FINAL

FIFTH FIVE-YEAR REVIEW REPORT
FOR
FORT RILEY, KANSAS

Prepared for

United States Department of the Army
Fort Riley

and

United States Army Environmental Command
Fort Sam Houston, Texas

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Final

FIFTH FIVE-YEAR REVIEW REPORT FOR FORT RILEY, KANSAS

Signature 14 September 2022

Date

Herbert J. Abel, Chief
Environmental Division
Directorate of Public Works

Signature 26 Sep 2022

Date

Michael J. Foote
Colonel, U.S. Army
Garrison Commander

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ACRONYMS AND ABBREVIATIONS

μg/dL	micrograms per deciliter
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
AED-R	Army Environmental Database-Restoration
Aerostar	Aerostar Environmental and Construction LLC
AOC	area of concern
AOPI	Area of Potential Interest
AR	Army Regulation
ARARs	Applicable or Relevant and Appropriate Requirements
ASR	Annual Summary Report
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, & Liability Act
CFR	code of federal regulations
cis 1,2,-DCE	*cis* 1,2-dichloroethene
cm^2	square centimeters
COCs	chemicals of concern
CPFi	Cancer Potency Factor for inhalation exposure
CPFo	Cancer Potency Factor for oral exposure
cy	cubic yards
DCA or DCFA	Dry Cleaning Facilities Area
DCE	dichloroethene
DD	decision document
DO	dissolved oxygen
DoD	Department of Defense
DPT	direct push technology
EOD	Explosive Ordnance Disposal
ESD	Explanation of Significant Difference
FFA	Federal Facility Agreement
FS	feasibility study
ft	foot/feet
FTRI	Fort Riley
FYR	five-year review
HALs	health advisory levels
HI	Hazard Index
HQAES	Headquarters Army Environmental System
IAP	Installation Action Plan
ICs	institutional controls
ID	identification
IEUBK	Integrated Exposure Uptake Biokinetic Model
IRP	Installation Restoration Program

IUR	Inhalation Unit Risk
KDHE	Kansas Department of Health and the Environment
KSWQS	Kansas Surface Water Quality Standards
L	liter
LFTC	Landfarm Treatment Cell
LTM	long-term monitoring
LTMCP	Long-Term Management Control Plan
LTO	Long-term operations
LUC	land use control
LUCIP	Land Use Control Implementation Plan
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MAAF	Marshall Army Airfield
MEC	munitions and explosives of concern
MNA	monitored natural attenuation
MPEO	Master Plan Environmental Overlay
MRS	Munitions Response Site
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
ng/L	nanograms/liter
NPL	National Priorities List
O&M	operations and maintenance
OB/OD	Open Burning/Open Detonation
ORP	oxidation reduction potential
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
PA	Preliminary Assessment
PAL	Project Action Level
PCA	1,1,2,2-tetrachloroethane, or TeCA
PCE	tetrachloroethene
PDI	Pre-Design Investigation
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutane sulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PM	project manager
PRG	Preliminary Remediation Goal
PWE	Directorate of Public Works – Environmental Division
RACR	Remedial Action Completion Report
RAOs	Remedial Action Objectives

RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action Plan
RfCi	inhalation Reference Concentration
RfDi	inhalation Reference Dose
RfDo	Oral Reference Dose
RG	remediation goal
RI	remedial investigation
ROD	Record of Decision
RPM	Remedial Project Manager
RPMP	Real Property Master Plan
RSKs	Kansas risk-based action levels
RSLs	Regional Screening Levels
SDWA	Safe Drinking Water Act
SFI	inhalation slope factor
SFL or SWFL	Southwest Funston Landfill
SFO	oral cancer slope factor
SHSAR	Sherman Heights Small Arms Range
SI	Site Investigation
SVOCs	semi-volatile organic compounds
TA2	Training Area 2
TBC	to-be-considered
TCE	trichloroethene
TeCA	1,1,2,2-tetrachloroethane, or PCA
TM	Technical Memorandum
UPRR	Union Pacific Railroad
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
U.S. Army	United States Department of the Army
USEPA	United States Environmental Protection Agency
UST	underground storage tank
UU/UE	unlimited use and unrestricted exposure
VC	vinyl chloride
VI	vapor intrusion
VOCs	volatile organic compounds
XRF	X-ray fluorescence

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EXECUTIVE SUMMARY

Five-year reviews (FYRs) are required when implementation of a remedial action (RA) results in hazardous substances, pollutants, or contaminants remaining on site that are above the levels allowing for unlimited use and unrestricted exposure (UU/UE). To meet this requirement, the scope of this review includes assessing the protectiveness of remedies at all sites that, at the end of the review period, had remedies in place and hazardous substances remaining at levels that do not allow for UU/UE.

Introduction

The United States Department of the Army (U.S. Army) conducted a FYR of the remedies implemented at five operable units (OUs): OU 001, OU 003, OU 005, OU 006, and OU 008 at Fort Riley (FTRI), which is a National Priorities List (NPL) site located in Geary, Clay, and Riley Counties in Kansas. The signature deadline for this FYR is 28 September 2022. This is the fifth FYR conducted at FTRI.

Remedies for the following OUs are covered by this FYR:

- *OU 001, Southwest Funston Landfill (SFL) (FTRI-003):* Institutional controls (ICs), long-term monitoring (LTM) for groundwater, Kansas River bank stabilization, and landfill cover maintenance;
- *OU 003, Dry Cleaning Facilities Area (DCFA) (FTRI-027):* Monitored natural attenuation (MNA) with ICs;
- *OU 005, 354 Area Solvent Detections (FTRI-031):* MNA with ICs;
- *OU 006, Open Burning/Open Detonation (OB/OD) Grounds:* Soil removal with treatment and disposal, groundwater/surface water monitoring, and ICs; and
- *OU 008, Sherman Heights Small Arms Range (SHSAR):* LTM and land use controls (LUCs).

There are nine OUs at FTRI, numbered OU 001 through OU 009. This FYR evaluated the performance and protectiveness of the remedies in place at five of the OUs. Three of the OUs (OU 001, 003, 005) had remedies in place at the time of the previous FYR and were evaluated in the fourth FYR (2017). Implementation of the remedy at two of the OUs (OU 006, OU 008) had not been initiated at the time the fourth FYR was conducted, but have since then remedies have been implemented and are in place and their performance and protectiveness was evaluated in this fifth FYR.

The four remaining OUs (OU 002, OU 004, OU 007, OU 009) are not addressed in this FYR because they either have achieved a UU/UE designation after remedy implementation (OU 002, OU 004 and OU 007) or a remedy has not been selected (OU 009).

Protectiveness Determinations

The purpose of the FYR is to evaluate the implementation and performance of the selected remedy at each OU and to determine if it is, or will be, protective of human health and the environment.

A summary of the remedy and protectiveness determination for each of the five FTRI OUs is provided in Table ES-1. The outcome of the FYR is a statement of protectiveness for each OU, as well as a list of issues, recommendations, and follow-up actions that may be needed, which are provided below.

Table ES-1. FTRI Site Summary

Site	Media	RAOs	Remedy Components				Protectiveness Determination	
			Soil Cover	Soil Removal	Monitoring / MNA	ICs / LUCs	Protective	Short-Term Protective
OU 001, SFL (FTRI-003)	Soil and Ground-water	• Minimize human and ecological direct contact with landfill contents. • Reduce the potential for leachate generation by reducing stormwater ponding and infiltration as practical. • Stabilize the Kansas River bank slope adjacent to OU 001 to prevent movement of the channel into the landfill and to prevent exposure and erosion of the landfill contents. • Prevent ingestion, inhalation, and dermal contact with groundwater having organic contaminant concentrations that exceed RGs.	✓		✓	✓		✓
OU 003, DCFA (FTRI-027)	Soil and Ground-water	• Prevent further degradation in groundwater in the Kansas River alluvium and off-site migration in groundwater of COCs that exceed cleanup goals. • Achieve cleanup goals of MCLs for COCs in groundwater in the Kansas River alluvium using natural and/or active remedial processes.			✓	✓	✓	
OU 005, 354 Area Solvent Detect-ions (FTRI-031)	Soil and Ground-water	• Prevent the potential for degradation of the surface waters of the Kansas River by reducing levels or eliminating contaminants from the margin of the Kansas River alluvial aquifer. • Reduce contamination levels to below MCLs within the Kansas River alluvial aquifer through use of natural and/or active remedial processes. • Reduce contaminant levels, to the extent practicable and appropriate, within the terrace aquifer, through natural and/or active remedial processes.			✓	✓	✓	

Site	Media	RAOs	Remedy Components				Protectiveness Determination	
			Soil Cover	Soil Removal	Monitoring/ MNA	ICs / LUCs	Protective	Short-Term Protective
OU 006, OB/OD Grounds	Soil, Ground -water, Surface water	<u>Soil</u> • Prevent/minimize migration of COCs that would result in groundwater with concentrations of chemicals exceeding MCLs or risk-based cleanup goals. • Prevent/minimize inhalation of vapors from soil with COCs that exceed risk-based cleanup goals and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range or a HI greater than 1. <u>Groundwater</u> • Prevent/minimize ingestion of or direct contact with groundwater with COCs that exceed MCLs or risk-based cleanup goals for COCs without MCLs, and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range. • Prevent/minimize ingestion of groundwater with COCs that exceed MCLs or risk-based cleanup goals for COCs without MCLs, and/or have a HI greater than 1. • Prevent/minimize inhalation of vapors from groundwater that has COCs that exceed MCLs or risk-based cleanup goals and/or a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range or a HI greater than 1. <u>Surface Water</u> • Prevent/minimize direct contact with surface water with COCs that exceed the risk-based cleanup goals and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range. • Meet the criteria of the KSWQS.		✓	✓	✓	✓	

Site	Media	RAOs	Remedy Components				Protectiveness Determination	
			Soil Cover	Soil Removal	Monitoring/ MNA	ICs / LUCs	Protective	Short-Term Protective
OU 008, SHSAR	Soil	• Prevent ingestion/direct contact with lead in soil having concentrations in excess of 400 mg/kg.			✓	✓		✓

COC = chemical of concern
ICs = institutional controls
MCL = maximum contaminant level
OB/OD = Open Burning/Open Detonation
RG = remediation goal
SHSAR = Sherman Heights Small Arms Range
DCFA = Dry Cleaning Facilities Area
KSWQS = Kansas Surface Water Quality Standards
mg/kg = milligrams per kilogram
OU = operable unit
SFL = Southwest Funston Landfill
USEPA = U.S. Environmental Protection Agency
HI = hazard index
LUCs = land use controls
MNA = monitored natural attenuation
RAO = remedial action objective

Site Protectiveness Statements

As summarized below, based on the data reviewed, interviews, and site inspections, the remedies at OU 001, OU 003, OU 005, OU 006, and OU 008 are functioning as intended by their respective decision documents (DDs; Records of Decision [RODs]). One issue was identified for OU 001 and one issue was identified for OU 008 that could affect the future protectiveness of the remedies.

OU 001, Southwest Funston Landfill

The remedy at OU 001, SFL, currently protects human health and the environment because direct exposure to buried waste is prevented; degradation of the underlying groundwater by minimizing migration of potential constituents from waste to groundwater is prevented by the landfill cover; and exposure to groundwater is prevented by enforcement of ICs that prohibit drilling and installation of water wells, or other activities that could damage the integrity of the landfill cover. However, for the remedy to be protective in the long term, elevated per-and polyfluoroalkyl substances (PFAS) detected in groundwater should be further investigated by defining the nature and extent of PFAS contamination and determining the associated exposure risks.

OU 003, Dry Cleaning Facilities Area

The remedy at OU 003, DCFA, which consists of MNA with ICs, is protective of human health and the environment. Monitoring demonstrates that biodegradation continues to effectively reduce concentrations of chemicals of concern (COCs) and ICs are in place to prevent exposure to groundwater by prohibiting drilling and installation of water wells.

OU 005, 354 Area Solvent Detections

The remedy at OU 005, Building 354 Solvent Area Detections, is protective of human health and the environment. Enforcement of ICs that prohibit drilling and installation of water wells prevent exposure to groundwater; monitoring demonstrates that biodegradation continues to effectively reduce concentrations of COCs; and ICs are in place to prevent exposure to groundwater and prohibit drilling and installation of water wells.

OU 006, Open Burning/Open Detonation (OB/OD) Grounds

The remedy for OU 006, OB/OD Grounds, is protective of human health and the environment. Source removal has been performed; monitoring demonstrates that biodegradation continues to effectively reduce concentrations of COCs; and ICs are in place to prevent exposure to groundwater and prohibit drilling and installation of water wells.

OU 008, Sherman Heights Small Arms Range

The remedy for OU 008, SHSAR, currently protects human health and the environment because: annual fence and sign inspections/maintenance and LUC inspections are performed; biennial soil sampling outside the fence-line surrounding the former range is conducted to ensure that soil containing lead that exceeds the remediation goal (RG) of 400 milligrams per kilogram (mg/kg) has not migrated off slope; exposure to soil that contains lead concentrations that exceed the RG has been prevented through maintaining fencing and signage; and groundwater monitoring will be performed every five years to ensure that lead in soil has not migrated into groundwater.

However, for the remedy to be protective in the long term, the areas of soil contamination above the lead RG outside the fence-line must be identified; the fence-line must be expanded to encompass the area where concentrations of lead exceed the RG based on the results of the additional sampling; and the footprint of the LUC boundary must be revised in the Real Property Master Plan (RPMP).

Five-Year Review Summary Form

The results of the FYR for each of the in-place remedies at the five FTRI OUs are summarized in the form below.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Fort Riley, Kansas		
EPA ID: KS6214020756		
Region: 7	**State:** KS	**City/County:** Junction City, Geary, Clay, and Riley Counties
SITE STATUS		
NPL Status: Final		
Multiple Sites? Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** United States Department of the Army		
Author name (Federal or State Project Manager): Jeff Keating, Installation Restoration Program Manager		
Author affiliation: United States Department of the Army, Fort Riley		
Review period: 5 May 2021 – 28 September 2022		
Date of site inspection: 16 September 2021		
Type of review: Statutory		
Review number: 5		
Initial triggering action date: 6 August 1997		
Due date *(five-year cycle after initial triggering action date)*: 28 September 2022		

Issues/Recommendations				
Sites Without Issues/Recommendations Identified in the Periodic Review:				
OU 003, OU 005, OU 006				
Issues and Recommendations Identified in the Five-Year Review:				
Site: OU 001				
Issue Category: Remedy Performance				
Issue: Emerging contaminants PFAS were detected in groundwater at concentrations that exceeded screening criteria.				
Recommendation: Conduct the investigations necessary to define the nature and extent of PFAS contamination and determine the associated exposure risks.				
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	28 September 2023
Site: OU 008				
Issue Category: Remedy Performance				
Issue: Areas of soil contamination above the lead RG were identified in 2020 outside the fence-line on the west side of the site.				
Recommendation: Conduct additional composite soil sampling outside the fence-line to delineate the area where concentrations of lead in soil exceed the RG; expand the fence-line to encompass the area where concentrations of lead in soil exceed the RG based on the results of the additional sampling; and revise the footprint of the LUC boundary in the RPMP.				
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	30 September 2022

Protectiveness Statement(s)		
Site: OU 001	*Protectiveness Determination:* Short-term Protective	*Addendum Due Date (if applicable):*
Protectiveness Statement: The remedy at OU 001, SFL, currently protects human health and the environment because direct exposure to buried waste is prevented; degradation of the underlying groundwater by minimizing migration of potential constituents from waste to groundwater is prevented by the landfill cover; and exposure to groundwater is prevented by enforcement of ICs that prohibit drilling and installation of water wells, or other activities that could damage the integrity of the landfill cover. However, for the remedy to be protective in the long term, elevated PFAS detected in groundwater should be further investigated by defining the nature and extent of PFAS contamination and determining the associated exposure risks.		

Protectiveness Statement(s)		
Site: OU 003	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):*
Protectiveness Statement: The remedy at OU 003, DCFA, which consists of MNA with ICs, is protective of human health and the environment. Monitoring demonstrates that biodegradation continues to effectively reduce concentrations of COCs; and ICs are in place to prevent exposure to groundwater by prohibiting drilling and installation of water wells.		

Protectiveness Statement(s)		
Site: OU 005	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):*
Protectiveness Statement: The remedy at OU 005, Building 354 Solvent Area Detections, is protective of human health and the environment. Enforcement of ICs that prohibit drilling and installation of water wells prevent exposure to groundwater; monitoring demonstrates that biodegradation continues to effectively reduce concentrations of COCs; and ICs are in place to prevent exposure to groundwater and prohibit drilling and installation of water wells.		

Protectiveness Statement(s)		
Site: OU 006	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):*
Protectiveness Statement: The remedy for OU 006, OB/OD Grounds, is protective of human health and the environment. Source removal has been performed; monitoring demonstrates that biodegradation continues to effectively reduce concentrations of COCs; and ICs are in place to prevent exposure to groundwater and prohibit drilling and installation of water wells.		

Protectiveness Statement(s)		
Site: OU 008	*Protectiveness Determination:* Short-term Protective	*Addendum Due Date (if applicable):*
Protectiveness Statement: The remedy for OU 008, SHSAR, currently protects human health and the environment because: annual fence and sign inspections/maintenance and LUC inspections are performed; biennial soil sampling is conducted outside the fence-line surrounding the former range to ensure that soil containing lead that exceeds the RG of 400 mg/kg has not migrated off slope; exposure to soil that contains lead concentrations that exceed the RG has been prevented through maintaining fencing and signage; and groundwater monitoring will be performed every five years to ensure that lead in soil has not migrated into groundwater. However, for the remedy to be protective in the long term, the areas of soil contamination above the lead RG outside the fence-line must be identified; the fence-line must be expanded to encompass the area where concentrations of lead exceed the RG based on the results of the additional sampling; and the footprint of the LUC boundary must be revised in the RPMP.		

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1. INTRODUCTION

1.1 PURPOSE

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy is or will be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports. In addition, FYR reports identify issues found during the review, if any, and recommendations to address them.

The United States Department of the Army (U.S. Army) conducted this FYR of the remedies implemented at five operable units (OUs) at Fort Riley (FTRI), which is a National Priorities List (NPL) site located in Geary, Clay, and Riley Counties in Kansas (Figure 1-1).

The five OUs reviewed in this FYR are designated with the Army Environmental Database-Restoration (AED-R) site name FTRI. The AED-R has been replaced by Headquarters Army Environmental System (HQAES), for which the site designators are listed below:

- OU 001, Southwest Funston Landfill (SFL; FTRI-003)—HQAES Environmental Site identification (ID) 20605.1003;
- OU 003, Dry Cleaning Facilities Area (DCFA; FTRI-027)—HQAES Environmental Site ID 20605.1026;
- OU 005, 354 Area Solvent Detections (FTRI-031)—HQAES Environmental Site ID 20605.1030
- OU 006, Open Burning/Open Detonation (OB/OD) Grounds (Range 16) (FTRI-009)—HQAES Environmental Site ID 20605.1009; and
- OU 008, Sherman Heights Small Arms Range (SHSAR Impact Slope) (FTRI-001-R-02)—HQAES Environmental Site ID 20605.1076.

The signature deadline for this FYR is 28 September 2022. This is the fifth FYR for FTRI.

1.2 AUTHORITY

The U.S. Army is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the Site, the President shall review such remedial action no less often than every five years after the initiation of the selected remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such Site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."*

The United States Environmental Protection Agency (USEPA) interpreted this requirement further in the NCP [40 Code of Federal Regulations (CFR) §300.430(f)(4)(ii)], stating:

> *"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after initiation of the selected remedial action."*

This is the fifth FYR for FTRI. The triggering action for the first statutory review was the signature date of the Record of Decision (ROD) for OU 001, SFL, dated 6 August 1997. The triggering action for this fifth FYR was the planned completion date for the fourth FYR of 20 September 2017, five years after completion of the Third FYR, dated 20 September 2012.

The U.S. Army is the lead agency for the OUs at FTRI, and is represented by the United States Army Environmental Command (USAEC). Remedies for the following OUs are covered by this FYR:

- *OU 001, SFL (FTRI-003):* Institutional controls (ICs), long-term monitoring (LTM), Kansas River bank stabilization, and landfill cover maintenance;
- *OU 003, DCFA (FTRI-027):* Monitored natural attenuation (MNA) with ICs;
- *OU 005, 354 Area Solvent Detections (FTRI-031):* MNA with ICs;
- *OU 006, OB/OD Grounds:* Soil removal with treatment and disposal, groundwater/surface water monitoring, and ICs; and
- *OU 008, SHSAR:* LTM and land use controls (LUCs).

There are nine OUs at FTRI, numbered OU 001 through OU 009 (Figure 1-2). The numeric designations following the OUs include three digits (e.g., "OU 001") that are consistent with the nomenclature used in documents reviewed for this fifth FYR. The three-digit numeric designations throughout this FYR report are equivalent to the USEPA two-digit nomenclature (e.g., "OU 01"). This FYR evaluated the performance and protectiveness of the remedies in place at five of the OUs. Three of the OUs (OU 001, 003, 005) had remedies in place at the time of the previous FYR (United States Army Corps of Engineers [USACE], 2017) However, implementation of the remedy at two of the OUs (OU 006, OU 008) had not been initiated at the time the fourth FYR was conducted but have since had remedies implemented and in place and their performance and protectiveness was evaluated in this fifth FYR.

The four remaining OUs (OU 002 [Pesticide Storage Facility], OU 004 [Former Fire Training Area-Marshall Army Airfield], OU 007 [World War I Incinerator NW Camp Funston], and OU 009 [Camp Forsyth Landfill Area 2]) are not subject to this FYR. OUs 002, 004 and 007 have achieved unlimited use and unrestricted exposure (UU/UE) designations. A remedy has not been implemented for OU 009.

Aerostar Environmental and Construction LLC (Aerostar) conducted this FYR on behalf of USAEC. This report documents the results of the fifth FYR, which was conducted from 5 May 2021 through 28 September 2022. The previous FYR was completed on 20 September 2017 (USACE, 2017).

The FYR is required since hazardous substances, pollutants, or contaminants remain at OU 001, OU 003, OU 005, OU 006, and OU 008 above levels that allow for UU/UE.

1.3 COMMON ELEMENTS OF THE FIVE-YEAR REVIEW PROCESS

1.3.1 Administrative Components

The U.S. Army initiated this FYR in May 2021 and scheduled its completion for 28 September 2022. The review team included Allison Bailey and Andrea Heinzenberger, with Aerostar. On 5 May 2021, a scoping call was held with the USACE and USAEC to discuss FTRI and items of interest as they related to the protectiveness of the remedies currently in place at the five OUs. A review schedule was established that consisted of the following:

- community notification;
- document review;
- data collection and review;
- site inspection;
- interviews; and
- FYR report development and review.

The fifth FYR included interviews with U.S. Army staff and regulatory agencies, review of relevant site documents, and a site inspection conducted 16 September 2021. In addition, changes in cleanup levels, toxicity values and Applicable or Relevant and Appropriate Requirements (ARARs) were also reviewed, as well as relevant regulatory guidance documents.

1.3.2 Community Involvement

A Public Notice was published in the Junction City Union newspaper on December 28, 2021, to notify the community of the commencement of the FYR. The notice included a brief description of the sites being reviewed, the FYR process, contact information for any questions that may arise, and an invitation for members of the community to participate in the FYR process. No public contacts, comments, or questions were received after the notice was published. The Public Notice is presented in Appendix A.

A second Public Notice will be issued to announce the completion of the FYR. The FYR report will be made available to the public once it has been finalized, and a copy of the document will be placed in the Information Repository.

1.3.3 Document Review

During this FYR, relevant site-related documents including Remedial Investigations (RIs), Feasibility Studies (FSs), Pre-Design Reports and addenda, Remedial Action Completion Reports (RACRs), Remedial Design work plans, RODs/DDs and addenda, Long-Term Monitoring (LTM) Plans, Annual Summary Reports (ASRs) and Technical Memoranda (TMs), Land Use Control Implementation Plans (LUCIPs), Real Property Master Plans (RPMPs), Long-Term Operations (LTO)/LTM Reports, monitoring and inspection records, the 2017 FYR, and correspondences and regulatory guidance documents were reviewed. A complete list of the documents reviewed is provided in Appendix B.

1.3.4 Site Inspection

The FYR site inspection for FTRI was conducted on 16 September 2021 to visually inspect and document the conditions of the five OUs for inclusion in the FYR Report, as well as to review of any issues noted from Annual LTM inspections and the 2017 FYR. The site inspection included a teleconference with stakeholders including FTRI, USACE, USEPA, Kansas Department of Health and Environment (KDHE), USAEC, and Aerostar. Following the teleconference, representatives from FTRI, USACE, and Aerostar performed the site inspection.

The following personnel were present and performed the site inspection:

- Gary Richards – USACE Kansas City District Project Manager (PM);
- Jeff Keating – FTRI Directorate of Public Works – Environmental Division (PWE) Installation Restoration Program (IRP) Manager;
- Kelly Peterson – USACE Kansas City District; and
- Allison Bailey (PM) and Andrea Heinzenberger – Aerostar.

Appendix C provides details of the Site Inspection including the participants, FYR Site Inspection Checklist, and photographs. Observations made during the inspection are provided in the site-specific discussions.

1.3.5 Interviews

During the FYR process, interviews were conducted with parties knowledgeable of the sites, including current landowners and regulatory agencies involved in site activities. The purpose of the interviews is to document views about current site conditions, problems, or related concerns. Table 1-1 provides a list of persons interviewed. The complete interview records are included in Appendix D.

Table 1-1. Interviewee List

Name	Title/Affiliation	Date Interviewed	Interview Method	Contact Information
Jeff Keating	PWE IRP Manager/ FTRI	17 Sep 2021	Written	785-239-3194 jeffrey.f.keating.civ@army.mil
Michael Bowlby	Environmental Support Manager / USAEC	10 Sep 2021	Written	210-846-8652 michael.a.bowlby.civ@mail.mil
Margaret Townsend	KDHE Bureau of Environmental Remediation / Unit Chief Federal Facilities	15 Sep 2021	Written	785-296-8801 Margaret.Townsend@ks.gov
Danny O’Connor[1]	Remedial Project Manager / USEPA Region 7	29 Sep 2021	Written	913-551-7868 oconnor.daniel@epa.gov
Kelly Peterson	Geologist / USACE, Kansas City District	29 Sep 2021	Written	785-424-3859 kelly.r.peterson@usace.army.mil

[1] Danny O’Connor was the USEPA RPM when the interviews were conducted in September 2021. Angela Sena is the current RPM.

FTRI = Fort Riley
IRP = Installation Restoration Program
KDHE = Kansas Department of Health and Environment
PWE = Directorate of Public Works – Environmental Division
RPM = Remedial Project Manager
USACE = Army Corps of Engineers
USAEC = U.S. Army Environmental Command
USEPA = U.S. Environmental Protection Agency

2. BACKGROUND

The information presented in this section includes a summary of the background, physical characteristics, land resources and use of FTRI as presented in the Final LUCIP (Aerostar, 2015) for OU 001, OU 003, and OU 005; and the RODs for the five OUs: OU 001 (U.S. Army, 1995), OU 003 (U.S. Army, 2008), OU 005 (U.S. Army, 2006), OU 006 (U.S. Army, 2016), and OU 008 (U.S. Army, 2015).

FTRI is in north-central Kansas, north-northeast of Junction City and west of Manhattan, Kansas. The installation occupies approximately 101,733 acres in Clay, Geary, and Riley Counties (Figure 1-1). Interstate 70, Junction City, and Ogden bound the installation to the south, and Milford Lake bounds part of the western side of the installation. There are six cantonment areas in FRTI, including: Main Post, Camp Forsyth, Camp Funston, Camp Whitside, Marshall Army Airfield, and Custer Hill.

2.1 PHYSICAL CHARACTERISTICS

The physical characteristics of FTRI are summarized below; characteristics of the individual OUs are provided in Sections 3 through 7. The FTRI is situated along the north banks of the Kansas and Republican Rivers in north central Kansas (Figure 1-1), near the cities of Manhattan, Ogden, Junction City and Grandview Plaza, Kansas.

The topography of FTRI and the surrounding area consists of a low plain that has been eroded by streams and rivers. FTRI is located within the Flint Hills Uplands physiographic region. Sedimentary bedrock strata dip gently to the west-northwest. East-facing escarpments of more resistant rock units are separated by gentle, westward sloping plains. The resulting topography can be divided into upland areas with bluffs along alluvial valleys, and lowland areas that consist of alluvial plains and associated terraces. The upland areas are dissected by numerous ephemeral, intermittent, and perennial streams; the lowlands areas occur along the banks of the major rivers in the area: The Republican, Smoky Hill, and Kansas Rivers. Note that the Republican and Smoky Hill Rivers converge at Junction City to become the Kansas River.

The general topography around FTRI consists of plains incised by steep drainage features. Terrain on the installation varies among alluvial bottomlands, steep slopes and hilly relief, and flat-lying or slightly dipping uplands. FTRI is composed of two types of alluvial bottomlands: wide meandering floodplains of major rivers with associated terraces along the Republican, Smoky Hill and Kansas Rivers, and areas created by smaller creeks and streams that cut the uplands.

FTRI is underlain by bedrock of Pennsylvanian (in deeper subsurface) and Permian age. The bedrock is exposed at the ground surface in many areas or covered by a thin mantle of loess. The Permian bedrock units consist of alternating layers of shale and limestone.

Groundwater at FTRI occurs in alluvial deposits along the major streams and rivers and in the fissured, near-surface limestone of the upland areas (Fort Riley, 2001). Water table maps indicate that the direction of groundwater flow in the alluvial aquifer generally flows south down the valley towards the Republican River, however it can be highly variable near the Kansas and Republican Rivers in the FTRI vicinity where the flow is to the southeast, but can also be toward or away from the river depending on its stage.

Groundwater is unconfined in the terrace deposits (terrace aquifer). Groundwater within the terrace aquifer is present directly above the bedrock surface, with a saturated thickness ranging from zero (dry) to about 16 feet (ft). The bedrock surface has been eroded by rivers and streams. On the terrace, the bedrock topography was sculpted by tributary streams, which flowed into the ancestral Kansas River at roughly right angles to the direction of river flow. Groundwater flow in the terrace aquifer on FTRI is controlled by the topography of the bedrock surface, which imparts a southerly direction of groundwater flow.

The installation is located between two major surface water reservoirs: Tuttle Creek Lake completed in 1962, and Milford Lake completed in 1965. Surface waters on FTRI are within the Kansas River and Republican River drainage basins and consist of intermittent and perennial creeks, ponds, lakes, wetlands, and rivers. Surface water runoff at FTRI runs to, and is drained by, the Republican River, Kansas River, Smoky Hill River, Threemile Creek, Sevenmile Creek, Honey Creek, Wildcat Creek, and numerous smaller tributaries. The majority of FTRI lies north of the Republican and Kansas Rivers. However, a small portion of the installation, including the Marshall Army Airfield, lies south of the Kansas River, with drainage north to the Kansas River and west to the Smoky Hill River.

2.2 LAND RESOURCE AND USE

FTRI is an active U.S. Army installation under the jurisdiction of Installation Management Command. FTRI's primary mission is to train forces to meet joint force requirements across the full spectrum of current and future operations. About 71,000 of the installation's approximately 101,000 acres are managed for multiple use. While the installation's primary mission is to be a warfighting center for the U.S. Army, it also provides an area where a variety of outdoor recreation activities can be pursued by both military personnel and the general public. The drinking water for the Main Post Public Water Supply on FTRI comes from a well field containing a total of eight wells located on the installation. Groundwater is withdrawn from alluvial aquifers that are recharged by the Republican River.

2.3 HISTORY OF CONTAMINATION

Previous investigations have identified impacts to soil and groundwater resulting from historical activities at the five OUs at FTRI addressed by this FYR. Contaminants associated with these OUs include chlorinated solvents (volatile and semi-volatile organic compounds [VOCs/SVOCs]) and lead.

The history of contamination is provided by OU within each OU-specific subsection of this FYR report (Sections 3.3, 4.3, 5.3, 6.3, and 7.3).

2.4 EMERGING CHEMICALS

PFOS, PFOA, perfluorobutane sulfonic acid (PFBS), and perfluorohexane sulfonate (PFHxS), are part of a larger class of emerging chemicals known as PFAS.

In 2016, the USEPA issued new lifetime health advisories (HAs) for two PFAS: PFOS and PFOA. The HAs established by USEPA are 70 nanograms/liter [ng/L] or 70 parts per trillion [ppt]) for PFOS or PFOA individually, or 70 ppt as the total concentration of PFOS and PFOA. In June 2022, USEPA (2022) issued interim updated lifetime HAs of 0.004 ppt for PFOA and 0.02 ppt for PFOS, and final lifetime HAs of 2000 ppt for PFBS and 10 ppt for hexafluoropropylene oxide dimer acid (HFPO-DA, or GenX).

The risk-based screening levels for PFOA, PFOS, and PFBS for soil and groundwater are documented in the December 2019 *USEPA Interim Recommendations to Address Groundwater Contaminated with Perfluorooctanoic Acid and Perfluorooctanesulfonate* (USEPA, 2019) while the risk-based screening levels for PFBS for groundwater are documented in the April 2021 *USEPA Human Health Toxicity Values for PFBS and Related Compound PFBS* (USEPA, 2021). In July 2022, DoD established a screening level of 600 ppt for PFBS, 4 ppt for PFOS, 39 ppt PFHxS, and for 6 ppt for individual PFOA, perfluorononanoic acid (PFNA), and HFPO-DA in groundwater when evaluating the nature and extent of PFAS at DoD installations (DoD, 2022). HFPO-DA has primarily been used as a replacement for PFOA in the manufacture of fluoropolymers, so it is not likely to have been released at the vast majority of DoD properties (DoD, 2022). Screening levels are risk-based, chemical-specific values based on default exposure parameters, USEPA-approved toxicity values, and a hazard quotient of 0.1 and an incremental lifetime cancer risk of 1E-06. In general, when contaminant concentrations fall below screening levels, further action or investigation is not required.

As part of the Army's commitment to supplying quality drinking water at its installations and in response to the lifetime HA released by USEPA, the Army implemented a comprehensive PFAS drinking water testing program. In 2019, the U.S. Army initiated a review of historical records at DoD sites across the country to identify areas having the potential for PFAS use. As a proactive measure, FTRI initiated an emerging contaminant investigation for PFAS. The Preliminary Assessment/ Site Investigation (PA/SI) process was guided by information presented in a Memorandum for Investigating PFAS within the Department of Defense Cleanup Program issued by the DoD (DoD, 2019). The objective of the PA/SI was to identify locations that are areas of potential interest (AOPIs) based on whether there was use, storage or disposal of any PFAS-containing material and determine the presence or absence of PFOS, PFOA or PFBS at or above screening levels.

Groundwater sampling and analysis for PFAS was conducted in 2020 and the Final PA/SI report concluded that one area associated with this FYR, OU 001, SFL (AOPI, FFTA-SFL [OU 001, FTRI-028, 2065.1027]) required further evaluation because PFOA was present in groundwater at concentrations exceeding the October 2019 risk screening levels of 40 ng/L (Arcadis, 2022).

Groundwater sampling and analysis for PFAS conducted in 2020 found one off-post drinking water well had PFAS detections exceeding the USEPA HA. It is improbable for the PFAS detected in the off-post drinking water well to have originated from OU 001.

- The PFAS would have to cross over to the other side of the river, contradicting the groundwater model finding that the Kansas River segments FTRI into groundwater flow compartments as it flows within the aquifer;
- The PFAS would have to migrate upstream, against the Kansas River ground flow, contradicting the groundwater model finding that the Kansas River is a strong sink for regional groundwater discharge; and
- The PFAS would have to migrate upstream of the Kansas River ground flow a distance of 1.65-2.8 miles, with none to minimal dilution (as the PFOA and PFOS levels detected at the drinking water

well and OU 001 are approximately the same), contradicting a hydrogeology principle that downgradient concentrations will decrease with migration distance due to dilution.

The groundwater sampling and analysis for PFAS conducted in 2020 also discovered PFAS in the soil and groundwater at Marshall Army Airfield (MAAF). Groundwater flow modeling shows that groundwater flows from MAAF north and off-post into private lands, potentially impacting off-post drinking water, including the currently impacted off-post well.

Further CERCLA investigation of PFAS is planned at FTRI (including MAAF and OU 001) for 2022 to define the nature and extent of the identified PFAS in groundwater based on the PA/SI. A review of the PFAS groundwater data is provided in the subsequent Emerging Chemical discussion in the Question B Technical Assessment for OU 001 (Section 3.9.4) while Appendix H provides Tables and figures for OU 001 from the PA/SI report.

3. OU 001 - SOUTHWEST FUNSTON LANDFILL

3.1 SITE DESCRIPTION

OU 001 is an IRP site and is identified in the FTRI Installation Action Plan (IAP) as FTRI-003 (HQAES Environmental Site ID 20605.1003), SFL. OU 001 is also referred to by the acronyms “SWFL” or “SFL” in some supporting documents. The site covers approximately 120 acres in the southern portion of FTRI, adjacent to the southwest corner of the Camp Funston cantonment area.

The limits of the OU 001 extend from the north bank of the Kansas River north to near Well House Road, and east from the pre-1951 flood Kansas River channel to just west of Threemile Creek (Figure 3-1). The waste was placed in trenches approximately 16 ft in depth in an area that covers approximately 107 acres.

3.1.1 Physical Characteristics

The topography at OU 001 slopes very gently toward the east-southeast and lies entirely within the 50-year floodplain and alluvial bottomlands of the Kansas River. The landfill area was graded and a continuous soil cover was constructed as part of closure activities in 1983. The area was then seeded with native grasses. Steep slopes exist along the banks of the Kansas River to the south and along Threemile Creek to the east. Depth to groundwater is variable and highly dependent upon the flow/stage of the Kansas River. During periods of average flow, groundwater is present at a depth of approximately 20 ft below ground surface (bgs). Bedrock is at a depth of approximately 45 ft bgs. The dominant groundwater flow is to the southeast toward the Kansas River (Figure 3-1).

3.1.2 Land and Resource Use

OU 001 is located adjacent to the Kansas River and is bounded by vacant land to the west and the Camp Funston cantonment area to the north and east (Figure 3-1). Currently, the entire OU 001 is within a zone designated as “Open Space” in the Environmental Overlay of the FTRI RPMP, dated 15 May 2007. Zones designated as “Open Space” include conservation areas, buffer spaces, undeveloped land, utility easements, safety clearances and security areas. Land use at OU 001 is not expected to change. The groundwater underlying OU 001 is currently not a drinking water source.

3.2 SITE CHRONOLOGY

The chronology of key events for OU 001 is provided in Table 3-1.

Table 3-1. Chronology of Key Events at OU 001

Event	Date
Landfill Operations Began	1950s
Landfill Operations Ceased	1981
Landfill Closed	1983
Initial Discovery of Problem/Contamination	April 1984
RI Report/Revised	1993/1994
Engineering Evaluation/Cost Analysis Report for Riverbank Stabilization and Landfill Cover Repairs	July 1993
Action Memorandum	December 1993
Riverbank Stabilization over 1,200 ft	April 1994
Proposed Plan	November 1994
Landfill Cover Repair with 160,000 cy of fill placed	1994-1995
ROD	1 November 1995
Landfill Cover Improvements	1996 - 1997
O&M Plan approved	March 1996
First FYR	September 2002
USEPA approves request to change groundwater monitoring from semi-annual to annual and to delete analysis for lead	July 2006
Second FYR	September 2007
RACR signed by USEPA	February 2010
USEPA approved reduction in the groundwater monitoring frequency from annual to a five-year schedule to coincide with FYRs	February 2010
LTMCP approved	March 2011
Third FYR	September 2012
Fourth FYR	September 2017

cy = cubic yards
FYR = five-year review
O&M = Operations and Maintenance
RI = Remedial Investigation
USEPA = United States Environmental Protection Agency
ft = feet
LTMCP = Long-Term Management Control Plan
RACR = Remedial Action Completion Report
ROD = Record of Decision

3.3 HISTORY OF CONTAMINATION

The landfill at OU 001 received waste products from the mid-1950s to 1981. The wastes included typical municipal waste and industrial wastes from various activities at the installation. Some of these industrial wastes were reported to have contained hazardous substances and were identified as potential sources of contamination. The types of wastes reportedly disposed at the landfill included wastes generated by vehicle and aircraft maintenance shops, print shops, furniture repair shops, painting facilities, oil analysis laboratory, sterilized biological waste, pesticide/herbicide storage and preparation, laundry and DCFA, and wastewater treatment plants. The wastes may also have included metal-laden oils, solvents, inks, paints and heavy metals, and dried wastewater treatment plant sludge.

An RI in 1992 and 1993 confirmed the presence of VOCs in groundwater with exceedances of the Federal Maximum Contaminant Levels (MCLs) for drinking water. These included vinyl chloride (VC), 1,2-dichloroethane, benzene and 1,1,2-trichloroethane. Two additional chemicals of concern (COCs), cis-1,3-dichloropropene and 1,1,2,2-tetrachloroethane, did not have MCLs, but exceeded Kansas risk-based action levels (RSKs).

3.4 INITIAL RESPONSE

The landfill area was graded and a continuous soil cover was constructed as part of KDHE-approved closure activities, and the landfill was closed in 1983 under a closure plan administered by the KDHE under KDHE Permit Number 370 (USEPA 1991, Fort Riley 1997).

3.5 BASIS FOR TAKING ACTION

The basis for taking action was unacceptable risk associated with direct contact with the waste and concentrations of the following COCs in groundwater that exceeded the MCLs: benzene, 1,2-dichloroethane, cis-1,3-dichloropropene, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, and VC. COCs were not identified for other media.

Additionally, an Engineering Evaluation/Cost Analysis performed in 1993 to assess the appropriateness of performing non time critical removal actions at OU 001 identified the need for physical improvements of the landfill, including riverbank stabilization. These were initiated in January 1994 and completed in 1996.

3.6 REMEDIAL ACTION

3.6.1 Remedy Selection

The remedy for OU 001 was selected in the ROD approved on 1 November 1995 (U.S. Army, 1995).

3.6.2 Remedial Action Objectives

The ROD included the following Remedial Action Objectives (RAOs):

- Minimize human and ecological direct contact with landfill contents;
- Reduce the potential for leachate generation by reducing stormwater ponding and infiltration as practical;
- Stabilize the Kansas River bank slope adjacent to OU 001 to prevent movement of the channel into the landfill and to prevent exposure and erosion of the landfill contents; and
- Prevent ingestion, inhalation, and dermal contact with groundwater having organic contaminant concentrations that exceed remediation goals (RGs).

3.6.3 Remediation Goals

The RGs for the groundwater COCs as presented in the ROD are shown on Table 3-2.

Table 3-2. OU 001 Groundwater Remediation Goals

COC	Remediation Goal (µg/L) [a]	Basis
Benzene	5	MCL
1,2-Dichloroethane	5	MCL
cis-1,3-Dichloropropene	0.28, 2.8 [b], 28	Cancer Risk 1E-06, 1E-05, 1E-04
1,1,2,2-Tetrachloroethane	0.042, 0.42 [b], 4.2	Cancer Risk 1E-06, 1E-05, 1E-04
1,1,2-Trichloroethane	5	MCL
Vinyl Chloride	2	MCL

[a] Remediation Goals (RGs) from "Table 2-3. Governing Remediation Goals for Groundwater" in the 1995 Record of Decision (ROD) are based on May 1993 USEPA MCLs, if they exist; otherwise, they are risk-based Region 9 Preliminary Remediation Goals (PRGs), for which a range of RGs based on carcinogenic target risks were identified.

[b] Risk-based RG identified based on carcinogenic target risk of 1E-05 representative of commercial/industrial worker exposure.

µg/L = micrograms per liter MCL = maximum contaminant level

USEPA = United States Environmental Protection Agency

3.6.4 Remedy Description

The remedy for OU 001 includes restricting future site use, stabilizing the Kansas River bank adjacent to the landfill, repairing and improving the existing native soil cover, and prohibiting the future use of the site's groundwater. The major components of the selected remedy, as listed in the ROD, include the following:

- ICs to restrict future site uses and prohibit the future use of the site groundwater;
- placing rock revetment along the Kansas River bank (completed in the spring of 1994 as part of the removal action);
- improvement and repairs of the existing soil cover over the landfill so that it meets the criteria of 40 CFR 258.60;
- conducting semi-annual groundwater monitoring at the site; and
- a contingency for future active remediation of the site, if warranted.

ICs include signage, restrictions on future site uses, and prohibiting the use of groundwater. Restrictions on future site uses include restricting the construction of structures that involve excavation for foundations, restricting the permanent occupancy of any structure, and limiting future utility easements to the outside edge of the landfill.

Groundwater is monitored to evaluate contaminant concentrations in the vicinity of OU 001 to determine trends, and detect if constituents are migrating under Threemile Creek, which would warrant additional actions. According to the ROD, the groundwater monitoring program "may be modified, including reduction or cessation, if monitoring warrants and a FYR justifies."

Annual inspections are conducted to monitor the cover conditions. Long-term maintenance would include mowing, periodic burning, seeding, and fertilizing to maintain the grass. Filling and other earthwork might be required to correct long-term settlement or erosion. Revegetating might also be required in eroded areas, particularly after dry years.

3.6.5 Remedy Implementation

In addition to the Kansas River bank stabilizations (1994), repairs (1995), improvements to the existing soil cover and installation of fencing and signage (1996), FRTI completed additional landfill cover repairs in June 2002 and November 2006 that included filling settled areas in the cover. The riverbank stabilization structure was also extended 100 ft upstream in November 2006 to reduce the risk that the river could erode behind the structure.

The RACR was approved by USEPA in February 2010, and OU 001 was determined to be functionally stable and to have reached the remedial action completion milestone.

ICs were implemented at the SFL through the FTRI RPMP, which identified an area of influence around the landfill and specified what activities were restricted within the area of influence. Restricted activities included drilling water wells, digging/trenching, the use of track vehicles, and building construction/demolition. A Long-Term Management Control Plan (LTMCP) for OU 001 was completed in March 2011. The LTMCP stated that the plan would:

> *"Keep the landfill in the restricted category in the installation's RPMP. Maintain the SFL site institutional control features. This will preclude drilling of a drinking water well, any building construction, excavation, and other incompatible uses as given in the RPMP.*
>
> *The institutional controls found in the RPMP are considered when each proposed project at Fort Riley undergoes its screening by Fort Riley's National Environmental Policy Act coordinator. The fencing and signage are to be maintained."*

A LUCIP was prepared in October 2015 and described the process to implement and maintain LUCs at OU 001. LUCs at OU 001 are enforced through annual inspections and reporting. The inspecting organization, per the IAP, is the KDHE.

The LUCIP identified the following specific objectives for LUCs at OU 001:

<u>Media-Specific Restrictions</u>

- Prohibit use of groundwater for consumption or domestic purposes.
- Restrict drinking water well installation.

Landfill Restrictions

- Prohibit activities that would impact the landfill cap, cover system and drainage system.
- Prohibit excavation on landfill cap or cover system.
- Prohibit installation of utility system lines through the site.
- Restrict access to the site.
- Restrict construction of buildings that may interfere with landfill cap or cover system.
- Restrict plantings that interfere with the landfill cap or cover system (roots that penetrate the cap or cover system).
- Restrict vehicular traffic.

The LUCIP noted that LUCs were functioning in accordance with the ROD and that no new LUCs were anticipated for OU 001.

3.6.6 Operations and Maintenance

Operations and maintenance (O&M) activities required for OU 001 were conducted annually in accordance with the LTMCP. O&M activities included conducting annual maintenance or repairs, as needed, mowing and performing annual sampling activities.

O&M costs include groundwater sample collection, sample analysis and reporting, maintenance of the landfill cover and riverbank stabilization structure, and maintenance of the monitoring wells. Annual O&M costs for OU 001 are managed under a firm fixed-price contract.

3.6.6.1 LUC and Landfill Inspections

Inspections were performed annually at OU 001 during the 2017 to 2021 reporting period to document that the land use within the LUC boundary conforms to the LUC requirement and that no LUC deficiencies, violations, or inconsistencies were identified. The inspections also were performed to assess the landfill surface, vegetative cover, signage, and monitoring wells. Documented activities and observations on field forms and with photographs are provided in the LTO/LTM Reports.

Controlled burning and/or haying of grassland cover of the landfill is conducted annually. In general, the landfill cover was observed to be in good condition during the 2017 to 2021 reporting period, with repair or maintenance conducted from 2017 to 2019 to address issues such as localized ponding, subsidence, exposed debris, or vegetation removal performed prior to the following year’s inspection.

The October 2020 landfill inspection noted a few items requiring repair or maintenance, mainly filling small areas with dirt. A small area of subsidence was observed near monitoring well SFL92-301, just north of the rip-rap along the southern border between the Kansas River and SFL92-301. Maintenance items were addressed in September 2021.

The completed landfill inspection forms, photographs, and a map showing the inspection route and features/items noted during the landfill cover inspection are provided in the LTO/LTM Reports.

The site inspections confirmed that no intrusive work occurred inside the LUC boundaries during the reporting period. None of the landfill inspection reports for OU 001 described any activity, event, or condition to be inconsistent with LUC objectives, use restrictions, or effectiveness.

Groundwater monitoring well inspections, which include inspecting the condition of associated pads, bollards, protective covers, and locks, were also conducted as part of the annual inspections. All wells were generally found to be in good condition; however, inspections routinely identified minor maintenance and repair needs, but none that would impact well integrity during the 2017 to 2021 reporting period.

3.6.6.2 Groundwater Monitoring

Groundwater monitoring data have been collected at OU 001 since 1985. Analytical results are discussed in Section 3.8.1.

The groundwater monitoring program focused on the perimeter of the landfill and originally included groundwater sampling and analysis for VOCs, antimony, and lead. Analysis for antimony was discontinued in December 1999, and analysis for lead was discontinued in January 2007. Nine wells are used to monitor groundwater (Figure 3-2). Field parameters monitored included Dissolved Oxygen (DO), Oxidation-Reduction Potential, Temperature, Turbidity, Conductivity, pH, and Iron(II). Laboratory parameters monitored included Method 8260 VOCs.

Groundwater monitoring was performed semi-annually until 2007, after which the USEPA approved an annual sampling frequency. There were no exceedances of RGs in the wells sampled in 2007, 2008, and 2009. In February 2010, USEPA approved the request from FTRI to reduce the groundwater monitoring frequency from annual to quinquennial (every five years) to coincide with FYRs. However, this reduction apparently did not occur as groundwater samples were collected in 2013 and 2016 during the fourth FYR period, with approval of the Fourth FYR Report in 2017.

In 2018, the U.S. Army submitted a Groundwater Monitoring Recommendation Report for USEPA and KDHE review that recommended the groundwater monitoring program at OU 001 be terminated. The justification presented in the report was that groundwater had been sampled at the site for 32 years and there had been no exceedances of RGs in 11 years (since 2007). USEPA and KDHE did not approve the U.S. Army's recommendation to terminate groundwater monitoring, and recommended that since there is waste remaining in place, groundwater should continue to be monitored once every five years to coincide with the FYRs to "provide a means of evaluating the efficacy/maintenance of the landfill cap in reducing infiltration and enhancing runoff while addressing areas where water may pond, [as well as] differential settlement and erosion of riprap."

In July 2018, the U.S. Army accepted the KDHE and USEPA proposed groundwater monitoring frequency of continued quinquennial monitoring to coincide with the FYRs, with the next sampling period to occur during fiscal years 2018-2022. Groundwater monitoring had already been conducted in May 2018 prior to the July 2018 agreement to perform one event every five years, and the planned groundwater monitoring event for March 2021 was subsequently conducted to provide data prior to this fifth FYR.

Sampling results evaluated in this FYR reporting period from each sampling event are provided in Annual LTO/LTM Reports. The current LTM program, as detailed in the LTMCP (LATA, 2021) consists of measuring static water levels and collecting groundwater samples for chemical analysis at OU 001. Groundwater sampling was performed at OU 001 in May 2018 and March 2021. The objectives of the groundwater monitoring plan are to detect increases in contaminant concentrations in the vicinity of OU 001 that would warrant additional actions, and to determine if constituents from OU 001 were migrating under Threemile Creek.

3.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

3.7.1 Protectiveness Statement From The Last Review

The final protectiveness statement for OU 001 from the last FYR is provided below.

> *"The remedy for OU 001, Southwest Funston Landfill, is protective of human health and the environment.*
> *The remedy, which consists of maintaining a landfill cover and ICs, remains protective by:*
> - *Preventing direct exposure to buried waste;*
> - *Preventing degradation of the underlying groundwater by minimizing migration of potential constituents from waste to groundwater; and*
> - *Preventing exposure to groundwater by enforcement of ICs that prohibit drilling and installation of water wells, or other activities that could damage the integrity of the landfill cover."*

3.7.2 Status of Recommendations and Follow-Up Actions from Last Review

No issues were identified during the fourth FYR that affect the current or future protectiveness of the remedy at OU 001.

3.8 FIVE-YEAR REVIEW PROCESS

3.8.1 Data Review

The FYR process consists of a review and evaluation of data generated in relation to the remedy objectives. The results of the data review indicate the RAOs established in the ROD are being achieved as follows:

- The landfill cover has been improved, is being maintained, has reduced the potential for leachate generation, and in conjunction with LUCs prevents contact with the landfill contents;
- The Kansa's River bank slope adjacent to OU 001 has been stabilized to prevent movement of the channel into the landfill and to prevent exposure and erosion of the landfill contents, and ongoing evaluation of its stability is being performed through an upcoming scour evaluation of the channel; and
- Ingestion, inhalation, and dermal contact with groundwater with concentrations of COCs that exceed RGs has been prevented, and RGs have been achieved for all the COCs in groundwater since 2007.

Six monitoring wells are included in the current LTM and are analyzed for VOCs (Figure 3-2). A summary of previous analytical results for COCs detected in groundwater sampled in 2013 and 2016 are included in Appendix E1 (page E1-1). The most recent analytical results for COCs detected in groundwater sampled in May 2018 and March 2021 are summarized below, and are presented in data tables included in Appendix E1 (pages E1-2 and E1-8, respectively) which also include detected non-COC VOCs.

Table 3-3 summarizes the detections of COCs at OU 001 in 2018 and 2021.

Table 3-3 OU 001 Summary of COC Detections

VOC	Units	MCL	SFL92-301		SFL92-601		SFL92-403		SFL92-401	
			5/18	3/21	5/18	3/21	5/18	3/21	5/18	3/21
Vinyl chloride	µg/L	2	ND	ND	ND	ND	**0.14 J**	ND	**0.15 J**	ND

Bold = detection µg/L = micrograms per liter MCL = maximum contaminant level ND = Not Detected
J = Estimated SFL = Southwest Funston Landfill VOC = volatile organic compound

There were no exceedances of RGs in 2018 or 2021. A review of historical data indicated that there have been no exceedances of the RGs at OU 001 since March 2007. VC was the only detected COC in 2018, and the results were J-qualified (estimated).

3.8.2 Site Inspection

The site inspection was conducted on 16 September 2021 and consisted of observations of the engineering controls and a representative portion of the landfill cover. Aerostar and USACE, Kansas City District personnel were accompanied on the site inspection by the FTRI PWE IRP Manager. The FTRI IRP Manager provided an overview of activities at OU 001 and noted that there have been no exceedances of remediation cleanup goals. He further indicated that inspections are conducted annually at OU 001 and that the remedy was functioning as intended.

