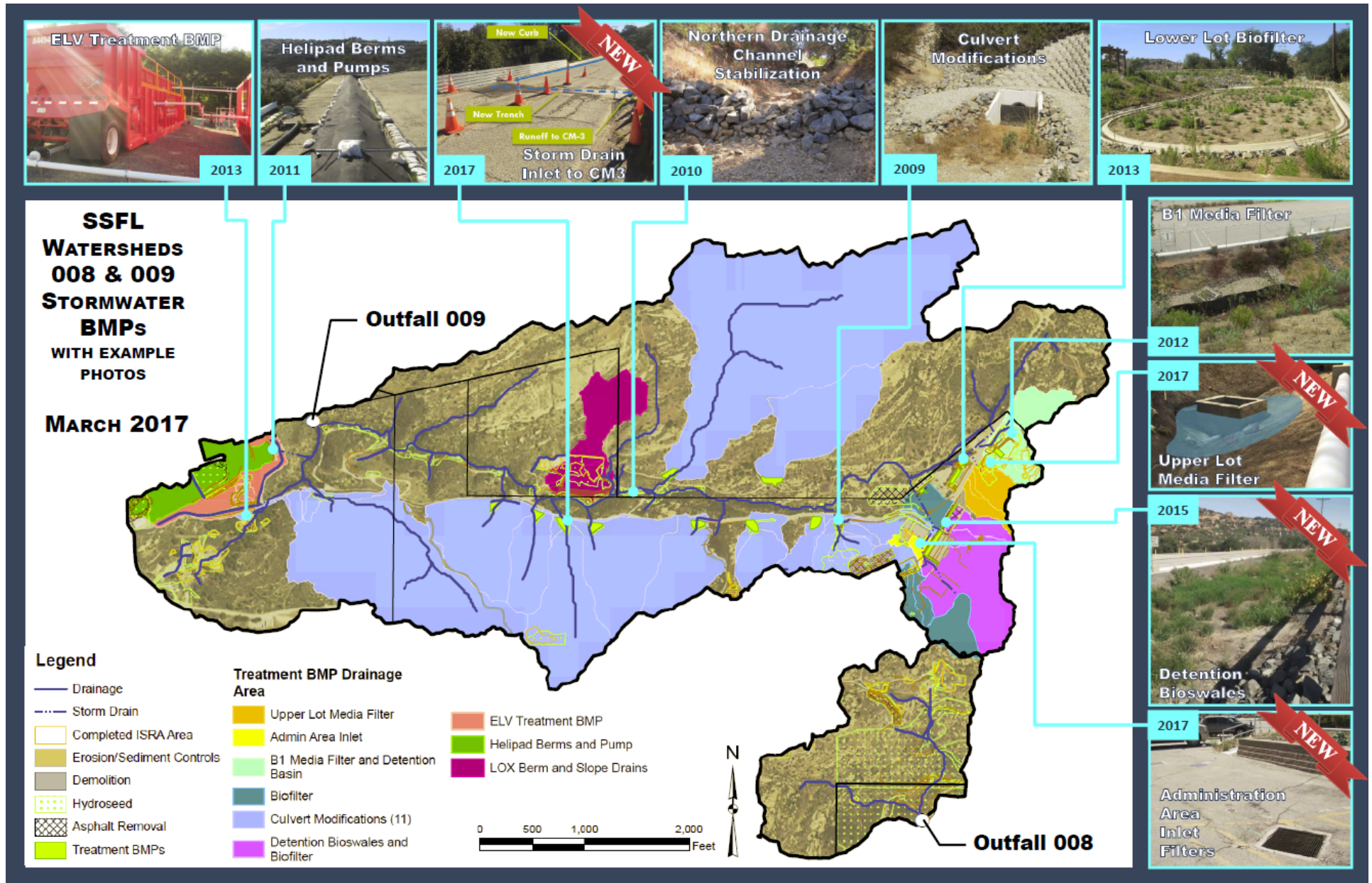




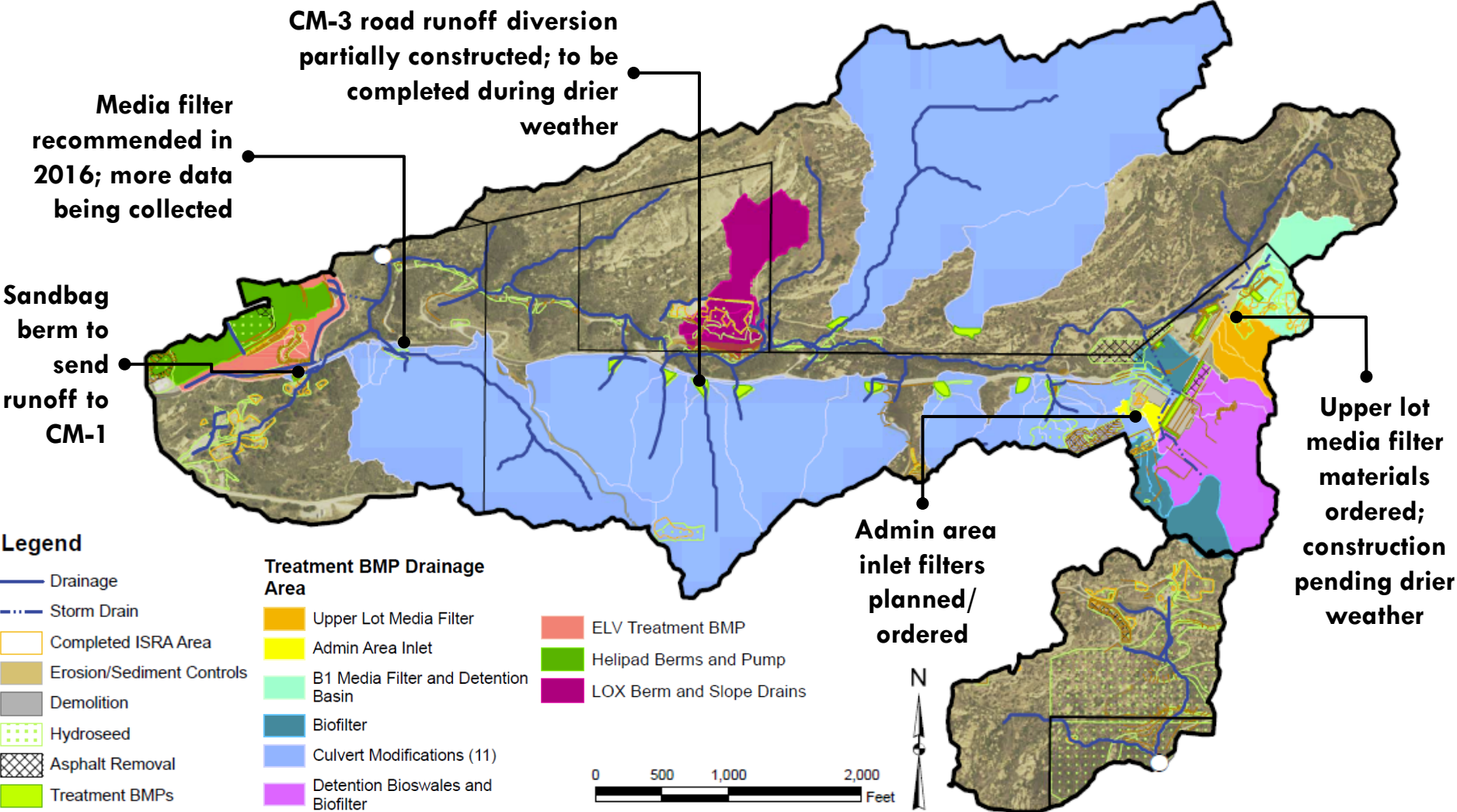


# Recent Activities

# Existing BMPs in 008 and 009 Watersheds



# Most Recently Installed BMPs





# Detention Bioswales



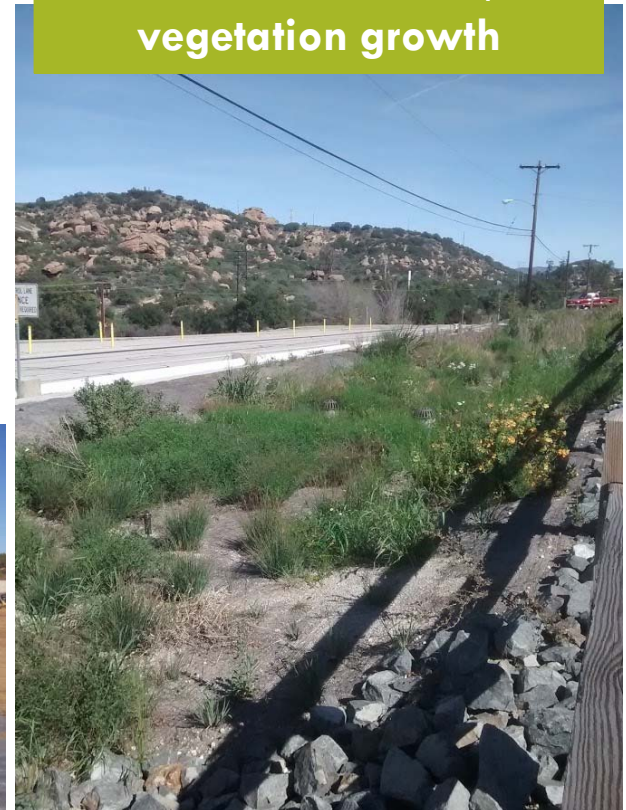
