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October 30, 2008

Subject: *Meeting Minutes: Environmental Project Status Meeting (10-July-08) – SWMU Investigations and Closures, Groundwater Overview, and Pilot Studies Update*
Camp Stanley Storage Activity, Boerne, Texas
Contract DACA87-02-D-0005, Delivery Order DY01

Dear Mr. Rayos:

Enclosed is a copy of the *Meeting Minutes: Environmental Project Status Meeting (10-July-08)* as referenced above. These minutes provide a summary of the main discussion items and main action items from the meeting.

If you have any questions or comments, please feel free to contact me at 512-719-6017.

Sincerely,

Lea Aurelius for

Julie Burdey
Project Manager

Attachments
cc:
Glaré Sanchez, CSSA
Chris Beal, CSSA
Brenda Shirley, CSSA
Greg Lyssy, USEPA
Jorge Salazar, TCEQ
Wayne Elliott, USACE
Bob Edwards, Noblis
Mike Chapa, Weston
Steve Mitchell, Weston
745953 Project File

Environmental Project Status Meeting

SWMU Investigations and Closures, Groundwater Overview, and Pilot Studies Update

Camp Stanley Storage Activity
Boerne, TX

Parsons, DACA87-02-D-0005, Delivery Order DY01
July 10, 2008

Date: Thursday, July 10, 2008

Time: 9:30 AM – 12:30 PM

Place: Camp Stanley Storage Activity, Boerne, Texas

Subject: SWMU Investigations and Closures, Groundwater Overview, and Pilot Studies Update

Attendees:

Glaré Sanchez	CSSA	321-662-3718
Chris Beal	Portage/CSSA	210-336-1171
Julie Burdey	Parsons	512-719-6062
Greg Lyssy	USEPA Region VI	214-665-8317
Sonny Rayos	TCEQ	512-239-2371
Jorge Salazar	TCEQ	210-403-4059
Bob Edwards	Noblis	210-408-5552
Ken Rice	Parsons	512-719-6050
Scott Pearson	Parsons	512-719-6087
Samantha Elliot	Parsons	210-347-6012
Lea Aurelius	Parsons	512-719-6017
Steve Mitchell	Weston	512-651-7104
Mike Chapa	Weston	210-248-2428

INTRODUCTION

The meeting was held at Camp Stanley Storage Activity. Attendees included representatives from CSSA, TCEQ, USEPA (Region VI), Noblis, Weston Solutions, Inc., and Parsons. The sign-in sheet is provided as **Attachment A**. A copy of the slide presentation was provided as a handout at the meeting and is included as **Attachment B**. A second handout with additional information was also provided at the meeting and is included as **Attachment C**.

These minutes are intended to provide a summary of the main discussion items and action items from the meeting.

SLIDE PRESENTATION

Slides 1-4. Introduction and closure status of SWMUs/AOCs. CSSA's goal is to close as many sites as possible with Release Investigation Reports (RIR).

Slides 5-10. AOC-73 overview. RIR distributed to CSSA and USACE for review; RIR submitted to TCEQ and USEPA following CSSA/USACE comments.

Slides 11-13. SWMU I-1 overview. RIR submitted to TCEQ and USEPA.

Slides 14-17. AOC-69 overview. Further removal actions planned, followed by RIR.

Slides 18-19. AOC-67/68 overview. TCEQ and USEPA agreed that an RIR could be submitted for AOC-67/68 following additional removal actions in the immediate area of the Wheelabrator, which can reasonably be achieved between the buildings and the roads. When operations at neighboring Building 90 are discontinued, closure of the wider area around this building will be addressed.

Slides 20-24. Overview of North Pasture sites (SWMUs B-2, B-8, B-20/21, and B-24). Further removal/remedial actions planned, followed by APAR.

Tier 2 calculations for the North Pasture sites will use the following data: (1) the average soil pH and soil type for the North Pasture; (2) the most conservative (shallowest) depth to groundwater in monitoring wells located in the North Pasture; and (3) the most conservative (maximum) thickness of affected soil from the four SWMUs in the North Pasture.

Mr. Rayos requested that Parsons provide TCEQ with (1) all of the data that will be used in the Tier 2 calculations, and (2) the calculated Tier 2 PCLs.

Slides 25-34. Weston's presentation regarding AOC-63, AOC-64, and SWMU B-71. For AOC-63, the draft APAR had been distributed to CSSA and Parsons for review (Weston requested comments by 18 July 08). For AOC-64 and SWMU B-71, further removal actions planned, followed by RIRs.

Slides 35-48. CSSA groundwater monitoring and long-term monitoring optimization (LTMO) was discussed, including on-post and off-post MWs with COC exceedances.

The schedule for the next public meeting for LTMO off-post was discussed; it was decided that the meeting should be planned for the Fall 2009.

Analytical parameters for groundwater monitoring were discussed. It was agreed that nickel could be dropped from the list of analytical parameters. Chromium and mercury will be added to the list of parameters. Lead has been detected in newly installed MWs (CS-MW22-LGR and CS-MW25-LGR) and will continue to be monitored.

TCE and PCE were detected at an off-post VOC monitoring well (I10-4) during the March 2007 sampling event. According to the landowner, the well was plugged following that sampling event. Concentrations of TCE/PCE were above their respective reporting limits (RLs), but below MCLs and Tier 1 residential drinking water PCLs.

Slides 49-58. The hydrogeologic conceptual site model was discussed. Contamination beyond Ralph Fair Road and possible locations of MWs beyond I-10 were discussed.

There is a need to either locate existing private well(s) or to install new MW(s) west of I-10 so that the western extent of the plume can be identified.

Slides 59-90. CSSA pilot studies (SWMU B-3 bioreactor and AOC-65 SVE) were discussed. The proposed monitoring schedules were discussed and agreed to (slides 84 and 90). Future investigation work for AOC-65 was discussed. Possible options discussed included tracer tests (soil gas or groundwater) and additional wells.

Concern was expressed about the potential for vapor intrusion in recently developed areas west of CSSA. USEPA indicated that there is a need to focus on ways to collect/evaluate data related to vapor intrusion, especially related to AOC-65 SVE.

The next meeting was proposed for early November 2008, to be held at the Parsons office, Austin, TX.

MEETING ADJOURNED

ATTACHMENT A
Meeting Sign-In Sheet

Meeting Sign-In Sheet

Date:	10 July 2008
Time:	9:30 AM to 12:00 PM
Place:	Camp Stanley Storage Activity, Boerne, Texas
Project:	Environmental Project Status Meeting

Name	Organization	Base/Location	Phone No.	Fax No.	E-Mail
Julie Burdey	Parsons	Austin	512-719-6062	512-719-6099	julie.burdey@parsons.com
Brian Vanderglas	Parsons	Austin	512 719 6059	"	brian.vanderglas@parsons.com
Scott Pearson	Parsons	Austin	512 719 6087	"	william.scott.pearson @parsons.com
Samantha Elliott	Parsons	San Antonio	210-347-6012		samantha.elliott@ parsons.com
Lea Aurelius	Parsons	Austin	512-719-6017	512-719-6099	lea.aurelius@parsons.com
GREG LYSSY	EPA	DALLAS	214 665 8317	214 665 7263	LYSSY.GREGORY@EPA.GOV
MIKE CHATA	WESTON	SATX	2102482428	2103984329	MIKE.CHATA@WESTONSOLUTIONS.COM
Ken Rice	Parsons	Austin	512-719-6050	512-719-6059	Ken.rice@Parsons.com
Chris Beal	PORTAGE/CSSA	SATX	210 336-1171	210 295-7386	bealc@envirodept.NET
Steve Mitchell	Weston	Austin	512 651 7104	512 651 7101	s.mitchell@westonsolutions.com
Bob Edwards	Noblis	SATX	210 408 5552		robert.edwards@noblis.org

Meeting Sign-In Sheet (page 2)

Name	Organization	Base/Location	Phone No.	Fax No.	E-Mail
Sonny Rayos	TCEQ	Austin	512.239.2371	239.2346	SRAYOS@TCEQ.STATE.TX.US
Glori Sanchez	CSSA	CSSA	321-662-3718		Sanchezg@envirodept.net
Jorge Salazar	TCEQ	San Antonio	210-403-4059	(210) 545-4329	JSALAZAR@tceq.state.tx.us

ATTACHMENT B

Slide Presentation

Environmental Project Status Meeting

July 10, 2008

Camp Stanley Storage Activity
Boerne, TX

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Agenda

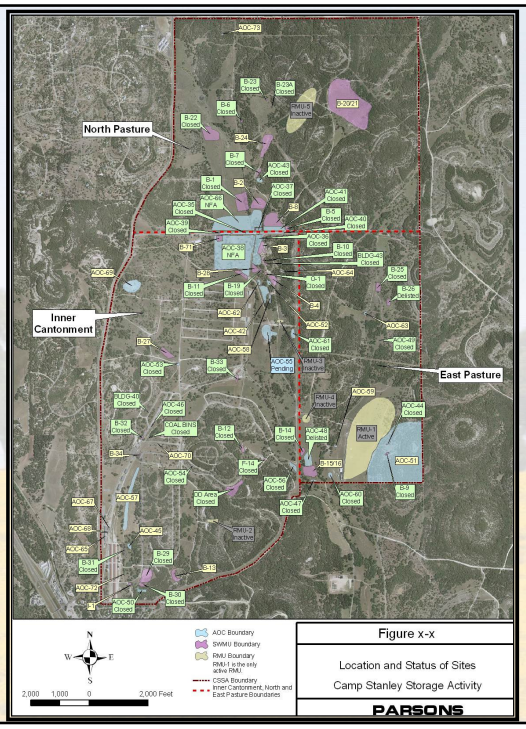
- AOC-73
- SWMU I-1
- AOC-69
- AOC-67/68
- North Pasture SWMUs (B-2, B-8, B-20/21, B-24)
- AOC-63
- AOC-64 and SWMU B-71
- Groundwater Overview
- CSSA Pilot Studies Update

2

Overview of Waste Management Sites

Closed Sites
- 24 SWMUs
- 23 AOCs

Remaining Open Sites
- 15 SWMUs
- 16 AOCs



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For Remaining Open Sites

"*Determining Which Releases are Subject to TRRP*" (TCEQ, 2003).

RIR

- Concentrations do not exceed Tier 1 residential soil action levels (defined as the 0.5 acre $^{Tot}Soil_{Comb}$ PCL and the $^{GW}Soil_{Ing}$ PCL, or the background concentration if higher than PCL).
- No evidence of other affected or threatened media (groundwater, surface water, or sediment).
- Site passes the Tier 1 Ecological Exclusion Criteria Checklist.
- CSSA's goal is to close as many sites as possible with RIR.

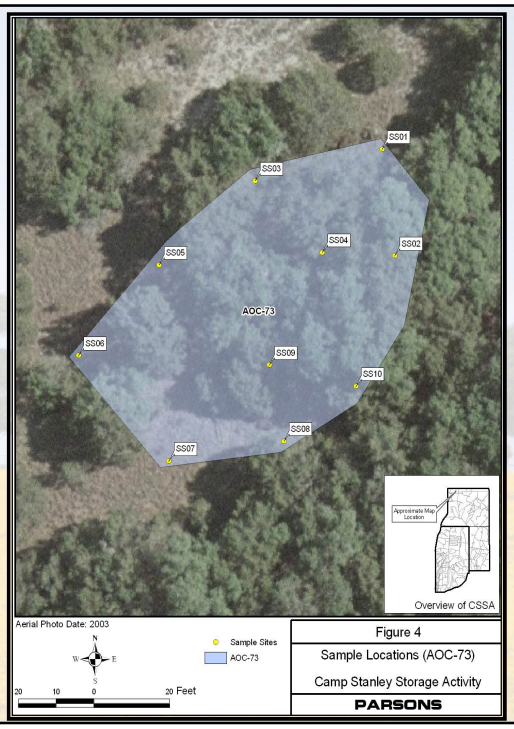
APAR

- Concentrations exceed Tier 1 residential soil action levels (as defined).
- Development of Tier 2 PCLs.
- If concentrations do not exceed Tier 2 PCLs, then no further action (NFA) may be recommended.
- At this time, anticipate need for APAR for North Pasture sites (B-2, B-8, B-20/21, and B-24) due to possible UXO and metals above background/PCLs. Still removing metals contaminated soils to extent practical.

4

AOC-73

- An RIR has been submitted to CSSA for review.
- Follows TCEQ requirements for determining releases that do not trigger applicability to the TRRP rule ("*Determining Which Releases are Subject to TRRP*," TCEQ, 2003).



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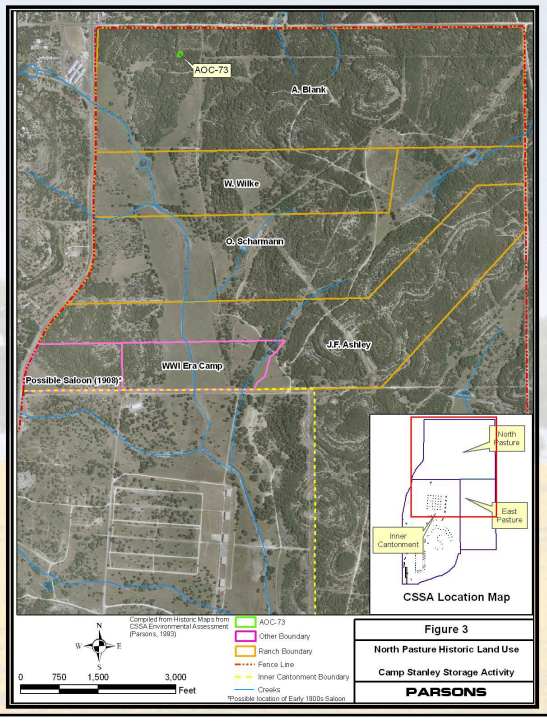
AOC-73

- Small ~0.113-acre site used by a former rancher for dumping general household trash and metal and lumber debris (including miscellaneous old tools, cans, bottles, barbed wire, and scraps of lumber and sheet metal).



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AOC-73

Typical waste debris and vegetation at AOC-73 (photo taken 2-29-08).

7

AOC-73

- Removal efforts were conducted in March 2008 to clear the debris; due to the scattered nature of debris, surface soil was also removed to a depth between ~ ½ and 1 foot.
- Three small soil/waste piles were generated from the excavation with a combined volume of only ~170 yd^3 of soil/waste. The soil/waste material was sampled and determined to be non-hazardous and was taken off site for disposal at Waste Management Inc., Covel Gardens Landfill in San Antonio, Texas.

8

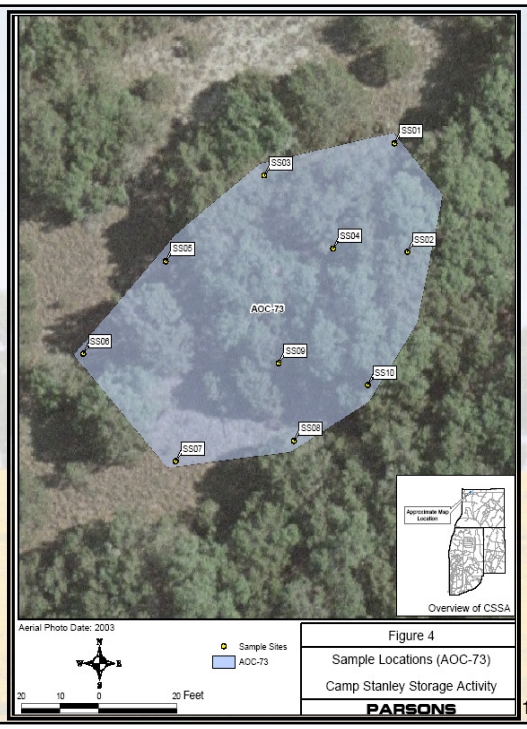
AOC-73

Waste piles from cleanup activities (photo taken 3-4-08).

9

AOC-73
Soil Samples

- Ten surface soil samples collected from excavated/cleared area and analyzed for VOCs, SVOCs, and metals.
- Conclusions:
  1) Concentrations do not exceed Tier 1 residential soil action levels.
  2) No evidence of other affected or threatened media.
  3) Site passes the Tier 1 Ecological Exclusion Criteria Checklist.
- When these three criteria are met, the release is not subject to TRRP. Submit RIR and request NFA.



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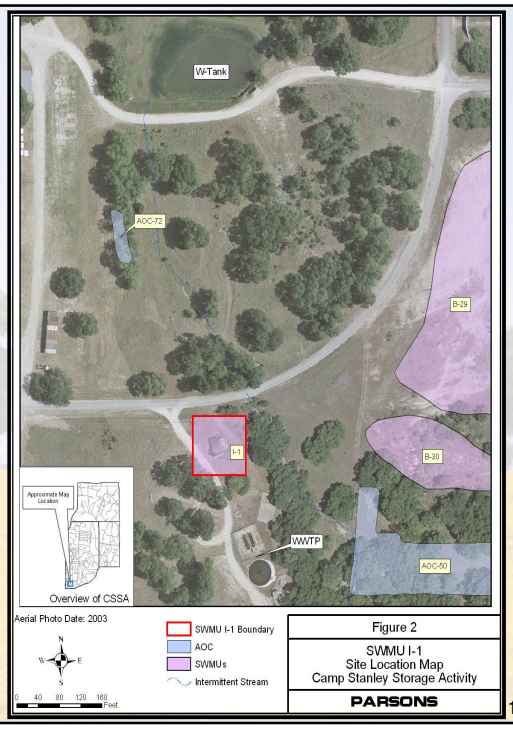
SWMU I-1
Site Location

- An RIR has been submitted for SWMU I-1.
- Follows TCEQ requirements for determining releases that do not trigger applicability to the TRRP rule ("*Determining Which Releases are Subject to TRRP*," TCEQ, 2003).



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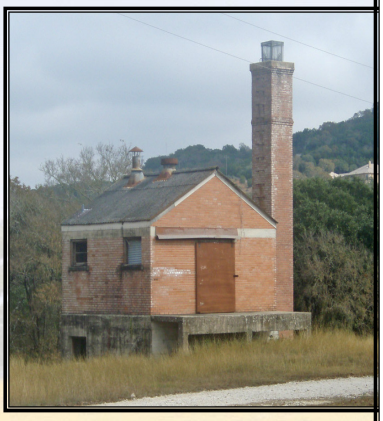
SWMU I-1



- Small ~0.223-acre site.
- Inactive incinerator at Bldg 294 used to burn classified paper documents (1943 to late 1960s).
- Building later used to store non-PCB transformers.

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SWMU I-1 Investigations

Date	Investigation Description	Results
March 1996	Geophysical survey of the area surrounding the building	No subsurface anomalies detected
August 1996	13 soil gas samples collected in the area surrounding the building	No VOCs detected
March 2000	9 samples from 3 borings installed adjacent to building – analyzed for VOCs and metals	No concentrations exceeded Tier 1 residential soil action levels
April 2000	3 surface soil samples – analyzed for PCBs	No PCBs detected
March 2001	1 wipe sample collected from within the incinerator stack and at the opening of the incinerator unit – analyzed for dioxins and furans	Concentrations within the incinerator were extremely low and do not indicate that surrounding soil would be affected. Likely due to the burning of classified paper documents at the site. According to 2006 USEPA data, backyard burning of household trash (including newspapers, books, magazines, junk mail, *etc.*) is the most common source of dioxin and furan emissions in the U.S.
July 2006	1 transformer oil sample collected from 13 transformers – analyzed for PCBs	Results showed the transformers to be non-PCB transformers. No PCBs were detected in 12 of the samples. One sample had a very low level of PCB (6.1 ppm). USEPA 40 CFR §761.3 defines "non-PCB transformer" as "any transformer that contains less than 50 ppm PCB."
October 2007	During a March 2007 meeting discussing site closure, TCEQ, USEPA and CSSA agreed to collect one additional sample (1 composite concrete floor sample from 5 locations in building and analyze for PCBs)	No PCBs detected RECOMMENDATIONS: Submit RIR and request NFA

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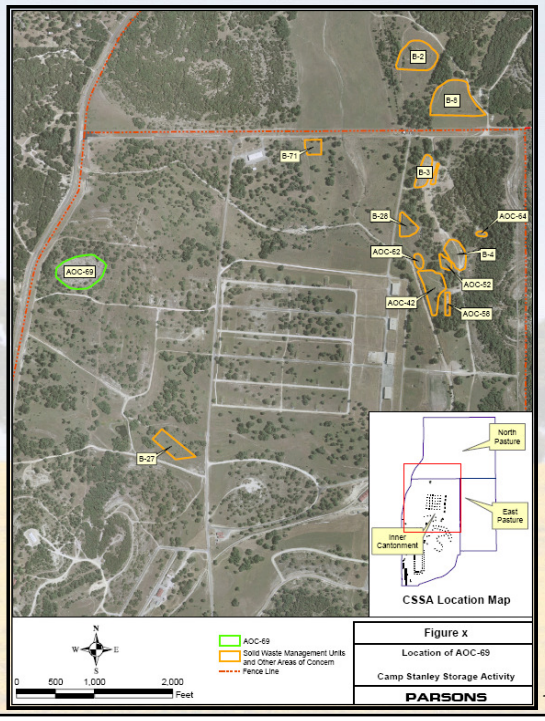
AOC-69

- AOC-69 is a possible former ammunition burn and munitions disposal area.
- Exact dates of use are unknown, but based on evidence found at the site, was potentially operational in the 1950s and 60s.