Access to OU 001 was restricted by a locked gate. Locks were in place with no indications of trespassing. Signs were in good condition and legible. Observations of landfill cover were limited because the area was heavily vegetated with tall native grasses. No inappropriate use of OU 001 was observed. No subsidence, standing water, or exposed waste was noted during the inspection. The areas that could not be observed during the site inspection were inspected during the annual LUC inspection of the landfill cover in October 2020 discussed in Section 3.6.6.1, which provides a more detailed description of the condition of the landfill cover. The team performed a limited review of the riverbank stabilization area and did not observe any deficiencies.

Appendix C provides details of the Site Inspection including the participants, FYR Site Inspection Checklist, and photographs.

3.8.3 Interviews

Interviews regarding OU 001 are summarized below and the complete interview records are included in Appendix D.

Interviewees indicated the remedy at OU 001 is functioning as intended, and noted in general:

- Mr. Danny O'Connor, the USEPA RPM at the time the interviews were conducted in September 2021, reported that his overall impression of the environmental program for OU 001 was good and that he was kept well informed about the activities and progress related to the site;
- Ongoing O&M activities include annual landcover inspections, burning and/or haying of grassland cover annually, refilling of trenches and areas of substantial water ponding, removal of small trees from landfill cover, removal of debris;
- Ongoing annual LTM groundwater sampling has decreased in frequency to once every five years, scheduled to coincide with the FYR timeline; though inspections will remain annual;
- The U.S. Army plans to perform a scour evaluation for the portion of the landfill adjacent to the Kansas River as part of ongoing stabilization activities of the riverbank slope and preventing movement of the channel into the landfill, preventing exposure and erosion of the landfill contents as specified in the ROD.

3.9 TECHNICAL ASSESSMENT

The technical assessment of the protectiveness of the remedy for OU 001 is based on the responses to these three questions:

Question A: *Is the remedy functioning as intended by the decision documents?*

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?*

Question C: *Has any other information come to light that could question the protectiveness of the remedy?*

3.9.1 Question A: Is The Remedy Functioning As Intended By The Decision Document?

Yes, the remedy at OU 001 is functioning as intended by the ROD based on review of documents, interviews, and the site inspection.

The remedy was completed in 2010 and included stabilization of the riverbank, repairing and improving the soil cover and maintaining the landfill cover, and conducting semi-annual groundwater monitoring. These actions minimize human and ecological direct contact with landfill contents and reduce the potential for leachate generation. The remedy also included implementing ICs involving land use and access controls.

During the FYR, landfill inspection reports for 2018, 2019, 2020, and 2021 were reviewed and confirmed that in addition to inspection of the landfill cover and riverbank stabilization area, signage is also inspected. The signage was also noted to be present, in good condition, and legible during the site inspection for the FYR.

Groundwater monitoring was conducted in 2018 and 2021, and LTM reports were reviewed and confirmed there were no exceedances of RGs in 2018 or 2021. A review of historical data indicated that there have been no exceedances of the RGs in groundwater at OU 001 since March 2007, indicating that the remedy is effective and functioning as intended. Since groundwater monitoring RAOs have been achieved, regulatory agency approval was obtained to reduce monitoring to every five years to coincide with the FYRs.

There are no structures at OU 001. ICs have been implemented and maintained at SFL through the 2006 RPMP and 2011 LTMCP. In 2015, a LUCIP was also prepared to ensure that current and future activities are compatible with land use restrictions. The LUCIP identifies several processes that ensure the LUCs remain effective including "Site Approval Process" for reviewing and approving excavation and construction projects, as well as other land use changes on the installation. Based on interviews with FTRI Environmental Personnel, this process is being followed as part of the installation's compliance with the National Environmental Policy Act (NEPA). The FTRI NEPA Coordinator provides the IRP manager proposed projects for review that could impact IRP sites.

The FTRI land use and planning documents include restrictions on the type of development at OU 001 (i.e., restrict construction of structures that involve excavation for the foundation and restrict the permanent occupancy of any structure), restrictions on future utility easements (i.e., limit future utility easements to outside the edge of the landfill), and prohibition on groundwater use in the vicinity of the landfill. Implementation and enforcement of LUCs ensures activities are prevented that could result in unacceptable exposure to waste or groundwater, indicating that the remedy is effective and functioning as intended.

3.9.2 Question B: Are The Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used At the Time Of The Remedy Selection Still Valid?

Yes, the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid.

However, newly identified contaminants have been detected that may affect the protectiveness of the remedy. Concentrations of PFAS were detected above screening criteria during a site investigation (SI) conducted to investigate these emerging contaminants (see Section 3.9.4). Additional investigation is required to define the nature/extent of and risks associated with these contaminants.

3.9.3 Changes in Standards, Newly Promulgated Standards, and TBCs

ARARs identified in the ROD as the principal ARARs for OU 001 are MCLs and Resource Conservation and Recovery Act (RCRA) Subtitle D, Criteria for Municipal Solid Waste Landfills (40 CFR 258.60 and 258.61), which have not changed. The ROD also identified action- and location-specific standards, such as endangered and/or threatened species, floodplain, historical, and RCRA requirements, which have not changed. RGs were established in the 1995 ROD for OU 001 groundwater COCs, which are presented in Table 3-4.

Table 3-4. ROD Remediation Goals for OU 001 Groundwater COCs

Analyte	ROD RG (µg/L) [a]	RG Basis
Benzene	5	MCL
1,2-Dichloroethane	5	MCL
cis-1,3-Dichloropropene	2.8 [b]	PRG
1,1,2,2-Tetrachloroethane	0.42 [b]	PRG
1,1,2-Trichloroethane	5	MCL
Vinyl Chloride	2	MCL

[a] Remediation Goals (RGs) from "Table 2-3. Governing Remediation Goals for Groundwater" in the 1995 Record of Decision (ROD) are based on May 1993 USEPA MCLs, if they exist; otherwise, they are risk-based Region 9 Preliminary Remediation Goals (PRGs), for which a range of RGs based on carcinogenic target risks were identified.
[b] Risk-based RG identified based on carcinogenic target risk of 1E-05 representative of commercial/industrial worker exposure.
MCL = maximum contaminant level USEPA = United States Environmental Protection Agency

The RGs for benzene, 1,2-dichloroethane, 1,1,2-trichloroethane, and VC are MCLs, which have not changed since the 1995 ROD. The RGs for cis-1,3-dichloropropene and 1,1,2,2-tetrachloroethane are risk-based (see Table 3-2) and discussed in Section 3.9.5. There are no changes in standards since the ROD; therefore the protectiveness of the remedy is not affected.

3.9.4 Changes in Exposure Pathways

There have been no changes in exposure pathways since the 1995 ROD. In addition, LUCs are currently in place to prevent all exposures and prohibit construction of future buildings. Therefore, there are no changes in exposure pathways regarding vapor intrusion (VI) that could affect the protectiveness of the remedy.

Emerging Chemicals

As presented in Section 2.4, a relatively new class of emerging contaminants, PFAS, is being investigated at DoD sites across the country, including FTRI. In 2020, PFOA was identified in groundwater at concentrations that exceeded the October 2019 risk screening levels of 40 ng/L during groundwater sampling conducted at OU 001(Arcadis, 2022). The data tables and figures are included in Appendix E1 (pages E1-3 through E1-7); as shown in Table 7-1 and on Figure 7-3, PFOA was measured at concentrations of 110 ppt in two groundwater samples associated with monitoring wells SFL92-301 and SFL92-601, respectively, in AOPI FFTA-SFL (OU 001, FTRI-028). Although no current exposures are occurring at OU 001 as LUCs are in place to prevent exposure to impacted groundwater, the PA/SI recommended further evaluation to define the nature and extent of the identified PFAS in groundwater. Therefore, the presence of PFAS in the groundwater at OU 001 calls the protectiveness of the remedy into question. Note that all new PFAS data collected in the future will be evaluated consistent with the most current USEPA and DoD screening level guidance.

3.9.5 Changes in Toxicity and Other Contaminant Characteristics

The RGs for benzene, 1,2-dichloroethane, 1,1,2-trichloroethane, and VC are the MCL and are not dependent on toxicity data. The risk-based RGs for cis-1,2-dichloropropene and 1,1,2,2-tetrachloroethane are based on toxicity data and are impacted by changes since the 1995 ROD RGs were established. Table 3-5 presents the toxicity data used in the ROD, as well as the current toxicity data for comparison.

Table 3-5. Changes in Toxicity Data for OU 001 COCs in Groundwater

COCs	ROD Toxicity Values [1]	RSL Toxicity Values [2]	Changes
cis-1,2-Dichloropropene	SFO (1/mg/kg-d): 0.18 SFI (1/mg/kg-d): 0.13	SFO (1/mg/kg-d): 0.1 IUR (μg/m^3)$^{-1}$: $4x10^{-6}$	Cancer: Decreased SFO; SFI replaced by IUR
	RfDo (mg/kg-d): $3x10^{-4}$ RfDi (mg/kg-d): $5.71x10^{-3}$	RfDo (mg/kg-d): 0.03 RfCi (mg/m3): 0.02	Non-cancer: Increased RfDo; RfDi replaced by RfCi
1,1,2,2-Tetrachloroethane	SFO (1/mg/kg-d): 0.2 SFI (1/mg/kg-d): 0.203	SFO (1/mg/kg-d): 0.2 IUR (μg/m^3)$^{-1}$: $5.8x10^{-5}$	Cancer: No change to SFO; SFI replaced by IUR
	RfDo (mg/kg-d): NA RfDi (mg/kg-d): NA	RfDo (mg/kg-d): 0.02 RfCi (mg/m3): NA	Non-cancer: New RfDo

[1] Record of Decision (ROD) toxicity data (1995).
[2] Most recent toxicity data are from the USEPA Regional Screening Levels (RSL) tables from May 2022 (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables).
COC = chemical of concern
mg/kg = milligrams per kilogram
RfDi = inhalation reference dose
SFI = inhalation slope factor
USEPA = United States Environmental Protection Agency
IUR = inhalation unit risk
RfCi = Inhalation toxicity reference concentration
RfDo = Oral toxicity reference dose
SFO = Oral cancer slope factor

For cis-1,2-dichloropropene, the current toxicity data includes an increase in the oral reference dose (RfDo), which indicates lower toxicity via the oral exposure pathway, meaning that an acceptable Hazard Index (HI) would be associated with higher groundwater concentrations. Additionally, the oral cancer slope factor (SFO) has decreased, indicating that acceptable cancer risks would be associated with higher groundwater concentrations. The changes in toxicity data would correspond with an increase in the RG for cis-1,2-dichloropropene (see Table 3-5).

For 1,1,2,2-trichloroethane, a new inhalation unit risk (IUR) was established, which results in an acceptable cancer risk at higher groundwater concentrations. The changes in toxicity data would correspond with an increase in the RG for 1,1,2,2-trichloroethane (see Table 3-5).

Because the changes in toxicity data result in values greater than the RGs presented in the 1995 ROD, the protectiveness of the remedy is not affected by changes in toxicity data. Potential ecological exposure to aquatic receptors via groundwater to surface water pathways is adequately addressed by the groundwater RGs selected for OU 001. Current groundwater concentrations are not a concern for ecological risk, and terrestrial exposure pathways are controlled by the landfill cover and streambank stabilization. Therefore, the protectiveness of the remedy is not affected by changes in contaminant characteristics.

3.9.6 Changes in Land Use

The entire OU 001 is within a zone designated as "Open Space" in the RPMP, which hasn't changed since the 1995 ROD and is not expected to change in the future; therefore, the protectiveness of the remedy has not been affected by changes in land use.

3.9.7 Changes in Risk Assessment Methods

Risk assessment methods for calculating risk to residents have changed since calculations were performed for the screening values presented in the 1995 ROD. In 2014, the USEPA provided supplemental guidance (Office of Solid Waste and Emergency Response [OSWER] Directive 9200.1-120) that updated the standard default exposure factors for evaluating human health impacts. Key exposure parameters used for the 1995 ROD screening values are listed in Table 3-6 with their previous and current values.

Table 3-6. Changes in Residential Exposure Parameters

Parameter	Units	ROD	RSL
Body Weight – Adult	kg	70	80
Ingestion Rate – Adult	L/day	2	2.5
Ingestion Rate – Child	L/day	1	0.78
Skin Surface Area – Adult	cm^2/day	20,000	19,652
Skin Surface Area – Child	cm^2/day	8,000	6,365

cm^2 = square centimeters   Kg = kilograms   L = liters   RSL = regional screening level

Additional changes to the risk assessment methods include changes to the toxicity data to reflect a revision to the approach for characterizing inhalation exposures. Historically, inhalation intakes and doses were calculated to compare with inhalation reference doses (RfDi) or slope factors, as follows:

Inhalation cancer incidence risk = Inhalation dose (mg/kg-d) x SFI (risk per mg/kg-d)

Inhalation toxicity hazard quotient = Inhalation dose (mg/kg-d) / RfDi (mg/kg-d)

Where:

SFI – inhalation slope factor

RfDi – inhalation reference dose

The updated approach establishes IUR factors (units of cancer risk per µg/m3) and inhalation reference concentrations (RfCi; units of mg/m3) that can be directly compared with exposure point concentrations in air to characterize the risks, as follows:

Inhalation cancer incidence risk = Exposure Point Concentration (mg/m3) x IUR (risk per mg/m3)

Inhalation toxicity hazard quotient = Exposure Point Concentration (mg/m3) / RfCi (mg/m3)

Where:

IUR – inhalation unit slope factor

RfCi – inhalation reference concentration

The changes in risk methods would result in updated risk-based screening criteria that are higher than those presented in the 1995 ROD (see Table 3-3); therefore, these changes do not affect the protectiveness of the remedy.

3.9.8 Expected Progress Toward Meeting RAOs

The RAOs for OU 001, including repairs to the landfill cover, riverbank stabilization, and implementation of ICs have been met. In addition, the RAO identified in the ROD for groundwater monitoring has been achieved since RGs have been met, with regulatory agency approval to reduce annual monitoring to every five years to coincide with the FYRs.

3.9.9 Question C: Has Any Other Information Come To Light That Could Call Into Question The Protectiveness of the Remedy?

No, no other information has come to light that could call into question the protectiveness of the remedy.

3.10 ISSUES

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
PFAS were detected at concentrations in groundwater that exceeded screening criteria.	N	Y

PFAS = per- and polyfluoroalkyl substances

3.11 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1.	Conduct the investigations necessary to define the nature and extent of PFAS contamination and determine the associated exposure risks.	U.S. Army	EPA, with assistance from KDHE	28 September 2023	N	Y

KDHE = Kansas Department of Health and Environment
PFAS = per- and polyfluoroalkyl substances
U.S. Army = United States Department of the Army

3.11.1 Other Findings

The following other finding not affecting protectiveness of the remedy was identified during this FYR and is provided to describe potential improvements to the remedy in the long term.

The scour evaluation should be completed in 2022 to:

- Assess the integrity of the landfill embankment along the Kansas River;
- Evaluate historical river channel locations to determine the rate of migration towards the landfill

- Perform a Geographic Information System-based survey of the landfill cap boundary and riverbank;
- Perform an evaluation of rip-rap efficacy;
- Assess the size, rock quality, condition, and thickness of the existing riprap revetment, and providing recommended improvements to channel bank protection measures; and
- Develop a hydraulic model of the Kansas River to estimate velocities in the channel adjacent to the landfill.

In addition, a controlled burn should be performed to clear vegetation in the study area to ensure the scour study can be performed effectively.

3.12 PROTECTIVENESS STATEMENT

The remedy at OU 001, SFL, currently protects human health and the environment because direct exposure to buried waste is prevented; degradation of the underlying groundwater by minimizing migration of potential constituents from waste to groundwater is prevented by the landfill cover; and exposure to groundwater is prevented by enforcement of ICs that prohibit drilling and installation of water wells, or other activities that could damage the integrity of the landfill cover. However, for the remedy to be protective in the long term, potential exposure to PFAS in groundwater should be addressed by defining the nature and extent of PFAS contamination and determining the associated exposure risks.

4. OU 003 - DRY CLEANING FACILITIES AREA

4.1 SITE DESCRIPTION

OU 003 is an IRP site and is identified in the FRTI IAP as FTRI-027 (HQAES Environmental Site ID 20605.1026), DCFA. OU 003 is also referred to by the acronyms "DCA" or "DCFA" in some supporting documents. OU 003 is a former DCFA located in the southwestern corner of the main post cantonment area, north of the Kansas River (Figure 2-1). FTRI-027 is bisected by the Kansas River, which runs through the site from the northwestern edge to the southeastern edge. The site consists of five separate, but related areas (Figure 4-1) identified in the ROD (USACE, 2008):

- The former DCFA—the original study area consisting of two areas: Former Buildings 180/181/182 Area and Former Buildings 183/184 Area;
- The Transition Zone—a change in soil type located between the former DCFA and a point bar ("Island") next to the Kansas River;
- The Island—a point bar next to the Kansas River;
- The Horse Corral—located east of the Island where horses are pastured and trained; and
- Training Area 2 (TA2)—located south of the river where the U.S. Army holds field exercises.

4.1.1 Physical Characteristics

The topography across OU 003 is dominated by alluvial terraces, a soil Transition Zone, point bars (the Island and the Horse Corral Area) of the Kansas River, and the Kansas River Floodplain. The alluvial terrace consists of clays, sands and silts overlying Permian-age alternating shales and limestones. The Transition Zone separates the alluvial terraces from the river alluvial deposits that underlie the Island and the Horse Corral. The east/west Union Pacific Railroad (UPRR) tracks lie within the Transition Zone. The Island is a heavily wooded point bar that serves as habitat for bald eagles. The Horse Corral is the western portion of a point bar located downstream (east) of the Island. The Horse Corral is used for pasture and training of horses. TA2 is located on the south side of the Kansas River and the Island. The TA2 area is undeveloped, heavily wooded and is used for military exercises.

4.1.2 Land and Resource Use

The FTRI RPMP designates OU 003 study area as an "Open Space", in which future development for residential or commercial industrial use is not permitted. There are no buildings at OU 003. Buildings 180/181 and the surrounding structures, parking lots and sidewalks, were demolished in summer 2000. Building 183 and the surrounding structures were demolished in fall 2002. Open areas have building restrictions and are used only for safety areas, utility clearances and easements, conservation areas, and buffer zones. It is anticipated that land use activities within OU 003 will remain unchanged into the foreseeable future based on building restrictions.

The groundwater underlying OU 003 is currently not a drinking water source; however, the aquifer beneath OU 003 is considered a potential future drinking water aquifer (Class II). FTRI water supply wells are located approximately three miles upgradient from OU 003. OU 003 lies within bald eagle habitat areas on both sides of the Kansas River.

4.2 SITE CHRONOLOGY

The chronology of key events for OU 003 is provided in Table 4-1.

Table 4-1. Chronology of Key Events at OU 003

Event	Date
Buildings 180/181 operated as a laundry	1915 – 1983
Buildings 180/181 operated as dry-cleaning facilities	1930 – 1983
Building 183 operated as a laundry	1941 – 2002
Building 183 operated as a dry-cleaning facility	1983 – 2002
FFA Requires SI of former Dry Cleaners	June 1991
PA/SI	1991 – 1992
RI/FS	February 1993 – March 1998
Soil Vapor Extraction and Groundwater Extraction Pilot Studies Initiated	May 1994
Soil Vapor Extraction Pilot Test	November – December 1994
Proposed Plan	December 1998
KDHE Dispute and Resolution	January – April 1999
Work Plan Addendum	March 2002
Phase 1 Field Work – OU 003 Geoprobe	May – July 2002
Phase 2 Field Work –TA2 Geoprobe	October 2002
Final RI Work Plan Addendum Building 183	June 2003
Install TA2 monitoring wells DCF96-36 and DCF03-50C	July 2003
Collect Building 183 Soil Samples	July 2003
RI Report Addendum	April 2004
FS Addendum (Cancelled vice Pilot Study)	May 2004
USEPA approves FTRI request to abandon 29 monitoring wells to change sampling frequency from semi-annual to annual, and to limit analysis to COCs	March 2005
Pilot Study Work Plan approved	August 2005
Pilot Study Field Work	October – November 2006
Pilot Study Report	January 2008
ROD approved	18 March 2008
Revised Work Plan – CAP 18® Injection Project Environmental Remediation Services	October 2009
CAP 18® Injection and treatment.	February 2010

Event	Date
TM – CAP 18® Injection Project approved. Confirmation sampling demonstrated remediation of soil.	October 2010
Third FYR	September 2012
Bench-Scale Microcosm Study	November 2015
TA2 wells missing (DCF96-36) or decommissioned (DCF03-50C) and no longer sampled as part of LTM	Prior to 2017
Fourth FYR	September 2017

COC = chemical of concern
FS = Feasibility Study
PA = Preliminary Assessment
SI = site investigation
KDHE = Kansas Department of Health and Environment
FTRI = Fort Riley
RI = Remedial Investigation
TA2 = Training Area 2TM = technical memorandum
FFA = Federal Facility Agreement
FYR = five-year review
ROD = Record of Decision
USEPA = United States Environmental Protection Agency

4.3 History of Contamination

Dry cleaning operations were conducted at Buildings 180/181 from 1930 until 1983. Dry cleaning operations were conducted at Building 183 from 1983 to 2002. Stoddard solvent, a petroleum distillate mixture, was used as the dry cleaning solution from 1944 until 1966. From 1966 until dry cleaning operations ceased, tetrachloroethene (PCE) was used as the cleaning solution. RIs to characterize potential contamination at OU 003 were completed in 2004. The studies confirmed that leaking sewer lines had resulted in soil and groundwater contaminated with PCE. Three Areas of Concern (AOCs) were identified based on exceedances of KDHE RSKs in soil and groundwater (Figure 4.2): AOC 1 and AOC 2 addressed soil and groundwater contamination, respectively, at former Buildings 180/181. AOC 3 addressed both soil and groundwater contamination located in portions of the Transition Zone and the Island. An additional groundwater plume, "Other Areas", was identified near the Island and Horse Corral.

4.4 Initial Response

Response actions conducted at OU 003 prior to approval of the ROD included a soil vapor extraction pilot study in the vicinity of AOCs 1 and 2 in 1994 and 1995. An estimated 24 pounds of contaminants, primarily PCE, were removed during this effort.

In 2005 and 2006, a soil source removal pilot study was conducted at AOC 1. Approximately 2,400 cubic yards (cy) of soil were excavated near the Building 180 footprint. Select abandoned-in-place sewer lines were also excavated. A 10% sodium permanganate solution was also injected into sewer lines to oxidize any remaining chlorinated hydrocarbons. A groundwater treatment pilot study was conducted at AOC 2 that included injection of approximately 8,200 pounds of CAP 18® (a proprietary non-emulsified soybean oil-based product that provides a long-term carbon source for anaerobic bioremediation) at 72 different points into groundwater at AOC 2.

In 2005, an aqueous solution of sodium permanganate was injected into the vadose zone near monitoring well DCF02-42 in AOC 3. Approximately 7,400 pounds of sodium permanganate were injected at 23 locations. A second pilot study in the same area was conducted in 2006 to evaluate the injection of potassium permanganate into the saturated zone. Potassium permanganate was injected at 44 different locations between the two wells.

In 2006, CAP 18® was injected into the "Other Areas" near monitoring well DCF02-49C (the Island) and DCF99-37C and 354-99-11C (Horse Corral). Approximately 5,530 pounds were injected at 37 injection points.

In February 2010, an additional groundwater injection pilot study was conducted at AOC 2.

4.5 BASIS FOR TAKING ACTION

The basis for taking action at OU 003 was the unacceptable risk associated with potential future use of groundwater as a drinking water source due to its hydraulic connection to the Kansas River. Four VOCs—PCE, trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and VC—in the Kansas River alluvial aquifer exceeded the drinking water MCLs and were identified as COCs.

4.6 REMEDIAL ACTION

4.6.1 Remedy Selection

The remedy for OU 003 was selected in the ROD approved on 18 March 2008.

4.6.2 Remedial Action Objectives

The ROD included the following RAOs for OU 003:

- Prevent further degradation in groundwater in the Kansas River alluvium and off-site migration in groundwater of COCs that exceed cleanup goals.
- Achieve cleanup goals of MCLs for COCs in groundwater in the Kansas River alluvium using natural and/or active remedial processes.

4.6.3 Remediation Goals

The numerical RGs established for OU 003 in the ROD are presented in Table 4-2.

Table 4-2. OU 003 Groundwater Remediation Goals

COC	Remediation Goal[1] (µg/L)	Basis
PCE	5	MCL
TCE	5	MCL
cis-1,2-DCE	70	MCL
VC	2	MCL

[1] Remediation goal based on May 1993 USEPA MCL.
µg/L = micrograms per liter; cis-1,2-DCE = cis 1,2,-dichloroethene; COC = chemical of concern
MCL = maximum contaminant level; PCE = tetrachloroethene; TCE = trichloroethene
USEPA = United States Environmental Protection Agency

4.6.4 Remedy Description

The remedy relies on natural degradation processes already occurring to further reduce contaminant concentrations below their respective MCLs, groundwater monitoring annually for three years (2008, 2009, and 2010), followed by sampling every five years, thereafter. According to the ROD, once concentrations of COCs in the alluvial wells were below MCLs, OU 003 could be recommended for site closeout.

ICs included restricting residential land use, limiting public access, prohibiting installation of drinking water wells and groundwater use in the area, and involving the FTRI PWE personnel in proposed future plans for the site.

4.6.5 Remedy Implementation

A Remedial Design/Remedial Action Plan (RD/RA) for OU 003 was produced in June 2008 to identify and describe remedy activities to be conducted to accomplish each of the components of the remedy. The groundwater monitoring program for the DCF Study Area was based on more than 16 years of groundwater sampling, evaluation, and trend analyses. The RD/RA plan called for wells selected for LTM to be sampled annually for a minimum of three years, followed by sampling every five years to be coincident with FYRs. The data was to be evaluated following each monitoring event to determine if further sampling was necessary.

The objectives for ICs identified in the ROD include:

- Restricting use to non-residential;
- Limiting public access;
- Prohibiting installation of drinking water wells and groundwater use in the area; and
- Involving PWE personnel in proposed future plans for the DCFA site.

Restrictions are to be enforced through the FTRI RPMP. In addition, compliance with Army Regulations (ARs) and Executive Orders regarding the restriction of certain land uses in floodplains is required.

ICs were implemented at OU 003 in 2008. The FTRI RPMP restricts building construction and demolition, digging and trenching, and installation of drinking water wells at OU 003. The ICs have been enforced through annual inspections and the dig permitting procedures that are monitored by FTRI PWE personnel.

A LUCIP was also prepared in 2015 to ensure that current and future activities are compatible with land use restrictions. The LUCIP identifies several processes that ensure the LUCs remain effective including "Site Approval Process" for reviewing and approving excavation and construction projects, as well as other land use changes on the installation. Based on interviews with FTRI PWE personnel, this process is being followed as part of the installation's compliance with NEPA.

The LUCIP identified the following specific objectives for LUCs at OU 003:

- Prohibit use of groundwater for consumption or domestic purposes; and
- Restrict drinking water well installation.

The LUCIP noted that LUCs were functioning in accordance with the ROD and that no new LUCs were anticipated for OU 003.

4.6.6 Operations and Maintenance

O&M activities required for OU 003, as detailed in the RD/RA, were conducted from 2017 to 2021. O&M activities included conducting annual well maintenance and repairs, as needed.

O&M costs include LUC inspections, groundwater sample collection, sample analysis and reporting, and maintenance of the monitoring wells. Annual O&M costs for OU 003 are managed under a firm fixed-price contract.

4.6.6.1 Inspections

Inspections were performed annually at OU 003 during the 2017 to 2021 reporting period to document that the land use within the LUC boundary conforms to the LUC requirement and that no LUC deficiencies, violations, or inconsistencies were identified. The inspections also were performed to assess the condition of monitoring wells. Documented activities and observations on field forms and with photographs are provided in the LTO/LTM Reports.

Groundwater monitoring well inspections, which include inspecting the condition of associated pads, bollards, protective covers, and locks, were also conducted as part of the annual inspections. Groundwater monitoring well inspections routinely identified maintenance and repair needs, but none that would impact well integrity during the 2017 to 2021 reporting period.

The wells were inspected during the March 2021 sampling event and noted conditions were recorded on the Well Maintenance Form included in the LTO/LTM Report (Appendix B). Most of the wells were in good condition with the following exceptions:

- DCF00-34C needed a new lock;
- The polyvinyl chloride riser at DCF02-47A was noted to be sticking up above the well lid;
- The well pad at DCF02-41 was slightly unstable; and
- The dedicated pump at DCF92-05 needed to be replaced.

The lock was replaced at DCF00-34C during the 2021 sampling event. The remaining maintenance items were noted for future sampling decisions.

4.6.6.2 Groundwater Monitoring

The LTM program, as detailed in the RD/RA Work Plan, consists of measuring static water levels and collecting groundwater samples for chemical analysis during MNA monitoring/sampling events. Sampling has been conducted annually at OU 003 from May 2017 through March 2021. Sampling results included in this FYR reporting period from each sampling event are provided in Annual LTO/LTM Reports.

The objectives of the annual groundwater monitoring plan are to monitor natural attenuation processes and contaminant concentrations in the vicinity of OU 003. Analytical results are discussed in Section 4.8.1.

Field parameters monitored included DO, oxidation reduction potential (ORP), temperature, conductivity, pH, and iron(II). Laboratory parameters monitored included Method 8260 VOCs. MNA parameters included methane, ethane, ethene, alkalinity (total as $CaCO_3$), chloride, nitrogen (nitrite and nitrate), sulfate and sulfide. Analytical results for groundwater since the previous FYR are summarized below, and provided in the Data Report provided in Appendix E2 (pages E2-1 through E2-10).

During the groundwater monitoring event in March 2021, a total of 21 wells were inspected and gauged and 18 wells were sampled for VOCs and MNA parameters. The gauging data from 19 wells indicated groundwater flow at the site is generally south to southwest toward the Kansas River. Analytical data indicated VOCs exceeding MCLs in 5 wells.

4.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

4.7.1 Protectiveness Statement From The Last Review

The final protectiveness statement for OU 003 from the fourth FYR is provided below.

> *"The remedy for OU 003, Dry Cleaning Facilities Area, is protective of human health and the environment.*
> *The remedy, which consists of MNA with ICs, remains protective by:*
> - *Monitoring groundwater to ensure that biodegradation continues to effectively reduce concentrations of COCs and eventually meet remediation goals; and*
> - *Preventing exposure to groundwater with enforcement of ICs that prohibit drilling and installation of water wells."*

4.7.2 Status of Recommendations and Follow-Up Actions from Fourth Review

No issues were identified during the fourth FYR that affect the current or future protectiveness of the remedy at OU 003.

4.8 FIVE YEAR REVIEW PROCESS

4.8.1 Data Review

The FYR process consists of a review and evaluation of data generated in relation to the remedy objectives. The results of the data review indicate the RAOs established in the ROD are being achieved as follows:

- No further degradation of groundwater has occurred;
- COCs in groundwater have not migrated offsite; and
- RGs have been achieved for one of the four COCs and are anticipated to be achieved for the remaining COCs within the next decade based on trend analyses performed as part of the LTM.

Groundwater monitoring data between 2012 and 2021 suggests that MNA continues to be effective in meeting the RAOs for OU 003, and the ranges of MNA parameters continue to indicate ongoing biodegradation processes are occurring. Statistical trend analysis generally indicated decreasing and stable trends for VOC concentrations in groundwater across OU 003, and the presence of breakdown products that is expected where MNA is occurring.

Although MNA appears to be occurring at OU 003 and concentrations of COCs are decreasing, they currently exceed MCLs in several wells. The current LTM program includes inspection of 21 LTM wells, collection of static water level measurements in 19 LTM wells, and sampling and analysis of groundwater in 18 LTM wells for VOCs and MNA parameters (Figure 4-2).

Three of the four COCs (PCE, cis-1,2-DCE, TCE and VC) were detected above their respective RGs in March 2021. The most recent analytical results for groundwater sampled in March 2021 are summarized in Table 4-3, and provided in the data tables in Appendix E2 (pages E2-1 through E2-10), which also include historical data (pages E2-1 through E2-4). The results of each annual sampling event are summarized below, and presented in Annual LTO/LTM Reports.

Table 4-3. COCs in OU 003 Groundwater

COC	RG (µg/L)	Maximum COC Concentration Detected March 2021 (µg/L)	Number of Wells Where COC Concentration Exceeded the RG
PCE	5	15.0	4
cis-1,2-DCE	70	95.0	1
VC	2	5.80	1

µg/L = micrograms per liter | cis-1,2-DCE = cis 1,2,-dichloroethene | COC = chemical of concern
PCE = tetrachloroethene | RG = remedial goal | VC = vinyl chloride

Based on the data review, ongoing biodegradation processes are decreasing concentrations of COCs in groundwater significantly over time.

- PCE is the primary COC in groundwater and concentrations in most wells (14 of 18 wells sampled) are below the RG and are decreasing. PCE concentrations within the pilot study area wells that were historically the highest are decreasing in three of the four wells and stable in the fourth well.

- cis-1,2-DCE and VC are biodegradation breakdown products, and concentrations in most wells (17 of 18 wells sampled) are below the RG or are decreasing.

- All TCE concentrations are currently below the RG.

The historical PCE, TCE, cis-1,2-DCE, and VC results through March 2020 are shown on Figures 4-3, 4-4, 4-5, and 4-6, respectively.

Figure 4-3 presents the March 2020 PCE concentration and historical data. The figure shows one PCE plume of contamination above the RG which includes the AOC 3 Pilot Study Area located to the southeast near the Kansas River. Historically, a smaller plume of contamination that has had concentrations above the RG was centered on the AOC 1 and AOC 2 Pilot Study Area. The PCE plume in this area has fluctuated over the monitoring time period.

Temporal trends were evaluated for PCE at AOC 1 and AOC 2 wells using data from 2012 through 2021. Only one well in the AOC 1 and AOC 2 areas was identified as having an Increasing trend. Out of the other nine wells with four or more detections that were analyzed, the following trends were observed:

- PCE in two wells had No Trend, four wells had Decreasing trends, and three wells had Stable trends; and
- The plume mass for PCE has a Stable or No Trend over time in size of the plume, while the mass of the plume is Stable (see Appendix E2, page E2-9).

A temporal analysis performed for all wells to obtain sampling frequency recommendations indicates that all AOC 1 and AOC 2 wells should be sampled on an annual basis, except for four wells that it suggests should be sampled biennially (every other year).

A spatial analysis performed to identify any redundant sampling locations or monitoring wells that could be discontinued indicates all wells should continue to be sampled, and no areas were identified requiring new monitoring wells.

4.8.2 Site Inspection

The site inspection was conducted on 16 September 2021 and consisted of observations of the site conditions. Aerostar and USACE, Kansas City District, personnel were accompanied on the site inspection of OU 003 by the FTRI PWE IRP Manager. The FTRI PWE IRP Manager provided an overview of activities at OU 003 and indicated that inspections are conducted annually and that the remedy was functioning as intended.

The Team reviewed OU 003 and found that the land use in the area has not changed and there are no occupied structures within the site boundary. No inappropriate use of OU 003 was observed.

Appendix C provides details of the Site Inspection including the participants, FYR Site Inspection Checklist, and photographs.

4.8.3 Interviews

Interviews regarding OU 003 are summarized below and the complete interview records are included in Appendix D.

Interviewees indicated the remedy at OU 003 is functioning as intended, and noted in general:

- There have been no significant changes in the remedy since the previous FYR;

- There is an expectation that the remedial action will be completed within the next five years; and
- The concentrations of COCs show decreasing trends.

4.9 TECHNICAL ASSESSMENT

The technical assessment of the protectiveness of the remedy for OU 003 is based on the responses to these three questions:

Question A: *Is the remedy functioning as intended by the decision documents?*

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?*

Question C: *Has any other information come to light that could question the protectiveness of the remedy?*

4.9.1 Question A: Is The Remedy Functioning As Intended By The Decision Document?

Yes, the remedy at OU 003 is functioning as intended by the ROD based on review of documents, interviews, and the site inspection.

The remedy for OU 003 includes MNA with ICs.

Groundwater monitoring data between 2012 and 2021 suggests that MNA continues to be effective in meeting the RAOs for OU 003. The ranges of MNA parameters also indicated favorable conditions for biodegradation. Statistical trend analysis generally indicated decreasing and stable trends for VOC concentrations in groundwater across OU 003, and the presence of breakdown products that is expected where MNA is occurring.

Although MNA appears to be occurring at OU 003, concentrations of COCs still currently exceed MCLs in several wells.

ICs have been implemented and maintained at OU 003 through the 2006 RPMP and 2011 LTMCP. In 2015, a LUCIP was also prepared to ensure that current and future activities are compatible with land use restrictions. The LUCIP identifies several processes that ensure the LUCs remain effective at OU 003. The “Site Approval Process” establishes processes for reviewing and approving excavation and construction projects, as well as other land use changes on the installation. Based on interviews with FTRI Environmental Personnel, this process is being followed as part of the installation’s compliance with the NEPA. The FTRI NEPA Coordinator provides the IRP manager proposed projects for review that could impact IRP sites, including OU 003. A review of the procedures for monitoring and enforcement indicated that the FTRI O&M program is effective in preventing unacceptable exposure to groundwater.

4.9.2 Question B: Are The Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used At the Time Of The Remedy Selection Still Valid?

Yes, the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid.

4.9.3 Changes in Standards, Newly Promulgated Standards, and TBCs

The ROD identified the principal ARARs that are relevant and appropriate for OU 003, as MCLs. The ROD also identified action- and location-specific standards such as endangered and/or threatened species, floodplain, historical, and RCRA requirements that have not changed. RGs were established in the 2008 ROD for OU 003 groundwater COCs, which are presented in Table 4-4.

Table 4-4. Remediation Goals for OU 003 Groundwater COCs

COC	ROD RG (µg/L)	Basis
Tetrachloroethene	5	MCL
Trichloroethene	5	MCL
cis-1,2-Dichloroethene	70	MCL
Vinyl Chloride	2	MCL

Remediation Goals (RGs) from 2008 Record of Decision (ROD) (USACE, 2008)
Maximum Contaminant Level (MCL)
(https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations)
COC = chemical of concern   µg/L = milligrams per liter   USACE = United States Army Corps of Engineers

The RGs for all COCs in groundwater are MCLs, which have not changed since the 2008 ROD; therefore, the protectiveness of the remedy is not affected. Potential ecological exposure to aquatic receptors via groundwater to surface water pathways is adequately addressed by the groundwater RGs selected for OU 003.

4.9.4 Changes in Exposure Pathways

There have been no changes in exposure pathways since the ROD for OU 003 was approved in 2008. OU 003 was designated as "Open Space" in the RPMP, and restricted activities include building construction, digging and trenching, and drilling drinking water wells. There are no structures on OU 003. As a result, there is no pathway for exposure to groundwater or vapors intrusion and no expectation that exposure will occur in the future. Therefore, the VI pathway is not expected to pose an unacceptable risk at this site. In addition, LUCs are currently in place to prevent all exposures and prohibit construction of future buildings. Therefore, there are no changes in exposure pathways that could affect the protectiveness of the remedy.

4.9.5 Changes in Toxicity and Other Contaminant Characteristics

The RGs for all OU 003 COCs were the USEPA MCLs, which are not dependent on toxicity data; therefore changes in toxicity data do not affect the protectiveness of the remedy.

4.9.6 Changes in Land Use

The entire OU 003 is within a zone designated as "Open Space" in the RPMP, which hasn't changed since the 2008 ROD and is not expected to change in the future; therefore, the protectiveness of the remedy has not been affected by changes in land use.

4.9.7 Changes in Risk Assessment Methods

There have been no changes in risk assessment methods since the 2008 ROD that impact the standards used in the site evaluations; therefore the protectiveness of the remedy has not been affected by changes in risk assessment methods.

4.9.8 Expected Progress Toward Meeting RAOs

Significant progress has been made toward meeting the RAOs through MNA, as concentrations of COCs in groundwater in general have been decreasing or are stable and there is evidence of biodegradation occurring. The RAO to achieve RGs in groundwater is expected to be met in the future since concentrations of COCs in groundwater are decreasing.

4.9.9 Question C: Has Any Other Information Come To Light That Could Call Into Question The Protectiveness of the Remedy?

No, no other information has come to light that could call into question the protectiveness of the remedy.

4.10 Issues

There were no issues found affecting the protectiveness of the remedy.

4.11 Recommendations and Follow-up Actions

No issues that could affect current and/or future protectiveness were identified for OU 003. Therefore, no follow-up actions are required at this time.

4.12 Protectiveness Statement

The remedy at OU 003, DCFA, which consists of MNA with ICs, is protective of human health and the environment. Monitoring demonstrates that biodegradation continues to effectively reduce concentrations of COCs; and ICs are in place to prevent exposure to groundwater by prohibiting drilling and installation of water wells.

5. OU 005 - 354 AREA SOLVENT DETECTIONS

5.1 SITE DESCRIPTION

OU 005 is an IRP site and is identified in the IAP as FTRI-031 (HQAES Environmental Site ID 20605.1030), 354 Area Solvent Detections, also referred to as "Building 354 Area", "354 Area", or "354 Sites" in some supporting documents. OU 005 is located at the Main Post cantonment area north of the Kansas River (Figure 1-2). The Site currently encompasses portions of the Main Post as far north as Godfrey Avenue, and most of the point bar of the Kansas River south of the UPRR and east of the Henry Drive Bridge (Figure 5-1). The site is characterized by chlorinated solvents in groundwater that form a VOC plume consisting primarily of PCE, TCE, and benzene.

5.1.1 Physical Characteristics

The point bar and an ancient alluvial terrace dominate the topography across this area. The point bar is part of the active floodplain and consists of approximately 60 ft of alluvial sediments overlying shale or limestone bedrock. The terrace, located to the north of the railroad grade, also consists of alluvial sediments deposited on shale and limestone bedrock. However, this area is topographically higher than the floodplain and the unconsolidated terrace deposits vary in thickness from nine to 64 ft.

5.1.2 Land and Resource Use

North and west of the UPRR grade is a developed area (the Main Post) with building and road development. Buildings include offices, barracks, family housing units, warehouses, and maintenance facilities. South and east of the UPRR grade is the point bar of the Kansas River, which is mainly covered with forest and vegetation. There is one developed area between the UPRR grade and Marshall Avenue that consists of warehouses, several of which have been converted to office buildings (Figure 5-1).

Land use at OU 005 is classified under multiple land use designations in the RPMP, including open space, industrial, maintenance, supply/storage, and administration. It is anticipated that land use activities will remain unchanged into the foreseeable future. The Main Post area to the north of the UPRR grade is classified as a National Register Historic District. The area to the south of the UPRR grade is classified as "Open Space" in the RPMP. This classification is not expected to change because it is within the active floodplain of the Kansas River where AR 200-2 requires land use to comply with Executive Order 11988 – Floodplain Management. This Order restricts and places requirements on actions that occur within a floodplain. Additionally, the area within 100 meters of the current Kansas River bank is wildlife habitat for bald eagles that winter at FTRI.

The groundwater aquifer underlying OU 005 is currently not a drinking water source. The FTRI water supply wells are located approximately four miles upgradient (west) of OU 005.

5.2 SITE CHRONOLOGY

The chronology of key events for OU 005 is provided in Table 5-1.

Table 5-1. Chronology of Key Events at OU 005

Event	Date
Building 354 constructed as a gasoline service station	1935
The 354 site formally designated an OU after soil and groundwater investigation undertaken after UST removals reveals the presence of chlorinated solvents	January 1997
RI/FS Work Plan	February 1999
RI Field Work	June 1999 – July 2000
Field Data Evaluation Addendum	January 2001
Additional RI Field Work	May – November 2001
354 Air Sampling Plan	December 2002
Air Sampling 354 Area Solvent Detections Work Plan	February 2003
Phase 1 Air Sampling	February 2003 – April 2004
Phase 2 Air Sampling	April – June 2003
RI Report	November 2003
Pilot Study Work Plan	December 2003
Pilot Study Field Work	March 2004 – February 2005
Soil Gas Investigation Work Plan and Field Work	September 2004 – January 2005
FS Report	December 2004
Proposed Plan	May 2005
Soil Gas Investigation Report	June 2005
Pilot Study Report	June 2005
ROD	June 2006
RD/RA Approved	April 2007
First FYR	September 2007
Second FYR	September 2012
Addendum to the Third FYR and TM	October 2013
Soil removal conducted to address potential VI at Building 367	October 2013
Increasing concentrations of PCE in three monitoring wells	March, July 2014
Explanation of Significant Difference	March 2015
Final Work Plan for PDI	April 2016
PDI	April-May 2016
Fourth FYR	September 2017
Final PDI Report Addendum	July 2021

FS = Feasibility Study
PCE = tetrachloroethene
RI = Remedial Investigation
TM = technical memorandum
FYR = five-year review
PDI = pre-design investigation
ROD = Record of Decision
UST = underground storage tank
OU = operable unit
RD/RA = Remedial Design/Remedial Action Plan

5.3 HISTORY OF CONTAMINATION

The former Building 354 was constructed in 1935 as a gasoline service station. A total of five underground storage tanks (USTs) installed at the site circa 1935 used for storage of gasoline and diesel fuel, and subsequently possibly solvents and road oil, were removed in 1990 and 1992. The former USTs were located 20 ft south of the former Building 354 and approximately 60 ft northwest of the site.

Following the removal of the USTs at the Building 354, investigation of soil and groundwater revealed the presence of chlorinated solvent contamination in groundwater, primarily PCE. The major findings of a 2004 RI were that soil and groundwater were media of concern. Although Building 354 was not confirmed as a source of PCE contamination, one of the former USTs was reportedly used to store solvents. The additional investigation indicated that the primary source of PCE was Building 367, located approximately 1,200 ft north and upgradient of Building 354 on Carr Avenue.

Building 367 was constructed in 1903 and originally served as an artillery gun shed. It was later used for storage and some limited small vehicle maintenance. It is on the National Register of Historic Places as part of the Main Post Historic District.

5.4 INITIAL RESPONSE

Response actions were conducted at OU 005 prior to approval of the ROD in 2004 and 2005.

A 2004 soil remediation performed at the Building 367 location included treatment with an in-situ mixing of potassium permanganate to oxidize the chlorinated solvents present. At that time, the soil mixture remained too wet and was subsequently removed to a land-farm cell where it was dried, tilled, and tested until the PCE tested below the regulatory standard (180 µg/kg). The excavation was backfilled with clean soil and the site re-paved with 8” of asphalt. Approximately 1,000 cy of chlorinated solvents-contaminated soil was remediated at Building 367.

5.5 BASIS FOR TAKING ACTION

The basis for taking action at OU 005 was the unacceptable risk associated with potential future use of groundwater as a drinking water source. Four VOCs (PCE, TCE, cis-1,2-DCE, and benzene) were identified.

5.6 REMEDIAL ACTION

5.6.1 Remedy Selection

The remedy for OU 005 was selected in the ROD approved on 16 June 2006.

5.6.2 Remedial Action Objectives

The ROD included the following RAOs for OU 005:

- Prevent the potential for degradation of the surface waters of the Kansas River by reducing levels or eliminating contaminants from the margin of the Kansas River alluvial aquifer;

- Reduce contamination levels to below MCLs within the Kansas River alluvial aquifer through use of natural and/or active remedial processes; and
- Reduce contaminant levels, to the extent practicable and appropriate, within the terrace aquifer, through natural and/or active remedial processes.

5.6.3 Remediation Goals

The numerical RGs established for OU 005 in the ROD were the drinking water standards, or MCLs, as summarized in Table 5-2.

Table 5-2. OU 005 Groundwater Remediation Goals

Analyte	Remediation Goal[1] (µg/L)	Basis
PCE	5	MCL
TCE	5	MCL
cis-1,2-DCE	70	MCL
Benzene	5	MCL

[1] Remediation goal based on May 1993 USEPA MCL.
µg/L = micrograms per liter cis-1,2-DCE = cis 1,2,-dichloroethene MCL = maximum contaminant level
PCE = tetrachloroethene TCE = trichloroethene USEPA = United States Environmental Protection Agency

5.6.4 Remedy Description

The remedy for OU 005 included ICs and MNA and relies on natural degradation processes already occurring to further reduce contaminant concentrations below their respective MCLs, and annual groundwater monitoring. According to the ROD, once concentrations of COCs in the alluvial wells were below MCLs, OU 005 could be recommended for site closeout. The activities that ICs are intended to control include restricting residential land use, limiting public access, prohibiting installation of drinking water wells and groundwater use in the area, and involving the FTRI PWE personnel in proposed future plans for the site.

The ROD was modified in March 2016 by an Explanation of Significant Difference (ESD) following an increase in PCE concentrations during sampling events in March and April 2014. Based on that data, it was determined that continuing with the passive MNA remedy would result in ineffective PCE treatment of terrace groundwater that could eventually impact downgradient wells. The Summary of Basis presented in the ESD stated:

> *"The changed remedy will consist of in situ bioremediation of the soil and ground water in the upland terrace materials at the site followed by MNA in the terrace and alluvial aquifers in order to monitor remedial progress. In situ bioremediation will consist of injections of a carbon donor substrate in order to create a reducing environment in the subsurface that will promote anaerobic degradation of the PCE contamination by naturally-occurring microbial populations in the subsurface."*

5.6.5 Remedy Implementation

Groundwater sampling of the nine existing monitoring wells occurred at the site in 2006, 2007, 2008, 2009, 2011, and 2012 with the final annual post-ROD groundwater sampling events completed in March and July 2014. Following these events, the ESD was prepared in response to levels of PCE in three terrace aquifer monitoring wells (354- 01-27, 354-99-09, and TS0292-01) that indicated active remediation was required.

Following this, a Pre-Design Investigation (PDI) was completed to further delineate the nature and extent of groundwater contaminants following the installation of four new monitoring wells at the 354 Area to better understand the extent of groundwater contamination. After completing eight rounds of quarterly groundwater sampling from May 2016 to February 2018, it was found that the overall concentration of PCE in the terrace aquifer wells was decreasing and alluvial monitoring wells have not been impacted by the PCE contamination. Therefore, the 2018 PDI Report concluded in situ bioremediation of the soil and groundwater in the upland terrace materials was not necessary and recommended to “rescind the ESD and revert to the remedy selected in the ROD (MNA with ICs)”. In its comment letter regarding the 2018 Draft PDI Report, USEPA requested additional monitoring wells be installed to better define the eastern plume boundary and to monitor the area of highest impact found during the PDI. USEPA agreed to consider the remedy status following sampling of the newly installed monitoring wells. In response, four new monitoring wells (354-19-32 through 354-19-35) were installed at the site in 2019, and one year of quarterly groundwater sampling was performed in 2021. The results of the additional monitoring well installation and groundwater monitoring results were presented in the July 2021 Final PDI Report Addendum. The addendum concluded the groundwater contaminant plume is adequately delineated and data is sufficient to consider rescinding the ESD and reverting back to the remedy selected in the ROD of MNA and ICs. However, in a letter dated 30 June 2021, the USEPA requested that because the data in the addendum offered minimal evidence that conditions with the terrace aquifer are supportive of natural contaminant degradation processes, the U.S. Army instead consider implementing a limited in-situ bioremediation study to enhance conditions supportive of PCE degradation (USEPA, 2021). This approach, which the USEPA considers consistent with the 2015 ESD thereby eliminating the need for a post-ROD decision document, is scheduled for implementation in 2022.

ICs were implemented at OU 005 in 2008. FTRI ICs are documented in the RPMP and include restricting land use to non-residential, limiting public access, and prohibiting installation of drinking water wells and groundwater use at OU 005. The FTRI RPMP restricts building construction and demolition, digging and trenching, and installation of drinking water wells at OU 005. The ICs have been enforced through annual inspections and the dig permitting procedures that are monitored by PWE personnel.

The LUCIP report dated October 2015 indicated that LUCs at OU 005 were functioning as intended in accordance with the ROD and that no new LUCs were planned for the site.

5.6.6 Operations and Maintenance

O&M activities required for OU 005 include annual well maintenance and repairs, as needed.

Annual O&M costs for OU 005 are managed under a firm fixed-price contract.

5.6.6.1 Inspections

Inspections were performed annually at OU 005 during the 2017 to 2021 reporting period to document that the land use within the LUC boundary conforms to the LUC requirement and that no LUC deficiencies, violations, or inconsistencies were identified. The inspections also were performed to assess the condition of monitoring wells. Documented activities and observations on field forms and with photographs are provided in the LTO/LTM Reports.

Groundwater monitoring well inspections, which include inspecting the condition of associated pads, bollards, protective covers, and locks, were also conducted as part of the annual inspections. Groundwater monitoring well inspections routinely identified maintenance and repair needs, but none that would impact well integrity during the 2017 to 2021 reporting period.

The wells were inspected during the quarterly 2021 sampling events and were in good condition, as recorded on the Well Maintenance Form included in the PDI Report attached in Appendix B.

5.6.6.2 Groundwater Monitoring

Groundwater monitoring data have been collected at OU 005 since 2000. Analytical results are discussed in Section 5.8.1.

Groundwater monitoring at OU 005 has been conducted in February 2018, and on a quarterly basis in 2020 (January, May, July, and October) since the previous FYR.

The LTM program, as detailed in the ROD and subsequent PDI Addendum Report, consists of measuring static water levels and collecting groundwater samples for chemical analysis during the four rounds of monitoring/sampling events that have been conducted at OU 005 during quarterly sampling in 2020.

The 354 Area Solvent Detections site monitoring well network consists of 13 monitoring wells. Nine of these wells are screened in either the terrace or the alluvial aquifer as listed below:

- Terrace aquifer: TS0292-01, 354-99-09, 354-00-10, 354-01-26, and 354-01-27; and
- Alluvial aquifer: TS0292-02, 354-99-12C, 354-99-13C, and 354-01-30C.

Four of these wells are new monitoring wells, which were installed as part of the 2020 groundwater sampling and are screened in either the terrace or the alluvial aquifer as listed below:

- Terrace aquifer: 354-19-32, 354-19-33, and 354-19-34; and
- Alluvial aquifer: 354-19-35.

Sampling results included in this FYR reporting period from each sampling event are provided in Annual LTO/LTM Reports and the PDI Addendum Report.

The objectives of the groundwater monitoring plan are to monitor natural attenuation processes and contaminant concentrations in the vicinity of OU 005.

2020 groundwater sampling activities conducted at the Building 354 Area Solvent Detections site were performed in support of determining if the groundwater contaminant plume is adequately delineated and if data is sufficient to rescind the ESD and revert back to the remedy selected in the ROD. Groundwater flow in the terrace aquifer at the 354 Area Solvent Detections site was toward the south during all four quarterly 2020 groundwater sampling events. Groundwater flow in the alluvial aquifer was south-southeast moving with the general direction of flow of the Kansas River.

5.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

5.7.1 Protectiveness Statement From The Last Review

The final protectiveness statement for OU 005 from the last FYR is provided below.

> *"The remedy at OU 005, 354 Area Solvent Detections, is expected to be protective of human health and the environment upon completion of the remedy as described in the 2016 ESD. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas."*

5.7.2 Status of Recommendations and Follow-Up Actions from Last Review

No issues were identified during the fourth FYR that affect the current or future protectiveness of the remedy at OU 005.

5.8 FIVE-YEAR REVIEW PROCESS

5.8.1 Data Review

The FYR process consists of a review and evaluation of data generated in relation to the remedy objectives. The results of the data review indicate the RAOs established in the ROD are being achieved as follows:

- The potential for degradation of the surface waters of the Kansas River has been prevented by reducing levels or eliminating COCs from the margin of the Kansas River alluvial aquifer;
- COC concentrations have been reduced below RGs within the Kansas River alluvial aquifer through use of natural and/or active remedial processes; and
- COC concentrations have been reduced, to the extent practicable and appropriate, within the terrace aquifer, through natural and/or active remedial processes.

