



# Santa Susana Field Laboratory (SSFL) Site-Wide Stormwater Public Meeting

PRESENTED BY

SSFL Surface Water Expert Panel | November 17, 2022

# Meeting Orientation

## Meeting Objectives

- Provide an opportunity for the Surface Water Expert Panel to provide an update on stormwater sampling results and management activities at SSFL and respond to questions raised in a recent public survey
- Provide interested members of the public an opportunity to ask additional questions of the Surface Water Expert Panel

## Agenda

- 1:00 – 4:00 pm      Site Tour at SSFL
- 6:00 – 7:30 pm      Panel Presentation at Grand Vista Hotel
- 7:30 – 8:00 pm      Questions at Grand Vista Hotel

# Meeting Orientation

## Proposed Ground Rules

- Keep questions brief and focus on topics addressed by the Surface Water Expert Panel
- We will answer your questions after the presentation
  - If you are attending in person, please raise your hand and wait for the microphone
  - If you are watching online, please submit your questions using the Q&A feature on Zoom
    - If unable to use Q&A feature, please call 818-207-2196 to submit your questions for the Expert Panel
- Please treat everyone in the meeting with kindness and respect

# Outline

1. Panel Introduction and Site Background
2. Public Survey Responses
3. 2021/22 Rainy Season Monitoring Results
4. Human Health Risks
5. Existing Structural Controls
6. Treatment Performance
7. Future BMPs

# 1 Panel Introduction and Site Background

# Surface Water Expert Panel Introduction

- Dr. Bob Gearheart, PE, California State Polytechnic University, Humboldt
- Jon Jones, PE, Wright Water Engineers
- Dr. Michael Josselyn, WRA Consultants
- Dr. Bob Pitt, PE, University of Alabama, Emeritus
- Dr. Michael K. Stenstrom, PE, University of California, Los Angeles
- Panel consultant: Geosyntec Consultants



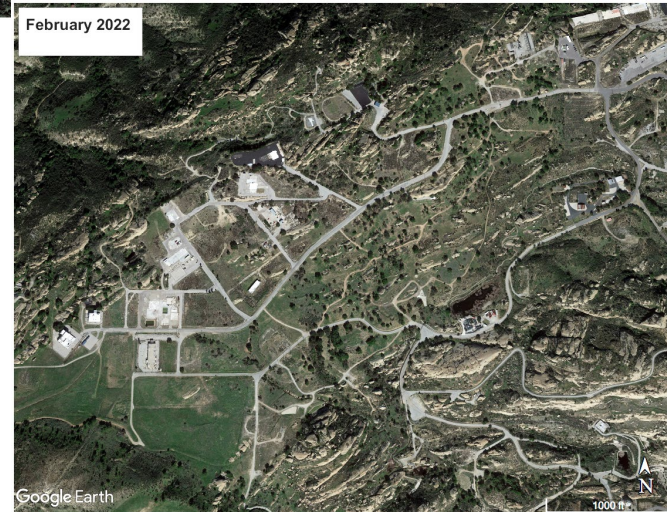
# Panel's Ongoing Role and Scope

- **Independent panel formed in response to the 2007 Cease and Desist Order from the RWQCB**
  - “...a panel to review site conditions, modeled flow, contaminants of concern, and evaluate the BMPs capable of providing the required treatment to meet the final effluent limits.”
  - Ordered Boeing to fund the panel as with other NPDES expenses
- **Ongoing Charge (2015 Permit)**
  - Review NPDES compliance and BMP performance monitoring data
  - Investigate site-wide stormwater pollutant sources
  - Make recommendations for new BMPs or improvements to existing BMPs
  - Review Stormwater Human Health Risk Assessment (HHRA)
  - Public outreach
  - Review of site cleanup Stormwater Pollution Prevention Plans (SWPPPs)
- **Memorandum of Understanding Regarding NPDES Permit**
  - Background Stormwater Thresholds
  - Stormwater Modeling
  - Post-Cleanup Stormwater Monitoring Plan



# SSFL Overview

- Former rocket testing and energy research facility
- Industrial activities have ceased and facilities removal is underway
  - Nuclear energy research operations ceased in 1989
  - Rocket engine testing operations ended in 2006
- Current activities include environmental monitoring/sampling, remediation planning, and demolition
- Numerous stormwater Best Management Practices (BMPs) to treat stormwater from developed and undeveloped areas





# NPDES Permit Overview

- Stormwater discharges at SSFL are regulated by the LARWQCB through an individual NPDES permit, which requires:
  - Composite sampling at 12 stormwater outfalls; and
  - Compliance with approximately 50 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 Lead: 5.2 µg/L (ppb)
  - Gross Alpha: 15 pCi/L (drinking water limit)

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
LOS ANGELES REGION  
3101 W. 17th Street, Suite 200, Los Angeles, California 90024  
Phone: (213) 373-3100 or (213) 373-3101  
4421 Westwood Blvd., Suite 200, Los Angeles, CA 90024  
4421 Westwood Blvd., Suite 200, Los Angeles, CA 90024

ORDER NO. RA-2016-0066  
NPDES NO. CA505038

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	6500 Yosemite Canyon Road Cerritos Park, CA 91304-1148 Ventura County

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

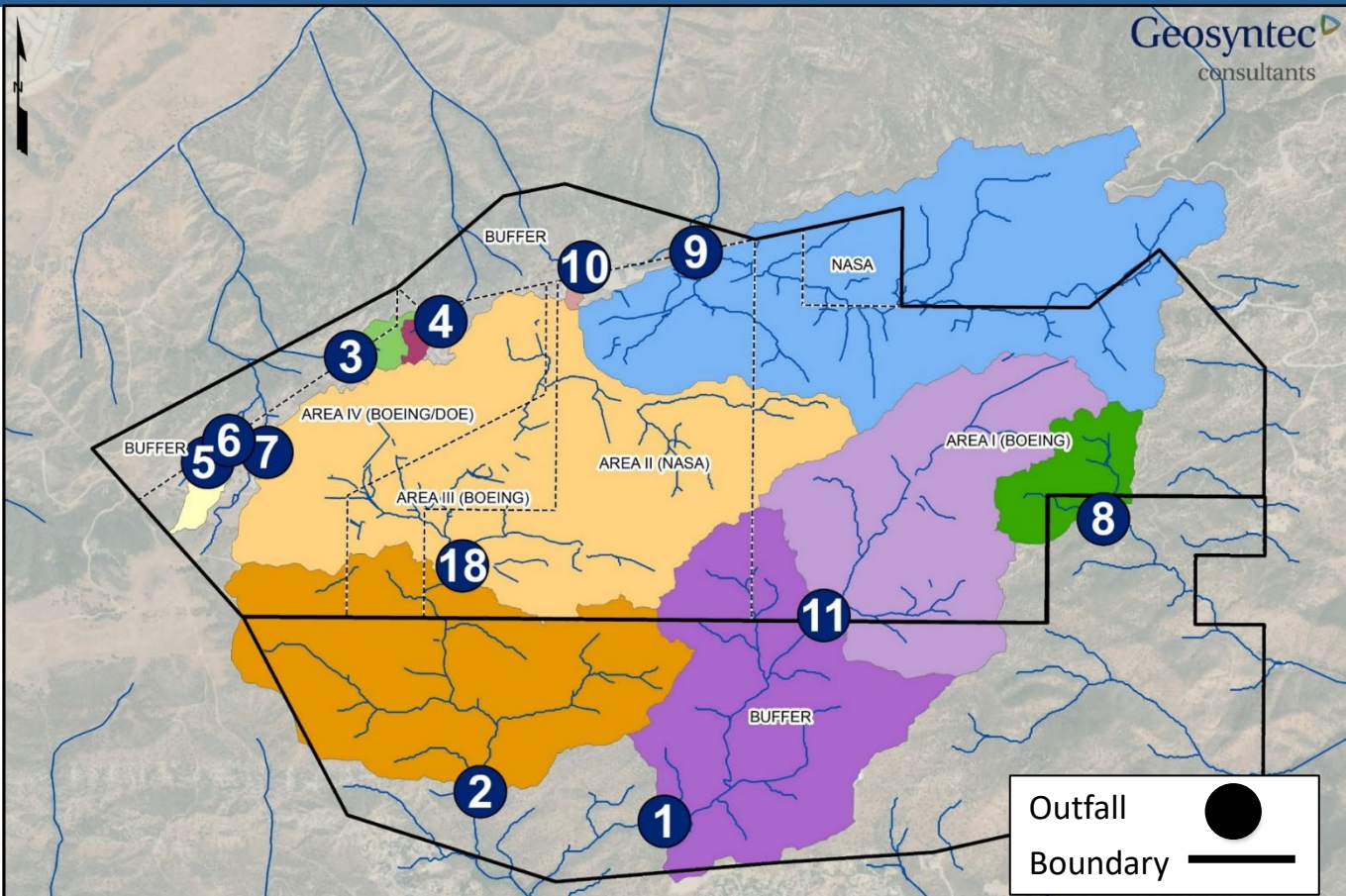
The discharge by the Owner from the discharge points identified below is subject to waste discharge requirements as set forth in this Order.

