2015 Update

Three-Tiered
Long Term Monitoring Network
Optimization Evaluation

Prepared for:

Camp Stanley Storage Activity
Boerne, Texas

January 2016

GEOSCIENTIST CERTIFICATION

2015 Update for
Three-Tiered
Long Term Monitoring Network
Optimization Evaluation

For

Department of the Army
Camp Stanley Storage Activity
Boerne, Texas

I, Adrien Lindley, P.G., hereby certify that the Updated Three-Tiered Long Term Monitoring Network Optimization Evaluation for the Camp Stanley Storage Activity installation in Boerne, Texas accurately represents the site conditions of the subject area. This certification is limited only to geoscientific products contained in the subject report and is made on the basis of written and verbal information provided by the CSSA Environmental Office, laboratory data provided by APPL Laboratory, and field data obtained during ongoing groundwater monitoring conducted at the site, and is true and accurate to the best of my knowledge and belief.

_____

Adrien Lindley, P.G.
State of Texas
Geology License No. 10487

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Date

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ACRONYMS AND ABBREVIATIONS

3TMO	three-tiered monitoring optimization
AFCEE	Air Force Center for Engineering and the Environment
AOC	area of concern
BDCME	bromodichloromethane
bgs	below ground surface
BZME	toluene
BS	Bexar Shale
CAO	Corrective Action Objectives
CC	Cow Creek
CMA	corrective measures alternative
CMD	Corrective Measures Design
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COC	contaminant of concern
COV	coefficient of variation
CQA	Construction Quality Assurance
CSSA	Camp Stanley Storage Area
DCE	dichloroethene
DQO	data quality objective
FM	Farm to Market Road
GAC	granular-activated carbon
HCSM	hydrogeologic conceptual site model
HS	Hammett Shale
ID	identification
IH	Interstate Highway
ISCO	in situ chemical oxidation
LGR	Lower Glen Rose
LTM	long-term monitoring
LTMO	Long Term Monitoring Optimization
µg/L	microgram(s) per liter
MCL	maximum contaminant level
MNO	Monitoring Network Optimization
PCE	tetrachloroethene
ppb	parts per billion
PQL	practical quantitation limit
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act

ACRONYMS AND ABBREVIATIONS (*continued*)

RL	reporting limit
RMU	rifle management unit
SAWS	San Antonio Water System
SWMU	solid waste management unit
SVE	soil vapor extraction
TBME	bromoform
TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality
UGR	Upper Glen Rose
USEPA	United States Environmental Protection Agency
UU/UE	unrestricted use/unrestricted exposure
VC	vinyl chloride
VOC	volatile organic compound
WB	Westbay™-equipped well

EXECUTIVE SUMMARY

Since volatile organic compounds (VOCs) were first reported in Camp Stanley Storage Activity (CSSA) groundwater in 1991, the U.S. Army has enacted a robust groundwater monitoring program to delineate two VOC plumes originating from CSSA. Numerous on-post wells and privately-held off-post wells have been incorporated into a VOC detection and delineation network that was routinely sampled on a quarterly basis. By 2004, approximately 88 on- and off-post wells were regularly sampled on a quarterly basis to develop a large statistical database. At that time it became evident that most wells sampled contained no VOCs or concentrations well below the federally-mandated Maximum Contaminant Levels (MCLs). At that time, CSSA initiated a Long Term Monitoring Optimization (LTMO) process to evaluate if statistical and spatial parameters would support a reduction in sampling locations and/or sampling frequencies without sacrificing the monitoring objectives. Overall, since on-post LTMO was implemented, there has been no overall increasing or a significantly decreasing trend in size or concentration with either CSSA VOC plume; however, remediation efforts underway at the plumes have resulted in localized variations in concentrations.

In 2005, Parsons used validated analytical data spanning from 1992 through December 2004 from the monitoring well network to perform a Three-Tiered LTMO evaluation. The U.S. Environmental Protection Agency (USEPA) and Texas Commission on Environmental Quality (TCEQ) approved the use of the LTMO recommendations for on-post monitoring wells and the Westbay® (WB) multi-port wells.

In 2007, CSSA began the bioreactor treatability study at the SWMU B-3. This study involved the establishment of an extraction well network to provide contaminated water to the Bioreactor to augment solvent de-chlorination. Groundwater monitoring associated with this study has been a separate sampling plan/schedule and, until this year, was not included in the LTMO studies.

An additional change to the LTMO sampling frequency was made in 2009 to provide for an additional 9-month "snapshot" event. This "snapshot," in which all on- and off-post wells were sampled, was adopted to provide an area-wide status of the two VOC plumes at CSSA. The 9-month sampling interval was selected to provide long-term assurance that seasonal changes associated with the hydrologic cycle were identified.

In 2010, USEPA and TCEQ approved the updates to the 2005 LTMO report. An additional four years of analytical data from the existing and new wells were added to the three-tiered evaluation to determine if there had been changes in trends and if the sampling frequency could be further refined. The same qualitative, temporal/statistical, and spatial evaluations were conducted to provide recommendations to further enhance or streamline the monitoring network.

As a result of this 2015 LTMO evaluation, it is recommended that the proposed monitoring schedules for retained wells range from quarterly (e.g., drinking water wells) to every 9, 15, or 30 months for monitoring wells.

- The proposed 15- or 30-month sampling schedule for monitoring wells replaces most existing 9- or 18-month sampling frequencies.
- Bioreactor performance monitoring wells will be incorporated into the post-wide

program and moved from semi-annual to 9-month sampling.

- Wells on a 9-month (i.e., bioreactor performance wells) or 15/30-month sampling schedule allow for observation of potential seasonal influences on contaminant concentrations and water levels.
- All off-post wells will also continue to be evaluated by the approved Off-Post Wells Data Quality Objectives (DQOs) that dictate sampling frequencies and remedial actions based upon the VOC concentrations detected in a given well. At all times, the DQOs will supersede the recommended LTMO sampling frequency if conditions change.

The LTMO recommendations proposed herein result in an overall decrease in sampling events over a five-year period versus the current program, as shown below.

	Plume 1 Sampling Events Over 5-Year Period		**Plume 2 Sampling Events Over 5-Year Period**	
Frequency	**Current Program**	**Optimized Program**	**Current Program**	**Optimized Program**
Every 30 months	0	40	0	36
Every 18 months	21	0	42	0
Every 15 months	0	28	0	196
Every 9 months	84	252	558	0
As needed	As needed	0	0	0
Quarterly	80	80	120	120
Semi-annual	420	0	0	0
Semi-annual + snapshot	91	0	52	0
Total	**696**	**400**	**772**	**352**
Reduction over 5 Years:		**43%**		**54%**

SECTION 1
INTRODUCTION

Groundwater monitoring programs have two primary objectives (U.S. Environmental Protection Agency [USEPA], 1994; Gibbons, 1994):

1. Evaluate long-term temporal trends in contaminant concentrations at one or more points within or outside of the remediation zone, as a means of monitoring the performance of the remedial measure (*temporal objective*); and
2. Evaluate the extent to which contaminant migration is occurring, particularly if a potential exposure point for a susceptible receptor exists (*spatial objective*).

The relative success of any remediation system and its components (including the monitoring network) must be judged based on the degree to which it achieves the stated objectives of the system. Designing an effective groundwater monitoring program involves locating monitoring points and developing a site-specific strategy for groundwater sampling and analysis to maximize the amount of relevant information that can be obtained while minimizing incremental costs. Relevant information are the data required to effectively address the temporal and spatial objectives of monitoring. The effectiveness of a monitoring network in achieving these two primary objectives can be evaluated quantitatively using statistical techniques. In addition, there may be other important considerations associated with a particular monitoring network that are most appropriately addressed through a qualitative assessment of the network. The qualitative evaluation may consider such factors as hydrostratigraphy, locations of potential receptor exposure points with respect to a dissolved contaminant plume, and the direction(s) and rate(s) of contaminant migration.

This report presents a description and evaluation of the groundwater monitoring program associated with the Camp Stanley Storage Activity (CSSA) in Boerne, Texas. A 152-well monitoring network containing 193 sampling locations was evaluated to identify potential opportunities to streamline monitoring activities while still maintaining an effective monitoring program. The long-term monitoring optimization (LTMO) evaluation was performed using 3TMO software protocol, which was developed by Parsons and Environ International Corp. on behalf of the Air Force Center for Engineering and the Environment (AFCEE) in 2011. 3TMO is a comprehensive, public domain LTMO decision support tool that uses a combination of statistics and professional judgment in a structured protocol to optimize sampling locations, sampling frequency, and target analytes for monitoring wells with no loss of required information. Results of the 3TMO analysis were used to assess the optimal frequency of monitoring and the spatial distribution of the components of the monitoring network, and were also used to develop recommendations for optimizing the monitoring program at CSSA.

SECTION 2
SITE BACKGROUND INFORMATION

The location, operational history, geology, and hydrogeology of CSSA are briefly described in the following subsections.

2.1 SITE DESCRIPTION

2.1.1 Site Background

CSSA is an active installation located in Bexar County, approximately 19 miles northwest of downtown San Antonio, Texas. Its higher headquarters is the McAlester Army Ammunition Plant in McAlester, Oklahoma. The mission of CSSA is the receipt, storage, and issuance of ordnance materiel as well as quality assurance testing and maintenance of military weapons and ammunition. Because of its ordnance mission, CSSA is a restricted-access facility.

CSSA consists of 4,004 acres immediately east of Farm to Market Road (FM) 3351, and approximately half a mile east of Interstate Highway (IH) 10 (**Figure 2.1**). Camp Bullis borders CSSA on the north, east, and southeast. The land on which CSSA is located was used for ranching and agriculture until the early 1900s. Six tracts of land were purchased by the U.S. Government during 1906 and 1907 and designated the Leon Springs Military Reservation, which later evolved into Camp Stanley.

Prior to 2010, the lands surrounding CSSA were primarily a mix of residential developments and ranching properties. Legacy communities and subdivisions included Leon Springs, Leon Springs Villa, Hidden Springs Estates, The Dominion, Fair Oaks Ranch, and Jackson Woods. Although, the past five years has seen dramatic shift in demographics as the IH 10 corridor near CSSA has experienced significant suburban growth. In that time, three new subdivisions (Stonehaven, Lost Creek, and Sable Chase) and commercial properties have been developed to the west of CSSA on former ranching properties. For the most part, ranching and agricultural land use now only exists to the north of CSSA. The urbanization has also promoted the regionalization of the water supply system, such that most new development utilizes alternative water sources provided by the San Antonio Water System (SAWS), rather than the local groundwater system.

2.1.2 Investigative and Remedial Activities

A total of 84 sites, including 39 solid waste management units (SWMUs), 41 areas of concern (AOCs), and five range management units (RMUs), were identified at CSSA since 1993, and investigations and interim removal actions (if warranted) were conducted at a total of 83 of those sites (**Figure 2.2**). As of July 2014, 77 sites were either delisted or closed to unrestricted use/unrestricted exposure (UU/UE) in accordance with TCEQ requirements. In 2012, four SWMUs (B-2, B-8, B-20/21, and B-24) were combined with RMU-1 as they are part of the active firing range. Soils at the remaining open sites that were combined with the active firing range will be addressed under a separate investigation when the range is no longer active.

SWMU B-3 located near well CS-16, and AOC-65 located near the SW corner of the post, are the two remaining open sites considered source areas for groundwater contamination. Analytical data indicate that tetrachloroethene (PCE), trichloroethene (TCE), and *cis*-1,2-dichloroethene (DCE) are the primary contaminants of concern (COC) in groundwater at SWMU B-3. Additional information on these site investigations is included in the CSSA Environmental

Encyclopedia (*www.stanley.army.mil*). The CSSA Environmental Encyclopedia is maintained as the Administrative Record for CSSA under provisions of the Administrative Order on Consent issued to CSSA on May 5, 1999, pursuant to §3008(h) of the Resource Conservation and Recovery Act (RCRA) (USEPA, 1999).

SWMU B-3. SWMU B-3 was a landfill area thought to have been used primarily for garbage disposal and trash burning, presumably during the 1980's. Subsequent source investigations identified an area of open burn pits and disposal trenches containing PCE and its degradation products. The six trenches varied in depth from 5 to 15 feet, and were approximately 350 to 400 feet long and 12 to 20 feet wide. Groundwater beneath the landfill footprint occurs within a fractured bedrock aquifer composed of limestone and shales. The depth to the water table is typically 150 feet below ground surface (bgs), but can vary from 70 to 300 feet bgs depending on rainfall and recharge. Numerous environmental investigations have occurred at SWMU B-3, including soil gas surveys, geophysical surveys, soil boring and groundwater well installations, and soil vapor extraction (SVE) pilot study.

To remediate contaminated groundwater, an *in situ* "bioreactor" was created in 2007 by removing the waste in the disposal trenches, backfilling with a gravel/mulch mixture, and infiltrating contaminated groundwater. Microbial activity was augmented with addition of the KB-1 commercial culture of *dehalococcoides*. The current system distributes contaminated groundwater collected from seven extraction wells (CS-EXW01-LGR, CS-EXW02-LGR, CS-EXW03-LGR, CS-EXW04-LGR, CS-EXW05-LGR, CS-MW16-LGR, and CS-MW16-CC) located around the perimeter of the site into the bioreactor trenches where the water encounters microbial activity which degrades the organic contaminants. Approximately 50,000 gallons of contaminated groundwater from extraction wells is treated within the bioreactor each day. Groundwater from the extraction wells typically includes PCE and TCE in concentrations exceeding 100 parts per billion (ppb).

Samples collected from within the bioreactor indicate reductive dechlorination is occurring resulting in the production of *cis*-1,2-DCE, vinyl chloride (VC), and ethene and low (~5 ppb) to non-detect concentrations of PCE and TCE. The decrease in VOC concentrations within the vadose zone beneath the bioreactor indicates the source material is being transformed within the system.

AOC-65. AOC-65, located along the southwestern side of CSSA, consists of Building 90 and potential source areas associated with Building 90. Building 90 was used for weapons cleaning and maintenance. A metal vat, used for cleaning with chlorinated liquid solvents such as PCE and TCE, was installed in the western vault at Building 90 (main portion of AOC-65) prior to 1966 and removed in 1995. In 1995, after removal of the former solvent vat, a metal plate was welded over the concrete vault, and PCE and TCE solvents were replaced with a citrus-based cleaner system.

In 1999, CSSA identified PCE-impacted drinking water off-post near AOC-65. The fractured nature of the underlying bedrock aquifer provided multiple flow paths for contamination within the vadose zone at AOC-65 to migrate both laterally as well as vertically. As a result, VOC contamination in excess of the MCL was identified off-post in both private and public water well systems. In response, CSSA implemented a proactive community relations plan to provide clean, potable water to the affected community and engaged in aggressive

remedial investigations and treatability studies for AOC-65. These studies included source area identifications, soil boring and well installations, and pilot scale treatability studies.

An SVE system proved ineffective after 10 years of operations due to large fluctuations in water levels within the aquifer. Extraction well screens and flow paths (fractures) were flooded during periods of higher groundwater elevations. An approach was designed for application of in situ chemical oxidation (ISCO) within AOC-65 by taking advantage of lessons learned from successful operation of the SMWU B-3 bioreactor. In 2012, the approach for injecting ISCO material at AOC-65 included the creation of a trench within a suspected point of release (i.e., drainage ditch) and backfilling this trench with alternating layers of ½-inch-sized gravel and compacted clay. Irrigation lines were installed within each of the gravel layers creating three separate infiltration galleries within the 15-foot-deep, 4.5-foot-wide, 320-foot-long trench. The infiltration galleries were configured to target injection in multiple fractures, some solutionally enlarged, that had been identified on the exposed trench walls. In 2013, four injection wells in the upper portion of the bedrock vadose zone were installed along the post boundary to create a reactive curtain for intercepting potential PCE migration off-post.

Three rounds of ISCO injections of 10, 22 and 66 tons of a 20 percent sodium persulfate solution occurred in 2012, 2013 and 2014, respectively. Groundwater samples collected at AOC-65 indicate the ISCO solution followed preferential flow paths. This was inferred by the positive field identification of persulfate (oxidant) and elevated pH (activator), and the presence of reaction by-products within the monitoring well network. Continued monitoring will provide data for determining the overall effectiveness of the ISCO application and the need for further ISCO application(s).

2.1.3 Corrective Measures Study and Implementation

Under the Order, CSSA performed a Corrective Measures Study (CMS) to screen and develop corrective measures alternatives for removal, containment, treatment, and/or other remediation of groundwater contamination identified at SWMU B-3 and AOC-65 (Parsons 2014b). All potential technologies that may be used to achieve the Corrective Action Objectives (CAOs) outlined in the CMS were identified and evaluated for potential further consideration as part of corrective measures alternatives (CMAs).

The CMA chosen by USEPA in the Statement of Basis (USEPA, 2015) as the final remedy to address groundwater contamination at CSSA includes source area treatment (bioremediation and ISCO), point-of-use treatment (granular-activated carbon [GAC]), land use controls, and long-term monitoring (LTM). The remedy is protective of human health and the environment, complies with applicable waste management standards, provides both short- and long-term effectiveness for the protection of human health, and will attain media cleanup standards. Bioremediation and ISCO are already reducing source contamination at SWMU B-3 and AOC-65 at CSSA, and would continue to do so effectively in the future. It is therefore easily implementable since all of the elements for these alternatives are already in place at CSSA. The remedy also addresses CSSA's desire to choose environmentally sustainable remedial alternatives.

The final remedy selected by USEPA will be implemented through the Corrective Measures Implementation (CMI) phase as outlined in the Order. In summary, the CMI process is as follows (ordered consecutively):

1. A Decision Document is issued by USEPA;
2. A CMI Program Plan is developed to document the overall management strategy for the corrective measures;
3. A Corrective Measures Design (CMD) Report is prepared to address the requirements necessary to implement the corrective measures;
4. A Construction Quality Assurance (CQA) Plan is developed to ensure that the completed corrective measures meet or exceed all design criteria, plans, and specifications; and
5. A CMI Report is compiled that includes information such as inspection summary reports, problem identification, photographs, design engineers' acceptance reports, deviations from original designs, and as-built drawings.

2.2 GEOLOGY AND HYDROGEOLOGY

At CSSA, the near-surface geology and aquifer are composed of Trinity Group carbonate bedrock, which includes the Glen Rose and Travis Peak Formations. In particular for CSSA, the units of interest are the Glen Rose Limestone, Bexar Shale (BS), and Cow Creek (CC) Limestone that form the Middle Trinity aquifer.

The upper member of the Trinity Group is the Glen Rose Limestone. The Glen Rose represents a thick sequence of shallow water marine shelf deposits. This formation is divided into the Upper Glen Rose (UGR) and Lower Glen Rose (LGR) members. Underlying the Glen Rose Limestone is the Travis Peak Formation which is divided into five members, in descending order: the Hensell Sand (and BS facies), the CC Limestone, the Hammett Shale (HS), the Sligo Limestone, and the Hosston Sand. At CSSA, groundwater is produced from the LGR and CC intervals of the Middle Trinity Aquifer.

The geologic units present at CSSA were informally divided into hydrostratigraphic units to provide a framework for describing the local hydrogeology. Three aquifers are present in the area of CSSA: the Upper, Middle, and Lower Trinity. The Glen Rose Formation and the Travis Peak and Pearsall Formations are the principle water-bearing units. As depicted on **Figure 2.3**, the Upper Member of the Glen Rose Formation composes the Upper Trinity Aquifer, and the Lower Member, a portion of the Middle Trinity Aquifer. Only the Middle and Upper Trinity aquifers are addressed for this study. Detailed descriptions of the geologic and hydrogeologic conditions present at CSSA are available in the *Hydrogeologic Conceptual Site Model for Camp Stanley Storage Activity* (Parsons, 2008).

2.3 NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

The COCs at CSSA are based on historically detected analytes (since the inception of the groundwater monitoring program in 1991) and process knowledge. Analytes detected above regulatory standards in soil and groundwater at CSSA are limited to a short list of chlorinated VOCs. Past releases resulted in contamination of the UGR and LGR Limestone member of the Middle Trinity aquifer. Detections of solvent contamination (PCE, TCE, and *cis*-1,2-DCE) were first reported in 1991. Since that time, solvent contamination has been detected in off-post private and public water supply wells.

At CSSA, the inorganic constituents in groundwater normally analyzed for include arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, and zinc. Although there have been some metals exceedances on-post, they have been sporadic and limited largely to wells located in

the interior areas of the post and/or associated with heavy rainfall events. Hazards due to exposure to lead in groundwater may occur in some on-post locations. The highest lead hazard was calculated for wells CS-11 and CS-9 where lead has been consistently detected though the concentrations have only been sporadically above the action level. Lead detections in these two wells have been attributed to the materials used in well construction (remnants of broken casing, column pipe, and possibly equipment pumping at depths greater than 130 feet bgs). Neither well is used as a source of drinking water on-post, and because of the contamination, both wells were plugged and abandoned in August 2015. Currently metals are not sampled at off-post locations due to the minimal or lack of on-post metals detections exceeding MCLs.

The groundwater plume associated with SWMU B-3 exists in the north-central area of the post (Plume 1) and has migrated to the south and west. The groundwater plume associated with AOC-65 at the southwestern boundary of the post (Plume 2) has also migrated south and west, and has impacted some off-post drinking water wells. These plumes are the focus of this Monitoring Network Optimization (MNO) evaluation. The COCs for both plumes include PCE, TCE, and *cis*-1,2-DCE. Groundwater contamination is most widespread within the LGR water-bearing unit. Although the highest concentrations of VOCs have been found in the UGR, previous investigations demonstrated that the largest aerial extent of VOC impact resides within the LGR.

Within Plume 1, concentrations above the MCL for PCE and/or TCE are detected in wells CS-4, CS-D, CS-MW1-LGR, CS-MW2-LGR, and the CS-MW16 cluster. Concentrations above 200 µg/L for PCE and/or TCE have been reported at CS-D, CS-16-LGR, CS-MW16-CC, and the extraction and multi-port wells at SWMU B-3. This plume has migrated to the south and west-southwest. In contrast, little to no contamination is detected in the BS and impact to the CC is limited to the area immediately around CS-MW16-CC and CS-WB05.

Contamination at Plume 2 originated at or near AOC-65 and Building 90, and has migrated to the south and west. The highest concentrations of PCE have been reported adjacent to the source area at concentrations of 65,000 µg/L in Treatability Study Well 01 (TSW-01) and 30,000 µg/L in multi-port well CS-WB03-UGR-01. Within the CSSA boundary, concentrations greater than 100 µg/L have been reported in perched groundwater intervals above the main aquifer body. However, once the main aquifer body is penetrated, lower VOC levels are detected. Off-post, concentrations above the MCLs have been detected in private and public wells with open borehole completions. Concentrations greater than 30 µg/L have been reported 1,200 feet west-southwest of CSSA at RFR-10. Vertical profiling within that well shows that discrete intervals within uncased upper strata contribute PCE concentrations at over 90 µg/L. Only sporadic, trace concentrations of solvents have been detected in BS and CC wells within Plume 2. The general extent of Plumes 1 and 2 are shown on **Figure 2.4.** The groundwater monitoring program at CSSA is fully described in Section 3.

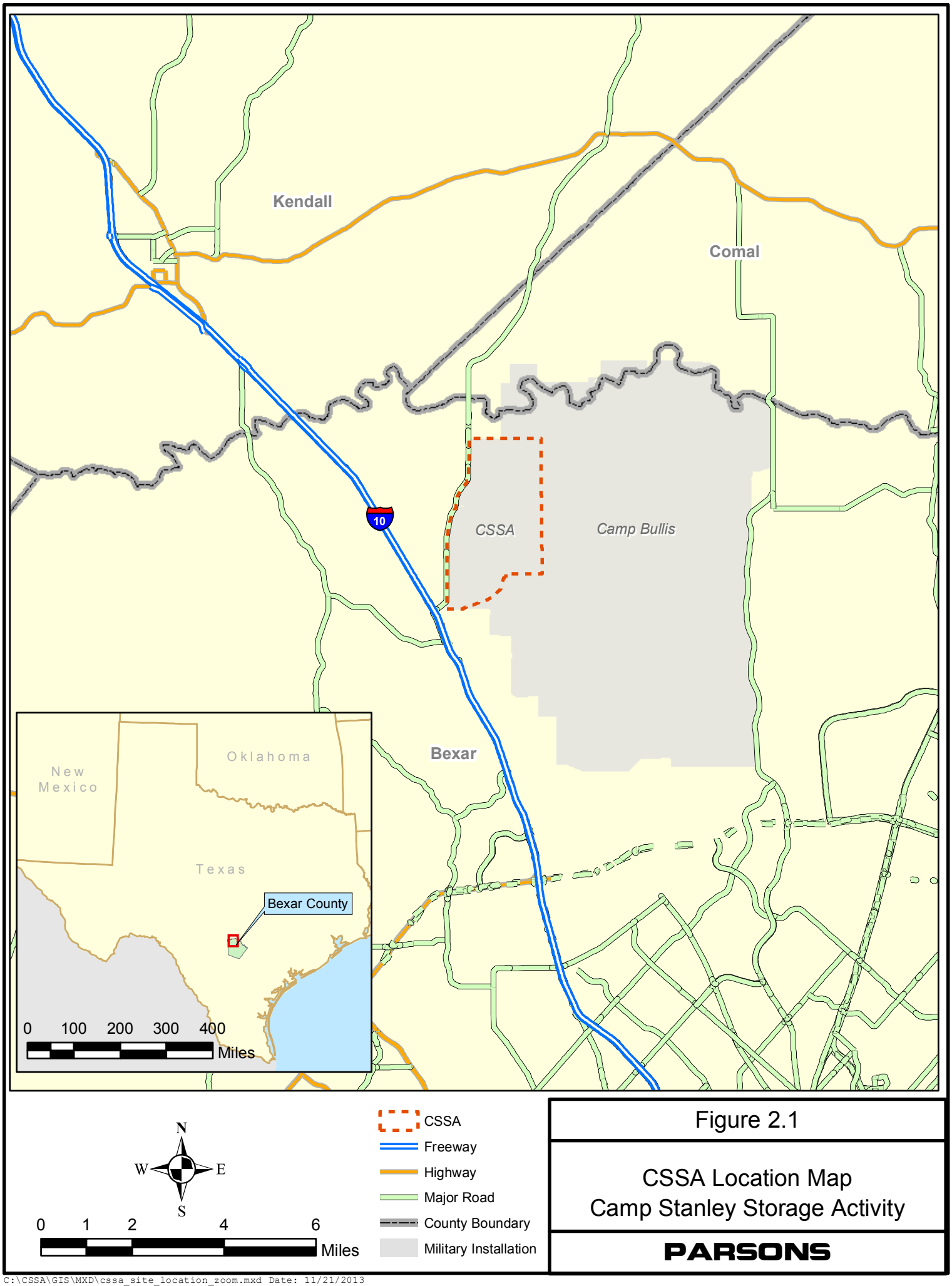

Figure 2.1

CSSA Location Map
Camp Stanley Storage Activity

PARSONS

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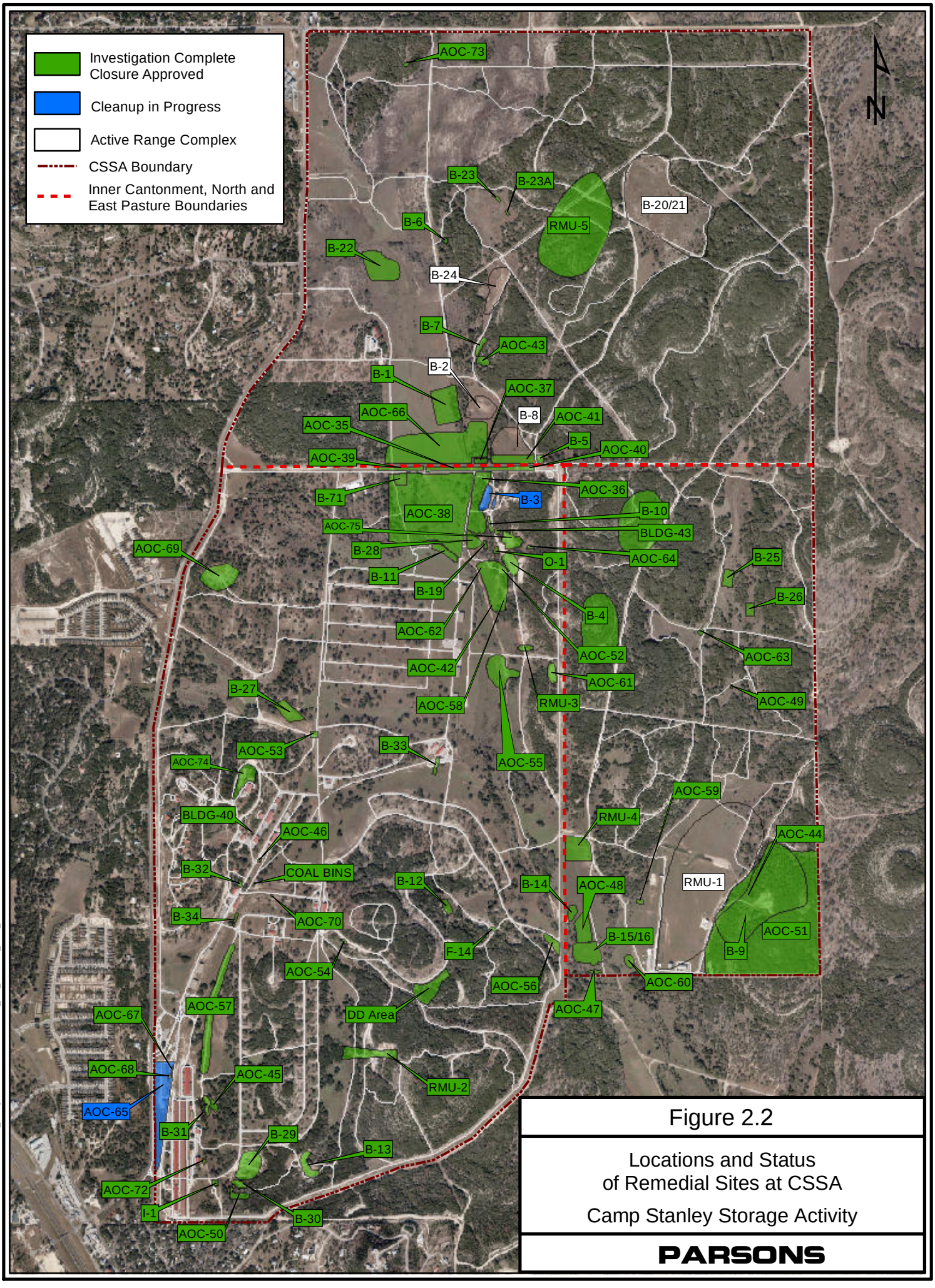