The objective of the remedy was to prevent further degradation of groundwater and exposure to contaminated groundwater until concentrations of COCs met RGs. The remedy was subsequently modified in March 2016 in an ESD to the ROD following a significant increase in PCE concentrations in groundwater in 2014. The revised remedy included a PDI to identify other potential sources of PCE and evaluation of in-situ bioremediation technologies.

However, after the PDI was conducted, which included installation of four additional monitoring wells to further define the extent of the VOC plume, it was concluded the plume was adequately defined; no other potential PCE sources were identified; and the selected remedy is still effective in preventing contamination from reaching the alluvial aquifer and Kansas River at levels above the RGs. Therefore, the revised remedy presented in the ESD was not implemented, and it was concluded that consideration be given to rescinding the ESD and reverting back to the selected remedy in the ROD of MNA and ICs. However, the ESD was not rescinded, and subsequent monitoring data indicated PCE concentrations that exceeded RGs in three wells were not decreasing significantly. Therefore, the U.S. Army is planning to conduct additional substrate injections to enhance conditions supportive of PCE degradation via direct push technology (DPT) in two transects perpendicular to groundwater flow, one upgradient and one downgradient of the highest remaining PCE impacts in and around MW 354-19-34.

The monitoring well network consists of 13 monitoring wells. During the four quarters of 2020 groundwater sampling, PCE concentrations exceeded the RG in three monitoring wells. While the other COCs (TCE, cis-1,2-DCE, and benzene) were detected in all four quarters of 2020 at some monitoring wells, the concentrations did not exceed RGs.

Table 5-3. COCs in OU 005 Groundwater

COC	RG (µg/L)	Maximum COC Concentration Detected 2020 (µg/L)	Number of Wells Where COC Concentration Exceeded the RG
PCE	5	70	3

µg/L = micrograms per liter COC = chemical of concern PCE = tetrachloroethene RG = Remediation Goal

The piezometric surface map for the fourth quarter 2020 sampling event is presented on Figure 5-3. The potentiometric surface contour shown on the figure is based on water elevation data collected over time from the onsite and northern and southern boundary monitoring wells, which are aligned with the approximate groundwater flow direction to the south-southeast.

VOC concentrations in groundwater in both the terrace and alluvial aquifers for each quarterly 2020 groundwater sampling event are presented on Figure 5-4.

The most recent analytical results for quarterly monitoring (2020) are presented in the PDI Report Addendum and summarized below with the corresponding data tables provided in Appendix E3 (pages E3-1 through E3-19).

- Chlorinated solvents, including PCE, TCE, and cis-1,2-DCE have currently and historically been detected in groundwater from both the terrace and alluvial aquifers. The highest concentrations of PCE have been detected in groundwater from the terrace aquifer. PCE is also present in the alluvial aquifer, but at significantly lower concentrations. Contaminants are transported south within the terrace aquifer to the alluvial aquifer. Based on the evaluation of MNA indicator parameters within the terrace aquifer and the contaminant chemistry, it appears that little or no biotransformation of chlorinated solvents is occurring. Based on the evaluation of MNA indicator parameters within the alluvial aquifer and the contaminant chemistry, it appears that limited biotransformation of chlorinated solvents is occurring, but not to a significant degree.

- Once the contaminant plume intersects the alluvial aquifer, geochemical conditions change. The direction of transport changes to a south-southeast direction, moving with the general direction of flow of the Kansas River. Groundwater in the alluvial aquifer generally has lower DO, ORP, and nitrate levels and increased ferrous iron levels, suggesting that the environmental conditions improve for reductive dechlorination.
- The newly installed monitoring wells indicate the contaminant plume is adequately delineated. Additionally, the data indicate that COC concentrations in the three historical monitoring wells (TS0292-01, 354-99-09, and 354-01-27) with RG exceedances display a statistically decreasing trend over time as presented in the Mann Kendall Analysis tables and graphs included in Appendix E3 (pages E3-20 through E3-22). The newly-installed monitoring well (354-19-34) had exceedances of PCE during each of the 2020 groundwater sampling events. However, due to the limited data set, a statistical plume stability trend could not be determined.
- All monitoring wells screened within the alluvial aquifer (TS0292-02, 354-99-12c, 354-99-13c, 354-01- 30c, and 354-19-35) indicate some limited evidence of favorable conditions for reductive dechlorination. The results of the MNA evaluation are consistent with the findings in the RI Report and the selection of MNA as a remedy in the ROD.

5.8.2 Site Inspection

The site inspection was conducted on 16 September 2021 and consisted of observations of the site conditions. Aerostar and USACE, Kansas City District, personnel were accompanied on the site inspection of OU 005 by the FTRI PWE IRP Manager. The FTRI IRP Manager provided an overview of activities at OU 005 and indicated that inspections are conducted annually and that the remedy was functioning as intended.

The Team reviewed OU 005 and found that the land use in the area has not changed and there are no occupied structures within the site boundary. No inappropriate use of OU 005 was observed.

Appendix C provides details of the Site Inspection including the participants, FYR Site Inspection Checklist, and photographs.

5.8.3 Interviews

Interviews regarding OU 005 are summarized below and the complete interview records are included in Appendix D.

Interviewees indicated the remedy at OU 005 is functioning as intended, and noted in general:

- The PDI was completed to study remaining contamination in support of further plume delineation and potentially conducting additional substrate injections to enhance conditions supportive of PCE degradation as described in the PDI Addendum Report; and
- Four new monitoring wells were installed in 2019 to provide further delineation of the PCE plume at OU 005. This was followed by one year of quarterly sampling in 2021 and a U.S. Army request to revert the remedy to MNA. Based on data review, USEPA recommended the U.S. Army instead

move forward with implementing the remedy described in the 2015 ESD, in situ bioremediation. The U.S. Army project team agreed with this approach and is planning to implement the remedy in 2022.

5.9 TECHNICAL ASSESSMENT

The technical assessment of the protectiveness of the remedy for OU 005 is based on the responses to these three questions:

Question A: *Is the remedy functioning as intended by the decision documents?*

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?*

Question C: *Has any other information come to light that could question the protectiveness of the remedy?*

5.9.1 Question A: Is The Remedy Functioning As Intended By The Decision Document?

Yes, the remedy at OU 005 is functioning as intended by the ROD based on review of documents, interviews, and the site inspection.

The selected remedy was completed in 2006 and included MNA and ICs for impacted groundwater following an increase in concentrations of PCE in 2014, an ESD to the ROD in 2015 modified the remedy to include in-situ bioremediation of the groundwater plume and quarterly groundwater monitoring for two years. However, the modified remedy was not implemented because groundwater monitoring data between 2012 and 2021 suggests that MNA continues to be effective in meeting the RAOs for OU 005. MNA indicator parameters used to evaluate if aquifer conditions were favorable for supporting reductive dechlorination and the occurrence and/or extent of dechlorination provided limited evidence of favorable conditions in either the terrace or alluvial aquifer. All monitoring wells screened within the alluvial aquifer indicate some limited evidence for anaerobic biodegradation. From Mann-Kendall analysis, a downward trend was noted for all COCs for wells with large enough datasets to determine a trend. This downward trend in VOC concentrations is likely associated with the source area removal combined with natural physical, chemical, and biological processes including biodegradation, dilution, dispersion, volatilization, adsorption, absorption, and/or reactions with subsurface materials. Statistical trend analysis generally indicated decreasing and stable trends for VOC concentrations in groundwater across OU 005, and the presence of breakdown products that is expected where MNA is occurring.

Although MNA appears to be occurring, as COC concentrations are decreasing overall in OU 005 wells and PCE is the only COC with concentrations above MCLs in three wells, the concentrations have not been decreasing significantly in recent years. Therefore, the U.S. Army has agreed to implement a limited in situ bioremediation study to enhance conditions supportive of PCE degradation. The U.S. Army project team agreed with this approach and is planning to implement the remedy in 2022.

ICs have been implemented and maintained at OU 005 through the 2006 RPMP and 2011 LTMCP. In 2015, a LUCIP was also prepared to ensure that current and future activities are compatible with land use restrictions. The LUCIP identifies several processes that ensure the LUCs remain effective at OU 005. The "Site Approval Process" establishes processes for reviewing and approving excavation and construction projects, as well as other land use changes on the installation. Based on interviews with FTRI Environmental Personnel, this process is being followed as part of the installation's compliance with NEPA. The FTRI NEPA Coordinator provides proposals for projects that could impact IRP sites, including OU 005, to the IRP PM for review. A review of the procedures for monitoring and enforcement indicated that the FTRI O&M program is effective in preventing unacceptable exposure to groundwater.

5.9.2 Question B: Are The Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used At the Time Of The Remedy Selection Still Valid?

Yes, the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid.

5.9.3 Changes in Standards, Newly Promulgated Standards, and TBCs

The ROD identified the principal ARARs that are relevant and appropriate for OU 005, as MCLs. The ROD also identified action- and location-specific standards such as endangered and/or threatened species, floodplain, historical, and RCRA requirements that have not changed. RGs were established in the 2006 ROD for OU 005 groundwater COCs, which are presented in Table 5-4. Potential ecological exposure to aquatic receptors via groundwater to surface water pathways is adequately addressed by the groundwater RGs selected for OU 001.

Table 5-4. Remediation Goals for OU 005 Groundwater COCs

COC	ROD RG (µg/L)	Basis
PCE	5	MCL
TCE	5	MCL
cis-1,2-DCE	70	MCL
Benzene	5	MCL

Remediation Goals (RGs) from 2006 OU0005 Record of Decision (ROD) (USACE, 2006)
Maximum Contaminant Level (MCL) www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations
cis-1,2-DCE = cis-1,2-dicholoroethene COC = chemical of concern PCE = tetrachloroethene TCE = trichloroethene
µg/L = micrograms per liter USACE = United States Army Corps of Engineers

The RGs for all COCs were the MCL, which have not changed since the 2006 ROD; therefore the protectiveness of the remedy is not affected.

5.9.4 Changes in Exposure Pathways

There have been no changes in exposure pathways since the ROD for OU 005 was approved in 2006. The baseline risk assessment did not evaluate the VI pathway; however this pathway was evaluated as a component of the 2012 FYR as organic compounds that may volatilize are present within the soil at OU 005 and occupied buildings are present within the site boundary.

The 2013 Addendum to the 2012 FYR report included a TM that was prepared to address the deferred protectiveness of the OU 005 remedy due to potential VI exposures associated with Building 367. The evaluation concluded that VI did not pose a potential threat to human health at OU 005, and specifically Building 367, due to the following:

- Soil sources were removed during remedial actions, with clean soil backfill and re-pavement of the area, and;
- Continuous decreases of concentrations of COCs in monitoring wells over time, with PCE the only COC exceeding MCLs in three wells.

In addition, the TM suggested that the RPMP be updated to include a statement that there is a limited potential for VI, which should be reassessed if the building use, conditions and/or tenants are changed. Calculated VI risks presented in the 2003 RI were based on measured soil-gas concentrations and indicated that the risks associated with VI were all orders of magnitude below the acceptable cancer risk range of 1E-6 to 1E-4 and the acceptable HI of 1. In addition, building use, conditions and/or tenants have not changed. Therefore, the VI pathway is not expected to pose an unacceptable risk at this site, and there are no changes in exposure pathways that could affect the protectiveness of the remedy.

5.9.5 Changes in Toxicity and Other Contaminant Characteristics

The RGs for all OU 005 COCs were the USEPA MCLs, which are not dependent on toxicity data, and risks associated with VI presented in the 2003 RI were all orders of magnitude below the acceptable cancer risk range of 1E-6 to 1E-4 and the acceptable HI of 1; therefore, changes in toxicity data do not affect the protectiveness of the remedy.

5.9.6 Changes in Land Use

There have been no changes to land use since the 2006 ROD and there are no anticipated changes to future land uses associated with OU 005; therefore, the protectiveness of the remedy has not been affected.

5.9.7 Changes in Risk Assessment Methods

There have been no changes in risk assessment methods since the 2008 ROD that impact the standards (MCLs) used in the site evaluations; therefore the protectiveness of the remedy has not been affected.

5.9.8 Expected Progress Toward Meeting RAOs

Significant progress has been made toward meeting the RAOs through MNA, as concentrations of COCs in groundwater overall have been decreasing since 2016 and there is evidence of anaerobic degradation occurring. However, the PCE concentrations have not been decreasing significantly in recent years. Therefore, the U.S. Army has agreed to implement a limited in situ bioremediation study to enhance conditions supportive of PCE degradation. The U.S. Army project team agreed with this approach and is planning to implement the remedy in 2022, which is anticipated to further reduce concentrations of PCE in groundwater. The RAO to achieve RGs in groundwater is expected to be met in the future since in situ treatment will be performed and concentrations of COCs in groundwater are decreasing.

5.9.9 Question C: Has Any Other Information Come To Light That Could Call Into Question The Protectiveness of the Remedy?

No, no other information has come to light that could call into question the protectiveness of the remedy.

5.10 Issues

There were no issues found affecting the protectiveness of the remedy.

5.11 Recommendations and Follow-up Actions

No issues that could affect current and/or future protectiveness were identified for OU 005. Therefore, no follow-up actions are required at this time.

5.11.1 Other Findings

There were no other findings identified during this FYR for OU 005.

5.12 Protectiveness Statement

The remedy at OU 005, Building 354 Solvent Area Detections, is protective of human health and the environment. Enforcement of ICs that prohibit drilling and installation of water wells prevents exposure to groundwater; monitoring demonstrates that biodegradation continues to effectively reduce concentrations of COCs; and ICs are in place to prevent exposure to groundwater and prohibit drilling and installation of water wells.

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6. OU 006 - OPEN BURNING/OPEN DETONATION GROUNDS

6.1 SITE DESCRIPTION

OU 006 is identified in the FTRI IAP as OB/OD Grounds, FTRI-009 (HQAES Environmental Site ID 20605.1009), also referred to as the "OB/OD site" or "Range 16" in some supporting documents. The OB/OD Grounds is an active range located approximately 2.5 miles to the northeast of Custer Hill, in the Impact Area, and outside of the developed areas of FTRI (Figure 1-2). The active portion of the OB/OD Grounds is an area approximately 700 ft by 550 ft, an inverted L-shaped area located within Range 16 in the southern part of the Impact Area, approximately 2,300 ft north of Vinton School Road (Figure 6-1).

6.1.1 Physical Characteristics

The OB/OD Grounds is a sparsely vegetated area underlain by rocky soil (regolith) and bedrock that consists of alternating shale and limestone beds. Controlled burning is conducted by FTRI on a regular basis for the management of the tall-grass prairie ecosystem, as well as to control wildfires. Ephemeral streams are present to the east and west of the active portion of the OB/OD Grounds, and wet weather springs are present within the active portion of the site (Figure 6-2).

Bedrock at the OB/OD Grounds consists of alternating limestone and shale units of the Permian Chase and Council Grove Groups. Bedrock dips gently to the southwest. Two sets of joints, one set orientated east-northeast and one set orientated north-northwest, are present in the bedrock and are more prominent in the limestone beds. At some locations, fractures are also present in the top of bedrock due to the discharge of explosives.

Groundwater is present at the OB/OD Grounds (OU 006) in the regolith and the upper weathered bedrock in the upper aquifer, and in bedrock units within the lower aquifer.

The soils at the OB/OD site are composed of silt-loams and silty-clay loams overlying alternating sequences of shale and limestone. Groundwater at the OB/OD site is present from upgradient aquifer recharge and through precipitation. Precipitation is transported along the ground surface via overland flow and migrates downward by infiltration and percolation through micro- and macro-fractures within the regolith. Following infiltration and percolation, groundwater moves horizontally along bedding planes in the shale (semi-confining) and limestone formations and vertically by preferential and non-preferential pathways into the weathered bedrock mass through fractures and joints. Additional fractures are also possible at the OB/OD site due to its historical and continued use as a range for detonation of explosives.

Springs and wet weather seeps are present at the OB/OD site. During periods of heavier precipitation, they flow as the fracture and joint network within the weathered bedrock mass reach maximum pore volume/fracture aperture capacities. This allows wet weather features like ephemeral streams, springs, and seeps to flow and weep. This flow path along the top of more resistant units in the soil/weathered bedrock interface infiltrates the deeper soils near the bedrock interface located down gradient of the metal debris pits.

Groundwater at the OB/OD site is found mainly within two horizons, the regolith/weathered bedrock horizon and the Threemile Limestone Member. The majority of monitoring wells at OB/OD are set within the upper regolith/weathered bedrock horizon. During the baseline sampling event, the groundwater flow direction within the regolith/weathered aquifer was to the south-southwest, while the groundwater flow direction in the lower bedrock aquifer mounded around Monitoring Well OB-12-20D and sloped to the northwest and to the south.

6.1.2 Land and Resource Use

Prior to 1942, the OB/OD Grounds was used for ranching and farming. In 1942, the land was obtained by the military and has been in use by the U.S. Army from 1942 to the present for munitions burning and detonation. Historic site use has not changed, although detonation activities have diminished.

OU 006 is located in an isolated part of FTRI, and surrounding lands consist of undeveloped wooded and grassy lands. No residential or commercial structures exist near the site. Land use is classified as "training/ranges" under the FTRI RPMP, and it is anticipated that land use activities will remain unchanged into the foreseeable future.

OU 006 is part of the Impact Area for weapons training at FTRI and access is restricted by the U.S. Army due to the nature of the training. Access is limited to Explosive Ordnance Disposal (EOD)/Range personnel during detonation of ordnance.

Currently, the 74th EOD Detachment at FTRI manages ordnance materials from FTRI, the DoD, and other state and federal agencies. Since 1991, the 74th EOD Detachment has been responsible for providing support to military installations, operations, and exercises; and to civilian and federal authorities within an operational area that includes the states of Kansas, Nebraska, Missouri, and South Dakota.

Ordnance was formerly disposed of by the 74th EOD Detachment at the OB/OD Grounds by open burning and open detonation. Currently, only open detonations for emergency disposal of ordnance and training are conducted. Open detonation occurs on open ground and creates crater-like pits, which typically reach a maximum size of 25 ft in diameter and 10 to 15 ft in depth. Open burning was formerly conducted within a specific area that was characterized by a small pit with a metal grating surrounded by a 9-ft high, horseshoe-shaped embankment (South Burn Pit). The open burn pit was primarily used to dispose of black powder and phosphorus-based munitions.

At present, there are three active detonation pit areas, two metal debris pits, and two non-active burn pits at the OB/OD (Figure 6-2). Open detonation is currently being conducted at the Northwest, West, and East Demolition Pits. Generally, detonations are conducted within the same area but may not be within the same pit.

A water supply well is located on the military reservation at Range 18, approximately 4,200 ft toward the east, up gradient of OU 006. This well is used only for non-potable purposes. A potable water supply well is also located on the former Range 19, approximately 5,000 ft to the east and up gradient of OU 006. No other supply wells are located on or within one mile of the site. The nearest potable public water supply well is the City of Ogden well field located approximately three miles away to the southeast and screened in the Kansas River alluvium. Based on the FTRI RPMP, the mission for the OB/OD Grounds will not change for the foreseeable future and water at Range 16 will not be used for either potable or non-potable purposes.

6.2 SITE CHRONOLOGY

The chronology of key events for OU 006 is provided in Table 6-1.

Table 6-1. Chronology of Key Events at OU 006

Event	Date
Initial SI conducted	1993
Confirmation sampling of existing monitoring wells	1995
Soil, groundwater, and surface water sampling	1997-1999
Site Analysis performed	1999
Soil, groundwater, and surface water sampling	2003-2011
RIs conducted	2011 - 2013
RI Report approved	2013
ROD	June 2016
RD/RA Approved	April 2018

RD/RA = Remedial Design/Remedial Action Plan RI = remedial investigation ROD = Record of Decision SI = site investigation

6.3 HISTORY OF CONTAMINATION

An initial SI was conducted in 1993 that determined TCE was found in groundwater at a concentration that exceeded its MCL, and again during confirmation sampling of monitoring wells conducted in 1995. Additional monitoring wells were installed in 1997 to evaluate possible sources and extent of contamination at the OB/OD Grounds, and surface water was sampled. TCE exceeded the MCL in a spring and the hand-dug well.

Between 2005 and 2007, a monitoring well screened within the regolith was installed downgradient of the active portion of Range 16 in the southwestern portion of the OB/OD (OU 006), and seven locations were direct-pushed for the collection of groundwater samples for VOC analysis. Exceedances of the TCE MCL were reported at two of the locations.

The findings of the RI field activities conducted from 2011 to 2013 indicated VOCs [TCE and 1,1,2,2-tetrachloroethane (1,1,2,2-PCA or TeCA)] were the most common exceedances of the screening levels. Exceedances were found in the area of the metal debris pits for the surface and subsurface soil media, down gradient of the pits for the groundwater, and in the surface water at locations where the groundwater discharges to the surface water.

6.4 Initial Response

No initial response was conducted at the site related to COCs in site media, although munitions and explosives of concern (MEC) surveys and removal actions have been historically conducted throughout the Impact Area.

6.5 Basis For Taking Action

The basis for taking action at OU 006 was the unacceptable risk associated with potential future use of groundwater as a drinking water source due to risk based exceedances of TCE detected in subsurface soil; risk based exceedances of PCA and naphthalene detected in groundwater; exceedances of TCE, bis(2-ethylhexyl)phthalate, and benzo(a)pyrene detected in groundwater above MCLs; and risk based exceedances of PCA, TCE, and benzo(a)pyrene detected in surface water.

6.6 Remedial Action

6.6.1 Remedy Selection

The remedy for OU 006 was selected in the ROD approved in June 2016.

6.6.2 Remedial Action Objectives

The RAOs identified in the ROD were:

Soil

- Prevent/minimize migration of COCs that would result in groundwater with concentrations of chemicals in excess of MCLs or risk-based cleanup goals for the current and future site worker and current and future demolition worker.
- Prevent/minimize inhalation of vapors from soil with COCs that exceed risk-based cleanup goals and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range or a HI greater than one for the current and future site worker and current and future demolition worker.

Groundwater

- Prevent/minimize ingestion of or direct contact with groundwater with COCs that exceed MCLs or risk-based cleanup goals for COCs without MCLs, and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range for the current and future site worker and current and future demolition worker
- Prevent/minimize ingestion of groundwater with COCs that exceed MCLs or risk-based cleanup goals for COCs without MCLs, and/or have a HI greater than one for the future site worker and current and future demolition worker
- Prevent/minimize inhalation of vapors from groundwater that has COCs that exceed MCLs or risk-based cleanup goals and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range or a HI greater than one for current and future site worker and current and future demolition worker

Surface Water

- Prevent/minimize direct contact with surface water with COCs that exceed the risk-based cleanup goals and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range for the current and future site worker and current and future demolition worker
- Meet the criteria of the Kansas Surface Water Quality Standards (KSWQS) (Kansas Administrative Regulations 28-16-28c and 28-16-28e [b]).

6.6.3 Remediation Goals

RGs identified in the ROD for soil, groundwater, and surface water are summarized in Table 6-2.

Table 6-2. OU 006 Remediation Goals

Media	COC	Remediation Goal
Soil	Trichloroethene	10.72 mg/kg [a, b]
Groundwater	1,1,2,2-Tetrachloroethane	2.55 µg/L [a]
	Naphthalene	2.61 µg/L [a]
	Trichloroethene	5 µg/L [c]
	Benzo(a)pyrene	0.2 µg/L [c]
	Bis(2-ethylhexyl) phthalate	6 µg/L [c]
Surface Water	1,1,2,2-Tetrachloroethane	236 µg/L [d]
	Trichloroethene	613 µg/L [d]
	Benzo(a)pyrene	0.0374 µg/L [d]

a Remediation Goals (RG) from 2016 OU006 Record of Decision (ROD) (USACE, 2016). Values are site-specific risk-based concentrations for a worker exposure at a target cancer risk level of 1E-5 and/or a target non carcinogenic hazard index of 1.
b The RG selected in the ROD for TCE in soil was not based on the potential leaching to groundwater pathway. The potential for TCE in soil to leach into groundwater was addressed through source removal performed as part of the remedy for OU 006, followed by monitoring of TCE concentrations in groundwater.
c USEPA Maximum Contaminant Level (MCL) from Safe Drinking Water Act (SDWA) National Primary Drinking Water Regulations (https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations)
d RG from 2016 OU006 ROD (USACE, 2016). Values are site-specific risk -based concentrations for surface water dermal contact to a worker at a target cancer risk level of 1E-5 and/or a target non-carcinogenic hazard index of 1.
COC = chemical of concern mg/kg = micrograms per kilogram ROD = record of decision
TCE = trichloroethene µg/L = micrograms per liter USACE = United States Army Corps of Engineers
USEPA = United States Environmental Protection Agency

6.6.4 Remedy Description

The remedy for OU 006 included soil removal and onsite treatment, groundwater/surface water monitoring, and ICs described as follows in the 2016 ROD.

Soil Removal with Treatment and Disposal

The remedy includes excavation and treatment on site by land farming of contaminated soil that was located in the area of the metal debris pits (source area) and contained concentrations of TCE that exceeded the RG. The area will be restored with backfilling, grading, and reseeding after excavation. Solar radiation, wind, and disking of the soil will promote volatilization and biodegradation of the TCE in the soil. After onsite soil treatment is completed, the soil would either be spread on site or transported to the Campbell Hill construction/debris landfill for use as landfill cover.

<u>Groundwater and Surface Water Monitoring</u>

The remedy includes performing groundwater monitoring at monitoring wells within the OB/OD (OU 006) monitoring well network, and surface water monitoring at surface water sampling points, until their respective RGs have not been exceeded for a period of three consecutive monitoring events. This will ensure that COCs continue to decrease in concentration, the contaminant plumes are continuing to decrease in size, and the remedy is not adversely impacting water quality.

<u>ICs through the FTRI RPMP</u>

ICs will be implemented through the FTRI RPMP, which is one means the post authorities have to control and limit development and other activities at FTRI. ICs include overall controls on restricting changes in land use, limiting access, prohibiting the installation of drinking water wells and groundwater/surface water use, and involving FTRI's IRP PM in the proposed future plans.

ICs with respect to site-related contamination would continue until the soil, groundwater, and surface water are no longer a threat to human health or the environment. However, because OU 006 is an active range located within the Impact Area, the range controls are anticipated to remain in place for the foreseeable future.

6.6.5 Remedy Implementation

<u>Soil</u>

The Landfarm Treatment Cell (LFTC) was constructed in March 2019 to treat soil contaminated with TCE and PCA that was removed from the OB/OD site excavation area; source area removal was completed in June 2019. Tilling operations began in June 2019 and occurred every other week until November 2019 when operations were suspended due to winter weather conditions. Tilling resumed every other week in June 2020 and was suspended in August 2020.

Four confirmation sampling events were completed as part of the LFTC operations. Data from the fourth sampling event found that concentrations in all samples for TCE and all samples except one for PCA in soil were below their respective RGs for soil. It was estimated that the RG would be achieved by the end of 2020, but one of 64 cells tested above the RG. Thus, tilling of the landfarm continued during the summer of 2021, with three additional rounds of sampling conducted in June 2021, September 2021, and January 2022. Due to laboratory dilution issues, three separate sampling events were needed to develop one complete data set and confirm that all soil was treated to concentrations below the RG.

<u>Groundwater and Surface Water</u>

During Year 1 of LTM, four quarterly groundwater and surface water sampling events were conducted at the 24 monitoring well locations and six surface water sampling locations. These sampling events were conducted in August 2019, December 2019, May 2020, and July 2020. Field work for each sampling event consisted of the following activities:

- Monitoring well inspections and maintenance, if needed;
- Groundwater level measurements;
- Monitoring well purging and sample collection; and
- Surface water sample collection.

ICs

ICs were implemented at OU 006 after signature of the ROD in 2016. The FTRI RPMP restricts building construction and demolition, digging and trenching, and installation of drinking water wells at OU 006. The ICs have been enforced through annual inspections and the dig permitting procedures that are monitored by PWE personnel.

FTRI ICs are documented in the RPMP and include restricting land use to non-residential, limiting public access, and prohibiting installation of drinking water wells and groundwater use at OU 006. Restrictions are to be enforced through the FTRI RPMP.

6.6.6 Operations and Maintenance

O&M activities required for OU 006 are detailed in the ROD and include onsite landfarm treatment of excavated soil and annual well maintenance and repairs, as needed. Onsite landfarm treatment of excavated soil is close to completion at the OB/OD Grounds, after which treated soil will be reused as landfill cover at the on-post construction and debris landfill at Campbell Hill.

Annual O&M costs for OU 006 are managed under a firm fixed-price contract.

6.6.6.1 Inspections

Inspections have been performed annually at OU 006 since implementation of the remedy in 2019 to document that the land use within the IC boundary conforms to the IC requirements identified in the RPMP and that no deficiencies, violations, or inconsistencies were identified. The inspections also were performed to assess the condition of monitoring wells. Documented activities and observations on field forms and with photographs are provided in the LTO/LTM Reports.

Groundwater monitoring well inspections, which include inspecting the condition of associated pads, bollards, protective covers, and locks, were also conducted as part of the annual inspections. Groundwater monitoring well inspections routinely identified maintenance and repair needs, but none that would impact well integrity during the reporting period.

The wells were inspected and were in good condition during the 2020 sampling events and noted conditions were recorded on the Well Maintenance Form in the ASR, which documents the groundwater and surface water LTM activities performed at the OB/OD site during Year 1 of the LTM.

6.6.6.2 Groundwater and Surface Water Monitoring

Groundwater and surface water monitoring data have been collected at OU 006 since 1993.

Under the selected remedy in the 2016 ROD, groundwater and surface water was sampled on a quarterly basis in 2020 and 2021 (Years 1 and 2 of 3 Years of LTM), to be followed by semi-annual monitoring in 2022 (Year 3). If concentrations of COCs decrease below RGs at the end of Year 3, LTM activities will cease for OU 006.

The LTM program, as detailed in the ROD and subsequent RD/RA Work Plan, consists of measuring static water levels and collecting groundwater samples for chemical analysis during the four rounds of monitoring/sampling events conducted at OU 006 during quarterly sampling in 2020 and 2021, and semi-annually in 2022 and beyond, for as long as required.

The OB/OD site monitoring well network consist of 24 monitoring wells, 15 of which are screened in the regolith or weathered bedrock:

- OB-05-15, OB-12-15D, OB-12-16, OB-12-17, OB-12-18, OB-18-21, OB-18-22, OB-18-23, OB-18-25, OB-93-01, OB-93-02, OB-97-06, OB-97-07, OB-97-08, and OB-97-14.

The remaining nine monitoring wells are screened in the lower bedrock:

- OB-12-19D, OB-12-20D, OB-18-24D, OB-18-26D, OB-18-27D, OB-18-28D, OB-93-03, OB-93-04, and OB-97-05.

There are six surface water sampling locations at the OB/OD site:

- Seep, Spring 1, Spring 2, East Stream, Surface Water 1, and Surface Water 2.

The locations of the monitoring wells and surface water sampling locations are illustrated on Figure 6-3. Sampling results included in this FYR reporting period are described in the ASR data tables included in Appendix E4 (pages E4-1 through E4-36).

The Regolith/Weathered Bedrock and Lower Bedrock Aquifer Potentiometric Surface Maps for the July 2020 sampling event are presented on Figures 6-4 and 6-5, respectively.

The Regolith/Weathered Bedrock Aquifer and Surface Water and Lower Bedrock Aquifer VOC Concentration Maps from the first year of LTM (Year 1 LTM) are presented on Figures 6-6 and 6-7, respectively.

The objectives of the groundwater and surface water monitoring plan are to monitor contaminant concentrations before, during, and after the soil remedy was implemented in 2019, until RGs for COCs in groundwater and surface water have not been exceeded for a period of three consecutive monitoring events.

6.7 Progress Since The Last Five-Year Review

This is the first FYR for OB/OD Grounds.

6.8 FIVE-YEAR REVIEW PROCESS

6.8.1 Data Review

The FYR process consists of a review and evaluation of data generated since remedy selection for the OB/OD Grounds in relation to the objectives established in the 2016 ROD. The results of the data review indicate the RAOs established in the ROD are being achieved as follows:

Soil

- Migration of COCs that would result in groundwater with concentrations of COCs that exceed RGs has been mitigated/prevented through source removal.
- Inhalation of vapors from soil with COCs that exceed RGs has been mitigated/prevented through source removal.

Groundwater

- Ingestion of or direct contact with groundwater with COCs that exceed RGs has been prevented/minimized through implementation and maintenance of LUCs that prohibit installation of drinking water wells.

Surface Water

- Direct contact with surface water with COCs that exceed the RGs has been prevented because the occurrences of surface water were sporadic during Year 1 of LTM, there were no COC exceedances of RGs in the surface water samples, and ICs severely restrict access to the site.

6.8.1.1 Soil

Source removal was fully implemented and RGs in soil were met based on the results of confirmation sampling within the excavated area. Excavated soil was treated in the LFTC, and the proposed confirmation sampling events were completed as part of the LFTC operations. Data from the fourth sampling event confirmed that concentrations of TCE in all soil samples from the 64 sampling grids were below the RG, but one cell had a PCA concentration above the RG. Tilling of the land-farm continued during the summer of 2021, with three additional samplings conducted in June 2021, September 2021, and January 2022. Due to laboratory dilution issues, three additional samplings were needed to develop one complete data set and confirm that all soil was treated to concentration below the RG. Results of this most recent sampling may determine that the soil component of the remedy is completed.

The recommendation to officially close the LFTC would then be made. Upon approval for closure, the remediated soil will be transported to the Campbell Hill Construction/Debris Landfill where it can be beneficially utilized as landfill cover.

6.8.1.2 Groundwater and Surface Water Monitoring

The first two years of quarterly groundwater and surface water monitoring were conducted in 2020 (Year 1) and 2021 (Year 2), with concentrations of COCs in groundwater overall decreasing since implementation of the source removal.

The most recent analytical results available for quarterly monitoring (2020) are summarized below, and provided in the data tables attached in Appendix E4 (pages E4-1 through E4-36).

The monitoring well network consist of 24 monitoring wells, and there are six surface water sampling locations. During the four quarters of groundwater sampling in 2019 (Baseline Event) and 2020 (Year 1), PCE concentrations exceeded the RG in five monitoring wells and PCA concentrations exceeded the RG in four monitoring wells. While the other COCs, (TCE, naphthalene, benzo(a)pyrene, and bis(2-ethylhexyl) phthalate) were detected in all four quarters of 2020 at some monitoring wells, the concentrations did not exceed RGs.

Sampling results summarized in Table 6-3 are included in the data tables attached in Appendix E4 (pages E4-1 through E4-36).

Table 6-3. COCs in OU 006 Groundwater

COC	RG (µg/L)	Maximum COC Concentration Detected 2019-2020 (µg/L)	Number of Wells Where COC Concentration Exceeded the RG
PCE	5	120	5
1,1,2,2-PCA	2.55	15	4

µg/L = micrograms per liter COC = chemical of concern PCE = tetrachloroethene RG = Remediation Goal

The locations of the monitoring wells and surface water sampling locations are illustrated on Figure 6-3.

The Regolith/Weathered Bedrock and Lower Bedrock Aquifer Potentiometric Surface Maps for the July 2020 sampling event are presented on Figures 6-4 and 6-5, respectively.

The Regolith/Weathered Bedrock Aquifer and Surface Water and Lower Bedrock Aquifer VOC Concentration Maps from the first year of LTM (Year 1 LTM) are presented on Figures 6-6 and 6-7, respectively.

Groundwater and surface water sampling and data evaluation were conducted in 2020 to assess the effectiveness of the remedial action and evaluate aquifer conditions for supporting reductive dechlorination. Based on Year 1 LTM groundwater results, VOC concentrations at the site are trending downward since the completion of remedial action activities and the number of monitoring wells with RG exceedances have decreased. SVOC detections in groundwater was sporadic during Year 1 LTM. There was very limited evidence of favorable conditions for reductive dechlorination through the primary mechanism of anaerobic degradation in either the regolith/weathered bedrock aquifer or the lower bedrock aquifer due to aerobic conditions present in these formations. The occurrences of surface water were sporadic during Year 1 of LTM, and there were no RG exceedances of VOCs or SVOCs in the surface water samples.

6.8.2 Site Inspection

The site inspection was conducted on 16 September 2021 and consisted of observations of the site conditions. Aerostar and USACE, Kansas City District personnel were accompanied on the site inspections by the FTRI PWE IRP Manager. The FTRI PWE IRP Manager provided an overview of activities at OU 006 and indicated that inspections are conducted annually and that the remedy was functioning as intended.

The team reviewed OU 006 from the locked gate as the site is located within an area that is off-limits due to the current use as a detonation/firing range. The area is restricted with signage in place and is noted as a prohibited area in the FTRI RPMP. Locks were in place with no indications of trespassing.

Appendix C provides details of the Site Inspection including the participants, FYR Site Inspection Checklist, and photographs.

6.8.3 Interviews

Interviews regarding OU 006 are summarized below and the complete interview records are included in Appendix D.

Interviewees indicated the remedy at OU 006 is functioning as intended, and noted in general:

- The remedy for the soil contamination is nearing completion. As described in the ROD, the contaminated soil is to be land-farmed until the COCs are below the RGs, then the soil will be taken to the on-post Campbell Hill construction/debris landfill to be used as cover. It was estimated that the RG would be achieved by the end of 2020, but 1 of 64 cells tested above the RG. Tilling of the land-farm continued during the summer of 2021, with another round of sampling scheduled for later in 2021.
- USEPA requested an additional monitoring well be installed north of monitoring well OB-18-22, where the highest TCE concentrations have been observed. The U.S. Army agreed and is in the process of doing a limited DPT investigation to determine the best location for the additional well.

6.9 Technical Assessment

The technical assessment of the protectiveness of the remedy for OU 006 is based on the responses to these three questions:

Question A: *Is the remedy functioning as intended by the decision documents?*

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?*

Question C: *Has any other information come to light that could question the protectiveness of the remedy?*

6.9.1 Question A: Is The Remedy Functioning As Intended By The Decision Document?

Yes, the remedy at OU 006 is functioning as intended by the ROD based on review of documents, interviews, and the site inspection.

The selected remedy for OU 006 includes source removal and onsite treatment, and LTM of groundwater and surface water with ICs. Soil removal and treatment has been conducted; Year 1 of groundwater and surface water monitoring has been completed and shows overall concentrations of COCs have decreased since source removal. ICs have been implemented.

Soil

The remedy for the soil contamination is nearing completion. As described in the ROD, the contaminated soil is to be land-farmed until the COCs are below the RGs, then the soil will be taken to the on-post Campbell Hill construction/debris landfill to be used as cover.

The LFTC was constructed in March 2019 to treat soil contaminated with TCE and PCA that was removed from the OB/OD site excavation area. Source area removal was completed in June 2019. Tilling operations of the LFTC began in June 2019 and occurred every other week until November 2019 when operations were suspended due to winter weather conditions. Tilling resumed in June 2020 and occurred every other week until it was suspended after the fourth sampling event was conducted in August 2020.

Six sampling events were completed at the LFTC to check soil contaminant levels as part of the LFTC operations. Data from the fourth sampling event showed that concentrations in all samples were below their respective RGs for TCE and all samples except one were below their respective RGs for PCA. Because one of 64 cells tested above the RG in 2020, tilling of the land-farm continued during the summer of 2021, with three additional rounds of sampling conducted in June 2021, September 2021, and January 2022.

Groundwater and Surface Water

During Year 1 of LTM, four quarterly groundwater and surface water sampling events were conducted at the 24 monitoring well locations and six surface water sampling locations. Year 1 of groundwater and surface water monitoring has found overall concentrations of COCs have decreased since source removal.

ICs

ICs have been implemented and maintained at OU 006 through the RPMP. The "Site Approval Process" establishes processes for reviewing and approving excavation and construction projects, as well as other land use changes on the installation. Based on interviews with FTRI Environmental Personnel, this process is being followed as part of the installation's compliance with NEPA. The FTRI NEPA Coordinator provides proposals for projects that could impact IRP sites, including OU 006, to the IRP PM. A review of the procedures for monitoring and enforcement indicated that the FTRI O&M program is effective in preventing unacceptable exposure to groundwater.

6.9.2 Question B: Are The Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used At the Time Of The Remedy Selection Still Valid?

Yes, the exposure assumptions, toxicity data, and cleanup levels, and RAOs used at the time of the remedy are still valid.

6.9.3 Changes in Standards, Newly Promulgated Standards, and TBCs

RGs were established in the 2016 ROD for OU 006 soil, groundwater, and surface water COCs, which are presented in Table 6-4.

Table 6-4. Remediation Goals for OU 006 COCs

COC	ROD RG
Soil (mg/kg)	
Trichloroethene (TCE)	10.72 [a, b]
Groundwater (µg/L)	
1,1,2,2-Tetrachloroethane (PCA)	2.55 [a]
Naphthalene	2.61 [a]
Trichloroethene (TCE)	5 [c]
Benzo(a)pyrene	0.2 [c]
Bis(2-ethylhexyl) phthalate	6 [c]
Surface Water (µg/L)	
1,1,2,2-Tetrachloroethane (PCA)	236 [d]
Trichloroethene (TCE)	613 [d]
Benzo(a)pyrene	0.0374 [d]

[a] Remediation Goals (RG) from 2016 OU006 Record of Decision (ROD) (USACE, 2016). Values are site-specific risk-based concentrations for a worker exposure at a target cancer risk level of 1E-5 and/or a target non-carcinogenic hazard index of 1.
[b] The RG selected in the ROD for TCE in soil was not based on the potential leaching to groundwater pathway. The potential for TCE in soil to leach into groundwater was addressed through source removal performed as part of the remedy for OU 006, followed by monitoring of TCE concentrations in groundwater. Long term monitoring data indicate concentrations of TCE in groundwater have decreased significantly since source removal was performed, and data trends do not indicate ongoing leaching of TCE in soil into groundwater is occurring. Also see Section 6.9.4 (Changes in Exposure Pathways).
[c] USEPA Maximum Contaminant Level (MCL) from Safe Drinking Water Act (SDWA) National Primary Drinking Water Regulations (https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations)
[d] RG from 2016 OU006 ROD (USACE, 2016). Values are site-specific risk -based concentrations for surface water dermal contact to a worker at a target cancer risk level of 1E-5 and/or a target non-carcinogenic hazard index of 1.
µg/L = micrograms per liter
mg/kg = micrograms per kilogram
USEPA = United States Environmental Protection Agency
COC = chemical of concern
USACE = United States Army Corps of Engineers

The ROD identified the principal ARARs that are relevant and appropriate for three of the groundwater COCs, trichloroethene, beno(a)pyrene, and bis (2-ethylhexyl) phthalate, as MCLs. The other RGs for groundwater, surface water, and soil are risk-based and discussed further in Section 6.9.5. Since the ROD, there have been no changes in standards or newly promulgated standards; therefore the protectiveness of the remedy is not affected.

6.9.4 Changes in Exposure Pathways

There have been no changes in exposure pathways since the 2016 ROD. However, the baseline risk assessment did not evaluate the VI pathway. Although VOCs are present in the soil, the VI pathway does not exist at OU 006 based on the site conditions, as the OB/OD Grounds are an active range that is unoccupied and has no structures within the boundaries of the site. Therefore, the protectiveness of the remedy is not affected.

In addition, although the soil RGs selected in the DD were based on industrial exposures to site workers rather than the exposure pathway related to potential for leaching of COCs in soil into groundwater, the source removal that was performed has reduced concentrations of COCs in groundwater significantly and data trends do not indicate that ongoing leaching of COCs in soil into groundwater is occurring or causing COCs in groundwater to exceed RGs over time. Therefore, the assumptions used in the selection of RGs for soil that did not evaluate the potential for the leaching to groundwater pathway do not affect the protectiveness of the remedy.

6.9.5 Changes in Toxicity and Other Contaminant Characteristics

The ROD RGs for 1,1,2,2-tetrachloroethane, TCE, naphthalene, and benzo(a)pyrene are risk-based. Table 6-5 compares the toxicity values used to develop the risk-based RGs in the ROD to the current toxicity values used by the USEPA. Changes to the toxicity values have occurred since the 2016 ROD RGs were established and are discussed in further detail below.

Table 6-5. Changes in Toxicity Data for OU 006 COCs

COC	ROD Toxicity Values [1]	RSL Toxicity Values [2]	Changes
TCE	SFO (1/mg/kg-d): $4.6\text{x}10^{-2}$ IUR (μg/m^3)$^{-1}$: $4.1\text{x}10^{-6}$	SFO (1/mg/kg-d): $4.6\text{x}10^{-2}$ IUR (μg/m^3)$^{-1}$: $4.1\text{x}10^{-6}$	Cancer: No Changes
	RfDo (mg/kg-d): $5\text{x}10^{-4}$ RfCi (mg/m^3): $2\text{x}10^{-3}$	RfDo (mg/kg-d): $5\text{x}10^{-4}$ RfCi (mg/m^3): $2\text{x}10^{-3}$	Non-cancer: No Changes
Naphthalene	SFO (1/mg/kg-d): NA IUR (μg/m^3)$^{-1}$: $3.4\text{x}10^{-5}$	SFO (1/mg/kg-d): 0.12 IUR (μg/m^3)$^{-1}$: $3.4\text{x}10^{-5}$	Cancer: New SFO
	RfDo (mg/kg-d): 0.02 RfCi (mg/m^3): $3\text{x}10^{-3}$	RfDo (mg/kg-d): 0.02 RfCi (mg/m^3): $3\text{x}10^{-3}$	Non-cancer: No Changes
PCA	SFO (1/mg/kg-d): 0.2 IUR (μg/m^3)$^{-1}$: $5.8\text{x}10^{-5}$	SFO (1/mg/kg-d): 0.2 IUR (μg/m^3)$^{-1}$: $5.8\text{x}10^{-5}$	Cancer: No Changes
	RfDo (mg/kg-d): 0.02 RfCi (mg/m^3): NA	RfDo (mg/kg-d): 0.02 RfCi (mg/m^3): NA	Non-cancer: No Changes
Benzo(a)pyrene	SFO (1/mg/kg-d): 7.3 IUR (μg/m^3)$^{-1}$: 1.0	SFO (1/mg/kg-d): 1.0 IUR (μg/m^3)$^{-1}$: $6\text{x}10^{-4}$	Cancer: Lower SFO and IUR
	RfDo (mg/kg-d): NA RfCi (mg/m^3): NA	RfDo (mg/kg-d): $3\text{x}10^{-4}$ RfCi (mg/m^3): $2\text{x}10^{-6}$	Non-cancer: New RfDo and RfCi

[1] Record of Decision (ROD) toxicity data from (USACE, 2016).
[2] Most recent toxicity data are from the USEPA Regional Screening Levels (RSL) tables from May 2022 (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables).CPFo = Cancer Potency Factor for oral exposure CPFi = Cancer Potency Factor for inhalation exposure
µg/m3 = micrograms per cubic meter COC = chemical of concern IUR = inhalation unit risk
mg/kg-d = milligrams per kilogram-day mg/m3 = milligrams per cubic meter PCA = 1,1,2,2-tetrachloroethane
RfCi = inhalation reference concentration RfDo = oral reference dose SFO = Oral cancer slope factor
TCE = trichloroethene USACE = United States Army Corps of Engineers
USEPA = United States Environmental Protection Agency

For TCE in soil, the toxicity data did not change (see Table 6-5) and a comparison of the ROD RG (10.72 mg/kg) to the USEPA Regional Screening Level (RSL; 19 mg/kg) indicates that the RG is less than the cancer RSLs for TCE therefore the protectiveness of the soil remedy is not affected.

PCA and naphthalene have current screening criteria that have changed from those used in the development of the ROD RGs for groundwater. The current default screening criteria for PCA are lower than those used in the development of the ROD RG, however, the toxicity data didn't change, and the differences are due to site-specific exposure parameters and calculation methods used for the ROD RG. For naphthalene in groundwater, changes in toxicity data, as well as the use of site-specific exposure parameters and calculation methods result in current generic screening levels that are lower than those used in the development of the ROD RG. However, the changes are not significant, and the worker risks would remain in the acceptable cancer risk range of E-6 to E-4 and acceptable non-carcinogenic HI of 1; therefore, the protectiveness of the groundwater remedy is not affected.

For the surface water COCs, the changes in toxicity data for PCA and TCE are not significant, indicating that changes in generic screening criteria from those used in the development of the ROD RG are due to site-specific exposure parameters and calculation methods. Similarly, the ROD surface water RG is based on the carcinogenic toxicity data for benzo(a)pyrene, which has decreased (see Table 6-5), indicating that the lower current screening criteria are also due to site-specific exposure parameters and calculation methods. Additionally, surface water sampling results do not indicate exceedances of Ecological Screening Values (ESV). Therefore, because changes in screening criteria since the ROD do not correspond with worker risks that exceed the acceptable cancer risk range of E-6 to E-4 or the acceptable non-carcinogenic HI of 1, and the ESV are not exceeded, the protectiveness of the remedy is not affected.

6.9.6 Changes in Land Use

There have been no changes to land use since the 2016 ROD and there are no anticipated changes to future land uses associated with OU 006; therefore, the protectiveness of the remedy has not been affected.

6.9.7 Changes in Risk Assessment Methods

There have been no changes in risk assessment methods since the 2016 ROD that impact the RGs; therefore, the protectiveness of the remedy has not been affected.

6.9.8 Expected Progress Toward Meeting RAOs

Significant progress has been made toward meeting the RAOs as follows:

<u>Soil</u>

- Migration of COCs that would result in groundwater with concentrations of COCs that exceed RGs has been mitigated/prevented through source removal (excavation and onsite treatment), which is anticipated to be completed in 2022 after a final soil confirmation sample is collected from the treatment cell. In addition, source removal significantly reduced the potential leaching of COCs from soil into groundwater and causing exceedances of RGs, as evidenced by concentrations of contaminants decreasing over time.
- Inhalation of vapors from soil with COCs that exceed RGs has been mitigated/prevented through source removal.

Groundwater

- Ingestion of or direct contact with groundwater with COCs that exceed RGs has been prevented/minimized through implementation and maintenance of LUCs that prohibit installation of drinking water wells.

Surface Water

- Direct contact with surface water with COCs that exceed the RGs has been prevented because the occurrences of surface water were sporadic during Year 1 of LTM, and there were no COC exceedances of RGs in the surface water samples.

6.9.9 Question C: Has Any Other Information Come To Light That Could Call Into Question The Protectiveness of the Remedy?

No, no other information has come to light that could call into question the protectiveness of the remedy.

6.10 ISSUES

There were no issues found affecting the protectiveness of the remedy.

6.11 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No issues that could affect current and/or future protectiveness were identified for OU 006. Therefore, no follow-up actions are required at this time.

6.11.1 Other Findings

No other findings were identified during this FYR.

6.12 PROTECTIVENESS STATEMENT

The remedy for OU 006, OB/OD Grounds, is protective of human health and the environment. Source removal has been performed, monitoring demonstrates that biodegradation continues to effectively reduce concentrations of COCs; and ICs are in place to prevent exposure to groundwater and prohibit drilling and installation of water wells.

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7. OU 008 - SHERMAN HEIGHTS SMALL ARMS RANGE

7.1 SITE DESCRIPTION

OU 008 is identified in the FTRI IAP as SHSAR, FTRI-001-R-02 (HQAES Environmental Site ID 20605.1076), also referred to as the "Sherman Heights SAR", or "SHSAR", "SHSAR Impact Slope" or "SHSAR Impact Slope Munitions Response Site (MRS)" in supporting documents. The SHSAR is located on FTRI near the southern Post boundary and consists of a steeply sloping ridge that rises from approximately 1,180 to 1,280 ft above mean sea level (Figure 1-2). The former range is approximately 52 acres and 150 to 400 ft wide by 8,000 ft in length. The former range is located between the Colyer Manor military family housing complex and the Sherman Heights highlands (Figure 7-1).

7.1.1 Physical Characteristics

The area north of the Colyer Manor military family housing complex, with the steep hillside that serves as a natural backstop, has likely been a range area since the first Soldiers arrived on FTRI and started training (Figure 7-1). Formal use peaked during war time and ended after the Vietnam War. One overhead utility line transects (north-south) the site near the midpoint. Much of the area was developed into the Colyer Manor military family housing complex, including the area to the north of Pistol Range Road. There are also recreational fields east of the housing complex. Areas formerly utilized as small arms ranges were identified in historical aerial photos.

There are no wetland areas within or adjacent to the MRS. The Colyer Manor military family housing complex sits atop alluvial deposits associated with the Republican River that extend to the toe of the adjacent SHSAR Impact Slope MRS.

7.1.2 Land and Resource Use

The SHSAR is undeveloped. Ground cover ranges from exposed bedrock to grass interspersed with small trees. Access was unrestricted on the steep slope until a fence with signage was constructed in 2017. This fence restricted access to the contaminated portion of the site as part of implementation of the selected remedy identified in the ROD. The fenced area is close to Post housing and had unrestricted access by residents, including children playing within the MRS area.

A dirt road runs along the upper highlands, from a drinking water treatment plant located immediately north of OU 008 and across the northeast portion at the top of the ridge. Access from the lower side of the site is by foot from the north side of the Colyer Manor military family housing complex.

Groundwater at the SHSAR and downgradient of the site is currently not used as a potable water source. The Colyer Manor military family housing complex is connected to FTRI water supply wells located upgradient of the site, which is in the uplands area.

Potential for expanded use of OU 008 in the future is limited by terrain and its proximity to the Colyer Manor military family housing complex. Future reuse or residential land use is not planned and the physical characteristics of the slope limit development.

7.2 SITE CHRONOLOGY

The chronology of key events for OU 008 is provided in Table 7-1.

Table 7-1. Chronology of Key Events at OU 008

Event	Date
XRF sampling & confirmatory sampling conducted	1994
Soil and MEC removal actions conducted	1995
SI conducted	2005
RI/FS conducted	2010-2011
ROD approved	2015

FS = Feasibility Study MEC = munitions and explosives of concern RI = Remedial Investigation
ROD = Record of Decision SI = Site Inspection XRF = X-ray fluorescence

7.3 HISTORY OF CONTAMINATION

Historical aerial photographs indicate that much of the former range area was developed into the Colyer Manor military family housing complex, including areas to the north of Pistol Range Road. Investigations of the SHSAR conducted since 1994 found lead in soil across the former range primarily from spent ammunition (small arms) deposited on the surface during past training activities. The former range includes the Impact slope and contained metal munitions debris and old rounds, referred to as MEC, deposited on the surface during past training activities. Based on the results from the environmental studies, it was concluded that there was only a low risk for exposure to MEC at the former impact slope resulting from munitions and explosives during training activities, so no further evaluation of MEC was recommended.

However, environmental impacts associated with lead in surface soils occurred. An area contaminated by lead was fenced off with signage in 2018 to act as an engineered, physical control to prevent access to the site. The impacted area is approximately 5.5 acres and extends to approximately 0.5 ft bgs, equating to approximately 4,437 cy of impacted soil.

7.4 INITIAL RESPONSE

A lead-removal action was performed at the Colyer Manor military family housing complex in 1994 (Figure 7-2). Approximately 1,500 cy of soil was removed to remediate lead levels to below the USEPA Residential RSL/KDHE Tier 2 Standard of 400 mg/kg. The majority of this soil was south of the SHSAR Impact Slope MRS boundary. In addition, a full-coverage survey for MEC was completed. This included removal of items from the surface and subsurface soils and utilized the same methods as those employed for a removal action. The net effect of the investigation was a removal action, therefore, a no further action determination for MEC was warranted.