24



During construction

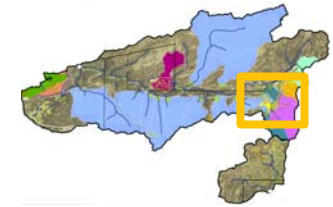


After construction/  
vegetation growth

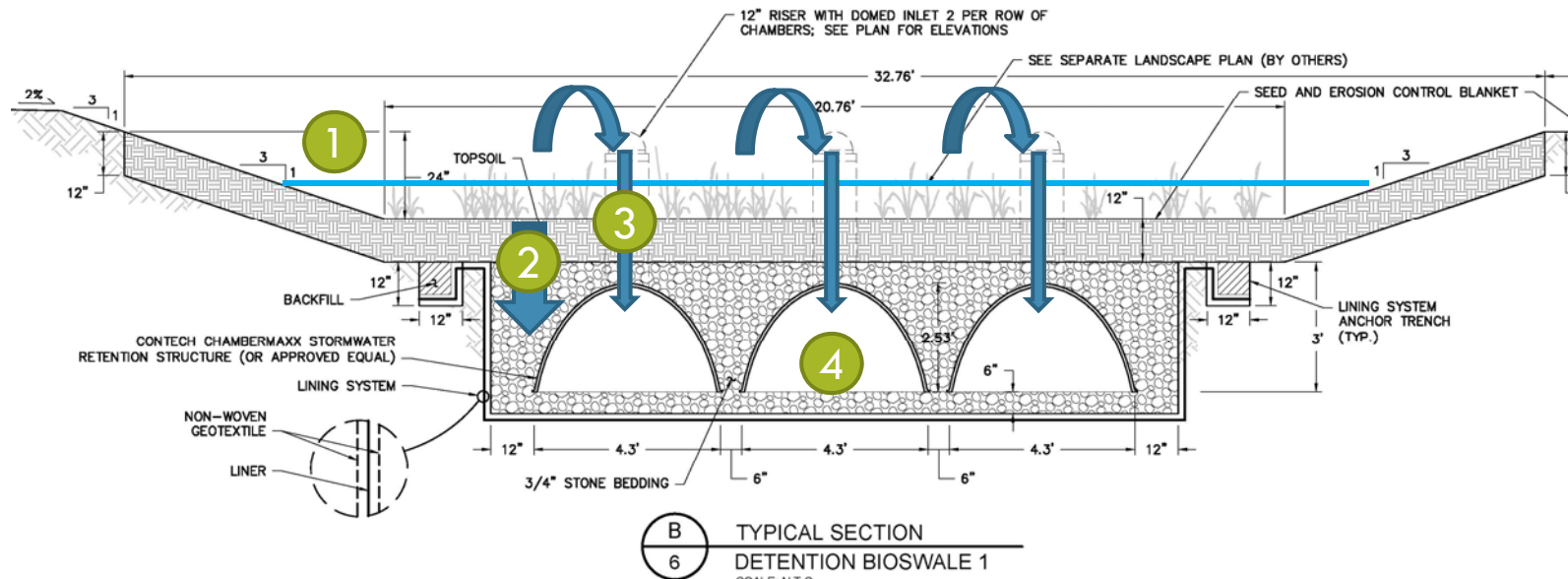




# Detention Bioswales



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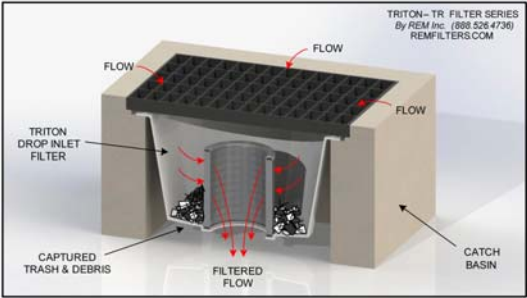
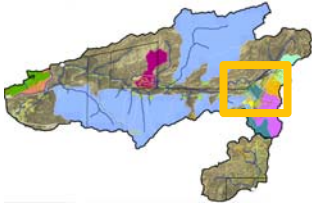


**Concept:** Hold runoff from upper lot until lower lot runoff is treated, then slowly release for downstream treatment by biofilter.

