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

November 29, 2023

PRESENTED BY

SSFL Surface Water Expert Panel

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
- 7:30 – 8:00 pm Questions

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

  (please raise your hand and wait for the microphone)
- Please treat everyone in the meeting with kindness and respect

Outline

1. Panel Introduction and Site Background
2. Site Stormwater Overview & Local Context
3. 2022/23 Rainy Season Monitoring Results
4. Interim Soil Cleanup
5. Pond Infiltration Study
6. Public Survey Responses

1 Panel Introduction and Site Background

MS

Surface Water Expert Panel Introduction

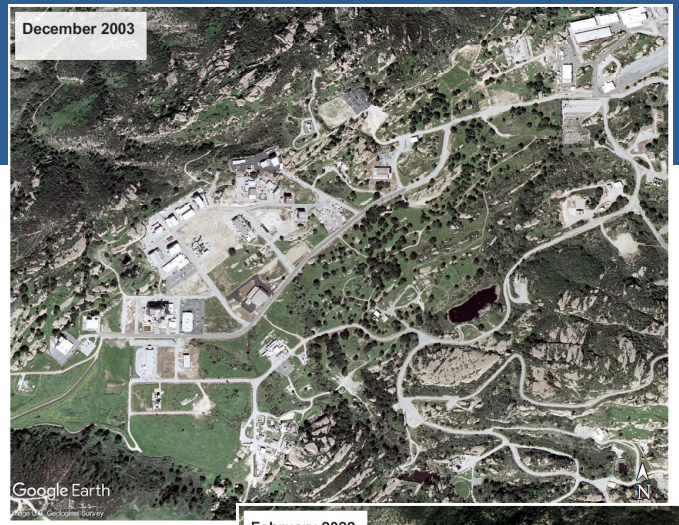
- Dr. Bob Gearheart, PE, California State Polytechnic University, Humboldt, Emeritus
- Jon Jones, PE, Wright Water Engineers
- Dr. Bob Pitt, PE, University of Alabama, Emeritus
- Dr. Michael K. Stenstrom, PE, University of California, Los Angeles
- Panel consultant: Geosyntec Consultants

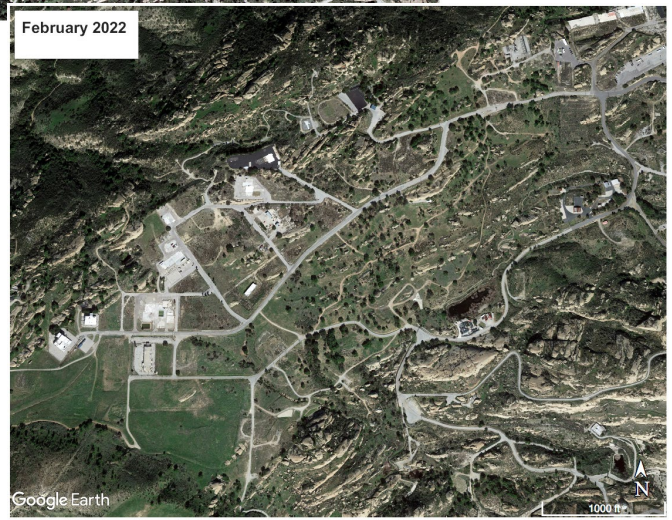
Panel's Ongoing Role and Scope

- 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 and 2023 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



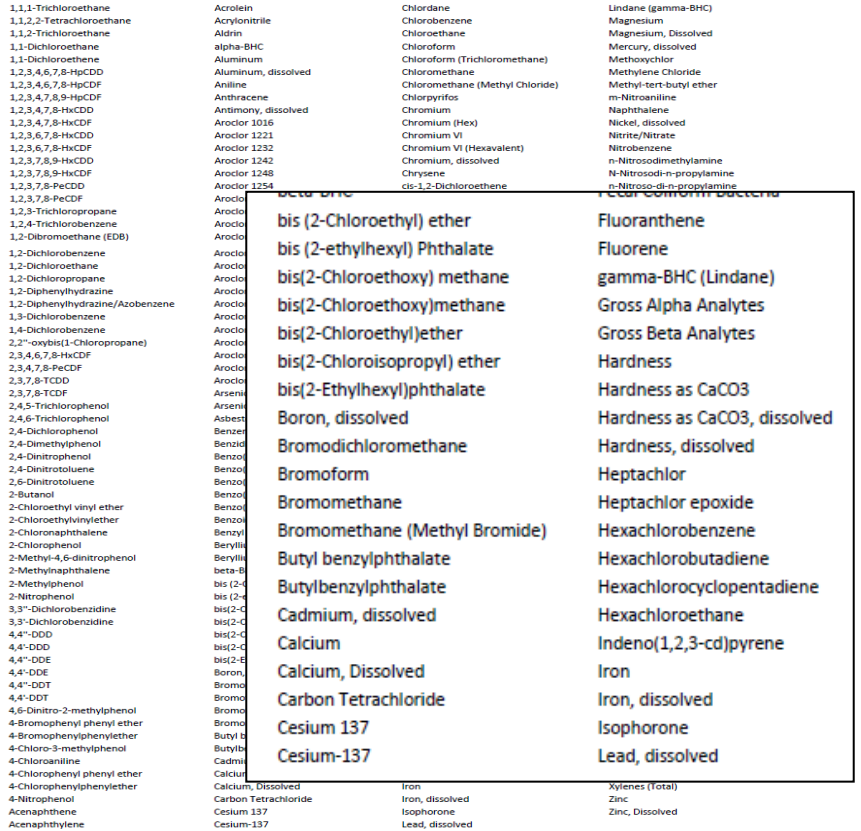


NPDES Permit Overview

- Stormwater discharges at SSFL are regulated by the LARWQCB through an individual NPDES permit, which requires:
  - Composite sampling at 12 stormwater outfalls;
  - Influent sampling at 2 active stormwater treatment systems; 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 annual average (drinking water limit)

Monitored Parameters

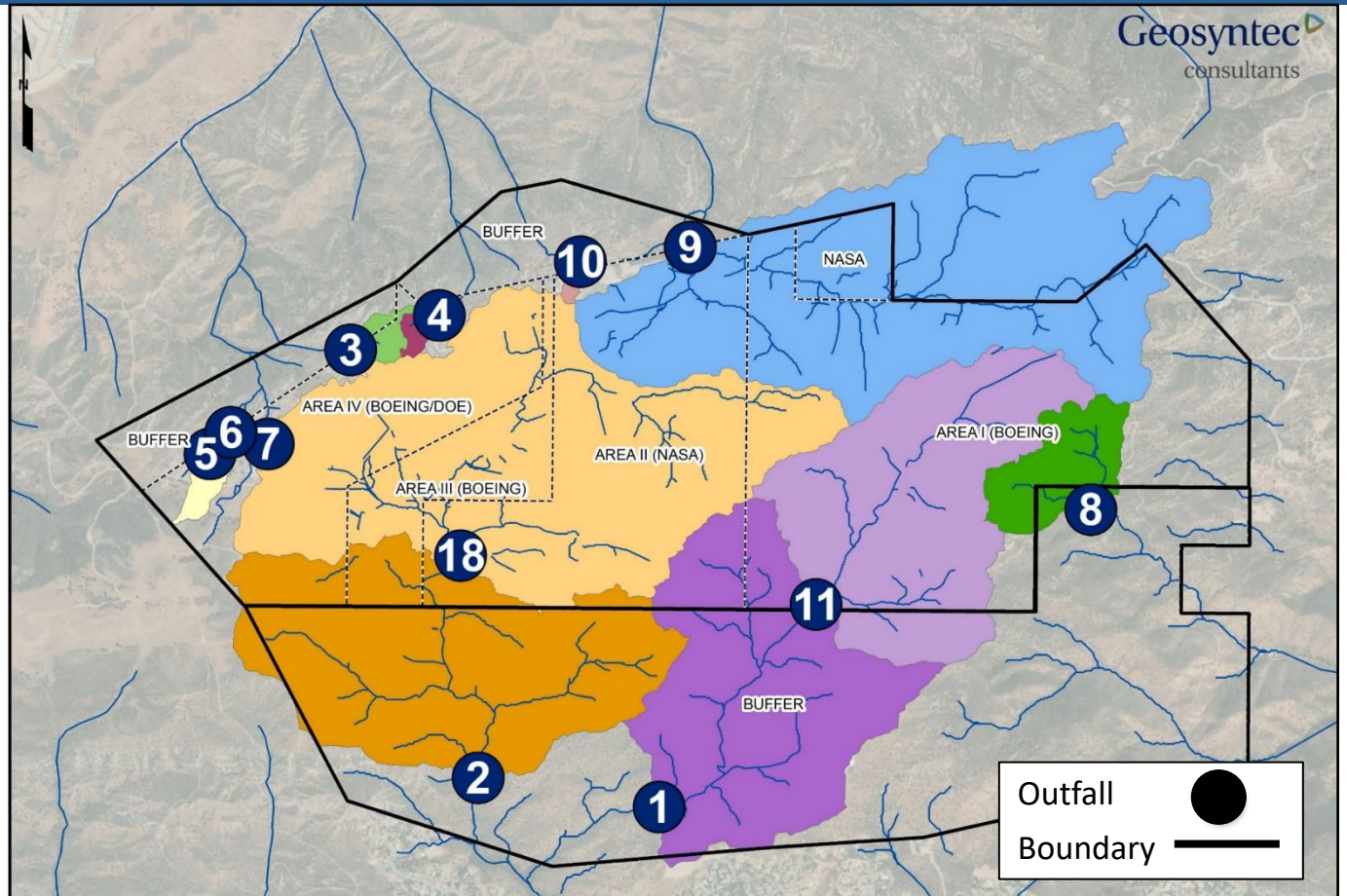
- 32-44 constituents are analyzed at every surface water outfall during every storm that produces runoff
- Over 250 constituents are analyzed at every outfall at least once annually
- **More constituents added to the newly adopted permit in response to public comments**



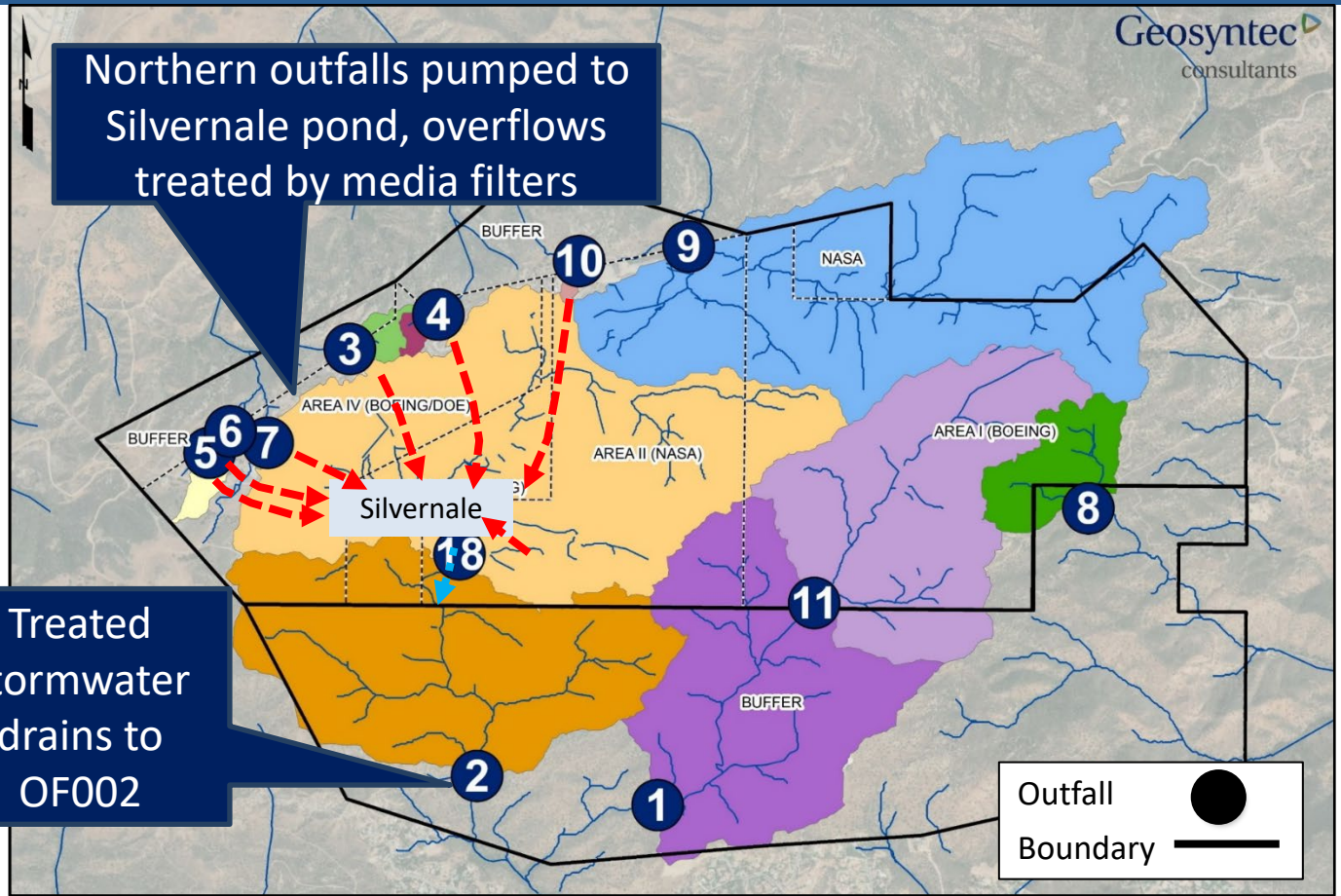
2 Site Stormwater Overview & Local Context

