MEETING MINUTES

OVERVIEW			
CLIENT	Camp Stanley Storage Activity	**PROJECT**	Task Order TO9
MEETING DESCRIPTION			
SUBJECT	Regulatory Meeting	**LOCATION**	CSSA
MEETING DATE	9/19/2017	**REPORT AUTHOR**	Shannon Schoepflin
MEETING TIME	10:00 AM Central	**REPORT DATE**	9/19/2017

ATTENDEES		
CSSA	**Regulators**	**PARSONS**
Felicia Kraintz	Greg Lyssy, USEPA Paul Gregorio, TCEQ Jorge Salazar, TCEQ	Julie Burdey Adrien Lindley Scott Pearson Ken Rice Shannon Schoepflin

TOPICS

Topics discussed included: status of Administrative Order documents; groundwater monitoring update; solid waste management unit (SWMU) B-3 remediation update; and area of concern (AOC)-65 remediation update; new AOC-76, and the Army's Operational Range Assessment Program (ORAP). The slide presentation is attached. Discussion points are listed below:

Administrative Order Closure Documents

- The Corrective Measures Implementation (CMI) Report was submitted to Mr. Lyssy earlier in the month.
- Mr. Lyssy agreed that the semi-annual progress reports can be reduced to annual. The Fact Sheet will continue to go out in the spring and the progress report will be submitted at the end of the year.

Groundwater Monitoring Update

- Mr. Pearson provided an overview of the groundwater sampling that has been conducted since the last regulatory meeting in February 2017. He also summarized analytical results from MW5-LGR and new well CS-MW37-LGR (replacement well for LS-1).
- East Pasture drinking water well CS-13 is commissioned and operational. Mr. Pearson outlined the TCEQ-prescribed 12 months of sampling that was initiated in June 2017 and will continue at the well.
- Mr. Pearson outlined recent discussions with USGS regarding the creation of a 3-D hydrology property model of the Trinity aquifer. The model would provide additional information to CSSA and stakeholders regarding subsurface conditions at CSSA; however it is not known if USGS will be able to get sufficient financial support from local stakeholders to fund the effort.

SWMU B-3 Remediation Update

- Mr. Rice presented the results of the March 2017 bioreactor groundwater sampling, and outlined the sampling currently underway at SWMU B-3, and outlined the sampling schedule for September 2017 through July 2018.
- Substrate injections were performed at SWMU B-3 in March-June 2017. A total of 265 gallons of lactate and/or emulsified vegetable oil (EVO) were injected into four monitoring wells and six bioreactor trenches.
- Dr. David Freedman of Clemson University joined the meeting by phone to discuss his research on "Abiotic Transformation of Chloroethene's in Low Permeability Formations." If CSSA is asked to

continue with the study, Dr. Freedman and his colleagues will study and report abiotic degradation rate constants and whether or not stimulation with lactate enhances degradation.

AOC-65 Remediation Update

- Mr. Lindley summarized recent ISCO monitoring activities at AOC-65, including data collected since the deployment of the permanganate cylinders in six wells at AOC-65. Westbay well/zone WB01-LGR09 has shown the most favorable response to the cylinder application.
- Ms. Burdey suggested that Well CS-MW36 be added to the quarterly ISCO sampling in order to evaluate whether it has a similar response as WB01-LGR09.

New AOC-76

- Mr. Rice presented the history, status, and path forward for AOC-76, a recently discovered site composed of lead-contaminated fill sand beneath the parking lot nearest the CSSA swimming pool.
- Approximately 20 subsurface samples are proposed to be collected from beneath and surrounding the paved parking lot.
- Mr. Lyssy noted that CSSA can notify EPA and TCEQ with an email when new AOCs are identified.

Operational Range Assessment Program

- Ms. Schoepflin provided an overview of the Army's ORAP, including a breakdown of the Qualitative Phase I and Quantitative Phase II general requirements and objectives. A Phase I report was drafted for CSSA in 2008 but never submitted to regulators.
- Path forward was discussed, and Ms. Burdey suggested Parsons re-evaluate the Phase I report since nearly 10 years have passed. Depending on the results of the Phase I assessment, a Phase II may be initiated.

It was agreed that the next regulatory meeting would be held in Spring 2017.

MINUTES DISTRIBUTION

Greg Lyssy, Paul Gregorio, Jorge Salazar, Felicia Kraintz, Julie Burdey, Brenda Shirley

Camp Stanley Regulatory Meeting – September 19, 2017

Name	Organization	Contact	Signature
Ken Rice	Parsons	ken.r.rice@parsons.com	
Shannon Schoeplin	Parsons	512-919-6810	
Paul Gregorio	TCEQ	paul.gregorio@tceq.texas.gov	
Felicia Krantz	CSSA	krantzf@cssamma.com	
GREG LYSSY	EPA	LYSSY.GREGORY@EPA.GOV	
Julie Burdey	Parsons	julie.burdey@parsons.com	
Jorge Salazar	TCEQ	Jorge.Salazar@TCEQ.Texas.gov	
Adrien Lindley	Parsons	adrien.lindley@parsons.com	
Scott Pearson	PARSONS	Scott.pearson@PARSONS.com	

Camp Stanley Storage Activity Status Update

September 19, 2017

INTRODUCTIONS AND WELCOME

Agenda

EPA Order Status

- Order Documents

Groundwater Monitoring

- Long-Term Monitoring Optimization
- Monitoring Program Overview
- USGS 3-D Modeling

SWMU B-3

- Monitoring Results Update
- Operations, Maintenance, and Monitoring

AOC-65

- ISCO Results Update
- Operations, Maintenance, and Monitoring

AOC-76 “New”

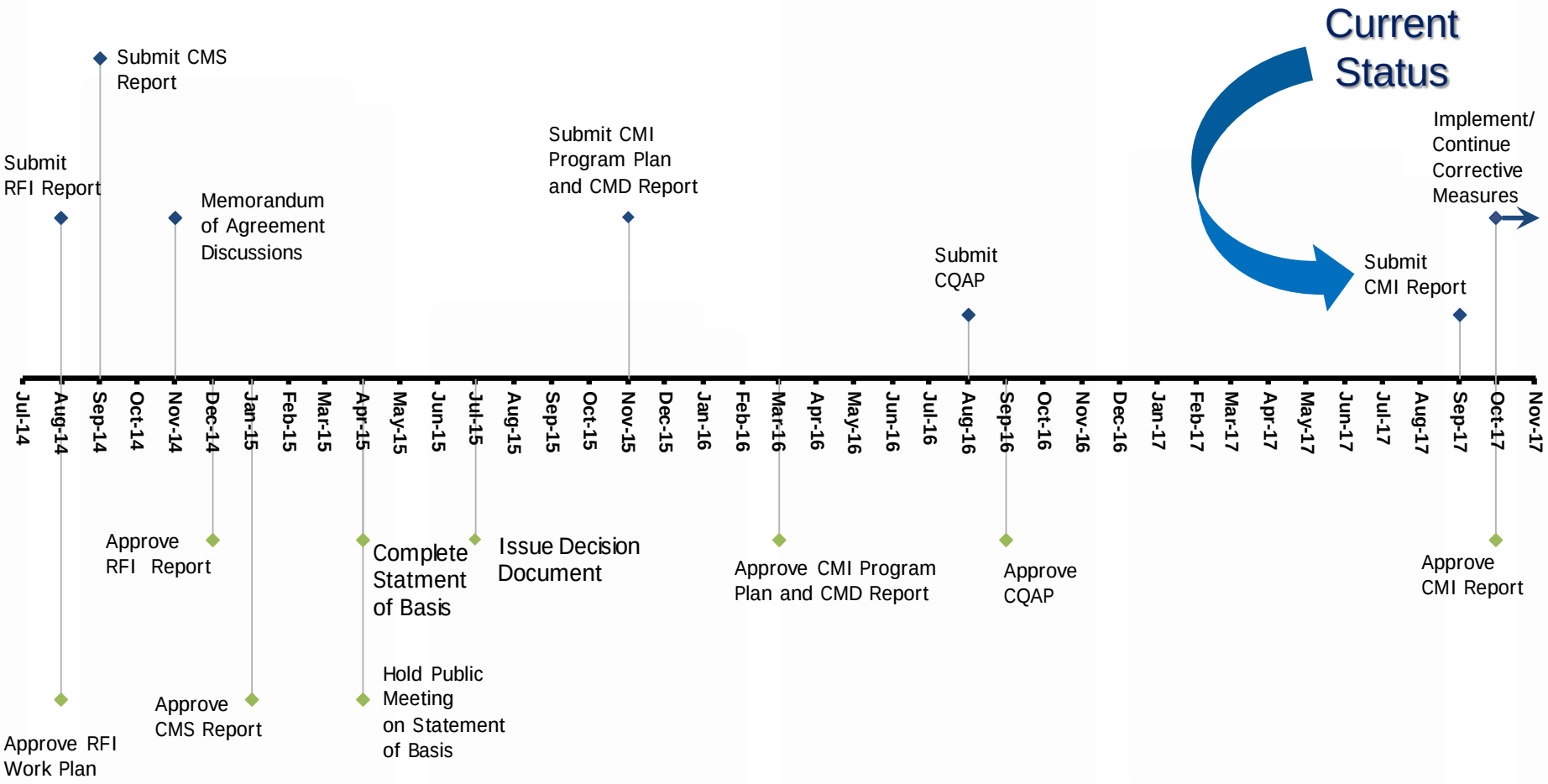
Operational Range Assessment Program

EPA ORDER STATUS

EPA Order

- In May 1999, EPA issued an Administrative Order of Consent under Title 3008(h) of the Resource Conservation and Recovery Act (RCRA)
- The Order requires:
  - Perform Interim/Stabilization Measurements to prevent further migration of contaminants
  - Perform an RCRA Facilities Investigation (RFI) to determine the extend of any release
  - Perform a Corrective Measurement Study to identify and evaluate corrective actions
  - Implement the Corrective Measurements

CSSA 3008(h) Order Timeline



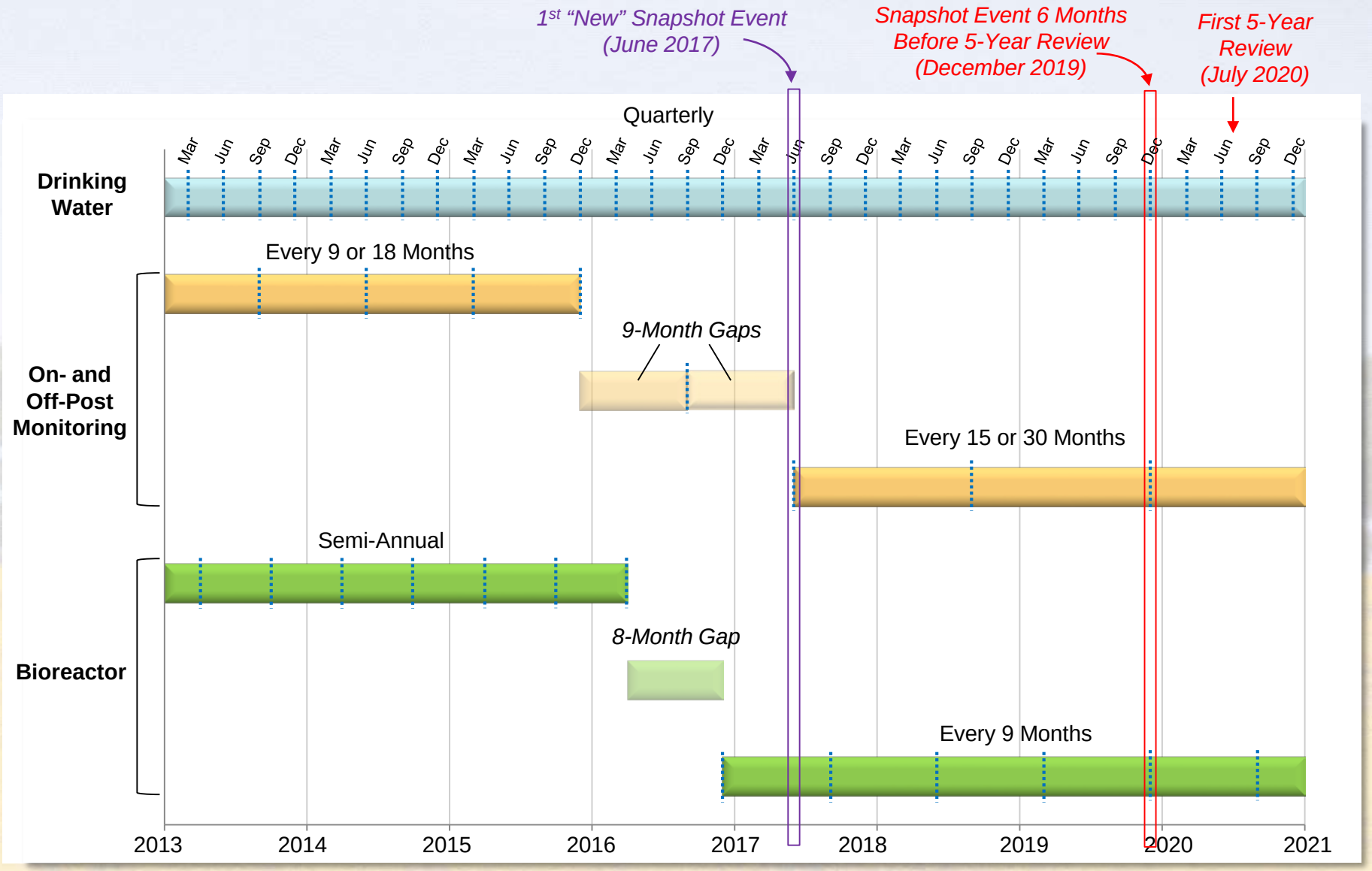
Upcoming Order Documents

Corrective Measures Implementation Report submitted September 2017.

First five-year review scheduled for July 2020.

GROUNDWATER MONITORING

LTMO Transition



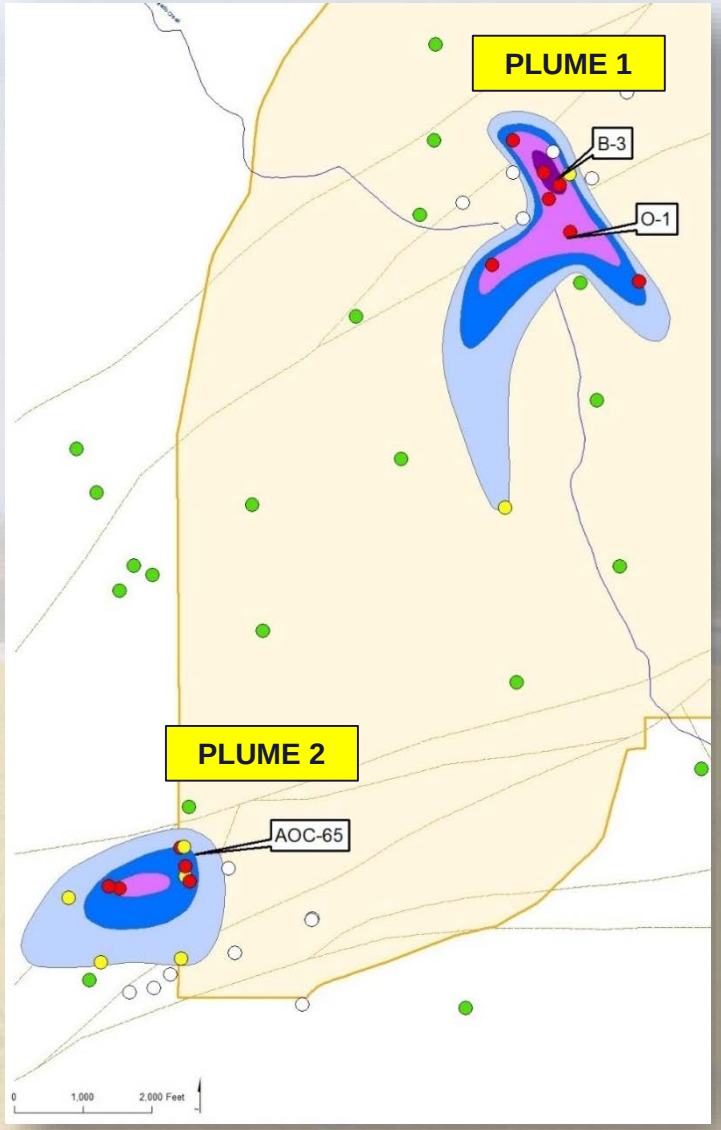
2010 LTMO Transition 2015 LTMO

Groundwater Monitoring Program
Overview

- Quarterly Monitoring Program:
  - On-post since December 1999: 71 events
  - Off-post since September 2001: 64 events
- Available Well Monitoring Network includes:
  - 4 On-post drinking water supply wells
  - 46 On-post monitoring wells
  - 45 Bioreactor wells (including 27 multi-port zones in Westbay wells)
  - 56 Off-post private and public supply wells
    (6 off-post wells have GAC units due to past exceedances)
- CSSA has been refining the monitoring program through a series of Long-Term Monitoring Optimization (LTMO) processes in 2005, 2010, and 2015.
- The groundwater program currently follows the 2015 LTMO recommendations.

