



Cardinal Yu Pin Manor

**SFPP Norwalk Tank Farm Update  
Presented to the  
Norwalk Restoration Advisory Board on  
February 28<sup>th</sup>, 2019**



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# Agenda

## 1. Remediation Systems Operations Update

- Site Overview
- SVE and Biosparge Systems
- Groundwater and Total Fluids Extraction Systems
- Exposition Aquifer Update – MTBE in EXP-1
- 2017 Southeastern Horizontal Biosparge Well Installation
- 2018 Installation of New Biosparge Compressor
- Conclusions from 2018 South-Central Soil Investigation/Biosparge Effectiveness Evaluation

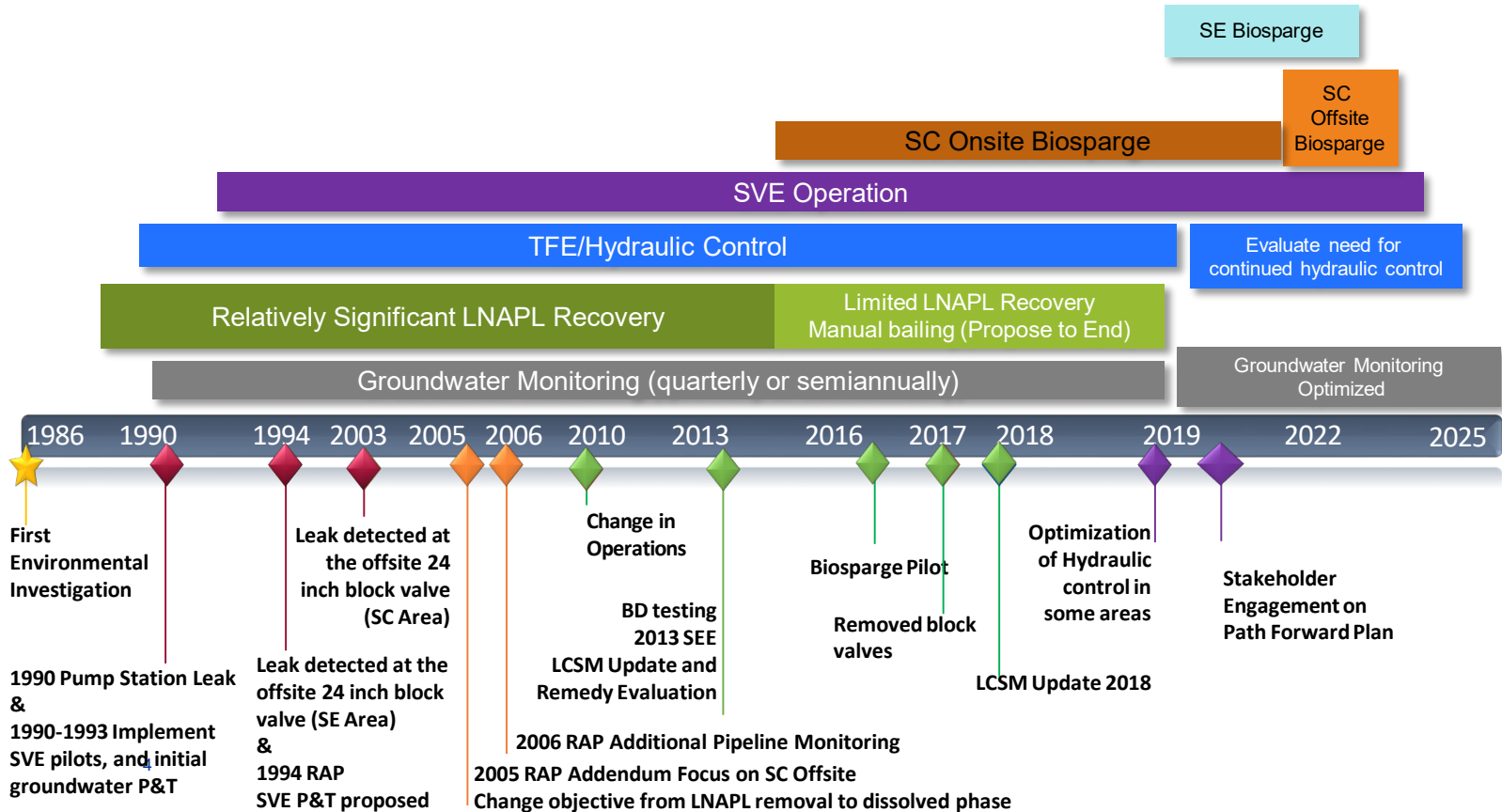
## 2. Planned Remediation Activities

- Overview of All Remediation Activities
- Expand SVE System in Southeastern Area and Activate Biosparging
- Potential Offsite/Residential Biosparging
- Path Forward