## How it works:

- 1 Stormwater enters the bioswale and ponds on the surface.
- 2 Stormwater infiltrates into the soil and stone reservoir and chambers below.
- 3 When water ponding exceeds the height of the risers, stormwater flows directly into subsurface chambers.
- 4 The chambers slowly drain to the storm drain and lower lot biofilter.

# Administration Area Inlet Filters



**Drop Inlet Filters filled with Site Media (Sand, GAC, Zeolite)**

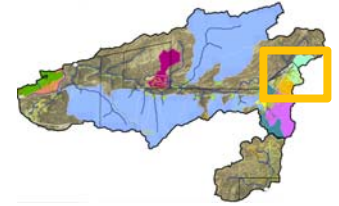


**Weighted Wattle filled with proprietary media (Perlite, GAC, Zeolite)**

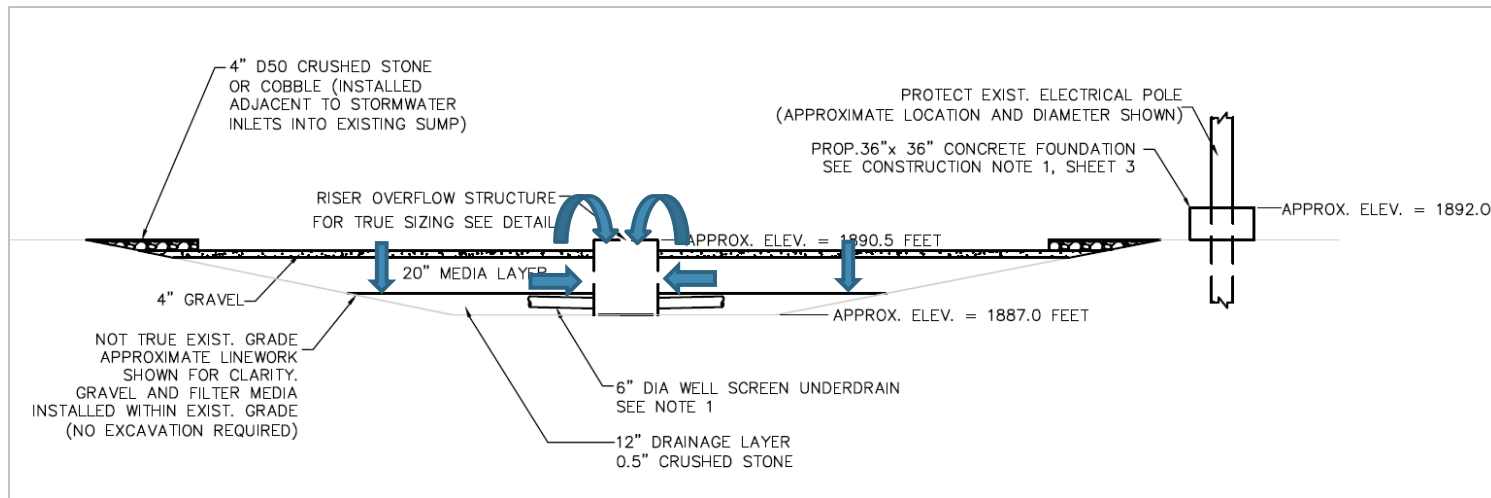


**Sandbag berm to increase settling of solids**

# Upper Parking Lot Media Filter



27



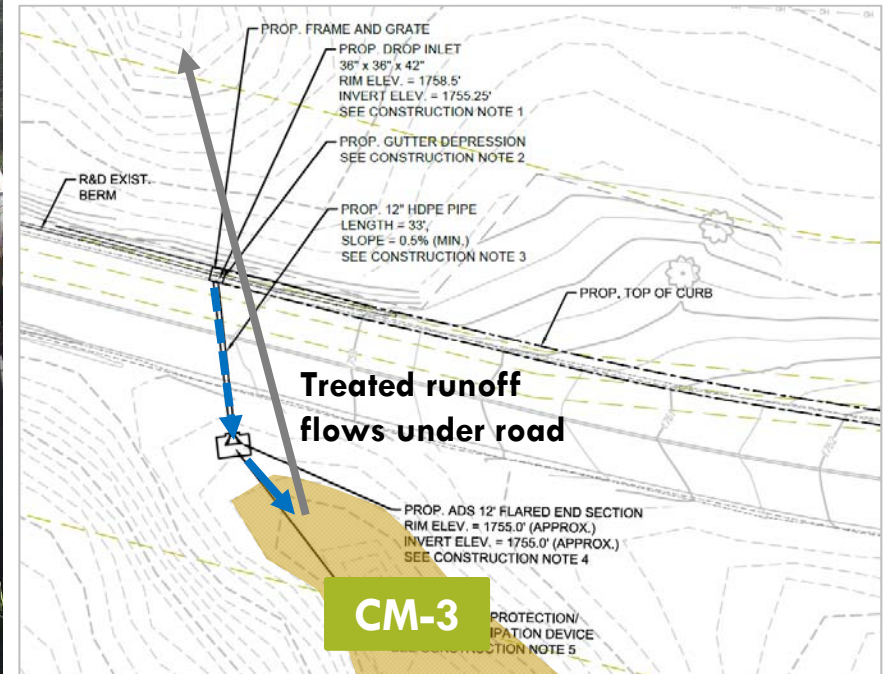
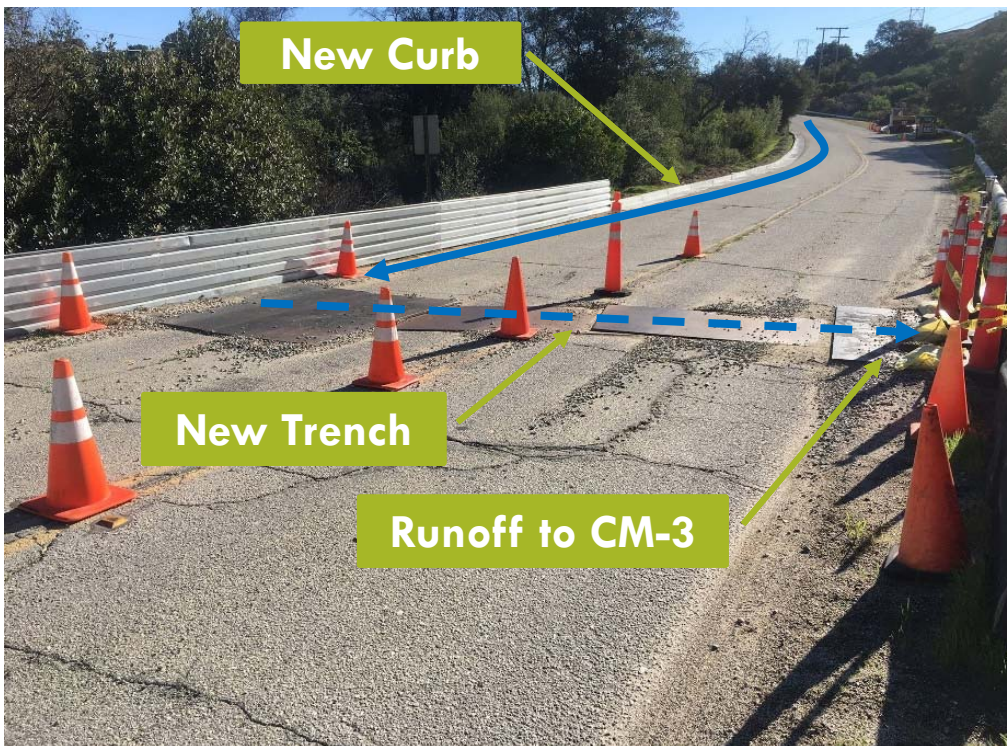