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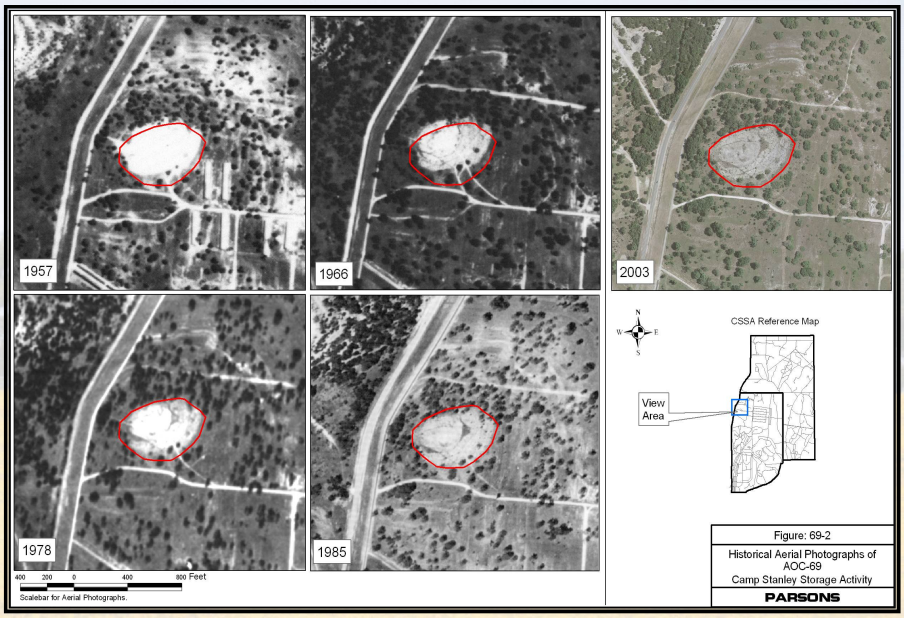
AOC-69



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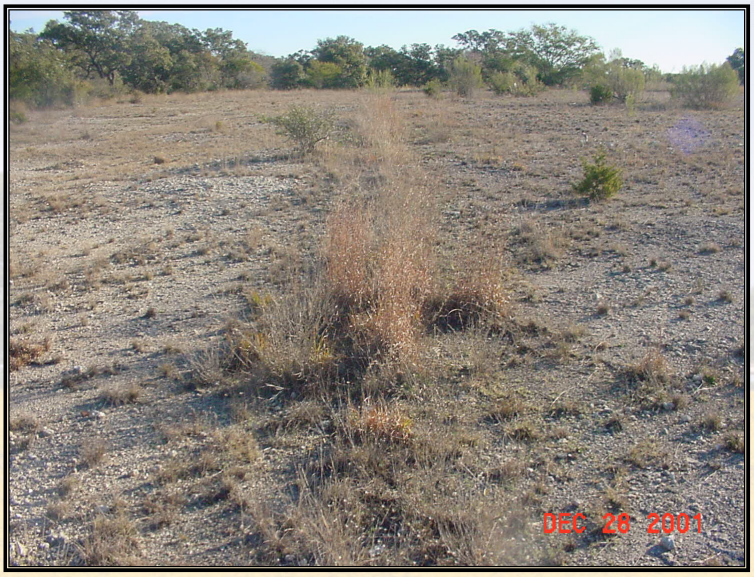
AOC-69



Site is sparsely vegetated; bare rock; shallow areas of soil (photo taken 12-28-01).

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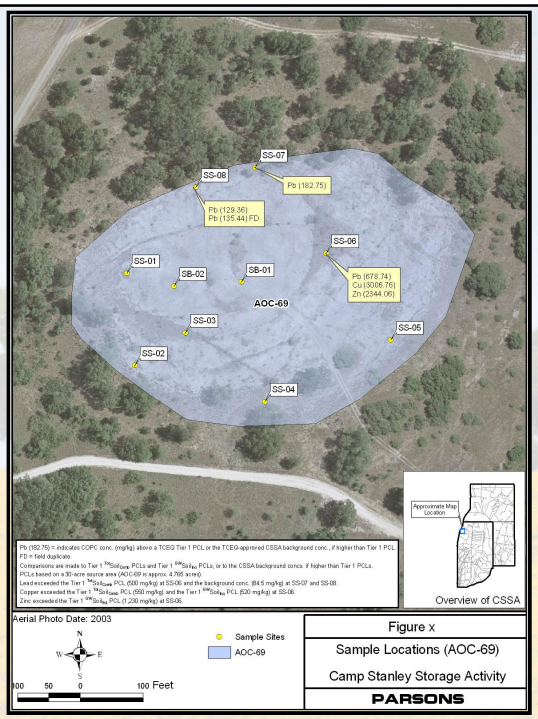
AOC-69

- Ten surface samples collected in April 2008.
- Three sample locations had exceedances (*i.e.*, above Tier 1 residential PCLs) for lead.
- One sample location also had exceedances for copper and zinc.
- Follow-up sampling conducted in June 2008 (results pending).
- Further remedial activities planned for AOC-69, followed by RIR.



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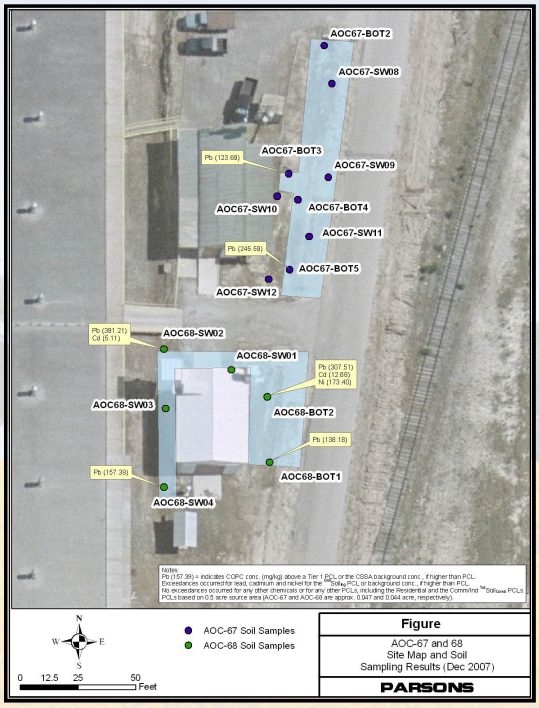
AOC-67/68

- Fifteen samples collected in Dec 07.
- Six sample locations had exceedances (*i.e.*, above Tier 1 residential PCLs) for lead.
- Of these six locations, two also had exceedances for cadmium and one had exceedance for nickel.



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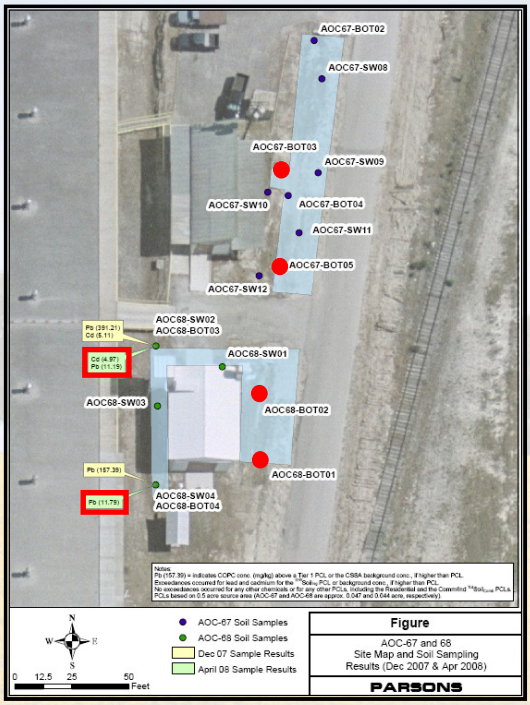
AOC-67/68

- Follow-up sampling conducted in April 2008 (collection of six samples from bottom of excavation).
- From the April 2008 sampling, only a slight exceedance for cadmium in one sample.
- Further remedial activities planned for AOC-67/68, followed by RIR.



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North Pasture

Feb/Mar 08 Remedial Activities:

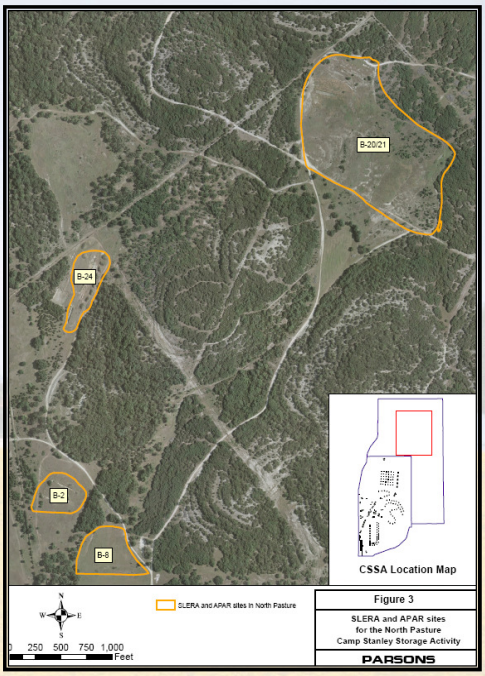
- B-2: ~60 cy removed; no remaining COCs above Tier 1 PCLs.
- B-8: ~2,200 cy of non-hazardous lead impacted soils removed to east pasture firing range berm; ~400 cy of lead and barium impacted soils remain at B-8 until treatment.
- B-24: UXO/visual investigation of potential eastern trench; no waste identified.

June/July 08 Remedial Activities:

- Confirmation/investigation sampling at B-8, B-20/21, and B-24.

Human Health & Ecological Risk Assessments:

- Final Work Plan for ERA submitted.
- Pending confirmation/investigation sampling results.
- APAR – Tier 2 human health PCLs.



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SWMU B-8

Ordnance

Soil/Waste pile

Finished berm

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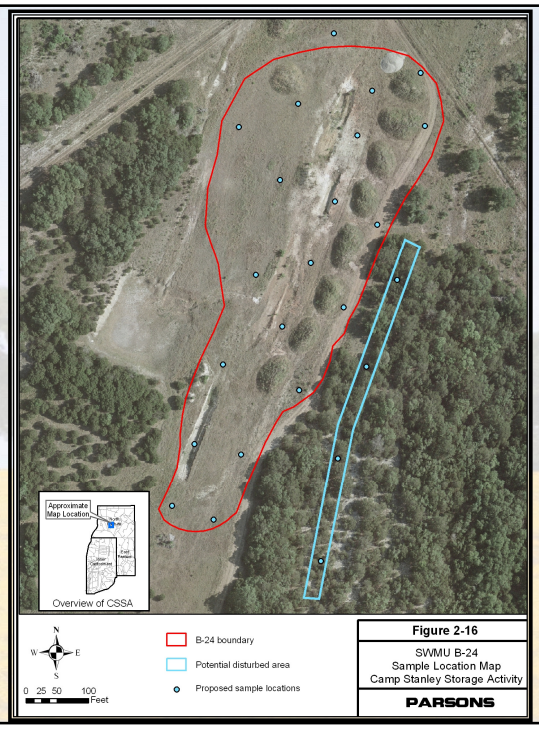
SWMU B-24

Feb 28, 2008 Remedial Activities:

- UXO/visual investigation of potential disturbed area.



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SWMU B-24

Tree clearing in potential disturbed area

One of the investigation trenches

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Human Health Tier 2 PCLs TRRP §§350.71 – 350.79

Compound-specific variables used in Tier 2 calculations:

- pH-dependent soil-water partition coefficients (K_d values) for inorganics.
  Using average pH for North Pasture.
- Depth from top of affected soil to groundwater table (ft).
  Using most conservative (shallowest) depth from five monitoring wells in North Pasture and all data collected (Oct 92 to most current).
- Thickness of affected soil (ft).
  Using most conservative (maximum) thickness of affected soil from the four SWMUs in North Pasture.

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Background: AOC 63

Soil/Rubble Pile with Drums

Bedrock Outcrop at Northeast Area Investigated

Evidence of Surface Water Flow and Ponding to the South

Investigation Area less than One Acre

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Site Investigation Timeline: AOC 63

January 2001
Soil Vapor Survey: no VOC impact detected.

December 2006
Historical Aerial Photo Review: no indications of disposal or suspect land use other than denuded vegetation in 1957 photo.

February 2007
Site Reconnaissance and Geophysical Survey: anomalies generally correlate to features visible at ground surface.

March 2007
Exploratory Trenching and Sampling with Analysis of VOCs, SVOCs, metals, and explosives constituents: benzene concentrations exceed Texas Risk Reduction Program (TRRP) Tier 1 Protective Concentration Level (PCL) for ingestion of groundwater ($^{GW}Soil_{Ing}$), assumed residential land use and 30-acre source area.

May 2007
Technical Interchange Meeting: consensus to re-sample for benzene, with contingency follow-on analysis by Synthetic Precipitation Leaching Procedure (SPLP).

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Site Investigation Timeline: AOC 63 (continued)

June 2007

Re-sampling confirms presence of benzene above Tier 1 PCL. Follow-on analysis by SPLP: no detectable benzene (sample reporting limit 0.000225 milligrams per liter (mg/l); TRRP drinking water PCL for benzene is 0.005 mg/l).

July 2007

Informal reconnaissance survey of surrounding area: no upgradient contaminant sources observed.

Technical Interchange Meeting: TCEQ indicates use of SPLP results for determining no further action will require pre-approval as Tier 3 PCL.

August 2007

TCEQ soil attenuation model (SAM) used to develop site-specific Tier 2 $^{GW}Soil_{Ing}$ PCL for benzene in soil.

September 2007

Technical Interchange Meeting: obtain vertical delineation of benzene in soil or sample groundwater to determine no further action necessary.

December 2007

Vertical delineation of benzene in soil to below Method Quantitation Limit (MQL).

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Next Action

Submittal of Affected Property Assessment Report (APAR) for TCEQ Review

–No PCL Exceedance Zone
–No Further Assessment or Remedial Response Required

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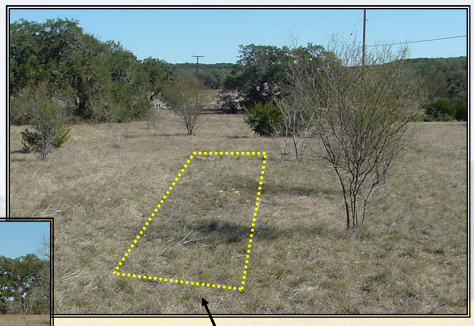
Site Background: SWMU B-71

- Munitions Debris (MD) Disposal Area: Spent Small Arms Casings and Bullets Identified Circa 1990
- Surface Litter and Depressed Areas
- Bordered on three sides by AOC 38
- (Closed Sep 2004)
- Located Within Floodplain of Salado Creek
- Investigation Area Approximately 2.5 Acres



Surface Depressions with MD Litter

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Investigation Data: SWMU B-71

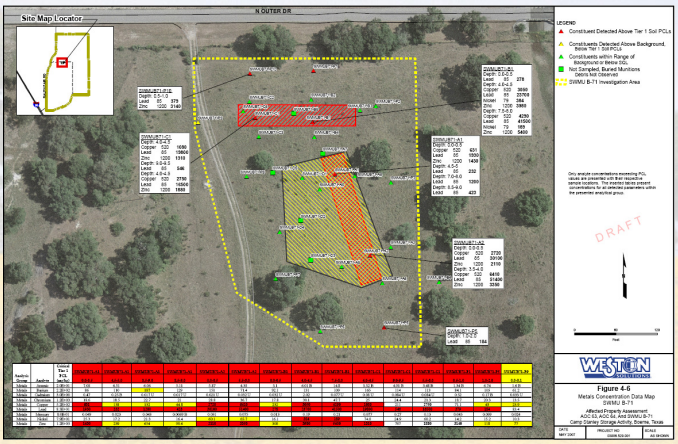
March 2007

Chemicals of Concern (COCs) exceeding Tier 1 GWP concentrations: Copper, Lead, Nickel, Zinc, Benzene, and N-Nitrosodiphenylamine

Impacted Media: Buried MD to Depth of Bedrock (seven to ten feet below ground surface [bgs]); Shallow Peripheral Area Soil

Preliminary Ecological Risk Screening: Benchmark Values Exceeded in Buried Debris and Limited Peripheral Areas

No Unexploded Ordnance (UXO) Observed



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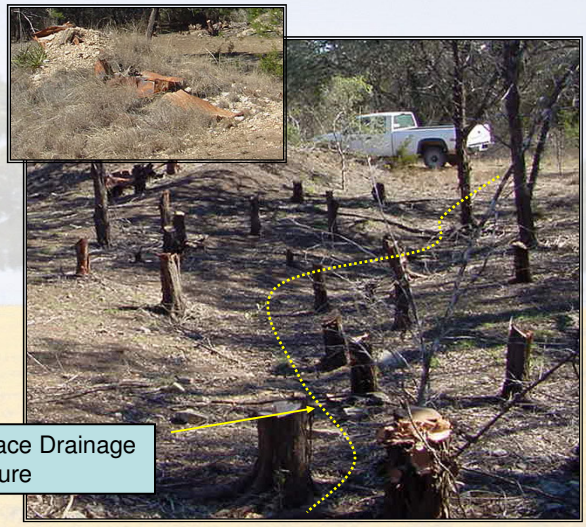
Site Background: AOC 64

- Explosive Ordnance Disposal (EOD) Burn Area
- Buried MD and Surface Litter
- Soil Mounds with Rubble and Refuse
- Large "Kick-Out" Area with Shrapnel and Other Debris
- Surface Water Drainage Feature through South End of Site
- Bedrock Outcrop at North Side of Site
- Investigation Area Approximately 1.5 Acres



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Investigation Data: AOC 64

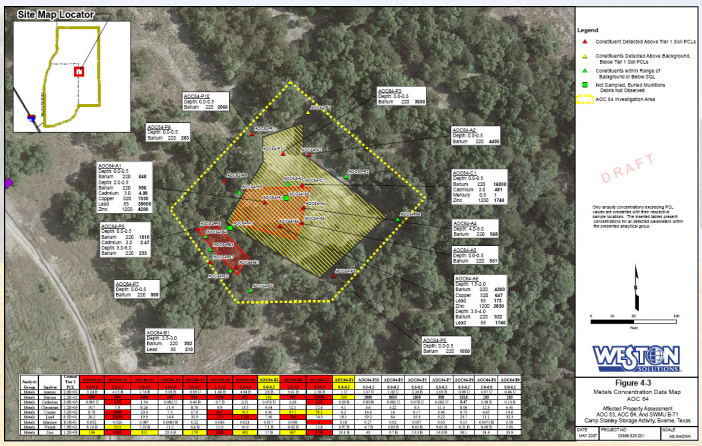
March 2007

COCs exceeding Tier 1 GWP concentrations : Barium, Cadmium, Copper, Lead, Mercury, Benzene, and 2,4-Dinitrotoluene

Impacted Media: Buried Munitions Debris to Depth of Bedrock (four to seven feet bgs); Shallow Peripheral Area Soils

Preliminary Ecological Risk Screening: Benchmark Values Exceeded in Buried Debris and Peripheral Areas

No UXO Observed



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May 2007 Technical Progress Meeting

- TCEQ/EPA/United State (US) Army Consensus to Conduct IRAs Addressing Areas with Munitions Debris and Affected Soil
- Post-Removal COC conditions to be Evaluated through TRRP Tier 2 Soil Attenuation Model (SAM) or Tier 3 SPLP Processes

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Reporting

Confirmation Sampling Results and Locations, Volumes Removed, and Final Excavation Dimensions Presented in Affected Property Assessment Reports (APARs)

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Groundwater Monitoring Program

Overview

- Quarterly Monitoring Program:
  - On-post since December 1999: 35 events
  - Off-post since September 2001: 28 events
- Wells included:
  - 43 On-post monitoring wells
  - 3 On-post supply wells
  - 4 Westbay®-equipped wells
  - 50 Off-post private and public supply wells
- 5 off-post wells have GAC units due to past exceedances

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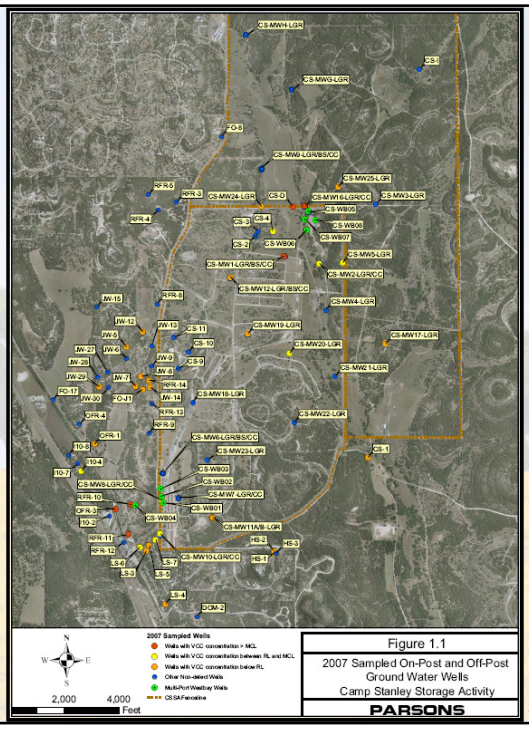
Groundwater Monitoring Program

Sampling Locations



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Groundwater Monitoring Program
Sampling Plan

- **All wells in the monitoring program are analyzed for:**
  - PCE
  - *trans*-1,2-DCE
  - *cis*-1,2-DCE
  - TCE
  - 1,1-DCE
  - vinyl chloride
- **On-Post wells are also analyzed for metals:**
  - Nickel
  - Cadmium
  - Lead
- **Newly-installed wells are analyzed for:**
  - VOCs - full list
  - Metals - barium, chromium, copper, nickel, zinc, arsenic, cadmium, lead, mercury & cations - calcium, iron, potassium, magnesium, manganese, sodium
  - Anions - bromide, chloride, fluoride, nitrate, nitrite, sulfate, phosphate
  - Alkalinity - carbonate & bicarbonate
  - pH, temperature, & conductivity are collected in the field

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Groundwater Monitoring Program
LTMO & DQOs

- Three-Tiered **L**ong **T**erm **M**onitoring Network **O**ptimization Evaluation completed in 2005
- **LTMO** recommendations implemented on-post with regulatory approval in December 2005
- Off-post monitoring follows the provisions of the Data Quality Objectives (DQO) for the Groundwater Monitoring Program
- Anticipate updating LTMO study in 2010

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Groundwater Monitoring Program
Interaction with the Public