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



# NPDES Watersheds and Outfalls at SSFL

Geosyntec  
consultants

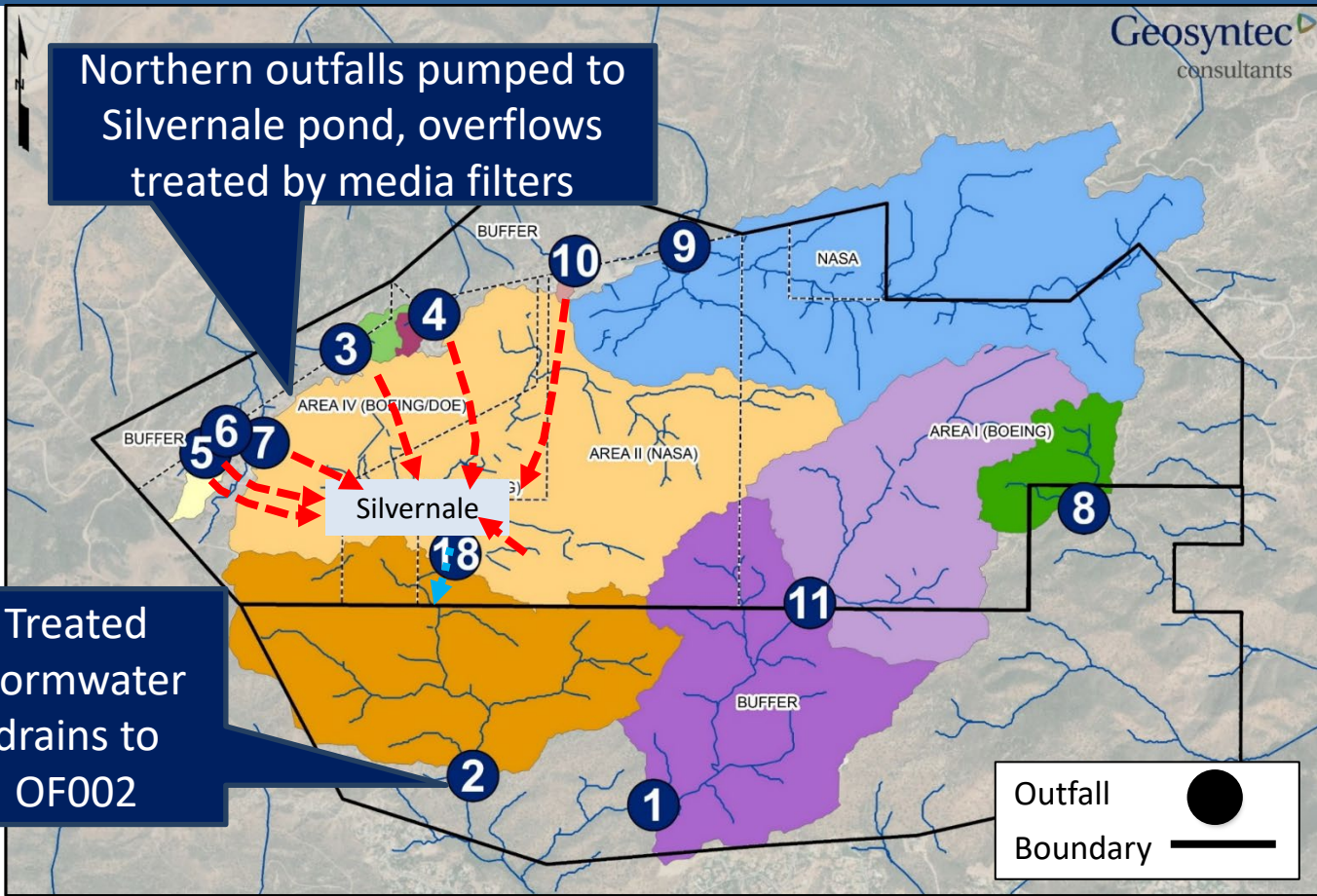


# NPDES Watersheds and Outfalls at SSFL

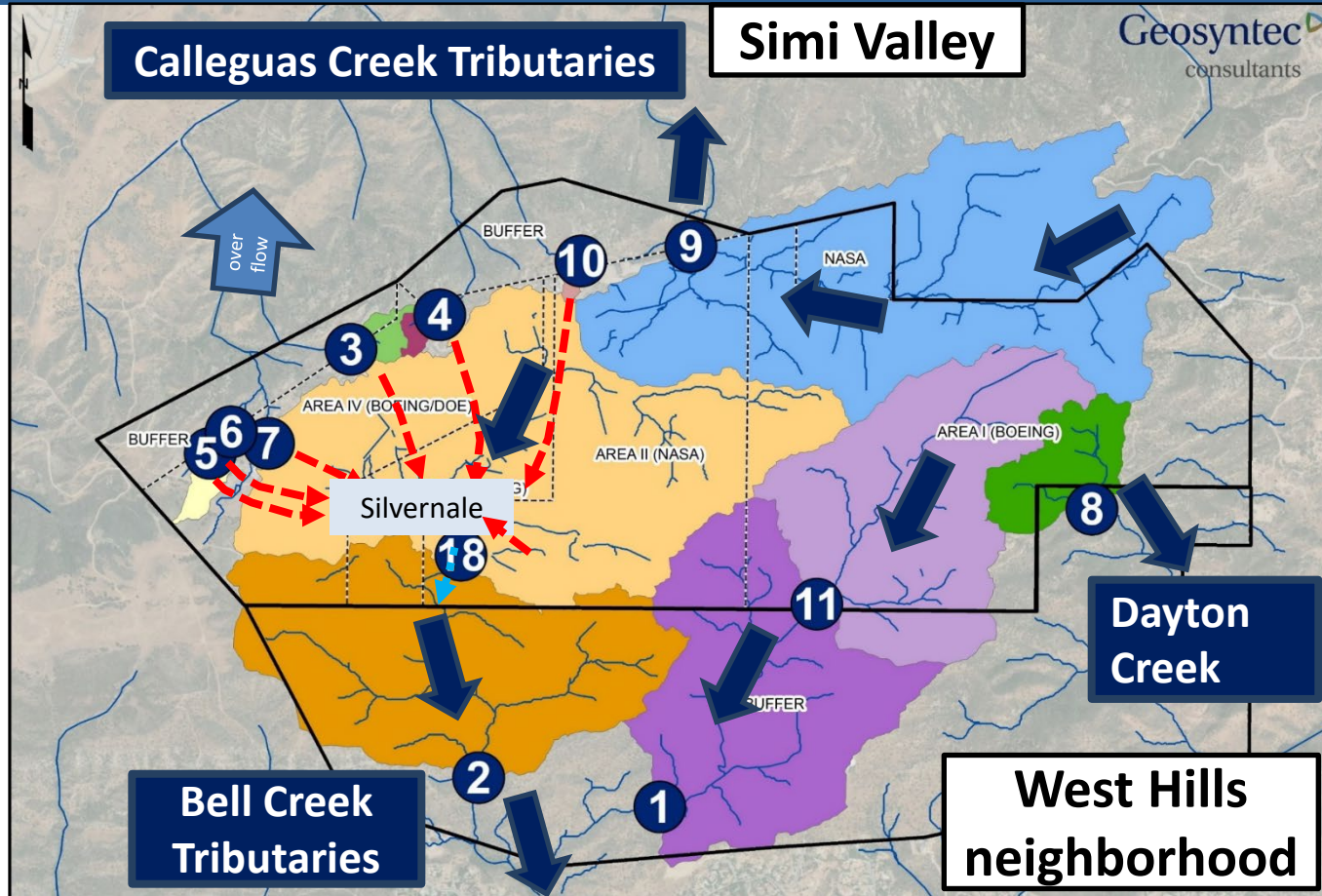
Geosyntec  
consultants

Northern outfalls pumped to  
Silvernale pond, overflows  
treated by media filters

Treated  
stormwater  
drains to  
OF002



# Surface Water Flow through NPDES Watersheds and Outfalls at SSFL



2

# Public Survey Responses

# Public Survey Responses

## **Top 5 ranked interest in stormwater topics:**

1. Human health risk associated with stormwater
2. Description of existing structural stormwater control measures and treatment systems
3. 2021/2022 rainy season exceedances and source analysis summary
4. Treatment performance of stormwater control measures
5. 2021/2022 rainy season monitoring results summary