# New Road Runoff Inlet to CM-3



28

Currently under construction; completion pending extended period of dry weather

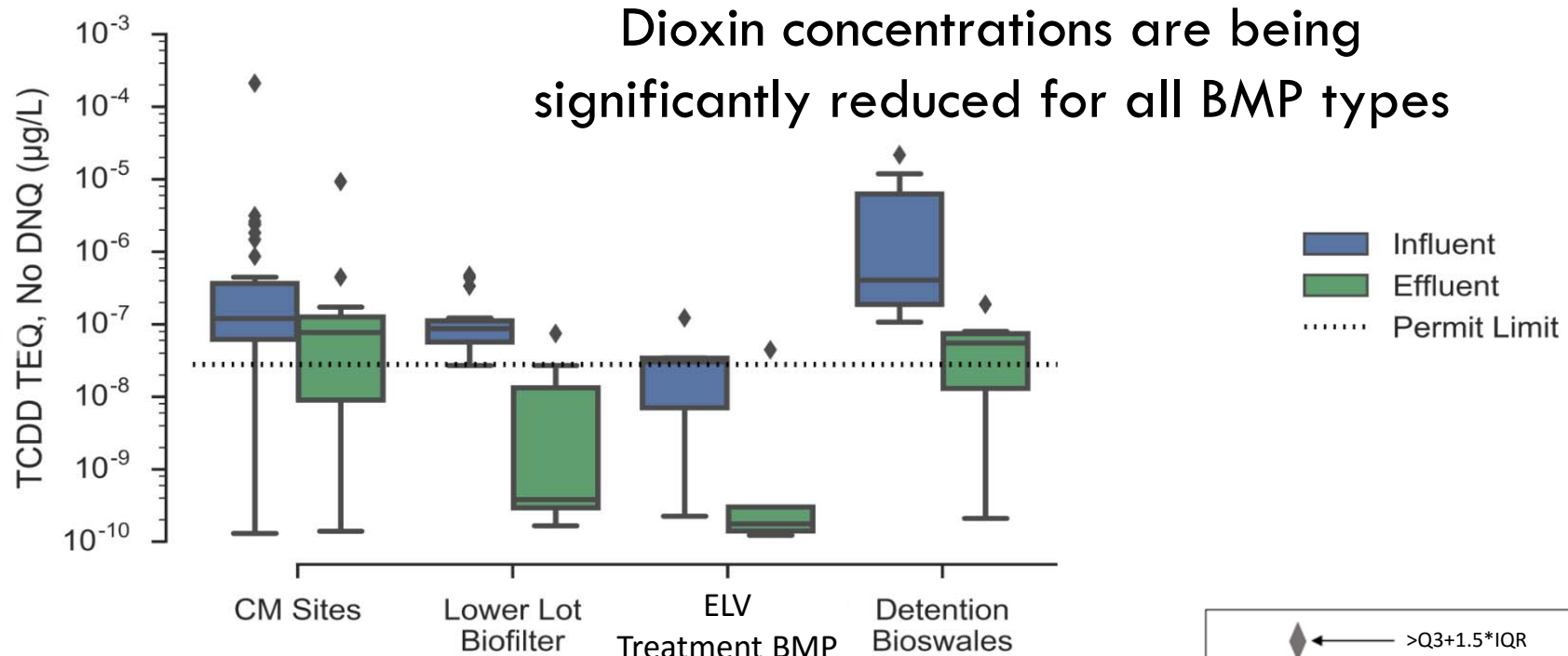




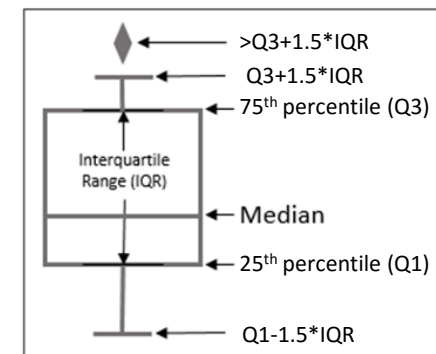
# BMP Performance



# BMP Performance: Dioxins

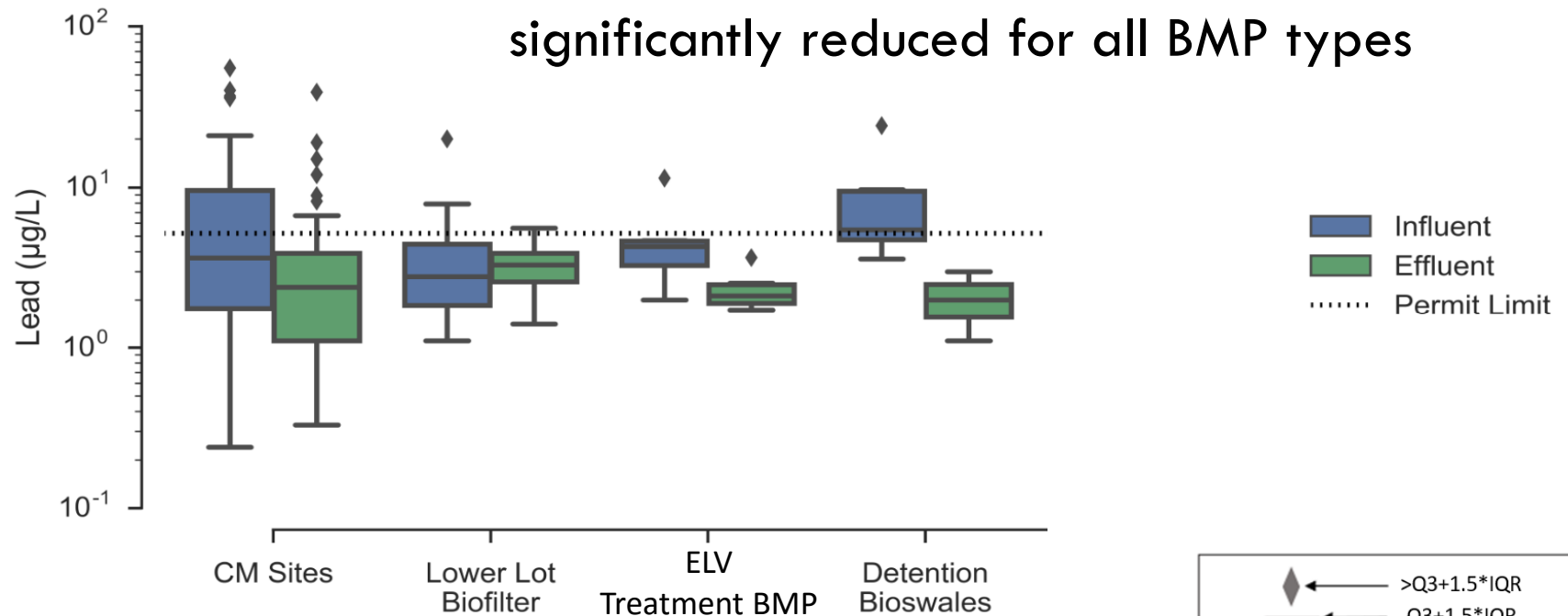


<b>Average % reduction</b>	<b>95%</b>	<b>94%</b>	<b>79%</b>	<b>99%</b>
