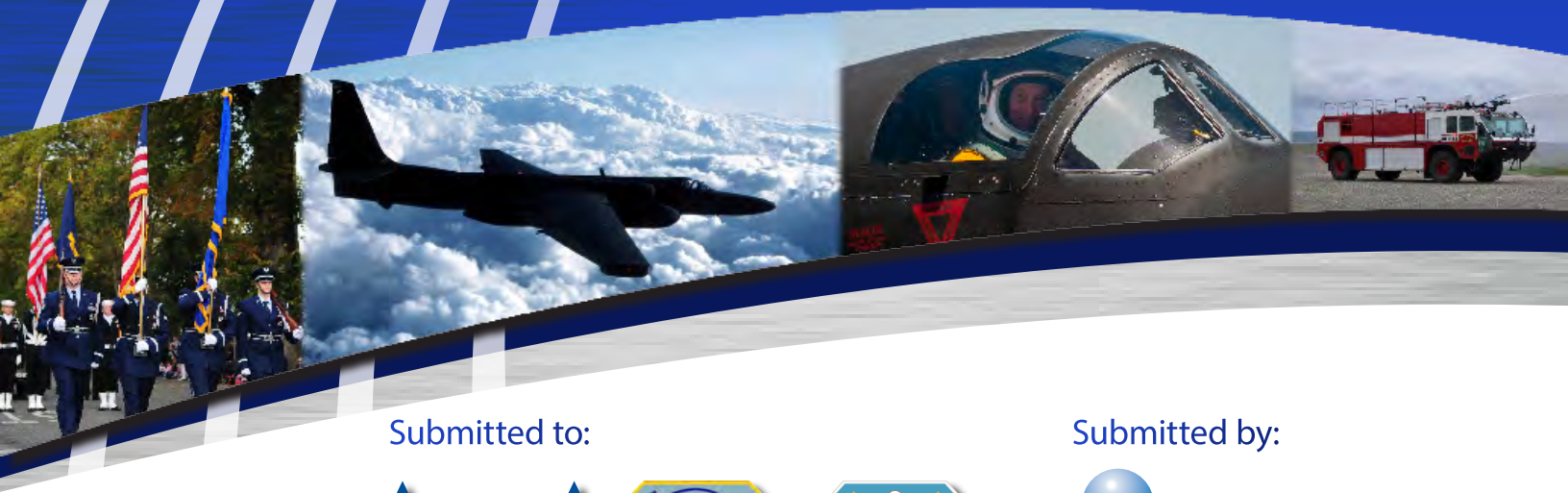
FINAL

PERFORMANCE-BASED REMEDIATION
Site SS023 Corrective Measures Implementation Report

JULY 2015

BEALE AIR FORCE BASE, CALIFORNIA
Project No.: BAEY20147501PB
Contract No.: FA8903-09-D-8557
Task Order: 0003



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Final Site SS023 Corrective Measures Implementation Report
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July 14, 2015

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Mr. David Leeson
HQ AFCEC/CZRW
3515 S. General McMullen
San Antonio, TX 78226-2018

Subject: Beale Air Force Base, California
Performance-based Remediation
Final *Site SS023 Corrective Measures Implementation Report*
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Payment Milestone: AF/Regulator Approval of Final CMI Report
Project No.: BAEY20147501PB
File Plan No.: 17-A-211
Contract No.: FA8903-09-D-8557
Task Order: 0003

Dear Mr. Leeson:

This letter documents the submittal of the Final *Site SS023 Corrective Measures Implementation Report* for Beale Air Force Base, California. This submittal satisfies Sub-CLIN: 0009CL, Sub-sub-CLIN: NA, Payment Milestone No.: 2 – AF/Regulator Approval of Final CMI Report, Task Order: 0003.

Copies of this document have been delivered to the individuals included on the attached distribution list.

Regulatory concurrence on this Final document is requested by **Friday, August 14, 2015.**

If you have any questions concerning this submittal, you can contact me at (916) 286-0248.

Sincerely,

CH2M HILL

D. Jay Wilburn
Project Manager

Enclosures

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Final

Beale Air Force Base, California

Site SS023 Corrective Measures Implementation Report

Sub-CLIN: 0009CL
Sub-sub-CLIN: NA

Prepared for
Air Force Civil Engineer Center

Contract No.: FA8903-09-D-8557
Task Order: 0003
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July 14, 2015

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This Corrective Measures Implementation (CMI) Report for Site SS023, Beale Air Force Base, California, summarizes the optimization of the interim corrective measures and documents that the final remedy is in place at Site SS023. This work is being conducted at Beale AFB, California (Task Order 0003; Project No.: BAEY20147501PB; Contract No.: FA8903-09-D-8557).

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Final

Site SS023 Corrective Measures Implementation Report

Beale Air Force Base, California

Prepared for

Air Force Civil Engineer Center

July 2015

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Executive Summary

This Corrective Measures Implementation (CMI) Report for Site SS023, Beale Air Force Base, California, summarizes the optimization of the interim corrective measures and documents that the final remedy is in place at Site SS023 (Figure ES-1). The final remedy was selected and implemented in accordance with the *Site SS023 Statement of Basis / Corrective Measures Implementation Work Plan* (Work Plan) (CH2M HILL, 2014). No further action was selected for soil and soil vapor. In situ chemical oxidation (ISCO), enhanced attenuation (EA), and land use controls (LUCs) were selected for groundwater. Trichloroethene (TCE) and tetrachloroethene (PCE) were identified as contaminants of concern (COCs) in groundwater.

This report is being prepared by CH2M HILL for the Air Force Civil Engineer Center under the Worldwide Environmental Restoration and Construction Contract No. FA8903-09-D-8557, Task Order 0003.

Corrective Measure Objectives

The site-specific objectives at Site SS023 are to reduce concentrations of COCs in underlying groundwater originating at Site SS023 (Figure ES-2) to support restoration of groundwater, to restrict potential exposure to COCs in groundwater, and to comply with state Resource Conservation and Recovery Act requirements. TCE and PCE levels in underlying groundwater will be reduced to allow for unlimited use/unrestricted exposure, which support the restoration of groundwater to designated beneficial uses (domestic, municipal, agricultural, and industrial supply).

Corrective Measure Implementation

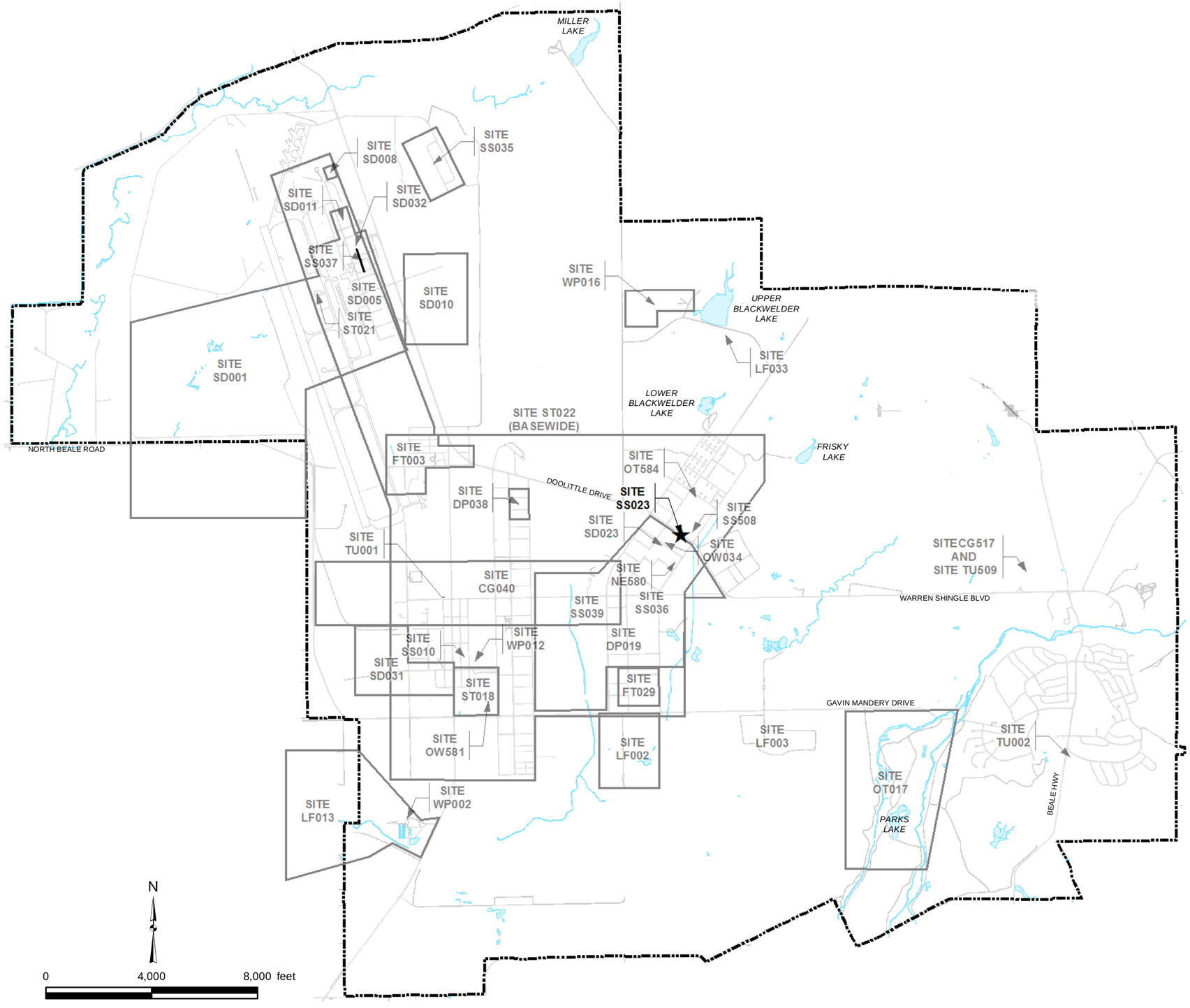
The remedy implemented at Site SS023 consists of three main components: ISCO, EA, and LUCs.
To implement the ISCO portion of the remedy, four injection wells were constructed and developed in June 2014, baseline sampling was conducted, sodium permanganate was injected into new and existing wells, and monitoring was performed from November 5, 2014, to January 23, 2015. During the baseline sampling event (July 2014), the highest TCE concentration was detected in a groundwater sample collected from injection well SWMU23C016IW with a TCE concentration of 564 micrograms per liter (µg/L) (Figure ES-3). Groundwater samples collected from the new injection wells near Doolittle Drive (SWMU23C015IW, SWMU23C016IW, and SWMU23C017IW) contained TCE concentrations ranging from 54 to 564 µg/L. The detection of TCE in groundwater collected from these wells further confirms that there is a residual TCE mass in groundwater beneath Doolittle Drive (upgradient of the ozone/air sparge system). EA involves groundwater monitoring downgradient from the ISCO treatment zone and will be documented in the Basewide Groundwater Monitoring Program Reports. LUCs were implemented to prevent exposure to groundwater containing COCs at concentrations greater than the cleanup levels.

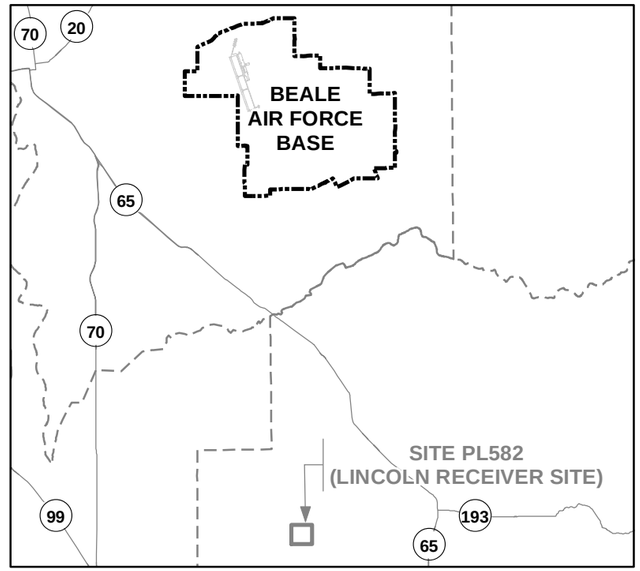
Monitoring Plan

After injection, performance monitoring will be conducted semiannually to assess the long-term effectiveness of the ISCO and EA remedies. Compliance monitoring will be conducted for 1 year or until objectives of the Monitoring and Reporting Program (MRP) have been met. Exceedances of baseline concentrations in a downgradient compliance monitoring well would indicate an adverse impact to groundwater outside the transition zone. A contingency plan has been developed to provide a general overview of efforts that the U.S. Air Force would take to address exceedances of dissolved chromium, dissolved manganese, or permanganate at concentrations greater than twice baseline concentrations in downgradient compliance monitoring wells.

Works Cited

CH2M HILL. 2014. *Site SS023 Statement of Basis / Corrective Measures Implementation Work Plan*. Prepared for Beale Air Force Base, California. Final. September.





LEGEND

- LOCATION OF SITE SS023
- SITE INVESTIGATION BOUNDARY
- SURFACE WATER
- ROAD
- BASE BOUNDARY

FIGURE ES-1
SITE SS023 VICINITY MAP
SITE SS023 CORRECTIVE MEASURES IMPLEMENTATION REPORT
BEALE AIR FORCE BASE, CALIFORNIA

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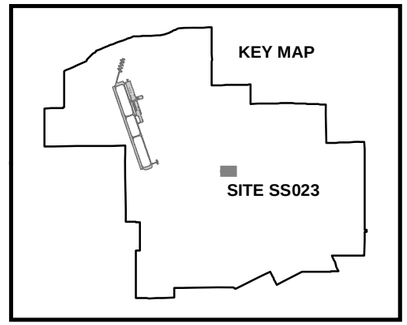

LEGEND

- GROUNDWATER MONITORING WELL
- GROUNDWATER INJECTION WELL
- OZONE/AIR SPARGE WELL
- M FORMER OIL/WATER SEPARATOR
- UNDERGROUND CONVEYANCE FOR OZONE SPARGE SYSTEM
- SANITARY SEWER/IWL CONVEYANCE
- EXCAVATED AREA AND GREASE RACK (TN & ASSOCIATES, 2000)
- NO FURTHER ACTION AREA FOR SOIL AND SOIL VAPOR

N

0 125 250 FEET

FIGURE ES-2
SITE SS023 LOCATION AND FEATURES MAP

SITE SS023 CORRECTIVE MEASURES IMPLEMENTATION REPORT
BEALE AIR FORCE BASE, CALIFORNIA

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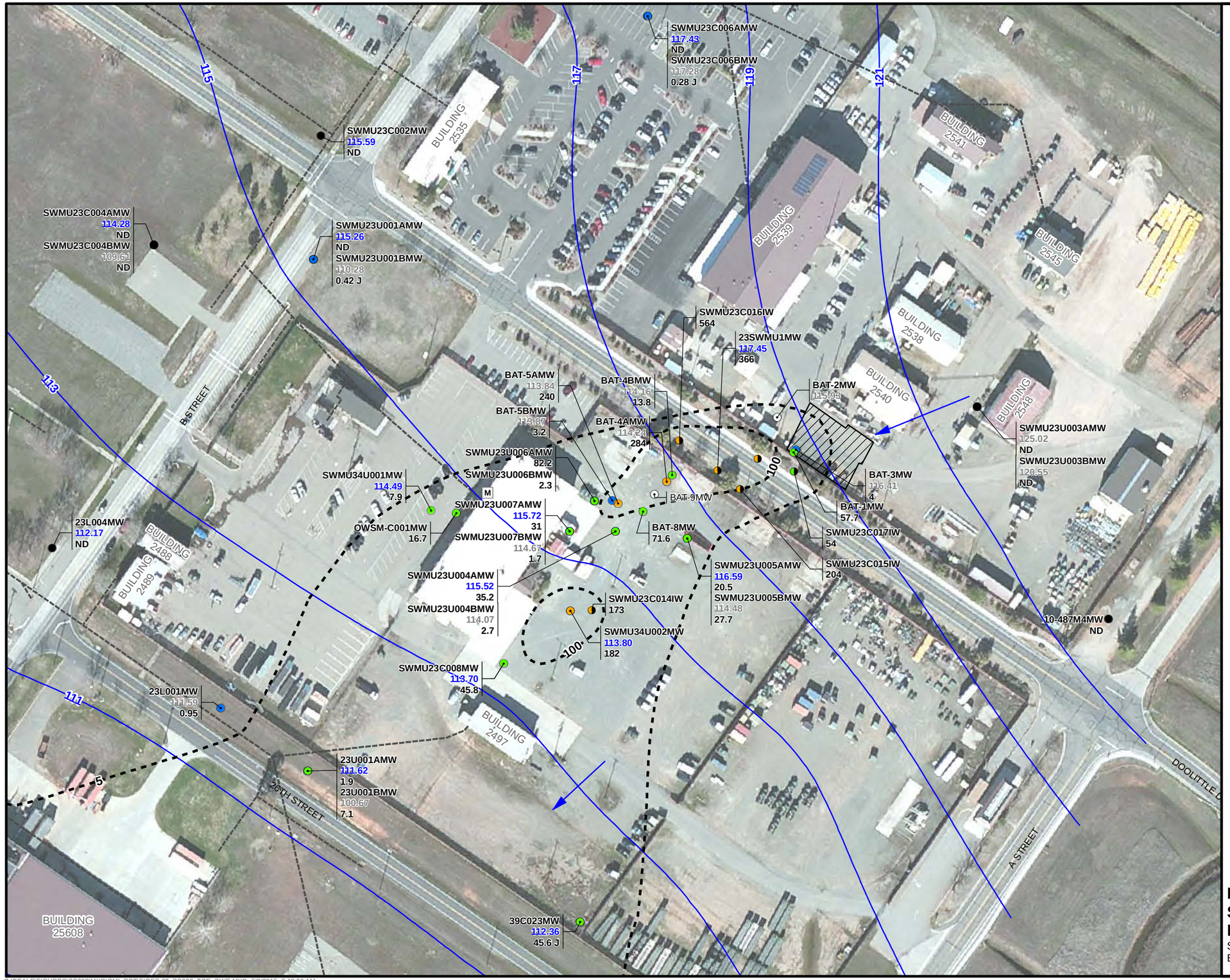

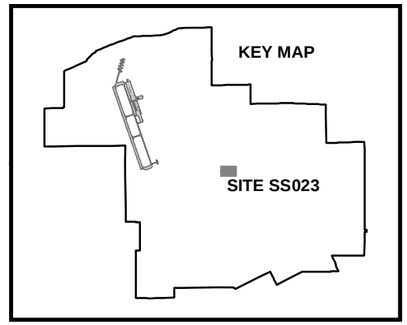

LEGEND

TCE CONCENTRATION IN GROUNDWATER (µg/L)

- NOT DETECTED (ND)
- ND to 5
- 5 to 100
- >100
- GROUNDWATER MONITORING WELL
- GROUNDWATER INJECTION WELL
- 116.59 MEASURED GROUNDWATER ELEVATION (feet NAVD88) (GREY TEXT INDICATES ELEVATION NOT USED IN CONTOURING)
- 20.5 TCE CONCENTRATION IN GROUNDWATER (µg/L)
- M FORMER OIL/WATER SEPARATOR
- TCE CONCENTRATION CONTOUR (µg/L)
- GROUNDWATER ELEVATION CONTOUR (feet NAVD88)
- GROUNDWATER FLOW DIRECTION
- SANITARY SEWER/IWL CONVEYANCE
- EXCAVATED AREA AND GREASE RACK (TN & ASSOCIATES, 2000)

NOTES:

DATA PRESENTED ON THIS FIGURE WAS COLLECTED DURING THE 2014 ANNUAL BGMP SAMPLING EVENT.

µg/L = MIGROGRAMS PER LITER.

J = THE ANALYTE WAS POSITIVELY IDENTIFIED, AND THE QUANTITATION IS AN ESTIMATE.

NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

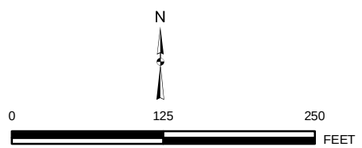

FIGURE ES-3
SITE SS023 TCE CONCENTRATIONS IN GROUNDWATER

SITE SS023 CORRECTIVE MEASURES IMPLEMENTATION REPORT
BEALE AIR FORCE BASE, CALIFORNIA

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Appendixes

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Acronyms and Abbreviations

°C	degree(s) Celsius
µg/L	microgram(s) per liter
AFB	Air Force Base
Air Force	U.S. Air Force
Base	Air Force Base
BGMP	Basewide Groundwater Monitoring Program
bgs	below ground surface
btoc	below top of casing
BW	background well
CCR	California Code of Regulations
CE	Civil Engineering
Central Valley Water Board	Central Valley Regional Water Quality Control Board
CMI	Corrective Measures Implementation
CMW	compliance monitoring well
COC	contaminant of concern
DCE	dichloroethene
DO	dissolved oxygen
DTSC	California Department of Toxic Substances Control
EA	enhanced attenuation
EPA	U.S. Environmental Protection Agency
gpd/ft	gallon(s) per day per foot
gpm	gallon(s) per minute
gpm/ft	gallon(s) per minute per foot
ISCO	in situ chemical oxidation
IW	injection well
LAR	limited access rig
LUC	land use control
MCL	maximum contaminant level
mg/L	milligram(s) per liter
MRP	Monitoring and Reporting Program

mS/cm	milliSiemen(s) per centimeter
mV	millivolt(s)
$NaMnO_4$	sodium permanganate
NOI	Notice of Intent
ORP	oxidation reduction potential
PCE	tetrachloroethene
PID	photoionization detector
PMW	performance monitoring well
PVC	polyvinyl chloride
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
ROI	radius of influence
SOP	standard operating procedure
State Water Board	State Water Resources Control Board
Subtronic	Subtronic Corporation
SWMU23	Solid Waste Management Unit 23
TCE	trichloroethene
TDS	total dissolved solids
TEFA	Technical and Economic Feasibility Analysis
TW	transition zone well
TZW	treatment zone well
UCL	upper confidence limit
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
VOC	volatile organic compound
WQO	water quality objective
Yuba County	Yuba County Environmental Health Department
WDR	waste discharge requirement

SECTION 1

Introduction

This Corrective Measures Implementation (CMI) Report for Site SS023, Beale Air Force Base (AFB or Base), California, summarizes the optimization of the interim corrective measures and documents that the final remedy is in place at Site SS023 (Figure 1-1) (figures are located at the end of each section). The final remedy was selected and implemented in accordance with the *Site SS023 Statement of Basis / Corrective Measures Implementation Work Plan* (Work Plan) (CH2M HILL, 2014a). No further action was selected for soil and soil vapor. In situ chemical oxidation (ISCO), enhanced attenuation (EA), and land use controls (LUCs) were selected for groundwater. Trichloroethene (TCE) and tetrachloroethene (PCE) were identified as contaminants of concern (COCs) in groundwater.

This report is being prepared by CH2M HILL for the Air Force Civil Engineer Center under the Worldwide Environmental Restoration and Construction Contract No. FA8903-09-D-8557, Task Order 0003.

1.1 Site Background

Beale AFB is located in the southeastern portion of the Sacramento Valley, approximately 40 miles north of Sacramento and 13 miles east of Marysville. Site SS023 is part of Solid Waste Management Unit 23 (SWMU23) and is located in the central portion of Beale AFB in the Cantonment Area, northeast of the intersection at 26th and B Streets (Figure 1-1). Site SS023 is an electrical transformer storage area inside the Civil Engineering (CE) yard. Site SS023 consists of two concrete pads measuring 52 by 60 feet, located approximately 80 feet south of Building 2539. The concrete pads are both adjacent to the northern side of the fence along Doolittle Drive. Electrical equipment, used transformers, and transformer oil were stored as part of operations and maintenance activities at the exterior electrical shop in Building 2539 (URS, 2004). The site is currently used for storage by the 9th Civil Engineering Squadron. Materials currently stored at the site (such as transformers, gravel/sand, utility poles, and generators) do not contain significant quantities of polychlorinated biphenyls or chlorinated solvents. Site SS023 is zoned for industrial use (CH2M HILL, 2013). Figure 1-2 shows the site features located at Site SS023.

Solid Waste Management Unit 23 (SWMU23) has been classified as a Resource Conservation and Recovery Act (RCRA) facility because waste management practices resulted in a transformer spill in the mid-1990s. The interim cleanup effort was conducted under the U.S. Air Force (Air Force) compliance program (URS, 2004). The sources of contaminants at SWMU23 are divided into three different sites. The COCs are TCE, PCE, and 1,1-dichloroethene (DCE). The 1,1-DCE plume (Site SS507) is west of Site SS023, while the PCE plume (Site SS508) is north of Doolittle Drive and west of A Street (northeast of Site SS023), within the CE yard. These two plumes are considered separate sites from Site SS023 and are not addressed further as part of this CMI Report.

1.1.1 Hydrogeology

The depth to groundwater at Site SS023 is approximately 5 to 36 feet below ground surface (bgs), with an average depth of 19 feet bgs (CH2M HILL, 2014b). The horizontal hydraulic gradient at the site is southwesterly. A groundwater trough is evident, which corresponds to a trough in the erosional surface of the marine siltstone layer. Overall, the hydraulic conductivity estimates ranged from 0.75 to 14.3 feet per day (Battelle and SteamTech Environmental Services, 2001). South of Doolittle Drive where the plume is migrating, the hydraulic conductivities ranged from 0.75 to 4.5 feet per day. For well BAT-5 (shallow/deep), the hydraulic conductivity in the shallow well (25 to 30 feet bgs) was roughly twice that of the deep well (35 to 40 feet bgs).

1.1.2 Site History and Response Actions

Phased investigations and interim corrective measures conducted at Site SS023 from 1994 to 2014 are summarized in the Work Plan (CH2M HILL, 2014a). Historical investigations at Site SS023 led to a number of interim corrective measures, which included soil excavation, operation of a groundwater treatment system, and operation of an ozone/air sparge system.