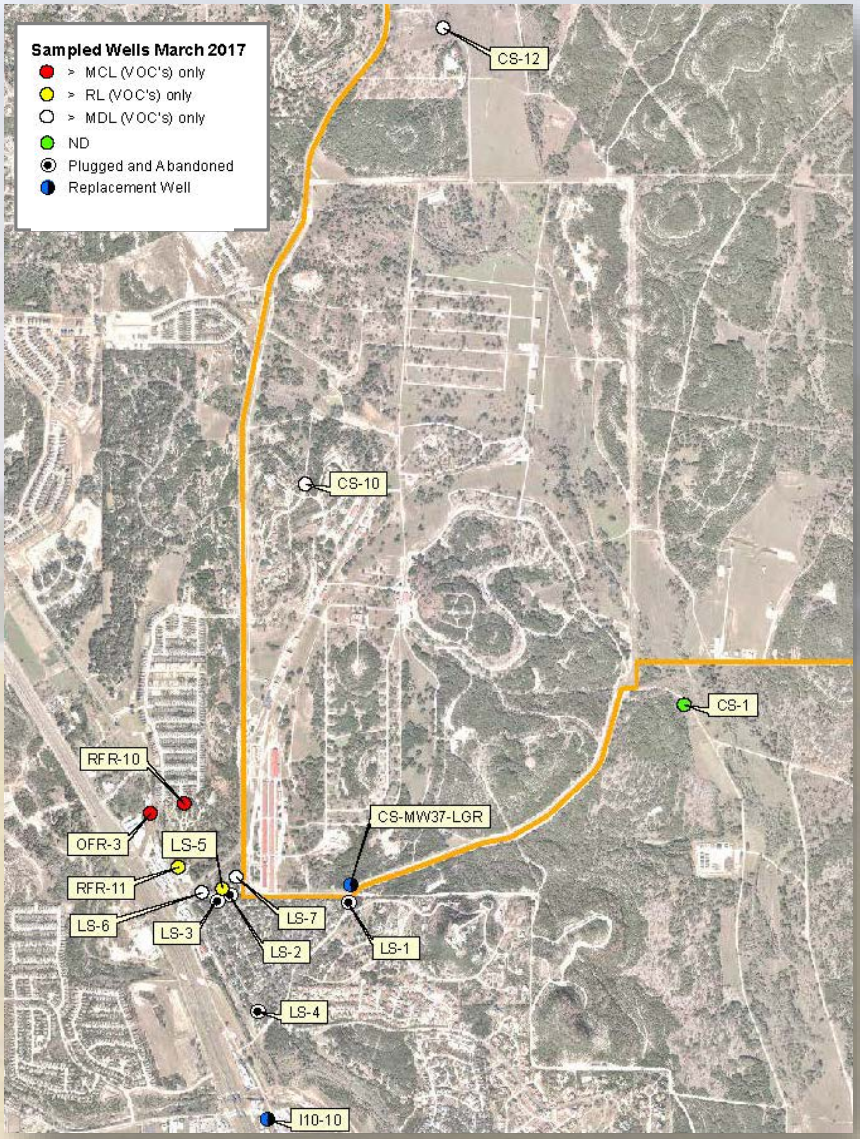
Groundwater Monitoring Program
General Facts

- **Plume 1** originates from SWMUs B-3 and O-1 in the Inner Cantonment
- **Plume 2** originates from AOC-65 in the SW corner of CSSA
- The new DQOs and LTMO program (approved in January 2016) were enacted in December 2016.
- A **"snapshot"** event (all LGR and off-post wells sampled simultaneously) occurs every 15 months under the 2015 LTMO.
- June 2017 is the most recent snapshot event. September 2018 will be the next snapshot event.



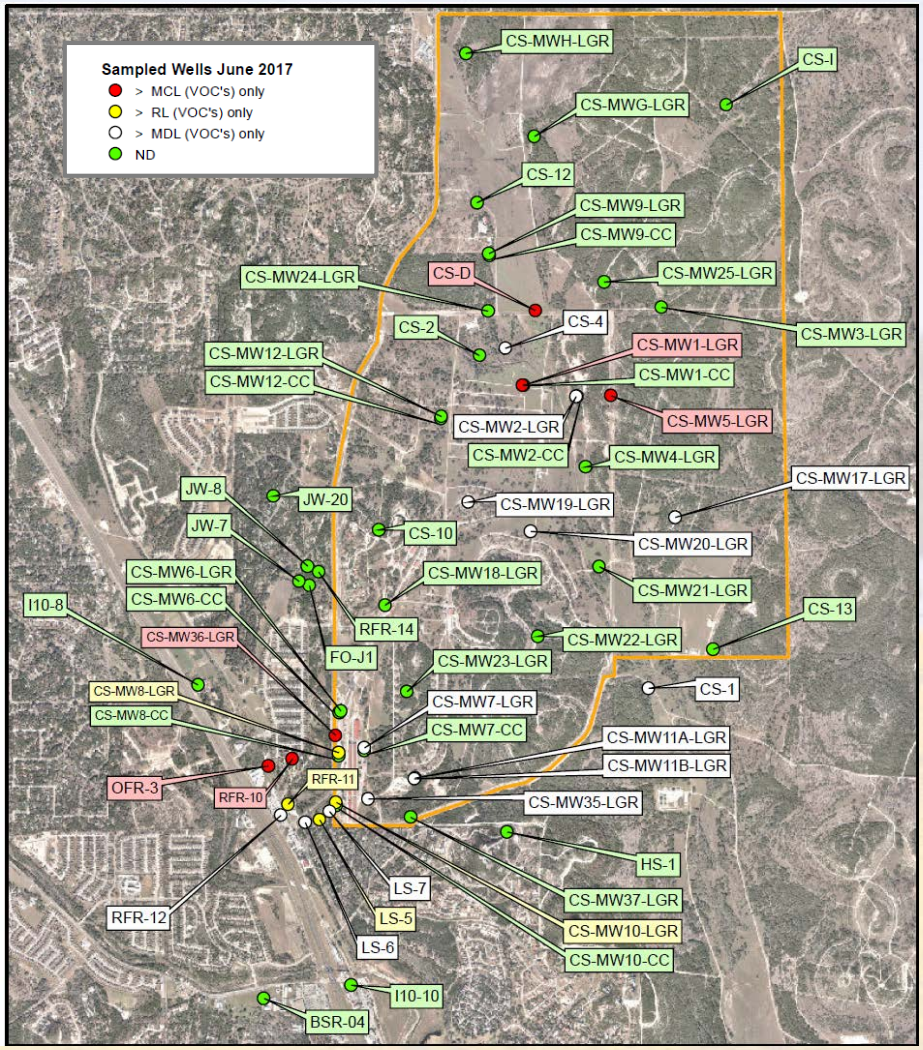
Groundwater Monitoring Program
March 2017 Results Overview

- The March 2017 event included 3 On-post and 6 Off-post wells.
  - No detections of VOCs at supply well CS-1, and supply wells CS-10 and CS-12 had trace detections of PCE (above MDL and below RL).
  - All metals in supply wells were below ALs, MCLs, SCLs.
  - No Westbay zones (WBs 01-04) were sampled during this event.
  - Off-post private wells RFR-10 and OFR-3 exceeded the MCL for PCE (8.46 µg/L and 6.98 µg/L, respectively).
  - Semi-annual GAC carbon change-out and other routine maintenance performed



Groundwater Monitoring Program
June 2017 Results Overview

- This “snapshot” event included 15-month sample collection at 43 On-post, 16 Off-post wells and 46 Westbay zones.
  - Supply wells CS-10, CS-12, and CS-13 had no detections of VOCs; supply well CS-1 had a trace detection (F-Flagged) of TCE (0.19F µg/L).
  - All metals in supply wells were below ALs, MCLs, SCLs.
  - Off-post private wells RFR-10 and OFR-3 exceeded the MCL for PCE (9.67 µg/L and 6.29 µg/L, respectively).



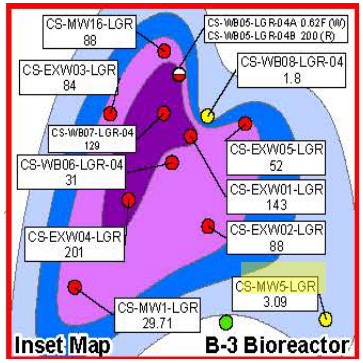
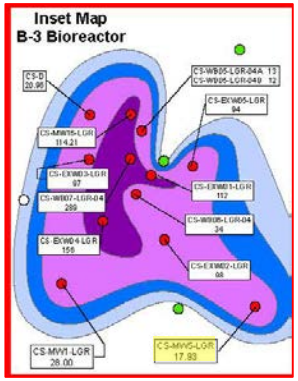
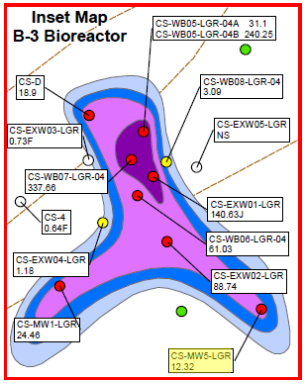
Groundwater Monitoring Program
September 2017 Overview

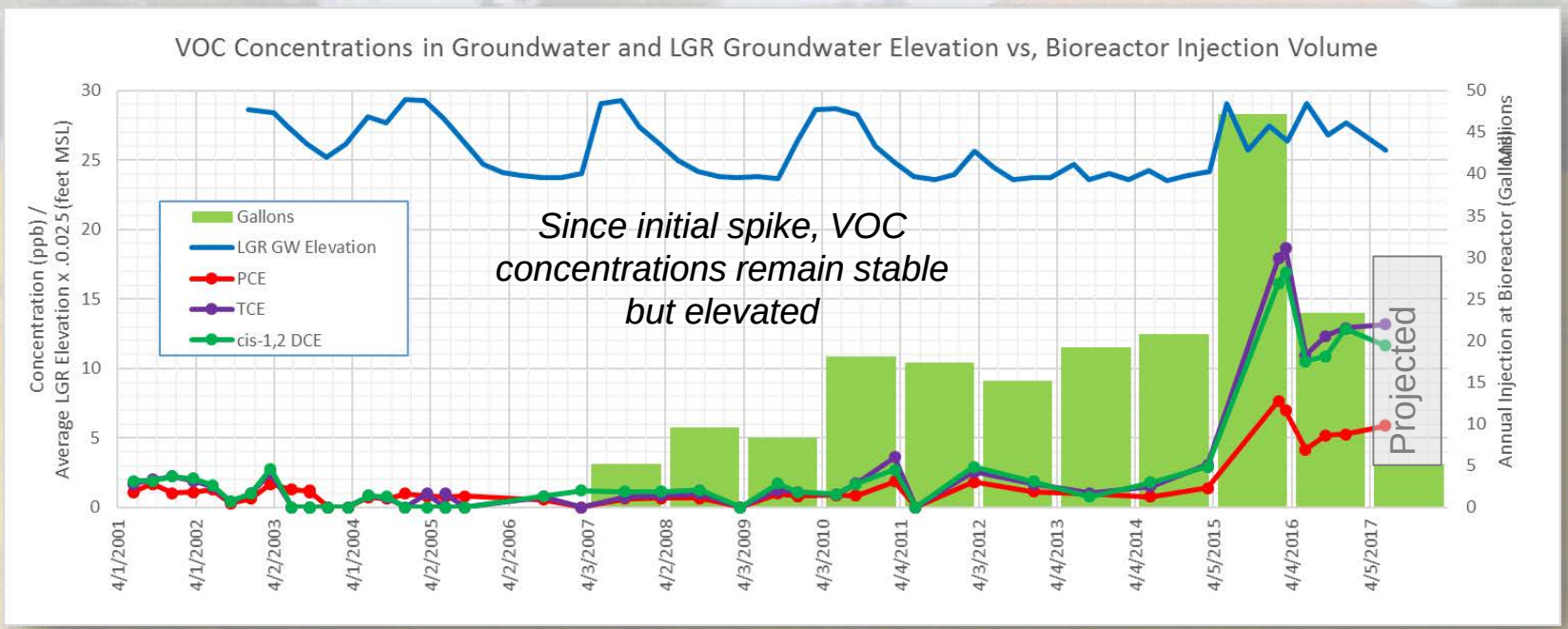
- In accordance with the LTMO schedule, 20 samples will be collected in September 2017 (in progress):
  - 4 Drinking water wells
  - 8 On-post monitoring wells
  - 8 Off-post wells
- Continued baseline sampling for the TCEQ monitoring program for CS-13:
  - **CS-13:** Organics, Inorganics, BACT
  - **MW1-CC, MW2-CC:** VOCs, metals, BACT
  - **MW4-LGR, MW17-LGR, MW21-LGR:** VOCs, metals
- Semi-annual GAC carbon change out and routine maintenance

Groundwater Monitoring: MW5-LGR

- VOCs above MCLs since December 2015
- Sampling frequency increased to quarterly to monitor changes/ trends
- Average groundwater levels were up more than 130 feet from March 2015 (end of drought conditions) through March 2017
- Levels now closer to 60 feet above drought conditions

TCE

March 2015	December 2015 - February 2016	September 2016	June 2017
			*Plume Map in Progress*
3.09 µg/L	17.93 µg/L	12.32 µg/L	13.16 µg/L



CS-MW37-LGR

- Well installed in February 2017; has been integrated into the groundwater monitoring program
- Will be sampled quarterly during the first year of operation
- Initially sampled 7/12/17 for VOCs, metals, anions, alkalinity, and TDS; VOCs were all non-detect
- Water quality parameters were measured during well development per standard procedure
- Water quality results are similar to other sentry wells (e.g., former LS-1)