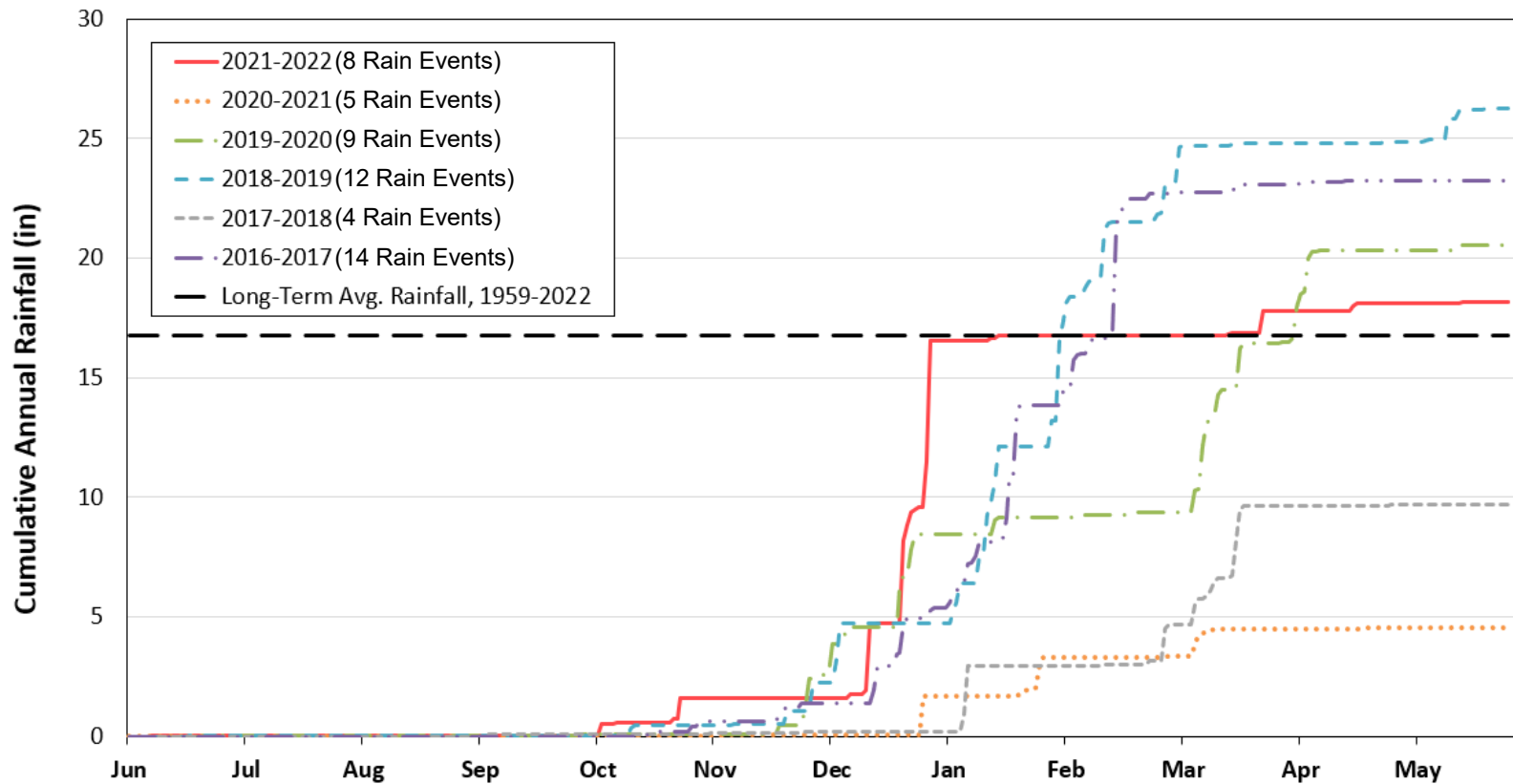
# 3

## 2021/22 Reporting Year

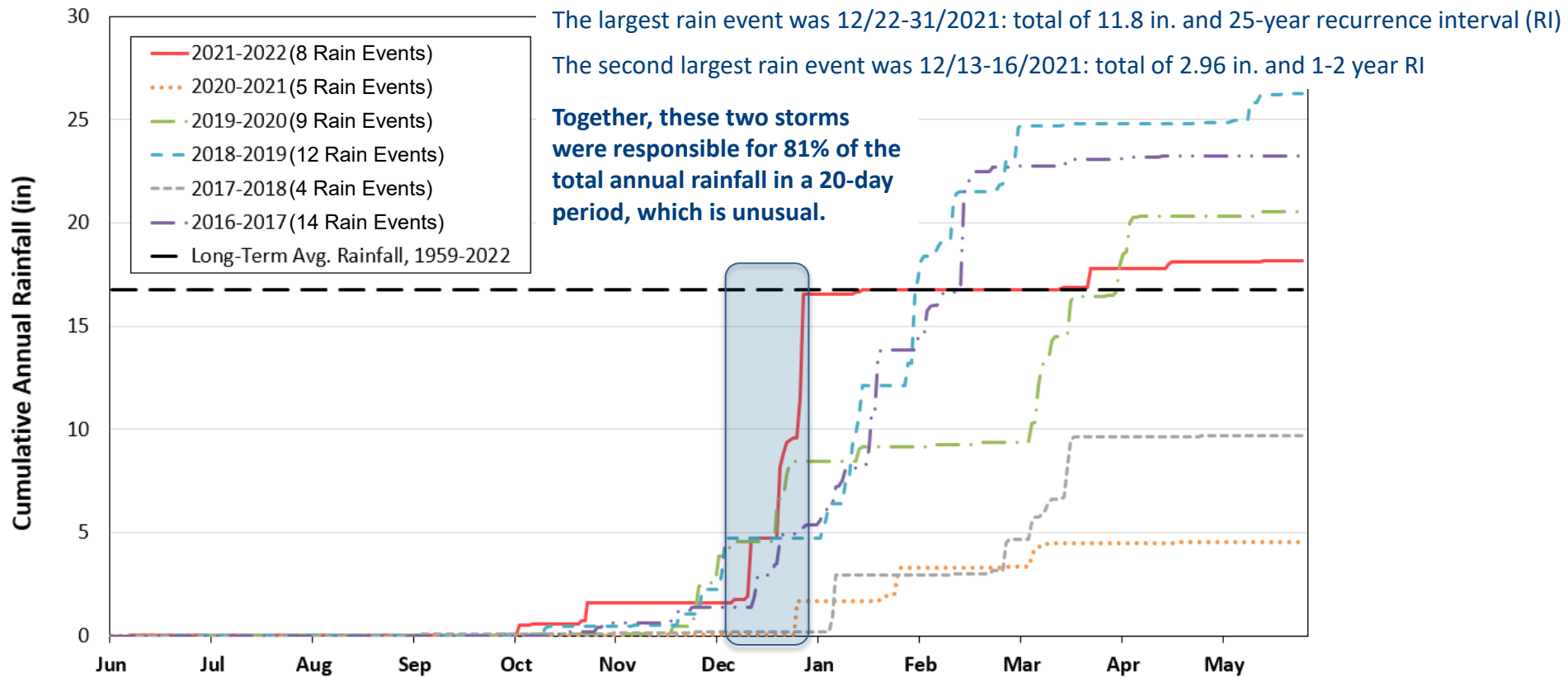
- Rainy season summary
- Monitoring results summary
- Exceedances and source analysis