Surface Water Flow On and Off SSFL

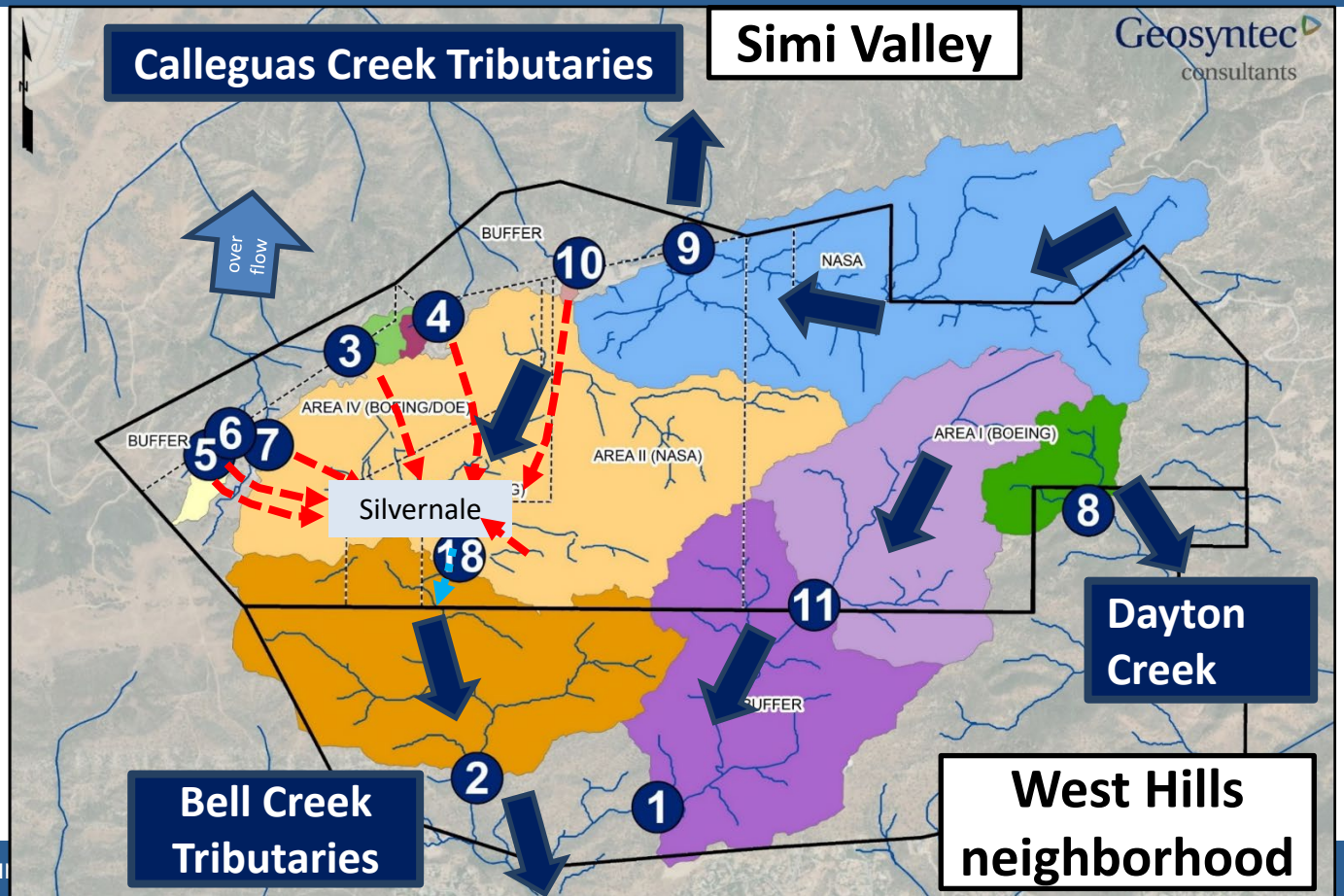
NPDES Watersheds and Outfalls at SSFL



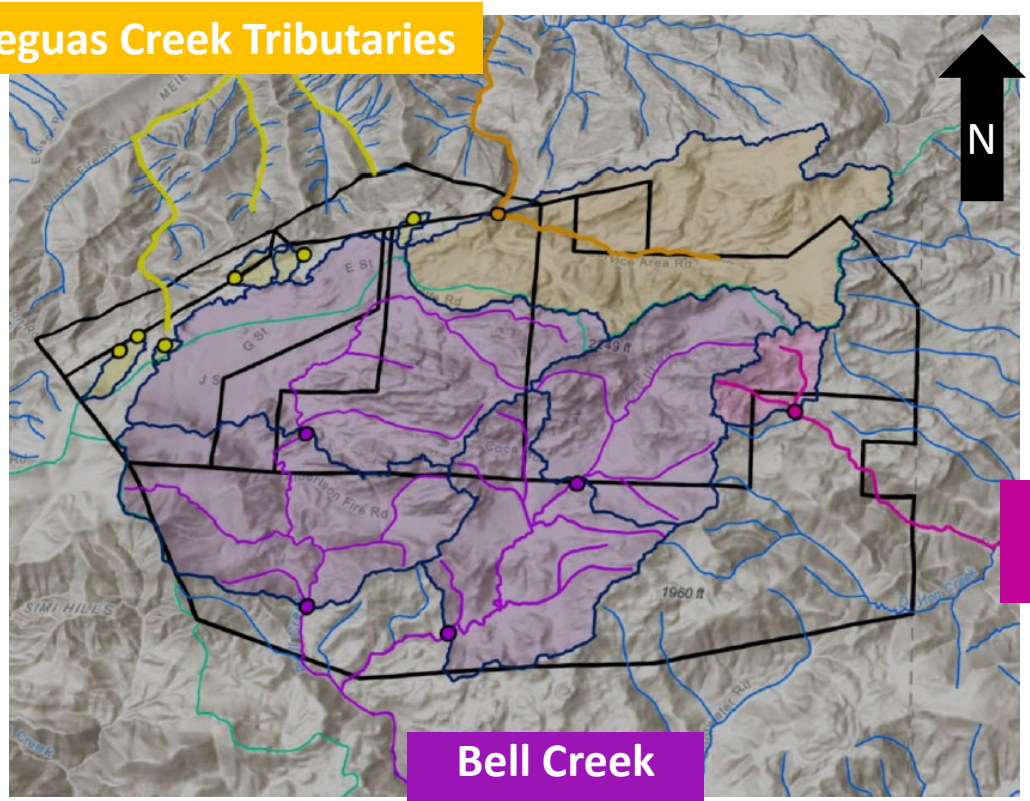
NPDES Watersheds and Outfalls at SSFL



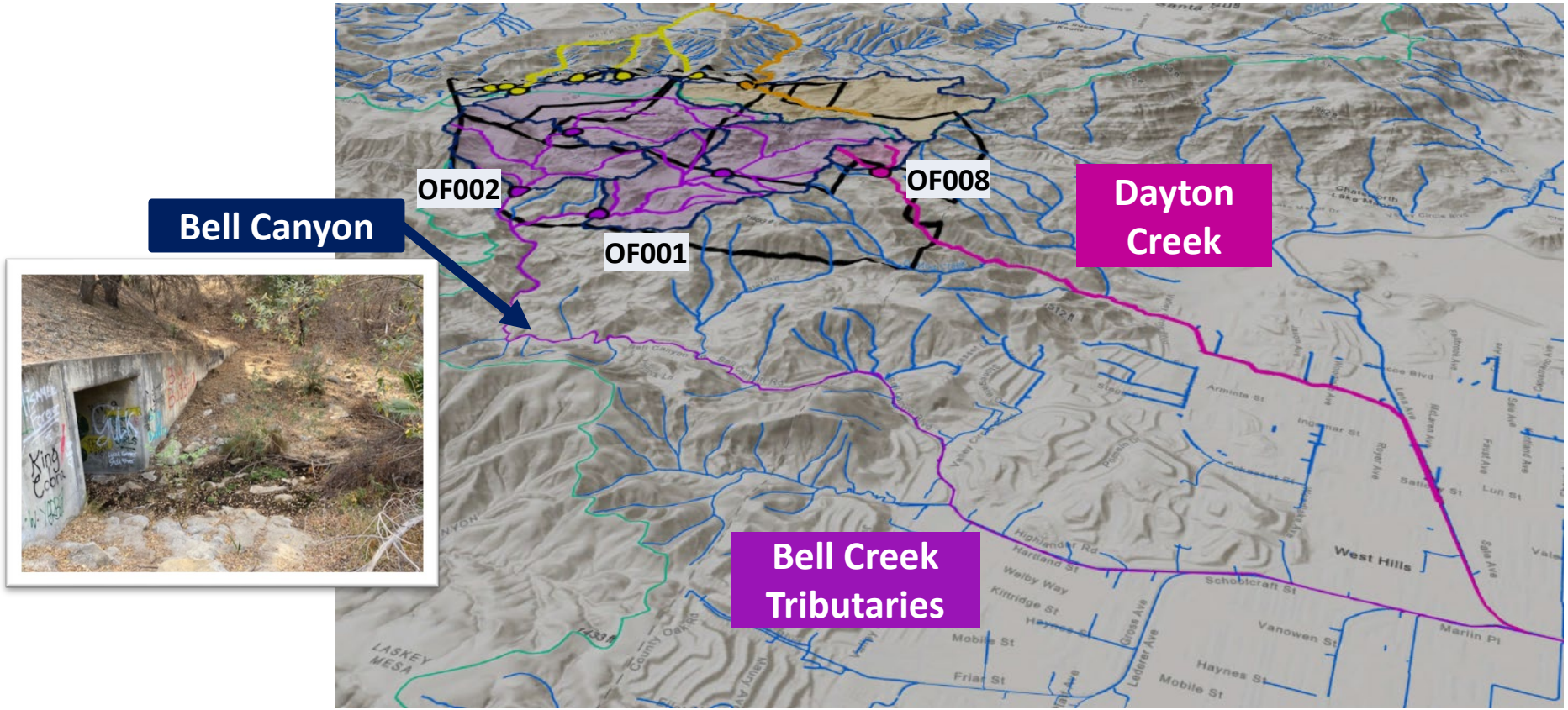
Surface Water Flow through NPDES Watersheds and Outfalls at SSFL