Figure 2.2

Locations and Status
of Remedial Sites at CSSA

Camp Stanley Storage Activity

PARSONS

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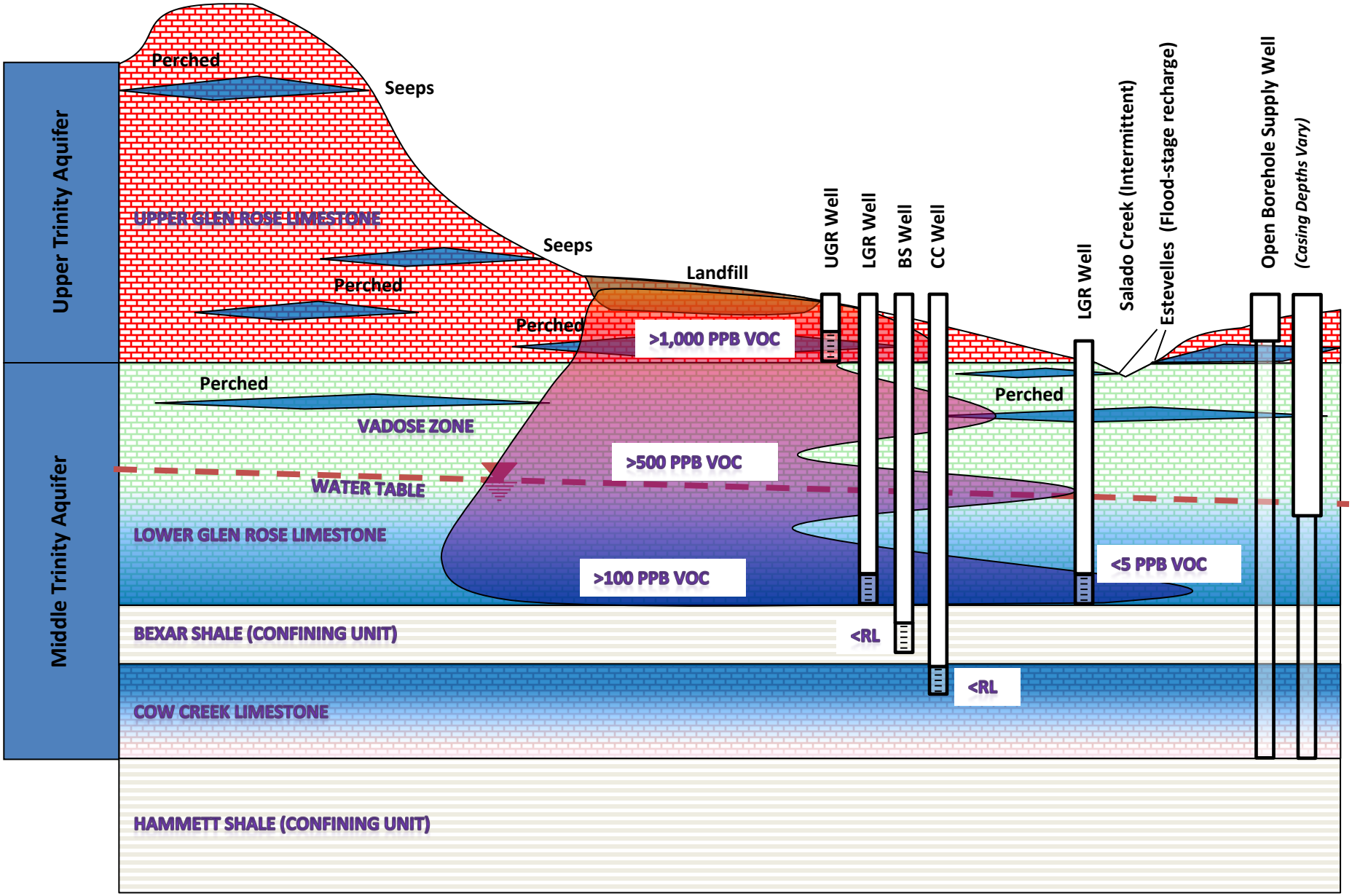
Figure 2.3 CSSA Hydrogeologic Conceptual Site Model



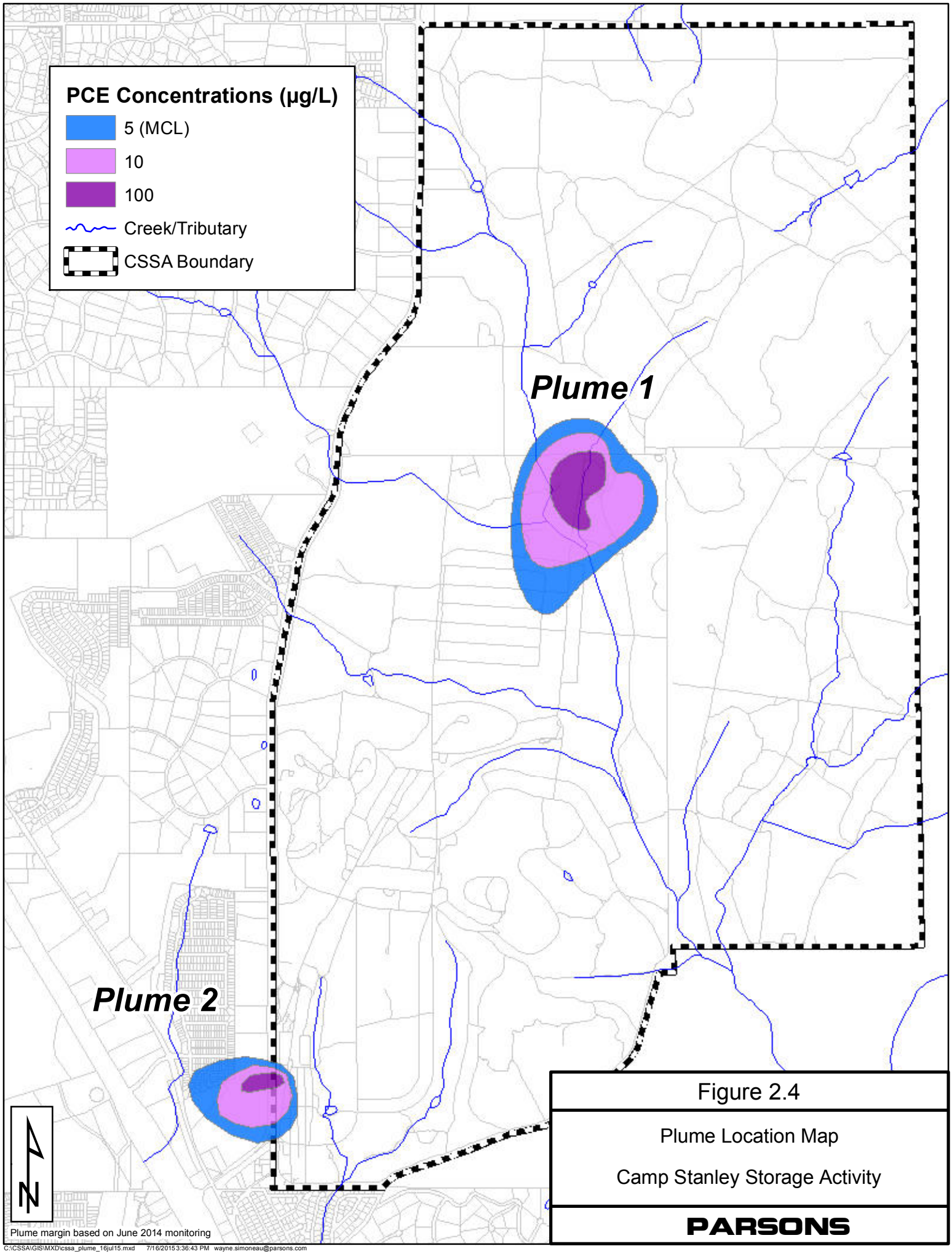


Figure 2.4

Plume Location Map

Camp Stanley Storage Activity

PARSONS

SECTION 3
LONG-TERM MONITORING PROGRAM AT CSSA

The groundwater monitoring program at CSSA was examined to identify potential opportunities for streamlining monitoring activities while still maintaining an effective monitoring program.

3.1 DESCRIPTION OF MONITORING PROGRAM

The CSSA groundwater monitoring well network includes 164 wells, including on-post, off-post and multi-port Westbay® (WB)-equipped wells (**Figure 3.1**), and the program has monitored water quality on a quarterly basis for 17 years resulting in 64 sampling events. The WB wells have ports at multiple depths across the LGR, BS, and CC zones; the eight wells have 73 distinct sampling locations that are considered separately for the LTMO analysis. Thus, the monitoring program examined in this LTMO evaluation includes 196 sampling locations (**Table 3.1**). The objectives of the monitoring program at CSSA are presented in both the *Data Quality Objectives for the Groundwater Contamination Investigation* (November, 2010) and in the CSSA *Off-post Groundwater Monitoring Response Plan* (June, 2002) and include, in part:

- Determine whether on- and off-post drinking water meets the standards for safe drinking water as prescribed under the USEPA and TCEQ rules;
- Determine if VOC concentrations in on-post and off-post drinking water wells exceed values stated in project data quality objectives (DQOs) and the CSSA off-post Monitoring Response Plan;
- Determine which formation(s) in the Middle Trinity aquifer are impacted by VOC contaminants;
- Determine the impacts of rain events, drought conditions, and groundwater recharge on concentrations and migration of VOCs in the aquifer and vadose zone.

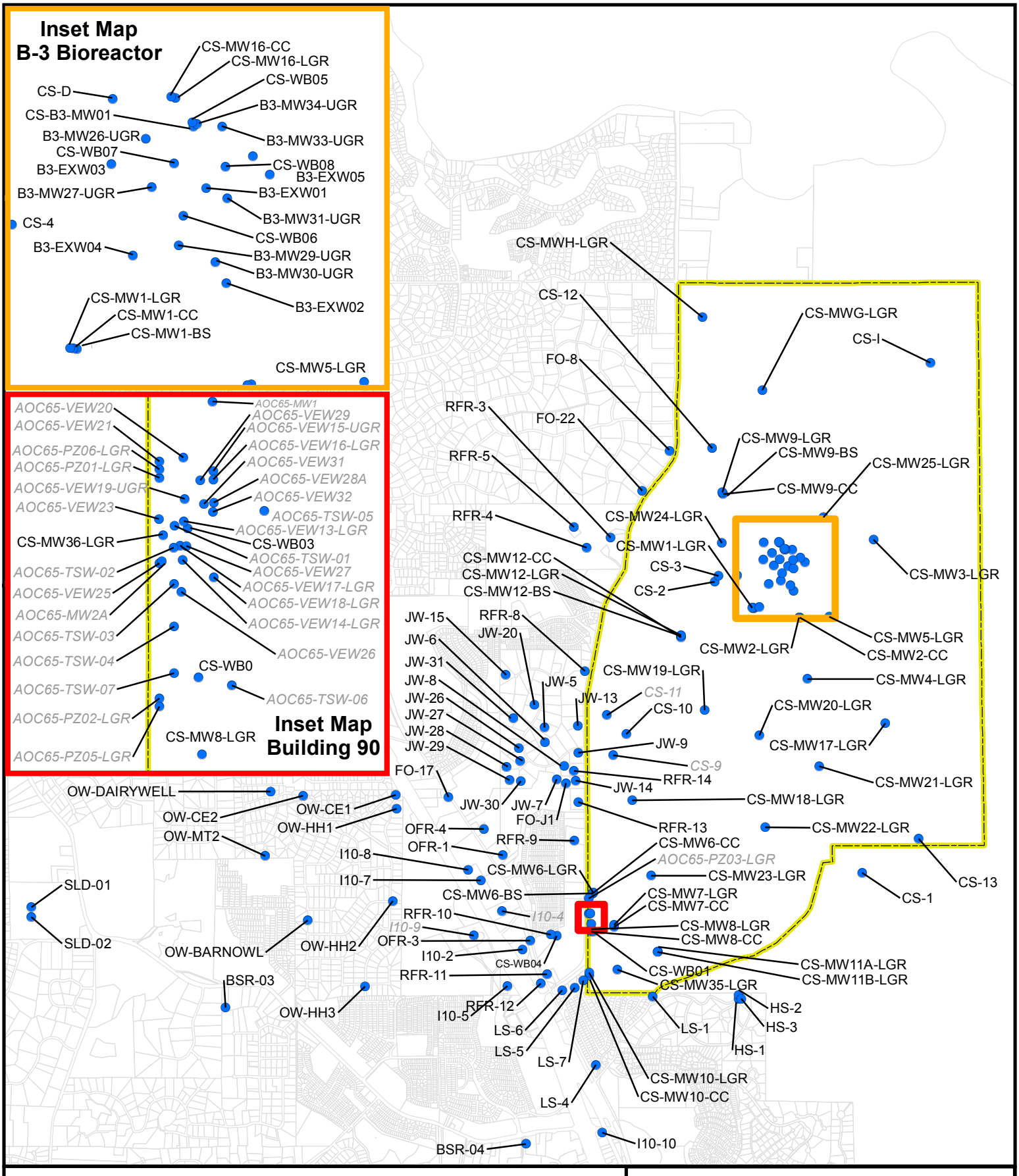
The current CSSA LTM sampling frequency for a well is determined by the type, location, and detection history of the well. On-post drinking water wells, off-post private supply wells that exceed 80% of the MCL, and newly installed monitoring wells are sampled quarterly at minimum. Other on- and off-post wells are currently sampled every 9 or 18 months. Every 9 months, a simultaneous round of samples is collected from each on-post well to provide a "snapshot" of groundwater concentrations and elevations across the installation. Wells that have previously been used only for bioreactor performance monitoring (i.e., not part of the current LTM program) are sampled semi-annually.

Figure 3.1 and **Table 3.1** include LTM network sampling locations, wells that were recently or will soon by plugged and abandoned, as well as sampling locations more closely associated with ongoing corrective measures within the AOC-65 source area (e.g., well identifications [IDs] beginning with "AOC65-"). These sampling locations are *not* included in the current or proposed versions of the LTM program, and are sampled on an as-needed basis. PCE concentrations observed within the source area (where ongoing remediation efforts occur) are typically much higher than those observed within the majority of the plume.

3.2 SUMMARY OF ANALYTICAL DATA

The CSSA groundwater plumes are well-characterized both laterally and vertically. The groundwater monitoring program was summarized using results for sampling events performed from 1991 through December 2014. The database was processed to remove duplicate data by retaining the maximum result for each duplicate sample pair.

Other COCs have previously included bromoform (TBME) and bromodichloromethane (BDCME) because of their action levels of zero, and toluene (BZME) due to sporadic detections in screening level samples collected at discrete intervals during well installations. These three compounds were screened out following the first iteration of LTMO, and with the development and approval of a short list of VOC compounds, were subsequently dropped from the program in 2006. The VOC short list for groundwater sampling at CSSA includes the compounds: PCE, TCE, *cis*-1,2-DCE, *trans*-1,2-DCE, VC, and 1,1-DCE. PCE and TCE parent compounds, and the presence of *cis*-DCE, *trans*-DCE, and VC are indicators of reductive dechlorination (naturally, and as a component of enhanced bioremediation).


Inset Map
B-3 Bioreactor
CS-MW16-CC
CS-MW16-LGR
CS-WB05
CS-D
B3-MW34-UGR
CS-B3-MW01
B3-MW33-UGR
B3-MW26-UGR
CS-WB07
CS-WB08
B3-EXW03
B3-EXW05
B3-MW27-UGR
B3-EXW01
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CS-4
CS-WB06
B3-EXW04
B3-MW29-UGR
B3-MW30-UGR
B3-EXW02
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CS-MW5-LGR
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AOC65-VEW21
AOC65-VEW15-UGR
AOC65-VEW16-LGR
AOC65-PZ06-LGR
AOC65-VEW31
AOC65-PZ01-LGR
AOC65-VEW28A
AOC65-VEW19-UGR
AOC65-VEW32
AOC65-VEW23
AOC65-TSW-05
AOC65-VEW13-LGR
CS-MW36-LGR
CS-WB03
AOC65-TSW-01
AOC65-TSW-02
AOC65-VEW27
AOC65-VEW25
AOC65-VEW17-LGR
AOC65-VEW18-LGR
AOC65-MW2A
AOC65-VEW14-LGR
AOC65-TSW-03
AOC65-VEW26
AOC65-TSW-04
CS-WB0
AOC65-TSW-07
AOC65-TSW-06
AOC65-PZ02-LGR
CS-MW8-LGR
Inset Map
Building 90
AOC65-PZ05-LGR
CS-MWH-LGR
CS-12
CS-MWG-LGR
CS-I
FO-8
RFR-3
FO-22
CS-MW9-LGR
CS-MW9-BS
RFR-5
CS-MW25-LGR
CS-MW9-CC
RFR-4
CS-MW24-LGR
CS-MW1-LGR
CS-3
CS-MW3-LGR
CS-MW12-CC
CS-MW12-LGR
CS-2
CS-MW12-BS
JW-15
RFR-8
JW-20
CS-MW5-LGR
JW-6
CS-MW2-LGR
CS-MW2-CC
JW-31
CS-MW19-LGR
CS-MW4-LGR
JW-8
JW-5
JW-26
JW-13
CS-11
CS-10
CS-MW20-LGR
JW-27
JW-28
CS-MW17-LGR
JW-29
JW-9
CS-9
FO-17
RFR-14
CS-MW21-LGR
JW-14
OW-DAIRYWELL
JW-30
JW-7
CS-MW18-LGR
OW-CE2
OW-CE1
FO-J1
OW-HH1
RFR-13
CS-MW22-LGR
OW-MT2
OFR-4
RFR-9
CS-MW6-CC
OFR-1
AOC65-PZ03-LGR
I10-8
CS-MW6-LGR
CS-MW23-LGR
CS-13
I10-7
CS-MW6-BS
CS-MW7-LGR
CS-1
SLD-01
CS-MW7-CC
RFR-10
I10-4
I10-9
CS-MW8-LGR
SLD-02
OFR-3
CS-MW8-CC
OW-BARNOWL
OW-HH2
I10-2
CS-MW11A-LGR
CS-WB04
CS-WB01
CS-MW11B-LGR
RFR-11
BSR-03
CS-MW35-LGR
HS-2
RFR-12
OW-HH3
I10-5
HS-3
LS-6
LS-1
LS-5
HS-1
LS-7
CS-MW10-LGR
CS-MW10-CC
LS-4
BSR-04
I10-10
Well
CSSA Boundary
Note: Wells shown in italics are not part of the current or proposed long-term monitoring program
N
0
0.5
1 Miles
C:\CSSA\GIS\MXD\ANNUAL_GW_FACT_SHEET\LTMO.mxd 7/20/2015 5:00:03 PM wayne.simoneau@parsons.com
Figure 3.1
Groundwater Monitoring Well Locations
Camp Stanley Storage Activity
PARSONS

TABLE 3.1
CURRENT GROUNDWATER MONITORING PROGRAM
LONG TERM MONITORING OPTIMIZATION
CAMP STANLEY STORAGE ACTIVITY, TEXAS

Well ID	Vertical Zone	Current Sampling Frequency	First Sampling Event	Most Recent Data	Classification
On Post Monitoring Wells					
AOC65-MW1	UGR(D)	Sample after major rain event	04/12/2001	12/02/2004	UGR[a/]
AOC65-MW2A	UGR(D)	Sample after major rain event	04/23/2001	12/02/2004	UGR
AOC65-PZ01-LGR	LGR(B)	ISCO	07/19/2002	11/18/2014	LGR[b/]
AOC65-PZ02-LGR	UGR(D)	ISCO	07/19/2002	11/18/2014	LGR
AOC65-PZ03-LGR	LGR(B)	ISCO	06/05/2003	04/16/2013	LGR
AOC65-PZ04-LGR	UGR(D)	ISCO	06/05/2003	04/16/2013	LGR
AOC65-PZ05-LGR	LGR(B)	ISCO	07/30/2002	11/18/2014	LGR
AOC65-PZ06-LGR	UGR(D)	ISCO	06/05/2003	11/18/2014	LGR
AOC65-TSW-01		ISCO	07/18/2012	11/18/2014	UGR
AOC65-TSW-02		ISCO	04/16/2013	11/18/2014	UGR
AOC65-TSW-03		ISCO	07/20/2012	11/18/2014	UGR
AOC65-TSW-04		ISCO	07/20/2012	11/18/2014	UGR
AOC65-TSW-05		ISCO	07/20/2012	11/18/2014	UGR
AOC65-TSW-06		ISCO	07/20/2012	04/18/2013	UGR
AOC65-TSW-07		ISCO	07/20/2012	11/18/2014	UGR
AOC65-VEW13-LGR		ISCO	07/03/2002	04/16/2013	LGR
AOC65-VEW14-LGR		ISCO	07/03/2002	08/31/2011	LGR
AOC65-VEW15-UGR		ISCO	12/04/2002	11/18/2014	UGR
AOC65-VEW16-LGR		ISCO	12/04/2002	04/17/2013	LGR
AOC65-VEW17-LGR		ISCO	01/19/2004	08/31/2011	LGR
AOC65-VEW18-LGR		ISCO	01/20/2004	04/18/2013	LGR
AOC65-VEW19-UGR		ISCO	12/04/2002	11/18/2014	UGR
AOC65-VEW20		ISCO	08/18/2011	04/16/2013	UGR
AOC65-VEW21		ISCO	08/18/2011	04/16/2013	UGR
AOC65-VEW23		ISCO	08/18/2011	04/16/2013	UGR
AOC65-VEW25		ISCO	08/18/2011	11/18/2014	UGR
AOC65-VEW26		ISCO	08/18/2011	07/18/2012	UGR
AOC65-VEW27		ISCO	08/18/2011	11/18/2014	UGR
AOC65-VEW28A		ISCO	08/18/2011	04/18/2013	LGR
AOC65-VEW28B		ISCO	08/18/2011	04/18/2013	LGR
AOC65-VEW29		ISCO	08/18/2011	04/17/2013	UGR
AOC65-VEW31		ISCO	08/18/2011	04/17/2013	UGR
AOC65-VEW32		ISCO	08/18/2011	11/18/2014	UGR
B3-EXW01		Semi-annually, Bioreactor	05/12/2009	10/08/2014	OPBH[c/]
B3-EXW02		Semi-annually, Bioreactor	05/19/2010	10/08/2014	OPBH
B3-EXW03		Semi-annually, Bioreactor	01/16/2013	10/08/2014	OPBH
B3-EXW04		Semi-annually, Bioreactor	01/16/2013	10/08/2014	OPBH
B3-EXW05		Semi-annually, Bioreactor	01/16/2013	10/08/2014	OPBH
B3-MW26-UGR		Semi-annually, Bioreactor	06/23/2010	10/14/2014	UGR
B3-MW27-UGR		Semi-annually, Bioreactor	02/24/2010	10/14/2014	UGR
B3-MW29-UGR		Semi-annually, Bioreactor	06/23/2010	10/15/2012	UGR
B3-MW30-UGR		Semi-annually, Bioreactor	06/23/2010	04/12/2013	UGR
B3-MW31-UGR		Semi-annually, Bioreactor	06/23/2010	10/14/2014	UGR
B3-MW32-UGR		Semi-annually, Bioreactor	06/23/2010	04/10/2014	UGR
B3-MW33-UGR		Semi-annually, Bioreactor	06/23/2010	10/14/2014	UGR
B3-MW34-UGR		Semi-annually, Bioreactor	06/23/2010	10/14/2014	UGR
CS-1	LGR(D), LGR(E), LGR(F), BS(A), BS(B), CC(A), CC(B)	Quarterly	08/09/1991	12/08/2014	OPBH

TABLE 3.1
CURRENT GROUNDWATER MONITORING PROGRAM
LONG TERM MONITORING OPTIMIZATION
CAMP STANLEY STORAGE ACTIVITY, TEXAS

Well ID	Vertical Zone	Current Sampling Frequency	First Sampling Event	Most Recent Data	Classification
CS-2	LGR(E), LGR(F), BS(A)	Every 9 months	11/03/1992	06/16/2014	OPBH
CS-3	LGR(E), LGR(F), BS(A)	Exclude	11/04/1992	02/05/2010	OPBH
CS-4	LGR(E)	Semi-annually	12/04/1991	06/25/2013	OPBH
CS-9	LGR(E), LGR(F), BS(A), BS(B), CC(A)	Quarterly	08/09/1991	09/23/2013	OPBH
CS-10	LGR(F), BS(A), BS(B), CC(A), CC(B)	Quarterly	08/09/1991	12/08/2014	OPBH
CS-12	LGR(D), LGR(E), LGR(F), BS(A), BS(B), CC(A), CC(B)	Quarterly	03/25/2009	12/08/2014	OPBH
CS-13	LGR, CC	Quarterly	03/15/2012	12/08/2014	OPBH
CS-B3-MW01		Semi-annually, Bioreactor	07/27/2007	10/09/2014	LGR
CS-D	LGR(D), LGR(E), LGR(F)	Semi-annually	12/04/1991	01/10/2013	OPBH
CS-I	LGR(E), LGR(F)	Every 9 months	11/04/1992	06/11/2014	OPBH
CS-MW1-BS	BS(A)	Biennially	11/21/2002	12/18/2012	BS[d/]
CS-MW1-CC	CC(A)	Biennially	11/10/2002	09/08/2014	CC[e/]
CS-MW1-LGR	LGR(F)	Semi-annually	09/08/1999	10/09/2014	LGR
CS-MW2-CC	CC(A)	Biennially	03/02/2003	06/16/2014	CC
CS-MW2-LGR	LGR(F)	Semi-annually	09/09/1999	09/08/2014	LGR
CS-MW3-LGR	LGR(F)	Semi-annually	06/14/2001	06/11/2014	LGR
CS-MW4-LGR	LGR(F)	Semi-annually	06/14/2001	06/17/2013	LGR
CS-MW5-LGR	LGR(F)	Semi-annually	06/14/2001	06/16/2014	LGR
CS-MW6-BS	BS(A)	Biennially	06/13/2001	12/13/2012	BS
CS-MW6-CC	CC(A)	Biennially	06/13/2001	06/19/2014	CC
CS-MW6-LGR	LGR(F)	Semi-annually; ISCO	04/09/2001	11/13/2014	LGR
CS-MW7-CC	CC(A)	Biennially	07/18/2001	06/19/2014	CC
CS-MW7-LGR	LGR(F)	Semi-annually: ISCO	07/31/2001	11/13/2014	LGR
CS-MW8-CC	CC(A)	Biennially	06/14/2001	06/19/2014	CC
CS-MW8-LGR	LGR(F)	Every 9 months; ISCO	06/12/2001	11/13/2014	LGR
CS-MW9-BS	BS(A)	Biennially	06/14/2001	12/11/2012	BS
CS-MW9-CC	CC(A)	Biennially	11/19/2000	06/11/2014	CC
CS-MW9-LGR	LGR(F)	Semi-annually	02/18/2001	06/11/2014	LGR
CS-MW10-CC	CC(A)	Biennially	09/26/2001	01/10/2013	CC
CS-MW10-LGR	LGR(F)	Every 9 months	09/26/2001	06/19/2014	LGR
CS-MW11A-LGR	LGR(F)	Semi-annually	03/19/2003	09/08/2014	LGR
CS-MW11B-LGR	LGR(B)	Semi-annually	04/04/2003	09/09/2010	LGR
CS-MW12-BS	BS(A)	Biennially	12/16/2002	12/17/2012	BS
CS-MW12-CC	CC(A)	Biennially	09/26/2002	06/12/2014	CC
CS-MW12-LGR	LGR(F)	Every 9 months	09/13/2002	06/12/2014	LGR
CS-MW16-CC	CC(A)	Semi-annually	04/21/2003	10/08/2014	CC
CS-MW16-LGR	LGR(E), LGR(F)	Semi-annually	08/09/1991	10/08/2014	OPBH
CS-MW17-LGR	LGR(F)	Every 9 months	09/12/2002	06/11/2014	LGR
CS-MW18-LGR	LGR(F)	Semi-annually	07/24/2002	01/10/2013	LGR
CS-MW19-LGR	LGR(F)	Semi-annually	08/06/2002	06/16/2014	LGR
CS-MW20-LGR	LGR(F)	Quarterly until new LTMO	10/18/2006	06/18/2014	LGR
CS-MW21-LGR	LGR(F)	Quarterly until new LTMO	12/12/2006	09/08/2014	LGR

TABLE 3.1
CURRENT GROUNDWATER MONITORING PROGRAM
LONG TERM MONITORING OPTIMIZATION
CAMP STANLEY STORAGE ACTIVITY, TEXAS

Well ID	Vertical Zone	Current Sampling Frequency	First Sampling Event	Most Recent Data	Classification
CS-MW22-LGR	LGR(F)	Quarterly until new LTMO	11/09/2006	06/18/2014	LGR
CS-MW23-LGR	LGR(F)	Quarterly until new LTMO	06/05/2007	06/18/2014	LGR
CS-MW24-LGR	LGR(F)	Quarterly until new LTMO	12/26/2006	09/08/2014	LGR
CS-MW25-LGR	LGR(F)	Quarterly until new LTMO	01/03/2007	06/11/2014	LGR
CS-MW35-LGR	LGR	Every 9 months	03/31/2011	09/09/2014	LGR
CS-MW36-LGR	LGR	Every 9 months; ISCO	04/08/2011	12/02/2014	LGR
CS-MWG-LGR	LGR(C), LGR(D), LGR(E)	Every 9 months	11/03/1992	06/11/2014	OPBH
CS-MWH-LGR	LGR(F)	Biennially	11/04/1992	06/11/2014	LGR
Off Post Monitoring Wells					
BSR-03		Every 9 months	03/09/2012	06/06/2014	OffBH[f/]
BSR-04		Every 9 months	12/06/2012	06/10/2014	OffBH
FO-8	LGR, CC	Annually	03/19/2002	06/05/2014	OffBH
FO-17	LGR, CC	Annually	03/19/2002	06/04/2014	OffBH
FO-22	LGR, CC	Annually	09/18/2001	06/05/2014	OffBH
FO-J1	LGR, CC	Qtrly, 1 year thru Dec. 10	09/18/2001	06/04/2014	OffBH
HS-1	LGR, CC	Quarterly	09/19/2006	06/05/2014	OffBH
HS-2	LGR, CC	Qtrly, 1 year thru June 10	12/19/2001	06/05/2014	OffBH
HS-3	LGR, CC	Annually	12/19/2001	06/05/2014	OffBH
I10-2	LGR, CC	Annually	09/19/2001	06/04/2014	OffBH
I10-4	LGR, CC	Quarterly	12/19/2001	12/09/2013	OffBH
I10-5	LGR, CC	Annually	12/06/2002	06/04/2014	OffBH
I10-7	LGR, CC	Qtrly, 1 year thru Dec. 10	03/21/2002	06/04/2014	OffBH
I10-8	LGR, CC	Annually	12/19/2005	06/04/2014	OffBH
I10-9		Every 9 months	09/06/2011	06/04/2012	OffBH
I10-10		Every 9 months	09/11/2013	09/11/2013	OffBH
JW-5	LGR, CC	Annually	06/22/2005	06/03/2014	OffBH
JW-6	LGR, CC	Annually	09/19/2001	06/03/2014	OffBH
JW-7	LGR, CC	Qtrly, 1 year thru Dec. 10	09/08/2003	06/03/2014	OffBH
JW-8	LGR, CC	Qtrly, 1 year thru Dec. 10	06/18/2003	06/06/2014	OffBH
JW-9	LGR, CC	Annually	09/18/2001	06/20/2014	OffBH
JW-13	LGR, CC	Annually	09/19/2001	06/16/2014	OffBH
JW-14	LGR, CC	Qtrly, due to location	09/18/2001	06/04/2014	OffBH
JW-15	LGR, CC	Annually	06/21/2005	06/06/2014	OffBH
JW-20	LGR, CC	Every 9 months	01/22/2014	09/04/2014	OffBH
JW-26	LGR, CC	Declined Access	03/21/2002	06/04/2014	OffBH
JW-27	LGR, CC	Annually	06/12/2003	06/10/2014	OffBH
JW-28	LGR, CC	Qtrly, due to location	09/10/2003	06/05/2014	OffBH
JW-29	LGR, CC	Qtrly, due to location	06/11/2003	06/06/2014	OffBH
JW-30	LGR, CC	Qtrly, due to location	09/08/1999	06/06/2014	OffBH
JW-31	LGR, CC	Qtrly, 1 year thru Dec. 10	12/01/2009	06/05/2014	OffBH
LS-1	LGR, CC	Quarterly	09/17/2001	06/05/2014	OffBH
LS-4	LGR, CC	Annually	09/17/2001	06/05/2014	OffBH
LS-5	LGR, CC	Qtrly, 1 year thru Dec. 10; ISCO	08/01/2001	12/01/2014	OffBH
LS-6	LGR, CC	Qtrly, 1 year thru Dec. 10; ISCO	08/01/2001	12/01/2014	OffBH
LS-7	LGR, CC	Qtrly, 1 year thru Dec. 10; ISCO	12/13/1999	12/01/2014	OffBH
OFR-1	LGR, CC	Qtrly, 1 year thru Dec. 10	12/20/2001	06/06/2014	OffBH
OFR-3	LGR, CC	Qtrly, 1 year thru Dec. 10; ISCO	10/25/2001	04/23/2013	OffBH
OFR-4	LGR, CC	Annually	06/12/2003	06/23/2014	OffBH
OW-BARNOWL	SL, HO	Every 9 months	02/28/2011	06/04/2014	OffBH
OW-CE1		Every 9 months	02/28/2011	06/04/2014	OffBH
OW-CE2		Every 9 months	02/28/2011	06/04/2014	OffBH