- **Quarterly**
  - Letters are sent to well owners
  - Groundwater summary reports prepared
- **Annually**
  - Fact sheets describing results
  - Groundwater Report prepared

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Groundwater Monitoring Program
Recent Changes

- Bexar Met no longer operates supply wells in Leon Springs Villas, these wells have been removed from service
- SAWS now provides water to the new Centex Homes subdivisions, Leon Springs Villas & operates 4 drinking water supply wells in Hidden Springs
- One new recent ROE denial from homeowner
- In 2007, six new wells installed on-post
- One new drinking water supply well in the near future

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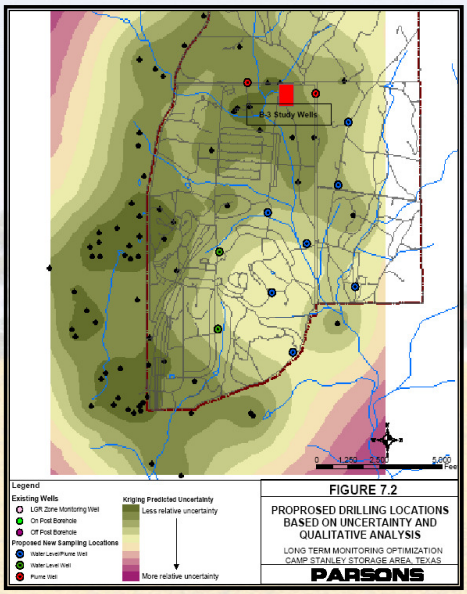
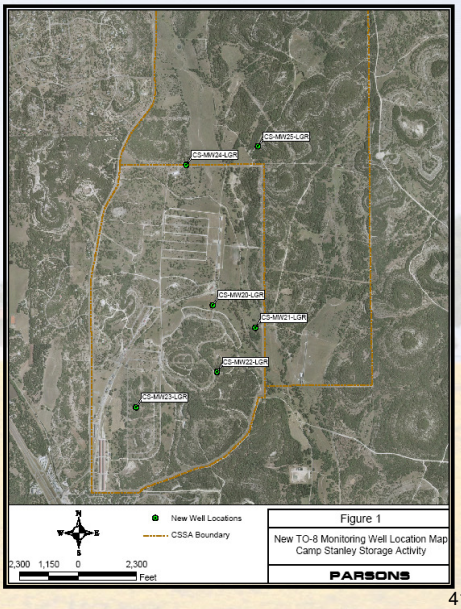
Groundwater Monitoring Program

LTMO Process and Well Selection





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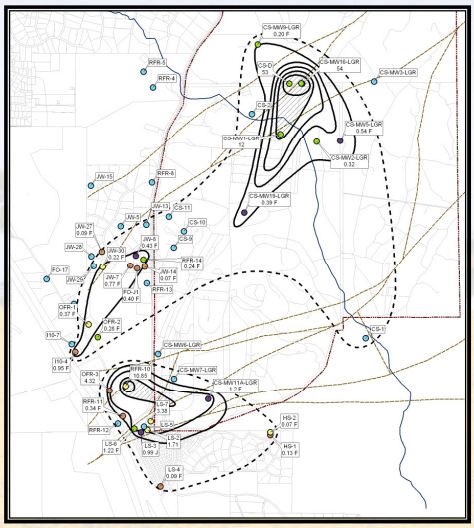
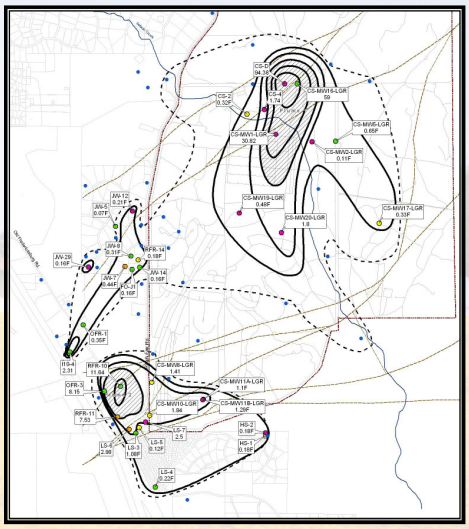
Groundwater Monitoring Program

Recent Results - PCE

2006 Composite (PCE Maximum)



2007 Composite (PCE Maximum)



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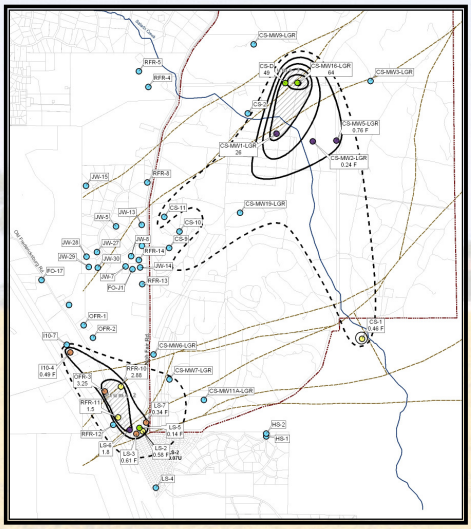
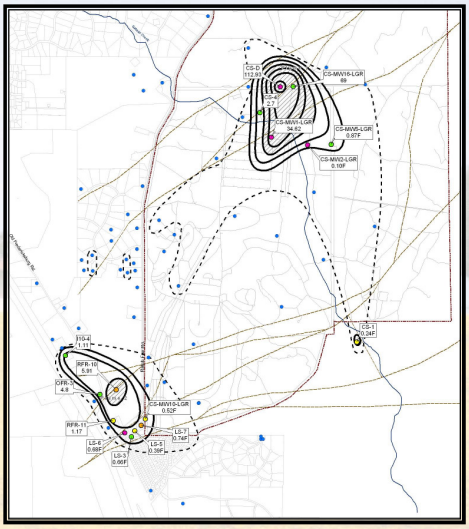
Groundwater Monitoring Program

Recent Results - TCE

2006 Composite (TCE Maximum)



2007 Composite (TCE Maximum)

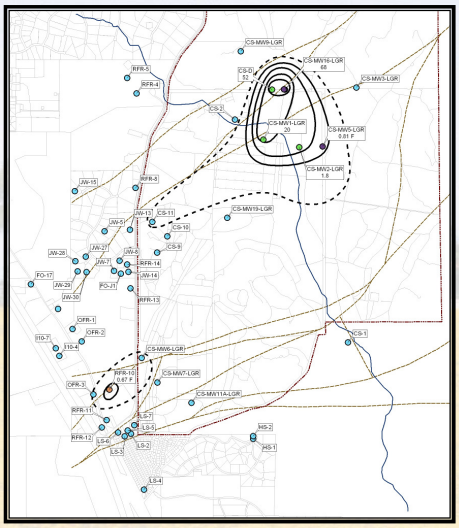


43

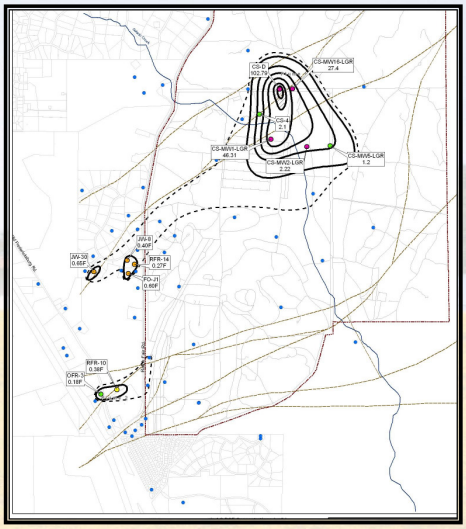
Groundwater Monitoring Program

Recent Results – *cis*-1,2-DCE

2006 Composite (DCE Maximum)



2007 Composite (DCE Maximum)



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Groundwater Monitoring Program
Recent Results

- **Metals Results:**
  - Historic results showed only sporadic MCL/AL exceedances, no consistent pattern
  - New wells CS-MW22-LGR & CS-MW25-LGR have shown consistent exceedance for lead over the past 4 quarterly monitoring events
  - AL/MCLs were exceeded for lead, chromium, & mercury in 2007
    - Cr: MW25-LGR
    - Hg: MW23-LGR
    - Pb (CS-9, CS-11, MW9-BS, MW22-LGR, MW25-LGR)

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Groundwater Monitoring Program
Metals above ALs/MCLs

Historic Metals Exceedances

Well ID	Sample Date	Pb (mg/L)	Well ID	Sample Date	Pb (mg/L)	Cd (mg/L)
	MCL	0.015		MCL	0.015	0.005
CS-1	11-Dec-95	0.023	CS-2	12-Dec-95	0.25	0.008
	19-Jan-96	0.015	CS-3	12-Dec-95	0.029	
	1-Mar-96	0.015		27-Feb-96	0.028	
	20-Mar-00	0.0172		13-Jun-06	0.018	
CS-9	13-Dec-07	0.0362		13-Sep-06	0.028	
CS-10	12-Dec-95	0.06		13-Dec-07	0.0362	
CS-11	17-Jun-02	0.0154	CS-MWG-LGR	19-Jan-96	0.048	
	13-Dec-07	0.0359		28-Feb-96	0.094	
CS-I	12-Dec-95	0.019		12-Sep-01	0.0369	
	19-Jan-96	0.022	CS-MWH-LGR	12-Dec-96	0.045	
	28-Feb-96	0.018		12-Jun-01	0.0459	
	12-Jun-01	0.0349		12-Sep-01	0.047	
	12-Sep-01	0.0193	CS-MW2-CC	25-Sep-07		0.0073
	17-Dec-01	0.0827	CS-MW9-BS	25-Sep-07	0.1065	
	13-Mar-02	0.087				

New Monitoring Well Exceedances

Well ID	Sample Date	Pb (mg/L)	Cr (mg/L)	Fe (mg/L)	Mn (mg/L)	Zn (mg/L)	Hg (mg/L)
	MCL	0.015	0.1	0.3 (SS)	0.05 (SS)	5.0 (SS)	0.002
CS-MW22-LGR	7-Jun-07	0.091		7,300M	0.067	8.0	
	1-Oct-07	0.086				6.7	
	13-Mar-08	0.04					
Duplicate	13-Mar-08	0.038					
CS-MW23-LGR	5-Jun-07			1.1			0.0078
CS-MW25-LGR	5-Jun-07	0.017		3.9			
	1-Oct-07	0.032	0.24				
	11-Dec-07	0.023	0.22				

MCL = Maximum Contaminant Level

SS = Secondary Standard

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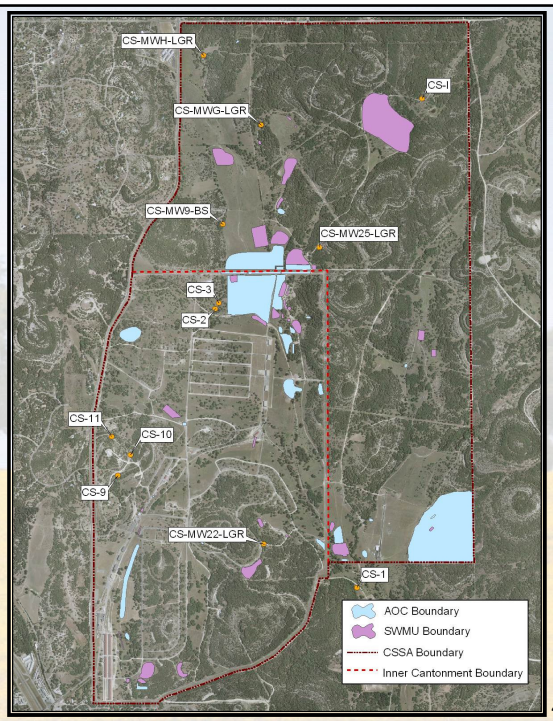
Locations of Historical Lead Action Limit (AL) Exceedances in Groundwater



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Groundwater Monitoring Program
Recommendations

- **Continue quarterly monitoring with changes:**
  - Add lead, chromium, mercury to analytical parameters
  - Drop nickel
  - "Snapshot" event of all wells
  - Additional wells to help with CSM
  - LTMO off-post

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Conceptual Site Model
Overview – May 2005 Report

- Parsons issued a Hydrogeologic Conceptual Site Model (CSM) report in May 2005
- The report characterized the geologic and hydrogeologic framework of the Middle Trinity aquifer below CSSA
- Groundwater occurrence, movement, and hydrologic budget (recharge/discharge estimates)
- The CSM summarized potential source areas, investigations, and interim measures
- Plume identification and delineation
- Recommendations

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Conceptual Site Model Update
Revision - July 2008

- **New Data Inputs**
  - 6 New LGR wells (LTMO Recommendation)
    - Geology
    - Hydrology
    - Aquifer Level
    - Plume Delineation
  - Analytical Data (2005-2007)
  - Aquifer Level Data (2005-2007)

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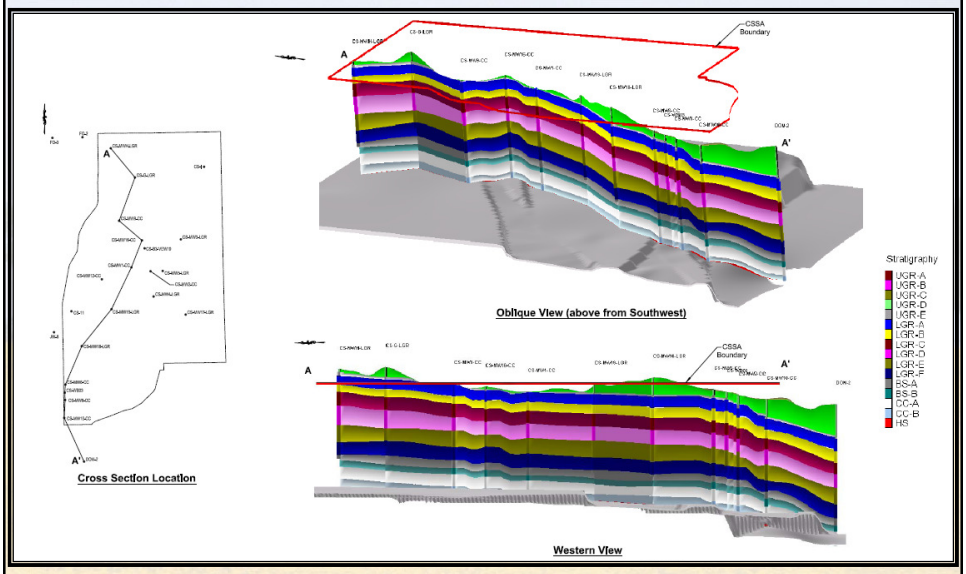
Conceptual Site Model Update

CSM Geologic Layers



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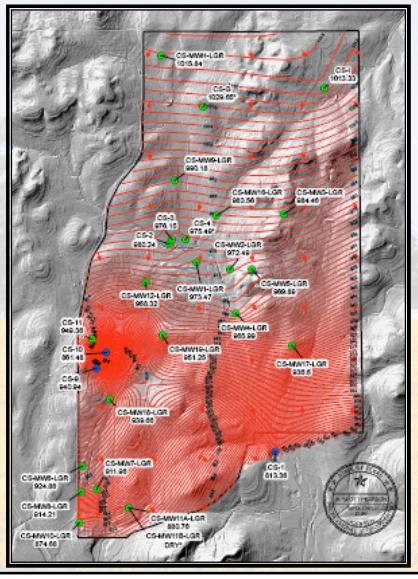
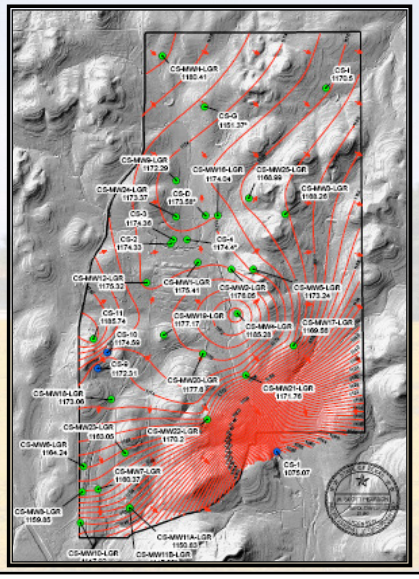
Conceptual Site Model Update

Groundwater Flow Patterns

December 2006 (Drought – 18")



September 2007 (Abnormally High – 45")



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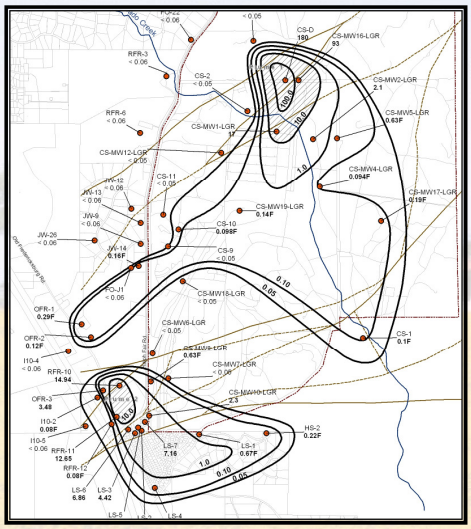
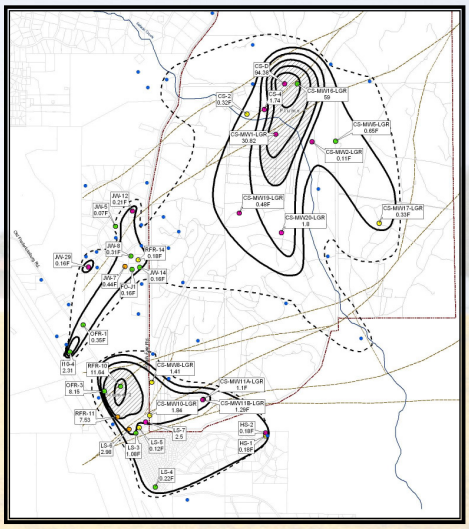
Conceptual Site Model Update

Plume History

December 2002 (PCE)



2007 Composite (PCE Maximum)



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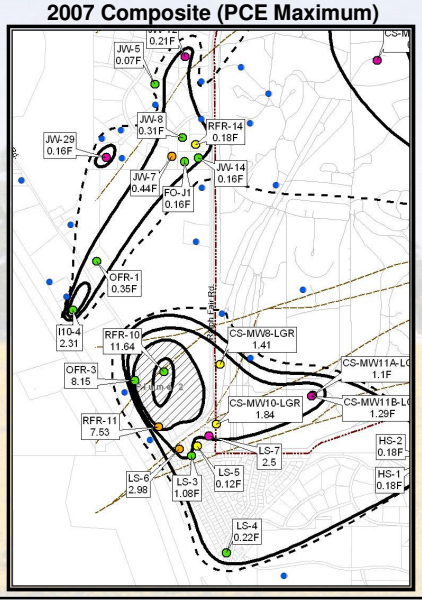
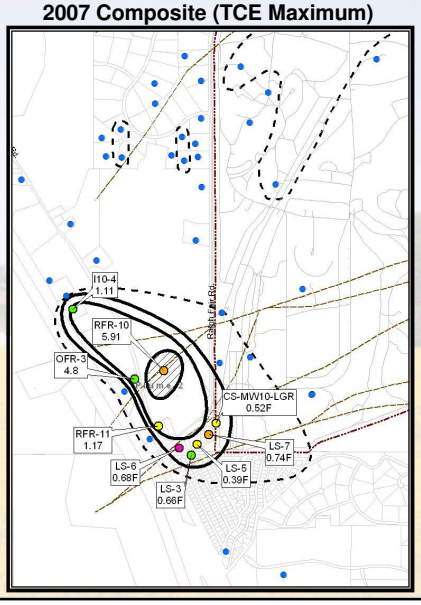
Conceptual Site Model Update

Plume Co-Mingling

2007 Composite (PCE Maximum)



2007 Composite (TCE Maximum)



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Conceptual Site Model Update
Revision - July 2008

- **Conclusions**
  - New data collected since 2005 continue to support fault-driven flow concept
  - Inorganic detections in MW22-LGR and MW25-LGR *(more info in Groundwater Section)*
  - LTMO Sampling frequency precludes the "snapshot" condition of the plume distribution
  - Concern that I10-4 off-post well has gone from "ND" (March 2002) to as high as 3.47 µg/L (June 2005) in "slugs"
  - Changes in surrounding land use has changed receptors potentially exposed to groundwater

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Conceptual Site Model Update
Additional Wells helped to focus the picture but there are unanswered questions…

- What is the flow velocity and directions away from B-3 and AOC-65?
- Are Plume 1 and 2 co-mingled west of CSSA?
- Are plumes following faults further southwest of CSSA?
- What is the significance of the groundwater mounding at MW4-LGR in the central portion of the facility?

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Conceptual Site Model Update
Revision - July 2008

- **Recommendations**
  - Quantify groundwater flow direction and velocity with Tracer tests
  - Additional wells near Plume 2 in preparation of future remediation/containment activities?