7.5 Basis For Taking Action

The basis for taking action at OU 008 was the unacceptable risk associated with potential future residential use due to lead in soil that exceeded the USEPA RSL of 400 mg/kg across the former range.

7.6 Remedial Action

7.6.1 Remedy Selection

The remedy of LUCs and LTM for OU 008 was selected in the ROD approved in February 2015.

7.6.2 Remedial Action Objectives

The RAO identified in the ROD is to prevent ingestion/direct contact with lead in soil having concentrations in excess of 400 mg/kg.

7.6.3 Remediation Goals

The RG identified in the ROD for soil is shown in Table 7-2.

Table 7-2. OU 008 Remediation Goal

COC	RG (mg/kg)	Basis
Lead	≤ 400	USEPA IEUBK

Remediation Goal (RG) from 2015 Record of Decision (ROD) based on residential lead exposure using USEPA Integrated Exposure Uptake Biokinetic Model (IEUBK) using default parameters.
COC = chemical of concern mg/kg = milligrams per kilogram USEPA = United States Environmental Protection Agency

The residential lead exposure value of 400 mg/kg was considered relevant and appropriate as the RG for lead in soil. The RG was based on the USEPA Integrated Exposure Uptake Biokinetic Model (IEUBK) model using default parameters.

7.6.4 Remedy Description

The remedy for OU 008 included LTM and LUCs and was described as follows in the 2015 ROD.

<u>LTM</u>

- Conducting LTM/management, which includes: performing soil sampling outside the downslope fence-line boundary every two years, groundwater sampling every five years and inspection/maintenance of the physical barrier (fencing and signage) annually.

<u>LUCs</u>

- Public education initiatives involving distribution of information about lead exposure, educational activities and meetings with area stakeholders and adding data to the facility Information Repository.
- Restricting physical access using physical barriers and signage notifying that lead-contaminated soil exists and access is restricted.

- Restricting land use from public and commercial uses.

LUCs will be required indefinitely or until such a time as it is determined that lead concentrations in soil are below the RG of 400 milligrams per kilogram (mg/kg) and are to be applied through the FTRI RPMP. The FTRI RPMP is the means the post authorities have to control and limit development and other activities on the post. This includes overall controls on restricting changes in land use; limiting access; prohibiting the installation of drinking water wells and groundwater/surface water use; and involving FTRI PWE personnel in the proposed future plans.

The FTRI RPMP ensures compatibility of land uses are considered when planning for locations of functions or facilities. It is the equivalent of a city or county zoning plan. It also serves as a framework for maintenance and repair resource allocation, and development activities. Master planning for U.S. Army installations is required by AR 210-20, which establishes a relationship between environmental planning and real property master planning to ensure that the environmental factors are included in planning decisions and land use. This is accomplished by the long-range component in the FTRI RPMP. It consists of a variety of narratives and supporting graphics. One of these graphic representations is the Master Plan Environmental Overlay (MPEO). This graphic reflects operational and environmental constraints. The SHSAR (OU 008) is designated as restricted land use in the FTRI RPMP.

The restricted designation in the FTRI RPMP directs users to the MPEO that subsequently identifies the restrictions. Restrictions will limit exposure at the SHSAR (OU 008) by:

- restricting change of land use;
- limiting access;
- prohibiting the installation of drinking water wells and groundwater use in the area; and
- involving FTRI PWE personnel in any proposed future plans for the site.

OU 008 is a former range located within the SHSAR impact slope. The site is fenced and gated with signage to restrict access. LUCs with respect to site-related contamination located within OU 008 on the impact slope are anticipated to remain in place for the foreseeable future.

7.6.5 Remedy Implementation

The fence and signage surrounding the area of lead exceedances of the RG at the site was constructed in 2017 and is inspected and maintained on an annual basis.

<u>LTM</u>

LTM activities implemented at OU 008 include biennial soil sampling for lead downslope and outside of the fence-line in 2020. In December 2019, USEPA approved the U.S. Army's requested sampling protocol changes to the schedule presented in the ROD for OU 008. The USEPA concurred with the U.S. Army's proposal to delay the biennial composite soil sampling of areas with lead concentrations in soil that exceeded the RG downslope and outside the fence-line, and resume the biennial sampling in 2021 on the ROD schedule using composite instead of discrete soil sampling techniques. Two composite soil samples collected in 2020 exceeded the RG for lead in soil. Additional soil sampling outside the fence-line to delineate the exceedances occurred in December 2021. Expansion of the fence-line to encompass the exceedances is anticipated to be completed in 2022. Groundwater sampling that is conducted every five years to assess the potential for lead in soil to migrate into groundwater was performed in 2021, coinciding with the additional soil sampling fieldwork.

<u>LUCs</u>

LUCs were implemented at OU 008 after signature of the ROD in 2015. The FTRI RPMP restricts building construction and demolition, digging and trenching, and installation of drinking water wells at OU 008. LUCs are documented in the RPMP and include restricting land use to non-residential, limiting public access, and prohibiting installation of drinking water wells and groundwater use at OU 008.

Restrictions are enforced through the FTRI RPMP. The FTRI NEPA Coordinator provides the IRP manager proposed projects for review that could impact IRP sites, including OU 008.

7.6.6 Operations and Maintenance

LTM activities include annual maintenance of the physical barrier around the site (fencing with signage) and adjacent vegetation; biennial composite soil sampling for lead downslope and outside of the fence-line; and quinquennial groundwater sampling (every five years).

7.6.6.1 Fence, Sign, and LUC Inspections

Fence, sign, and LUC inspections have been performed annually at OU 008 since implementation of the remedy in 2018 to document that the fence and signage are intact and in good condition; land use within the LUC boundary conforms to the LUC requirements identified in the RPMP; and that no deficiencies, violations, or inconsistencies were identified. Documented activities and observations on field forms and with photographs are provided in annual Fence and Sign LTM Summary Memoranda. LUCs are maintained and updated as necessary in the FTRI RPMP.

The January 2020 Fence & Sign Inspection Summary Memo stated based on November 2019 inspections, the following maintenance was needed:

> "*Long-term management of vegetation will be required in 2020 and beyond to address saplings and other brush that have started to develop along the west end of the south fence line. Continued growth of trees in this area could adversely affect the structural integrity of the fence and lead to reduced effectiveness of the LUC.*"

Based on the Site Inspection conducted on 16 September 2021, the fence is intact; however, it appears that the saplings and brush that have started to develop along the west end of the south fence-line have not yet been removed. The U.S. Army has a contract in place to perform the vegetation removal work identified, that is expected to begin in 2022. In addition, vegetation removal/maintenance will be added to the LTM activities that will be conducted annually in the future, and will be documented in the annual Summary Memorandum, LTM Fence and Sign Inspection Event (Fence and Sign Inspection Summary Memorandum).

Two soil composite samples collected in 2020 just outside the fence-line as part of biennial sampling to confirm that lead is not migrating downslope (due to erosion downslope of the steep site terrain) outside the boundaries of the fence-line surrounding the site exceeded the lead RG outside the fence-line on the west side of the site per the 2020 Soil Sampling TM, which recommended:

> "*Future sampling will fully delineate the extent of contamination. Additional fencing would then be installed to surround the newly delineated area.*"

In December 2021, an additional Site Inspection was conducted concurrent with soil sampling to delineate the extent of contamination outside the fence-line. The Site Inspection did not result in any new findings since the September 2021 inspection other than reiterating the need for vegetation removal along the fenceline, as follows:

> *"It is recommended that the area still be burned. The amount of saplings and vines growing up near and onto/through the fence will soon reach an unmanageable level and could soon impact the integrity of the fencing."*

7.6.6.2 Soil Sampling

Soil sampling results from previous investigations conducted to delineate lead in soil at OU 008 are presented on Figure 7-3.

Under the selected remedy in the 2015 ROD, soil downslope and outside the fence-line surrounding the site is to be sampled every two years and analyzed for lead to assess the potential for lead in soil to migrate offsite (outside the fence-line) due to the steep slope onsite.

The first post-ROD soil sampling event was conducted in 2020, and three discrete samples contained lead at concentrations that exceeded the RG. Composite soil sampling was conducted in December 2021 to further delineate lead in soil outside the fence-line at OU 008 and the area where the fence-line will need to be expanded to encompass all soil containing lead that exceeds the RG. Three composite samples contained lead at concentrations that exceeded the RG. Additional composite sampling was conducted in the area of the three exceedances in May 2022; the report that presents the results is pending.

The results of the soil sampling activities conducted in 2020 and 2021 are presented on Figure 7-2, and discussed in further detail in Section 7.8.1.

7.6.6.3 Groundwater Sampling

Groundwater monitoring data have been collected at OU 008 since 2010.

Under the selected remedy in the 2015 ROD, groundwater is to be sampled every five years and analyzed for lead to assess the potential for lead in soil to migrate into groundwater.

The first post-ROD five-year groundwater sampling event was conducted in December 2021 coinciding with additional composite soil sampling outside the fence-line.

All four proposed groundwater sampling locations were drilled to at least the proposed depth of 60 ft bgs. Samples were collected at GW02 and GW03, with GW02 drilled to a depth of 71 ft before hitting bedrock (Figure 7-2). Locations GW01 and GW04 were both dry at the proposed depth and no samples were collected. The report summarizing the data is pending. Preliminary results indicate lead was detected in the unfiltered samples collected from GW02 and GW03 at concentrations that exceeded the Project Action Level (PAL) of 15 µg/L. Due to PAL exceedances in unfiltered groundwater, the samples were filtered at the lab and analyzed for dissolved lead. Lead was not detected in either of the two filtered groundwater samples collected from GW02 or GW03 at a concentration that exceeded the PAL.

7.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the initial FYR for SHSAR.

7.8 FIVE YEAR REVIEW PROCESS

7.8.1 Data Review

The FYR process consists of a review and evaluation of data generated since remedy selection for the SHSAR in relation to the objectives established in the 2015 ROD.

In November 2017, following the establishment of LUCs, the first routine LTM soil sampling event at OU 008 was conducted in accordance with the approved ROD. LTM surface soil sampling was performed around the perimeter of the fence-line to confirm that lead was not migrating downslope beyond the remedy fence-line. Forty-eight surface soil samples were collected and analyzed for lead (Figure 7-2). Due to lead concentrations at three discrete sample locations (SP17, SP38, and SP39) along the perimeter of the fence exceeding the RG of 400 mg/kg identified in the ROD, additional composite sampling to further characterize lead concentrations in the area of these samples was performed in April 2020 in compliance with USEPA and KDHE 2018 approval letters. Composite samples were collected near the base of the slope along the southern fence-line at discrete sample location SP17 and side slope along the western fence-line at discrete sample locations SP38 and SP39. Analytical results indicated detections of lead in all 40 parent samples and 4 duplicate samples, and the RG was exceeded in three of the samples.

The USEPA concurred with the U.S. Army's proposal to delay the biennial composite soil sampling of areas with lead concentrations in soil that exceeded the RG downslope and outside the fence-line, and resume the biennial sampling in 2021 on the ROD schedule using composite instead of discrete soil sampling techniques; each sample was comprised of a 5-point composite sample taken at different increments which was combined to make one composite sample.

The 2020 analytical results for composite soil sampling conducted outside the fence-line to delineate the extent of soil containing lead concentrations that exceeded the RG in 2017 are summarized in Table 7-3 and below, and the soil data table is attached in Appendix E5 (page E5-1). Although the report summarizing the data is pending, preliminary results of soil and groundwater sampling conducted in 2021 were reviewed and are summarized in Table 7-3, Table 7-4, and on Figure 7-2, as follows:

- Additional soil sampling was conducted to fully delineate the extent of lead contamination in surface soils that exceed the lead RG outside the fence-line on the west side of the site. Composite soil sampling was conducted in the December 2021 to delineate the extent of lead contamination on the surface outside the fence-line. Samples were collected from locations along the outer perimeter of the downslope portion of the fence-line and site and LUC boundary. Ten samples were collected from all proposed composite soil sampling locations (SP38/39-01 through SP38/39-10). Three samples contained lead at concentrations that exceeded the RG. Additional composite sampling was conducted in the area of the three exceedances in May 2022; the report that presents the results is pending. The fence-line will be expanded to encompass these locations. The U.S. Army is in the process of initiating a contract for the fence-line expansion and plans to expand the footprint of the LUC boundary in 2022.

- The first groundwater sampling event was conducted in December 2021 coinciding with additional composite soil sampling. All four proposed groundwater sampling locations were drilled to at least the proposed depth of 60 ft bgs. Samples were collected at GW02 and GW03 (Figure 7-2). Locations GW01 and GW04 were both dry at the proposed depth and no samples were collected. Preliminary results indicate lead was detected in the unfiltered samples collected from GW02 and GW03 at concentrations that exceeded the PAL of 15 µg/L. Due to PAL exceedances in unfiltered groundwater, the samples were filtered at the lab and analyzed for dissolved lead. Lead was not detected in either of the two filtered groundwater samples collected from GW02 or GW03 at a concentration that exceeded the PAL.

Table 7-3. COCs in OU 008 Soil

Summary of Sample Results	2020	2021
Maximum Lead Concentration Detected	2,530 mg/kg	635 mg/kg
Number of Sampling Locations Where Lead Concentration Exceeded the RG	3	3

mg/kg = milligrams per kilogram

The results of the December 2021 soil and groundwater sampling conducted at OU 008 presented in the *Regulatory Draft Quality Control Summary Report, Long-Term Monitoring, Sherman Heights Small Arms Range, Operable Unit 008, Fort Riley, Kansas, 2021 Sampling Event (June 2022)* are summarized in Table 7-4.

Table 7-4. OU 008 2021 Annual Sampling Data Summary Table

Soil Field Sample ID	Lead Concentration (mg/kg)
SHSAR/SP38/39-01/121721	347
SHSAR/SP38/39-02/121721	175
SHSAR/SP38/39-03/121721	364 J
SHSAR/SP38/39-04/121721	183
SHSAR/SP38/39-05/121721	351
SHSAR/SP38/39-06/121721	276
SHSAR/SP38/39-07/121721	**442**
SHSAR/SP38/39-08/121721	181
SHSAR/SP38/39-09/121721	**446**
SHSAR/SP38/39-10/121721	**635**
Groundwater Field Sample ID	**Lead Concentration (µg/L)**
SHSAR/GW02/GW01/121621	**112 J***
SHSAR/GW03/GW01/121621	**305***

Footnotes:
ID = Identification Number.
J = Estimated value.
Bold = Detected concentration exceeded the RG of 400 mg/kg for soil or the PAL of 15 µg/L for groundwater.
* Unfiltered sample. Due to PAL exceedances in unfiltered groundwater, the samples were filtered at the lab and analyzed for dissolved lead. Lead was not detected in either of the two filtered groundwater samples collected from GW02 or GW03 at a concentration that exceeded the PAL.
mg/kg = milligrams per kilogram

7.8.2 Site Inspection

The FYR site inspection was conducted on 16 September 2021 and consisted of observations of the site conditions. Aerostar and USACE, Kansas City District, personnel were accompanied on the site inspections by the FTRI PWE IRP Manager. The FTRI PWE IRP Manager provided an overview of activities at OU 008 and indicated that inspections are conducted annually.

The Team inspected the fence and signs at OU 008. The site is located on a slope within a fenced area just north of military family housing. The fence is intact with signage, and locks were in place with no indications of trespassing. It appears that no trees/vegetation have been removed as was recommended in the January 2020 Fence & Sign Inspection Summary Memorandum. The FTRI PWE IRP Manager noted that a new contract is in place to perform the LTM of vegetation, and work is anticipated to begin in early 2022. The IRP manager also noted that based on the results of the 2020 soil sampling effort (lead greater that RG of 400 mg/kg), additional sampling will be performed, and the fence-line will be expanded in 2022 to encompass the confirmed exceedances.

Appendix C provides details of the Site Inspection including the participants, FYR Site Inspection Checklist, and photographs.

7.8.3 Interviews

Interviews regarding OU 008 are summarized below. Complete interview records are included in Appendix D.

Interviewees indicated the remedy at OU 008 is functioning as intended, and noted in general:

- The remedy for this site was recently completed and requires soil sampling outside the LUC fencing every two years to confirm no contamination has left (most likely through erosion/storm runoff) the fenced area. During the initial O&M soil sampling in 2020, it was discovered that lead concentrations outside of the fence exceeded the RG just outside and downslope of the LUC fencing. Additional composite sampling is planned in 2022 to confirm all areas of elevated lead concentrations are delineated in order to determine the extent of the fencing expansion to encompass the exceedances. In addition, initial biennial soil sampling was conducted via discrete sampling, however, the project team has now agreed it more appropriate/representative to perform composite sampling.

Vegetation removal necessitated by encroachment into the fence on the southern side of the perimeter fence will be completed in 2022.

7.9 TECHNICAL ASSESSMENT

The technical assessment of the protectiveness of the remedy for OU 008 is based on the responses to these three questions:

Question A: *Is the remedy functioning as intended by the decision documents?*

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?*

Question C: *Has any other information come to light that could question the protectiveness of the remedy?*

7.9.1 Question A: Is The Remedy Functioning As Intended By The Decision Document?

Yes, the remedy at OU 008 is functioning as intended by the ROD based on review of documents, interviews, and the site inspection.

The selected remedy for OU 008 included LTM with LUCs.

<u>LTM</u>

Fencing off the area with signage was completed in 2018 to prevent access to lead concentrations in soil that exceed the RG. The first biennial soil sampling event outside and downslope of the site to assess the potential for lead in soil to migrate offsite/outside the fence-line was conducted in 2017, and the results indicated several locations just outside the fence-line contained concentrations of lead in surface soil composite samples that exceeded the RG. Therefore, additional sampling was conducted in 2020, 2021, and 2022 to delineate the extent of lead in soil that exceeds the RG outside the fence-line and LUC boundary, and the fence-line will be expanded to encompass the locations where composite samples exceed the RG. It is anticipated that the fence expansion activities will be performed in 2022.

The first five-year groundwater sampling event occurred in 2021, to coincide with the soil sampling field effort.

LUCs

LUCs have been implemented and maintained at OU 008 through the RPMP. The "Site Approval Process" establishes processes for reviewing and approving excavation and construction projects, as well as other land use changes on the installation. Based on interviews with FTRI Environmental Personnel, this process is being followed as part of the installation's compliance with NEPA. The FTRI NEPA Coordinator provides proposals for projects that could impact IRP sites, including OU 008, to the Environmental Division for review. A review of the procedures for monitoring and enforcement indicated that the FTRI O&M program is effective in preventing unacceptable residential exposure to lead in soil. Based on data from soil sampling activities conducted in 2020 and preliminary data from soil sampling activities conducted in 2021 to delineate the extent of lead in soil outside the fence-line and site/LUC boundary, the LUC boundary and fence-line will be expanded in 2022.

7.9.2 Question B: Are The Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used At the Time Of The Remedy Selection Still Valid?

Yes, the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid.

7.9.3 Changes in Standards, Newly Promulgated Standards, and TBCs

The RG was established in the 2015 ROD for lead in soil at OU 008, as presented in Table 7-5.

Table 7-5. ROD Remediation Goal for Lead in Soil

COC	Receptor	RG (mg/kg)	Basis
Lead	Resident	400	IEUBK

COC = chemical of concern
mg/kg = milligrams per kilogram
IEUBK = Integrated Exposure Uptake Biokinetic Model
RG = Remediation Goal

The ROD identified the principal to-be-considered (TBC) criteria that are relevant and appropriate for OU 008, as the chemical-specific RG for lead. The RG is based on USEPA OSWER 1994 and 1998 soil lead Directives that identify 10 micrograms per deciliter (µg/dL) as the blood lead level of concern. Changes to the blood lead level of concern have not been promulgated; however, the more recent 2016 Directives indicate:

- The blood lead level of concern may be lower for the potential risk to child resident scenario used to develop the RG; and

- The Directive recommends that Regions should "consider the current scientific conclusions" when implementing the Office of Land and Emergency Management's soil lead policy.

Therefore, if the blood lead level of concern is revised to a value less than 10 µg/dL, the resulting RG for lead in soil identified in the ROD of 400 mg/kg, that is based on potential health risks to a child receptor, would need to be evaluated for continued protectiveness. However, based on current guidance, the protectiveness of the remedy has not been affected by changes in toxicity data presented in soil lead Directives or contaminant characteristics.

The 2015 ROD RG of 400 mg/kg for residential lead exposure based on the USEPA IEUBK model using default parameters is unchanged; therefore, the protectiveness of the remedy has not been affected.

7.9.4 Changes in Exposure Pathways

There have been no changes in exposure pathways since the 2015 ROD; therefore, the protectiveness of the remedy has not been affected.

7.9.5 Changes in Toxicity and Other Contaminant Characteristics

Lead in soil is the only COC associated with OU 008. Toxicity of lead in soil is evaluated using a threshold blood lead level of 10 µg/dL to determine the potential for adverse health effects. For lead in soil, the EPA's OSWER Directives 9355.4-12 (EPA, 1994) and 9200.4-27P (EPA, 1998), were identified as federal chemical-specific TBC guidance documents. These Directives identify 10 µg/dL as the blood lead level of concern. However, since the time those Directives were issued, increasing evidence has shown that blood lead levels below 10 µg/dL may also have negative health impacts.

If the blood lead level of concern is revised to a value less than 10 µg/dL, the resulting RG for lead in soil identified in the ROD of 400 mg/kg would need to be evaluated for continued protectiveness. Additionally, lead in soil is present at concentrations below the ecological PRG. Based on current guidance, the protectiveness of the remedy has not been affected by changes in toxicity data presented in soil lead Directives or contaminant characteristics and because the ecological PRG has not been exceeded.

7.9.6 Changes in Land Use

There have been no changes to land use since the 2015 ROD and there are no anticipated changes to future land uses associated with OU 008; therefore, the protectiveness of the remedy has not been affected.

7.9.7 Changes in Risk Assessment Methods

There have been no changes in risk assessment methods since the 2015 ROD that impact the RG; therefore, the protectiveness of the remedy has not been affected.

7.9.8 Expected Progress Toward Meeting RAOs

Significant progress has been made toward meeting the RAOs since the remedy for OU 008 was selected in the 2015 ROD. Accomplished tasks are restricting site access with installation and maintenance of a perimeter fence and signage; conducting LTM activities (biennial soil sampling downslope and outside the fence-line, groundwater sampling every five years) to assess the potential for migration of lead offsite and into groundwater; and implementation and maintenance of LUCs that prohibit site use.

Two soil composite samples collected in 2020 as follow-up to scheduled biennial sampling (that is a component of LTM) exceeded the lead RG outside the fence-line on the west side of the site. Per the 2020 Soil Sampling TM recommendations:

> "*Future sampling will fully delineate the extent of contamination. Additional fencing would then be installed to surround the newly delineated area.*"

The U.S. Army has a contract for conducting the fence-line expansion, and revision of the footprint of the LUC boundary in the RPMP will be performed in 2022. In addition, in December 2019, USEPA approved the U.S. Army's requested sampling protocol changes to the schedule presented in the ROD for OU 008. The USEPA concurred with the U.S. Army's proposal to delay the biennial composite soil sampling of areas with lead concentrations in soil that exceeded the RG downslope and outside the fence-line, and resume the biennial sampling in 2021 on the ROD schedule using composite instead of discrete soil sampling techniques.

Although data was not yet available for review and inclusion in this FYR, it should be noted that:

- Soil sampling was conducted in December 2021 to delineate the extent of contamination outside the fence-line, with samples being collected from locations along the outer perimeter of the downslope portion of the fence-line/LUC boundary. Samples were collected from all proposed composite soil sampling locations (SP38/39-01 through SP38/39-10). Additional composite sampling was conducted in the area of the three exceedances in May 2022; the report that presents the results is pending.

- The first groundwater sampling event was conducted in December 2021 coinciding with additional composite soil sampling. All four proposed groundwater sampling locations were drilled to at least the proposed depth of 60 ft bgs. Samples were collected at sites GW03 and GW02 with GW02 drilled to a depth of 71 ft before hitting bedrock. Locations GW01 and GW04 were both dry at the proposed depth and no samples were collected.

7.9.9 Question C: Has Any Other Information Come To Light That Could Call Into Question The Protectiveness of the Remedy?

No, no other information has come to light that could call into question the protectiveness of the remedy.

7.10 ISSUES

Table 7-6. OU 008 Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1. Areas of soil contamination above the lead RG were identified in 2020 outside the fence-line on the west side of the site.	N	Y

N = No RG = Remediation Goal Y = Yes

7.11 Recommendations and Follow-up Actions

Table 7-7. OU 008 Recommendations

Issue	* Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
1.	• Conduct additional composite soil sampling outside the fence-line to delineate the area where concentrations of lead in soil exceed the RG. • Expand the fence-line to encompass the area where concentrations of lead in soil exceed the RG based on the results of the additional sampling. • Revise the footprint of the LUC boundary in the RPMP.	U.S. Army	USEPA	28 September 2023	N	Y

* It should be noted:
(1) In 2021, the additional composite soil sampling was conducted to delineate the extent of soil that contains lead outside the fence-line. The report that presents the results of the sampling is pending; preliminary results are summarized in this FYR.
(2) In 2022, the U.S. Army is in the process of planning the expansion of the fence-line to encompass the extent of surface soil that contains lead that exceeds the RG; and
(3) In 2022, the U.S. Army is in the process of planning the expansion of the LUC boundary to encompass the extent of surface soil that contains lead that exceeds the RG.
LUC = Land Use Control
N = No
RG = remediation goal
RPMP = Real Property Master Plan
U.S. Army = United States Department of the Army
USEPA = United States Environmental Protection Agency
Y = Yes

7.11.1 Other Findings

The following other findings not affecting protectiveness of the remedy were identified during this FYR and are provided to describe potential improvements to the remedy in the long term.

Ensure that maintenance of vegetation along the west side of the south fence-line is performed in 2022. The January 2020 Fence & Sign Inspection Summary Memo stated based on November 2019 inspections, the following maintenance was needed:

> "*Long-term management of vegetation will be required in 2020 and beyond to address saplings and other brush that have started to develop along the west end of the south fence line. Continued growth of trees in this area could adversely affect the structural integrity of the fence and lead to reduced effectiveness of the LUC.*"

Based on the Site Inspection conducted on 16 September 2021, the fence is intact; however, it appears that the saplings and brush that have started to develop along the west end of the south fence-line have not yet been removed. The U.S. Army has a contract in place to perform the vegetation removal work identified that is to begin in early 2022. In addition, vegetation removal/maintenance will be added to the LTM activities that will be conducted annually in the future, and will be documented in the annual Summary

Memorandum, LTM Fence and Sign Inspection Event (Fence and Sign Inspection Summary Memorandum).

The schedule should be revised for the second biennial soil sampling to occur in 2023 and groundwater sampling event to occur in 2026.

7.12 PROTECTIVENESS STATEMENT

The remedy for OU 008, SHSAR, currently protects human health and the environment because:

- Annual fence and sign inspections/maintenance and LUC inspections are performed;
- Biennial soil sampling outside the fence-line surrounding the former range is conducted to ensure that soil containing lead that exceeds the RG of 400 mg/kg has not migrated off slope;
- Exposure to soil that contains lead concentrations that exceed the RG has been prevented through maintaining fencing and signage; and
- Groundwater monitoring will be performed every five years to ensure that lead in soil has not migrated into groundwater.

However, in order for the remedy to be protective in the long term, the areas of soil contamination above the lead RG outside the fence-line must be identified; the fence-line must be expanded to encompass the area where concentrations of lead exceed the RG based on the results of the additional sampling; and the footprint of the LUC boundary must be revised in the RPMP.

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8. NEXT REVIEWS

The next FYR for OU 001, OU 003, OU 005, OU 006, and OU 008 is due on 28 September 2027.

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FIGURES

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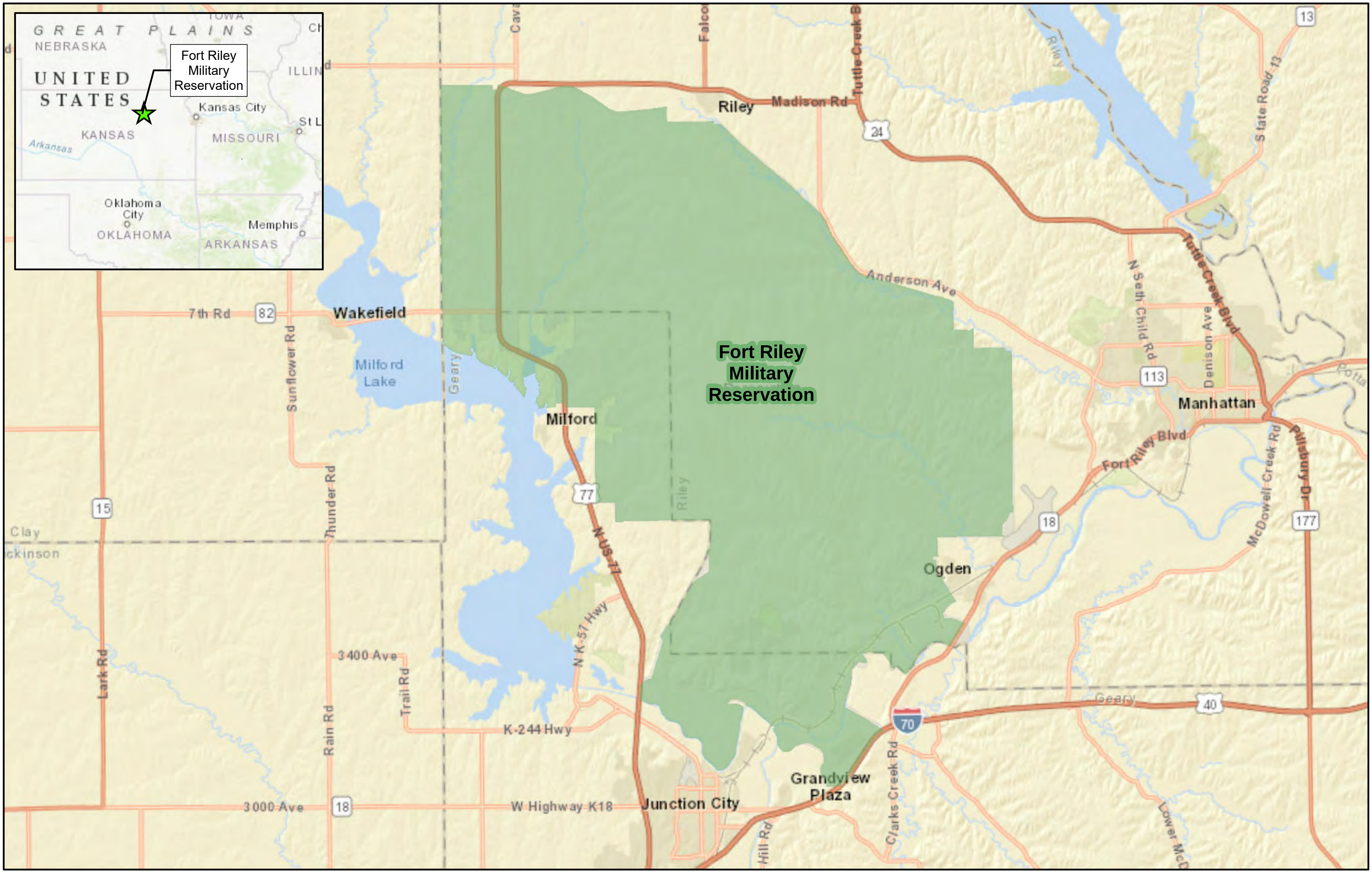

Legend

Fort Riley Boundary

U.S. Army Corps of Engineers

Aerostar Environmental and Construction

Aerostar Environment and Construction LLC
1006 Floyd Culler Court
Oak Ridge, TN 37830

FIGURE 1-1
Site Location Map
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 12,500 25,000 Feet

N

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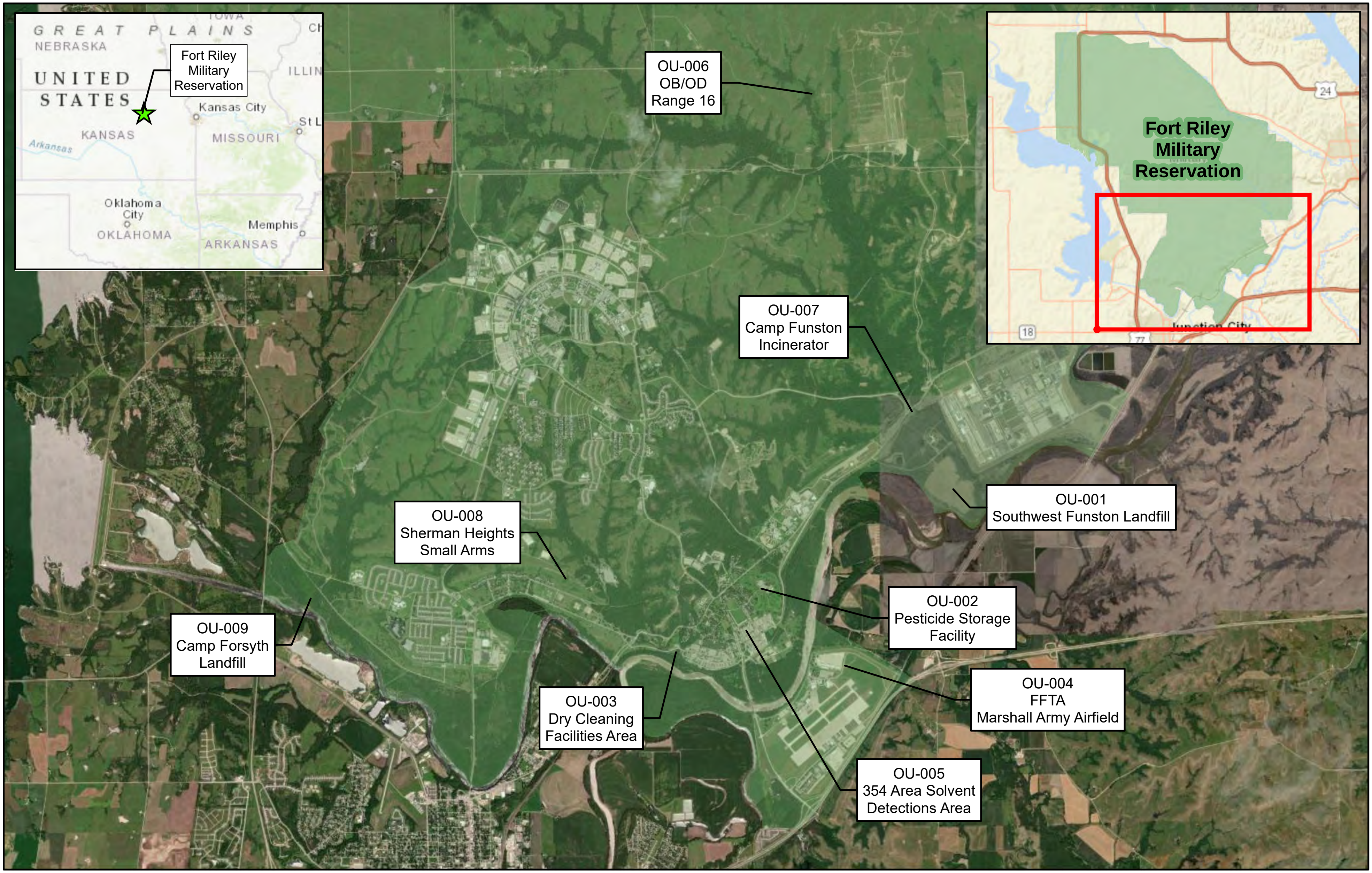

Legend

Fort Riley Boundary

U.S. Army Corps of Engineers

Aerostar Environmental and Construction LLC
1006 Floyd Culler Court
Oak Ridge, TN 37830

FIGURE 1-2
Operable Unit Locations
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 3,500 7,000 Feet

N

Date modified: 03/25/2022	File: Ft_Riley_OU_Locations		
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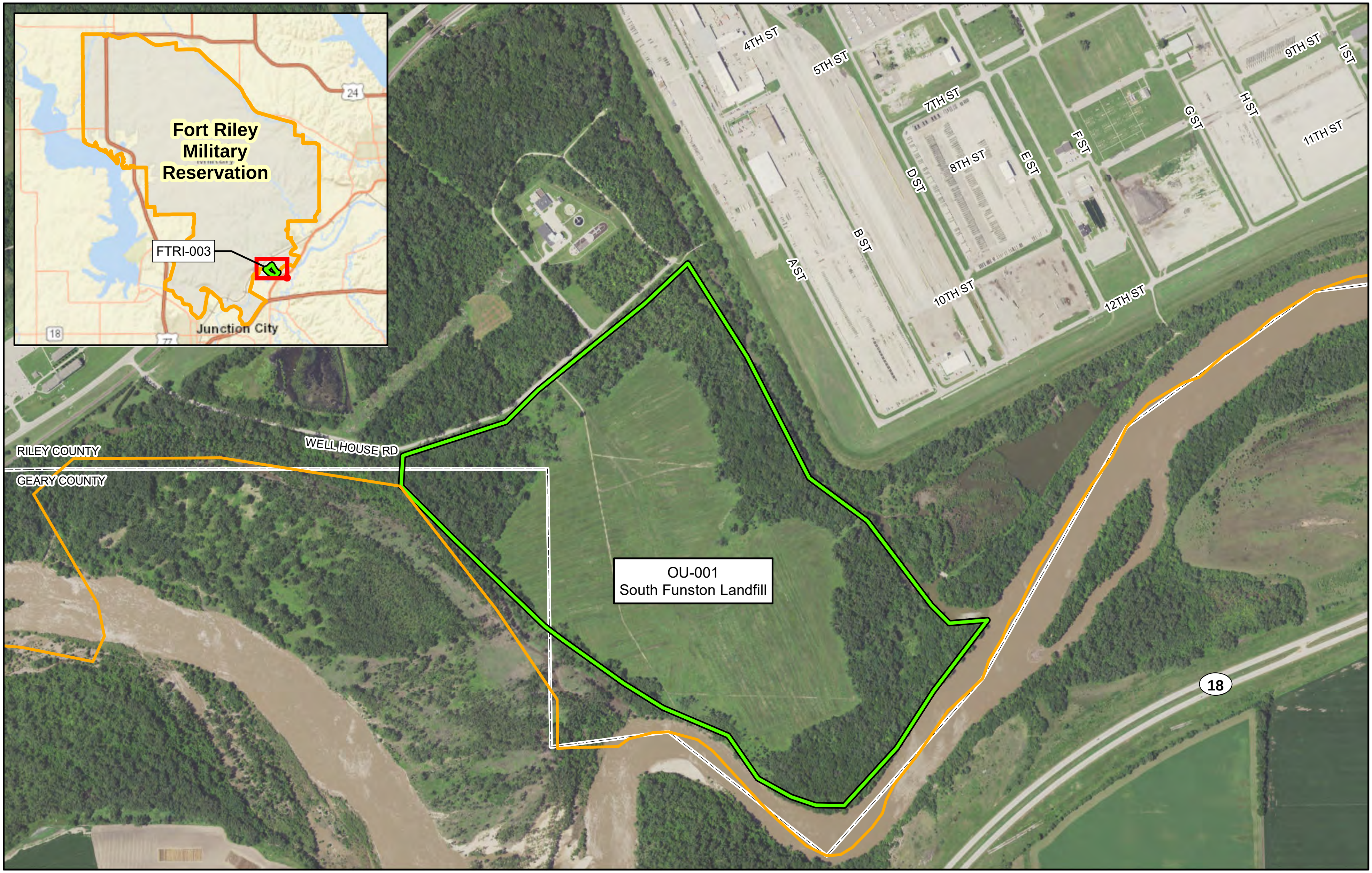

Legend

- Fort Riley Boundary
- FTRI-003 Site Boundary
- County Boundary

U.S. Army Corps of Engineers

Aerostar Environmental and Construction

Aerostar Environment and Construction LLC
1006 Floyd Culler Court
Oak Ridge, TN 37830

FIGURE 3-1
OU 001 Site Location Map
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 500 1,000 Feet

N

Date modified: 10/25/2021	File: Ft_Riley_OU001_Site_Location		
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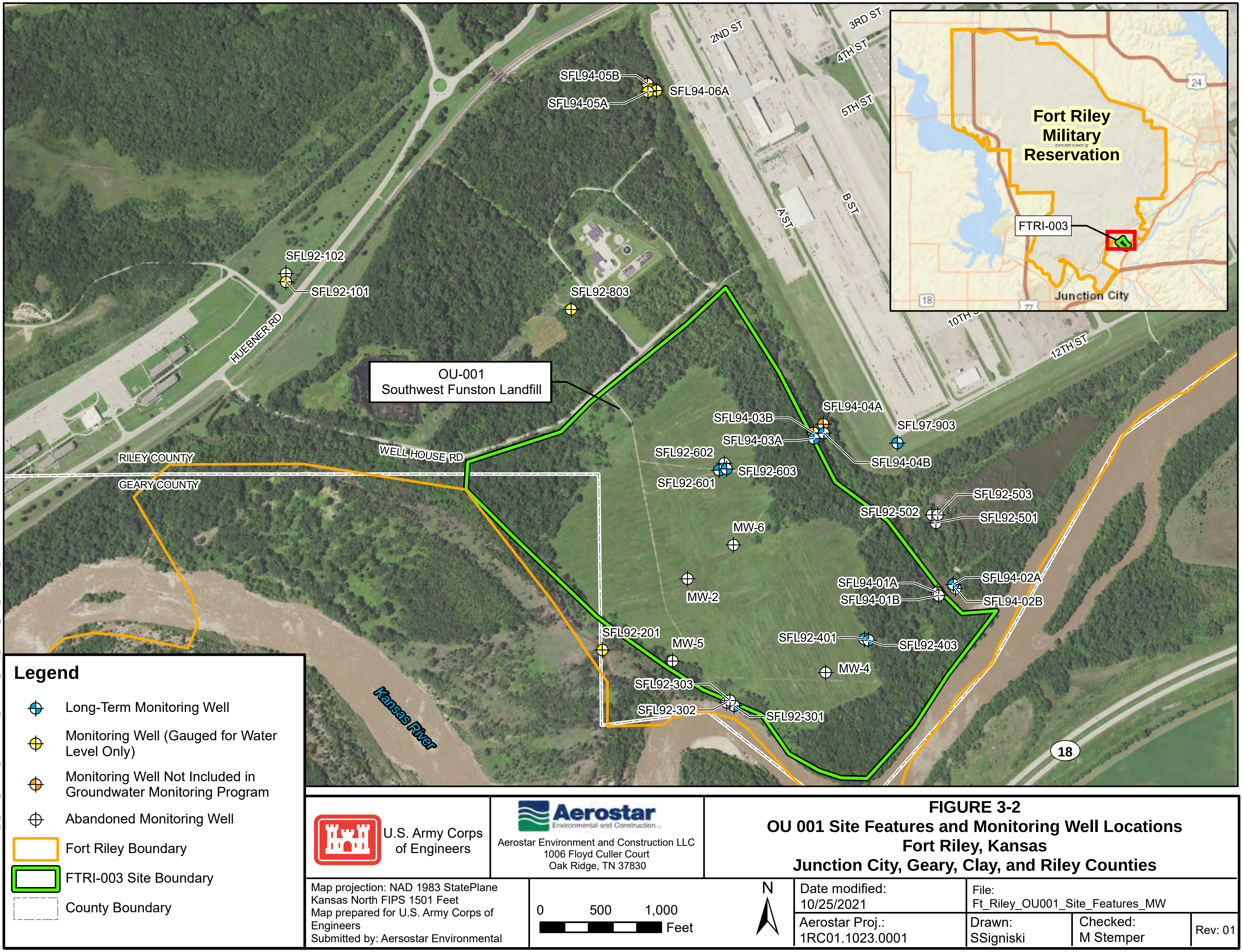

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U.S. Army Corps of Engineers

Aerostar Environmental and Construction

Aerostar Environment and Construction LLC
1006 Floyd Culler Court
Oak Ridge, TN 37830

FIGURE 3-2
OU 001 Site Features and Monitoring Well Locations
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

Date modified: 10/25/2021	File: Ft_Riley_OU001_Site_Features_MW		
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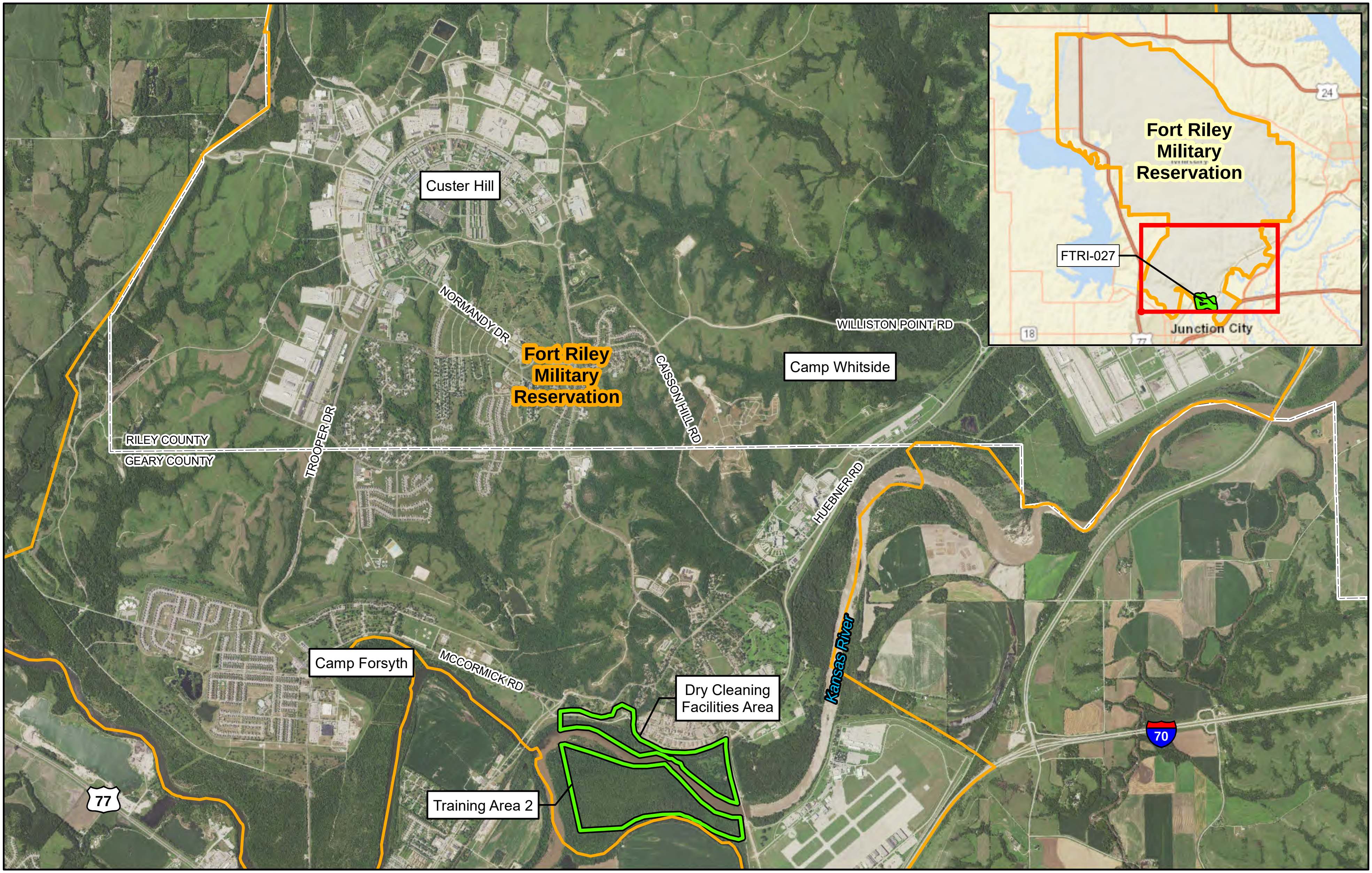

Legend

FTRI-027 Site Boundary

Fort Riley Boundary

County Boundary

U.S. Army Corps of Engineers

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Oak Ridge, TN 37830

FIGURE 4-1
OU 003 Site Location Map
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 2,250 4,500 Feet

N

Date modified: 07/21/2022	File: Ft_Riley_OU003_Site_Location		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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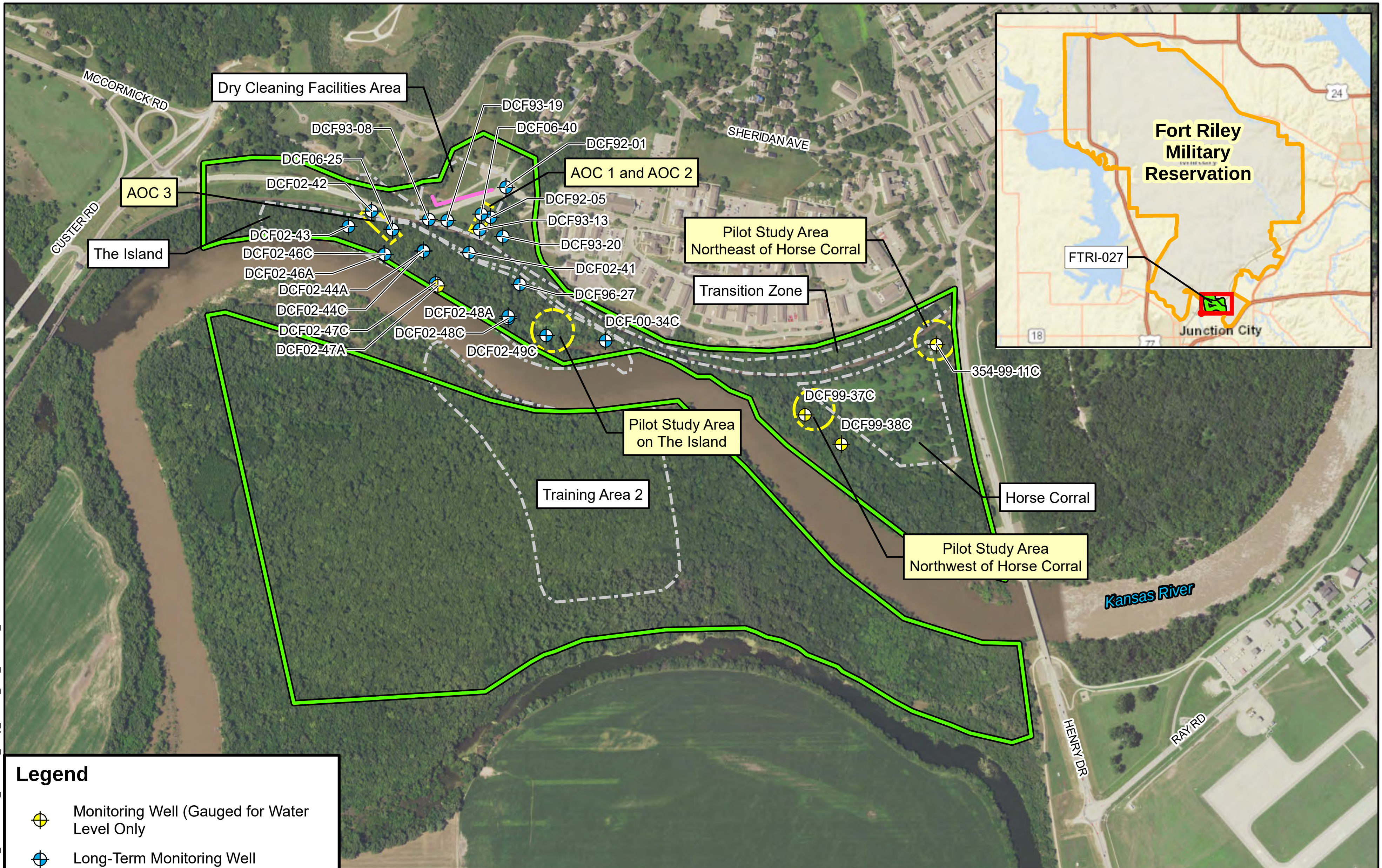

Legend

- Monitoring Well (Gauged for Water Level Only
- Long-Term Monitoring Well
- Utility Corridor
- FTRI-027 Site Boundary
- Investigation Area
- Pilot Study Area
- Fort Riley Boundary

U.S. Army Corps of Engineers

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Oak Ridge, TN 37830

FIGURE 4-2
OU 003 Site Features and Monitoring Well Locations
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 500 1,000 Feet

N

Date modified: 07/21/2022	File: Ft_Riley_OU003_Site_Features_MW		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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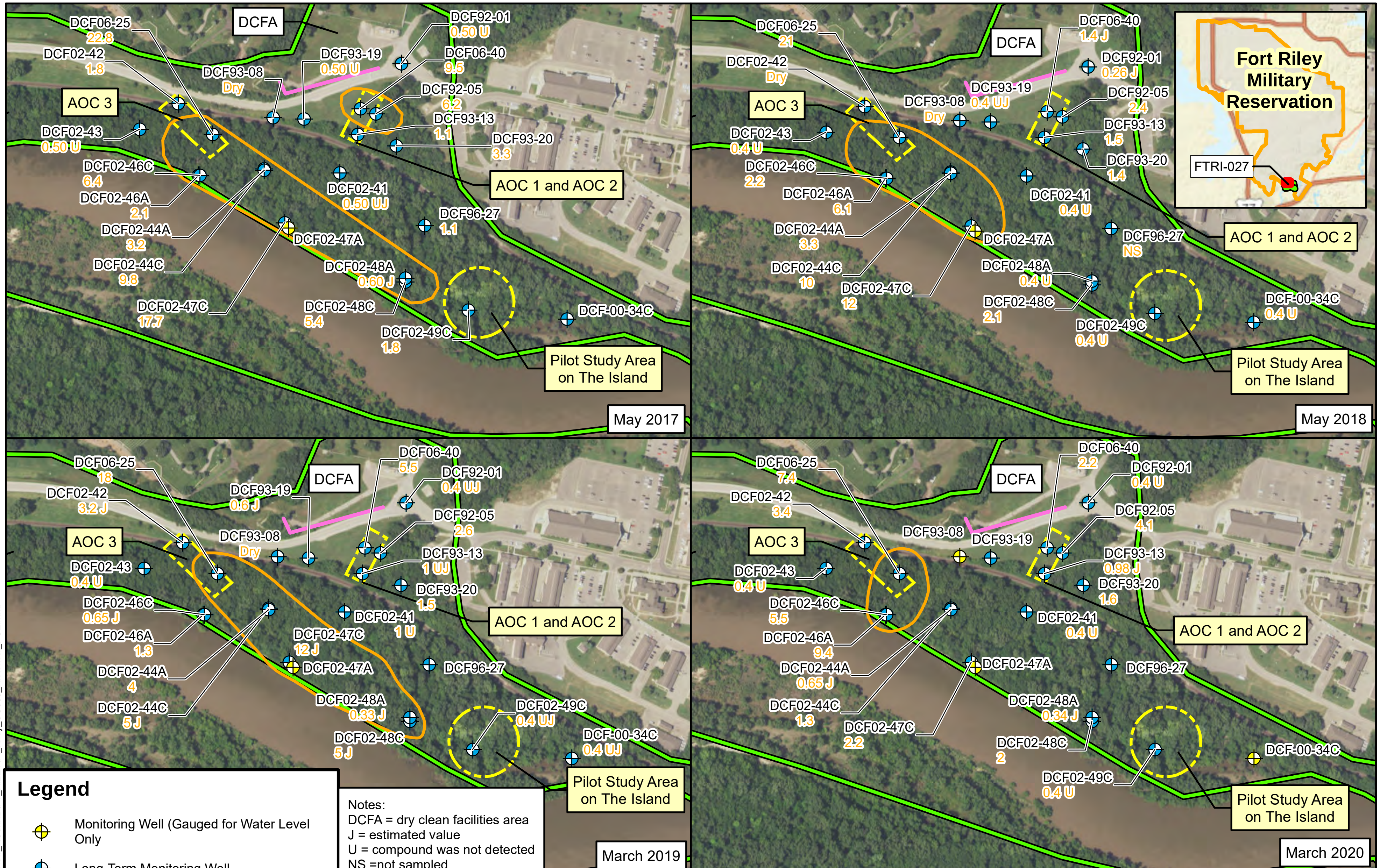