# Site Timeline (SFPP Portion of Site)



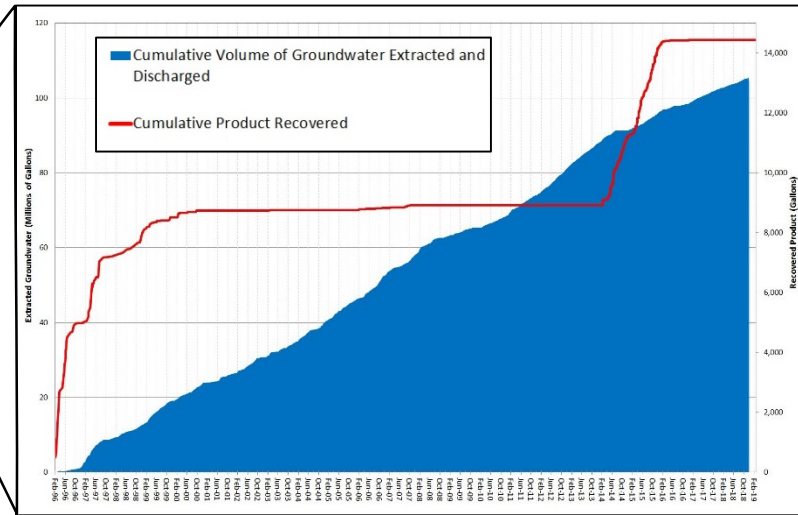
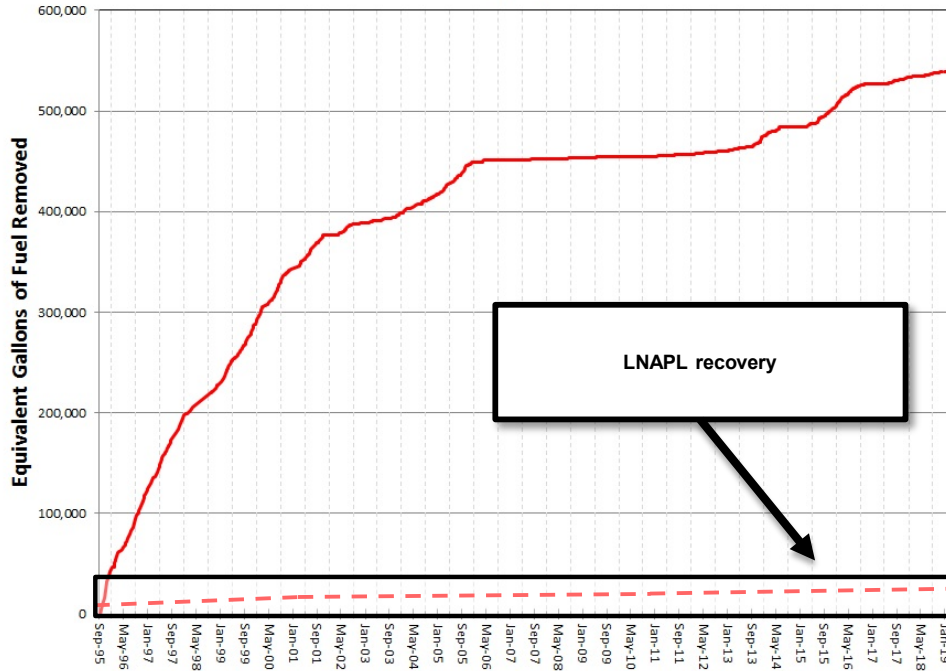
# Remediation Systems Operations Summary

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Time	SVE Runtime	Biosparge Runtime	Mass Removal	GWTS Runtime	GWTS Removal Volume	Notes (No LNAPL was recovered in 2018)
<b>Q3 2018</b>	92%	82%	2,482 gal (16,379 lbs)	92%	1,021,192	<p>-SVE and biosparge was shut down July 6-12, 2018 due to a fire adjacent to the gas line along Norwalk Boulevard. The system was restarted after gas line repairs were completed.</p> <p>-The biosparge was off from August 16-23, 2018 and September 1-4, 2018 for system cooling maintenance.</p> <p>-The GWTS was shut down on August 21, 2018, due to a high level in the transfer tank and restarted on August 23, 2018.</p>
<b>Q4 2018</b>	61%	28%	1,357 gal (8,958 lbs)	61%	544,102	<p>-The SVE and biosparge was shutdown on October 15, 2018, due to a high combustion temperature on the RTO. The system was restarted on October 16, 2018.</p> <p>-SVE, biosparge, and GWTS was shut down from October 22 to November 15, 2018 to facilitate gauging and sampling activities for the second semiannual groundwater and the annual soil vapor monitoring event.</p>
<b>Total</b>	~90%	~80%	539,067 gal (3.6 million lbs)	~90%	105.4 million gal	<p>-GWTS were shut down on December 22 to December 31, 2018 due to a faulty motors of the air compressors that supply air for the pneumatic valves on the RTO.</p> <p>-The 500-scfm biosparge system was shut down on October 15, 2018, to accommodate installation of the new 883-scfm biosparge system.</p>

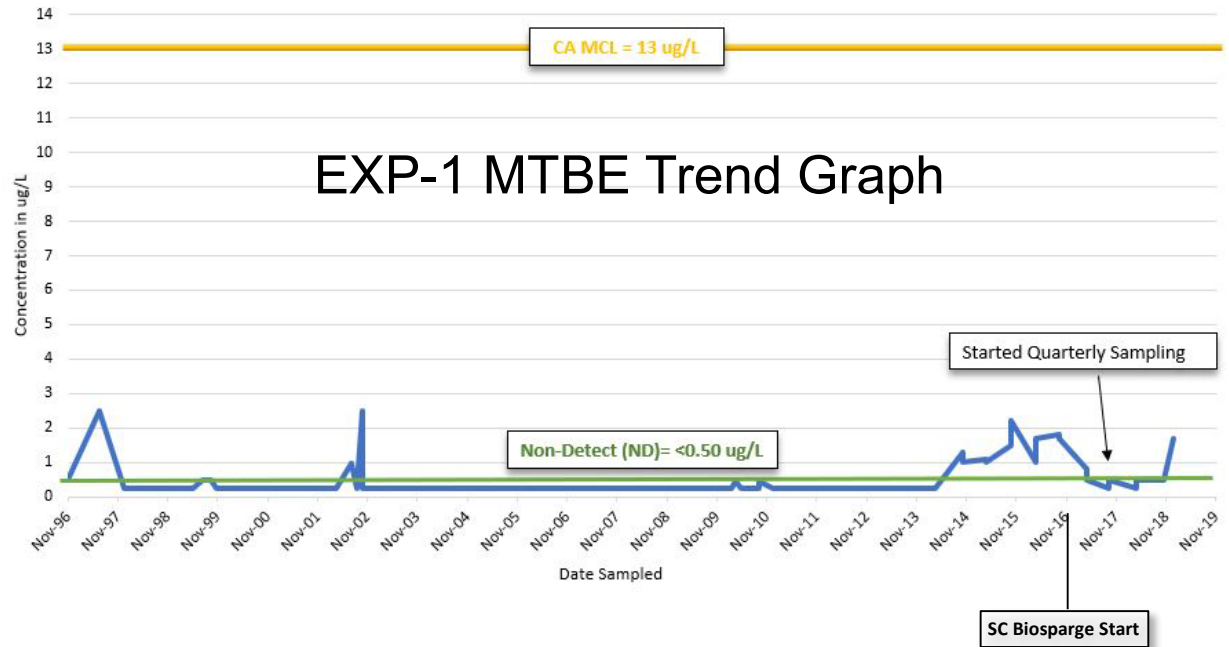
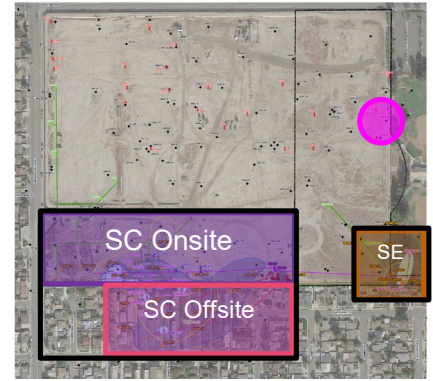
# Site Mass Recovery Summary