<b>Median effluent concentration (µg/L)</b>	6.1e-8	3.1e-10	3.2e-10	2.6e-8

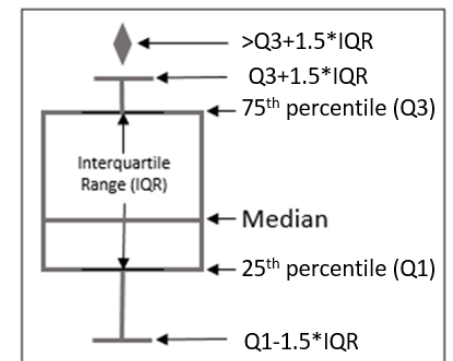


# BMP Performance: Lead

Lead concentrations are being significantly reduced for all BMP types



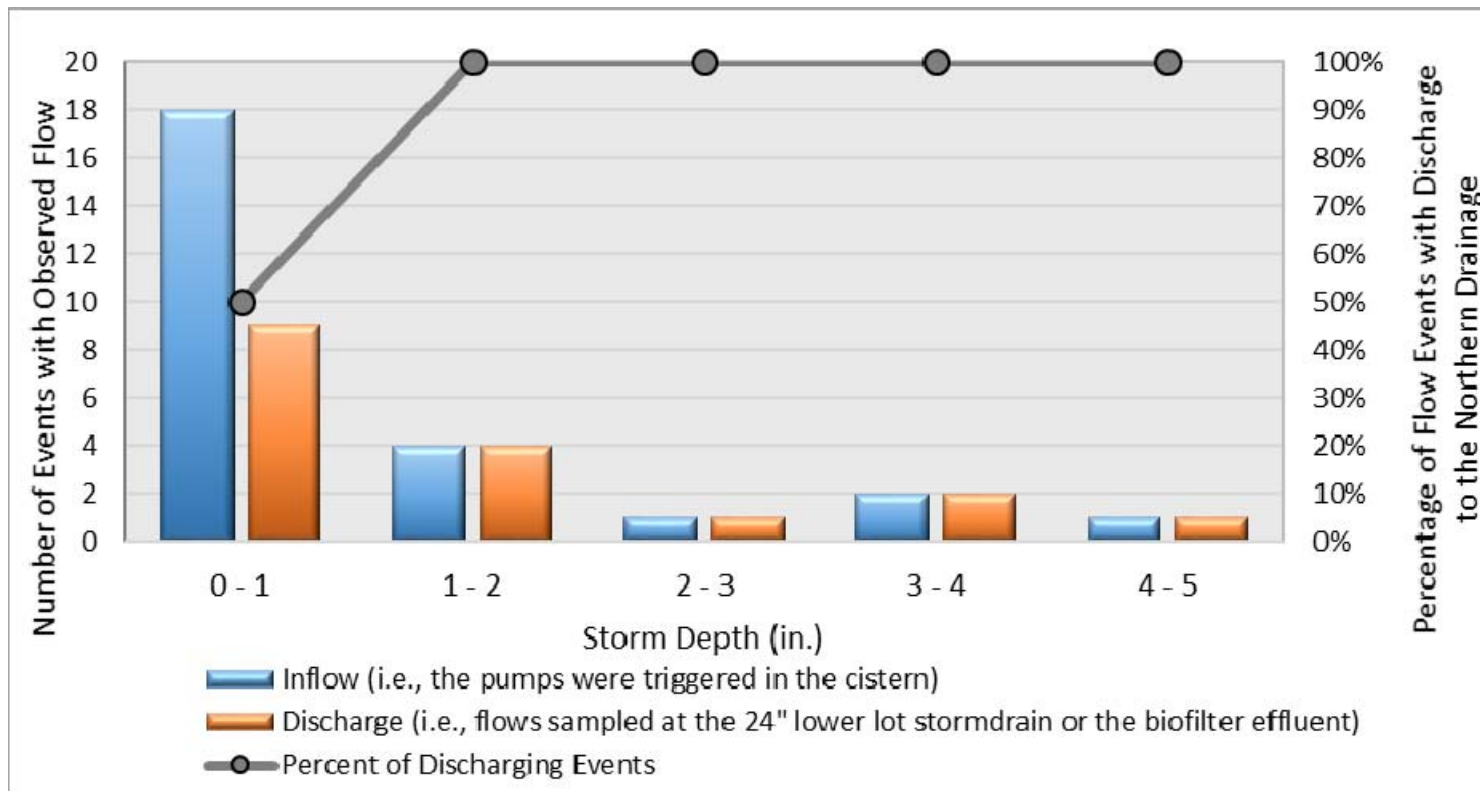
<b>Average % reduction</b>	<b>42%</b>	<b>22%</b>	<b>53%</b>	<b>76%</b>
<b>Median effluent concentration (µg/L)</b>	2.4	3.3	2.0	1.9