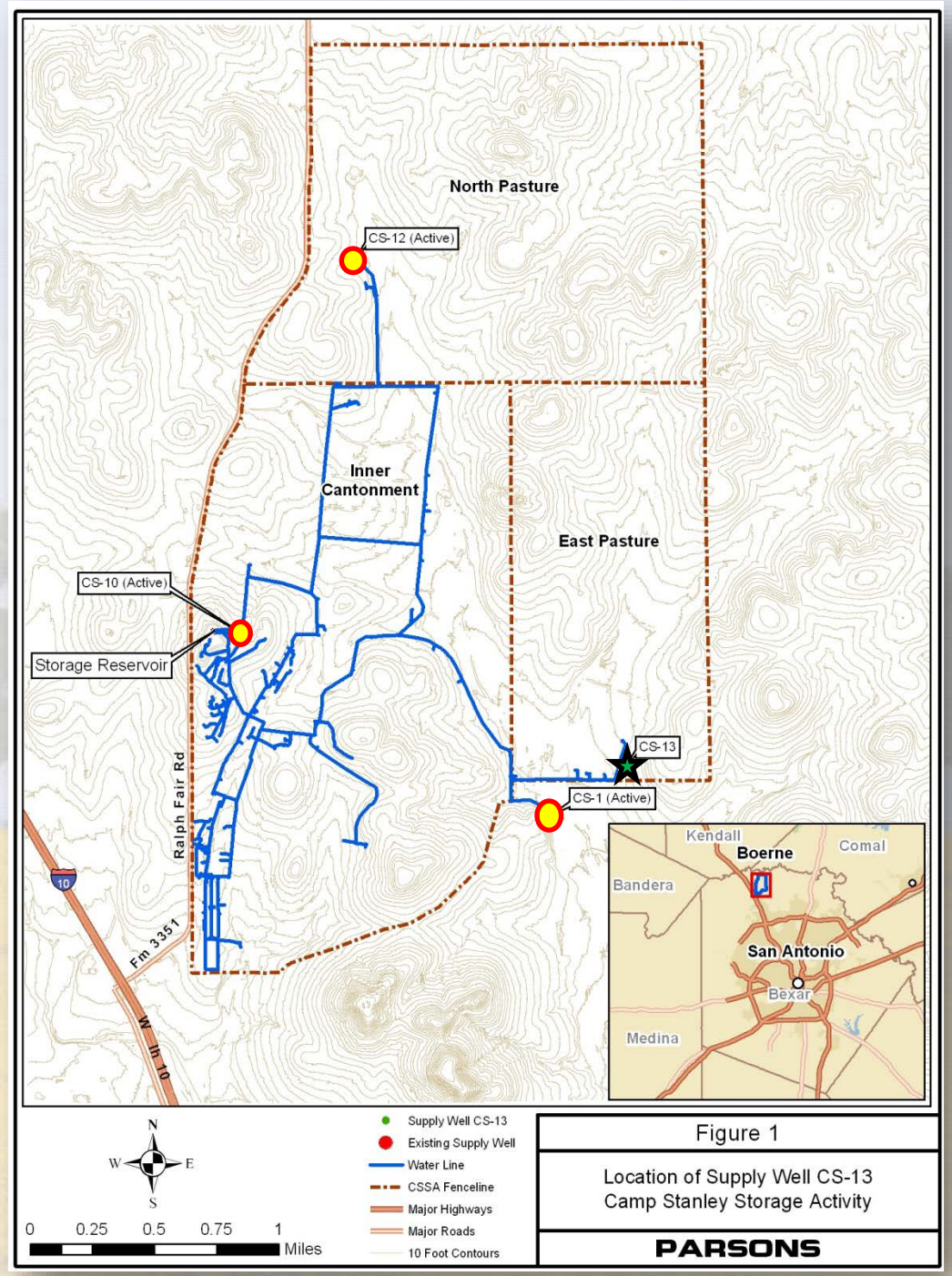
Well Development Parameters

Well ID	Date	Time	Turbidity	Temperature	Conductivity	pH	Pumping Rate	Volume Pumped	Cumulative Volume Pumped
			(NTUs)	(°C)	(mS/cm)		(gpm)	(gal)	(gal)
CS-MW37-LGR	**2/6/2017**	**0813**	---	---	---	---	**27**	**0**	**0**
	2/6/2017	1313	8.09	21.42	0.567	7.27	21	189	6,933
	2/6/2017	1343	3.52	21.84	0.566	7.27	21.5	630	7,563
	2/6/2017	1413	3.23	21.71	0.567	7.15	---	645	8,208

SAMPLE ID: / DATE SAMPLED: / LAB SAMPLE ID:	Units	CS-MW37-LGR 7/12/2017 AZ58025	
Metals - SW6010B/SW7470A			
Arsenic	mg/L	**0.00076**	F
Barium	mg/L	**0.0442**	
Cadmium	mg/L	0.00050	U
Chromium	mg/L	**0.0076**	F
Copper	mg/L	0.0030	U
Lead	mg/L	0.0019	U
Manganese	mg/L	--	
Mercury	mg/L	0.00010	U
Zinc	mg/L	**0.588**	
Anions - SW9056			
Bromide	mg/L	**0.20**	F
Chloride	mg/L	**11.96**	
Fluoride	mg/L	**0.42**	
Nitrate as N	mg/L	**4.60**	
Nitrite as N	mg/L	**0.12**	F
Sulfate	mg/L	**20.74**	
Alkalinity - E310.1			
Alkalinity, Bicarbonate	mg/L	**264.0**	
Alkalinity, Carbonate	mg/L	0.85	U
Alkalinity, Total	mg/L	**264.01**	
TDS - E160.1			
Total Dissolved Solids	mg/L	**321**	

CS-13 Potable Water Supply Well

- The CS-13 Water Production Facility was constructed between October 2016 and May 2017.
- CS-13 has been commissioned and operational.
- The TCEQ-prescribed 12 months of groundwater monitoring was initiated in June 2017.
- Includes VOCs, metals, and BACT for CS-13 and select area wells.

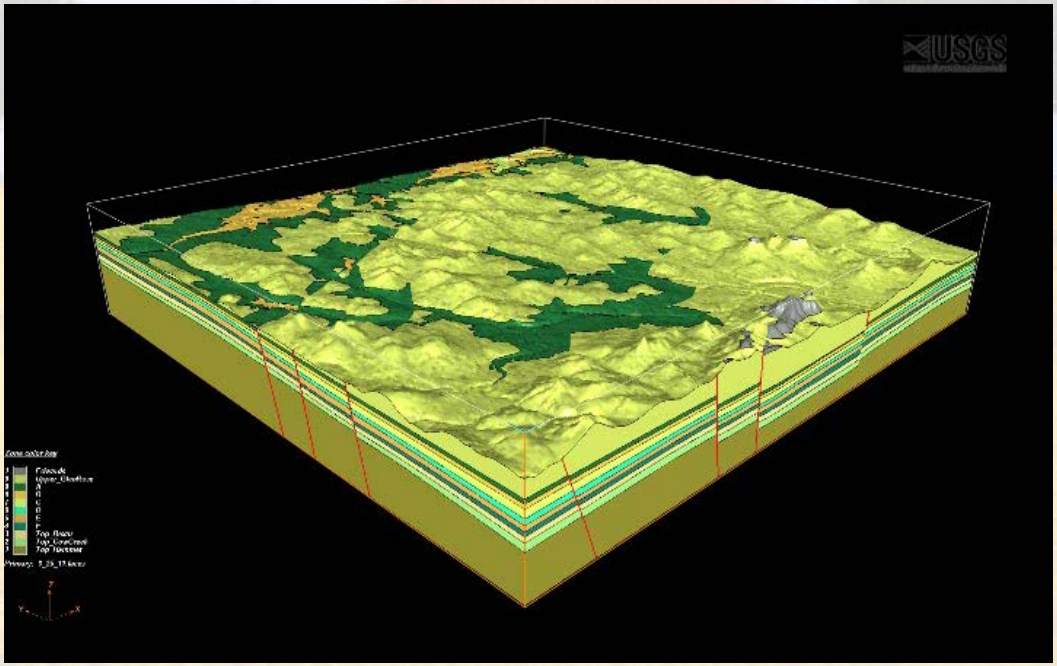


CS-13 Potable Water Supply Well

- Includes a new well house, disinfection equipment, and controls.
- Upgrade of ~5,000 feet of new distribution pipe to 8” diameter, and provides fire protection to the East Pasture complex.
- Five fire hydrants and two truck-filling stands.

USGS 3-D Modeling

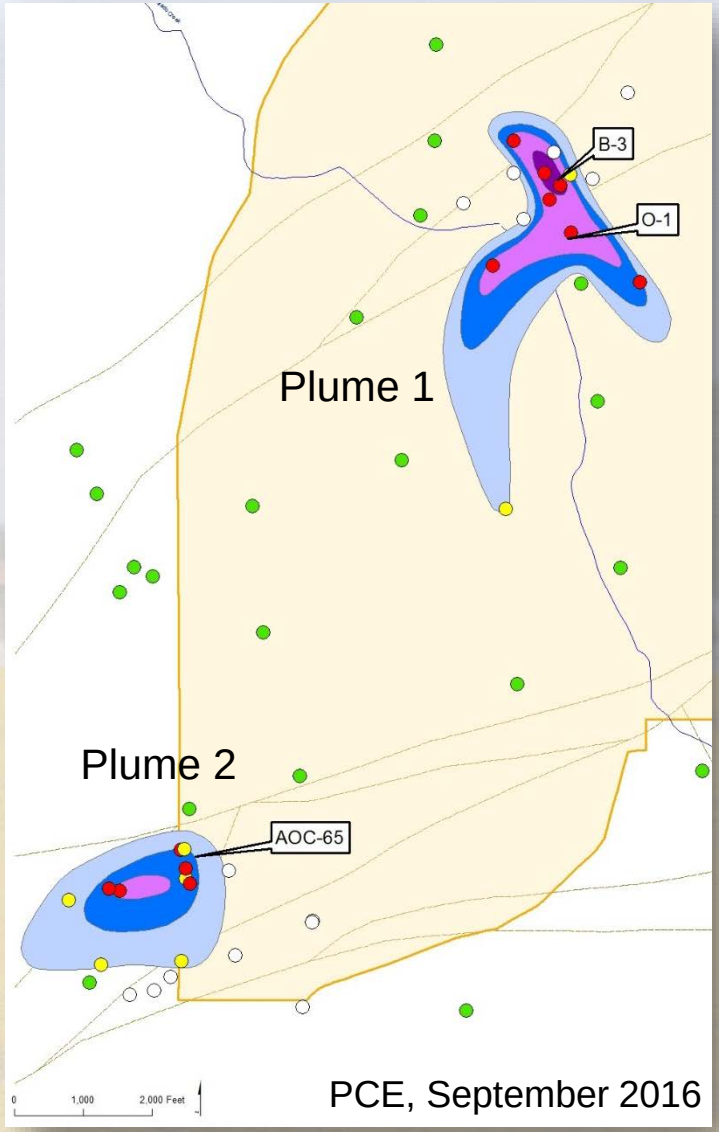
- CSSA has been in discussions with the USGS to determine the viability of undertaking a 3-D hydrologic property model of the Trinity aquifer in northwestern Bexar County.
- This is the next step to link the previous 3D geologic model (2014), and move forward towards a numerical groundwater model simulation.
- The USGS would incorporate quantitative measurements for porosity/permeability (both laboratory and geophysical data) into the existing Earthvision 3-D model. Including collecting additional data from boreholes, drill core, and rock outcrops.
- USGS is also engaging other Trinity cooperators such as Camp Bullis, SAWS, EAA, and various Trinity aquifer groundwater districts for funding support.



SWMU B-3 and AOC-65
Description

1. **SWMU B-3 Bioreactor:** Enhanced anaerobic bioremediation of chlorinated hydrocarbons in underlying fractured limestone at Plume 1.

2. **AOC-65 ISCO Treatment:** Destruction of chlorinated hydrocarbons in underlying fractured limestone at Plume 2.



SWMU B-3 SOURCE AREA TREATMENT: BIOREMEDIATION

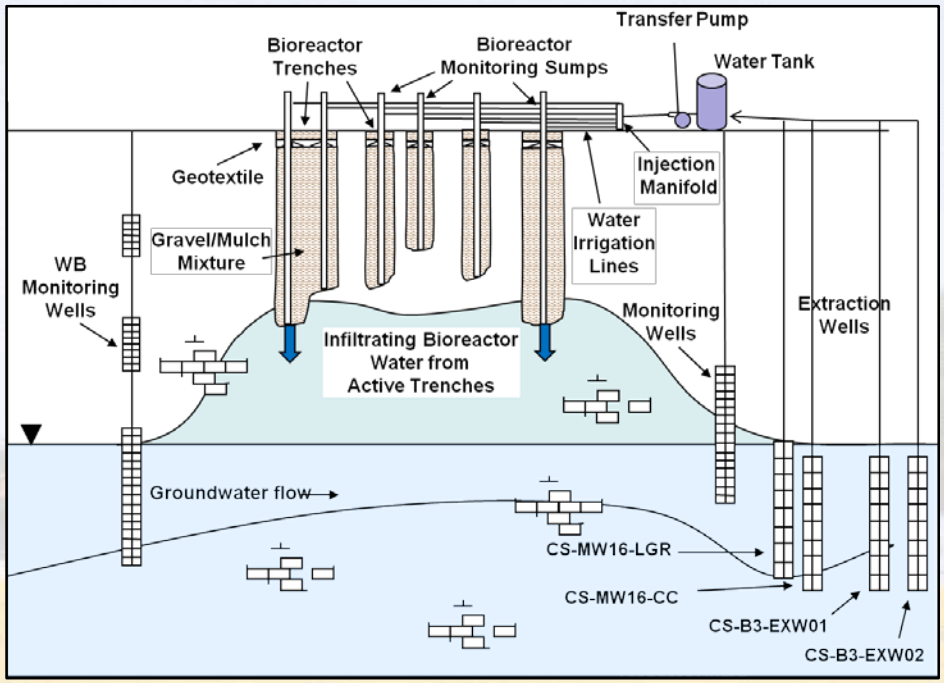
Bioremediation: Use of organisms to neutralize contamination.

B-3 Bioreactor
Summary of Recent Activities

- **Continued Bioreactor Operations**
  - Application of extracted VOC impacted groundwater to trenches
- **Installed three monitoring wells for substrate injections**
  - CS-B3-MW02
  - CS-B3-MW03
  - CS-B3-MW04
- **Replaced pumps in EXW-05 and CS-MW16-LGR**
- **Performed Substrate Injections**
  - 4 Wells and 6 Bioreactor trenches
- **Quarterly and Semi-Annual Regulatory Sampling**
  - Quarterly UIC sampling of extracted water prior to bioreactor application
  - Semi-annual sampling of Trench Sumps and Westbay wells
- **Performance Sampling – 9 months**
  - Remaining WB well zones and surrounding LGR and UGR MWs
- **Combined two existing UIC Authorizations**
  - 5X2600408 (injection wells) into 5X2600431(bioreactor)
- **Annual Reporting – UIC notification / Performance report**