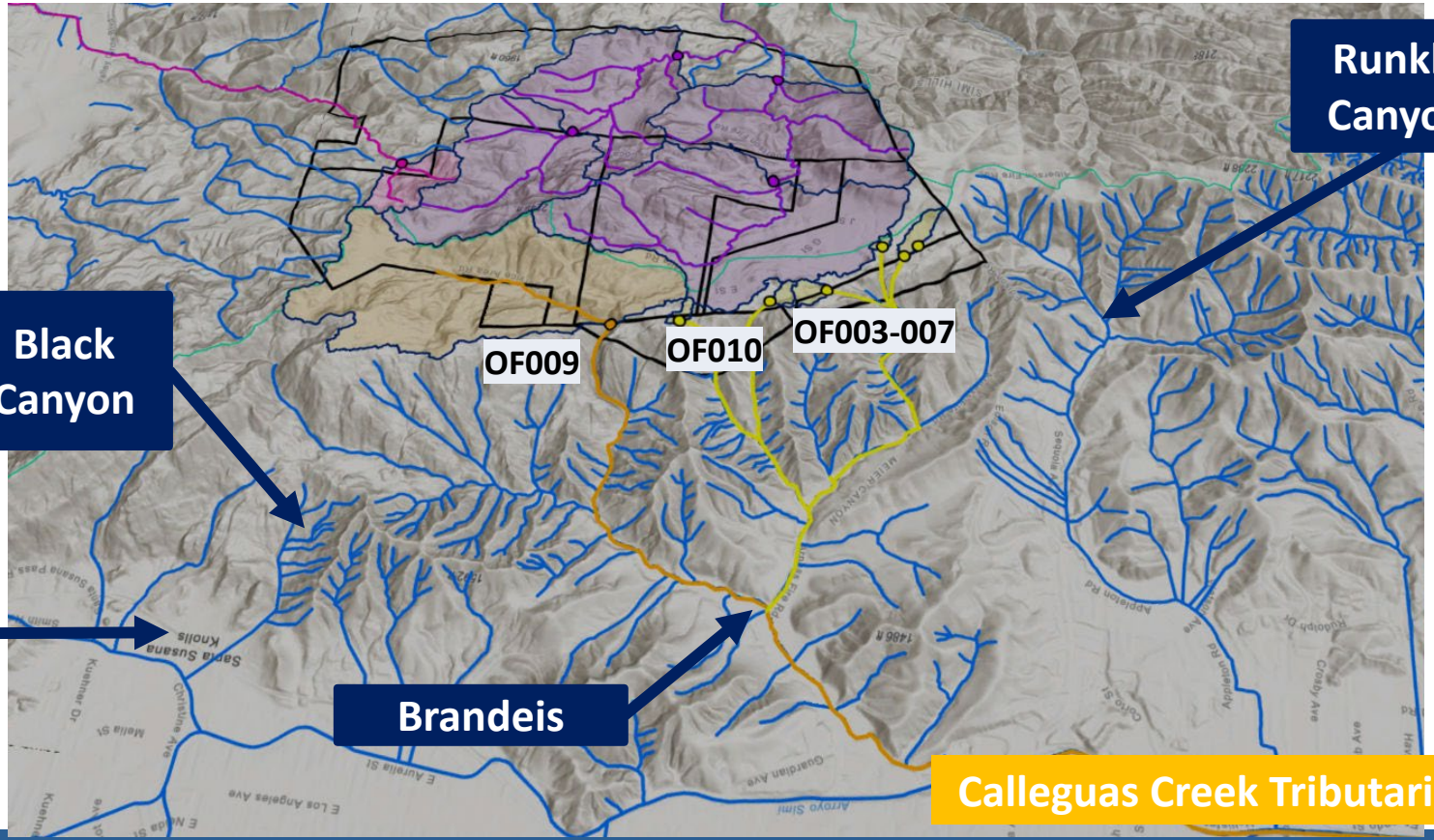
SSFL relative to nearby communities



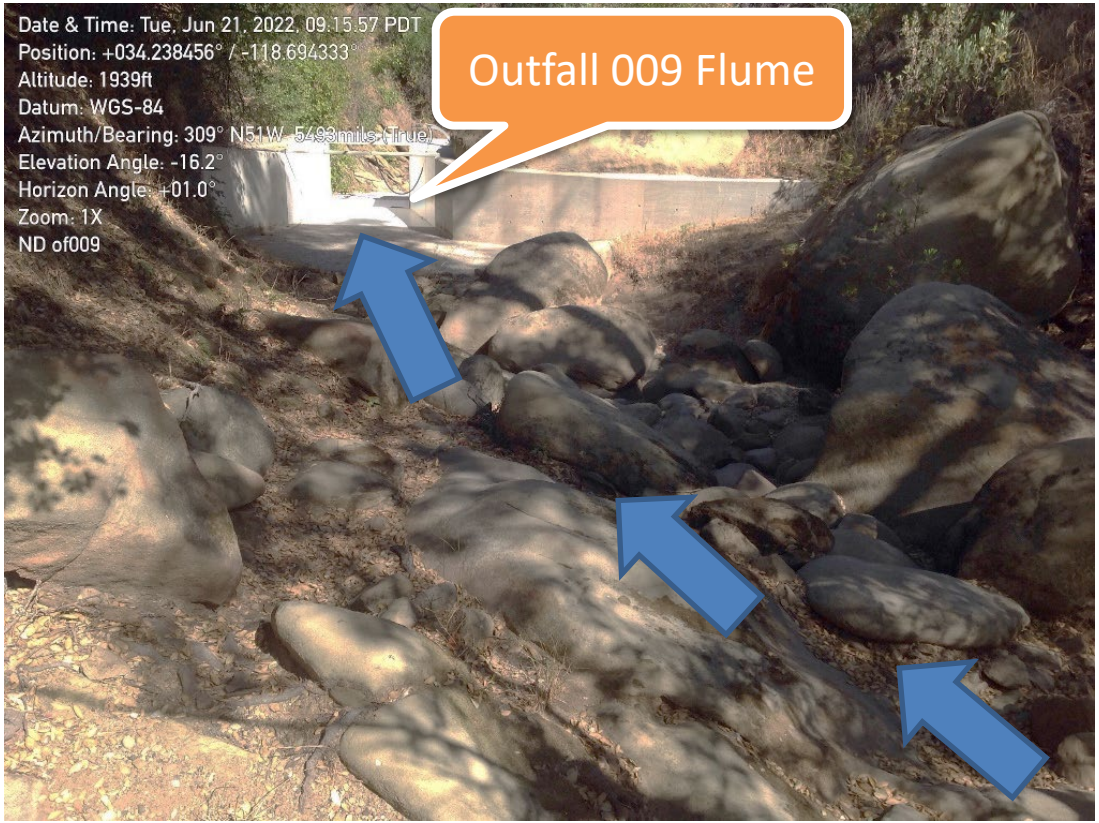
View of south-flowing watersheds and Bell Canyon neighborhood



Oblique view of north-flowing watersheds and Brandeis



NPDES Outfall Example: Looking Downstream Toward Outfall 009

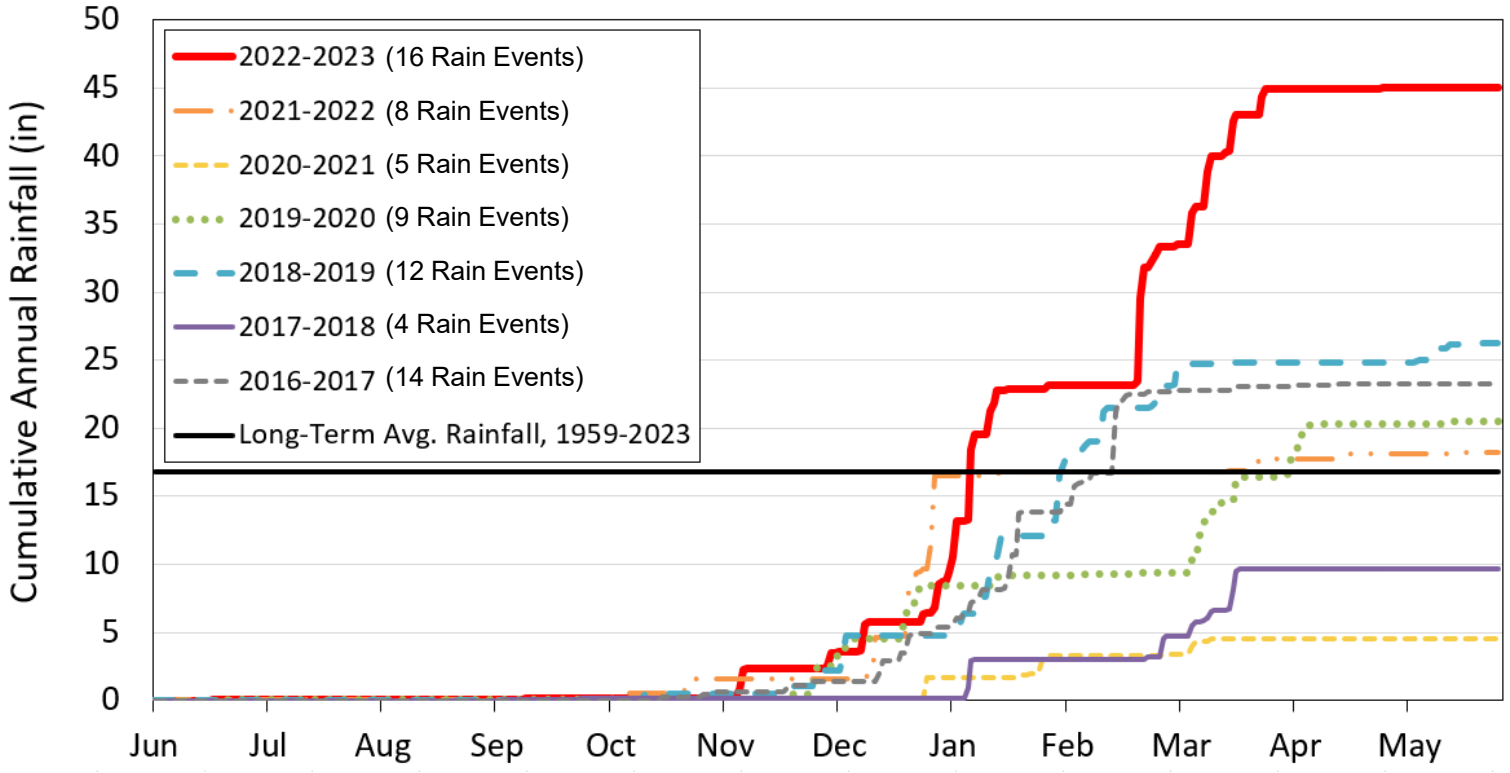


- All flow in the stream/drainage is directed into the flume
- Sample collection and flow measurements occur in the flume
- Every outfall is equipped with an autosampler and flow meter

3 2022/23 Reporting Year

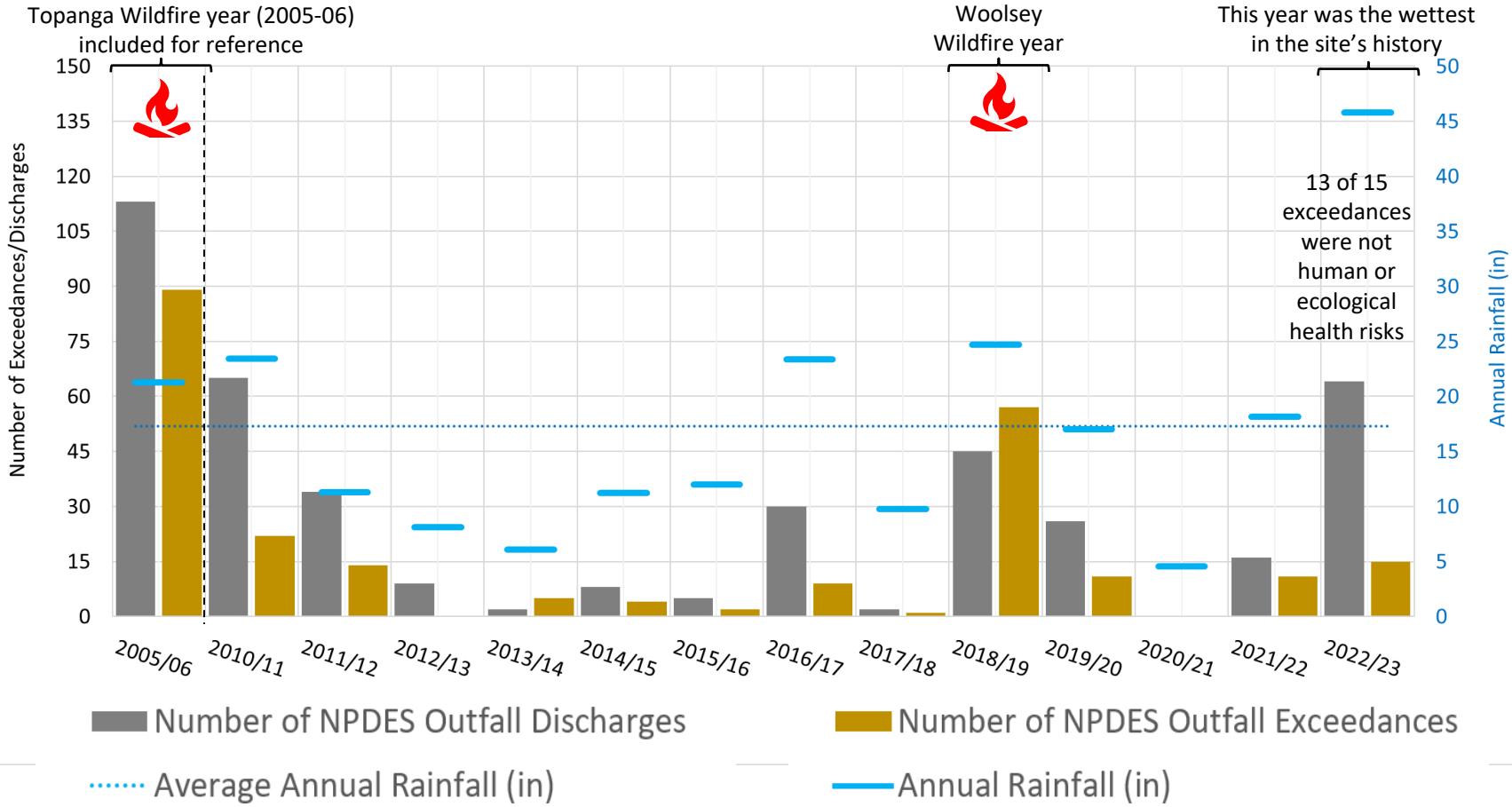
- Rainy season summary
- Monitoring results summary
- Exceedances and source analysis

2022/2023 Rainfall



Highest annual rainfall total in the 64-year-long record at the site

Historical Overview – NPDES Sampling



2022/2023 Exceedance Summary

Parameter	Criteria Basis	Outfall 001 (11 samples)	Outfall 002 (14 samples)	Outfall 008 (10 samples)	Outfall 009 (11 samples)	Outfall 010 (1 sample)	Outfall 011 (7 samples)	Outfall 018 (11 samples)	Total* (65 samples)
Iron	Aesthetic (taste/odor)	4	3	NR	NR	0	3	0	10
Manganese	Aesthetic (taste/odor)	0	0	NR	NR	0	2	0	2
Sulfate	LA Basin Plan (antidegradation)	0	1	0	0	0	0	0	1
TCDD TEQ (no DNQ)	Human health (fish consumption)	0	0	0	0	1	1	0	2
Total		4	4	0	0	1	6	0	15

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.

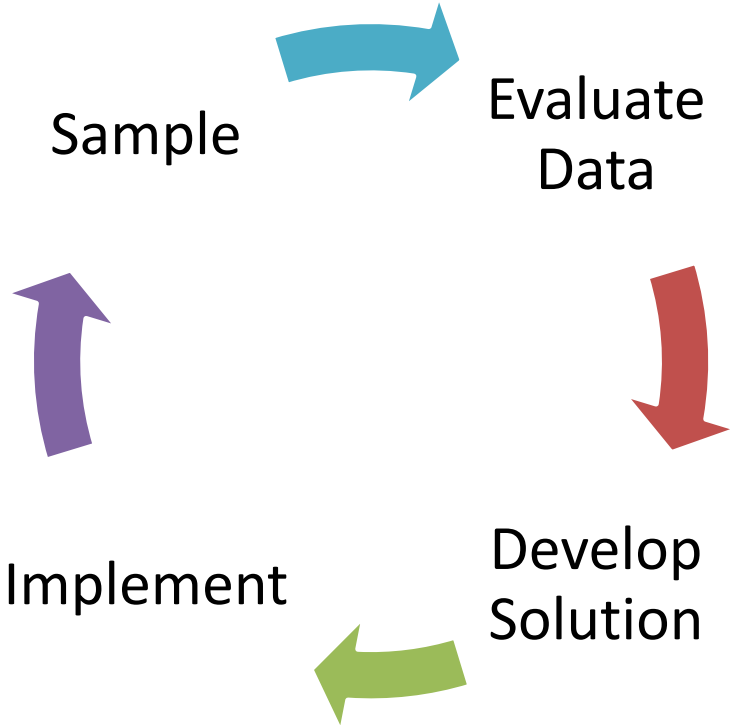
99.3% of all onsite outfall samples and analytes were in compliance.