In 1998, maximum concentrations of TCE and PCE detected in groundwater were 1,600 and 110 micrograms per liter (µg/L), respectively. From 2001 to 2003, a pilot-scale groundwater treatment system was installed that used dynamic underground stripping with hydrous pyrolysis oxidation technology to degrade the chlorinated solvents. The TCE and PCE concentrations in groundwater were reduced 85 and 91 percent, respectively. An ozone sparge system was operated from 2005 to 2012. In 2013, monitoring wells SWMU23C008MW and SWMU23C009MW were constructed to define the extent of the 100-µg/L TCE plume to support optimization of the ISCO remedy. Groundwater samples from well SWMU23C009MW contained 956 µg/L TCE and 47.2 µg/L PCE, indicating a need to optimize the ISCO remedy (CH2M HILL, 2014a). The high TCE concentration in well SWMU23C009MW, located along the shoulder of Doolittle Drive (Figure 1-2), showed that most of the TCE mass remains beneath Doolittle Drive, and remediation should be emphasized in this area.

1.2 Report Objectives

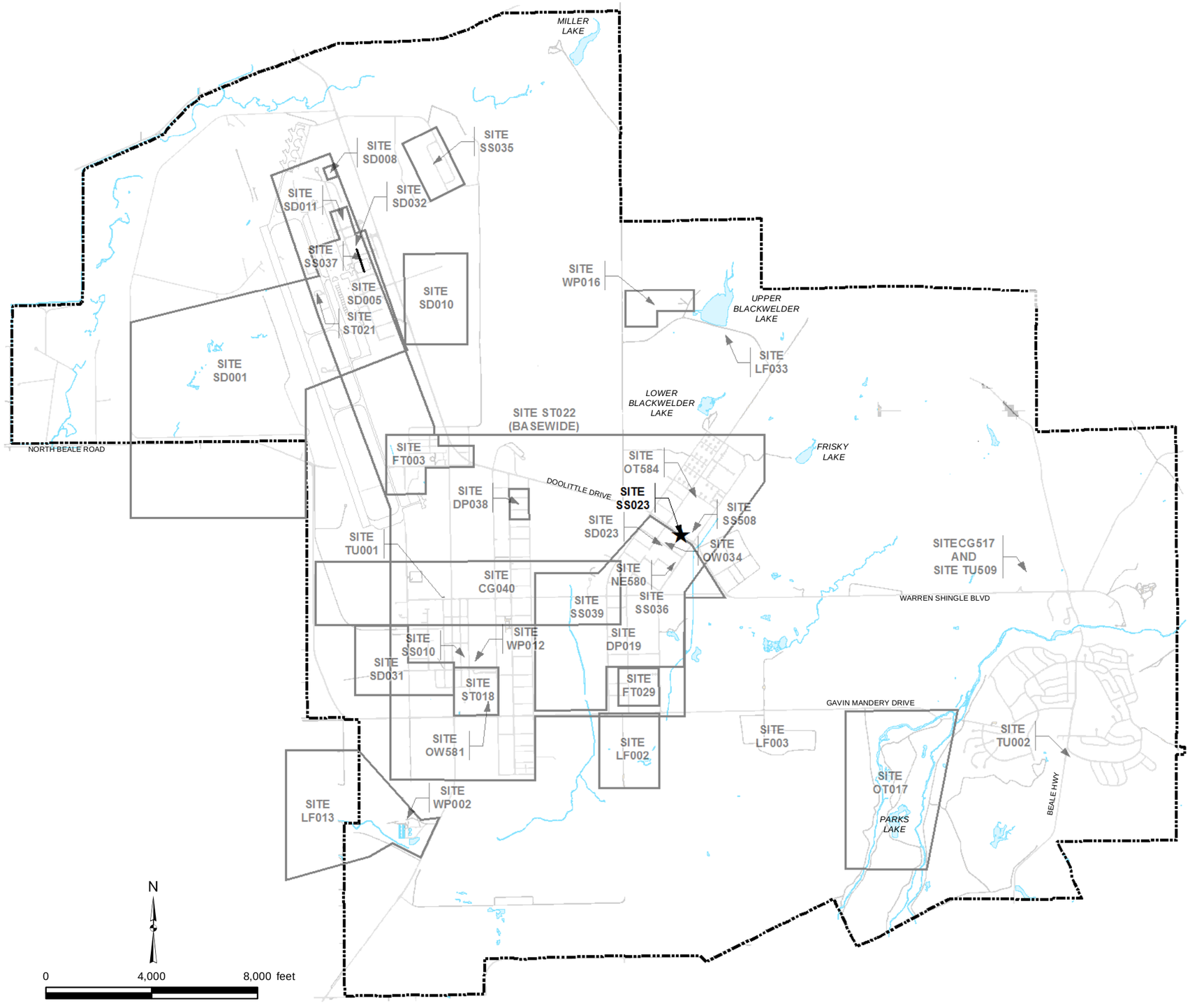
The objectives of this CMI Report are as follows:

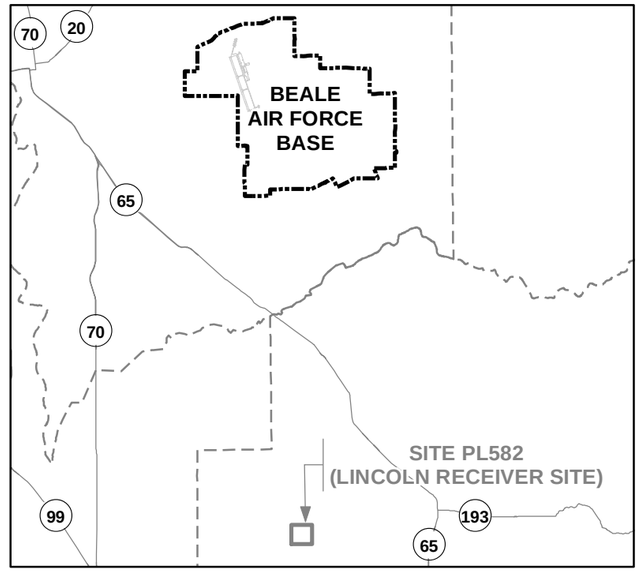
- Document implementation of the corrective measures at Site SS023.
- Provide baseline concentrations prior to ISCO implementation.
- Provide the monitoring plan for the ISCO remedy at Site SS023.

1.3 Report Organization

The organization of this report is as follows:

- **Section 1: Introduction.** Provides the Site SS023 background and the purpose and organization of this CMI Report.
- **Section 2: Corrective Measure Objectives.** Provides the objectives that the selected corrective measure will achieve.
- **Section 3: Corrective Measure Implementation.** Documents the implementation of the selected corrective measure and discusses deviations from the Work Plan. An updated conceptual site model is included in this section.
- **Section 4: Monitoring Plan.** Describes the performance and compliance monitoring for the ISCO remedy at Site SS023.
- **Section 5: Conclusions and Recommendations.** Provides a summary of the work completed and conclusions from the implementation of the ISCO remedy.
- **Section 6: Works Cited.** Provides a list of the references used to prepare this report.
- **Appendix A: Fieldwork Documentation.**
- **Appendix B: Site SS023 Baseline Groundwater Analytical Data.**
- **Appendix C: Injection Monitoring Documentation.**
- **Appendix D: Response to Comments.**





LEGEND

- ★ LOCATION OF SITE SS023
- SITE INVESTIGATION BOUNDARY
- SURFACE WATER
- ROAD
- BASE BOUNDARY

FIGURE 1-1
SITE SS023 VICINITY MAP
SITE SS023 CORRECTIVE MEASURES IMPLEMENTATION REPORT
BEALE AIR FORCE BASE, CALIFORNIA

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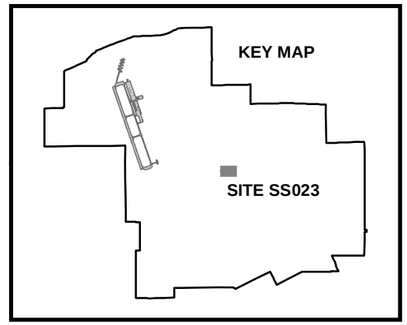

LEGEND

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- M FORMER OIL/WATER SEPARATOR
- UNDERGROUND CONVEYANCE FOR OZONE SPARGE SYSTEM
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- NO FURTHER ACTION AREA FOR SOIL AND SOIL VAPOR

N

0 125 250 FEET

FIGURE 1-2
SITE SS023 LOCATION AND FEATURES MAP
SITE SS023 CORRECTIVE MEASURES IMPLEMENTATION REPORT
BEALE AIR FORCE BASE, CALIFORNIA

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SECTION 2

Corrective Measure Objectives

This section provides the objectives that the selected corrective measure will achieve. This section also provides the basis for cleanup levels and discharge limits that substantively comply with State RCRA requirements.

2.1 Corrective Measure Objectives

The site-specific objectives for the corrective measure at Site SS023 include the following:

- Reduce concentrations of COCs (TCE and PCE) in underlying groundwater originating at Site SS023 to support restoration of groundwater to designated beneficial uses (domestic, municipal, agricultural, and industrial supply).
- Restrict potential exposure to COCs in groundwater until concentrations are at such levels to allow for unlimited use/unrestricted exposure.
- Comply with State RCRA requirements.

2.2 Cleanup Levels for Groundwater

The final cleanup levels presented in Table 2-1 were established to achieve the site-specific objectives. Cleanup levels for restoring designated beneficial uses of groundwater are based on the lowest of either the federal or state primary maximum contaminant levels (MCLs). In the case of TCE and PCE, federal and state primary MCLs are the same.

TABLE 2-1
Cleanup Levels for Contaminants of Concern
Site SS023 Corrective Measures Implementation Report, Beale Air Force Base, California

Media: Groundwater
Site Area: SS023
Available Use: Unrestricted use

COC	Cleanup Level (µg/L)*	Basis for Cleanup Level
TCE	5	Federal Primary MCL
PCE	5	Federal Primary MCL

* Cleanup levels are derived from the lowest of the state or federal primary MCLs referenced in Title 22, CCR, Section 64444 and Title 40, *Code of Federal Regulations*, Part 300.430(e)(2)(I)(B). A TEFA will be conducted when these cleanup levels are achieved or when concentrations reach asymptotic levels as demonstrated by evaluation of monitoring data.

Notes:

CCR = California Code of Regulations
TEFA = technical and economic feasibility analysis

SECTION 3

Corrective Measure Implementation

This section documents construction and operation of the remedy implemented for groundwater at Site SS023. The remedy consists of three main components: ISCO, EA, and LUCs. The ISCO component is the major component documented in this section. To implement the ISCO portion of the remedy, four injection wells were constructed and developed, baseline sampling was performed, sodium permanganate was injected into new and existing wells, and monitoring was performed. EA involves groundwater monitoring in the distal portion of the plume (downgradient from the ISCO treatment zone) and will be documented in the Basewide Groundwater Monitoring Program (BGMP) reports. EA is discussed in Section 3.2, and LUCs are discussed in Section 3.3.

3.1 ISCO Implementation

This section discusses the methods and details of the injection well construction, baseline monitoring, and sodium permanganate injection.

3.1.1 Permitting

During June 2014, four injection wells were drilled and constructed at Site SS023. Four well permits (WP0009910 to WP0009913) were obtained from the Yuba County Environmental Health Department (Yuba County) for the construction of injection wells SWMU23C014IW through SWMU23C017IW. A Base dig permit (14.073A), was obtained from Beale AFB Civil Engineering on June 9, 2014, for the construction of the four injection wells. The Yuba County well permit and the Beale AFB dig permit are presented in Appendix A, Attachments A1 and A2, respectively. CH2M HILL contracted with Subtronic Corporation (Subtronic) to check the four proposed boring locations for underground utilities using geophysical methods. Subtronic performed utility locating on June 11, 2014.

A Notice of Intent (NOI) was submitted on July 8, 2014, requesting coverage under Waste Discharge Requirement (WDR) General Order R5-2008-0149 and the Central Valley Water Board prepared a Notice of Applicability on September 18, 2014, which contained a tentative Monitoring and Reporting Program (MRP). No public comments were received. On October 29, 2014, approval to proceed with injections was provided by the Central Valley Water Board via e-mail. The MRP (Order R5-2008-0149-054) is presented in Appendix A, Attachment A3.

A lane closure notification was required because it was necessary to close one lane of traffic on Doolittle Drive for drilling operations. The notification was submitted to Beale AFB 2 weeks prior to the commencement of drilling. Flaggers were used to control traffic and a traffic count was conducted to record the number of vehicles inconvenienced by the lane closure. A copy of the lane closure notification and traffic count sheets are presented in Appendix A, Attachment A4.

3.1.2 Hollow-stem Auger Drilling and Injection Well Construction

CH2M HILL contracted with National Exploration, Wells, & Pumps of Woodland, California, to pothole, drill, and construct four injection wells (SWMU23C014IW through SWMU23C017IW) at Site SS023. The drilling and well construction, which occurred from June 14 through 17, 2014, was completed using hollow-stem auger drilling methods with a limited access rig (LAR) equipped with 8-inch-outer-diameter augers. Prior to drilling each boring, the LAR rig, drilling tools, and downhole coring equipment were decontaminated in accordance with the *Basewide Uniform Federal Policy Quality Assurance Project Plan* (Basewide UFP-QAPP) (CH2M HILL, 2014c). Drilling, well construction, and decontamination activities

were continuously monitored by CH2M HILL personnel. Drill cuttings were temporarily contained in a hopper provided by the drilling subcontractor, then transferred to a roll-off bin provided by Intrinsic. Waste management information is discussed in Section 3.1.9.

Lithologic samples were obtained and logged at 5-foot intervals during drilling using a continuous dry-core sampling system. Soil cores were logged using the Unified Soil Classification System. Similar to previous borings at Site SS023, a clay-dominated horizon underlain by sand and clay (23 to 35 feet bgs) was observed in the four borings (see Figure 3-1 for the geologic cross section). Field documentation including field notes, lithologic logs, and a photo log is presented in Appendix A, Attachments A5 through A7, respectively.

Air monitoring was conducted during drilling and construction of the injection wells. Volatile organic compounds (VOCs) were monitored in the breathing zone and in the head space of the lithologic samples using a MultiRAE with a 10.6-eV lamp photoionization detector (PID). VOCs were not detected in the breathing zone, but were detected in head space of the lithologic samples. The concentrations were less than 0.2 parts per million by volume in the headspace samples. PID readings are shown on the lithologic logs in Appendix A, Attachment A6.

3.1.3 Injection Well Construction

Table 3-1 outlines well construction details for the injection wells. Well completion diagrams are presented in Appendix A, Attachment A8. Each injection well was constructed with 2-inch-diameter Schedule 40 polyvinyl chloride (PVC) blank casing, 2-inch-diameter machine-slotted PVC screen with 0.040-inch openings, filter pack material consisting of #6 sand, a transition seal consisting of hydrated medium bentonite chips, and a sanitary seal consisting of cement grout with 3 to 5 percent (by weight) bentonite powder additive. The injection wells were constructed as single completions and screened from 15 to 35 feet bgs, except for well SWMU23C014IW, which was screened from 30 to 50 feet bgs. Wells were completed as a flush mount set in a 24-inch-diameter concrete pad.

TABLE 3-1
Drilling and Well Construction Details
Site SS023 Corrective Measures Implementation Report, Beale Air Force Base, California

Well ID	Screen Interval (feet bgs)	Filter Pack Interval (feet bgs)	Borehole Depth (feet bgs)	Well Casing Diameter (inches)
SWMU23C014IW	30 to 50	28 to 51.0	51.0	2
SWMU23C015IW	15 to 35	13 to 36.5	36.5	2
SWMU23C016IW	15 to 35	13 to 36.5	36.5	2
SWMU23C017IW	15 to 35	13 to 36.0	36.0	2

Note:

Borehole diameter was 8 inches for each injection well.

3.1.4 Well Development

Following well construction, each injection well was developed to remove fines from the filter pack and well screen in accordance with standard operating procedure (SOP)-72, included in Appendix A to the Basewide UFP-QAPP (CH2M HILL, 2014c). Table 3-2 contains the volume discharged during well development of the new injection wells.

TABLE 3-2
Site SS023 Well Development Summary
Site SS023 Corrective Measures Implementation Report, Beale Air Force Base, California

Well ID	Development Date	Volume Discharged (gallons)
SWMU23C014IW	06/18/2014	124
SWMU23C015IW	06/18/2014	140
SWMU23C016IW	06/17/2014	225
SWMU23C017IW	06/17/2014	209
Total		**698**

Well development logs are included in Appendix A, Attachment A8. Wells were developed by a combination of swabbing, bailing, and overpumping until the discharge was clear. A truck-mounted electric winch was used to operate the swab and the bailer. Pumping was conducted using an 11-inch-long, 1.8-inch-outer-diameter Grundfos electric submersible pump.

During the overpumping phase of well development, grab samples of groundwater were collected every 5 minutes by the field geologist, and water quality measurements (temperature, pH, conductivity, turbidity, dissolved oxygen [DO], and oxygen reduction potential [ORP]) were recorded. The average discharge rate ranged from 1.0 to 2.2 gallons per minute (gpm). The total quantity of water discharged from well development was 698 gallons.

3.1.5 Baseline Monitoring

This section discusses the methods used for the baseline groundwater sampling conducted as part of the BGMP in July and August 2014, prior to ISCO treatment. Baseline sampling was performed to determine groundwater conditions prior to injection. The baseline groundwater data included depth to water, pH, ORP, DO, turbidity, electrical conductivity, and permanganate concentration. Permanganate concentrations were measured using a HACH DR890 colorimeter. Groundwater samples collected during the BGMP event were analyzed for VOCs (SW8260B), metals (SW6010/7199), and total dissolved solids (TDS) (E160.1) concentrations. Low-flow groundwater sampling methods were used in accordance with SOP-83 included in Appendix A to the Basewide UFP-QAPP (CH2M HILL, 2014c). Groundwater samples were submitted to PEL laboratories, Tampa, Florida, for laboratory analyses.

3.1.6 Hydrogeological Investigation

A hydrogeological investigation (well recovery test) was conducted at injection wells SWMU23C014IW through SWMU23C017IW following well development to provide an indication of well performance and to obtain data for determining the specific capacity, transmissivity, and hydraulic conductivity of the screened hydrogeologic unit. The well recovery test was conducted following SOP-72 (CH2M HILL, 2014c). An initial water level was recorded, and then the wells were pumped at a constant rate until 5 to 10 feet of drawdown (or the maximum drawdown for the well if 5 feet was not achievable) was observed. Water levels were monitored during recovery until the water level returned to within 80 percent of the static water level. Recovery test logs are located in Appendix A, Attachment A10.

The results of the tests are presented in Table 3-3. The injection wells, in general, are screened in a sandy clay unit (boring logs in Appendix A). The data presented in Table 3-3 are consistent with the geology, and hydraulic conductivity measurements are within the range (0.75 to 4.5 feet per day) reported by Battelle and SteamTech Environmental Services (2001; Section 1.1.1).

TABLE 3-3
Site SS023 Hydrogeological Investigation Summary
Site SS023 Corrective Measures Implementation Report, Beale Air Force Base, California

Well ID	Flow Rate (gpm)	Maximum Drawdown (feet)	Specific Capacity (gpm/ft)	Transmissivity (gpd/ft)	Hydraulic Conductivity (feet per day)
SWMU23C014IW	2	4.35	0.46	690	4.6
SWMU23C015IW	1	9.62	0.10	156	1.1
SWMU23C016IW	2	6.84	0.29	439	2.9
SWMU23C017IW	2.3	4.28	0.53	789	5.2
Average	**1.8**	**6.27**	**0.35**	**519**	**3.4**

Notes:

gpd/ft = gallon(s) per day per foot
gpm/ft = gallon(s) per minute per foot

3.1.7 Updated Conceptual Site Model

The following is an updated conceptual site model for the nature and extent of contamination in groundwater at Site SS023 using the recent baseline monitoring data. Laboratory reports for the baseline groundwater sampling are included in Appendix B, and a summary of baseline groundwater analytical data is presented in Table B-1. TCE and PCE are the COCs for groundwater. The TCE and PCE distributions in groundwater at Site SS023 are shown on Figures 3-2 and 3-3, respectively. During the baseline sampling event (July and August 2014), the highest TCE concentration was detected in a groundwater sample collected from injection well SWMU23C016IW with a TCE concentration of 564 µg/L (Figure 3-2). Twenty-three wells sampled as part of the baseline groundwater sampling event contained TCE concentrations greater than the groundwater screening level of 5 µg/L.

Historically, the highest TCE concentrations in groundwater are from samples collected from well 23SWMU1MW. Groundwater samples from the new injection wells near Doolittle Drive (SWMU23C014IW through SWMU23C017IW) contained TCE concentrations ranging from 54 to 564 µg/L. This further confirms that there is a residual TCE mass in groundwater beneath Doolittle Drive that was not treated by the ozone/air sparge ISCO system located to the west-southwest. Furthermore, the 2014 TCE plume contours revealed that the 100-milligram-per-liter (mg/L) plume in the northern area is larger and extends further to the southwest (Figure 3-2).

During the baseline sampling event (July and August 2014), the highest PCE concentration was detected in a groundwater sample collected from monitoring well BAT-3MW (located just north of Doolittle Drive) with a PCE concentration of 43.4 µg/L (Figure 3-3). Twenty-three wells sampled as part of the baseline groundwater sampling event contained PCE concentrations greater than the groundwater screening level of 5 µg/L. Groundwater samples collected from the new injection wells near Doolittle Drive (SWMU23C014IW through SWMUC017IW) contained PCE concentrations ranging from 18.4 to 27.2 µg/L. PCE from Site SS508 is impacting Site SS023.

3.1.8 Baseline Concentrations

Five analytes (chromium, manganese, permanganate, selenium, and TDS) will be used to compare post-injection samples to baseline samples for compliance monitoring. It is anticipated that these five analytes will exceed baseline groundwater concentrations in the treatment zone wells (TZWs). Chromium, manganese, and selenium can be released via oxidation of natural metals in the formation. Sodium permanganate was injected into the groundwater, and therefore, permanganate concentrations

are expected to be elevated where injections occurred. TDS is directly increased by injection of sodium permanganate. The baseline concentration for each analyte was calculated using a 95 percent upper confidence limit (UCL) (Equation 1), which assumes that all data are normally distributed, and the detection limit is used for nondetects:

$$95 \text{ percent UCL} = \text{Mean} + \text{Standard Deviation} \times \text{T statistic} / \sqrt{(n-1)} \quad (1)$$

Where:

The T statistic is dependent on number of samples and n is the number of samples.

Using the baseline data, the results of this calculation are presented in Table 3-4 for the five analytes. In cases where the primary or secondary MCL is greater than the 95 percent UCL, the MCL is used as the baseline concentration. The trigger level is defined as the greater of twice the 95 percent UCL of the analyte or the analyte's MCL. Trigger levels are only provided for chromium, manganese, and permanganate (see Contingency Plan in Section 4.5). The primary MCL for chromium will be used as the baseline concentration because the 95 percent UCL is less than the MCL. Twice the baseline concentration will be used as the baseline concentration for manganese. Permanganate was not detected in the 16 baseline samples and is not naturally occurring in the environment. Therefore, a concentration of 0.0 mg/L will be used as the baseline concentration. The trigger level for permanganate is the method detection limit of 1.0 mg/L. Selenium was not measured during the baseline event because selenium was not proposed as an analyte to monitor in the Work Plan (CH2M HILL, 2014a); however, selenium was added in the tentative MRP from the Central Valley Water Board. The MCL for selenium will be used as the baseline concentration. TDS exceeded the 95 percent UCL in wells BAT-1MW and 23U001BMW with concentrations of 479 and 426 mg/L, respectively. However, TDS concentrations in these wells were less than the secondary MCL of 500 mg/L; therefore, the secondary MCL will be used as the baseline concentration.

TABLE 3-4
Baseline Concentrations for Selected Analytes
Site SS023 Corrective Measures Implementation Report, Beale Air Force Base, California

Analyte	Samples	Detects	Minimum	Maximum	Average	Standard Deviation	95% UCL (mg/L)	MCL (mg/L)	Trigger Level (mg/L)[d]
Chromium	10	10	0.001	0.014	0.005	0.005	0.008	**0.05**[b]	0.05
Manganese	10	8	0.001	0.657	0.138	0.257	**0.329**	0.05[c]	0.66
Permanganate	16	0	--	--	--	--	**0**[a]	--	1.0
Selenium	--	--	--	--	--	--	--	**0.05**[b]	**--**
TDS	10	10	223	479	313	84	375	**500**[c]	**--**

[a] The method detection limit for permanganate is 1.0 mg/L.
[b] Primary MCL
[c] Secondary MCL
[d] The trigger level is defined as the greater of twice the 95 percent UCL of the analyte or the analyte's MCL. Trigger levels are only provided for chromium, manganese, and permanganate as stated in the contingency plan (Section 4.5).

Notes:

Bold indicates the chosen baseline concentration.

-- = data not available
CMW = compliance monitoring well

3.1.9 Waste Management

Remediation waste generated during the Site SS023 ISCO implementation consisted of drill cuttings, decontamination and purge water, and general trash such as personal protective equipment. Drill

cuttings were placed in a hopper and then transferred to a 20-cubic-yard rolloff bin staged in a vacant parking lot south of the intersection of Doolittle Drive and B Street to await characterization. Approximately 15 cubic yards of soil were produced from drilling injection wells SWMU23C014IW through SWMU23C017IW. Approximately 838 gallons of decontamination and purge water were temporarily stored at Site LF013 in tanks. Soil and liquid wastes were characterized in accordance with the procedures in SOP-91, Analysis and Characterization (CH2M HILL, 2014c). Personal protective equipment and disposable sampling equipment were disposed of in a trash bin at the CH2M HILL field office. All wastes were managed in accordance with applicable State of California and federal regulations and the Basewide UFP-QAPP (CH2M HILL, 2014c).

The soil waste characterization samples collected from the 20-cubic-yard rolloff bin were analyzed for metals (SW6010B) and VOCs (SW8260C). Analysis of analytical results indicates that the waste is classified as nonhazardous.

Analytical results for drill cuttings were submitted with a waste profile to Hay Road Landfill for review and acceptance. Intrinsic transported the rolloff bin on August 27, 2014. The waste tracking log, analytical results, signed profile, weight ticket, and waste manifest are provided in Appendix A, Attachment A11.