SWMU B-3 Bioreactor

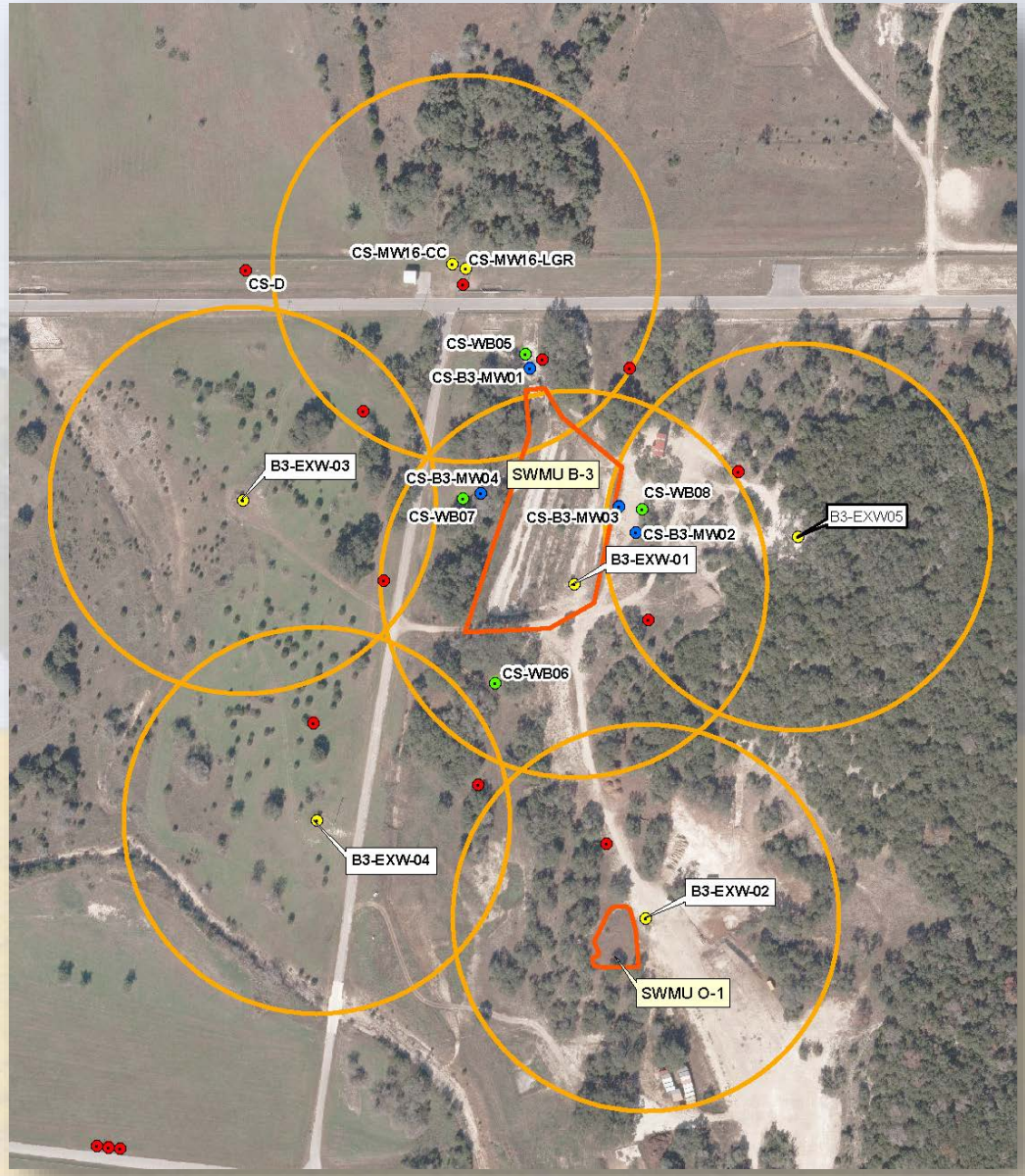
- VOC degradation is occurring with biological degradation end products methane, ethene, ethane, and CO_2 identified in surrounding UGR wells and LGR wells.
- Bioreactor maintains appropriate geochemical conditions (low DO, ORP, and pH) for effective anaerobic dechlorination.
- Between April and June 2017, approximately 3,815,043 gallons of groundwater were extracted and injected into Trenches 1 - 6.
- Approximately 192,474,000 gallons of extracted groundwater have been injected into the bioreactor.



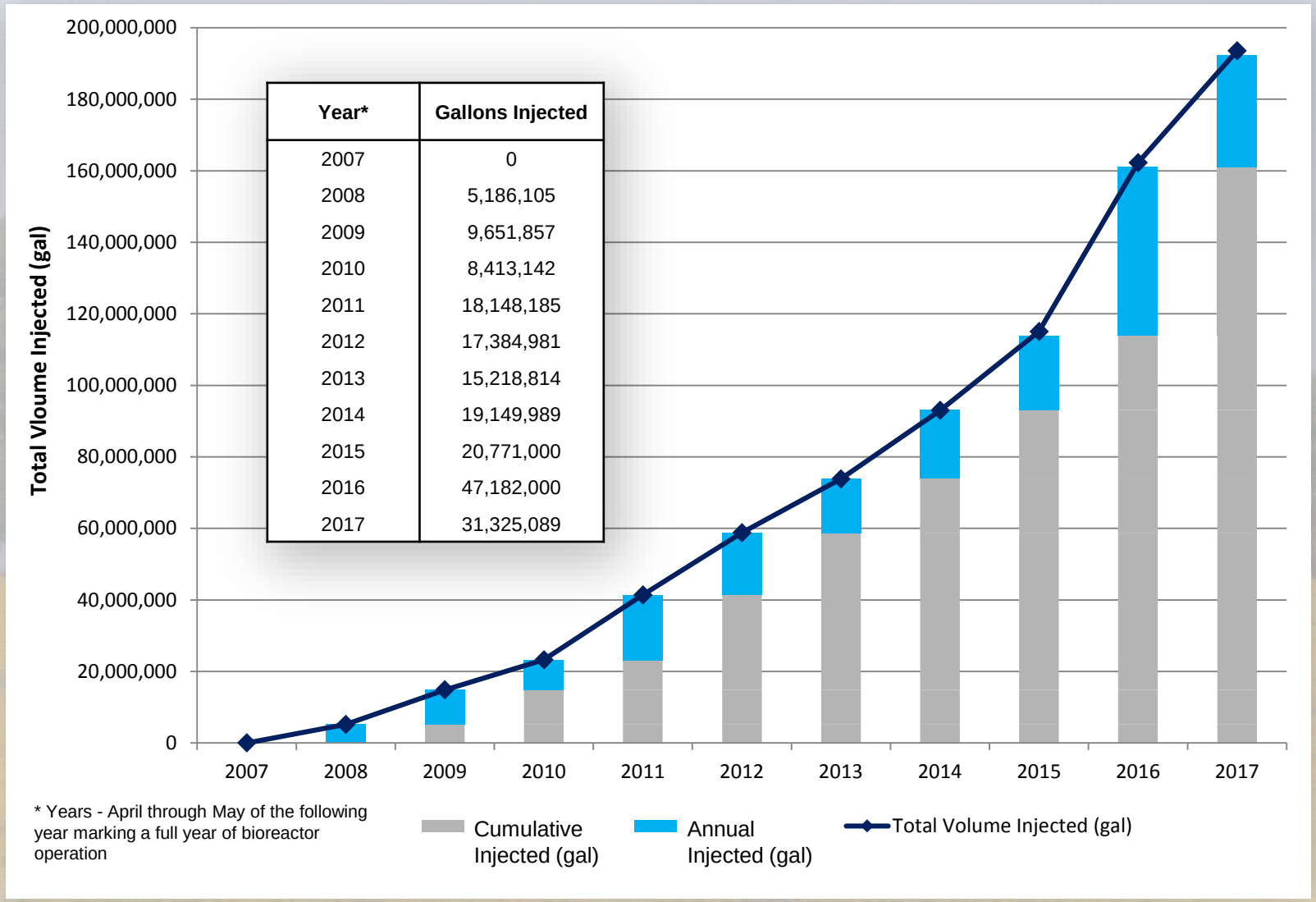
Bioreactor Conceptual Diagram

SWMU B-3 Bioreactor

- EXWs -01 through -05 are operational and are contributing extracted water to the bioreactor
- MWs 16-CC and 16-LGR contribute ~10 and 15 gpm, respectively
- Three new wells installed for injection of substrates to compliment reductive dechlorination efforts at B3-MW01



SWMU B-3 Bioreactor



Year*	Gallons Injected
2007	0
2008	5,186,105
2009	9,651,857
2010	8,413,142
2011	18,148,185
2012	17,384,981
2013	15,218,814
2014	19,149,989
2015	20,771,000
2016	47,182,000
2017	31,325,089

* Years - April through May of the following year marking a full year of bioreactor operation

SWMU B-3 Bioreactor

Operations, Maintenance, and Monitoring

- Continue monitoring bioreactor and surrounding wells for UIC permit and performance parameters
- Continue monitoring and maintenance activities for delivery of groundwater to the trenches
- Conduct semi-annual and 9-month monitoring
- Continue UIC monitoring with annual report in July 2018
- Continue SCADA control and automation integration
- Plan to convert solar to on-demand service only (no battery storage)

Maintenance and sump monitoring upgrades allowing continuous reading/recording of bioreactor trench water levels through SCADA.

B-3 Bioreactor
Current Sampling Efforts

Regulatory Sampling
- VOCs
- TDS
- pH at injection site (field)

Regulatory Sampling Locations
- Injection Manifold (UIC) - Quarterly
- Trench Sumps - Semi-Annual
- WB-03B Zones - Semi-Annual

Performance Sampling
- MEE + CO_2
- Ferrous Iron
- Manganese
- Arsenic
- Total Organic Carbon
- Dissolved Organic Carbon
- Sulfide
- Sulfate and Chloride
- *Dehalococcoides*
- Dissolved Hydrogen

Performance Sampling Locations

Frequency: Every 9 months
- Trench Sumps (5)
- WB zones (27)
- Extraction Wells (7)
- LGR Monitoring Wells (4)
- UGR Monitoring Wells (9)

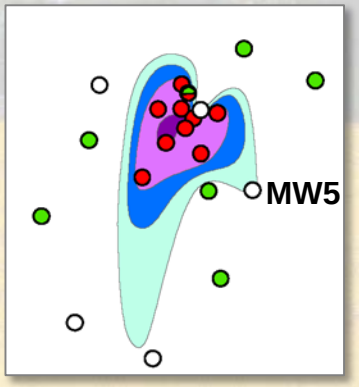
Trench Sump Field Parameters

Frequency: Monthly
- **pH**
- **DO**
- **Conductivity**
- **ORP**
- **Temp**
- **Water Level**

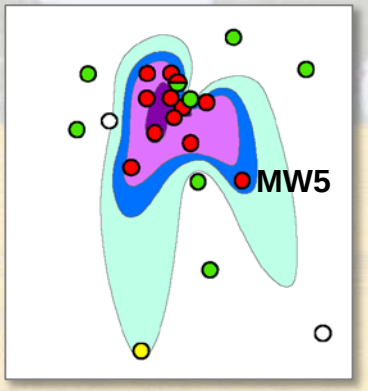
SWMU B-3 Bioreactor

Extent of SWMU-B3 LGR PCE plume

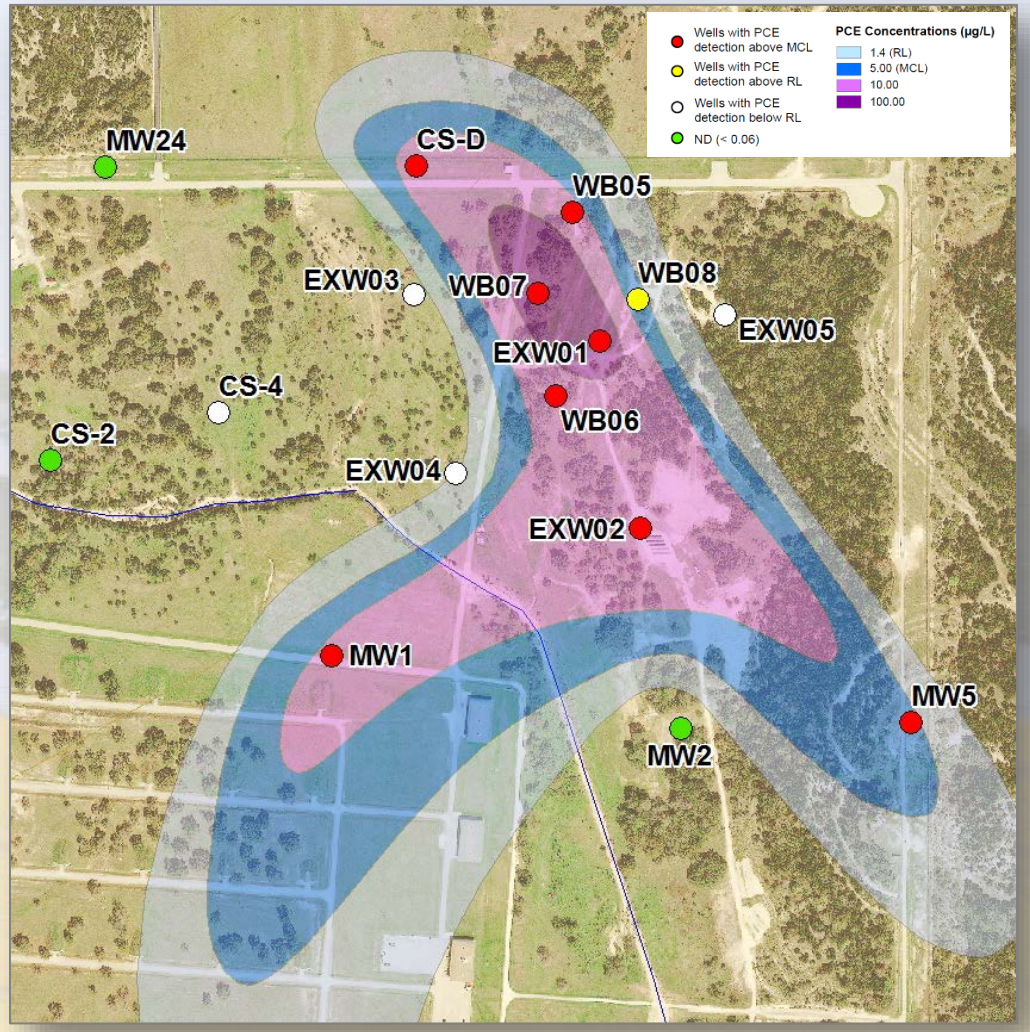
March 2015

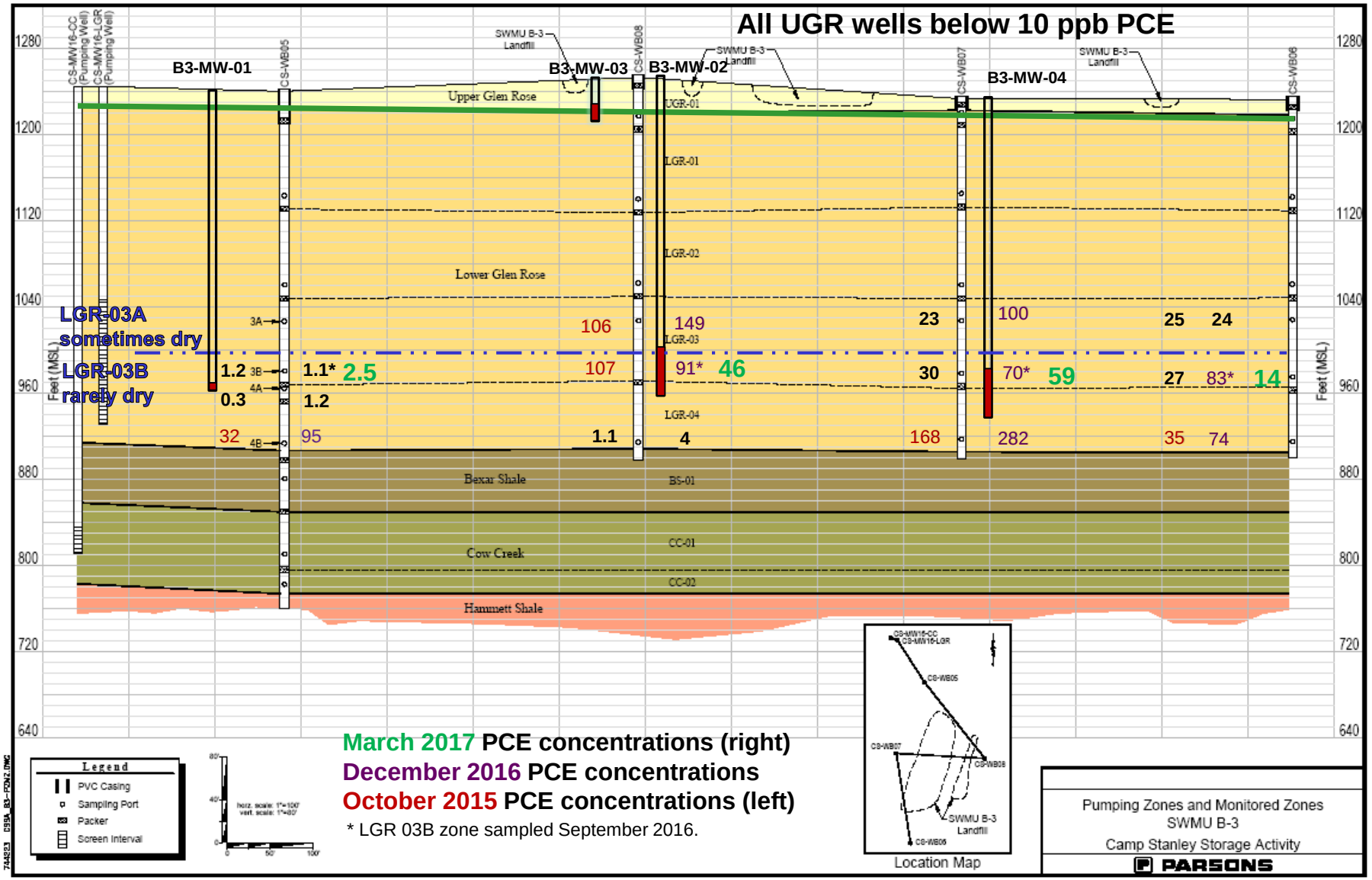


December 2015



September 2016





PCE Concentrations Beneath the Bioreactor.