Cumulative Fuel Removed by Vapor Extraction To Date



# Exposition Aquifer Update

- 5 wells screened in Exposition Aquifer, only one with detections in the last 10 years
- EXP-1 below MCLs, no increasing trend
- 6 of the last 7 results were non-detect.
- Return to semi-annual sampling frequency





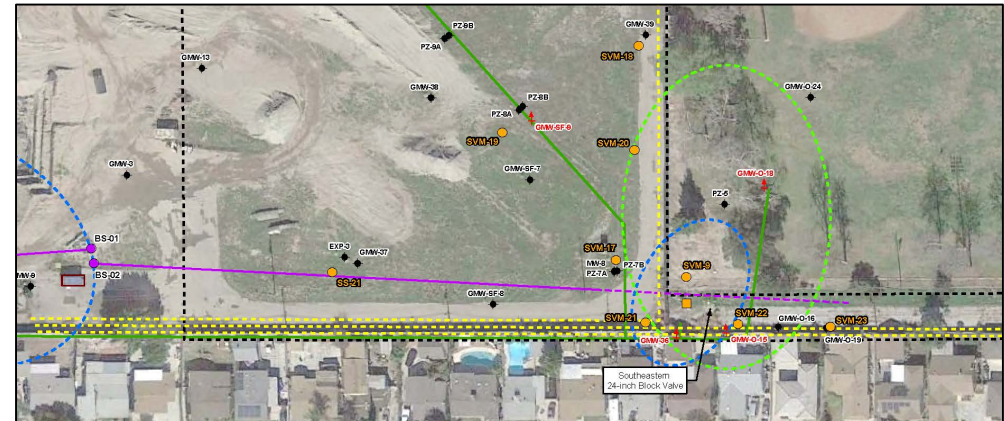
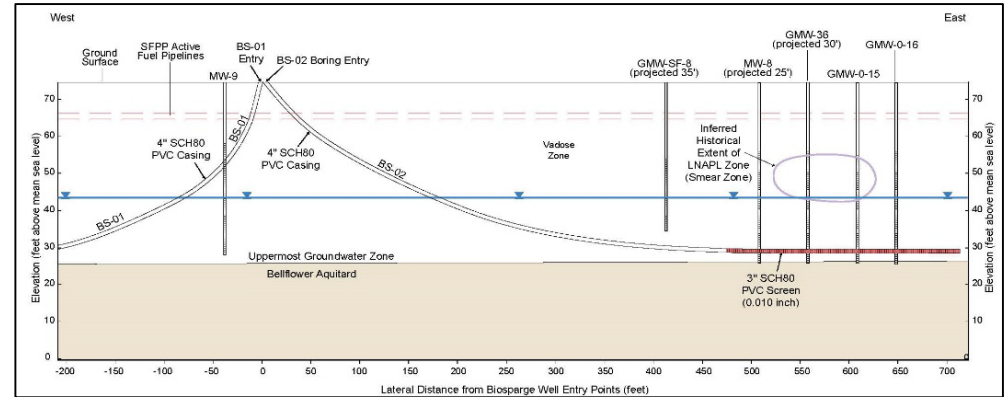
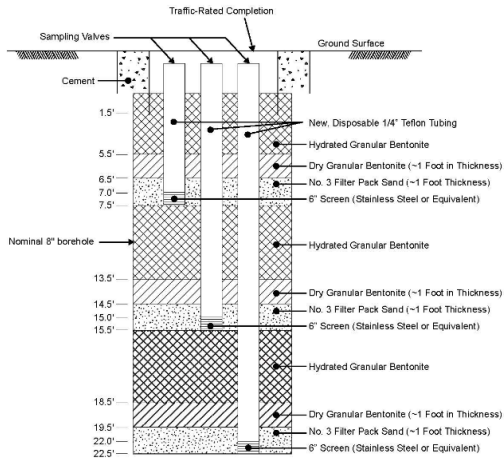
# Southeastern Horizontal Biosparge Well and SVE

## Well Casing and Screen

- SCH 80 PVC 4-inch diameter well
- Open slot design (no sand pack required); slot width 0.012 inches
- Screen depth of 45 feet bgs
- Total length = 733 feet
- 493 feet of riser casing; 240 feet of screen

## Soil Vapor Monitoring Probe Network

- SVM-9, -17, -21, -22, -23, etc.
- Double or Triple Nested (7, 15, 22 feet bgs)



# New Biosparge Compressor (175HP)

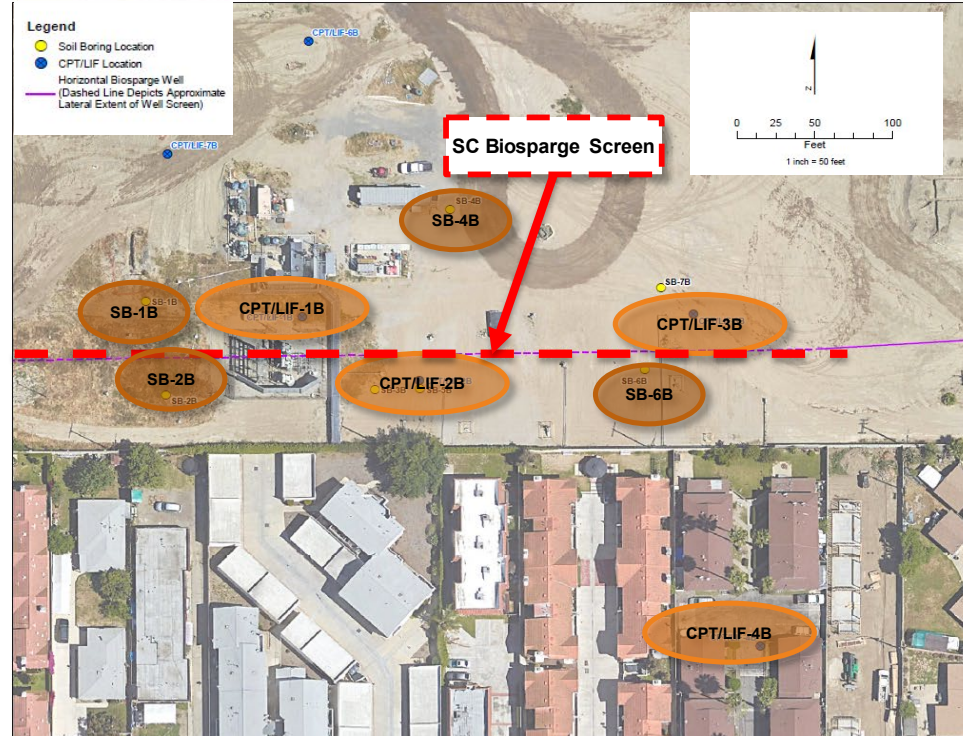


- Compressor upgraded to operate both the onsite south-central and southeastern biosparge well.
- Installation was completed in 4Q 2018
- Testing in Q1 2019
- Compressor will be activated in Q2 2019