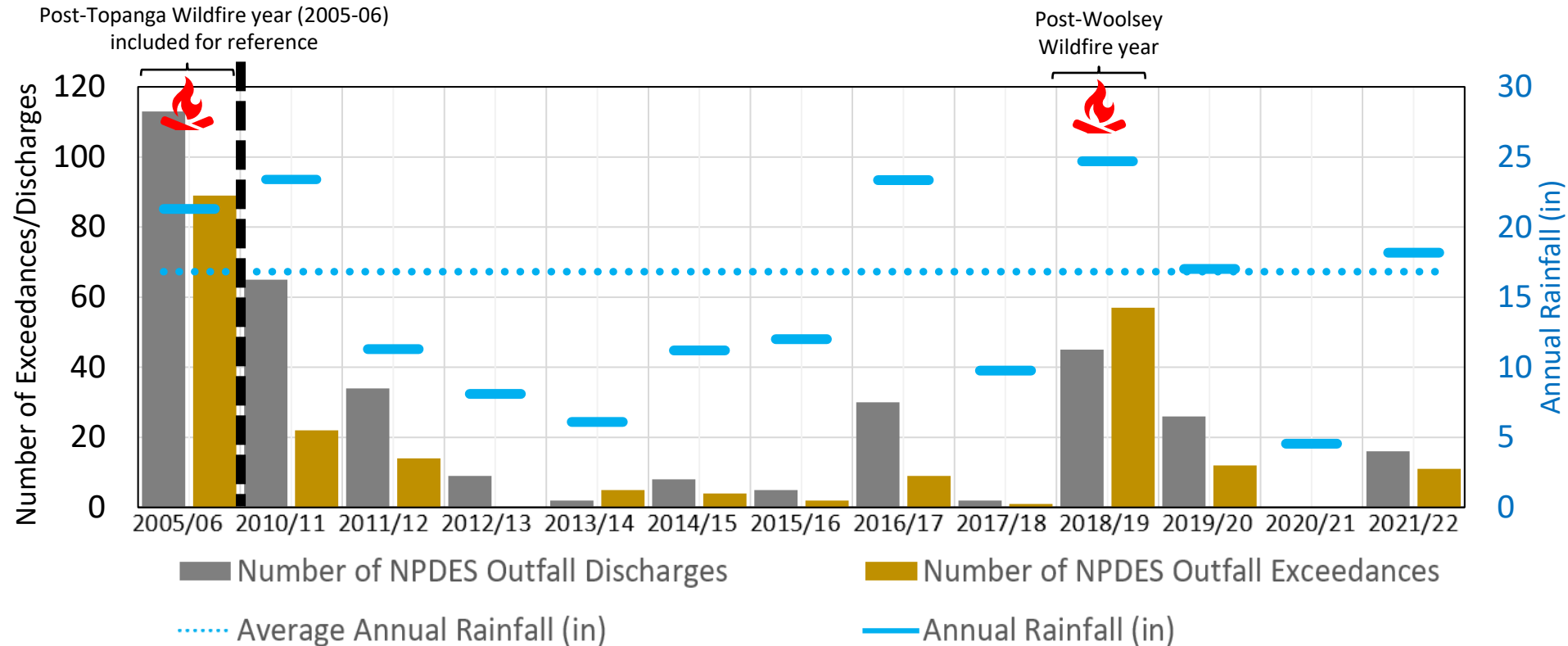
# 2021/2022 Rainfall



# 2021/2022 Rainfall



# Historical Overview – NPDES Sampling All SSFL Outfalls



# Historical Overview – 2015 Permit Term NPDES Sampling 2015-2022 Limit & Benchmark Exceedance Summary

Analyte	Sample Count	Single Sample Exceedance Count	% of Samples Exceeding
Iron	70	26	37%
TCDD TEQ (no DNQ)	124	14	11%
Lead	124	13	10%
Manganese	46	12	26%
Copper	124	6*	5%
Gross Alpha	124	3	2%
Zinc	124	3	2%
Nitrate + Nitrite as Nitrogen (N)	103	2	2%
pH	123	2	2%
Nitrate as Nitrogen (N)	79	2	3%
Arsenic	55	2	4%
Chronic Toxicity, Selenastrum	63	2*	3%
Selenium	124	1	1%
Nickel	74	1	1%
Biochemical Oxygen Demand (BOD)	72	1*	1%
Sulfate	103	1	1%
Cyanide	98	1	1%

Orange shaded analytes only exceeded in the first winter following the Woolsey Wildfire

Gross alpha single sample exceedance triggers speciation of radionuclides which indicated natural sources

\* 2021/22 result was a suspected lab error

# 2021/2022 Exceedance Summary

Parameter	Criteria Basis	Outfall 001	Outfall 002	Outfall 009	Outfall 011	Outfall 018	Total*
Biochemical Oxygen Demand (BOD)	Wastewater Treatment Technology-Based	0	0	0	0	1**	1
Chronic Toxicity, Selenastrum	Aquatic life	0	0	1**	0	0	1
Copper	Aquatic life	0	0	1	0	0	1
Iron	Aesthetic (taste/odor)	1	1	NR	1	1	4
Manganese	Aesthetic (taste/odor)	1	0	NR	1	0	2
TCDD TEQ (no DNQ)	Human health (fish consumption)	1	0	0	1	0	2
<b>Total</b>		<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>11</b>

NR = this parameter does not have a Permit Limit or Benchmark at this outfall

\* Note this total reflects exceedances of concentration-based limits at Outfalls 001-018. Mass-based limits at outfalls and offsite Arroyo Simi results were not considered here. 98.8% of all onsite outfall samples and analytes were in compliance.

\*\* Both the original and baseline toxicity tests were conducted outside of the prescribed hold time.

# 2021/2022 Exceedance Source Investigation

Parameter	Date	Outfall	Exceedance Sources with Most Weight of Evidence
Biochemical Oxygen Demand	12/28/2021	018	inconclusive, likely lab error
Chronic Toxicity	12/26/2021	009	inconclusive, repeat analysis was non-toxic
Iron	12/26/2021	001	natural background soils
Iron	12/30/2021	011	natural background soils
Iron	1/5/2022	018	inconclusive
Manganese	12/26/2021	001	natural background soils
Manganese	12/30/2021	011	natural background soils
Copper	12/15/2021	009	inconclusive, likely lab error
TCDD TEQ (no DNQ)	12/26/2021	001	natural background soils, impacted soils**, treated wood poles, pavement solids
TCDD TEQ (no DNQ)	12/30/2021	011	natural background soils, impacted soils**, treated wood poles, pavement solids

12/30/2021 received 6.22 inches of rainfall, which corresponds to a 25-year storm event, exceeding the design storm

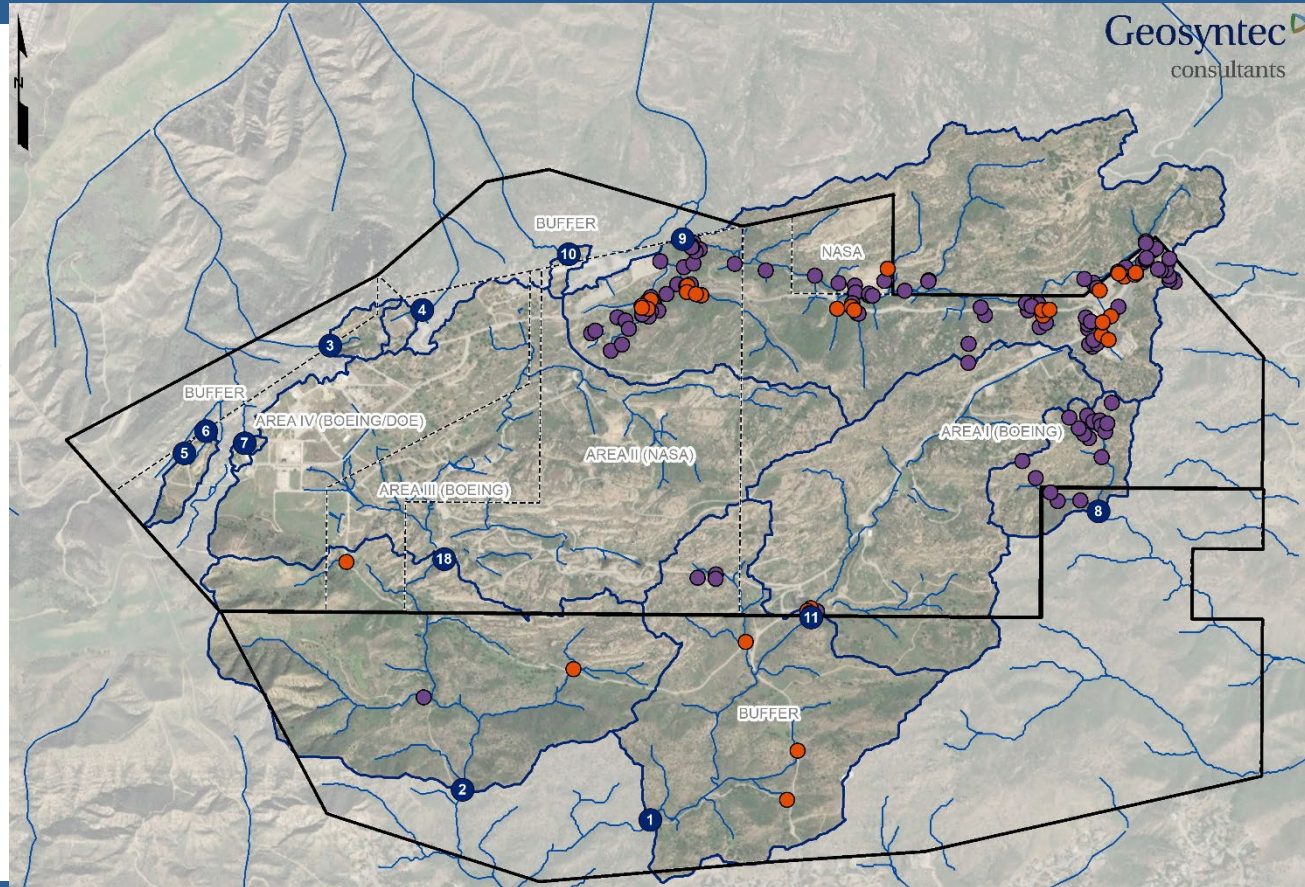
**\*\*Where impacted soils could not be ruled out as a source, new BMPs or improvements were recommended**