Legend

- Monitoring Well (Gauged for Water Level Only)
- Long-Term Monitoring Well
- Tetrachloroethene (PCE) Concentration Contour (MCL (maximum contaminant level) 5 µg/L (micrograms per Liter)
- Utility Corridor
- FTRI-027 Site Boundary
- Pilot Study Area

Notes:
DCFA = dry clean facilities area
J = estimated value
U = compound was not detected
NS =not sampled

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FIGURE 4-3
OU 003 Historical PCE Results Through March 2020
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 300 600 Feet

N

Date modified: 10/25/2021	File: Ft_Riley_OU003_Historical_PCE		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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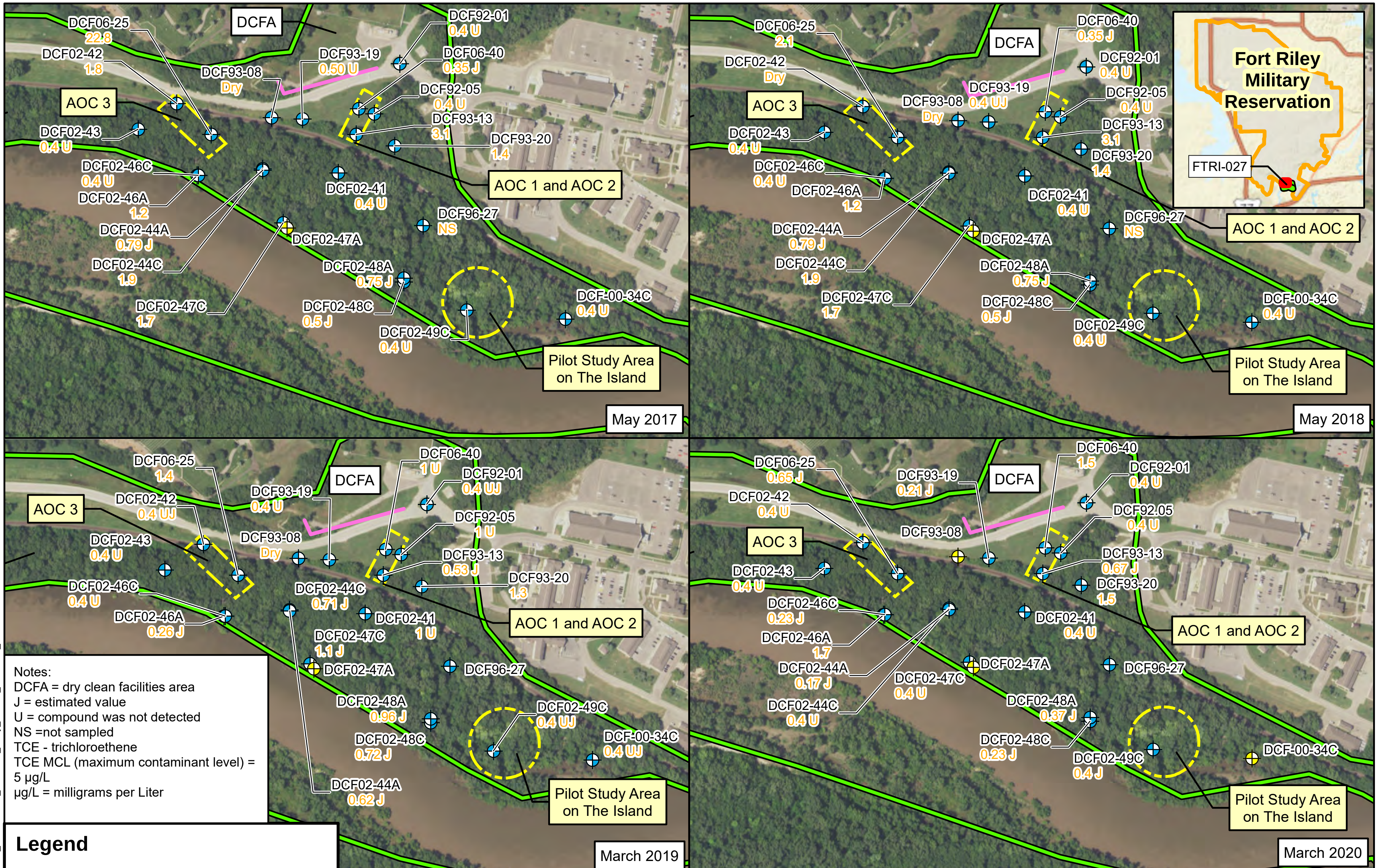

Notes:
DCFA = dry clean facilities area
J = estimated value
U = compound was not detected
NS =not sampled
TCE - trichloroethene
TCE MCL (maximum contaminant level) = 5 µg/L
µg/L = milligrams per Liter

Legend

- Monitoring Well (Gauged for Water Level Only
- Long-Term Monitoring Well
- Utility Corridor
- FTRI-027 Site Boundary
- Pilot Study Area

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FIGURE 4-4
OU 003 Historical TCE Results Through March 2020
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 300 600 Feet

N

Date modified: 10/25/2021	File: Ft_Riley_OU003_Historical_TCE		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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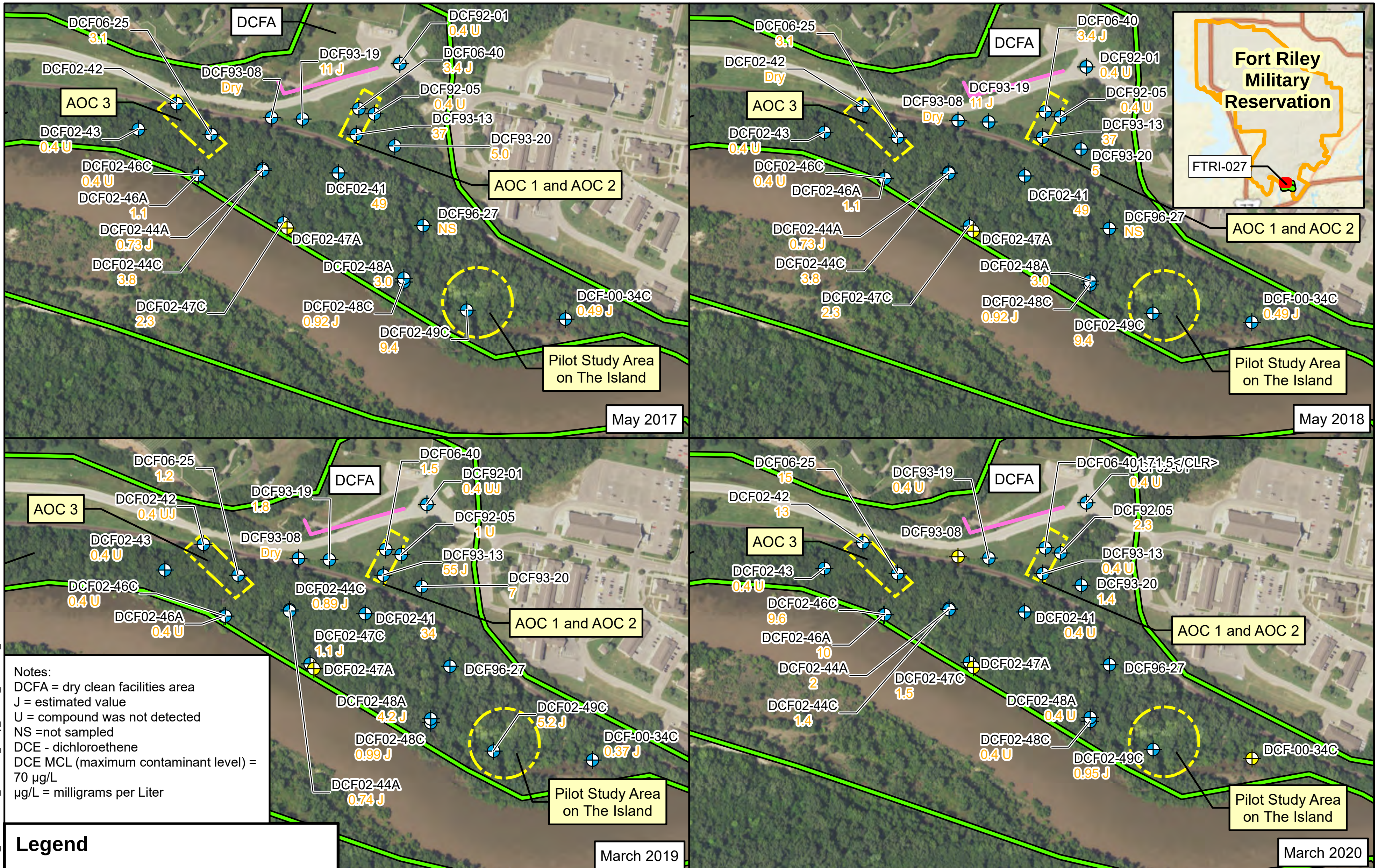

Notes:
DCFA = dry clean facilities area
J = estimated value
U = compound was not detected
NS =not sampled
DCE - dichloroethene
DCE MCL (maximum contaminant level) = 70 µg/L
µg/L = milligrams per Liter

Legend

- Monitoring Well (Gauged for Water Level Only
- Long-Term Monitoring Well
- Utility Corridor
- FTRI-027 Site Boundary
- Pilot Study Area

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FIGURE 4-5
OU 003 Historical cis-1,2-DCE Results Through March 2020
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 300 600 Feet

N

Date modified: 10/25/2021	File: Ft_Riley_OU003_Historical_DCE		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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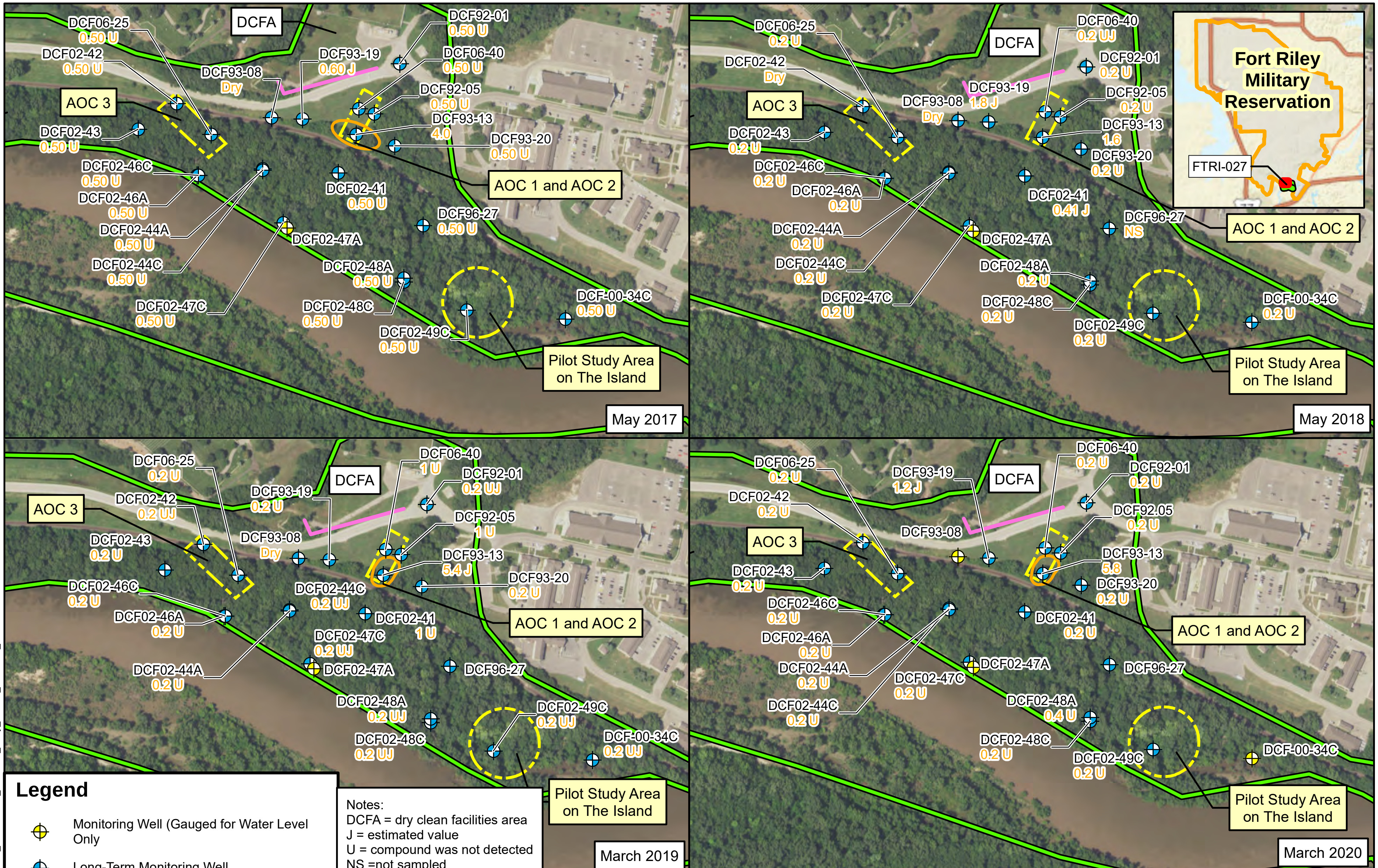

Legend

- Monitoring Well (Gauged for Water Level Only)
- Long-Term Monitoring Well
- VC (vinyl chloride) Concentration Contour (MCL (maximum contaminant level) 2 µg/L (micrograms per Liter)
- Utility Corridor
- FTRI-027 Site Boundary
- Pilot Study Area

Notes:
DCFA = dry clean facilities area
J = estimated value
U = compound was not detected
NS =not sampled

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FIGURE 4-6
OU 003 VC Results Through March 2020
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 300 600 Feet

N

Date modified: 10/25/2021	File: Ft_Riley_OU003_Historical_VC		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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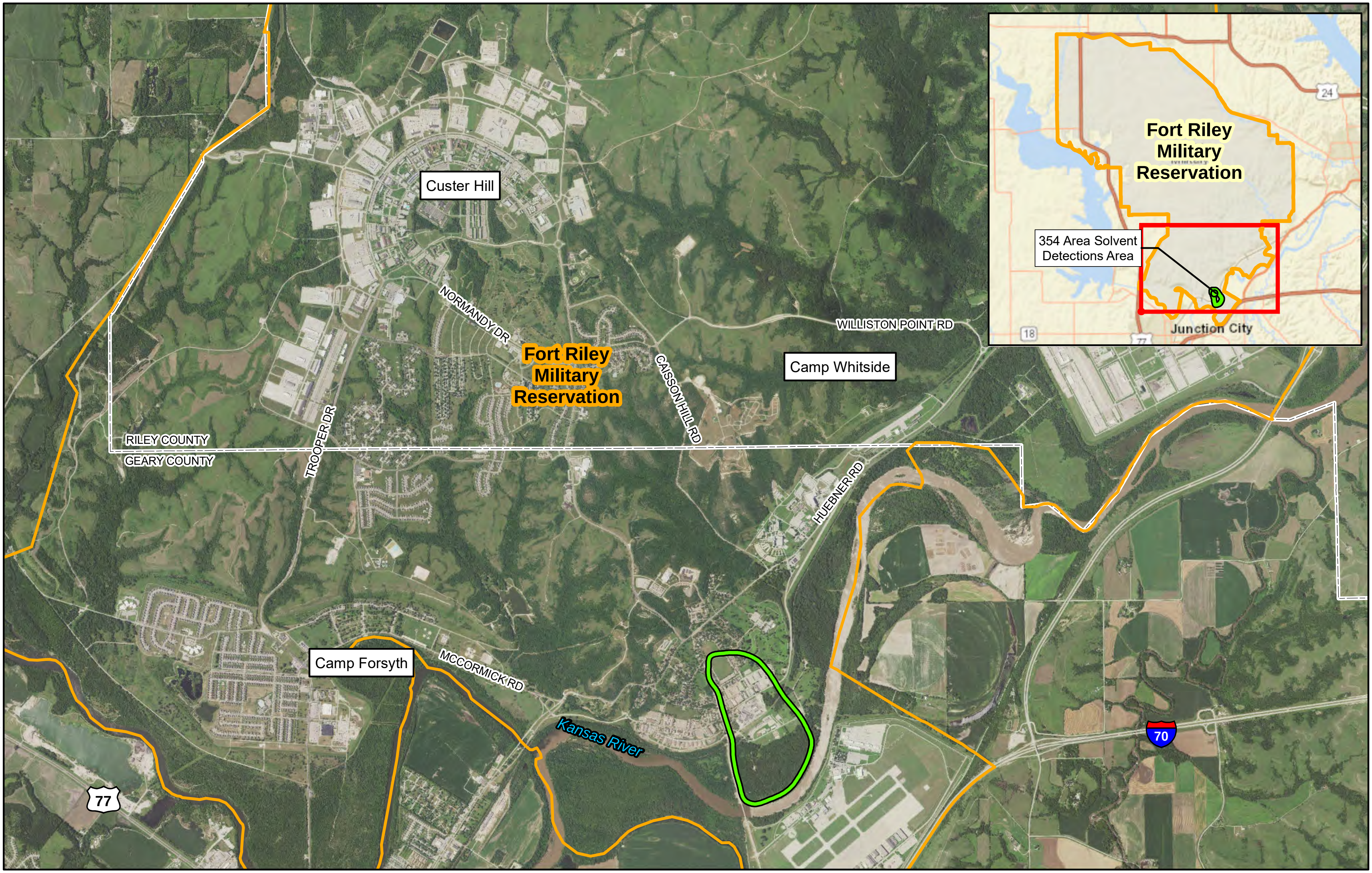

Legend

- 354 Area Solvent Detections
- Fort Riley Boundary
- County Boundary

U.S. Army Corps of Engineers

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Oak Ridge, TN 37830

FIGURE 5-1
OU 005 Site Location Map
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 2,250 4,500 Feet

N

Date modified: 07/21/2022	File: Ft_Riley_OU005_Site_Location		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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Legend

- Monitoring Well
- Aquifer Boundary
- 354 Area Solvent Detections Area
- Fort Riley Boundary

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FIGURE 5-2
OU 005 Monitoring Well Location Map
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 500 1,000 Feet

N

Date modified: 10/22/2021	File: Ft_Riley_OU005_MW_Locs		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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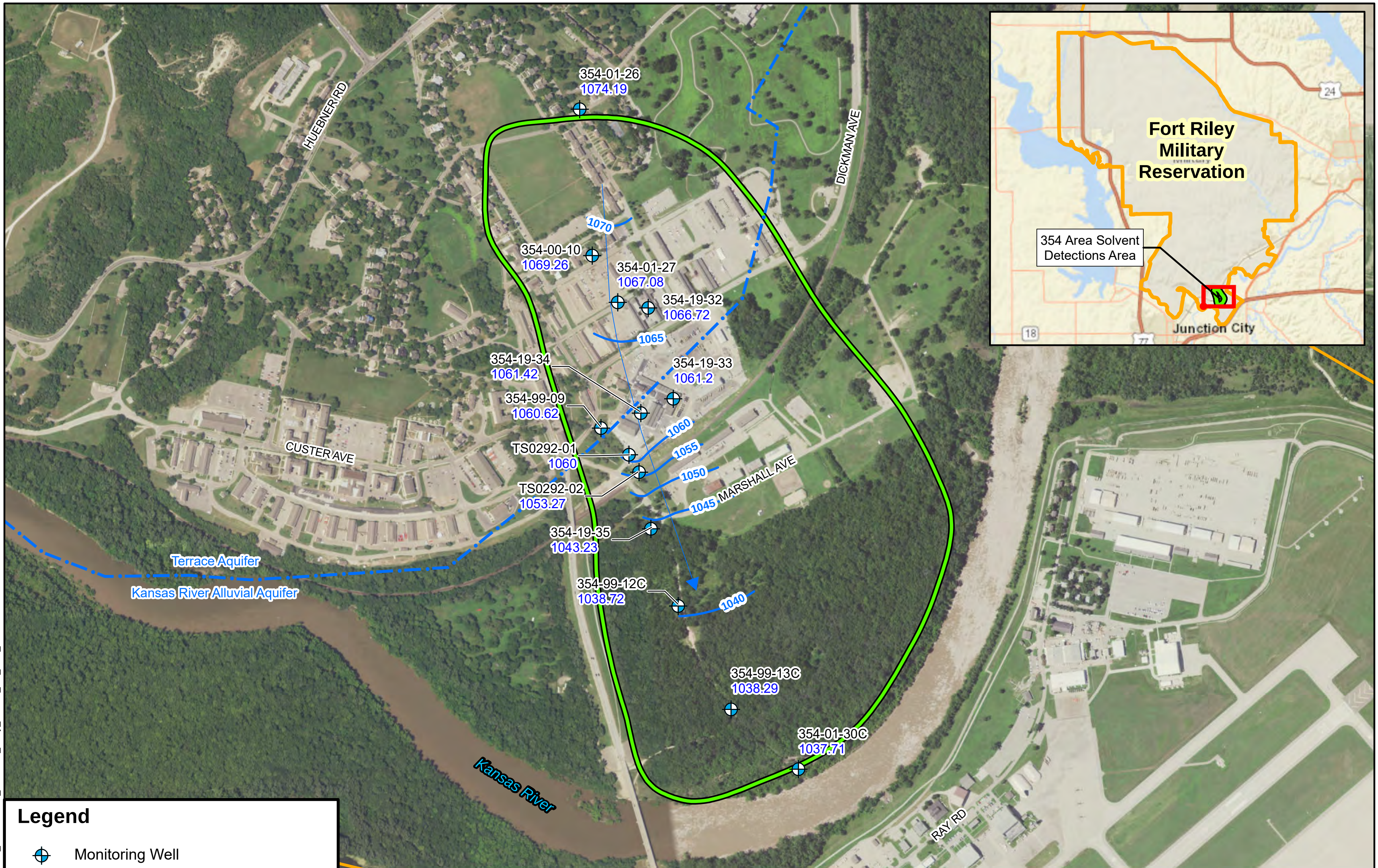

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Oak Ridge, TN 37830

FIGURE 5-3
OU 005 Piezometric Surface Map, 4th Quarter 2020
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 500 1,000 Feet

N

Date modified: 10/22/2021	File: Ft_Riley_OU005_Q4_Piez_Surface		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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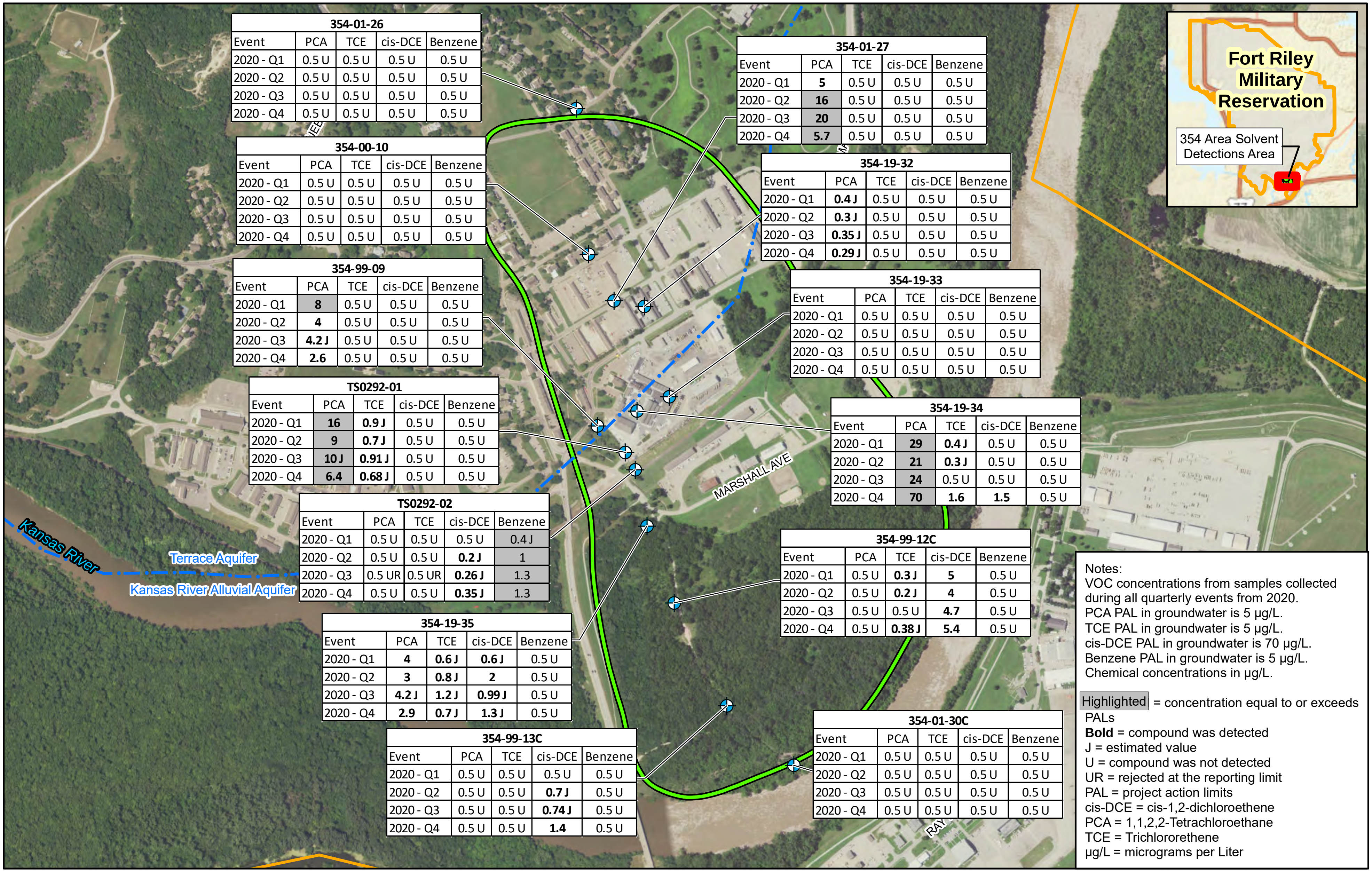

354-01-26

Event	PCA	TCE	cis-DCE	Benzene
2020 - Q1	0.5 U	0.5 U	0.5 U	0.5 U
2020 - Q2	0.5 U	0.5 U	0.5 U	0.5 U
2020 - Q3	0.5 U	0.5 U	0.5 U	0.5 U
2020 - Q4	0.5 U	0.5 U	0.5 U	0.5 U

354-01-27

Event	PCA	TCE	cis-DCE	Benzene
2020 - Q1	**5**	0.5 U	0.5 U	0.5 U
2020 - Q2	**16**	0.5 U	0.5 U	0.5 U
2020 - Q3	**20**	0.5 U	0.5 U	0.5 U
2020 - Q4	**5.7**	0.5 U	0.5 U	0.5 U

354-00-10

Event	PCA	TCE	cis-DCE	Benzene
2020 - Q1	0.5 U	0.5 U	0.5 U	0.5 U
2020 - Q2	0.5 U	0.5 U	0.5 U	0.5 U
2020 - Q3	0.5 U	0.5 U	0.5 U	0.5 U
2020 - Q4	0.5 U	0.5 U	0.5 U	0.5 U

354-19-32

Event	PCA	TCE	cis-DCE	Benzene
2020 - Q1	**0.4 J**	0.5 U	0.5 U	0.5 U
2020 - Q2	**0.3 J**	0.5 U	0.5 U	0.5 U
2020 - Q3	**0.35 J**	0.5 U	0.5 U	0.5 U
2020 - Q4	**0.29 J**	0.5 U	0.5 U	0.5 U

354-99-09

Event	PCA	TCE	cis-DCE	Benzene
2020 - Q1	**8**	0.5 U	0.5 U	0.5 U
2020 - Q2	**4**	0.5 U	0.5 U	0.5 U
2020 - Q3	**4.2 J**	0.5 U	0.5 U	0.5 U
2020 - Q4	**2.6**	0.5 U	0.5 U	0.5 U

354-19-33

Event	PCA	TCE	cis-DCE	Benzene
2020 - Q1	0.5 U	0.5 U	0.5 U	0.5 U
2020 - Q2	0.5 U	0.5 U	0.5 U	0.5 U
2020 - Q3	0.5 U	0.5 U	0.5 U	0.5 U
2020 - Q4	0.5 U	0.5 U	0.5 U	0.5 U

TS0292-01

Event	PCA	TCE	cis-DCE	Benzene
2020 - Q1	**16**	**0.9 J**	0.5 U	0.5 U
2020 - Q2	**9**	**0.7 J**	0.5 U	0.5 U
2020 - Q3	**10 J**	**0.91 J**	0.5 U	0.5 U
2020 - Q4	**6.4**	**0.68 J**	0.5 U	0.5 U

354-19-34

Event	PCA	TCE	cis-DCE	Benzene
2020 - Q1	**29**	**0.4 J**	0.5 U	0.5 U
2020 - Q2	**21**	**0.3 J**	0.5 U	0.5 U
2020 - Q3	**24**	0.5 U	0.5 U	0.5 U
2020 - Q4	**70**	**1.6**	**1.5**	0.5 U

TS0292-02

Event	PCA	TCE	cis-DCE	Benzene
2020 - Q1	0.5 U	0.5 U	0.5 U	0.4 J
2020 - Q2	0.5 U	0.5 U	**0.2 J**	1
2020 - Q3	0.5 UR	0.5 UR	**0.26 J**	1.3
2020 - Q4	0.5 U	0.5 U	**0.35 J**	1.3

354-99-12C

Event	PCA	TCE	cis-DCE	Benzene
2020 - Q1	0.5 U	**0.3 J**	**5**	0.5 U
2020 - Q2	0.5 U	**0.2 J**	**4**	0.5 U
2020 - Q3	0.5 U	0.5 U	**4.7**	0.5 U
2020 - Q4	0.5 U	**0.38 J**	**5.4**	0.5 U

354-19-35

Event	PCA	TCE	cis-DCE	Benzene
2020 - Q1	**4**	**0.6 J**	**0.6 J**	0.5 U
2020 - Q2	**3**	**0.8 J**	**2**	0.5 U
2020 - Q3	**4.2 J**	**1.2 J**	**0.99 J**	0.5 U
2020 - Q4	**2.9**	**0.7 J**	**1.3 J**	0.5 U

354-99-13C

Event	PCA	TCE	cis-DCE	Benzene
2020 - Q1	0.5 U	0.5 U	0.5 U	0.5 U
2020 - Q2	0.5 U	0.5 U	**0.7 J**	0.5 U
2020 - Q3	0.5 U	0.5 U	**0.74 J**	0.5 U
2020 - Q4	0.5 U	0.5 U	**1.4**	0.5 U

354-01-30C

Event	PCA	TCE	cis-DCE	Benzene
2020 - Q1	0.5 U	0.5 U	0.5 U	0.5 U
2020 - Q2	0.5 U	0.5 U	0.5 U	0.5 U
2020 - Q3	0.5 U	0.5 U	0.5 U	0.5 U
2020 - Q4	0.5 U	0.5 U	0.5 U	0.5 U

Notes:
VOC concentrations from samples collected during all quarterly events from 2020.
PCA PAL in groundwater is 5 µg/L.
TCE PAL in groundwater is 5 µg/L.
cis-DCE PAL in groundwater is 70 µg/L.
Benzene PAL in groundwater is 5 µg/L.
Chemical concentrations in µg/L.

Highlighted = concentration equal to or exceeds PALs
Bold = compound was detected
J = estimated value
U = compound was not detected
UR = rejected at the reporting limit
PAL = project action limits
cis-DCE = cis-1,2-dichloroethene
PCA = 1,1,2,2-Tetrachloroethane
TCE = Trichlororethene
µg/L = micrograms per Liter

Legend

- Monitoring Well
- Aquifer Boundary
- 354 Area Solvent Detections Area
- Fort Riley Boundary

U.S. Army Corps of Engineers

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FIGURE 5-4
OU 005 VOC Concentration Map, All Quarters 2020
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 500 1,000 Feet

N

Date modified: 04/11/2022

File: Ft_Riley_OU005_VOC_Results

Aerostar Proj.: 1RC01.1023.0001

Drawn: SSigniski

Checked: M Stemper

Rev: 01

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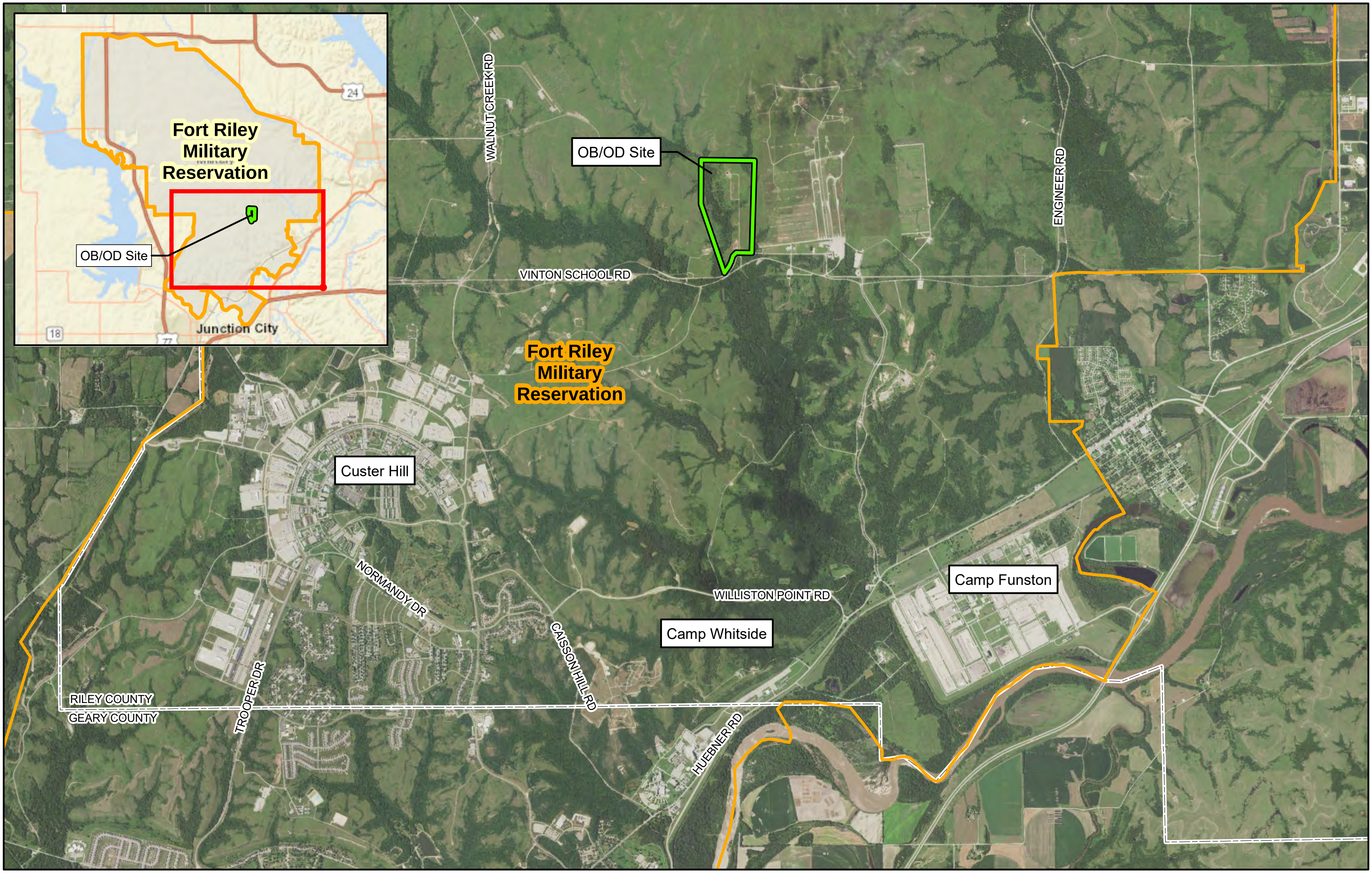

Legend

OB/OD Site Boundary

Fort Riley Boundary

County Boundary

U.S. Army Corps of Engineers

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FIGURE 6-1
OU 006 Site Location Map
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 1,500 3,000
Feet

N

Date modified: 10/21/2021	File: Ft_Riley_OU006_Site_Location		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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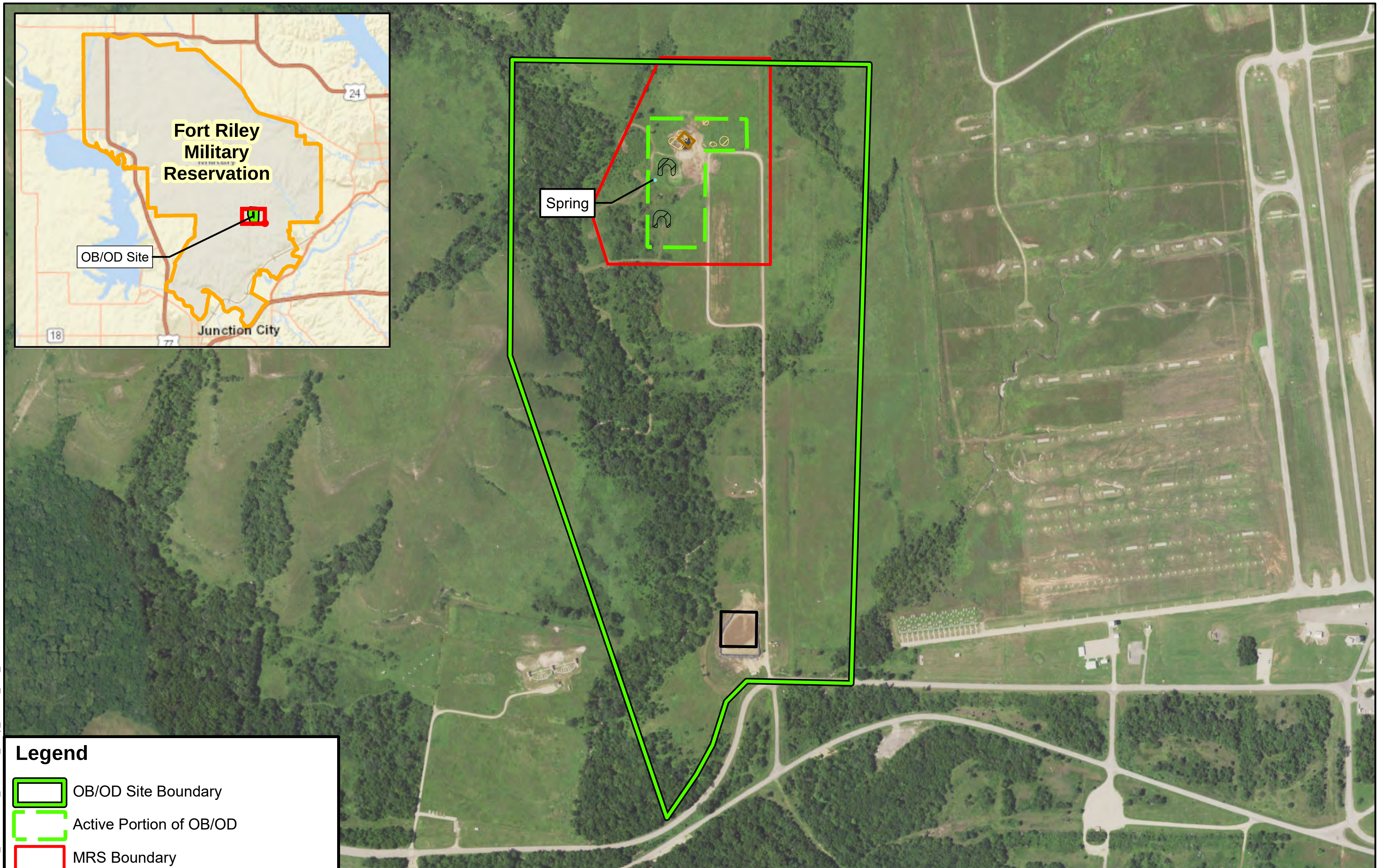

Legend

- OB/OD Site Boundary
- Active Portion of OB/OD
- MRS Boundary
- Excavation Area
- Burn Pit
- Metal Debris or Demo Pit
- Spring
- Land Farm Treatment Cell

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FIGURE 6-2
OU 006 Site Features
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 375 750 Feet

N

Date modified: 10/22/2021	File: Ft_Riley_OU006_Site_Features		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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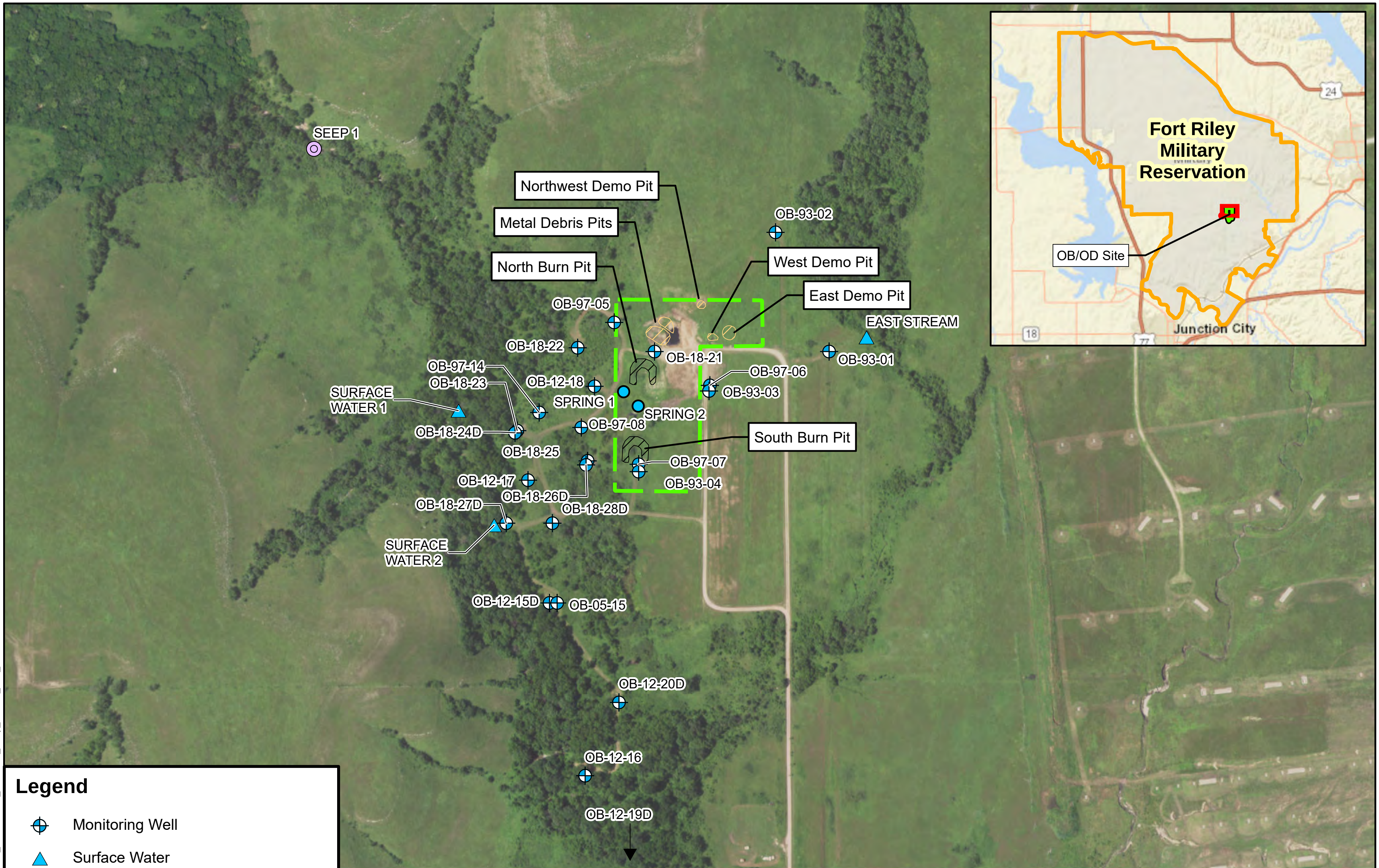

Legend

Monitoring Well
Surface Water
Seep
Spring
Active Portion of OB/OD
Burn Pit
Metal Debris or Demo Pit

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FIGURE 6-3
OU 006 Groundwater and Surface Water Monitoring Locations
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 375 750 Feet
N

Date modified: 10/22/2021	File: Ft_Riley_OU006_GW_SW		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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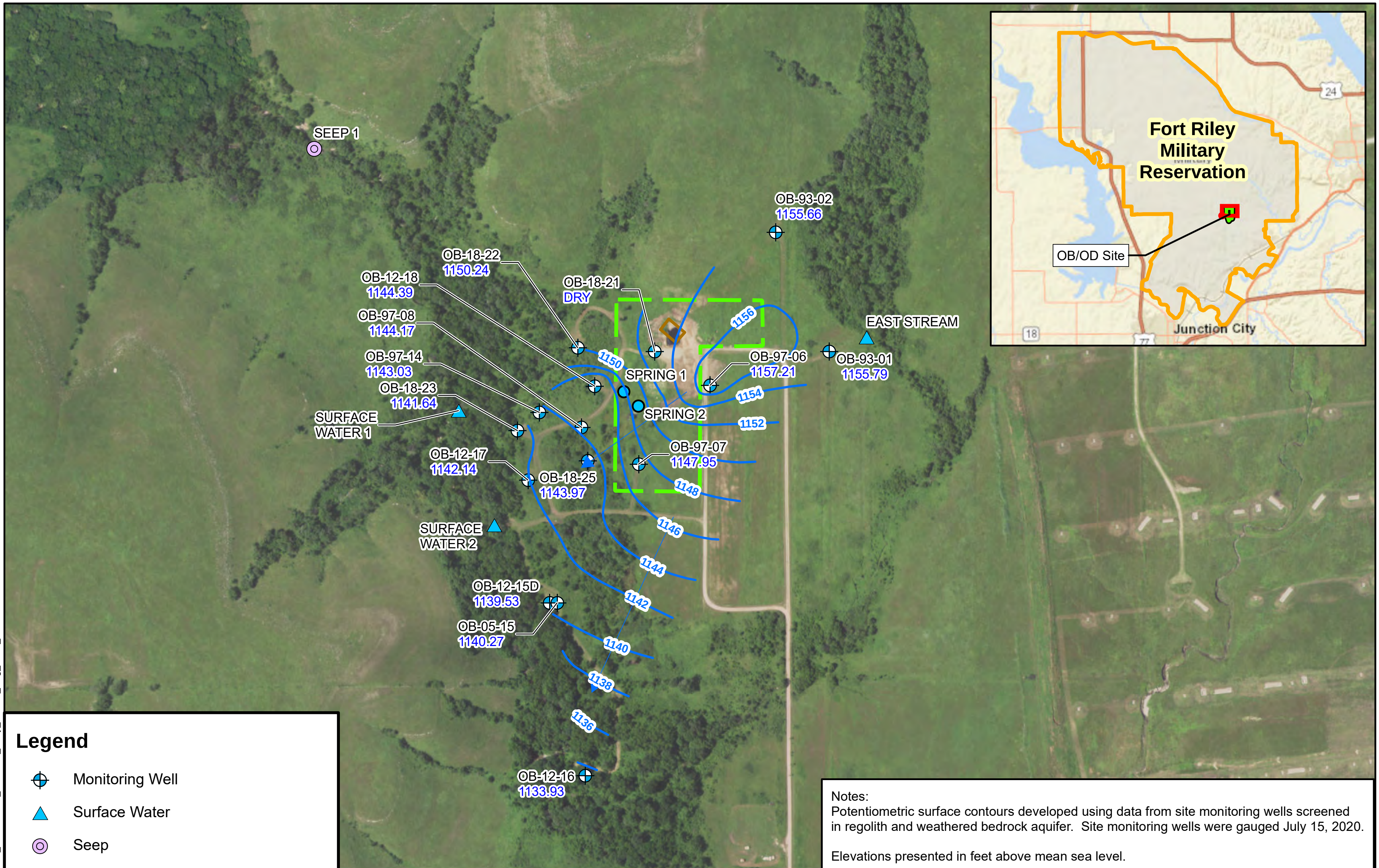

Legend

- Monitoring Well
- Surface Water
- Seep
- Spring
- Potentiometric Surface Contour
- Approximate Groundwater Flow Direction
- Active Portion of OB/OD
- Excavation Area

Notes:
Potentiometric surface contours developed using data from site monitoring wells screened in regolith and weathered bedrock aquifer. Site monitoring wells were gauged July 15, 2020.

Elevations presented in feet above mean sea level.

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FIGURE 6-4
OU 006 Regolith/Weathered Bedrock Aquifer Potentiometric Surface Map, July 2020
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 375 750 Feet

N

Date modified: 10/22/2021	File: Ft_Riley_OU006_Reg_WBR_Contours		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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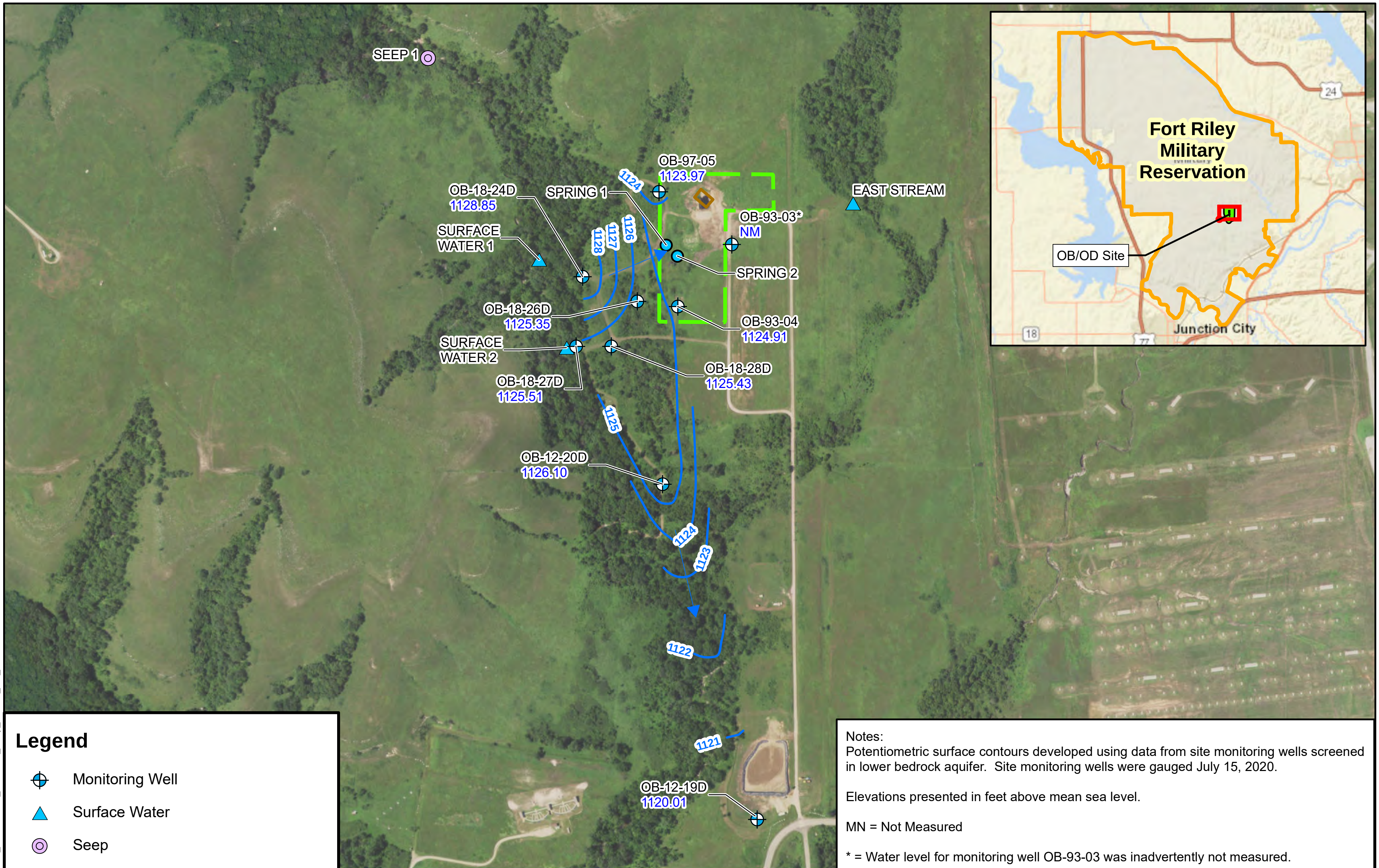

Legend

- Monitoring Well
- Surface Water
- Seep
- Spring
- Potentiometric Surface Contour
- Approximate Groundwater Flow Direction
- Active Portion of OB/OD
- Excavation Area

Notes:
Potentiometric surface contours developed using data from site monitoring wells screened in lower bedrock aquifer. Site monitoring wells were gauged July 15, 2020.

Elevations presented in feet above mean sea level.

MN = Not Measured

* = Water level for monitoring well OB-93-03 was inadvertently not measured.