# LNAPL Mobility Evaluation – Conceptual Site Model Updates

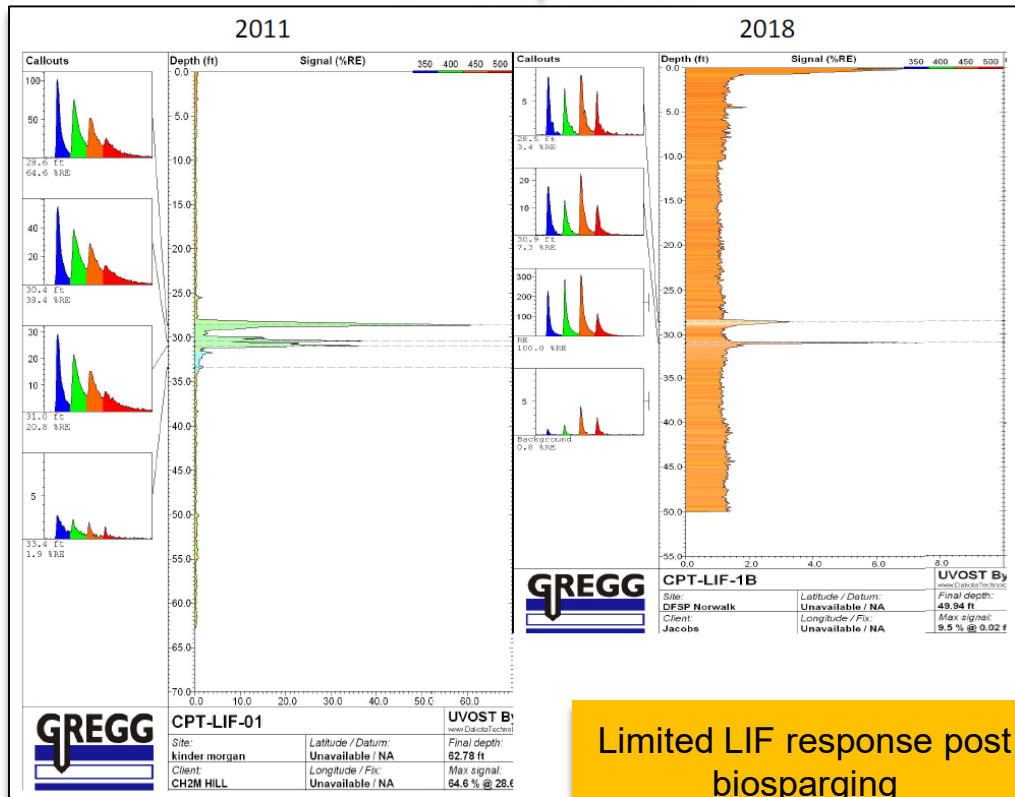
- A comparative follow-up LNAPL study in the South-Central area.
- Review of mass removal trends
- Distribution of LNAPL prior to and following treatment
- 4 replicate LIF borings (adjacent to 2011 borings)
- Undisturbed Soil Cores
- Soil Analytical Testing
- See study locations (on right)

2011/2018  
Corollary  
Locations



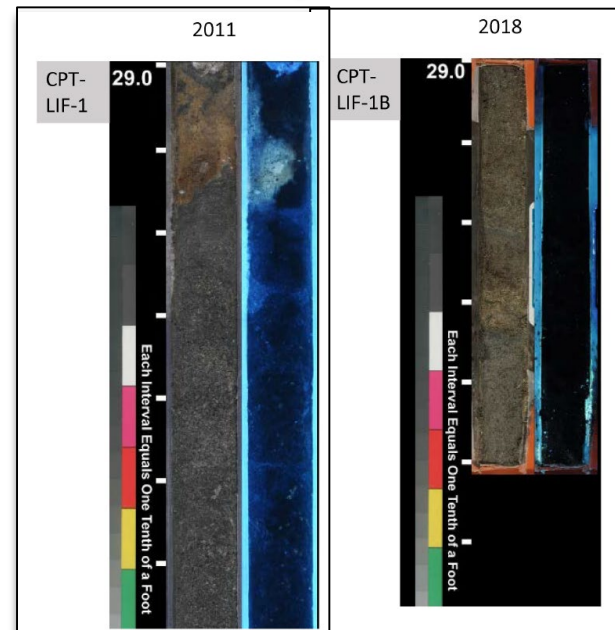
# Before and After Biosparge LIF and Soil Cores