Note: UGR PCE concentrations are low. Install LGR wells and inject there to “put the pill where the pain is.”

SWMU B-3 Bioreactor

Substrate Injection Summary

- Injections began in late March and were completed in early June
- Water from bioreactor was used to “seed” injection wells with *DHC*
- Raw CS-10 water used to flush wells
- Lactate applied within the bioreactor was split between all 6 trenches

Location	Substrate
B3-MW02 and B3-MW04	265 gal lactate 265 gal EVO
B3-MW03	265 gal EVO
B3-MW01-LGR	265 gal lactate
Trenches 1-6	1,325 gal lactate

SWMU B-3 Bioreactor

September 2017 – July 2018 Schedule

- September 2017 - Full scheduled bioreactor monitoring
  - Quarterly UIC
  - Semi-annual UIC
  - 9-month Performance monitoring
- December 2017 - Quarterly UIC
- March 2018 - Quarterly UIC, Semi-annual UIC
- June 2018 - Quarterly UIC, 9-month Performance monitoring
- July 2018 - Annual Reporting

STRATEGIC ENVIRONMENTAL RESEARCH AND DEVELOPMENT PROGRAM (SERDP)

"Abiotic Transformation of Chloroethene's in Low Permeability Formations" project ER-2622

Project Team:

David L. Freedman (PI), *Clemson University*
Ramona Darlington, *Battelle*
David Adamson, *GSI*
Lee Slater, *Rutgers University*
Fred Day-Lewis, *USGS*
Tony Danko, *Navy*

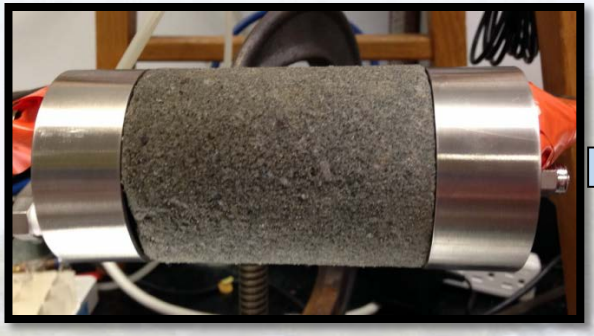
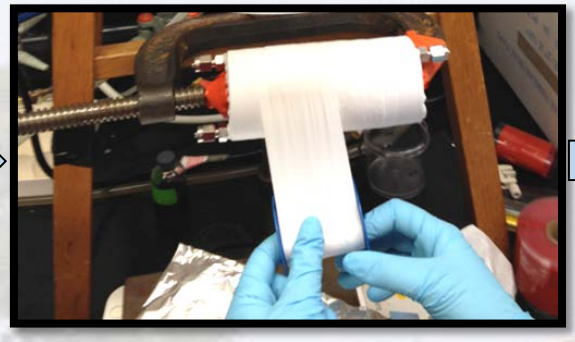
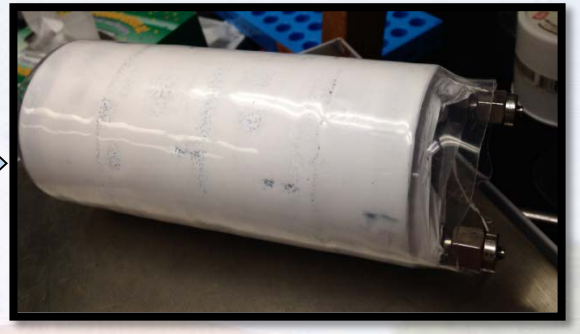
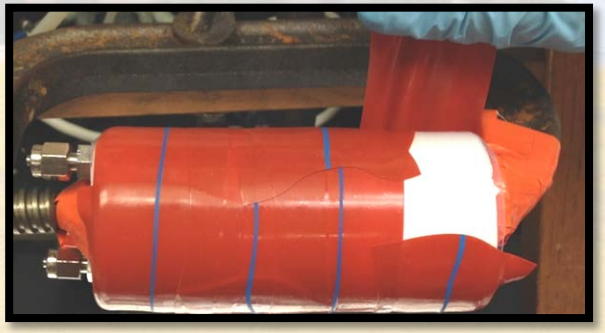
Objective is to develop a protocol that can be used to estimate the contribution and impact of productive abiotic transformation processes on chlorinated ethene contaminant degradation under intrinsic or enhanced conditions.

BACKGROUND

- Looking for sites that have a reasonable probability that abiotic transformation of TCE is occurring
- 19 DOD sites were screened
- 3 will be selected that meet these minimum criteria
  - Ability to force water through the rock in order to increase the pore water concentration of TCE, add bromide as a conservative tracer, add resazurin as a redox indicator, add ^{14}C-TCE to allow tracking of degradation of contaminants, and add mercuric chloride to control biotic activity
  - Site groundwater contains at least a trace level of acetylene, often viewed as a benchmark indicator of abiotic degradation mediated by iron bearing minerals
  - A preliminary test with crushed rock + filter sterilized groundwater +^{14}C-TCE shows evidence for accumulation of ^{14}C-labeled degradation products, including $^{14}CO_2$
  - Geochemical modeling indicates that iron-bearing minerals are likely
- Search has been narrowed to 4 sites, including CSSA

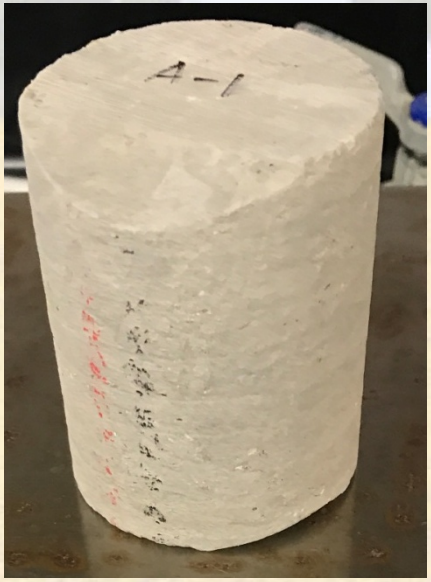
BACKGROUND

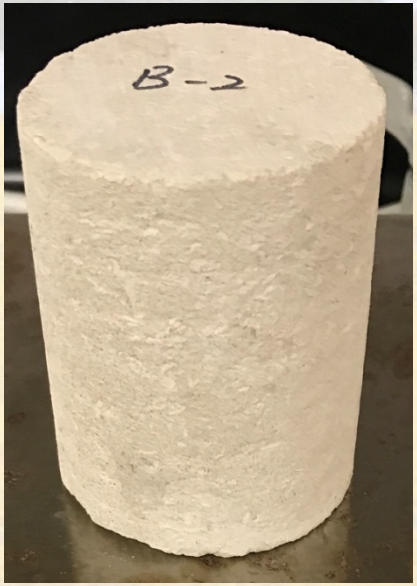
- Procedure for testing water passage

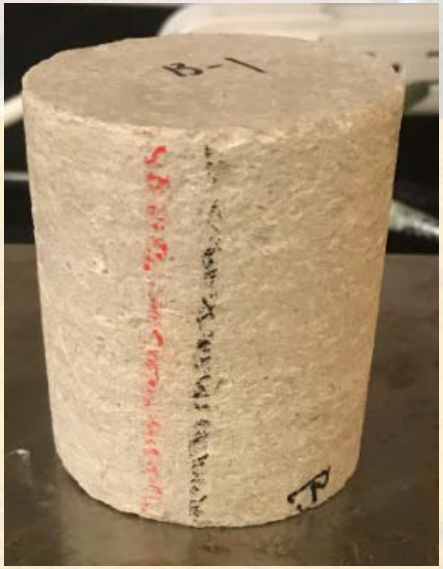






PROGRESS RELATED TO CSSA

- **Can water be forced through CSSA cores?**
  - Samples of rock cores were sent to Clemson University
  - The cores were trimmed to the size that will be used to construct intact rock core microcosms (2.5” diameter x 3.0” long)
  - Cores were sandwiched between stainless steel end caps and encased in Teflon tape + heat-shrinkable Teflon tubing + rubberized tape + hose clamps
  - Site groundwater applied to the bottom under pressure
- **The result: YES, we were able to force water through the cores!**

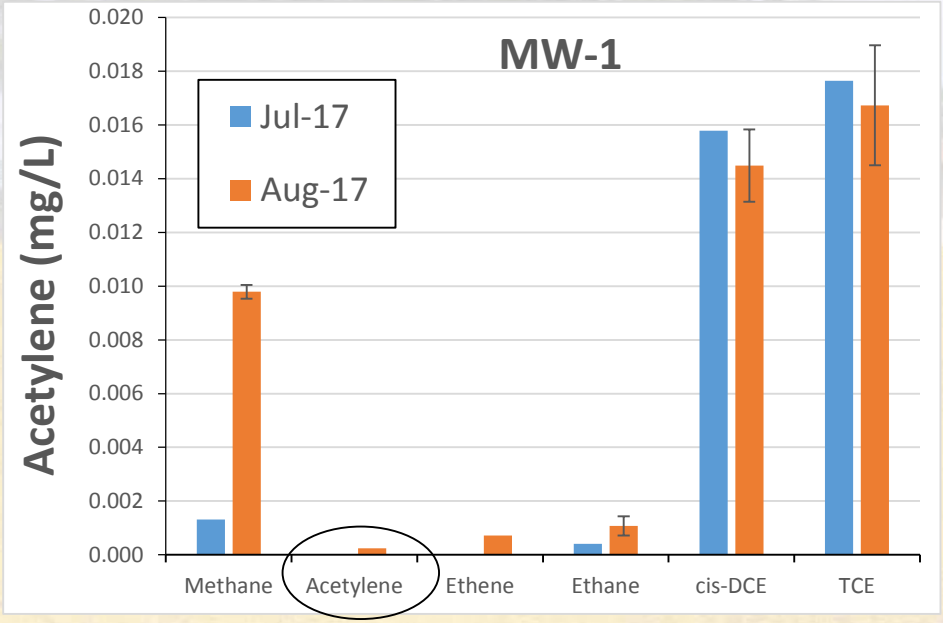


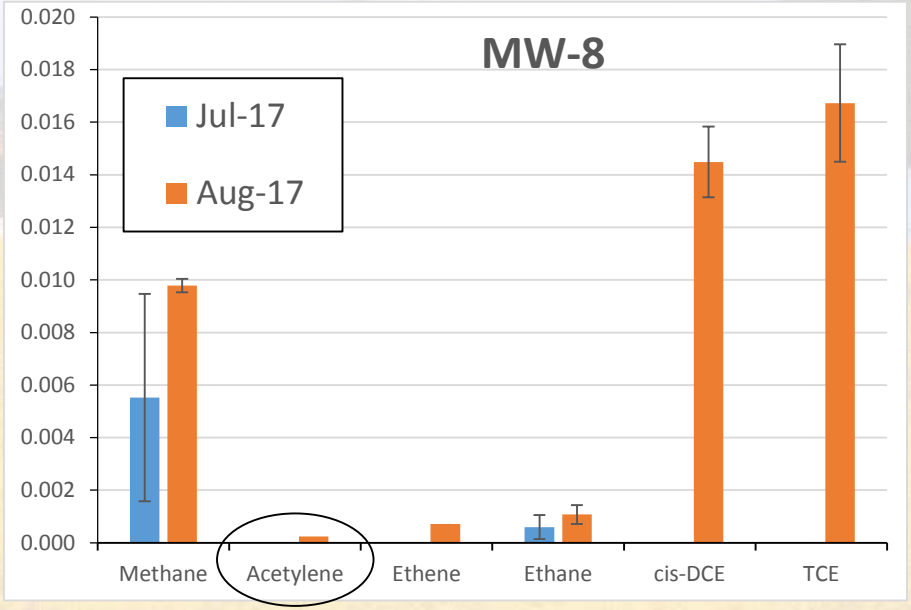




PROGRESS RELATED TO CSSA

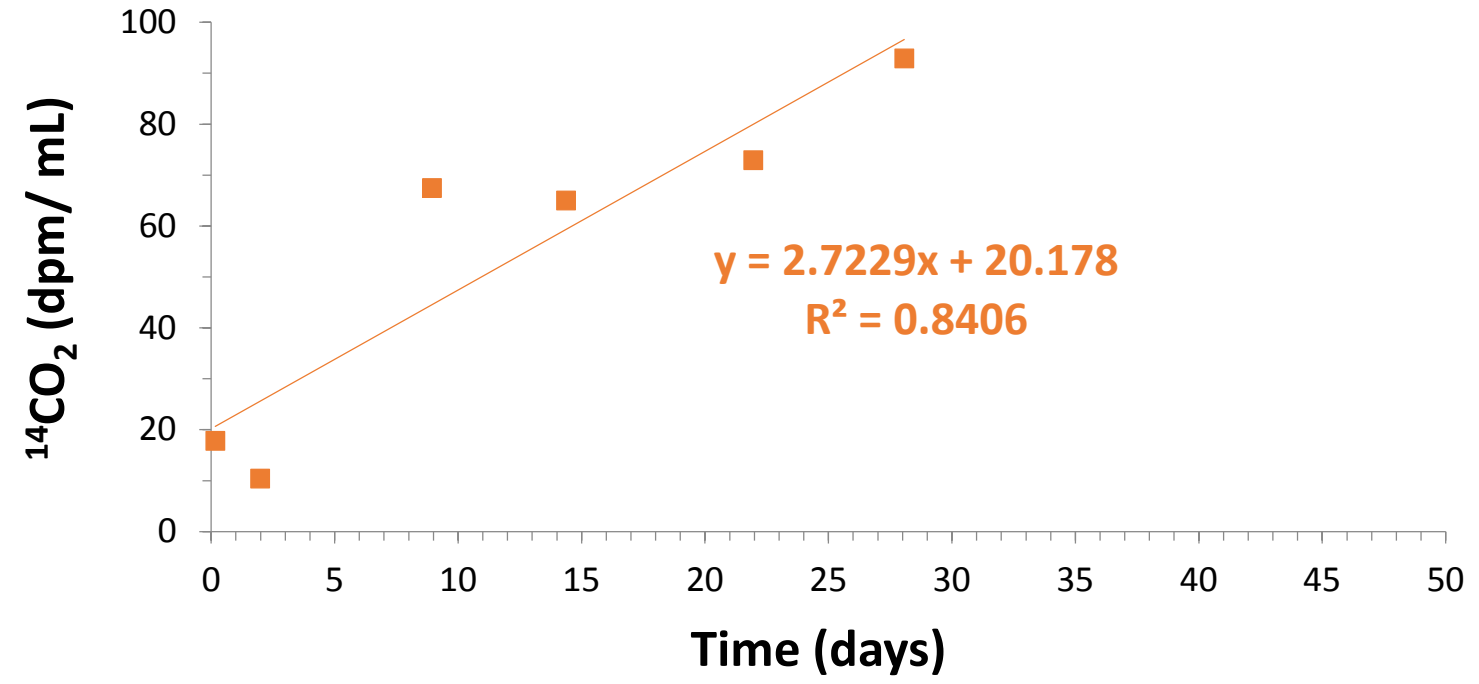
- **Is there evidence of acetylene?**
  - Tested in conventional groundwater samples and
  - Tested using passive vapor diffusion samplers provided by GSI, placed in 4 wells for ~2 weeks
- **The result: YES, we detected a low level of acetylene in 2 of the 4 wells in the August samples; not a lot, but some!**