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Conceptual Site Model Update
Google Earth (GE) Tool

- **Internet-based Mapping Program**
  - Freeware internet program available at: *http://earth.google.com/*
  - Allows for 3D aerial viewing, navigating, and measuring
  - ArcView shapefiles can be easily imported as KMZ files into GE
  - Some basic layers have been created are available for your use at the CSSA FTP site:

    ftp://ftp.envirodept.net/pub/Google Earth/
  - Save **CSSA.KMZ** to your local Drive from the FTP site
  - Using File/Open within GE, navigate to **CSSA.KMZ** and open the file
  - *Note: GE imagery is off by about 85 feet. Use KMZ Image Overlay files to correct the image when detail is needed*

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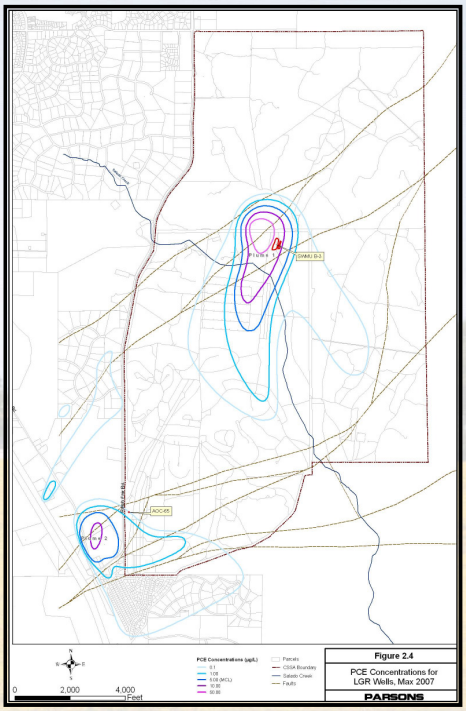
CSSA Pilot Studies

Update July 2008

1. **SWMU B-3 Bioreactor Pilot Study -** designed for an enhanced anaerobic bioremediation of chlorinated hydrocarbons within the underlying fracture limestone in the area of Plume 1.
2. **AOC-65 Soil Vapor Extraction Pilot Study -** designed for removal of chlorinated hydrocarbons within the underlying fracture limestone in the area of Plume 2.



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Bioreactor Pilot Study Objective

Review

- Determine if the bioreactor is an effective approach for treatment of groundwater at SWMU B-3 (Plume 1).
- Determine the extent of bioreactor influence on the effectiveness of treatment in the vadose intervals.
- Evaluate the migration of contaminants through the underlying formations and into the underlying aquifer.

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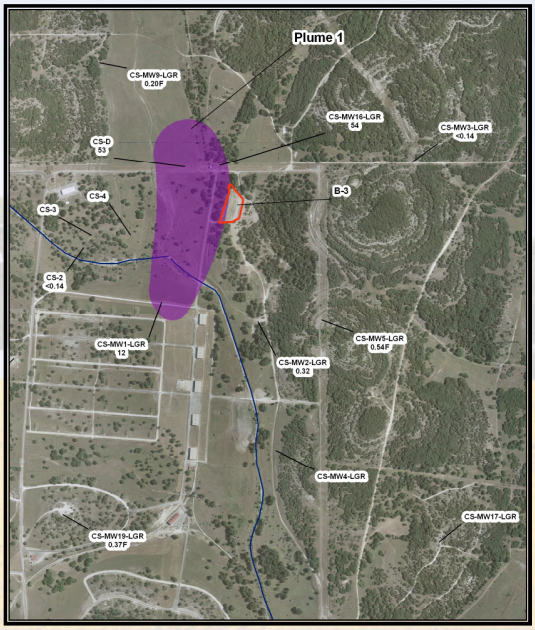
SWMU B-3 Bioreactor Update

Overview

Chlorinated volatile organic compounds (CVOCs) PCE, TCE, and cis-1,2DCE are present in groundwater underlying Camp Stanley Storage Activity (CSSA).

Right: Aerial photograph showing the estimated PCE plume 1 boundary (5 µg/L) for initial start-up year 2006.



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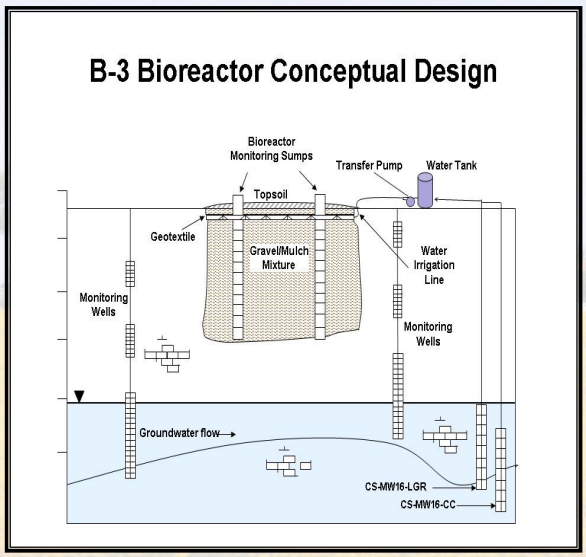
SWMU B-3 Bioreactor Update

Conceptual Design



Water from the bioreactor infiltrates through the vadose portions of the formation and is intended to enhance biological treatment of contaminants.

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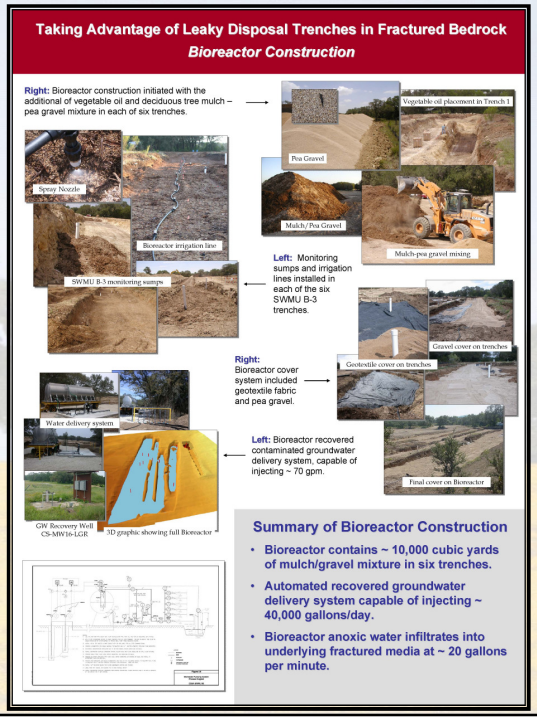
SWMU B-3 Bioreactor Update

Construction

A bioreactor was constructed in disposal trenches that were converted into a bioreactor after waste and debris were removed.

Right: Battelle Conference poster detailing CSSA's SWMU B-3 Bioreactor Construction.



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SWMU B-3 Bioreactor Update

Construction

The bioreactor requires delivery of groundwater and/or precipitation to maintain saturated conditions as it sits above the water table (between 100-300 feet bgs).

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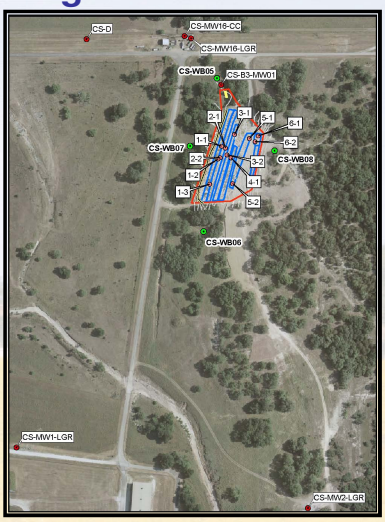
SWMU B-3 Bioreactor Update

Monitoring

Westbay® monitoring equipment.



Aerial photograph of the area surrounding the bioreactor at SWMU B-3 showing monitoring locations.

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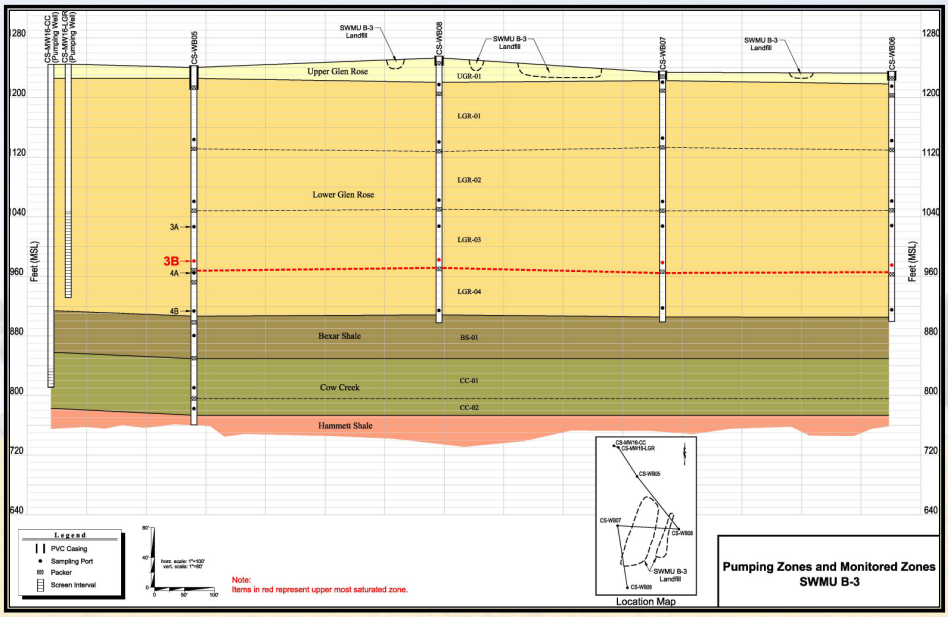

Geologic cross-section depicting the stratigraphic units and formation, and corresponding MPMW discrete screened intervals.

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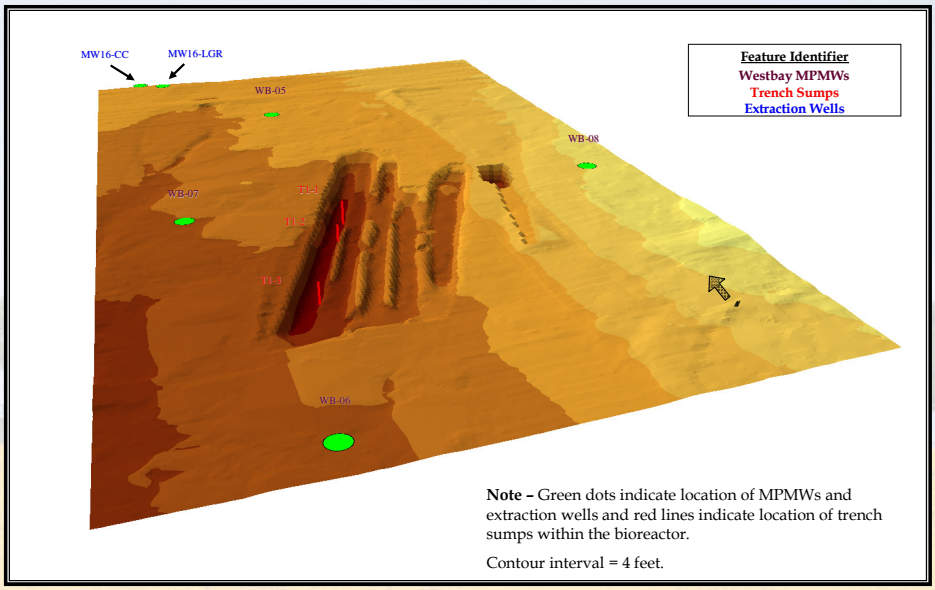

Image depicting the area surrounding the bioreactor at CSSA with trench sump, MPMW, and extraction well locations relative to bioreactor.

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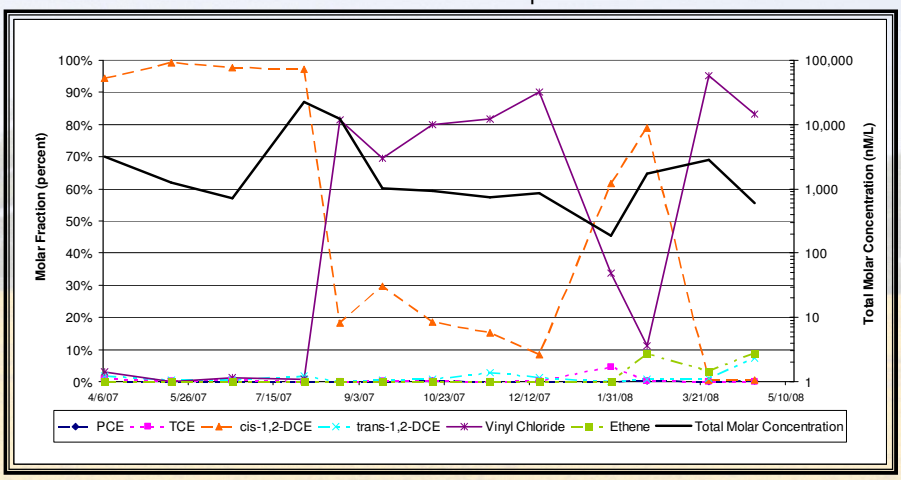
Bioreactor Pilot Study Observations

Update July 2008

Trench Sump 1-2 Mole Fractions and Total Molar Concentrations Through 12 Months of Bioreactor Operations



Trench sump data through the initial 12 months of bioreactor operations indicate reductive dechlorination to ethene is occurring in the bioreactor.

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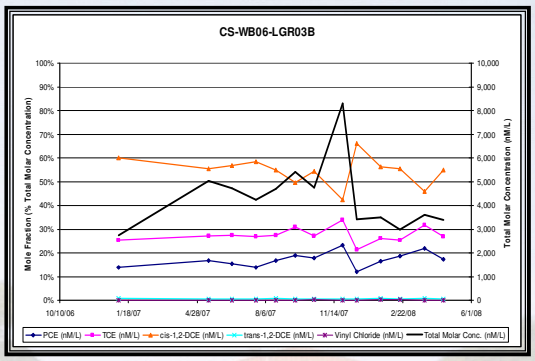
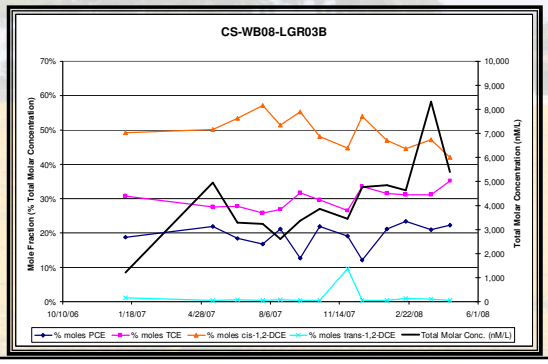
Bioreactor Pilot Study Observations

Update July 2008

Right: Westbay 06 – LGR03B
CVOC degradation is occurring

Below: Westbay 08 – LGR03B
CVOC flushing from SWMU B-3





Total molar concentrations and Mole fractions of groundwater in MPMWs CS-WB06 and CS-WB08, LGR03B zone

Total Molar Concentration scale (right axis)

0 – 10,000 nM/L

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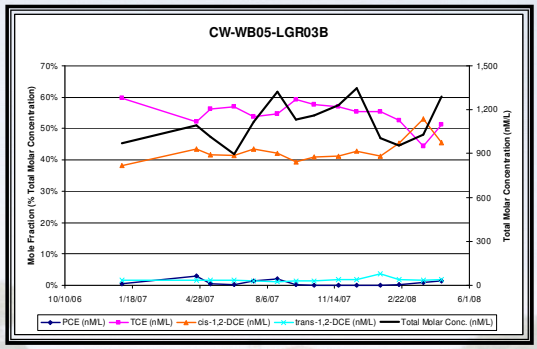
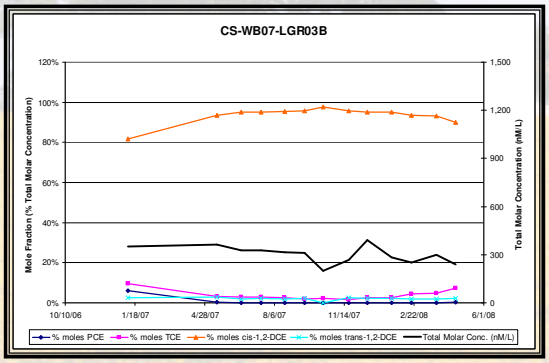
Bioreactor Pilot Study Observations

Update July 2008

Right: Westbay 05 – LGR03B
Connected to CS-MW16-LGR

Below: Westbay 07 – LGR03B





Total molar concentrations and Mole fractions of groundwater in MPMWs CS-WB05 and CS-WB07, LGR03B zone

Total Molar Concentration scale (right axis)

0 – 1,500 nM/L

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Bioreactor Pilot Study Observations

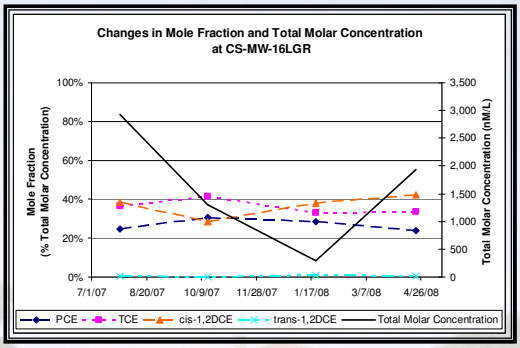
Update July 2008

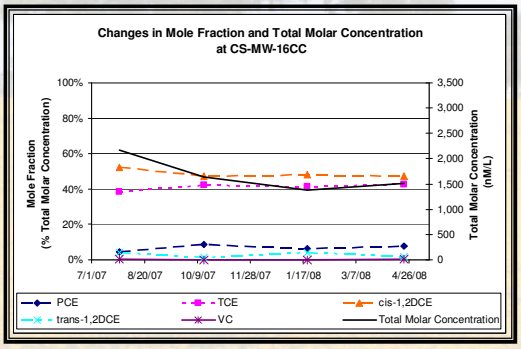
Right: CS-MW–16LGR

Increase in total molar mass due to flushing of vadose zone under Bioreactor?

Below: CS-MW–16CC

VC observed at 0.25 µg/L





Total molar concentrations and Mole fractions of groundwater in extraction wells.

Total Molar Concentration scale (right axis)

0 – 3,500 nM/L

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Bioreactor Pilot Study Observations

Update July 2008

- The Bioreactor is an effective method for treatment of injected contaminated groundwater.
- Continued increase in molar mass of CVOCs in underlying multipoint monitoring well intervals provides strong evidence that significant contaminant concentrations remain in the fractured bedrock formation.
- Data through 12 months of operation shows potential flushing of CVOCs within unsaturated fractured media underlying the bioreactor.
- Additional data is required to determine the effectiveness of the bioreactor to treat contamination in the underlying fractured bedrock.

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SWMU B-3 Bioreactor Update

Bioaugmentation of Trench 1

- Parsons added 21 liters of KB-1 culture (SiRem) in early February 2008.
- Within 2 weeks ethene was detected and has been consistently detected since then, but at low concentrations.
- Dissolved hydrogen (DH) remain consistently in the range desired to promote microbial dechlorination.
- Dissolved organic carbon (DOC) levels have decreased but microbial populations remained relatively robust; DOC may not be the best measure to track performance of bioreactor.

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SWMU B-3 Bioreactor Update

Bioaugmentation With KB-1

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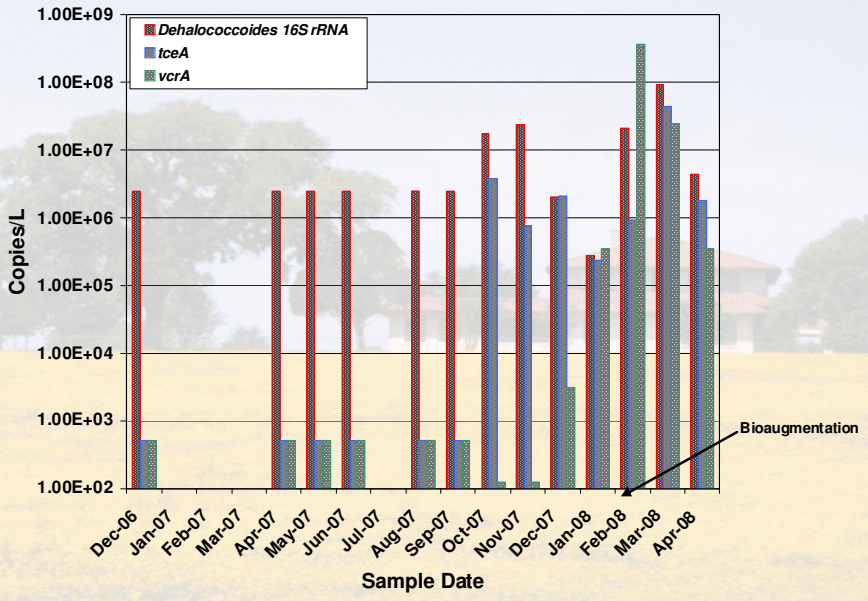
SWMU B-3 Bioreactor Update

Post-bioaugmentation PCR Results - Trench 1



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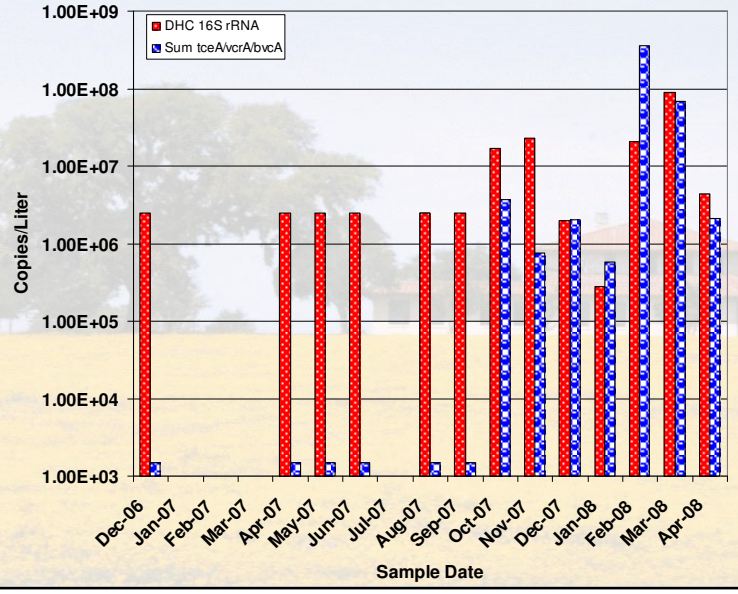
SWMU B-3 Bioreactor Update