TABLE 3.1
CURRENT GROUNDWATER MONITORING PROGRAM
LONG TERM MONITORING OPTIMIZATION
CAMP STANLEY STORAGE ACTIVITY, TEXAS

Well ID	Vertical Zone	Current Sampling Frequency	First Sampling Event	Most Recent Data	Classification
OW-DAIRYWELL	SL, HO	Every 9 months	02/28/2011	06/04/2014	OffBH
OW-HH1	SL, HO	Every 9 months	02/28/2011	06/04/2014	OffBH
OW-HH2	LGR, CC	Every 9 months	02/28/2011	06/04/2014	OffBH
OW-HH3		Every 9 months	02/28/2011	06/04/2014	OffBH
OW-MT2	LGR, CC	Every 9 months	02/28/2011	06/04/2014	OffBH
RFR-3	LGR, CC	Annually	09/08/1999	06/05/2014	OffBH
RFR-4	LGR, CC	Annually	03/10/2004	06/05/2014	OffBH
RFR-5	LGR, CC	Annually	03/10/2004	06/05/2014	OffBH
RFR-8	LGR, CC	Annually	09/08/1999	06/06/2014	OffBH
RFR-9	LGR, CC	Qtrly, 1 year thru Sept. 10	09/19/2001	06/06/2014	OffBH
RFR-10	LGR, CC	Qtrly, 1 year thru Dec. 10; ISCO	09/19/2001	12/01/2014	OffBH
RFR-11	LGR, CC	Qtrly, 1 year thru Dec. 10; ISCO	10/04/2001	12/01/2014	OffBH
RFR-12	LGR, CC	Annually; ISCO	08/30/2001	06/03/2014	OffBH
RFR-13	LGR, CC	Annually	12/16/2004	06/10/2014	OffBH
RFR-14	LGR, CC	Qtrly, 1 year thru Sept. 10	03/23/2006	06/06/2014	OffBH
SLD-01		Every 9 months	09/08/2011	12/02/2014	OffBH
SLD-02		Every 9 months	03/06/2012	06/10/2014	OffBH
WestBay Wells					
CS-WB01-LGR-01	LGR-01	Semi-annually; ISCO	09/09/2003	12/09/2014	LGR
CS-WB01-LGR-02	LGR-02	Semi-annually	09/09/2003	12/09/2014	LGR
CS-WB01-LGR-03	LGR-03	Semi-annually	09/09/2003	12/09/2014	LGR
CS-WB01-LGR-04	LGR-04	Semi-annually	09/08/2003	12/09/2014	LGR
CS-WB01-LGR-05	LGR-05	Semi-annually	09/08/2003	12/09/2014	LGR
CS-WB01-LGR-06	LGR-06	Semi-annually	09/08/2003	12/09/2014	LGR
CS-WB01-LGR-07	LGR-07	Semi-annually	09/08/2003	12/09/2014	LGR
CS-WB01-LGR-08	LGR-08	Semi-annually	09/08/2003	12/09/2014	LGR
CS-WB01-LGR-09	LGR-09	Semi-annually; ISCO	09/08/2003	12/09/2014	LGR
CS-WB01-UGR-01	UGR-01	Semi-annually; ISCO	11/18/2004	12/02/2004	UGR
CS-WB02-LGR-01	LGR-01	Semi-annually; ISCO	09/09/2003	12/10/2014	LGR
CS-WB02-LGR-02	LGR-02	Semi-annually	04/16/2004	03/11/2010	LGR
CS-WB02-LGR-03	LGR-03	Semi-annually	09/09/2003	12/10/2014	LGR
CS-WB02-LGR-04	LGR-04	Semi-annually	09/09/2003	12/10/2014	LGR
CS-WB02-LGR-05	LGR-05	Semi-annually	09/09/2003	12/10/2014	LGR
CS-WB02-LGR-06	LGR-06	Semi-annually	09/09/2003	12/10/2014	LGR
CS-WB02-LGR-07	LGR-07	Semi-annually	09/09/2003	12/10/2014	LGR
CS-WB02-LGR-08	LGR-08	Semi-annually	09/09/2003	12/10/2014	LGR
CS-WB02-LGR-09	LGR-09	Semi-annually; ISCO	09/09/2003	12/10/2014	LGR
CS-WB02-UGR-01	UGR-01	Semi-annually; ISCO	07/02/2004	12/02/2004	UGR
CS-WB03-LGR-01	LGR-01	Semi-annually; ISCO	11/18/2004	12/03/2014	LGR
CS-WB03-LGR-02	LGR-02	Semi-annually	11/30/2004	10/04/2007	LGR
CS-WB03-LGR-03	LGR-03	Semi-annually	09/10/2003	12/03/2014	LGR
CS-WB03-LGR-04	LGR-04	Semi-annually	09/10/2003	12/03/2014	LGR
CS-WB03-LGR-05	LGR-05	Semi-annually	09/10/2003	12/03/2014	LGR
CS-WB03-LGR-06	LGR-06	Semi-annually	09/10/2003	12/03/2014	LGR
CS-WB03-LGR-07	LGR-07	Semi-annually	09/10/2003	12/03/2014	LGR
CS-WB03-LGR-08	LGR-08	Semi-annually	09/10/2003	12/03/2014	LGR
CS-WB03-LGR-09	LGR-09	Semi-annually; ISCO	09/10/2003	12/03/2014	LGR
CS-WB03-UGR-01	UGR-01	Semi-annually; ISCO	11/18/2004	12/03/2014	UGR
CS-WB04-BS-01	BS-01	Biennially	09/18/2003	03/06/2014	BS
CS-WB04-BS-02	BS-02	Biennially	09/18/2003	03/06/2014	BS
CS-WB04-CC-01	CC-01	Biennially	09/18/2003	03/06/2014	CC
CS-WB04-CC-02	CC-02	Biennially	09/18/2003	03/06/2014	CC

TABLE 3.1
CURRENT GROUNDWATER MONITORING PROGRAM
LONG TERM MONITORING OPTIMIZATION
CAMP STANLEY STORAGE ACTIVITY, TEXAS

Well ID	Vertical Zone	Current Sampling Frequency	First Sampling Event	Most Recent Data	Classification
CS-WB04-CC-03	CC-03	Biennially	09/18/2003	03/06/2014	CC
CS-WB04-LGR-01	LGR-01	Semi-annually; ISCO	10/16/2003	12/08/2014	LGR
CS-WB04-LGR-02	LGR-02	Semi-annually	05/12/2004	03/10/2010	LGR
CS-WB04-LGR-03	LGR-03	Semi-annually	10/16/2003	03/06/2014	LGR
CS-WB04-LGR-04	LGR-04	Semi-annually	09/19/2003	03/06/2014	LGR
CS-WB04-LGR-06	LGR-06	Semi-annually	09/19/2003	12/08/2014	LGR
CS-WB04-LGR-07	LGR-07	Semi-annually	09/19/2003	12/08/2014	LGR
CS-WB04-LGR-08	LGR-08	Semi-annually	09/19/2003	12/08/2014	LGR
CS-WB04-LGR-09	LGR-09	Semi-annually	09/19/2003	12/08/2014	LGR
CS-WB04-LGR-10	LGR-10	Semi-annually	09/18/2003	12/08/2014	LGR
CS-WB04-LGR-11	LGR-11	Semi-annually; ISCO	09/18/2003	12/08/2014	LGR
CS-WB04-UGR-01	UGR-01	Semi-annually; ISCO	11/18/2004	11/18/2004	UGR
CS-WB05-BS-01	BS-01	Semi-annually, Bioreactor	11/21/2005	10/24/2014	BS
CS-WB05-CC-01	CC-01	Semi-annually, Bioreactor	11/21/2005	10/24/2014	CC
CS-WB05-CC-02	CC-02	Semi-annually, Bioreactor	11/21/2005	10/27/2014	CC
CS-WB05-LGR-01	LGR-01	Semi-annually, Bioreactor	07/17/2007	10/23/2014	LGR
CS-WB05-LGR-02	LGR-02	Semi-annually, Bioreactor	07/17/2007	10/26/2010	LGR
CS-WB05-LGR03A	LGR-03	Semi-annually, Bioreactor	07/17/2007	04/18/2012	LGR
CS-WB05-LGR03B	LGR-03	Semi-annually, Bioreactor	12/29/2005	10/23/2012	LGR
CS-WB05-LGR-04A	LGR-04	Semi-annually, Bioreactor	11/21/2005	10/24/2014	LGR
CS-WB05-LGR-04B	LGR-04	Semi-annually, Bioreactor	11/21/2005	10/24/2014	LGR
CS-WB06-LGR-01	LGR-01	Semi-annually, Bioreactor	12/27/2005	10/28/2014	LGR
CS-WB06-LGR-02	LGR-02	Semi-annually, Bioreactor	12/27/2005	10/28/2014	LGR
CS-WB06-LGR03A	LGR-03	Semi-annually, Bioreactor	12/27/2005	10/27/2014	LGR
CS-WB06-LGR03B	LGR-03	Semi-annually, Bioreactor	12/27/2005	10/27/2014	LGR
CS-WB06-LGR-04	LGR-04	Semi-annually, Bioreactor	12/27/2005	10/27/2014	LGR
CS-WB06-UGR-01	UGR-01	Semi-annually, Bioreactor	07/25/2007	10/28/2014	UGR
CS-WB07-LGR-01	LGR-01	Semi-annually, Bioreactor	12/28/2005	10/22/2014	LGR
CS-WB07-LGR-02	LGR-02	Semi-annually, Bioreactor	12/28/2005	10/22/2014	LGR
CS-WB07-LGR03A	LGR-03	Semi-annually, Bioreactor	12/28/2005	04/20/2012	LGR
CS-WB07-LGR03B	LGR-03	Semi-annually, Bioreactor	12/28/2005	10/22/2014	LGR
CS-WB07-LGR-04	LGR-04	Semi-annually, Bioreactor	12/28/2005	10/22/2014	LGR
CS-WB07-UGR-01	UGR-01	Semi-annually, Bioreactor	07/19/2007	02/01/2011	UGR
CS-WB08-LGR-01	LGR-01	Semi-annually, Bioreactor	12/29/2005	10/21/2014	LGR
CS-WB08-LGR-02	LGR-02	Semi-annually, Bioreactor	12/29/2005	10/21/2014	LGR
CS-WB08-LGR03A	LGR-03	Semi-annually, Bioreactor	07/26/2007	01/25/2011	LGR
CS-WB08-LGR03B	LGR-03	Semi-annually, Bioreactor	12/28/2005	10/30/2012	LGR
CS-WB08-LGR-04	LGR-04	Semi-annually, Bioreactor	12/28/2005	10/21/2014	LGR
CS-WB08-UGR-01	UGR-01	Semi-annually, Bioreactor	07/26/2007	10/21/2014	UGR

[a/] UGR = On Post monitoring well, AOC-65 area well, or WestBay-equipped well screened in the UGR zone; included in vertical analysis.

[b/] LGR = On Post monitoring well, AOC-65 area well, or WestBay-equipped well screened in the LGR zone; included in vertical analysis.

[c/] OPBH = On Post Borehole; included in vertical analysis.

[d/] BS = On Post monitoring well or WestBay-equipped well screened in the Bexar Shale zone; included in vertical analysis.

[e/] CC = On Post monitoring well or WestBay-equipped well screened in the Cow Creek zone; included in vertical analysis.

[f/] OffBH = Off Base Borehole; included in vertical analysis.

SECTION 4
LTMO EVALUATION

An effective groundwater monitoring program will provide information regarding contaminant plume migration and changes in chemical concentrations through time at appropriate locations, enabling decision-makers to verify that contaminants are not endangering potential receptors, and that remediation is occurring at rates sufficient to achieve remedial action objectives (RAO) within a reasonable time frame. The design of the monitoring program should therefore include consideration of existing receptor exposure pathways, as well as exposure pathways arising from potential future use of the groundwater.

Performance monitoring wells located within and downgradient from a plume provide a means of evaluating the effectiveness of a groundwater remedy relative to performance criteria. LTM of these wells also provides information about migration of the plume and temporal trends in chemical concentrations. Groundwater monitoring wells located downgradient from the leading edge of a plume (*i.e.,* sentry wells) are used to evaluate possible changes in the extent of the plume and, if warranted, to trigger a contingency response action if contaminants are detected.

Primary factors to consider when developing a groundwater monitoring program include at a minimum:

- Aquifer heterogeneity;
- Types of contaminants;
- Distance to potential receptor exposure points;
- Groundwater seepage velocity and flow direction(s);
- Potential surface-water impacts; and
- The effects of the remediation system.

These factors will influence the locations and spacing of monitoring points and the sampling frequency. Typically, the greater the seepage velocity and the shorter the distance to receptor exposure points, the more frequently groundwater sampling should be conducted.

One of the most important purposes of LTM is to confirm that the contaminant plume is behaving as predicted. Graphical and statistical tests can be used to evaluate plume stability. If a groundwater remediation system or strategy is effective, then over the long term, groundwater-monitoring data should demonstrate a clear and meaningful decreasing trend in concentrations at appropriate monitoring points. The CSSA Groundwater Monitoring Program is conducted under the provisions of the *Off-post Groundwater Monitoring Program Response Plan* (CSSA, 2002) and the *Data Quality Objectives for the Groundwater Monitoring Program* (Parsons, 2010).

4.1 THREE-TIERED OPTIMIZATION APPROACH USING 3TMO

The current groundwater monitoring program at CSSA was evaluated using a three-tiered monitoring optimization (3TMO) protocol, which was developed by Parsons and Environ International Corp. on behalf of AFCEE in 2011. 3TMO is a comprehensive, public domain, user-friendly, LTMO decision support tool that uses a combination of statistics and professional

judgment in a structured protocol to optimize sampling locations, sampling frequency, and target analytes for monitoring wells while maintaining an effective performance and compliance monitoring program with no loss of required information. It is intended to facilitate more efficient performance and successful implementation of long-term groundwater monitoring optimization evaluations through the following capabilities:

- Embedded decision-making frameworks for conducting multi-tiered qualitative and quantitative optimization evaluations;
- On-demand graphs of chemical concentrations over time with user-selected chemical and time range parameters;
- Map-based display of relevant information;
- Well-by-well optimization recommendations and reports; and
- LTMO best practices guidance and documentation.

3TMO is based on the three-tiered approach to evaluating and optimizing LTM programs that was developed by Parsons in 2001 (Nobel and Anthony 2004; USEPA 2005). The three tiers consist of:

1. A qualitative evaluation of the monitoring program;
2. A statistical evaluation of temporal trends in contaminant concentration;
3. A qualitative analysis of the spatial importance of each monitoring location.

Each of the three evaluation tiers is performed separately to yield three distinct sets of optimization recommendations. The results of the three evaluations are then combined to assess the degree to which the existing monitoring network addresses the primary objectives of monitoring. A decision algorithm is applied to assess the optimal frequency of monitoring, to assess the optimal spatial distribution of the components of the monitoring network, and to develop final recommendations for monitoring program optimization. The three-tiered LTMO approach is unique when compared with existing LTMO statistical applications due to its focus on qualitative factors that are supported by quantitative statistical analysis. The spatial analysis incorporated into 3TMO is qualitative rather than statistical. The user enters a recommendation to retain or exclude each well based on qualitative spatial analysis facilitated by plume maps, time-versus-concentration charts, and well parameter information (e.g. screened interval).

This report presents the results of two separate optimization evaluations that were performed for Plumes 1 and 2 at CSSA. Each evaluation included wells currently in the groundwater monitoring program and wells used as monitoring points for ongoing remedial efforts. The components of these evaluations are described in greater detail in **Section 5**.

4.2 OPTIMIZATION METHODS

4.2.1 Identification of Key Constituents of Concern

The 2013 *Baseline Risk Assessment* identified the COCs in groundwater as PCE, TCE, *cis*-1,2-DCE, and VC (Parsons, 2014a). The groundwater DQOs address these COCs (Parsons, 2015). Of all the COCs listed, PCE is the most widely distributed compound above its respective MCL. Limited exceptions include areas where chemical biodegradation/natural attenuation

processes are occurring near the plume source areas and the associated active remediation efforts.

To simplify the 3TMO evaluation and presentation of findings, PCE was selected as the "indicator" compound for which to conduct the LTMO process. Because PCE has historically exceeded its MCL in a relatively large percentage of samples collected over the greatest aerial extent, its relatively high concentration and distribution as compared to the other COCs are the primary influences on the scope of the groundwater monitoring program.

4.2.2 Data Input

Data input to 3TMO included **well parameters** and **sample data** as described below.

Well parameters included well identification numbers, survey coordinates (northing and easting), screen intervals, the hydrogeologic zone in which the screen was placed, the well functional category (described below), the current sampling frequency, and a qualitative assessment of the current or potential future importance of the monitoring location (low, moderate, or high) based on multiple factors (described below).

The well functional category was assigned based on the location of each well with regard to the contaminant plume, potential receptors, and/or the Site boundary. Potential functional categories available in 3TMO include background, upgradient, cross-gradient or cross-gradient plume edge, downgradient or downgradient plume edge, in-plume, source area, point of compliance, sentinel, and distant/offsite.

The assignment of the importance of the monitoring location was based on the magnitude of COC concentrations, plume dynamics (i.e., receding, stable, expanding), the estimated contaminant transport velocity between the well and any downgradient receptors, the proximity of the well to potential receptors, and predictability of COC concentrations at the well as shown below.

Assessing the Importance of the Monitoring Location

Lower Importance	Higher Importance
Lower COC concentrations	Higher COC concentrations
Stable to receding plume	Expanding plume or plume dynamics unknown
Lower groundwater and contaminant transport velocities	Higher groundwater and contaminant transport velocities
Well is not located in a preferential groundwater flow pathway (e.g., well is located in a less-permeable portion of the water-bearing zone)	Well is located in a preferential groundwater flow pathway (e.g., more-permeable portion of the water-bearing zone such as a gravel or cobble zone with relatively permeable sediments)
No nearby receptors	Nearby receptors
COC concentrations are stable over time or vary in a predictable manner. This criterion could apply to stable, high-concentration, in-plume wells or stable, low-concentration wells that are along the exterior of the plume, either upgradient or cross-gradient of the plume axis.	COC concentrations are variable and unpredictable; this criterion is especially applicable to wells in sensitive locations such as downgradient plume-edge wells where a change in concentration could alter a decision or course of action.

Some in-plume wells were assigned a relatively "high" importance because they:

- Are installed in key locations such as near potential surface water discharge areas or downgradient of plume "hotspots" (and therefore useful to monitor for downgradient migration of COC mass that could result in plume expansion); or
- Had increasing or unpredictable concentration trends that warrant relatively frequent sampling to monitor the trends, understand plume dynamics (expanding, stable, decreasing), and determine whether additional response action is called for to maintain protectiveness of human health and the environment.

Other in-plume wells that do not exhibit the characteristics identified above were mostly assigned a "moderate" importance. Some in-plume wells that are located near the upgradient or cross-gradient fringes of plumes and are hydraulically distant from surface water were assigned a "low" importance.

A relatively small number of cross-gradient or upgradient wells that are minimally contaminated (i.e., near or below MCLs) or uncontaminated and considered to be exterior to the plume were also assigned a "low" importance. In these cases, there is no evidence to indicate that cross-gradient or upgradient plume expansion is occurring at these locations, and therefore there is no reason to expect that contaminant concentrations at these wells would substantially change from year to year.

Sample data included historical laboratory analytical results for PCE within varying timeframes for each plume. Plume 1 data included in the 3TMO evaluation coincided with the operational period of SWMU B-3 bioreactor (2007 to present). Treatability study wells used to

monitor bioreactor performance are not a component of the current (2010) LTM program. The addition of these wells to the LTM network incorporates bioreactor performance monitoring wells with the rest of the groundwater monitoring program for Plume 1.

Well data used for Plume 2 3TMO analyses were limited to the period following the implementation of the 2010 LTMO recommendations. Data collected prior to 2010 would result in a bias toward older analytical results due to typically shorter sampling frequencies (i.e., monthly or quarterly). Eliminating this bias more accurately evaluates the more recent conditions since the implementation of the current "9-month snapshot" sampling schedule.

4.3 WELL RETENTION EVALUATION

The 3TMO Well Retention evaluation consisted of the following components:

- **Qualitative Evaluation:** Each well was evaluated using an interactive decision tree embedded within 3TMO (**Figure 4.1**) that examines whether the well is needed to meet any of the common monitoring objectives listed below:
    - Monitor water quality near a compliance point (e.g., the facility boundary) or a potential receptor exposure point (e.g., edge of wetlands, surface water body, residential area)
    - Monitor upgradient or background water quality or biogeochemistry
    - Monitor the lateral or vertical extent of contamination or the magnitude of contaminant concentrations within the plume over time
    - Monitor to satisfy regulatory or community concerns
- **Temporal Trend Evaluation**: 3TMO calculates Mann-Kendall trend results based on user-defined date ranges and applies specific decision logic (**Figure 4.2**) to recommend retention or exclusion/frequency reduction for each well based on the functional category of the well and the temporal trend result. The Mann-Kendall test for trends (Gilbert 1987; USEPA 2000) is well suited for evaluation of environmental data because the sample size can be small (as few as four data points), and no assumptions are made regarding the underlying statistical distribution of the data (it is nonparametric).
- Potential trend outcomes that 3TMO provides include:
    - **Increasing:** statistically significant (>95% confidence) increasing trend in concentrations
    - **Probably Increasing:** statistically significant (90-95% confidence) increasing trend in concentrations
    - **Stable:** no statistically significant (<90% confidence) temporal trend in concentrations; low variability of results (coefficient of variation [COV] < 1)
    - **No Trend:** no statistically significant (<90% confidence) temporal trend in concentrations; high variability of results (COV> 1)
    - **Probably Decreasing:** statistically significant (90-95% confidence) decreasing trend in concentrations

- **Decreasing:** statistically significant (>95% confidence) decreasing trend in concentrations
- **ND (i.e., non-detect):** constituent has not been detected during the history of monitoring at the indicated well
- **Less than (<) PQL:** all sample results are below the practical quantitation limit (PQL), or the results are a mixture of non-detects and results less than the PQL
- **<4 Results**: Fewer than four measurements for the parameter; no trend evaluated

- **Spatial Evaluation:** The spatial evaluation was performed in addition to the qualitative and temporal evaluations to provide an additional line of evidence to determine which wells should be retained or excluded from the monitoring program based solely on spatial considerations. Retention or exclusion of each well was recommended based solely on a qualitative (map-based) analysis of whether there are any spatial redundancies in the monitoring well network and whether a particular well is located in an area that should be monitored to meet one or both of the objectives listed in Section 1.
- **Combined Evaluation Summary:** 3TMO provides a program-generated retention or exclusion recommendation based on the results of the qualitative, temporal, and spatial evaluation results for each well in accordance with embedded decision logic (**Figure 4.3**). A final retention or exclusion recommendation was then made based on the combination of qualitative, temporal, and spatial evaluation results for each well and the 3TMO preliminary recommendation.

Mann-Kendall trends were not derived for wells that had an insufficient number of sampling events to determine a statistical trend with sufficient confidence (i.e., less than four events).

4.4 MONITORING FREQUENCY EVALUATION

The 3TMO Monitoring Frequency Evaluation consisted of the following components:

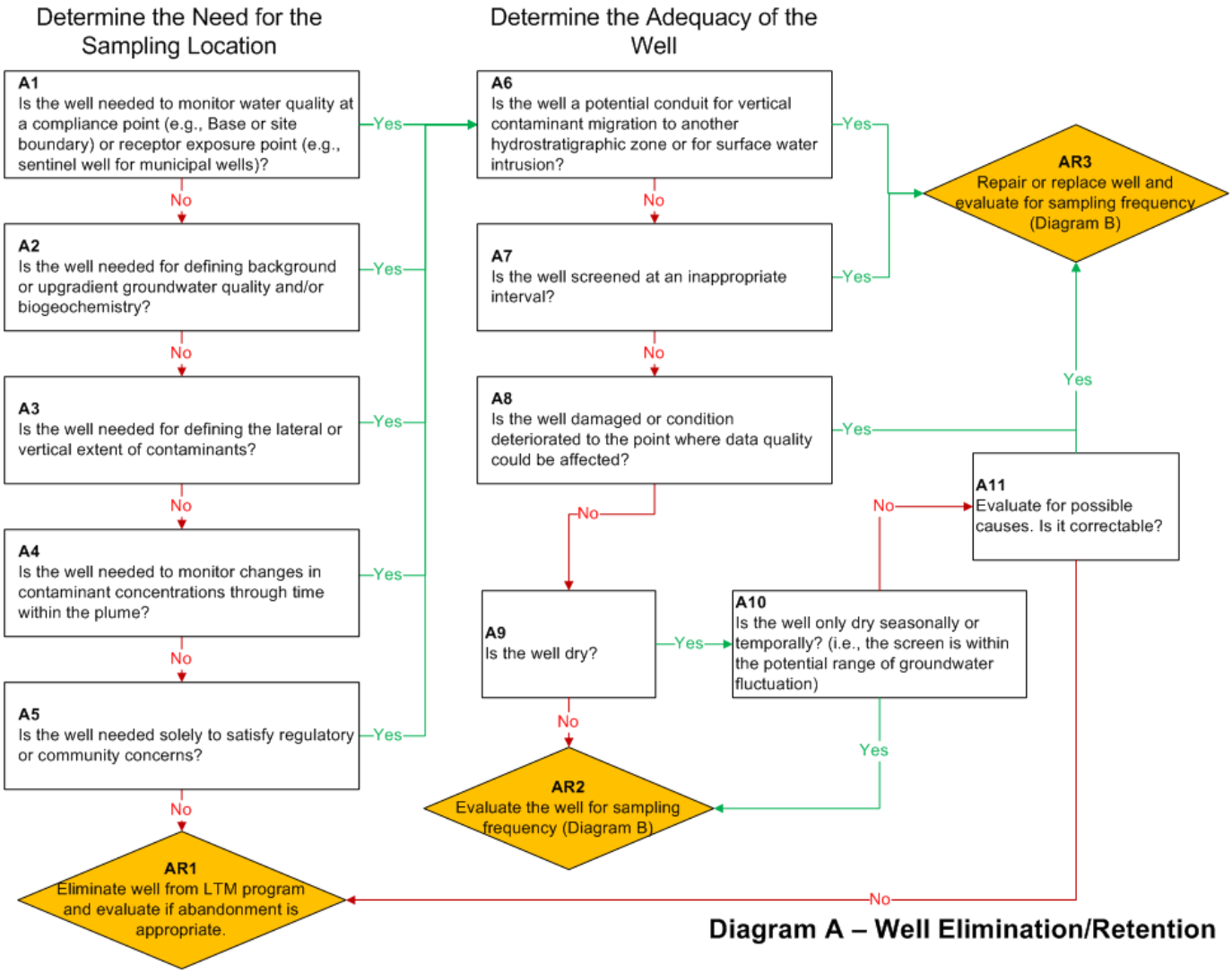
- **Qualitative Evaluation**: An appropriate generic monitoring frequency for each well was identified using an interactive decision tree **(Figure 4.4**) that takes into account the functional category of the well (Section 4.2), plume dynamics (i.e., is the plume expanding, stable, or retreating), the magnitude of contaminant concentrations, temporal concentration trends, and the location of the well with respect to potential receptors. Potential generic frequency outcomes available in the decision tree include low, moderate, high, or "estimate a conservative solute transport velocity to determine the appropriate frequency for unimpacted downgradient wells based on distance from plume to well(s)." 3TMO then uses the generic frequency result from the decision tree in combination with the importance assigned to each well (Section 4.2) to recommend a specific monitoring frequency using the following embedded decision logic:

	Low Importance	**Moderate Importance**	**High Importance**
High Sampling Frequency	Annual	Semi-annual	Monthly to quarterly
Moderate Sampling Frequency	Biennial	Annual	Semi-annual
Low Sampling Frequency	Less than biennial	Biennial	Annual

- **Temporal Trend Evaluation:** 3TMO calculates Mann-Kendall trend results based on user-defined date ranges and applies an embedded decision logic (Figure 4.2) to recommend retention or exclusion/frequency reduction for each well (same interface used in the Well Retention evaluation described in Section 4.3).
- **Combined Evaluation Summary:** A final frequency recommendation was made based on the combination of the qualitative and temporal evaluation results.

Contaminant mass and concentrations in groundwater at CSSA are expected to decrease in the future as PCE naturally attenuates and engineered remedial actions are performed. Therefore, the groundwater monitoring program recommendations for some areas outlined in this report are likely conservative in that they are based on current conditions and do not take into account the beneficial impact of future natural attenuation and engineered remedial actions. In some instances, groundwater monitoring frequencies for some wells may need to be temporarily increased to monitor the effectiveness of a short-term remedial action (e.g., enhanced *in situ* bioremediation). The remedial action work plans will outline the specific groundwater monitoring plans that will be implemented in localized areas to monitor the impact of the remedial actions.