## LIF Replicates



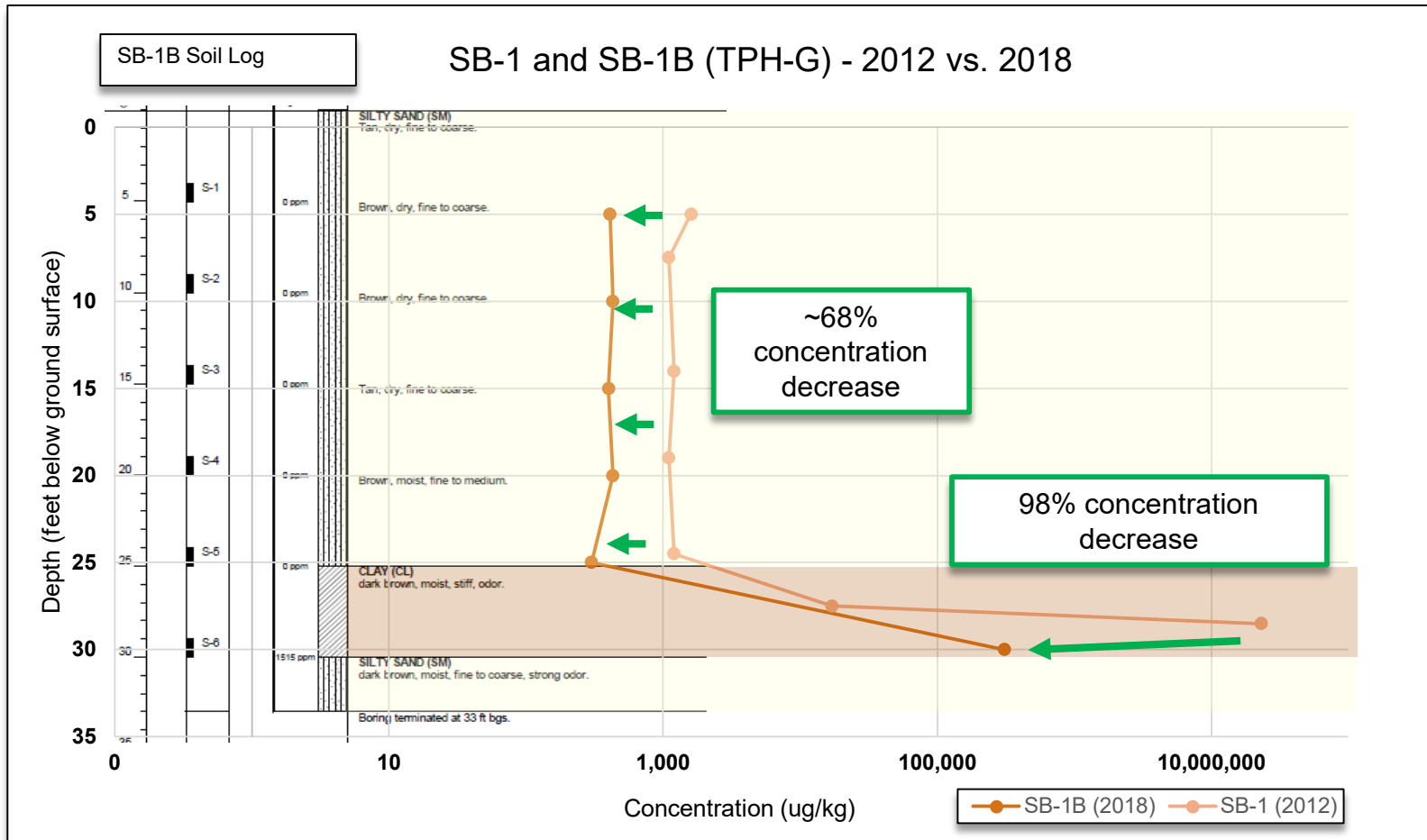
Limited LIF response post biosparging

## Soil Core Photograph Replicates



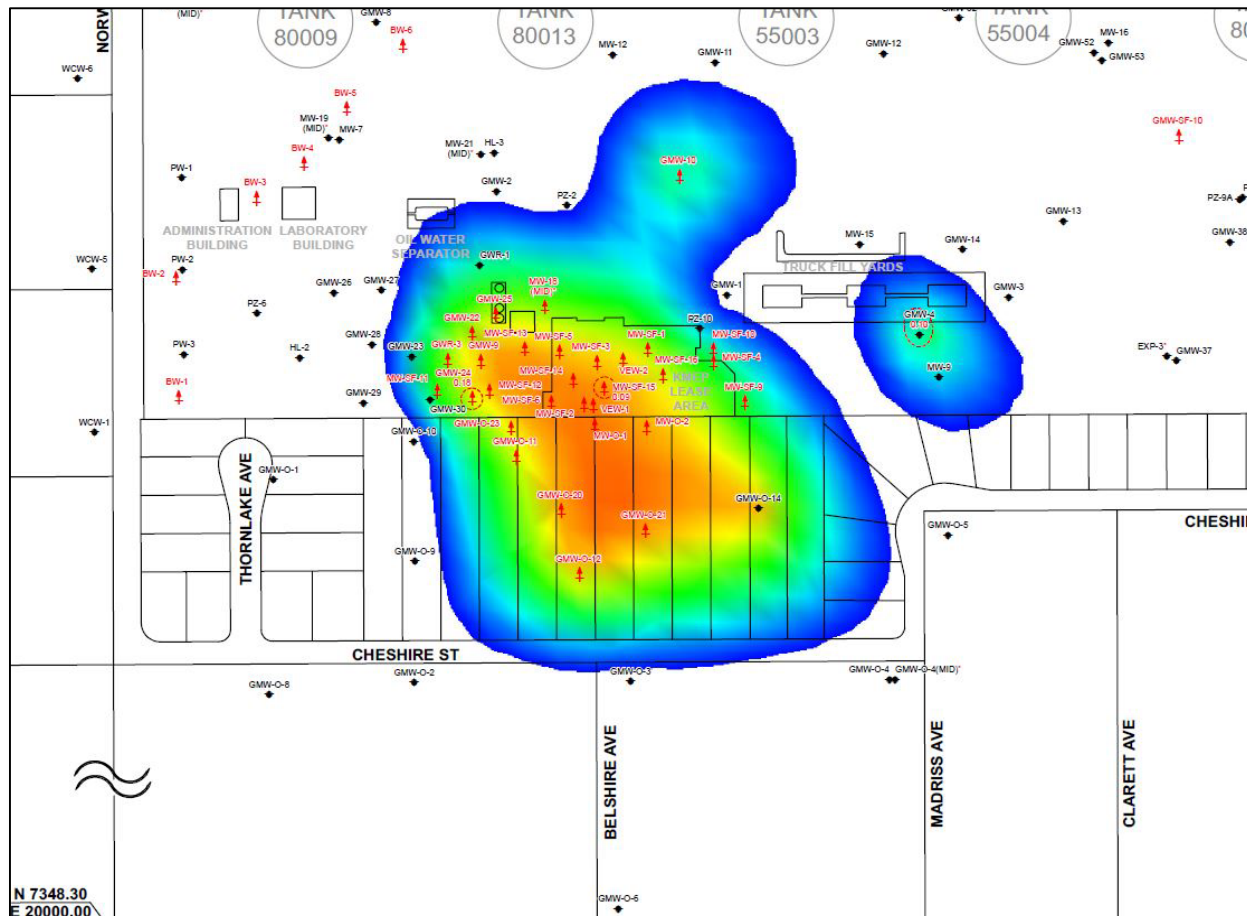
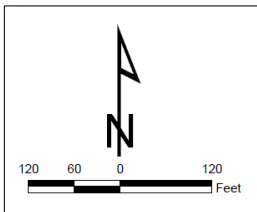
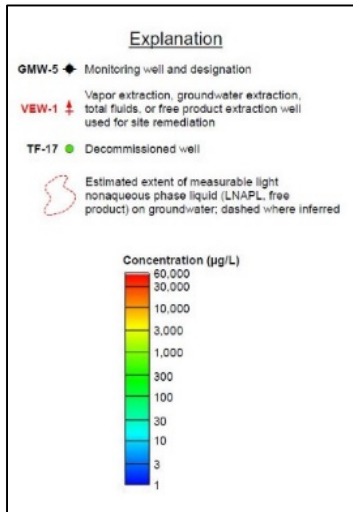
No visual fluorescence post biosparging