Total Dehalogenase vs 16S rRNA



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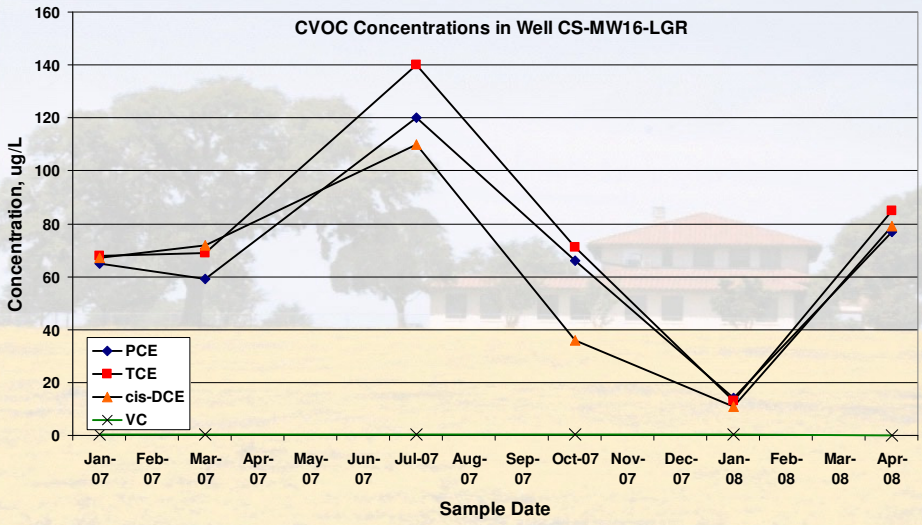
SWMU B-3 Bioreactor Update

CVOC Concentrations in CS16-LGR



77

SWMU B-3 Bioreactor Update

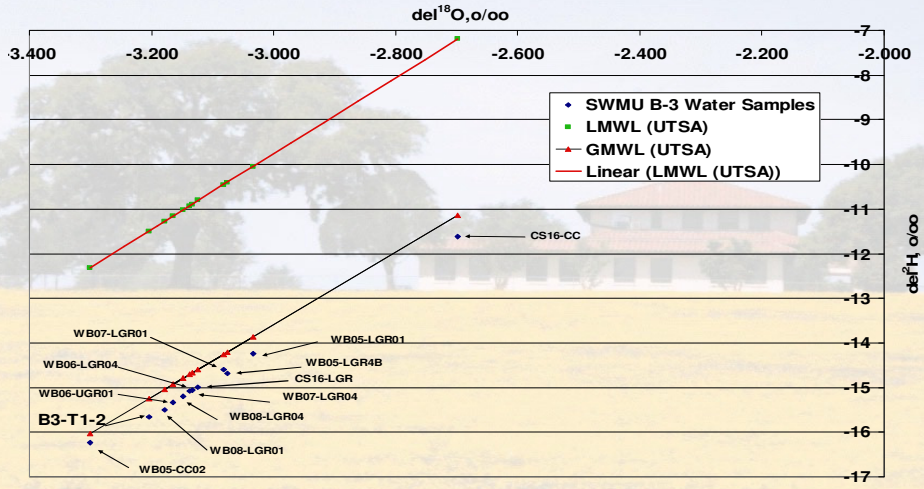
Post-bioaugmentation Results

- Addition of KB-1 culture increased *Dehalococcoides* 16S rRNA copies about 2 orders of magnitude.
- *vcrA* copies increased significantly.
- Population decreasing recently for unknown reason.
- Metabolic profile of *Dehalococcoides* population did not change substantially after addition of KB-1.
- Ethene detected in bioreactor trench, but why this required addition of KB-1 culture is still unknown.
- Early in project dechlorination occurred despite the absence of measurable levels of the genes responsible for dechlorination; either other genes in the DHC genome or other microbes or an abiotic mechanism were responsible for the dechlorination activity until November 2007 when the # of copies of *tceA* increased by four orders of magnitude.

78

SWMU B-3 Bioreactor Update

O and H Isotope Analysis of SWMU B-3 Water



79

SWMU B-3 Bioreactor Update

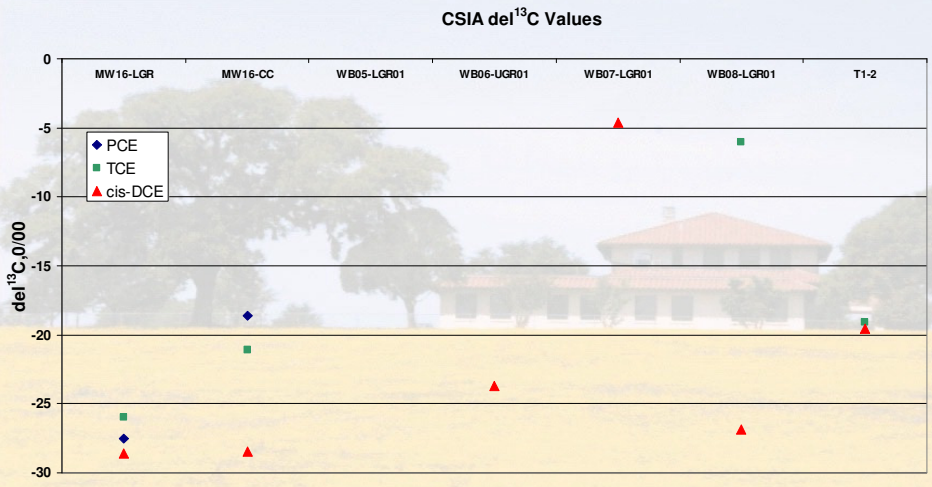
Interpretation of Water Isotope Data

- Groundwater from CS16-LGR is isotopically different from CS16-CC groundwater
- Groundwater from WB05-CC02 is isotopically different from CS16-CC groundwater; mixing with another source of groundwater?
- Water from B3-T1-2 is isotopically depleted, like sample from WB05-CC02, but unlike the source of its water
- Water from WB08 and WB06 cluster at one end of the data set while water from WB05 and WB07 are more isotopically enriched; this may indicate that a barrier or divide segregates the flow of groundwater under the bioreactor and that the groundwater originates from different sources

80

SWMU B-3 Bioreactor Update

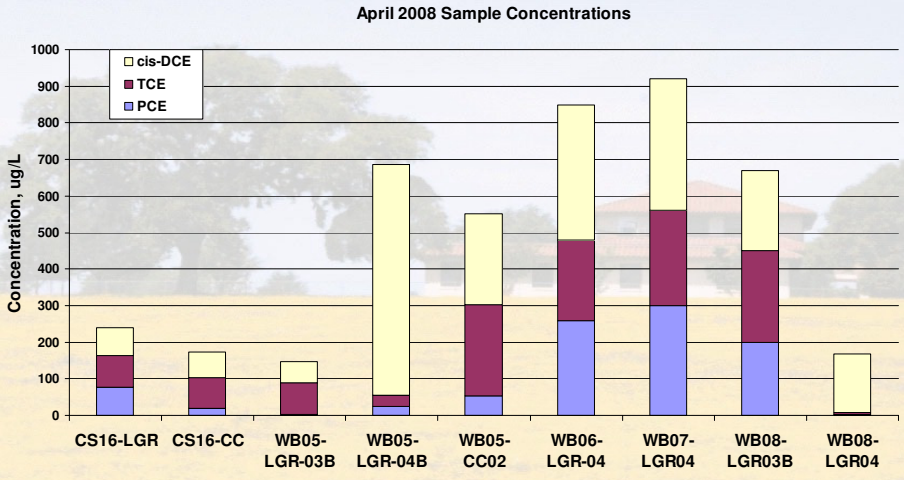
SWMU B-3 Carbon Stable Isotope Analysis



81

SWMU B-3 Bioreactor Update

CVOC Concentrations – April 2008



82

SWMU B-3 Bioreactor Update
CVOC Isotope Results

- The carbon isotope results for CVOCs from WB08-LGR are isotopically distinct from the results for the other samples; this suggests that TCE (PCE) in that well sample either has a different source or a different mechanism for formation from PCE
- The ratios of PCE:TCE:cis-DCE in samples from wells WB06, WB07, and WB08 are quite similar, and different from the ratios in samples from the other wells; this suggests a similar source and/or process for dechlorination
- CVOC ratios in samples from WB08-LGR03B and WB08-LGR04 are very different
- We need more O, H, and C isotope data as a time series to determine if different sources or dechlorination mechanisms are leading to the results for WB08

83

SWMU B-3 Bioreactor Update
Monitoring Schedule

- CSSA requested modification of the regulatory UIC permit monitoring schedule and reporting requirements by letter dated April 24, 2008.
- Performance monitoring schedule will continue as originally planned. However, CSSA will report performance monitoring data quarterly.

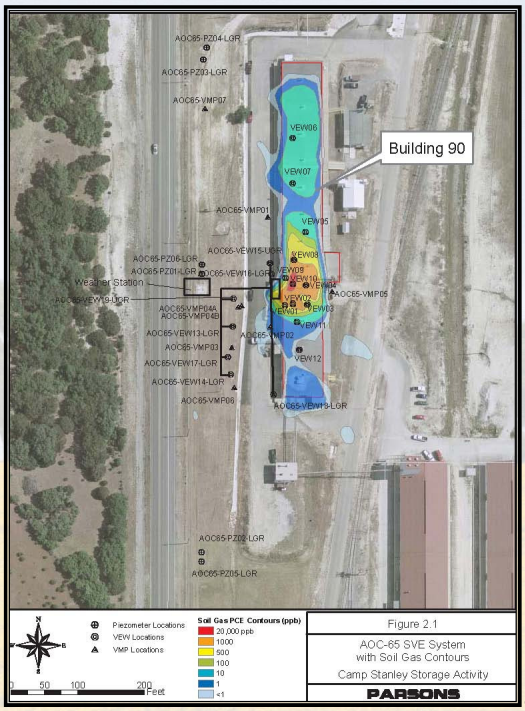
84

AOC-65 SVE Pilot Study

Overview

Soil Vapor Extraction (SVE) system initially installed in December 2002. System constructed with two blowers and 12 vapor extraction wells (VEW) located inside Building 90 and 7 VEWs west of Building 90.

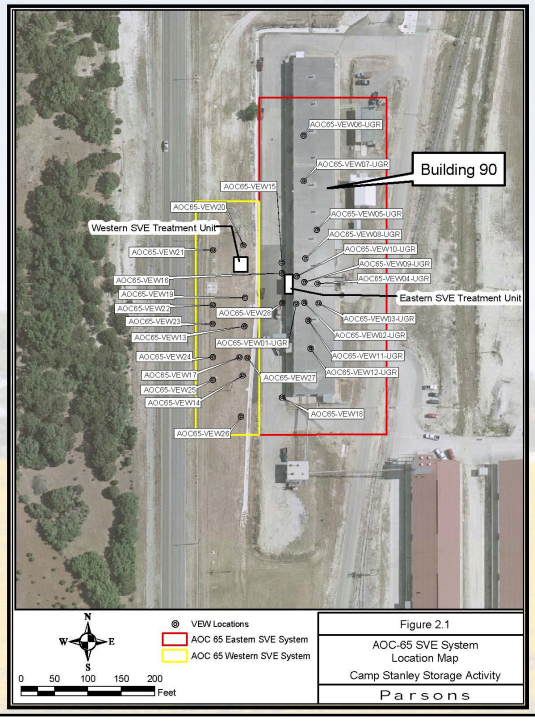
Right: Aerial photograph of the original 2002 AOC-65 SVE system with soil gas plume data.



85

AOC-65 SVE Pilot Study

Overview



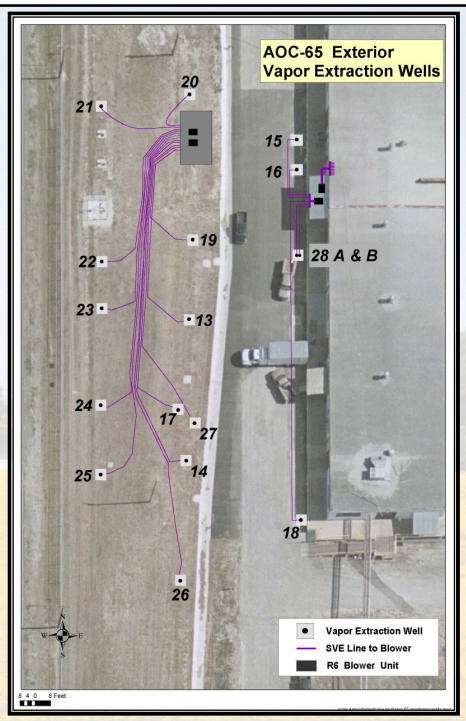
SVE system expanded with the addition of 10 new VEWs west of Building 90 with two additional blowers (Western SVE Treatment Unit).

Left: Aerial photograph of the original 2008 AOC-65 SVE system

86

AOC-65 SVE Pilot Study
Overview

Figure showing location of VEWs and Blower units within AOC-65 exterior SVE system.



87

AOC-65 SVE Pilot Study
Objective

- Determine if SVE is an effective approach for removal of CVOC from the underlying limestone formation.
- Determine the effectiveness of SVE removal on groundwater concentrations within AOC-65 monitoring well network.

88

SVE Pilot Study Observations

Update July 2008

- SVE appears to be removing significant amounts of CVOCs from the underlying limestone formation. The estimated removal rate of PCE (based on analytical data from average of sampling events) for the SVE system is:
  - ‘eastern’ SVE system = 15 to 100 lb/yr; and
  - ‘western’ SVE system = 5 to 700[1] lb/yr.
- Emissions continue to be within permit by rule (PBR) allowable emission limitations.

- Note 1 – Estimated removal rate from initial sampling of newly installed SVE extraction wells.

89

SVE Monitoring Schedule

Update July 2008

- Twice monthly systems checks (blowers, vacuum relief valves, knock-out pots).
- Monthly field data collection (flows, vacuum, temperature, VOC, O_2 and CO_2)
- Semi-annual samples collected from new VEWs and all blower discharge streams.

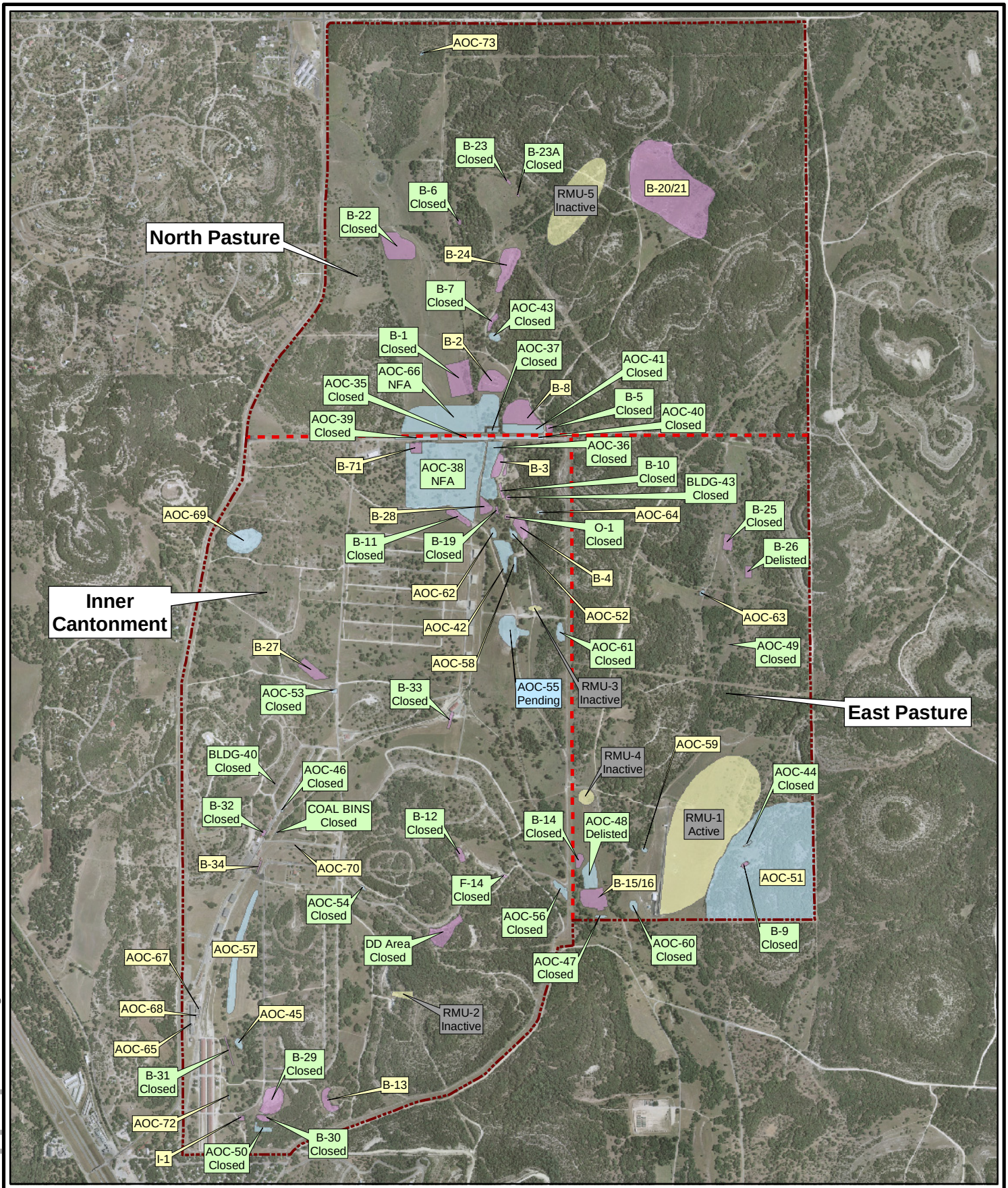
90

Open Discussion

- Follow-up questions
- Next meeting

91

ATTACHMENT C
Other Handouts



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AOC Boundary
SWMU Boundary
RMU Boundary
RMU-1 is the only active RMU.
CSSA Boundary
Inner Cantonment, North and East Pasture Boundaries

Figure x-x

Location and Status of Sites

Camp Stanley Storage Activity

P a r s o n s

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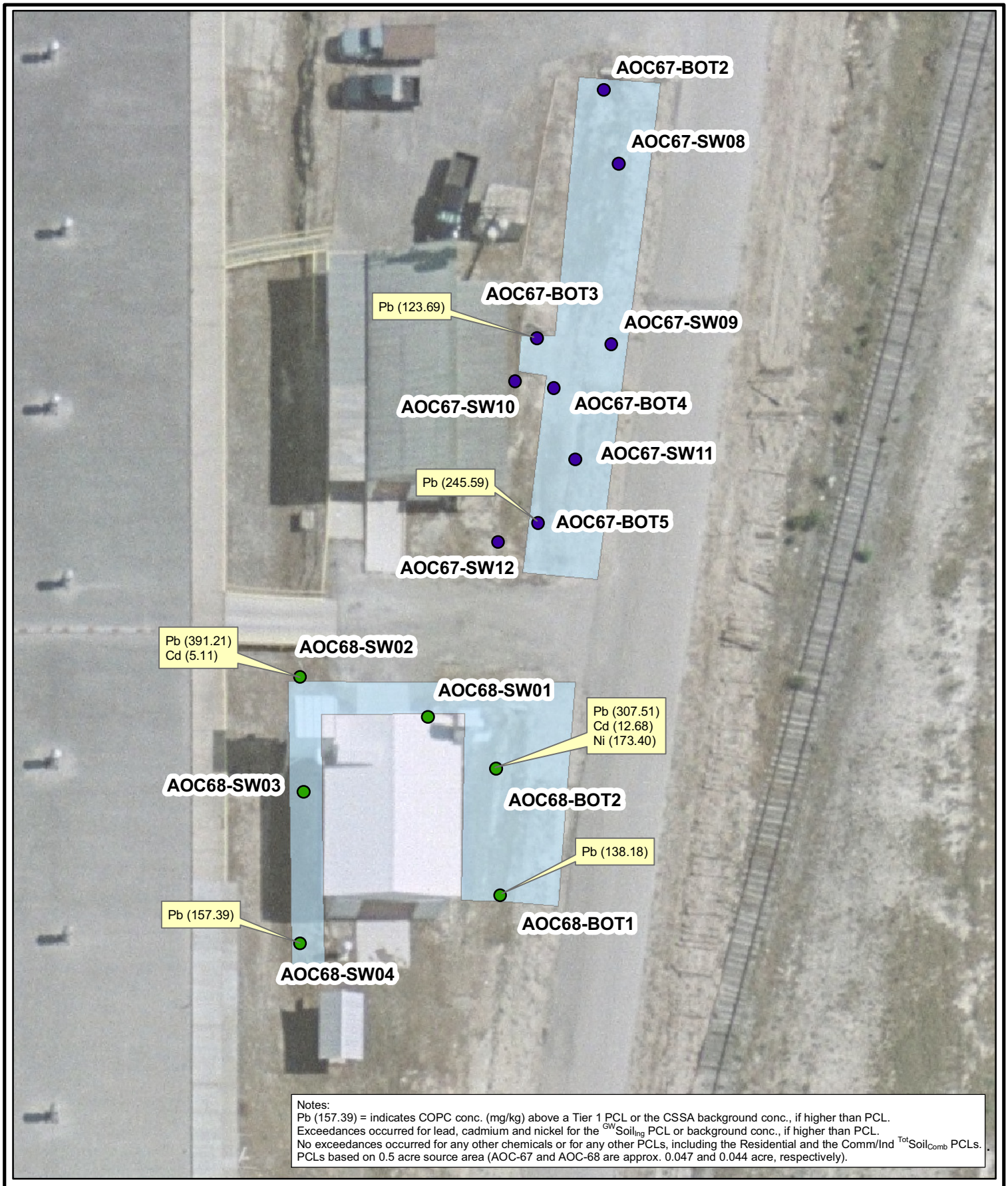
HANDOUT #1



Notes:
Pb (157.39) = indicates COPC conc. (mg/kg) above a Tier 1 PCL or the CSSA background conc., if higher than PCL.
Exceedances occurred for lead, cadmium and nickel for the $^{GW}Soil_{Ing}$ PCL or background conc., if higher than PCL.
No exceedances occurred for any other chemicals or for any other PCLs, including the Residential and the Comm/Ind $^{Tot}Soil_{Comb}$ PCLs.
PCLs based on 0.5 acre source area (AOC-67 and AOC-68 are approx. 0.047 and 0.044 acre, respectively).