Figure 4.1
3TMO Decision Diagram for Qualitative Evaluation of Well Elimination/Retention
Long-Term Monitoring Network Optimization Evaluation
Camp Stanley Storage Activity, Boerne, TX



Source: 3TMO User's Guide
"AR" indicates a recommendation endpoint for Decision Diagram A (Well Elimination/Retention Evaluation)

FIGURE 4.2
Temporal Trend Decision Flowchart
Long-Term Monitoring Network Optimization Evaluation
Camp Stanley Storage Activity, Boerne, TX

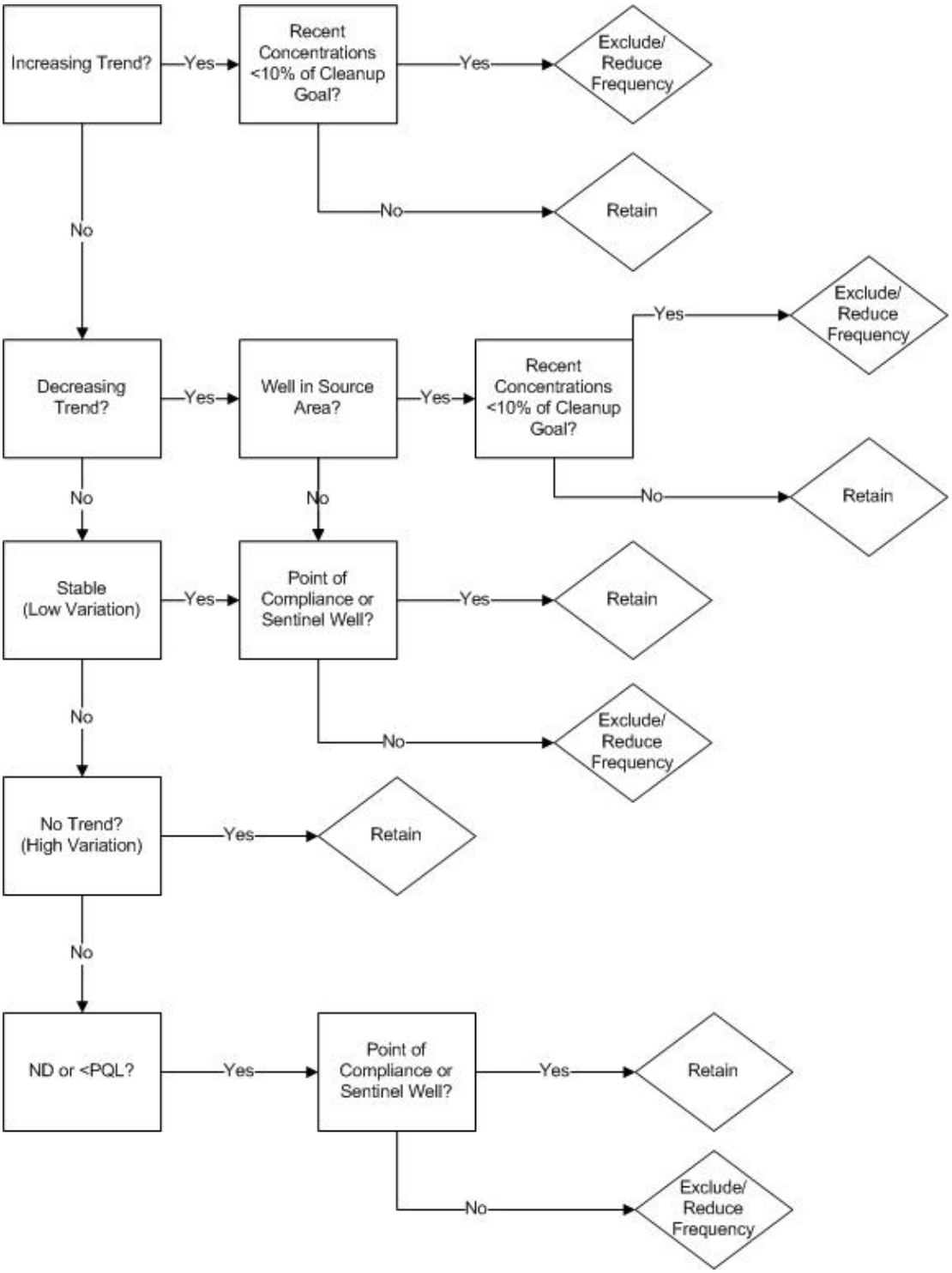


Figure 4.3
3TMO Retain/Exclude Recommendation Logic
Long-Term Monitoring Network Optimization Evaluation
Camp Stanley Storage Activity, Boerne, TX

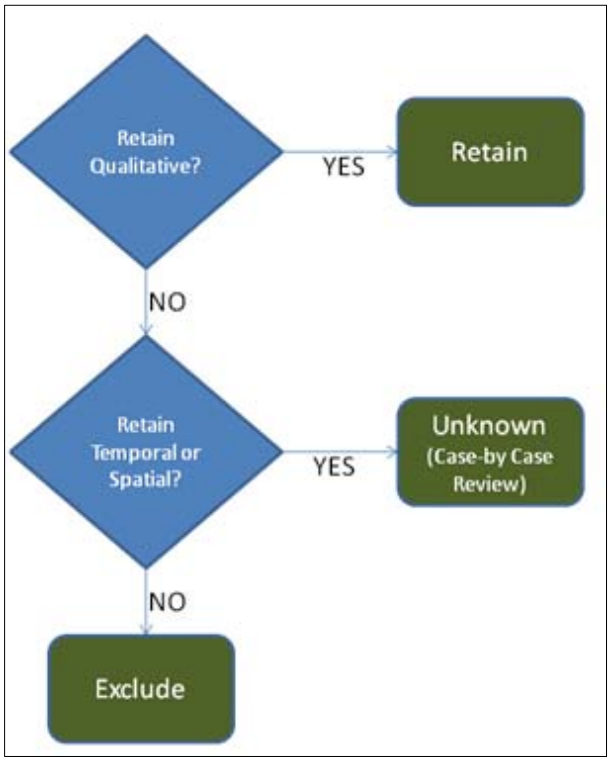


Figure 4.4
3TMO Decision Diagram For Monitoring Frequency Evaluation
Long-Term Monitoring Network Optimization Evaluation
Camp Stanley Storage Activity, Boerne, TX

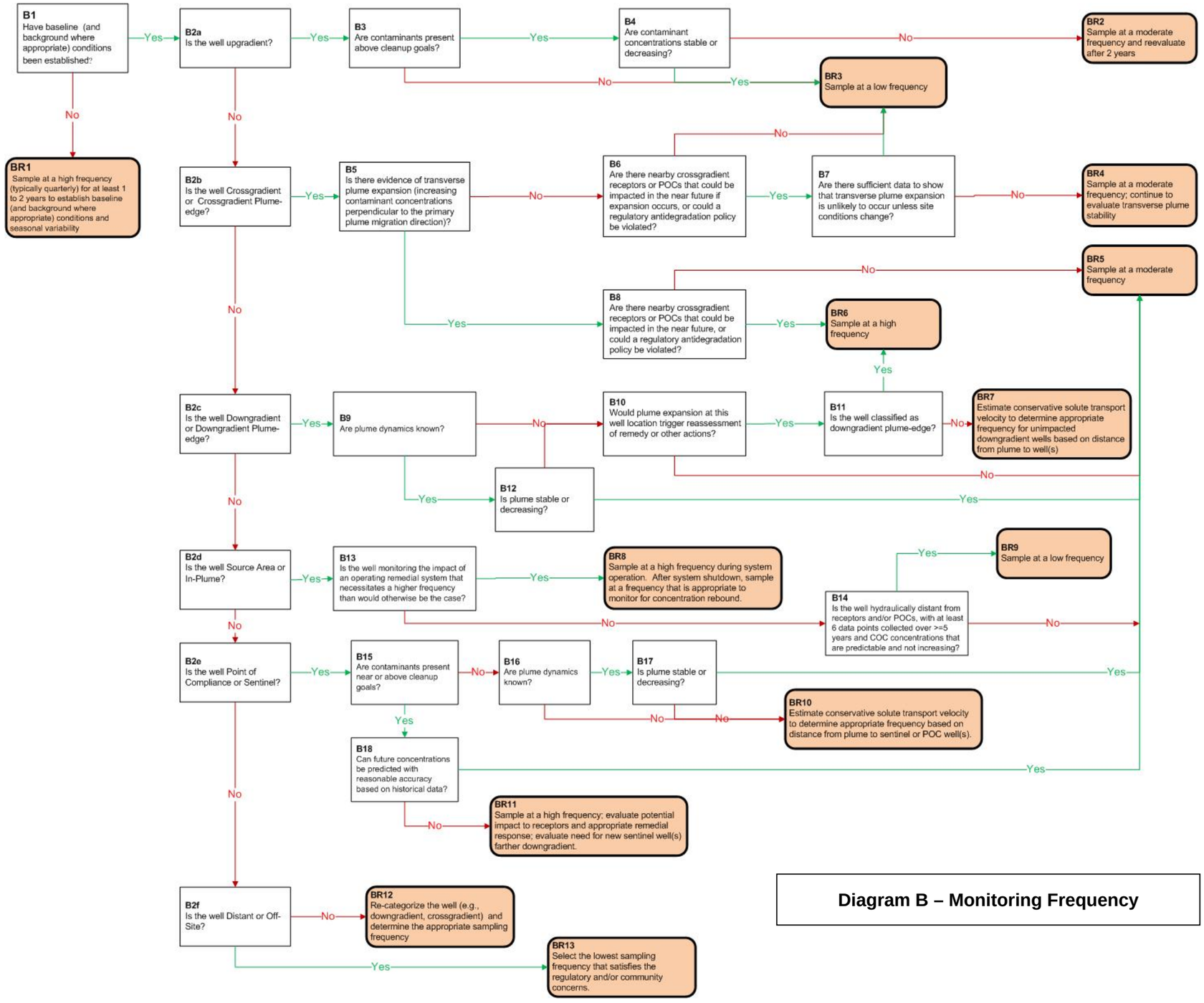


Diagram B – Monitoring Frequency

Source: 3TMO User's Guide.
"BR" indicates a recommendation endpoint for Decision Diagram B (Monitoring Frequency)

SECTION 5
LTMO RESULTS FOR PLUMES 1 AND 2

A total of 128 sampling locations were included in the LTMO evaluation. LTMO results for the Plumes 1 and 2 areas are presented and discussed in the following sections. Sampling locations for Plumes 1 and 2 are shown on **Figure 5.1**. Wells labeled as "Excluded" on **Figure 5.1** are explained further in Sections 5.1.2 and 5.2.2 below.

5.1 PLUME 1

A total of 77 sampling locations were included in the LTMO evaluation for the Plume 1 area. As described in Section 4.2, Plume 1 data included analytical results from both bioreactor performance monitoring (42 sampling locations) and the LTM program (59 sampling locations) from 2007 to December 2014. Well-specific details for Plume 1 sampling locations input into 3TMO are provided in **Table 5.1**.

5.1.1 Plume 1 Trend Analysis Results

As described in Section 4.2, the data set used for temporal trend analysis incorporated historical laboratory analytical results for COCs for sampling that occurred from 2007 through December 2014. Therefore, the calculated trends (**Table 5.2**) can be influenced by many years of data. The date range for the temporal trend analysis was selected to best discern any trends that have emerged since the full-scale operation of the bioreactor.

In general, the Mann Kendall trends for Plume 1 sampling locations indicate that the PCE plume is stable or decreasing. Samples collected from wells located outside of the Plume 1 boundary typically do not show PCE, or PCE is detected but below the reporting limit (RL), thus no trend is derived. Wells within or near the Plume 1 source area, in close proximity to the bioreactor, indicate stable or decreasing trends in PCE concentrations. Exceptions to the observed decreasing trends occur at EXW-03 and at some zones within WB-07. These increases may be due to increased pumping operations at EXW-03 causing PCE to be pulled from the source area, past WB-07, before being extracted at the well and conveyed to the bioreactor distribution system. One additional plume-edge well (CS-MW5-LGR) indicated an increasing PCE concentration trend; however, all reported concentrations for the well were below the MCL (5 ppb).

5.1.2 Plume 1 Well Retention Evaluation Results

Four wells that are currently monitored at various frequencies are recommended for exclusion from future monitoring as summarized below.

Well ID(s)	Reason for Exclusion of Currently Sampled Wells from the Monitoring Program
B3-MW28-UGR	Consistently dry.
CS-MW1-BS, CS-MW9-BS, CS-MW12-BS	BS is not a viable portion of the aquifer, and has been demonstrated to be an effective aquitard between the LGR and CC segments of the Middle Trinity aquifer.

5.1.3 Plume 1 Monitoring Frequency Evaluation Results

Sixty-nine of the 73 Plume 1 sampling locations retained are recommended for a reduction in sampling frequency for future monitoring (**Table 5.3)**. This includes the 42 sampling locations previously used to gauge bioreactor performance. The primary reasons for recommending an overall reduction in monitoring intensity for the Plume 1 area are as follows:

- The area has been intensely monitored for many years, and the conceptual site model, including plume footprints and temporal concentration trends, has been well-defined.
- Human and ecological health risks in the Plume 1 area are low due to a lack of receptors (Parsons 2014a).
- Most temporal trends for PCE are not increasing (i.e., they are stable, decreasing, or do not exhibit a statistically defensible trend [i.e., "no trend]), indicating that contaminant plumes are primarily stable or diminishing.

The above reasons demonstrate that the intensity of monitoring at Plume 1 can be reduced while still achieving monitoring objectives and being protective of human health and the environment.

Recommended monitoring frequencies for retained Plume 1 area wells range from quarterly to every 30 months. The proposed 15- or 30-month sampling schedule would replace the existing 9- or 18- frequency discussed in Section 3.1. The bioreactor performance monitoring wells would be incorporated into the post-wide program, and moved from semi-annual to 9-month sampling. Wells on a 9- or 15-month sampling schedule allow for observation of potential seasonal influences on contaminant concentrations and water levels.

Twenty of the 73 wells recommended for continued monitoring are recommended for sampling every 30 months, seven wells are recommended for sampling every 15 months, 42 wells are recommended for sampling every nine months, and four wells are recommended for quarterly sampling.

5.1.4 Plume 1 Comparison of Current and Optimized Monitoring Programs

The scopes of the current and optimized monitoring programs for the Plume 1 area are summarized below. Periodic monitoring of 73 wells is recommended in the optimized monitoring program versus 77 wells in the current program. As a result of frequency reductions, the optimized monitoring program includes 400 well sampling events over a five-year period versus 696 sampling events in the current program. This equates to a reduction of 43 percent (%) over the five years. A well sampling event is defined as a single sampling event at a single well. As described in Section 5.1.3, the intensity of monitoring can be reduced while still achieving monitoring objectives and being protective of human health and the environment.

5.2 PLUME 2

5.2.1 Plume 2 Trend Analysis Results

A total of 117 sampling locations were included in the LTMO evaluation for the Plume 2 area. Well-specific details input into 3TMO are provided in **Table 5.4**. Temporal trend analysis results are included in **Table 5.5** and **Figures 5.2** through **5.7**. Well data used in the 3TMO analyses for Plume 2 were limited to the period following the 2010 LTMO evaluation (March

	Plume 1 Summary Comparison			
	Number of Sampling Points (Well or WB Zone)		Sampling Events Over 5-Year Period	
Frequency	**Current Program**	**Optimized Program**	**Current Program**	**Optimized Program**
Every 30 months	0	20	0	40
Every 18 months	7	0	21	0
Every 15 months	0	7	0	28
Every 9 months	14	42	84	252
As needed	3	0	As needed	0
Quarterly	4	4	80	80
Semi-annual	42	0	420	0
Semi-annual + snapshot	7	0	91	0
Total	**77**	**73**	**696**	**400**
			Reduction over 5 Years	43%

2010 through December 2014). Including data prior to 2010 would result in a bias favoring the older data, due to typically shorter sampling frequencies, and would therefore not accurately evaluate the more recent conditions.

In general, the Mann Kendall trend analyses for Plume 2 wells indicate a stable PCE plume. The majority of sampling results were non-detect or detections were below the RL. There were an equal number of wells exhibiting decreasing PCE concentration trends as there were increasing and probably increasing trends. Increasing PCE concentration trends were limited to Westbay well zones within the existing plume boundary. Decreasing trends included Westbay well zones (in-plume) and one on-post cross-gradient well. PCE concentrations at the cross-gradient well were below the MCL. Stable PCE concentration trends were observed at in-plume sampling locations including: Westbay well zones, off-post supply wells, and on-post monitoring wells. Some sampling locations had fewer than four sampling results for the selected date range. This was primarily due to current sampling frequencies for a particular well (18 months), the well having been recently added to the LTM network, access-related issues, low water levels stemming from drought conditions, or a combination of these reasons.

5.2.2 Plume 2 Well Retention Evaluation Results

Forty-two wells that are currently monitored at various frequencies are recommended for exclusion from future monitoring of Plume 2 as summarized below. Well CS-MW6-BS (on-post) will be immediately excluded from the sampling program, because it is screened in a non-viable portion of the aquifer. The remaining 41 off-post wells are considered ideal candidates for exclusion from the sampling program either because of their sheer distance from the plume origin combined with a long history of non-detects, or stable/reducing detections below the RL.

The DQO flowchart in **Figure 5.8** shows the potential monitoring paths for off-post wells. Based on the DQO flowchart, wells that are greater than 1.5 miles from the CSSA boundary or have consecutive non-detects over the last 5-year period are dropped from the sampling program, but retained for future sampling if conditions change or warrant further sampling. Off-post wells

that meet the distance or 5-year criteria of non-detect can be excluded immediately. The remainder of these wells will be retained at their recommended frequency until they satisfy the DQO of 5 years without a reportable detection.

Off-post well owners will be notified by mail using a public fact sheet followed by a personal notification letter that their well is slated for removal from the sampling network. Each notification letter will include a graph or other visual representation of all past sampling results for the well. Additional details on well owner notification are included **Appendix A**. CSSA will maintain a list of well owner information, verified on a regular basis with the county appraisal district, for all off-post wells in the sampling program even if they are removed from the program in the future.

New off-post drinking water wells may be added to the program in the future. Locations of new wells to be sampled will be based on the inferred-flow direction of the off-post VOC plume derived from historical data. Concerns of area residential well owners will be dealt with on a case-by-case basis. If a well owner outside of the 1.5-mile radius of CSSA requests a sample, that sampling, if done, would not be part of the DQO program.

Well ID(s)	**Reason for Exclusion of Currently Sampled Wells from Monitoring Program**
CS-MW6-BS	BS is not a viable portion of the aquifer.
BSR-03, OW-DAIRYWELL, OW-MT2, SLD-01, SLD-02	Distance from CSSA greater than 1.5 miles.
BSR-04, FO-17, FO-22, FO-8, HS-1, HS-2, HS-3, I10-2, I10-5, JW-5, JW-6, JW-9, JW-12, JW-13, JW-14, JW-15, JW-20, JW-26, JW-27, JW-28, JW-29, JW-30, JW-31, OW-BARNOWL, OW-CE1, OW-CE2, OW-HH1, OW-HH2, OW-HH3, RFR-13, RFR-3, RFR-4, RFR-5, RFR-8, RFR-9	ND history.
I10-7	Redundancy with I10-8, ND history.

Additional information on the rationale for a particular well's exclusion is included in **Table 5.6,** including a brief synopsis of the history of non-detects in the off-post wells recommended for future exclusion.

5.2.3 Plume 2 Monitoring Frequency Evaluation Results

Recommended monitoring frequencies for retained Plume 2 area wells range from quarterly to every 30 months. The proposed 15- or 30-month sampling schedule would replace the existing 9- or 18- frequency discussed in Section 3.1. Wells on a 15-month sampling schedule allow for observation of potential seasonal influences on contaminant concentrations and water levels.

Forty-nine wells are recommended for sampling every 15 months, and 18 wells are recommended for sampling every 30 months (**Table 5.6)**. The primary reasons for recommending an overall reduction in monitoring intensity for the Plume 2 area are as follows:

- The area has been intensely monitored for many years, and the conceptual site model, including plume footprints and temporal concentration trends, has been well-defined.

- Both ecological and human health risks to receptors in the Plume 2 area are low. All private groundwater wells with solvents present at concentrations greater than 90 percent of the MCL have been equipped with GAC units and wells in the area are sampled quarterly. Only sporadic, trace concentrations of VOCs have been detected in BS and CC wells within Plume 2 (Parsons 2014a).
- Most temporal trends, especially those measured over the most recent five years of sampling are not increasing (i.e., they are stable, decreasing, or do not exhibit a statistically defensible trend [i.e., "no trend"]), indicating that contaminant plumes are primarily stable or diminishing.

As a result of the above, the intensity of monitoring at Plume 2 can be reduced while still achieving monitoring objectives and being protective of human health and the environment. Recommended monitoring frequencies for retained Plume 2 wells range from quarterly to every 30 months. Six of the 52 wells recommended for continued monitoring are recommended for quarterly sampling. All five are private water supply wells with GAC wellhead protection units.

5.2.4 Plume 2 Comparison of Current and Optimized Monitoring Programs

The scopes of the current and optimized monitoring programs for the Plumes 2 area are summarized below. Periodic monitoring of 73 sampling locations is recommended in the optimized monitoring program versus 117 in the current program. As a result of frequency reductions, the optimized monitoring program includes 352 well sampling events over a five-year period versus 772 sampling events in the current program. This equates to a reduction of 54%. A well sampling event is defined as a single sampling event at a single well. As described in Section 5.2.3, the intensity of monitoring can be reduced while still achieving monitoring objectives and being protective of human health and the environment.

	Plume 2 Summary Comparison			
	Number of Sampling Points (Well or WB Zone)		**Sampling Events Over 5-Year Period**	
Frequency	**Current Program**	**Optimized Program**	**Current Program**	**Optimized Program**
Every 30 months	0	18	0	36
Every 18 months	14	0	42	0
Every 15 months	0	49	0	196
Every 9 months	93	0	558	0
Quarterly	6	6	120	120
Semi-annual + snapshot	4	0	52	0
Total	**117**	**73**	**772**	**352**
			Reduction over 5 Years	54%

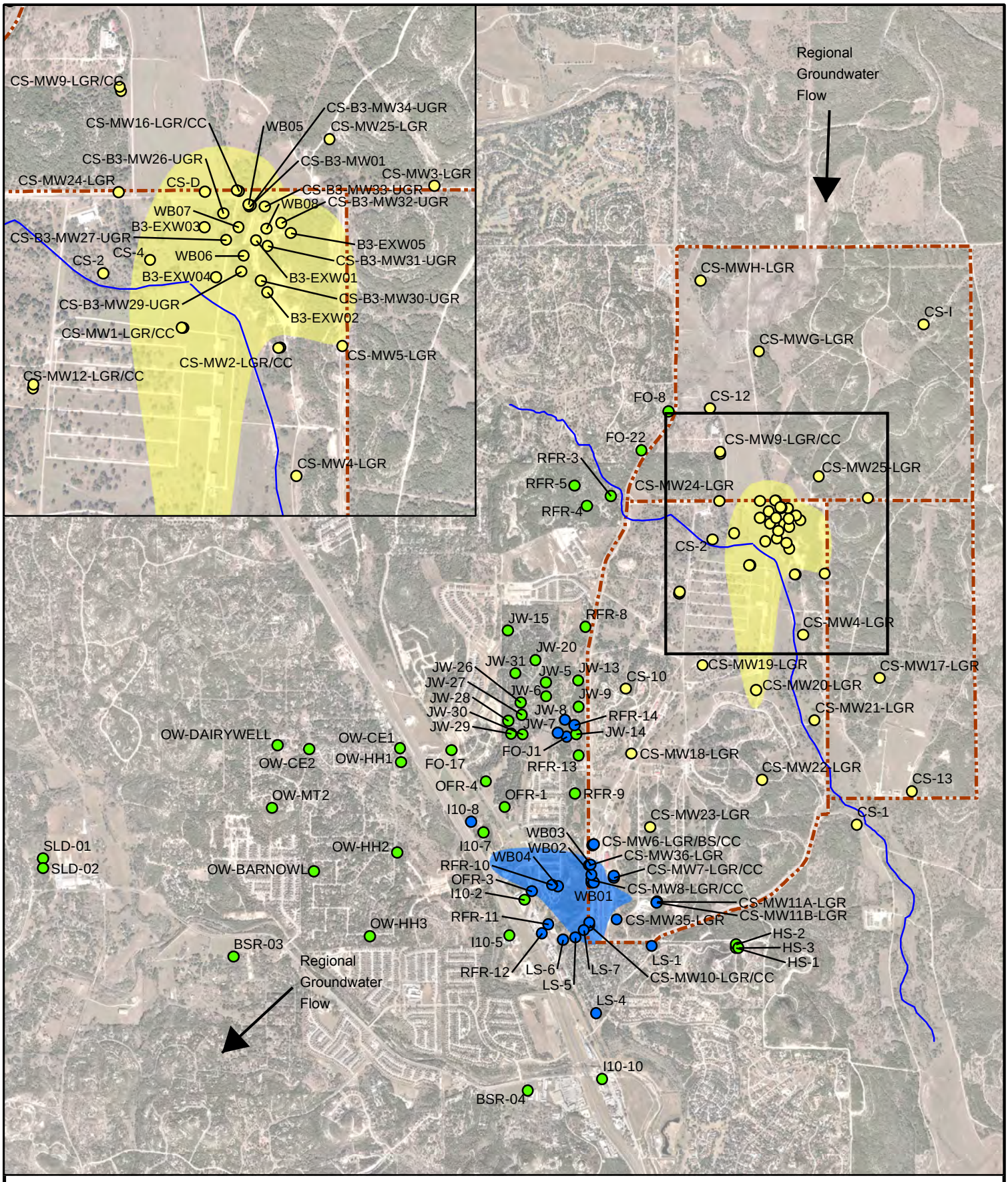


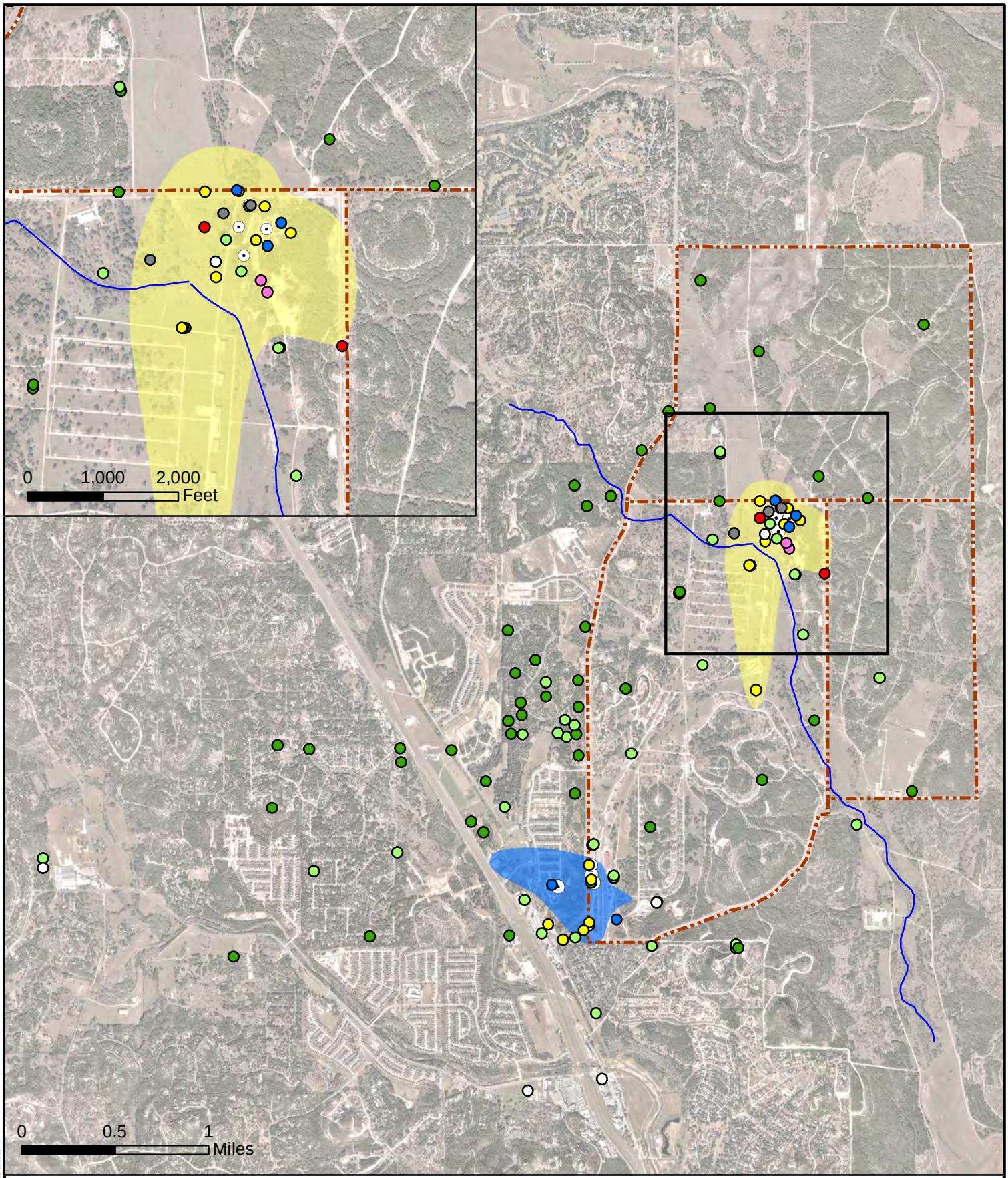
Figure 5.1

Groundwater Wells and Associated Plumes

Camp Stanley Storage Activity

PARSONS

J:\CSSA\GIS\Groundwater\Maps\Groundwater_wells_and_associated_plumes.mxd 6/2/2015 2:15:10 PM



Fence Line
Plume 1
Plume 2

<4 Results
<PQL
ND
Decreasing
Probably Decreasing

No Trend
Stable
Probably Increasing
Increasing
Westbay Well

N
W
E
S

Note: Temporal trends for Westbay well depth intervals are shown on Table 5.2 (Plume 1) and Table 5.5 (Plume 2).

Figure 5.2

Temporal Trends for PCE in Groundwater

Camp Stanley Storage Activity

PARSONS

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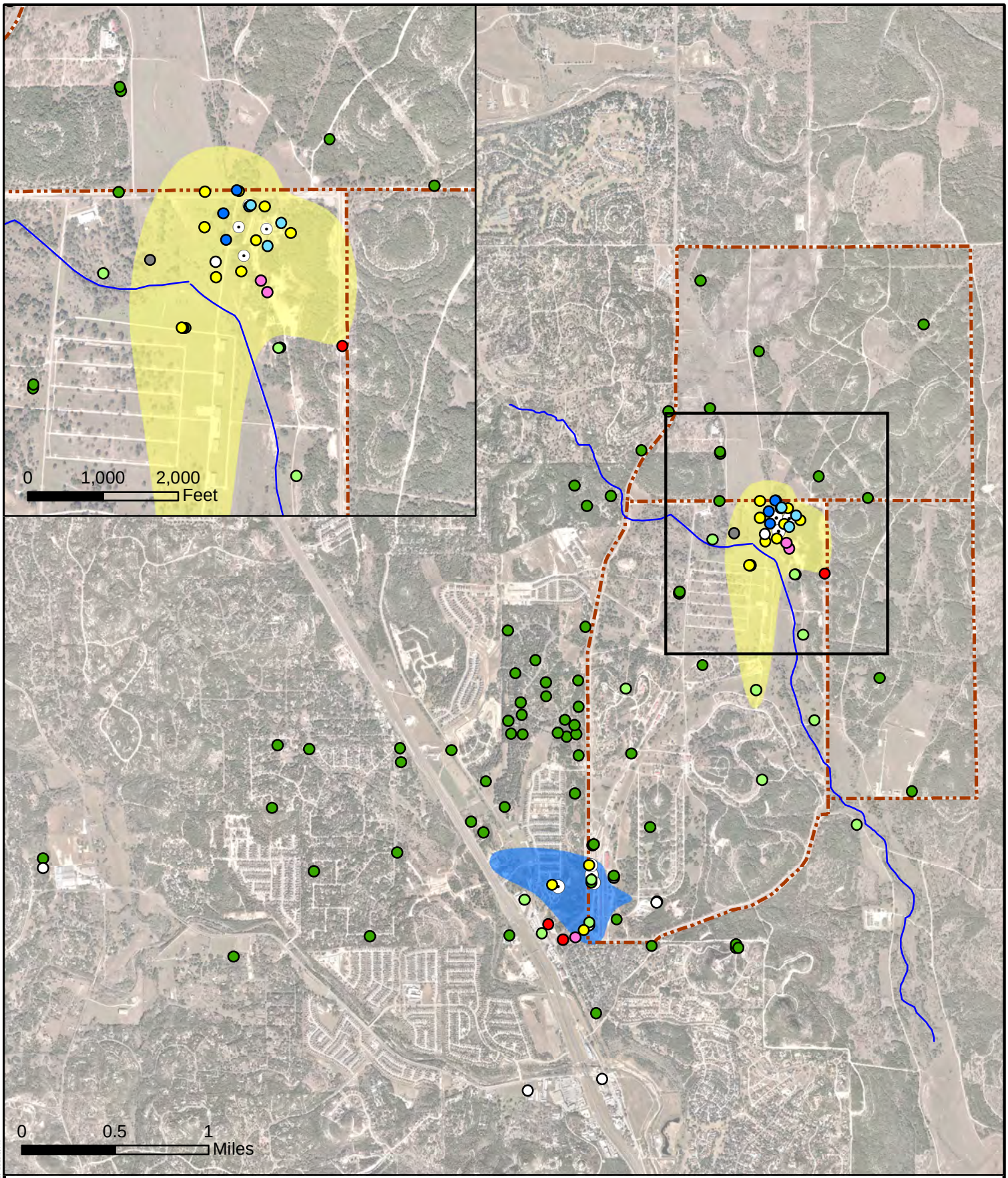

Fence Line
Plume 1
Plume 2

<4 Results
<PQL
ND
Decreasing
Probably Decreasing

No Trend
Stable
Probably Increasing
Increasing
Westbay Well

N
W
E
S

Note: Temporal trends for Westbay well depth intervals are shown on Table 5.2 (Plume 1) and Table 5.5 (Plume 2).