# 2021/2022 Subarea Monitoring Summary

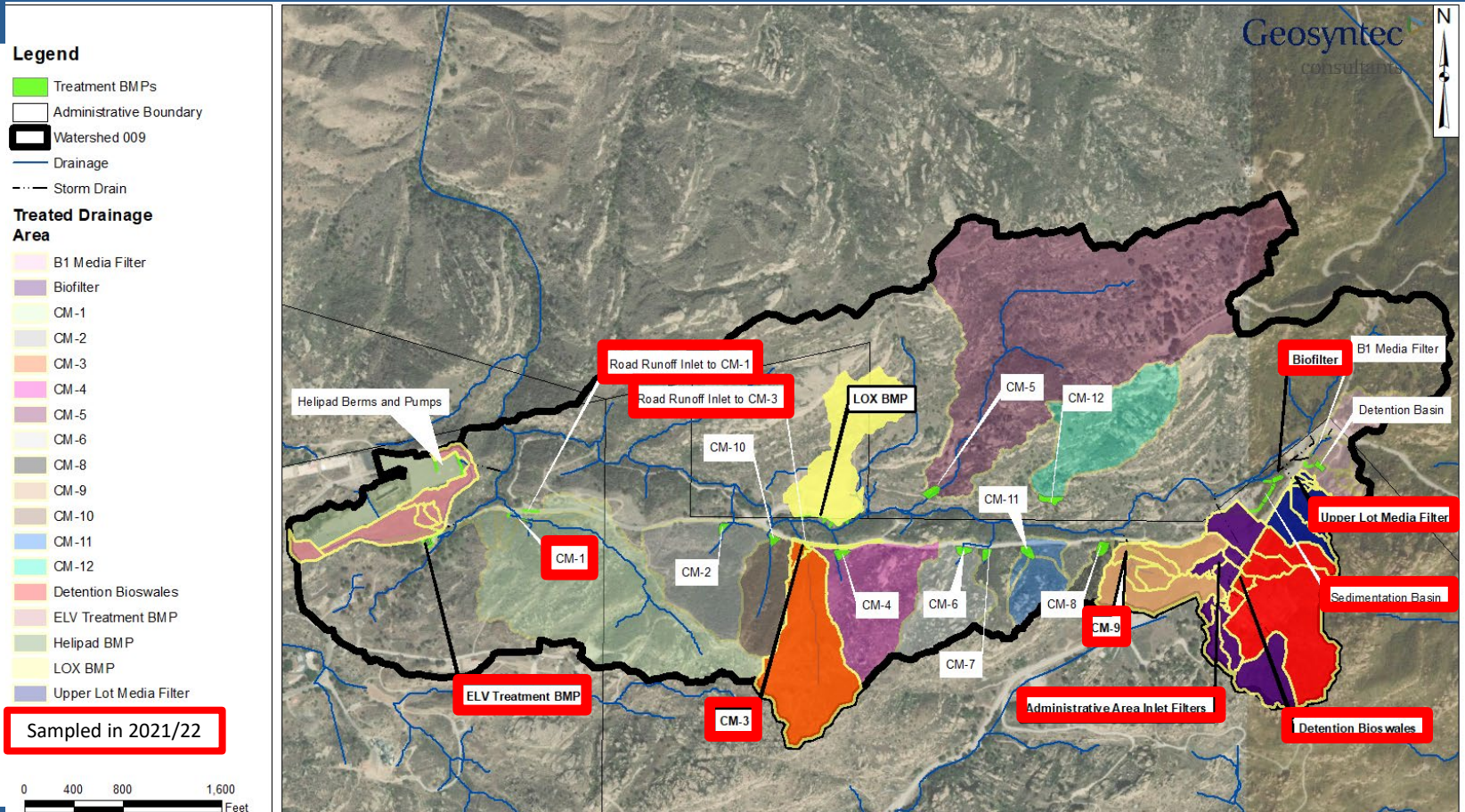
- Over 200 internal stormwater monitoring locations to identify potential source areas
- Subareas target potential areas for stormwater BMPs

## Legend

- NPDES Outfall
- ~ Drainage
- ⊕ Drainage Area
- ▭ Property Boundary
- ⊞ Administrative Boundary
- 2021/22 Subarea Sample Locations (n=34)
- Previous Subarea Sample Locations (n=188)



# Distributed Controls in Watershed 009





# 4

## Human Health Risks

Stormwater Human Health Risk Assessment (HHRA)

Drinking Water Risk Analysis

# Human Health Risk Assessment

- The stormwater Human Health Risk Assessment (HHRA) found low health risks from exposure to SSFL stormwater based on stormwater conditions present from 2009-2016 (less than the risk level of 1:1,000,000)
- [Stormwater HHRA](#) was reviewed and approved by Office of Environmental Health Hazard Assessment (OEHHA)
- Exposure pathways included:
  - Dermal contact
  - Inhalation
  - Incidental ingestion (e.g., splashing)

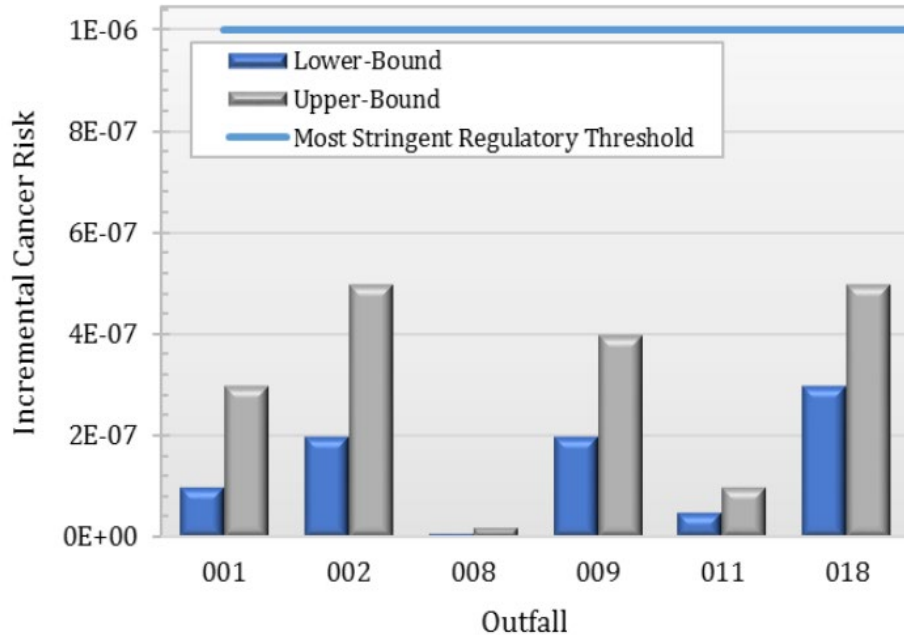
# Human Health Risk Assessment

- **Exposure rates assumed:**
  - Up to 26 exposures per year at stormwater outfalls (outfall flow dependent)
  - 30 years of exposure

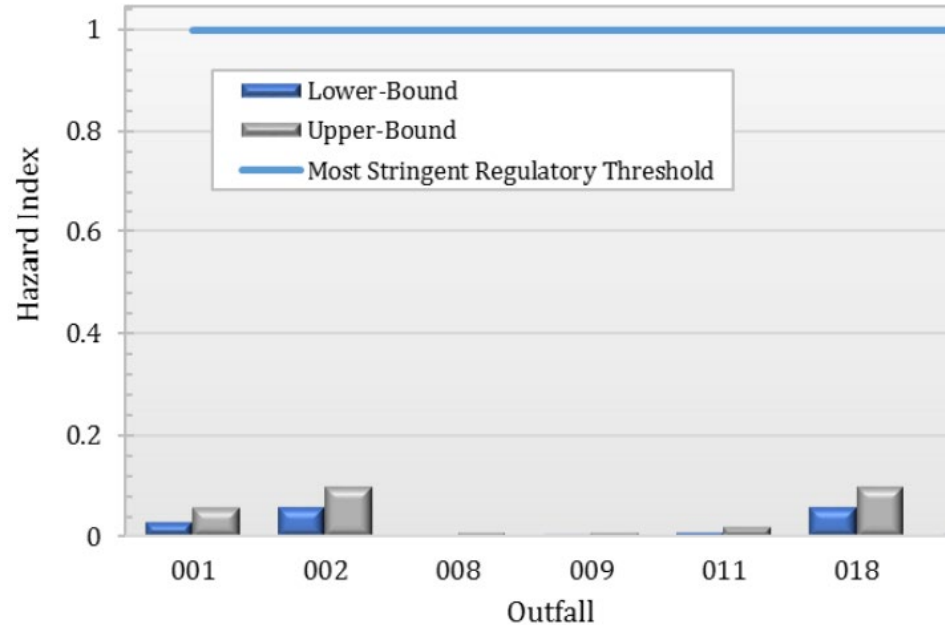
	<b>Outfall – Exposure Frequency - Days per Year</b>					
<b>Exposure Frequency Estimate</b>	<b>001</b>	<b>002</b>	<b>008</b>	<b>009</b>	<b>011</b>	<b>018</b>
Lower-bound	3	9	5	13	1	6
Upper-bound	6	18	10	26	2	12

# Human Health Risk Assessment

## Cumulative Incremental Cancer Risk Estimates by Outfall



## Cumulative Hazard Index Estimates by Outfall



# Drinking Water Risk Assessment

- Drinking water pathway (i.e., stormwater infiltrating offsite to groundwater that's used for untreated drinking) has now also been evaluated in recognition of questions from public
- Exposure point concentration calculated consistent with HHRA, but for the entire monitoring period from 1998-2022
- Exposure point concentrations were compared to primary maximum contaminant levels (MCLs), which assume consumption of drinking water for a lifetime

# Drinking Water Risk Assessment

Based on a preliminary assessment of all monitoring data since 1998 (including post-wildfire years), three analytes have a potential exposure point concentration (EPC) above the primary MCL using conservative assumptions:

- Aluminum based on 95UCL
- bis (2-ethylhexyl) Phthalate based on maximum detected concentration
- Pentachlorophenol based on maximum detected concentration