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0 12.5 25 50 Feet

AOC-67 Soil Samples
AOC-68 Soil Samples

Figure

AOC-67 and 68
Site Map and Soil
Sampling Results (Dec 2007)

PARSONS

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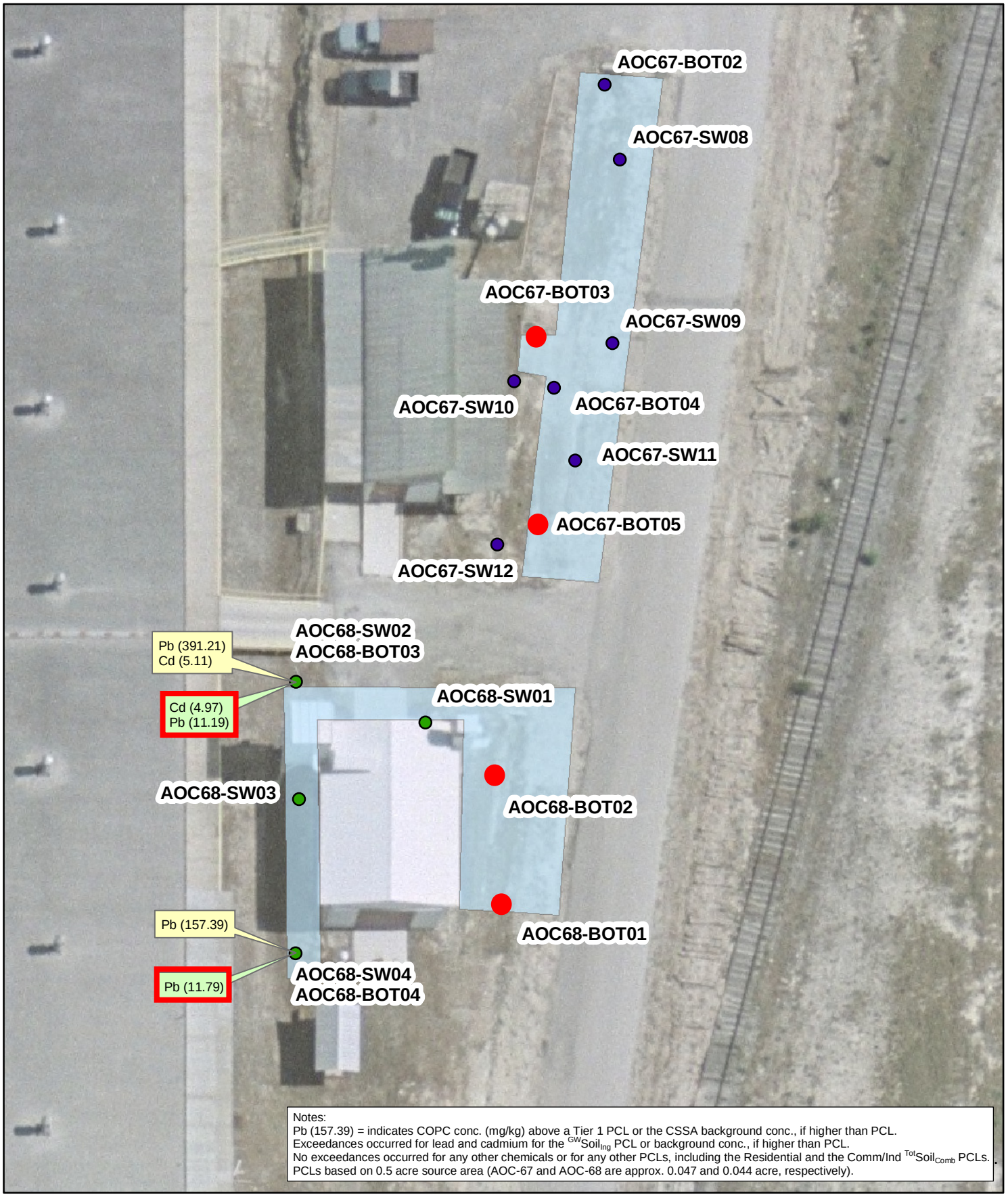
HANDOUT #2



Notes:
Pb (157.39) = indicates COPC conc. (mg/kg) above a Tier 1 PCL or the CSSA background conc., if higher than PCL.
Exceedances occurred for lead and cadmium for the $^{GW}Soil_{Ing}$ PCL or background conc., if higher than PCL.
No exceedances occurred for any other chemicals or for any other PCLs, including the Residential and the Comm/Ind $^{Tot}Soil_{Comb}$ PCLs.
PCLs based on 0.5 acre source area (AOC-67 and AOC-68 are approx. 0.047 and 0.044 acre, respectively).

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AOC-67 Soil Samples
AOC-68 Soil Samples
Dec 07 Sample Results
April 08 Sample Results

Figure

AOC-67 and 68
Site Map and Soil Sampling
Results (Dec 2007 & Apr 2008)

P A R S O N S

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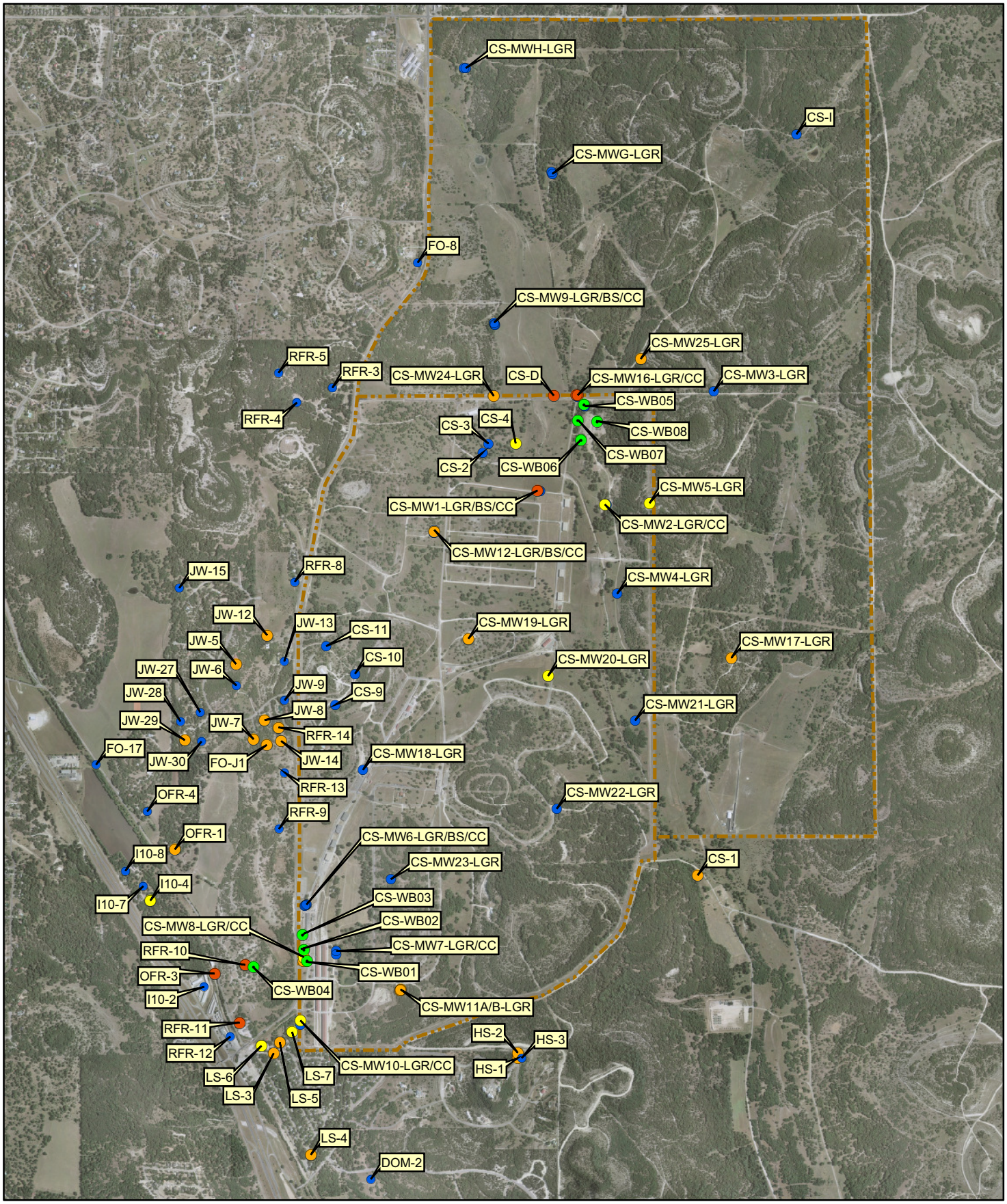
HANDOUT #3



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2007 Sampled Wells

- Wells with VOC concentration > MCL
- Wells with VOC concentration between RL and MCL
- Wells with VOC concentration below RL
- Other Non-detect Wells
- Multi-Port Westbay Wells
- CSSA Fenceline

Figure 1.1

2007 Sampled On-Post and Off-Post Ground Water Wells
Camp Stanley Storage Activity

PARSONS

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HANDOUT #4

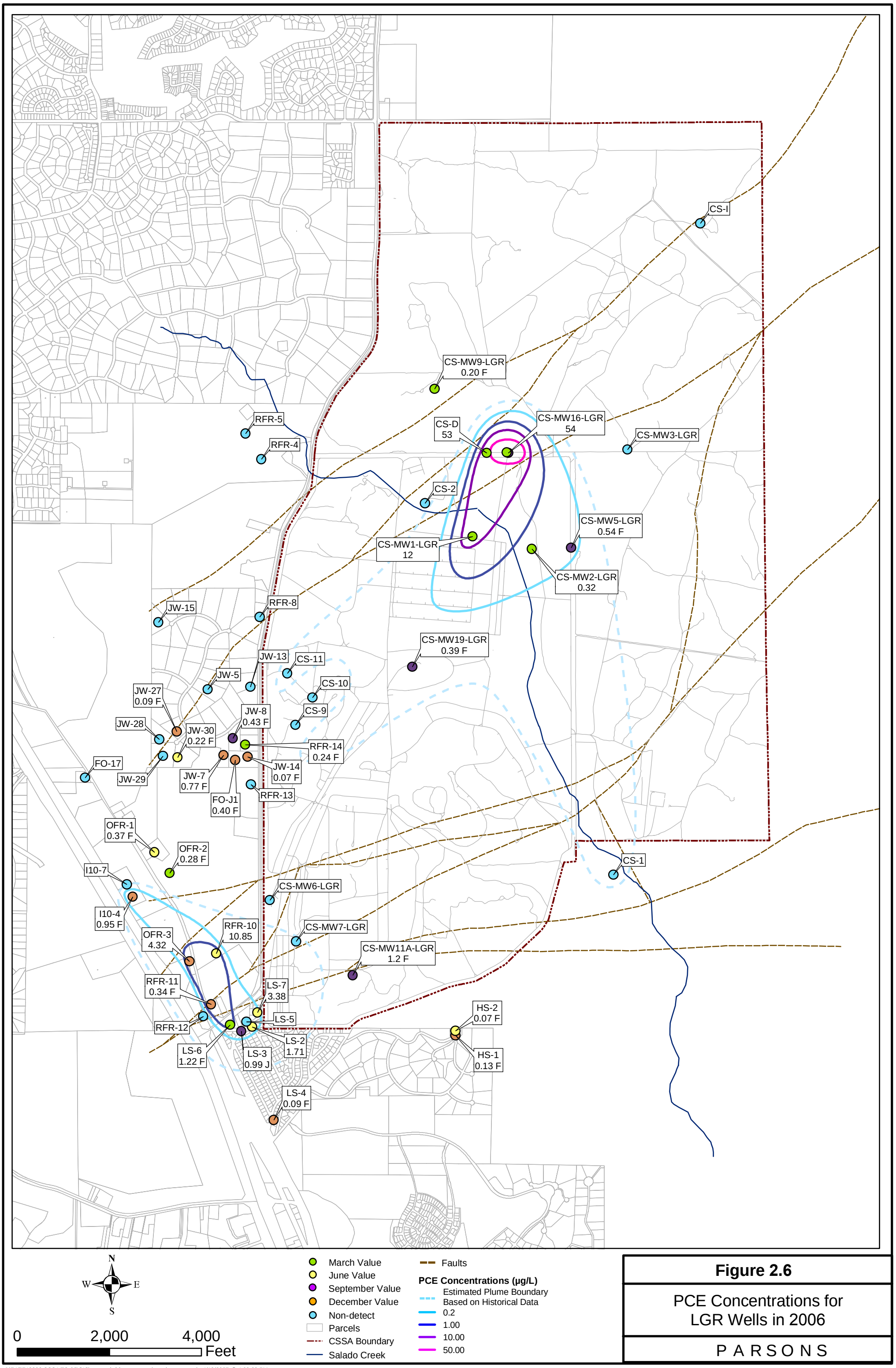

Figure 2.6

PCE Concentrations for LGR Wells in 2006

P A R S O N S

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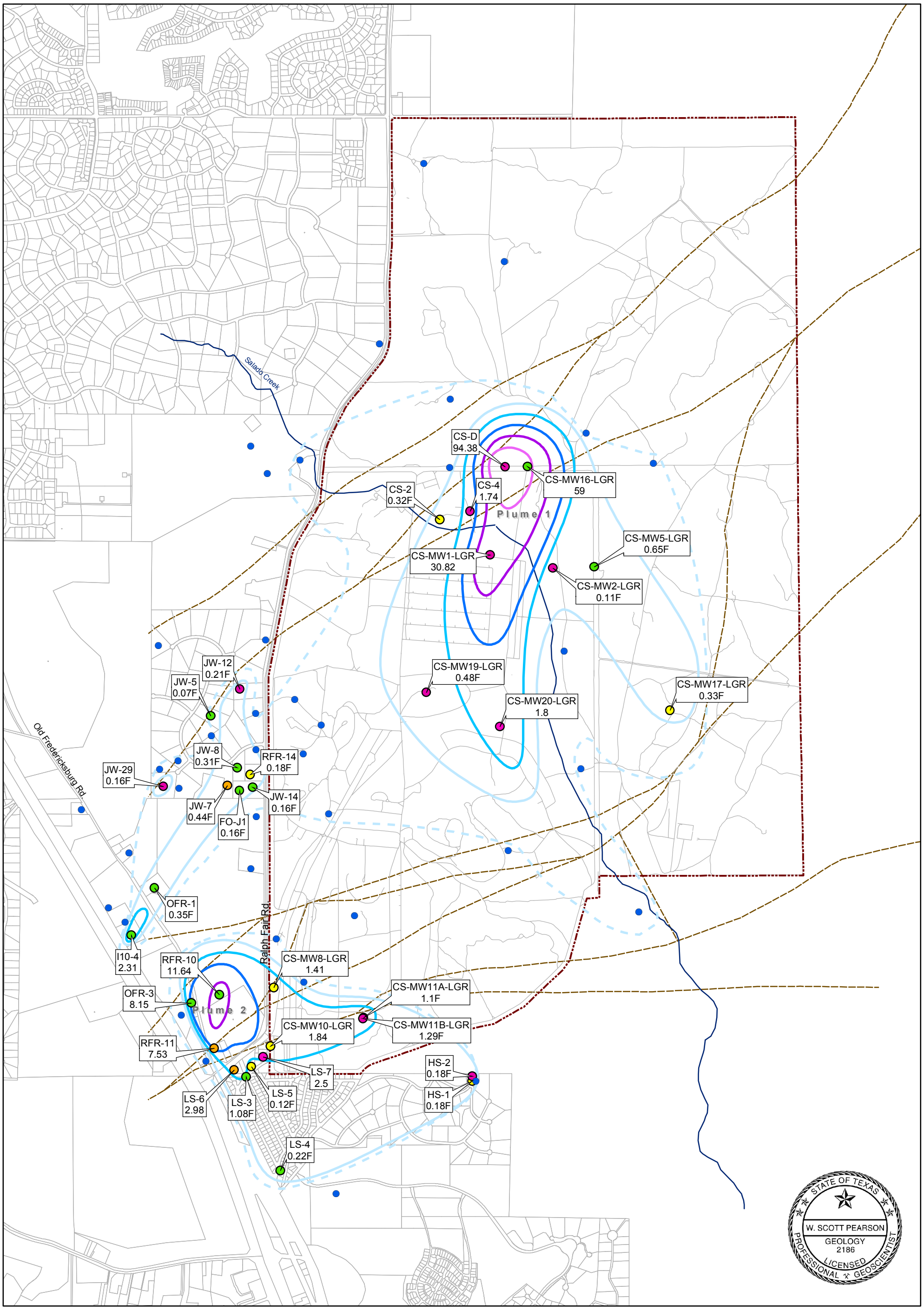

Figure 2.4

PCE Concentrations for LGR Wells, Max 2007

PARSONS

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HANDOUT #6

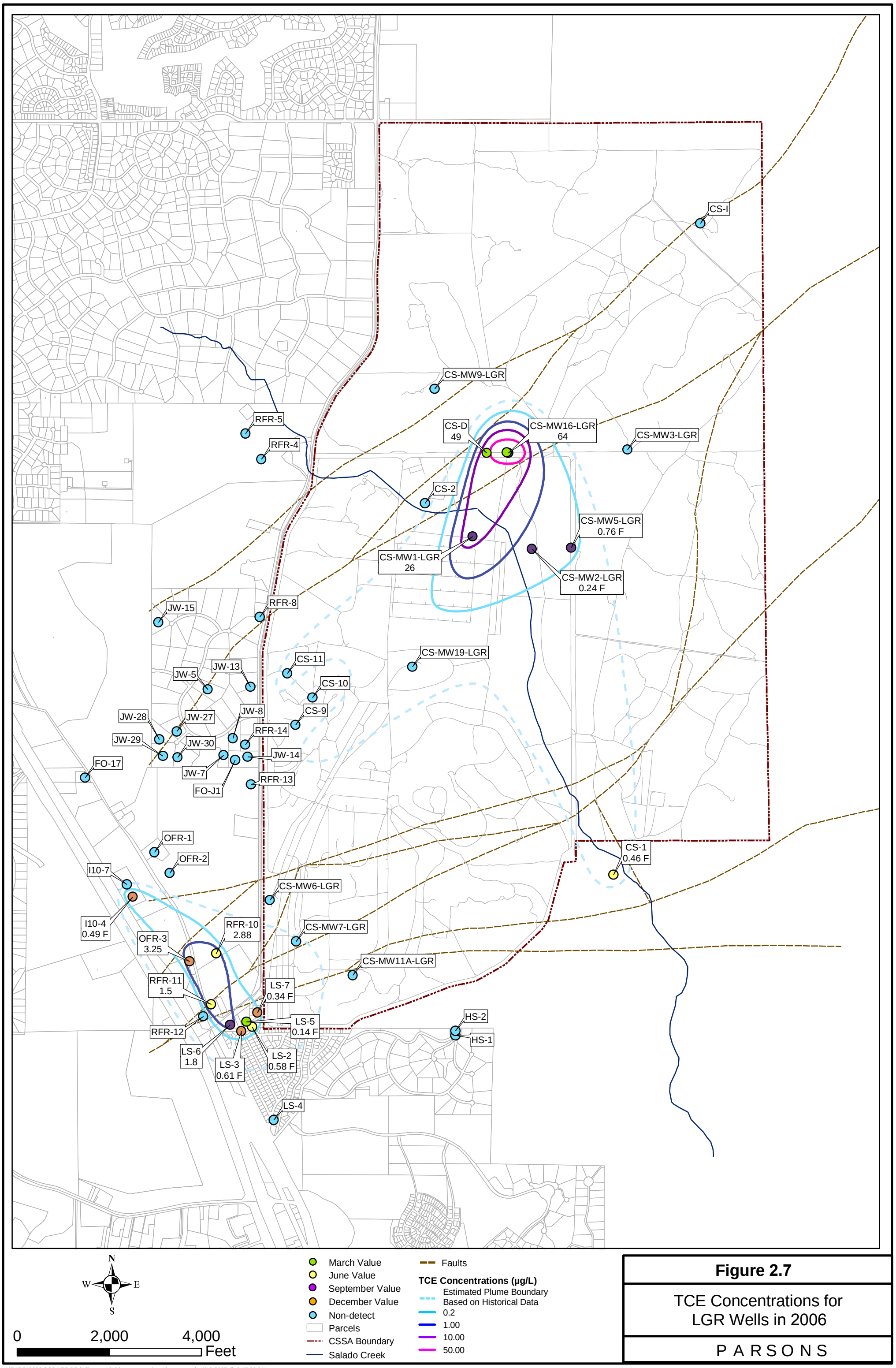

Figure 2.7

TCE Concentrations for LGR Wells in 2006

P A R S O N S

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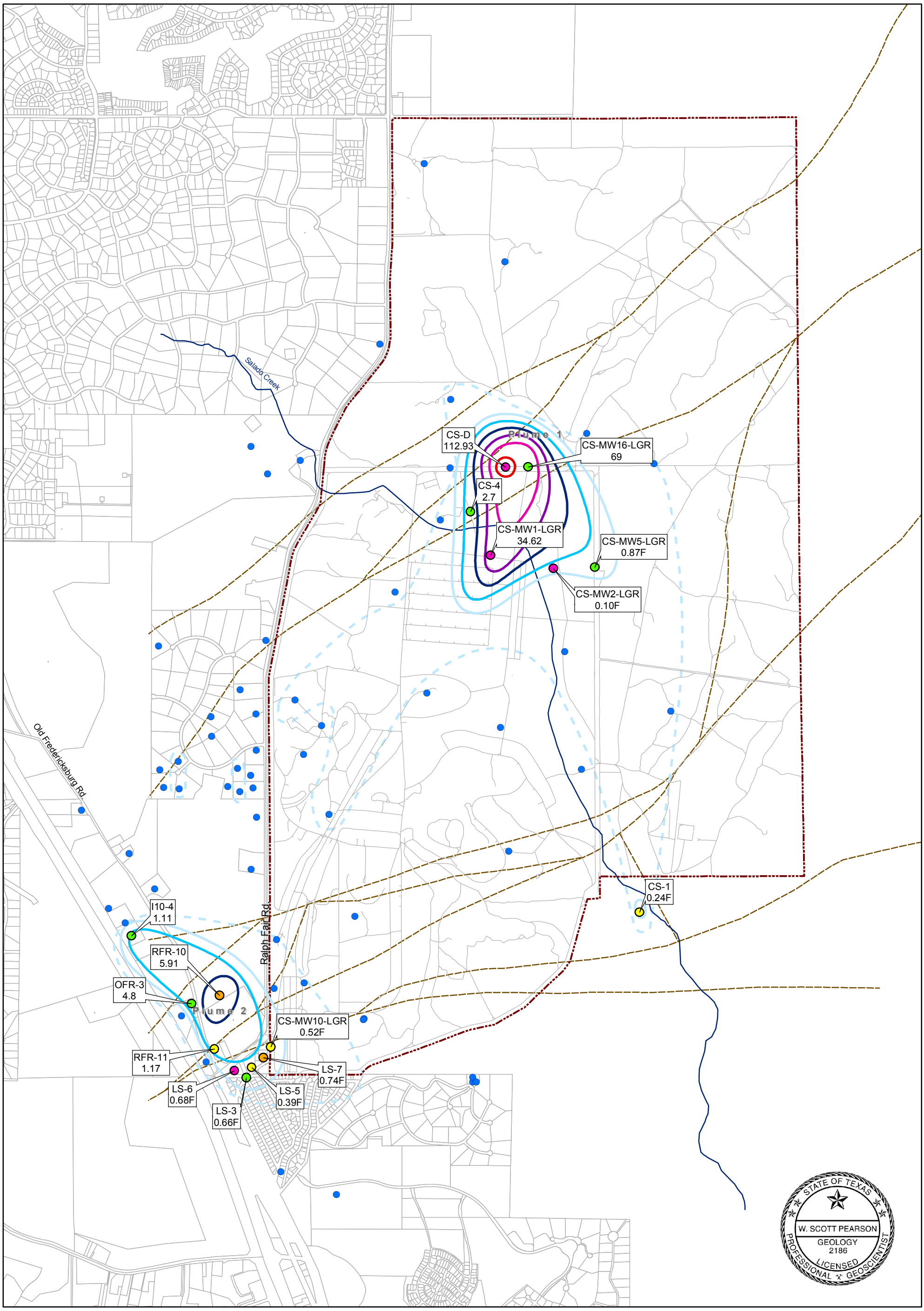
HANDOUT #7