Figure 5.3

Temporal Trends for TCE in Groundwater

Camp Stanley Storage Activity

PARSONS

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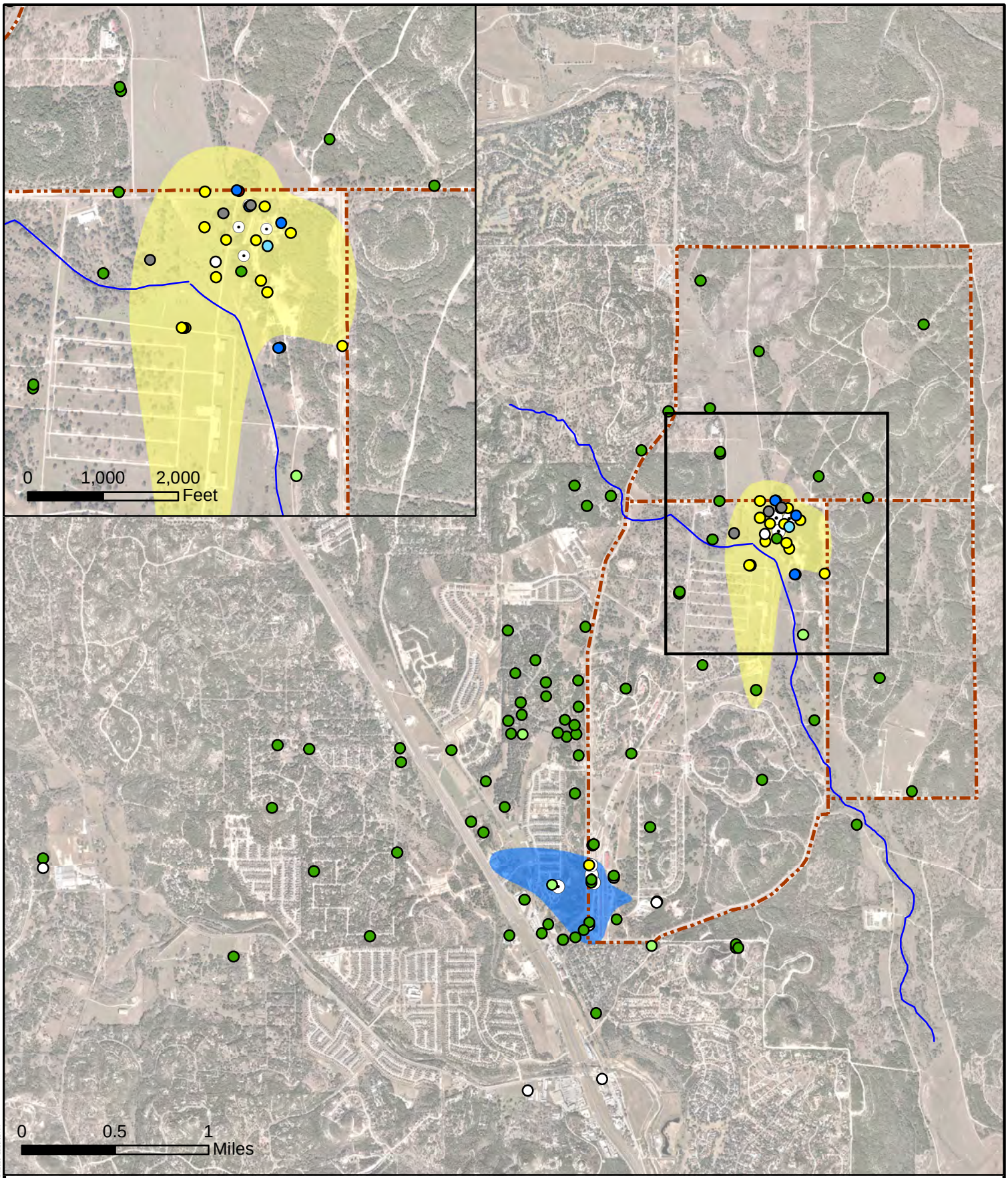


Fence Line
Plume 1
Plume 2

<4 Results
<PQL
ND
Decreasing
Probably Decreasing

No Trend
Stable
Probably Increasing
Increasing
Westbay Well

N
W
E
S

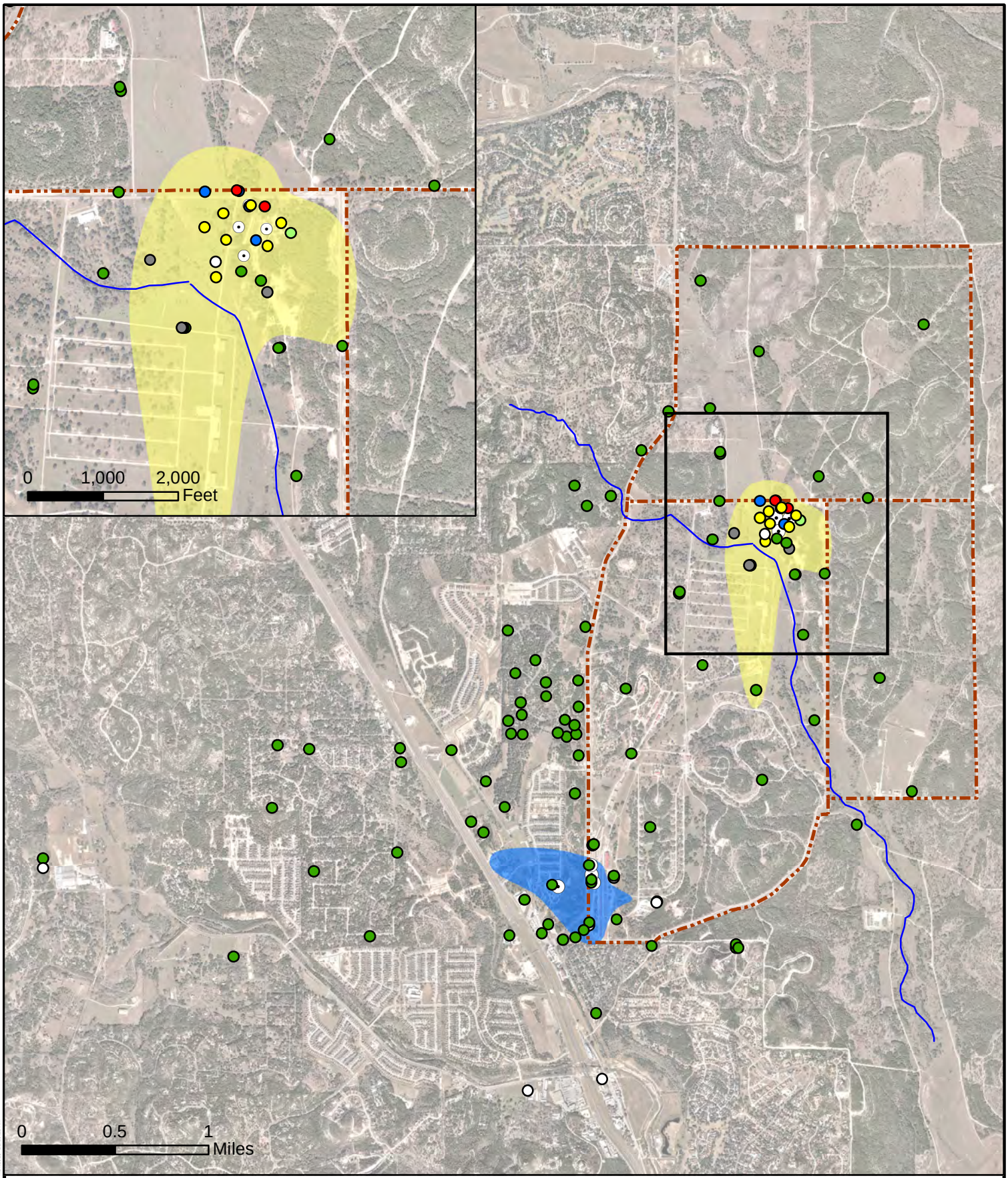
Note: Temporal trends for Westbay well depth intervals are shown on Table 5.2 (Plume 1) and Table 5.5 (Plume 2).

Figure 5.4

Temporal Trends for *cis*-1,2-DCE
in Groundwater
Camp Stanley Storage Activity

PARSONS

J:\CS\MXD\SG\roundwater\Maps\Groundwater_Trend_ewd_1-2dcDCE.mxd 7/14/2015 11:13:51 AM



Fence Line
Plume 1
Plume 2

<4 Results
<PQL
ND
Decreasing
Probably Decreasing

No Trend
Stable
Probably Increasing
Increasing
Westbay Well

N
W
E
S

Note: Temporal trends for Westbay well depth intervals are shown on Table 5.2 (Plume 1) and Table 5.5 (Plume 2).

Figure 5.5

Temporal Trends for *trans*-1,2-DCE in Groundwater
Camp Stanley Storage Activity

PARSONS

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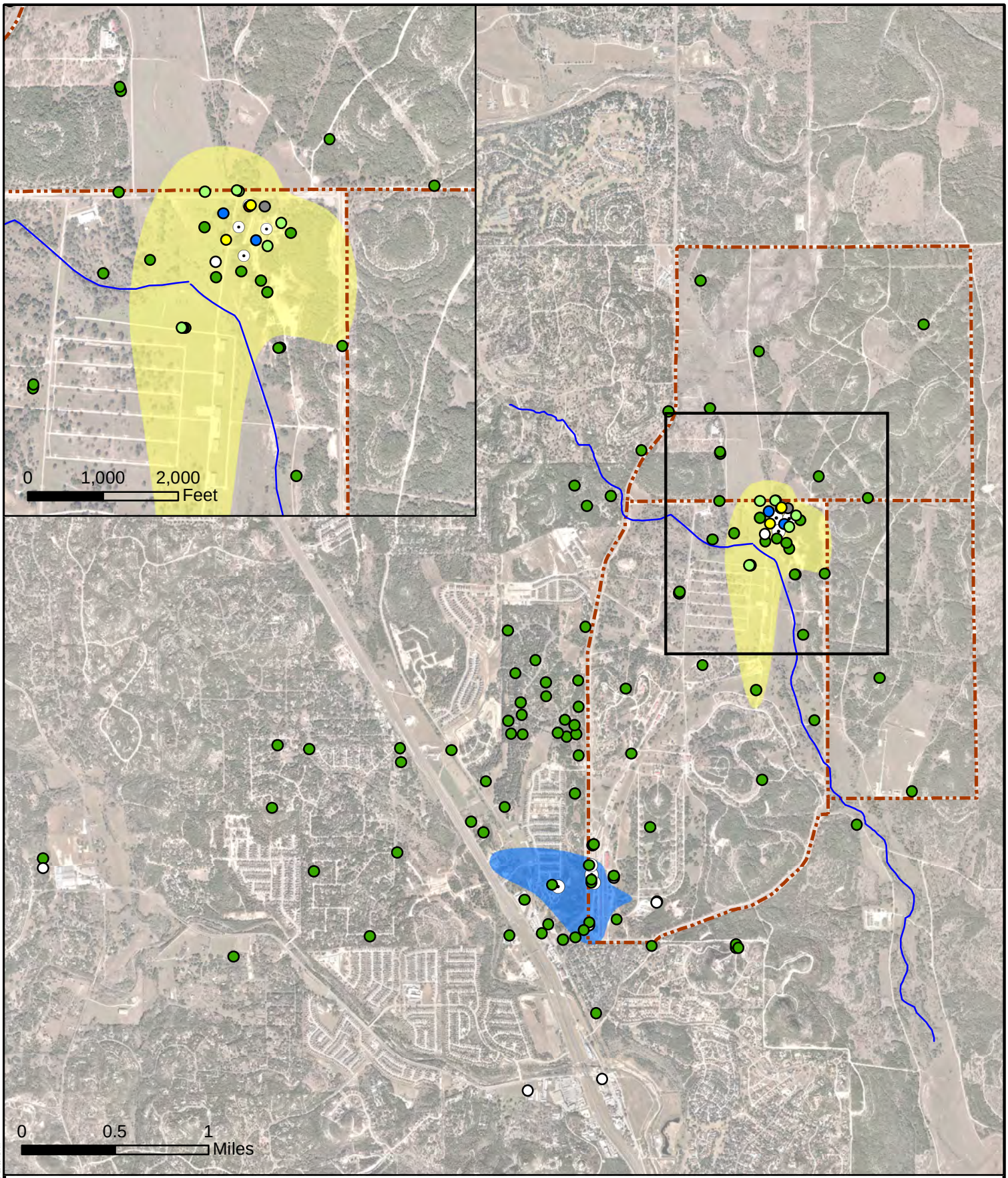
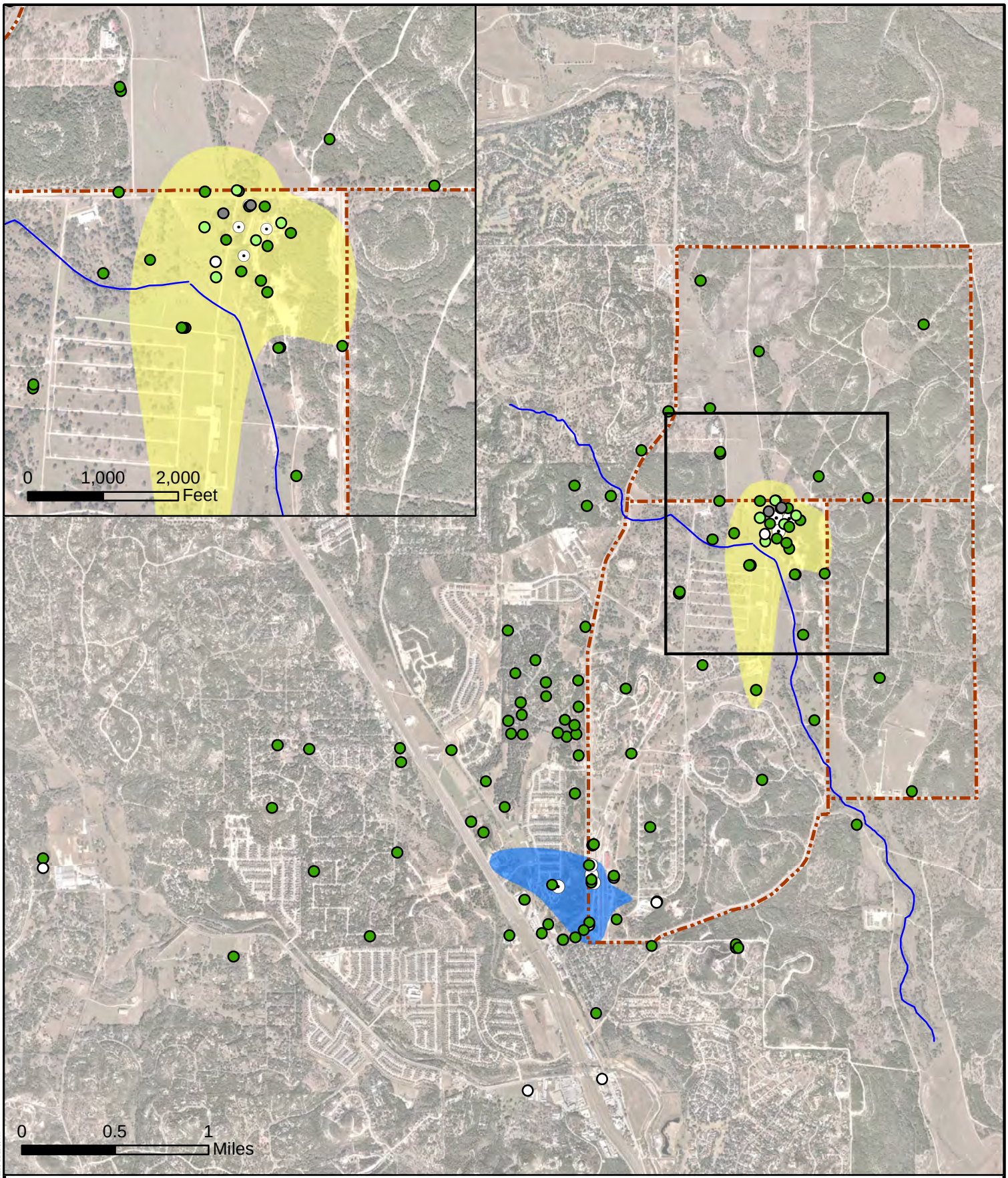


Note: Temporal trends for Westbay well depth intervals are shown on Table 5.2 (Plume 1) and Table 5.5 (Plume 2).

Figure 5.6

Temporal Trends for Vinyl Chloride in Groundwater Camp Stanley Storage Activity

PARSONS



Fence Line
Plume 1
Plume 2

<4 Results
<PQL
ND
Decreasing
Probably Decreasing

No Trend
Stable
Probably Increasing
Increasing
Westbay Well

N
W
E
S

Note: Temporal trends for Westbay well depth intervals are shown on Table 5.2 (Plume 1) and Table 5.5 (Plume 2).

Figure 5.7

Temporal Trends for 1,1-DCE in Groundwater

Camp Stanley Storage Activity

PARSONS

FIGURE 5.8 - OFF-POST WELLS DECISION TREE

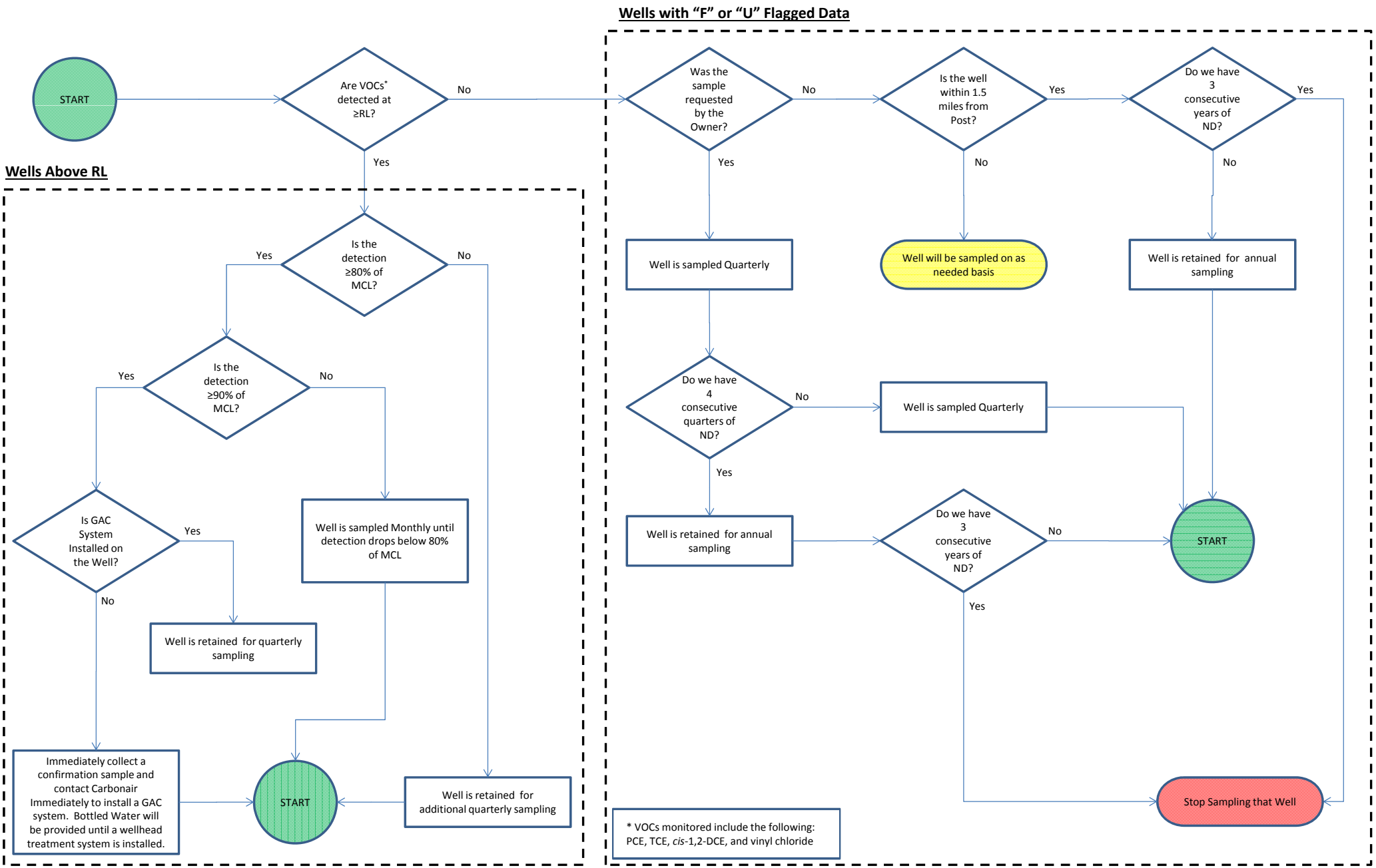


Table 5.1
Plume 1 Well Parameter Inputs
Camp Stanley Storage Activity, Boerne, TX

Well ID	X Coordinates	Y Coordinates	Top of Screen (bgs)[a/]	Bottom of Screen (bgs)	Zone[b/]	Functional Category	Current Sampling Frequency	Risk to Receptors	Predictability of COC Concentrations
B3-EXW01 [c/]	537354.1158	3286642.159	--	--	LGR	Source	Semi-annual	Low	Predictable
B3-EXW02 [c/]	537399.53	3286431.654	--	--	LGR	In-Plume	Semi-annual	Low	Unpredictable
B3-EXW03 [c/]	537145.031	3286694.994	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
B3-EXW04 [c/]	537191.735	3286493.127	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
B3-EXW05 [c/]	537495.283	3286671.945	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
B3-MW26-UGR [c/]	537221.125	3286751.008	7.5	17.5	UGR	In-Plume	Semi-annual	Low	HighlyUnpredictable
B3-MW27-UGR [c/]	537233.758	3286644.368	7	17	UGR	In-Plume	Semi-annual	Low	Predictable
B3-MW28-UGR [c/]	537189.764	3286554.696	5.5	15.5	UGR	In-Plume	Semi-annual	Low	Predictable
B3-MW29-UGR [c/]	537293.645	3286515.453	7.5	17.5	UGR	In-Plume	Semi-annual	Low	Predictable
B3-MW30-UGR [c/]	537374.479	3286478.375	10.8	20.8	UGR	In-Plume	Semi-annual	Low	Unpredictable
B3-MW31-UGR [c/]	537400.902	3286619.711	16	36	UGR	In-Plume	Semi-annual	Low	Predictable
B3-MW32-UGR [c/]	537457.707	3286713.06	26	56	UGR	In-Plume	Semi-annual	Low	Predictable
B3-MW33-UGR [c/]	537389.399	3286778.414	6	26	UGR	In-Plume	Semi-annual	Low	Predictable
B3-MW34-UGR [c/]	537334.222	3286783.61	12	22	UGR	In-Plume	Semi-annual	Low	HighlyUnpredictable
CS-B3-MW01 [c/]	537326.48	3286778.36	277	287	LGR	In-Plume	Semi-annual	Low	Predictable
CS-1	537981.325	3284051.974	--	--	LGR	Point of Compliance	Quarterly	Moderate	Predictable
CS-2	536734.986	3286508.539	--	--	LGR	Downgradient Plume-edge	9 months	Low	Predictable
CS-4	536924.813	3286561.387	--	--	LGR	Downgradient Plume-edge	Semi-annual + snapshot	Moderate	HighlyUnpredictable
CS-10	535990.386	3285222.523	--	--	LGR + CC	Point of Compliance	Quarterly	Moderate	Predictable
CS-12	536715.1288	3287637.248	--	--	LGR + CC	Point of Compliance	Quarterly	Moderate	Predictable
CS-13	538456.824	3284340.274	--	--	LGR + CC	Point of Compliance	Quarterly	Moderate	Predictable
CS-D	537147.068	3286839.895	--	--	LGR	In-Plume	Semi-annual + snapshot	Low	Predictable
CS-I	538556.568	3288359.354	--	--	LGR	Upgradient	18 months	Low	Predictable
CS-MW1-BS	537067.858	3286286.231	340.5	365.5	BS	In-Plume	As needed	Low	Predictable
CS-MW1-CC	537060.274	3286287.112	394.7	419.7	CC	In-Plume	18 months	Low	Predictable
CS-MW1-LGR	537052.727	3286288.001	288	313	LGR	In-Plume	Semi-annual + snapshot	Low	Predictable
CS-MW2-CC	537454.016	3286207.172	425.7	450.7	CC	Downgradient Plume-edge	18 months	Low	Predictable
CS-MW2-LGR	537445.734	3286205.856	318	343	LGR	Crossgradient Plume-edge	Semi-annual + snapshot	Low	Predictable
CS-MW3-LGR	538077.889	3286863.946	402	427	LGR	Upgradient	9 months	Low	Predictable
CS-MW4-LGR	537517.318	3285687.194	299	324	LGR	Crossgradient Plume-edge	9 months	Low	Predictable
CS-MW5-LGR	537704.585	3286213.329	420	445	LGR	Crossgradient Plume-edge	9 months	Low	Predictable
CS-MW9-BS	536804.861	3287255.137	352	377	BS	Upgradient	As needed	Low	Predictable
CS-MW9-CC	536807.382	3287247.326	425	450	CC	Upgradient	18 months	Low	Predictable
CS-MW9-LGR	536801.781	3287263.36	296	321	LGR	Upgradient	9 months	Low	Predictable
CS-MW12-BS	536451.2422	3286049.657	382	407	BS	Crossgradient Plume-edge	As needed	Low	Predictable
CS-MW12-CC	536450.7062	3286041.508	440	465	CC	Crossgradient Plume-edge	18 months	Low	Predictable
CS-MW12-LGR	536451.9458	3286057.765	333	358	LGR	Downgradient Plume-edge	9 months	Low	Predictable
CS-MW16-CC	537277.448	3286844.086	406	431	CC	In-Plume	Semi-annual + snapshot	Low	Predictable
CS-MW16-LGR	537285.8965	3286841.192	--	--	LGR	In-Plume	Semi-annual + snapshot	Low	Predictable
CS-MW17-LGR	538177.981	3285314.293	367	392	LGR	Downgradient	9 months	Low	Predictable
CS-MW18-LGR	536037.3779	3284664.459	385	410	LGR	Downgradient	9 months	Low	Predictable
CS-MW19-LGR	536650.9536	3285425.697	340	365	LGR	Crossgradient Plume-edge	9 months	Low	Predictable
CS-MW20-LGR	537111.877	3285210.644	305	330	LGR	Downgradient Plume-edge	9 months	Low	Predictable

Table 5.1
Plume 1 Well Parameter Inputs
Camp Stanley Storage Activity, Boerne, TX

Well ID	X Coordinates	Y Coordinates	Top of Screen (bgs)[a/]	Bottom of Screen (bgs)	Zone[b/]	Functional Category	Current Sampling Frequency	Risk to Receptors	Predictability of COC Concentrations
CS-MW21-LGR	537618.542	3284950.017	289	314	LGR	Crossgradient	9 months	Low	Predictable
CS-MW22-LGR	537163.077	3284436.585	392	417	LGR	Downgradient	9 months	Low	Predictable
CS-MW23-LGR	536199.409	3284027.777	372	397	LGR	Downgradient	9 months	Low	Predictable
CS-MW24-LGR	536797.414	3286837.705	300	325	LGR	Downgradient	Semi-annual + snapshot	Low	Predictable
CS-MW25-LGR	537652.534	3287052.589	352	377	LGR	Upgradient	9 months	Low	Predictable
CS-MWG-LGR	537134.055	3288139.147	--	--	LGR	Upgradient	18 months	Low	Predictable
CS-MWH-LGR	536634.309	3288741.135	314.5	364.5	LGR	Upgradient	18 months	Low	Predictable
CS-WB05-BS-01 [c/]	537323.36	3286787.53	--	--	BS	In-Plume	Semi-annual	Low	Predictable
CS-WB05-CC-01 [c/]	537323.36	3286787.53	--	--	CC	In-Plume	Semi-annual	Low	Predictable
CS-WB05-CC-02 [c/]	537323.36	3286787.53	--	--	CC	In-Plume	Semi-annual	Low	Predictable
CS-WB05-LGR-01 [c/]	537323.36	3286787.53	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB05-LGR-02 [c/]	537323.36	3286787.53	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB05-LGR03A [c/]	537323.36	3286787.53	--	--	LGR	In-Plume	Semi-annual	Low	HighlyUnpredictable
CS-WB05-LGR03B [c/]	537323.36	3286787.53	--	--	LGR	In-Plume	Semi-annual	Low	HighlyUnpredictable
CS-WB05-LGR-04A [c/]	537323.36	3286787.53	--	--	LGR	In-Plume	Semi-annual	Low	HighlyUnpredictable
CS-WB05-LGR-04B [c/]	537323.36	3286787.53	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB06-LGR-01 [c/]	537304.5	3286580.07	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB06-LGR-02 [c/]	537304.5	3286580.07	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB06-LGR03A [c/]	537304.5	3286580.07	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB06-LGR03B [c/]	537304.5	3286580.07	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB06-LGR-04 [c/]	537304.5	3286580.07	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB06-UGR-01 [c/]	537304.5	3286580.07	--	--	UGR	In-Plume	Semi-annual	Low	HighlyUnpredictable
CS-WB07-LGR-01 [c/]	537283.85	3286696.392	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB07-LGR-02 [c/]	537283.85	3286696.392	--	--	LGR	In-Plume	Semi-annual	Low	HighlyUnpredictable
CS-WB07-LGR03A [c/]	537283.85	3286696.392	--	--	LGR	In-Plume	Semi-annual	Low	Unpredictable
CS-WB07-LGR03B [c/]	537283.85	3286696.392	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB07-LGR-04 [c/]	537283.85	3286696.392	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB07-UGR-01 [c/]	537283.85	3286696.392	--	--	UGR	In-Plume	Semi-annual	Low	Predictable
CS-WB08-LGR-01 [c/]	537397.17	3286689.26	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB08-LGR-02 [c/]	537397.17	3286689.26	--	--	LGR	In-Plume	Semi-annual	Low	HighlyUnpredictable
CS-WB08-LGR03A [c/]	537397.17	3286689.26	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB08-LGR03B [c/]	537397.17	3286689.26	--	--	LGR	In-Plume	Semi-annual	Low	Predictable
CS-WB08-LGR-04 [c/]	537397.17	3286689.26	--	--	LGR	In-Plume	Semi-annual	Low	Unpredictable
CS-WB08-UGR-01 [c/]	537397.17	3286689.26	--	--	UGR	In-Plume	Semi-annual	Low	Predictable

[a/] bgs = below ground surface; "--" = not available or not applicable.
[b/] LGR = Lower Glen Rose; UGR = Upper Glen Rose; CC = Cow Creek; BS = Bexar Shale.
[c/] Well has been primarily used for bioreactor performance monitoring.