Analyte	Units	Primary MCL	Calleguas Creek Watershed			LA River Watershed		
			Sample Count	Detection Count	EPC	Sample Count	Detection Count	EPC
<b>Constituents with EPC of Potential Concern</b>								
Aluminum	µg/L	1000	42	41	3022	16	16	7640
bis (2-ethylhexyl) Phthalate (DEHP)	µg/L	4	99	1	10.6	173	18	1.716
Pentachlorophenol (PCP)	µg/L	1	99	1	1.46	173	5	0.984
<b>Other Selected Constituents out of 70 with MCLs evaluated</b>								
2,3,7,8-TCDD	µg/L	3E-05	306	6	2.3E-06	208	4	5.1E-06
Arsenic	µg/L	10	105	11	2.358	130	48	2.973
Gross Alpha	pCi/L	15	287	182	0.498	209	82	10.53
Gross Beta	pCi/L	50 (4 mrem/yr)	290	247	8.874	205	139	9.427
Lead	µg/L	15	317	240	4.561	260	147	3.704
Perchlorate	µg/L	6	218	2	4.26	266	20	1.145

# Drinking Water Risk Assessment:

## Many factors of safety make drinking water safe

- Concentrations in stormwater that infiltrates to groundwater offsite would be blended with ambient groundwater
- These stormwater concentrations are for all time (pre-BMPs, post-BMPs, post-wildfire), but recent data would reflect effects of BMPs that lower these levels
- These are total concentrations, whereas dissolved concentrations are much less, and dissolved levels better reflect what would reach groundwater (and be biologically available)
- Finally, most drinking water is treated at municipal water treatment plants, which would further reduce these concentrations

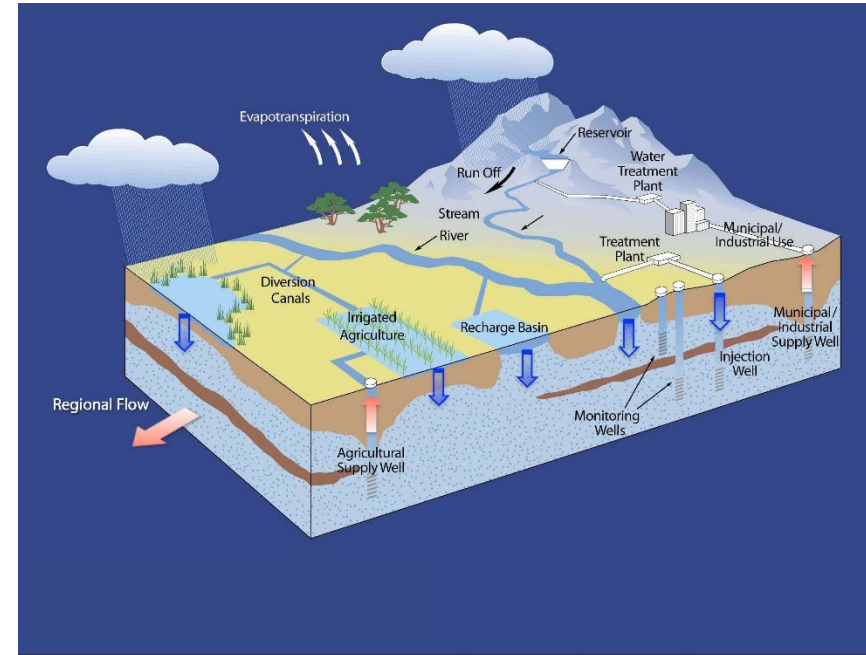


Image from <https://mavensnotebook.com/2017/09/20/dr-andy-fisher-enhancing-groundwater-recharge-with-stormwater/>

# 5

## Existing Structural Controls

- Stormwater control measures
- Active stormwater treatment systems (Outfalls 011 and 018)





# Existing Structural Controls

- **Distributed Passive Treatment BMPs**
  - Filter media mix developed for SSFL BMPs consisting of sand, zeolite, and granulated activated carbon (GAC)
  - Located throughout Outfall 009 Watershed
  - Variety of formats depending on space available
    - Culvert Modifications (CMs) and Media Filters
    - Lower Lot Biofilter
    - Detention Bioswales
    - ELV Treatment BMP
- **Active stormwater treatment systems (SWTS)**
  - Coagulation, sedimentation, and filtration plants in Outfall 011 and 018 watersheds

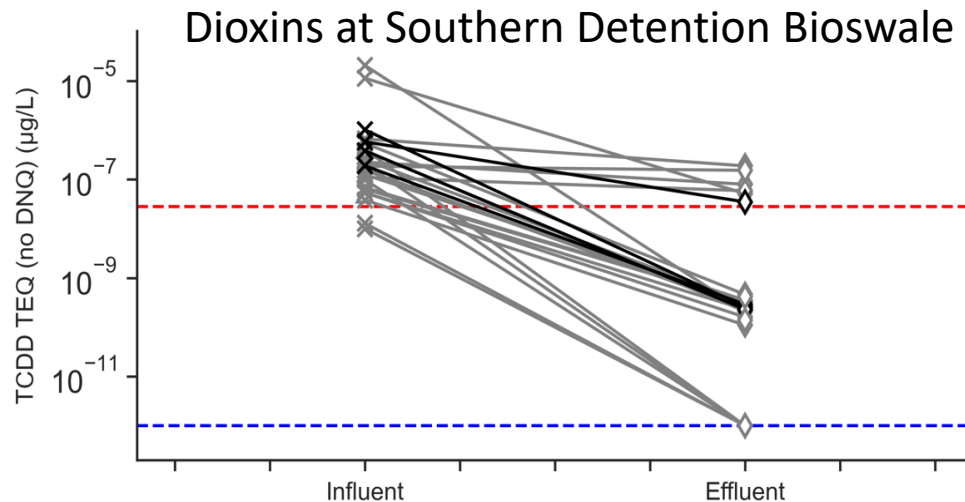
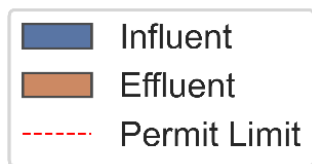
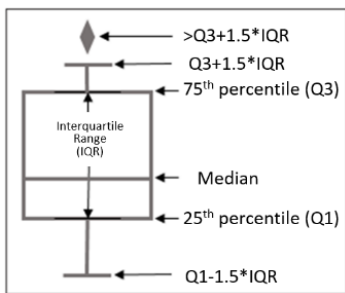
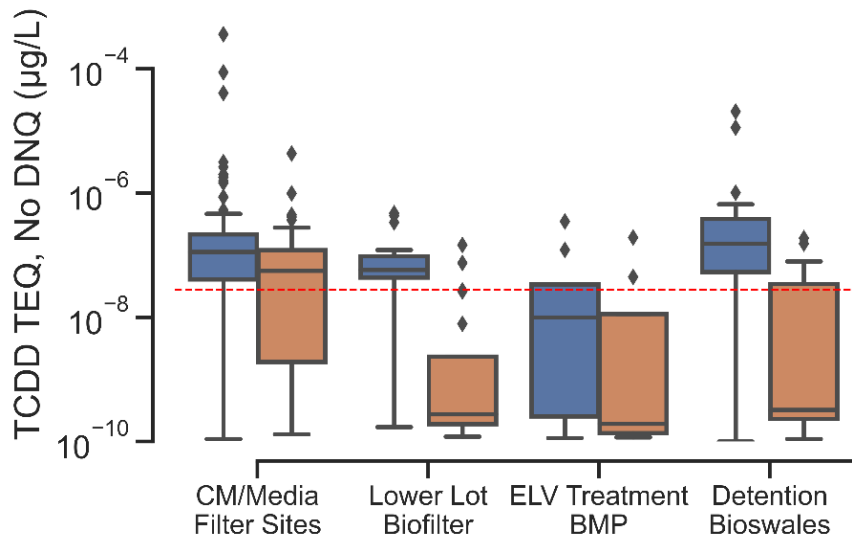


# 6

## Treatment Performance

- Stormwater control measures
- Active stormwater treatment systems (Outfalls 011 and 018)

# Treatment Performance: Distributed Passive BMPs



# Treatment Performance: Distributed Passive BMPs

BMP	Parameter	% Above Outfall 009 Permit Limit	
		Influent	Effluent
B-1	Lead	33%	8.7%
	TCDD TEQ no DNQ	86%	68%
CM-1	Lead	31%	17%
	TCDD TEQ no DNQ	58%	48%
CM-9	Lead	42%	24%
	TCDD TEQ no DNQ	49%	24%
Upper Lot Media Filter	Lead	11%	0%
	TCDD TEQ no DNQ	79%	58%
CM-3	Lead	29%	0%
	TCDD TEQ no DNQ	0%	0%

