MEETING MINUTES

OVERVIEW			
CLIENT	Camp Stanley Storage Activity	**PROJECT**	Task Order TO9
MEETING DESCRIPTION			
SUBJECT	Regulatory Meeting	**LOCATION**	CSSA
MEETING DATE	2/28/2016	**REPORT AUTHOR**	Shannon Schoepflin
MEETING TIME	1:00 pm Central	**REPORT DATE**	3/6/2017

ATTENDEES		
CSSA	**Regulators**	**PARSONS**
Felicia Kraintz James Cannizzo	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; Active Range Fan (North and East Pasture) sites; groundwater monitoring update; solid waste management unit (SWMU) B-3 remediation update; and area of concern (AOC)-65 remediation update; CSSA public outreach overview; CSSA internal audit topics and SAWS meetings. Slide presentation is attached. The slide presentation is attached. Discussion points are listed below:

Administrative Order Closure Documents

- A Corrective Measures Implementation (CMI) Report outline was presented to and verbally approved by Mr. Lyssy.

Active Range Fan Sites

- An overview of the remaining open Active Range Fan sites (SWMUs B-2, B-8, B-20/21, B-24, and RMU-1) was presented to provide a brief history of each site, current status, and potential future investigation and/or remediation activities.

Groundwater Monitoring Update

- An overview of the most recent LTMO and DQO updates was provided to give Mr. Gregorio a view of where we are in our monitoring program.
- Mr. Pearson presented the results of the September and December 2016 groundwater sampling events. He also presented information on new well CS-MW37-LGR which was drilled on-post as a monitoring replacement for LS-1, an off-post SAWS-owned well that SAWS is planning to abandon. CSSA will continue to monitor LS-1 until it is abandoned.
- PFAS results from samples collected in December 2016 were presented, and Mr. Lyssy agreed that PFAS is not a significant issue at CSSA.

SWMU B-3 Remediation Update

- Three new injection wells (B3-MW02 through -MW04) were installed on either side of the bioreactor to facilitate the planned lactate/EVO injections in March 2017. B3-MW03 was originally intended to be an LGR well, but due to an oily substance encountered during drilling, it was decided to discontinue drilling and leave it in place as a UGR well (total depth = 38 ft). Analytical results indicated the substance consisted of weathered fuel as well as chlorinated compounds (DCE primarily).
- The solar equipment connection at SWMU B-3 will go forward, but rather than use a battery to store power, it will be converted to an on-demand service only.

AOC-65 Remediation Update

- Installation of permanganate cylinders conducted in December 2016 was discussed (photos, locations, longevity).
- More data collection needed in future sampling events to assess the effectiveness.

Miscellaneous/Open Discussion

- Topic 1: In order to meet fire suppression needs and due to its aging reservoir, the Army has discussed the potential for switching CSSA to SAWS for water supply.
  - Public perception may be a problem if CSSA is on SAWS but off-post wells located on the plume and equipped with a GAC are not.
  - In addition, the possible liability of continued use of GAC-equipped wells is a consideration of Army management, though the GACs remain effective at removing contaminants, and are carefully maintained and monitored.
  - Mr. Lyssy indicated that a public meeting would need to be held to present CSSA's rationale to the public. He added that CSSA may potentially meet with the 6 off-post GAC well owners in advance of a public meeting because of CSSA's impact on their groundwater quality.
  - Some off-post well owners equipped with a GAC have indicated that they would like to be connected to SAWS. However, some may not want to be connected to SAWS.
  - Mr. Lyssy said the Statement of Basis does not preclude CSSA from connecting GAC well owners to a public water supply. It only states that they must be protected from exposure to groundwater contaminants.
  - If CSSA connects these off-post wells to SAWS, they would still want to retain the current wells for monitoring purposes. Texas water rights may prevent CSSA from locking landowners out of their own wells, though aquifer districts may have the authority to do so.
  - Ms. Kraintz will discuss all the issues further with the Army in the coming months.
- Topic 2: CSSA internal audit findings (listed below)
  - CSSA has not had a site-wide PA/SI completed for MMRP sites. Ms. Kraintz discussed Parsons pulling together all MMRP documents to see if we meet the PA/SI requirements and provide to EPA and TCEQ for review. Mr. Lyssy said EPA would not require a PA/SI at this time, but they would review it if it is required for CSSA internal purposes.
  - CSSA does not have a current Operational Range Assessment Program (ORAP). Parsons may have some documentation of an older ORAP and will look into it for Ms. Kraintz.
  - Final audit finding discussed was for CSSA to perform a third-party optimization study to assess the Remedies-in-Place. Mr. Lyssy indicated it is premature to conduct a third-party review at this time; the Statement of Basis was just signed in 2015. Mr. Lyssy believes the 5-year reviews will accomplish this from EPA's perspective and that perhaps this review could be added in with the 2020 5-year review. Mr. Rice suggested looking at SERDP as the 3rd party.

A site visit was conducted to view newly installed wells, SWMU B-3, and AOC-65. It was agreed that the next regulatory meeting would be held in Fall 2017.

MINUTES DISTRIBUTION

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

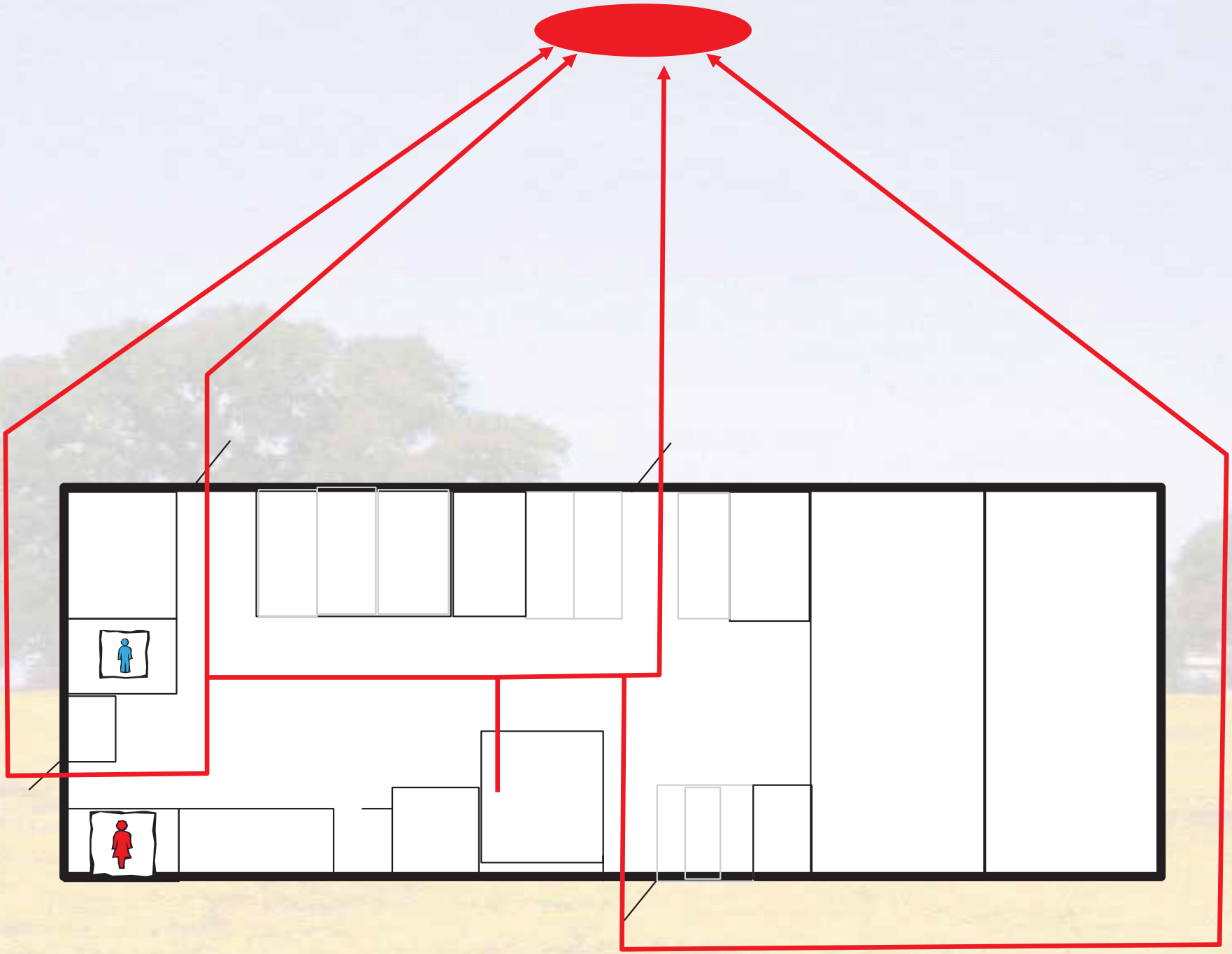
CSSA Regulatory Update Meeting
February 28, 2017

Name		Company & Phone Number	Signature
Last	First		
LYSSY	GREG	EPA 214 5734415	
Lindley	Adrian	Parsons 512 719 6052	
Burdey	Julie	Parsons: 512-719-6062	
Rice	Ken	Parsons 512-719-6050	
Pearson	Scott	Parsons 512-719-6087	
Schoepflin	Shannon	Parsons 719-6810	
Gregorio	Paul	TCEQ 512-239-1025	
Salazar	Jorge	TCEQ 210-403-4059	
Cannizzo	Jim	US Army CSSA 210 295-7082	
Krauntz	Felicia	CSSA 2102957067	

Camp Stanley Storage Activity Status Update

February 28, 2017

INTRODUCTIONS AND WELCOME



Emergency Evacuation & Restrooms

Agenda

EPA Order Status

- Order Documents
- Site Remediation Progress

Groundwater Monitoring

- Long-Term Monitoring Optimization
- Monitoring Program Overview
- MW5-LGR
- New Well CS-MW37-LGR
- PFAS Sampling

SWMU B-3

- Monitoring Results Update
- New Well
- Operations, Maintenance, and Monitoring

AOC-65

- ISCO Results Update
- Permanganate Candles

CSSA Public Outreach

CSSA Miscellaneous – Open Discussion

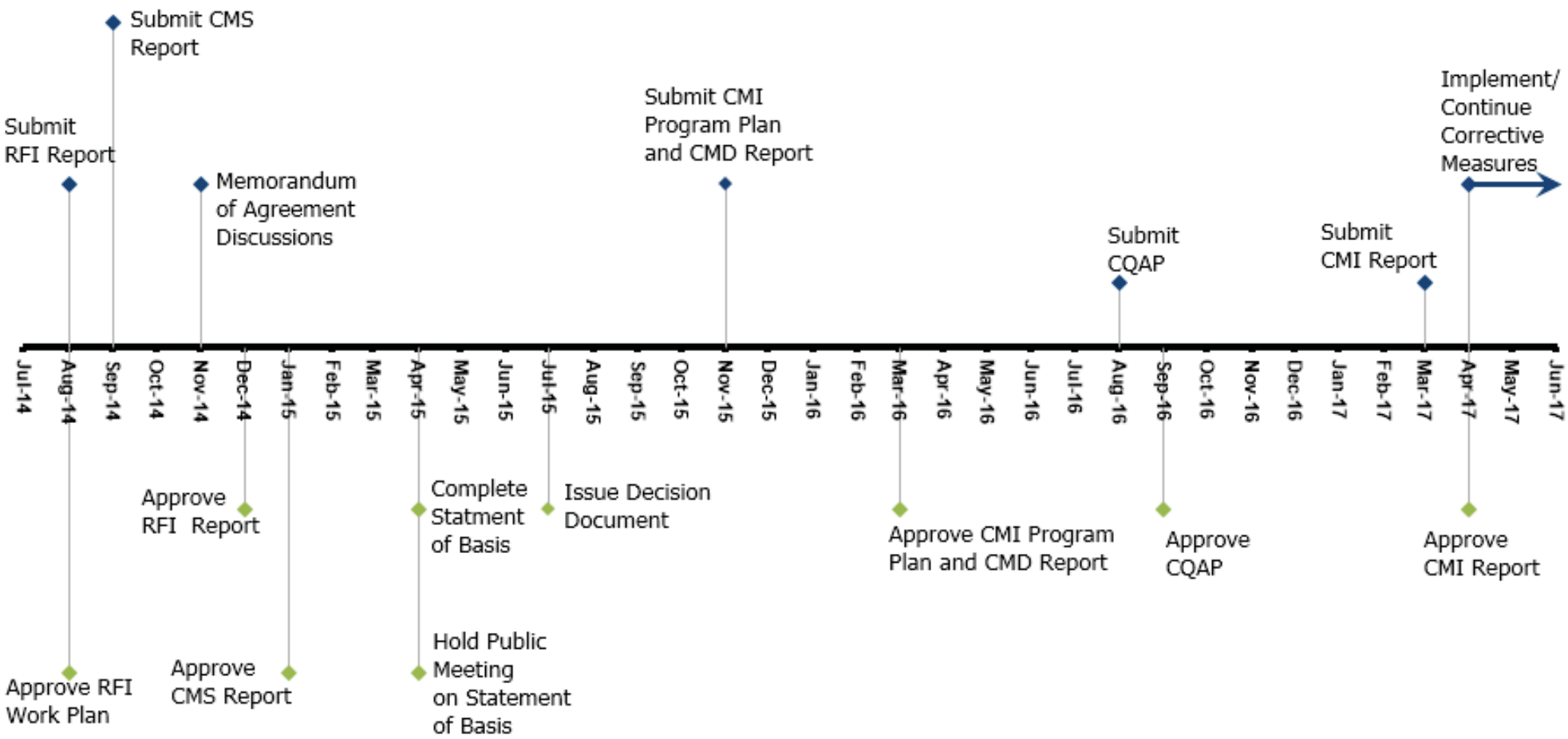
Site Visit

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

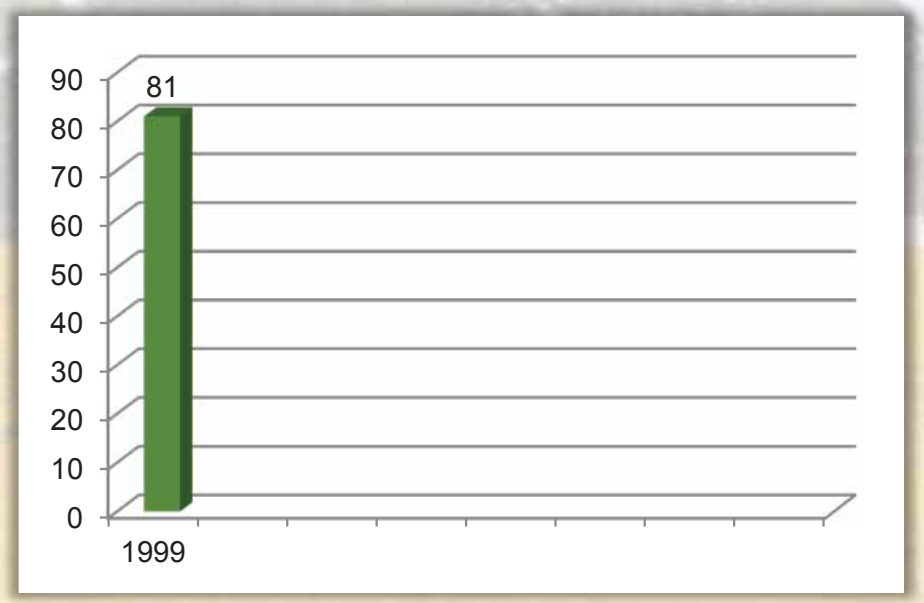
- ✓ Corrective Measures Implementation Program Plan
- ✓ Corrective Measures Design Report
- ✓ Construction Quality Assurance Plan
- ❑ Corrective Measures Implementation Report

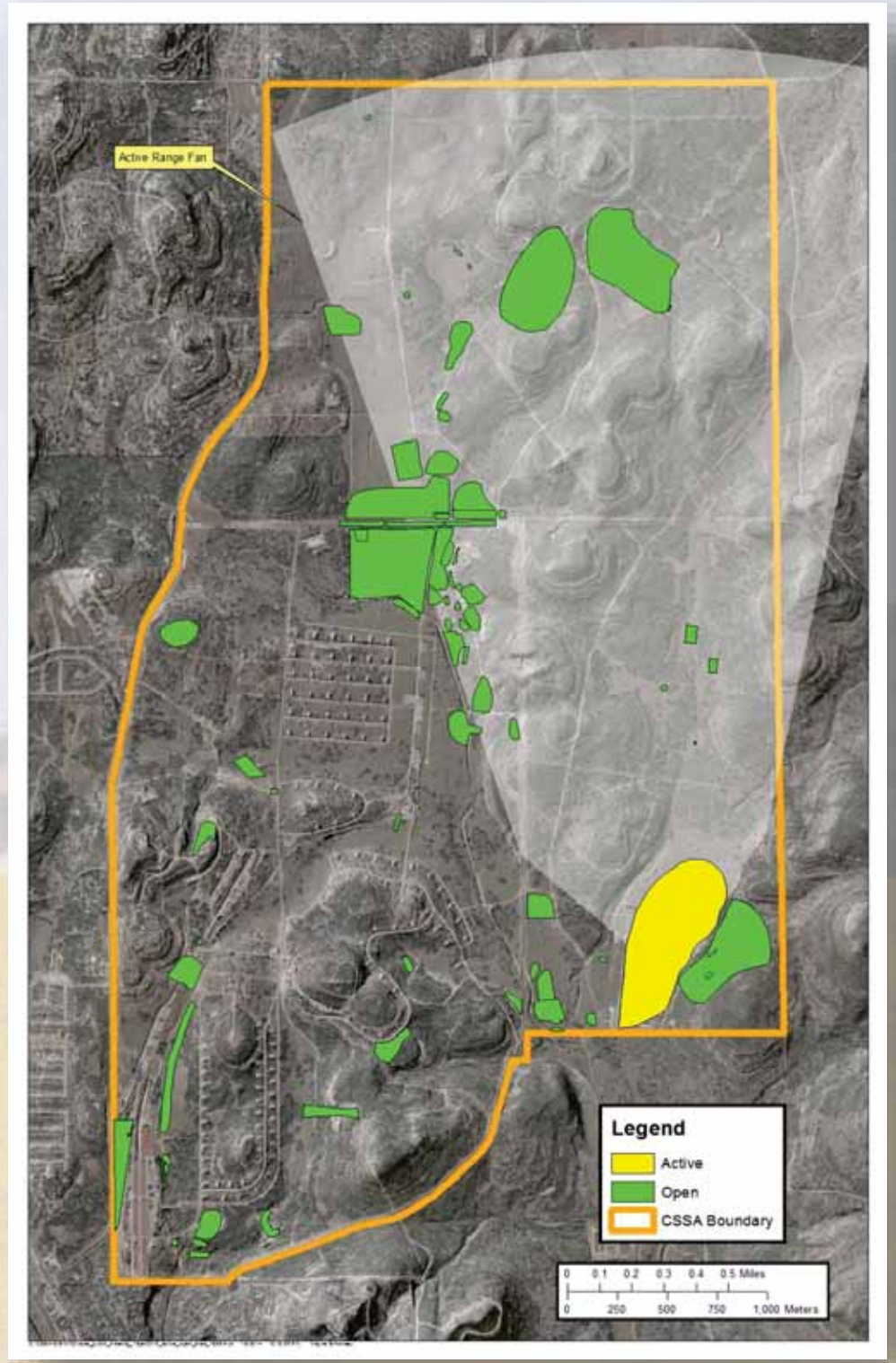
Current Outline:

- Section 1: Introduction
- Section 2: Site Description and Background
- Section 3: Scope of CMI
- Section 4: CMI Activities
- Section 5: Results
- Section 6: Quality Assurance
- Section 7: Conclusions
- Section 8: References