PROGRESS RELATED TO CSSA

- **Does crushed rock from CSSA react with TCE?**
  - 4 Rock cores shipped from Clemson University to Battelle where the rock was crushed and returned
  - 4 Microcosms constructed with 12 g rock + 92 mL of filter-sterilized groundwater
  - Samples of the groundwater removed periodically to test for ^{14}C products
- **Preliminary result: Yes, $^{14}CO_2$ is accumulating in 2 of the 4 microcosms; incubation is on-going**



PROGRESS RELATED TO CSSA

- **Does geochemcial modeling predict iron minerals?**
  - Work in progress; still collecting geochemical data

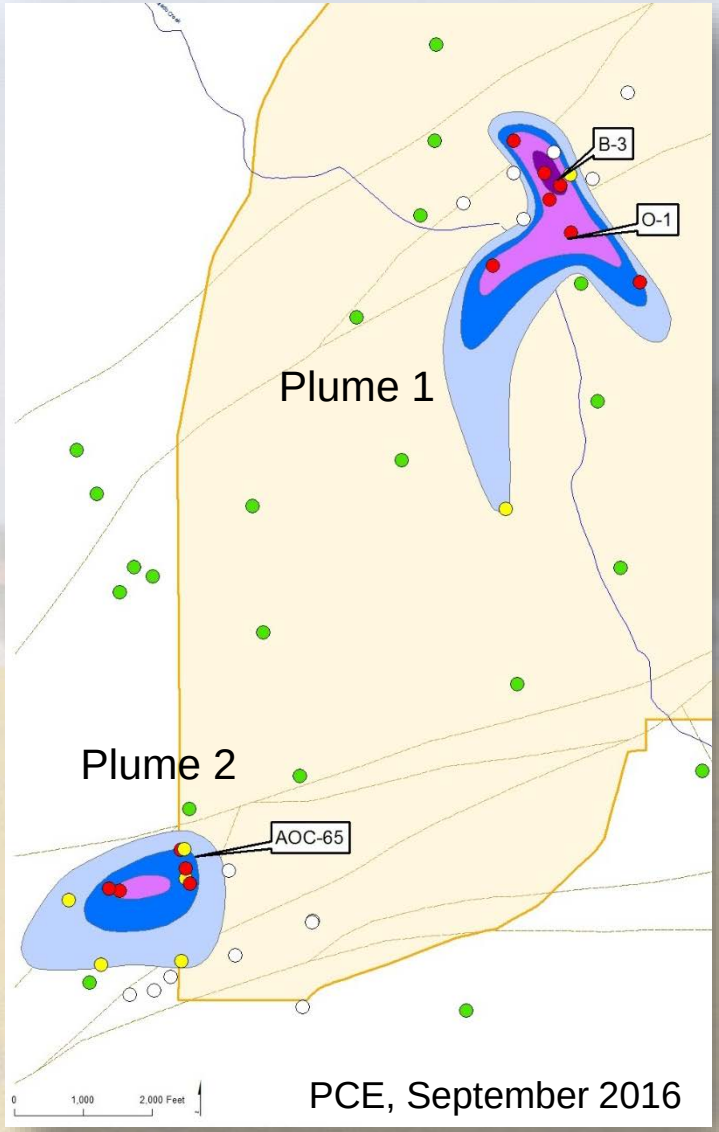
- **Bottom line: CSSA is still actively being considered; *cooperation from Ken Rice has been a big plus***
- **Final decision on selection of CSSA expected within one month**
- **If yes, arrangements need to be made for collection of fresh core samples**
  - Need 48 pieces of 3” rock, 2.5” in diameter
  - Will construct 32 intact core microcosms
- **Outcome: we will report abiotic degradation rate constants and whether or not stimulation with lactate enhances degradation**
  - **Useful for modeling the fate of TCE within the rock matrix, evaluating MNA**

CORRECTIVE MEASURES UPDATES: AOC-65

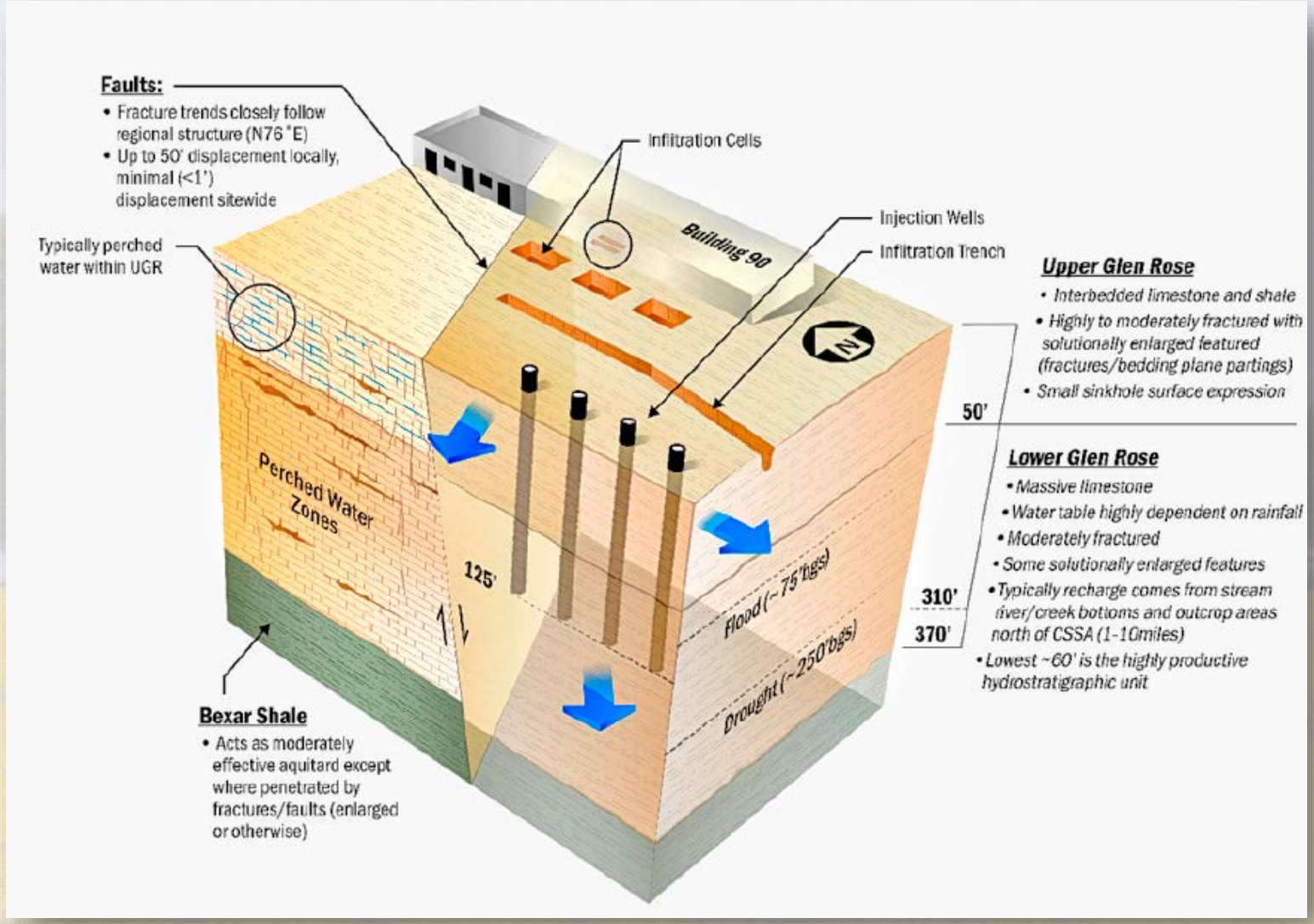
SWMU B-3 and AOC-65
Description

1. **SWMU B-3 Bioreactor:** Enhanced anaerobic bioremediation of chlorinated hydrocarbons in underlying fractured limestone at Plume 1.

2. **AOC-65 Vapor Intrusion Study and *In-Situ* Chemical Oxidation:** Removal/destruction of chlorinated hydrocarbons in underlying fractured limestone at Plume 2.

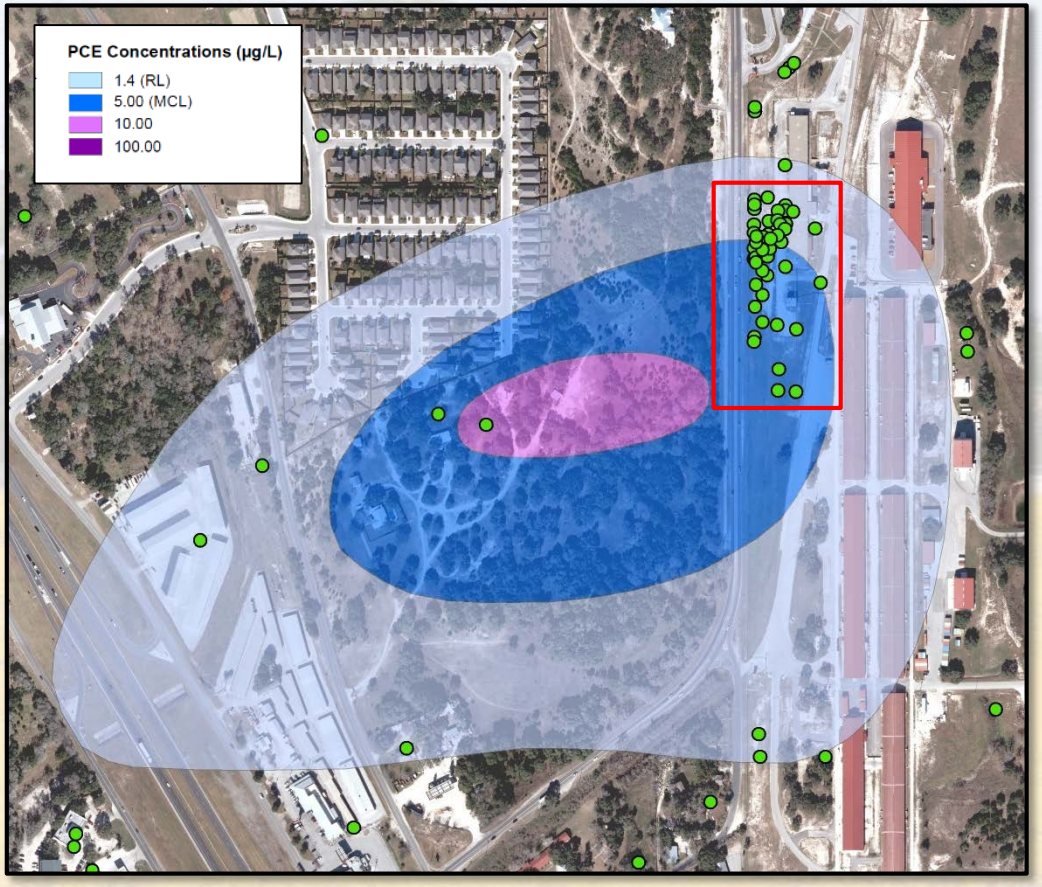


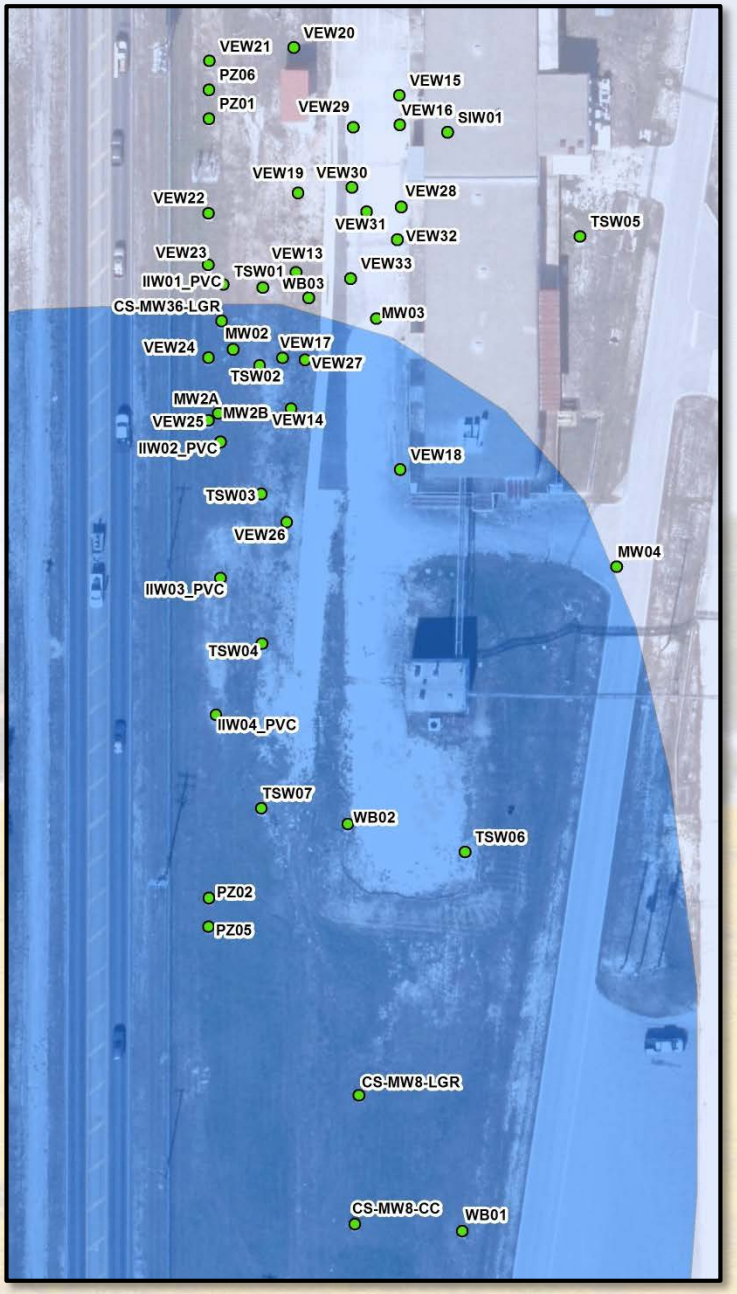
AOC-65 Source Area Treatment



AOC-65

Extent of PCE within LGR
September 2016



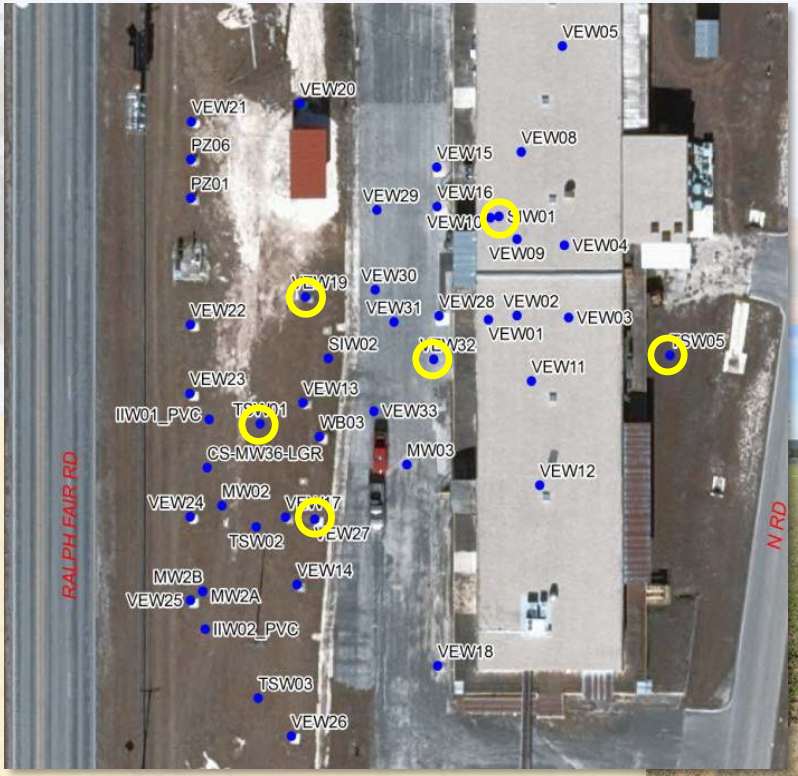


AOC-65 Source Area Treatment

In-Situ Chemical Oxidation (ISCO) selected corrective measure for VOC-impacted groundwater at AOC-65 with a phased approach initiated in 2012