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FIGURE 6-5
OU 006 Lower Bedrock Aquifer Potentiometric Surface Map, July 2020
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aerostar Environmental

0 325 650 Feet

N

Date modified: 10/22/2021	File: Ft_Riley_OU006_BR_Contours		
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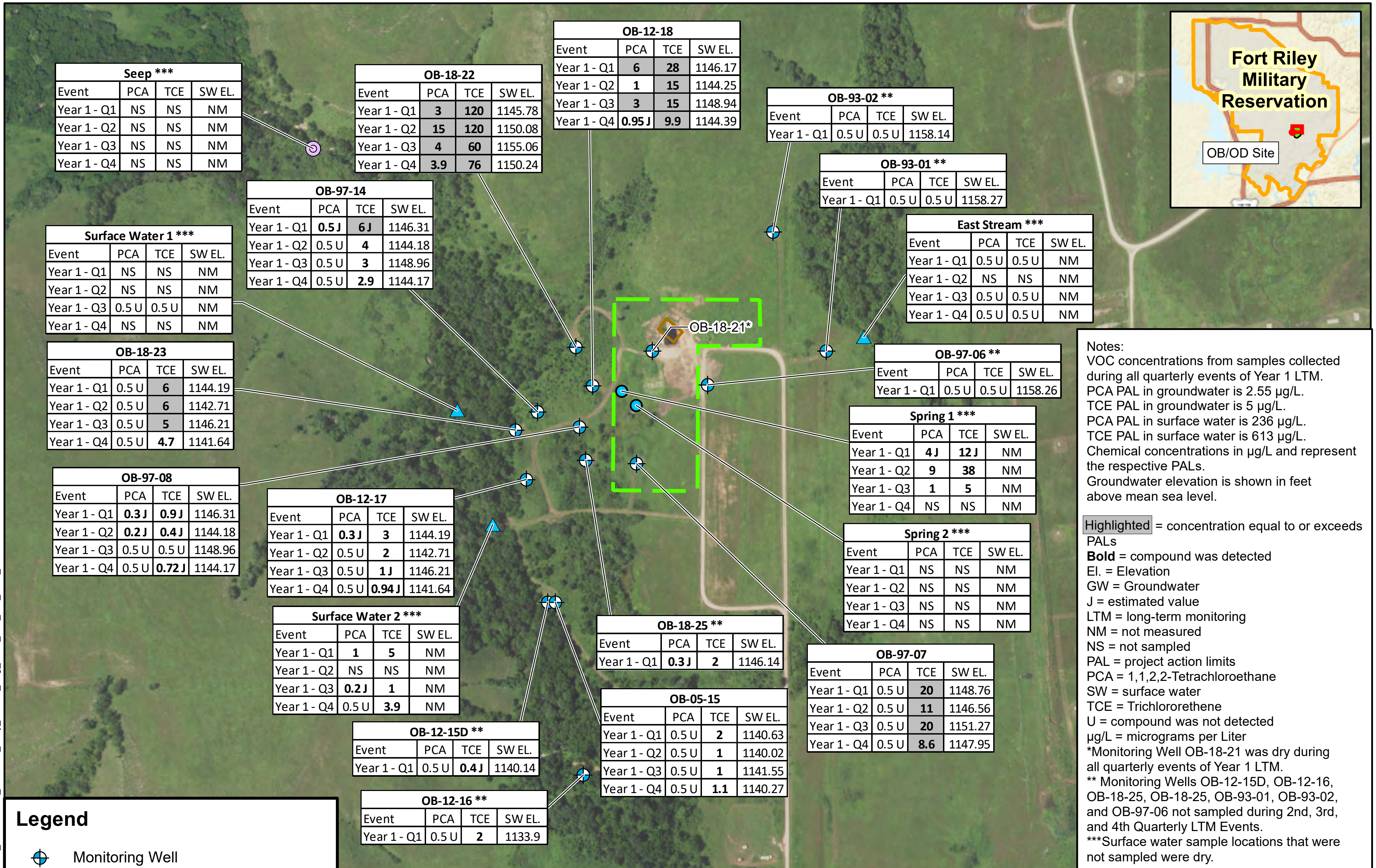

Seep ***

Event	PCA	TCE	SW EL.
Year 1 - Q1	NS	NS	NM
Year 1 - Q2	NS	NS	NM
Year 1 - Q3	NS	NS	NM
Year 1 - Q4	NS	NS	NM

OB-18-22

Event	PCA	TCE	SW EL.
Year 1 - Q1	**3**	**120**	1145.78
Year 1 - Q2	**15**	**120**	1150.08
Year 1 - Q3	**4**	**60**	1155.06
Year 1 - Q4	**3.9**	**76**	1150.24

OB-12-18

Event	PCA	TCE	SW EL.
Year 1 - Q1	**6**	**28**	1146.17
Year 1 - Q2	**1**	**15**	1144.25
Year 1 - Q3	**3**	**15**	1148.94
Year 1 - Q4	**0.95 J**	**9.9**	1144.39

OB-93-02 **

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	0.5 U	1158.14

OB-93-01 **

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	0.5 U	1158.27

East Stream ***

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	0.5 U	NM
Year 1 - Q2	NS	NS	NM
Year 1 - Q3	0.5 U	0.5 U	NM
Year 1 - Q4	0.5 U	0.5 U	NM

OB-97-14

Event	PCA	TCE	SW EL.
Year 1 - Q1	**0.5 J**	**6 J**	1146.31
Year 1 - Q2	0.5 U	**4**	1144.18
Year 1 - Q3	0.5 U	**3**	1148.96
Year 1 - Q4	0.5 U	**2.9**	1144.17

Surface Water 1 ***

Event	PCA	TCE	SW EL.
Year 1 - Q1	NS	NS	NM
Year 1 - Q2	NS	NS	NM
Year 1 - Q3	0.5 U	0.5 U	NM
Year 1 - Q4	NS	NS	NM

OB-18-23

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**6**	1144.19
Year 1 - Q2	0.5 U	**6**	1142.71
Year 1 - Q3	0.5 U	**5**	1146.21
Year 1 - Q4	0.5 U	**4.7**	1141.64

OB-97-06 **

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	0.5 U	1158.26

Spring 1 ***

Event	PCA	TCE	SW EL.
Year 1 - Q1	**4 J**	**12 J**	NM
Year 1 - Q2	**9**	**38**	NM
Year 1 - Q3	**1**	**5**	NM
Year 1 - Q4	NS	NS	NM

Spring 2 ***

Event	PCA	TCE	SW EL.
Year 1 - Q1	NS	NS	NM
Year 1 - Q2	NS	NS	NM
Year 1 - Q3	NS	NS	NM
Year 1 - Q4	NS	NS	NM

OB-97-08

Event	PCA	TCE	SW EL.
Year 1 - Q1	**0.3 J**	**0.9 J**	1146.31
Year 1 - Q2	**0.2 J**	**0.4 J**	1144.18
Year 1 - Q3	0.5 U	0.5 U	1148.96
Year 1 - Q4	0.5 U	**0.72 J**	1144.17

OB-12-17

Event	PCA	TCE	SW EL.
Year 1 - Q1	**0.3 J**	**3**	1144.19
Year 1 - Q2	0.5 U	**2**	1142.71
Year 1 - Q3	0.5 U	**1 J**	1146.21
Year 1 - Q4	0.5 U	**0.94 J**	1141.64

Surface Water 2 ***

Event	PCA	TCE	SW EL.
Year 1 - Q1	**1**	**5**	NM
Year 1 - Q2	NS	NS	NM
Year 1 - Q3	**0.2 J**	**1**	NM
Year 1 - Q4	0.5 U	**3.9**	NM

OB-18-25 **

Event	PCA	TCE	SW EL.
Year 1 - Q1	**0.3 J**	**2**	1146.14

OB-12-15D **

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**0.4 J**	1140.14

OB-05-15

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**2**	1140.63
Year 1 - Q2	0.5 U	**1**	1140.02
Year 1 - Q3	0.5 U	**1**	1141.55
Year 1 - Q4	0.5 U	**1.1**	1140.27

OB-97-07

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**20**	1148.76
Year 1 - Q2	0.5 U	**11**	1146.56
Year 1 - Q3	0.5 U	**20**	1151.27
Year 1 - Q4	0.5 U	**8.6**	1147.95

OB-12-16 **

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**2**	1133.9

Notes:
VOC concentrations from samples collected during all quarterly events of Year 1 LTM.
PCA PAL in groundwater is 2.55 μg/L.
TCE PAL in groundwater is 5 μg/L.
PCA PAL in surface water is 236 μg/L.
TCE PAL in surface water is 613 μg/L.
Chemical concentrations in μg/L and represent the respective PALs.
Groundwater elevation is shown in feet above mean sea level.

Highlighted = concentration equal to or exceeds PALs
Bold = compound was detected
El. = Elevation
GW = Groundwater
J = estimated value
LTM = long-term monitoring
NM = not measured
NS = not sampled
PAL = project action limits
PCA = 1,1,2,2-Tetrachloroethane
SW = surface water
TCE = Trichlororethene
U = compound was not detected
μg/L = micrograms per Liter
*Monitoring Well OB-18-21 was dry during all quarterly events of Year 1 LTM.
** Monitoring Wells OB-12-15D, OB-12-16, OB-18-25, OB-18-25, OB-93-01, OB-93-02, and OB-97-06 not sampled during 2nd, 3rd, and 4th Quarterly LTM Events.
***Surface water sample locations that were not sampled were dry.

Legend

- Monitoring Well
- Surface Water
- Seep
- Spring
- Active Portion of OB/OD
- Excavation Area

U.S. Army Corps of Engineers

Aerostar Environmental and Construction

Aerostar Environment and Construction LLC
1006 Floyd Culler Court
Oak Ridge, TN 37830

FIGURE 6-6
OU 006 Regolith/Weathered Bedrock Aquifer and Surface Water VOC Concentration Map, Year 1 LTM
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 375 750 Feet
N

Date modified: 10/22/2021	File: Ft_Riley_OU006_Reg_WBR_GW_SW_VOC_LTM		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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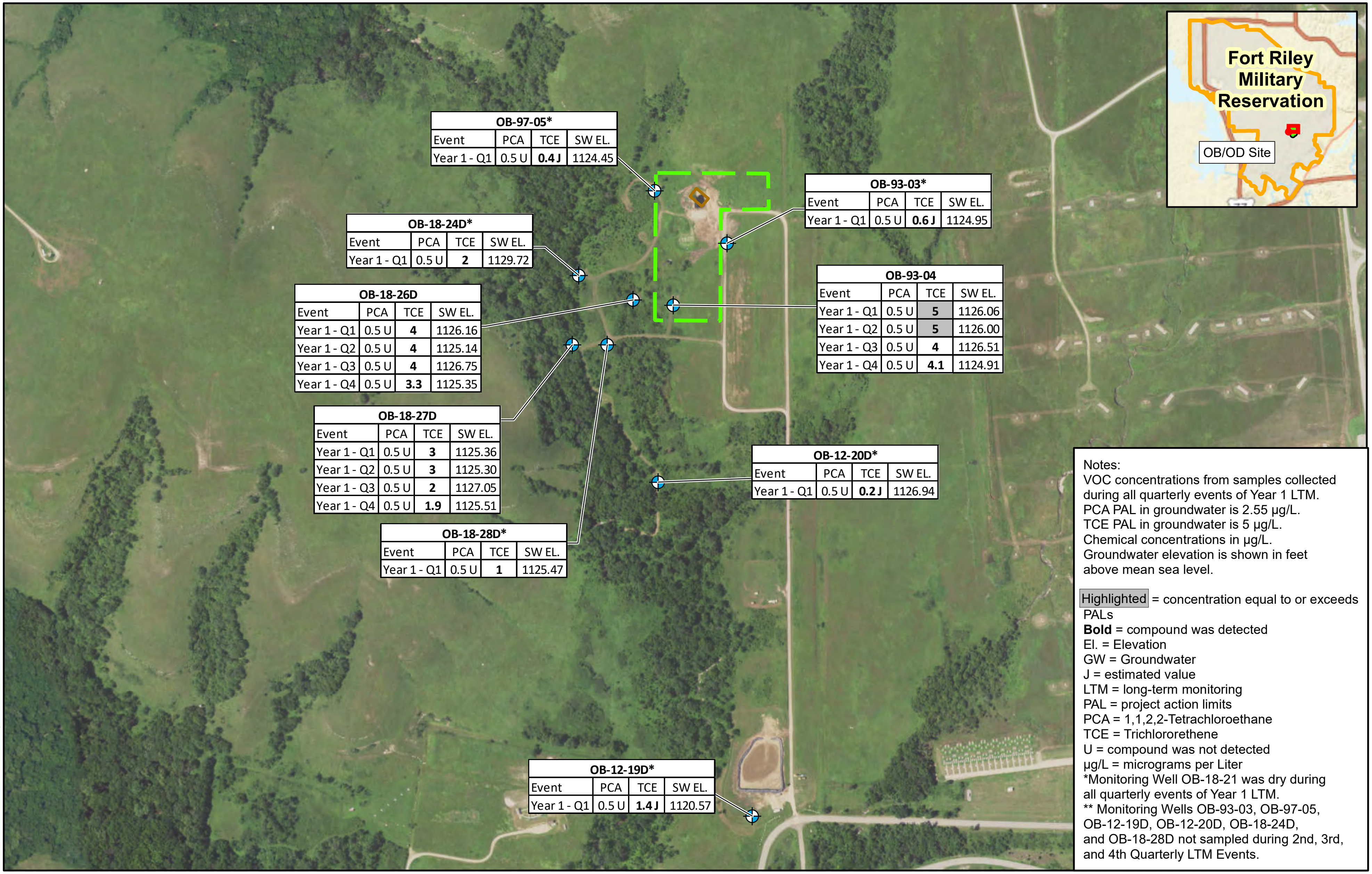

OB-97-05*

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**0.4 J**	1124.45

OB-93-03*

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**0.6 J**	1124.95

OB-18-24D*

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**2**	1129.72

OB-18-26D

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**4**	1126.16
Year 1 - Q2	0.5 U	**4**	1125.14
Year 1 - Q3	0.5 U	**4**	1126.75
Year 1 - Q4	0.5 U	**3.3**	1125.35

OB-93-04

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**5**	1126.06
Year 1 - Q2	0.5 U	**5**	1126.00
Year 1 - Q3	0.5 U	**4**	1126.51
Year 1 - Q4	0.5 U	**4.1**	1124.91

OB-18-27D

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**3**	1125.36
Year 1 - Q2	0.5 U	**3**	1125.30
Year 1 - Q3	0.5 U	**2**	1127.05
Year 1 - Q4	0.5 U	**1.9**	1125.51

OB-12-20D*

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**0.2 J**	1126.94

OB-18-28D*

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**1**	1125.47

OB-12-19D*

Event	PCA	TCE	SW EL.
Year 1 - Q1	0.5 U	**1.4 J**	1120.57

Notes:
VOC concentrations from samples collected during all quarterly events of Year 1 LTM.
PCA PAL in groundwater is 2.55 μg/L.
TCE PAL in groundwater is 5 μg/L.
Chemical concentrations in μg/L.
Groundwater elevation is shown in feet above mean sea level.

Highlighted = concentration equal to or exceeds PALs
Bold = compound was detected
El. = Elevation
GW = Groundwater
J = estimated value
LTM = long-term monitoring
PAL = project action limits
PCA = 1,1,2,2-Tetrachloroethane
TCE = Trichlororethene
U = compound was not detected
μg/L = micrograms per Liter
*Monitoring Well OB-18-21 was dry during all quarterly events of Year 1 LTM.
** Monitoring Wells OB-93-03, OB-97-05, OB-12-19D, OB-12-20D, OB-18-24D, and OB-18-28D not sampled during 2nd, 3rd, and 4th Quarterly LTM Events.

Legend

Monitoring Well
Active Portion of OB/OD
Excavation Area

U.S. Army Corps of Engineers

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Oak Ridge, TN 37830

FIGURE 6-7
OU 006 Lower Bedrock Aquifer VOC Concentration Map,
Year 1 LTM
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 325 650 Feet

N

Date modified: 10/22/2021	File: Ft_Riley_OU006_BR_GW_VOC_LTM1		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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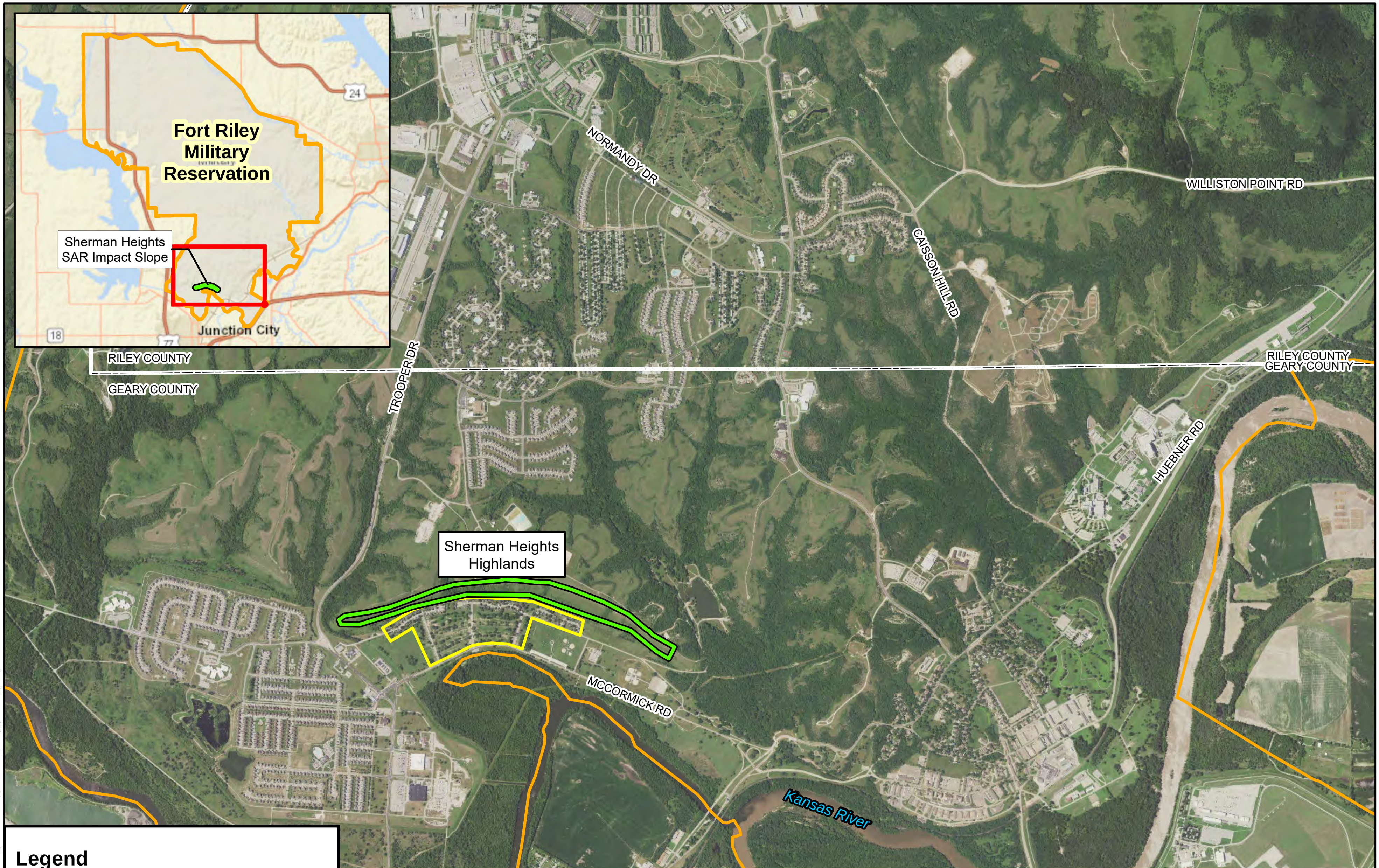

Legend

- Sherman Heights Small Arms Range Impact Slope MRS
- Colyer Manor Military Family Housing
- Fort Riley Boundary
- County Boundary

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FIGURE 7-1
OU 008 Site Location Map
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 1,500 3,000 Feet

N

Date modified: 07/21/2022	File: Ft_Riley_OU008_Site_Location		
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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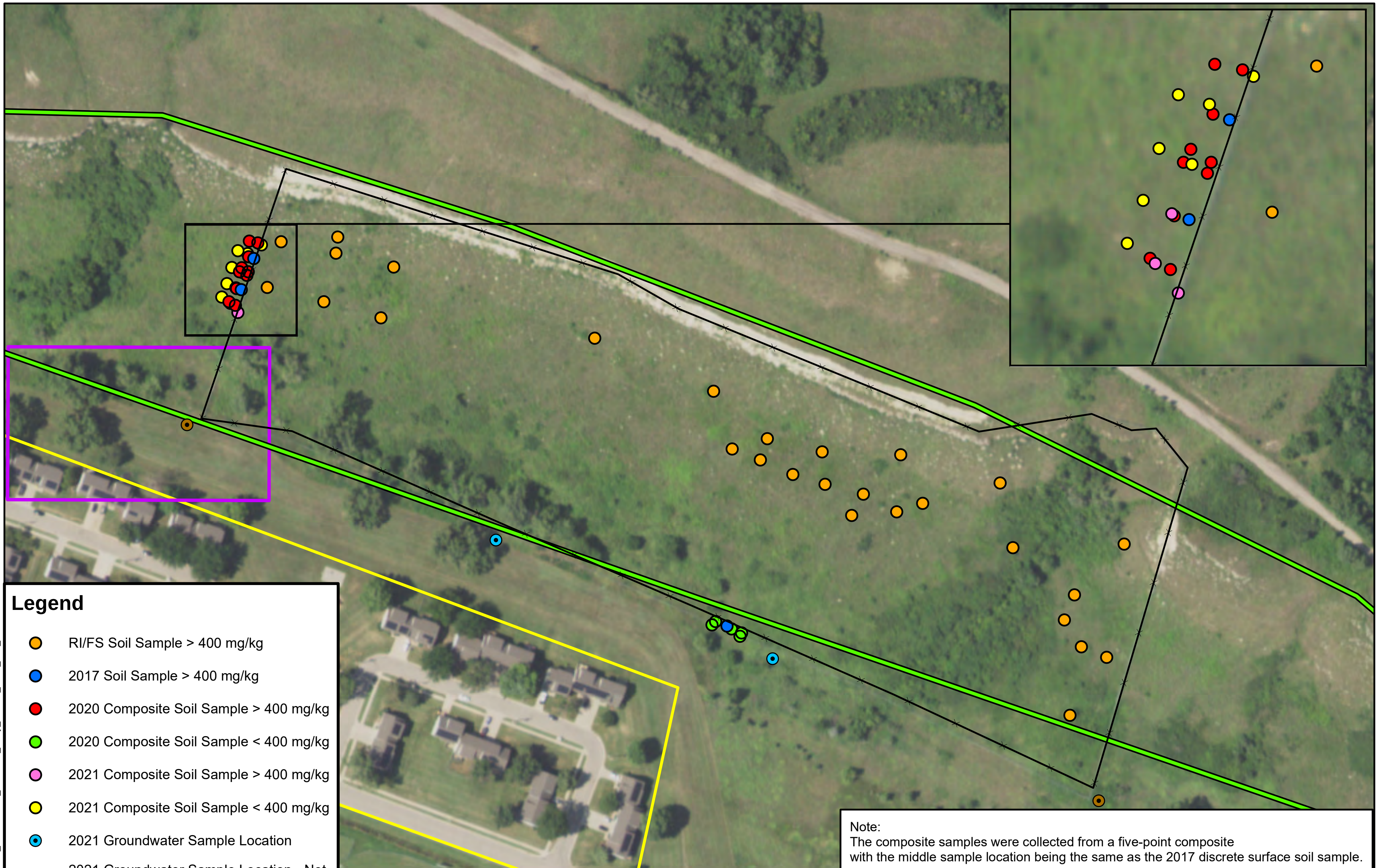

Legend

- RI/FS Soil Sample > 400 mg/kg
- 2017 Soil Sample > 400 mg/kg
- 2020 Composite Soil Sample > 400 mg/kg
- 2020 Composite Soil Sample < 400 mg/kg
- 2021 Composite Soil Sample > 400 mg/kg
- 2021 Composite Soil Sample < 400 mg/kg
- 2021 Groundwater Sample Location
- 2021 Groundwater Sample Location - Not Sampled
- Fence
- Sherman Heights Small Arms Range Impact Slope MRS
- Colyer Manor Military Family Housing
- 1994 Excavation Area

Note:
The composite samples were collected from a five-point composite with the middle sample location being the same as the 2017 discrete surface soil sample.

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Oak Ridge, TN 37830

FIGURE 7-2
OU 008 Composite Lead Soil Sample Concentrations, 2020 - 2021, and Groundwater Sample Locations, 2021
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 100 200 Feet

N

Date modified: 08/29/2022	File: Ft_Riley_OU008_Lead_Soil_GW	
Aerostar Proj.: 1RC01.1023.0001	Drawn: SSigniski	Checked: M Stemper	Rev: 01

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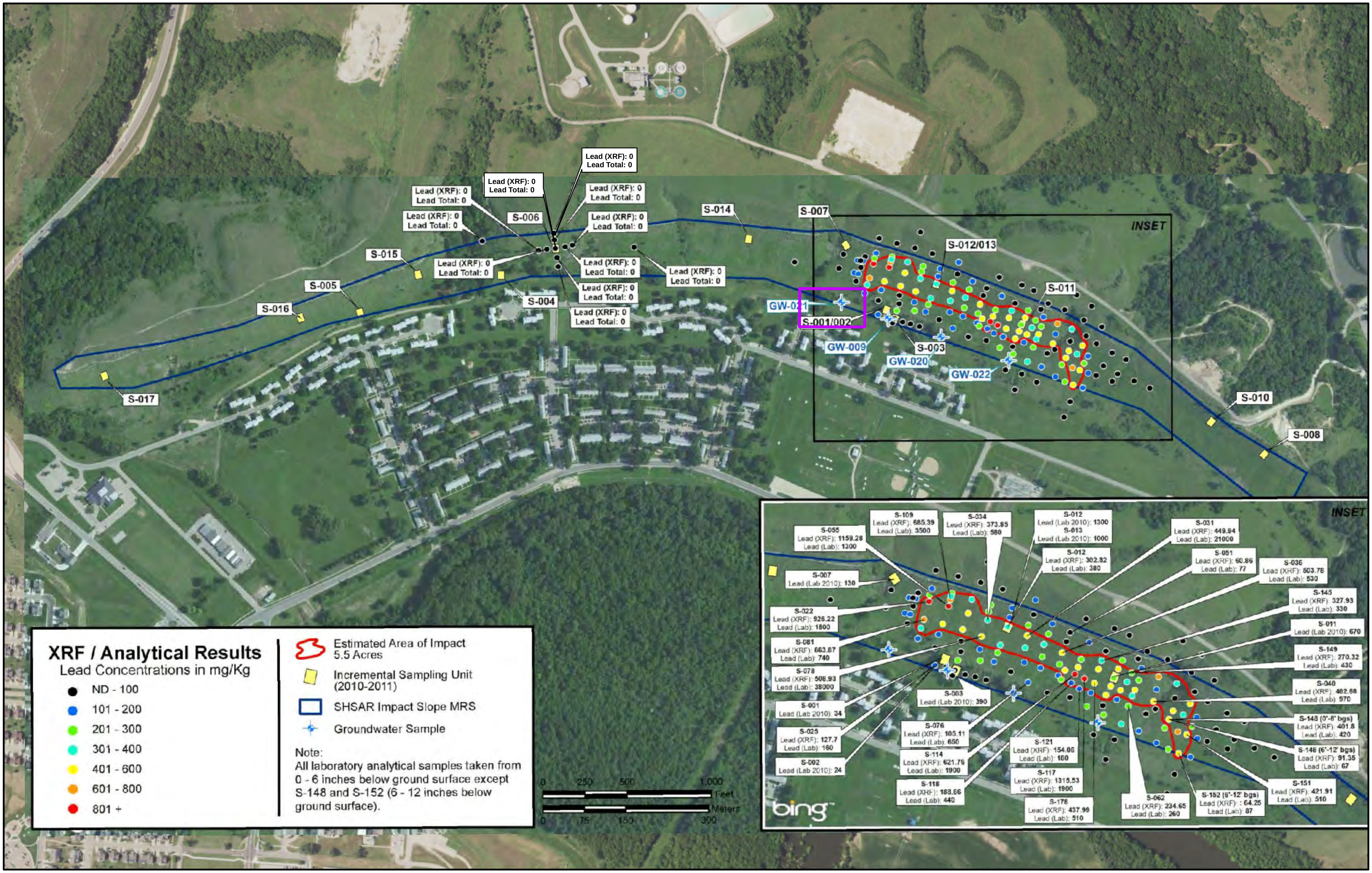

Legend

1994 Excavation Area

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FIGURE 7-3
OU 008 Lead Soil Sample Concentrations, Previous Investigations
Fort Riley, Kansas
Junction City, Geary, Clay, and Riley Counties

Map projection: NAD 1983 StatePlane Kansas North FIPS 1501 Feet
Map prepared for U.S. Army Corps of Engineers
Submitted by: Aersostar Environmental

0 400 800 Feet

N

Date modified: 07/21/2022

File: Ft_Riley_OU008_Lead_Soil_Previous

Aerostar Proj.: 1RC01.1023.0001

Drawn: SSigniski

Checked: M Stemper

Rev: 01

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Appendix A

Public Notice

FORT RILEY

THE U.S. ARMY BEGINS FIVE YEAR REVIEW OF CLEANUP ACTIONS

The U.S. Army, in conjunction with the U.S. Environmental Protection Agency (EPA) and the Kansas Department of Health and Environment (KDHE), is conducting the fifth, five-year review (FYR) of the final remedies in place after cleanup actions were performed at the following five Operable Unit (OU) sites at Fort Riley, Kansas:

- OU 001, Southwest Funston Landfill (Installation Action Plan [IAP] site FTRI-003);
- OU 003, Dry Cleaning Facilities Area (IAP site FTRI-027);
- OU 005, 354 Area Solvent Detections (IAP site FTRI-031);
- OU 006, Open Burning/Open Detonation Ground (Range 16); and
- OU 008, Sherman Heights Small Arms Range

The purpose of the FYR is to determine whether the remedy remains protective of human health and the environment. Historical operations at the five sites resulted in unacceptable levels of contaminants in soil, surface water, and groundwater. The remedies, chosen in coordination with the EPA and the KDHE, include land use controls and monitored natural attenuation. The FYR is currently in progress and includes a review of current and historical data and information, and inspection of the sites. The FYR Report, scheduled for completion in September 2022, will document the methods used for the review and present the findings and conclusions. In addition, the report will identify issues, if any, found during the review, and make recommendations to address them. A public notice announcing the completion and location of the final report will be published after finalization. Members of the community are encouraged to ask questions, make comments, and/or report concerns about the sites. For more information, contact:

Mr. Jeff Keating, Fort Riley Installation Restoration Manager
jeffrey.f.keating.civ@army.mil
785-239-3194

Ms. Margaret Townsend, KDHE Federal Facilities Unit Manager
margaret.townsend@ks.gov
785-296-8801

Ms. Angela Sena, EPA Remedial Project Manager
sena.angela@epa.gov
913-551-7989

Seaton Media, Inc

The Manhattan Mercury, Junction City Union
Smoke Signal, The Times
1st Infantry Division Post, Flint Hills Shopper
P.O. Box 787, Manhattan, KS 66505

In The Matter of
IN THE DISTRICT COURT OF GEARY COUNTY , KANSAS

STATE OF KANSAS
GEARY COUNTY SS

FORT RILEY
THE U.S. ARMY BEGINS FIVE YEAR REVIEW OF CLEANUP ACTIONS

The U.S. Army, in conjunction with the U.S. Environmental Protection Agency (EPA) and the Kansas Department of Health and Environment (KDHE), is conducting the fifth, five-year review (FYR) of the final remedies in place after cleanup actions were performed at the following five Operable Unit (OU) sites at Fort Riley, Kansas:

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- OU 005, 354 Area Solvent Detections (IAP site FTRI-031)
- OU 006, Open Burning/Open Detonation Ground (Range 16)
- OU 008, Sherman Heights Small Arms Range

The purpose of the FYR is to determine whether the remedy remains protective of human health and the environment. Historical operations at the five sites resulted in unacceptable levels of contaminants in soil, surface water, and groundwater. The remedies, chosen in coordination with the EPA and the KDHE, include land use controls and monitored natural attenuation. The FYR is currently in progress and includes a review of current and historical data and information, and inspection of the sites. The FYR Report, scheduled for completion in September 2022, will document the methods used for the review and present the findings and conclusions. In addition, the report will identify issues, if any, found during the review, and make recommendations to address them. A public notice announcing the completion and location of the final report will be published after finalization. Members of the community are encouraged to ask questions, make comments, and/or report concerns about the sites. For more information, contact:

I, Tabitha Hiltgen-Lee being first duly sworn, depose and say: That I am Inside Sales of The Junction City Union, a weekly newspaper printed in the state of Kansas, and published in and of general circulation in Geary County, Kansas, with a general paid circulation on a weekly basis in Geary County, Kansas and that said newspaper is not a trade, religious or fraternal publication.

Said newspaper has been so published continuously and uninterruptedly in said county and state for a period of more than five years prior to the first publication of said notice; and has been admitted at the post office of Junction City in said county as second class matter.

That the attached notice is a true copy thereof and was published in the regular and entire issue of said newspaper for 1 consecutive insertions, the first publication thereof being made as aforesaid on the 28 day of December, 2021 with subsequent publications being made on the following dates:

On the ___ day of ______________, 2021

On the ___ day of ______________, 2021

On the ___ day of ______________, 2021

On the ___ day of ______________, 2021

Tabitha Hiltgen-Lee

Subscribed and sworn to before me this 28 day of December, 2021

Jemie Wataha Notary Public

JEMIE WATAHA
Notary Public - State of Kansas
My Appt. Expires 08-29-2025

AD# 118726

Mr. Jeff Keating, Fort Riley Installation Restoration Manager
jeffrey.f.keatin g,civ@army.mil
785-239-3194
Ms. Margaret Townsend, KDHE Federal Facilities Unit Manager
margaret.townsend@ks.gov
785-296-8801
Ms. Angela Sena, EPA
Remedial Project Manager
sena.angela@epa.gov
913-551-7989

J118726
December 28, 2021

Appendix B

List of Documents Reviewed

LIST OF DOCUMENTS REVIEWED
Fifth Five Year Review Report, Fort Riley, Kansas

Documents Reviewed for All Operable Units (OUs) Included in The Fifth Five Year

Arcadis, 2022. *Final Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances, Fort Riley, Kansas.* January**.**

Fort Riley Directorate of Environment and Safety (Fort Riley), 2001 . *Wellhead Protection Plan for Drinking Water Supply Wells, Fort Riley, Kansas.*

Department of Defense (DoD), 2022. *Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program*. July 6.

DoD, 2021. *Memorandum: Investigating Per- and Polyfluoroalkyl Substances Within The Department of Defense Cleanup Program*. September.

U.S. Army, 2021. *Fort Riley Real Property Master Plan, Institutional Controls for OU 006 and OU 008, Fort Riley, Kansas*. September.

U.S. Army, 2019. *Fort Riley Camp Forsyth District Area Development Plan*. June.

U.S. Army, 2016. *Fort Riley Installation Action Plan, Army Defense Environmental Restoration Program*. August.

U.S. Army, 2014. *Fort Riley Military Value Analysis Data, Fort Riley, Kansas*. June.

USACE, 2021. *Abbreviated Accident Prevention Plan Five-Year Review Site Inspection, Fort Riley, Fort Riley, Kansas*. January.

USACE, 2017. *Final Fourth Five-Year Review Report, Fort Riley, Kansas*. September.

USACE, 2015. *Final Land Use Control Implementation Plan, Fort Riley, Junction City, Kansas*. October.

USACE, 2012. *Final Third Five-Year Review Report, Fort Riley, Kansas*. September.

USACE, 2013. *Final Third Five-Year Review Report Addendum, Fort Riley, Kansas*. January.

USACE, 2006. *Final Site Inspection Report, Fort Riley, Kansas*. June.

USACE, 2007. *Final Second Five-Year Review Report, Fort Riley, Kansas*. September.

USAEC, 2020. *Final Revision 01 Fourth Five-Year Review Report For Lake City Army Ammunition Plant, USEPA ID. No. MO3213890012, Independence, Missouri*. August.

USEPA, 2001. *Comprehensive Five-Year Review Guidance. Office of Solid Waste and Emergency Response (OSWER) Directive Number 9355.7-038-P*. June.

USEPA, 2015. *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, OSWER Publication 9200.2-154*, June.

USEPA, 2019. *Interim Recommendations to Address Groundwater Contaminated with Perfluorooctanoic Acid and Perfluorooctanesulfonate*. December.

USEPA, 2021. *Human Health Toxicity Values for PFBS and Related Compound PFBS* (USEPA, 2021). April.

USEPA, 2022. Regional Screening Levels. May.

Documents Reviewed for OU 001, Southwest Funston Landfill

USACE, 2021. *Final 2020 Annual Long-Term Monitoring Report Southwest Funston Landfill (FTRI-003) Operable Unit No. 001 Fort Riley, Kansas*. June.

USACE, 2020. *Final 2019 Annual Long-Term Monitoring Report Southwest Funston Landfill (FTRI-003) Operable Unit No. 001 Fort Riley, Kansas*. April.

USACE, 2019. *Final 2018 Annual Long-Term Monitoring Report Southwest Funston Landfill (FTRI-003) Operable Unit No. 001 Fort Riley, Kansas*. March.

USACE, 2018. *South Funston Landfill (FTRI-003), OU 001 Groundwater Monitoring Recommendation Report, Fort Riley, Kansas*. April.

USACE, 2017. *Technical Memorandum, Southwest Funston Landfill (FTRI-003) Repair and Maintenance, Fort Riley, Kansas*. October.

USACE, 2016. *Final 2016 Long-Term Monitoring Report, Southwest Funston Landfill (FTRI-003), Fort Riley, Kansas*. October.

USACE, 2012. *Long-Term Monitoring Report, Southwest Funston Landfill, Fort Riley, Kansas, 2011*. February.

USACE, 2011. *Draft Final Long Term Management and Care Plan, Southwest Funston Landfill, Operable Unit 001, Fort Riley, Kansas*. March.

USACE, 1995. *Southwest Funston Landfill, Operable Unit 001, Record of Decision, Fort Riley, Kansas*. November.

Documents Reviewed for OU 003, Dry Cleaning Facilities Area

U.S. Army, 2019. *DRAFT Remedial Action Completion Report Dry Cleaning Facilities Study Area (Operable Unit 003) at Main Post Fort Riley, Kansas.* June.

U.S. Army, 2019. *DRAFT Remedial Action Completion Report Dry Cleaning Facilities Study Area (Operable Unit 003) at Main Post Fort Riley, Kansas*. February.

USACE, 2019. *Final 2019 Annual Long-Term Monitoring Report Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027), Fort Riley, Kansas*. December.

USACE, 2019. *Final 2018 Annual Long-Term Monitoring Report Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027), Fort Riley, Kansas*. May.

USACE, 2018. *Final 2017 Annual Long-Term Monitoring Report Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027), Fort Riley, Kansas*. January.

USACE, 2018. *Final 2017 Annual Long-Term Monitoring Report Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027), Fort Riley, Kansas*. January.

USACE, 2016. *Final 2016 Annual Long-Term Monitoring Report Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027), Fort Riley, Kansas*. December.

USACE, 2015. *Microcosm / Bench-scale Studies for the DCFA Site, Fort Riley, Kansas*. November.

USACE, 2012. *Final 2012 Annual Groundwater Sampling Report Dry Cleaning Facilities Area OU-003 Fort Riley, Kansas*. December.

USACE, 2008. *Record of Decision, Dry Cleaning Facilities Study Area (Operable Unit 003) at Main Post, Fort Riley, Kansas*. January.

USACE, 2008. *Remedial Design/Remedial Action Plan, Dry Cleaning Facilities Study Area (Operable Unit 003) at Main Post, Fort Riley, Kansas*. June.

Documents Reviewed for 005, 354 Area Solvent Detections

U.S. Army, 2015. *Explanation of Significant Difference for the Record of Decision at the 354 Area Solvent Detections Operable Unit 005, Fort Riley, Kansas*. March.

USACE, 2021. *Final Pre-Design Investigation Report Addendum 354 Area Solvent Detections, Operable Unit 005 Fort Riley, Kansas*. July.

USACE, 2020. *Final Post-Construction Technical Memorandum, Monitoring Well Installation and Groundwater Monitoring at 354 Area Solvent Detections – Operable Unit 005 Fort Riley, Kansas*. April.

USACE, 2018. *Final Annual Summary Report #2 for Groundwater Sampling Events 6, 7 and 8, 354 Area – Operable Unit 005 Fort Riley, Kansas*. September.

USACE, 2017. *Final Annual Summary Report #1 for Groundwater Sampling Events 3, 4 and 5, 354 Area – Operable Unit 005, Fort Riley, Kansas*. December.

USACE, 2017. *Final Pre-Design Investigation Report 354 Area - Operable Unit 005 Fort Riley, Kansas*. June.

USACE, 2016. *Final July 2016 Long-Term Monitoring Report 354 Area Solvent Detections OU 005 (FTRI-031) Fort Riley, Kansas*. December.

USACE, 2015. *Final 2014 Annual Long-Term Monitoring Report 354 Area Solvent Detections OU 005 (FTRI-031) Fort Riley, Kansas*. April.

USACE, 2013. *Final Third Five-Year Review Report Addendum for Vapor Intrusion Analysis, Fort Riley, Kansas*. January.

USACE, 2012. *Final Groundwater Sampling Report April 2012 354 Area Solvent Detections OU-005 Fort Riley, Kansas*. April.

USACE, 2009. *Draft Final Remedial Design/Remedial Action Plan 354 Area Solvent Detections (Operable Unit 005) At Main Post Fort Riley, Kansas*. June.

USACE, 2007. *Draft Final Remedial Design/Remedial Action Plan 354 Area Solvent Detections (Operable Unit 005) At Main Post Fort Riley, Kansas*. March.

USACE, 2006. *Record of Decision, 354 Area Solvent Detections, (Operable Unit OO5) at Main Post, Fort Riley, Kansas*. June.

USACE, 2005. *Pilot Study Report for Pilot Study for Soil Remediation, 354 Area Solvent Detections at Main Post, Fort Riley, Kansas*. June.

USACE, 2005. *Soil-Gas Investigation Report, 354 Area Solvent Detections at Main Post, Fort Riley, Kansas*. May.

USEPA, 2021. *Letter from Danny O'Connor, USEPA Remedial Project Manager, to Alan Hynek, Ft. Riley Restoration Program Manager. Review of the Draft Pre-Design (PDI) Report Addendum for Operable Unit 5 at Fort Riley*. June.

Documents Reviewed for 006, Open Burning/Open Detonation Grounds

USACE, 2022. *Regulator Draft Quality Control Summary Report for the Remedial Design/Remedial Action at Open Burning/Open Detonation Range 16, Fort Riley, Kansas. Landfarm Treatment Cell – Event 7, January 2022 Sampling Event.* May.

USACE, 2022. *Regulator Draft Quality Control Summary Report for the Remedial Design/Remedial Action at Open Burning/Open Detonation Range 16, Fort Riley, Kansas. Landfarm Treatment Cell – Event 6, September 2021 Sampling Event.* May.

USACE, 2022. *Regulator Draft Quality Control Summary Report for the Remedial Design/Remedial Action at Open Burning/Open Detonation Range 16, Fort Riley, Kansas. Landfarm Treatment Cell – Event 5, June 2021 Sampling Event.* May.

USACE, 2021. *Army Draft Annual Summary Report Year 1 Groundwater and Surface Water Long-Term Monitoring; Open Burning/Open Detonation Ground (Range 16) Operable Unit 006, Fort Riley, Kansas*. March.

USACE, 2021. *Final Annual Summary Report Year 1 Groundwater and Surface Water Long-Term Monitoring; Open Burning/Open Detonation Ground (Range 16) Operable Unit 006, Fort Riley, Kansas*. August.

U.S. Army, 2021. *Real Property Master Plan*. September.

USACE, 2020. *Army Draft Landfarm Treatment Cell Closure Report, Remedial Design/Remedial Action Open Burning/Open Detonation Range 16, Fort Riley, Kansas*. September.

USACE, 2019. *Final Groundwater and Surface Water Long-Term Monitoring Plan, Open Burning/Open Detonation Ground (Range 16), Fort Riley, Kansas*. December.

USACE, 2018. *Draft RD/RA Pre-Excavation Soil Investigation Summary Memo Open Burn/Open Detonation (Range 16), OU-006, Fort Riley, Kansas*. June.

USACE, 2018. *Final Remedial Design/Remedial Action Work Plan, Open Burning/Open Detonation Range 16, Fort Riley, Kansas*. April.

USACE, 2016. *Final Record of Decision, Open Burning/Open Detonation Ground (Range 16), Operable Unit 006, Fort Riley, Kansas*. June.

Documents Reviewed for 008, Sherman Heights Small Arms Range

USACE, 2022. *Regulatory Draft, Quality Control Summary Report, Long-Term Monitoring, Sherman Heights Small Arms Range, Operable Unit 008, Fort Riley, Kansas, 2021 Sampling Event*. June.

USACE, 2020. *Final Summary Technical Memorandum Composite Surface Soil Sampling Event, Sherman Heights Small Arms Range (SHSAR) Impact Slope, Fort Riley, Kansas*. December.

USACE, 2020. *Draft Final Summary Memorandum, 2019 Long-Term Monitoring (LTM) Fence And Sign Inspection Event, Sherman Heights Small Arms Range (SHSAR) Impact Slope, Fort Riley, Kansas*. January.

USACE, 2018. *Final Summary Memorandum, 2017 Long-Term Monitoring (LTM) Surface Soil Sampling Event, Sherman Heights Small Arms Range (SHSAR) Impact Slope, Fort Riley, Kansas*.

USACE, 2018. *Working Draft Final Summary Memorandum, 2018 Long-Term Monitoring (LTM) Fence And Sign Inspection Event, Sherman Heights Small Arms Range (SHSAR) Impact Slope, Fort Riley, Kansas*. October.

USACE, 2018. *Final Remedial Action Completion Report Sherman Heights Small Arms Range (SHSAR) Impact Slope, Fort Riley, Kansas*. October.

USACE, 2017. *Final Remedial Design Plan, Sherman Heights Small Arms Range Site - Operable Unit 008 at Fort Riley, Kansas*. September.

USACE, 2015. *MMRP Record Of Decision, Fort Riley, Sherman Heights Small Arms Range Impact Slope, Junction City, Kansas*. February.

U.S. Army, 2021. *Real Property Master Plan*. September.

Appendix C

FYR Site Inspection Checklist and Photographic Log

SITE INSPECTION

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The Five -Year Review (FYR) site inspection for Fort Riley, Kansas was conducted on 16 September 2021 to visually inspect and document the conditions of five sites for inclusion into the FYR Report. The site inspection included a teleconference with stakeholders including Fort Riley (FTRI), United States Army Corp of Engineers (USACE), US Environmental Protection Agency (USEPA), Kansas Department of Health and Environment (KDHE), US Army Environmental Command (USAEC), and Aerostar Environmental and Construction (Aerostar). Following the teleconference, representatives from Fort Riley, USACE, and Aerostar performed the site inspection. The meeting minutes for the teleconference are included in this appendix along with a site inspection Trip Report, the *FYR Site Inspection Checklist,* and photographs taken during the site visit. Interviews for the FYR were completed through Interview Record Questionnaires submitted via email, which are included as Appendix C.

FORT RILEY
FYR SITE INSPECTION
MEETING MINUTES

Date of Call: 16 September 2021
Time of Call: 0830 CT/0930 EST
Call In Number: 1-805-309-2350, 37354
Meeting Leader: Allison Bailey, Aerostar Environmental and Construction (Aerostar)
Attendees:

Name	Present	Organization	Phone No.
Allison Bailey	✓	Aerostar	865-483-9280
Andrea Heinzenberger	✓	Aerostar	865-813-2755
Margaret Stemper	✓	Aerostar	865-469-1110
Gary Richards	✓	USACE Kansas City	816-389-3760
Amy Rosewicz	✓	USACE Kansas City	816-389-2468
Kelly Peterson	✓	USACE Kansas City	
Michael Bowlby	✓	USAEC	210-466-1348
Jeff Keating	✓	Fort Riley	785-239-3194
Danny O'Connor	✓	USEPA	913-551-7868
Margaret Townsend	✓	KDHE	785-296-8801
Jesse Saegert	✓	KDHE	785-296-1682

Introductions
The meeting began by introducing the attendees along with their roles on the project. Ms. Bailey stated that this contract is with Aerostar Environment and Construction (Aerostar) under United States Army Corp of Engineers (USACE) Kansas City District Contract W912DQ-20-C-3013. The purpose of today's meeting is to discuss the site inspection/visit activities for the Ft. Riley Five Year Review (FYR) project. Ms. Bailey confirmed that the attendees had received her email with the agenda and schedule and began the discussion by presenting the meeting agenda.

Agenda Overview
- Project Team
- Schedule
- Five Year Review Sites – Current Status/Issues
- Five Year Review Interviews/Questionnaires
- Public Notice
- Site Visit Activities

Schedule
- The Final FYR Report is due for Army signature **20 September 2022**

    - Mr. O'Connor (US Environmental Protection Agency [USEPA]) noted that the statutory due date for the Final FYR is 28 September 2022 and the FYR becomes Final with the signature from the USEPA. He reminded the Team the importance of meeting this schedule. The Team concurred.
- Draft scheduled for submittal to USEPA/Kansas Department of Health and Environment (KDHE) **25 April 2022**.
    - 65-day review period for the Regulators included on the schedule **(25 April to 26 June)**

FYR Sites – Current Status/Issues

The Fort Riley FYR covers the following five sites:

- OU 001, Southwest Funston Landfill (FTRI-003)
- OU 003, Dry Cleaning Facilities Area (FTRI-027)
- OU 005, 354 Area Solvent Detections (FTRI-031)
- OU 006, Open Burning/Open Detonation (OB/OD) Grounds
- OU 008, Sherman Heights Small Arms Range

Ms. Bailey stated that this is the Fifth FYR Report for Fort Riley. Remedies for OU 006 and 008 have recently been completed and these two sites will be included in the FYR for the first time. She noted that in preparation for the site visit, Aerostar reviewed the remedies, including land use controls (LUCS) and Institutional Controls (ICs) and Long-Term Monitoring (LTM) data; current status; and developed questions. She noted that the FYR will also be evaluating emerging contaminants, specifically per-and polyfluoroalkyl substances (PFAS), at Operable Unit 001 (OU 001). Aerostar is aware that a draft Preliminary Assessment/Site Inspection (PA/SI) has identified PFAS associated with the Southwest Funston Landfill (OU 001). Ms. Bailey indicated that the FYR will consider the PFAS evaluation/language from the Lake City FYR, as recommended by EPA, and follow the Army DCS G-9, Office of the Secretary of Defense (OSD), and EPA Office of the Solid Waste and Emergency Response (OSWER) Guidance for evaluating PFAS in the FYR.

Mr. O'Connor asked the Team if he could provide a high-level overview of the sites to identify items that may be potential issues in the FYR. The Team agreed and Mr. O'Connor provided the following discussion.

- OU 001
    - There are two tracks for PFAS in the FYR. PFAS should be identified as an issue under Question B for OU 001 as it has been found in monitoring wells at the landfill however it is unknown if it is coming from OU 001, therefore it should be listed as an issue impacting long-term protectiveness with the recommendation for additional sampling. If additional information becomes available in the future indicating that the PFAS contamination is coming from the fire training area the evidence can be presented and the PFAS issue resolved for OU1. The second track would be if the PFAS on base isn't associated with any of the OUs the PFAS investigation could be summarized and presented in the body of the report.

    - Additionally, he recommends that the discussion of the scour evaluation that is planned for OU 001 is discussed in "other findings" (see the 2016 FYR template) as the scour evaluation is an issue that needs to be looked at/resolved but does not impact remedy protectiveness and should not be included in the protectiveness statement.

- OU 008
  - Under Question A, identify the lead concentration in surface soil above the remediation goal (RG) that was found outside the LUC fencing as an issue. He is aware that there is a plan in place to address the lead with the sampling and additional fencing and that it could possibly be resolved before the FYR is completed, but as it is, it's a remedy protective issue.

- OU 006
  - Question B, the TCE cleanup goal was based on the KDHE risk-based values. Mr. O'Connor indicated that the RG should have been based on leaching to groundwater rather than the KDHE risk-based value. Normally the EPA would set a trichloroethene (TCE) soil clean up level closer to 60 ug/kg based on leaching to groundwater rather than the current RG of 10.7 mg/kg. It's not necessarily that the RG is not being protective, but it does fall into the category of have concentrations of TCE been left in place that are high enough to be leaching to groundwater. This needs to be considered when doing the Question B analysis.

- **General**
  - Question B is a recurring struggle for all the Army FYRs in how to evaluate and compare RGs to updates in toxicity and exposure parameters. One thing to consider is, this is what the RG was when the ROD was written and here is the current RSL. Mr. O' Connor suggest that for any kind of risk-based RG, create a table that shows the contaminant, what the RG is as written in the Record of Decision (ROD), and the risk range/hazard quotient that was used to derive the RG. Also, instead of putting an RSL or in addition to putting an RSL, put what that value would represent from a risk or hazard quotient today. Mr. O'Connor notes there is a way in the RSL calculator, enter the values and RSL calculator will output what that value represents today from a risk and hazard standpoint. This makes it easier for the EPA to see if it's protective or there is an issue with it that needs to be looked at closer. Mr. O'Connor indicated that he is happy to provide assistance with the RSL calculator, if needed.

Following Mr. O'Connor's overview, Ms. Bailey noted that the FYR document format will include specific/individual responses to Questions A, B, and C for each site and that information with common elements across all the OUs would be provided in the front matter of the report. Supporting documentation, such as calculations, will be included in the Appendices. Mr. O'Connor noted that anything to make the reports more concise would be positive and assist with the review. Ms. Bailey asked Ms. Townsend (KDHE) if she has any additional information or foresees any issues with the sites. Ms. Townsend stated that the EPA is the lead on the Ft. Riley FYR and KDHE concurs with the input from Mr. O'Connor.

FYR Interviews/Questionnaires

Ms. Bailey noted that the FYR questionnaires had been sent out to the applicable parties on 7 September and to date we have received responses from Ms. Townsend and Mr. Bowlby (US Army Environmental Command [USAEC]). Aerostar has requested that the completed questionnaires be returned by 4 October. Mr. O'Conner stated he would try to get his in by tomorrow, 17 September. Mr. Keating (Fort Riley) also indicated that he would have his questionnaire completed by 17 September.

Public Notice

Ms. Bailey stated that a draft public notice was submitted for review to the Army. The Army is currently determining the points of contact to be listed in the publication. The notice is anticipated to be published by 1 October.

Site Visit Activities

Ms. Bailey stated that following this meeting, the Team will perform an inspection/evaluation of each site relative to remedy and condition, as well as a review of any issues noted from Annual LTM inspection/ 2017 FYR. A FYR Site Inspection Checklist will also be completed for each site as well as a photolog.

Final Questions or Comments

Ms. Bailey asked the team if there were any further questions or comments. Mr. Keating asked Mr. O'Connor if he had any expectations regarding the need to address a potential change of the RG for lead in the future. Mr. O'Connor indicated that the team should address the potential change for lead in Question B for OU 008. Mr. O'Connor noted that the language regarding lead was sent in an email to Aerostar for another FYR site (Weldon Spring). Mr. O'Connor stated that the language relates to the information in the 2016 OSWER Memo indicating that newer science is available regarding the elevated blood level. There is no formal policy change at this time to indicate that the 400 ppm RG is not protective however, a discussion should be provided to acknowledge that updated information is available, including the updated exposure parameters that go into the model. Mr. O'Connor noted that a change could occur within the next six months and if so, a separate meeting would be needed with the Team to discuss how it would impact the FYR. Ms. Bailey indicated she had the information and that the lead language would be used in the Ft. Riley FYR report.

No further questions or comments were made, and the meeting was adjourned at 0900.

FORT RILEY
FYR SITE INSPECTION
TRIP REPORT

Date of Visit: 16 September 2021
Meeting Time: 0830 (CT)
Location: Fort Riley, Kansas

Team:
Gary Richards – USACE Kansas City District Project Manager (PM)
Jeff Keating – Fort Riley Directorate of Public Works – Environmental (PWE), Installation Restoration Manager (IRP)
Kelly Peterson – USACE Kansas City District
Allison Bailey – Aerostar, PM
Andrea Heinzenberger – Aerostar, Technical Support

Summary:

The team assembled at Building 407 at 0800 and after introductions, a teleconference was held from 0830 to 0900 with the USEPA, KDHE, and USAEC. Following the teleconference, Aerostar conducted a health and safety briefing that included a review of activity hazards and discussed the approach for inspecting the sites. The Team departed at 0930 to perform the site inspections in the following order:

1. **OU 008, Sherman Heights Small Arms Range**
2. **OU 003, Dry Cleaning Facilities Area (IAP site FTRI-027**
3. **OU 005, 354 Area Solvent Detections (IAP site FTRI-031)**
4. **OU 001, Southwest Funston Landfill (Installation Action Plan [IAP] site FTRI-003**
5. **OU 006, Open Burning/Open Detonation Ground (Range16)**

All sites have Institutional Controls/Land Use Controls as part of the selected remedy. OU 003, 005, and 001 also include groundwater monitoring as part of the remedy.