SITE REMEDIATION PROGRESS

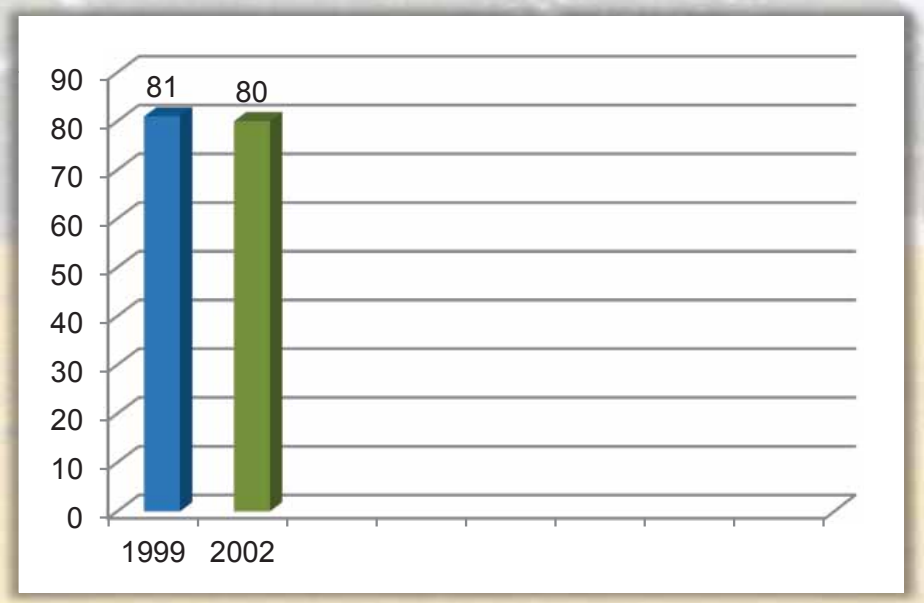
1999: 81 Open Sites

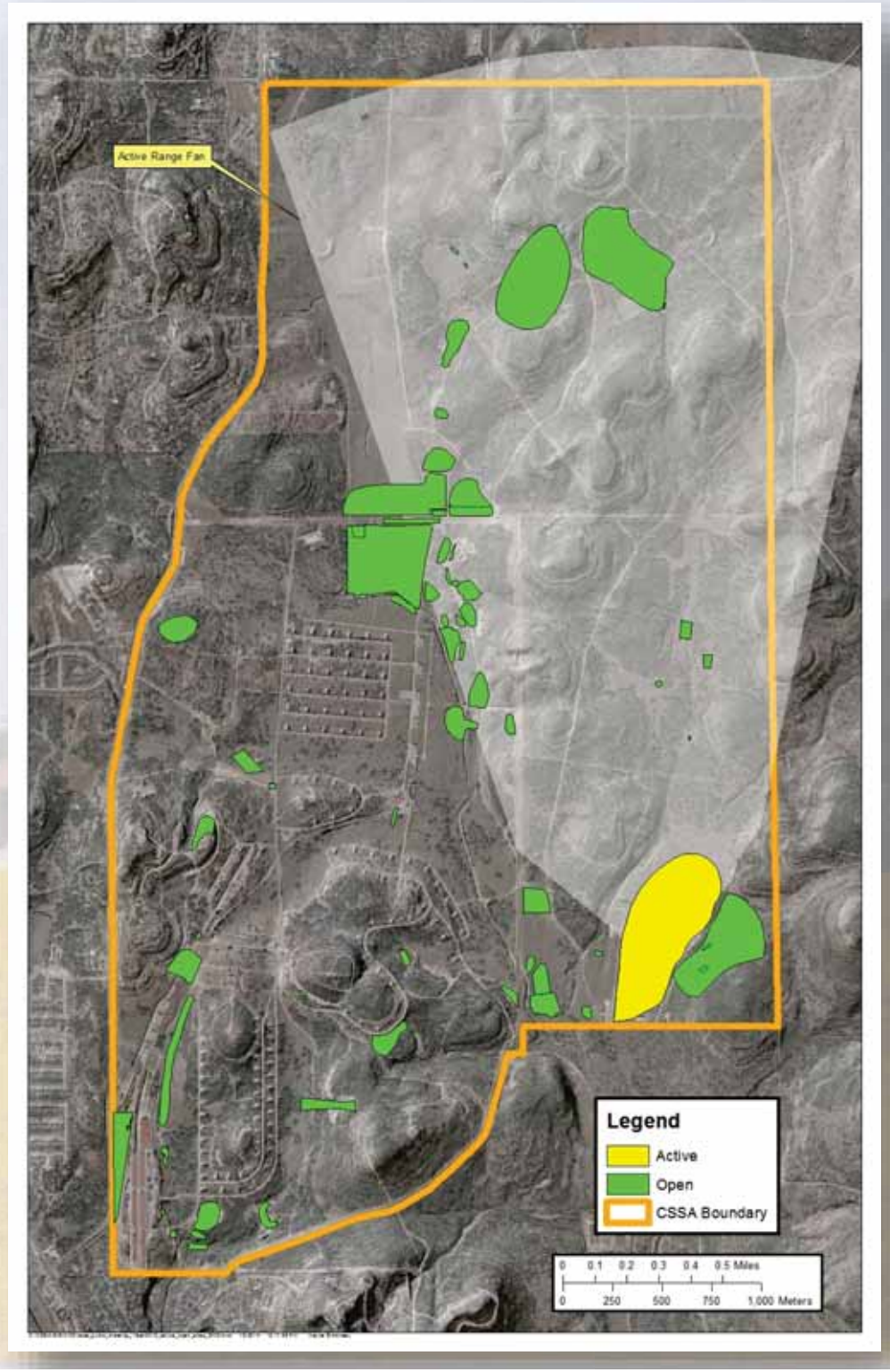




SITE REMEDIATION PROGRESS

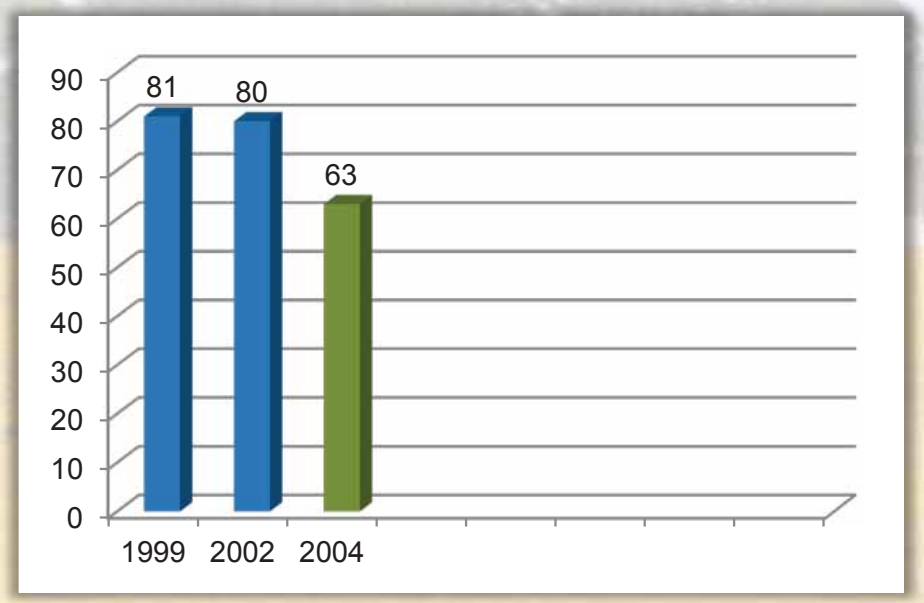
2002: 80 Open Sites

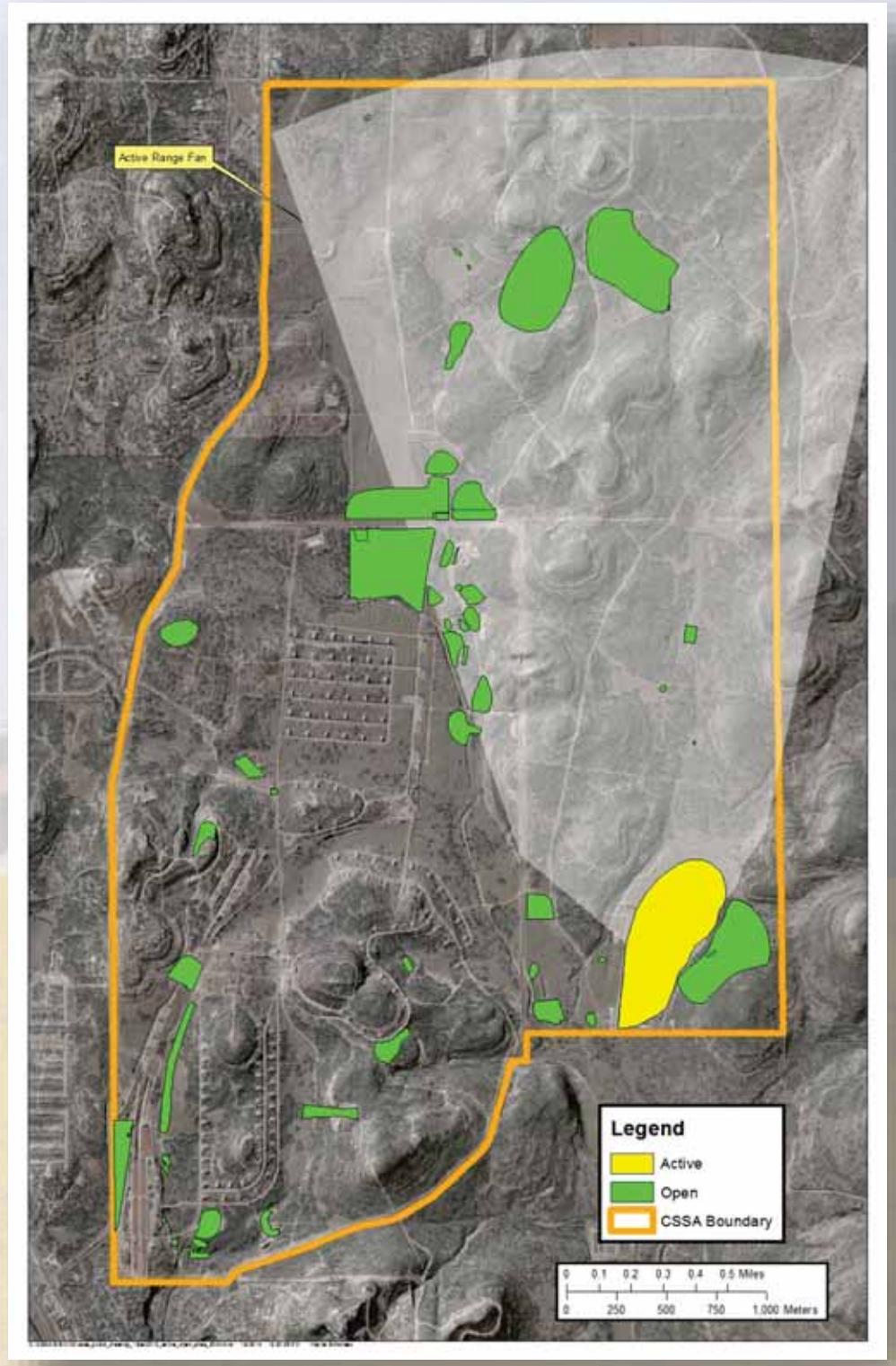




SITE REMEDIATION PROGRESS

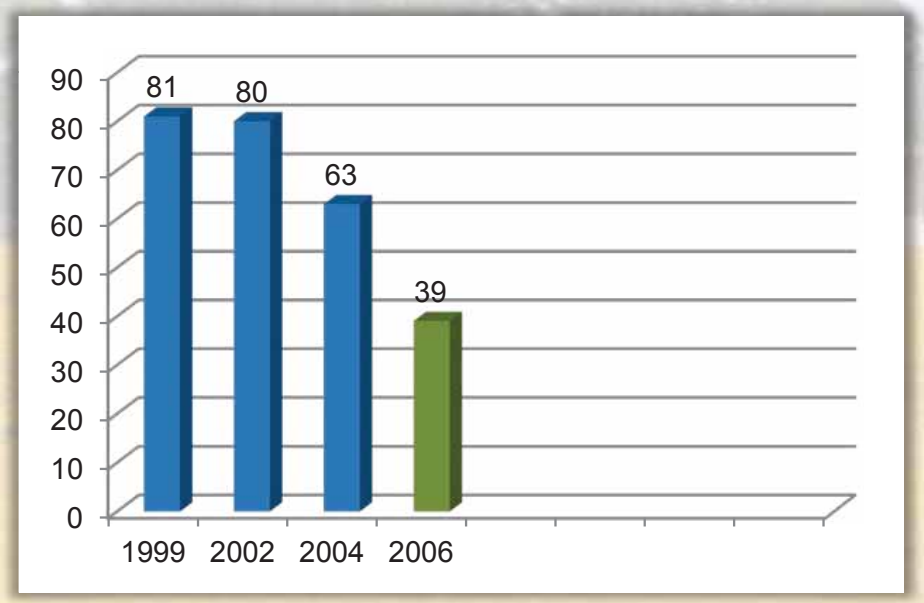
2004: 63 Open Sites

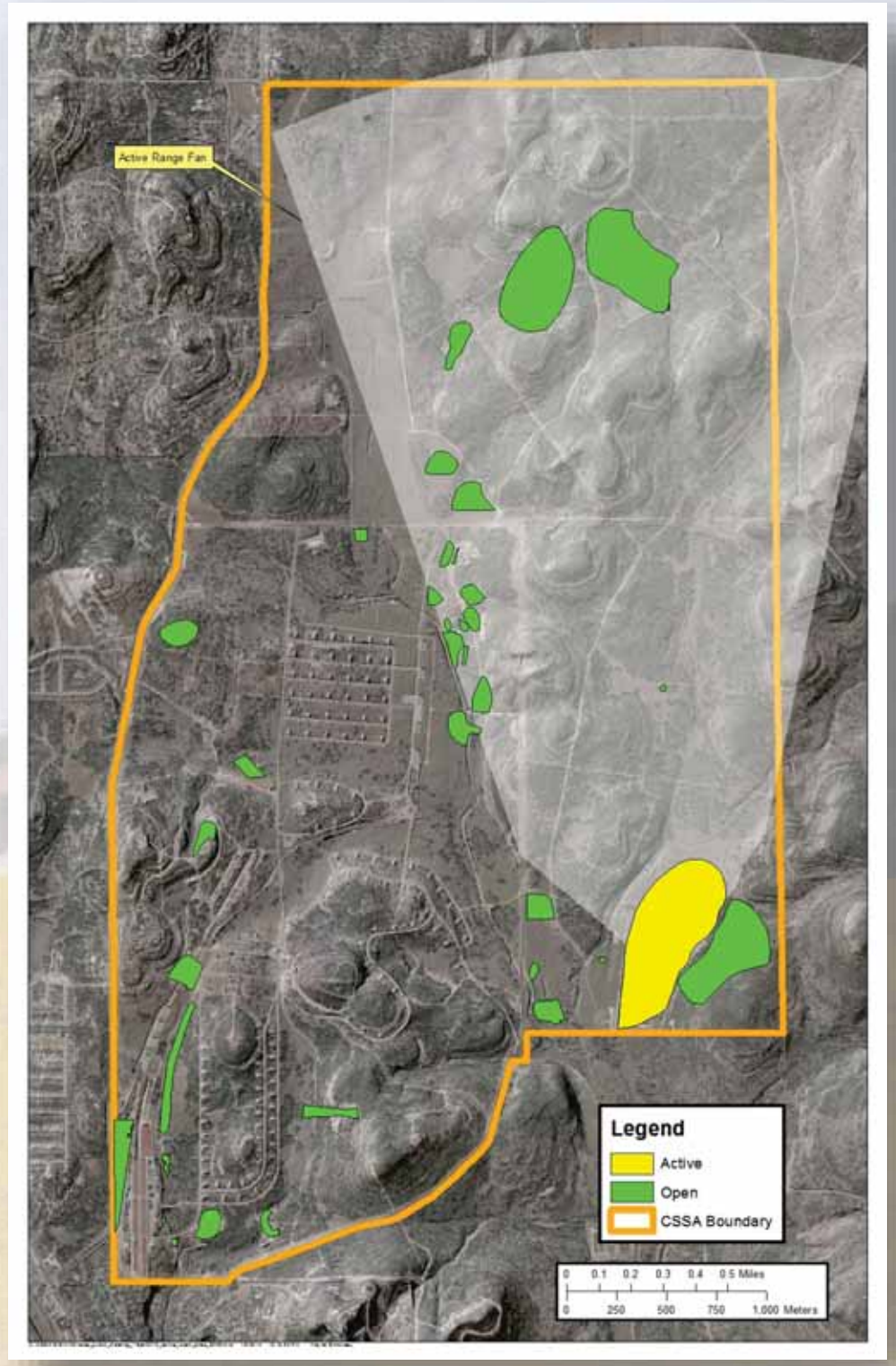




SITE REMEDIATION PROGRESS

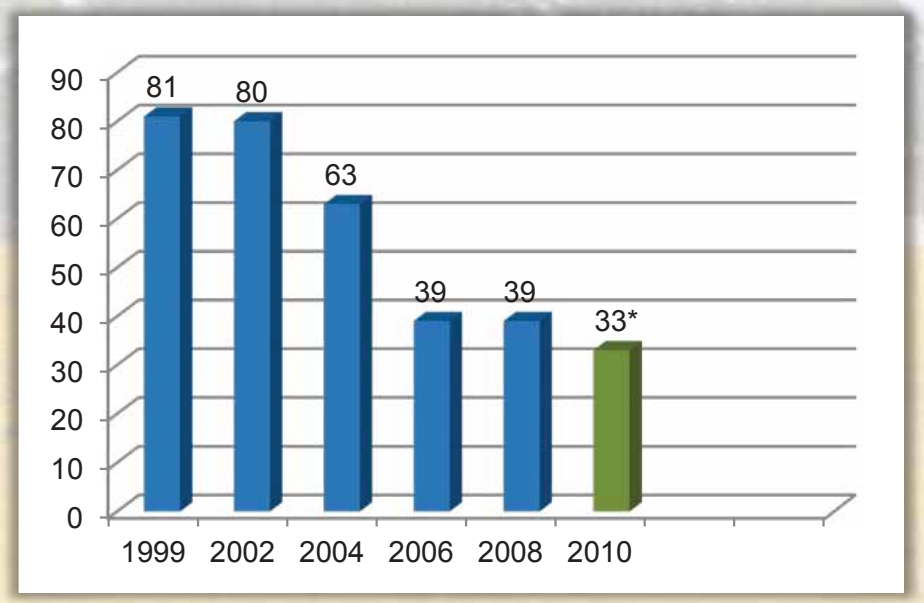
2006: 39 Open Sites



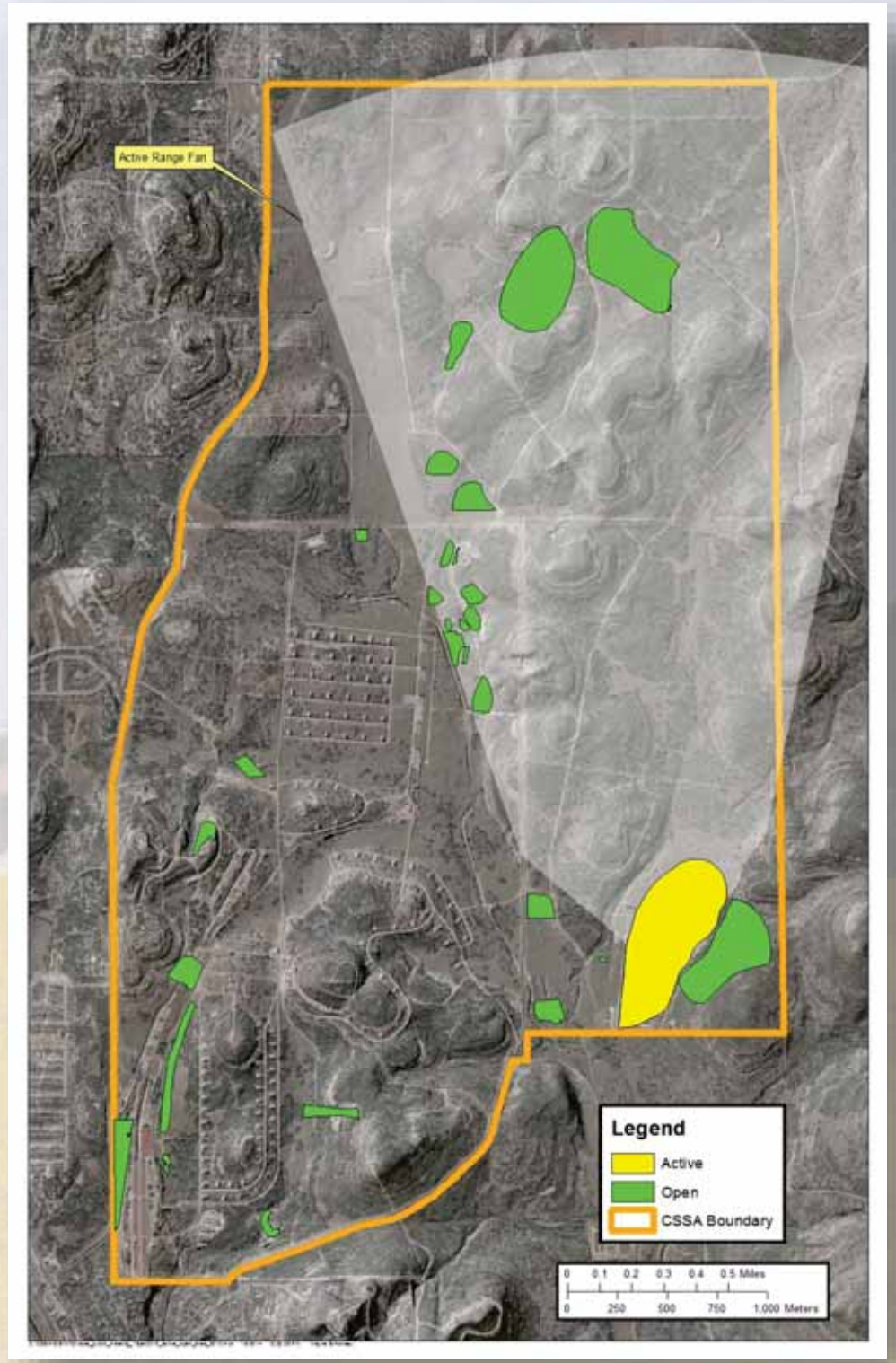


SITE REMEDIATION PROGRESS

2010: 33 Open Sites

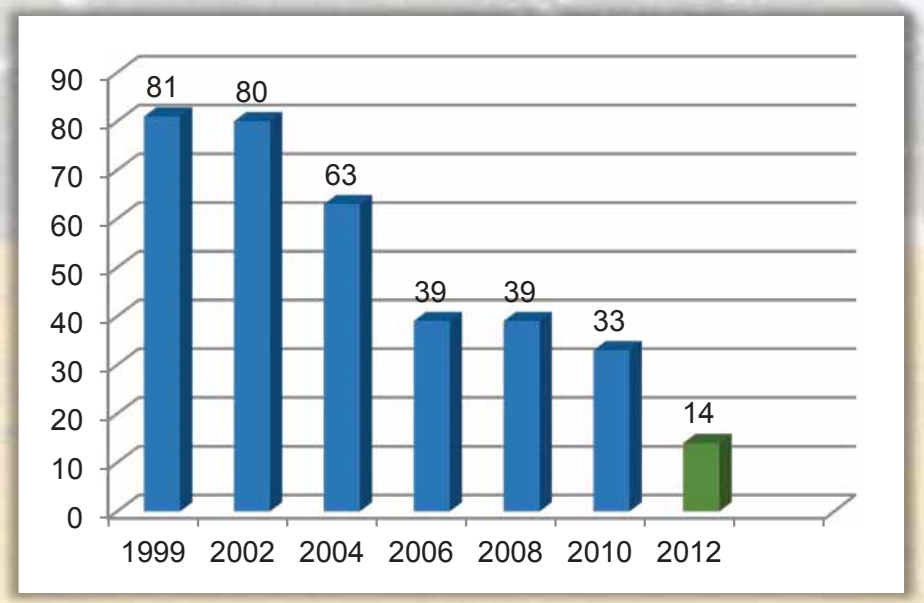


*AOC-74 and AOC-75 were added in 2010.