Table 5.2
Plume 1 Temporal Trend Evaluation
Camp Stanley Storage Activity, Boerne, TX

Well ID	Temporal Recommendation	Start Date	End Date	Number of Samples	Category	Contaminants of Concern[a/]					
						PCE	TCE	1,2-cis-DCE	1,2-trans-DCE	VC	1,1-DCE
CS-1	Retain	3/6/2007	12/8/2014	27	Point of Compliance	<PQL	<PQL	ND	ND	ND	ND
CS-10	Retain	3/6/2007	12/8/2014	28	Point of Compliance	ND	<PQL	ND	ND	ND	ND
CS-12	Retain	3/25/2009	12/8/2014	22	Point of Compliance	ND	ND	ND	ND	ND	ND
CS-13	Retain	3/15/2012	12/8/2014	6	Point of Compliance	ND	ND	ND	ND	ND	ND
CS-2	Exclude/Reduce	3/8/2007	6/16/2014	12	Downgradient Plume-edge	<PQL	<PQL	ND	ND	ND	ND
CS-4	Retain	3/13/2007	6/25/2013	16	Downgradient Plume-edge	No Trend*	No Trend*	No Trend*	No Trend	ND	ND
CS-B3-MW01	Retain	7/27/2007	10/9/2014	24	In-Plume	<PQL	Decreasing	Decreasing*	Decreasing	Increasing*	ND
B3-MW26-UGR	Retain	6/23/2010	10/14/2014	13	In-Plume	No Trend*	Decreasing*	No Trend*	Stable	Decreasing*	No Trend
B3-MW27-UGR	Exclude/Reduce	2/24/2010	10/14/2014	17	In-Plume	<PQL	Decreasing	Stable*	Stable	Stable*	ND
B3-MW28-UGR	No Recommendation, < 4 samples	1/1/0001	12/31/9999	0	In-Plume	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
B3-MW29-UGR	Exclude/Reduce	6/23/2010	10/15/2012	4	In-Plume	<PQL	Stable	ND	ND	ND	ND
B3-MW30-UGR	Retain	6/23/2010	4/12/2013	6	In-Plume	Prob. Increasing*	Prob. Increasing*	Stable*	ND	ND	ND
B3-MW31-UGR	Exclude/Reduce	6/23/2010	10/14/2014	13	In-Plume	Decreasing*	Prob. Decreasing*	Prob. Decreasing*	Stable	<PQL	ND
B3-MW32-UGR	Exclude/Reduce	6/23/2010	4/10/2014	12	In-Plume	Decreasing*	Prob. Decreasing*	Decreasing*	Stable	<PQL	<PQL
B3-MW33-UGR	Retain	6/23/2010	10/14/2014	12	In-Plume	Stable*	Stable*	Stable*	Increasing	No Trend*	ND
B3-MW34-UGR	Retain	6/23/2010	10/14/2014	13	In-Plume	No Trend*	Prob. Decreasing*	No Trend*	Stable	Stable*	No Trend
CS-D	Exclude/Reduce	3/12/2007	1/10/2013	24	In-Plume	Stable*	Stable*	Stable*	Decreasing	<PQL	ND
B3-EXW01	Exclude/Reduce	5/12/2009	10/8/2014	16	Source	Stable*	Stable*	Stable*	Decreasing	Decreasing*	<PQL
B3-EXW02	Retain	5/19/2010	10/8/2014	11	In-Plume	Prob. Increasing*	Prob. Increasing*	Stable*	No Trend	ND	ND
B3-EXW03	Retain	1/16/2013	10/8/2014	5	In-Plume	Increasing*	Stable*	Stable*	Stable	ND	<PQL
B3-EXW04	Exclude/Reduce	1/16/2013	10/8/2014	5	In-Plume	Stable*	Stable*	Stable*	Stable	ND	<PQL
B3-EXW05	Exclude/Reduce	1/16/2013	10/8/2014	5	In-Plume	Stable*	Stable*	Stable*	<PQL	ND	ND
CS-I	Exclude/Reduce	3/16/2009	6/11/2014	6	Upgradient	ND	ND	ND	ND	ND	ND
CS-MW12-BS	Exclude/Reduce	9/27/2007	12/17/2012	6	Crossgradient Plume-edge	ND	ND	ND	ND	<PQL	ND
CS-MW12-CC	Exclude/Reduce	9/27/2007	6/12/2014	5	Crossgradient Plume-edge	ND	ND	ND	ND	ND	ND
CS-MW12-LGR	Exclude/Reduce	3/8/2007	6/12/2014	11	Downgradient Plume-edge	ND	ND	ND	ND	ND	ND
CS-MW16-CC	Retain	3/6/2007	10/8/2014	40	In-Plume	Decreasing*	Decreasing*	Decreasing*	Increasing	<PQL	<PQL
CS-MW16-LGR	Retain	1/10/2007	10/8/2014	41	In-Plume	Stable*	Stable*	Increasing*	Decreasing	<PQL	ND
CS-MW17-LGR	Exclude/Reduce	3/16/2007	6/11/2014	8	Downgradient	<PQL	ND	ND	ND	ND	ND
CS-MW18-LGR	Exclude/Reduce	3/13/2007	1/10/2013	9	Downgradient	<PQL	ND	ND	ND	ND	ND
CS-MW19-LGR	Exclude/Reduce	3/12/2007	6/16/2014	15	Crossgradient Plume-edge	<PQL	ND	ND	ND	ND	ND
CS-MW1-BS	Exclude/Reduce	9/25/2007	12/18/2012	6	In-Plume	ND	<PQL	Stable	ND	ND	ND
CS-MW1-CC	Exclude/Reduce	9/25/2007	9/8/2014	9	In-Plume	ND	ND	ND	ND	ND	ND
CS-MW1-LGR	Retain	1/11/2007	10/9/2014	45	In-Plume	Stable*	Stable*	Stable*	No Trend	<PQL	ND
CS-MW20-LGR	Exclude/Reduce	6/6/2007	6/18/2014	21	Downgradient Plume-edge	Stable	<PQL	ND	ND	ND	ND
CS-MW21-LGR	Exclude/Reduce	6/7/2007	9/8/2014	23	Crossgradient	ND	<PQL	ND	ND	ND	ND
CS-MW22-LGR	Exclude/Reduce	6/7/2007	6/18/2014	21	Downgradient	ND	<PQL	ND	ND	ND	ND
CS-MW23-LGR	Exclude/Reduce	6/5/2007	6/18/2014	21	Downgradient	ND	ND	ND	ND	ND	ND
CS-MW24-LGR	Exclude/Reduce	6/6/2007	9/8/2014	26	Downgradient	ND	ND	ND	ND	ND	ND
CS-MW25-LGR	Exclude/Reduce	1/3/2007	6/11/2014	22	Upgradient	ND	ND	ND	ND	ND	ND
CS-MW2-CC	Exclude/Reduce	9/25/2007	6/16/2014	6	Downgradient Plume-edge	ND	ND	ND	ND	ND	ND
CS-MW2-LGR	Exclude/Reduce	1/11/2007	9/8/2014	20	Crossgradient Plume-edge	<PQL	<PQL	Decreasing	ND	ND	ND
CS-MW3-LGR	Exclude/Reduce	3/12/2007	6/11/2014	15	Upgradient	ND	ND	ND	ND	ND	ND
CS-MW4-LGR	Exclude/Reduce	3/13/2007	6/17/2013	11	Crossgradient Plume-edge	<PQL	<PQL	<PQL	ND	ND	ND
CS-MW5-LGR	Retain	3/7/2007	6/16/2014	15	Crossgradient Plume-edge	Increasing	Increasing	Stable	ND	ND	ND
CS-MW9-BS	Exclude/Reduce	9/25/2007	12/11/2012	8	Upgradient	ND	ND	ND	ND	ND	ND
CS-MW9-CC	Exclude/Reduce	9/25/2007	6/11/2014	6	Upgradient	ND	ND	ND	ND	ND	ND
CS-MW9-LGR	Exclude/Reduce	3/16/2007	6/11/2014	16	Upgradient	<PQL	ND	ND	ND	ND	ND
CS-MWG-LGR	Exclude/Reduce	3/16/2007	6/11/2014	9	Upgradient	ND	ND	ND	ND	ND	ND
CS-MWH-LGR	Exclude/Reduce	9/24/2007	6/11/2014	6	Upgradient	ND	ND	ND	ND	ND	ND
CS-WB05-BS-01	Retain	1/3/2007	10/24/2014	25	In-Plume	Decreasing	Decreasing*	Prob. Decreasing*	Decreasing	Increasing*	<PQL
CS-WB05-CC-01	Retain	1/3/2007	10/24/2014	25	In-Plume	Decreasing*	Decreasing*	Decreasing*	No Trend	<PQL	<PQL
CS-WB05-CC-02	Retain	1/2/2007	10/27/2014	25	In-Plume	Decreasing*	Decreasing*	Decreasing*	Increasing	No Trend*	Decreasing
CS-WB05-LGR-01	Retain	7/17/2007	10/23/2014	24	In-Plume	Decreasing	Decreasing	Increasing	Increasing	<PQL	ND

Table 5.2
Plume 1 Temporal Trend Evaluation
Camp Stanley Storage Activity, Boerne, TX

Well ID	Temporal Recommendation	Start Date	End Date	Number of Samples	Category	Contaminants of Concern[a/]					
						PCE	TCE	1,2-cis-DCE	1,2-trans-DCE	VC	1,1-DCE
CS-WB05-LGR-02	Retain	7/17/2007	10/26/2010	8	In-Plume	<PQL	Stable*	Increasing*	Stable	ND	ND
CS-WB05-LGR03A	Retain	7/17/2007	4/18/2012	11	In-Plume	No Trend*	Decreasing*	Increasing*	Increasing	Increasing*	ND
CS-WB05-LGR03B	Retain	1/3/2007	10/23/2012	55	In-Plume	No Trend*	Decreasing*	Increasing*	Increasing	Increasing*	ND
CS-WB05-LGR-04A	Retain	1/4/2007	10/24/2014	23	In-Plume	No Trend*	Decreasing*	Prob. Increasing*	Increasing*	Increasing*	<PQL
CS-WB05-LGR-04B	Retain	1/3/2007	10/24/2014	25	In-Plume	Decreasing*	Stable*	Prob. Decreasing*	Prob. Increasing	Increasing*	Decreasing
CS-WB06-LGR-01	Exclude/Reduce	1/10/2007	10/28/2014	26	In-Plume	Stable*	Decreasing*	Decreasing*	Decreasing	Decreasing*	ND
CS-WB06-LGR-02	Exclude/Reduce	1/5/2007	10/28/2014	26	In-Plume	Decreasing*	Stable*	Stable*	Decreasing	<PQL	ND
CS-WB06-LGR03A	Exclude/Reduce	1/5/2007	10/27/2014	26	In-Plume	Decreasing*	Decreasing*	Decreasing*	Prob. Decreasing	<PQL	<PQL
CS-WB06-LGR03B	Retain	1/4/2007	10/27/2014	62	In-Plume	Decreasing*	Stable*	Stable*	No Trend	<PQL	<PQL
CS-WB06-LGR-04	Retain	1/4/2007	10/27/2014	26	In-Plume	Decreasing*	Decreasing*	Decreasing*	Decreasing	Increasing	<PQL
CS-WB06-UGR-01	Retain	7/25/2007	10/28/2014	25	In-Plume	No Trend*	No Trend*	Stable*	No Trend	Decreasing*	<PQL
CS-WB07-LGR-01	Retain	1/9/2007	10/22/2014	24	In-Plume	Decreasing	No Trend*	Increasing*	Increasing	Increasing*	ND
CS-WB07-LGR-02	Retain	1/8/2007	10/22/2014	24	In-Plume	No Trend*	No Trend*	Increasing*	Increasing	Increasing*	ND
CS-WB07-LGR03A	Retain	1/8/2007	4/20/2012	17	In-Plume	Prob. Increasing*	No Trend*	Increasing*	No Trend	ND	ND
CS-WB07-LGR03B	Retain	1/8/2007	10/22/2014	58	In-Plume	Increasing*	Increasing*	Stable*	Stable	ND	ND
CS-WB07-LGR-04	Exclude/Reduce	1/8/2007	10/22/2014	24	In-Plume	Stable*	Stable*	Stable*	Prob. Decreasing	<PQL	<PQL
CS-WB07-UGR-01	Exclude/Reduce	7/19/2007	2/1/2011	7	In-Plume	<PQL	<PQL	Decreasing*	Stable	Decreasing*	ND
CS-WB08-LGR-01	Retain	1/10/2007	10/21/2014	26	In-Plume	Decreasing*	Decreasing*	Prob. Decreasing*	Stable	Prob. Increasing	<PQL
CS-WB08-LGR-02	Retain	1/9/2007	10/21/2014	26	In-Plume	No Trend*	No Trend*	Stable*	No Trend	<PQL	ND
CS-WB08-LGR03A	Exclude/Reduce	7/26/2007	1/25/2011	9	In-Plume	Stable*	Stable*	Stable*	Stable	ND	ND
CS-WB08-LGR03B	Retain	1/9/2007	10/30/2012	51	In-Plume	Stable*	Stable*	Stable*	No Trend	ND	ND
CS-WB08-LGR-04	Retain	1/9/2007	10/21/2014	26	In-Plume	Prob. Decreasing*	No Trend*	Decreasing*	Decreasing	No Trend*	ND
CS-WB08-UGR-01	Retain	7/26/2007	10/21/2014	17	In-Plume	Decreasing*	Decreasing*	No Trend*	Prob. Increasing	Increasing*	<PQL

[a/] PCE = tetrachloroethene, TCE = trichloroethene, DCE = dichloroethene, VC = vinyl chloride, ND = not detected; * = Trends contain a sample result that exceeds the cleanup goal entered in the COC information for that parameter;
< PQL = all sample results are less than the practical quantitation limit (PQL), or are a micture of non-detects and detections less than the PQL; < 4 Results = fewer than four measurements, no trend evaluated.

Table 5.3
Plume 1 3TMO Results Summary
Camp Stanley Storage Activity, Boerne, TX

Well Name	Zone[a/]	Current Sampling Frequency	Qualitative Evaluation		Temporal Evaluation	Spatial Evaluation	Summary			
			Retention Evaluation	Recommended Monitoring Frequency			Final Retention Evaluation	Retention Rationale[b/]	Recommended Monitoring Frequency	Frequency Rationale
CS-1	LGR	Quarterly	Retain	Annual	Retain	Retain	Retain	DWW	Quarterly	Drinking Water Well
CS-10	LGR + CC	Quarterly	Retain	Annual	Retain	Retain	Retain	DWW	Quarterly	Drinking Water Well
CS-12	LGR + CC	Quarterly	Retain	Biennial	Retain	Retain	Retain	DWW	Quarterly	Drinking Water Well
CS-13	LGR + CC	Quarterly	Retain	Annual	Retain	Retain	Retain	DWW	Quarterly	Drinking Water Well
CS-2	LGR	9 months	Exclude	Biennial	Exclude/Reduce	Retain	Retain	Monitor plume edge	30 months	Provide back up for CS-4 as plume-edge monitoring point
CS-4	LGR	Semi-annual + snapshot	Retain	Annual	Retain	Retain	Retain	Monitor plume	15 months	Plume-edge monitoring point, historically ND COC concentrations
CS-B3-MW01	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Monitor plume	15 months	Monitor Bioreactor Performance LGR
B3-MW26-UGR	UGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Monitor plume in UGR	9 months	Monitor Bioreactor Performance UGR
B3-MW27-UGR	UGR	Semi-annual	Retain	Biennial	Exclude/Reduce	Retain	Retain	Monitor plume in UGR	9 months	Monitor Bioreactor Performance UGR
B3-MW28-UGR	UGR	Semi-annual	Exclude	Exclude	Not Analyzed	Exclude	Exclude	Consistently Dry	Exclude	
B3-MW29-UGR	UGR	Semi-annual	Retain	Biennial	Exclude/Reduce	Retain	Retain	Monitor plume in UGR	9 months	Monitor Bioreactor Performance UGR
B3-MW30-UGR	UGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Monitor plume in UGR	9 months	Monitor Bioreactor Performance UGR
B3-MW31-UGR	UGR	Semi-annual	Retain	Biennial	Exclude/Reduce	Retain	Retain	Monitor plume in UGR	9 months	Monitor Bioreactor Performance UGR
B3-MW32-UGR	UGR	Semi-annual	Retain	Biennial	Exclude/Reduce	Retain	Retain	Monitor plume in UGR	9 months	Monitor Bioreactor Performance UGR
B3-MW33-UGR	UGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Monitor plume in UGR	9 months	Monitor Bioreactor Performance UGR
B3-MW34-UGR	UGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Monitor plume in UGR	9 months	Monitor Bioreactor Performance UGR
CS-D	LGR	Semi-annual + snapshot	Retain	Biennial	Exclude/Reduce	Retain	Retain	Western plume edge	15 months	Monitor Bioreactor Performance LGR, currently stable or decreasing COC concentration trends
B3-EXW01	LGR	Semi-annual	Retain	Biennial	Exclude/Reduce	Retain	Retain	Extraction well	9 months	Bioreactor Component Extraction Well
B3-EXW02	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Extraction well	9 months	Bioreactor Component Extraction Well
B3-EXW03	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Extraction well	9 months	Bioreactor Component Extraction Well
B3-EXW04	LGR	Semi-annual	Retain	Biennial	Exclude/Reduce	Retain	Retain	Extraction well	9 months	Bioreactor Component Extraction Well

Table 5.3
Plume 1 3TMO Results Summary
Camp Stanley Storage Activity, Boerne, TX

Well Name	Zone[a/]	Current Sampling Frequency	Qualitative Evaluation		Temporal Evaluation	Spatial Evaluation	Summary			
			Retention Evaluation	Recommended Monitoring Frequency			Final Retention Evaluation	Retention Rationale[b/]	Recommended Monitoring Frequency	Frequency Rationale
B3-EXW05	LGR	Semi-annual	Retain	Biennial	Exclude/Reduce	Retain	Retain	Extraction well	9 months	Bioreactor Component Extraction Well
CS-I	LGR	18 months	Exclude	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Provides background/ most upgradient well	30 months	Retain as upgradient/background monitoring point, distant from Plume 1
CS-MW12-BS	BS	As needed	Exclude	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Cross/downgradient well in BS	Exclude	BS is not a viable portion of the aquifer
CS-MW12-CC	CC	18 months	Exclude	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Cross/downgradient well in CC	30 months	Cross-gradient, along fault, between source and CSSA boundary; Between plume and fence line; ND COC concentrations
CS-MW12-LGR	LGR	9 months	Exclude	Biennial	Exclude/Reduce	Retain	Retain	Cross/downgradient well in LGR	15 months	Cross-gradient, along fault, between source and CSSA boundary; Between plume and fence line; Cross-gradient and all ND. Retain as sentinel well for CS-10
CS-MW16-CC	CC	Semi-annual + snapshot	Retain	Biennial	Retain	Retain	Retain	Extraction well	9 months	Bioreactor Component Extraction Well; monitor VOC levels feeding injection; Active remediation well
CS-MW16-LGR	LGR	Semi-annual + snapshot	Retain	Biennial	Retain	Retain	Retain	Extraction well	9 months	Bioreactor Component Extraction Well; monitor VOC levels feeding injection; Active remediation well
CS-MW17-LGR	LGR	9 months	Exclude	Biennial	Exclude/Reduce	Retain	Retain	Upgradient DWW CS-13	15 months	Well down/cross gradient of plume and up gradient of CS-13; Only monitoring well in the east pasture; Downgradient and all F Flag or ND. Retain as sentinel well for CS-13
CS-MW18-LGR	LGR	9 months	Exclude	Biennial	Exclude/Reduce	Retain	Retain	Down gradient CS-10; between B3 and AOC-65	30 months	Distant downgradient well with ocassional trace detections
CS-MW19-LGR	LGR	9 months	Exclude	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Between plume 1 and CS-10	30 months	Downgradient well with predictable trace detections

Table 5.3
Plume 1 3TMO Results Summary
Camp Stanley Storage Activity, Boerne, TX

Well Name	Zone[a/]	Current Sampling Frequency	Qualitative Evaluation		Temporal Evaluation	Spatial Evaluation	Summary			
			Retention Evaluation	Recommended Monitoring Frequency			Final Retention Evaluation	Retention Rationale[b/]	Recommended Monitoring Frequency	Frequency Rationale
CS-MW1-BS	BS	As needed	Retain	Biennial	Exclude/Reduce	Retain	Retain	In-plume, down gradient source	Exclude	BS is not a viable portion of the aquifer
CS-MW1-CC	CC	18 months	Retain	Biennial	Exclude/Reduce	Retain	Retain	In-plume, down gradient source	30 months	Historically ND, downgradient
CS-MW1-LGR	LGR	Semi-annual + snapshot	Retain	Biennial	Retain	Retain	Retain	In-plume, down gradient source	15 months	Downgradient well with stable COC concentrations
CS-MW20-LGR	LGR	9 months	Retain	Biennial	Exclude/Reduce	Retain	Retain	Toe of plume 1	30 months	Downgradient well with predictable/stable COC concentrations
CS-MW21-LGR	LGR	9 months	Exclude	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	down gradient plume, up gradient DWW CS-1	30 months	Cross-gradient well with historical ND
CS-MW22-LGR	LGR	9 months	Exclude	Biennial	Exclude/Reduce	Retain	Retain	down gradient of toe of plume	30 months	Downgradient well with historical ND
CS-MW23-LGR	LGR	9 months	Exclude	Biennial	Exclude/Reduce	Retain	Retain	between B-3 and AOC-65	30 months	Downgradient well with historical ND
CS-MW24-LGR	LGR	Semi-annual + snapshot	Exclude	Biennial	Exclude/Reduce	Retain	Retain	Monitor western plume-edge migration	30 months	Downgradient well with historical ND
CS-MW25-LGR	LGR	9 months	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor upgradient of plume	30 months	Upgradient well with historical ND
CS-MW2-CC	CC	18 months	Retain	Biennial	Exclude/Reduce	Retain	Retain	Monitor SE plume-edge in CC	30 months	Downgradient well with historical ND
CS-MW2-LGR	LGR	Semi-annual + snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor SE plume-edge	30 months	Downgradient well with historical ND/trace detctions and decreasing trends
CS-MW3-LGR	LGR	9 months	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor upgradient of plume	30 months	Upgradient well with historical ND
CS-MW4-LGR	LGR	9 months	Exclude	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor cross-gradient near southern toe of plume	30 months	Cross-gradient well with historical ND/trace detections
CS-MW5-LGR	LGR	9 months	Retain	Less than Biennial, see users guide	Retain	Retain	Retain	Monitor up/cross-gradient near plume body	15 months	Cross-gradient plume edge with increasing trends in PCE/TCE
CS-MW9-BS	BS	As needed	Exclude	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor BS background	Exclude	BS is not a viable portion of the aquifer

Table 5.3
Plume 1 3TMO Results Summary
Camp Stanley Storage Activity, Boerne, TX

Well Name	Zone[a/]	Current Sampling Frequency	Qualitative Evaluation		Temporal Evaluation	Spatial Evaluation	Summary			
			Retention Evaluation	Recommended Monitoring Frequency			Final Retention Evaluation	Retention Rationale[b/]	Recommended Monitoring Frequency	Frequency Rationale
CS-MW9-CC	CC	18 months	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor CC background	30 months	Upgradient and cross-gradient of Plume 1, historical ND
CS-MW9-LGR	LGR	9 months	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor LGR background	30 months	Upgradient and cross-gradient of Plume 1, historical ND
CS-MWG-LGR	LGR	18 months	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Provides background in unaffected area	30 months	Retain as upgradient/background monitoring point, distant from Plume 1
CS-MWH-LGR	LGR	18 months	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Provides background in unaffected area	30 months	Retain as upgradient/background monitoring point, distant from Plume 1
CS-WB05-BS-01	BS	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB05-CC-01	CC	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB05-CC-02	CC	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB05-LGR-01	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB05-LGR-02	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB05-LGR03A	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB05-LGR03B	LGR	Semi-annual	Retain	Annual	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB05-LGR-04A	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB05-LGR-04B	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system

Table 5.3
Plume 1 3TMO Results Summary
Camp Stanley Storage Activity, Boerne, TX

Well Name	Zone[a/]	Current Sampling Frequency	Qualitative Evaluation		Temporal Evaluation	Spatial Evaluation	Summary			
			Retention Evaluation	Recommended Monitoring Frequency			Final Retention Evaluation	Retention Rationale[b/]	Recommended Monitoring Frequency	Frequency Rationale
CS-WB06-LGR-01	LGR	Semi-annual	Retain	Biennial	Exclude/Reduce	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB06-LGR-02	LGR	Semi-annual	Retain	Biennial	Exclude/Reduce	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB06-LGR03A	LGR	Semi-annual	Retain	Biennial	Exclude/Reduce	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB06-LGR03B	LGR	Semi-annual	Retain	Annual	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB06-LGR-04	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB06-UGR-01	UGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB07-LGR-01	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB07-LGR-02	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB07-LGR03A	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB07-LGR03B	LGR	Semi-annual	Retain	Annual	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB07-LGR-04	LGR	Semi-annual	Retain	Biennial	Exclude/Reduce	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB07-UGR-01	UGR	Semi-annual	Retain	Biennial	Exclude/Reduce	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB08-LGR-01	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system

Table 5.3
Plume 1 3TMO Results Summary
Camp Stanley Storage Activity, Boerne, TX

Well Name	Zone[a/]	Current Sampling Frequency	Qualitative Evaluation		Temporal Evaluation	Spatial Evaluation	Summary			
			Retention Evaluation	Recommended Monitoring Frequency			Final Retention Evaluation	Retention Rationale[b/]	Recommended Monitoring Frequency	Frequency Rationale
CS-WB08-LGR-02	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB08-LGR03A	LGR	Semi-annual	Retain	Biennial	Exclude/Reduce	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB08-LGR03B	LGR	Semi-annual	Retain	Annual	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB08-LGR-04	LGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system
CS-WB08-UGR-01	UGR	Semi-annual	Retain	Biennial	Retain	Retain	Retain	Provides vertical distribution	9 months	Monitor vertical distribution of contaminants near remediation system

[a/] LGR = Lower Glen Rose; UGR = Upper Glen Rose; CC = Cow Creek; BS = Bexar Shale.
[b/] DWW = drinking water well.

Table 5.4
Plume 2 Well Parameter Inputs
Camp Stanley Storage Activity, Boerne, TX

Well ID	X Coordinates	Y Coordinates	Top of Screen (bgs)[a/]	Bottom of Screen (bgs)	Zone[b/]	Functional Category	Current Sampling Frequency	Risk to Receptors	Predictability of COC Concentrations
BSR-03	532608.8482	3282914.19	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable
BSR-04	535144.2039	3281761.128	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable
CS-MW10-CC	535676.797	3283185.962	470	495	CC	In-Plume	Every 18 months	Low	Predictable
CS-MW10-LGR	535675.595	3283209.09	370	395	LGR	In-Plume	9-month snapshot	Low	Predictable
CS-MW11A-LGR	536257.579	3283387.196	420.3	445.3	LGR	Crossgradient	Semi-annual + snapshot	Low	Predictable
CS-MW11B-LGR	536253.156	3283382.35	182	207	LGR	Crossgradient	9-month snapshot	Low	Predictable
CS-MW23-LGR	536199.409	3284027.777	372	397	LGR	Upgradient	9-month snapshot	Low	Predictable
CS-MW35-LGR	535913.65	3283233.943	405	430	LGR	Crossgradient	9-month snapshot	Low	Predictable
CS-MW36-LGR	535673.212	3283702.697	345	370	LGR	In-Plume	Quarterly - ISCO	Moderate	Unpredictable
CS-MW6-BS	535706.509	3283877.847	397	422	BS	Upgradient	9-month snapshot	Low	Predictable
CS-MW6-CC	535701.478	3283873.245	451	476	CC	Upgradient	Every 18 months	Low	Predictable
CS-MW6-LGR	535711.319	3283882.507	340	365	LGR	Upgradient	Quarterly - ISCO	Moderate	Predictable
CS-MW7-CC	535885.458	3283593.004	430	455	CC	Upgradient	Every 18 months	Low	Predictable
CS-MW7-LGR	535884.568	3283611.409	322	347	LGR	Upgradient	Quarterly - ISCO	Moderate	Predictable
CS-MW8-CC	535695.084	3283554.08	439.5	464.5	CC	In-Plume	Every 18 months	Low	Predictable
CS-MW8-LGR	535695.762	3283575.281	332	357	LGR	In-Plume	Quarterly - ISCO	Moderate	Predictable
CS-WB01-LGR-01	535712.781	3283552.968	--	--	LGR	In-Plume	Quarterly - ISCO	Moderate	Predictable
CS-WB01-LGR-02	535712.781	3283552.968	--	--	LGR	In-Plume	9-month snapshot	Low	Predictable
CS-WB01-LGR-03	535712.781	3283552.968	--	--	LGR	In-Plume	9-month snapshot	Low	Predictable
CS-WB01-LGR-04	535712.781	3283552.968	--	--	LGR	In-Plume	9-month snapshot	Low	Predictable
CS-WB01-LGR-05	535712.781	3283552.968	--	--	LGR	In-Plume	9-month snapshot	Low	Predictable
CS-WB01-LGR-06	535712.781	3283552.968	--	--	LGR	In-Plume	9-month snapshot	Low	Predictable
CS-WB01-LGR-07	535712.781	3283552.968	--	--	LGR	In-Plume	9-month snapshot	Low	Predictable
CS-WB01-LGR-08	535712.781	3283552.968	--	--	LGR	In-Plume	9-month snapshot	Low	Predictable
CS-WB01-LGR-09	535712.781	3283552.968	--	--	LGR	In-Plume	Quarterly - ISCO	Moderate	Predictable
CS-WB01-UGR-01	535712.781	3283552.968	--	--	UGR	In-Plume	Quarterly - ISCO	Moderate	Predictable
CS-WB02-LGR-01	535693.987	3283619.881	--	--	LGR	In-Plume	Quarterly - ISCO	Moderate	Unpredictable
CS-WB02-LGR-02	535693.987	3283619.881	--	--	LGR	In-Plume	9-month snapshot	Low	Unpredictable
CS-WB02-LGR-03	535693.987	3283619.881	--	--	LGR	In-Plume	9-month snapshot	Low	Unpredictable
CS-WB02-LGR-04	535693.987	3283619.881	--	--	LGR	In-Plume	9-month snapshot	Low	Unpredictable
CS-WB02-LGR-05	535693.987	3283619.881	--	--	LGR	In-Plume	9-month snapshot	Low	Unpredictable
CS-WB02-LGR-06	535693.987	3283619.881	--	--	LGR	In-Plume	9-month snapshot	Low	Unpredictable
CS-WB02-LGR-07	535693.987	3283619.881	--	--	LGR	In-Plume	9-month snapshot	Low	Unpredictable
CS-WB02-LGR-08	535693.987	3283619.881	--	--	LGR	In-Plume	9-month snapshot	Low	Unpredictable
CS-WB02-LGR-09	535693.987	3283619.881	--	--	LGR	In-Plume	Quarterly - ISCO	Moderate	Unpredictable
CS-WB02-UGR-01	535693.987	3283619.881	--	--	UGR	In-Plume	Quarterly - ISCO	Moderate	Unpredictable
CS-WB03-LGR-01	535687.504	3283706.512	--	--	LGR	Source	Quarterly - ISCO	Moderate	Unknown
CS-WB03-LGR-02	535687.504	3283706.512	--	--	LGR	In-Plume	9-month snapshot	Low	Unpredictable
CS-WB03-LGR-03	535687.504	3283706.512	--	--	LGR	In-Plume	9-month snapshot	Low	Unpredictable
CS-WB03-LGR-04	535687.504	3283706.512	--	--	LGR	In-Plume	9-month snapshot	Low	Unpredictable