# Lower Lot Biofilter Diversion

32

The diversion to the biofilter prevented half of all small, frequent storms from discharging to the Northern Drainage through evapotranspiration in the BMP





# Remaining Stormwater Pollutant Sources



# Panel is Leading a Study to Investigate Sources of OF009 Exceedances

34

Study acknowledges and is complementary to ongoing efforts to characterize and remediate soils, including ongoing work in shooting range.

## Study Objectives:

- Where (spatially) are dioxins and lead in stormwater predominantly coming from within 009 watershed?
- What are the predominant pollutant sources to the paved subareas? E.g.,
  - ▣ pavement (weathered or newly resurfaced)
  - ▣ vehicles
  - ▣ soils near treated wood (including utility poles)
  - ▣ atmospheric deposition
  - ▣ drainage sediments
  - ▣ upland soils



# Special Study Preliminary Results

35

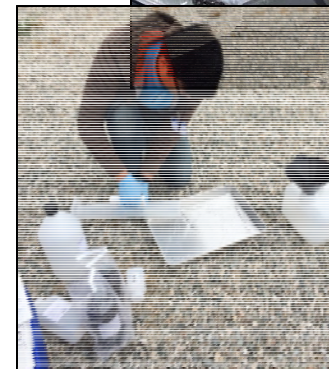
Initial results indicate potential contributors to OF009 stormwater exceedances:

- Dioxins:

- ▣ Soils near treated wood
- ▣ Fine solids from all pavement types (e.g., weathered, newly resurfaced, high/low traffic)

- Lead:

- ▣ Atmospheric deposition
- ▣ Fine solids from higher traffic roads



# Summary

36

**Q1: What has recent water quality been like?**

**A:** NPDES exceedances were infrequent during recent drought years. This season's results are still coming in so we'll know more soon, but initial results have been very good in light of heavy rains.

**Q2: What is SSFL doing to improve water quality?**

**A:** Recent BMP efforts have been significant and reflect the best available technology.



2013 Outstanding Stormwater BMP Award from California Stormwater Quality Association (CASQA)



# Summary (cont'd)

37

## **Q3: How are the BMPs working?**

**A:** Significant performance data have been collected, and all BMPs are highly effective at reducing their targeted pollutants.

## **Q4: What's causing the remaining NPDES exceedances?**

**A:** Potential contributors include impacted soils and “urban background” sources, such as treated wood and pavement. We continue to address both through BMPs.



2013 Outstanding Stormwater BMP Award from California Stormwater Quality Association (CASQA)

# Questions

38

## THANK YOU!!

Additional Information (e.g., NPDES Permit, Panel Presentations, and Technical Reports):

[www.boeing.com/principles/environment/santa\\_susana](http://www.boeing.com/principles/environment/santa_susana)