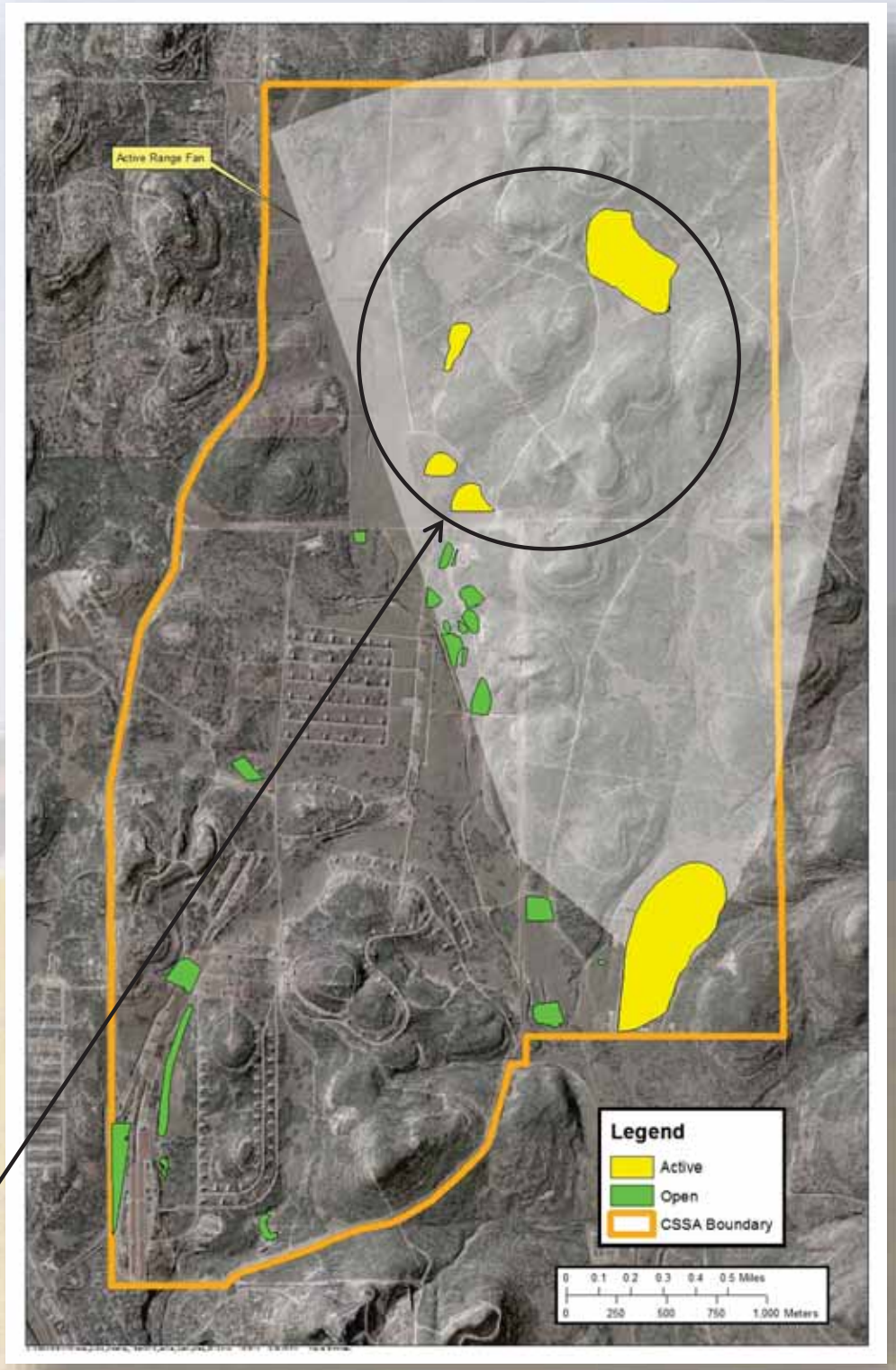


SITE REMEDIATION PROGRESS

2012: 18 Open Sites Including the Active Range fan*

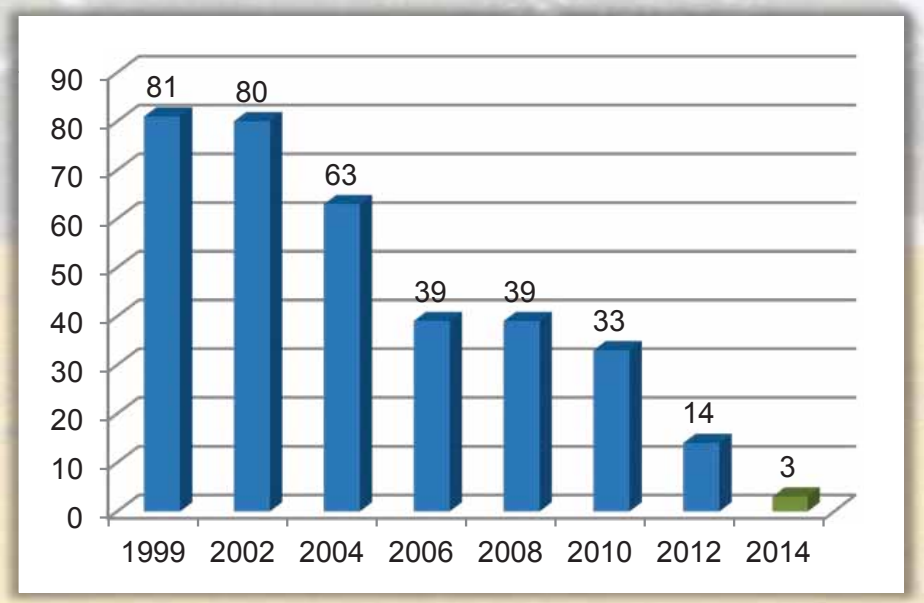


*Per agreement with the USEPA, the four remaining sites located within the Active Range fan were consolidated into one site.

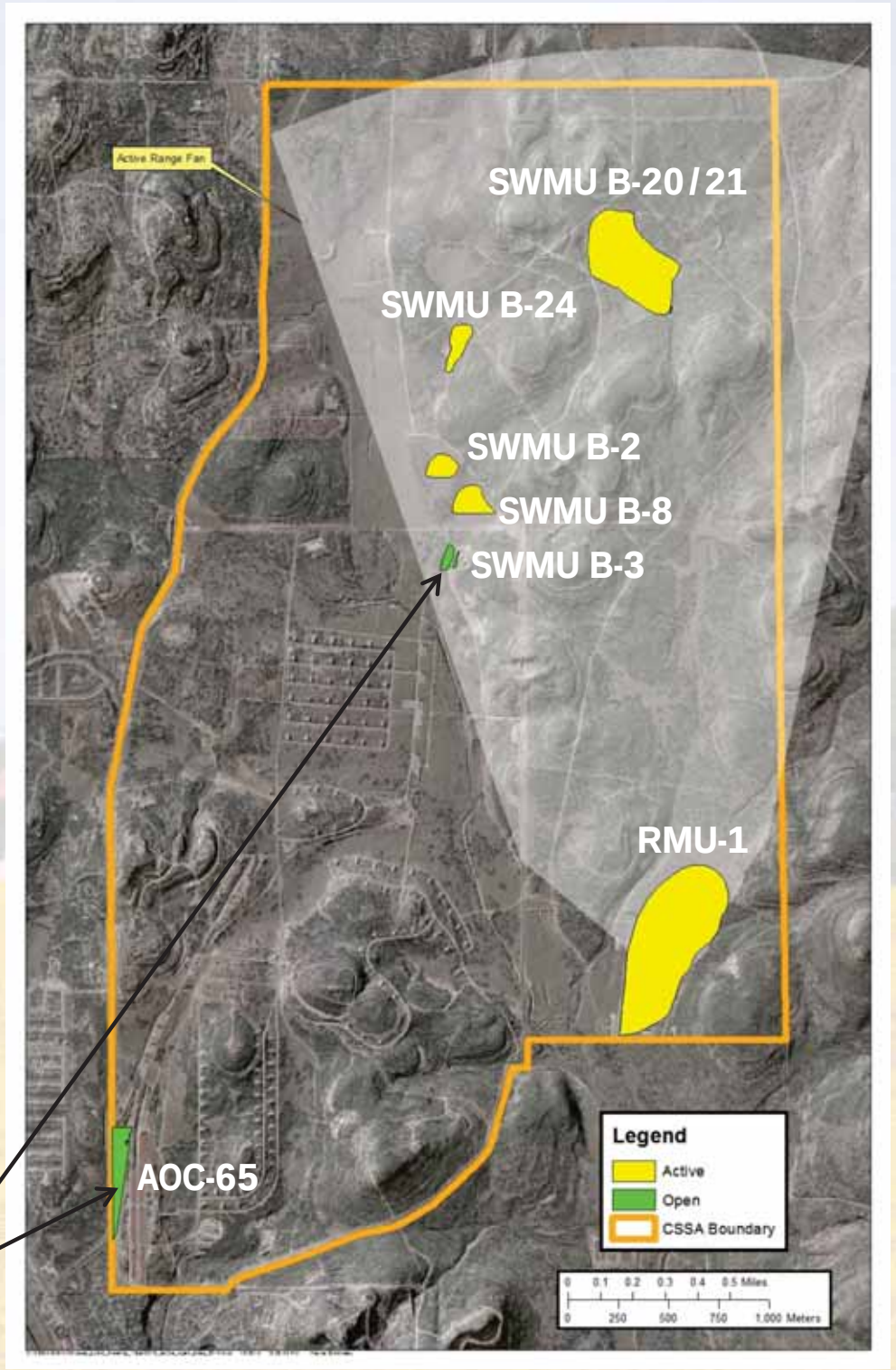


SITE REMEDIATION PROGRESS

2014-present: 7 Open Sites Including the Active Range fan



Two remaining open sites are part of the long-term groundwater monitoring program.



Contaminants at Active Range Fan Sites

- Contaminants of Concern (COCs) at the remaining open sites within the Active Range fan include munitions constituents (MC), munitions debris (MD), and munitions and explosives of concern (MEC).
  - MC - contaminants originating from military munitions
  - MD - remnants of munitions (fragments, shell casings) remaining after munitions use or disposal.
  - MEC - military munitions that may still pose an explosive safety risk

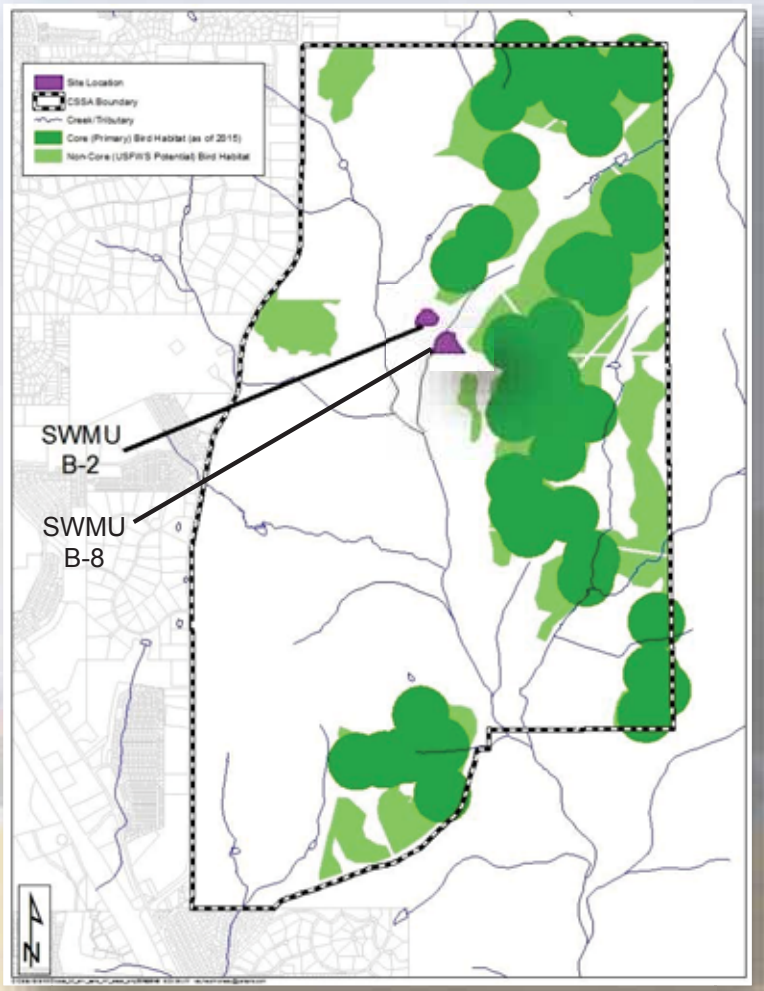
	SWMU B-2	SWMU B-8	SWMU B-20/21	SWMU B-24	RMU-1*
COCs in Soil	Lead Zinc	Barium Copper Lead Zinc	MEC Barium Cadmium Copper Lead Zinc	MEC Barium Cadmium Copper Lead Zinc	MEC Barium Cadmium Copper Lead Zinc

*No previous investigations have been conducted at RMU-1, however COCs are anticipated to be similar to other range sites.

SWMUs B-2 and B-8

(within Active Range Fan)

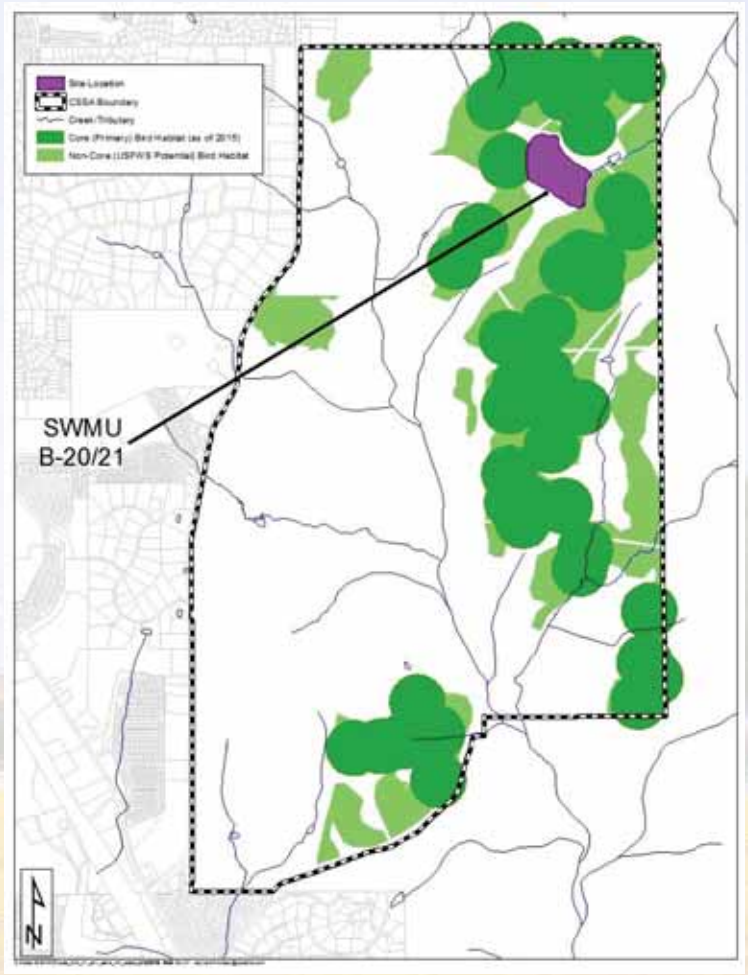
- SWMU B-2 (3.6 acres) is a former munitions disposal area
- SWMU B-8 (5.2 acres) is a former burn area with suspected disposal trench
- Due to close proximity and similar COCs, SWMUs B-2 and B-8 may be addressed with one removal action in the future
- Goal would be to remove all soils present at the sites that exceed TRRP Residential Standards and close with the preparation of an RIR
- Anticipate excavated soils would meet non-hazardous criteria and could be transported to the East Pasture berm

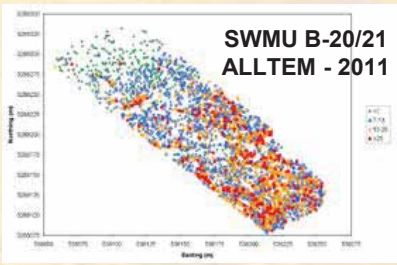


SWMU B-20/21

(within Active Range Fan)

- SWMU B-20/21 is a 36-acre former open burn/open detonation (OB/OD) area used to treat and dispose of waste ordnance. Surrounding 600-acre kick-out area is also impacted.
- Previous investigations identified MEC and MC contamination in soil within both the site boundary and within the surrounding kick-out area
- Numerous geophysical and removal efforts have taken place involving the removal of over 1,300 surficial and subsurface MEC items
- Recent geophysical work shows magnetic anomalies remaining across the site and MEC items in the kick-out area
- Future work will include MEC clearance, soil excavation and sifting, MEC/soil disposal or recycling/reuse when possible
- Anticipate TRRP Tier 2 Remedy Standard B closure

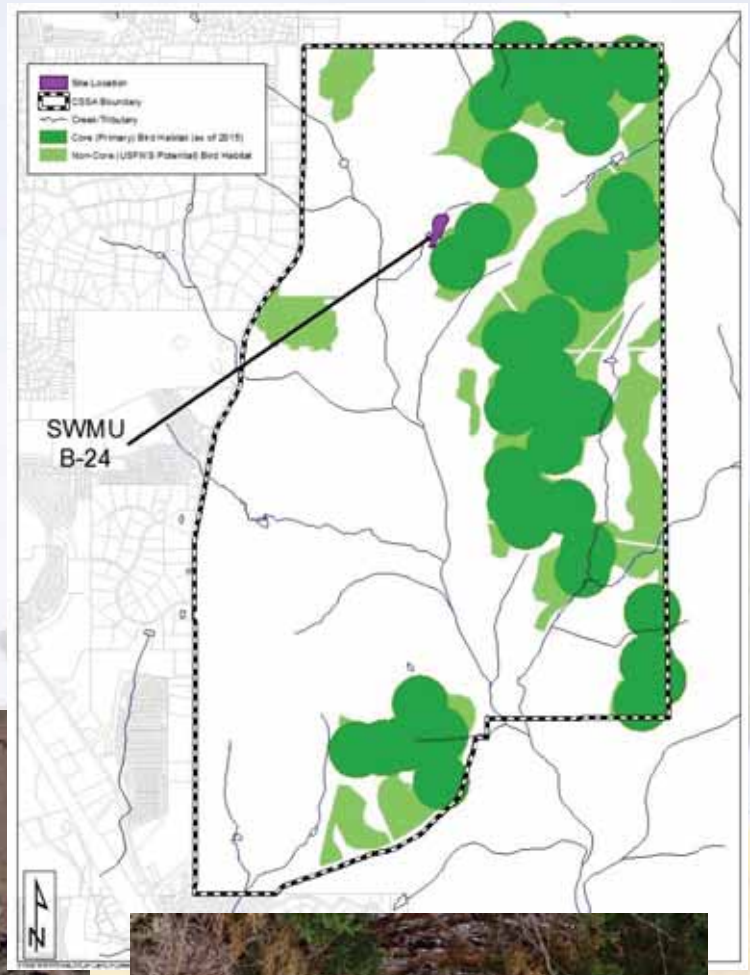


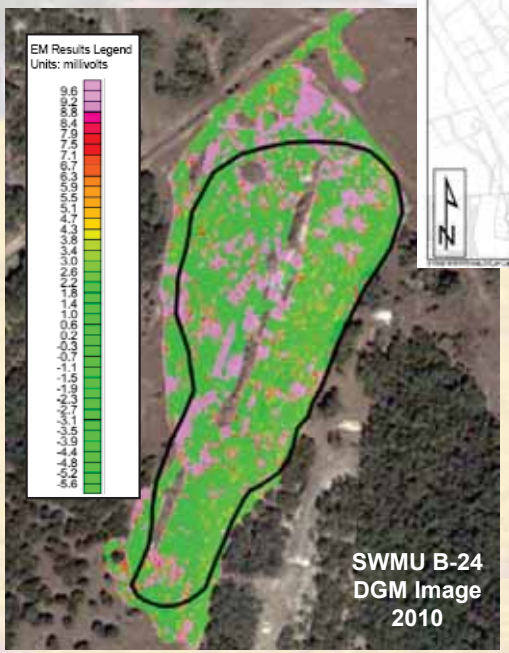


SWMU B-24

(within Active Range Fan)

- SWMU B-24 (4.1 acres) is a former munitions disposal area consisting of multiple disposal trenches
- Previous investigations identified MD on the ground surface and “hot spots” of MC soil contamination
- COCs in soil include MEC and MC
- Recent geophysical investigations show magnetic anomalies remaining across the site
- Future work will include soil excavation and sifting, MD/MEC/soil disposal or recycling/reuse when possible
- Anticipate TRRP Tier 2 Remedy Standard B closure