2022/2023 Exceedance Source Investigation

Parameter	Outfall	Sample Date	Exceedance Sources with Most Weight of Evidence
Iron	001	1/6/2023	background soils
Iron	001	1/15/2023	background soils
Iron	001	2/26/2023	background soils
Iron	001	3/11/2023	background soils
Iron	002	1/2/2023	background soils
Iron	002	1/6/2023	background soils
Iron	002	1/15/2023	background soils
Iron	011	1/17/2023	background soils
Iron	011	2/25/2023	background soils
Iron	011	3/16/2023	background soils
Manganese	011	1/10/2023	inconclusive, possible SWTS effects
Manganese	011	2/25/2023	background soils
Sulfate	002	5/5/2023	natural shale geology, natural seeps
TCDD TEQ (No DNQ)	010	1/11/2023	pavement solids, soils near treated wood, impacted soils*
TCDD TEQ (No DNQ)	011	2/25/2023	pavement solids, soils near treated wood, impacted soils*, and/or background soils

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

Panel's Process for Stormwater Quality Management

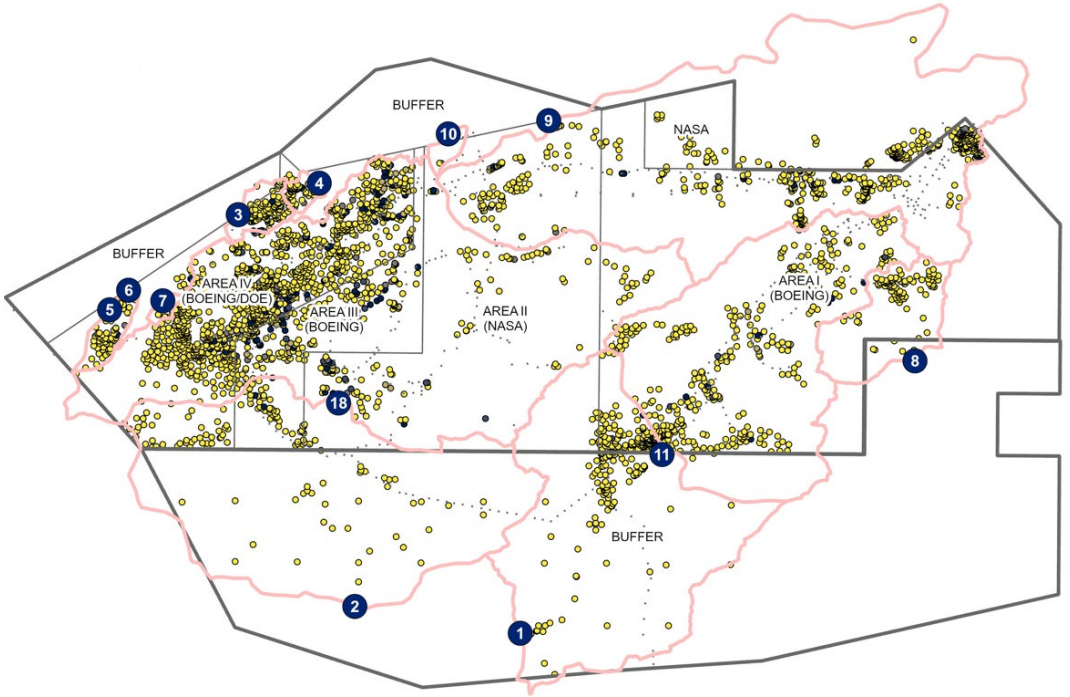


Example: Lead at Outfall 009

1. Outfall sample result shows exceedance of permit limit
2. Subarea results were evaluated and confirmed that impacted Shooting Range soils likely contributed
3. Existing Shooting Range BMPs evaluated, improvements identified, and targeted accelerated source removal (lead shot along trail) requested
4. Requested actions implemented

Source Investigation Example

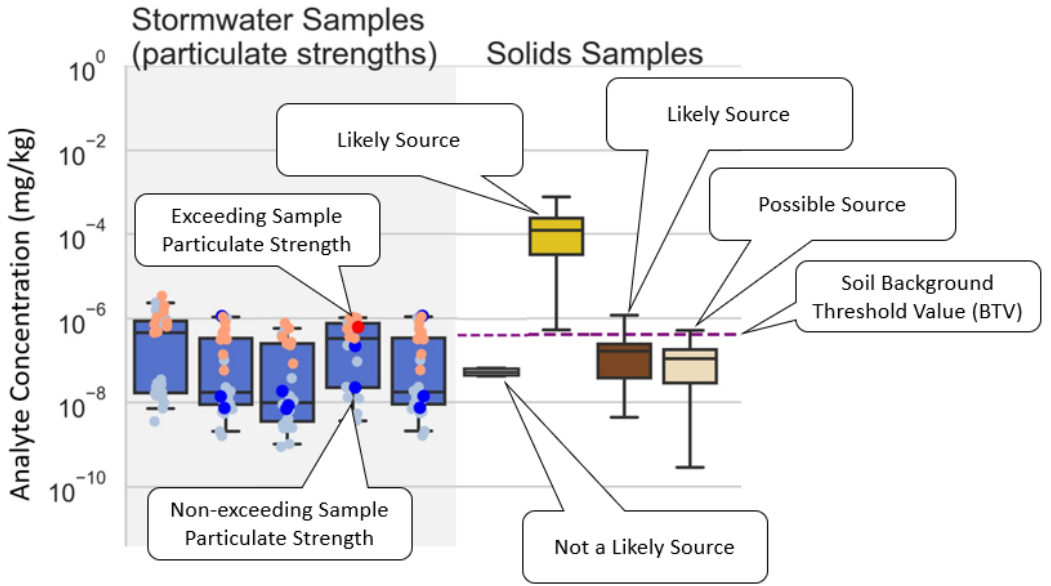
- **Could soils impacted by industrial activities be contributing to the exceedance?**
- What sources have sufficiently high concentrations to cause an exceedance?
- Does the fingerprint (e.g. metal ratios) of the exceedance match background soils?



Example Soil Sample Map
(Data from RFI Source Investigation)

Source Investigation Example

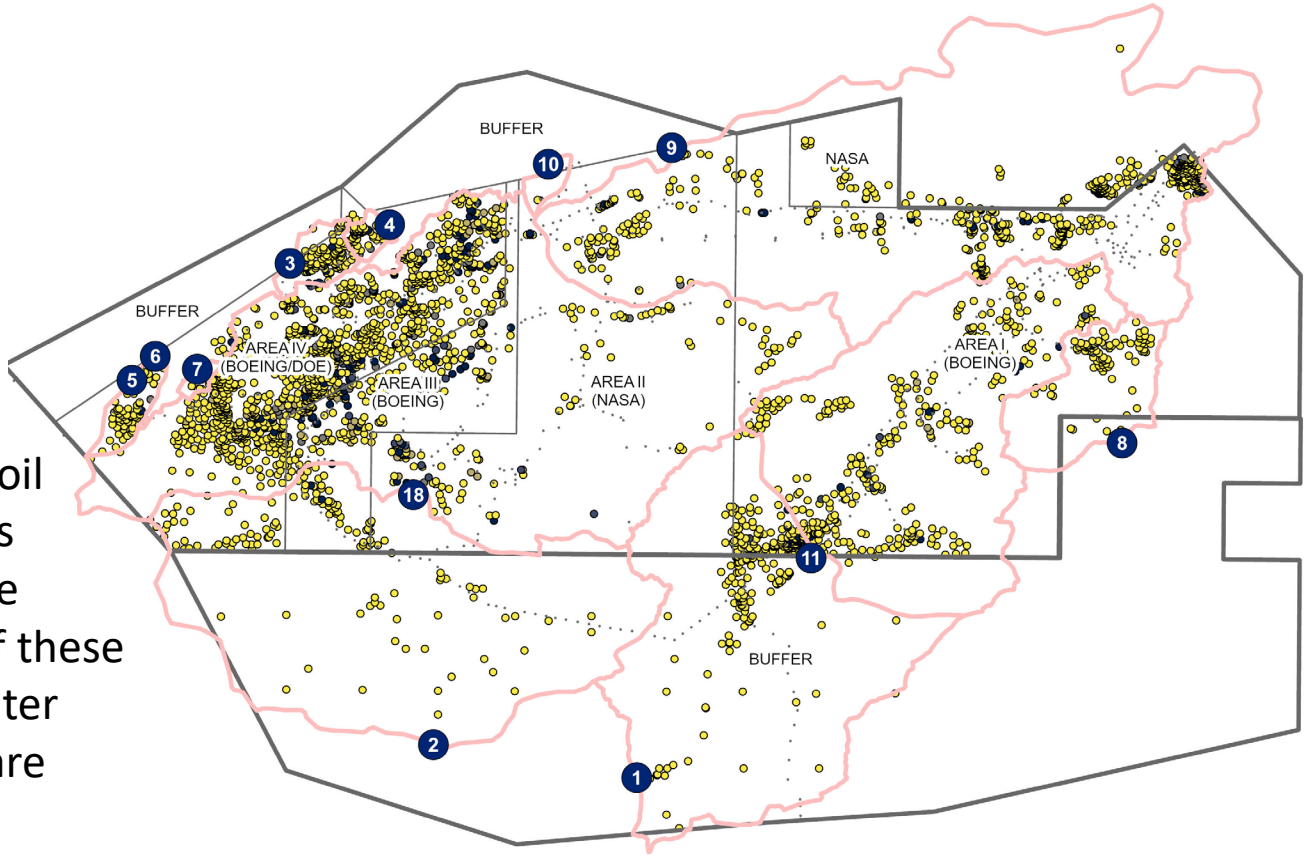
- Could soils impacted by industrial activities be contributing to the exceedance?
- **What sources have sufficiently high concentrations to cause an exceedance?**
- Does the fingerprint (e.g. metal ratios) of the exceedance match background soils?



Example Particulate Strength vs Solid Concentration Exceedance Source Evaluation

Surface Soil Sample Maps – Dioxin TEQ

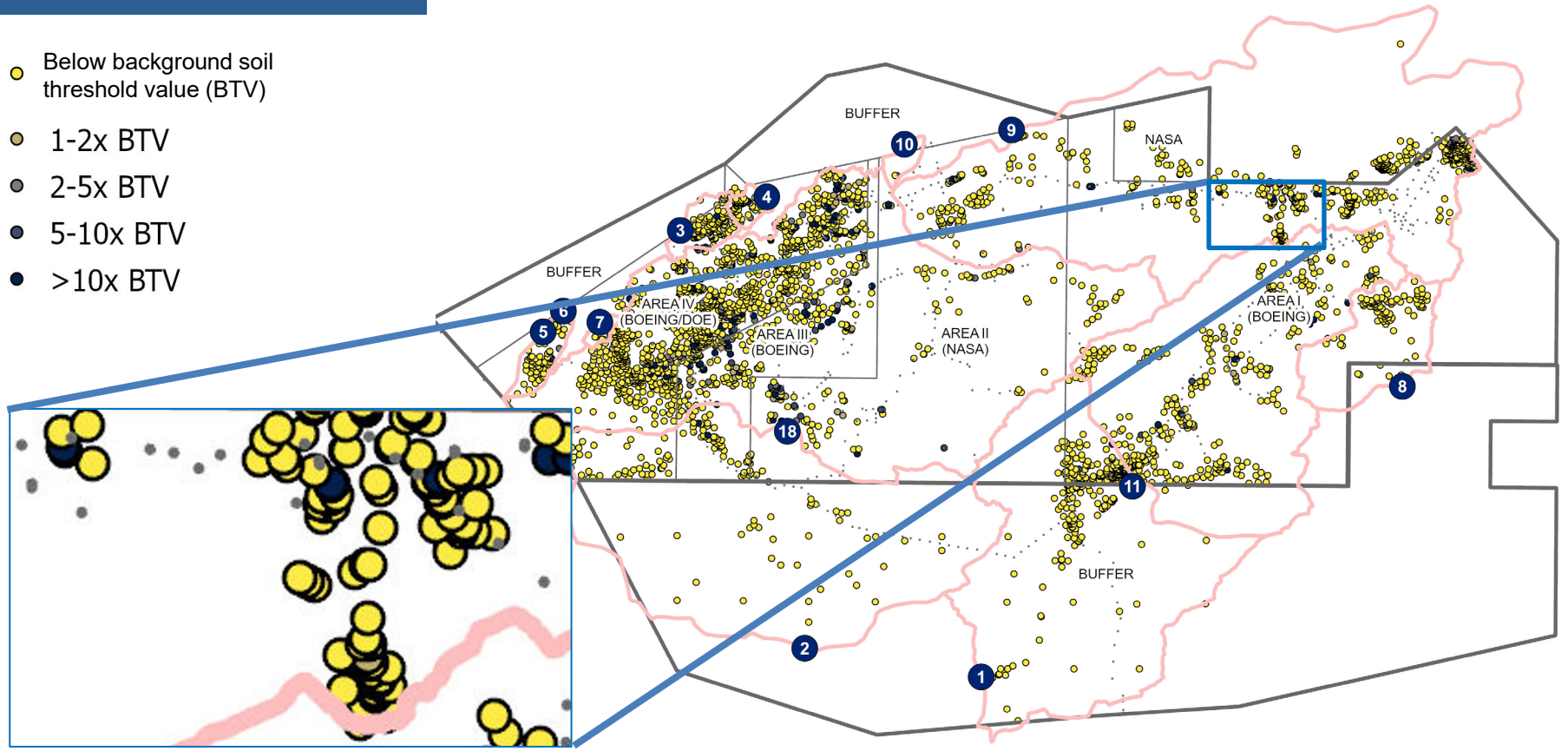
- Below background soil threshold value (BTV)
- 1-2x BTV
- 2-5x BTV
- 5-10x BTV
- >10x BTV