ISCO Cylinders

- Provide a continuous oxidant source
- Installed within multiple locations at AOC-65
- Oxidant distributed under varying hydrologic conditions
- Consist of long-lived permanganate and higher oxidation potential persulfate



ISCO Injections

Oxidant	Application Phase (date)	Volume and Type	Application/ Injection Location
Persulfate Solution	Phase I (2012)	~15,000 gallons 20% sodium persulfate	Infiltration trench and SIW-01
	Phase II (2013)	~34,000 gallons 20% sodium persulfate	Infiltration trench, SIW-01, IIWs
	Phase III (2014)	~106,000 gallons 20% sodium persulfate	Infiltration trench, SIW-01, IIWs
Permanganate Solution	Phase IVa Phase IVb (2015)	~3,500 gallons 0.45% ~7,000 gallons 0.9% sodium permanganate	Newly constructed infiltration cells (3 exterior, 2 vault)
	Phase IVc (2016)	~12 permanganate-infused paraffin wax cylinders	TSWs, SIWs, VEWs

AOC-65 ISCO
Summary of Recent Activities

- **Continued ISCO Monitoring**
  - 12 Persulfate/Permanganate cylinders installed in December 2016

- **Quarterly Sampling**
  - Baseline sampling November 2016
  - Performance monitoring performed March and June 2017
  - September 2017 sampling currently underway
  - UGR wells (TSWs, VEWs, PZs) within AOC-65
  - Off-Post private supply wells (GACs installed)

- **Annual Reporting – UIC notification submitted in July 2017**

- **UIC Amendment –** Anticipated to include all AOC-65 wells as injection wells.

AOC-65 ISCO
Current Sampling Efforts

Quarterly Sampling Locations
- VEWs, TSWs, PZs, SIW-01
- WB01-03: UGR-01, LGR-01, LGR-09
- WB04: UGR-01, LGR-01, LGR-11
- 6 off-post GAC'd wells

Performance Analytes
- VOCs
- Anions:
  - Chloride and Sulfate
- Metals:
  - Ag, As, Be, Cd, Cr, Cu, Hg, Na, Ni, Pb, Sb, Se, Ti, Zn, Mg, Mn

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Additional Sampling Locations
Frequency: Every 15 months
- CS-MW06-LGR, 07-LGR, and 08-LGR, CS-MW36-LGR
- WB01 - 04 LGR zones (27)
  Frequency: Every 30 months
- WB04 BS/CC zones (5) and,
- WB04 LGR zones (3)

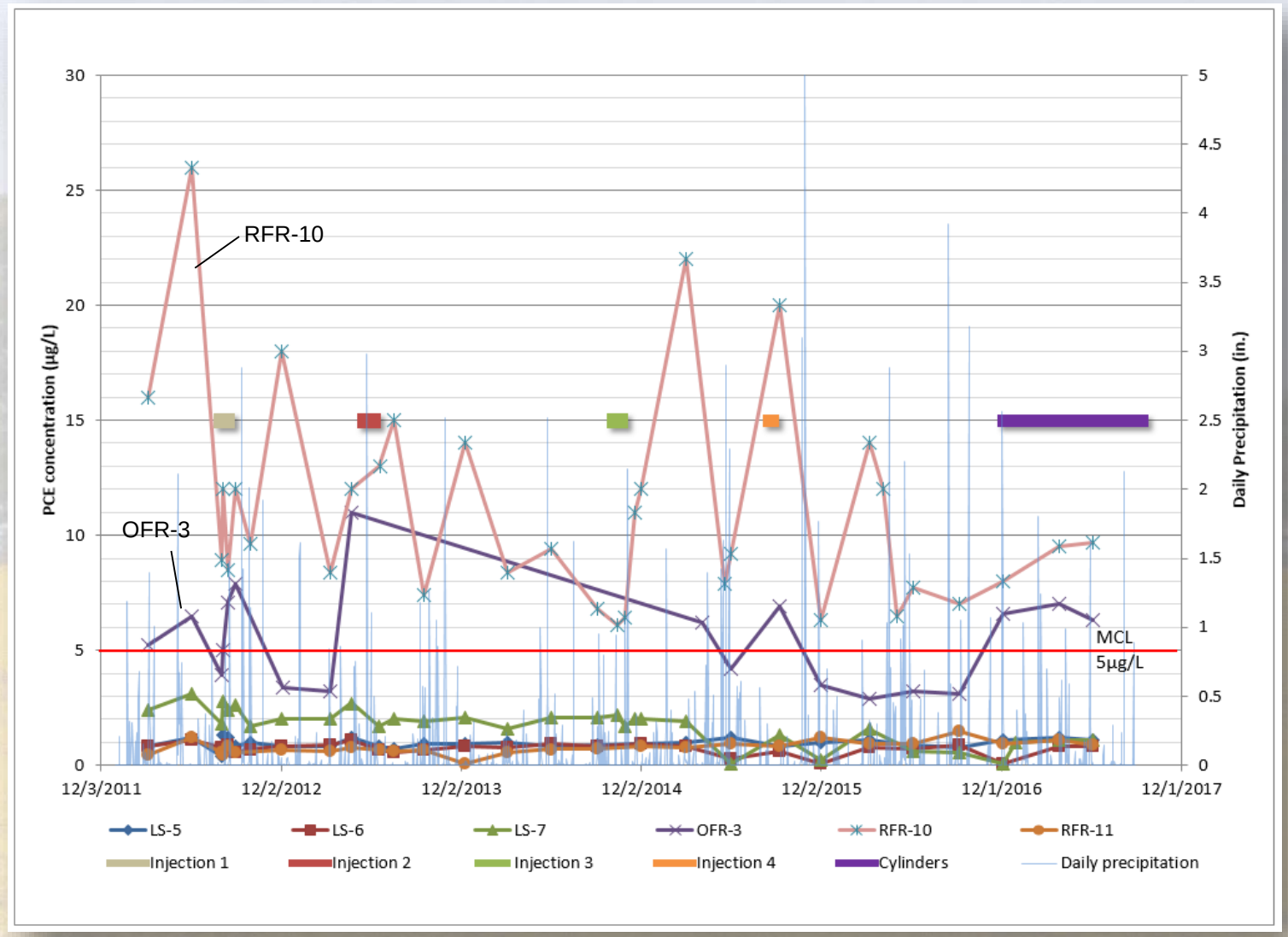
Field Parameters
- **pH**
- **DO**
- **Conductivity**
- **ORP**
- **Temp**
- **Water Level**

Phase IVc Oxidant Infused Cylinder Application Observations

- Continue to see fluctuating PCE concentrations in cylinder-installed wells and in monitoring wells; however, reducing trends in 5 of 6 wells with cylinders installed
- PCE increases in cylinder-installed wells indicates; manganese-oxide fouling of screens is not occurring
- PCE actually increased in VEW-32 following cylinder installation (occurred during persulfate applications as well)
- Increases in manganese concentrations in non-cylinder wells indicate connected pathways (possibly) from wells with cylinders installed.
- No metals mobilization issues to private wells
- Off-post drinking water wells in the plume area are protected with wellhead GAC units.

ISCO Observations

Off-Post Drinking Water Well Monitoring



PCE Concentrations Following December 2016 Cylinder Installation

Well ID	PCE Concentration (µg/L)		
	Nov. 2016	Mar. 2017	Jun. 2017
TSW-01	3,134	930	600
TSW-04	1.38	2	5.1
TSW-05	137	180	89
TSW-06	3	2	2
TSW-07	1.24	1.7	8.5
SIW-01	445	18	1.8
VEW-32	1,144	4,900	NA
VEW-31	37	70	NA
VEW-29	97	170	NA
VEW-27	551	150	NA
VEW-25	6.37	5.5	NA
VEW-23	24	NS	NA
VEW-19	120	49	NA
VEW-18	24	5.6	NA
VEW-15	44	16	NA
WB03-UGR-01	18,548	6,500	9,400

NA - Not Analyzed: Samples collected arrived at laboratory out of temperature range, therefore, it was decided to forgo analysis.

NS - Not Sampled

= Permanganate cylinder installed in well.

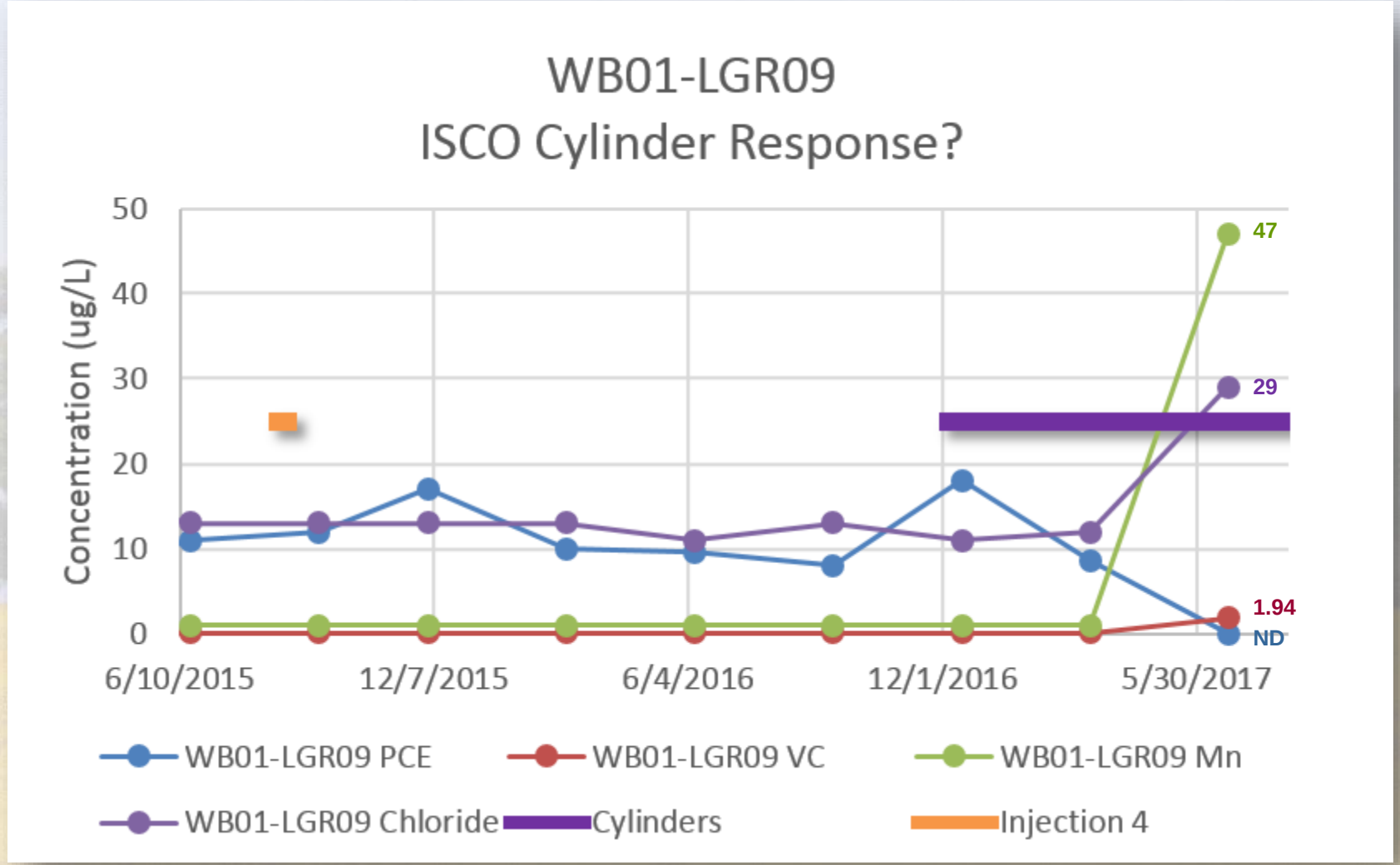
Manganese Concentrations Following December 2016 Cylinder Installation

Well ID	Manganese Concentration (µg/L)		
	Nov. 2016	Mar. 2017	Jun. 2017
TSW-01	24	25,000	120,000
TSW-04	200	160	480
TSW-05	1	1,900	2,400
TSW-06	1	5	9
TSW-07	5	36	39
SIW-01	25	130,000	47,000
VEW-32	11	27,000	16,000
VEW-31	140	32	85
VEW-29	12	5	120
VEW-27	69	17,000	33,000
VEW-25	14	90	770
VEW-23	44	NS	NS
VEW-19	8	7,400	220,000
VEW-18	96	390	620
VEW-15	27	27	24
WB03-UGR-01	1	1	1
PZ-01	1	9	4
PZ-02	1	36	38
PZ-05	1	1	10
PZ-06	1	1	3

NS - Not Sampled

50

= Permanganate cylinder installed in well.