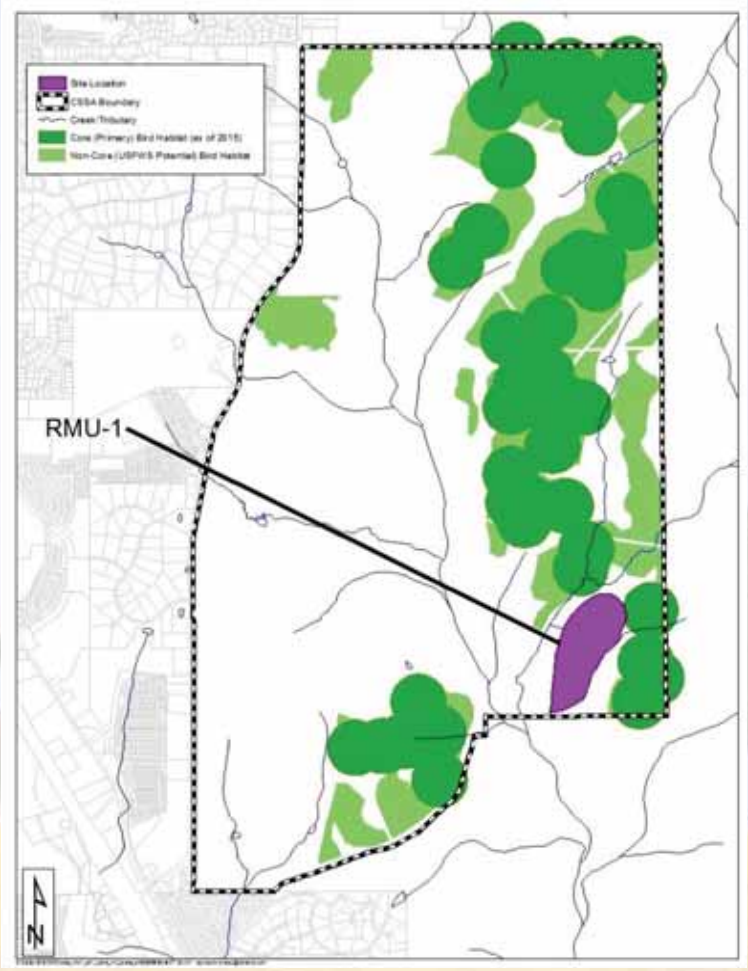
SWMU B-24
DGM Image
2010


MD at SWMU-24
2011

RMU-1

(within Active Range Fan)

- RMU-1 is CSSA's active firing range (64 acres) located in the East Pasture
- No previous investigations
- Anticipated COCs include MEC and MC in soil
- An Affected Property Assessment would include geophysical surveys, soil sampling, and potential intrusive investigations
- A Response Action would include MEC removal, soil excavation and sifting, soil disposal or treatment, and institutional controls



GROUNDWATER MONITORING

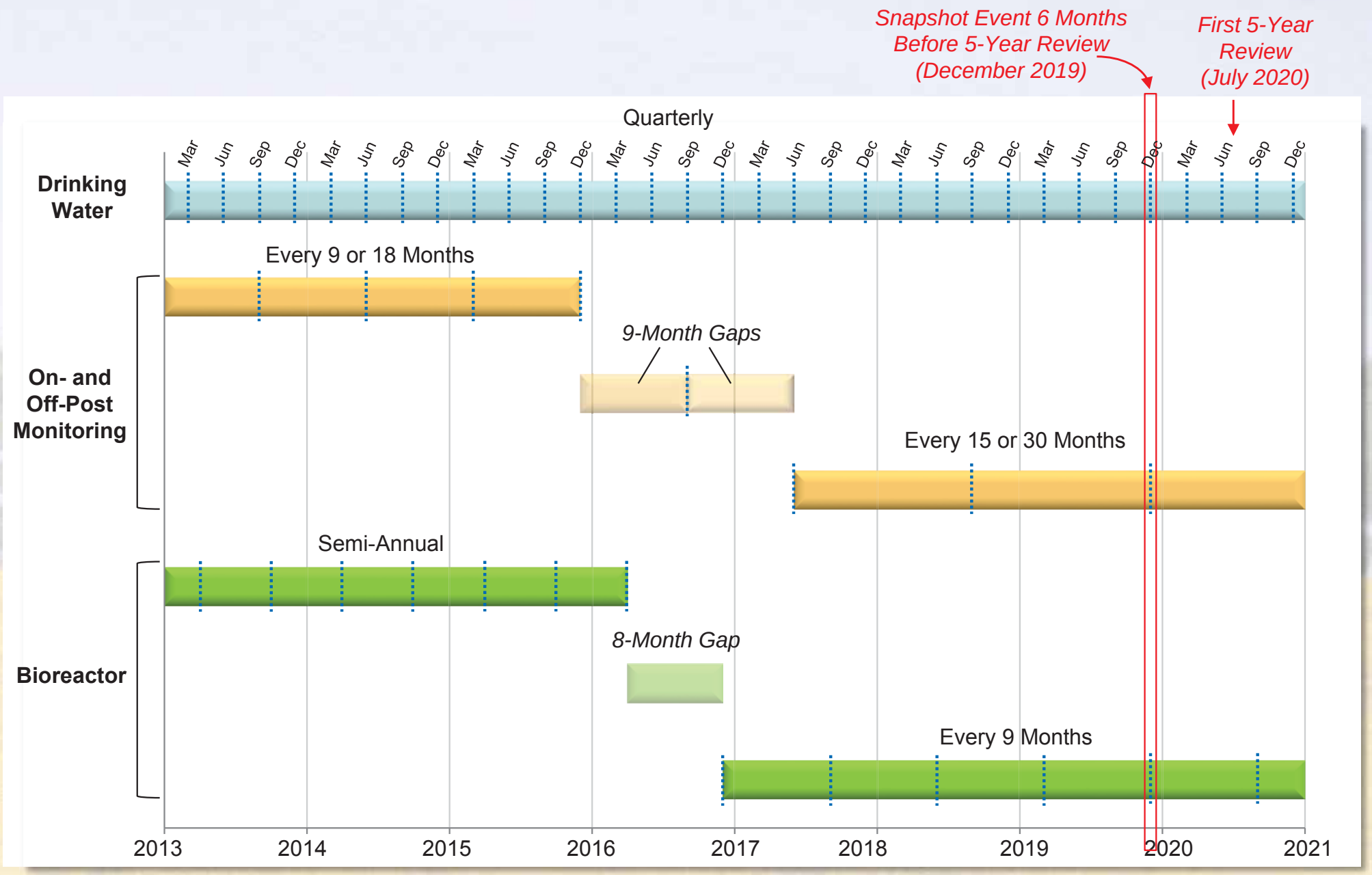
2015 Long-Term Monitoring Optimization (LTMO)

The updated 2015 DQOs and LTMO were submitted to the TCEQ in January 2016. Both documents were approved for implementation by May 2016.

	Sampling Points (Well or WB Zone)	Previous Frequency	2015 LTMO Frequency
On-post Drinking Water Wells	4	Quarterly	Quarterly
Off-Post Wells w/ GACs	6	Quarterly	Quarterly
On-Post and Off-Post Wells	56	Every 9 months	Every 15 months
On-Post Wells	38	Every 18 months	Every 30 months
Bioreactor Wells	42	Every 6 months	Every 9 months

- Based on the revised LTMO and DQOs, letters were sent to 31 off-post wells that were scheduled for immediate exclusion by the 2015 LTMO. 10 more off-post wells are scheduled to be excluded by December 2018.
- Continue to exclude off-post wells 1.5 miles from the boundary or after 5 consecutive years of ND results.
- Transition sampling events:
  - Two more 9-month events (September 2016 and June 2017) will occur for the bulk of on- and off-post wells, with the first 15-month event occurring in September 2018
  - One 8-month event will occur at the Bioreactor in December 2016, with the first 9-month event occurring in October 2017
  - A “snapshot” event of all wells will occur in December 2019, six months before the first 5-year report due in July 2020

LTMO Transition



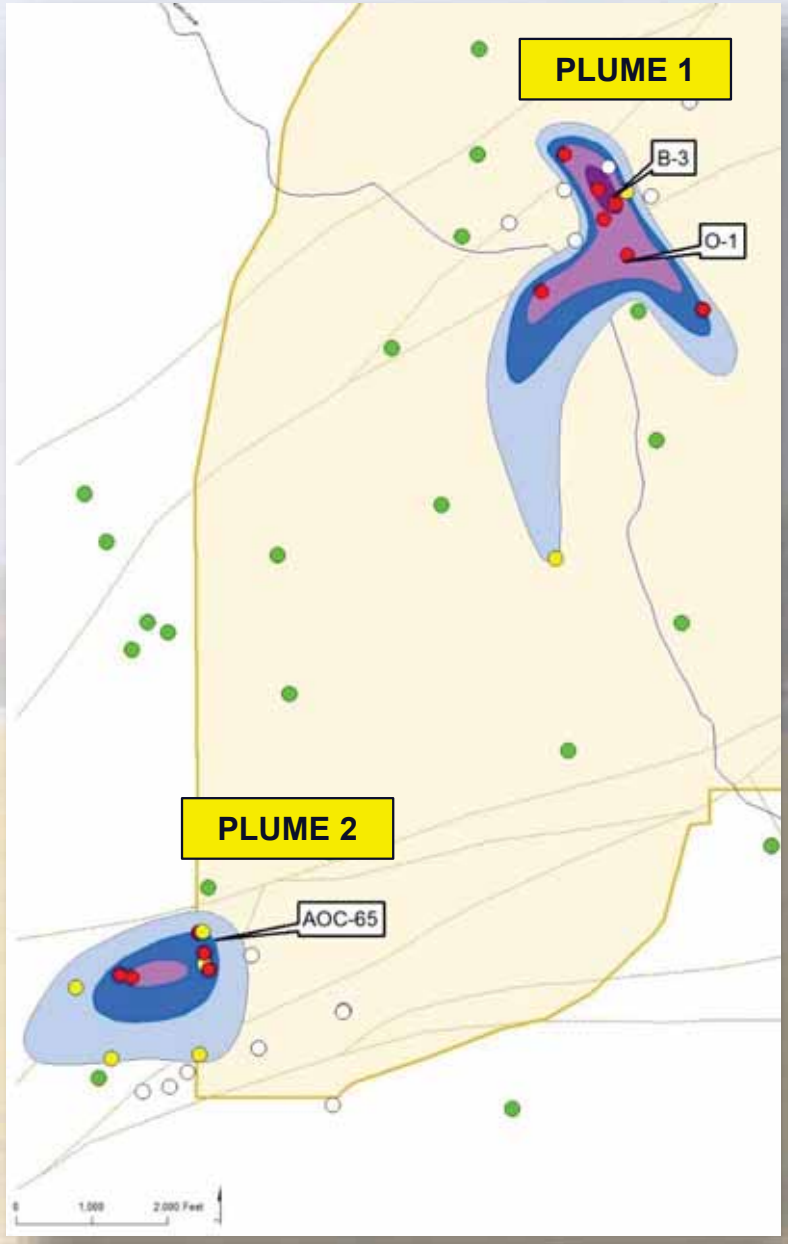
2010 LTMO **Transition** **2015 LTMO**

Groundwater Monitoring Program
Overview

- Quarterly Monitoring Program:
  - On-post since December 1999: 69 events
  - Off-post since September 2001: 62 events
- Available Well Monitoring Network includes:
  - 4 On-post drinking water supply wells
  - 45 On-post monitoring wells
  - 42 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 is currently transitioning into the 2015 LTMO recommendations.

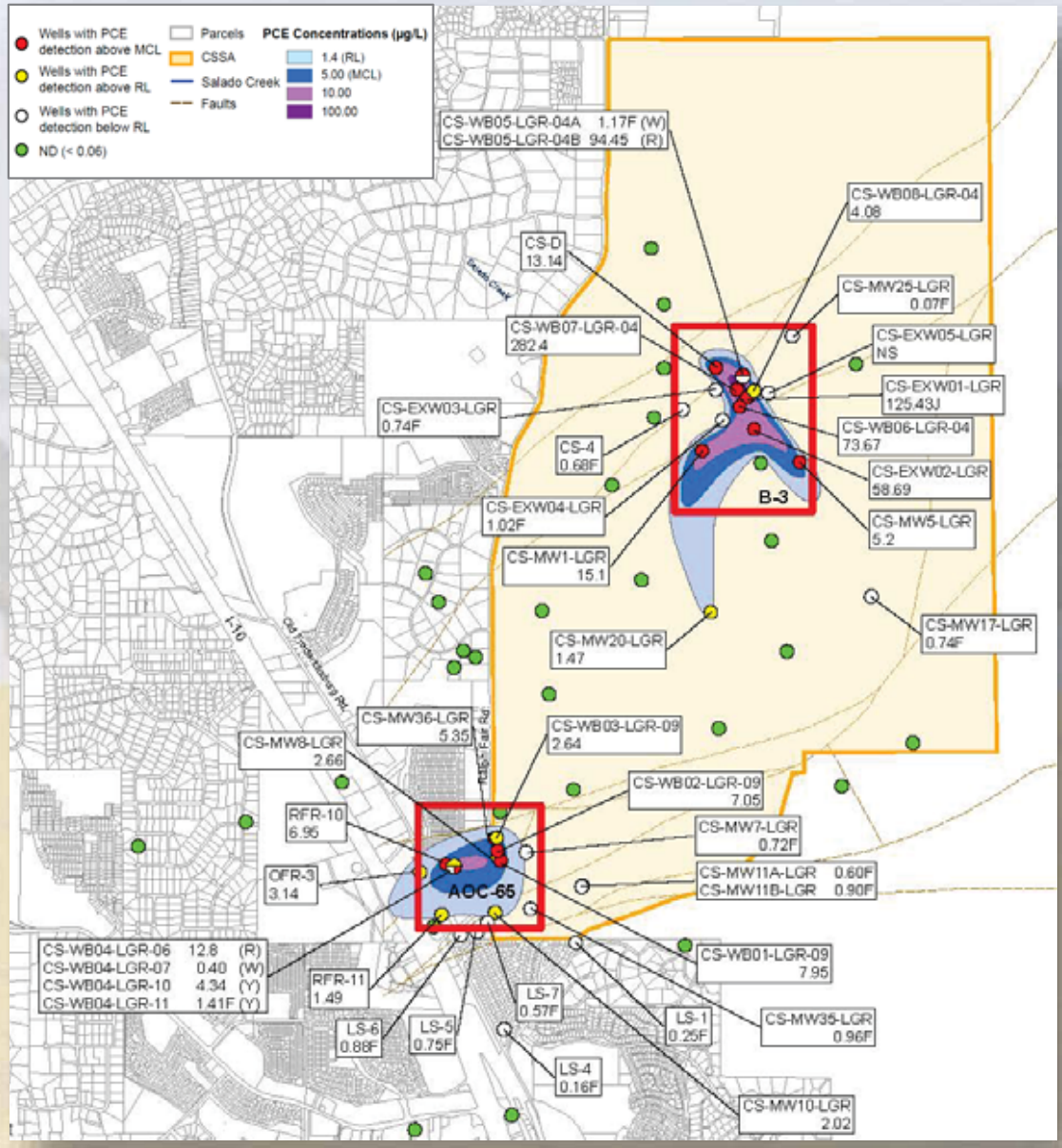
Groundwater Monitoring Program
General Facts

- **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 9 months under the 2010 LTMO, and transitioning to every 15 months under the 2015 LTMO.
- September 2016 is the most recent snapshot event. June 2017 will be the next snapshot event.



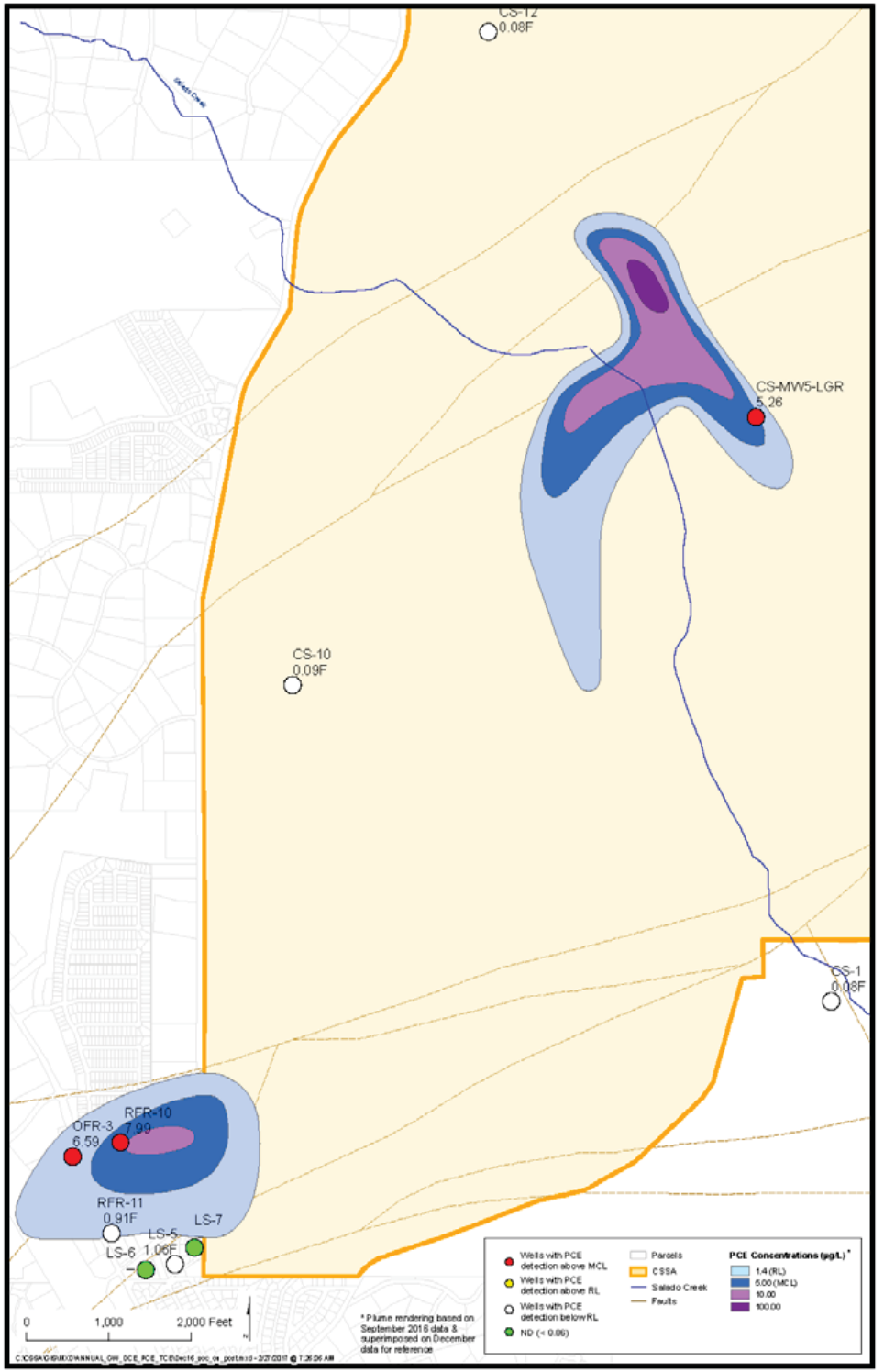
Groundwater Monitoring Program
September 2016 Results Overview

- This LTMO snapshot event included 31 On-post and 20 Off-post wells. 32 zones from 4 multi-port wells were also sampled.
  - Supply wells CS-1, CS-10, CS-12, and CS-13 had no detections of VOCs. All metals in supply wells were below ALs, MCLs, SCLs.
  - On-post wells CS-D, CS-MW1-LGR, CS-MW5-LGR, and CS-MW36-LGR) continues to exceed the MCL for PCE and/or TCE.
  - 28 of 32 multi-port zones had PCE, TCE, DCE, or VC detections above the RLs. 13 zones also exceeded the MCL for PCE and/or TCE.
  - Only Off-post private well RFR-10 exceeded the MCL for PCE.



Groundwater Monitoring Program
December 2016 Results Overview

- This LTMO event included 4 On-post and 6 Off-post wells.
  - Supply wells CS-1, CS-10, and CS-12 had trace detections (F-Flagged) of PCE, ranging from 0.08 µg/L 0.09 µg/L. All metals in supply wells were below ALs, MCLs, SCLs.
  - Following a recent developing trend, On-post well CS-MW5-LGR continues to exceed the MCL for PCE and TCE.
  - Only two Off-post private wells, OFR-3 and RFR-10, exceeded the MCL for PCE.



Groundwater Monitoring Program
March 2017 Overview

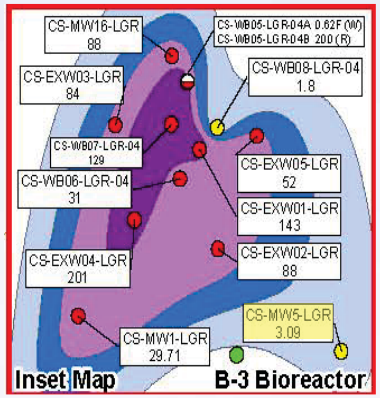
- In accordance with the LTMO schedule, 22 samples will be collected in March 2017.
  - 4 Drinking water wells
  - 6 Off-post wells
- Additional baseline sampling for the TCEQ monitoring program for CS-13.
  - **CS-13:** Organics, Inorganics, BACT
  - **MW1-CC, MW2-CC:** VOCs, metals, BACT
  - **MW4-LGR, MW17-LGR, MW21-LGR:** VOCs, metals
- Validated results will be available in mid-April.