- Map shows all surface soil sample results for dioxins
- Some of these are above background, and most of these areas drain to a stormwater treatment BMP (yellow are below background)

Surface Soil Sample Maps – Dioxin TEQ

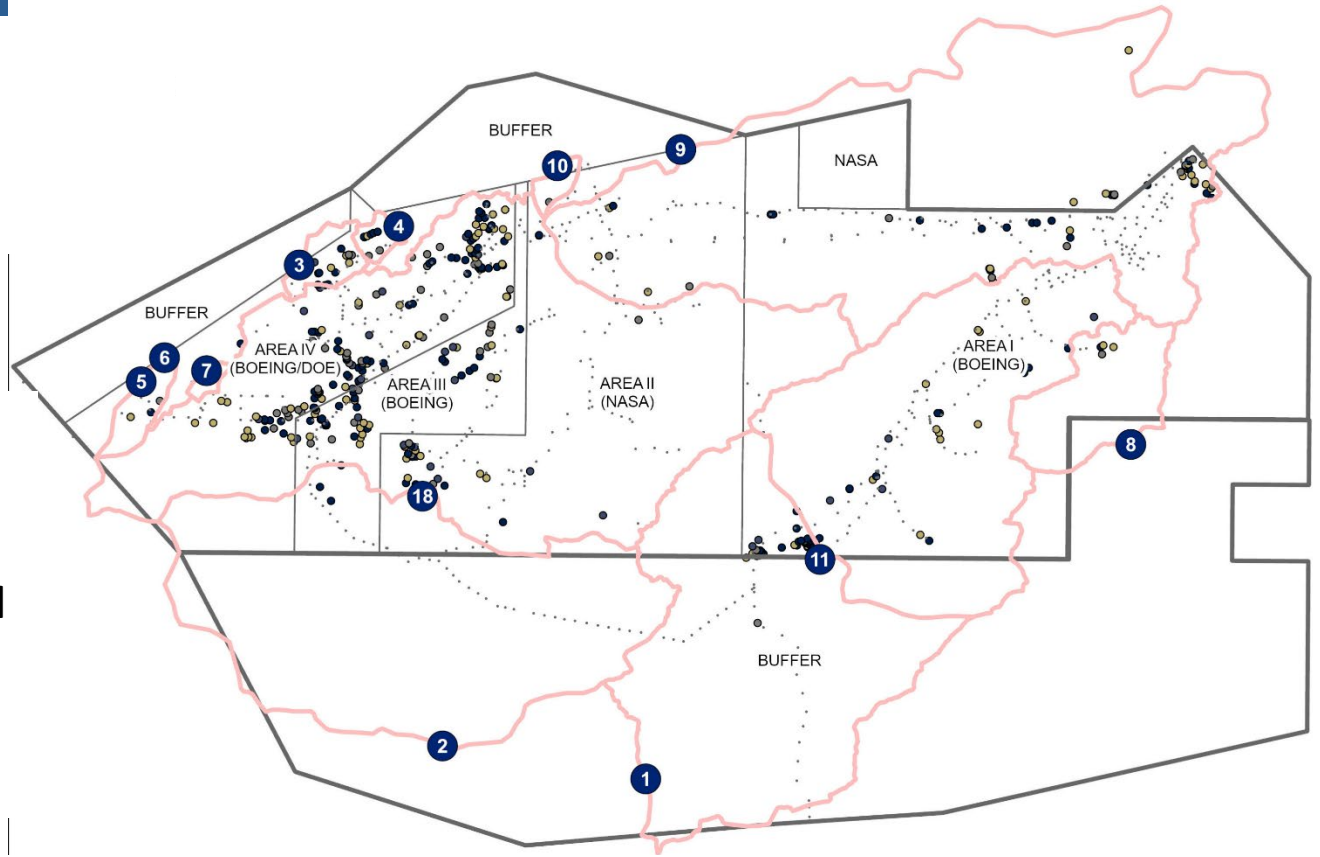
- Below background soil threshold value (BTV)
- 1-2x BTV
- 2-5x BTV
- 5-10x BTV
- >10x BTV



Surface Soil Sample Maps – Dioxin TEQ

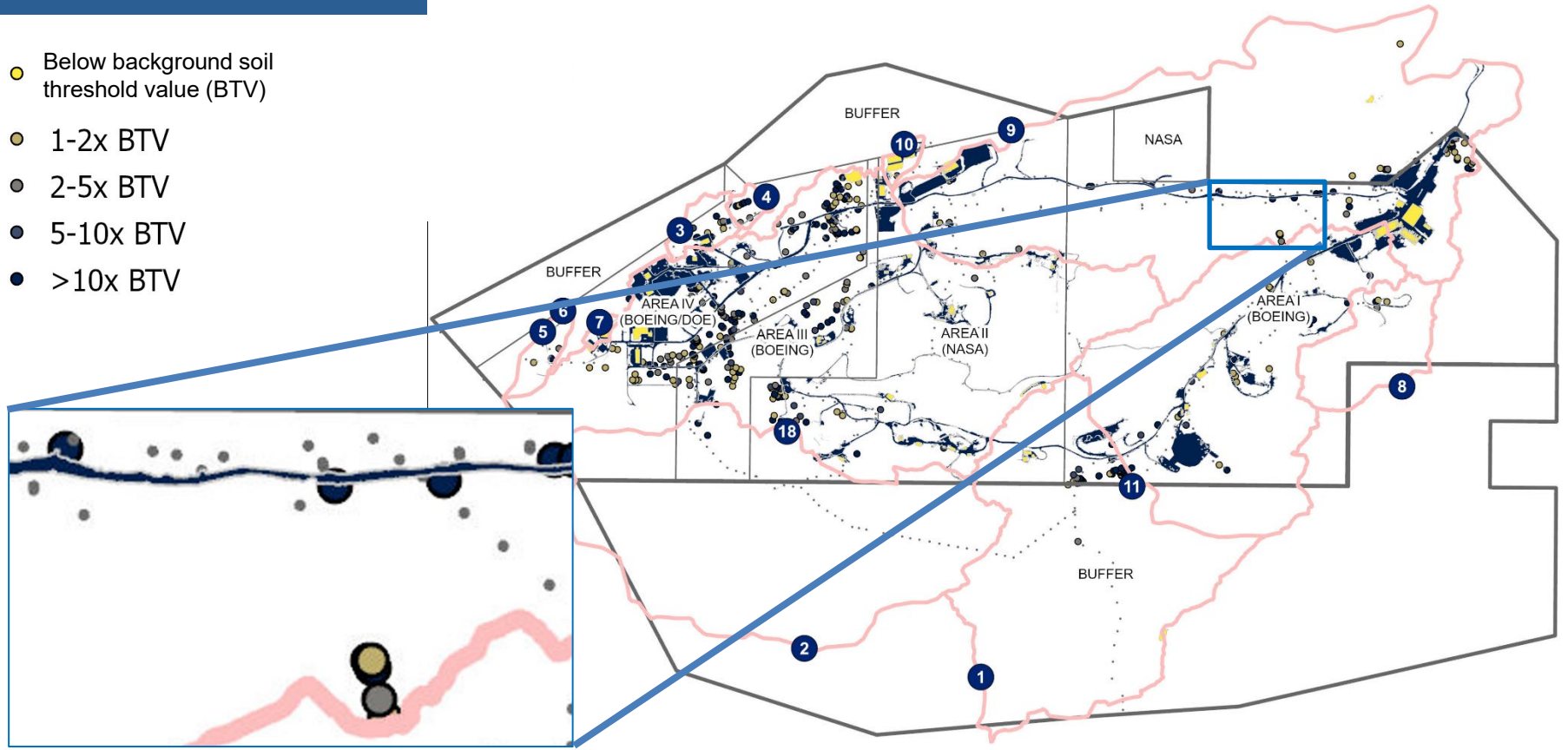
- Below background soil threshold value (BTV)
- 1-2x BTV
- 2-5x BTV
- 5-10x BTV
- >10x BTV

- Map shows only surface soil sample results for dioxins that are **above background**
- Nearly all of these areas drain toward BMPs



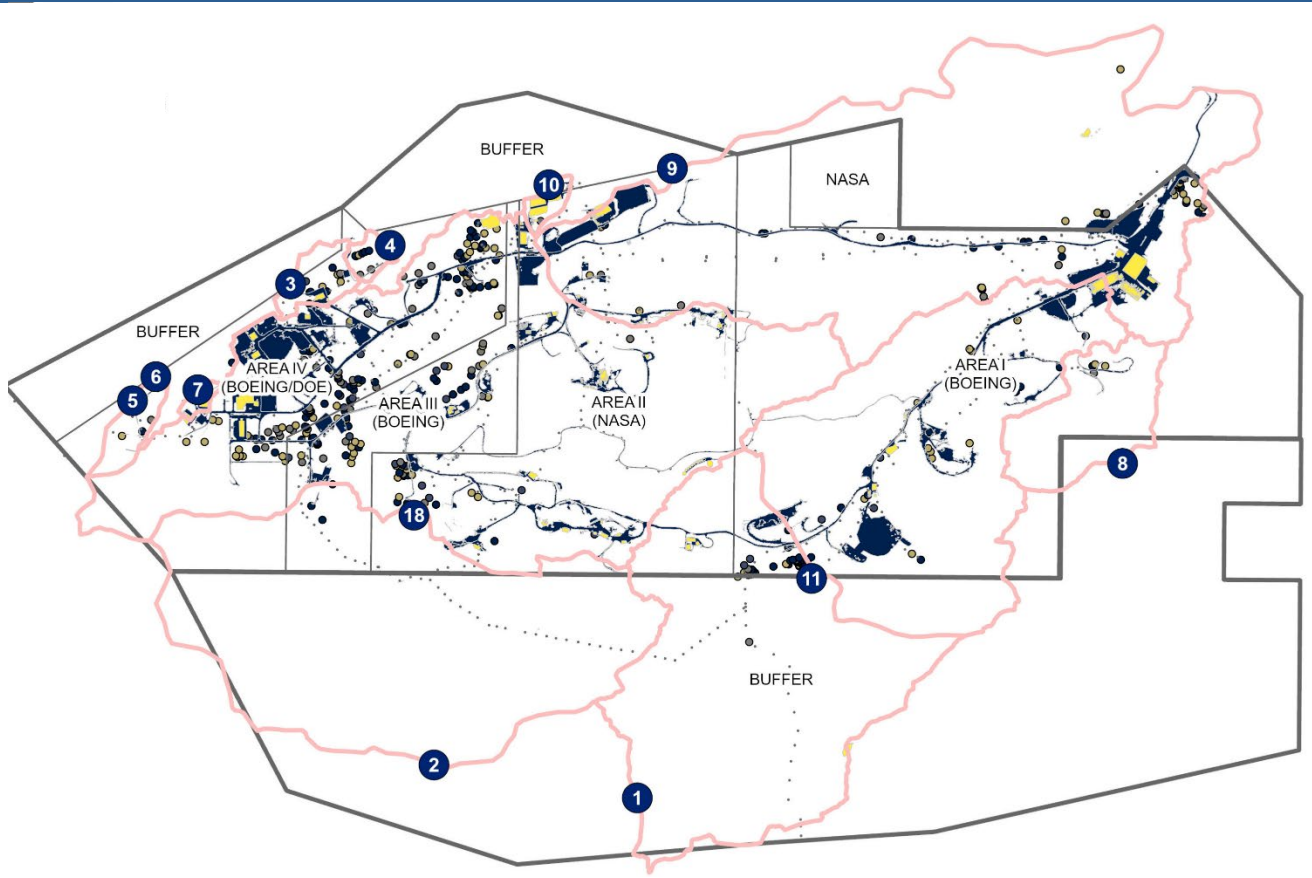
Surface Soil Sample Maps – Dioxin TEQ

- Below background soil threshold value (BTV)
- 1-2x BTV
- 2-5x BTV
- 5-10x BTV
- >10x BTV