- The Team inspected the fence and signs at OU 008. The site is located on a slope within a fenced area just north of military family housing. The fence is intact with signage, but it appears that no trees/vegetation have been removed as was recommended in the January 2020 Fence & Sign Inspection Summary Memo. Mr. Keating noted that a new contract is in place with ECC to perform the Long-Term management of vegetation. A QAPP has been prepared and work is anticipated to begin in early 2022. Mr. Keating also noted that based on the results of the 2020 soil sampling effort (lead greater that RG of 400 mg/kg) that additional sampling will be performed, and the fence line will be expanded.
- The Team reviewed OU 003. The land use in the area has not changed and there are no occupied structures within the site boundary. An electric substation is located along the northeastern portion of the site along Brick Row Road. The August 2021 LTM report noted three wells (DCF02-47A, DCF02-41 and DCF92-05) that required repairs. Mr.

Keating noted that well maintenance/repairs will begin next year (2022) with the award of the new O&M contract.

- The Team inspected reviewed OU 005. The Public Works Compound is located in the southern portion of the site near the location of former Bldg. 354 (source of contamination). Bldg. 330 is the location of the Public Works Department office, Bldg. 334 is a warehouse, and Bldg. 332 is a maintenance shop. The land use for the area has not changed. According to Mr. Keating, in-situ bioremediation is scheduled for March 2022 along two transects in the vicinity of the highest remaining PCE impacts in and around MW 354-19-34, which is near Bldg. 332.
- The Team inspected OU 001 including the riprap along the southern border and monitoring well SFL92-301 where subsidence was noted. The access to the landfill is through a locked gate with signage. There are no structures located on the landfill and the land use has not changed. The area was heavily vegetated especially around the riprap and the Team discussed the status of the Annual LTM Inspection and scour study. Mr. Keating noted that the Annual LTM Inspection is scheduled for the week of 20 September and that the scour study would be conducted next year, after a contract has been put in place for the work. Any repairs would be conducted after the study. He indicated that a control burn would be conducted prior to the scour study to remove the vegetation around the riprap. He also mentioned that the landfill cap is mowed in July/August as part of the Agricultural Hay Lease Agreement. During the inspection, Mr. Keating also pointed out the location of a former fire training area where AFFF was used. This area is located to the northeast of the site and is the suspected source of the PFAS detected at OU 001.
- The Team reviewed OU 006 from the located gate as the site is located within an area that is off-limits due to the current use as a detonation/firing range. The area is restricted with signage in place and is noted as a prohibited area in the Fort Riley Real Property Master Plan.

The Team returned to Bldg. 407 at after the site inspection were completed with Aerostar and USACE personnel departing Fort Riley at 1150.

I. SITE INFORMATION	
Site name: **OU1 – South Funston Landfill (FTRI-003)**	Date/Time of inspection: **September 16, 2021**
Location and region: Junction City, Kansas – Region 9	USEPA ID: KS6214020756
Agency, office or company leading the Five-Year Review: US Army/Aerostar	Weather/temperature: **Sunny, Warm, Windy / 85**
Remedy Includes: (Check all that apply) ☒ Landfill cover/containment ☒ Access controls ☒ Land use controls ☐ Groundwater pump and treat ☐ Surface water collection and treatment ☒ Other (Riverbank Stabilization)	☐ Monitored natural attenuation ☐ Groundwater containment ☐ Vertical barrier walls
Attachments: ☒ Inspection team roster (below) ☒ Site map attached • Gary Richards, USACE Kansas City District (NWK), Project Manager • Jeff Keating, Ft. Riley IRP Manager • Kelly Peterson, USACE, USACE Kansas City District, Geologist • Allison Bailey, Aerostar, FYR Project Manager • Andrea Heinzenberger, Aerostar, Project Support	
II. INTERVIEWS (Check all that apply)	
1. O&M site manager **Jeff Keating, Ft. Riley IRP Manager 9/16/2021** Name Title Date Interviewed ☒ at site ☒ at office/email ☐ by phone Phone no. **785-239-3194** Problems, suggestions: ☒ Interview Questionnaire in Appendix	
2. O&M staff - NA	
3. Local regulatory authorities and response agencies (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply. Agency ***USEPA*** Contact Danny O'Conner Agency ***KDHE*** Contact Margaret Townsend Problems; suggestions; ☒ Interview Questionnaire in Appendix	
4. Other interviews (optional) ☒ Interview Questionnaire in Appendix D Mike Bowlby – USAEC Environmental Support Manager Kelly Peterson – USACE-NWK, Geologist/Technical Support	

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - O&M manual ☒ Readily available ☒ Up to date ☐ N/A
   - As-built drawings ☒ Readily available ☒ Up to date ☐ N/A
   - Maintenance logs ☒ Readily available ☐ Up to date ☐ N/A

   Remarks:

2. **Site Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A
   - Contingency plan/emergency response plan ☒ Readily available ☒ Up to date ☐ N/A

   Remarks: Plans are developed by contractors for any activities performed. AAPP was on-site for FYR site visit and signed by all attendees.

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A

   Remarks:

4. **Permits and Service Agreements**
   - ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A
   - ☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
   - ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☒ N/A
   - ☐ Other permits________ ☐ Readily available ☐ Up to date ☒ N/A

   Remarks:

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A

   Remarks:

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A

   Remarks:

7. **Groundwater Monitoring Records** ☒ Readily available ☐ Up to date ☐ N/A

   Remarks:

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A

   Remarks:

9. **Discharge Compliance Records**
   - ☐ Air ☐ Readily available ☐ Up to date ☒ N/A
   - ☐ Water (effluent) ☐ Readily available ☐ Up to date ☒ N/A

   Remarks:

10. **Daily Access/Security Logs**
    - ☐ Readily available ☐ Up to date ☒ N/A

Remarks:

IV. O&M COSTS

1. O&M Organization

- ☐ State in-house
- ☐ PRP in-house
- ☐ Federal Facility in-house
- ☐ Other
- ☐ Contractor for State
- ☐ Contractor for PRP
- ☒ Contractor for Federal Facility

2. **O&M Cost Records**

☒ Readily available ☐ Up to date
☒ Funding mechanism/agreement in place
Original O&M cost estimate: ☐ Breakdown attached Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
01 October 2017	30 Sept 2018	*$ 12,553*	☐ Breakdown attached
01 October 2018	30 Sept 2019	*$ 12,553*	☐ Breakdown attached
01 October 2019	30 Sept 2020	*$ 12,553*	☐ Breakdown attached
01 October 2020	30 Sept 2021	*$ 12,553*	☐ Breakdown attached
01 October 2021	30 Sept 2022	*$ 12,553*	☐ Breakdown attached

Note: Costs provided by IRP Manager, Jeff Keating

3. U**nanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons:____

V. ACCESS AND LAND USE CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A
Remarks:

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on map ☐ N/A
Remarks: Signs at entrance, good condition.

C. Land Use Controls (LUCs)

1. **Implementation and Enforcement**

Site conditions imply LUCs not properly implemented ☐ Yes ☒ No ☐ N/A
Site conditions imply LUCs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Daily Security Patrols, Annual Inspections
Responsible party/agency **Ft. Riley**
Contact: ______________________
Name Title Phone no.

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Have there been violations ☐ Yes ☒ No ☐ N/A

Other problems or suggestions ☐ Report attached

2. **Adequacy** ☒ LUCs are adequate ☐ LUCs are inadequate ☐ N/A
Remarks:

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks: ______________________

2. **Land use changes onsite** ☒ N/A
Remarks: ______________________

3. **Land use changes offsite** ☒ N/A
Remarks: ______________________

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads Adequate ☐ N/A
Remarks: Unpaved road through site.

B. Other Site Conditions

Remarks: The Annual 2020 landfill inspection found a small area of subsidence near monitoring well SFL92-301. The well was viewed during the FYR inspection. The subsidence was noted to be very minor. The riprap revetment area was also reviewed during FYR Inspection. This area was overgrown making inspection difficult. Vegetation across the landfill was high as the annual mowing event occurred over one month prior to the site inspection. Jeff Keating noted that a Scour Evaluation is scheduled to be conducted in 2022 to evaluate the integrity of the landfill embankment and assess the existing riprap revetment. He indicated that a controlled burn of the area to clear vegetation would be conducted prior to the scour evaluation.

VII. LANDFILL COVERS ☒ Applicable ☐ N/A
1. **Settlement** (Low spots) ☒ Location shown on site map ☐ Settlement not evident Areal extent________________ Depth ______________ **Remarks: 2020 Landfill Cover Inspection found subsidence near monitoring well SFL92-301 north of the rip-rap along the southern border between the Kansas River and the Landfill Cover. The subsidence was noted to be very minor during the FYR site inspection. It was noted that any well repairs would be completed when the contract was awarded (2022).**
2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident Lengths________________Widths_________________Depths ________________ Remarks: ____
3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident Areal extent________________ Depth ______________ Remarks: ____
4. **Holes** ☐ Location shown on site map ☒ Holes not evident Areal extent________________ Depth ______________ Remarks: ____
5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☒ No signs of stress ☐ Trees/Shrubs (indicate size and locations on a diagram) Remarks: ____
6. **Alternative Cover (armored rock, concrete, etc.)** ☒ N/A Remarks: Rip-rap revetment for landfill embankment stabilization
7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident Areal extent________Height _________________________ Remarks: ____
8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on site map Areal extent ________________ ☐ Ponding ☐ Location shown on site map Areal extent ________________ ☐ Seeps ☐ Location shown on site map Areal extent ________________ ☐ Soft subgrade ☐ Location shown on site map Areal extent ________________ **Remarks:**
9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Remarks: ____
B. Benches ☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope to slow down and intercept surface runoff and convey the runoff to a lined channel.)
C. Letdown Channels ☐ Applicable ☒ N/A **(**Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover which allows the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)
D. Cover Penetrations ☐ **Applicable** ☒ **N/A**

E. Gas Collection and Treatment ☐ **Applicable** ☒ **N/A**

F. Cover Drainage Layer ☐ **Applicable** ☒ **N/A**

G. Detention/Sedimentation Ponds ☐ **Applicable** ☒ **N/A**

H. Retaining Walls ☐ **Applicable** ☒ **N/A**

I. Perimeter Ditches/Off-Site Discharge ☒ **Applicable** ☐ **N/A**

1. Siltation ☐ **Location shown on site map** ☒ **Siltation not evident**
Areal extent **Depth**
Remarks

2. Vegetative Growth ☐ **Location shown on site map** ☒ **Vegetation does not impede flow** ☐ **N/A**
Lengths **Widths** **Depths**
Remarks:

3. Erosion ☐ **Location shown on site map** ☒ **Erosion not evident**
Areal extent **Depth**
Remarks:

4. Discharge Structures ☐ **Functioning** ☒ **N/A Areal extent**

Remarks:

VIII. VERTICAL BARRIER WALLS ☐ **Applicable** ☒ **N/A**

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines
☐ **Applicable** ☐ **N/A**
Remarks:

B. Surface Water Collection Structures, Pumps, and Pipelines
☐ **Applicable** ☐ **N/A**

C. Treatment System ☐ **Applicable** ☒ **N/A**

D. Monitored Natural Attenuation

1. Monitoring data
☒ **Is routinely submitted on time** ☒ **Is of acceptable quality**

2. Monitoring data suggest
☒ **Contaminant concentrations are declining** ☐ **Contaminant concentrations are increasing**
☒ **Groundwater plume is effectively contained** ☐ **Groundwater plume is not contained**
Remarks: Annual groundwater monitoring dropped to every five years in 2016. Annual monitoring scheduled for week of 20 September 2021

3. Monitoring Wells (natural attenuation remedy)
☒ **Properly secured/locked** ☒ **Functioning** ☒ **Routinely Sampled** ☒ **Good Condition**
☒ **All Required Wells Located** ☐ **Needs Maintenance**
Remarks: _Sampling event scheduled for week of 20 September 2021
____.
-

X. OTHER REMEDIES
If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). **Remedy includes controlling future land use and site access through institutional controls; stabilizing the Kansas River bank along the southern perimeter of the landfill; repairing and improving the existing native vegetation and soil cover; prohibiting the future use of site groundwater; and implementing a long-term groundwater monitoring program. The remedy was found to be effective and functioning as designed.**
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. **No issues observed.**
C. Early Indicators of Potential Remedy Problems
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. **No observations regarding changes in scope or cost of O&M identified.**
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. **No opportunities for further optimization were identified.**

<table>
<tr><th colspan="2">I. SITE INFORMATION</th></tr>
<tr><td>Site name:
OU3 – Dry Cleaning Facilities Area \ (FTRI-027)</td><td>Date/Time of inspection: September 16, 2021</td></tr>
<tr><td>Location and region: Junction City, Kansas – Region 9</td><td>USEPA ID: KS6214020756</td></tr>
<tr><td>Agency, office or company leading the Five-Year Review: US Army/Aerostar</td><td>Weather/temperature:
Sunny, Warm, Windy / 85</td></tr>
<tr><td colspan="2">Remedy Includes: (Check all that apply)
☐ Landfill cover/containment ☒ Monitored natural attenuation
☐ Access controls ☐ Groundwater containment
☒ Land use controls ☐ Vertical barrier walls
☐ Groundwater pump and treat
☐ Surface water collection and treatment
☐ Other</td></tr>
<tr><td colspan="2">Attachments: ☒ Inspection team roster (below) ☒ Site map attached

• Gary Richards, USACE Kansas City District (NWK), Project Manager
• Jeff Keating, Ft. Riley IRP Manager
• Kelly Peterson, USACE, USACE Kansas City District, Geologist
• Allison Bailey, Aerostar, FYR Project Manager
• Andrea Heinzenberger, Aerostar, Project Support</td></tr>
<tr><th colspan="2">II. INTERVIEWS (Check all that apply)</th></tr>
<tr><td colspan="2">1. O&M site manager <u>Jeff Keating, Ft. Riley IRP Manager 9/16/2021</u>
Name Title Date
Interviewed ☒ at site ☒ at office/email ☐ by phone Phone no. <u>785-239-3194</u>
Problems, suggestions: ☒ Interview Questionnaire in Appendix</td></tr>
<tr><td colspan="2">2. O&M staff - NA</td></tr>
<tr><td colspan="2">3. Local regulatory authorities and response agencies (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.
Agency <u>USEPA</u>
Contact <u>Danny O'Conner</u>
Agency <u>KDHE</u>
Contact <u>Margaret Townsend</u>

Problems; suggestions; ☒ Interview Questionnaire in Appendix</td></tr>
<tr><td colspan="2">4. Other interviews (optional) ☒ Interview Questionnaire in Appendix D
Note: Interview Records included as Appendix D in FYR report
Mike Bowlby – USAEC Environmental Support Manager
Kelly Peterson – USACE-NWK, Geologist/Technical Support</td></tr>
</table>

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
O&M manual ☒ Readily available ☒ Up to date ☐ N/A
As-built drawings ☒ Readily available ☒ Up to date ☐ N/A
Maintenance logs ☒ Readily available ☐ Up to date ☐ N/A
Remarks:

2. **Site Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A
Contingency plan/emergency response plan ☒ Readily available ☒ Up to date ☐ N/A
Remarks: Plans are developed by contractors for any activities performed. AAPP was on-site for FYR site visit and signed by all attendees.

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A
Remarks:

4. **Permits and Service Agreements**
☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A
☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☒ N/A
☐ Other permits______ ☐ Readily available ☐ Up to date ☒ N/A
Remarks:

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks:

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks:

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A
Remarks:

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks:

9. **Discharge Compliance Records**
☐ Air ☐ Readily available ☐ Up to date ☒ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☒ N/A
Remarks:

10. **Daily Access/Security Logs**
☐ Readily available ☐ Up to date ☒ N/A
Remarks:

IV. O&M COSTS

1. O&M Organization

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other

2. O&M Cost Records

☒ Readily available ☐ Up to date
☒ Funding mechanism/agreement in place
Original O&M cost estimate ☐ Breakdown attached Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
01 October 2017	30 Sept 2018	***$ 12,523***	☐ Breakdown attached
01 October 2018	30 Sept 2019	***$ 12,523***	☐ Breakdown attached
01 October 2019	30 Sept 2020	***$ 12,523***	☐ Breakdown attached
01 October 2020	30 Sept 2021	***$ 12,523***	☐ Breakdown attached
01 October 2021	30 Sept 2022	***$ 12,523***	☐ Breakdown attached

Note: These cost for LTM and include a written report

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: None

V. ACCESS AND LAND USE CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A
Remarks:

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on map ☒ N/A
Remarks:

C. Land Use Controls (LUCs)

1. **Implementation and Enforcement**

Site conditions imply LUCs not properly implemented	☐ Yes	☒ No	☐ N/A
Site conditions imply LUCs not being fully enforced	☐ Yes	☒ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Daily Security Patrols, Annual Inspections
Responsible party/agency **<u>Ft. Riley</u>**
Contact: ____
Name Title Phone no.

Reporting is up-to-date	☒ Yes	☐ No	☐ N/A
Reports are verified by the lead agency	☒ Yes	☐ No	☐ N/A
Specific requirements in deed or decision documents have been met	☒ Yes	☐ No	☐ N/A
Have there been violations	☐ Yes	☒ No	☐ N/A

Other problems or suggestions ☐ Report attached

2. **Adequacy** ☒ LUCs are adequate ☐ LUCs are inadequate ☐ N/A
Remarks:

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks: ______________________________

2. **Land use changes onsite** ☒ N/A
Remarks: ______________________________

3. **Land use changes offsite** ☒ N/A
Remarks: ______________________________

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☒ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads Adequate ☒ N/A
Remarks: ______________________________

B. Other Site Conditions

<u>Remarks:</u>

VII. LANDFILL COVERS ☐ Applicable ☒ N/A
VIII. VERTICAL BARRIER WALLS ☐ **Applicable** ☐ **N/A**
IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ **Applicable** ☐ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ **Applicable** ☒ **N/A** **Remarks:**
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ **Applicable** ☒ **N/A**
C. Treatment System ☐ **Applicable** ☒ **N/A**
D. Monitored Natural Attenuation
1. Monitoring data ☒ **Is routinely submitted on time** ☒ **Is of acceptable quality**
2. Monitoring data suggest ☒ **Contaminant concentrations are declining** ☐ **Contaminant concentrations are increasing** ☒ **Groundwater plume is effectively contained** ☐ **Groundwater plume is not contained** **Remarks:**
3. Monitoring Wells (natural attenuation remedy) ☒ **Properly secured/locked** ☒ **Functioning** ☒ **Routinely Sampled** ☐ **Good Condition** ☒ **All Required Wells Located** ☒ **Needs Maintenance** **Remarks:** _In the August 2021 LTM Report it was reported that the following MW repairs need to be completed -The polyvinyl chloride (PVC) riser at DCF02-47A was noted to be sticking up above the well lid; - -The well pad at DCF02-41 is slightly unstable; and -The dedicated pump at DCF92-05 needs to be replaced
D. Cover Penetrations ☐ **Applicable** ☐ **N/A**

X. OTHER REMEDIES
If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). **No issues observed during the FYR Site Inspection. The remedy consists of MNA with ICs. Prior response included soil removal building demolition. In addition, In-Situ biodegradation treatment pilot studies were performed to reduce VOC concentrations in groundwater at AOC-1, AOC-2, and AOC-3 in 2005 and 2006 and again at AOC-2 in 2010. The remedy is effective and functioning as designed.**
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. **None.**
C. Early Indicators of Potential Remedy Problems
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. **No observations regarding changes in scope or cost of O&M identified.**
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. **No opportunities for further optimization were identified.**

I. SITE INFORMATION	
Site name: **OU5 – 354 Solvent Detections (FTRI-031)**	Date/Time of inspection: **September 16, 2021**
Location and region: Junction City, Kansas – Region 9	USEPA ID: KS6214020756
Agency, office or company leading the Five-Year Review: US Army/Aerostar	Weather/temperature: **Sunny, Warm, Windy / 85**
Remedy Includes: (Check all that apply) ☐ Landfill cover/containment ☐ Access controls ☒ Land use controls ☐ Groundwater pump and treat ☐ Surface water collection and treatment ☐ Other	☒ Monitored natural attenuation ☐ Groundwater containment ☐ Vertical barrier walls
Attachments: ☒ Inspection team roster (below) ☒ Site map attached • Gary Richards, USACE Kansas City District (NWK), Project Manager • Jeff Keating, Ft. Riley IRP Manager • Kelly Peterson, USACE, USACE Kansas City District, Geologist • Allison Bailey, Aerostar, FYR Project Manager • Andrea Heinzenberger, Aerostar, Project Support	
II. INTERVIEWS (Check all that apply)	
1. O&M site manager **Jeff Keating, Ft. Riley IRP Manager 9/16/2021** Name Title Date Interviewed ☒ at site ☒ at office/email ☐ by phone Phone no. **785-239-3194** Problems, suggestions: ☒ Interview Questionnaire in Appendix	
2. O&M staff - N/A	
3. Local regulatory authorities and response agencies (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply. Agency ***USEPA*** Contact Danny O'Conner Agency ***KDHE*** Contact Margaret Townsend Problems; suggestions; ☒ Interview Questionnaire in Appendix	
4. Other interviews (optional) ☒ Interview Questionnaire in Appendix D Mike Bowlby – USAEC Environmental Support Manager Kelly Peterson – USACE-NWK, Geologist/Technical Support	

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)
1. **O&M Documents** O&M manual ☒ Readily available ☒ Up to date ☐ N /A As-built drawings ☒ Readily available ☒ Up to date ☐ N/A Maintenance logs ☒ Readily available ☐ Up to date ☐ N/A **Remarks:**
2. **Site Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A Contingency plan/emergency response plan ☒ Readily available ☒ Up to date ☐ N/A **Remarks: Plans are developed by contractors for any activities performed. AAPP was on-site for FYR site visit and signed by all attendees.**
3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A **Remarks:**
4. Permits and Service Agreements ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A ☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☒ N/A ☐ Other permits________ ☐ Readily available ☐ Up to date ☒ N/A **Remarks:**
5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A Remarks:
6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A Remarks:
7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A **Remarks:**
8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A Remarks:
9. **Discharge Compliance Records** ☐ Air ☐ Readily available ☐ Up to date ☒ N/A ☐ Water (effluent) ☐ Readily available ☐ Up to date ☒ N/A Remarks:
10.**Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A **Remarks:**

IV. O&M COSTS

1. O&M Organization

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other

2. **O&M Cost Records**

☒ Readily available ☐ Up to date
☒ Funding mechanism/agreement in place
Original O&M cost estimate ☐ Breakdown attached Total annual cost by year for review period if available

From 01 October 2017 To Date	30 Sept 2018 Date	***$ 11,796*** Total cost	☐ Breakdown attached
From 01 October 2018 To Date	30 Sept 2019 Date	***$ 11,796*** Total cost	☐ Breakdown attached
From 01 October 2019 To Date	30 Sept 2020 Date	***$ 11,796*** Total cost	☐ Breakdown attached
From 01 October 2020 To Date	30 Sept 2021 Date	***$ 11,796*** Total cost	☐ Breakdown attached
From 01 October 2021 To Date	30 Sept 2022 Date	***$ 11,796*** Total cost	☐ Breakdown attached

Note: Costs provided by IRP Manager, Jeff Keating

3. U**nanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: None

V. ACCESS AND LAND USE CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A
Remarks:

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on map ☒ N/A
Remarks: The Site is located in the Public Works Compound. Building 330 is the Public Works Department.

C. Land Use Controls (LUCs)

1. **Implementation and Enforcement**

Site conditions imply LUCs not properly implemented ☐ Yes ☒ No ☐ N/A
Site conditions imply LUCs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Daily Security Patrols, Annual Inspections
Responsible party/agency **Ft. Riley**
Contact: ______________________
Name Title Phone no.

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Have there been violations ☐ Yes ☒ No ☐ N/A

Other problems or suggestions ☐ Report attached

2. **Adequacy** ☒ LUCs are adequate ☐ LUCs are inadequate ☐ N/A
Remarks:

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks: ______________________

2. **Land use changes onsite** ☒ N/A
Remarks: ______________________

3. **Land use changes offsite** ☒ N/A
Remarks: ______________________

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☒ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads Adequate ☒ N/A
Remarks: ______________________

B. Other Site Conditions

Remarks:

VII. LANDFILL COVERS ☐ Applicable ☒ N/A	
VIII. VERTICAL BARRIER WALLS ☐ **Applicable** ☒ **N/A**	
IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ **Applicable** ☐ **N/A**	
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ **Applicable** ☒ **N/A** **Remarks:**	
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ **Applicable** ☒ **N/A**	
C. Treatment System ☐ **Applicable** ☒ **N/A**	
D. Monitored Natural Attenuation	
1. Monitoring data ☒ **Is routinely submitted on time** ☒ **Is of acceptable quality**	
2. Monitoring data suggest ☒ **Contaminant concentrations are declining** ☐ **Contaminant concentrations are increasing** ☒ **Groundwater plume is effectively contained** ☐ **Groundwater plume is not contained** **Remarks:** <u>**The July 2021 Pre-Design Investigation (PDI) Report Addendum indicated 2 carbon substrate injections would be performed to attempt to reduce PCE concentrations highest remaining PCE impacts in and around MW 354-19-34. Jeff Keating noted that the In situ bioremediation is scheduled for March 2022.**</u>	
3. Monitoring Wells (natural attenuation remedy) ☒ **Properly secured/locked** ☒ **Functioning** ☒ **Routinely Sampled** ☐ **Good Condition** ☒ **All Required Wells Located** ☒ **Needs Maintenance** **Remarks:**	

X. OTHER REMEDIES
If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). <u>**The remedy includes MNA with ICs. Specifically, groundwater monitoring and restricting residential land use, limiting public access, and prohibiting use of groundwater. COCs are decreasing in groundwater and PCE is the only COC with concentrations above MCLs in three wells. Newly installed wells indicated the contaminant plume is adequately delineated; however, a limited in situ bioremediation injection will be performed in the area of the highest remaining PCE impacts in and around MW 354-19-34 to assist with the reduction of PCE. The remedy is effective and functioning as designed.**</u>
B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. **None.**
C. Early Indicators of Potential Remedy Problems
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. **No observations regarding changes in scope or cost of O&M identified.**
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. **No opportunities for further optimization were identified.**

<table>
<tr><th colspan="2">I. SITE INFORMATION</th></tr>
<tr><td>Site name:
OU6 – Open Burning/Open Detonation (OB/OD) Grounds</td><td>Date/Time of inspection: September 16, 2021</td></tr>
<tr><td>Location and region: Junction City, Kansas – Region 9</td><td>USEPA ID: KS6214020756</td></tr>
<tr><td>Agency, office or company leading the Five-Year Review: US Army/Aerostar</td><td>Weather/temperature:
Sunny, Warm, Windy / 85</td></tr>
<tr><td colspan="2">Remedy Includes: (Check all that apply)
☐ Landfill cover/containment
☐ Access controls
☒ Land use controls
☐ Groundwater pump and treat
☐ Surface water collection and treatment
☐ Other
☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls</td></tr>
<tr><td colspan="2">Attachments: ☒ Inspection team roster (below) ☒ Site map attached
• Gary Richards, USACE Kansas City District (NWK), Project Manager
• Jeff Keating, Ft. Riley IRP Manager
• Kelly Peterson, USACE, USACE Kansas City District, Geologist
• Allison Bailey, Aerostar, FYR Project Manager
• Andrea Heinzenberger, Aerostar, Project Support</td></tr>
<tr><th colspan="2">II. INTERVIEWS (Check all that apply)</th></tr>
<tr><td colspan="2">1. O&M site manager <u>Jeff Keating, Ft. Riley IRP Manager 9/16/2021</u>
Name Title Date
Interviewed ☒ at site ☒ at office/email ☐ by phone Phone no. <u>785-239-3194</u>
Problems, suggestions: ☒ Interview Questionnaire in Appendix</td></tr>
<tr><td colspan="2">2. O&M staff - NA</td></tr>
<tr><td colspan="2">3. Local regulatory authorities and response agencies (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.
Agency <u>USEPA</u>
Contact <u>Danny O'Conner</u>
Agency <u>KDHE</u>
Contact <u>Margaret Townsend</u>

Problems; suggestions; ☒ Interview Questionnaire in Appendix D.</td></tr>
<tr><td colspan="2">4. Other interviews (optional) ☒ Report attached. Interview Questionnaire in Appendix D.
Mike Bowlby – USAEC Environmental Support Manager
Kelly Peterson – USACE-NWK, Geologist/Technical Support</td></tr>
</table>

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

O&M manual ☒ Readily available ☒ Up to date ☐ N/A
As-built drawings ☒ Readily available ☒ Up to date ☐ N/A
Maintenance logs ☒ Readily available ☐ Up to date ☐ N/A
Remarks:

2. **Site Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A
Contingency plan/emergency response plan ☒ Readily available ☒ Up to date ☐ N/A
Remarks: Plans are developed by contractors for any activities performed. AAPP was on-site for FYR site visit and signed by all attendees.

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A
Remarks:

4. **Permits and Service Agreements**

☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A
☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☒ N/A
☐ Other permits________ ☐ Readily available ☐ Up to date ☒ N/A
Remarks:

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks:

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks:

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A
Remarks:

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks:

9. **Discharge Compliance Records**

☐ Air ☐ Readily available ☐ Up to date ☒ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☒ N/A
Remarks:

10. **Daily Access/Security Logs**

☐ Readily available ☐ Up to date ☒ N/A
Remarks:

IV. O&M COSTS

1. O&M Organization

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other

2. O&M Cost Records

☒ Readily available ☐ Up to date
☒ Funding mechanism/agreement in place
Original O&M cost estimate ☐ Breakdown attached Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
01 October 2017	30 Sept 2018	***$ 29,310***	☐ Breakdown attached
01 October 2018	30 Sept 2019	***$ 29,310***	☐ Breakdown attached
01 October 2019	30 Sept 2020	***$ 29,310***	☐ Breakdown attached
01 October 2020	30 Sept 2021	***$ 29,310***	☐ Breakdown attached
01 October 2021	30 Sept 2022	***$ 29,310***	☐ Breakdown attached

Note: Costs provided by IRP Manager, Jeff Keating

3. Unanticipated or Unusually High O&M Costs During Review Period
Describe costs and reasons: None

V. ACCESS AND LAND USE CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☒ Gates secured ☒ N/A
Remarks:

B. Other Access Restrictions – Site is within impact area which is restricted

1. Signs and other security measures ☐ Location shown on map ☐ N/A
Remarks: There are signs around the restricted area. Site is within an active range currently used for ordnance disposal; the site is gated with severely restricted access that is controlled through range controls. The area is off-limits and is noted as a prohibited area in the Ft Riley Real Property Master Plan and on all Installation Maps.

C. Land Use Controls (LUCs)

1. **Implementation and Enforcement**

Site conditions imply LUCs not properly implemented ☐ Yes ☒ No ☐ N/A
Site conditions imply LUCs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Daily Security Patrols, Annual Inspections
Responsible party/agency **Ft. Riley**
Contact: ______________________________
Name Title Phone no.

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Have there been violations ☐ Yes ☒ No ☐ N/A

Other problems or suggestions ☐ Report attached

2. **Adequacy** ☒ LUCs are adequate ☐ LUCs are inadequate ☐ N/A
Remarks:

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks: ______________________________

2. **Land use changes onsite** ☒ N/A
Remarks: ______________________________

3. **Land use changes offsite** ☒ N/A
Remarks: ______________________________

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☒ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads Adequate ☒ N/A
Remarks: ______________________________

B. Other Site Conditions

Remarks:
The onsite soil treatment land farm was observed from a distance during the FYR Site Inspection

VII. LANDFILL COVERS ☐ Applicable ☒ N/A
VIII. VERTICAL BARRIER WALLS ☐ **Applicable** ☒ **N/A**
IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ **Applicable** ☐ **N/A**
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ **Applicable** ☒ **N/A** **Remarks:**
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ **Applicable** ☒ **N/A**
C. Treatment System ☐ **Applicable** ☒ **N/A**
D. Monitored Natural Attenuation
1. Monitoring data ☒ **Is routinely submitted on time** ☒ **Is of acceptable quality**
2. Monitoring data suggest ☒ **Contaminant concentrations are declining** ☐ **Contaminant concentrations are increasing** ☒ **Groundwater plume is effectively contained** ☐ **Groundwater plume is not contained** **Remarks:**
3. Monitoring Wells (natural attenuation remedy) ☐ **Properly secured/locked** ☒ **Functioning** ☒ **Routinely Sampled** ☐ **Good Condition** ☐ **All Required Wells Located** ☐ **Needs Maintenance** **Remarks: <u>Wells could not be accessed during the FYR site visit because they are located within an area of restricted access.</u>**

X. OTHER REMEDIES
If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). **<u>No issues observed with the remedy. The remedy includes excavation of soil and onsite land farm treatment. LTM & MNA for groundwater, LTM for surface water. ICs through the Ft. Riley Real Property Master Plan that control and limit development and other activities at the site including restricting changes in land use; limiting access; prohibiting the installation of drinking water wells and groundwater/surface water use. The remedy is effective and functioning as designed.</u>**
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. **<u>None.</u>**

C. Early Indicators of Potential Remedy Problems
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. **No observations regarding changes in scope or cost of O&M identified.**

D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. **No opportunities for further optimization were identified.**

<table>
<tr><th colspan="2">I. SITE INFORMATION</th></tr>
<tr><td>Site name:
OU8 – Sherman Heights Small Arms Range (SHSAR)</td><td>Date/Time of inspection: September 16, 2021</td></tr>
<tr><td>Location and region: Junction City, Kansas – Region 9</td><td>USEPA ID: KS6214020756</td></tr>
<tr><td>Agency, office or company leading the Five-Year Review: US Army/Aerostar</td><td>Weather/temperature:
Sunny, Warm, Windy / 85</td></tr>
<tr><td colspan="2">Remedy Includes: (Check all that apply)
☐ Landfill cover/containment
☒ Access controls
☒ Land use controls
☐ Groundwater pump and treat
☐ Surface water collection and treatment
☐ Other
☐ Monitored natural attenuation
☐ Groundwater containment
☐ Vertical barrier walls</td></tr>
<tr><td colspan="2">Attachments: ☒ Inspection team roster (below) ☒ Site map attached
• Gary Richards, USACE Kansas City District (NWK), Project Manager
• Jeff Keating, Ft. Riley IRP Manager
• Kelly Peterson, USACE, USACE Kansas City District, Geologist
• Allison Bailey, Aerostar, FYR Project Manager
• Andrea Heinzenberger, Aerostar, Project Support</td></tr>
<tr><th colspan="2">II. INTERVIEWS (Check all that apply)</th></tr>
<tr><td colspan="2">1. O&M site manager <u>Jeff Keating, Ft. Riley IRP Manager 9/16/2021</u>
Name Title Date
Interviewed ☒ at site ☒ at office/email ☐ by phone Phone no. <u>785-239-3194</u>
Problems, suggestions: ☒ Interview Questionnaire in Appendix</td></tr>
<tr><td colspan="2">2. O&M staff - NA</td></tr>
<tr><td colspan="2">3. Local regulatory authorities and response agencies (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.
Agency <u>USEPA</u>
Contact <u>Danny O’Conner</u>
Agency <u>KDHE</u>
Contact <u>Margaret Townsend</u>

Problems; suggestions; ☒ Interview Questionnaire in Appendix D.</td></tr>
<tr><td colspan="2">4. Other interviews (optional) ☒ Interview Questionnaire in Appendix D.
Mike Bowlby – USAEC Environmental Support Manager
Kelly Peterson – USACE-NWK, Geologist/Technical Support</td></tr>
</table>

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   O&M manual ☒ Readily available ☒ Up to date ☐ N/A
   As-built drawings ☒ Readily available ☒ Up to date ☐ N/A
   Maintenance logs ☒ Readily available ☐ Up to date ☐ N/A
   Remarks:

2. **Site Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A
   Contingency plan/emergency response plan ☒ Readily available ☒ Up to date ☐ N/A
   Remarks: Plans are developed by contractors for any activities performed. AAPP was on-site for FYR site visit and signed by all attendees.

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A
   Remarks:

4. **Permits and Service Agreements**
   ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Other permits________ ☐ Readily available ☐ Up to date ☒ N/A
   Remarks:

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks:

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks:

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A
   Remarks:

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks:

9. **Discharge Compliance Records**
   ☐ Air ☐ Readily available ☐ Up to date ☒ N/A
   ☐ Water (effluent) ☐ Readily available ☐ Up to date ☒ N/A
   Remarks:

10. **Daily Access/Security Logs**
    ☐ Readily available ☐ Up to date ☒ N/A
Remarks:

IV. O&M COSTS

1. O&M Organization

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other

2. O&M Cost Records

☒ Readily available ☐ Up to date
☒ Funding mechanism/agreement in place
Original O&M cost estimate ☐ Breakdown attached Total annual cost by year for review period if available

From (Date)	To (Date)	Total cost	
01 October 2017	30 Sept 2018	*$ 7,304*	☐ Breakdown attached
01 October 2018	30 Sept 2019	*$ 7,304*	☐ Breakdown attached
01 October 2019	30 Sept 2020	*$ 7,304*	☐ Breakdown attached
01 October 2020	30 Sept 2021	*$ 7,304*	☐ Breakdown attached
01 October 2021	30 Sept 2022	*$ 7,304*	☐ Breakdown attached

Note: Costs provided by IRP Manager, Jeff Keating

3. Unanticipated or Unusually High O&M Costs During Review Period
Describe costs and reasons: None

V. ACCESS AND LAND USE CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A
Remarks: Trees along the southern fence line will need to be removed to maintain the integrity of the fence.

B. Other Access Restrictions – ☐ Location shown on map ☒ N/A

1. **Signs and other security measures** ☐ Location shown on map ☐ N/A
Remarks: There are signs on the fence.

C. Land Use Controls (LUCs)

1. **Implementation and Enforcement**

	Yes	No	N/A
Site conditions imply LUCs not properly implemented	☐	☒	☐
Site conditions imply LUCs not being fully enforced	☐	☒	☐

Type of monitoring (*e.g.*, self-reporting, drive by) Daily Security Patrols, Annual Inspections

Responsible party/agency **Ft. Riley**

Contact: ______________________________
Name Title Phone no.

	Yes	No	N/A
Reporting is up-to-date	☒	☐	☐
Reports are verified by the lead agency	☒	☐	☐
Specific requirements in deed or decision documents have been met	☒	☐	☐
Have there been violations	☐	☒	☐

Other problems or suggestions ☐ Report attached

2. **Adequacy** ☐ LUCs are adequate ☒ LUCs are inadequate ☐ N/A

Remarks: Concentrations of lead were detected in soil above the RG outside of the fenced area on the west side. Confirmation sampling is scheduled to occur in early 2022 and the fence line will be expanded to encompass the exceedances. Management of the vegetation along the fence line will also be completed in early 2022.

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks: ______________________________

2. **Land use changes onsite** ☒ N/A

Remarks: ______________________________

3. **Land use changes offsite** ☒ N/A

Remarks: ______________________________

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☒ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads Adequate ☒ N/A

Remarks: ______________________________

B. Other Site Conditions

Remarks:

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ **Applicable** ☒ **N/A**

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ **Applicable** ☒ **N/A**

A. Groundwater Extraction Wells, Pumps, and Pipelines
☐ **Applicable** ☒ **N/A**
Remarks:

B. Surface Water Collection Structures, Pumps, and Pipelines
☐ **Applicable** ☒ **N/A**

C. Treatment System ☐ **Applicable** ☒ **N/A**

D. Monitored Natural Attenuation

1. Monitoring data
☒ **Is routinely submitted on time** ☒ **Is of acceptable quality**
The remedy for OU8 was recently completed for soil. Soil containing concentrations of lead above the RG was removed south outside the impact slope boundary at adjacent Colyer Housing Area. Biannual soil sampling outside the fence line is conducted to confirm soil has not migrated offsite. In 2020 soil sampling detected concentrations of lead in the soil above the RG outside the fenced boundary. A Tech Memo was prepared and recommended future sampling to fully delineate the extent of exceedances outside the site fencing and installation of additional fencing surrounding the newly delineated area.

2. Monitoring data suggest
☐ **Contaminant concentrations are declining** ☐ **Contaminant concentrations are increasing**
☐ **Groundwater plume is effectively contained** ☐ **Groundwater plume is not contained**
Remarks: In 2020, soil sampling detected concentrations of lead in the soil above the RG outside the fenced boundary.

Monitoring Wells (natural attenuation remedy) ☒ **NA**
☐ **Properly secured/locked** ☐ **Functioning** ☐ **Routinely Sampled** ☐ **Good Condition**
☐ **All Required Wells Located** ☐ **Needs Maintenance**
Remarks:

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

Remedy includes Long Term LUCs of fence and signs, soil sampling outside the fenceline every 2 years and groundwater monitoring every 5 years to assess the potential for migration of lead. Soil sampling outside of the fence indicated that lead in soil exceeded the RG. There are plans in place to delineate the extent of lead exceedances and then add additional fencing around the contaminated soil area, and to conduct the first groundwater monitoring event concurrently in early 2022.

B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. **None**
C. Early Indicators of Potential Remedy Problems
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. **Additional O&M costs will be incurred due to the additional sampling and extension of the fence, however the additional cost will not compromise the protectiveness of the remedy.**
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. **No opportunities for further optimization were identified.**

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Five-Year Review Site Inspection
OU 001,Southwest Funston Landfill
Fort Riley, Kansas

Photograph 1:

Direction: N

Comments:

View of the SW Funston Landfill looking north.

Photograph 2:

Direction: SW

Comments:

View of the Kansas River and riprap from the SW Funston Landfill facing southwest.

Five-Year Review Site Inspection
OU 001,Southwest Funston Landfill
Fort Riley, Kansas

Photograph 3: **Direction: NE** **Comments:** View of the SW Funston Landfill looking northeast.	
Photograph 4: **Direction: S** **Comments:** View of one of the monitoring wells at the SW Funston Landfill, on the southern portion of the landfill.	

Five-Year Review Site Inspection
OU 001,Southwest Funston Landfill
Fort Riley, Kansas

Photograph 5: **Direction: S** **Comments:** View of the SW Funston Landfill facing south.	
Photograph 6: **Direction: SE** **Comments:** View of the signage at the entrance to the SW Funston Landfill.	

Five-Year Review Site Inspection
OU 001,Southwest Funston Landfill
Fort Riley, Kansas

Photograph 7: **Direction: SE** **Comments:** View of the locked gate at the entrance to the SW Funston Landfill.	
Photograph 8: **Direction: S** **Comments:** View of the road that transects the SW Funston Landfill.	

Five-Year Review Site Inspection
OU 003, Dry Cleaning Facilities Area
Fort Riley, Kansas

Photograph 1:	
Direction: W	
Comments: View of the substation located in the area facing west.	
Photograph 2:	
Direction: SW	
Comments: View of the former Dry-Cleaning facility area facing southwest.	

Five-Year Review Site Inspection
OU 003, Dry Cleaning Facilities Area
Fort Riley, Kansas

Photograph 3:

Direction: NW

Comments:

View of a monitoring well associated with the former Dry-Cleaning facility facing northwest.

Photograph 4:

Direction: SW

Comments:

View of the area southwest of the former Dry-Cleaning facility where the contaminant plume is being monitored.

Five-Year Review Site Inspection
OU 005, 354 Area Solvent Detections
Fort Riley, Kansas

Photograph 1:

Direction: SE

Comments:

View of Building 332 facing southeast.

Photograph 2:

Direction: N

Comments:

View of Building 330 facing north.

Five-Year Review Site Inspection
OU 005, 354 Area Solvent Detections
Fort Riley, Kansas

Photograph 3:	
Direction: E	
Comments: View of Building 333 facing east.	

Page 2

Five-Year Review Site Inspection
OU 006, Open Burning/Open Detonation (OB/OD) Grounds
Fort Riley, Kansas

Photograph 1:

Direction: N

Comments:

View of the entrance to the OB/OD site facing north. Entrance is prohibited.

Photograph 2:

Direction: N

Comments:

View of a sign at the entrance of the Range area where the OB/OD is located.

Five-Year Review Site Inspection
OU 006, Open Burning/Open Detonation (OB/OD) Grounds
Fort Riley, Kansas

Photograph 3:	
Direction: SW	
Comments: View of the restricted range area facing southwest.	
Photograph 4:	
Direction: N	
Comments: View of a sign at the entrance to the range facing north.	

Five-Year Review Site Inspection
OU 006, Open Burning/Open Detonation (OB/OD) Grounds
Fort Riley, Kansas

Photograph 5:

Direction: N

Comments:

Additional view of the sign at the perimeter of the range area where OB/OD is located.

Photograph 6:

Direction: W

Comments:

View of the soil treatment cell at the OB/OD.

Five-Year Review Site Inspection
OU 008, Sherman Heights Small Arms Range
Fort Riley, Kansas

Photograph 1:

Direction: NE

Comments:

View of the southern fence line of OU8 – Sherman Heights facing northeast.

Photograph 2:

Direction: NE

Comments:

View of a sign at the southern fence line of OU8- Sherman Heights. Note that the trees/ vegetation has not been removed as was recommended in the January 2020 Fence & Sign Inspection. The activity is necessary to retain the integrity of the fence.

Five-Year Review Site Inspection
OU 008, Sherman Heights Small Arms Range
Fort Riley, Kansas

Photograph 3:

Direction: NE

Comments:

View of the western fence line of OU8-Sherman Heights where the soil has lead exceeding the RG – the fence line is to be expanded west.

Photograph 4:

Direction: SE

Comments:

View of the southern fence line facing southeast.

Five-Year Review Site Inspection
OU 008, Sherman Heights Small Arms Range
Fort Riley, Kansas

Photograph 5: **Direction: SW** **Comments:** View from the north facing southwest onto OU8. Signs restricting access were visible.	
Photograph 6: **Direction: SE** **Comments:** View from the top of the ridge facing southeast of the northern fence line of OU8.	

Appendix D

Interview Records

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Five-Year Review Interview Record		
Site: Fort Riley, Kansas • OU 001, Southwest Funston Landfill (FTRI-003) • OU 003, Dry Cleaning Facilities Area (FTRI-027) • OU 005, 354 Area Solvent Detections (FTRI-031) • OU 006, Open Burning/Open Detonation (OB/OD) Grounds • OU 008, Sherman Heights Small Arms Range	**EPA ID No:**	KS6214020756

Interview Type:
Location of Visit:
Date:
Time:

Interviewers

Name	Title	Organization
Note that the FYR Interview was conducted through this Questionnaire that was filled out by the Interviewee and submitted to Aerostar via email.		

Interviewees

Name	Organization	Title	Telephone	Email
Danny O'Connor	USEPA Region 7	Remedial Project Manager	913-551-7868	oconnor.daniel@epa.gov

Summary of Questions/Responses

1) **How long and in what capacity have you been involved with Fort Riley and with the five Operable Unit (OU) sites (OU 001, 003, 005, 006, 008) included in this Five-Year Review?** I've been the EPA RPM for the site since the summer of 2018. I've been involved in overseeing Army remedial activities at the five aforementioned OUs during that time.

2) **Have there been routine communications or activities conducted by your office regarding the sites? If so, please give purpose and results.** Yes. The EPA project team has overseen and provided feedback regarding Army remedial activities at the five OUs. Monthly Project Manager meetings are held to discuss status updates and discuss any outstanding issues. EPA has also been involved in annual site inspections for OU1.

3) **How are contracts for monitoring and inspections for the sites managed?** All environmental contracting for Fort Riley is the responsibility of the Army project team. EPA does not have contracting in place for monitoring and inspections of the site.

4) **Is there a continuous Operations & Maintenance (O&M) presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.** See response to question 3. EPA does not have a continuous on-site presence.

5) **Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? Please describe changes and impacts.**

For OU1, groundwater monitoring is occurring once every five years, to coincide with FYRs. The Army previously requested to cease sampling but EPA requested instead that the groundwater sampling frequency be changed from annual to once every five years. Waste remains within the landfill and detections of COCs persist in groundwater. For these reasons, EPA requested less frequent sampling to confirm groundwater concentrations remain below RGs. In addition, the Army plans to perform a scour evaluation for the portion of the landfill adjacent to the Kansas River.

For OU5, the Army recently installed four new monitoring wells to supplement the existing network. This was followed by one year of quarterly sampling and an Army request to revert the remedy to MNA. Based on data review, EPA recommended the Army instead move forward with implementing the remedy described in the 2015 ESD, in situ bioremediation. The Army project team agreed with this approach and is planning to implement the remedy in the Spring/Summer of 2022.

For OU6, EPA requested an additional monitoring well be installed north of OB-18-22, where the highest TCE concentrations have been observed. The Army agreed and is in the process of doing a limited DPT investigation to determine the best location for the additional well.

For OU8, the remedy requires soil sampling outside the LUC fencing every two years to confirm no contamination has left (most likely through erosion/storm runoff) the fenced area. Sampling in 2018 identified multiple areas outside the LUC fencing with lead above the RG. Additional composite sampling is planned to confirm all areas of elevated lead concentrations are delineated prior to additional fence installation. In addition, initial biennial soil sampling was conducted via discrete sampling. The project team has now agreed it more appropriate/representative to perform composite sampling.

6) **What are the annual operating costs for your organization's involvement with each of the five sites?** NA

7) **Have there been unexpected O&M difficulties or costs associated with any of the sites in the last five years? If so, please give details.** See response to Question 5.

8) **Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.** See response to Question 5.

9) **Other than routine groundwater monitoring, are you aware of any other work completed at each of the five sites in the last five years? If so, please explain.** Annual inspections of the cap are performed for OU1 and several minor repairs have been made in the past five years. Four additional monitoring wells were installed for OU5 to supplement the MNA well network.

10) **Are you aware of any intrusive activities performed at any of the five sites? If so, please explain.** Not other than the additional well installations at OU5.

11) **Are you aware of any changes in land use at Ft Riley or in the area surrounding the five sites? If so, please explain.** No.
12) **Are you aware of any trespassing at any of the five sites? If so, please explain.** No.
13) **Have you received any complaints, violations, or comments from the community or other stakeholders requiring a response by your office? If so, please explain.** No.
14) **Do you feel well informed about the sites' activities and progress?** Yes.
15) **Is the remedy functioning as expected at each site? How well is the remedy performing at each site?** EPA will evaluate the Army's response to Question A in the Draft FYR Report before determining if the remedies are functioning as intended by the decision documents.
16) **What does the monitoring data show at each site? Are there any trends that show contaminant levels are changing?** The Army should review contaminant trends as part of the FYR and provide a summary in the report. EPA is unaware of significant trends, increasing or decreasing, in contaminants at any of the OUs.
17) **Has any other information come to light that could call into question the protectiveness of the remedy at each site?** Not at this time.
18) **Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedies at each of the five sites?** No.
19) **Do you have any comments, suggestions, or recommendations regarding the project?** No.
Additional Site-Specific Questions
[If needed]

Five-Year Review Interview Record		
Site: Fort Riley, Kansas • OU 001, Southwest Funston Landfill (FTRI-003) • OU 003, Dry Cleaning Facilities Area (FTRI-027) • OU 005, 354 Area Solvent Detections (FTRI-031) • OU 006, Open Burning/Open Detonation (OB/OD) Grounds • OU 008, Sherman Heights Small Arms Range	**EPA ID No:**	KS6214020756

Interview Type: Written
Location of Visit:
Date: 17 September 2021
Time: 1400 hours

Interviewers

Name	Title	Organization
Note that the FYR Interview was conducted through this Questionnaire that was filled out by the Interviewee and submitted to Aerostar via email.		

Interviewees

Name	Organization	Title	Telephone	Email
Jeff Keating	DPW-Environmental, Fort Riley	IRP Project Manager	785-239-3194	jeffrey.f.keating.civ@army.mil

Summary of Questions/Responses

1) **How long and in what capacity have you been involved with Fort Riley and with the five Operable Unit (OU) sites (OU 001, 003, 005, 006, 008) included in this Five-Year Review?** From 1993-2005 I reviewed work plans and oversaw operational and management actions at the OUs in regards as to potential effects on threatened and endangered species. I took over management of the IRP project as fulltime manager in July 2020 and remain in the role at this time.

2) **Have there been routine communications or activities conducted by your office regarding the sites? If so, please give purpose and results.** Yes, I participate in frequent actions and communique regarding actions at the OU's. Monthly there are phone conferences between regulators, contractors and government staff to provide updates and status reports on actions and progress at each OU. Over the past year, each OU has had at least one sampling event and had one annual report. I review each Quality Control Summary Report that accompanied each sampling event, and the annual report for each OU, the comments received from the EPA and KDHE on these reports, and help coordinate the distribution of reports. Because I am stationed on Fort Riley, I have opportunity to get to each site for casual or scheduled inspection events, and view each OU at least quarterly, but often monthly. Lines of communication between Fort Riley and the regulators seem strong.

3) **How are contracts for monitoring and inspections for the sites managed?**
Over the past 5 years, the Corps of Engineers has managed contracts that address monitoring and inspection actions at the OU sites. The contractors produce Quality Control Sample Reports from soil and groundwater sampling, as required by the ROD, and provide annual reports of actions taken. Going forward, these multiple contracts have been replaced by one overall site contract that is to be managed by the Army Environmental Command.

4) **Is there a continuous Operations & Maintenance (O&M) presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.**

Yes, there is a full time IRP manager stationed at Fort Riley who reviews all reports submitted by contractors, who assesses scheduled field activities, routinely visits the OU sites to verify LUC's remain in place, and coordinates all access to the sites (such as for prescribed burning actions).

5) **Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? Please describe changes and impacts.**

OU 001 (SWFL): Groundwater sampling has decreased in frequency to once every 5 years, and is scheduled to coincide with the Five Year Review timeline.

OU 003 (DCF): There have been no significant changes.

OU 005 (354): Four new monitoring wells were established in 2019 to provide further delineation of the PCE plume at OU 005. Quarterly groundwater sampling events occurred for one year, but have reverted to annual sampling at this time. It is also intended that bioremediation injections will occur in the spring of 2022 in order to enhance the MNA actions at the site, with annual sampling continuing.

OU 006 (OB/OD): The remedy for the soil contamination is nearing completion. As described in the ROD, the contaminated soil is to be land-farmed until the COC's are below the remediation goals, then the soil will be taken to the on-post C/D landfill to be used as cover. It was estimated that the remediation goal would be achieved by EOY 2020, but 1 of 64 cells tested above the RG. Tilling of the land-farm continued during the summer of 2021, with another round of sampling scheduled for later this year.

OU-008 (SHSAR): The remedy for this site was recently completed. During the initial O&M soil sampling in 2020, it was discovered that lead concentrations outside of the fence exceeded the RG. Thus, additional step out soil sampling at these locations will occur in 2022 in order to determine the need to extend the fencing to the west.

6) **What are the annual operating costs for your organization's involvement with each of the five sites?**

OU 001: $12,523
OU 003: $12,523
OU 005: $11,796
OU 006: $26,356 + $2,954 = $29,310
OU 008: $7,304
Plus 1 FTE GS-12 staff

7) **Have there been unexpected O&M difficulties or costs associated with any of the sites in the last five years? If so, please give details.**

OU1: none
OU3: none
OU5: ESD in 2015 resulted in quarterly groundwater sampling rather than annual. Due to lack of evidence of MNA, additional injections of reagents to stimulate MNA will be required.
OU6: Timeframe for soil remediation within landfarm exceeded projection, delaying the closing of the landfarm and need to continue tilling actions by at least one year. Supposed perimeter monitoring well tested positive for PCE in levels that exceed RG, necessitating the need for additional perimeter wells to be installed in order to fully delineate the PCE plume. A wildfire burned through the OU6 site location, requiring additional repair and maintenance to equipment at the site.
OU8: Composite soil sampling found soil that exceeded RG outside of the fence perimeter, necessitating the need to perform additional sampling outside of the existing fence with the intention to move the western fence line in order to encompass the area with soil lead that exceeds RG.