Liquid waste (decontamination and purge water) was managed at the CG041-013 Groundwater Treatment System. Drilling and development activities at Site SS023 generated approximately 838 gallons of liquid waste. The combined water was analyzed for metals (SW6010B) and VOCs (SW8260C). Analysis of analytical results indicates that the waste is classified as nonhazardous. The liquid waste was discharged to the CG041-013 Groundwater Treatment System on August 28, 2014.

3.1.10 Surveying

A survey of the new injection wells was conducted on October 23, 2014, using the global positioning system satellite technology with real-time kinematic surveying instruments to provide horizontal and vertical positions for the locations listed in Table 3-5. The horizontal datum for wells and soil borings is the California Coordinate System, North American Datum of 1983, Zone 2; and the vertical datum used is the North American Geodetic Vertical Datum of 1988. The survey originated from the monuments established at Beale AFB by the National Aeronautics and Space Administration in their geodetic control survey performed in 1999, which was intended to be the basis for all future surveys performed on the Base. All results are reported in United States survey feet. The work was performed under the direct supervision of a California Professional Land Surveyor. Survey coordinates and elevations are provided in Table 3-5.

TABLE 3-5
Summary of Site SS023 Survey Details
Site SS023 Corrective Measures Implementation Report, Beale Air Force Base, California

Well	Northing (feet)[a]	Easting (feet)[a]	Ground Surface Elevation (feet NAVD88)[b]	Top of Casing Elevation (feet NAVD88)[b,c]
SWMU23C014IW	2169921.51	6735083.96	133.23	133.12
SWMU23C015IW	2170076.76	6735274.83	131.97	131.77
SWMU23C016IW	2170139.69	6735196.79	133.07	132.79
SWMU23C017IW	2170099.96	6735344.08	131.55	131.32

[a] North American Datum of 1983 (NAD83/1992 HPGN), California State Plane Zone 2, U.S. survey feet.
[b] North American Vertical Datum of 1988 (NAVD88), U.S. survey feet.
[c] Measuring point is a black marking on the north side on the top of the PVC casing for injection wells.

Note:

Locations were surveyed on October 23, 2014.

3.1.11 Sodium Permanganate Injection

The ISCO Design Tool was used to calculate the volume and mass of permanganate to inject into each injection well (input and output worksheets are listed in Appendix C of the Work Plan [CH2M HILL, 2014a]). Table 3-6 lists the design and actual injection volumes for each injection well. Injection was split into three phases because of the location of wells and ability to monitor the wells during injection. Injections began upgradient of the TCE plume at wells SWMU23C017IW and SWMU23C009MW.

TABLE 3-6
Summary of Site SS023 Injection
Site SS023 Corrective Measures Implementation Report, Beale Air Force Base, California

Injection Well[a]	Injection Dates	Total Volume (gallons)		$NaMnO_4$ Volume (gallons 40 percent $NaMnO_4$)		$NaMnO_4$ Concentration (mg/L)		Average Flow Rate (gpm)
		Design	Actual	Design	Actual	Design	Actual	
Phase 1								
SWMU23C009MW[b]	11/5/14 to 01/06/15	8,100	9,319	243	287	16,314	16,748	3.5
SWMU23C017IW	11/5/14 to 11/17/14	8,100	6,886	243	196	16,314	15,479	3.4
Phase 2								
SWMU23C015IW	11/19/14 to 12/18/14	11,340	12,817	227	241	10,876	10,225	2.7
SWMU23C016IW	11/19/14 to 12/18/14	11,340	12,296	227	232	10,876	10,261	2.7
23SWMU1MW	11/19/14 to 12/18/14	10,080	9,884	202	212	10,876	11,664	2.2
Phase 3								
SWMU23C014IW	01/8/15 to 01/23/15	17,280	15,665	173	182	5,438	6,318	3.9
Total		**66,240**	**66,867**	**1,315**	**1,350**			

[a] Screen length is 20 feet except for well 23SWMU1MW, which is 19 feet.
[b] Injection into well SWMU23C009MW was completed in two parts: (1) November 5 to 17, 2014, and (2) January 5 to 6, 2015.

Note:

$NaMnO_4$ = sodium permanganate

Before and during injections, water quality monitoring (temperature, pH, conductivity, turbidity, DO, and ORP) was conducted at wells that were screened within the treatment zone (15 to 50 feet bgs) and within the expected radius of influence (ROI) of wells with active injection. During Phase 1 (injection into wells SWMU23C009MW and SWMU23C017IW), wells BAT-1MW, BAT-3MW, SWMU23C015IW, SWMU23C016IW, and 23SWMU1MW were monitored. During Phase 2 (injection into wells SWMU23C015IW, SWMU23C016IW, and 23SMU1MW), wells BAT-4AMW, BAT-4BMW, and BAT-8MW were monitored. After breakthrough was observed at BAT-4AMW, BAT-5AMW was monitored. During Phase 3 (injection into well SWMU23C014IW), wells SWMU34U002MW, SWMU23U004AMW, and SWMU23C008MW were monitored. Water levels were recorded in the select wells each day of injection before injections, midday, and before the system was flushed.

Sodium permanganate (RemOx ISCO Reagent) was purchased from Carus Chemical Company and delivered to the site in five 300-gallon-capacity totes. Each tote held approximately 270 gallons of 40 percent sodium permanganate for a total of 1,350 gallons. The certificate of analysis for the sodium permanganate is presented in Appendix C, Attachment C1. An injection trailer with a Dosatron (40 gpm: D8RE5) was used to mix the correct proportion of potable water (obtained from fire hydrants)

and sodium permanganate. The design and actual volume of water, sodium permanganate, and percent solution of 40 percent sodium permanganate for each injection well are provided in Table 3-6.

Phase 1 injections (injection into wells SWMU23C009MW and SWMU23C017IW) were completed between November 5, 2014, and January 6, 2015, using approximately 3 percent permanganate solution. Injections were completed at injection well SWMU23C017IW on November 17, 2014, but the Dosatron malfunctioned at low flow rates when only injecting into well SWMU23C009MW. Flow rate into well SWMU23C009MW was restricted by injection pressure (injection pressure was maintained at less than 15 pounds per square inch to avoid fracturing the aquifer formation and possibly causing surface breakout at the injection point). A new Dosatron (11 gpm: D25RE5) capable of lower flow rates was ordered, and injections were moved to Phase 2. After completing Phase 2 injections, injection into well SWMU23C017IW was completed on January 5 and 6, 2015, using the new Dosatron.

Phase 2 injections (injection into wells SWMU23C015IW, SWMU23C016IW, and 23SWMU1MW) were completed between November 19 and December 18, 2014, using approximately 2 percent permanganate solution. The total reagent injected into each well was greater than the design volume because the Work Plan assumed a total of 1,315 gallons were needed to complete injections. However, 1,350 gallons of sodium permanganate were delivered to the site; therefore, the excess 35 gallons of sodium permanganate were split between the Phase 2 and Phase 3 injections. Additional water was injected to maintain the desired permanganate concentrations.

Phase 3 injection into well SWMU23C014IW was completed between January 8 and 23, 2015, using approximately 1 percent permanganate solution. Efforts were made to control the injection at 1 percent sodium permanganate solution, but the Dosatron kept drifting. Sodium permanganate was injected at a concentration between 1.3 and 1.5 percent solution and flush water was used to dilute the injection after sodium permanganate injection was completed.

Injection logs, depth to water records, water quality monitoring, and permanganate test results collected during injections are provided in Appendix C, Attachments C2 through C5, respectively.

Breakthrough was identified by visual observation of permanganate (pink to purple colored water) in an observation well. Breakthrough can also be observed in water quality parameters such as depth to groundwater (decrease in depth to groundwater), DO (significant increase to near saturation levels), ORP (significant increase to greater than 300 millivolts [mV]), and permanganate readings (significant increase from baseline conditions). The volume injected at the time of breakthrough was used to estimate the ROI of the nearest injection well. Breakthrough was noted in all observations wells within 43 feet of an injection well. Table 3-7 presents breakthrough information, including the estimated mobile porosity and ROI, for wells monitored during injections. Table 3-8 presents water quality monitoring data recorded at the time of breakthrough.

One week after initiating Phase 1 injections, breakthrough occurred at monitoring well BAT-3MW (located 30 feet north of injection well SWMU23C017IW) as evidenced by pink purge water, an ORP increase to 540 mV, and elevated permanganate concentration (13.6 mg/L). During Phase 1 injections, breakthrough was also observed in monitoring wells BAT-1MW (located 25 feet north of injection well SWMU23C017IW) and 23SWMU1MW (located 55 feet downgradient of injection well SWMU23C009MW) 12 and 14 days after initiating injections, respectively. Injection at well SWMU23C017IW contributed to breakthrough at two wells; therefore, two ROIs were estimated for this well. Table 3-7 shows the estimated mobile porosity is between 1.2 and 2.0 percent and the estimated ROI is between 25 and 36 feet for injection well SWMU23C017IW.

TABLE 3-7
Summary of Breakthrough Details
Site SS023 Corrective Measures Implementation Report, Beale Air Force Base, California

Calculation Reference (in Notes section):			A	B	C	D	E
Breakthrough Well	**Injection Well**	**Date of Breakthrough**	**Distance from Injection Point (feet)**	**Total Volume Injected (gallons)**	**Volume at Breakthrough (gallons)**	**Estimated Mobile Porosity[a] (percent)**	**Estimated ROI[b] (feet)**
BAT-3MW	SWMU23C017IW	11/12/2014	30	6,886	4,892	1.2	36
BAT-1MW	SWMU23C017IW	11/17/2014	25	6,886	6,636	2.0	25
23SWMU1MW	SWMU23C009MW	11/19/2014	55	9,319	7,435	1.0	62
BAT-4AW	SWMU23C016IW	12/16/2014	45	12,296	10,650	1.0	48
SWMU34U002MW	SWMU23C014IW	1/8/2015	30	15,665	817	0.2[c]	131[c]
					Average	**1.3[d]**	**43[d]**

[a] Porosity was estimated using the following equation: $D = C / (\pi \times A^2 \times 20 \times 7.48)$; where 20 represents the well screen length in feet and 7.48 represents gallons per cubic foot.

[b] ROI was estimated by using the following equation: $E = (B / C)^{0.5} \times A$

[c] Value is not an accurate representation of estimated mobile porosity or ROI. A preferential pathway between injection well SWMU23C014IW and SWMU34U002MW is believed to have caused the immediate breakthrough.

[d] Average does not include value from well SWMU34U002MW.

TABLE 3-8
Water Quality Parameters at Breakthrough
Site SS023 Corrective Measures Implementation Report, Beale Air Force Base, California

Well ID	Date	Time	Water Level (feet btoc)	DO (mg/L)	ORP (mV)	Conductivity (mS/cm)	Temperature (°C)	Color	$NaMnO_4$ (mg/L)
BAT-3MW	11/12/2014	13:21	8.95	1.2	540	0.276	21.51	Pink	13.6
BAT-1MW	11/17/2014	14:19	10.54	1.5	509	0.399	20.72	Pink	2.7
23SWMU1MW	11/19/2014	8:17	--	2.4	477	0.477	19.36	Pink	121.2
BAT-4AMW	12/16/2014	11:55	15.76	8.0	505	0.311	17.03	Pink	2.1
SWMU34U002MW	1/8/2015	12:04	18.11	6.4	645	0.827	22.47	Dark pink	98.8

Notes:

-- = data not recorded
°C = degree(s) Celsius
btoc = below top of casing
mS/cm = milliSiemen(s) per centimeter

During Phase 2 injections, injection into well SWMU23C016IW contributed to breakthrough at well BAT-4AW (located 45 feet south of injection well SWMU23C016IW) after injection was 87 percent completed. The ROI of SWMU23C016IW is approximately 48 feet. Monitoring well BAT-5AMW (located 112 feet downgradient from injection well SWMU23C016IW) was added to the list of Phase 2 monitoring wells after breakthrough was observed at well BAT-4AMW; however, as expected, no breakthrough was observed at well BAT-5AMW during injections.

Four hours after Phase 3 injections began at injection well SWMU23C014IW, breakthrough was observed in monitoring well SWMU34U002MW (30 feet west of injection well SWMU23C014IW). Because breakthrough occurred after injections were only 5 percent complete, the ROI was estimated to be 131 feet. The permanganate reading from purge water collected at well SWMU34U002MW on January 7, 2015, one day prior to injection, was 0.0 mg/L, and the permanganate reading after 4 hours of injection was 98.8 mg/L. The immediate breakthrough at monitoring well SWMU34U002MW is likely because of a preferential pathway between wells SWMU23C014IW and SWMU34U002MW, and therefore, the estimated mobile porosity and ROI are likely overestimated.

3.1.12 Deviations from the Work Plan

Several changes were required throughout ISCO implementation to complete the injections. The following summarizes the deviations from the Work Plan:

- In response to the low baseline TCE concentration (54 µg/L) in SWMU23C017IW and breakthrough observed in monitoring well BAT-3MW, the volume injected at SWMU23C009MW was increased from 8,100 to 9,500 gallons and decreased from 8,100 to 6,700 gallons at SWMU23C017IW.
- Phase 1 injections (SWMU23C017IW and SWMU23C009MW) were completed in two parts (November 2014 and January 2015) because the Dosatron was not reliable for injection at flow rates less than 5 gpm. A new Dosatron was ordered, and injections were completed at well SWMU23C009MW on January 5 and 6, 2015.
- The Work Plan assumed a total of 1,315 gallons were needed to complete injections; however, 1,350 gallons of sodium permanganate were delivered to the site. The excess 35 gallons of sodium permanganate were split between the Phase 2 and Phase 3 injections.
- The Dosatron used for injection at well SWMU23C014IW was not reliable at the design value of 1 percent permanganate solution at a flow rate less than 4 gpm. Injections were performed with the lowest possible setting on the Dosatron (approximately 1.3 to 1.5 percent permanganate), and flush water was injected after permanganate injection to dilute the solution.

3.2 Enhanced Attenuation

In conjunction with treatment, naturally occurring processes will reduce concentrations of COCs in groundwater within the treatment area (after hot spots are treated with ISCO) and outside of the treatment area. Naturally occurring physical and chemical processes are enhanced by the reduced influx of COCs following ISCO.

The plume will continue to be monitored in accordance with the BGMP using the Beale AFB monitoring well network. Frequency of monitoring for each well will be evaluated annually in accordance with the BGMP Decision Tree (Figure 2-1 in BGMP Annual Reports). The enhanced attenuation monitoring is in addition to the monitoring program described in Section 4.

When the cleanup level for TCE and PCE for the plume are achieved or when asymptotic conditions are achieved, whichever occurs first, a TEFA will be prepared to evaluate the technical and economic feasibility of continuing remediation. After three consecutive monitoring events confirm that the RAOs are satisfied, groundwater monitoring of the plume will stop, and a plan to decommission remedy infrastructure, including monitoring and injection wells, will be developed.

In the event of potential plume migration beyond downgradient wells (defined by the BGMP), additional monitoring, modeling, or treatment may be implemented as a corrective action. It should be noted that the Site SS023 plume is commingled with plumes from upgradient (Site SS508) and downgradient (CG041-039). Therefore, not all trends in site monitoring wells can be attributed to Site SS023.

3.3 Land Use Controls

To prevent exposure to groundwater containing COCs above MCLs, LUCs restricting access to groundwater are in place and the potential exposure pathway to COCs is incomplete.

The LUC objective applicable to the corrective measure is to ensure that no withdrawal or use of groundwater or land uses occurs that would result in human or ecological exposures to contaminants or adversely affect implementation of the selected remedy. No water supply wells or residential land uses will be allowed at Site SS023 without prior approval from the Air Force and appropriate regulatory agencies until the concentrations of COCs in the groundwater are at such levels to allow for unlimited use/unrestricted exposure.

Successful implementation includes adequate documentation, communication, and controls to protect human health and the environment. The following implementation measures are in place:

- Area subject to LUCs is delineated on the master planning maps.
- Geographic information system database layers with LUCs are updated and maintained, including information on the types of restrictions and monitoring and management requirements.
- LUCs were incorporated into the site approval, well installation, and dig permit process (used for well installation) for groundwater development, excavation, and construction projects.
- LUCs communicated to Base offices that are responsible for well installation approval/permitting.

The following maintenance measures are being conducted to ensure that LUCs remain effective:

- Conduct periodic inspections.
- Conduct periodic training and post internal notices to keep personnel updated on the presence of LUCs.
- Review the integrity and effectiveness of LUCs during annual reporting.

The Air Force continues to be committed to and responsible for the following:

- Implementing, maintaining, monitoring, reporting, and enforcing LUCs. Although the Beale AFB commander is ultimately responsible for implementing and enforcing all LUCs summarized above in accordance with RCRA, the Beale AFB restoration program manager is responsible for the day-to-day implementation, operation, maintenance, monitoring, and reporting of those LUCs.
- Informing, monitoring, enforcing, and binding, where appropriate, authorized lessees, tenants, contractors, and other authorized occupants of the site regarding LUCs impacting the site.
- Monitoring and inspecting all LUCs every 6 months (or more often if site-specific risks and conditions warrant it) to ensure compliance and to assess their effectiveness.
- Providing to the California Department of Toxic Substances Control (DTSC) and the Central Valley Water Board an annual report of monitoring and inspection activities that the Air Force has conducted.
- Notifying DTSC and the Central Valley Water Board as soon as practical, but no later than 10 days after discovery, of any LUC violation or deficiency or of any other action that interferes with LUC effectiveness. The notification will also describe corrective measures taken or planned and the

timeframe expected to accomplish the measures. For subsequent corrective measures, the Air Force will provide further notice when these measures have been completed.

- Ensuring that the Air Force will not modify or terminate LUCs, implementation actions, or modify land use without prior approval by DTSC and the Central Valley Water Board.
- Providing notice to the State of California at least 6 months prior to any transfer or sale of property. This ensures that the State of California can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs. If such notification cannot be accomplished 6 months prior, it will occur no later than 60 days prior to the transfer or sale.
- Whenever the Air Force transfers real property that is subject to LUCs and resource use restrictions to another federal agency, the transfer documents will require that the federal transferee include the LUCs and applicable resource use restrictions in its resource use plan or equivalent resource use mechanism. The Air Force will advise the recipient federal agency of all obligations contained in the Work Plan, including the obligation that a state land use covenant will be issued and recorded pursuant to 22 CCR Section 67391.1 if the federal agency transfers the property to a nonfederal entity.
- Whenever the Air Force proposes to transfer real property subject to resource use restrictions and LUCs to a nonfederal entity, it will provide information to that entity in the draft deed and transfer documents regarding necessary resource use restrictions and LUCs, including the obligation that a state land use covenant will be executed and recorded pursuant to 22 CCR Section 67391.1. The signed deed will include LUCs and resource restrictions equivalent to those contained in the state land use covenant.

A

Northwest

A'

Southeast

SWMU23 U006SB

SWMU23 U005SB

SWMU23 U004SB

BAT-4D

SWMU23 U013SB

SWMU23 U016SB

Water Level

SAND AND GRAVEL

GRAVEL

BEDROCK

FEET (bgs)

0

10

20

30

40

50

0

100

200

300

400

500

600

700

800

900

1000

1100

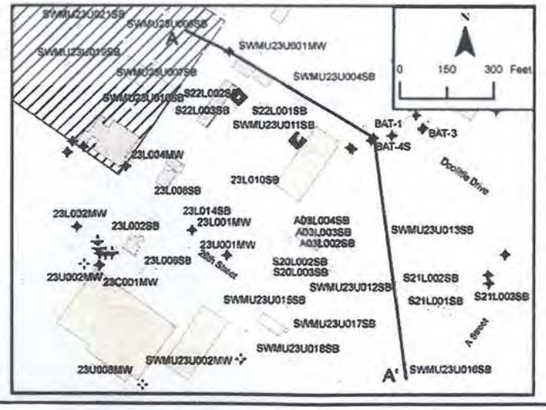
1200

1300

1400

1500

FEET



SOURCE:

SOLID WASTE MANAGEMENT UNIT 23 REMEDIAL PROCESS OPTIMIZATION DATA GAPS INVESTIGATION INFORMAL TECHNICAL INFORMATION REPORT (URS, 2008).

FIGURE 3-1
SITE SS023 GEOLOGIC CROSS SECTION
SITE SS023 CORRECTIVE MEASURES IMPLEMENTATION REPORT
BEALE AIR FORCE BASE, CALIFORNIA

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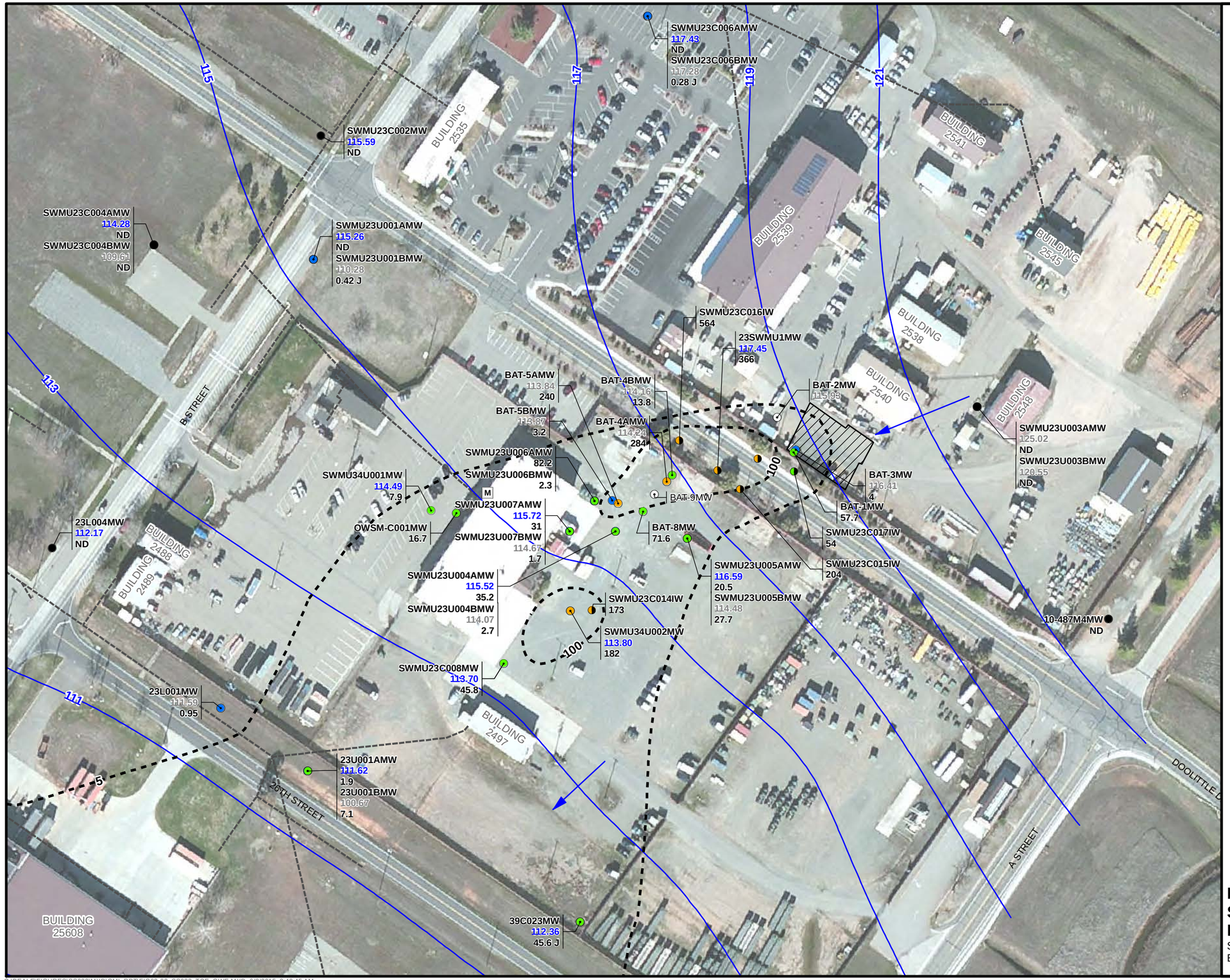

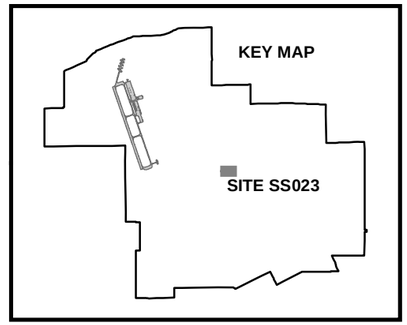

LEGEND

TCE CONCENTRATION IN GROUNDWATER (µg/L)

- NOT DETECTED (ND)
- ND to 5
- 5 to 100
- >100
- GROUNDWATER MONITORING WELL
- GROUNDWATER INJECTION WELL
- 116.59 MEASURED GROUNDWATER ELEVATION (feet NAVD88) (GREY TEXT INDICATES ELEVATION NOT USED IN CONTOURING)
- 20.5 TCE CONCENTRATION IN GROUNDWATER (µg/L)
- M FORMER OIL/WATER SEPARATOR
- TCE CONCENTRATION CONTOUR (µg/L)
- GROUNDWATER ELEVATION CONTOUR (feet NAVD88)
- GROUNDWATER FLOW DIRECTION
- SANITARY SEWER/IWL CONVEYANCE
- EXCAVATED AREA AND GREASE RACK (TN & ASSOCIATES, 2000)

NOTES:

DATA PRESENTED ON THIS FIGURE WAS COLLECTED DURING THE 2014 ANNUAL BGMP SAMPLING EVENT.

µg/L = MIGROGRAMS PER LITER.

J = THE ANALYTE WAS POSITIVELY IDENTIFIED, AND THE QUANTITATION IS AN ESTIMATE.

NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

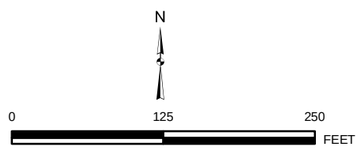

FIGURE 3-2
SITE SS023 TCE CONCENTRATIONS IN GROUNDWATER

SITE SS023 CORRECTIVE MEASURES IMPLEMENTATION REPORT
BEALE AIR FORCE BASE, CALIFORNIA

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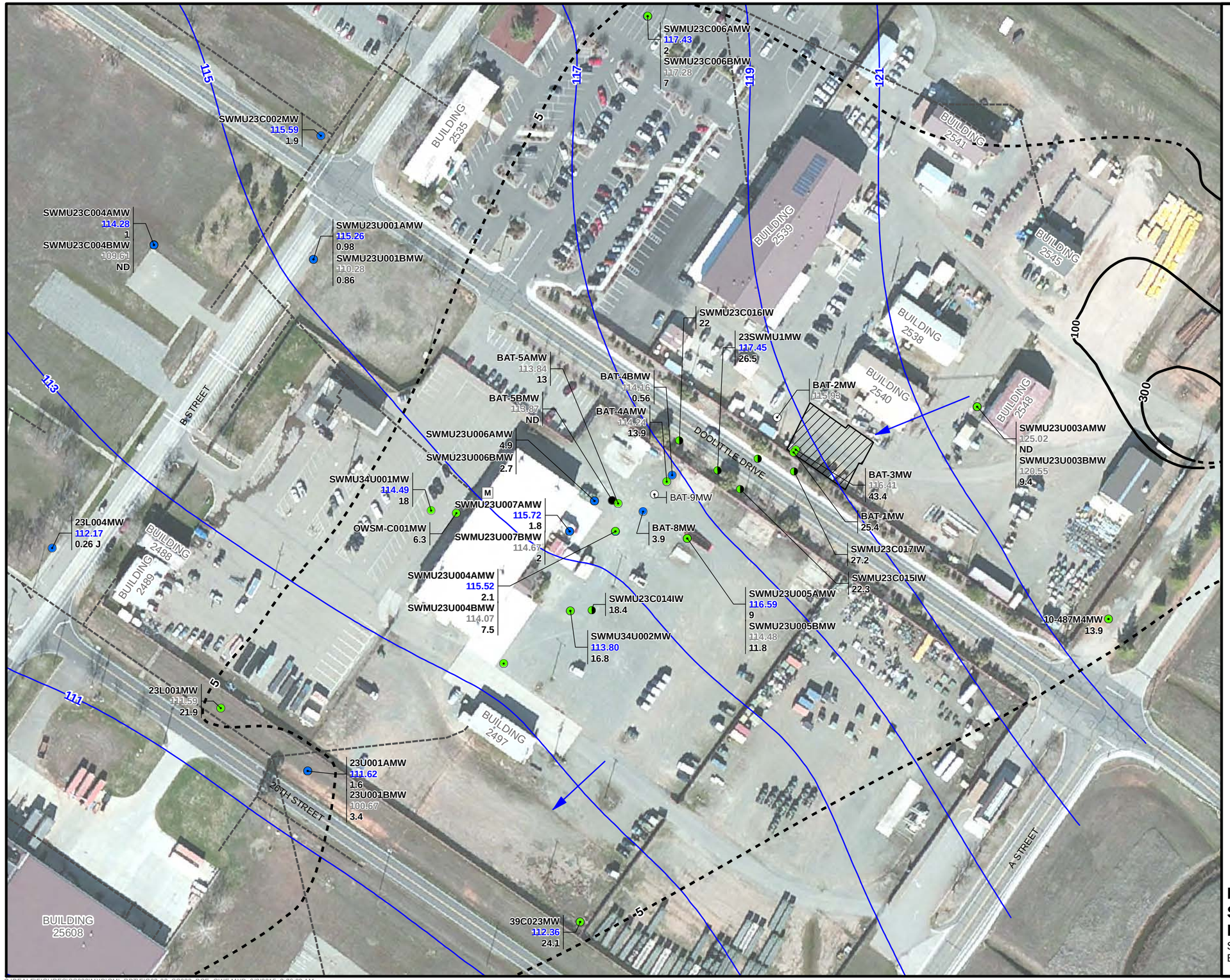

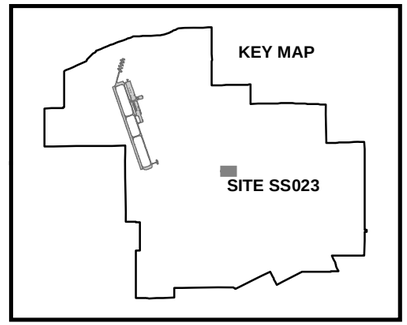

LEGEND

PCE CONCENTRATION IN GROUNDWATER (µg/L)

- NOT DETECTED (ND)
- ND to 5
- 5 to 100
- >100
- GROUNDWATER MONITORING WELL
- GROUNDWATER INJECTION WELL
- 116.59 MEASURED GROUNDWATER ELEVATION (feet NAVD88) (GREY TEXT INDICATES ELEVATION NOT USED IN CONTOURING)
- 9 PCE CONCENTRATION IN GROUNDWATER (µg/L)
- M FORMER OIL/WATER SEPARATOR
- PCE CONCENTRATION CONTOUR (µg/L) (DASHED WHERE INFERRED)
- GROUNDWATER ELEVATION CONTOUR (feet NAVD88)
- GROUNDWATER FLOW DIRECTION
- SANITARY SEWER/IWL CONVEYANCE
- EXCAVATED AREA AND GREASE RACK (TN & ASSOCIATES, 2000)

NOTES:

DATA PRESENTED ON THIS FIGURE WAS COLLECTED DURING THE 2014 ANNUAL BGMP SAMPLING EVENT.

µg/L = MIGROGRAMS PER LITER.

J = THE ANALYTE WAS POSITIVELY IDENTIFIED, AND THE QUANTITATION IS AN ESTIMATE.

NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988.

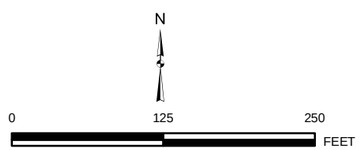

FIGURE 3-3
SITE SS023 PCE CONCENTRATIONS IN GROUNDWATER

SITE SS023 CORRECTIVE MEASURES IMPLEMENTATION REPORT
BEALE AIR FORCE BASE, CALIFORNIA

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SECTION 4

Monitoring Plan

This section describes the baseline performance and compliance monitoring for the ISCO remedy at Site SS023. Performance monitoring occurs in the treatment and transition zones, while compliance monitoring is designed to show the impact on groundwater quality outside the transition zone. The Central Valley Water Board prepared a tentative MRP (Appendix A, Attachment A3) for the ISCO remedy, outlining objectives for performance and compliance monitoring. The monitoring plan for Site SS023 complies with MRP Order R5-2008-0149-054.

4.1 Recommended Changes to the Tentative MRP

The following changes to the Tentative MRP are recommended:

- BAT-1MW should be changed from a compliance well to a treatment zone well. The ROI of the sodium permanganate injected at SWMU23C017IW extended beyond BAT-1MW during the permanganate injection. BAT-1MW was proposed as a background well (BW) (upgradient of the treatment zone), but the actual treatment zone is larger than the design.
- SWMU23U005BMW should be removed from the monitoring program as a transition zone well (TW) because the screen interval of this well (45 to 50 feet bgs) is deeper than the injection interval (15 to 35 feet bgs) in this area.
- Injection wells constructed in 2014 are labeled as SWMU23C014IW, SWMU23C015IW, SWMU23C016IW, and SWMU23C017IW.
- Background concentrations section should be revised to require background concentrations of TDS and dissolved metals. Sulfide, sulfate, carbon dioxide, methane, ethane, and dissolved organic carbon (filtered) should be removed because these analytes are applicable to anaerobic bioremediation (not applicable to ISCO).
- Monitoring of total chlorides will be measured by U.S. Environmental Protection Agency (EPA) Method E300 instead of EPA Method 6010B.
- Monitoring of dissolved selenium instead of total selenium.
- Monitoring of dissolved sodium will be performed instead of total potassium because injection of sodium permanganate occurred rather than potassium permanganate.

4.2 Performance Monitoring

The purpose of performance monitoring is to assess the long-term effectiveness of the ISCO and EA remedies. Semiannual performance sampling will be conducted for 1 year or until objectives of the MRP have been met to determine whether TCE concentrations decreased from baseline conditions after treatment. Additionally, annual sampling of the injection wells will be performed. Performance monitoring will be performed as part of the semiannual BGMP sampling event in February and the annual BGMP sampling event in July.

Performance monitoring wells (PMWs) were selected based on screen interval (similar interval to the injection well intervals) and elevated TCE concentration (greater than 100 µg/L). The PMWs are further separated into four TZWs and six TWs depending on whether they are located within the ROI of the

injection wells. Figure 4-1 displays the locations of the PMWs. The goal of the first year of post-injection sampling will be to evaluate the performance of the ISCO remedy and the need for subsequent injection. Post-injection sampling will be conducted and reported under the BGMP. A list of wells and their designated uses is included in Table 4-1.

TABLE 4-1
Well Type and Designation for Site SS023 Monitoring
Site SS023 Corrective Measures Implementation Report, Beale Air Force Base, California

Well Type	Designation	Number of Wells	Well Names
Treatment zone well	TZW	4	BAT-1MW, BAT-4AMW, BAT-4BMW, and SWMU34U002MW
Transition zone well	TW	6	BAT-5AMW, SWMU23C008MW, SWMU23U004AMW, SWMU23U005AMW, SWMU23U006AMW, and SWMU23U007AMW
Injection well	IW	6	23SWMU1MW, SWMU23C009MW, SWMU23C014IW, SWMU23C015IW, SWMU23C016IW, and SWMU23C017IW
Compliance monitoring well	CMW	2	23U001BMW and 39C023MW
Background well	BW	1	SWMU23U003AMW

The groundwater samples collected as part of the BGMP will be analyzed in the field for temperature, conductivity, turbidity, pH, ORP, DO, and permanganate concentrations. Permanganate concentrations will be measured using a Hach colorimeter. Groundwater samples will be submitted to a contract laboratory for analysis of VOCs (SW8260B), TDS (E160.1), total chlorides (E300), and dissolved chromium, dissolved manganese, dissolved selenium, and total sodium (SW6010B). Groundwater VOC samples with visible permanganate (pink to purple water) will be neutralized with ascorbic acid in accordance with the Basewide UFP-QAPP (CH2M HILL, 2014c) because of the effect of binary mixtures. In a binary mixture, the oxidant may reduce concentrations of organic contaminants in the sample container prior to analysis by the laboratory (Saebomet al., 2012). A list of analytical methods and sampling frequency is included in Table 4-2.

TABLE 4-2
Schedule of Performance and Compliance Monitoring
Site SS023 Corrective Measures Implementation Report, Beale Air Force Base, California

		Sampling Frequency – Long-term Operation	
Analysis	Method	Semiannual	Annual
Field parameters (pH, DO, ORP, conductivity, turbidity, and temperature)	Field electrodes	PMW, CMW	IW, BW
Groundwater elevation	Field probe	PMW, CMW	IW, BW
VOCs	SW8260B	PMW, CMW	IW, BW
TDS	160.2	PMW, CMW	IW
Total chlorides	E300	PMW, CMW	BW
Dissolved manganese, selenium, sodium, and chromium	SW6010B	PMW, CMW	BW
Permanganate	Colorimetric Ag Sol Standard	PMW, CMW	IW

4.3 Compliance Monitoring

Compliance monitoring will be completed in accordance with the requirements outlined in WDR Order R5-2008-0149 and MRP Order R5-2008-0149-054 (Appendix A, Attachment A3). Semiannual compliance sampling will be conducted post-injection for 1 year or until objectives of the MRP have been met. Two CMWs located downgradient from the plume and outside the transition zone were selected because of their location to the injection wells and screen intervals. One BW, SWMU23U003AMW was identified in the MRP as an upgradient well for the development of background concentrations of sulfide, sulfate, carbon dioxide, methane, ethane, dissolved organic carbon (filtered), TDS, and metals. Figure 4-1 displays the locations of the CMWs.

The samples will be analyzed in the field for temperature, conductivity, turbidity, pH, ORP, DO, and permanganate concentrations. Permanganate concentrations will be measured using a Hach colorimeter. Groundwater samples will be submitted to a contract laboratory for analysis of VOCs (SW8260B), TDS (E160.2), total chlorides (E300), and dissolved chromium, dissolved manganese, total selenium, and total sodium (SW6010B). The groundwater compliance monitoring will confirm that sodium permanganate injections are not adversely affecting the area outside the target treatment zone. A list of analytical methods and sampling frequency is included in Table 4-2.

4.4 Reporting

Four reporting requirements are included in the WDR:

1. Baseline Summary/Implementation Report
2. Phase II Evaluation Report (if a second phase of injections is performed)
3. Semiannual and Annual Data Reports (Monitoring Report)
4. Corrective Action Work Plan (if corrective action is required)

This document satisfies the Baseline Summary/Implementation Report requirement. The semiannual and annual reports will be submitted as part of the semiannual and annual BGMP reports. If analysis of TCE concentrations in groundwater show a decreasing trend and ISCO byproducts are at or approaching baseline conditions, then monitoring and reporting may be discontinued.

A change in the MRP involves submitting a recommendation to the Central Valley Water Board in a stand-alone document. Requests will also be presented in the recommendations section in the BGMP report. A meeting shall be held with the Air Force and Central Valley Water Board to gain concurrence on the proposed changes. The Central Valley Water Board staff shall recommend the proposed changes to the MRP to the Executive Officer.

4.5 Contingency Plan

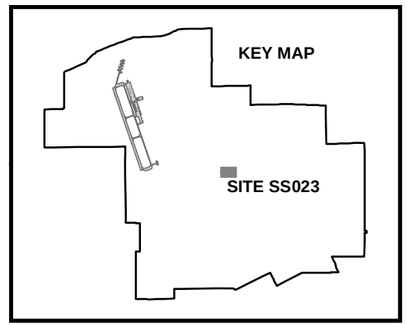
This section describes a contingency plan to meet report provisions specified by the Central Valley Water Board in the WDR Order R5-2008-0149. The contingency plan provides a general overview of efforts that the Air Force would take to address exceedances of dissolved chromium, dissolved manganese, or permanganate at concentrations greater than baseline concentrations in downgradient CMWs.

A concentration of the selected analyte greater than a trigger level (defined as the greater of twice the baseline concentration of the analyte or the analyte's MCL) in a downgradient CMW would constitute an adverse impact to groundwater outside the transition zone. If dissolved manganese, dissolved

chromium, or permanganate exceeds a trigger level in a downgradient CMW, a confirmation sample will be collected. If the exceedance is confirmed, the Central Valley Water Board will be notified in writing.

If an exceedance in a downgradient CMW is confirmed, a corrective action work plan will be submitted to the Central Valley Water Board for approval. One or more of the following corrective action would be considered:

- Increased monitoring frequency
- An expanded monitoring network
- Enhanced in situ bioremediation to reduce concentrations of any oxidants or dissolved metals mobilized during ISCO treatment
- Hydraulic control of amendments in the target treatment zone



LEGEND

- INJECTION WELL
- COMPLIANCE MONITORING WELL
- TREATMENT ZONE MONITORING WELL
- TRANSITION ZONE MONITORING WELL
- BACKGROUND MONITORING WELL
- GROUNDWATER MONITORING WELL
- GROUNDWATER FLOW DIRECTION
- SANITARY SEWER/IWL CONVEYANCE

NOTE:

MONITORING REPORTING PROGRAM (MRP) WELLS SHOWN IN **BOLD** TEXT.

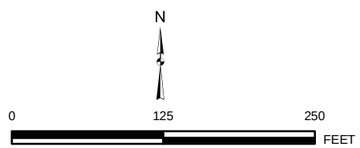


FIGURE 4-1
SITE SS023 GROUNDWATER MONITORING PROGRAM

SITE SS023 CORRECTIVE MEASURES IMPLEMENTATION REPORT
BEALE AIR FORCE BASE, CALIFORNIA

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SECTION 5

Conclusions and Recommendations

5.1 Conclusions

The following conclusions were determined by baseline monitoring, ISCO injection, and LUC implementation:

- Most of the TCE mass remains beneath Doolittle Drive as evidenced by the baseline groundwater sampling event. The highest TCE concentration in groundwater (564 µg/L) was observed in a sample collected from injection well SWMU23C016IW, located along Doolittle Drive.
- ISCO was successfully implemented in the treatment area as evidenced by breakthrough in the observation wells. The estimated ROI, excluding the ROI calculated for injection well SWMU23C014IW, ranged from 25 to 62 feet.

5.2 Recommendations

The following activities are recommended to optimize the remedy for Site SS023:

- Visually observe groundwater from BAT-9MW during the February 2015 BGMP. If water has visible permanganate, then analyze the sample for permanganate. BAT-9MW is between BAT-4AMW and BAT-5AMW. Breakthrough of permanganate was observed in BAT-4AMW, and BAT-5AMW was the downgradient extent of the 100-µg/L TCE plume as of July 2014. Visual inspection of groundwater from BAT-9MW will refine the extent of the ISCO treatment zone.
- Evaluate TCE and permanganate concentrations from BAT-5AMW. If BAT-5AMW has not shown an impact from ISCO injections (decrease in TCE or visible permanganate) by the 2015 Annual BGMP event, then permanganate injection directly into BAT-5AMW is recommended to treat the entire 100-µg/L TCE plume.

SECTION 6

Works Cited

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Saebom, Ko, Scott G. Huling, and Bruce Pivetz. 2012. *Ground Water Sample Preservation at In-Situ Chemical Oxidation Sites – Recommended Guidelines*. U.S. Environmental Protection Agency. Ground Water Issue. August.

URS. 2004. *SWMU 23 Corrective Measures Study Report, Beale Air Force Base, California*. December.

Appendix A
Fieldwork Documentation

Attachment A1
Site SS023 Yuba County Well Permits

YUBA COUNTY ENVIRONMENTAL HEALTH DEPARTMENT
915 8TH STREET, SUITE 123 MARYSVILLE, CA 95901
(530) 749-5450 FAX (530) 749-5454

PERMIT TO CONSTRUCT, REPAIR, INACTIVATE, OR DESTROY A WELL

FEE: 414.00 **PAID:** 414.00

PERMIT # WP0009910 to WP0009913 **RECEIPT #:** 100003655

SITE LOCATION: SS023 **CROSS STREET:** A STREET

APN#:

OWNER: US AIR FORCE

MAILING ADDRESS: 6601 B STREET BEALE AFB CA 95903- **PHONE:** 5306343856

DRILLING CONTRACTOR: NATIONAL EWP INC **LICENSE #:** 953646

MAILING ADDRESS: 630 LINCOLN AVENUE WOODLAND CA 95695- **PHONE:** 5306684080

CONSULTING FIRM: CH2M HILL **LICENSE #:**

MAILING ADDRESS: PO BOX 9004 BEALE AFB CA 95903- **PHONE:** 5307889131

PERMITTED ACTIVITY

TYPE OF WORK: CONSTRUCT NEW WELL
INTENDED USE: MONITORING
DRILLING METHOD: ROTARY

CONSTRUCTION SPECIFICATIONS

CASING DIAMETER: 2" **CASING MATERIAL:** PVC **GAUGE/THICKNESS:**
ANNULAR SEAL MATERIAL: NEAT CEMENT **SEAL DEPTH:** 9-36'

WELL DESTRUCTION

DIAMETER: **DEPTH:** **MATERIAL USED:**

1. Contractor will comply with all codes, rules, and regulations of the State of California and County of Yuba pertaining to or regulating well construction.
2. Contractor will call for a grout/destruction inspection at least 24 hours prior to pouring.
3. Contractor will submit a water well driller's report to the Yuba County Environmental Health Department within 15 days of completion.
4. Contractor will maintain the required minimum setbacks to all existing or proposed sewage disposal areas and to all other sources of contamination.
5. Owner will obtain final approval before placing the well in service.
6. All materials used shall meet manufacturer's specifications.
7. All required water sample results will be submitted to Yuba County Environmental Health prior to final approval.

ADDITIONAL COMMENTS:

PERMIT ISSUED BY: JODI BIRD **ISSUED DATE:** 06/10/2014 **SIGNATURE** Jodi E. Bird

530-635-3274

Permit expires 1 year from date of issue

Attachment A2
Site SS023 Beale Air Force Base Dig Permit

DP# 14.073A

BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST

(See Instructions on Reverse)

DATE PREPARED 6/3/2014

1. Clearance is requested to proceed with work at SS023

on Work Order No. Contract No. _FA8903-09-D-8557 , involving excavation or utility disturbance per

attached sketch, This area X has has not been staked or clearly marked.

2. TYPE OF FACILITY/WORK INVOLVED

☐ A. PAVEMENTS	☐ D. FIREDETECTION & PROTECTION SYSTEMS			☐ G. AIRCRAFT OR VEHICULAR TRAFFIC FLOW
☐ B. DRAINAGE SYSTEMS	☐ E. UTILITY	☐ OVERHEAD	☐ UNDERGROUND	☐ H. SECURITY
☐ C. RAILROAD TRACKS	☐ F. COMM	☐ OVERHEAD	☐ UNDERGROUND	X I. OTHER -

3. DATE CLEARANCE REQUIRED ,

4. DATE OF CLEARANCE

5. SIGNATURE OF REQUESTING OFFICIAL Shandon Sands

6. TELEPHONE NO. 788-9131

7. ORGANIZATION CH2MHILL

ORGANIZATION		REMARKS (Use Reverse for additional comments)	REVIEWER'S NAME AND INITIALS
8. BASE CIVIL ENGINEERING	A. ELECTRICAL DISTRIBUTION	No underground cables	B. Gislason BG 9 Jun 14
	B. STEAM DISTRIBUTION	N/A	[signature]
	C. WATER DISTRIBUTION	MARKED TROY BODEY	[signature]
	D. POL DISTRIBUTION	N/A	[signature]
	E. SEWER DISTRIBUTION	CLEAR TROY BODEY	[signature]
	F. ENVIRONMENTAL	READ & COMPLY WITH ATTACHED ENVIRONMENTAL PROTECTION MEASURES & MAP	[signature]
	G. PAVEMENTS/ GROUNDS		
	H. FIRE PROTECTION	Comply AFI, NFPA, UFC, ETL	[signature]
	I. ZONE		
	J. OTHER (Specify) NATURAL GAS	MARKED TROY BODEY	[signature]
9. SECURITY POLICE		CONCUR	[signature]
10. SAFETY		CLEAR	[signature] 6 JUN 14
11. COMMUNICATIONS		Attached Sheet -	
12. BASE OPERATIONS		Clear	[signature]
13. CABLE TV			
14. COMMERCIAL UTILITY COMPANY ☐ TELEPHONE ☐ GAS ☐ ELECTRIC		*Traffic Control Plan Submitted	

15. OTHER (Specify) USA # 222595

16. REQUESTED CLEARANCE X APPROVED ☐ DISAPPROVED

GREGORY R. ZSEDENNY, WS-10, DAF (APPROVING OFFICIAL) (Chief of Operations Flight or Chief of Engineering Flight) [signature]

17a. DATE SIGNED 9 June 14

AF IMT 103, 19940801, V3 PREVIOUS EDITIONS ARE OBSOLETE

BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST

(See Instructions on Reverse)

DATE PREPARED: 6/3/2014

1. Clearance is requested to proceed with work at SS023

on Work Order No. Contract No. _FA8903-09-D-8557 ,Involving excavation or utility disturbance per attached sketch, This area X has has not been staked or clearly marked.