Groundwater Monitoring: MW5-LGR

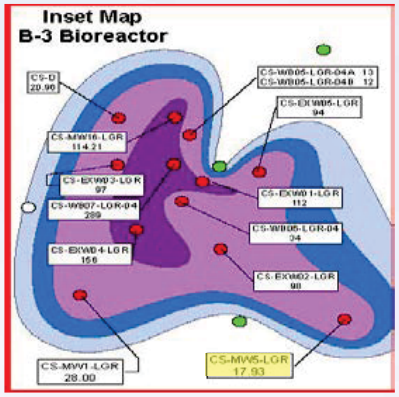
- VOCs above MCLs since December 2015 (re-sampled February 2016)
- Sampling frequency has been increased to quarterly to monitor changes/trends
- On average, groundwater levels have been up by more than 130 feet since March 2015
- Trend may suggest that the 2015 precipitation and resultant increase in Bioreactor injection quantity are related to the changes observed

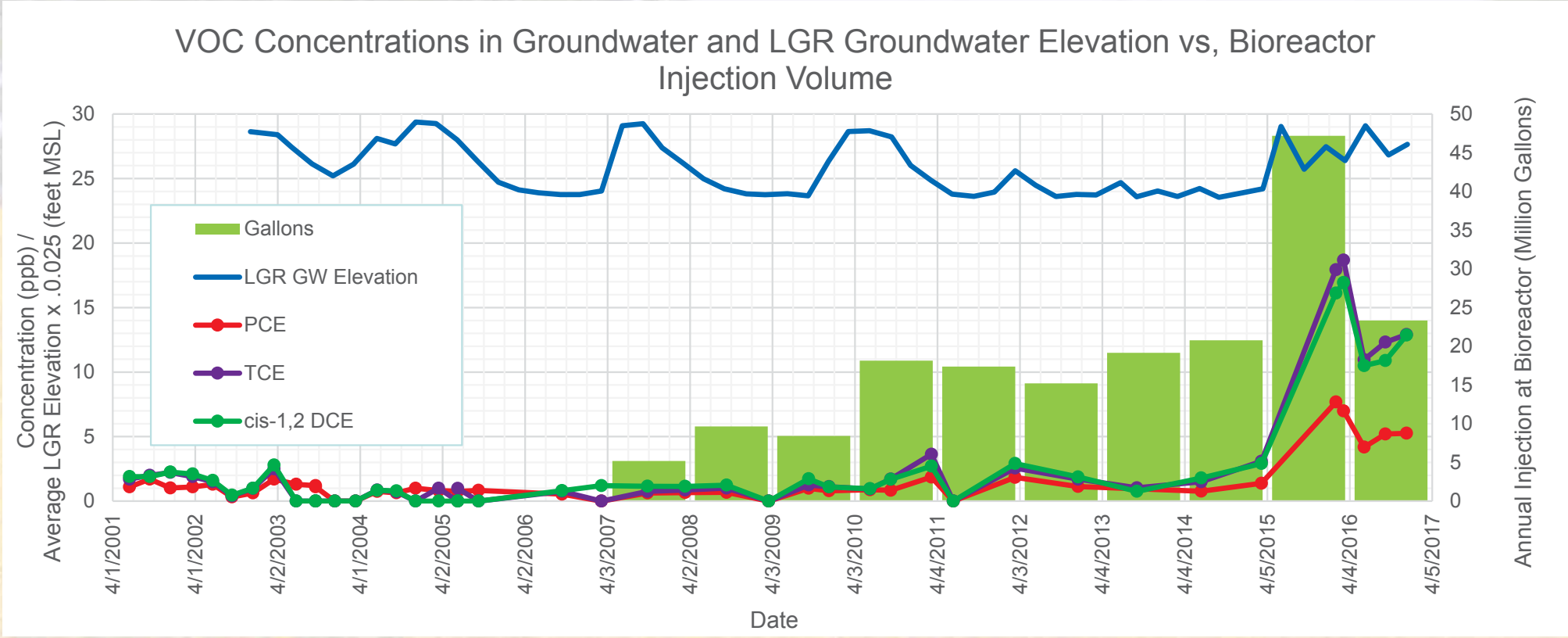
TCE

March 2015



December 2015 - February 2016



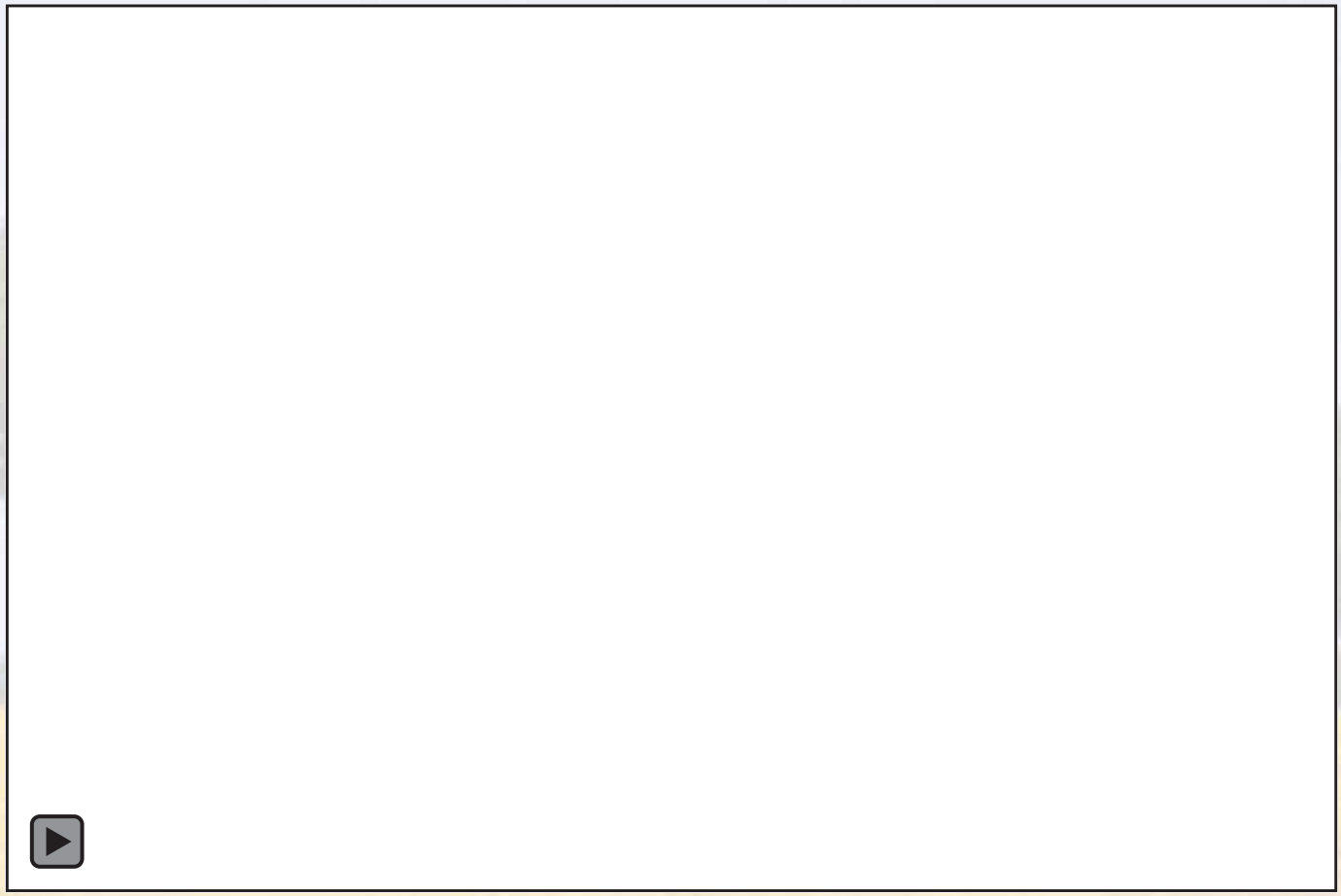


New Well Installation: CS-MW37-LGR

- SAWS-owned well LS-1 is scheduled to be plugged (timeframe unknown). CSSA has been sampling this well for 15 years.
- LS-1 routinely has PCE between the MDL and RL. Average concentration of 0.49 µg/L in 30 of 36 samples collected.
- CSSA installed a new On-Post well drilled approximately 300' northeast of LS-1.
- This well will replace LS-1 in CSSA's groundwater monitoring program.

New Well Installation: CS-MW37-LGR

- The well was drilled to 490’ below grade.
- The base of the Middle Trinity aquifer was logged at 472’ below grade.
- A 4” LGR well was screened from 447’ – 472’ below grade (25’ screen length).
- Significant fractures/karst was encountered between 52’ to 65’.
- Water table level is ~130’ below grade.
- Well is high-producing for a 4” LGR monitoring well.



PFAS Sampling of PWS Wells
December 2016

- In June 2016, the US Army issued a memorandum dictating that all facilities with water systems would be sampled for Perfluoroalkyl Substances (PFAS) before the end of 2016.
- In December 2016, Camp Stanley Storage Activity (CSSA) collected groundwater samples from three on-post public water supply wells (CS-1, CS-10, CS-12) for PFAS analysis.
- EPA Lifetime Health Advisory Fact Sheet (recommends total PFAS concentration less than 70 parts per trillion [ppt]).
- Texas Risk Reduction Program (TRRP) Groundwater Protective Concentration Levels (PCLs) for Residential Groundwater also exist for 16 PFAS compounds.

PFAS Sampling of PWS Wells
December 2016

- Three drinking water well samples, one duplicate sample (from CS-1), one trip blank, and one field blank were collected on December 6, 2016. None of the results exceeded either the TRRP Residential Groundwater PCLs or the EPA Health Advisory level:
- CS-1, CS-41 (CS-1 Duplicate), CS-12, and TB-1 had no PFAS detections, with the exception of low levels of PFTeA (M- and F-flagged). The validation report considers this a lab contaminant, since it was also associated with a method blank.
- CS-10 had detections of seven PFAS compounds (five of which are F-flagged). None of the individual concentrations exceeded TRRP Residential Groundwater PCLs. The PFAS total in this well is 31.16 ppt (EPA Advisory Level is 70 ppt).
- The field blank (FB-1) had no PFAS detections.

Camp Stanley Storage Activity
Polyfluoroalkyl Substances (PFAS) Sampling
Validated Results for Samples Collected December 6, 2016

	SAMPLE ID:		TRRP $^{GW}GW_{Ing}$ PCL [1]	EPA Lifetime Health Advisory Level[2]	CS-1		CS-41 (DUP of CS-1)		CS-10		CS-12		TB-1		FB-1	
	DATE SAMPLED:				12/6/2016		12/6/2016		12/6/2016		12/6/2016		12/6/2016		12/6/2016	
	LAB SAMPLE ID:				320-24118-6		320-24118-4		320-24118-3		320-24118-5		320-24118-1		320-24118-2	
	CAS #	Units														
Perfluorinated Hydrocarbons - E537M																
Perfluorobutanesulfonic acid (PFBS)	375-73-5	ng/L	34000		0.92	U	0.93	U	**1.3**	F	0.88	U	0.94	U	0.88	U
Perfluorobutanoic acid (PFBA)	375-22-4	ng/L	71000		0.46	U	0.46	U	**0.51**	F	0.44	U	0.47	U	0.44	U
Perfluorodecanesulfonic acid (PFDS)	335-77-3	ng/L	290		1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U
Perfluorodecanoic acid (PFDA)	335-76-2	ng/L	370		0.44	U	0.45	U	0.42	U	0.42	U	0.45	U	0.42	U
Perfluorododecanoic acid (PFDoA)	307-55-1	ng/L	290		0.58	U	0.59	U	0.56	U	0.56	U	0.60	U	0.56	U
Perfluoroheptanoic acid (PFHpA)	375-85-9	ng/L	560		0.80	U	0.81	U	0.77	U	0.77	U	0.82	U	0.77	U
Perfluorohexanesulfonic acid (PFHxS)	355-46-4	ng/L	93		0.87	U	0.88	U	**10**		0.83	U	0.89	U	0.83	U
Perfluorohexanoic acid (PFHxA)	307-24-4	ng/L	93		0.79	U	0.80	U	**1.1**	F	0.75	U	0.81	U	0.75	U
Perfluorononanoic acid (PFNA)	375-95-1	ng/L	290		0.65	U	0.66	U	0.63	U	0.63	U	0.67	U	0.63	U
Perfluorooctane Sulfonamide (FOSA)	754-91-6	ng/L	290		0.64	U	0.65	U	0.61	U	0.61	U	0.65	U	0.61	U
Perfluorooctanesulfonic acid (PFOS)	1763-23-1	ng/L	560		1.3	U	1.3	U	**17**		1.2	U	1.3	U	1.2	U
Perfluorooctanoic acid (PFOA)	335-67-1	ng/L	290		0.75	U	0.76	U	**0.72**	F	0.71	U	0.77	U	0.72	U
Perfluoropentanoic acid (PFPeA)	2706-90-3	ng/L	93		0.99	U	1.0	U	0.95	U	0.95	U	1.0	U	0.95	U
Perfluorotetradecanoic acid (PFTeA)	376-06-7	ng/L	290		**0.75**	M	**0.51**	M	**0.53**	F	**0.72**	F	**0.54**	F	0.38	U
Perfluorotridecanoic acid (PFTriA)	72629-94-8	ng/L	290		0.55	U	0.56	U	0.53	U	0.53	U	0.57	U	0.53	U
Perfluoroundecanoic acid (PFUnA)	2058-94-8	ng/L	290		0.75	U	0.76	U	0.72	U	0.71	U	0.77	U	0.72	U
Total Perfluorinated Hydrocarbons	--	ng/L		70	**0.75**		**0.51**		**31.16**		**0.72**		**0.54**		ND	

QA NOTES AND DATA QUALIFIERS:

(NO CODE) - Confirmed identification.
U - Analyte was not detected above the indicated Method Detection Limit (MDL).
F - Analyte was positively identified, but the quantitation is an estimation above the MDL and below the Reporting Limit (RL).
M - Concentration is estimated due to a matrix effect.
Detections are bolded.
ng/L - nanograms per liter.
ND - Not Detected.

NOTES:

[1] Residential Groundwater $^{GW}GW_{Ing}$ PCL, TRRP Tier 1 Groundwater PCLs - Residential and Commercial/Industrial, March 4, 2016.

[2] USEPA Lifetime Health Advisory Level from the EPA FACT SHEET PFOA & PFOS Drinking Water Health Advisories - November 2016 (EPA 800-F-16-003). To provide Americans, including the most sensitive populations, with a margin of protection from a life-time of exposure to PFOA and PFOS from drinking water, EPA established the health advisory levels at 70 parts per trillion (e.g., nanograms per liter [ng/L]). When both PFOA and PFOS are found in drinking water, the combined concentrations of PFOA and PFOS should be compared with the 70 parts per trillion health advisory level. This health advisory level offers a margin of protection for all Americans throughout their life from adverse health effects resulting from exposure to PFOA and PFOS in drinking water.

CORRECTIVE MEASURES UPDATES: SWMU B-3

Corrective Measures Objectives

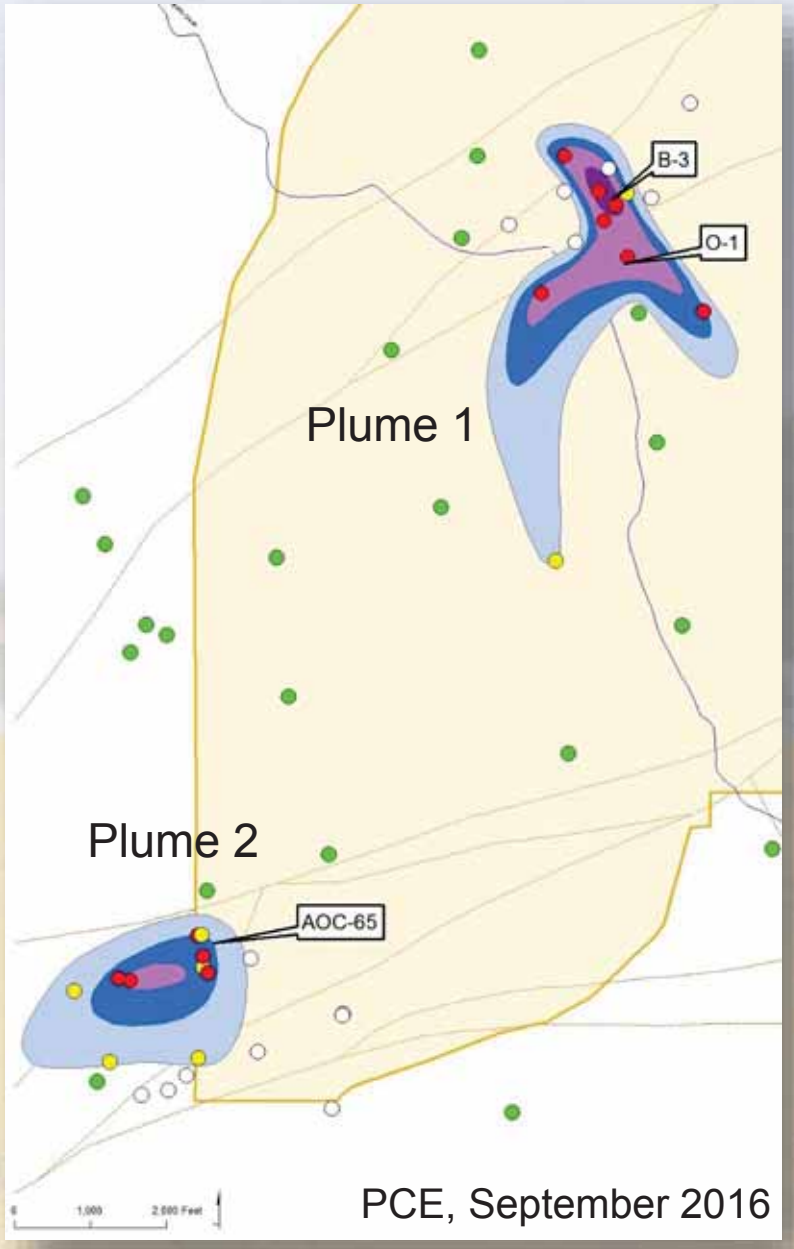
(from 2015 Statement of Basis)

1. Prevent or minimize migration of COCs in groundwater within the source area at concentrations exceeding the MCLs and restore groundwater to its most beneficial use in a reasonable timeframe.
2. Prevent human exposure to groundwater containing COCs at concentrations that exceed MCLs in water supply wells.
3. Prevent on-site worker dermal contact and/or ingestion of COCs in shallow groundwater at concentrations exceeding acceptable human health risk values.

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.

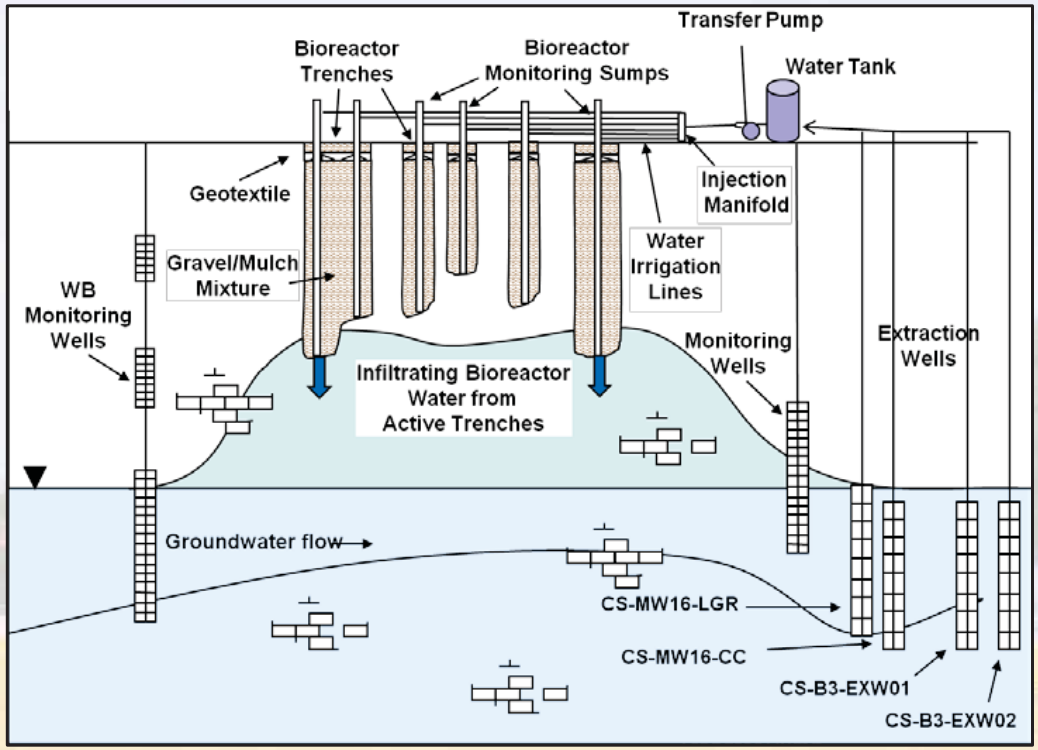


SWMU B-3 SOURCE AREA TREATMENT: BIOREMEDIATION

Bioremediation: Use of organisms to neutralize contamination.