# Before and After Soil Concentrations

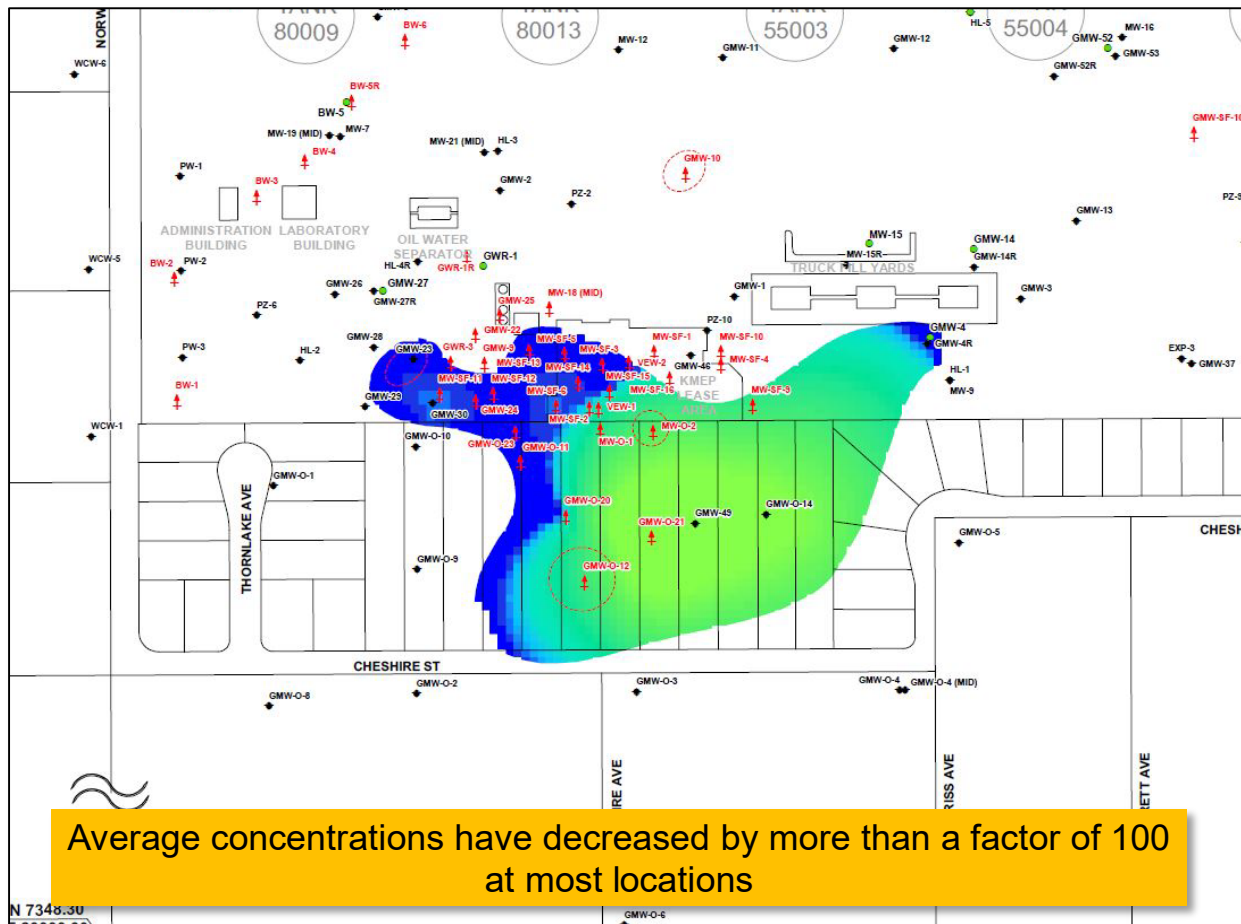
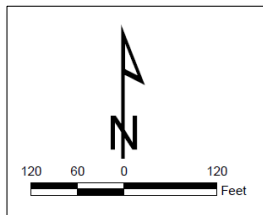
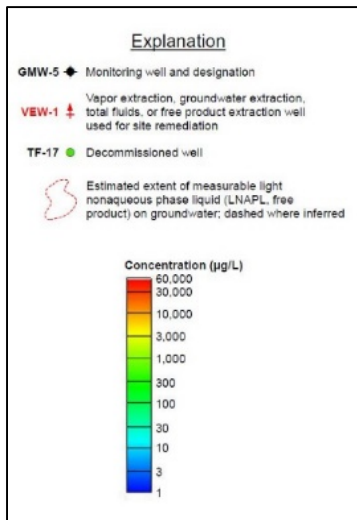




# 2013 Groundwater Benzene Concentrations (Pre-Biosparging)

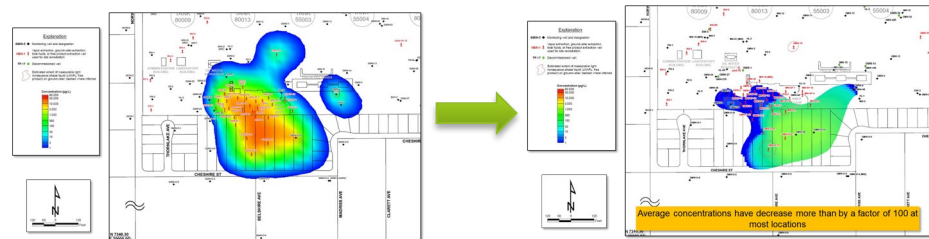
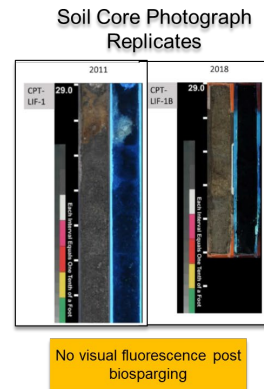
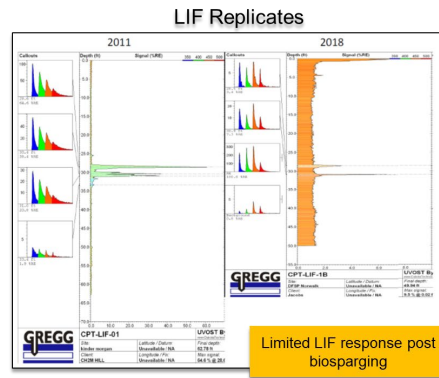