2. TYPE OF FACILITY/WORK INVOLVED

□ A. PAVEMENTS	□ D. FIRE DETECTION & PROTECTION SYSTEMS			□G. AIRCRAFT OR VEHICULAR TRAFFIC FLOW
□ 8. DRAINAGE SYSTEMS	□ E. UTILITY	□ OVERHEAD	□UNDERGROUND	□ H. SECURITY
□ C. RAILROAD TRACKS	□ F.COMM	□ OVERHEAD	□U NDERGROUND	X LOTHER -

3. DATE CLEARANCE REQUIRED ,	4. DATE OF CLEARANCE	
5. SIGNATURE OF REQUESTING OFFICIAL Shandon Sands	6. TELEPHONE NO. 788-9131	7. ORGANIZATION CH2MHILL

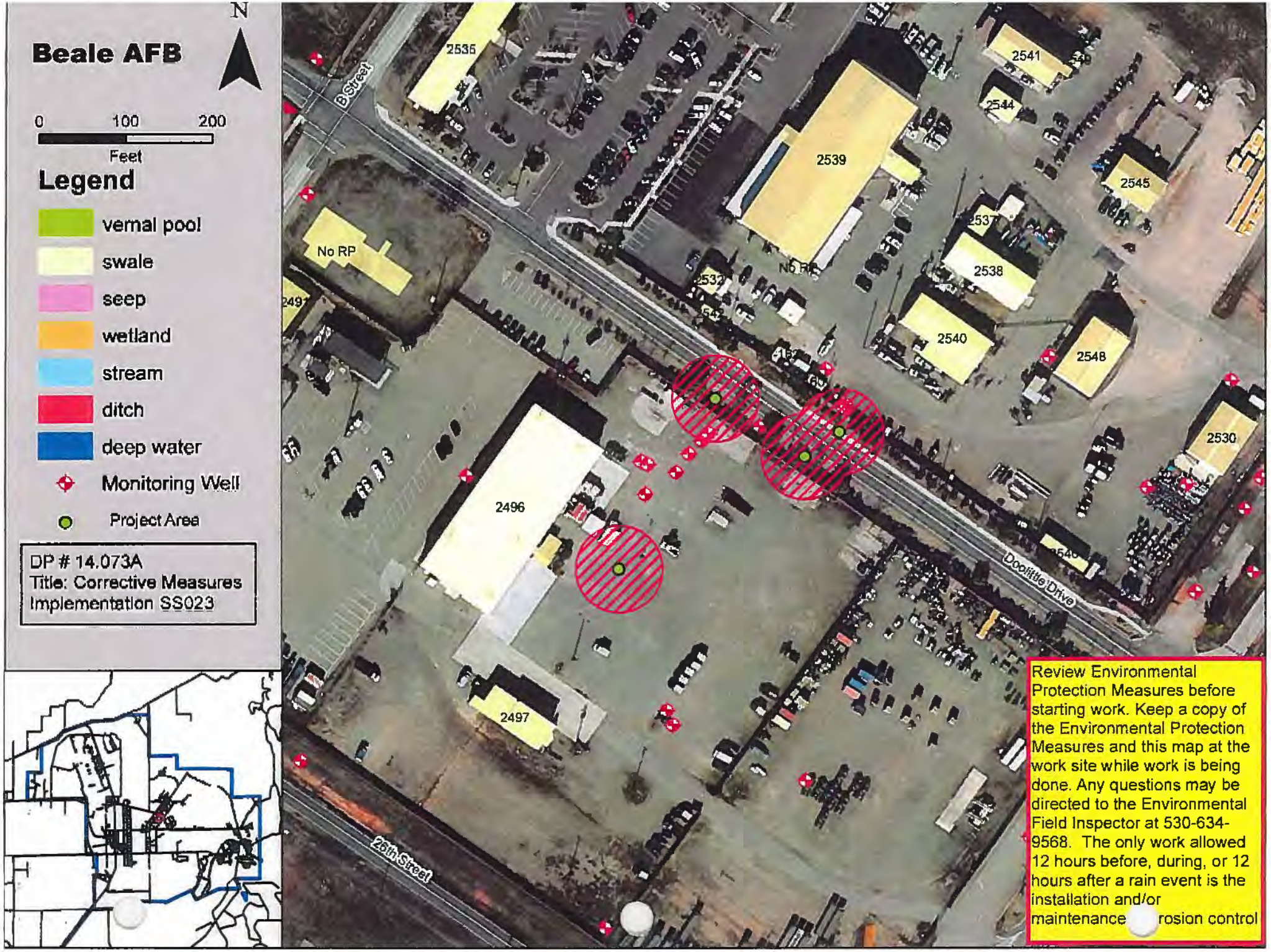
	ORGANIZATION	REMARKS *(Use Reverse for additional comments)*	REVIEWER'S NAME AND INITIALS
B. BASE CIVIL ENGINEERING	A. ELECTRICAL DISTRIBUTION		
	B. STEAM DISTRIBUTION		
	C. WATER DISTRIBUTION		
	D. POL DISTRIBUTION		
	ESEWER DISTRIBUTION		
	F.ENVIRONMENTAL		
	G. PAVEMENTS/ GROUNDS		
	H. FIRE PROTECTION	Comply with all AFIs, UFC, NFPA, ETL	
	I.ZONE		
	J. OTHER *(Specify)*		
9. SECURITY POLICE		Comply	
10. SAFETY		CLEAR	6JUN14
11 COMMUNICATIONS		Call before Digging: 634 4567 212 6395	
12. BASE OPERATIONS			Joshua Cooper
13. CABLE TV			
14. COMMERCIAL UTILITY COMPANY □TELEPHONE □GAS □ELECTRIC			

15. OTHER *(Specify)* _____

16. REQUESTED CLEARANCE □APPROVED □DISAPPROVED

17. TYPED NAME AND SIGNATURE OF APPROVING OFFICER *(Chief of Operations Flight or Chief of Engineering Flight)*	17a. DATE SIGNED

AF IMT 103, 19940801, V3 PREVIOUS EDITIONS ARE OBSOLETE


Beale AFB
N
0
100
200
Feet
Legend
vernal pool
swale
seep
wetland
stream
ditch
deep water
Monitoring Well
Project Area
DP # 14.073A
Title: Corrective Measures Implementation SS023
B Street
2535
2541
2544
2539
2545
2537
2538
No RP
2532
2540
2548
2530
2496
Doolittle Drive
2497
26th Street
Review Environmental Protection Measures before starting work. Keep a copy of the Environmental Protection Measures and this map at the work site while work is being done. Any questions may be directed to the Environmental Field Inspector at 530-634-9568. The only work allowed 12 hours before, during, or 12 hours after a rain event is the installation and/or maintenance of erosion control

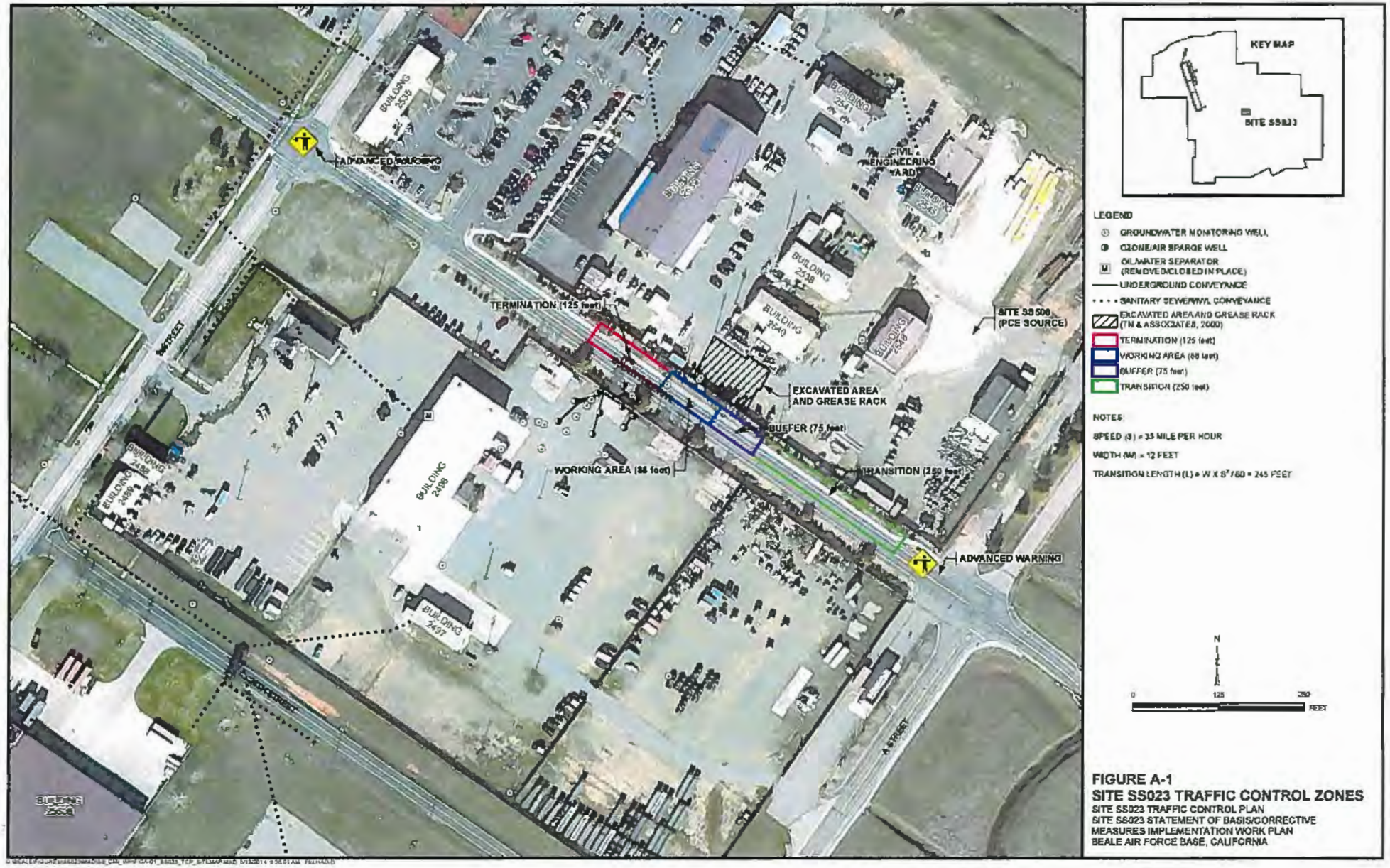
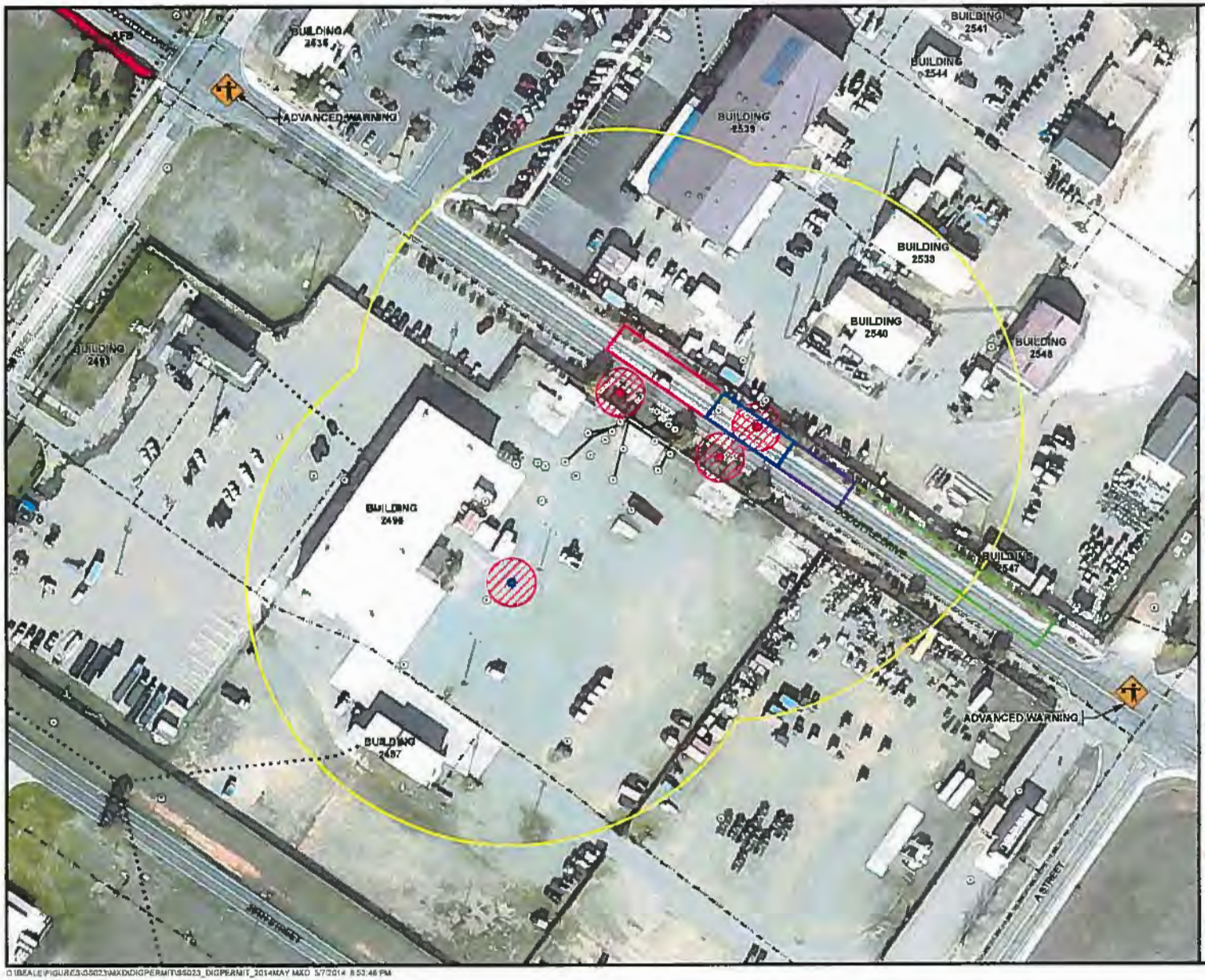
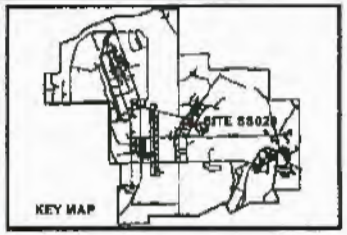


FIGURE A-1
SITE SS023 TRAFFIC CONTROL ZONES
SITE SS023 TRAFFIC CONTROL PLAN
SITE SS023 STATEMENT OF BASIS/CORRECTIVE MEASURES IMPLEMENTATION WORK PLAN
BEALE AIR FORCE BASE, CALIFORNIA





LEGEND

- PROPOSED WELL LOCATION (LIMITED ACCESS RIG)
- PROPOSED WELL LOCATION (HOLLOW STEM AUGER)
- EXISTING SAMPLING LOCATION
- UNDERGROUND CONVEYANCE
- SANITARY SEWER/MVL CONVEYANCE
- WATER LINE
- PROJECT AREA
- 250-FOOT BUFFER
- TERMINATION (125 feet)
- WORKING AREA (50 feet)
- BUFFER (75 feet)
- TRANSITION (250 feet)
- vernal pool
- swale
- seep
- wetland
- stream
- ditch
- deep water

Symbol	Media	Drill Equipment	Hole Diameter (inches)	Hole Depth (feet bgs)	Backfill Material
●	Soil	Limited Access Rig	6	0 to 30	NA*
●	Soil	Hollow-stem Auger	8	0 to 51	NA*

NOTE:

ACCESS ROUTES WILL BE FROM PAVED OR GRAVEL SURFACES WHERE POSSIBLE AND WILL STAY TO THE FAR SIDE OF ANY SENSITIVE HABITAT

N

0 100 200 Feet

DIG PERMIT MAP
FIGURE 1
SITE SS023
PROPOSED WELL LOCATIONS
SITE SS023 STATEMENT OF BASIS/CORRECTIVE MEASURES IMPLEMENTATION WORK PLAN
BEALE AIR FORCE BASE, CALIFORNIA

CH2MHILL

O:\BEALE\FIGURES\SS023\MXD\DIGPERMIT\SS023_DIGPERMIT_2014MAY.MXD 5/7/2014 8:53:46 PM

KEY

LEGEND
PROPO
PROPO
EXISTIN
UNDER
SANITA
WATER
PROJE
250-FO
TERMIN
WORKI
BUFFER
TRANSI
vernal p
swale
seep
wetland
stream
ditch
deep wa

Symbol

*Groundwater injection

NOTE:

ACCESS ROUTE WHERE POSSIB OF ANY SENSITI

0

DIG PER
FIGURE

Attachment A3
Site SS023 Regulatory Documents

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

TENTATIVE MONITORING AND REPORTING ORDER NO. R5-2008-0149-054
FOR
UNITED STATES AIR FORCE
BEALE AIR FORCE BASE
IN-SITU GROUNDWATER REMEDIATION OF VOLATILE ORGANIC COMPOUNDS
USING IN-SITU CHEMICAL OXIDATION AT SITE SS023
YUBA COUNTY

This Monitoring and Reporting Order (MRP) describes requirements for providing groundwater monitoring of an enhanced in-situ bioremediation (Bioremediation) system at Beale Air Force Base. This MRP is necessary to evaluate and determine whether the in-situ treatment of groundwater pollutants is effective. This MRP is issued pursuant to Water Code Section 13267. The United States Air Force (Discharger) shall not implement any changes to this MRP unless and until a revised MRP is issued by the Executive Officer.

Prior to construction of any new groundwater monitoring or injection wells, and prior to destruction of any groundwater monitoring or injection wells, the Discharger shall submit plans and specifications to the Central Valley Water Board staff for review and approval. Once installed, any new groundwater monitoring wells or injection wells added to the monitoring program shall be sampled semi-annually according to Table 2 of this Order.

All samples should be representative of the volume and nature of the discharge or matrix of material sampled. The time, date, and location of each grab sample shall be recorded on the sample chain of custody form.

GROUNDWATER MONITORING

As shown on Figure 1, the monitoring and reporting for Site SS023 consists of 6 injection locations. Two existing monitoring wells, (SWMU23C009MW and 23SWMU1MW) and four new injection wells will be used as injection locations to provide coverage of the target treatment area. The monitoring network for this treatability study will consist of three treatment zone monitoring wells, seven transition zone monitoring wells, three compliance monitoring wells and one background well. The injection locations, which will also be monitored, will provide a treatment area covering approximately 2500 square feet. The injection depth will extend from 15 to 50 feet below ground surface. Monitoring wells with free phase petroleum product or visible sheen, if present, shall be monitored, at a minimum, for product thickness and depth to water. Sample collection and analysis shall follow standard USEPA protocol.

The monitoring wells shall be sampled according to the schedule in Table 1, and the samples analyzed by the methods in Table 2, as follows:

Table 1: Sampling Frequency and Constituent Suite

Well Number [1]	Frequency	Constituent Suite(s) [2]	Monitoring Objective
SWMU23U003AMW	Annual	A,B	Background Well
23U001BMW	Semiannual	A,B,C	Compliance Monitoring
39C023MW	Semiannual	A,B,C	Compliance Monitoring
BAT-1MW	Semiannual	A,B,C	Compliance Monitoring
SWMU23U005AMW	Semiannual	A,B,C	Transition Zone Monitoring
SWMU23U005BMW	Semiannual	A,B,C	Transition Zone Monitoring
BAT-5AMW	Semiannual	A,B,C	Transition Zone Monitoring
SWMU23U006AMW	Semiannual	A,B,C	Transition Zone Monitoring
SWMU23U007AMW	Semiannual	A,B,C	Transition Zone Monitoring
SWMU23U004AMW	Semiannual	A,B,C	Transition Zone Monitoring
SWMU23C008MW	Semiannual	A,B,C	Transition Zone Monitoring
SWMU34U002MW	Semiannual	A,B,C	Treatment Zone Monitoring
BAT- 4AMW	Semiannual	A,B,C	Treatment Zone Monitoring
BAT-4BMW	Semiannual	A,B,C	Treatment Zone Monitoring
23SWMU1MW	Annual	A,C	Injection well Monitoring
SWMU23C009MW	Annual	A,C	Injection well Monitoring
SWMU2314IW	Annual	A,C	Injection well Monitoring
SWMU2315IW	Annual	A,C	Injection well Monitoring
SWMU2316IW	Annual	A,C	Injection well Monitoring
SWMU2317IW	Annual	A,C	Injection well Monitoring

[1] Well numbers as shown on Figure 1
[2] Constituent suite components (see Table 2)

Table 2: Analytical Methods

Constituent	**Method** [1]	**Maximum Practical Quantitation Limit (µg/L)**[2]
Suite A		
VOCs	SW8260B	0.5
Suite B		
total chlorides, total selenium, total potassium, dissolved manganese, dissolved chromium	EPA Method 6010B	various
Suite C		
Total Dissolved Solids[3], Permanganate	EPA 160.1 Hach Colorimeter	10,000 1.0 mg/L

[1] Or an equivalent USEPA Method that achieves the maximum Practical Quantitation Limit

[2] All concentrations between the Method Detection Limit and the Practical Quantitation Limit shall be reported as trace levels**.**

[3] Total Dissolved Solids (TDS) data should be correlated with electrical conductivity data. Conduct TDS analysis on 10 percent of samples to confirm correlation

FIELD SAMPLING

In addition to the above sampling and analysis, field sampling and analysis shall be conducted each time a monitoring well or extraction well is sampled. The sampling and analysis of field parameters shall be as specified in Table 3.

Table 3: Field Sampling Requirements

Parameters	**Units**	**Type of Sample**
Groundwater Elevation	Feet, Mean Sea Level	Measurement
Oxidation-reduction potential	Millivolts	Grab
Electrical Conductivity	uhmos/cm	Grab
Dissolved Oxygen	mg/L	Grab
pH	pH Units (to 0.1 units)	Grab

Field Test instruments (such as those used to test pH and dissolved oxygen) may be used provided that:

a. The operators are trained in proper use and maintenance of the instruments;
b. The instruments are calibrated prior to each monitoring event; and
c. Instruments are serviced and/or calibrated by the manufacturer at the recommended frequency

DISCHARGE MONITORING

The Discharger shall monitor daily the discharge of water and amendments that are injected into the groundwater according to the requirements specified in Table 4. Each amendment addition shall be recorded individually, along with information regarding the time period over which the amendment was injected into the aquifer.

Table 4: Discharge Monitoring Requirements

Parameters	Units	Type of Sample
Injected Volume	gallons per day	Meter
Amendment(s) Added	kilograms per day	Measured

ESTABLISHMENT OF BACKGROUND CONCENTRATION VALUES

The Discharger shall develop background values for concentrations of sulfide, sulfate, carbon dioxide, methane, ethane, dissolved organic carbon (filtered), TDS and metals (as noted in Table 2). Background values in groundwater should be developed by averaging the respective concentrations reported in background well SWMU23U003AMW. Alternatively, the Discharger shall develop background values for respective concentrations reported in monitoring wells listed in Table 1.

REPORTING

When reporting the data, the Discharger shall arrange the information in tabular form so that the date, the constituents, and the concentrations are readily discernible. The data shall be summarized in such a manner as to illustrate clearly the compliance with this Order. In addition, the Discharger shall notify the Central Valley Water Board within 48 hours of any unscheduled shutdown of groundwater extraction wells associated with the bioreactor.

As required by the California Business and Professions Code Sections 6735, 7835, and 7835.1, all reports shall be prepared by a registered professional or their subordinate and signed by the registered professional.

The Discharger shall submit semi-annual and annual electronic data reports, which conform to the requirements of the California Code of Regulations, Title 23, Division 3, Chapter 30. The semi-annual report and annual report shall be submitted electronically over the internet to the Geotracker database system by **1 June and 1 December,** respectively, of each calendar year until such time as the Executive Officer determines that the reports are no longer necessary. Hard copies of semi-annual and annual reports shall be submitted to the Central Valley Water Board **by 1 June and 1 December** of each year, respectively, until such time as the Executive Officer determines that the reports are no longer necessary.

Semi-annual reports shall include the following minimum information:

(a) A description and discussion of the groundwater sampling event and results, including trends in the concentrations of pollutants and groundwater elevations in the wells, how and when samples were collected, and whether the pollutant plume(s) is delineated;

(b) Field logs that contain, at a minimum, water quality parameters measured before, during, and after purging, method of purging, depth of water, volume of water purged, etc;

(c) Groundwater contour maps for all groundwater zones, if applicable;

(d) Isocontour pollutant concentration maps for all groundwater zones and all major constituents of concern, if applicable;

(e) A table showing well construction details such as well number, groundwater zone being monitored, coordinates (longitude and latitude), ground surface elevation, reference elevation, elevation of screen, elevation of bentonite, elevation of filter pack, and elevation of well bottom;

(f) A table showing historical lateral and vertical (if applicable) flow directions and gradients;

(g) Cumulative data tables for all major constituents of concern containing the water quality analytical results and depth to groundwater for all monitoring wells for the past five years, if applicable. Raw laboratory data shall be provided on CD or DVD and included in the report. The Central Valley Water Board may request additional data as necessary;

(h) A copy of the laboratory analytical data report;

(i) If applicable, the status of any ongoing remediation, including cumulative information on the mass of pollutant removed from the subsurface, system operating time, the effectiveness of the remediation system, and any field notes pertaining to the operation and maintenance of the system; and

(j) If applicable, the reasons for and duration of all interruptions in the operation of any remediation system, and actions planned or taken to correct and prevent interruptions.

Annual Reports shall contain an evaluation of the effectiveness and progress of the investigation and remediation. Annual Reports shall contain the following minimum information:

(a) Both tabular and graphical summaries of all data obtained during the year;

(b) Groundwater contour maps and pollutant concentration maps containing all data obtained during the previous year;

(c) A discussion of the long-term trends in the concentrations of the pollutants in the groundwater monitoring wells;

(d) An analysis of whether the pollutant plume is being captured by an extraction system or is continuing to spread;

(e) A description of all remedial activities conducted during the year, an analysis of their effectiveness in removing the pollutants, and plans to improve remediation system effectiveness;

(f) An identification of any data gaps and potential deficiencies/redundancies in the monitoring system or reporting program; and

(g) If desired, a proposal and rationale for any revisions to the groundwater sampling plan frequency and/or list of analytes.

The results of any monitoring done more frequently than required at the locations specified in the MRP shall also be reported to the Central Valley Water Board.
The Discharger shall implement the above monitoring program as of the date of the Order.

Ordered by:

_____
PAMELA C. CREEDON, Executive Officer

_____
(Date)

09/17/2014:RRR

Attachment A4
Site SS023 Lane Closure Notification

Road Lane Closure

- **WHO:** National Drilling with oversight by CH2M HILL
- **WHAT:** Close westbound lane of Doolittle Drive and sidewalk along north side of Doolittle Drive
- **WHEN:** 14-15 JUN 2014 (Weekend)
- **WHERE:** Doolittle Drive between A and B Street
- **WHY**: Install an injection well on the north side of Doolittle Drive
- **IMPACT**: Work will be conducted on the weekend to reduce impact. Flaggers will be used to control vehicle and pedestrian traffic in working area.