Table 5.4
Plume 2 Well Parameter Inputs
Camp Stanley Storage Activity, Boerne, TX

Well ID	X Coordinates	Y Coordinates	Top of Screen (bgs)[a/]	Bottom of Screen (bgs)	Zone[b/]	Functional Category	Current Sampling Frequency	Risk to Receptors	Predictability of COC Concentrations
CS-WB03-LGR-05	535687.504	3283706.512	--	--	LGR	In-Plume	9-month snapshot	Low	Unpredictable
CS-WB03-LGR-06	535687.504	3283706.512	--	--	LGR	In-Plume	9-month snapshot	Low	Unpredictable
CS-WB03-LGR-07	535687.504	3283706.512	--	--	LGR	In-Plume	9-month snapshot	Moderate	Unpredictable
CS-WB03-LGR-08	535687.504	3283706.512	--	--	LGR	In-Plume	9-month snapshot	Moderate	Unpredictable
CS-WB03-LGR-09	535687.504	3283706.512	--	--	LGR	In-Plume	Quarterly - ISCO	Moderate	Unpredictable
CS-WB03-UGR-01	535687.504	3283706.512	--	--	UGR	Source	Quarterly - ISCO	Moderate	HighlyUnpredictable
CS-WB04-BS-01	535402.031	3283519.471	--	--	BS	In-Plume	Every 18 months	Low	Predictable
CS-WB04-BS-02	535402.031	3283519.471	--	--	BS	In-Plume	Every 18 months	Low	Predictable
CS-WB04-CC-01	535402.031	3283519.471	--	--	CC	In-Plume	9-month snapshot	Low	Predictable
CS-WB04-CC-02	535402.031	3283519.471	--	--	CC	In-Plume	9-month snapshot	Low	Predictable
CS-WB04-CC-03	535402.031	3283519.471	--	--	CC	In-Plume	9-month snapshot	Low	Predictable
CS-WB04-LGR-01	535402.031	3283519.471	--	--	LGR	In-Plume	Quarterly - ISCO	Moderate	Predictable
CS-WB04-LGR-02	535402.031	3283519.471	--	--	LGR	In-Plume	9-month snapshot	Moderate	Predictable
CS-WB04-LGR-03	535402.031	3283519.471	--	--	LGR	In-Plume	9-month snapshot	Moderate	Predictable
CS-WB04-LGR-04	535402.031	3283519.471	--	--	LGR	In-Plume	9-month snapshot	Moderate	Predictable
CS-WB04-LGR-06	535402.031	3283519.471	--	--	LGR	In-Plume	9-month snapshot	Moderate	Predictable
CS-WB04-LGR-07	535402.031	3283519.471	--	--	LGR	In-Plume	9-month snapshot	Moderate	Predictable
CS-WB04-LGR-08	535402.031	3283519.471	--	--	LGR	In-Plume	9-month snapshot	Moderate	Predictable
CS-WB04-LGR-09	535402.031	3283519.471	--	--	LGR	In-Plume	9-month snapshot	High	Predictable
CS-WB04-LGR-10	535402.031	3283519.471	--	--	LGR	In-Plume	9-month snapshot	High	Predictable
CS-WB04-LGR-11	535402.031	3283519.471	--	--	LGR	In-Plume	Quarterly - ISCO	High	Predictable
CS-WB04-UGR-01	535402.031	3283519.471	--	--	UGR	In-Plume	As needed	Moderate	Unpredictable
FO-8	536356.25	3287612.75	310	--	LGR/CC	Distant/Off-Site	9-month snapshot	Low	Predictable
FO-17	534488	3284693.5	240	--	CC	Distant/Off-Site	9-month snapshot	Low	Predictable
FO-22	536123.9375	3287277	306	--	CC	Distant/Off-Site	9-month snapshot	Low	Predictable
FO-J1	535480	3284810	297	--	CC	Distant/Off-Site	9-month snapshot	Low	Predictable
HS-1	536938	3282990	--	--	CC	Distant/Off-Site	9-month snapshot	Low	Predictable
HS-2	536938	3283020	--	--	CC	Distant/Off-Site	9-month snapshot	Low	Predictable
HS-3	536960	3282990	--	--	CC	Distant/Off-Site	9-month snapshot	Low	Predictable
I10-2	535115.1875	3283403.5	--	--	LGR/CC	In-Plume	9-month snapshot	Moderate	Predictable
I10-5	534988.25	3283096	--	--	LGR/CC	In-Plume	9-month snapshot	Moderate	Predictable
I10-7	534763.1875	3283987	--	--	--	Distant/Off-Site	9-month snapshot	Moderate	Predictable
I10-8	534657.4297	3284077.475	--	--	--	Distant/Off-Site	9-month snapshot	Moderate	Predictable
I10-10	535788.2173	3281859.086	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-5	535300	3285278	203	--	LGR/CC	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-6	535303	3285155	160	--	LGR/CC	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-7	535403	3284842	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-8	535466	3284954	187	--	LGR/CC/HS	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-9	535583.125	3285067	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-13	535581	3285294.25	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable

Table 5.4
Plume 2 Well Parameter Inputs
Camp Stanley Storage Activity, Boerne, TX

Well ID	X Coordinates	Y Coordinates	Top of Screen (bgs)[a/]	Bottom of Screen (bgs)	Zone[b/]	Functional Category	Current Sampling Frequency	Risk to Receptors	Predictability of COC Concentrations
JW-14	535562.1875	3284831	202	--	LGR/CC	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-15	534972	3285722	200	--	LGR	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-20	535214	3285471	100	--	LGR/CC	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-26	535084	3285105	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-27	535094	3284999	104	--	LGR/CC	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-28	534978	3284947	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-29	535003	3284836	180	--	LGR	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-30	535100	3284828	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable
JW-31	535037.7457	3285355.695	--	--	LGR/CC	Distant/Off-Site	9-month snapshot	Low	Predictable
LS-1	536214	3283007	--	--	LGR/CC	Distant/Off-Site	9-month snapshot	Low	Predictable
LS-4	535735	3282429	--	--	LGR	Distant/Off-Site	9-month snapshot	Moderate	Predictable
LS-5	535555	3283080	--	--	--	In-Plume	Quarterly	High	Predictable
LS-6	535447.3125	3283059.5	--	--	--	In-Plume	Quarterly	High	Predictable
LS-7	535627.419	3283140.991	--	--	--	In-Plume	Quarterly	High	Predictable
OFR-1	534946	3284201	--	--	LGR/BS	Distant/Off-Site	9-month snapshot	Moderate	Predictable
OFR-3			--	--	LGR/CC	Distant/Off-Site	9-month snapshot	Moderate	Predictable
OFR-4	534786.25	3284423	--	--	--	Distant/Off-Site	9-month snapshot	Moderate	Predictable
OW-BARNOWL	533302.3157	3283649.438	--	--	SL/HO	Distant/Off-Site	9-month snapshot	Low	Predictable
OW-CE1	534043.2921	3284709.871	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable
OW-CE2	533261.0646	3284702.533	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable
OW-DAIRYWELL	532987.3162	3284737.596	--	--	SL/HO	Distant/Off-Site	9-month snapshot	Low	Predictable
OW-HH1	534050.365	3284590.794	--	--	SL/HO	Distant/Off-Site	9-month snapshot	Low	Predictable
OW-HH2	534018.3295	3283812.207	--	--	LGR/CC	Distant/Off-Site	9-month snapshot	Low	Predictable
OW-HH3	533783.3586	3283091.245	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable
OW-MT2	532940.0868	3284194.735	--	--	LGR/CC	Distant/Off-Site	9-month snapshot	Low	Predictable
RFR-3	535858.9092	3286883.608	--	--	LGR/CC	Distant/Off-Site	9-month snapshot	Low	Predictable
RFR-4	535653.856	3286798.789	--	--	LGR	Distant/Off-Site	9-month snapshot	Low	Predictable
RFR-5	535548.4814	3286970.049	--	--	LGR/CC	Distant/Off-Site	9-month snapshot	Low	Predictable
RFR-8	535642.1875	3285756.25	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable
RFR-9	535550.25	3284322	--	--	--	Distant/Off-Site	9-month snapshot	Moderate	Predictable
RFR-10	535354.186	3283530.66	--	--	--	In-Plume	Quarterly	High	Predictable
RFR-11	535322	3283195	--	--	--	In-Plume	Quarterly	High	Predictable
RFR-12	535269	3283115	--	--	LGR/CC/HS	In-Plume	9-month snapshot	High	Predictable
RFR-13	535584.2746	3284648.34	--	--	LGR/CC	Distant/Off-Site	9-month snapshot	Moderate	Predictable
RFR-14	535547.8541	3284911.329	--	--	LGR/CC	Distant/Off-Site	9-month snapshot	Low	Predictable
SLD-01	530967.6004	3283760.994	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable
SLD-02	530967.025	3283677.511	--	--	--	Distant/Off-Site	9-month snapshot	Low	Predictable

[a/] bgs = below ground surface; "--" = not available or not applicable.
[b/] LGR = Lower Glen Rose; UGR = Upper Glen Rose; CC = Cow Creek; BS = Bexar Shale; HO = Hosston; SL = Sligo.

Table 5.5
Plume 2 Temporal Trend Evaluation
Camp Stanley Storage Activity, Boerne, TX

Well ID	Temporal Recommendation	Start Date	End Date	Number of Samples	Category	Contaminants of Concern[a/]					
						PCE	TCE	1,2-cis-DCE	1,2-trans-DCE	VC	1,1-DCE
BSR-03	Exclude/Reduce	3/9/2012	6/6/2014	4	Distant/Off-Site	ND	ND	ND	ND	ND	ND
BSR-04	No Recommendation, < 4 samples	12/6/2012	6/10/2014	3	Distant/Off-Site	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-MW10-CC	No Recommendation, < 4 samples	9/15/2010	1/10/2013	2	In-Plume	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-MW10-LGR	Exclude/Reduce	9/15/2010	6/19/2014	6	In-Plume	Stable	<PQL	ND	ND	ND	ND
CS-MW11A-LGR	Exclude/Reduce	6/8/2010	9/8/2014	13	Crossgradient	<PQL	ND	ND	ND	ND	ND
CS-MW11B-LGR	No Recommendation, < 4 samples	3/8/2010	9/9/2010	2	Crossgradient	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-MW35-LGR	Exclude/Reduce	3/31/2011	9/9/2014	13	Crossgradient	Decreasing	ND	ND	ND	ND	ND
CS-MW6-BS	No Recommendation, < 4 samples	9/10/2010	12/13/2012	3	Upgradient	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-MW6-CC	No Recommendation, < 4 samples	9/10/2010	6/19/2014	3	Upgradient	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-MW7-CC	No Recommendation, < 4 samples	9/15/2010	6/19/2014	3	Upgradient	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-MW8-CC	Exclude/Reduce	9/15/2010	6/19/2014	4	In-Plume	ND	ND	ND	ND	ND	ND
CS-WB01-LGR-02	Exclude/Reduce	3/10/2010	12/9/2014	10	In-Plume	Stable*	Stable*	ND	ND	ND	ND
CS-WB01-LGR-03	Exclude/Reduce	3/10/2010	12/9/2014	10	In-Plume	Stable*	Stable*	ND	ND	ND	ND
CS-WB01-LGR-04	Exclude/Reduce	3/10/2010	12/9/2014	10	In-Plume	ND	<PQL	<PQL	ND	ND	ND
CS-WB01-LGR-05	Exclude/Reduce	3/10/2010	12/9/2014	10	In-Plume	<PQL	<PQL	ND	ND	ND	ND
CS-WB01-LGR-06	Exclude/Reduce	3/10/2010	12/9/2014	10	In-Plume	<PQL	Decreasing	<PQL	ND	ND	ND
CS-WB01-LGR-07	Exclude/Reduce	3/10/2010	12/9/2014	10	In-Plume	Decreasing*	Decreasing*	<PQL	ND	ND	ND
CS-WB01-LGR-08	Retain	3/10/2010	12/9/2014	10	In-Plume	Increasing*	Increasing*	Stable	ND	ND	ND
CS-WB02-LGR-02	No Recommendation, < 4 samples	3/11/2010	3/11/2010	1	In-Plume	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-WB02-LGR-03	Retain	3/11/2010	12/10/2014	10	In-Plume	Increasing*	Increasing*	ND	ND	ND	ND
CS-WB02-LGR-04	Retain	3/11/2010	12/10/2014	10	In-Plume	Prob. Increasing*	Stable*	ND	ND	ND	ND
CS-WB02-LGR-05	Exclude/Reduce	3/11/2010	12/10/2014	10	In-Plume	Stable	Decreasing*	ND	<PQL	ND	ND
CS-WB02-LGR-06	Retain	3/11/2010	12/10/2014	10	In-Plume	Stable*	Decreasing*	<PQL	No Trend	ND	ND
CS-WB02-LGR-07	Retain	3/11/2010	12/10/2014	10	In-Plume	No Trend	Stable	<PQL	ND	ND	ND
CS-WB02-LGR-08	Retain	3/11/2010	12/10/2014	10	In-Plume	No Trend*	Decreasing	Stable	Stable	ND	ND
CS-WB03-LGR-02	No Recommendation, < 4 samples	1/1/0001	12/31/9999	0	In-Plume	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-WB03-LGR-03	Exclude/Reduce	3/11/2010	12/3/2014	10	In-Plume	Stable*	Stable*	<PQL	ND	ND	ND
CS-WB03-LGR-04	Exclude/Reduce	3/11/2010	12/3/2014	10	In-Plume	Stable*	Stable*	ND	ND	ND	ND
CS-WB03-LGR-05	Exclude/Reduce	3/11/2010	12/3/2014	10	In-Plume	Stable*	Decreasing*	ND	ND	ND	ND
CS-WB03-LGR-06	Retain	3/11/2010	12/3/2014	10	In-Plume	Decreasing*	No Trend*	Increasing	ND	ND	ND
CS-WB03-LGR-07	Retain	3/11/2010	12/3/2014	10	In-Plume	Decreasing*	Decreasing*	Increasing*	ND	<PQL	ND
CS-WB03-LGR-08	Exclude/Reduce	3/11/2010	12/3/2014	10	In-Plume	Decreasing*	Decreasing	Stable*	ND	<PQL	ND
CS-WB04-UGR-01	No Recommendation, < 4 samples	1/1/0001	12/31/9999	0	In-Plume	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-WB04-LGR-01	Exclude/Reduce	3/10/2010	12/8/2014	11	In-Plume	<PQL	ND	ND	ND	ND	ND
CS-WB04-LGR-02	No Recommendation, < 4 samples	3/10/2010	3/10/2010	1	In-Plume	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-WB04-LGR-03	Exclude/Reduce	3/10/2010	3/6/2014	7	In-Plume	<PQL	<PQL	ND	ND	ND	ND
CS-WB04-LGR-04	Exclude/Reduce	3/10/2010	3/6/2014	7	In-Plume	<PQL	<PQL	<PQL	ND	ND	ND
CS-WB04-LGR-06	Retain	3/10/2010	12/8/2014	15	In-Plume	Increasing*	Decreasing*	Stable	<PQL	ND	ND
CS-WB04-LGR-07	Retain	3/10/2010	12/8/2014	15	In-Plume	Increasing*	Prob. Decreasing*	Prob. Decreasing*	No Trend	ND	ND
CS-WB04-LGR-08	Exclude/Reduce	3/10/2010	12/8/2014	10	In-Plume	<PQL	Stable	<PQL	ND	ND	ND
CS-WB04-LGR-09	Exclude/Reduce	3/10/2010	12/8/2014	15	In-Plume	Stable*	Stable*	ND	ND	ND	ND
CS-WB04-LGR-10	Retain	3/10/2010	12/8/2014	15	In-Plume	Increasing	<PQL	ND	ND	ND	ND
CS-WB04-BS-01	No Recommendation, < 4 samples	3/15/2011	3/6/2014	3	In-Plume	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-WB04-BS-02	No Recommendation, < 4 samples	3/15/2011	3/6/2014	3	In-Plume	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-WB04-CC-01	No Recommendation, < 4 samples	3/15/2011	3/6/2014	3	In-Plume	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-WB04-CC-02	No Recommendation, < 4 samples	3/15/2011	3/6/2014	3	In-Plume	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-WB04-CC-03	No Recommendation, < 4 samples	3/15/2011	3/6/2014	3	In-Plume	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
FO-17	Exclude/Reduce	6/1/2010	6/4/2014	6	Distant/Off-Site	ND	ND	ND	ND	ND	ND
FO-22	Exclude/Reduce	3/3/2010	6/5/2014	7	Distant/Off-Site	ND	ND	ND	ND	ND	ND
FO-8	Exclude/Reduce	3/3/2010	6/5/2014	7	Distant/Off-Site	ND	ND	ND	ND	ND	ND
FO-J1	Exclude/Reduce	3/2/2010	6/4/2014	8	Distant/Off-Site	<PQL	ND	ND	ND	ND	ND
HS-1	Exclude/Reduce	12/16/2010	6/5/2014	7	Distant/Off-Site	<PQL	ND	ND	ND	ND	ND
HS-2	Exclude/Reduce	3/3/2010	6/5/2014	8	Distant/Off-Site	<PQL	ND	ND	ND	ND	ND
HS-3	Exclude/Reduce	6/4/2010	6/5/2014	6	Distant/Off-Site	ND	ND	ND	ND	ND	ND

Table 5.5
Plume 2 Temporal Trend Evaluation
Camp Stanley Storage Activity, Boerne, TX

Well ID	Temporal Recommendation	Start Date	End Date	Number of Samples	Category	Contaminants of Concern[a/]					
						PCE	TCE	1,2-cis-DCE	1,2-trans-DCE	VC	1,1-DCE
I10-10	No Recommendation, < 4 samples	9/11/2013	9/11/2013	1	Distant/Off-Site	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
I10-2	Exclude/Reduce	3/3/2010	6/4/2014	8	In-Plume	<PQL	<PQL	ND	ND	ND	ND
I10-5	Exclude/Reduce	3/3/2010	6/4/2014	7	In-Plume	ND	ND	ND	ND	ND	ND
I10-7	Exclude/Reduce	3/2/2010	6/4/2014	6	Distant/Off-Site	ND	ND	ND	ND	ND	ND
I10-8	Exclude/Reduce	3/3/2010	6/4/2014	10	Distant/Off-Site	ND	ND	ND	ND	ND	ND
JW-13	Exclude/Reduce	6/9/2010	6/16/2014	6	Distant/Off-Site	ND	ND	ND	ND	ND	ND
JW-14	Exclude/Reduce	3/2/2010	6/4/2014	9	Distant/Off-Site	ND	ND	ND	ND	ND	ND
JW-15	Exclude/Reduce	3/2/2010	6/6/2014	7	Distant/Off-Site	ND	ND	ND	ND	ND	ND
JW-20	Exclude/Reduce	1/22/2014	9/4/2014	4	Distant/Off-Site	ND	ND	ND	ND	ND	ND
JW-26	Exclude/Reduce	8/30/2010	6/4/2014	5	Distant/Off-Site	ND	ND	ND	ND	ND	ND
JW-27	Exclude/Reduce	3/4/2010	6/10/2014	7	Distant/Off-Site	ND	ND	ND	ND	ND	ND
JW-28	Exclude/Reduce	3/4/2010	6/5/2014	10	Distant/Off-Site	ND	ND	ND	ND	ND	ND
JW-29	Exclude/Reduce	3/4/2010	6/6/2014	10	Distant/Off-Site	ND	ND	ND	ND	ND	ND
JW-30	Exclude/Reduce	3/2/2010	6/6/2014	10	Distant/Off-Site	<PQL	ND	<PQL	ND	ND	ND
JW-31	Exclude/Reduce	3/2/2010	6/5/2014	8	Distant/Off-Site	ND	ND	ND	ND	ND	ND
JW-5	Exclude/Reduce	3/2/2010	6/3/2014	7	Distant/Off-Site	<PQL	ND	ND	ND	ND	ND
JW-6	Exclude/Reduce	6/2/2010	6/3/2014	6	Distant/Off-Site	ND	ND	ND	ND	ND	ND
JW-7	Exclude/Reduce	3/4/2010	6/3/2014	10	Distant/Off-Site	<PQL	ND	ND	ND	ND	ND
JW-8	Exclude/Reduce	3/4/2010	6/6/2014	10	Distant/Off-Site	<PQL	ND	ND	ND	ND	ND
JW-9	Exclude/Reduce	3/4/2010	6/20/2014	6	Distant/Off-Site	ND	ND	ND	ND	ND	ND
LS-1	Exclude/Reduce	3/1/2010	6/5/2014	10	Distant/Off-Site	<PQL	ND	<PQL	ND	ND	ND
LS-4	Exclude/Reduce	3/1/2010	6/5/2014	10	Distant/Off-Site	<PQL	ND	ND	ND	ND	ND
LS-5	Retain	3/1/2010	12/1/2014	28	In-Plume	<PQL	Prob. Increasing*	ND	ND	ND	ND
LS-6	Retain	3/1/2010	12/1/2014	26	In-Plume	Stable	Increasing	ND	ND	ND	ND
LS-7	Exclude/Reduce	3/1/2010	12/1/2014	30	In-Plume	Stable*	Stable	ND	ND	ND	ND
OFR-1	Exclude/Reduce	3/3/2010	6/6/2014	10	Distant/Off-Site	<PQL	ND	ND	ND	ND	ND
OFR-4	Exclude/Reduce	3/5/2010	6/23/2014	7	Distant/Off-Site	ND	ND	ND	ND	ND	ND
OW-BARNOWL	Exclude/Reduce	2/28/2011	6/4/2014	12	Distant/Off-Site	<PQL	ND	ND	ND	ND	ND
OW-CE1	Exclude/Reduce	2/28/2011	6/4/2014	8	Distant/Off-Site	ND	ND	ND	ND	ND	ND
OW-CE2	Exclude/Reduce	2/28/2011	6/4/2014	8	Distant/Off-Site	ND	ND	ND	ND	ND	ND
OW-DAIRYWELL	Exclude/Reduce	2/28/2011	6/4/2014	8	Distant/Off-Site	ND	ND	ND	ND	ND	ND
OW-HH1	Exclude/Reduce	2/28/2011	6/4/2014	8	Distant/Off-Site	ND	ND	ND	ND	ND	ND
OW-HH2	Exclude/Reduce	2/28/2011	6/4/2014	12	Distant/Off-Site	<PQL	ND	ND	ND	ND	ND
OW-HH3	Exclude/Reduce	2/28/2011	6/4/2014	8	Distant/Off-Site	ND	ND	ND	ND	ND	ND
OW-MT2	Exclude/Reduce	2/28/2011	6/4/2014	8	Distant/Off-Site	ND	ND	ND	ND	ND	ND
RFR-10	Exclude/Reduce	3/1/2010	12/1/2014	29	In-Plume	Decreasing*	Stable*	<PQL	ND	ND	ND
RFR-11	Retain	3/1/2010	12/1/2014	26	In-Plume	Stable	Increasing*	ND	ND	ND	ND
RFR-12	Exclude/Reduce	3/3/2010	6/3/2014	9	In-Plume	<PQL	<PQL	ND	ND	ND	ND
RFR-13	Exclude/Reduce	6/2/2010	6/10/2014	6	Distant/Off-Site	ND	ND	ND	ND	ND	ND
RFR-14	Exclude/Reduce	3/3/2010	6/6/2014	10	Distant/Off-Site	<PQL	ND	ND	ND	ND	ND
RFR-3	Exclude/Reduce	12/21/2010	6/5/2014	6	Distant/Off-Site	ND	ND	ND	ND	ND	ND
RFR-4	Exclude/Reduce	12/21/2010	6/5/2014	6	Distant/Off-Site	ND	ND	ND	ND	ND	ND
RFR-5	Exclude/Reduce	12/21/2010	6/5/2014	6	Distant/Off-Site	ND	ND	ND	ND	ND	ND
RFR-8	Exclude/Reduce	6/4/2010	6/6/2014	6	Distant/Off-Site	ND	ND	ND	ND	ND	ND
RFR-9	Exclude/Reduce	3/5/2010	6/6/2014	7	Distant/Off-Site	ND	ND	ND	ND	ND	ND
SLD-01	Exclude/Reduce	9/8/2011	12/2/2014	8	Distant/Off-Site	<PQL	ND	ND	ND	ND	ND
SLD-02	No Recommendation, < 4 samples	3/6/2012	6/10/2014	3	Distant/Off-Site	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results	<4 Results
CS-MW23-LGR	Exclude/Reduce	3/9/2010	6/18/2014	10	Upgradient	ND	ND	ND	ND	ND	ND

[a/] PCE = tetrachloroethene, TCE = trichloroethene, DCE = dichloroethene, VC = vinyl chloride, ND = not detected; * = Trends contain a sample result that exceeds the cleanup goal entered in the COC information for that parameter;
< PQL = all sample results are less than the practical quantitation limit (PQL), or are a micture of non-detects and detections less than the PQL; < 4 Results = fewer than four measurements, no trend evaluated.

Table 5.6
Plume 2 3TMO Results Summary
Camp Stanley Storage Activity, Boerne, TX

Well Name	Zone[a/]	Current Sampling Frequency	Qualitative Evaluation		Temporal Evaluation	Spatial Evaluation	Summary			
			Retention Evaluation	Recommended Monitoring Frequency			Final Retention Evaluation	Retention Rationale[b/]	Recommended Monitoring Frequency	Frequency Rationale
BSR-03	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Exclude	Exclude	Distance from plume, ND history	Exclude	
BSR-04	--	9-month snapshot	Retain	Exclude	Not Analyzed	Retain	Exclude	Distance from plume, ND history	Exclude	
CS-MW10-CC	CC	Every 18 months	Retain	Biennial	Not Analyzed	Retain	Retain	Downgradient Plume 2 and adjacent to boundary	30 months	Monitor Plume 2 in CC downgradient of source area
CS-MW10-LGR	LGR	Semi-annual + snapshot	Retain	Biennial	Exclude/Reduce	Retain	Retain	Downgradient Plume 2 and adjacent to boundary	15 months	Monitor Plume 2 in LGR downgradient of source area
CS-MW11A-LGR	LGR	Semi-annual + snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Upgradient Plume 2, downgradient Plume 1, adjacent to boundary	15 months	Monitor LGR upgradient/cross-gradient Plume 2
CS-MW11B-LGR	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Not Analyzed	Retain	Retain	Upgradient Plume 2, downgradient Plume 1, adjacent to boundary	15 months	Monitor LGR upgradient/cross-gradient Plume 2
CS-MW23-LGR	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Upgradient Plume 2, downgradient Plume 1	30 months	Upgradient Plume 2/ background, downgradient Plume 1
CS-MW35-LGR	LGR	Semi-annual + snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Upgradient Plume 2	15 months	Monitor LGR upgradient/cross-gradient Plume 2
CS-MW36-LGR	LGR	9-month snapshot	Retain	Biennial	Exclude/Reduce	Retain	Retain	Within Plume 2	15 months	Monitor LGR within source area
CS-MW6-BS	BS	Every 18 months	Exclude	Exclude	Not Analyzed	Retain	Exclude	BS is not a viable portion of the aquifer	Exclude	
CS-MW6-CC	CC	Every 18 months	Retain	Less than Biennial, see users guide	Not Analyzed	Retain	Retain	Cross-gradient/upgradient plume-edge	30 months	Monitor CC upgradient Plume 2
CS-MW6-LGR	LGR	9-month snapshot	Retain	Biennial	Exclude/Reduce	Retain	Retain	Cross-gradient/upgradient plume-edge	15 months	Monitor LGR upgradient Plume 2
CS-MW7-CC	CC	Every 18 months	Retain	Less than Biennial, see users guide	Not Analyzed	Retain	Retain	Upgradient plume-edge	30 months	Monitor CC upgradient Plume 2
CS-MW7-LGR	LGR	9-month snapshot	Retain	Biennial	Exclude/Reduce	Retain	Retain	Upgradient plume-edge	15 months	Monitor LGR upgradient Plume 2
CS-MW8-CC	CC	Every 18 months	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Within Plume 2	15 months	Monitor Plume 2 within CC
CS-MW8-LGR	LGR	Semi-annual + snapshot	Retain	Biennial	Exclude/Reduce	Retain	Retain	Within Plume 2	15 months	Monitor Plume 2 in LGR
CS-WB01-LGR-01	LGR	9-month snapshot	Retain	Biennial	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB01-LGR-02	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB01-LGR-03	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants

Table 5.6
Plume 2 3TMO Results Summary
Camp Stanley Storage Activity, Boerne, TX

Well Name	Zone[a/]	Current Sampling Frequency	Qualitative Evaluation		Temporal Evaluation	Spatial Evaluation	Summary			
			Retention Evaluation	Recommended Monitoring Frequency			Final Retention Evaluation	Retention Rationale[b/]	Recommended Monitoring Frequency	Frequency Rationale
CS-WB01-LGR-04	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB01-LGR-05	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB01-LGR-06	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB01-LGR-07	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB01-LGR-08	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB01-LGR-09	LGR	9-month snapshot	Retain	Biennial	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB01-UGR-01	UGR	9-month snapshot	Retain	Biennial	Not Analyzed	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB02-LGR-01	LGR	9-month snapshot	Retain	Biennial	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB02-LGR-02	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Not Analyzed	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB02-LGR-03	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB02-LGR-04	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB02-LGR-05	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB02-LGR-06	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB02-LGR-07	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB02-LGR-08	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB02-LGR-09	LGR	9-month snapshot	Retain	Biennial	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB02-UGR-01	UGR	9-month snapshot	Retain	Biennial	Not Analyzed	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB03-LGR-01	LGR	9-month snapshot	Retain	Biennial	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB03-LGR-02	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Not Analyzed	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB03-LGR-03	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants

Table 5.6
Plume 2 3TMO Results Summary
Camp Stanley Storage Activity, Boerne, TX

Well Name	Zone[a/]	Current Sampling Frequency	Qualitative Evaluation		Temporal Evaluation	Spatial Evaluation	Summary			
			Retention Evaluation	Recommended Monitoring Frequency			Final Retention Evaluation	Retention Rationale[b/]	Recommended Monitoring Frequency	Frequency Rationale
CS-WB03-LGR-04	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB03-LGR-05	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB03-LGR-06	LGR	9-month snapshot	Retain	Less than Biennial, see users guide	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB03-LGR-07	LGR	9-month snapshot	Retain	Biennial	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB03-LGR-08	LGR	9-month snapshot	Retain	Biennial	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB03-LGR-09	LGR	9-month snapshot	Retain	Biennial	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB03-UGR-01	UGR	9-month snapshot	Retain	Biennial	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB04-BS-01	BS	Every 18 months	Retain	Less than Biennial, see users guide	Not Analyzed	Retain	Retain	Monitor vertical distribution of contaminants	30 months	Provides vertical distribution of contaminants
CS-WB04-BS-02	BS	Every 18 months	Retain	Less than Biennial, see users guide	Not Analyzed	Retain	Retain	Monitor vertical distribution of contaminants	30 months	Provides vertical distribution of contaminants
CS-WB04-CC-01	CC	Every 18 months	Retain	Less than Biennial, see users guide	Not Analyzed	Retain	Retain	Monitor vertical distribution of contaminants	30 months	Provides vertical distribution of contaminants
CS-WB04-CC-02	CC	Every 18 months	Retain	Less than Biennial, see users guide	Not Analyzed	Retain	Retain	Monitor vertical distribution of contaminants	30 months	Provides vertical distribution of contaminants
CS-WB04-CC-03	CC	Every 18 months	Retain	Less than Biennial, see users guide	Not Analyzed	Retain	Retain	Monitor vertical distribution of contaminants	30 months	Provides vertical distribution of contaminants
CS-WB04-LGR-01	LGR	Every 18 months	Retain	Biennial	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	30 months	Provides vertical distribution of contaminants
CS-WB04-LGR-02	LGR	Every 18 months	Retain	Biennial	Not Analyzed	Retain	Retain	Monitor vertical distribution of contaminants	30 months	Provides vertical distribution of contaminants
CS-WB04-LGR-03	LGR	Every 18 months	Retain	Biennial	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	30 months	Provides vertical distribution of contaminants
CS-WB04-LGR-04	LGR	Every 18 months	Retain	Biennial	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	30 months	Provides vertical distribution of contaminants
CS-WB04-LGR-06	LGR	9-month snapshot	Retain	Biennial	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB04-LGR-07	LGR	9-month snapshot	Retain	Biennial	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB04-LGR-08	LGR	9-month snapshot	Retain	Biennial	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB04-LGR-09	LGR	9-month snapshot	Retain	Annual	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants

Table 5.6
Plume 2 3TMO Results Summary
Camp Stanley Storage Activity, Boerne, TX

Well Name	Zone[a/]	Current Sampling Frequency	Qualitative Evaluation		Temporal Evaluation	Spatial Evaluation	Summary			
			Retention Evaluation	Recommended Monitoring Frequency			Final Retention Evaluation	Retention Rationale[b/]	Recommended Monitoring Frequency	Frequency Rationale
CS-WB04-LGR-10	LGR	9-month snapshot	Retain	Annual	Retain	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB04-LGR-11	LGR	9-month snapshot	Retain	Annual	Exclude/Reduce	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
CS-WB04-UGR-01	UGR	9-month snapshot	Retain	Biennial	Not Analyzed	Retain	Retain	Monitor vertical distribution of contaminants	15 months	Provides vertical distribution of contaminants
FO-17	CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	History of ND and distant location	Exclude	
FO-22	CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	History of ND and distant location	Exclude	
FO-8	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	History of ND and distant location	Exclude	
FO-J1	CC	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	History of F-flag PCE detections	30 months	Upgradient Plume 2, downgradient Plume 1 with trace detections
HS-1	CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	Distant location, ND in last 3 years with trace detections (F-flag) prior	Exclude	
HS-2	CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	Distant location, ND in last 4 years with trace detections (F-flag) prior	Exclude	
HS-3	CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	History of ND and distant location	Exclude	
I10-10	--	9-month snapshot	Retain	Exclude	Not Analyzed	Retain	Exclude	Distant location and ND history (3 events)	Exclude	
I10-2	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	Downgradient plume edge and ND history	Exclude	
I10-5	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2005	Exclude	
I10-7	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	Redundancy with I10-8	Exclude	
I10-8	--	9-month snapshot	Retain	Biennial	Exclude/Reduce	Retain	Retain	Upgradient/cross-gradient plume edge	30 months	Cross-gradient plume edge on downgradient side, ND history
JW-13	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2005	Exclude	
JW-14	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	No F-flag hits since 2009	Exclude	
JW-15	LGR	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2005	Exclude	
JW-20	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	Distance from plume, ND history	Exclude	
JW-26	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2005	Exclude	
JW-27	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	Periodic F-flag detections up to 2009, all ND since	Exclude	
JW-28	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2005	Exclude	

Table 5.6
Plume 2 3TMO Results Summary
Camp Stanley Storage Activity, Boerne, TX

Well Name	Zone[a/]	Current Sampling Frequency	Qualitative Evaluation		Temporal Evaluation	Spatial Evaluation	Summary			
			Retention Evaluation	Recommended Monitoring Frequency			Final Retention Evaluation	Retention Rationale[b/]	Recommended Monitoring Frequency	Frequency Rationale
JW-29	LGR	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	Periodic F-flag detections up to 2009, all ND since	Exclude	
JW-30	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	Periodic F-flag detections up to 2010, all ND since	Exclude	
JW-31	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2009	Exclude	
JW-5	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	Periodic F-flag detections up to 2011, all ND since	Exclude	
JW-6	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2005	Exclude	
JW-7	--	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Consistent F-flag detections of PCE since 2005	30 months	Upgradient Plume 2, downgradient Plume 1 with trace detections
JW-8	LGR/CC/HS	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Consistent F-flag detections of PCE since 2005	30 months	Upgradient Plume 2, downgradient Plume 1 with trace detections
JW-9	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2005	Exclude	
LS-1	LGR/CC	9-month snapshot	Retain	Biennial	Exclude/Reduce	Retain	Retain	Consistent F-flag detections of PCE since 2008, downgradient plume edge	15 months	Cross-gradient plume edge/downgradient
LS-4	LGR	9-month snapshot	Retain	Annual	Exclude/Reduce	Retain	Retain	Consistent F-flag detections of PCE since 2005, downgradient plume edge	15 months	Downgradient
LS-5	--	Quarterly	Retain	Semi-Annual	Retain	Retain	Retain	Within Plume 2, private supply well, GAC wellhead protection	Quarterly	PSW with GAC wellhead protection
LS-6	--	Quarterly	Retain	Semi-Annual	Retain	Retain	Retain	Within Plume 2, private supply well, GAC wellhead protection	Quarterly	PSW with GAC wellhead protection
LS-7	--	Quarterly	Retain	Semi-Annual	Exclude/Reduce	Retain	Retain	Within Plume 2, private supply well, GAC wellhead protection	Quarterly	PSW with GAC wellhead protection
OFR-1	LGR/BS	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	Plug and Abandonment imminent	Exclude	
OFR-3	--	Quarterly	Retain	Semi-Annual	Retain	Retain	Retain	Within Plume 2, private supply well, GAC wellhead protection	Quarterly	PSW with GAC wellhead protection
OFR-4	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	Plug and Abandonment imminent	Exclude	
OW-BARNOWL	SL/HO	9-month snapshot	Retain	Exclude	Exclude/Reduce	Exclude	Exclude	History of ND and distant location	Exclude	
OW-CE1	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Exclude	Exclude	History of ND and distant location	Exclude	
OW-CE2	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Exclude	Exclude	History of ND and distant location	Exclude	
OW-DAIRYWELL	SL/HO	9-month snapshot	Retain	Exclude	Exclude/Reduce	Exclude	Exclude	History of ND and distant location	Exclude	

Table 5.6
Plume 2 3TMO Results Summary
Camp Stanley Storage Activity, Boerne, TX

Well Name	Zone[a/]	Current Sampling Frequency	Qualitative Evaluation		Temporal Evaluation	Spatial Evaluation	Summary			
			Retention Evaluation	Recommended Monitoring Frequency			Final Retention Evaluation	Retention Rationale[b/]	Recommended Monitoring Frequency	Frequency Rationale
OW-HH1	SL/HO	9-month snapshot	Retain	Exclude	Exclude/Reduce	Exclude	Exclude	History of ND and distant location	Exclude	
OW-HH2	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Exclude	Exclude	History of ND and distant location	Exclude	
OW-HH3	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Exclude	Exclude	History of ND and distant location	Exclude	
OW-MT2	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Exclude	Exclude	History of ND and distant location	Exclude	
RFR-10	--	Quarterly	Retain	Semi-Annual	Exclude/Reduce	Retain	Retain	Within Plume 2, private supply well, GAC wellhead protection	Quarterly	PSW with GAC wellhead protection
RFR-11	--	Quarterly	Retain	Semi-Annual	Retain	Retain	Retain	Within Plume 2, private supply well, GAC wellhead protection	Quarterly	PSW with GAC wellhead protection
RFR-12	LGR/CC/HS	9-month snapshot	Retain	Semi-Annual	Exclude/Reduce	Retain	Retain	Downgradient plume edge	15 months	Downgradient plume edge well with detections
RFR-13	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2005	Exclude	
RFR-14	LGR/CC	9-month snapshot	Retain	Less than Biennial, see users guide	Exclude/Reduce	Retain	Retain	Periodic F-flag detections of PCE between 2010 and 2014	30 months	Upgradient Plume 2, downgradient Plume 1
RFR-3	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2005	Exclude	
RFR-4	LGR	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2005	Exclude	
RFR-5	LGR/CC	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2005	Exclude	
RFR-8	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2005	Exclude	
RFR-9	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Retain	Exclude	ND history since 2005 except one F-flag detection in 2009	Exclude	
SLD-01	--	9-month snapshot	Retain	Exclude	Exclude/Reduce	Exclude	Exclude	Distance from plume	Exclude	
SLD-02	--	9-month snapshot	Retain	Exclude	Not Analyzed	Exclude	Exclude	All ND since 2012 and distant from plume	Exclude	

[a/] LGR = Lower Glen Rose; UGR = Upper Glen Rose; CC = Cow Creek; BS = Bexar Shale; "--" = not available or not applicable.
[b/] ND = non-detect; GAC = granular activated carbon; PCE = tetrachloroethene; PSW = private source well.

SECTION 6
SUMMARY

The groundwater monitoring program for the CSSA Plume 1 and Plume 2 areas was evaluated for optimization opportunities using 3TMO, a public domain LTMO decision support tool. The evaluation determined that the intensity of monitoring can be reduced while still achieving the monitoring objectives and being protective of human health and the environment.

Periodic monitoring of 73 Plume 1 sampling locations is recommended in the optimized monitoring program versus 77 wells in the current program. As a result of frequency reductions, the optimized monitoring program for Plume 1 includes 400 well sampling events over a five-year period versus 696 sampling events in the current program. This equates to a reduction in sampling of 43%.

Periodic monitoring of 73 Plume 2 sampling locations is recommended in the optimized monitoring program versus 117 in the current program. As a result of frequency reductions, the optimized monitoring program includes 352 well sampling events over a five-year period versus 772 sampling events in the current program. This equates to a reduction in sampling of 54%.

Figure 6.1 shows a conceptual sampling schedule should the proposed LTMO recommendations be implemented at CSSA. The schedule not only meets the objectives listed in Section 3.1, it allows for the greatest number of sampling events, including a full "snapshot" event, and therefore the most comprehensive data set, prior to the Five-Year Review scheduled for July 2020.

Figure 6.1
Conceptual 5-Year Sampling Schedule at the Recommended LTMO Frequency

	Current Year Calendar	2015					
	Program Month	3	4	6	9	10	12
Plume 1	Quarterly (PWS Wells)	4		4	4		4
	Every 6 months (Bioreactor)		42			42	
	Every 9 months	20					20
	Every 18 months						7
Plume 2	Quarterly (GAC Wells)	6		6	6		6
	Every 9 months (DQO Elimination)*						
	Every 15 months	92					92
	Every 30 months						18
	Total Groundwater Samples Collected	122	42	10	10	42	147

		Year 1				Year 2				Year 3				Year 4				Year 5				Year 6			
	5-Year Calendar	2016				2017				2018				2019				2020				2021			
	Program Month	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72
Plume 1	Quarterly (PWS Wells)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Every 9 months (Bioreactor)	42			42			42			42			42			42			42			42		
	Every 15 months	7					7					7					7					7			
	Every 30 months						20										20								
Plume 2	Quarterly (GAC Wells)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Every 9 months (DQO Elimination)*	16			?			?			?			?			?			?			?		
	Every 15 months	49					49					49					49					49			
	Every 30 months						18										18								
	Total Groundwater Samples Collected	124	10	10	52	10	104	52	10	10	52	66	10	52	10	10	146	10	10	52	10	66	52	10	10

		Year 7				Year 8				Year 9				Year 10				Year 11				Year 12			
	5-Year Calendar	2022				2023				2024				2025				2026				2027			
	Program Month	75	78	81	84	87	90	93	96	99	102	105	108	111	114	117	120	123	126	129	132	135	138	141	144
Plume 1	Quarterly (PWS Wells)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
	Every 9 months (Bioreactor)	42			42			42			42			42			42			42			42		
	Every 15 months		7					7					7					7					7		
	Every 30 months		20										20										20		
Plume 2	Quarterly (GAC Wells)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
	Every 9 months (DQO Elimination)*	?			?			?			?			?			?			?			?		
	Every 15 months		49					49					49					49					49		
	Every 30 months		18										18										18		
	Total Groundwater Samples Collected	52	104	10	52	10	10	108	10	10	52	10	104	52	10	10	52	66	10	52	10	10	146		

** The actual quantity of samples collected at off-post wells scheduled for elimination by DQO based on 5 years of non-detect may vary depending on past sampling results (see Table A.1 in Appendix A)*

SECTION 7
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APPENDIX A

OFF-POST WELL EXCLUSION NOTIFICATION

Forty-two wells currently monitored at various frequencies are recommended for exclusion from future monitoring of Plume 2 as listed in **Table A.1** and shown on **Figure A.1**. Well CS-MW6-BS (on-post) will be immediately excluded from the sampling program, because it is screened in a non-viable portion of the aquifer. The remaining 41 off-post wells are considered ideal candidates for exclusion from the sampling program either because of their sheer distance from the plume origin combined with a long history of non-detects, or stable/reducing detections below the RL.

Based on the DQO flowchart (see Figure 5.8), wells that have consecutive non-detects over the course of 5 years are dropped from the sampling program, but retained for future sampling if conditions change or warrant further sampling. Off-post wells that meet the 5-year criteria of non-detect can be excluded immediately. The remainder of these wells will be retained at their recommended frequency until they satisfy the DQO of 5 years without a reportable detection.

Off-post well owners will be notified by mail using a public fact sheet followed by a personal notification letter that their well is slated for removal from the sampling network. Each notification letter will include a graph or other visual representation of all past sampling results for the well. The fact sheet will be sent out to the CSSA mailing list, which includes all well owners whose wells are currently part of the sampling program, in the spring of 2016. The fact sheet will summarize the rationale and process for excluding a well from future sampling, and will outline a comment period during which the public may provide feedback on the exclusion process.

`

Table A.1
Off-Post Well Exclusions based on DQOs

Well ID	LTMO Recommend-ation	Non-Detect (ND) Since	Distance from CSSA Boundary	Meets 5-Year ND DQO Exclusion NOW?	Anticipated to Meet 5-Year ND DQO Exclusion?	Notes
Excluded Due to Distance Greater than 1.5 Miles						
BSR-03	Exclude	Mar-12	1.90	No	Dec-16	Full ND History
OW-MT2	Exclude	Mar-11	1.69	No	Dec-15	Full ND History
OW-DAIRYWELL	Exclude	Mar-11	1.66	No	Dec-15	Full ND History
SLD-01	Exclude	Dec-14	2.92	No	Sep-19	2 trace PCE detections since Sept. 2011
SLD-02	Exclude	Mar-12	2.92	No	Dec-16	Full ND History
Excluded Due to History of Non-Detects						
BSR-04	Exclude	Dec-12	0.86	No	Sep-17	Full ND History
FO-8	Exclude	Mar-02	0.03	Yes		Full ND History
FO-17	Exclude	Mar-02	0.73	Yes		Full ND History
FO-22	Exclude	Sep-01	0.03	Yes		Full ND History
HS-1	Exclude	Mar-12	0.20	No	Sep-17	All trace detections of PCE below MDL
HS-2	Exclude	Sep-10	0.18	Yes		All trace detections of PCE below MDL
HS-3	Exclude	Dec-01	0.20	Yes		Full ND History
I10-2	Exclude	Sep-13	0.34	No	Jun-18	All trace detections of PCE and TCE below MDL
I10-5	Exclude	Dec-02	0.42	Yes		Full ND History
I10-7	Exclude	Mar-09	0.56	Yes		One trace hit of PCE in Dec. 2009, but duplicate sample was ND, redundant with I10-8.
JW-5	Exclude	Jun-11	0.22	No	Mar-16	All trace detections of PCE below MDL
JW-6	Exclude	Sep-01	0.22	Yes		Full ND History
JW-9	Exclude	Jun-04	0.05	Yes		All trace detections of DCE or PCE below MDL
JW-12	Exclude	Dec-07	0.10	Yes		Not in previous LTMO because there was no access agreement
JW-13	Exclude	Sep-01	0.05	Yes		Full ND History
JW-14	Exclude	Sep-09	0.06	Yes		All trace detections of PCE below MDL
JW-15	Exclude	Jun-05	0.44	Yes		Full ND History
JW-20	Exclude	Dec-13	0.28	No	Sep-18	New well in Dec-13. Full ND History
JW-26	Exclude	Mar-04	0.36	Yes		All trace detections of PCE below MDL
JW-27	Exclude	Jun-08	0.35	Yes		All trace detections of PCE or TCE below MDL
JW-28	Exclude	Sep-06	0.42	Yes		Full ND History
JW-29	Exclude	Jun-09	0.41	Yes		All trace detections of PCE below MDL
JW-30	Exclude	Mar-11	0.35	Yes		All trace detections of PCE or TCE below MDL
JW-31	Exclude	Dec-09	0.39	Yes		Full ND History
OW-HH1	Exclude	Mar-11	1.00	No	Dec-15	Full ND History
OW-HH2	Exclude	Jun-11	1.02	No	Mar-16	Trace PCE on 1st event. ND History since.
OW-HH3	Exclude	Mar-11	1.17	No	Dec-15	Full ND History
OW-CE1	Exclude	Mar-11	1.01	No	Dec-15	Full ND History
OW-CE2	Exclude	Mar-11	1.49	No	Dec-15	Full ND History
OW-BARNOWL	Exclude	Jun-11	1.47	No	Mar-16	Trace PCE on 1st event. ND History since.
RFR-3	Exclude	Mar-04	0.09	Yes		1 trace PCE in Dec. 2003. 4 Prior samples were ND.
RFR-4	Exclude	Mar-06	0.21	Yes		Full ND History
RFR-5	Exclude	Mar-04	0.29	Yes		Full ND History
RFR-8	Exclude	Dec-95	0.04	Yes		Full ND History
RFR-9	Exclude	Dec-09	0.07	Yes		One trace hit of PCE in Sept. 2009, but duplicate sample was ND!
RFR-13	Exclude	Dec-04	0.05	Yes		Full ND History

Well ID	2001 Sept	2001 Dec	2002 Mar	2002 June	2002 Sept	2002 Dec	2003 Mar	2003 June	2003 Sept	2003 Dec	2004 Mar	2004 June	2004 Sept	2004 Dec	2005 Mar	2005 June	2005 Sept	2005 Dec
BSR-03																		
OW-MT2																		
OW-DAIRYWELL																		
SLD-01																		
SLD-02																		
BSR-04																		
FO-8				-	-	-		-	-	-		-	-	-		-	-	-
FO-17				-	-	-		-	-	-	-		-	-	-		-	-
FO-22		-	-	-	-		-	-	-		-	-	-		-	-	-	
HS-1																		
HS-2																		
HS-3			-		-	-	-		-	-	-		-	-	-		-	-
I10-2																		
I10-5							-	-	-		-	-	-		-	-	-	
I10-7				-	-	-			-	-	-		-					
JW-5																		
JW-6		-	-		-	-	-		-	-	-		-	-	-		-	-
JW-9																-	-	-
JW-12		-	-	-	-		-	-	-	-		-	-	-		-	-	-
JW-13		-	-	-	-		-		-	-	-		-	-	-		-	-
JW-14																		
JW-15																		
JW-20																		
JW-26				-											-	-	-	
JW-27									-	-	-		-	-	-		-	
JW-28																		
JW-29																		
JW-30																		
JW-31																		
OW-HH1																		
OW-HH2																		
OW-HH3																		
OW-CE1																		
OW-CE2																		
OW-BARNOWL																		
RFR-3							-	-	-						-	-	-	
RFR-4												-	-	-		-	-	-
RFR-5												-	-	-		-	-	-
RFR-8		-	-		-	-	-		-	-	-		-	-	-		-	-
RFR-9			-		-	-	-			-	-	-		-	-	-		-
RFR-13											Well Installed							

Well ID	2006 Mar	2006 June	2006 Sept	2006 Dec	2007 Mar	2007 June	2007 Sept	2007 Dec	2008 Mar	2008 June	2008 Sept	2008 Dec	2009 Mar	2009 June	2009 Sept	2009 Dec	2010 Mar	2010 June	2010 Sept	2010 Dec
BSR-03																			access agreement received	
OW-MT2															access agreement received					
OW-DAIRYWELL															access agreement received					
SLD-01													permission to sample granted, no access agreement							
SLD-02													permission to sample granted, no access agreement							
BSR-04																				
FO-8		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-
FO-17	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-
FO-22	-	-	-		-	-	-	-		-	-	-		-	-	-		-	-	-
HS-1																	-	-	-	
HS-2																		-		
HS-3	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-
I10-2		-	-	-		-	-	-		-	-	-		-	-	-				NA
I10-5	-	-	-		-	-	-	-	-	-	-	-		-	-	-		-	-	-
I10-7																		-	NA	NA
JW-5		-	-	-										-	-	-		-	-	-
JW-6	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-
JW-9		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-
JW-12	-	-		-	-	-			NA		NA	NA			access agreement expired, no response from o					
JW-13	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-
JW-14																				
JW-15		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-
JW-20																				
JW-26	-	-	-		-	-	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		-
JW-27								-						-	-	-		-	-	-
JW-28							-	-	-											
JW-29																				
JW-30																				
JW-31													Well Installed							
OW-HH1															access agreement received					
OW-HH2															access agreement received					
OW-HH3															access agreement received					
OW-CE1															access agreement received					
OW-CE2															access agreement received					
OW-BARNOWL															access agreement received					
RFR-3	-	-	-		-	-	-		-	-	-		-	-	-		-	-	-	
RFR-4		-	-	-		-	-	-		-	-		-	-	-		-	-	-	
RFR-5		-	-	-		-	-	-		-	-		-	-	-		-	-	-	
RFR-8	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-
RFR-9	-	-		-	-	-		-	-	-		-	-	-						-
RFR-13			-	-	-		-	-	-		-	-	-		-	-	-		-	-

Well ID	2011 Mar	2011 June	2011 Sept	2011 Dec	2012 Mar	2012 June	2012 Sept	2012 Dec	2013 Mar	2013 June	2013 Sept	2013 Dec	2014 Mar	2014 June	2014 Sept	2014 Dec	2015 Mar	2015 June	2015 Sept	2015 Dec (Sampled)
BSR-03						-	-		-	-		-	-		-	-		-	-	Yes
OW-MT2						-	-		-	-		-	-		-	-		-	-	Yes
OW-DAIRYWELL						-	-		-	-		-	-		-	-		-	-	Yes
SLD-01				-		-	-	NA	-	-										Yes
SLD-02			NA	-		-	-	NA	-	-		-	-		-	-		-	-	Yes
BSR-04			access agreement received						-	-		-	-		-	-		-	-	Yes
FO-8			-	-		-	-		-	-		-	-		-	-		-	-	Yes
FO-17	-		-	-		-	-		-	-		-	-		-	-		-	-	Yes
FO-22			-	-		-	-		-	-		-	-		-	-		-	-	Yes
HS-1			-	-		-	-		-	-		-	-		-	-		-	-	Yes
HS-2	-		-	-		-	-		-	-		-	-		-	-		-	-	Yes
HS-3	-		-	-		-	-		-	-		-	-		-	-		-	-	Yes
I10-2	-		-	-		-	-		-	-		-	-		-	-		-	-	Yes
I10-5			-	-		-	-		-	-		-	-		-	-		-	-	Yes
I10-7	-		-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-5			-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-6	-		-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-9	-		-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-12				NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		-	Yes
JW-13	-		-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-14			-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-15			-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-20						access agreement received										-		-	-	Yes
JW-26	-		-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-27			-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-28			-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-29			-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-30			-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-31	-		-	-		-	-		-	-		-	-		-	-		-	-	Yes
OW-HH1						-	-		-	-		-	-		-	-		-	-	Yes
OW-HH2												-	-		-	-			-	Yes
OW-HH3						-	-		-	-		-	-		-	-		-	-	Yes
OW-CE1						-	-		-	-		-	-		-	-		-	-	Yes
OW-CE2						-	-		-	-		-	-		-	-		-	-	Yes
OW-BARNOWL												-	-		-	-			-	Yes
RFR-3	-		-	-		-	-		-	-		-	-		-	-		-	-	Yes
RFR-4	-		-	-		-	-		-	-		-	-		-	-	-	-	-	Yes
RFR-5	-		-	-		-	-		-	-		-	-		-	-		-	-	Yes
RFR-8	-		-	-		-	-		-	-		-	-		-	-		-	-	Yes
RFR-9	-		-	-		-	-		-	-	NA	-	-		-	-		-	-	Yes
RFR-13	-		-	-		-	-		-	-		-	-		No Electricity					Yes

Table A.1
Off-Post Well Exclusions based on DQOs

							2001		2002				2003				2004				2005				2006				2007				2008				2009				2010				2011				2012				2013				2014				2015			
Well ID	**LTMO Recommend-ation**	**Non-Detect (ND) Since**	**Distance from CSSA Boundary**	**Meets 5-Year ND DQO Exclusion NOW?**	**Anticipated to Meet 5-Year ND DQO Exclusion?**	**Notes**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec**	**Mar**	**June**	**Sept**	**Dec (Sampled)**
Retained for Sampling																																																																
FO-J1	30-Month	June-14	0.11			Upgradient Plume 2, downgradient Plume 1 with trace detections												-						-	-																						-	-	NA	-	-	NA	-	-		-	-		-	-		-	-	Yes
I10-8	30-Month	Dec-05	0.63			Cross-gradient plume edge on downgradient side, ND history																			-	-	-		-	-	-		-	-	-		-	-	-								-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-7	30-Month	Mar-15	0.16			Upgradient Plume 2, downgradient Plume 1 with trace detections																																									-	-		-	-		-	-		-	-		-	-		-	-	Yes
JW-8	30-Month	Mar-15	0.12			Upgradient Plume 2, downgradient Plume 1 with trace detections																																									-	-		-	-		-	-		-	-		-	-		-	-	Yes
LS-1	15-Month		0.02			Consistent Trace PCE													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-														-	-		-	-		-	-		-	-		-	-		-	-	Yes
LS-4	15-Month	Mar-15	0.38			Downgradient																								-	-	-	-														-	-		-	-		-	-		-	-		-	-		-	-	Yes
LS-5	Quarterly		0.07			PSW with GAC wellhead protection for TCE																																																											Yes
LS-6	Quarterly		0.13			PSW with GAC wellhead protection																																																											Yes
LS-7	Quarterly		0.02			PSW with GAC wellhead protection																																																											Yes
OFR-3	Quarterly		0.30			PSW with GAC wellhead protection																																						NA	-									NA	NA	NA	NA	NA	NA	NA				Yes
RFR-10	Quarterly		0.19			Consistently over MCL																																																											Yes
RFR-11	Quarterly		0.21			Consistently between RL and MCL																																																											Yes
RFR-12	15-Month		0.24			Downgradient plume edge well with detections																				-	-	-		-	-	-		-	-	-		-	-	-				NA	-			-		-	-		-	-		-	-		-	-		-	-	Yes
RFR-14	30-Month	Mar-15	0.07			Upgradient Plume 2, downgradient Plume 1																	Well Installed																								-	-		-	-		-	-		-	-		-	-		-	-	Yes

Well ID	LTMO Recommend-ation			Meets 5-Year ND DQO Exclusion NOW?	Anticipated to Meet 5-Year ND DQO Exclusion?	
Quarterly	**6**					
15-Month	**3**					
30-Month	**5**					
Exclude	**41**			**25**	**16**	
	55					

Legend	
(red)	VOCs detected are greater than 90% of the MCL. Sample monthly; quarterly after GAC installation.
(orange)	VOCs detected are greater than RL, but less than MCL.
(yellow)	VOCs detected are greater than MDL, but less than RL (trace detections).
(green)	Non-Detect
-	Not sampled for that event.
NA	Not applicable, sample could not be collected due to pump outage or well access conflict.
(grey)	Time before well was incorporated into groundwater monitoring program
Yes	Sampled in Dec 2015.

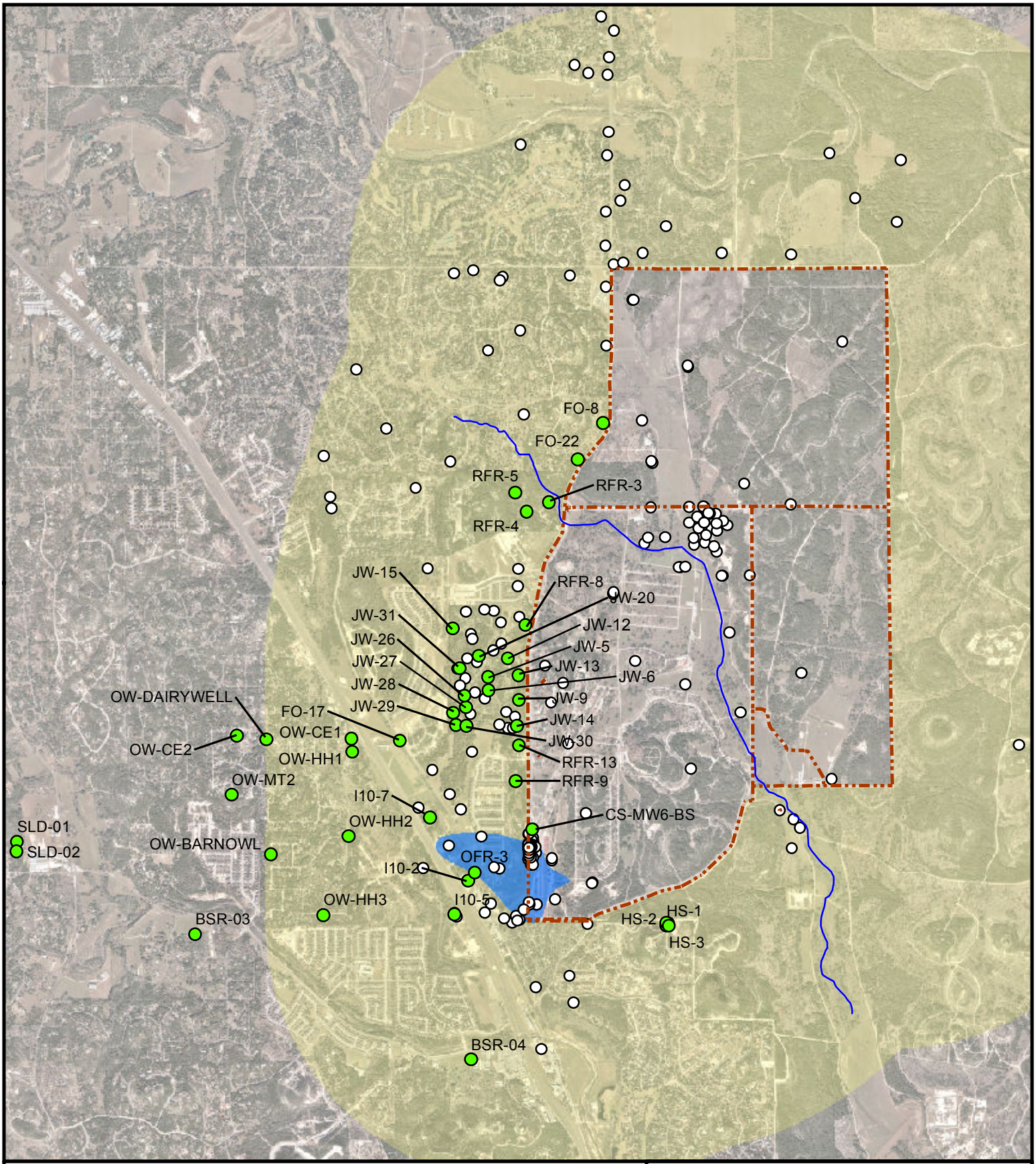

Figure A.1

Wells Scheduled for Exclusion

Camp Stanley Storage Activity

PARSONS