SWMU B-3 Bioreactor

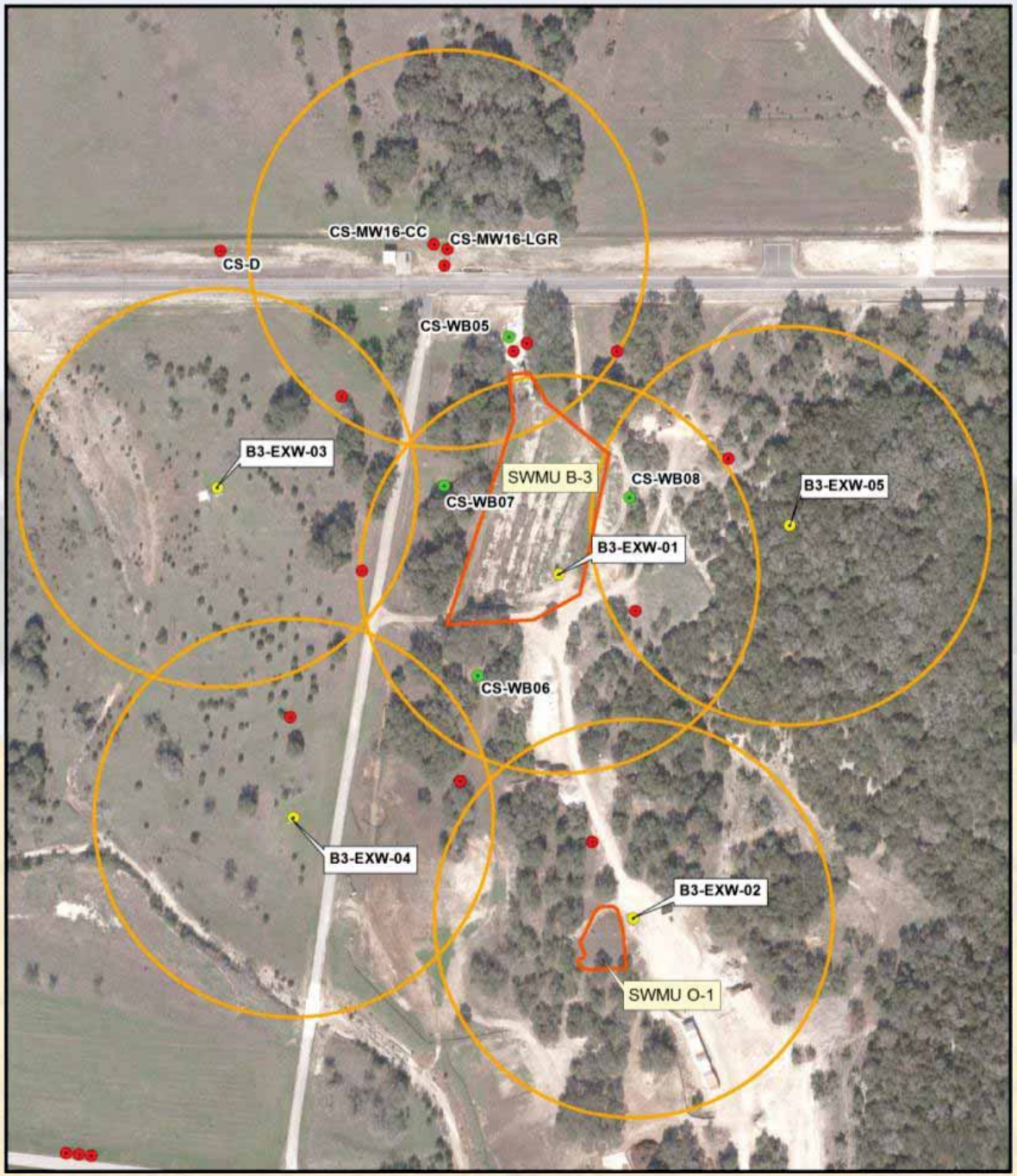
- VOC degradation is occurring with biological degradation end products methane, ethene, ethane, and CO_2 identified in surrounding UGR wells and LGR wells.
- Bioreactor maintains appropriate geochemical conditions (low DO, ORP, and pH) for effective anaerobic dechlorination.
- Between April 2016 and January 2017, approximately 23,328,000 gallons of groundwater were extracted and injected into Trenches 1 - 6.
- Approximately 184,434,000 gallons of extracted groundwater have been injected into the bioreactor.



Bioreactor Conceptual Diagram

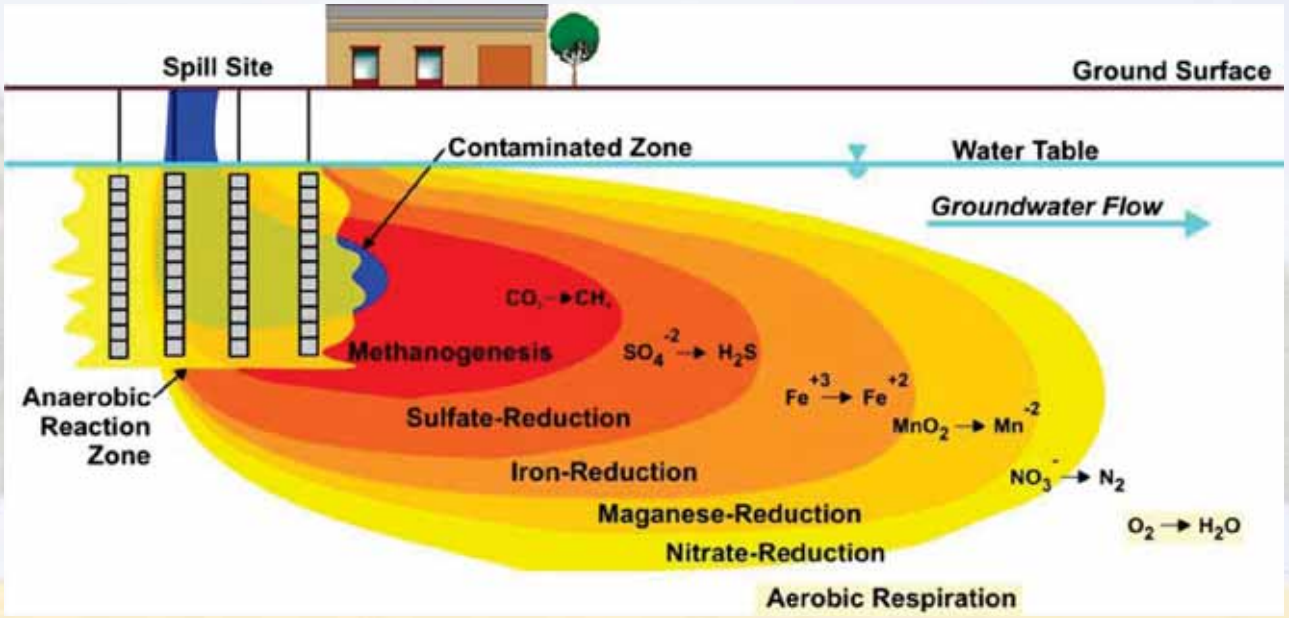
SWM B-3 Bioreactor

- EXWs -01 through -04 are operational and are contributing extracted water to the bioreactor
- EXW-05 awaiting pump replacement
- MWs 16-CC and 16-LGR contribute ~15 and 10 gpm, respectively



SWMU B-3 Bioreactor

- VOC-impacted groundwater is extracted from 7 wells located around the perimeter of the site
- This groundwater is then injected into the bioreactor trenches where microbes generate anaerobic conditions and reduce chlorinated compounds
- Currently all 6 trenches are in operation



Reductive Dechlorination
Conceptual Diagram

SWMU B-3 Bioreactor

- The bioreactor control building has been completed and SCADA automation and control is currently being installed.
- Currently, groundwater is being extracted via 7 wells and injected into Trenches 1 and 6.

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

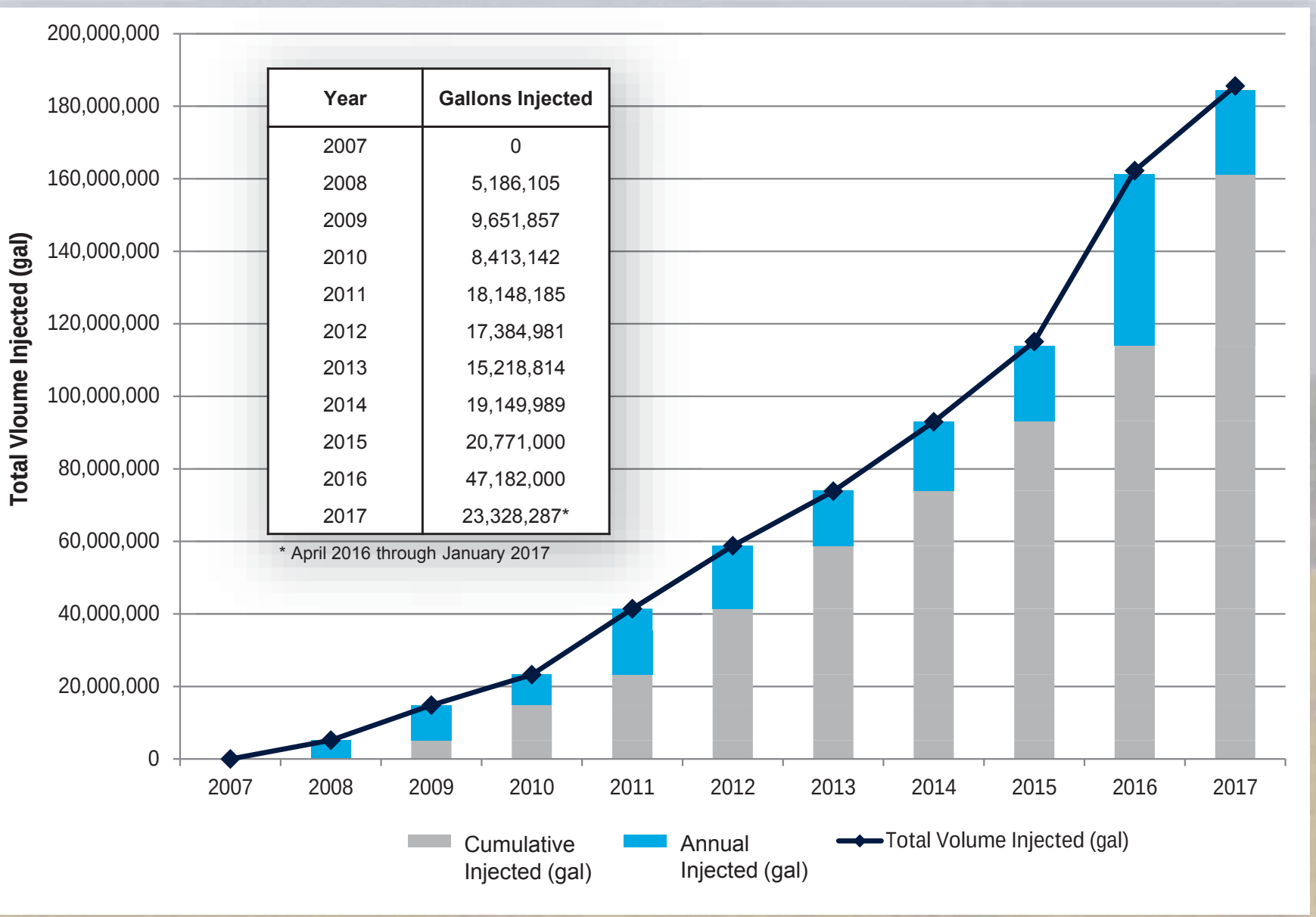
Performance Sampling Locations
Frequency: Every 9 months
- Trench Sumps (5)
- WB zones (27)
- Extraction Wells (7)
- LGR Monitoring Wells (4)
- UGR Monitoring Wells (9)

Trench Sump Field Parameters
Frequency: Monthly
- **pH**
- **DO**
- **Conductivity**
- **ORP**
- **Temp**
- **Water Level**

SWMU B-3 Bioreactor

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	23,328,287*

* April 2016 through January 2017



SWMU B-3 Bioreactor

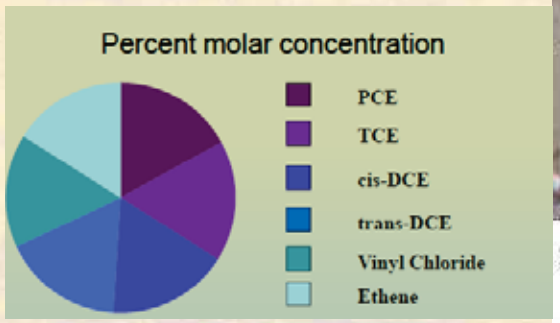
Strong evidence of dechlorination within the bioreactor

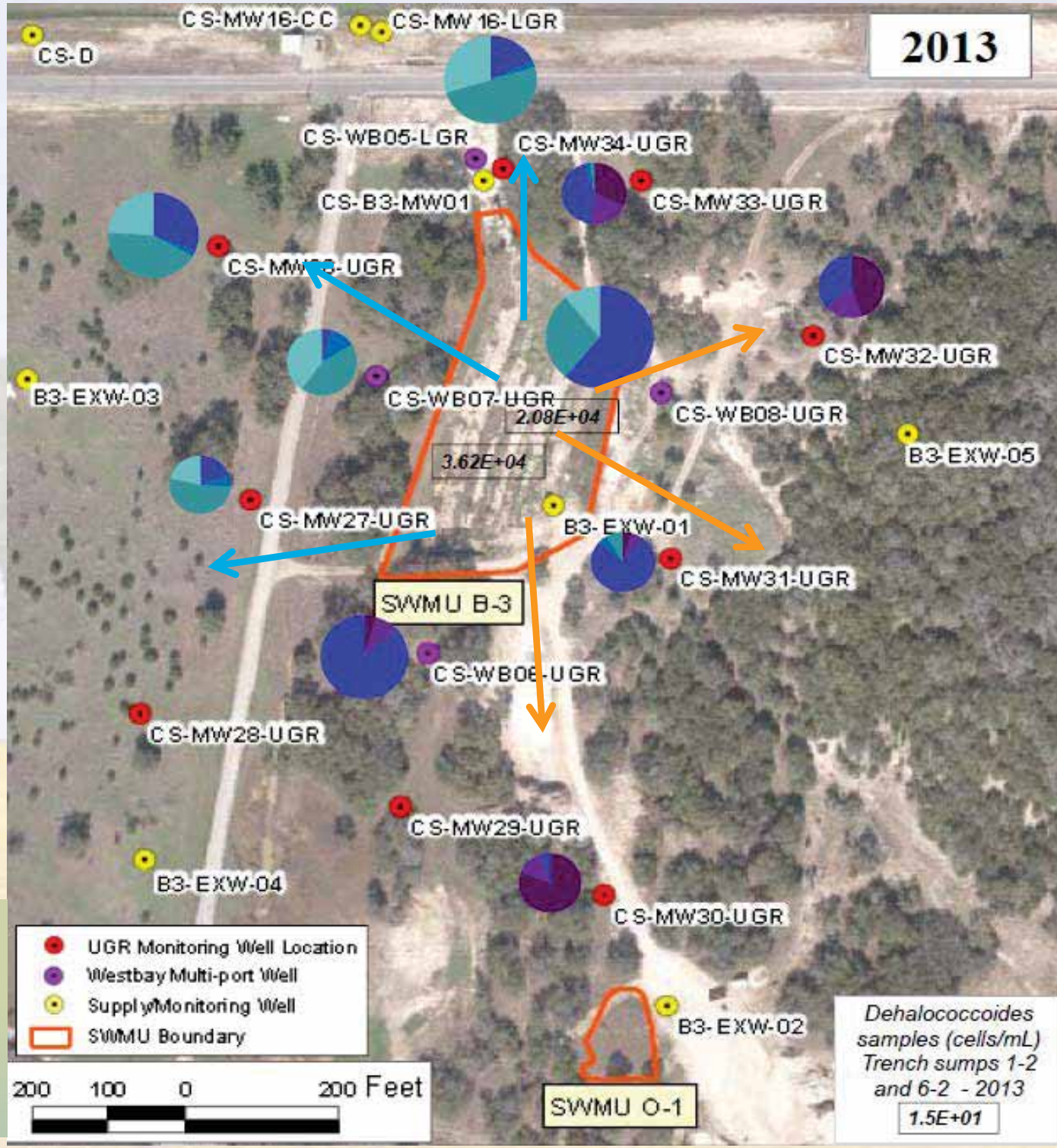
- -absence of PCE/TCE
- -presence of intermediates
- -presence of ethene
- -geochemistry
- -microbial population

Bioreactor effects in the UGR are migrating to the north and west but less pronounced to the south and east.

Bioreactor effects in the LGR are migrating to the north towards CS-MW16

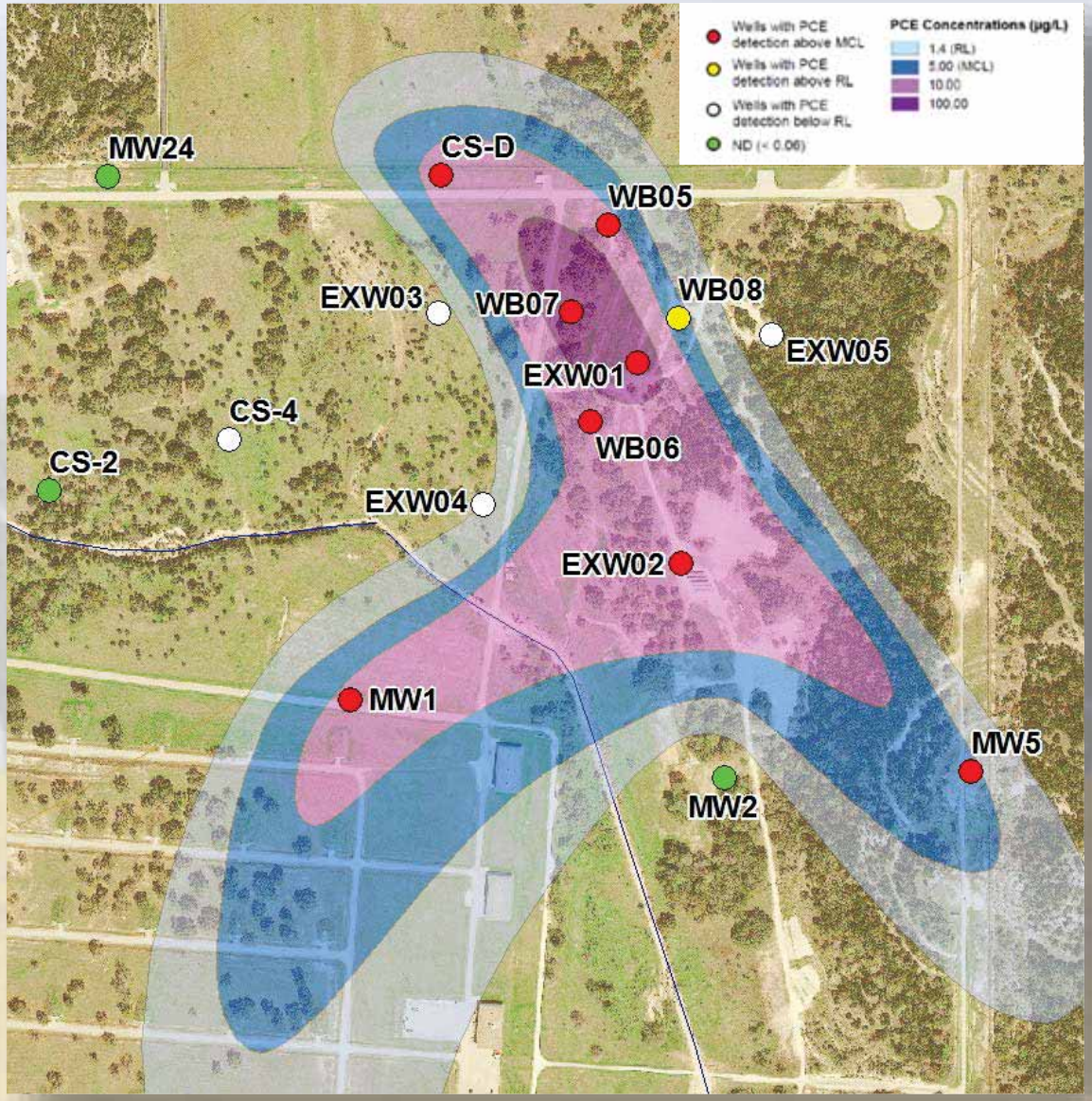
*Data from the 2014 bioreactor report





SWMU B-3 Bioreactor

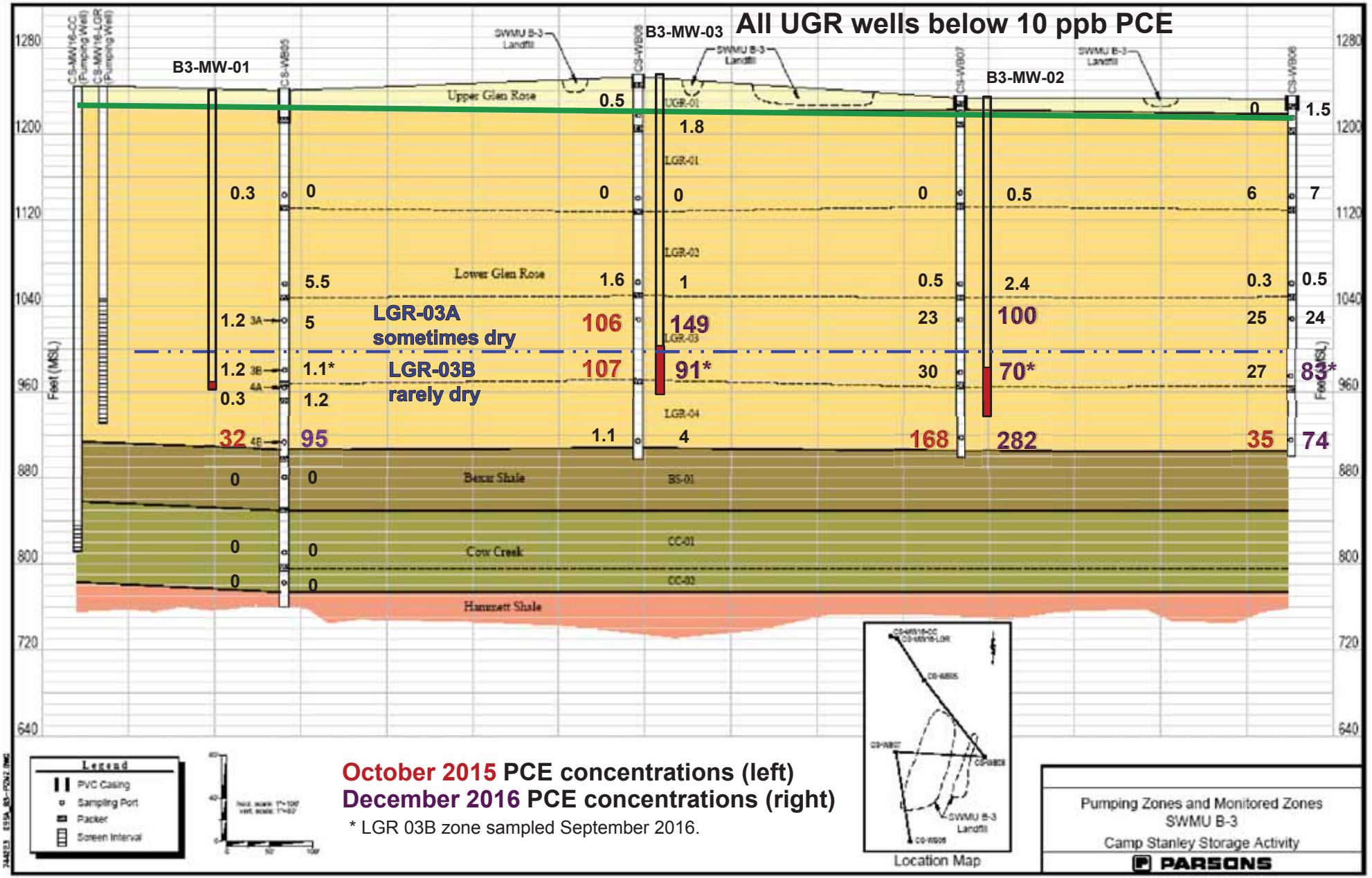
Extent of SWMU-B3 LGR plume based on September 2016 PCE results.