1

TRAFFIC COUNT ALONG DOOLITLE DRIVE (East Bound) –

SITE SS023, BEALE AFB

8 AM

Name of Flagger: Patrick Mullen *Date/Start time:* 6/14/14

Time	Vehicle count
8:15 AM	1 GRAY SEDAN
8:40 AM	1 PICK UP (GREY)
8:42 AM	1 ~~BEETLE~~ BICYCLE
8:48 AM	1 BLUE ISH TOYOTA 4 DOOR
8:50 AM	1 FIRE TRUCK
8:58 AM	1 white car
900 AM	1 Black car
902 AM	1 gray truck
9:20 AM	1 SMALL RED CAR
9:25 AM	1 WHITE SEDAN
9:30 AM	1 MUSTANG GREYISH
9:35 AM	1 WHITE SMALL CAR
9:36 AM	1 KIA SOUL ... WHITE
9:50 AM	2 1 RED CAR 1 GREY CAR
9:58 AM	2 SMALL CARS
10:27 AM	1 JEEP (WHITE)
10:35	2 1 - DODGE CHARGE 1 - FORD 4 DOOR SEDAN BLACK
10:40	1 GREY CADDY
10:43	1 SILVER 4 DOOR
10:44	1 SMALL CAR OF SOME SORT
10:46	1 FULL SIZE DODGE

Flagger's signature/Company/Date/Time: Pat E Mullen / 6-14-14 10:47 AM

(2)

TRAFFIC COUNT ALONG DOOLITLE DRIVE (East Bound) –

SITE SS023, BEALE AFB

10:55 AM

Name of Flagger: PATRICK MULLEN *Date/Start time:* 6-14-14

Time	Vehicle count
10:55 AM	1 GOLD MINI COOPER
11:01 AM	1 BLACK ~~HYUNDAI~~ HONDA
11:03 AM	WHITE HONDA CIVIC
11:07 AM	BLACK TOYOTA TRUCK
11:11 AM	BLACK HYUNDAI
11:13 AM	1 SILVER VAN
11:15 AM	1 GOLDISH SMALL CAR
11:20	1 SMALL WHITE CAR
11:22	WHITE TRUCK (POLICE)
11:25	1 RED CAR SUBARU
11:29	1 GREY VW
11:33	1 BLUE DODGE
11:37	1 GREY INFINITY LOTS OF GREY CARS ???
11:44	1 GREY AUDI
11:45	1 RED CHEVY CRUISE
11:47	1 GREY TOYOTA
11:49	1 BLACK TOYOTA
11:50	1 GREYISH SILVER HYNDA
11:53	1 GREY DODGE
11:58	WHITE TOYOTA SUV
12:07	GORD CHEY IMPALA
12:11	RED FORD FOCUS

Flagger's signature/Company/Date/Time: Patrick Mullen 6-14-14 12:11 PM

SS023
456998.09.22.CL.01

TRAFFIC COUNT ALONG DOOLITLE DRIVE (East Bound) –

SITE SS023, BEALE AFB

8:Am

Name of Flagger: PATRICK MULLEN *Date/Start time:* 6-15-14

A Time	B Vehicle count	A Time	B Vehicle count
8:50 Am	1	12:27	1
9:03 Am	1	12:31	1
9:20 Am	1	12:35	3
9:41 Am	1	12:39	1
9:45 Am	1	12:46	1
9:53 Am	1	12:55	1
10:01	1	1:10	1
10:27	1	1:17	2
10:37	2	1:40	1
10:46	1	1:47	1
10:51	2	2:22	1
11:11	1	2:30	1
11:16	1	2:35	1
11:22	1	2:40	1
11:41	2	3:01	1
11:46	1	3:05	1
11:49	1	3:08	1
12:14	2	3:10	5
12:16	1	3:19	1
12:18	2	3:23	1
12:21	1	3:31	1
= 26		= 28	

Flagger's signature/Company/Dote/Time: ~~Pat~~ E. Mullen 6-15-14

TOTAL = 54
FOR THIS PAGE 3:31 Pm

SS023

456998.09.22.CL.01

TRAFFIC COUNT ALONG DOOLITLE DRIVE (East Bound) –

SITE SS023, BEALE AFB

Name of Flagger: PATRICK MULLEN *Date/Start time:* 6-15-14

(A) TIME	~~TIME~~ VEHICLE	Vehicle count
4:08	1	
4:15	1	
4:35	1 POEPOE	
5:05	1	
5:07	1	
5:25	1	
5:36	1	

Flagger's signature/Company/Date/Time: ~~Patrick~~ E mullen 6-15-14 6 PM

1 of 3

TRAFFIC COUNT ALONG DOOLITTLE DRIVE (West Bound) –

SITE SS023, BEALE AFB

6-14-14

Name of Flagger: Joe Leiting *Date/Start Time:* 800 AM

Time	Vehicle count
8:30 AM	1
8:32 AM	2
8:33 AM	1
8:40 AM	1
8:49 AM	2
8:50 AM	2
8:54 AM	1
8:57 AM	1
9:01 AM	1
9:15 AM	1
9:15 AM	1
9:15 AM	1
918 AM	1 white pickup
920 AM	1 Red car
920 AM	1 Red car
924 AM	1 white car
925 AM	1 pickup
936 AM	1 Gray car
936 AM	1 white car
937 AM	1 white car
938 AM	1 car
944 AM	1 pickup

Flagger's signature/Company/Date/Time: Joe Leiting NEWP 6/14/14 6:50 P.

2 of 3

TRAFFIC COUNT ALONG DOOLITTLE DRIVE (West Bound) –

SITE SS023, BEALE AFB

6-14-14

Name of Flagger: Joe Keiting Gary Whitley *Date/Start Time:* 8:00 AM

Time	Vehicle count
952 AM	1 Red car
953 AM	1 Gray car
954 AM	1 Fire truck
1000 AM	1 Tan Jeep
1005 AM	1 gray car
1006 AM	1 Black pick up
1020 AM	1 Black car
1021 AM	1 gray car
1022 AM	1 Black SUV
1030 AM	1 Silver car
1038 AM	1 white pick up
1045 AM	1 whik car
1048 AM	2 cars
1050 AM	1 car
1055 AM	1 green car
1056 AM	1 Truck
1057 AM	1 truck
11:11 AM	1 Blk car
11:12 AM	1 Grey van
11:15 AM	1 Red suv
11:19 AM	1 Gray trk
11:21 AM	1 white trk
11:23 AM	1 white car 1 white trk
11:25 AM	1 Red car 1 white car
11:27	1 Grey car
11:29	1 Grey car
11:33	1 Blue car
11:36	1 Grey SUV 1 Grey car
11:48	1 white car
11:50	1 Black pick up
1155	1 Red car
12:13 PM	1 Gray car
12:23 PM	1 SUV
12:29 PM	1 white car
12:45 PM	2 Red cars
12:48 PM	1 Black car
12:50 PM	1 Pick up
1:00 PM	1 white car

Flagger's signature/Company/Date/Time: Joe Keiting Newp 6-14-14

over

JOULS

456998.09.22 CL.01

TRAFFIC COUNT ALONG DOOLITTLE DRIVE (West Bound) –

SITE SS023, BEALE AFB

Name of Flagger: JOE Leiting *Date/Start Time:* 6-15-14 800 AM

Time	Vehicle count
9:08 AM	1 car
9:06 AM	1 car
9:26 AM	1 car
9:41 AM	1 car
9:21 AM	1 car
9:58 AM	1 truck
10:28 AM	1 van
10:45 AM	2 truck
10:50 AM	2 truck
11:10 AM	2 cars
11:14 AM	1 meat wagon
11:22 AM	2 car
11:30 AM	1 car
11:35 AM	2 car
12:15 PM	2 car
12:30 pm	1 car
12:40 pm	2 car
12:43 pm	1 car
12:44 pm	1 car
12:50 pm	1 car
12:55 pm	1 truck
1:00 pm	2 car
1:03 pm	1 truck
1:05 pm	1 truck
1:10 pm	1 truck
1:16 pm	1 car
1:21 pm	2 cars
1:35 pm	1 car
2:15 pm	1 fire truck

Flagger's signature/Company/Date/Time: NEWP 6-15-14

(36)

SS023

456998.09.22.CL.01

TRAFFIC COUNT ALONG DOOLITTLE DRIVE (West Bound) –

SITE SS023, BEALE AFB

Name of Flagger: Joe Leiting *Date/Start Time:* 6-15-14 2:20 PM

Time	Vehicle count
220 pm	1 car
225 pm	2 car
240 PM	1 car
251 pm	1 car
303 pm	1 car
309 pm	1 car
326 pm	1 car
339 pm	1 Truck
358 pm	1 car
400 pm	1 car
420 pm	1 car
440 pm	1 car
443 pm	2 cars
448 PM	1 car
506 pm	1 car
520 pm	1 car
526 pm	2 cars
530 pm	1 Truck
532 pm	2 car
540 pm	2 Truck

Flagger's signature/Company/Date/Time: ..... NCWP 6-15-14

Attachment A5
Site SS023 Field Notes

Location SITE SS023 – BEALE AFB Date 10.16.2013

Project / Client SS023 DATA GAP – AFCEC

SURVEY NEW WELLS 456998.09.22.CK.02

TASK: SURVEY NEW WELLS SWMU23C008MW + 9MW

PERSONNEL: A. HALLORAN (CH2M)

JON MCBRIDE (CREIGEN)

WEATHER: SUNNY, CALM, WARM

H&S TOPIC: VEHICLE TRAFFIC, LOCKED GATE

1140 ON SITE, HOLDING TAILGATE MEETING. AREA UNDER LEVEL "C" – HAD TO SHOW ID AND WILL NEED ASSISTANCE TO LEAVE SITE THROUGH LOCKED GATE.

1150 BEGIN SURVEYING. USING SWMU34U002MW AND SWMU23U004AMW FOR LEVELS.

1220 DONE WITH SWMU23C008MW, MOVING INTO STREET FOR SWMU23C009MW.

1330 FINISHED SURVEYING SWMU23C009MW. USED 23SWMU1MW AND 10-487M4MW. LEAVING SITE.

~~////~~ RETURNED TO SITE 1552 TO LOCATE 23U003A/B MW, MARKED IN PINK PAINT. LOCATED BENEATH ASPHALT.

~~////~~ 10.16.2013

10.16.2013

Location Beale AFB, Site SS023 Date 6/11/14

Project / Client SS023 JSCo/AFCEC

Utility locate 456998.09.22.CL.01

0750 S. Paul/SAC on-site, prep for day.

Task: Locate buried utilities at 4 new IW locations.

Weather: Sunny, clear, windy, high of 90°

Personnel: S. Paul/SAC

Tim Blake/Subtronic

0915 Subtronic on-site. Go over PPSP. Talked about vehicular traffic.

0923 Depart for SS023

0935 Equipment: metal detector (Fisher TW-6)

Radio detector (RD8000, RadioDetection)

Transmitter (RadioDetection, TX-10)

GPR

0935 On-site at SS023. Site walk. Base has marked nearby utilities. Water, communication, natural gas, and irrigation lines in work area.

0940 Begin utility survey. Due to uneven ground from cobblestone bed will not be able to use GPR at the 3 locations on Doolittle Drive.

1012 2 irrigation lines clear of comm. line near SWMU23C017IW.

1040 Picked up a water line and irrigation line at SWMU23C015IW. There is also an electrical line steering off a nearby power

6/11/14

Location Beale AFB, SS023 Date 6/11/14

Project / Client SS023 ISCO / AFCEC

utility locate 456998.09.22.CL.01

pole, But it runs west away from the location.

1046 There is a water line, comm line, and an irrigation line near SWMW23C016IW

1050 After checking all locations, Tim Blake/Subtronic initialed all the drill boxes with "T.B."

1118 There is a marked natural gas line ~50' SW of SWMW23C014IW. But no utilities present in immediate vicinity.

1130 Back to trailer.

1145 Subtronic off-base

1300 End of Day

KLC 6/11/14

Location Beale AFB-SS023 Date 6/13/14

Project / Client SS023 ISCO/AFCEC

Field Prep/Roll off Delivery 456998.09.22.CL.0

TASK: Field Prep for drilling tomorrow

Personnel: K. Asmundson/RDD
K. Roberts/SAC
S. Sands/SAC

Weather: 80s - sunny (#206)

1230 Shandon observed roll off delivery. Roll off placed in vacant parking lot on B street between 26th street and Doolittle Drive. Bin delivered by Intrinsic. Shandon noted the bin was rusty and had a puncture in the lid (~5" long).

1340 Katie Arrives at field trailer. Call communications (per dig permit) and notify that we are drilling tomorrow. Head to Doolittle Drive to meet Eric from communications

1400 Eric visits all the drilling locations with us. He says the locations are far enough from his lines. Lines are no more than 4' bgs

Location Beale AFB-Site ~ Date 6/13/14
Project / Client SS023-ISCO / AFCEC
Field Prep 451998.09.22.CL.01

so we should reveal with AK. I told him SWMU23C00141W will not be potholed. He said that was fine and we were clear of all com lines.
1415 Head back to field office. Katie to finish prepping for field event.

6-13-14

Location Beale AFB - SS023 Date 6/14/14
Project / Client SS023 ISCO / AFCEC
Mobilization 451998.09.22.CL.01

Task: Pothole SWMU23C01511W - 17IW. Set up traffic control and drill SWMU23C01711N.
Personnel: K. Asmundson/RDD
K. Mouzakis/RDD
L. Pratt/SAC
Patrick Mullens (NEWP)
Gary Whitley (NEWP)
Javier Ruiz (NEWP)
Joe Leiting (NEWP)
Jake Gonzales (NEWP)
Weather: 60s, sunny (AM)
80s, partly sunny (PM)
0610 K. Asmundson arrive at trailer and begin prepping for the day.
#C102630 Calibrate PID (~~Thermo~~ ~~5000~~ MultiRae) KM
Fresh Air = Pass
Isobutylene = LTD074-RR-CM
Flow#: 713 0.5 LPM lot #: ~~[illegible]~~ KM
exp: 04/2017 VOC: pass 100.4 ppm
4 GAS =
lot #: FAN-413-18-13
Exp: 8/17/14
Flow #: 715 0.5 LPM

Location Beale AFB-SS023 Date 6-14-14

Project / Client SS023 ISCO / AFCEC

456998.09.22.CL.01

OXY: PASS 18%
LEL: PASS 50%
CO: PASS 49 PPM
H_2S: PASS 10.1 PPM
0715 Begin H&S meeting and discuss plan of the day. Highlight traffic control, Slips/trips/falls and complacency. ATC Jake from National not present. He has not arrived onsite. Traffic control AHA, drilling AHA, PTSP, and HSP signed. National is missing their forklift will start air knifing.
0800 mobilize to site SS023 and begin setting up traffic control. Air knifing will begin at SWMU23C0111W. Levi Pratt will observe air knifing.
0830 Traffic control set up and flaggers in place. Levi and Katy air knifing. Levi will add his notes at the end

Location Beale AFB-SS023 Date 6-14-14

Project / Client SS023 ISCO / AFCEC

456998.09.22.CL.01

of the day.
Katie placed labels on roll off #2016.
0900 Gary got a hold of Bryan Cook and Bryan contracted someone at Sunbelt who will deliver a forklift today.
0905 Joe moved air knife rig. Joe will take over flagging duties for Gary so Gary can start drilling SWMU0111W. Patrick & Joe on flagging duty and Gary and Javier on drill rig. Not enough personnel to continue air knifing. Jake still on his way to Beale AFB. Even with Jake, still not enough personnel. Plan is to drill SWMU23C0111W, install well, remove traffic control, and continue air knifing.
0910 Gary moving rig into place.
0915 Levi went to pick up Jake from the Wheatland Gate.
Drilling SWMU23C0111W on hold

Location [illegible] Date 6/14/14

Project / Client SS023 ISCO/AFCEC

Drilling SWMU23C017IW 456998.09.22.CL.01

While waiting for forklift delivery.

0919 Called Brad to discuss path forward. Access gate to SWMU23C014 is open. Brad said we could air knife location if open.

0940 Levi back with Jake. Levi is going over HSP, traffic control AHA, Drilling AHA, and PTSP. Jake will sign all documents.

0945 Gary getting rig in position.
LAR BE7N66
Suppor Truck: 364-1

1010 Levi with Jake to get forklift

1015 Inspected Drill Rig. All emergency Stop buttons are functional.

1030 Wilfred called to check in. I told him we were delayed by the forklift. He will communicate that to Bryan Cook.

1050 Heat Monitoring.
All personel ok. See monitoring Form

1055 Gary making phone calls to

Location Beale AFB-SS023 Date 6/14/14

Project / Client SS023 ISCO/AFCEC

Drilling SWMU23C017IW 456998.09.22.CL.01

determine where forklift is.

1105 Gary was called about forklift. Forklift will arrive to the gate in about 10 minutes. Gary took off (KA) over flagging duty for Joe and Joe set up on SWMU23C016IW. Joe is completely off the road and shoulder

1115 Begin airknifing SWMU23C016IW

1125 Finish airknifing SWMU23C016IW
VAC Master 4000 #696 Put soil back in hole

1130 Forklift arrived.

1145 Grout Inspection rescheduled for 1630

1150 Sand arrived in large sack instead of individual gallon size bags. Gary is requesting documentation for sack of sand. Will need to fill 5-gallon buckets to measure sand quantity.

1200 Drillers setting up on SWMU23C017IW (Gary).
$1\ ft^3 = 7.48$ gallons
8" augers

1225 Start drilling SWMU23C017IW.

1240 Levi got email confirmation SAND is 8/16

Location Beale AFB-SS023 Date 6/14/14

Project / Client SS023 ISCO / AFCEC

Drilling SWMU23C0171W 456998.09.22.CL.01

1240 Levi offsite.
1330 20' bgs at SWMU23C0171W
1340 Checked on flaggers to make sure no one needed a break.
1415 End boring 36' bgs at SWMU23C0171W.
1430 Break for lunch. Flaggers will stay.
1505 Return from lunch
Pulling last core barrel (35-36' bgs) at SWMU23C0171W.
1530 Adding water to the well.
1540 tagged bottom of hole at 35' 8" SWMU23C0171W
1545 Begin constructing well
sump 35-35.5' bgs
0.040-slot SCH40 PVC - 15-35' bgs
Blank casing 0-15' bgs
1550 Begin adding 8x16 Sand
sand is being added in 5 gallon buckets Sand volume calculation
sand 13-36' = 23 feet
$\pi(4/12)^2 \times 23 = 8 ft^3$

Location Beale AFB - SS023 Date 6/14/14

Project / Client SS023 ISCO / AFCEC

Constructing SWMU23C0171W 456998.09.22.CL.01

2" casing: $\pi(1/12)^2 \times 23 = 0.5 ft^3$
Total sand volume = 8 - 0.5 = $7.5 ft^3$
$1 ft^3 = 7.5$ gallons
$7.5 ft^3 \times \frac{7.5 \text{ gallons}}{ft^3} = 56$ gallons

1/2 buckets of sand added:
IIII IIII IIII IIII IIII I (26)
Total sand added (gallons) = 65

Bentonite Calculation
1 bag bentonite = $0.75 ft^3$
$\pi(4/12)^2 \times 2 = 0.7$
$\pi(1/12)^2 \times 2 = 0.05$
$0.65 ft^3$
$0.65 ft^3 / 0.75 ft^3 = 0.9$ bags bentonite

Bentonite is pure gold medium chips 50 lb bag
1630 Begin adding bentonite
Added 1 bag pure gold medium bentonite chips.
1630 Grout inspector not on site
Add 5 gallons H_2O to hydrate bentonite chips
1635 pulling augers will wait until 1645 and then seal without witness

Location Beale AFB-SS023 Date 6/14/14

Project / Client Site SS023/AFCEC

Grouting / Constructing SWMU23C017IW 456998.09 22.01

1640 Grout calculation (2-11' bgs)

$\pi(4/12)^2 \times 9 = 3.14$

$\pi(1/12)^2 \times 9 = 0.2$

total volume = 2.94 ft^3

$2.94 ft^3 \times \frac{7.5 \text{ gallons}}{ft^3} = 22$ gallons

1645 Gary said he will mix grout in 5 gallon buckets and pour down the well. Each bucket will be ~2.5 gallons H_2O and ~1 bag (80 lb 47 lb Quikcrete type 1/11 portland cement.

1655 Mast down at SWMU23C017IW

1700 Begin mixing grout. No inspector on site. Inspector was scheduled for 1630.

1/2 Filled ~~Gallon~~ Buckets Quikcrete MMI w/ Premium Gel Bentonite

1710 Finished 30 gallons total grouting Gary signed SWOJ form. Begin cleaning up site. LAR moved to SWMU23C016IW.

Location Beale AFB-SS023 Date 6-14-14

Project / Client SS023 ISCO / AFCEC

Clean up 456998.09.22.01

1713 Brad called and we discussed plan for tomorrow. We will block eastbound lane so that we can safely drill SWMU23C015IW and SWMU23C016IW.

1715 Continue cleaning up and preparing for work tomorrow.

1740 Heat Stress monitoring. Everyone okay (see form).

1800 Hopper ~1/4 full. With soil from SWMU23C017IW. ~~With~~ covered hopper and placed next to SWMU23C016IW.

1805 cleaned sidewalk. Small crack in sidewalk where the LAR was positioned. Picture taken.

1830 Begin removing traffic control

1840 everyone off site. Site is clean, secured, and no equipment or vehicles are blocking the roadway

1845 Javier deconning augers at field trailer. Water will be kept in decon trailer

Location Beale AFB-SS023 Date 6-14-14

Project / Client SS023 ISCO / AFCEC

Clean up 456998.09.22.CL.01

1650 Katie finishing up paperwork at field trailer

Forms submitted:

- Signed traffic control AHA
- signed drilling AHA
- signed HSP
- signed PTSP
- drilling self assessment checklist
- Driller comp schedule
- soil boring log SWMU23C017IW
- Photolog
- Driller Daily x2
- Heat Monitoring

Lev. Pratt's Notes for Air knifing of SWMU23C017IW as follows:

0840 Begin air knifing at SWMU23C017IW

0855 Air knifed to 5 feet bgs at SWMU23C017IW

No subsurface utilities encountered.

0930 Pick up J. Gonzales (NEWP) at Wheatland Gate

0940 Mob back to site.

2015 Offsite

6-14-14

Location Beale AFB-SS023 Date 6-15-14

Project / Client SS023 ISCO/ AFCEC

Start of day 456998.09.22.CL.01

Task: pothole SWMU23C015IW, drill and construct wells at 15IW & 16IW. Perform traffic control.

Personnel: K. Asmundson / RDD
K. Mouzakis / RDD
Patrick Mullen / NEWP
Jacob Gonzales / NEWP
Joe Leiting / NEWP
Jim Fraitis / NEWP
Daniel Martinez / NEWP

Weather: 60s, sunny (AM)
80s, sunny (PM)

Equipment Onsite:

LAR #BE7N666 Support truck #3647
Air knife #696 Flat Bed # 206-1
Forklift # RF4V716 (NCS)
MultiRae-# dev. rng #110-10

0635 Katie on site and begin field prep.

0645 Katy on site. Begin MultiRae calibration. #C102630
Fresh Air: PASS
Same calibrations used as on 6-14-2014 & Flow Controllers
Isobutylene: 99.6 ppm

Location Beale AFB - SS023 (EA) Date 6-15-14

Project / Client SS023 ISCO / AFCEC

Etc (EA) Start of day 456998.09.22.CL.01

oxygen: 18%	PASS	
LEL: 5 %	PASS	
CO: 50 %	PASS	
H_2S: 10.3 %	PASS	

0700 Jake, Patrick, and Joe on site. Waiting on Jimmy and Daniel.

0710 Jim and Daniel on site

0715 Begin H&S meeting. Jimmy showed his flagger training. He will step in if Joe or Patrick need a break. Discussed slips/trips/falls, traffic control, and fatique. Discussed hours and made plan to end earlier today because yesterday was too many hours. Jake presented the NEWP Traffic Control AHA

0735 All H&S forms signed. Katie to LF013 to dump decon water with Daniel. Katy to get crew organized at SWMU23C015IW to begin air knifing.

0755 Katie and Daniel at LF013 preparing to pump decon water from SWMU23C017IW into tank #5

Location Beale AFB - SS023 Date 6-15-14

Project / Client SS023 ISCO / AFCEC

456998.09.22.CL.01

tank #5 is empty. Label placed on tank #5. A total of ~ 40 gallons of decon water from SWMU23C017IW placed into tote #5.

0800 Wilfred called to check in. We discussed plan of the day.

0830 Depart LF013 and head to Doolittle Drive

0846 Katie arrive Site SS023.

0750 Katy M. arrive @ Site SS023. Setting up Traffic Control.

0800 Setting up Airknife at SWMU23C015IW

0810 Airknifing.

0830 Done Airknifing SWMU23C015IW

* 0839 Dropping off hopper to Rolloff. ~3 yd³ added to #2016

0853 Hopper returned to SS023.

0900 Katy to trailer to get camera. Flaggers ready, Jimmy to get flat bed support truck, Jake to close roll off. Set up on SWMU23C016IW to begin drilling.

0920 WL @ SWMU23C017IW = 12.3' bgs

Location Beale AFB-SS023 Date 6-15-14

Project / Client SS023 ISCO/AFCEC

Drilling SWMU23CO161W 456998.09.22.a01

0915 Katy back onsite
0930 Jimmy back onsite. Prep to
0945 drill SWMU23CO161W. Rig
Started.
* Cont. from 0839. Hopper ~1/4 full (<1 yd³) from drilling SWMU23CO171W. The rest of the 3 yd³ was from emptying the air knife.
1045 Called Jody (grout inspector) left voicemail cancelling the 1300 grout inspection. Rescheduled for 0900 tomorrow (6/16/14).
1040 Down 20' @ SWMU23CO~~0~~[6]1W
1130 Down 36' @ SWMU23CO161W.
TD tagged at 36.5' bgs.
1040 Begin constructing well at SWMU23CO161W.
Screen 2" SCH40 PVC 0.040 slot 15-35' bgs with sump on end (4")
Blank casing 0-15' bgs SCH40 PVC 2" Ø.
1145 add water to well. (~1 gallon)
1150 Begin adding 8x16 Sand.
Sand is same as 6/14/14 for

Location Beale AFB-SS023 Date 6-15-14

Project / Client SS023 ISCO / AFCEC

Installing SWMU23CO161W 456778.09.22.a01

SWMUCO711W. Calculations are also the same. Expected sand = 56 gallons Adding 2.5 gallons at a time. Number of 2.5 gallon buckets added:
𝍸 𝍸 𝍸 𝍸 11 (22)
1240 Heat stress monitoring. All okay.
1245 Finish adding sand. Total added was~~n~~ 55 gallons. SWMU23CO161W.
1240 Add 1 bag (50 lb) pure gold medium bentonite chips.
1250 Add 5 gallons H_2O to hydrate bentonite chips. Will not grout because need to finish drilling wells that require traffic control.
1305 augers pulled and mast down at SWMU23CO161W.
1310 lunch break, flaggers stay
1345 All personnel back on site. Katy and Jake to go to LF013 to decon augers and put decon water in the tote (#5). Katie to stay

Location Beale AFB - SS023 Date 6-15-14

Project / Client SS023 ISCO / AFCEC

Mob to SWMU23CO15IW 456998.09.22.CL.01

with drillers on Doolittle Drive.

1400 To save time, 3 augers and core barrels were decon'ed on site in the decon trailer. Jimmy began mobilizing the LAR to SWMU23CO15IW. Rope was used to tie back overgrown bushes near SWMU23CO15IW.