# 2018 Groundwater Benzene Concentrations (Post Biosparging)



# Summary of LNAPL Phase Change and Saturation Reduction in South-Central Biosparge Area

- LIF decreased to near non-detectable response at comparable locations and depths from 2011 to 2018.
- Photographs of soil cores also do not show petroleum hydrocarbons.
- TPH soil concentrations have decreased at almost all sample locations by at least 95%.
- There was an absence of measurable LNAPL in monitoring wells (within the treatment area) during second quarter 2018 groundwater monitoring compared to the 2011 investigation when measurable product was detected.



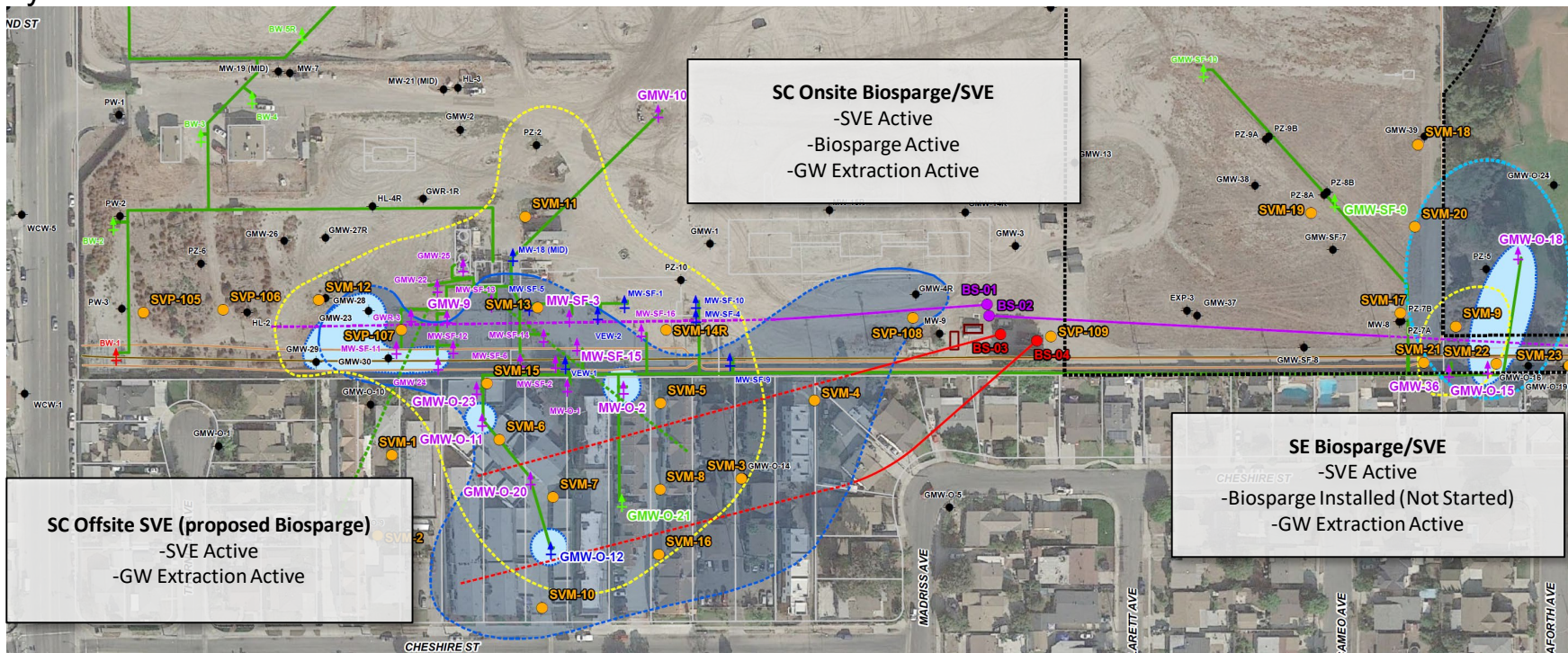
Biosparge has reached a technical endpoint in the south-central treatment area.