SWMU B-3 Bioreactor

Current Steps

- Drill and install 2 LGR injection wells (MW02 and MW04) on the east and west sides of the bioreactor to increase organic carbon distribution within the UGR or the LGR away from the bioreactor
- Inject additional substrate (EVO/Lactate) in the bioreactor to boost carbon loading and encourage anaerobic conditions
  - Planned application of 1,325 gallons of lactate within the bioreactor injections
  - Consistently achieve methanogenic conditions
  - Manage increased water from extraction wells



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

VOC detections	µg/L
cis-1,2-DCE	2,500
Napthalene	8
PCE	13
trans-1,2-DCE	7
TCE	28
Vinyl Chloride	18
SVOC detections	**µg/L**
2-Methylnapthalene	15
Anthracene	15
Benz(a)anthracene	14
Benzo[a]pyrene	14
Benzo[b]fluoranthene	10
Benzo[k]fluoranthene	12
Bis(2-Ethylhexyl) phthalate	64
Chrysene	22
Fluoranthene	11
Phenanthrene	45
Pyrene	22
TPH detections	**mg/L**
C6-C12	1,400
>C12-C28	1,460
>C28-C35	<100
Total C6-C35	2,850

Concentration exceeded the MCL for this compound.

While drilling on the east side of the bioreactor (B3-MW03 location) an oily substance was encountered between 27 and 38' bgs.

- Analytical results indicated the substance consisted of weathered fuel as well as chlorinated compounds (DCE primarily).
- A UGR monitoring well (B3-MW03) has been installed within this borehole and may be used for product recovery or as an injection well pending UIC permit modification.

SWMU B-3 Bioreactor

Schedule

December 2016

- Update B3MW01 UIC Permit (TCEQ Authorization No. 5X26000408) to include the 2 new injection wells and substrates lactate (Wilclear Plus) and EVO (LactOil)

February 2017

- Begin installation of new injection wells B3-MW02 and B3-MW04 (and B3-MW03)

February/March 2017

- Perform Lactate/EVO injections at all three LGR injection wells.
  - Wilclear Plus is a mixture of sodium lactate and nutrient blend to promote population growth.
  - One tote (~265 gallons per tote) of Wilclear Plus at each new location as well as B3-MW01 chased with ~500 to 1,000 gallons of bioreactor (sump) water.
  - LactOil is an emulsified vegetable oil to provide long-term carbon source.
  - One tote of LactOil at each new location and B3-MW01 chased with ~1,500 gallons water from CS-10 to flush gravel pack.

March 2017

- Apply 5 totes Wilclear Plus via the Bioreactor System's integrated eductor across all trenches following completion of LGR injections.

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 reporting in July 2017
- Continue SCADA control and automation integration
- Plan to convert solar to on-demand service only (no battery storage)

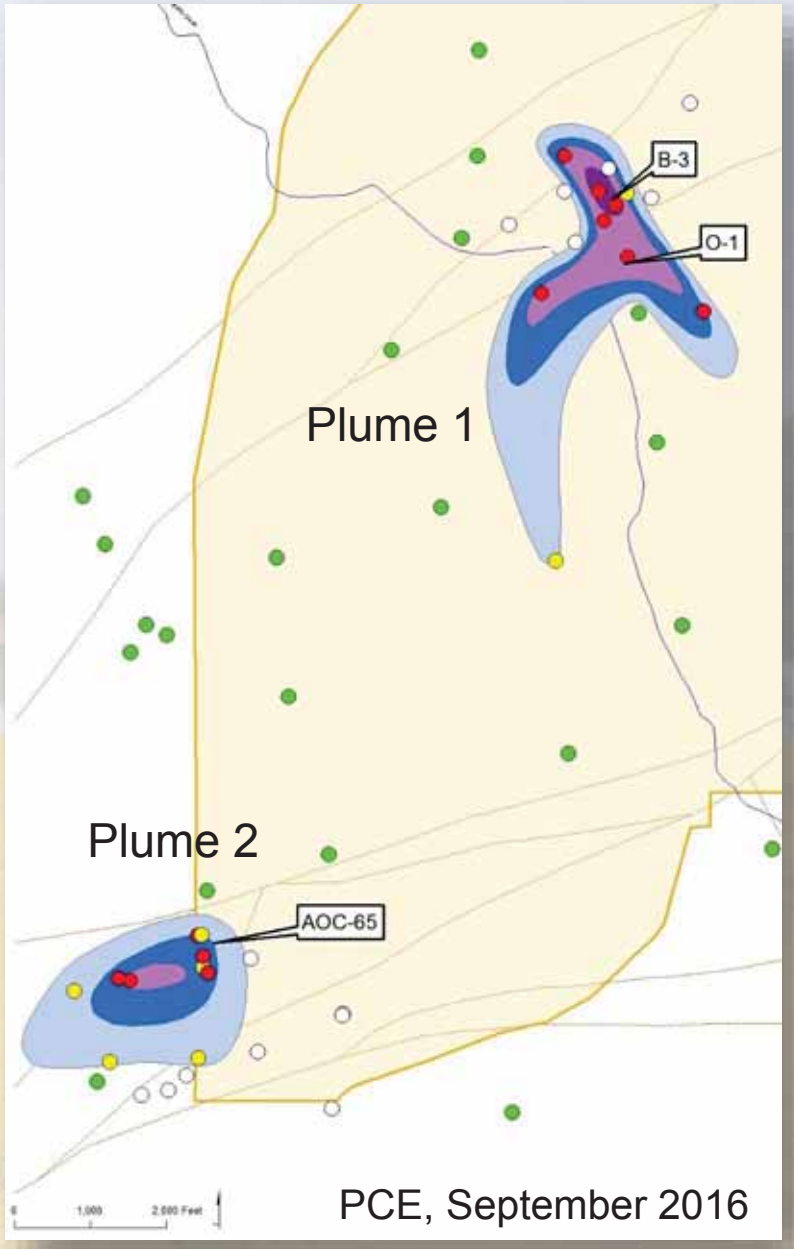
Maintenance and sump monitoring upgrades allowing continuous reading/recording of bioreactor trench water levels through SCADA.

CORRECTIVE MEASURES UPDATES: AOC-65

SWMU B-3 and AOC-65
Description

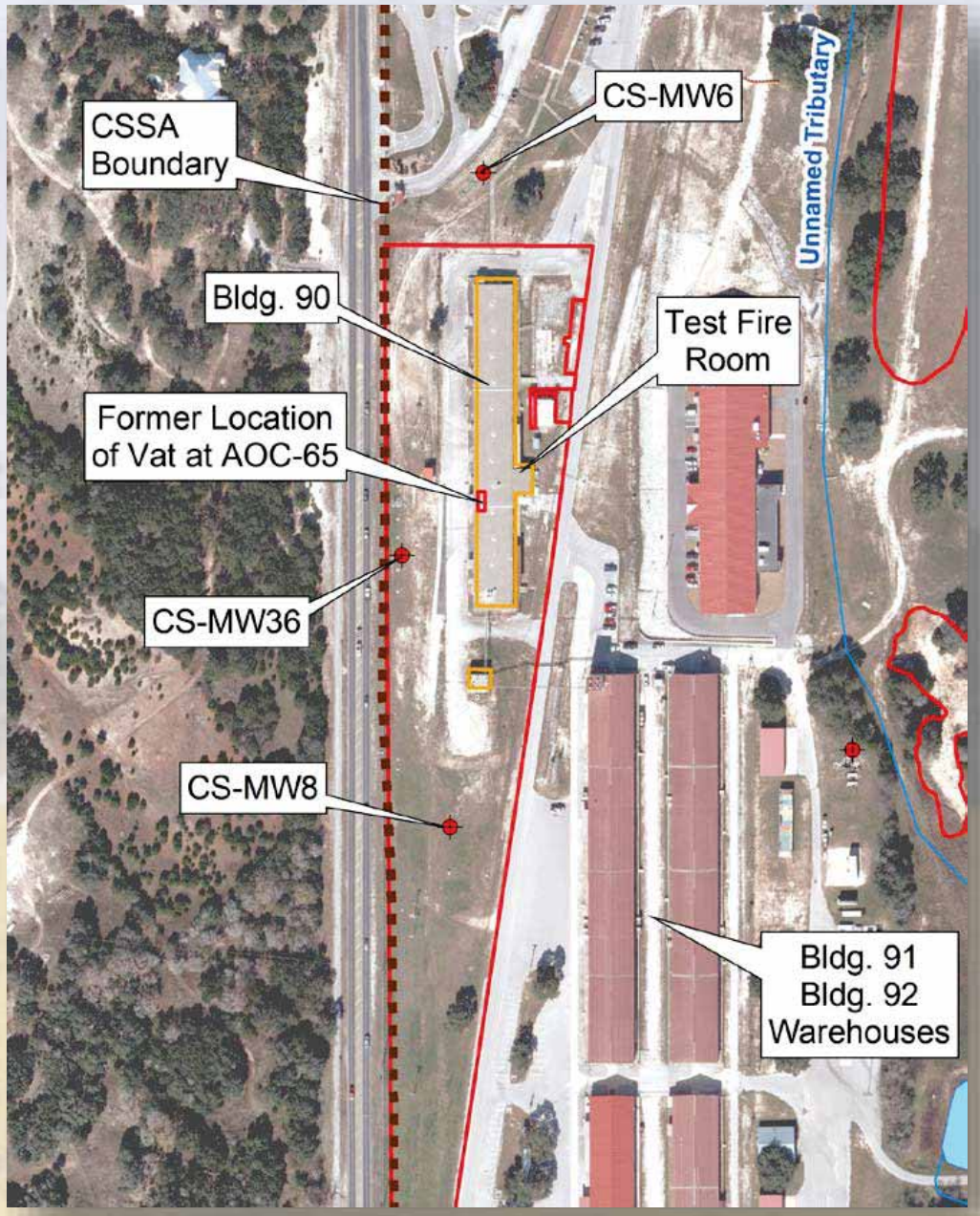
1. **SWMU B-3 Bioreactor:**
   Enhanced anaerobic bioremediation of chlorinated hydrocarbons in underlying fractured limestone at Plume 1.

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 Background

- AOC-65 consists of an area surrounding Building 90
- Chlorinated solvent use was discontinued in 1995
- Initial investigations identified groundwater Plume 2 in 1999
- Very high (NAPL) concentrations in shallow subsurface (UGR)
- Dissolved phase in deeper LGR formation
- Fractured bedrock
- Variable groundwater depth
- May contain multiple “hot spots” of PCE and associated daughter products



AOC-65
Previous Efforts

Source Removal Action (2001)

- Interim Removal Actions in 2001 excavated shallow soils along the drainage ditch and road and disposed of ~1,300 CY of impacted soil media off-post.

SVE System (2002-2012)

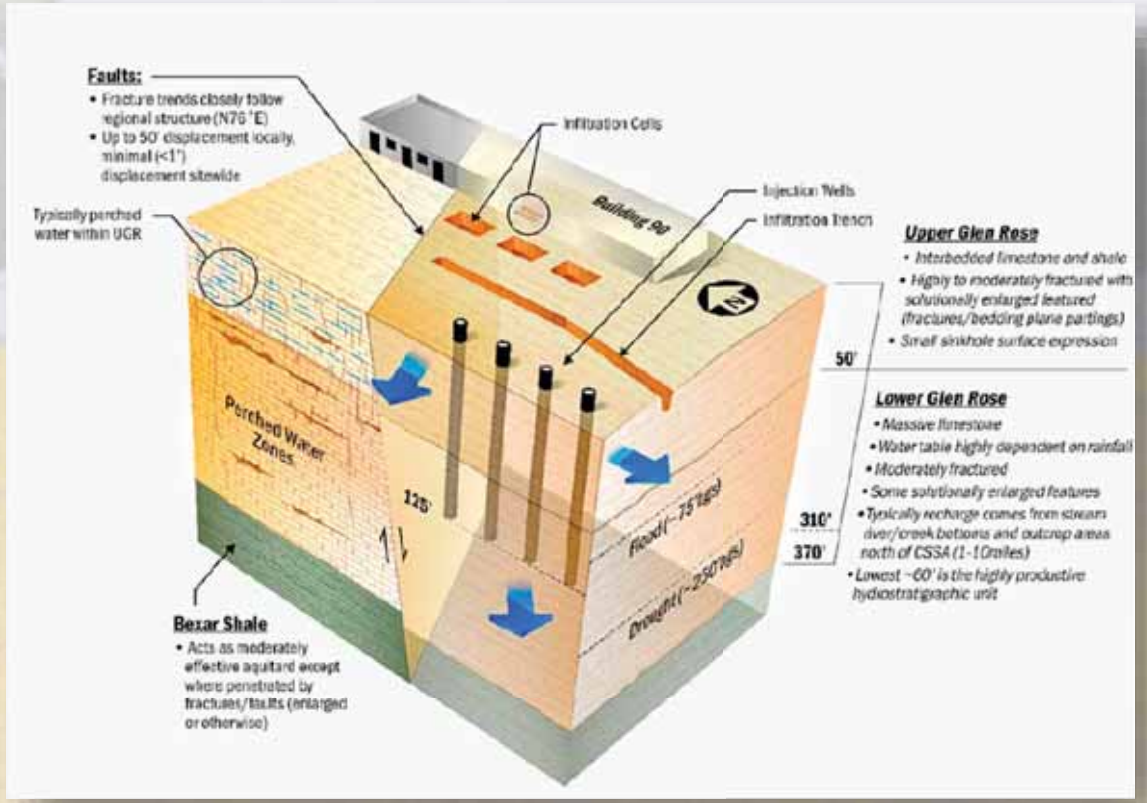
- Initially effective but soon reached equilibrium and diminishing returns
- Optimized several times by adding or removing VEWs, blowers, steam enhanced extraction
- SVE Pilot Study operations ceased in conjunction with commencement of ISCO treatability study (July 2012).

Interim Removal Action (2012)

- Interim Removal Action in 2012 excavated and managed ~1,000 CY of impacted soil media on-post as Class 3 waste.
- Created infiltration gallery

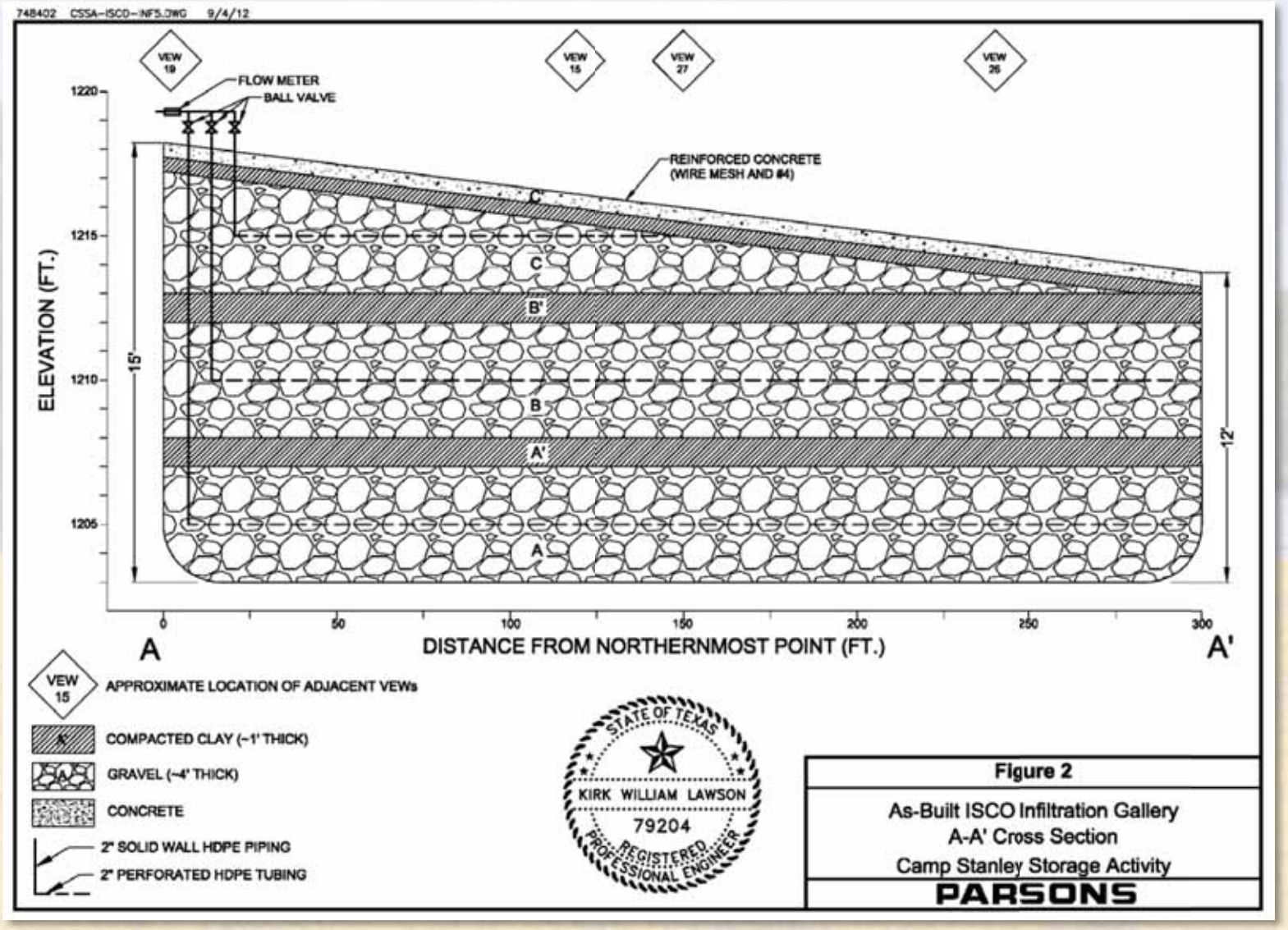
AOC-65 Source Area Treatment

- In-Situ Chemical Oxidation (ISCO) selected for a treatability study following an assessment of current groundwater treatment technologies
- Phased approach initiated in 2012
- Variables that factor into effectiveness at AOC-65:
  - Volume of ISCO solution injected
  - Location of injection and transmissivity (faults and fractures) to source
  - Persistence of solution
  - Depth to groundwater at time of injection



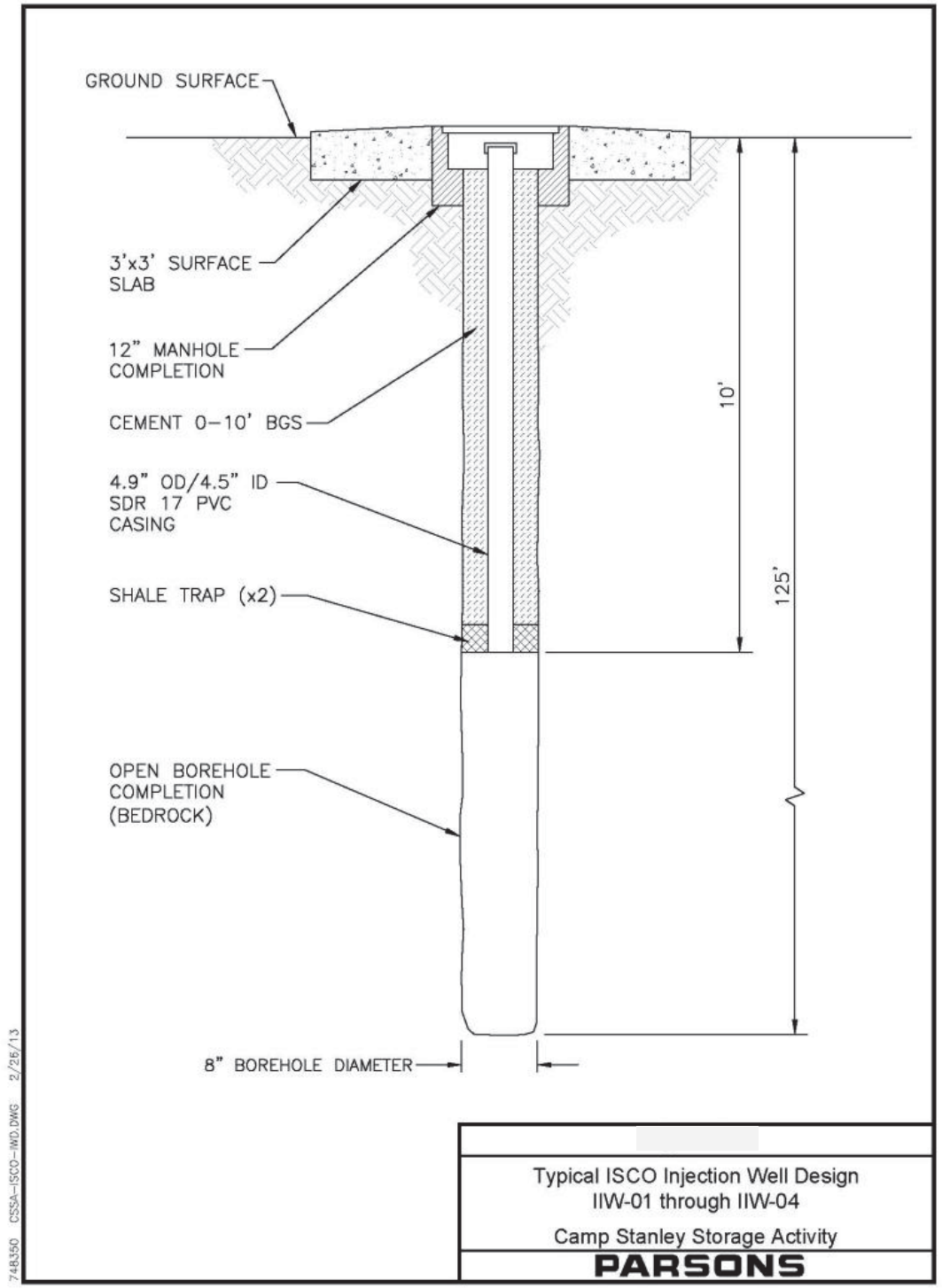
ISCO Infiltration Gallery Construction

- Each zone is comprised of ½" - sized quartz gravel and includes a 2" perforated HDPE line that runs the length of the trench and is separated from adjacent zones by a 1-foot thick layer of compacted clay.
- ISCO material was also injected at SIW-01, located in the former vat within Bldg. 90, and IIWs located along the western fenceline.