# Treatment Performance: Advanced SWTS

Analyte	Units	Daily Maximum Permit Limit	Outfall 018		Outfall 011	
			Untreated SWTS Influent Sample	Treated Discharge Sample	Untreated SWTS Influent Sample	Treated Discharge Sample
			12/25/2021	12/26/2021	1/10/2022	1/18/2022
Oil & Grease	mg/L	15	0.74 J	ND < 0.54	710	ND < 0.53
Mercury	µg/L	0.1	0.11 J	ND < 0.12	ND < 0.12	ND < 0.12
TCDD TEQ (no DNQ)	µg/L	2.8E-08	6.1E-08	ND	1.3E-08	ND
Iron	mg/L	0.3	2.2	ND < 0.05	1.2	0.092
Manganese	µg/L	50	77	15	19 J	25
Perchlorate	µg/L	6.0	ND < 9.1	ND < 0.91	3.9	ND < 0.95
Trichloroethylene (TCE)	µg/L	5	ND < 0.17	ND < 0.17	ND < 0.17	ND < 0.17
Gross Alpha	pCi/L	15	4.46+/-2.73	2.1+/-1.82	1.92+/-1.27	0.55+/-1.39
Gross Beta	pCi/L	50	4.17+/-1.75	4.07+/-1.12	3.68+/-0.904	2.81+/-1.01
Lead	µg/L	5.2	3.2	ND < 0.5	0.87	ND < 0.5

Green cells indicate concentrations were not detected above the Outfall Permit Limit

Orange cells indicate concentrations were detected above the Outfall Permit Limit

All other analytes were not detected above the Outfall Permit Limit

# 7

## Future BMPs

- New BMPs to address recent exceedances where impacted soils could not be ruled out
- Stormwater management at imminent and substantial endangerment (ISE) cleanups
- Additional detailed pond water balance and infiltration study

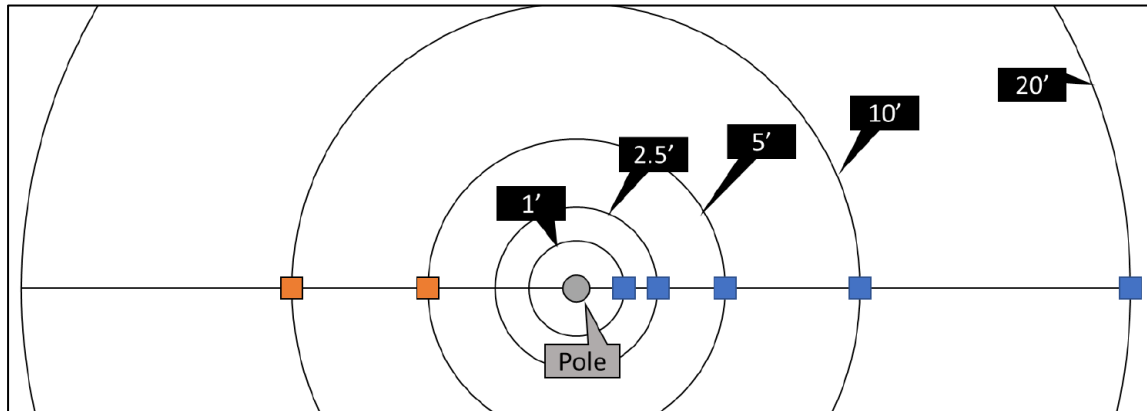
# New BMPs: Stormwater Control Measures

- R1 Pond berm repair completed in November 2022



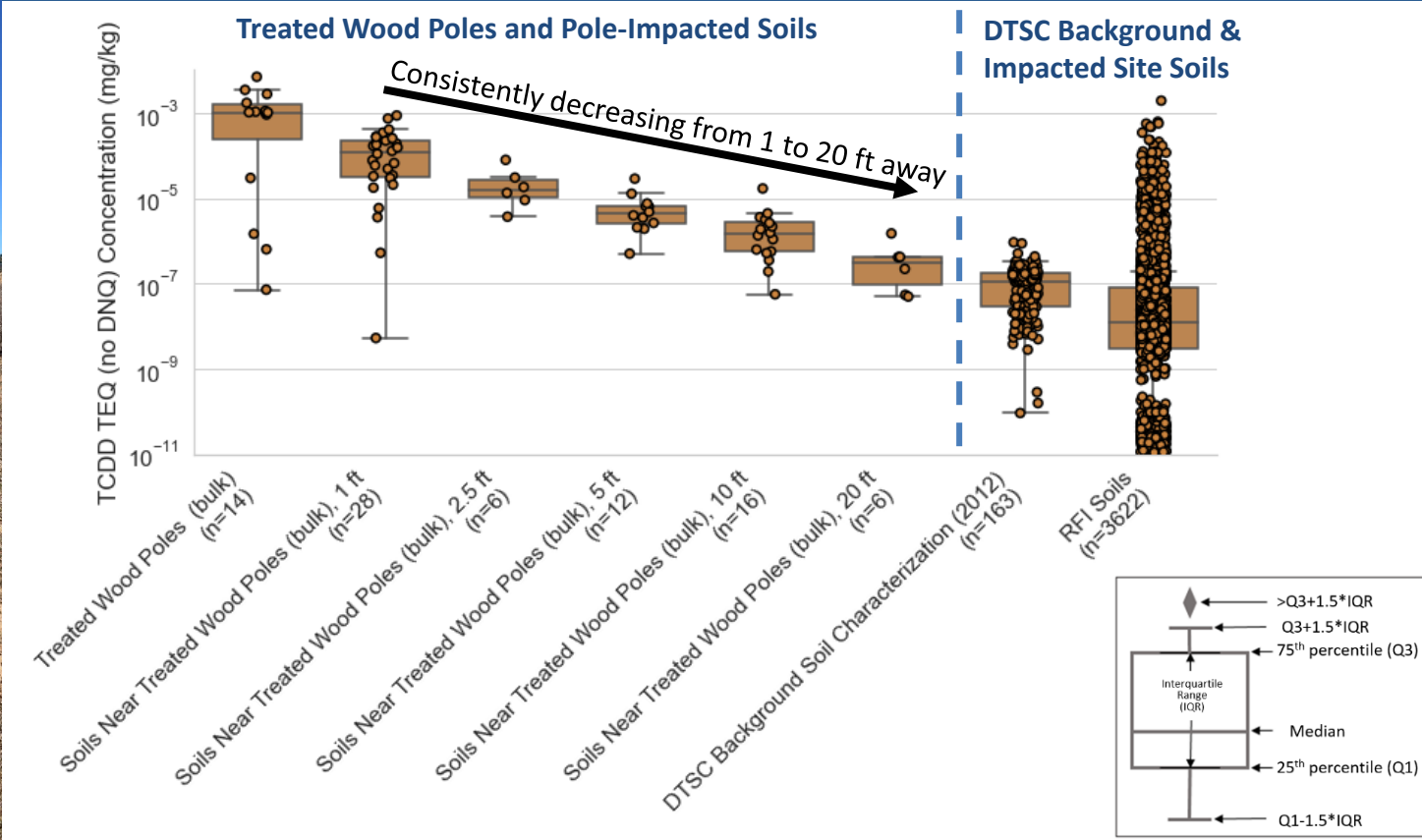
# New BMPs: Source Control Measures & Identifying Sources

- Sampled soil at various distances from treated wood utility poles
- Distinct relationship between distance from pole and dioxin concentration in soil
- Recommended removing unnecessary poles
- Updated BMP guidance to stabilize soils within a 10 ft radius of poles