# Planned Remediation Activities



# Overview of All Remedial Activities

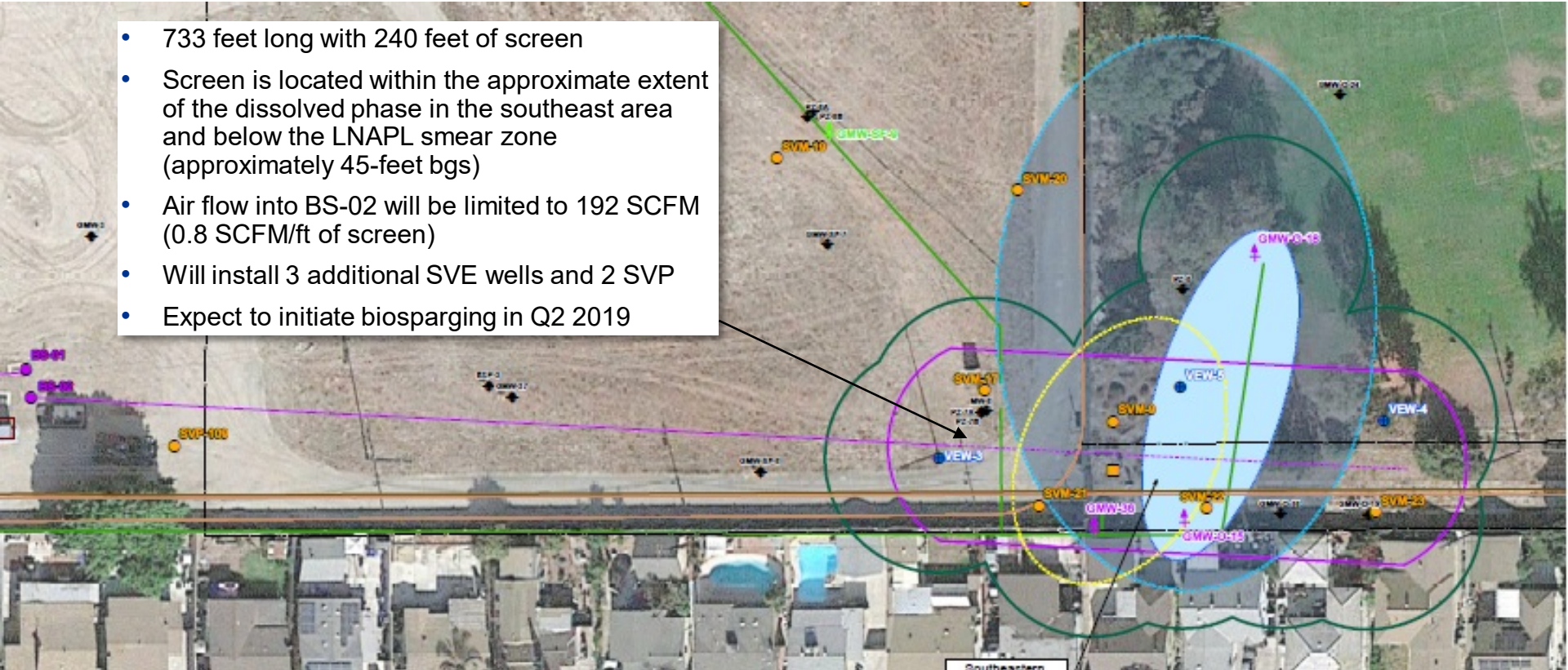
- SE and SC Offsite have similar LNAPL types and distribution as SC Onsite
- Biosparge treatment of both areas is anticipated to progress similarly to the onsite South-Central Biosparge system





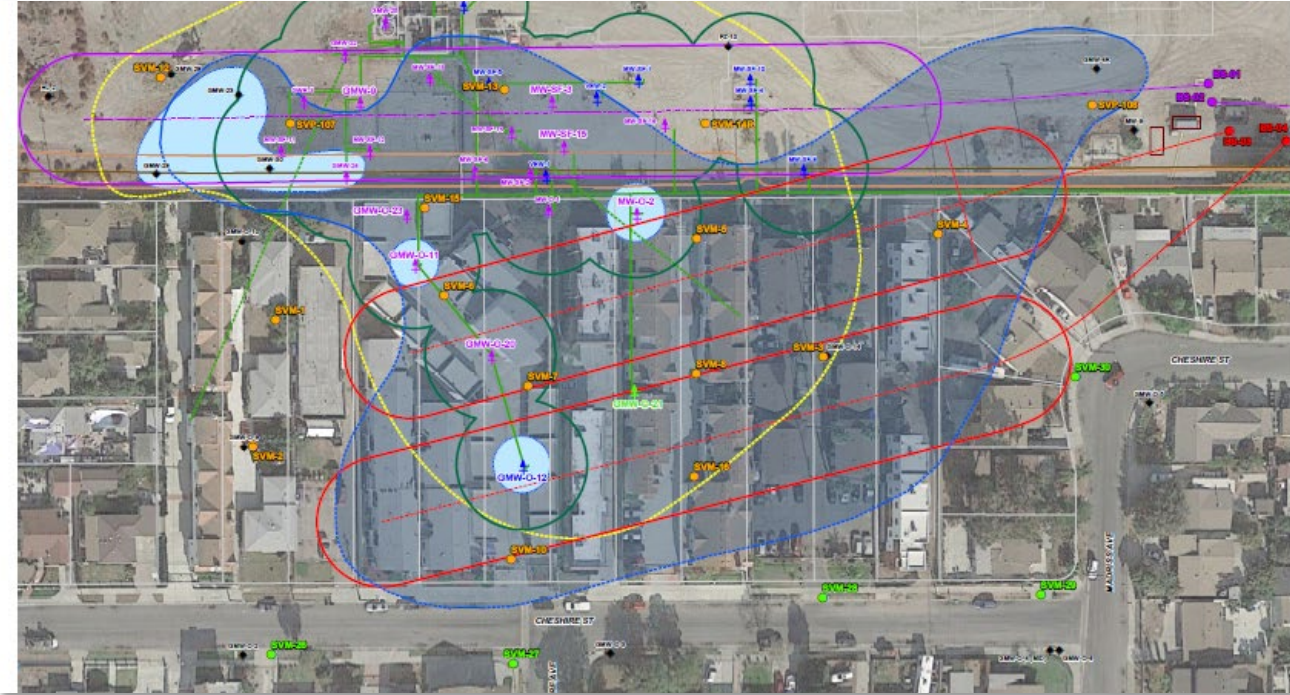
# Southeastern Biosparge Well

- 733 feet long with 240 feet of screen
- Screen is located within the approximate extent of the dissolved phase in the southeast area and below the LNAPL smear zone (approximately 45-feet bgs)
- Air flow into BS-02 will be limited to 192 SCFM (0.8 SCFM/ft of screen)
- Will install 3 additional SVE wells and 2 SVP
- Expect to initiate biosparging in Q2 2019



# Potential SC Offsite Biosparge Layout

- Two 500' horizontal biosparge wells paired with two horizontal SVE wells (stacked)
- Possible Installation in late 2019
- Operate to technical endpoint
- Utilize existing and additional probes for vapor monitoring



# Path Forward

LNAPL Source Control (1990-2019)

- LNAPL Recovery
- Pumping

**With the success observed in the biosparging area, remedial focus can be on residual LNAPL.**

For example, treatment has effectively shifted from LNAPL recovery to SVE/Biosparge in most areas.

Residual LNAPL Treatment (2015-2022)

- Biosparge
- SVE

**Reduction in the hydraulic control system.**

Dissolved phase concentrations have been reduced and stabilized and there is no longer a need to continuously pump groundwater in the southern portion of the site)

NSZD

- Monitoring
- Contingency Plan

**NSZD** (Natural Source Zone Depletion) will continue to occur and degrade the remaining residual LNAPL. This will be monitored using vapor observations and CO2 flux meters  
**A NSZD Work Plan/Contingency Plan** will be developed to temporarily suspend active remediation and monitor NSZD effectiveness.

# Questions?