N
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Wells

- March Values
- June Values
- September Values
- December Values
- Non-Detect in 2007

TCE Concentrations (µg/L)

- Estimated Plume Boundary Based on Historical Data
- 0.1
- 1.00
- 5.00 (MCL)
- 25.00
- 50.00
- 100.00

- Parcels
- CSSA Boundary
- Salado Creek
- Faults

Figure 2.5

TCE Concentrations for LGR Wells, Max 2007

PARSONS

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HANDOUT #8

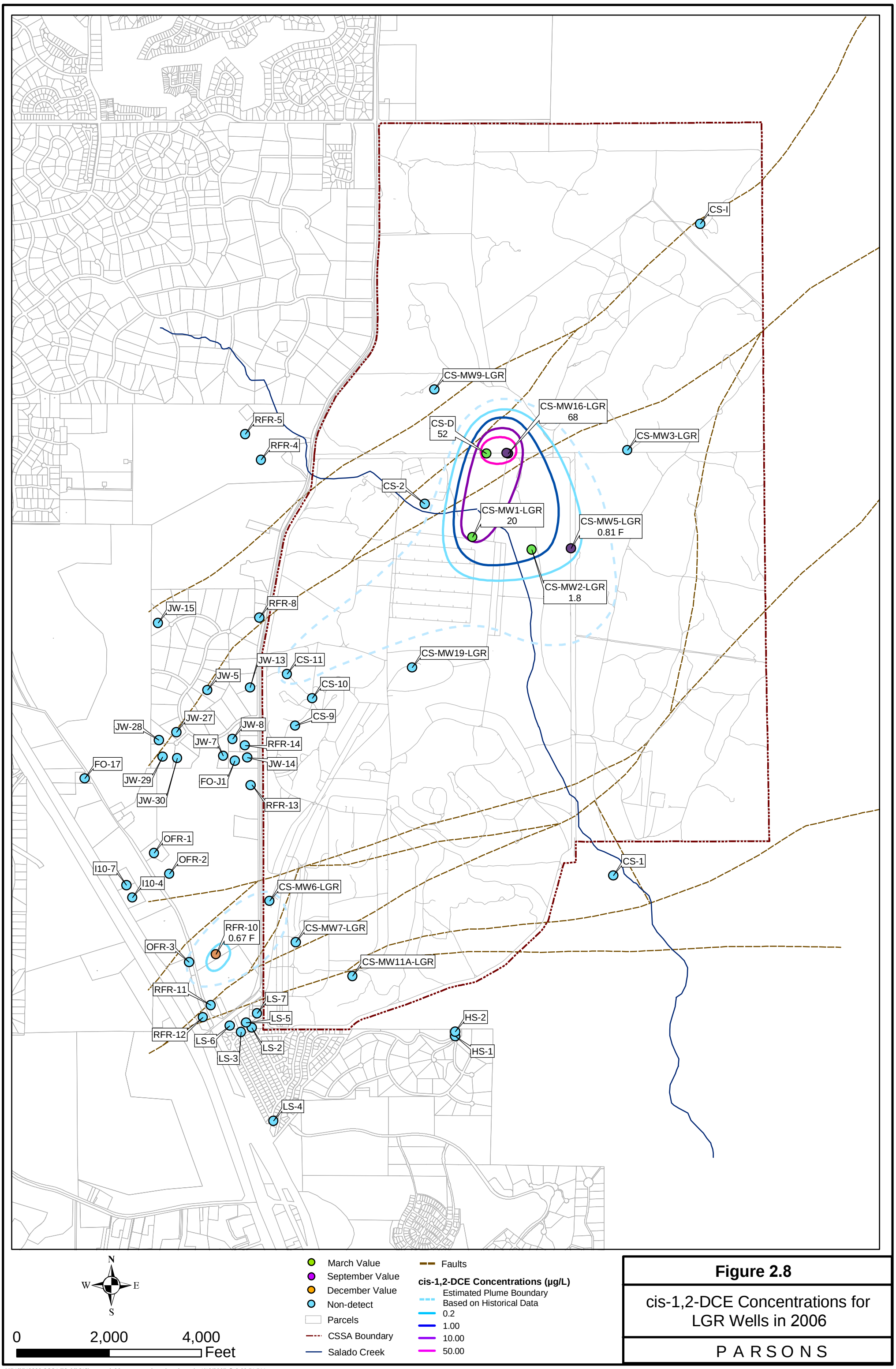

Figure 2.8

cis-1,2-DCE Concentrations for LGR Wells in 2006

P A R S O N S

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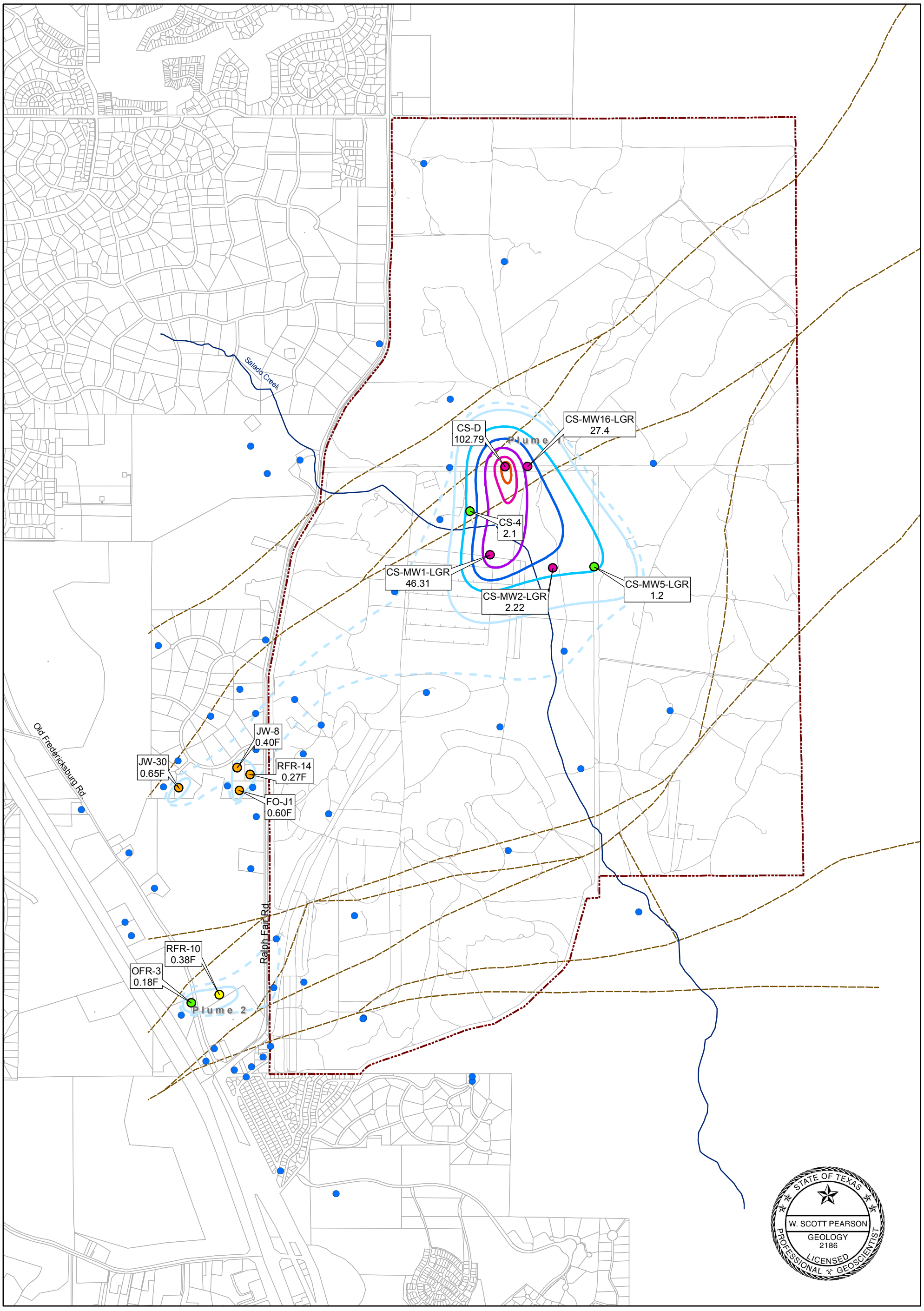
HANDOUT #9



N
W E
S

0 2,000 4,000 Feet

Wells

- March Values
- June Values
- September Values
- December Values
- Non-Detect in 2007

cis-1,2-DCE Concentrations (µg/L)

- Estimated Plume Boundary Based on Historical Data
- 0.1
- 1.00
- 5.00
- 35.00
- 70.00 (MCL)
- 100.00

- Parcels
- CSSA Boundary
- Salado Creek
- Faults

Figure 2.6

cis-1,2-DCE Concentrations for LGR Wells, Max 2007

PARSONS

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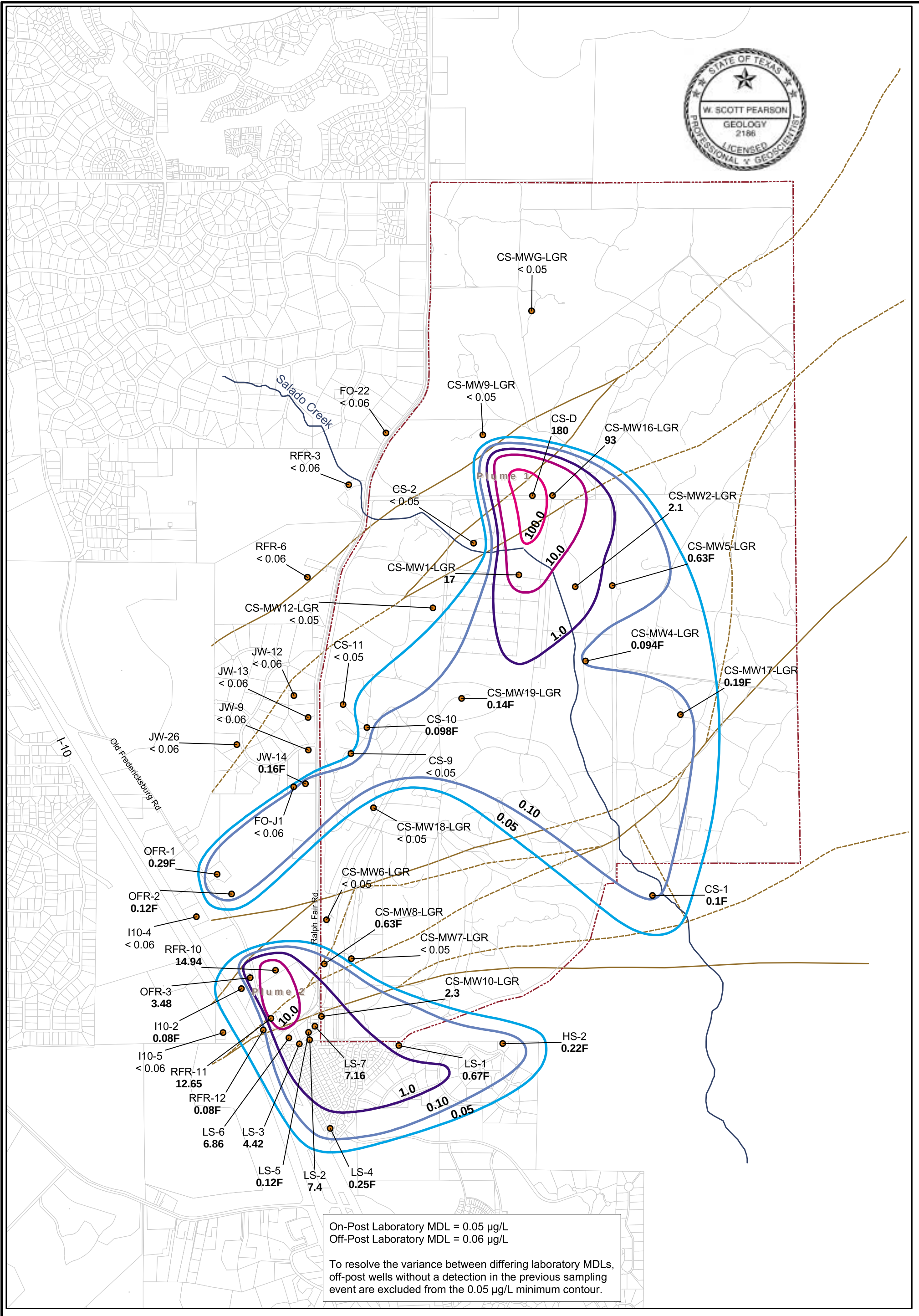

On-Post Laboratory MDL = 0.05 µg/L
Off-Post Laboratory MDL = 0.06 µg/L

To resolve the variance between differing laboratory MDLs, off-post wells without a detection in the previous sampling event are excluded from the 0.05 µg/L minimum contour.

Appendix C-1

PCE within the LGR
December 2002

PARSONS

HANDOUT #11

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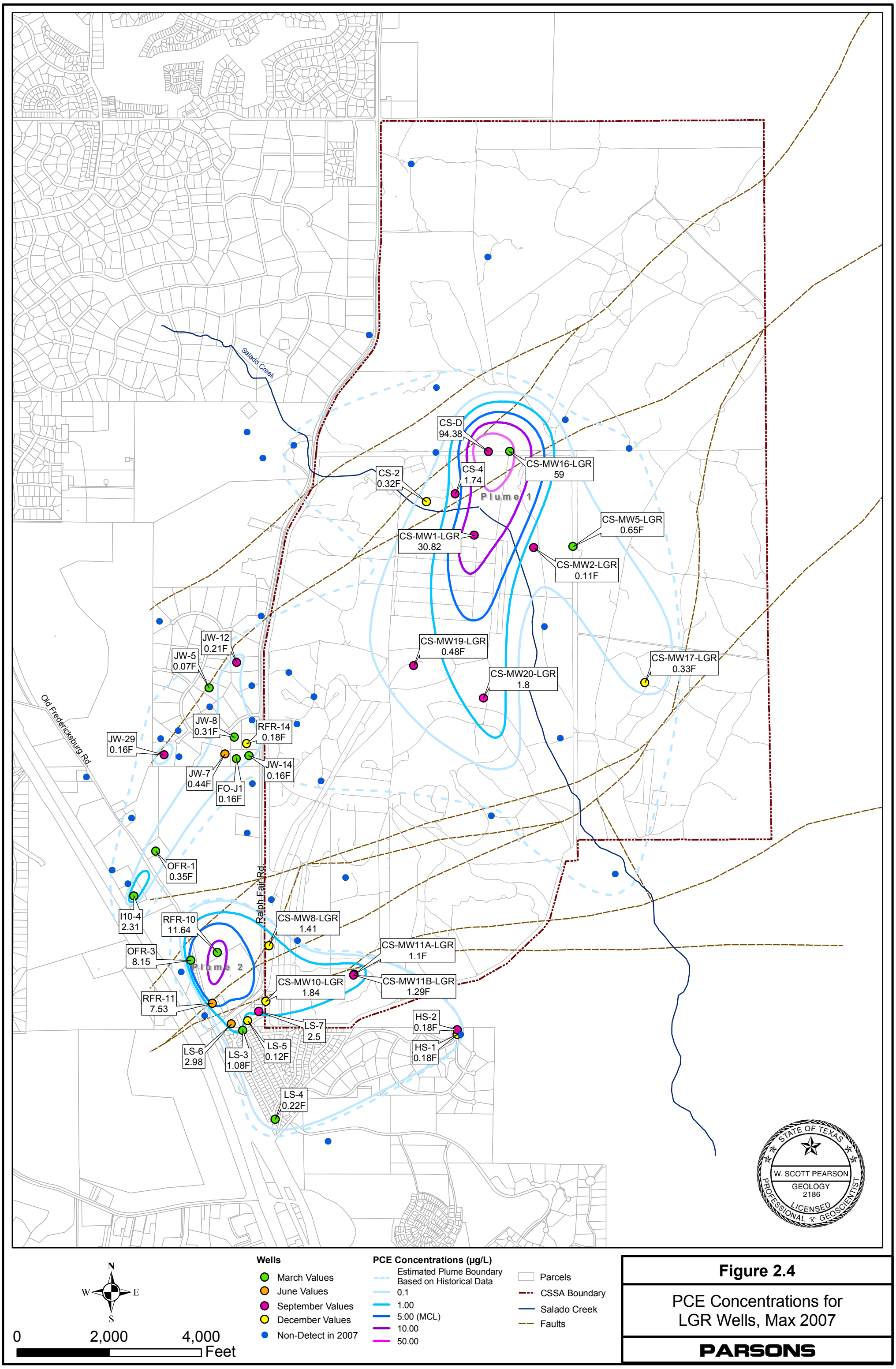

Figure 2.4

PCE Concentrations for LGR Wells, Max 2007

PARSONS

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Conceptual Site Model Update

Google Earth (GE) Tool

- **Internet-based Mapping Program**
  - Freeware internet program available at: *http://earth.google.com/*
  - Allows for 3D aerial viewing, navigating, and measuring
  - ArcView shapefiles can be easily imported as KMZ files into GE
  - Some basic layers have been created are available for your use at the CSSA FTP site:

    ftp://ftp.envirodept.net/pub/Google Earth/
  - Save **CSSA.KMZ** to your local Drive from the FTP site
  - Using File/Open within GE, navigate to **CSSA.KMZ** and open the file

  - *Note: GE imagery is off by about 85 feet. Use KMZ Image Overlay files to correct the image when detail is needed*

Taking Advantage of Leaky Disposal Trenches in Fractured Bedrock

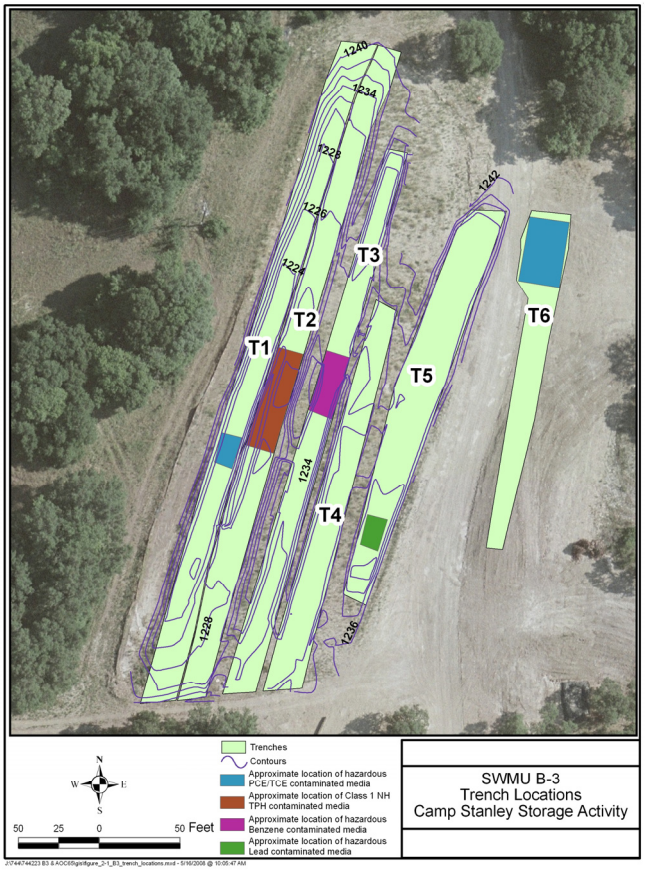
Removal Action

Ken R. Rice (Parsons, Austin, TX), Glare Sanchez (Camp Stanley Storage Activity, Boerne, TX), Chris Beal (Portage Environmental, Boerne, TX), Robert Edwards (Noblis, San Antonio, TX)

Right: Previous mission support at Camp Stanley Storage Activity (CSSA) has resulted in a contaminated groundwater plume from releases of chlorinated solvents in a former landfill referred to as Solid Waste Management Unit B-3 (SWMU B-3).