WB01-LGR09
ISCO Cylinder Response?
Concentration (ug/L)
50
40
30
20
10
0
6/10/2015
12/7/2015
6/4/2016
12/1/2016
5/30/2017
47
29
1.94
ND
WB01-LGR09 PCE
WB01-LGR09 VC
WB01-LGR09 Mn
WB01-LGR09 Chloride
Cylinders
Injection 4

WB01-LGR09 ISCO Response

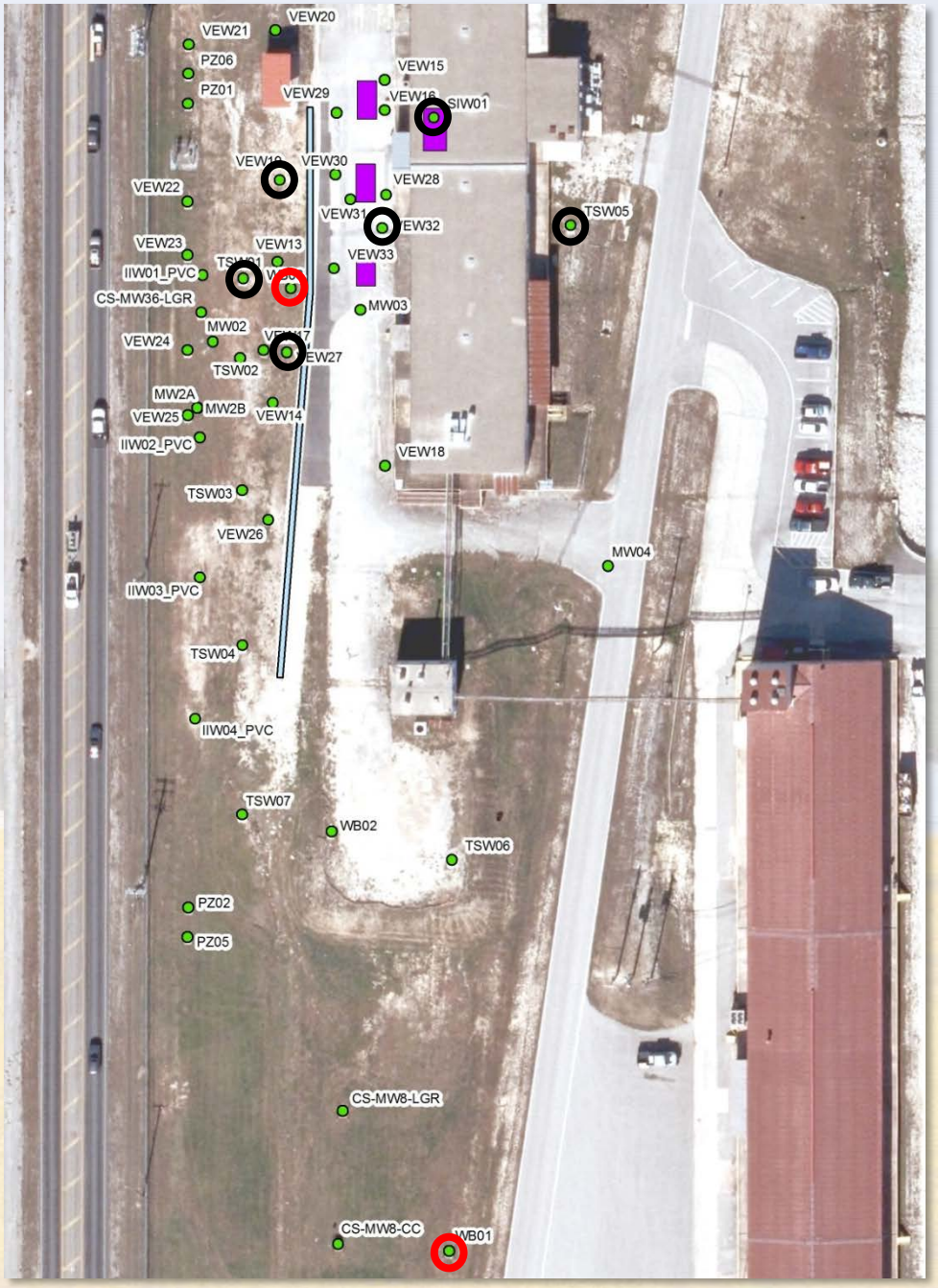
- WB01 is ~500’ south of WB03
- LGR-09 zone is ~300’ bgs

Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	TCE	PCE	Vinyl Chloride
2-Dec-15	<0.12	**0.58F**	<0.08	**19.05**	**16.96**	<0.08
9-Mar-16	<0.12	**0.44F**	<0.08	**12**	**10**	<0.08
8-Jun-16	<0.12	**0.69F**	<0.08	**12.56**	**9.55**	<0.08
14-Sep-16	NA	**0.49F**	NA	**10.89**	**7.95**	<0.08
14-Dec-16	<0.12	**0.61F**	<0.08	**18**	**18**	<0.08
15-Mar-17	<0.12	**0.61F**	<0.08	**11**	**8.6**	<0.08
21-Jun-17	NA	**0.49F**	NA	<0.05	<0.06	**1.94**

	Chloride	Sulfate
2-Dec-15	**13**	**16**
9-Mar-16	**13**	**17**
8-Jun-16	**11**	**14**
14-Sep-16	**13**	**17**
14-Dec-16	**11**	**15**
15-Mar-17	**12**	**16**
21-Jun-17	**29**	**0.87**

	Mn
2-Dec-15	1.0
9-Mar-16	1.0
8-Jun-16	1.0
14-Sep-16	1.0
14-Dec-16	1.0
15-Mar-17	1.0
21-Jun-17	**47**

All concentrations in µg/L



ISCO Observations
On-Post Cylinder Installed Wells

- How can we have high (or any) PCE concentrations in wells with oxidant cylinders installed?
  - Manganese concentrations within these wells indicate permanganate is being consumed
  - Low background natural oxidant demand, therefore most likely oxidizing VOCs

- Samples are collected via bailer, with cylinders removed
  - Removing cylinders mixes water within the well
  - If PCE resides near the top of the well, it is not likely to be oxidized prior to sampling, where the sample preservative neutralizes the oxidant

- Test non-uniform distribution of oxidant within well bore
  - Collect vertical VOC profile within cylinder-installed well via peristaltic pump
  - Collect VOC sample after water has been mixed and oxidant allowed to react

AOC-65 ISCO

Summary of Recent Activities

- **Continued ISCO Monitoring**
  - 12 Persulfate/Permanganate cylinders installed in December 2016
- **Quarterly Sampling**
  - Baseline sampling November, 2016
  - Performance monitoring performed March and June 2017
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- **Annual Reporting – UIC notification submitted in July 2017**

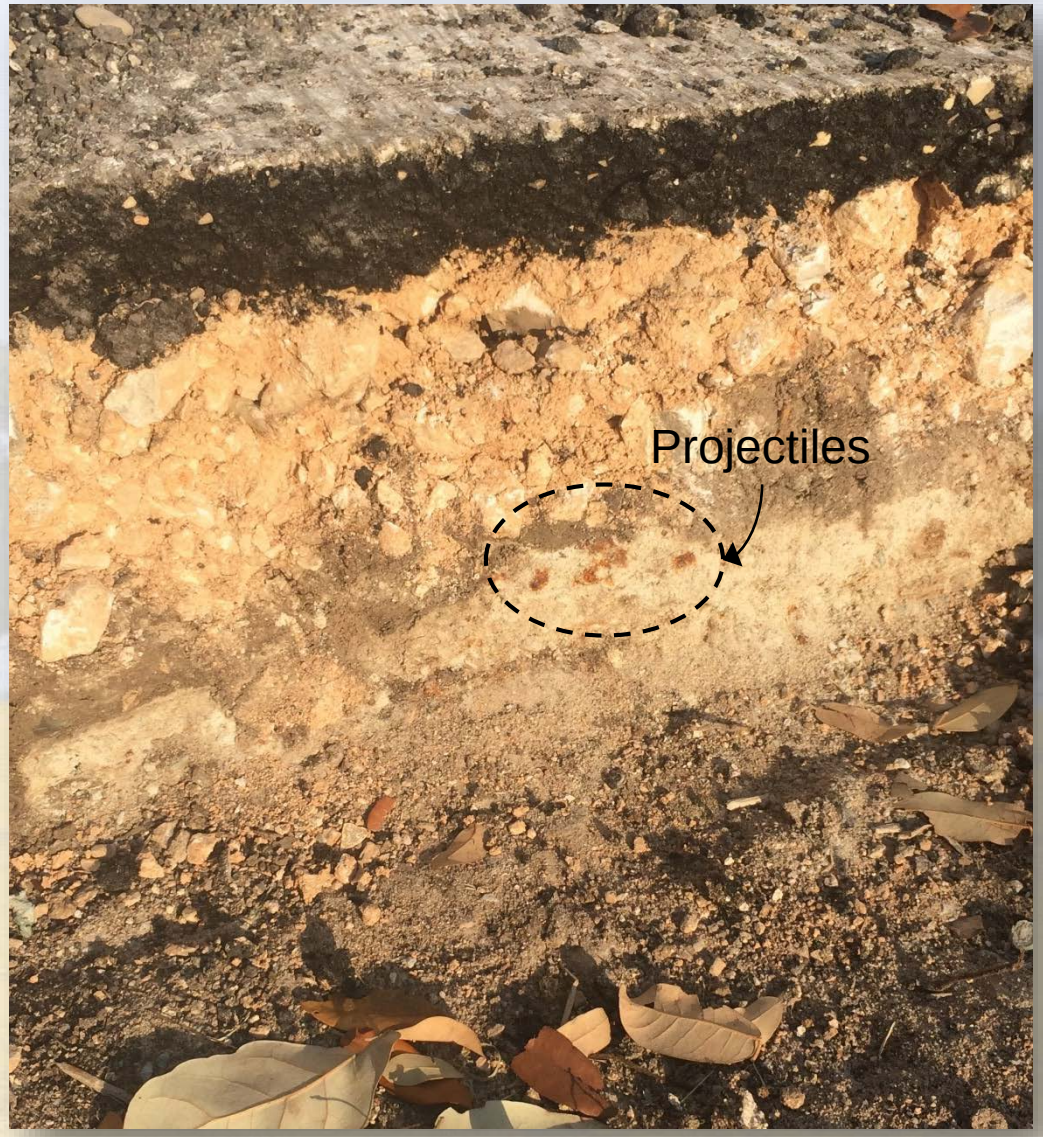
AOC-76 “NEW”

AOC-76
Overview

- Newly identified AOC-76 contained sand similar to material generated from Building 90 former test fire room.
- Located in the residential district of CSSA near the swimming pool
- Discovered by public works employees who observed small arms projectiles on the surface.

AOC-76
Overview

- Initial investigations accomplished for the sand to be used as bedding or marker material.
- Upon investigation in August 2017, discovered the lead projectile impacted sand not present along existing or former communication line, neither as a marker sand nor as a bedding sand.
- Further investigation showed it to be confined to the general area it was discovered in, but extending under the asphalt of the parking lot.



AOC-76
Proposed XRF and Surface Sampling

- Proposed sample locations, 25-ft centers across parking lot
- Samples to be collected in quadrants around a “hot” sample location
- Effort to determine the minimum area of paved surface to be removed for a remedial action

AOC-76
Proposed XRF and Subsurface Sampling

Collect approximately 20 subsurface samples from beneath swimming pool parking lot:

- Paved areas to be cored
- Undisturbed samples to be collected using a rig-mounted geotechnical hammer until bedrock refusal (typically <2')
- Subsurface beneath pavement is generally 2-6" of base material above a thin veneer of native soil, which overlies weathered limestone bedrock
- Samples to be retrieved and screened with XRF and sample submitted from the native soil, where present
- Results above 300 ppm on the XRF to be analyzed quickly with a 7-day TAT
- Remainder of results submitted with standard TAT

AOC-76
Potential Closure Standards

Scen-ario	Closure Path	Land Use Classification	Critical PCL	Route to Achieving said Closure	Closure Documents	Future implications
A	Release not Subject to TRPP	Residential	84.5 mg/kg	Remove contamination above the critical PCL.	RIR	Unrestricted future land use
B	TRRP Remedy Standard A - Residential	Residential	500 mg/kg	Remove contamination above the critical PCL.	APAR (no further action)	Unrestricted future land use
C	TRRP Remedy Standard A - Commercial	Commercial	1,600 mg/kg	Remove contamination above the critical PCL.	APAR (no further action)	Commercial/industrial land use only
D	TRRP Remedy Standard B - Residential	Residential	500 mg/kg	Remove contamination above the critical PCL, where accessible. Cover remaining contamination (much of it is already covered).	APAR RAP ICP RACR PRACR	Unrestricted land use in excavated areas; Post-response action care to ensure cover remains in place in other areas
E	TRRP Remedy Standard B - Commercial	Commercial	1,600 mg/kg	Remove contamination above the critical PCL, where accessible. Cover remaining contamination (much of it is already covered).	APAR RAP ICP RACR PRACR	Commercial/industrial land use only in excavated areas; Post-response action care to ensure cover remains in place in other areas

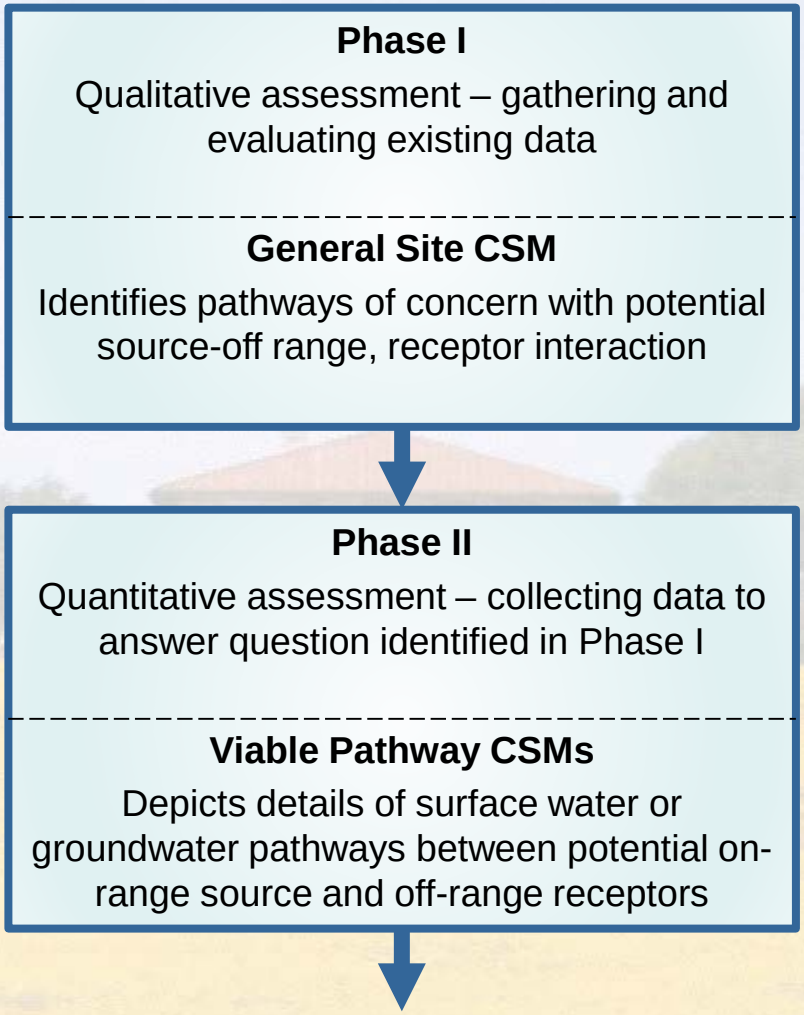
OPERATIONAL RANGE ASSESSMENT PROGRAM

Operational Range Assessment Program
Objectives

- Keep ranges open and available for testing and training
- Ensure people on and off Army installations are not drinking water contaminated by munitions constituents of concern (MCOC)
- Address regulatory and public concerns

Operational Range Assessment Program

ORAP Assessments use a phased approach and are based on Source – Receptor Interactions.



Operational Range Assessment Program
Phase I - Qualitative

A qualitative evaluation of whether:

1. A MCOC source exists on the operational range footprint
2. There is a potential migration mechanism
3. Human or sensitive ecological receptors are present

A Phase I Assessment Report for CSSA was drafted in 2008.

Operational Range Assessment Program
Phase I - Qualitative

All operational ranges at CSSA were placed into groups based on the three factors:

- **Referred** – Refer to Appropriate Cleanup Program: ranges with compelling evidence (e.g., sampling data) to indicate the presence of an off-range release that potentially poses an unacceptable risk to human health or the environment.
- **Inconclusive** – Phase II Quantitative Assessment Required: ranges where existing information either is insufficient to make a source-receptor interaction determination or indicates the potential for such interaction to be occurring.
- **Unlikely** – Five-Year Review: ranges where, based upon a review of readily available information, there is sufficient evidence to show that there are no known releases or source receptor interactions that could present an unacceptable risk to human health or the environment.

The 2008 draft report concluded: **Inconclusive**

- All six ranges were identified as having the potential for MCOC to migrate into off-range groundwater and adversely affect human receptors.

Operational Range Assessment Program
Phase II - Quantitative

- ORAP Phase II establishes whether the source-receptor pathway identified during Phase I is complete or new information has been identified that would impact the Phase I conclusions
- Parsons' Phase II approach:
  - Reevaluate existing literature (i.e., prior sampling results, previous investigation reports, and previous risk assessments
  - Contaminant modeling (if needed)
  - Collect additional soil samples (if needed)