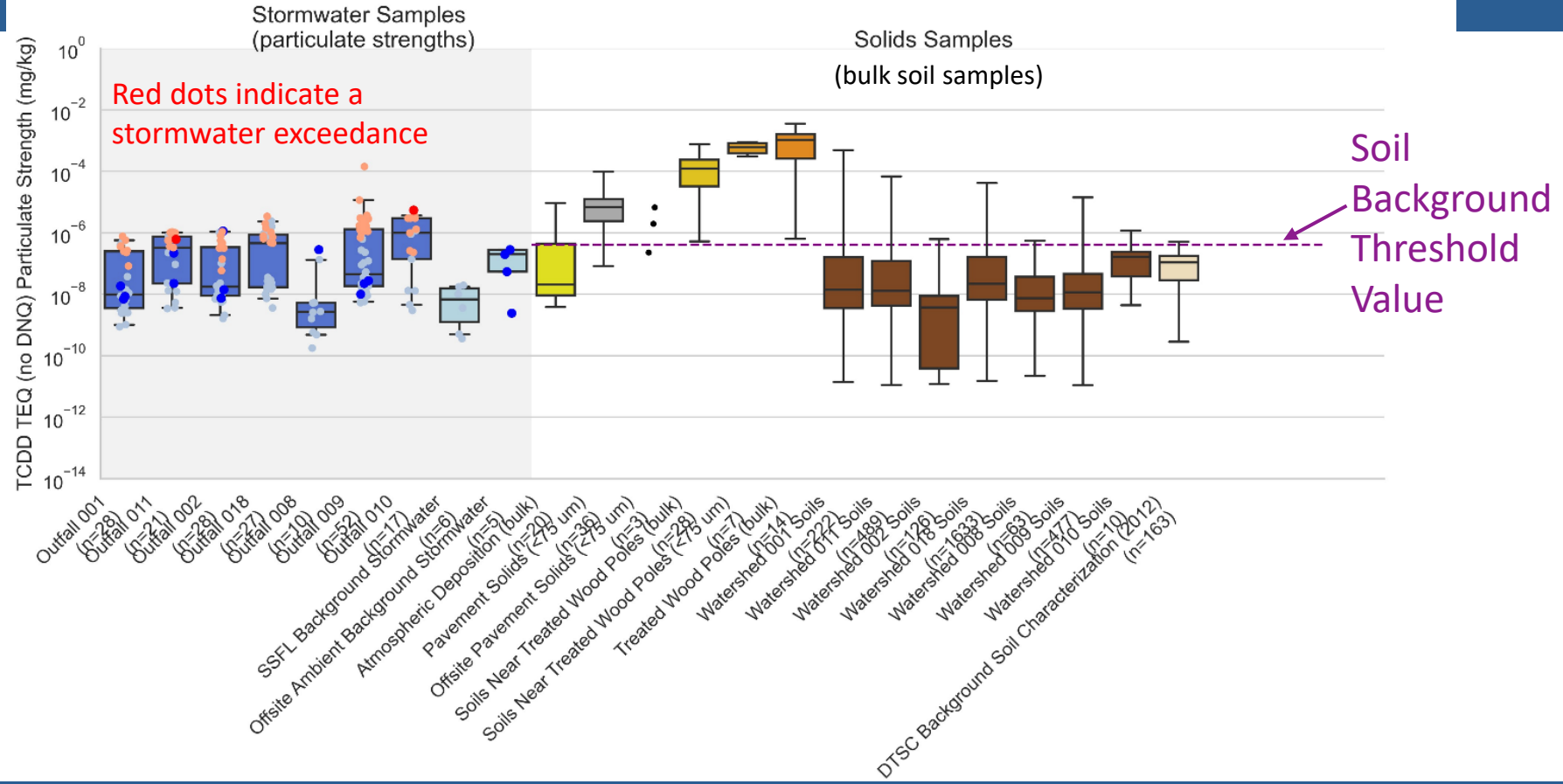


Surface Soil Sample Maps – Dioxin TEQ

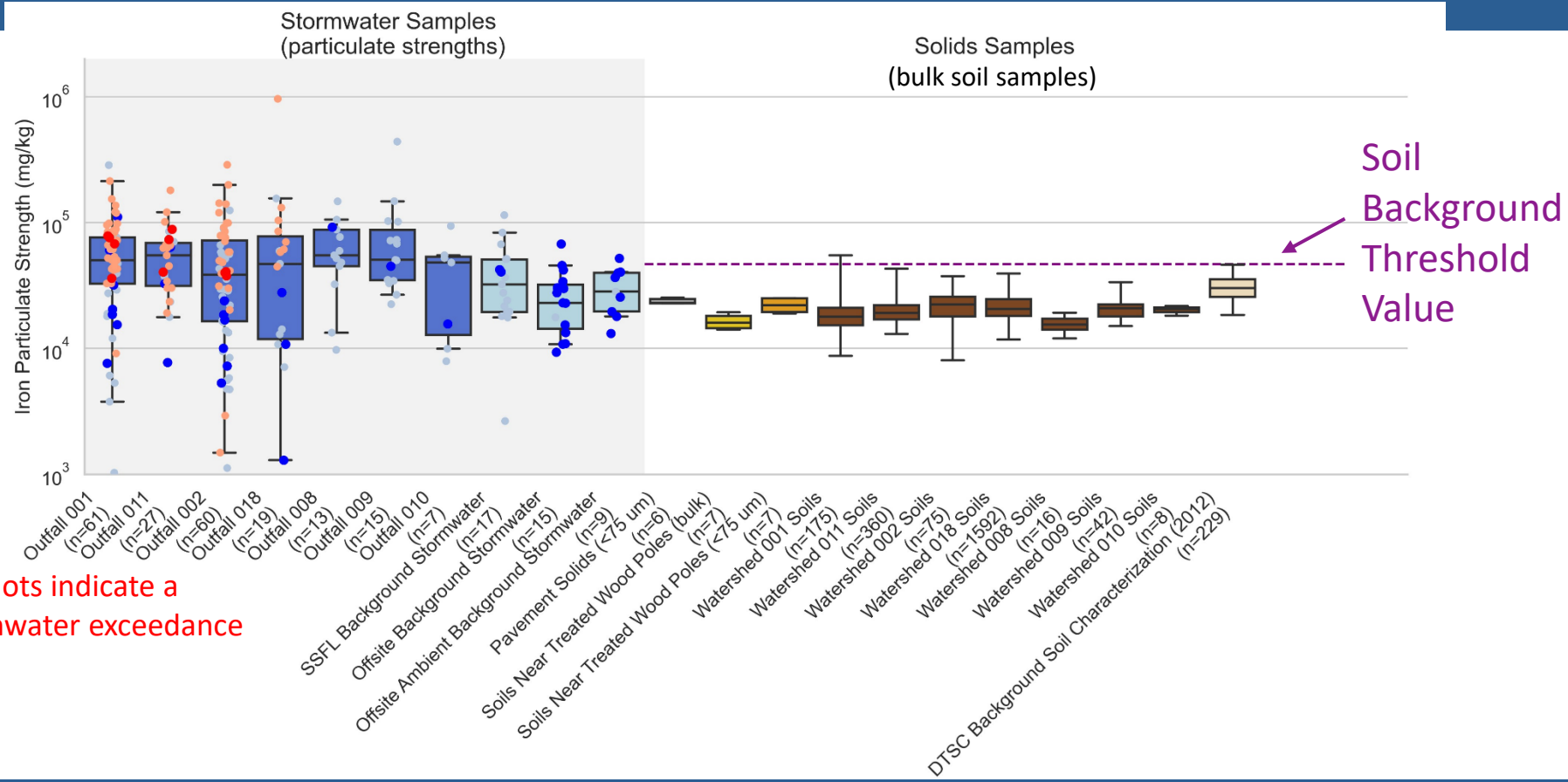
- Poles and pavement, are just as concentrated and similar or greater in area, so we've also focused on controlling stormwater from here as well
- These sources are not unique to SSFL, they're present in urban development everywhere