Left: Removal actions initiated April 2006 removed waste and contaminated media from six trenches at SWMU B-3.

Right: Waste matrix included metal debris and potential unexploded ordnance.



Left: Removal actions resulted in the removal of approximately 15,000 cubic yards of waste and contaminated media from SWMU B-3.

Summary of Removal Actions

- **Removal Action completed for all contaminated waste and media within SWMU B-3 and managed through off-post permitted facilities.**
- **Underlying fractured rock remaining under six trenches at SWMU B-3.**

HANDOUT #14

Taking Advantage of Leaky Disposal Trenches in Fractured Bedrock

Bioreactor Construction

Right: Bioreactor construction initiated with the additional of vegetable oil and deciduous tree mulch – pea gravel mixture in each of six trenches.

Pea Gravel

Vegetable oil placement in Trench 1

Mulch/Pea Gravel

Mulch-pea gravel mixing

Spray Nozzle

Bioreactor irrigation line

SWMU B-3 monitoring sumps

Left: Monitoring sumps and irrigation lines installed in each of the six SWMU B-3 trenches.

Right: Bioreactor cover system included geotextile fabric and pea gravel.

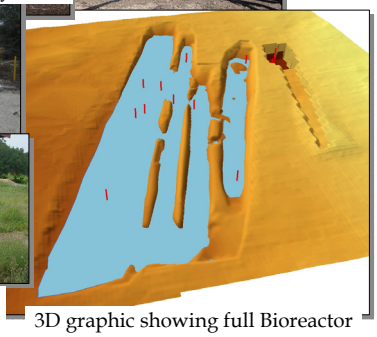
Gravel cover on trenches

Geotextile cover on trenches

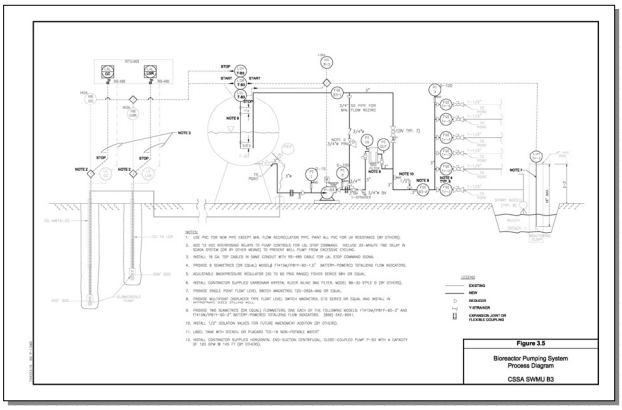
Final cover on Bioreactor

Water delivery system

GW Recovery Well
CS-MW16-LGR


3D graphic showing full Bioreactor

Left: Bioreactor recovered contaminated groundwater delivery system, capable of injecting ~ 70 gpm.



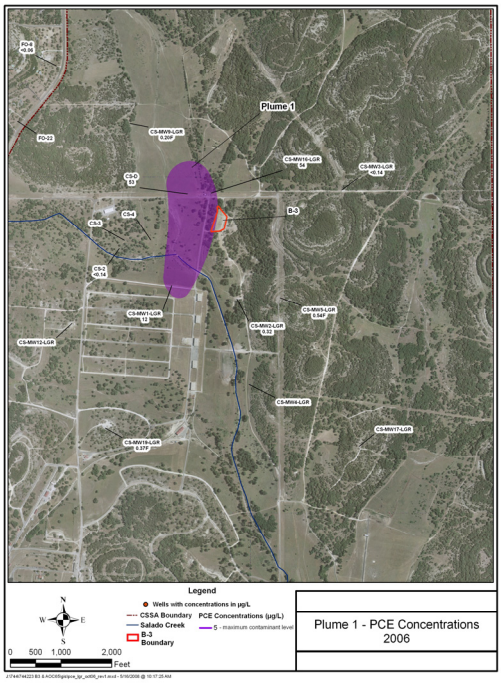
Summary of Bioreactor Construction

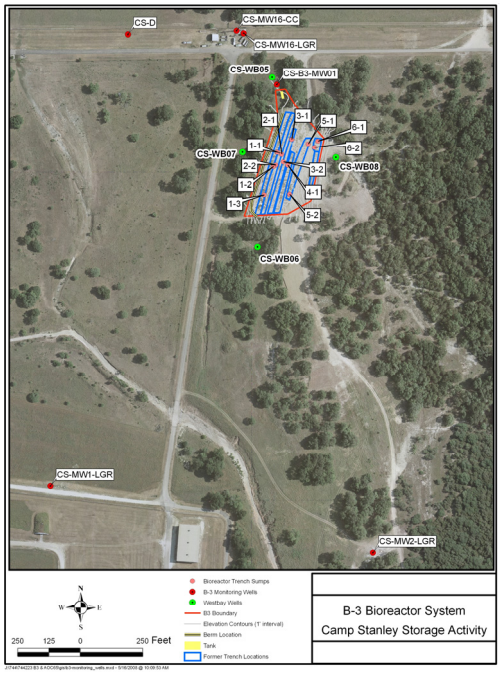
- **Bioreactor contains ~ 10,000 cubic yards of mulch/gravel mixture in six trenches.**
- **Automated recovered groundwater delivery system capable of injecting ~ 40,000 gallons/day.**
- **Bioreactor anoxic water infiltrates into underlying fractured media at ~ 20 gallons per minute.**

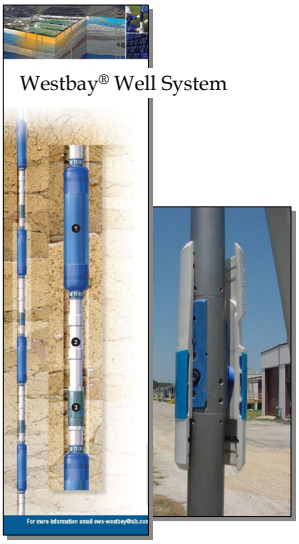
Taking Advantage of Leaky Disposal Trenches in Fractured Bedrock

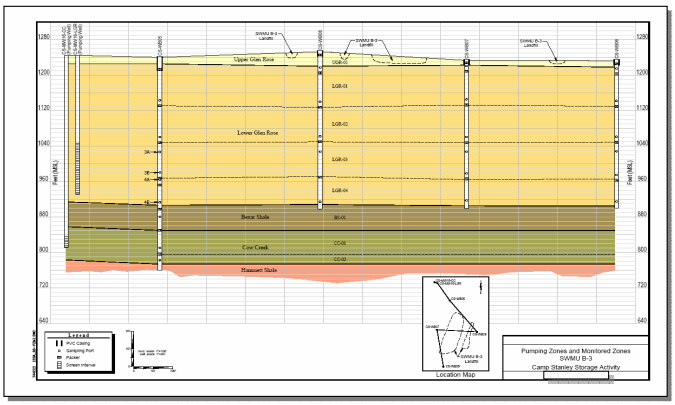
Bioreactor Monitoring

Right: Aerial photograph of the monitoring well network surrounding the bioreactor at SWMU B-3. Also shows estimated plume of PCE concentrations for Initial start-up year 2006.









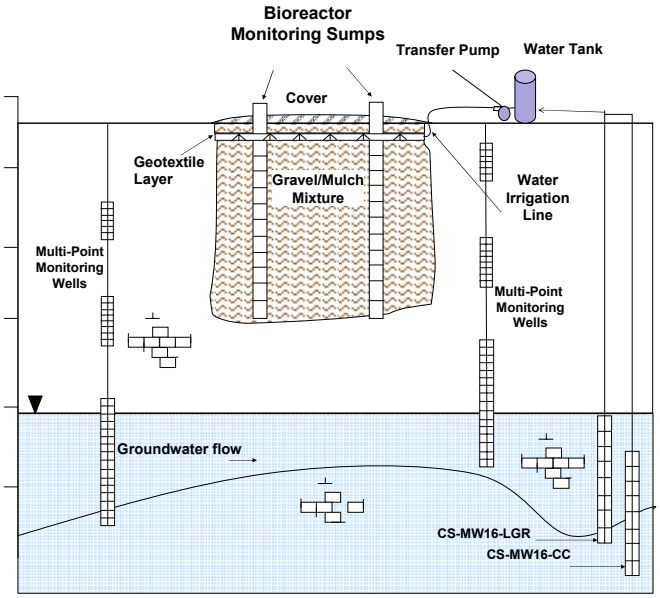
Above: Aerial photograph of the area surrounding the bioreactor at SWMU B3, showing locations of the Multi-port monitoring well (MPMW) network, and the extraction wells.

Left: Geologic cross-section depicting the stratigraphic units and formation, and corresponding MPMW discrete screened intervals.

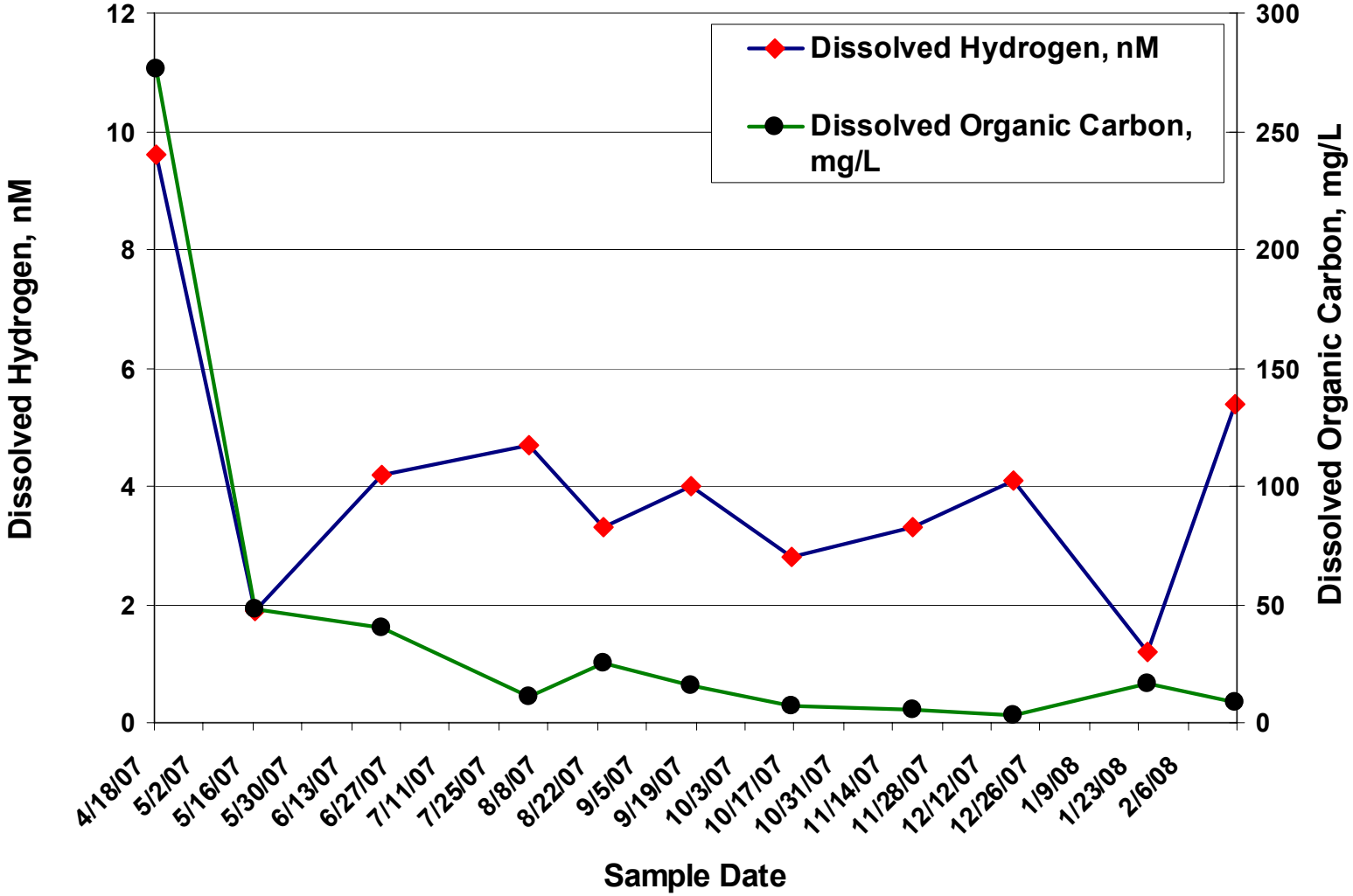
Below: Conceptual diagram of SWMU B-3 Bioreactor Pilot Study System.

Monitoring Objective

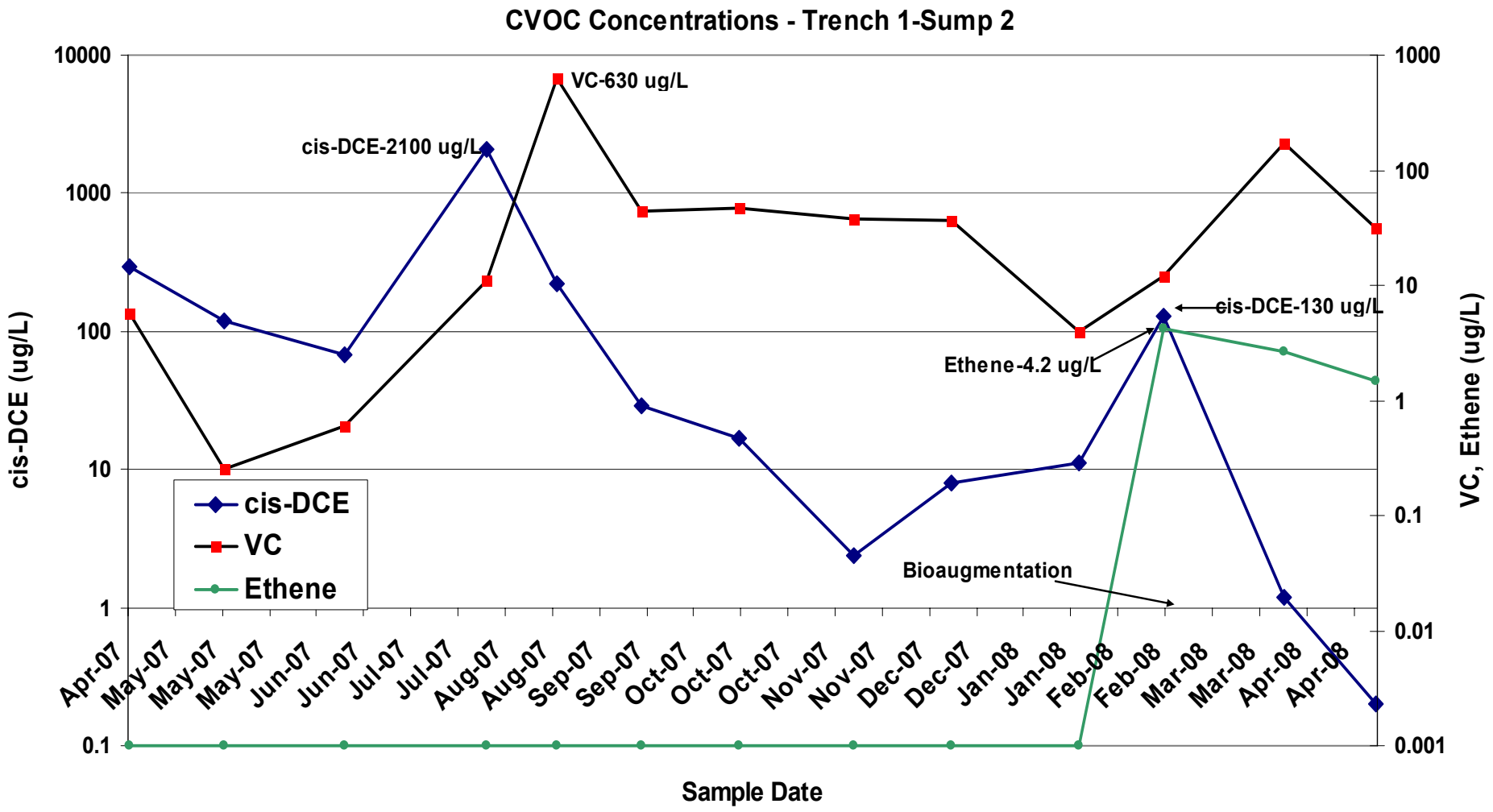
- **Determine if the bioreactor is an effective approach for dechlorination of contaminants for treatment of groundwater at SWMU B3.**
- **Determine the extent of bioreactor influence on the effectiveness of treatment in the vadose intervals.**
- **Evaluate the migration of contaminants through the underlying formations and into the underlying aquifer.**



Dissolved Hydrogen and Dissolved Organic Carbon in Trench 1

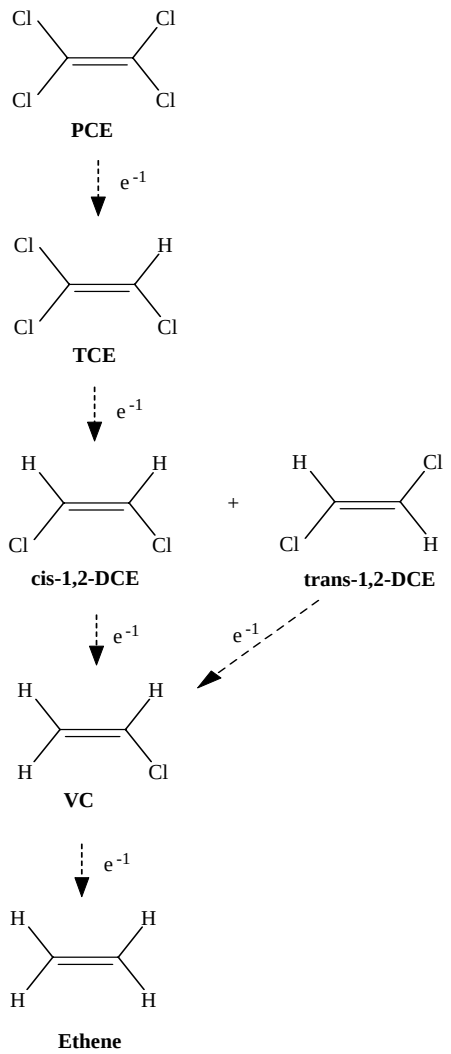


Post-bioaugmentation VOC Concentrations – Trench 1

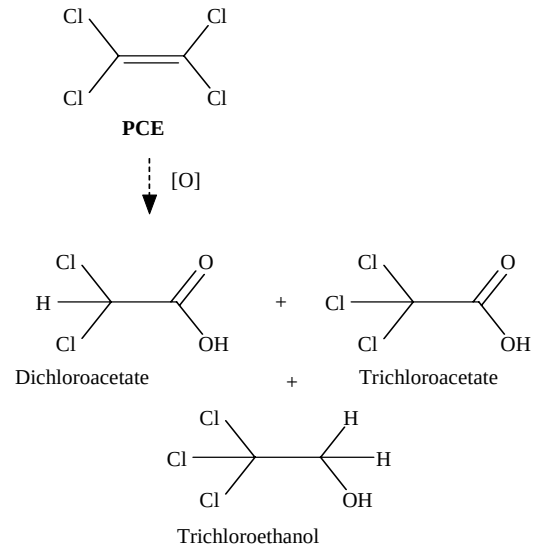


CVOC Dechlorination Mechanisms

Reductive Dechlorination Pathways

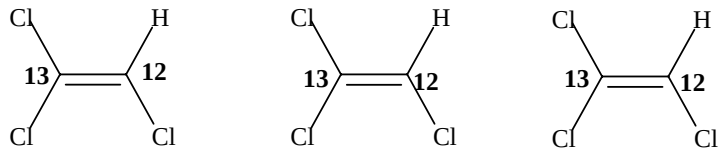


Oxidative Degradation Pathways

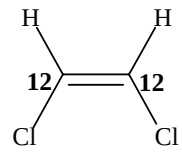


Isotopic Enrichment

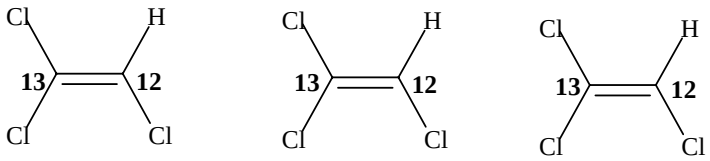
- **Slower reaction rate leads to enrichment (or fractionation) of the heavier isotope (^{13}C) in the <u>remaining substrate</u> if the reaction involves bond breaking, as in reductive dechlorination of CVOCs**
- **For example: TCE → cis-1,2-DCE**

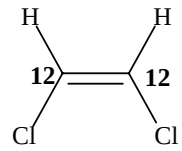


Isotopically enriched TCE



Isotopically depleted DCE





Metrics For Isotope Ratio Analysis

- $\delta^{13}C$ ‰ $= [(R_x/R_{std})-1]*1000$, where

  $R_x = {}^{13}C_x/{}^{12}C_x$

  $R_{std} = {}^{13}C_{std}/{}^{12}C_{std}$

- Rayleigh equation:

  $R_t/R_0 = f^{(\alpha-1)}$, where

  - R_t and R_0 are ratios ${}^{13}C/{}^{12}C$ for a specific substrate at times t and initially (t=0)
  - f = fraction of substrate remaining at time t = $[substrate]_t/[substrate]_0$
  - α = fractionation factor = $\frac{(1000+\delta^{13}C_p)}{(1000+\delta^{13}C_s)}$

- Enrichment factor, $\epsilon = (a-1)*1000$