ISCO Injection Well Construction

- IIWs are designed with 8" open boreholes from 10' bgs to maximize contact with the bedrock and fractures.
- IIWs terminate near a water-bearing zone at ~125'.
  - IIW-01 total depth = 117'
  - IIW-02 through -04 = 125'
- Temporary casing is currently installed within IIW-01 enabling a rig to resume drilling and re-complete the well at the intended total depth and/or develop the well further.



ISCO Injections

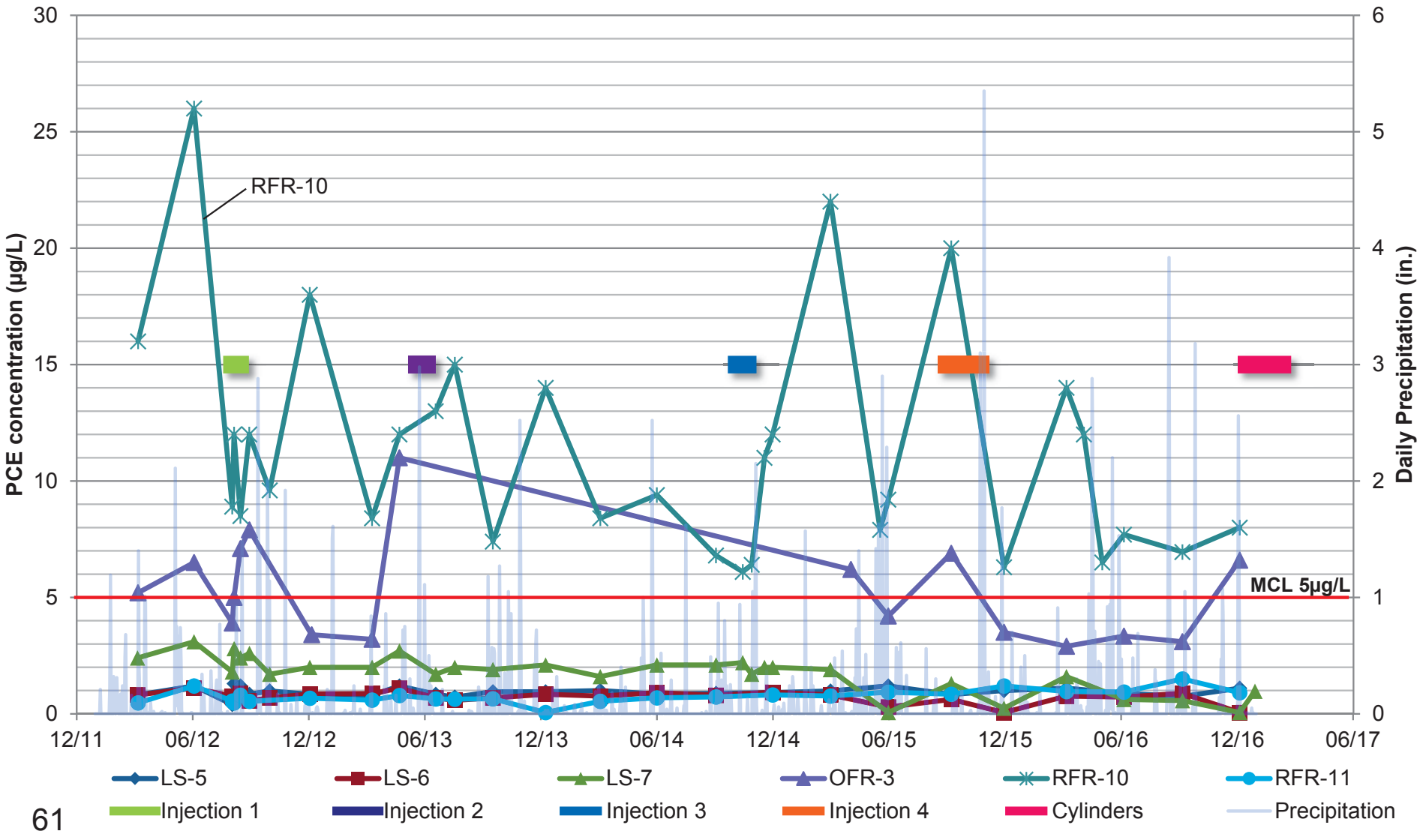
Oxidant	Application Phase (date)	Volume and Type	Application/ Injection Location
Persulfate Solution	Phase I (2012)	~15,000 gallons 20% sodium persulfate	Infiltration trench and SIW-01
	Phase II (2013)	~34,000 gallons 20% sodium persulfate	Infiltration trench, SIW-01, IIWs
	Phase III (2014)	~106,000 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

Phase IVa and IVb Permanganate Injection Observations

- With persulfate we were unable to influence WB zones, permanganate clearly did reach these zones
- PCE actually increased in VEW-32 during persulfate applications
- Increases in TSW PCE concentrations may be pneumatic
- 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



November 2016 PCE Concentrations

Well	Conc. µg/L
TSW-01	**3,134**
TSW-04	1.38
TSW-05	**137**
TSW-06	3
TSW-07	1.24
SIW-01	**445**
VEW-32	**1,144**
VEW-31	37
VEW-29	97
VEW-27	**551**
VEW-25	6.37
VEW-23	24
VEW-19	**115**
VEW-18	24
VEW-15	44
WB03-UGR-01	**18,548**

= Permanganate cylinder installed in well.

AOC-65 ISCO
Path Forward

- In times of heavy rain or saturated conditions, groundwater appears to flow in differing directions than during normal drier conditions.
- Goal is to provide a continuous oxidant source delivery to groundwater to affect contaminants during differing groundwater flow conditions.
- ISCO Cylinders: RemOx SR potassium permanganate crystals infused within a paraffin wax matrix installed at six locations within AOC-65
  - Diffuses permanganate into groundwater within the well
  - Relies on natural groundwater flow to carry oxidant

Sustained-Release ISCO
RemOx SR Permanganate Cylinders

Factors effecting longevity:

- Rate of VOC treatment and Natural Oxidant Demand (NOD) is relatively low at the site
- Hydraulic Conductivity
- Hydraulic Gradient
- Porosity

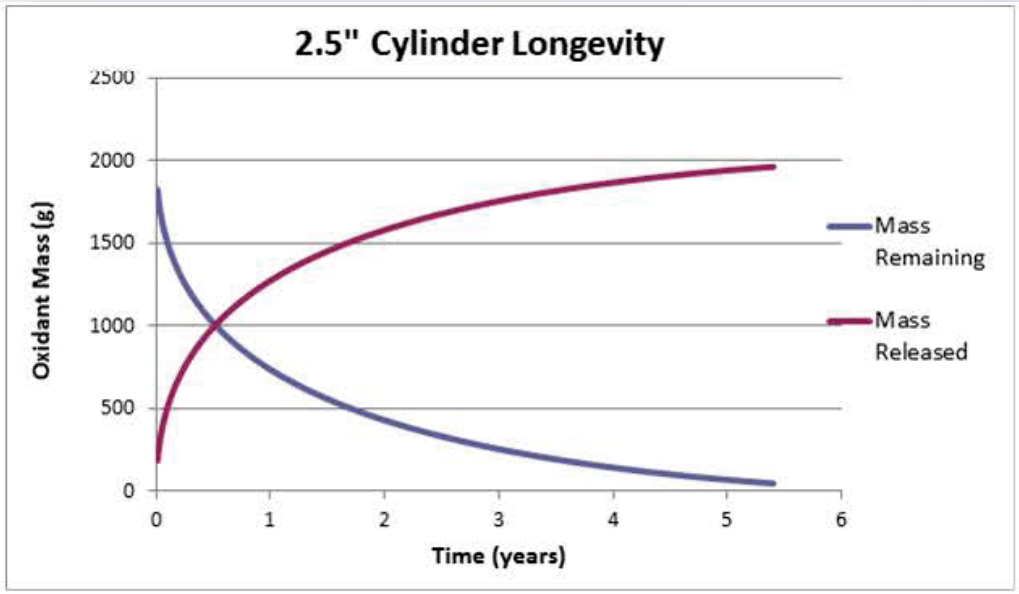


Figure 3. 2.5" (6.35 cm) Cylinder Longevity Prediction

Sustained-Release ISCO
RemOx SR Permanganate Cylinders

Sustained-Release ISCO
Permanganate Cylinder Installation

- Cylinders installed in December 2016
- Currently, one round of site-wide field parameters have been collected
  - No unusual readings noted
- Samples were collected from wells with cylinders installed one month following installation and analyzed for permanganate concentrations

Sustained-Release ISCO
Permanganate Observations

*Located inside Bldg 90

CSSA PUBLIC OUTREACH

CSSA takes its environmental role seriously and strives to keep the neighboring community informed.

CSSA PUBLIC OUTREACH

Informational Fact Sheets are sent out annually to keep the public informed about CSSA's Environmental Program.

Camp Stanley Storage Activity
Groundwater Contamination – 2012 Sampling

FACT SHEET

No. 33 – Annual Fact Sheet for 2012

The purpose of this Fact Sheet is to provide an overview of quarterly groundwater sampling conducted in 2012. ***The off-post groundwater contamination in a small area west of Camp Stanley Storage Activity (CSSA) continues to be stable and CSSA is making progress addressing contamination sources on-post.*** *Results for all groundwater sampling events are available in the CSSA Environmental Encyclopedia located at either the downtown San Antonio Public Library, (600 Soledad Street, on the 2nd floor behind the Reference Desk in the Government Documentation Section), the Patrick Heath Public Library in Boerne (451 North Main, see the Government Librarian for assistance), or on the internet at www.stanley.army.mil.*

On-post Groundwater Monitoring Plan

On-post groundwater monitoring has been conducted since 1991 as part of the CSSA environmental program. The wells sampled include drinking water, monitoring, and agriculture/livestock wells. Sampling frequencies for on-post wells are determined by the long-term monitoring optimization (LTMO) study completed in May 2005 and updated in 2010. This Plan, as approved by the U.S. Environmental Protection Agency (USEPA) and Texas Commission on Environmental Quality (TCEQ), sets the well sampling frequency at either quarterly (3 months), semi-annually (6 months), every nine months, or every 18 months. Currently, groundwater samples from monitoring wells are analyzed for chromium, cadmium, lead, and mercury, while the samples from the drinking water wells are analyzed for the additional metals arsenic, barium, copper, and zinc. All monitoring and drinking water wells were also analyzed for select volatile organic compounds (VOCs). VOCs make up substances such as paint thinners, dry cleaning solvents, and some constituents of petroleum fuels (*e.g.* gasoline and natural gas). Decades-old industrial practices sometimes accidentally release VOCs into the environment, where they can contaminate the soil and groundwater. CSSA ceased using VOC solvents in the mid-1990s. CSSA monitors for VOCs and metals associated with its past industrial processes. The CSSA Groundwater Monitoring Program Data Quality Objectives (DQO) that provides a description of the ongoing groundwater monitoring program and sampling frequencies is available in the Environmental Encyclopedia referenced above.

Off-post Groundwater Monitoring Plan

CSSA describes its groundwater monitoring program for off-post private wells in its *Off Post Monitoring Program and Response Plan*, July 2001 (Plan). The goals of this Plan are to confirm that off-post drinking water meets USEPA and TCEQ safe drinking water standards, determine where VOC contamination has migrated, assess if contaminant levels in those wells exceed standards, and define the appropriate response. As part of the Plan, 56 off-post wells were sampled in 2012.

Off-post water wells are selected for sampling based on CSSA's Plan to ensure protection of drinking water and to provide information for the environmental program. Factors considered in deciding if a well is sampled include where the well is located, how close it is to areas where VOCs have been detected, whether the well owner grants access for sampling, and results of previous sampling at the well. A well is initially sampled for four consecutive quarters (i.e., every three months for one year). Depending on the analytical results for the well, future sampling occurs as illustrated on Figure 1.

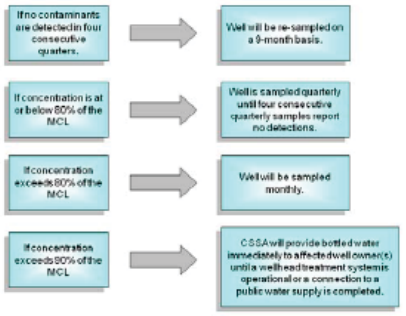


Figure 1. Off-Post Well Sampling Decision Chart

CSSA takes action if VOCs are detected in off-post wells at concentrations that begin approaching greater than 90 percent of the USEPA maximum contaminant level (MCL) of 5 parts per billion (ppb) for tetrachloroethene (PCE) and trichloroethene (TCE) (i.e., action is taken at concentrations greater than 4.5 ppb).

If a VOC exceedance occurs, CSSA will supply bottled water to affected residents within 24 hours of the detection and the well will be resampled to confirm the results. If additional sampling confirms previous test results, CSSA will either install a granular activated carbon (GAC) filtration system to remove contaminants from the water, or provide the well owner with an alternate water supply for as long as contaminant levels in the well exceed standards. Over the history of off-post sampling, eight off-post water wells have been fitted with GAC filtration systems: LS-7 (August 2001), LS-6 (August 2001), RFR-10 (two units, October 2001), RFR-11 (October 2001), LS-2 and LS-3 (installed April 2002, discontinued August 2007 when use of wells ceased), OFR-3 (April 2002), and LS-5 (October 2011).

2012 Groundwater Sampling Results

The locations of all on- and off-post wells sampled in 2012 are shown on Figure 2 (Page 2). According to the USEPA, concentrations below 5.0 ppb for PCE and TCE meet safe drinking water standards. Table 1 (Page 3) presents off-post groundwater data for PCE and TCE from all four 2012 sampling events (March, June, September, December). Three wells (I10-4, OFR-3, and RFR-10) exceeded the MCL for PCE, and two wells (OFR-3 and RFR-10) exceeded the MCL for TCE. In the past, four additional wells (LS-5, LS-6, LS-7, and RFR-11) had PCE and/or TCE detections at concentrations approaching or above the MCL (5.0 ppb). All in-use off-post wells with approaching or above-MCL detections have been equipped with GAC filtration systems, and samples of water collected after filtration for these wells had no detections of the VOC contamination. Well I10-4 is not currently being used and therefore is not equipped with a GAC filtration system. In all other wells

CSSA PUBLIC OUTREACH

The CSSA Administrative Record, or *Environmental Encyclopedia*, includes copies of documents, correspondence, and other environmental program information, and is available online, and at the Boerne and San Antonio Public Libraries.

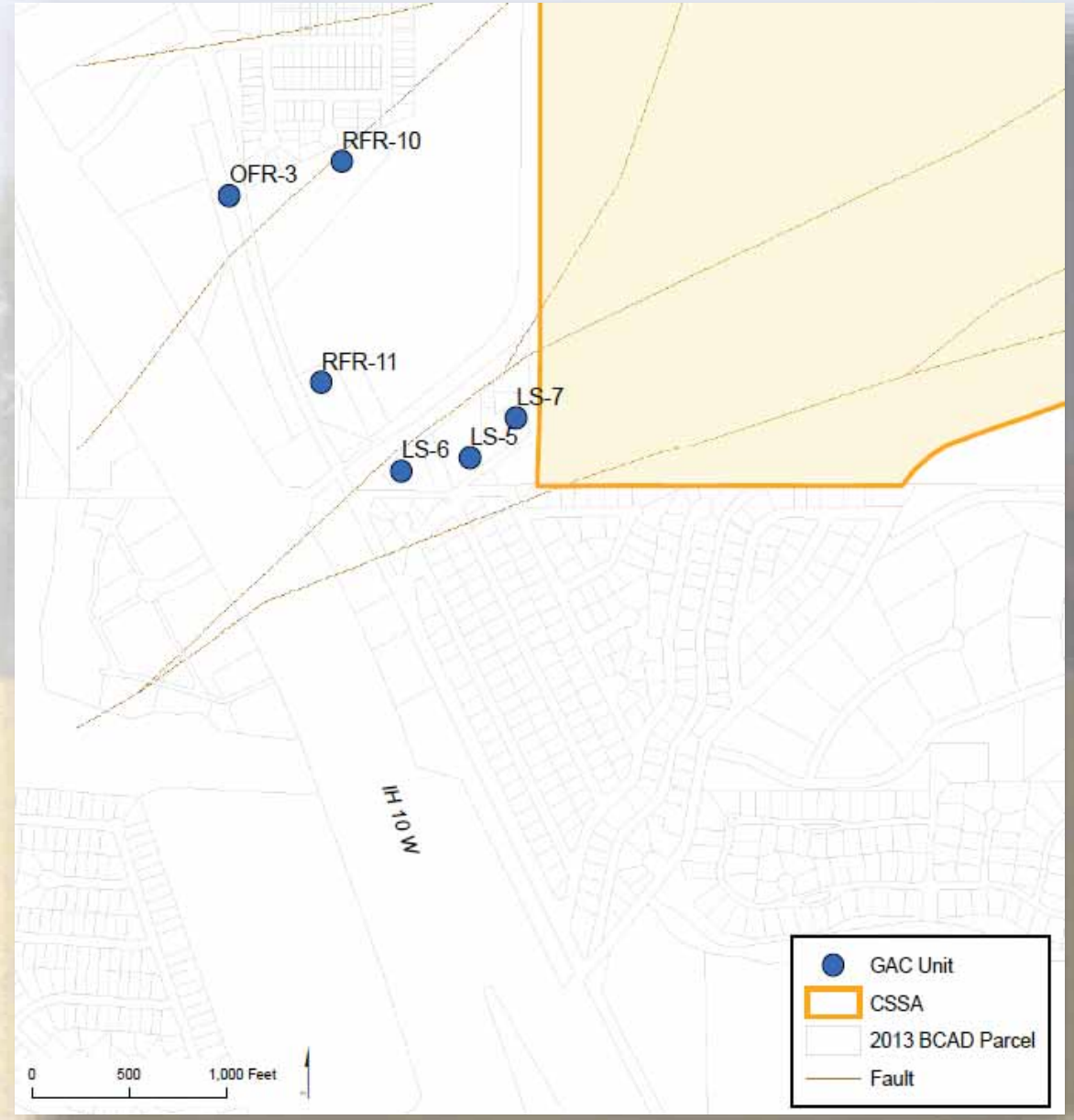
www.stanley.army.mil

CSSA PUBLIC OUTREACH

Public meetings on CSSA's environmental program have been routinely held in 2001, 2002, 2006, 2009, 2014, and 2015.

CSSA MISCELLANEOUS - OPEN DISCUSSION

Topic 1: 6 GAC Wells to SAWS



Topic 2: Audit Findings

- **Finding 1**: Site-wide Military Munitions Response Program (MMRP) Preliminary Assessment and Site Investigation (PA/SI) Missing

- **Recommendation 1**: Perform a MMRP PA/SI in accordance with Defense Environmental Restoration Program (DERP) Guidance and Army policy. Assess any program gaps and prepare documentation to demonstrate compliance with all requirements of the MMRP Preliminary Site Assessment and seek written regulatory concurrence from USEPA and TCEQ

Topic 2: Audit Findings

- **Finding 2**: Operational Range Assessment Program (ORAP) Missing
- **Recommendation 2**: Budget and initiate an Operational Range Assessment for all active ranges

Topic 2: Audit Findings

- **Finding 3:**Perform a Third Party Optimization Study to Assess the Remedy-in-Place (RIP)

- **Recommendation 3**: Perform a third party Optimization Study for Environmental Restoration RIPs at CSSA in accordance with DERP Guidance and Army policy:
  - Assess alternatives to treatment of residential drinking water to reduce future liabilities associated with contamination in off-site drinking water wells.
  - Track contaminant removal rates for RIP to assess treatment performance. Current metrics for AOC-65 and SWMU B-3 are based on contaminant concentration reduction. Recommend metric to quantify the amount of contamination removed through active treatment.
  - Assess CSSA Environmental Restoration progress for DERP metrics for installation restoration sites and munition response sites. Include progress compared to both the Department of Defense and Department of Army.