Source Investigation Example: Dioxin Particulate Strength



Source Investigation Example: Iron Particulate Strength

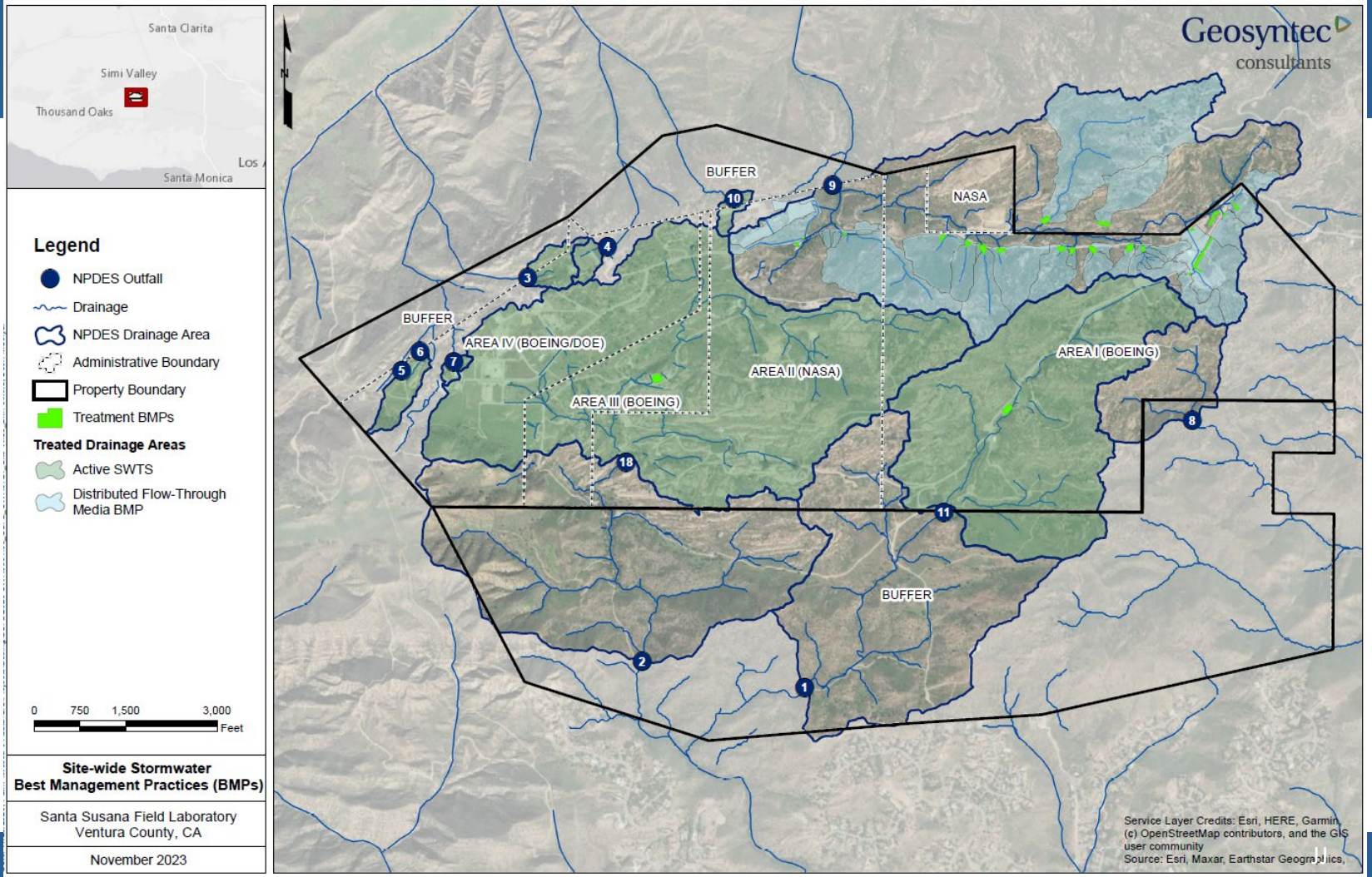


Red dots indicate a stormwater exceedance

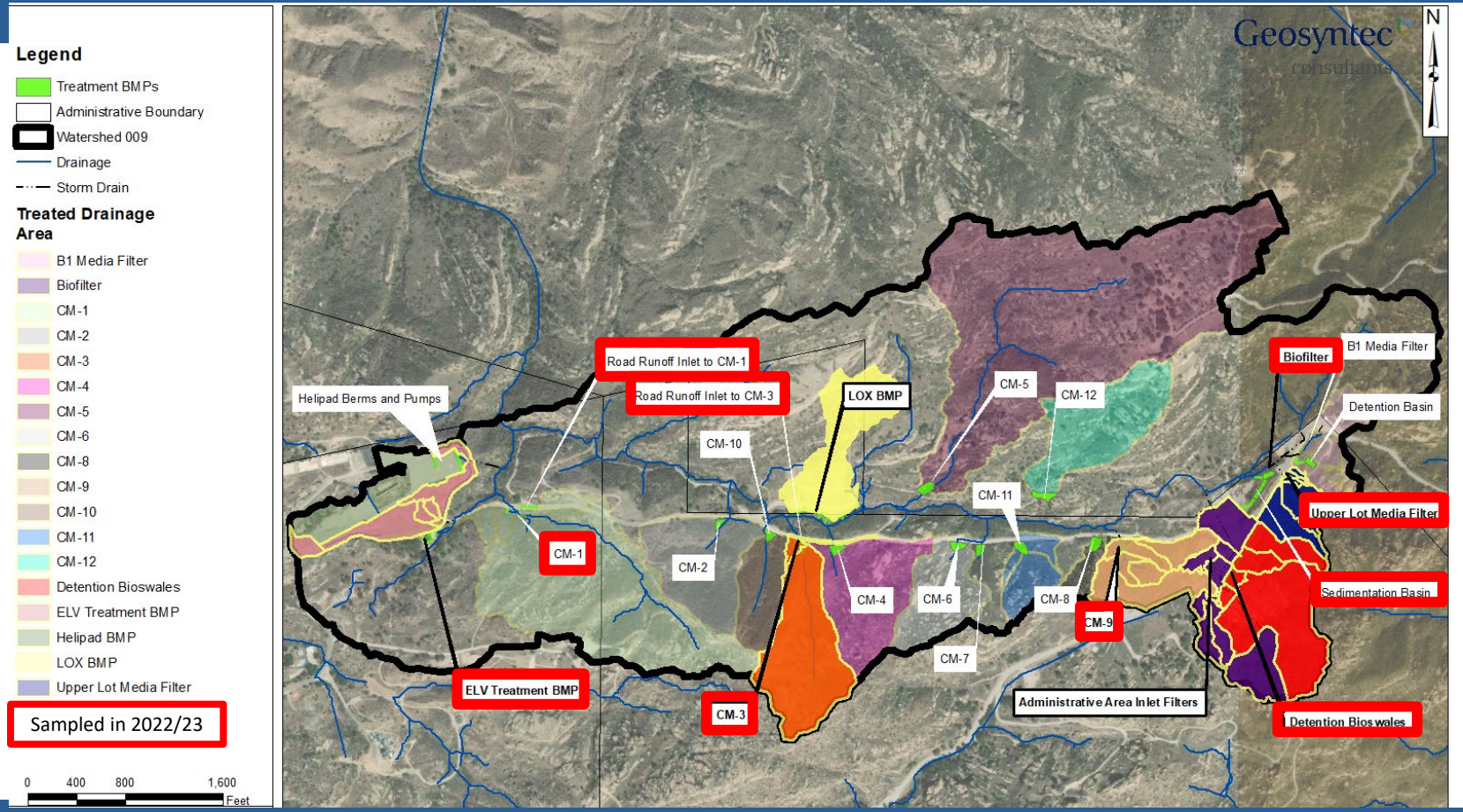
Existing Structural Controls

- **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

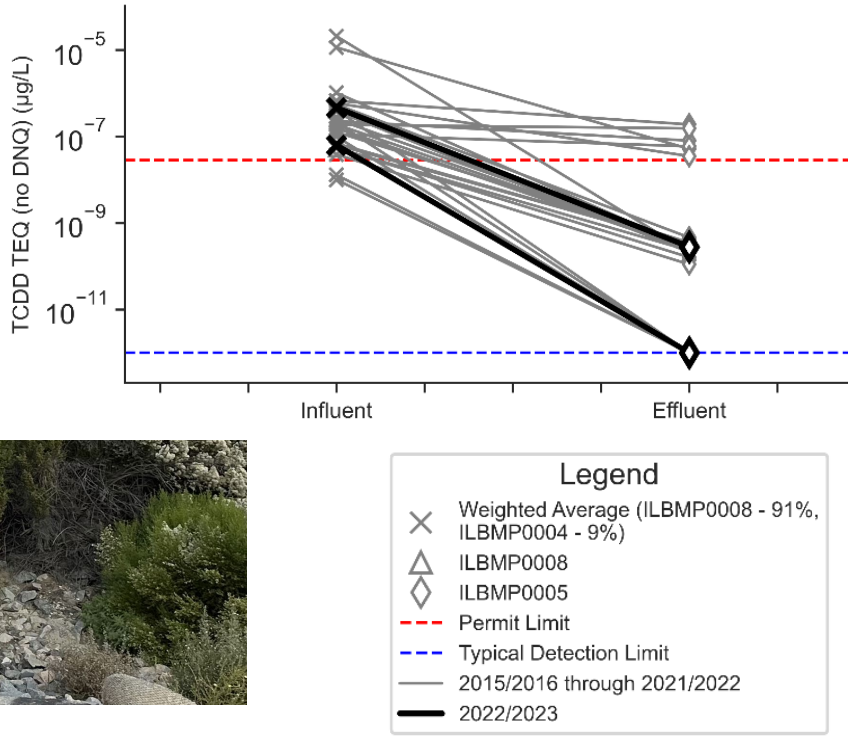

Santa Clarita
Simi Valley
Thousand Oaks
Santa Monica
Legend
NPDES Outfall
Drainage
NPDES Drainage Area
Administrative Boundary
Property Boundary
Treatment BMPs
Treated Drainage Areas
Active SWTS
Distributed Flow-Through Media BMP
0 750 1,500 3,000
Feet
Site-wide Stormwater Best Management Practices (BMPs)
Santa Susana Field Laboratory
Ventura County, CA
November 2023
Geosyntec consultants
BUFFER
NASA
BUFFER
AREA IV (BOEING/DOE)
AREA II (NASA)
AREA I (BOEING)
AREA III (BOEING)
BUFFER
Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Source: Esri, Maxar, Earthstar Geographics,

Distributed Controls in Watershed 009



Treatment Performance: Distributed Passive BMPs

Dioxins at Southern Detention Bioswale

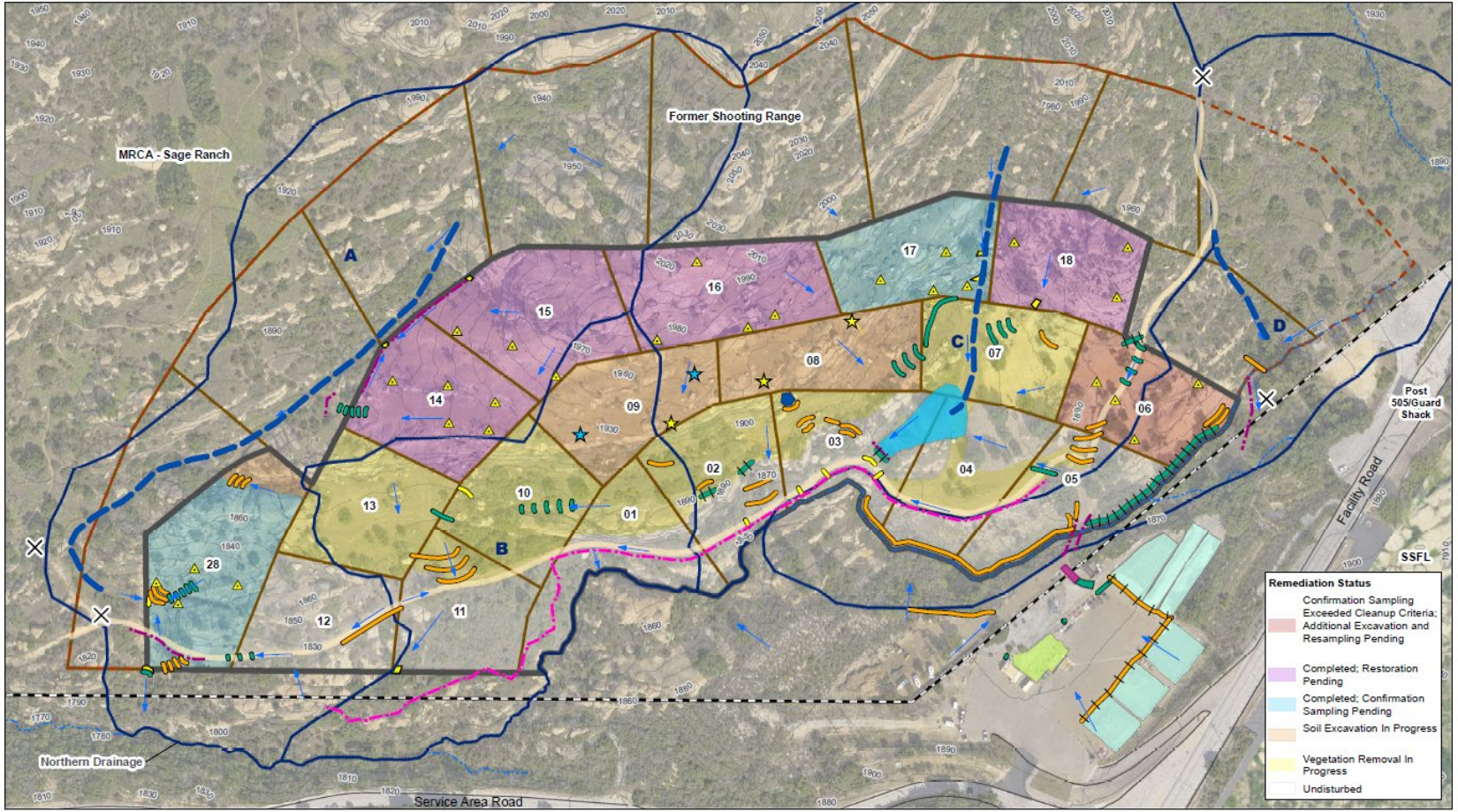


4 Interim Cleanup Measures

- Stormwater management at interim cleanup measures
- Former shooting range
- Area 1 Burn Pit

Interim Soil Cleanup Areas

- Two early cleanup actions have been ordered by DTSC
  - Former Shooting Range in progress
  - Area I Burn Pit (AIBP) scheduled to start in 2024
- The Panel is reviewing the Stormwater Pollution Prevention Plans (SWPPPs) and recommending stormwater BMPs for during and after cleanup



SSFL Property Boundary
Decision Unit (DU) Boundary
Removal Action
Sage Ranch Main Trail
Current Hiking Trial Closure Points (to be opened following completion of Removal Action)
Chute
Water Buffalo
Drainage
Surface Water Flow Direction
Path of Concentrated Flow
Sub-Watershed
XRF Hot Spot; Additional Soil Removed
Existing Silt Fence
Gravel Bag Berm
Gravel Bag Berm, 3 High
Rip Rap Dam
Silt Fence
Straw Wattle
Straw Wattle Under Edge of HDPE Liner
Covered Containment Cell
Detention Pond
Lower Lot Cistern
Gravel
Rip Rap Dam
Rumble Plates
Plastic Tarp

Former Shooting Range
BMP Plan - Remedial Action Areas
SAGE RANCH PARK

Path: C:\Working\Boeing\Rocketdyne\Shooting_Range_Order\MXD\Fig_E_B3_SWPPP_BMP_2023Nov.mxd Date: 11/27/2023

1 inch = 140 feet
0 70 140 210 280 Feet

Stantec

Figure B-3

Workflow

- Jacobs developing SWPPP for AIBP
- Geosyntec developed design for runoff capture from western portion
- Surface water expert panel reviewed design
- Design was submitted to Jacobs to incorporate into their SWPPP (in progress)
- SWPPP will be submitted to the regional water board

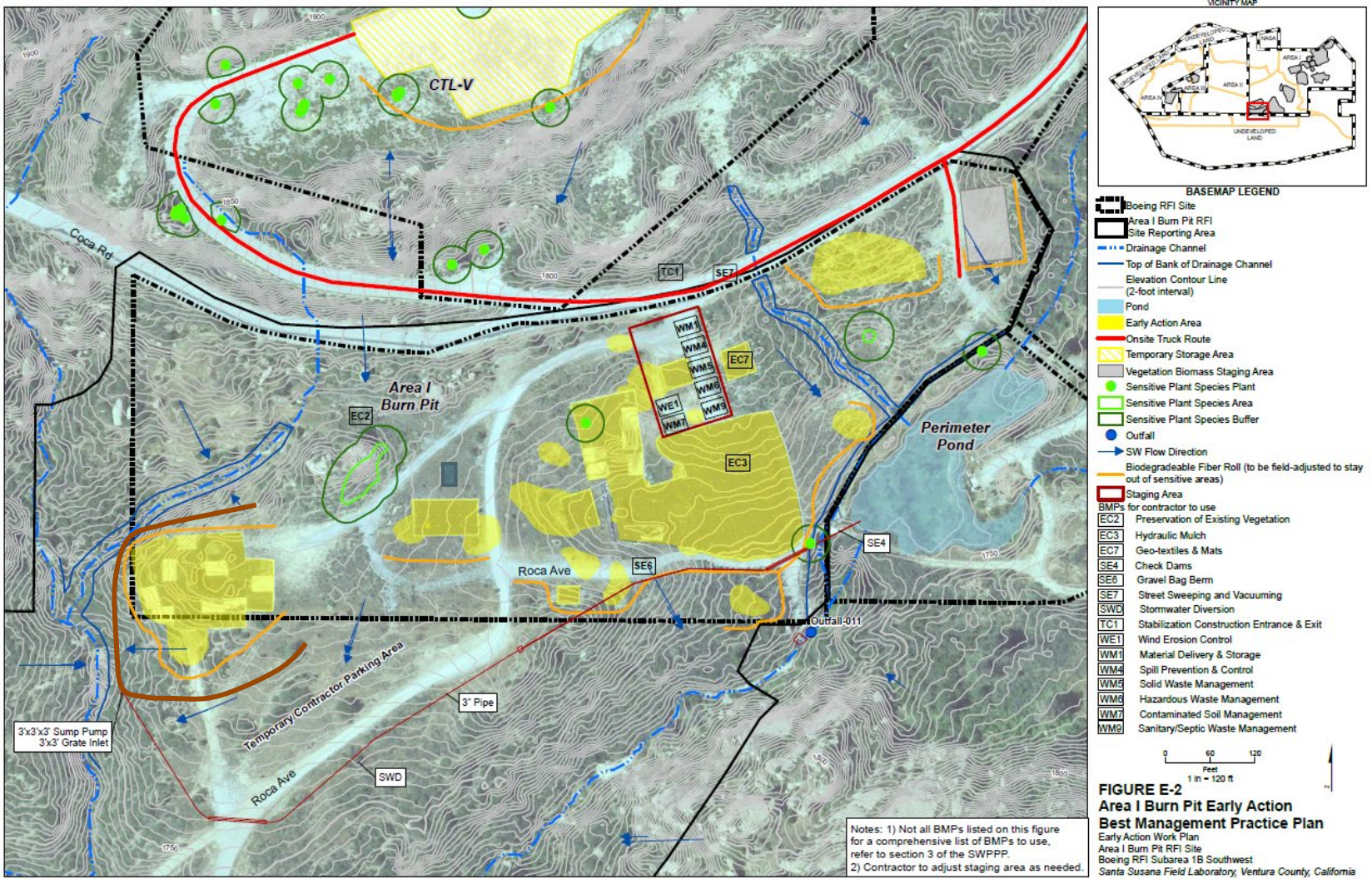
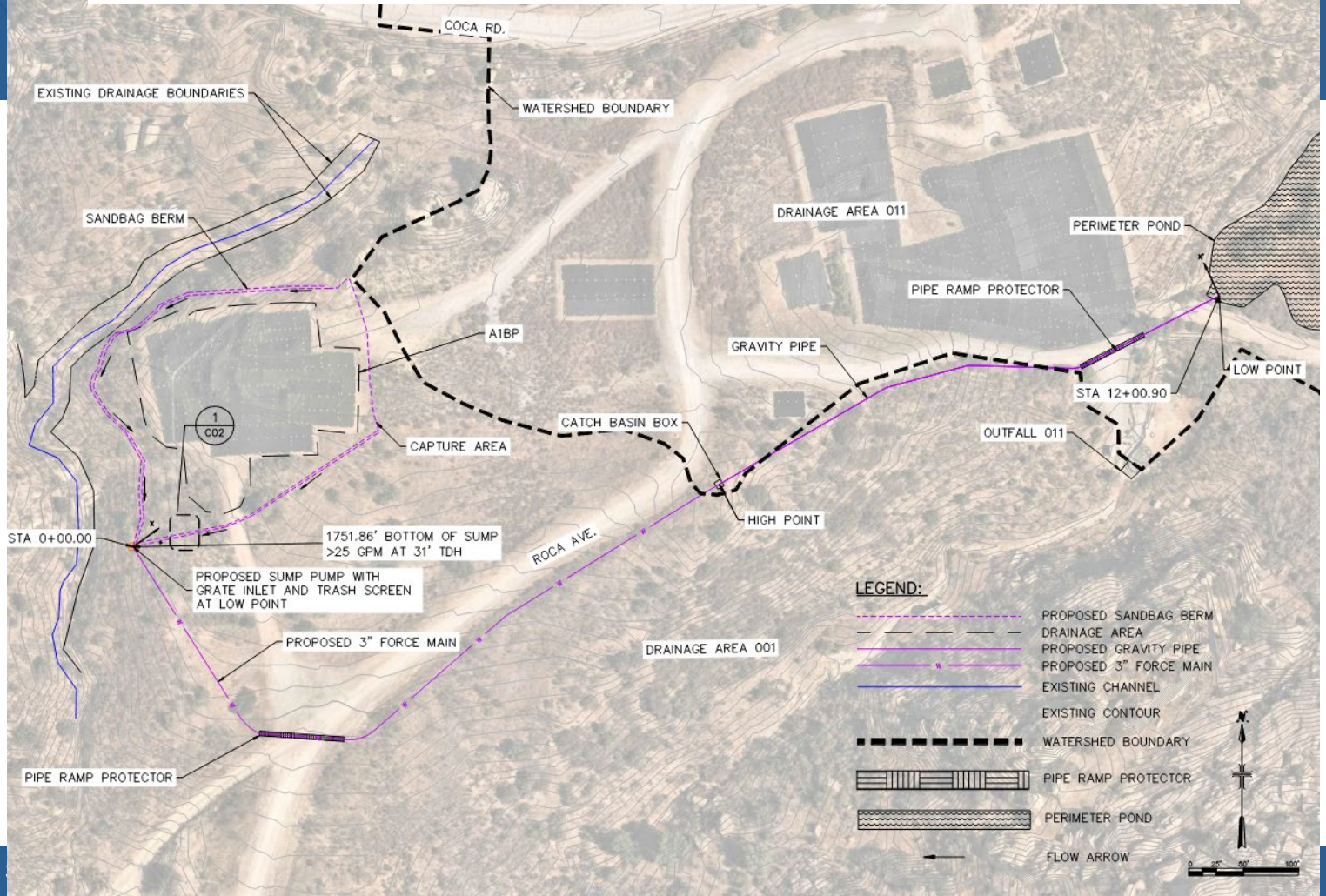