# New BMPs: Source Control Measures & Identifying Sources

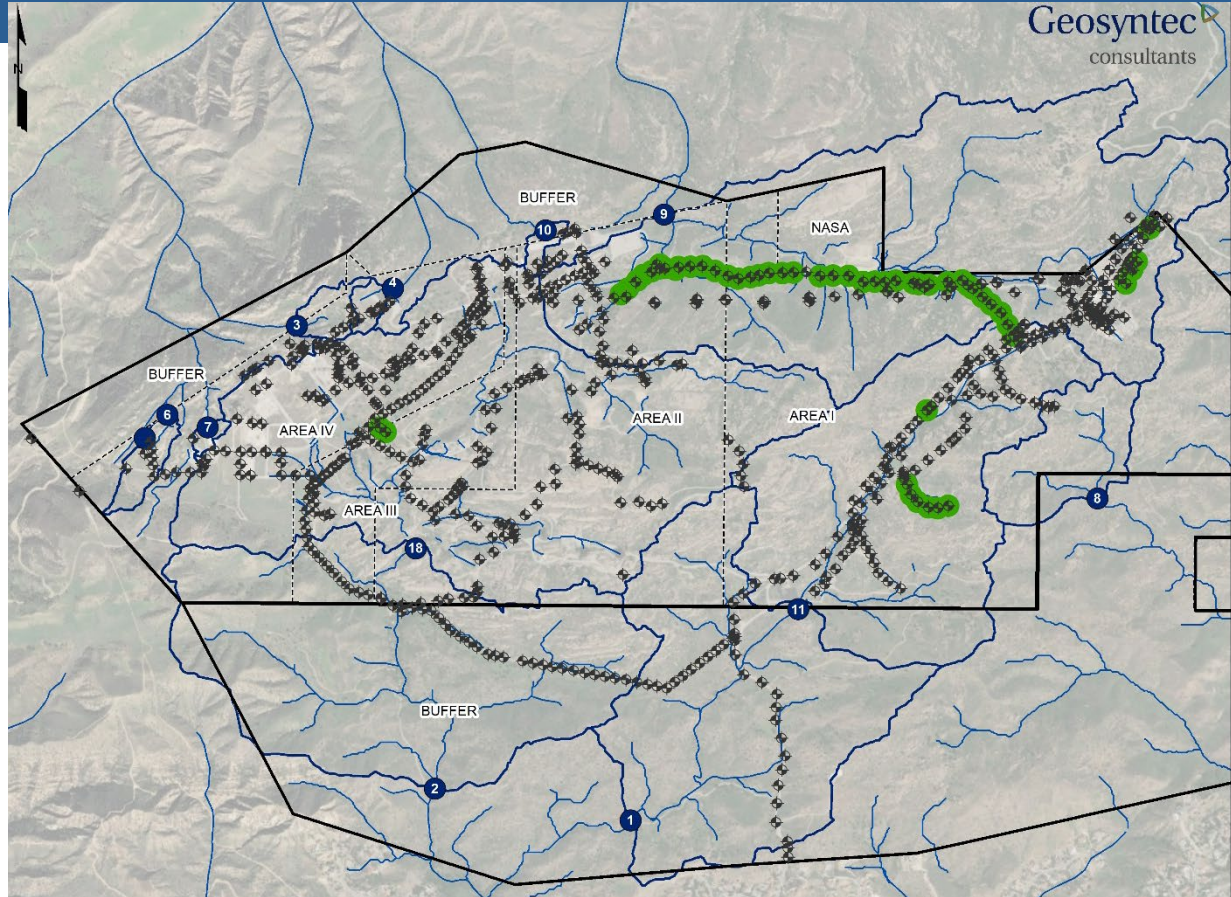


# New BMPs: Treated Pole Control Measures

Removed **42** unused treated wood utility poles off Boeing and **12** poles off NASA property, between April-June 2022. More are being evaluated for removal.

### Legend

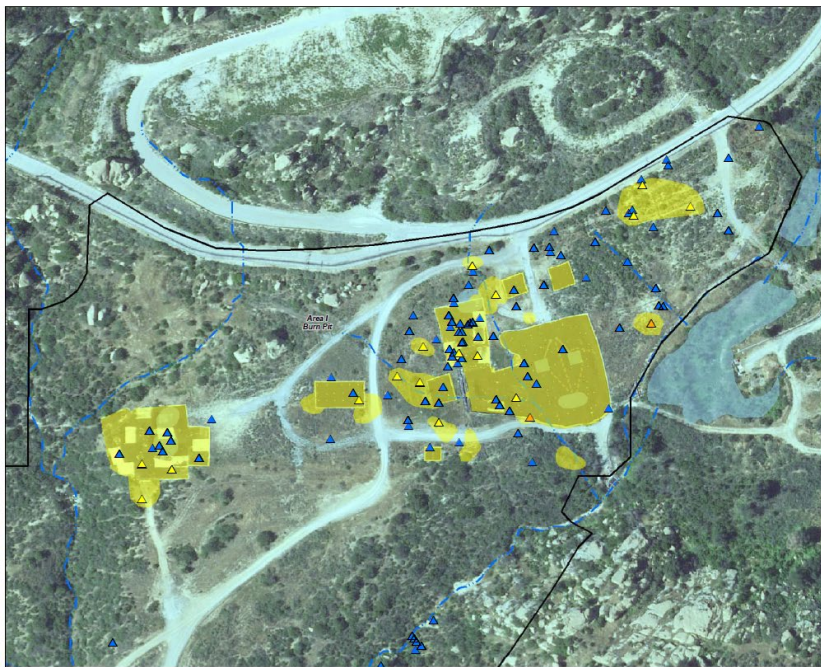
-  NPDES Outfall
-  Drainage
-  Drainage Area
-  Property Boundary
-  Administrative Boundary
-  Utility Poles
-  Utility Poles Removed in 2022



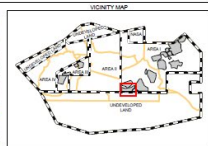
# Imminent and Substantial Endangerment (ISE) Cleanup Areas

- Two early cleanup actions have been ordered by DTSC
- Scheduled to start soil removal in 2023 after the rainy season
- The Panel is reviewing the SWPPPs and recommending stormwater BMPs for during and after cleanup

# Imminent and Substantial Endangerment (ISE) Cleanup Areas



Area 1 Burn Pit (Outfall 011 & 001 Watersheds)



BASEMAP LEGEND

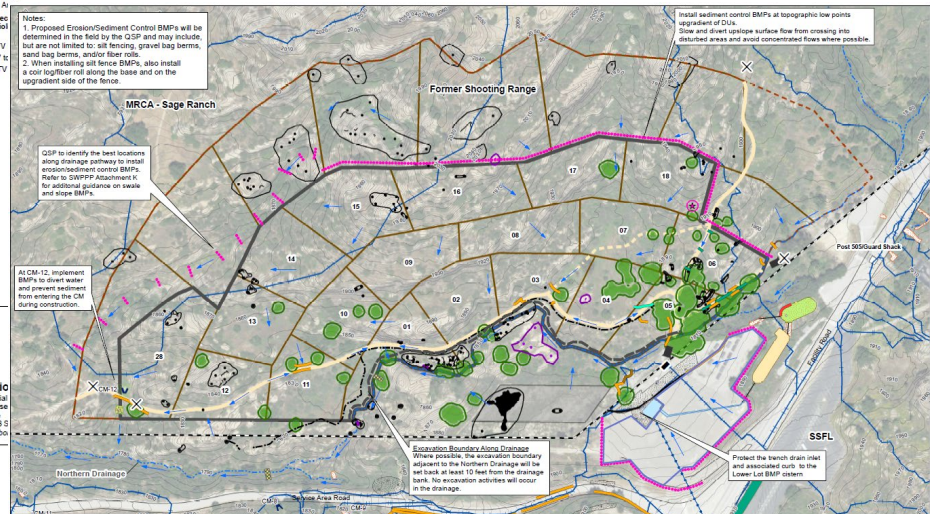
- Area 1 Burn Pit RFI
- Site Reporting Area
- Drainage Channel
- Operational Channel
- Pond
- Corrective Action Area

- Radionuclide Soil Detection Provisional Radii (LUTV)
- Detected 1-LUTV
- Detected 2-LUTV

Notes:  
 1. Proposed Erosion/Sediment Control BMPs will be determined in the field by the QSP and may include, but are not limited to: silt fencing, gravel bag berms, sand bag berms, and/or fiber rolls.  
 2. When installing silt fence BMPs, also install a cool fiber roll along the base and on the upgradient side of the fence.

FIGURE 1  
 Corrective Action  
 Imminent and Substantial  
 Determination and Course  
 Area 1 Burn Pit RFI Site  
 Santa Susana Field Lab

## Former Shooting Range (Outfall 009 Watershed)



<ul style="list-style-type: none"> <li>SSFL Property Boundary</li> <li>Decision Unit (DU) Boundaries</li> <li>SSFL Lower Lot Waste Storage and Staging Area</li> <li>Outfall 009 Sub-Watershed Boundaries</li> <li>Removal Action Area</li> </ul>	<ul style="list-style-type: none"> <li>Rip Rap</li> <li>Rip Rap Check Dam</li> <li>Stabilized Construction Entrance/Exit</li> <li>Inlet Protection</li> <li>Gravel</li> <li>Rip Rap</li> </ul>	<ul style="list-style-type: none"> <li>CMs</li> <li>B1430 Biocover</li> <li>Blotter</li> <li>Culvert</li> <li>Sediment Berm</li> <li>Water Bar</li> <li>Trench Drain</li> </ul>	<ul style="list-style-type: none"> <li>Silt Fence</li> <li>Fiber Roll</li> <li>Sand Bags</li> <li>Gravel Bags</li> <li>Rip Rap Berm</li> <li>Sage Ranch Trail</li> </ul>	<ul style="list-style-type: none"> <li>Paved Road</li> <li>SW Flow Direction</li> <li>Proposed EIS Control BMP</li> <li>Santa Susana Trenchless Buffer</li> <li>Plumbers' Mapoles Lily Avoidance Buffer</li> <li>Environmentally Sensitive Areas</li> </ul>
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Former Shooting Range  
 BMP Plan - Remedial Action Areas  
 SAGE RANCH PARK

Scale: 1 inch = 150 feet  
 Stantec  
 Figure B-3

# Thank you for attending

- Questions
  - Please raise your hand and the microphone will be brought to you
  - Enter your questions via Q&A on Zoom
- SSFL Stormwater Information (e.g., Annual Report, Panel Presentations, NPDES Permit, and Technical Reports) Available Online:  
[www.boeing.com/principles/environment/santa-susana](http://www.boeing.com/principles/environment/santa-susana)
- Additional Information Available Online:
  - Groundwater factsheet: [08.16.21 Santa Susana Groundwater 081621A.pdf \(boeing.com\)](#)
  - MOU FAQs: [Santa Susana Field Laboratory FAQ \(ca.gov\)](#)
  - DTSC SSFL Myths and facts: [Myths & Facts Regarding Boeing's Comprehensive Cleanup Framework at SSFL](#)
  - DTSC FAQs: [Boeing Settlement Agreement FAQs | Department of Toxic Substances Control \(ca.gov\)](#)