1425 Rig in position. Traffic control adjusted to protect new work area.

1430 Mast up @ SWMU23CO15IW.

1445 Begin drilling @ SWMU23CO15IW.

1525 Down 20' bgs at SWMU23CO15IW

1620 Down 36' bgs.

1625 Bottom of well tagged @ 36.5' bgs.

1630 Begin well construction at SWMU23CO15IW. Well construction same as SWMU23CO16IW (p. 42)

#2.5 Gallon Buckets of SAND:

1640 ||| ||| ||| ||| (23)

SAND added at 1640

1733 SAND Installation Finished at 1733

1734 Bentonite Chips ADDED 5 Gallons of

Location Beale AFB - SS023 Date 6-15-14

Project / Client SS023 ISCO / AFCEC

Drilling SWMU23CO15IW 456998.09.22.CL.01

50 lb bag - 1 bag added

1740 Begin cleaning up site. Bentonite and Sand calculations are the same as SWMU23CO17IW. (page 34-35)

1750 3/4 of hopper (hopper 3 yd³ capacity) placed into roll off #206. Soil cuttings from SWMU23CO15IW and SWMU23CO16IW.

1745 Jimmy confirmed with Bryan that LAR stays onsite and Gary will be here tomorrow as lead driller. Jimmy noted a sprinkler head was broken off near SWMU23CO15IW can be fixed with a 1" coupling.

1800 roll off secured.

1810 Traffic control down and head to CH2M yard.

1830 All NEW offsite

1900 Katy & Katie offsite

6-15-14

Location Beale AFB, SS023 Date 6/16/14

Project / Client SS023 ISCO/AFCEC

grouting/drilling 456998

0645 J. Paul/SAC on-site. Prep for day.

0700 National staff and Katy Mozoukis onsite.
Task: Grout SWMU23C015IW and SWMU23C016IW. Drill and install SWMU23C014IW. Grout if time permits.
Weather: Sunny, clear, high of 85°
Staff: J. Paul/SAC
Katy Mozoukis/RDD
Gary Whitley/NEWP
Javier Ruiz/NEWP
Conduct PTSP meeting. Talked about vehicular traffic. Read NEWP AHA on deconning augers.
Calibration: PID (MultiRae, # C102[illegible])

Gas	Fresh	Cal.	Std.
CO	0	pass	50 ppm
H_2S	0	pass	10 ppm
LEL	0	~~Fail~~ Pass	50%
O_2	20.9	pass	18%
VOC	0	pass	100 ppm

Multigas: Lot # FAN-413-18-13, exp 8/17/14
Isobutylene:

0730 Decon augers

0823 Katy M, Jeff, Gary, and Javier onsite. Gary dropped off supplies for grouting.

Location Beale AFB, SS023 Date 6/16/14

Project / Client SS023 ISCO/AFCEC

grouting 456998.01.22.CL.01

0840 Jeff offsite to get material from office. Katy M. stayed onsite. Driller removed last auger from SWMU23C015IW.

0850 Jeff onsite. Driller demobilized ~~from~~ Km LAR rig from SWMU23C015IW. Can't grout holes until 0900. If inspector does not show, will wait 15 min.

0900 No grout inspector yet. Will wait 15 min

0915 No grout inspector. Will proceed with grouting and fill out a seal without witness form. Begin grouting SWMU23C016IW

0928 SWMU23C016IW complete. Used 35 gallons of grout (4 bags). Move to SWMU23C015IW but need to add more water.

0930 Change of plans — need to drill SWMU23C014IW so we can finish before getting kicked out at 1530. Move to SWMU23C014IW

0940 We don't have enough sand to fully install the filter pack at SWMU23C014IW

[signature] 6/16/14

Location Beale AFB, SS023 Date 6/16/14

Project / Client SS023 JSCO/AFCEC

grouting 456998.09.22.CL.01

so we will not start drilling it. Continue grouting. Set up to grout SWMW23C015IW

0955 Begin grouting SWMW23C015IW with Portland Type II cement/5% bentonite.

1000 SWMW23C015IW complete. Used ~25 gallons (3 bags of cement)

1015 Driller Moved LAR RIG to SWMW23C014IW

1030 Bryan Cook/National has assured Gary that we will have the sand we need. Set up to drill SWMW23C014IW.

Equipment:

LAR rig (CME-75, # BE7N66)

Support Truck (Ford F-250, #364-1)

Forklift (JCB, # RF4U76)

PID (MultiRae, # 1102C530)

1108 Begin drilling SWMW23C014IW.

1250 First water at ~28' bgs.

1308 Good water bearing zone from 25-28' bgs. 28-30' bgs is a moist clay layer with ~15% sand.

1310 Break For lunch

1340 Hauled ~5 gallons of water into borehole to help increase recovery in Sampler. Resume drilling

6/16/14

Location Beale AFB, SS023 Date 6/16/14

Project / Client SS023 JSCO/AFCEC

Drilling SWMW23C014IW 456998.09.22.CL.01

1425 Scheduled a grout inspection with Paul from Yuba County at 0900 for SWMW23C014IW

1450 Boring terminated at 51' bgs - JT

1510 Drillers couldn't get an accurate TD measurement. Something has clogged up inside the augers. They hooked up the hammer to clear it out but the cable came off the runner. Had to put the mast down to fix it.

1520 SAND Delivered. Begin well installation

1530 ADDED 4/ 10# SAND

1/2 Buckets of SAND ADDED:

1550 Clean up for day. Have to be off-site by 1600.

1600 out of equipment yard. Setup to do surface completions.

1620 Set up on SWMW23C015IW and start construction flush mount surface completion

1655 SWMW23C015IW complete. Move to SWMW23C016IW

1725 SWMW23C016IW complete. Move to SWMW23C017IW.

1755 SWMW23C017IW complete. Clean up site.

6/16/14

Location: Beale AFB, SS023 Date: 6/16/14

Project / Client: SS023 ISCO/AFCEC

Surface completions 456998.09.22.CL.01

1810 All personnel off-site. Back to field trailer

1830 Wahood back to SAC.

1930 End of Day

6/16/14

Location: Beale AFB, SS023 Date: 6/17/14

Project / Client: SS023 ISCO/AFCEC

Well installation 456998.09.22.CL.01

0645 S. Paul/SAC and K. Mouzakis/RDD on-site. Prep for day

Task: install SWMU23C014IW, decon, demob after surface completion.

Weather: Sunny, clear, high of 84°

Staff: S. Paul/SAC A. Halloran/SAC
K. Mouzakis/RDD
Gary White/NEWP
Javier Ruiz/NEWP

0700 Safety. Talked about using sunscreen and potential vehicular traffic on Doolittle Dr. (development crew)

0740 Depart for SS023 equipment yard.

0800 All personnel and equipment on-site.

Equipment: LAR rig (CME-75, #BE7N65)
Support Truck (Ford F-250, #36441)
Fork lift (JCB, #RF4V36)
Flatbed Truck (Peterbilt, # 206-D)
Decon Trailer (#451-1)

0845 Begin adding filter pack. Sand calcs as follows:

8" borehole = 0.3491 $\frac{ft^3}{ft}$ (23 ft of filter pack)

2" casing = $-0.0218\ \frac{ft^3}{ft}$

$0.3273\ \frac{ft^3}{ft}$

23 ft × 0.3273 $\frac{ft^3}{ft}$ = 7.53 ft³ of sand.

S Paul 6/17/14

4/12 06-18-2014 04:12:54 p.m. 530-788-1098

Location Beale AFB, SS023 Date 6/17/14

Project / Client SS023 ISCO/AFCEC

well install (SWMU23(01)IW) 456798.07.22.CL.01

# of Additonal SAND Buckets - 1/2 Full
HHH HHH HHH only 1/2 of 1/2 bucket at end WAS Added.
Total # of Buckets From 6/16 & 6/17
15 + 14 1/2 = 29.5 1/2 Buckets

0825 K. Mazeikis/RDD off-site

0827 Filter pack complete (28-51 ft bgs)
Begin swabbing F.P.
30 buckets of sand ≈ 75 gallons
$75 \text{ gal} \times \frac{0.133 \text{ ft}^3}{1 \text{ gal}} = 9.98 \text{ ft}^3$ of sand

0842 Swabbing complete. Filter pack settled ~1 ft. added more sand to bring F.P. up to 28' bgs.

0844 Begin adding bentonite. Calcs as follows:
28-24 = 4 ft of seal
8" borehole - 0.3491 ft³
2" casing = 0.0218 ft³
0.3273 ft³/ft
$4 \text{ ft} \times 0.3273 \frac{\text{ft}^3}{\text{ft}} = 1.31 \text{ ft}^3$
$1.31 \text{ ft}^3 \times \frac{1 \text{ bgs}}{0.75 \text{ ft}^3} = 1.75 \text{ bgs}$

0845 K. Mazeikis/RDD back on-site.

0855 Added 4 ft bentonite seal (used ~1.90 bgs) Sealed from 28-24 ft bgs. We will hydrate the bentonite and wait ~20 min to grout.

[signature] 6/17/14

Location Beale AFB, SS023 Date 6/17/14

Project / Client SS023 ISCO / AFCEC

well install (SWMU23(01)IW) 456798.07.22.CL.01

0905 Yuba County Grout Inspector (Chris) on-site

0910 Begin mixing grout. Grout will consist of Portland Type II cement/5% bentonite and placed via tremmie)

0947 Grouting complete. (24-1 ft bgs). Will break down gear and clean up while grout settles, then top it off.

1000 used ~70 gallons of grout. (11 bags)
Grout inspector off-site.
Grout calcs as follows:
23 ft of grout.
8" borehole = 0.3491 ft³/ft
2" casing = 0.0218 ft³/ft
0.3273 ft³/ft
$23 \text{ ft} \times 0.3273 \frac{\text{ft}^3}{\text{ft}} = 7.53 \text{ ft}^3$
$7.53 \text{ ft}^3 \times \frac{1 \text{ gal}}{0.133 \text{ ft}^3} = 56.62$ gallons
Break down/clean up

1007 K. Mazeikis off-site.

1200 All equipment off-site except forklift. National is deconning augers.

1230 Pulled sample (IDW) SWMU23CIDW for SW6010B/SW7000 and SW8260B (metals and VOCs) from roll-off bin

[signature] 6/17/14

Location Beale AFB, SS023 Date 6/17/14

Project / Client SS023 ISCO / AFCEC

well installation 456998.09.22.CC.01

1215 Approximately 100 gallons of auger decon water was taken to take #5 for VOCs at LF013

1315 Go back to SS023 to finish surface completion at SWMU23CO14IW

1400 SWMU23CO14IW complete. Back to trailer

1430 National off-base. This concludes all drilling work.

1600 S. Paul/SAC off-base. End of Day

Location BEALE AFB SITE SS023 Date 06-17-2014

Project / Client SS023 ISCO /AFCEC

WELL DEVELOPMENT 456998.09.22-CC-01

TASK: WELL DEVELOPMENT OF SWMU23CO17IW, SWMUCO16IW, SWMUCO15IW AND SWMU23CO14IW

PERSONNEL: ALFREDO AKAH/SAC.

ANNIE HALLORAN/SAC

KATY MOUZAKIS/RDD

PATRICK MULLEN - NEWP

EQUIPMENT: SOUNDER G-101362 HERON

HORIBA U-22 #C102389

PID MULTIRAE #C102680

TURBIDITY METER HACH #C-101399

DEVELOPMENT RIG PULSTAR #110-10

TRAILER SUPPORT #410-8

GRUNDFOS REDI-FLOW PUMP WITH CHECK VALVE

0700 ON SITE. CALIBRATE EQUIPMENT

HACH CALIBRATION PASSED

MULTIRAE:	O_2	H_2S	LEL	CO	VOC
FRESH AIR	20.9	0.0	0	0	0.0
SPAN CAL	18.0	10.3	49	51	100.7

multigas Lot#1587320 cyl 65 exp 11/2015

iso. lot# GP11010 exp 4/2017

HORIBA cal soln Lot#4AD076 exp 4/2015

pH	COND	TURB	DO	TEMP	ORP
4.98	4.44	0.0	8.58	23.75	323

LOADING EQUIPMENT

06/17/2014

Location BEALE AFB SITE SSOZ3 Date 06/7/2014

Project / Client SSOZ3 ISCO /AFCEC

WELL DEVELOPMENT 456998.09.22.CL.01

0715 TAILGATE MEETING. DISCUSSED SUN EXPOSURE, TRAFFIC HAZARDS AND PROTECTION OF PROPERTY

0800 ONSITE AT SSOZ3, SET UP AT SWMUCO17IW. USE PLASTIC SHEETING TO PROTECT SIDEWALK AND CREATE EXCLUSION ZONE USING DELINEATORS, CAUTION TAPE AND SIGNAGE. LOCATION OF IRRIGATION PIPING PREVENTS RIG FROM POSITIONING ENTIRELY ON CONCRETE. FRONT CORNER EXTENDS ~3ft INTO DOOLITTLE DRIVE. NOTIFIED W. AKAH

0900 W. AKAH ONSITE TO INSPECT SETUP. APPROVES CURRENT SETUP AS LONG AS TRAFFIC FLOW IS NOT AFFECTED AND ROAD IS CLEARED BY 11:00.

0910 W. AKAH OFFSITE. PREPARE TO SURGE/BAIL SWMUBSCO17IW

PID 33.9 IN WELLHEAD, 0.0 IN BZ

CURBTING WELL) TOTAL DEPTH 34.80 ft bTOC

DTW 12.54 ft bTOC

WELL VOLUME = (34.80-12.54)ft x 0.163 gal/ft

FOR 2" DIA + 0.3 x (36.5-17)ft x 2.611 gal/ft

FOR 8" SAND PACK = 22.03 gallons

10 WELL VOLUMES = 220 gallons

0920 TOWER UP

0617 2014

Location BEALE AFB SITE SSOZ3 Date 06/7/2014

Project / Client SSOZ3 ISCO/AFCEC

WELL DEVELOPMENT 456998.09.22.CL.01

0939 BEGIN SURGE OF ENTIRE WATER COLUMN USING TIGHT RUBBER SEAL ON THE SURGE BLOCK AND FAST SURGING.

0949 BAILING. BAILED 4 gallons

INITIAL WQ READINGS:

pH	COND	TURB	DO	TEMP	ORP
5.02	0.90	>1000	7.02	21.52	303

1000 SURGING. K. MOUZAKIS ON SITE

1010 BAILING. BAILED 10 gallons

1028 SURGING. K. MOUZAKIS OFF SITE.

1038 BAILING. BAILED 4 GALLONS. WATER REMOVED IS MURKY BROWN. SEDIMENT AND FILTER PACK SAND SETTLED AT BOTTOM OF BUCKET.

1050 PREPARE TO DROP PUMP

DTW 12.72 AFTER BAILING

1100 ALL EQUIPMENT REMOVED FROM ROADWAY. INSTALLING CHECK VALVE ON PUMP. PROBLEMS WITH FITTINGS.

1137 PUMP DROPPED TO APPROX. 17 ft bTOC

DTW 12.75 (DISPLACED BY PUMP)

1139 PUMP ON. SEE WELL DEVELOPMENT LOG FOR DEVELOPMENT DATA. 2.25 gpm.

1235 PUMP LOWERED TO APPROX. 33 ft bTOC

0617 2014

Location BEALE AFB SITE SS023 Date 06/7/2014

Project / Client SS023 ISCO / AFCEC

WELL DEVELOPMENT 456998.09.72.CL.04

1304 WELL DEVELOPED, PUMP OFF, BEGIN WELL ~~REBOUND TEST~~ // RECHARGE TEST

TIME	WL (bTOC)	TIME	WL (bTOC)
1304 30	15.88	1316	14.11
1305	15.25	1317	14.06
1305 30	14.92	1318	14.02
1306	14.80	1913	17.98
1306 30	14.71	1324	13.84
1307	14.65	1329	13.74
1308	14.54	1334	13.66
1309	14.44	1339	13.60
1310	14.38	1344	13.53
1311	14.32	1349	13.45
1312	14.26	1354	13.41
1313	14.22	1359	13.35
1314	14.18	TOTAL DRAWDOWN 4.28 ft	
1315	14.15	80% RECOVERY 13.35 ft	

1340 NATIONAL SETTING UP AT SWMU23CO16IW DURING RECHARGE TEST

TOTAL DEPTH 34.80 ft bTOC

DTW 16.12 ft bTOC

PID 34.8 ppm IN WELLHEAD. VENTING.

0.0 ppm IN BREATHING ZONE.

1350 SURGING SWMU23CO16IW

06/7/2014

Location BEALE AFB SITE SS023 Date 06/7/2014

Project / Client SS023 ISCO / AFCEL

WELL DEVELOPMENT 456998.09.72.CL.01

1400	RECHARGE TEST COMPLETED AT SWMU23CO17IW. FINAL TD 34.80 ft bTOC
1405	BAILING SWMU23CO16IW. 5 gallons PURGE WATER INITIALLY BROWN + SOME FILTER PACK SAND OBSERVED
1410	SURGING SWMU23CO16IW
1420	BAILING. BAILED 5 gallons
1430	SURGING
1440	BAILING. 5 gallons
1447	PREPARE TO DROP PUMP
1500	DTW 16.40 ft bTOC AFTER BAILING
1505	PUMP ON (MED SCREEN) 2 gpm. SEE WELL DEVELOPMENT LOG FOR DATA.
1545	PUMP LOWERED TO APPROX. 33 ft bTOC
	WELL VOLUME = (34.80 - 16.12) ft x 0.163 gal/ft
	For 2" DIA + 0.3 (36.5-13) ft x 2.611 gal/ft
	For 8" FILTER PACK = 21.44 gallons
	10 WELL VOLUMES = 214 gallons
1645	TEN WELL VOLUMES RECOVERED. FINAL TURBIDITY 73.3 NTU. WELL DEVELOPED. BEGIN RECHARGE TEST.
	MAX DRAWDOWN 6.84 ft
	80% RECOVERY 17.52 ft bTOC

06/7/2014

Location BEALE AFB SITE SS023 Date 06/17/2014

Project / Client SS023 ISCO/AFCEC

WELL DEVELOPMENT 456998.09.22.CL.01

SWMU23CO16IW RECHARGE TEST:

TIME	WL (6TOC)	TIME	WL (6TOC)
1650 IP	22.00	1659	18.17
1657	21.75	1700	18.04
1651 IP	20.75	1701	17.93
1652	20.54	1702	17.85
1653	19.70	1703	17.76
1654	19.25	1704	17.69
1655	18.99	1705	17.60
1656	18.73	1706	17.53
1657	18.54	1707	17.46
1658	18.35	80% RECHARGED	

1708 CLEANING UP. FINAL TD 35.10 & 6TOC

1815 TRAILER IN YARD STILL CONTAINING ALL WATER GENERATED TODAY. ALL EQUIPMENT OFFSITE AT SS023. NATIONAL OFFSITE. A.HALLORAN BACK AT TRAILER.

1930 END OF DAY.

06/17/2014

Location BEALE AFB SITE SS023 Date 06/18/2014

Project / Client SS023 ISCO/AFCEL

WELL DEVELOPMENT 456998.09.22.CL.01

TASK: DEVELOP NEWLY INSTALLED INJECTION WELLS SWMU23CO14IW AND SWMU23CO15IW

PERSONNEL: ANNIE HALLORAN/SAC

PATRICK MULLEN-NEWP

EQUIPMENT: SUBMERSIBLE GRUNDFOS #G-101362

PID MULTIRAE #C-102650

HORIBA U-22 #C-102359

TURBIDITY METER HACH #C-101390

DEVELOPMENT RIG AUTOTAP #110-10

SUPPORT TRAILER #410-8

0645 A. HALLORAN ONSITE. CALIBRATIONS:

HACH CALIBRATION PASS

MULTIRAE	O2	CO	LEL	H2S	VOC
FRESH AIR	20.9	0	0	0.0	0.0
SPAN	18.0	51	49	10.4	100.2

4-GAS LOT#1587320 cyl 65 exp 11/2015

ISO LOT#GP11010 exp 4/2017

REGULATORS 0.5 LPM MODELS 715 & 713

HORIBA CAL SOLN LOT#4AC1749 exp 2/2015

pH	COND	TURB	DO	TEMP	ORP
3.92	4.52	1.4	8.85	23.35	857

0650 P.MULLEN ONSITE TAILGATE MEETING - REVIEWED AHA FOR SUBMERSIBLE PUMPS DISCUSSED TRAFFIC, TRIP/SLIP/FALLS

06/18/2014

Location BEALE AFB SITE SSOZJ Date 06 18 2014

Project / Client SSOZJ ISCO /AFCEC

WELL DEVELOPMENT 456998.09.22.CL01

0705 TRANSFER WATER GENERATED DURING DEVELOPMENT OF SWMW23CO1SIW AND SWMW23CO1FIW YESTERDAY INTO GIS VOC TANKS #5 AND #6. APPROXIMATELY 230 gallons. UPDATE WASTE TRACKING LOG.

0730 TALKED WITH MAINTENANCE YARD STAFF REGARDING SITE ACCESS. GATES CLOSE AT 1600.

0740 SETTING UP AT SWMW23CO1SIW. EXCLUSION ZONE WITH CONES AND CAUTION TAPE. OCCUPY BIKE LANE BUT NOT ROADWAY.

0810 TOWER UP. PID >1000 ppm ON WELLHEAD (FRESH PVC GLUE PRESENT) 0.0 ppm IN BREATHING ZONE. VENTING WELL.

TOTAL DEPTH 35.20 ft bTOC

DTW 13.80 ft bTOC

0815 SURGING SWMW23CO1SIW

0825 BAILING. REMOVE 5 gallons. WATER MURKY BROWN. SMALL AMMOUNT OF SAND OBSERVED.

0835 SURGING SWMW23CO1SIW

0840 BRAD SHEARER ONSITE. BRIEF TAILGATE MEETING.

0845 BAILING. REMOVED 8 gallons.

0618 2014

Location BEALE AFB SITE SSOZJ Date 06 18 2014

Project / Client SSOZJ ISCO/AFCEC

WELL DEVELOPMENT 456998.09.22.CL.01

0856 SURGING SWMW23CO1SIW. MODERATELY AGRESSIVE SURGING ACTION. REMOVING LESS FILTER PACK SAND THAN YESTERDAY.

0906 BAIL. REMOVE 5 gallons.

0920 DEVELOPMENT RIG REMOVED FROM EXCLUSION ZONE. PORTABLE GENERATOR WILL BE USED FOR PUMP.

0925 PUMP INSTALLED IN WELL 20 ft bTOC

NOTE: WATER QUALITY OF BAILED WATER:

pH	COND	TURB	DO	TEMP	ORP
5.54	0.90	>1000	8.75	22.06	-25

0936 POST-BAILING WATER LEVEL 14.30 ft bTOC

0930 B. SHEARER OFF SITE

0938 BREATHING ZONE AIR MONITORING

O_2 20.9%, LEL 0%, H_2S 0.0 ppm, VOC 0.0 ppm

0944 PUMP ON AT 2 gpm. SEE WELL DEVELOPMENT LOG FOR DATA.

SWMW23CO1SIW WELL VOLUME =

(35.20-13.80) ft x 0.163 gal/ft FOR 2" DIA

+ 0.3 (36.5-18) ft x 2.611 gal/ft FOR 8" DIA

= 21.90 gals

10 WELL VOLUMES = 219 gals

1001 PUMP LOWERED TO 29 ft bTOC, FLOW RATE REDUCED TO 1 gpm

0618 2014

Location BEALE AFB SITE 55023 Date 06 18 2014

Project / Client 55023 ISCO / AFCEC

WELL DEVELOPMENT 456998.09.22.CL 01

1134 SWMU23CO15IW DEVELOPED. PUMP OFF. BEGIN RECHARGE TEST. MAX DRAWDOWN DURING DEVELOPMENT WAS 9.62 ft

TIME	WL (6TOC)	TIME	WL (6TOC)
1134 30	22.29	1145	18.95
1135	21.94	1146	18.79
1135 30	21.75	1147	18.62
1136	21.54	1148	18.47
1136 30	21.23	1149	18.32
1137	21.04	1150	18.19
1138	20.88	1155	17.56
1139	20.37	1200	17.08
1140	20.06	1205	16.67
1141	19.81	1210	16.34
1142	19.53	1215	16.05
1143	19.32	1220	15.81
1144	19.09	1225	15.61

TEST COMPLETE. 80% RECOVERY ACHIEVED.

NOTE: TODAY AND YESTERDAY, CONDUCTIVITY READS FLASHING. RECALIBRATION DID NOT CHANGE. READS NORMAL IN CLEAN WATER.

NOTE: P. MULLEN MOVED TO SWMUCO14IW AT 1040 TO SWAB + BAIL. INITIAL PID 0.0ppm IN WELLHEAD AND BREATHING ZONE.

06 18 2014

Location BEALE AFB SITE 55023 Date 06 18 2014

Project / Client 55023 ISCO / AFCEC

WELL DEVELOPMENT 456998.09.22.CL.01

SWMU23CO14IW TOTAL DEPTH 50.40 ft BTOC

DTW 18.55 ft BTOC. SURGED 10 min, BAILED, SURGED 10 min, BAILED, SURGED 10 min, BAILED. TOTAL 20 gal WATER REMOVED. MURKY BROWN, SEDIMENTS SETTLE QUICKLY.

INITIAL WATER QUALITY:

pH	COND	TURB	DO	TEMP	ORP
6.84	0.90	1000	7.75	25.42	52

DTW POST BAIL 18.61 ft BTOC

1145 WELL RECHARGE TEST AT SWMU23CO15JW COMPLETED. PULL PUMP AND DECON (LIQUINOX AND DI). BREAK DOWN EXCLUSION ZONE AND MOVE INSIDE MAINTENANCE YARD TO SWMU23CO14MW.