FIGURE E-2
Area I Burn Pit Early Action
Best Management Practice Plan
Early Action Work Plan
Area I Burn Pit RFI Site
Boeing RFI Subarea 1B Southwest
Santa Susana Field Laboratory, Ventura County, California

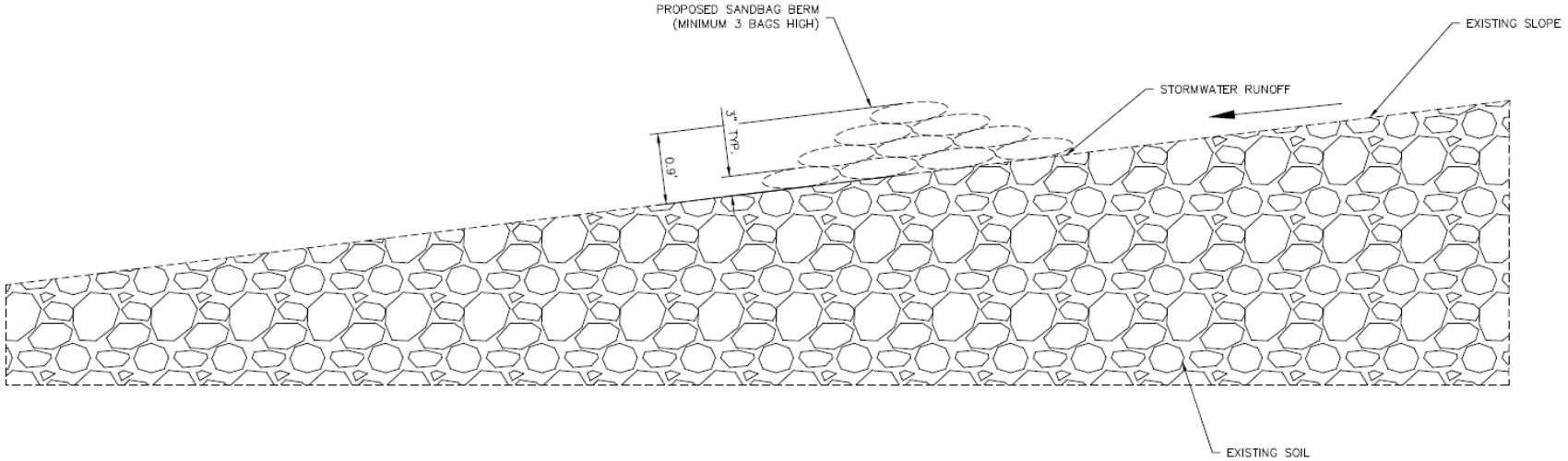
C:\USERS\CLARKE\APPDATA\LOCAL\TEMP\ARC348\AREA1BURNPIT_FIGUREE-2_BMP.MXD CLARKE 7/24/2023 7:48:59 AM

Jacobs

Area I Burn Pit Stormwater Capture and Conveyance Conceptual Design



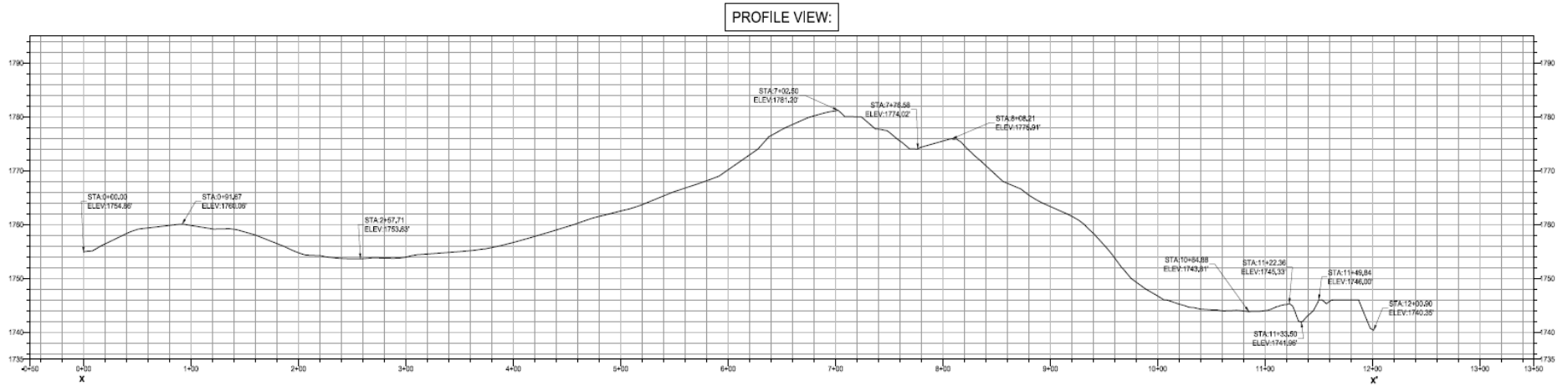
Area I Burn Pit Stormwater Capture and Conveyance



1 — TYPICAL SANDBAG BERM CROSS SECTION – EXISTING GRADE DESIGN

SCALE: 1" = 1'

Area I Burn Pit Stormwater Capture and Conveyance



5 Pond Infiltration Study

Concerns about stormwater infiltration in the ponds impacting groundwater quality prompted an infiltration study

Pond Infiltration Study

Assessment Method:

Utilizing water level measurement rainfall, and evapotranspiration records, infiltration rates were assessed through mass balance analysis in ponds upstream of Outfalls 011 and 018 over a six-month period.

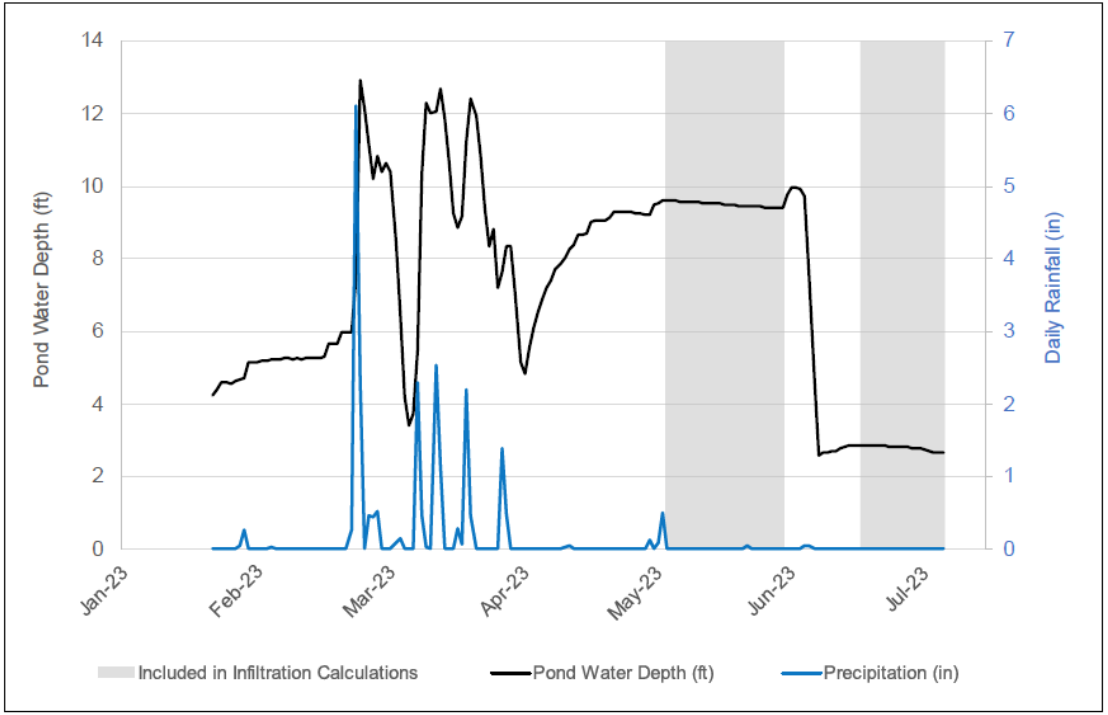


Figure 1. Water Depth and Precipitation at **Silvernale Pond**: January 23 – July 6, 2023 (gray shaded areas indicate infiltration calculation periods)

Pond Infiltration Study Conclusions

- Model results show that approximately 6 percent of sitewide infiltration occurs within the stormwater ponds – therefore, less than 0.23 percent (or 6% of 3.8%) of rainfall becomes groundwater recharge through stormwater infiltration in the ponds
- The average infiltration rates at Silvernale and R-1, and were calculated to be 0.0006 and 0.03 inches per hour, respectively.
- Constituents of potential concern (COPCs) in stormwater (e.g., metals and dioxins) are predominately in particulate form, which minimizes their downward migration as they are filtered and sorbed by sediment in the pond and underlying soils.
- Limited samples collected to date do not exceed primary MCLs.
- **Modeling analyses and field calculations both confirm that stormwater infiltration in onsite ponds is very low.**

6 Public Survey Responses

Responses to Submitted Public Survey Questions

- How water flows offsite in addition to the water that goes through the outfalls
- Outfalls 8 and 9
- Rainwater runoff
- Monitoring and reporting water and air quality
- What can be done to ensure that the toxic contaminants don't go off-site and affect people’s health?
- The extent of stormwater infiltration throughout the site, specific known locations of infiltration, and possible contamination that could enter the groundwater table at those locations.

These topics were covered in earlier slides

Responses to Submitted Public Survey Questions

- When will the groundwater be cleaned up? What is the process for cleaning up the groundwater?
  - This is outside the scope of the surface water expert panel. There is a separate groundwater expert panel.

- Why discharge conditions are loosened on some occasions and tightened on others. The threat remains the same. Who specifically is involved in loosening restrictions?
  - Permit limits were changed by the regional water quality control board based on watershed-wide changes for copper, nickel, and zinc and background demonstration for iron.
  - Board staff proposed removing some permit limits based on monitoring results showing no exceedances in the past permit term (even with a wildfire and the wettest year on record); however, these were added back in the final permit at the permit hearing

Key Takeaways

- Record rainfall year
- BMPs held up well and continue to show strong pollutant removal performance
- Exceedances mostly due to background sources
- Pond infiltration study indicates that infiltration in ponds is very small
- Stormwater Human Health Risk Assessment (HHRA) continues to show low risks from SSFL stormwater

Thank you for attending

- Questions
  - Please raise your hand and the microphone will be brought to you

- SSFL Stormwater Information (e.g., Annual Report, Panel Presentations, NPDES Permit, and Technical Reports) Available Online:

  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)