1245 PUMP INSTALLED IN SWMU23CO14IW AT 35 ft BTOC.

1255 PUMP ON AT 2gpm. SEE WELL DEVELOPMENT LOG FOR DATA.

BREATHING ZONE ASC MONITORING O2 20.9%, LEL 0%, H_2S 0.0ppm, VOC 0.0ppm

1310 PUMP LOWERED TO MID SCREEN

1325 PUMP LOWERED TO 49 ft BTOC

06 18 2014

Location BEALE AFB SITE SS023 Date 06 18 2014

Project / Client SS023 ISCO/AFCEC

WELL DEVELOPMENT 456998.09.22.CL.01

1347 PUMP OFF. SWMU23CD14IW DEVELOPED.
BEGIN RECHARGE TEST.

TIME	WL (BTOC)
1348	19.75
1348 10	19.60
1349	19.55
1349 30	~~19.49~~ 19.53
1350	~~19.42~~ 19.49
1351	19.42
1352	19.34
1353	19.29

MAXIMUM DRAWDOWN 4.35 ft
80% RECOVERY ACHIEVED.
1355 UPON REMOVAL OF PUMP FROM WELL, P. MULLEN FEELS THAT CHECK VALVE MAY HAVE BEEN LEAKING A SMALL AMMOUNT DUE TO GRIT GETTING STUCK IN MECHANISM. BRAD SHEARER WAS CONSULTED AND CONFIRMED THAT ANOTER TEST WILL NOT BE NEEDED.
FINAL TD 50.46 IN SWMU23CD14IW.
CLEANING UP.
1410 TRANSFER WATER GENERATED DURING DEVELOPMENT TO GTS TOTE #6,3
APPROX. 270 gallons. UPDATED LOG.

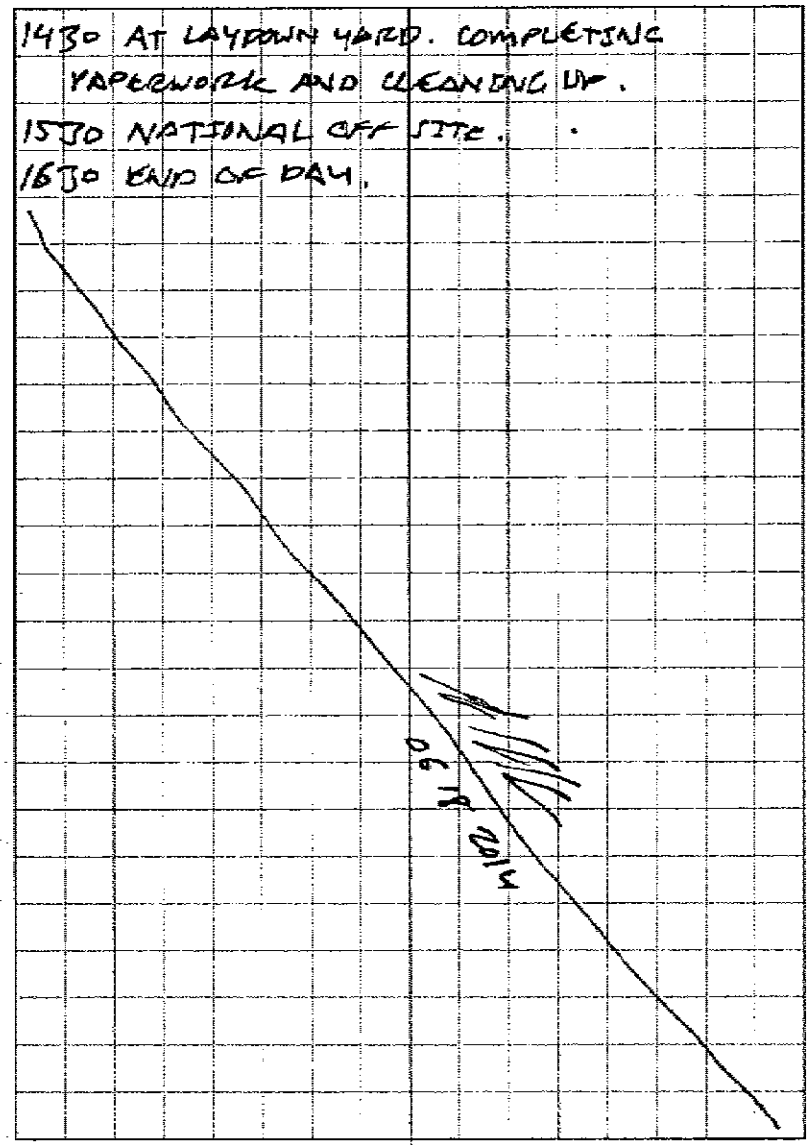
06 18 2014

Location BEALE AFB SITE SS023 Date 06 18 2014

Project / Client SS023 ISCO/AFCEC

WELL DEVELOPMENT 456998.09.22.CL.01

1430 AT LAYDOWN YARD. COMPLETING PAPERWORK AND CLEANING UP.
1530 NATIONAL OFF SITE.
1630 END OF DAY.



Location Site SS023 - Beale AFB Date July 7, 2014

Project / Client SS023 ISCO / AFCEC

456998.09.22.CL.01 Surveying

1415 Arrived at Site SS023 from Site TU509/CG517
Weather: Sunny, hot, temperature ≈ 95°F
Crew: Brian Coleson
David Ramirez
Task: Survey as 4 newly installed injection well ~~23C014IW through 23C017IW~~ was
Swmw23C014IW through Swmw23C017IW
1430 Started Surveying at Swmw23C016IW
1435 Started Surveying at Swmw23C015IW
1440 Surveying at Swmw23C017IW
Fenced yard containing Swmw23C014IW is locked surveying at Swmw23C014IW will be completed tomorrow.

7/7/14

Location Site SS023 - Beale AFB Date 07-09-14

Project / Client SS023 ISCO / AFCEC

456998.09.22.CL.01 SURVEYING

1015 Arrive at Site SS023 to survey location that was not sampled yesterday due to locked gate
1020 Surveyed SWMW23C014IW
1025 offsite after surveying location to try Site SS035 survey again (equipment dead battery on first attempt at Site SS035)

07-09-14

Location Site SS023 Beale AFB Date 10/23/14

Project / Client SS023 ISCO / AFCEC

ReSurvey 456998.09.22.cl-01

1421 Arrive at SS023 from SS035. Gate to yard is closed. Base is having a Securing drill all day. Knock on main shop door, explain our work, they are ok letting us in.

1430 J. Harlow looks at well locations and ref well locations, can't access both ref wells to establish total station. Looking to see if he has other data to use to re-survey SWMU23C014IW

1433 J. Harlow calls PAT Dami. to discuss. Pat ok with using single reference well to establish vertical to reshoot SWMU23C014IW. Set up total station.

1445 Shoot reference elevation at SWMUC008MW, using ref elevation to set total station elevation TO reshoot SWMUC014IW, old elevation 133.12, new elevation 133.10

1455 Mob to SS508 to try to get in Yard. Will return to resurvey locations along Doolittle

Location SS023 Beale AFB Date 10/23/14

Project / Client SS023 ISCO / AFCEC

Resurvey 456998.09.22.cl-01

1545 Return to SS023, Set up prism on SWMU23C017IW

1555 Set up total station.

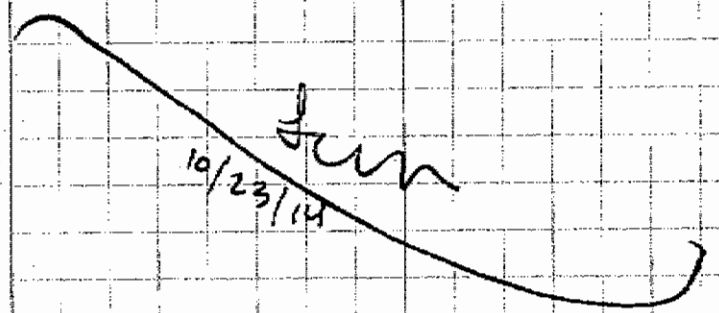
1558 Set total station elevation using given ref elevation for SWMUC009MW to anchor resurvey points.

1603 Resurvey SWMUC017MW, resurvey elevation differs from previously ±0.09

1607 Resurvey SWMUC015MW, resurvey elevation differs from previously ±0.01

1610 Resurvey SWMUC016MW, resurvey elevation differs from previous by ±0.01

1613 Tear down total station, prism. Mob to Clinic.



Location BEALE AFB SITE SS023 Date 11 05 2014

Project / Client SS023 ISCO / AFCEC

PERMANGANATE INJECTION 456998.09.22.CL.01

0700 CAISSE PREP PAPERWORK + LOAD EQUIPMENT

TASK: BEGIN INJECTION PHASE 1

PERSONNEL: KEVIN ROBERTS / SAIC

ANNE HALLORAN / SAIC (SCAC86)

WEATHER: SUN, HIGH 75°F

0710 CALIBRATE PID - ALL PASS

CALIBRATE HORIBA #C102675 - pH 4.01, COND 4.49 mS/cm, TURB 0.0 NTU, DO 8.47 mg/L

AUTO CAL SOLN LOT #4A1131 exp SEP/15

0800 AT SITE SS023, SITE WALK + TAILGATE MEETING - DISCUSS TRIP HAZARDS, SYSTEM OPERATION PROCEDURES, CHEMICAL HAZARDS + SPILL RESPONSE PLAN.

0820 BEGIN LEAK CHECK OF SYSTEM. REPAIRS AND NEW FIRE HOSE NEEDED.

1015 COLLECTED SAMPLE FROM WELL BAT 3MW FOR PERMANGANATE FIELD TEST. WELL WATER QUALITY PARAMETERS WERE RECORDED FOR BASELINE MONITORING. SEE PURGE LOG SHEET AND FIELD TEST SHEET FOR RESULTS.

1129 COLLECTED SAMPLE FROM WELL BAT 4BMW FOR PERMANGANATE FIELD TEST. SEE PURGE LOG SHEET AND FIELD TEST SHEET FOR RESULTS AND WATER QUALITY PARAMETERS.

Location BEALE AFB SITE SS023 Date 11 05 2014

Project / Client SS023 ISCO / AFCEC

PERMANGANATE INJECTION 456998.09.22.CL.01

1200 COLLECTED SAMPLE FROM BAT 8 MW FOR PERMANGANATE FIELD TEST. SEE LOG SHEET + FIELD TEST SHEET FOR RESULTS AND WATER QUALITY PARAMETERS.

1214 COLLECTED SAMPLE FROM SWMU54U002MW FOR FIELD TEST. SEE LOG SHEET + FIELD TEST SHEET FOR RESULTS + WQ PARAMETERS.

1310 WATER LEVEL SURVEY AND BEGIN COLLECTING PARAMETERS AT REMAINING WELLS NEEDED FOR BASELINE.

1430 COLLECTED PARAMETERS AT BAT 1 MW. SEE LOG SHEET.

1440 BEGIN INJECTING.

1530 PARAMETERS COLLECTED FOR SWMU23C016SW, 23SWMU1MW, + SWMU23C015SW. SEE LOG SHEETS. A. HALLORAN OFFSITE.

1605 Kevin leaves the site

Location 55025 Date 11/6/14

Project / Client ISCO injections

08:00 ON-SITE getting Ready To inject, Jeff Paul + Kevin Roberts 35" of Pecan in first tote. Pump 2" yesterday. Jeff is taking the Water Quality Readings I am getting the trailers Going.

08:38 Started pumping

0920 increase flows To 3.0 gpm on Both wells, 009 + 017.

0930 Shut down To tighten pressure gauge on well head 017IW. Just a drip Neutralized with Stabilizer.

1024 Shutting down To switch motors on dosatron.

1047 Back on line

1140 Move Both wells To 4.0 System Down.

Location Date 11/6/14

Project / Client SS025 ISCO injections

1330 System Back up and Running

662.0 5327.0

Brad moved it To 5.5%
Brad Bumped it To 4.5% @ 1500

Beale AFB, Site SS023 11/7/14

SS023 ISCO/AFCEC

Injections 456998.09.22.GL.01

0650 J. Paul/SAC arrives at trailer. Prep for day.

Task: Continue injections for phase 1

Weather: sunny, clear, high of 75°, low of 50°

Personnel: J. Paul/SAC.

0700 Tailgate meeting. Talked about potential for daylighting. Use of Sunscreen.

Equipment Geopump, # C1020090

Horriba U-10, # C102675

Hach Colorimeter,

water level meter, Heron, # G:01362

0745 Depart for SS023

0757 on-site. Begin collecting pre-injection [illegible]ls.

[illegible] starting system, it appears [illegible] permanganate tote was siphoned [illegible]ls overnight. Was instructed [illegible]mondson/NSO to start system [illegible] the dosatron to flush it out.

[illegible] System start up

0890 System seems to be running smoothly after walk-through. No daylighting or pressure spikes.

0848 Per request of K. Asmondson/NSO, all

11/7/14

injected 1,250 gallons of chase water into each well to dilute the 77 gallons of sodium permanganate that were siphoned into the wells overnight

Beale AFB, Site SS023 11/7/14

SS023 ISCO/AFCEC

Injections 456998.09.22.GL.01

wells will be purged for parameters at end of day.

0930 Take fotalizer/flow readings

1030 Take readings. No daylighting upon walk through.

1125 Take readings

1130 Collect mid-day water levels. No leaks upon walk-through

1230 Take readings

1300 Begin purging wells for permanganate data and water quality parameters

1325 take readings

1442 Well purges complete. Back to injection trailer

1450 reached target flush volume.

1455 System off.

1505 Site is buttoned-down for weekend. De-mob to trailer for paperwork.

1540 End of day

11/7/14

Location Site CS ISCO Date 11/10/14

Project / Client Injections

1200 TAKE Water Levels, Prior to Injecting. 75°, on site is Kevin Roberts.

1227 Begin injections to wells 017 + 009.

1338 Begin Water quality Sampling walk arounds Daylight

1500 Completed water quality Conduct Permagirite Hach testing

1545 Begin flushing of system

1605 Shut down wells

Location Site CS ISCO Date 11/11/14

Project / Client Injections

0800 @ Site 60° - Injections turn on fire hydrant. Switch Totes 3 4¼ in the one getting Ready Water Levels at observation wells

0903 Water flowing Set flow Rates,

0912 Begin Dosing.

0925 Conduct Walk arounds for Daylighting

1030 check for daylighting

1300 TAKE Water Levels Begin Water quality Readings

1400 Back on trailer Taking Bat-1, Bat-2 Readings.

1511 All quality Samples are Completed check for Daylighting

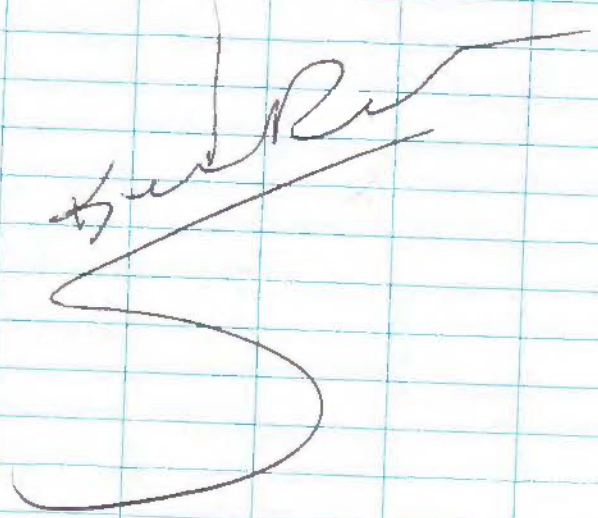
1520 Last Round of Water Levels

Location Site 23 Isco Date 11/4/14

Project / Client Injections

1530 Begin flushing.

1545 Done flushing packing up & cleaning up for the day



Location Site 32 Isco Date 11/12/14

Project / Client Injections

1050 00 east 60° Kevin Roberts on site.

Water Levels taken. Turn on water.

1015 Setting flows with just water

1025 START MIXTURE. Dosatron was moved to 5%

1100 Looking for Day lighting Looks Good.

1130 Set-up New EYE WASH.

1240 Shut off To get more DATA Steady

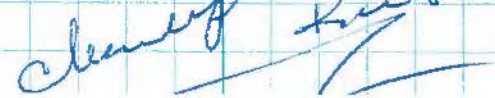
1255 Back-up Walk around No Day lighting

1300 Begin water reading Readings.

1510 Readings Done

1533 Begin flushing

1548 System off.



Location SS023 Date 11/13/14

Project / Client ISCO Injections

1040 Got to the site light dazzle taking water levels. turn on fire hydrant, Setting up for injections. 15' of perm. in second tote. Set flows

1048 Turn on the permag.

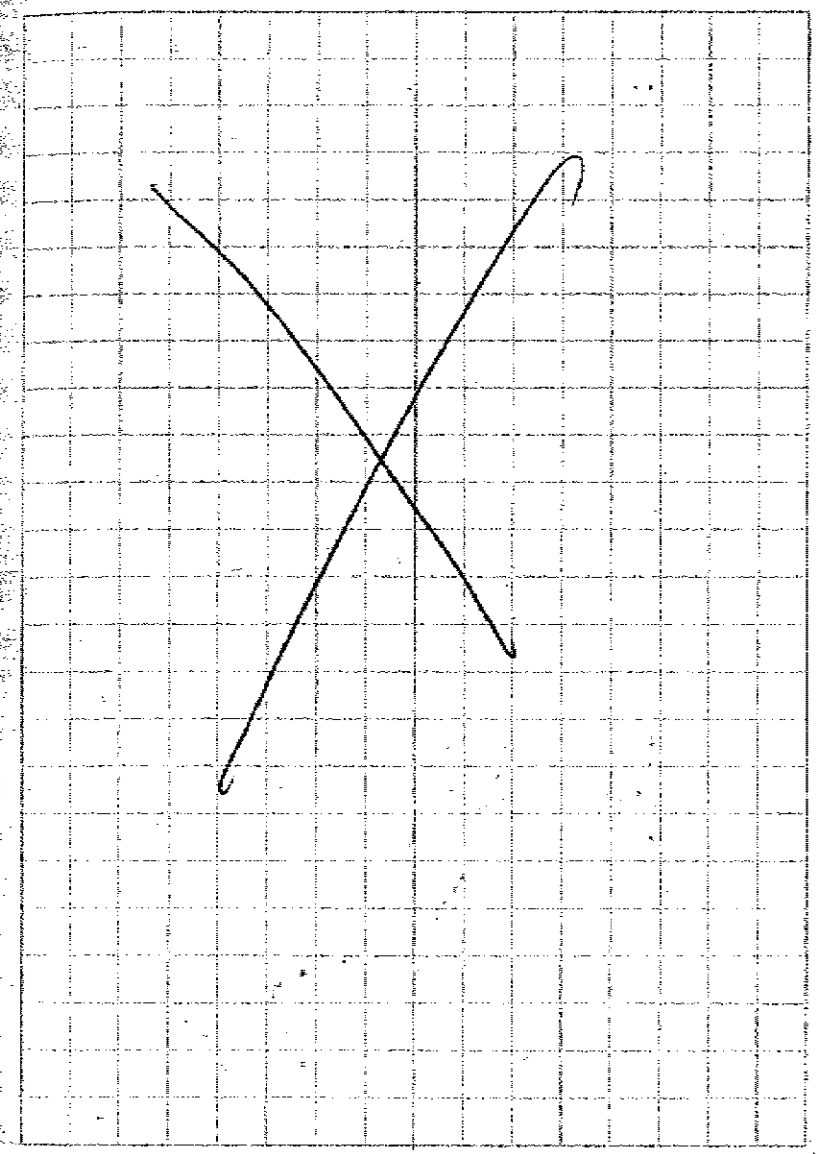
1130 Check for day lightings,

~~1245~~ 1145 hook rebar to suction line to keep hose on the bottom of the tote. going to do water quality readings early have to stop early.

1400 Done with injections

Location Date

Project / Client



Location SS-23 ISCO Date 11/17/14

Project / Client injections

38° Cold. Clear Sky's

0700 check injection points check trailer on hoses looks good from over the weekend.

0720 Getting Ready To TAKE water levels. and complete them.

0730 turn water on to injection trailer.

0745. setting water flows

~~0802~~ Switching Back To the first Tank which has 16 3/4" of product in it. 09:34 leaving To get pump

0802 Begin injections the dosatron skips on and off, I have to hit the on and off switch every so often to keep it going.

1204 Back Started ISCO injections again

Location SS-23 ISCO Date 11/17/14

Project / Client Injections.

1204 Begin pumping the 15" inches from one tote to the tote with the 5" in it.

1230 there was a total of 20" in last tank started @ 1204.

1300 walk around dosatron keeps shutting off. Need to leave trailer. got to keep dosatron Running Having to shut it off and turn it Back on To keep ISCO pumping. I will attemp to take water Quality Readings on the Road if pump keeps stalling I will only take Readings on Bat #1. and Bat 3.

1330 check for daylighting looks good.

1340 on other side and dosatron [illegible]

Location SS-23 ISCO Date 11/17/14

Project / Client Injections

CAN NOT keep dosatron Running. going to TAKE Water quality at Bat-1 & Bat #2 To keep dosatron Running. Begin at Bat-1

1427 Shut down 0017 hit mark. Trying to pump 009. Dosatron will Not Run under Low flow.

1512 Begin flush. Finish Bat-1 & Bat #2.

1600 Stop flush. Clean up and Leave Site

Location SS-23 ISCO Date 11/18/14

Project / Client INjections

0630 - Begin Tearing down phase 1 and moving into the transportation yard, moving Injection Trailer. Tearing down Berm areas.

1130 Building new Berm Running hoses - ETC.

1600 Leaving the Site for the Day. Site is Ready to go on phase 2 injections

88

Location SS-23 ISCO Date 11/12/14

Project / Client Injections

Raining 50°

0700 ON-Site taking water quality on 15, 16 and one 01 Before starting.

finish setting up Injection on phase #2.

1000 Begin phase 2

1030 Walk Around look for Day Lighting!

Begin Baseline water quality on 4 wells BAT-4A - 4B BAT-8 + BAT 5 there is a Bull dozer parked on BAT #5,

1130 Walk Around and Look for Day lighting - Still Raining.

1200 finished Water quality. TAKE Injection Readings

1300 Completed ISCO Readings do A complete Walk around for Daylighting.

1400 Check for Day lighting.

1432 Turn off ISCO Begin Flushing.

Location SS-23 ISCO Date 11/20/14 89

Project / Client Injections

foggy 48° 0002 CAST Ready for Rain.

0730 On-Site Tightening up Valve on incoming WATER.

0815 Setting flows. with flush WATER.

0830 Begin Injections.

0910 Completed Walk around for Day lighting.

0930 Check flows

1000 KATIE Arrived. HIS Tailgate

1010 Walk Around no Day lighting, Showing KATIE Set up

1030 Kevin Roberts offsite.

Check Flows @ 10:33

11:00 Walk Around, No DAY Lighting.

11:31 Check Flows.

11:55 Begin Baseline Water Quality on BAT 4B. Kevin R. onsite.

12:00 Walk Around, No Daylighting.

12:28 Sample - Permanbarak.

Location SS-23 ISCO Date 11/20/14

Project / Client Injections

1232 Check Flows. Begin Baseline Water Quality on BAT-4A. Sample at 12

1301 Walk Around, No Daylighting.

Begin Baseline Water Quality on BAT-3

1325 Begin Baseline Water Quality on BAT-5A.

1333 Check Flows. Heavy Rain

1402 Walk Around, No Daylighting

1500 Shutting Down ISCO To begin flushing.

1530 Done for the day Cleaning up

Kevin

Location SS-23 ISCO Date 11/20/14

Project / Client Injections

Kevin & Katie foggy Cold.

0700 had Tailgate Meeting

0720 TURN ON WATER

0733 TURN ON TRAILER
TURN ON ISCO.

0805 Walk Around, No Daylighting
Kevin Roberts offsite.

0830 Check Levels

0900 WALK AROUND, NO Daylighting

0930 Check Levels

0955 Kevin is back Katie leaves Site

1000 Complete Walk Around No Daylighting.

1015 Starting Water Quality Readings

1130 Completed WATER Quality Readings

1135 Conduct Walk grounds for Daylighting. Katie is Back On-Site.

1140 Kevin Roberts offsite.

1145 Took End of Day Water levels.

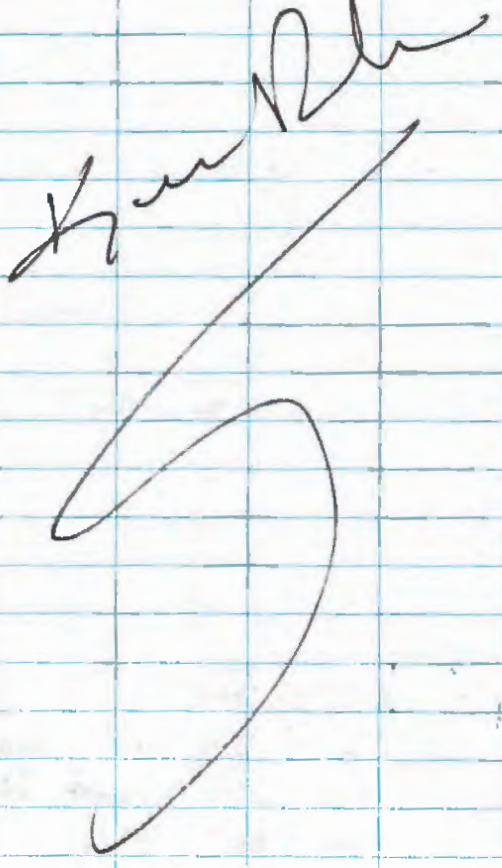
1200 Conducted Walk Around for Daylighting. No Daylight.

1210 K Onsite offsite

Location SS-23 ISCO Date 11/21/14

Project / Client Injections

1210 Turned off Dosimeter. Started Flushing.
1237 Completed Flushing. Turned water off.



Location SS-23 ISCO Date 11/24/14

Project / Client Injections

40° COLD, Sunny.

0730 ARRIVE ON-Site START WATER (NOT injections yet) TAKE WATER levels.
0755 TURN ON TRAILER injecting NOW.
0810 Could not keep dosatron running, switched to the second TANK.
0840 WALK Around No Daylighting it appears pressures are up slightly to the wells
0857 I think I found the problem with the dosatron it may be an Air leak on the Suction. Working with it trying To fix it.
0930 WALK Around / No Daylighting Dosatron going STRONG.
1030 WALK Around NO DAYlighting
1132 Shut down To go To the office.