8) **Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.**

Converting the contracts from multiple, single OU contracts to one overall contractor optimizes overhead cost savings.

9) **Other than routine groundwater monitoring, are you aware of any other work completed at each of the five sites in the last five years? If so, please explain.**

OU1: Annual landcover inspections, burning and/or haying of grassland cover annually, refilling of trenches and areas of substantial water ponding, removal of small trees from landfill cover, removal of debris.
OU3: No other significant work was performed.
OU5: A planned injection of carbon-based reagent to assist in the breakdown of PCE is planned for OU5 during the spring of 2022.
OU6: Excavation of soil believed to be source of PCE contamination, placement of contaminated in soil within a bermed landfarm treatment cell, and weekly/bi-weekly tilling of landfarm during summertime months of 2019-2021. Installation of additional monitoring wells to better delineate the plume is expected to occur during FY22. Maintenance of silt fence in accord with stormwater protection plan permit.
OU8: Composite soil sampling taken from around fence perimeter. Vegetation removal necessitated by encroachment into fence.

10) **Are you aware of any intrusive activities performed at any of the five sites? If so, please explain.** There have been no intrusive activities other than actions described as necessary in the respective RODs.

11) **Are you aware of any changes in land use at Ft Riley or in the area surrounding the five sites? If so, please explain.** There has been no change in land use for the 5 OU's, and no changes in designation requested through the Real Property Master Plan or other means.

12) **Are you aware of any trespassing at any of the five sites? If so, please explain.** OU 3 and 5 are not specifically closed for access, so trespassing at these two sites is not applicable. There are no reports of trespass received from OU 1, 6 or 8, no broken locks, and no evidence that individuals have trespassed onto either of these 3 OU's.

13) **Have you received any complaints, violations, or comments from the community or other stakeholders requiring a response by your office? If so, please explain.**

A FOIA request was received on May 14, 2020, from a soldier stationed on Fort Riley 1982-85 and assigned to 34 EN. The soldier recollection was that in 1984, the EPA released a study identifying contaminants in the Forsythe area which was near where he was stationed and working. The request was for contaminant information that may have affected the area around where 34 EN was located between 1982 and 1985. Fort Riley provided records obtained of contaminants from that time.

14) **Do you feel well informed about the sites' activities and progress?**

Yes.

15) Is the remedy functioning as expected at each site? How well is the remedy performing at each site?

OU 001: Remedy is functioning as expected. Annual inspections to repair subsidence of landfill cover is required.
OU 003: Remedy is functioning as expected. There is an expectation that the RACR will be completed within the next five years.
OU 005: An ESD was developed because MNA was not occurring to the extent predicted. Additional infusion of bio-reagents is deemed necessary in an attempt to improve conditions for additional breakdown of PCE.
OU 006: PCE is breaking down in the soil of the landfarm, but not as quickly as estimated. The remedial action complete designation has been delayed. The high clay component of the soil is believed to be retaining the COC longer than anticipated.
OU 008: The remedy is functioning at the site. The LUC fencing keeps intruders out of the area, and the annual monitoring effectively denoted a soil lead exceedance that needs addressed.

16) What does the monitoring data show at each site? Are there any trends that show contaminant levels are changing?

OU 001: The CoC are not being detected above RG, to the point that annual sampling has been reduced to once every five years.
OU 003: The CoC show decreasing trends.
OU 005: No evidence of MNA has been detected recently. Wells in the alluvial aquifer have CoC levels below the RG; however, this may be due more to dispersion than breakdown.
OU 006: Monitoring data has shown decrasing CoC concentrations in the 64 landfarm cells sampled, both in number of cells with detects and in the concentration of contaminant found.
OU 008: The monitoring data found a composite sample exceeded the RG for lead outside of the fence enclosure. It is believed that the fence was misplaced, not that the lead migrated laterally to the outside perimeter.

17) Has any other information come to light that could call into question the protectiveness of the remedy at each site?

The Site Inspection investigation for PFAS on Fort Riley detected PFOA/PFOS concentrations at OU 001. It is not known the source of these PFAS compounds.

Based upon results from sampling of OU 008, the current location of the western fence boundary needs to be moved.

18) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedies at each of the five sites?

No.

19) Do you have any comments, suggestions, or recommendations regarding the project?

Nothing additional.

Additional Site-Specific Questions

[If needed]

Five-Year Review Interview Record		
Site: Fort Riley, Kansas • OU 001, Southwest Funston Landfill (FTRI-003) • OU 003, Dry Cleaning Facilities Area (FTRI-027) • OU 005, 354 Area Solvent Detections (FTRI-031) • OU 006, Open Burning/Open Detonation (OB/OD) Grounds • OU 008, Sherman Heights Small Arms Range	**EPA ID No:**	KS6214020756

Interview Type: Form
Location of Visit:
Date: 9/28/21
Time:

Interviewers

Name	Title	Organization
Note that the FYR Interview was conducted through this Questionnaire that was filled out by the Interviewee and submitted to Aerostar via email.		

Interviewees

Name	Organization	Title	Telephone	Email
Kelly Peterson	USACE-NWK	Geologist	785-424-3859	Kelly.r.peterson@usace.army.mil

Summary of Questions/Responses

1) **How long and in what capacity have you been involved with Fort Riley and with the five Operable Unit (OU) sites (OU 001, 003, 005, 006, 008) included in this Five-Year Review?**

Technical support for geology for OU 001, 003, 005, 006 for last three years. Was previously KDHE (state) regulator for all OUs for three years prior.

2) **Have there been routine communications or activities conducted by your office regarding the sites? If so, please give purpose and results.**

Office has been in charge of contractors for site (though shifting over to USAEC managed contract).

3) **How are contracts for monitoring and inspections for the sites managed?**

USACE has managed contracts for monitoring and inspections. Contracts shifting to USAEC management as prior contract end.

4) **Is there a continuous Operations & Maintenance (O&M) presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.**

OU 001 – annual inspections, now 5 years sampling
OU 003 – annual groundwater sampling
OU 005 – annual groundwater sampling
OU 008 – annual inspections and soil sampling, 5 years groundwater sampling

5) **Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? Please describe changes and impacts.**

OU 001 – changed to once every 5 year groundwater sampling

6) What are the annual operating costs for your organization's involvement with each of the five sites?

Not sure.

7) Have there been unexpected O&M difficulties or costs associated with any of the sites in the last five years? If so, please give details.

No

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

OU 001 has shifted to every 5 years for groundwater sampling (though inspections will stay annual).

9) Other than routine groundwater monitoring, are you aware of any other work completed at each of the five sites in the last five years? If so, please explain.

OU 005 (B354) – finished PDI and addendum to study remaining contamination in support of additional injections
OU 006 (OB/OD) – Remedial action started, including excavation and landfarming
OU 007 (SHSAR) – fence and institutional controls installed

10) Are you aware of any intrusive activities performed at any of the five sites? If so, please explain.

OU 006 (OB/OD) – source excavation started

11) Are you aware of any changes in land use at Ft Riley or in the area surrounding the five sites? If so, please explain.

No.

12) Are you aware of any trespassing at any of the five sites? If so, please explain.

No.

13) Have you received any complaints, violations, or comments from the community or other stakeholders requiring a response by your office? If so, please explain.

No.

14) Do you feel well informed about the sites' activities and progress?

Yes.

15) Is the remedy functioning as expected at each site? How well is the remedy performing at each site?

Yes. Injections planned at OU 005 to speed up groundwater clean up.

16) What does the monitoring data show at each site? Are there any trends that show contaminant levels are changing? USACE contractors. Levels at most sites are decreasing or stable. OB/OD is still establishing trends.
17) Has any other information come to light that could call into question the protectiveness of the remedy at each site? No.
18) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedies at each of the five sites? No.
19) Do you have any comments, suggestions, or recommendations regarding the project? No.
Additional Site-Specific Questions
[If needed]

Five-Year Review Interview Record				
Site: Fort Riley, Kansas • OU 001, Southwest Funston Landfill (FTRI-003) • OU 003, Dry Cleaning Facilities Area (FTRI-027) • OU 005, 354 Area Solvent Detections (FTRI-031) • OU 006, Open Burning/Open Detonation (OB/OD) Grounds • OU 008, Sherman Heights Small Arms Range			**EPA ID No:**	KS6214020756
Interview Type: **Location of Visit:** **Date:** **Time:**				

Interviewers

Name	Title	Organization
Note that the FYR Interview was conducted through this Questionnaire that was filled out by the Interviewee and submitted to Aerostar via email.		

Interviewees

Name	Organization	Title	Telephone	Email
Michael Bowlby	USAEC	ESM	2108468652	Michael.a.bowlby.civ@mail.mil

Summary of Questions/Responses

1) **How long and in what capacity have you been involved with Fort Riley and with the five Operable Unit (OU) sites (OU 001, 003, 005, 006, 008) included in this Five-Year Review?**

- 2 Years as the Environmental Support Manager, USAEC

2) **Have there been routine communications or activities conducted by your office regarding the sites? If so, please give purpose and results.**

- Yes; daily and weekly routine discussions with USACE Personnel, Contractors, and Installation Personnel. Results vary but are routine in nature – status updates, determination of path forward, etc.

3) **How are contracts for monitoring and inspections for the sites managed?**

- USACE currently, with USAEC transitioning

4) **Is there a continuous Operations & Maintenance (O&M) presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.**

- Yes, IRP Manager Jeff Keating – 100% oversight of program

5) **Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? Please describe changes and impacts.**

- No

6) **What are the annual operating costs for your organization's involvement with each of the five sites?**

-	**Unsure how to answer this question**
7)	**Have there been unexpected O&M difficulties or costs associated with any of the sites in the last five years? If so, please give details.** - No
8)	**Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.** - Yes. See history on sampling parameters for all sites, namely SWFL. GWM efforts have been reduced across most sites.
9)	**Other than routine groundwater monitoring, are you aware of any other work completed at each of the five sites in the last five years? If so, please explain.** - MMRP site has underwent soil sampling and RA-C
10)	**Are you aware of any intrusive activities performed at any of the five sites? If so, please explain.** No
11)	**Are you aware of any changes in land use at Ft Riley or in the area surrounding the five sites? If so, please explain.** No
12)	**Are you aware of any trespassing at any of the five sites? If so, please explain.** No
13)	**Have you received any complaints, violations, or comments from the community or other stakeholders requiring a response by your office? If so, please explain.** No
14)	**Do you feel well informed about the sites' activities and progress?** - Yes
15)	**Is the remedy functioning as expected at each site? How well is the remedy performing at each site?** Yes
16)	**What does the monitoring data show at each site? Are there any trends that show contaminant levels are changing?** See specific site reports.

17) Has any other information come to light that could call into question the protectiveness of the remedy at each site? **No**
18) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedies at each of the five sites? No
19) Do you have any comments, suggestions, or recommendations regarding the project? **NO**
Additional Site-Specific Questions
[If needed]

Five-Year Review Interview Record		
Site: Fort Riley, Kansas • OU 001, Southwest Funston Landfill (FTRI-003) • OU 003, Dry Cleaning Facilities Area (FTRI-027) • OU 005, 354 Area Solvent Detections (FTRI-031) • OU 006, Open Burning/Open Detonation (OB/OD) Grounds • OU 008, Sherman Heights Small Arms Range	**EPA ID No:**	KS6214020756

Interview Type: Individual
Location of Visit: KDHE BER
Date: 09/15/2021
Time: 1 pm

Interviewers

Name	Title	Organization
Note that the FYR Interview was conducted through this Questionnaire that was filled out by the Interviewee and submitted to Aerostar via email.		

Interviewees

Name	Organization	Title	Telephone	Email
Margaret Townsend	KDHE BER	Unit Chief Federal Facilities	785-296-8801	Margaret.Townsend@ks.gov

Summary of Questions/Responses

1) **How long and in what capacity have you been involved with Fort Riley and with the five Operable Unit (OU) sites (OU 001, 003, 005, 006, 008) included in this Five-Year Review?**
About 4 years

2) **Have there been routine communications or activities conducted by your office regarding the sites? If so, please give purpose and results. Have done several site visits to provide oversight and do split samples. Meetings for FFA with EPA, KDHE staff, Ft. Riley staff, and USACE personnel.**

3) **How are contracts for monitoring and inspections for the sites managed? Through the USACE and the Army Environmental Command (as of 2021)**

4) **Is there a continuous Operations & Maintenance (O&M) presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.**
Base has contractors that do on-site inspections and activities.

5) **Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? Please describe changes and impacts.**
Not that I am aware of. Changes occur as needed based on data collection and discussion with EPA and KDHE and the Base.

6) What are the annual operating costs for your organization's involvement with each of the five sites? **Fort Riley participates in the DSMOA program. KDHE receives funding based on document reviews, meetings, and oversight work done at the sites. Varies over the year. Our grant is on a 2-year basis, so it is hard to determine annual costs.**
7) Have there been unexpected O&M difficulties or costs associated with any of the sites in the last five years? If so, please give details. The Fort has had some changes in remediation processes because of changing needs.
8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency. **OU-006 land farming was done to remediate soil instead of disposal. Soil will be reused at C&D landfill as cover.**
9) Other than routine groundwater monitoring, are you aware of any other work completed at each of the five sites in the last five years? If so, please explain. More wells were installed at OU-005; more sampling at Sherman Heights (OU-008) to further define the area of lead to be removed. More signage at OU-001 for the MEC issues. ***Note: No munitions and explosives concern (MEC) issues have been identified at OU 001. It is likely the interviewee is referencing OU 009 (Camp Forsyth Landfill Area 2), a Military Munitions Response Program (MMRP) site not included in this Five-Year Review.***
10) Are you aware of any intrusive activities performed at any of the five sites? If so, please explain. **Sherman Heights will have its fence moved out a few feet to prevent exposure to possible lead.**
11) Are you aware of any changes in land use at Ft Riley or in the area surrounding the five sites? If so, please explain. No
12) Are you aware of any trespassing at any of the five sites? If so, please explain. **Have heard of trespassing at OU_001 hence more signs. Not sure of other sites.** ***Note: It is likely the interviewee intended to reference potential trespassing at OU 009, not OU 001. Additional signage was added at OU 009 (Camp Forsyth Landfill Area 2), a MMRP site not included in this Five-Year Review.***
13) Have you received any complaints, violations, or comments from the community or other stakeholders requiring a response by your office? If so, please explain. No.

14) Do you feel well informed about the sites' activities and progress? **Yes. Monthly meetings, frequent calls if needed.**
15) Is the remedy functioning as expected at each site? How well is the remedy performing at each site? **So far, the remedies are working. OU-005 will be having injections for future work.**
16) What does the monitoring data show at each site? Are there any trends that show contaminant levels are changing? OU-003 showed changes. More plume delineation going forward. OU_006 shows some areas where more wells are needed to delineate plume and perhaps provide injections at a future time. OU-005 needs injections
17) Has any other information come to light that could call into question the protectiveness of the remedy at each site? No. Sites appear under control at present.
18) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedies at each of the five sites? No
19) Do you have any comments, suggestions, or recommendations regarding the project? No
Additional Site-Specific Questions
[If needed]

Appendix E

Data Reports

E1: OU 001 Data Reports
E2: OU 003 Data Reports
E3: OU 005 Data Reports
E4: OU 006 Data Reports
E5: OU 008 Data Reports

Appendix E – Data Reports

Appendix E1

Operable Unit 001 (OU 001) Southwest Funston Landfill (FRTI-003)

Report Reference	Excerpted Data Included	Page Number
South Funston Landfill (FTRI-003), OU 001 Groundwater Monitoring Recommendation Report, Fort Riley, Kansas. April 2018.	2013 and 2016 Groundwater Sampling Summary of COC Detections	E1-1
Final 2018 Annual Long-Term Monitoring Report, Southwest Funston Landfill (FTRI-003), Operable Unit No. 001, Fort Riley, Kansas. March 2019**.**	May 2018 Groundwater Sampling Data Tables	E1-2
Final Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances, Fort Riley, Kansas. January 2022**.**	March 2020 Groundwater Sampling Data Tables and Figures	E1-3
Draft 2021 Groundwater Monitoring Quality Control Summary Report for Southwest Funston Landfill (FTRI-003), Fort Riley, Kansas. August 2021.	March 2021 Groundwater Sampling Data Tables	E1-8

Field parameters monitored included Dissolved Oxygen, Oxidation-Reduction Potential, Temperature, Turbidity, Conductivity, pH, and Iron (II). Laboratory parameters monitored included Method 8260 VOCs. In February 2010, USEPA approved the request from Fort Riley to reduce the groundwater monitoring frequency from an annual to a five-year schedule to coincide with five-year reviews.

Inspections of landfill cover at OU 001 were conducted annually between 2007 and 2016. Deficiencies noted during the inspections (areas with differential settlement, low areas with standing water, or erosion of riprap along the Kansas River) were subsequently repaired and restored via fertilizing, mulching, and reseeding of disturbed areas.

4.0 DATA REVIEW

The Five Year Review report included a review and evaluation of data generated during 2013 and 2016. Those data are in Appendix B. Table 4-1 summarizes the detection of COCs at OU1 in 2013 and 2016.

Table 4-1
OU 001 Summary of COC detections in 2013 and 2016

VOC Compound	Units	MCL[1]	SFL92-301		SFL92-601		SFL92-403		SFL92-401	
			11/13	5/16	11/13	5/16	11/13	5/16	11/13	5/16
Benzene	µg/L	5	**0.59 J**	ND	**1.9**	**2.3**	ND	ND	ND	ND
Vinyl chloride	µg/L	5	ND	ND	**0.48 J**	ND	ND	ND	ND	ND

[1]USEPA December 2016
Bold = detection
ND = not detected
J = estimated

There were no exceedances of remediation goals in 2013 and 2016. Groundwater monitoring data have been collected for 32 years. A review of historical data indicated that there have been no exceedances of the remediation goals in the wells sampled at OU 001 since March 2007 (Appendix A). In 2016, benzene was the only COC detected, in one well, within the former landfill boundary. Benzene was detected with a concentration of 2.3 micrograms per liter (µg/L), below the RG of 5 µg/L. Based on the results of long-term groundwater monitoring, further monitoring does not appear necessary to maintain the protectiveness of the remedy.

5.0 SUMMARY AND RECOMMENDATIONS

5.1 Summary

The selected remedy for OU 001, Southwest Funston Landfill was to maintain the landfill cover and riverbank stabilization structure, and implement institutional controls. Numerical remediation goals also were developed for the COCs identified for groundwater. The RAOs, including repairs to the landfill cover, riverbank stabilization, and implementation of institutional

Table 3.3
Summary of VOCs Detected
May 2018 Groundwater Sampling Event
Southwest Funston Landfill (FTRI-003), Fort Riley, Kansas

VOC Compound	Units	MCL[1]	KDHE RSK[2]	Tap Water RSL[1]	SFL92-301	SFL92-401	SFL92-403	SFL92-603	SFL92-603	SFL94-04B	SFL97-903
					5/18/2018	5/18/2018	5/18/2018	5/17/2018	5/17/2018-FD	5/26/2018	5/14/2018
LTMCs and Associated LTMCs											
Vinyl chloride	µg/L	2	2	0.019	0.2 U	**0.15 J**	**0.14 J**	0.2 U	0.2 U	0.2 U	0.2 U
cis- 1,2-Dichloroethene	µg/L	70	70	36	0.4 U	**0.16 J**	**0.16 J**	0.4 U	0.4 U	0.4 U	0.4 U
Non-LTMC VOCs											
1,2-Dichlorobenzene	µg/L	600	600	300	**0.31 J**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2,4-Trimethylbenzene	µg/L	--	8.44	56	**0.16 J**	0.4 U	**0.2 J**	0.4 U	0.4 U	0.4 U	0.4 U
Acetone	µg/L	--	11500	14000	**3.1 J**	6.4 UJ	6.4 UJ	6.4 UJ	6.4 UJ	6.4 U	**2.2 J**
Chlorobenzene	µg/L	100	100	78	**2.7**	**1.1**	**0.55 J**	0.4 U	0.4 U	0.4 U	0.4 U
Methylene Chloride	µg/L	5	5	11	0.8 U	0.8 U	**0.33 J**	0.8 U	0.8 U	0.8 U	0.8 U
1,4-Dichlorobenzene	µg/L	75	75	0.48	**2.8**	**0.59 J**	**0.45 J**	0.4 U	0.4 U	0.4 U	0.4 U
Toluene	µg/L	1000	1000	1100	**0.18 J**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U

Notes:
[1] EPA MCLs and RSLs May 2018 from site: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2018.
[2] Groundwater, Residential Scenario, Risk-Based Standards for Kansas RSK Manual – 5th Version, October 2010 with revised tables from September 2015
Bold = Compound detected above the method detection limit.
J = The analyte was detected at the reported concentration; the quantitation is an estimate.
KDHE RSK = Kansas Department of Health and Environment Risk-Based Standards for Kansas
MCL = maximum contaminant level
µg/L = micrograms per liter
RSL = regional screening level
U = Not detected. The associated value indicates the analyte limit of detection.
UJ = Estimated, Not detected. The associated value indicates the analyte limit of detection.
VOC = volatile organic compound

Table 7-1 - Groundwater PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Fort Riley, Kansas

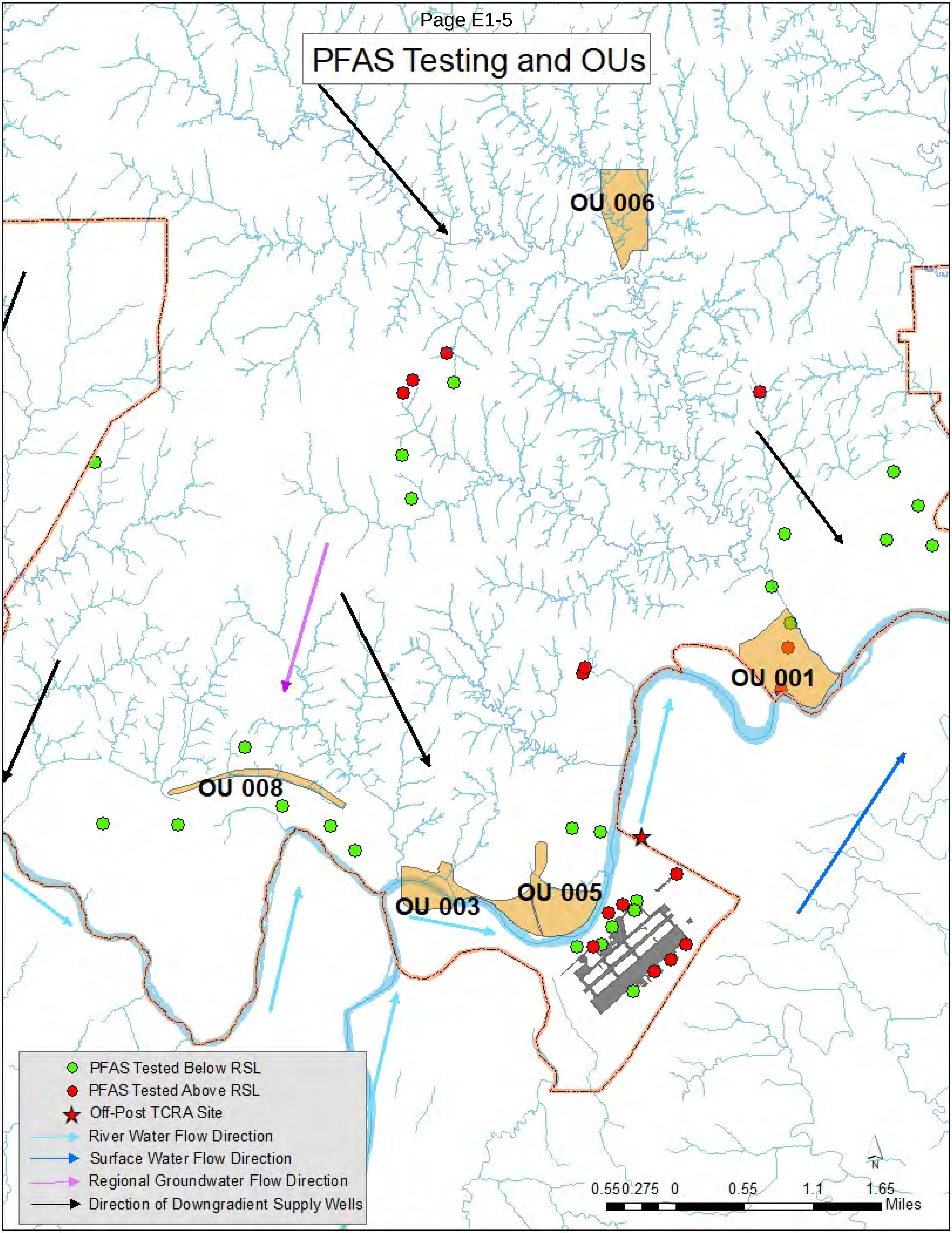
Associated AOPI	Location Type	Location ID	Sample ID	Sample Date	Sample Type	PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
						Result	Qual	Result	Qual	Result	Qual
	OSD Tapwater Risk Screening Level					40		40		600	
MAAF AOPIs											
FFTA-MAAF (OU 004, FTRI-019)	DPT Boring	FFTA-MAAF-01	FTRI-FFTA-MAAF-01-GW-(18)-03122020	3/12/2020	N	**300**	DJ	**26**		**5.0**	
Current Fire Station #3 (Building 706)	DPT Boring	B706-01	FTRI-B706-01-GW-(19)-03122020	3/12/2020	N	180	U	180	U	**3,200**	DJ
Building 710 Foam Storage	DPT Boring	B710-01	FTRI-B710-01-GW-(27)-03112020	3/11/2020	N	1.9	U	**23**	J+	**170**	DJ
Hangar 723	DPT Boring	B723-01	FTRI-B723-01-GW-(22)-03122020	3/12/2020	N	**8.4**		**30**		**29**	
Former Fire Station #3 (Building 743)	DPT Boring	B743-01	FTRI-B743-01-GW-(19)-03132020	3/13/2020	N	**180**	DJ	**890**	DJ	**14,000**	DJ
Hangar 746	DPT Boring	B746-01	FTRI-B746-01-GW-(21)-03182020	3/18/2020	N	**1.6**	J	**32**		**8.5**	
Building 817 Foam Release	DPT Boring	B817-01	FTRI-B817-01-GW-(27)-03122020	3/12/2020	N	1.8	U	1.8	U	1.8	U
Hangar 837	DPT Boring	B837-01	FTRI-B837-01-GW-(22)-03182020	3/18/2020	N	1.8	U	**1,100**	DJ	**2.3**	
Hangar 863	DPT Boring	B863-01	FTRI-B863-01-GW-(19)-03182020	3/18/2020	N	**80**	J-	**120**	J-	**14**	J-
FFTA-Building 892 (Gate 11) (FTRI-018)	DPT Boring	B892-01	FTRI-B892-01-GW-(18)-03182020	3/18/2020	N	**840**	J-	**1,700**	J-	**750**	J-
FNTA-Gate 8	DPT Boring	G8-01	FTRI-G8-01-GW-(21)-03132020	3/13/2020	N	**2.7**		**40**	J	**34**	
FFTA-Old Taxiway	DPT Boring	OTW-01	FTRI-OTW-01-GW-(19)-03122020	3/11/2020	N	20	U	**25**	J+	**52**	
General - the MAAF AOPIs	Monitoring Well	AGL-MW-03	FTRI-AGL-MW-03-03172020	3/17/2020	N	**100**		**1,100**	DJ	**2,600**	DJ
			FTRI-AGL-MW-03-DEBB-03172020	3/17/2020	N	**460**	DJ	**2,100**	DJ	**1,000**	DJ
		AGL-MW-05	FTRI-AGL-MW-05-03172020	3/17/2020	N	**300**	J-	**30,000**	DJ	**790**	J-
Camp Funston AOPIs											
Camp Funston Biosolids Application Site	Monitoring Well	1245MW07-10	FTRI-1245MW07-10-03182020	3/18/2020	N	20	UJ-	20	UJ-	**11**	J-
		1637CF95-05	FTRI-1637CF95-05-03172020	3/17/2020	N	**28**		**2.8**		**1.4**	J
		CF97-101	FTRI-CF97-101-03182020	3/18/2020	N	1.7	U	**20**		1.7	U
		CF99-901	FTRI-CF99-901-03182020	3/18/2020	N	**2.6**	J	1.8	U	**8.4**	
FFTA-SFL (OU 001, FTRI-028)	DPT Boring	FFTA-SFL-01	FTRI-FFTA-SFL-01-GW-(18)-03172020	3/17/2020	N	**4.6**		**7.8**		**20**	
	Monitoring Well	SFL92-301	FTRI-SFL92-301-03182020	3/18/2020	N	20	UJ-	**110**	J-	**17**	J-
		SFL92-601	FTRI-SFL92-601-03192020	3/19/2020	N	20	UJ-	**110**	J-	**16**	J-
		SFL97-903	FTRI-SFL97-903-03162020	3/16/2020	N	**13**		**8.8**		**4.8**	
Camp Funston Advanced WWTP	Monitoring Well	SFL92-803	FTRI-SFL92-803-03162020	3/16/2020	N	**8.0**		**2.1**	J	**3.8**	
			(FTRI-FD-1-GW-03162020)		FD	**9.3**		**5.8**	J	**4.1**	
			FTRI-SFL92-803-DEBB-03162020	3/16/2020	N	**11**	J	**19**		**5.1**	

Notes:

1. **Bolded** values indicate the result was detected greater than the limit of detection.
2. Gray shaded values indicate the result was detected greater than or equal to the Office of the Secretary of Defense (OSD) risk screening levels (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September.).
3. Samples were analyzed for PFAS by LC/MS/MS Compliant with Table B-15 of DoD QSM 5.1.1 (DoD. 2018. Quality Systems Manual, Version 5.1.1, 2018. February.)

Associated AOPI	Location Type	Location ID	Sample ID	Sample Date	Sample Type	PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
						Result	Qual	Result	Qual	Result	Qual
	OSD Tapwater Risk Screening Level					40		40		600	

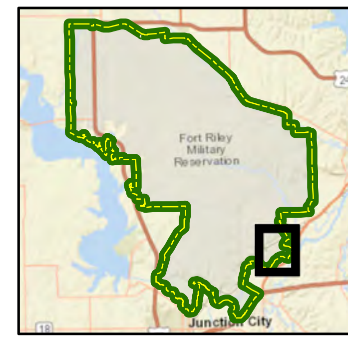
Acronyms/Abbreviations:
-- = not applicable
AOPI = area of potential interest
MAAF = Marshall Army Airfield
DJ = The analyte was analyzed at dilution and the result is an estimated quantity.
C/D = Construction and Debris
DEBB = dedicated equipment background
FD = field duplicate sample
FFTA = Former Fire Training Area
FNTA = Former Nozzle Testing Area
FTRI = Fort Riley
GW = groundwater
ID = identification
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only.
J+ = The result is an estimated quantity; the result may be biased high.
J- = The result is an estimated quantity; the result may be biased low.
MAAF = Marshall Army Airfield
N = primary sample
ng/L = nanograms per liter (parts per trillion)
OU = operable unit
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
Qual = qualifier
SFL = Southwest Funston Landfill
U = The analyte was analyzed for but the result was not detected above the limit of detection (LOD) and the limit of quantitation (LOQ). The non-detect value reported is the LOQ.
UJ- = The analyte was analyzed for but was not detected. The reported limit of quantitation (LOQ) is approximate and may be inaccurate or imprecise.
USEPA = United States Environmental Protection Agency
WWTP = wastewater treatment plant

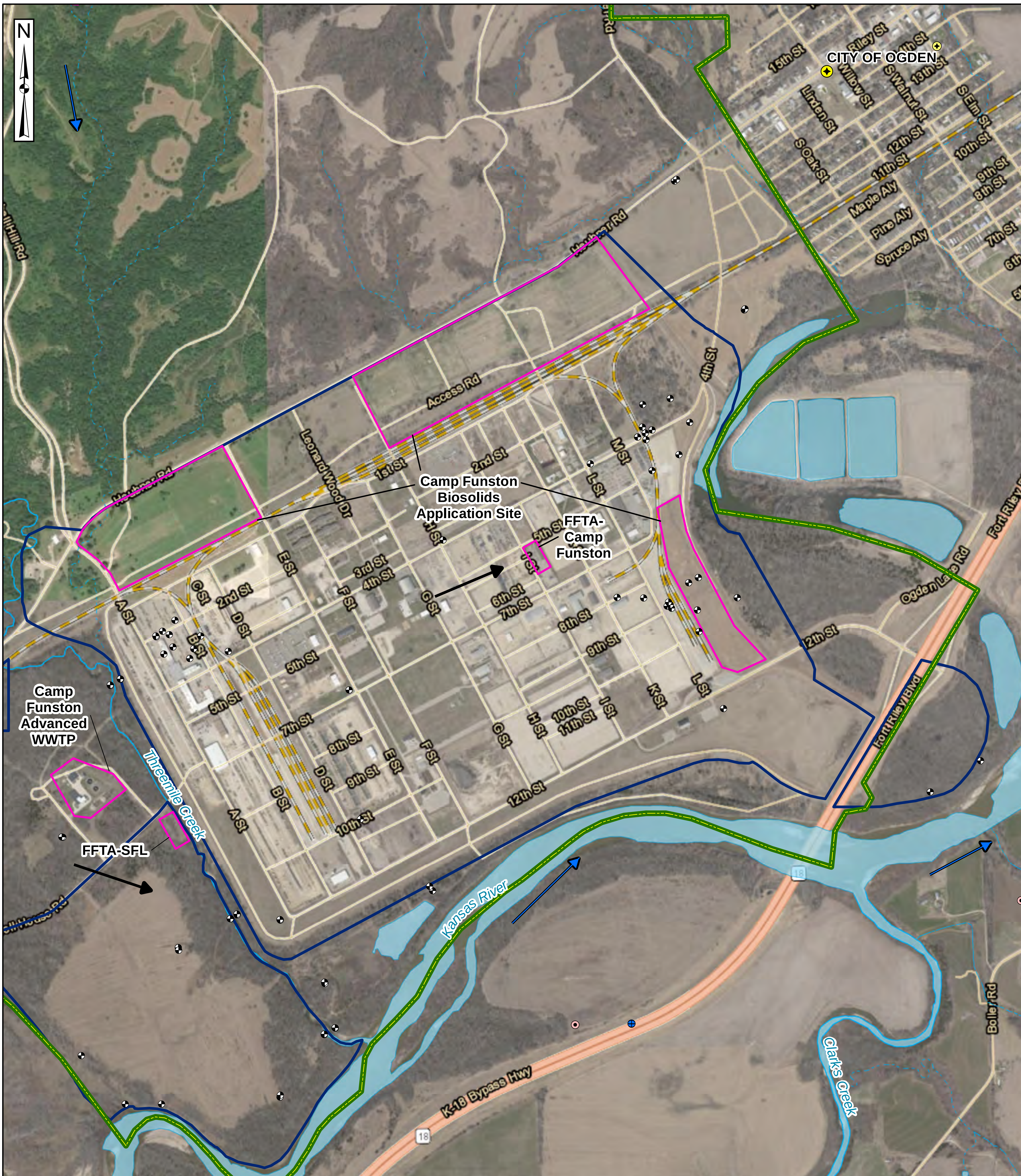

PFAS Testing and OUs
OU 006
OU 001
OU 008
OU 003
OU 005
PFAS Tested Below RSL
PFAS Tested Above RSL
Off-Post TCRA Site
River Water Flow Direction
Surface Water Flow Direction
Regional Groundwater Flow Direction
Direction of Downgradient Supply Wells
N
0.550.275 0 0.55 1.1 1.65
Miles

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Riley, KS

ARCADIS

Figure 5-4
Aerial Photo of the
Camp Funston AOPIs





Note:
1. The status of each monitoring well shown may not be available; some may be plugged and abandoned.

Installation Boundary	Surface Water Flow Direction
AOPI	Approximate Groundwater Flow Direction
IRP Influence	Monitoring Well
River/Stream (Perennial)	Public Supply Well (EDR)
Stream (Ephemeral/Intermittent)	Public Supply Well (KGS)
Water Body	Domestic Well (KGS)
	Irrigation Well (KGS)

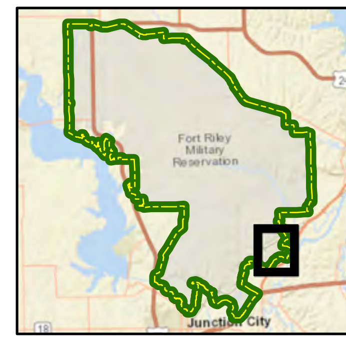
AOPI = Area of Potential Interest
EDR = Environmental Data Registry
FFTA = Former Fire Training Area
IRP = Installation Restoration Program
KGS = Kansas Geological Survey
SFL = Southwest Funston Landfill
WWTP = Wastewater Treatment Plant

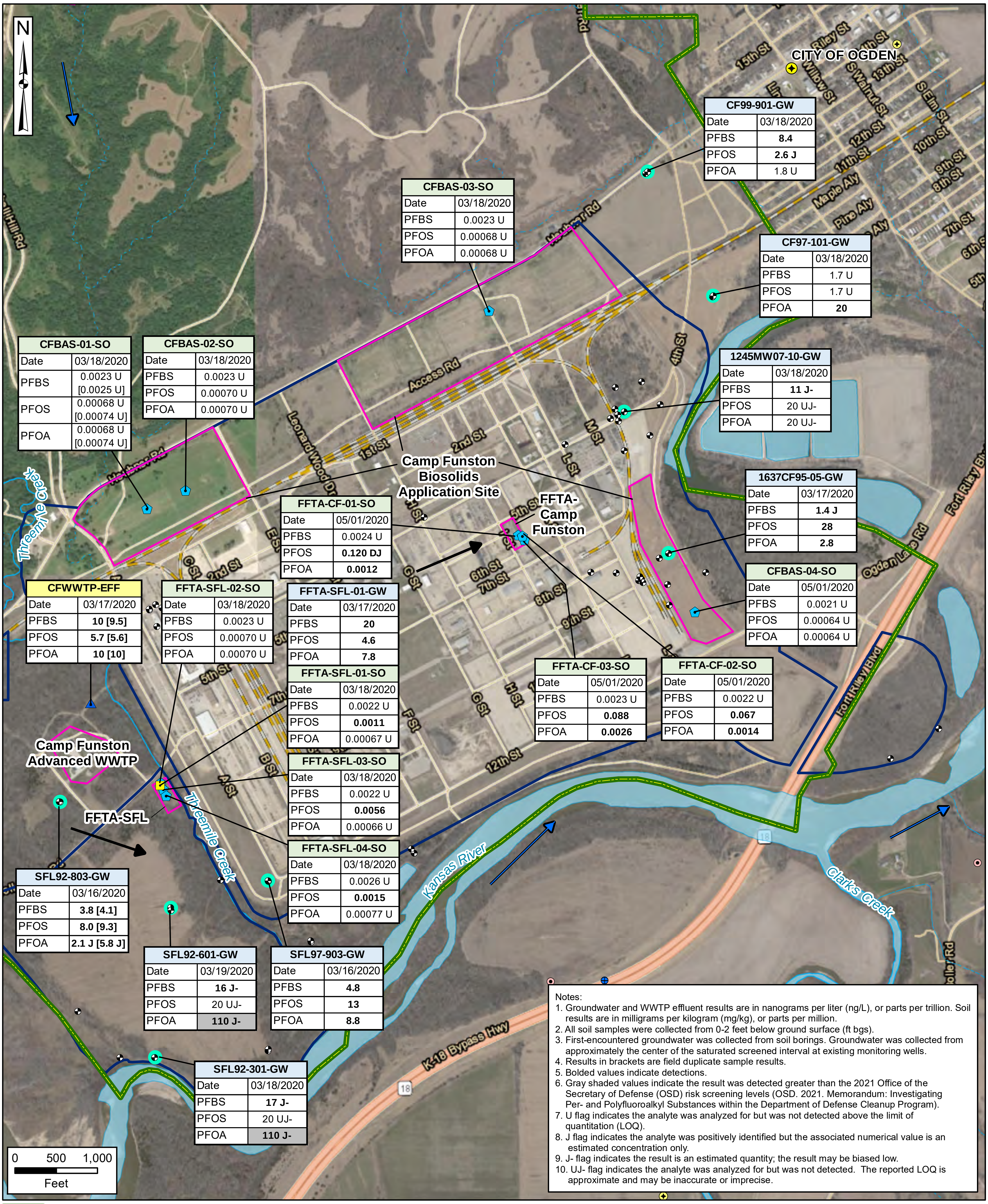
Data Sources:
EDR Well Data, 2018
KGS Well Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 14 North

USAEC PFAS Preliminary Assessment / Site Inspection
Fort Riley, KS

Figure 7-3
Camp Funston AOPIs
PFOS, PFOA, and PFBS Analytical Results





Installation Boundary
AOPI
IRP Influence
River/Stream (Perennial)
Stream (Ephemeral/Intermittent)
Water Body
Surface Water Flow Direction
Approximate Groundwater Flow Direction
Public Supply Well (EDR)
Public Supply Well (KGS)
Domestic Well (KGS)
Monitoring Well
Groundwater and Soil Sample Location (DPT Boring)
Surface Soil Sample Location (Hand Auger)
WWTP Effluent Sample Location
Groundwater Sample Location - Existing Well

AOPI = Area of Potential Interest
DPT = Direct-Push Technology
Environmental Data Resources, Inc.
FFTA = Former Fire Training Area
IRP = Installation Restoration Program
KGS = Kansas Geological Survey
SFL = Southwest Funston Landfill
WWTP = Wastewater Treatment Plant

Data Sources:
EDR Well Data, 2018
KGS Well Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 14 North

Table 3-1
Data Quality Evaluation Summary
Southwest Funston Landfill (FTRI-003)
Fort Riley, Kansas
Regional LTO/LTM For Seven Installations

Sample ID	Date Sampled	SDG	Laboratory Sample ID	Analysis Method	Dilution	Parameter	Result	Result Units	Laboratory Qualifier	Final Validation Qualifier	Reason For Qualification								
											Hold Time/Pres.	Method Blank	LCS/LCSD	MS/MSD	Surrogate	Field QC	Calibration	Other	Comment
FTRI-003-SFL97-903-030421	03/04/2021	280-146055	280-146055-11	SW 8260B	1.00	1,2,4-Trimethylbenzene	0.32	µg/L	J	U						U			Equipment Blank
FTRI-003-SFL97-903-030421	03/04/2021	280-146055	280-146055-11	SW 8260B	1.00	2-Hexanone	4.00	µg/L	U	UJ							UJ		Continuning Calibration Verification
FTRI-003-SFL97-903-030421	03/04/2021	280-146055	280-146055-11	SW 8260B	1.00	m,p-Xylene	0.41	µg/L	J	U						U			Field Blank
FTRI-068-EB-030421	03/04/2021	280-146055	280-146055-9	SW 8260B	1.00	1,2-Dibromo-3-chloropropane	1.60	µg/L	U	UJ							UJ		Continuning Calibration Verification
FTRI-068-EB-030421	03/04/2021	280-146055	280-146055-9	SW 8260B	1.00	2-Butanone	4.00	µg/L	U	UJ							UJ		Continuning Calibration Verification
FTRI-068-EB-030421	03/04/2021	280-146055	280-146055-9	SW 8260B	1.00	2-Hexanone	4.00	µg/L	U	UJ							UJ		Continuning Calibration Verification
FTRI-068-EB-030421	03/04/2021	280-146055	280-146055-9	SW 8260B	1.00	Carbon Disulfide	0.80	µg/L	U	UJ							UJ		Continuning Calibration Verification
FTRI-068-EB-030421	03/04/2021	280-146055	280-146055-9	SW 8260B	1.00	Ethylbenzene	0.24	µg/L	J	U						U			Field Blank
FTRI-068-EB-030421	03/04/2021	280-146055	280-146055-9	SW 8260B	1.00	m,p-Xylene	0.98	µg/L	J	U						U			Field Blank
FTRI-068-EB-030421	03/04/2021	280-146055	280-146055-9	SW 8260B	1.00	o-Xylene	0.40	µg/L	J	U						U			Field Blank
FTRI-068-EB-030421	03/04/2021	280-146055	280-146055-9	SW 8260B	1.00	Toluene	9.10	µg/L		U						U			Field Blank
TB-03/04/21-01	03/04/2021	280-146055	280-146055-1	SW 8260B	1.00	Bromoform	1.00	µg/L	U	UJ							UJ		Continuning Calibration Verification

Notes:

EB = equipment blank
FB = field blank
FTRI = Fort Riley
ID = identification
J = estimated
LCS = laboratory control spike
LCSD = laboratory control spike duplicate
µg/L = micrograms per liter
MS = matrix spike
MSD = matrix spike duplicate
QC = quality control
RPD = relative percent difference
SW = solid waste
U = non-detection
UJ = estimated non-detection

Appendix E – Data Reports

Appendix E2

Operable Unit 003 (OU 003) Dry Cleaning Facilities Area (FRTI-027)

Report Reference	Excerpted Data Included	Page Number
Army Draft 2021 Annual Long-Term Monitoring Report, Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027) Fort Riley, Kansas. August 2021.	March 2021 and Historic Groundwater Sampling Data Tables	E2-1

Table 2.3
Historical Analytical Results Summary - AOC 1 and AOC 2 Pilot Study Area
2021 Annual Long-Term Monitoring Report
Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027)
Fort Riley, Kansas

Study Area	Treatment Area												Upgradient	Side Gradient of Source Area										
Well	DCF92-05			DCF93-13					DCF01-40*	DCF06-40*			DCF92-01	DCF93-19				DCF93-20			DCF96-27			
Date/Compound	PCE	TCE	cis-1,2	PCE	TCE	cis-1,2	trans-1,2	VC	PCE	PCE	TCE	cis-1,2	PCE	PCE	TCE	cis-1,2	VC	PCE	TCE	cis-1,2	PCE	TCE	cis-1,2	VC
RG (µg/L)	5	5	70	5	5	70	10	2	5	5	5	70	5	5	5	70	2	5	5	70	5	5	70	2
February-00	15.6	2.2	4.9	83.8	83.4	25.3	2	0.8 U						3.9	0.9	3.1	0.8 U	1.1 U	3.3	12.5	4.6	3.7	22.3	1.2
July-00	17.9	2	4.4	89.7	152	42.4	4.6	0.8 U						1.3	0.6 U	3.1	0.8	3	14.6	18	1.1	0.6 U	13	0.8 U
October-00	21.8	3	8.4	76.1	54.5	19.6	1.5	0.8 U						1.1 U	0.6	6.6	1.2	1.1 U	4.5	15.1	3.1	2.1	10.1	1
March-01	14.4	1.6	2.3	49.0	31.7	10.2	0.9	0.8 U						1.1 U	0.6 U	9.5	1.3	2.9	34.8	26.2	3.8	1.3	8.8	0.8 U
October-01	11.9	0.9	2.1	67.0	50.1	14.9	1.5	0.8 U	127					1.1 U	0.6 U	5.9	1.4	1.8	14.9	16.7	4.5	1.1	5.2	0.8 U
March-02	16.0	1	1.1	61.5	56.5	15.9	1.4	0.8 U	169					1.1 U	0.6 U	7.2	1.3	2.7	13.6	15.7	2.1	1	8.2	0.8 U
July-02	14.4	1.2	0.5 U	72.8	256	58.4	6.8	0.8 U	121					1.1 U	0.6 U	3.1	0.8	1.1 U	7.6	16.3	2.1	1.2	5.7	2
October-02	18.9	1.5	0.5 U						165					1.1 U	0.6 U	2.7	1.3	1.1 U	6.3	14.8	1.6	0.8	8.3	1.8
April-03	24.2	2.1	5.8	44.5	18.9	8	0.5	0.8 U	74.8					1.1 U	0.6 U	3	0.9	1.9	5.6	12.9	1.4	0.6 U	7.4	0.8 U
July-03	17.7	1	0.5 U	63.2	76.1	19.7	2	0.8 U	113					1.1 U	0.6 U	2.8	1.00	1.5	6.7	13.6	1.8	0.6 U	2.9	1.5
October-03	12.6	0.6	0.7	30.9	10	9.9	0.5	0.8 U	96.8					1.1 U	0.6 U	3	1.3	1.1 U	2.8	11.7	1.2	0.6 U	8.1	1.2
April-04	11.9	0.9	1.8	36.3	13.4	4	0.5 U	0.8 U	47.3					1.1 U	0.6 U	11.4	3.3	1.1 U	12.7	18	1.1 U	0.6	4.3	0.8 U
August-04	9.7	0.6 U	0.5 U	33.2	66.7	24.1	2.3	0.8 U	89.6					1.1 U	0.6 U	4.1	2.3	1.1 U	9.3	21.4	1.2	1.3	15.3	0.5 U
April-05	7.4	0.5 U	0.7	26.7	5.8	2		0.5 U	56.6					0.5 U	0.5 U	12.1	3.2	0.7	4.7	29.2	2.1	0.9	5.3	
August-05									62															
October-05	8.4	0.5 U	0.5 U	26.5	20.6	9.9		0.5 U	80.2					0.5 U	0.5 U	2.4	1.7	1.1	4.8	32.5	0.5 U	0.5 U	29.5	0.5 U
March-06	5.9	0.5 U	0.5 U	28.7	6.7	2		0.5 U		78.1	0.5 U			0.5 U	0.5 U	3.4	2.4	0.5	3.6	23.7	0.5 U	0.5 U		0.8
April/May-06	2006 Pilot Study CAP18™												Upgradient	Side Gradient of 2006 Pilot Study Area										
October-06	5.7	0.6 U	0.5 U	9.6	1.4	0.5 U	0.5 U	0.8 U		61.2	0.6 U	1.2		1.1 U	0.6 U	4.5	2.9	1.1 U	7.4	23.3	2.5	1.1	11.8	0.8 U
January-07	ND	0.6	4.6	6.5	0.9	0.9	0.5 U	0.8 U		69.1	0.6 U	1.8												
April-07	2.1			2.6	1.9			ND		65.8							2.5	2.5	4.6					1.4
September-07										22.4														
April-08	ND			ND	ND			0.8		22.1							2.1	ND	3.6					ND
April-09	1.7	ND		ND	ND			4.2		19.5							1.2	1.7	3.2		ND	ND		ND
February-10	2010 Pilot Study CAP18™												Upgradient	Side Gradient of 2010 Pilot Study Area										
June-10								6.1		26.8														
September-10										19.1														
August-11										14.0	4.1	NA												
October-11	7.0	0.48 J	NA	ND	ND	NA	NA	2.2		4.4	2.6	NA		1.8	NA	NA	ND	2.4	4.4	NA	1	2.5	NA	0.47 J
April-12	6.0	1.0 U	0.33 J	1.0 U	1.0 U	17	0.4 J	4.0		5.6	2.4	22	1.0 U	1.2	1.0 U	1.2	1.0 U	2.1	2.8	6.6	2.9	2.3	23	0.50 J
May-13	5.0	0.31 U	0.24 U	0.71 J	0.6 J	14.3	0.45 J	4.3		0.60 J	0.88 J	28.4	0.32 U	0.32 U	0.38 J	13.1	1.3	4.0	5.1	12.3	0.93 J	2.0	28.6	0.79 J
April-14	3.4	0.31 U	0.33 U	0.26 U	0.41 J	44.9	1.4	6.6		0.71 J	0.50 J	12.6	0.26 U	0.26 U	0.30 U	5.9	0.95 J	4.9	4.7	7.1	4.1	2.1	18.5	0.63 J
May-15	3.9	0.31 U	0.5 U	0.5 U	0.27 J	58	1.8	5.7		7.0	1.7	14.4	0.50 U	0.50 U	0.50 U	6.5	1.1	2.2	2.3	5.0	1.9	1.1	19.4	0.43 J
May-16	3.3	0.31 U	0.5 U	0.5 U	0.81 J	73.4	2.1	7.5		3.8	0.55 J	2.2	0.50 U	0.50 U	0.50 U	4.3	0.75 J	3.2	2.8	4.5	0.50 J	2.2	21.8	0.32 J
May-17	6.2	0.31 U	0.5 U	1.1	3.6	51.2	1.5	4.0		9.5	0.62 J	0.5 U	0.50 U	0.50 U	0.50 U	2.6	0.60 J	3.3	2.7	4.6	1.1	0.5 U	17.2	0.50 U
May-18**	2.4	0.40 U	0.40 U	1.5	3.1	37	0.67 J	1.6		1.4 J	0.35 J	3.4 J	0.26 J	0.40 UJ	0.40 UJ	11 J	1.8 J	1.4	1.4	5.0				
March-19	2.6	1.0 U	1.0 U	1.0 UJ	0.53 J	55 J	1.5 J	5.4 J		5.5	1.0 U	1.5	0.40 UJ	0.60 J	0.40 U	1.8	0.20 U	1.5	1.3	7.0				
February and March-20 (Hydrasleeve© Results)	4.1/3.0***	0.40 U/0.40 U***	0.40 U/0.40 U***	0.70 J/ 0.98 J***	0.40 U/0.67 J***	2.5/ 25***	0.40 U/0.66 J***	0.20 U/1.7***		2.2	1.5	4.9	0.40 U	0.40 U	0.21 J	4.6	0.84 J	1.6	1.5	7.2				
March-21	2.3	0.40 U	0.40 U	0.40 U	2.3	95	2.3	5.8		1.7	0.46 J	5.3	0.40 U	0.40 U	0.40 U	5.9	1.2 J	1.4	1.7	19.0				

Notes:
All results are in µg/L
Data compiled from 2012, 2013 and 2014 Annual Groundwater Monitoring Reports (CTI, 2012; CTI, 2013; and CTI, 2014), Third Five-Year Review (USACE, 2012), spreadsheet of 1998-2007 data from USACE, and 2015 and 2016 sampling events.
When discrepancies in data were encountered the data presented in the 2014 Annual Groundwater Monitoring Report was used.
*Data for the following well pairs were combined in the Five-Year Review: DCF01-40 and DCF06-40; and DCF96-25 and DCF06-25.
**Data collected was from May 29 - June 8, 2018.
***Low-flow sample result
Blank = sample not collected or data not available
Bold = detection
Shaded = above RG, which is based on the MCL
cis-1,2 = cis-1,2-dichloroethene
J = The analyte was detected at the reported concentration; the quantiation is an estimate.

MCL = U.S. EPA Maximum Contaminant Level (May 2021)
µg/L = micrograms per liter
NA = not available
ND = not detected
PCE = tetrachloroethene

RG = remediation goal
trans-1,2 = trans-1,2-dichloroethene
TCE = trichloroethene
U = Not detected. The associated number indicates the analyte limit of detection.
VC = vinyl chloride

Table 2.3
Historical Analytical Results Summary - AOC 1 and AOC 2 Pilot Study Area
2021 Annual Long-Term Monitoring Report
Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027)
Fort Riley, Kansas

Study Area	Downgradient of Treatment Area																							
Well	DCF02-41					DCF02-44A			DCF02-44C			DCF02-47A			DCF02-47C			DCF02-48A				DCF02-48C		
Date/Compound	PCE	TCE	cis-1,2	trans-1,2	VC	PCE	TCE	cis-1,2	PCE	TCE	cis-1,2	PCE	TCE	cis-1,2	PCE	TCE	cis-1,2	PCE	TCE	cis-1,2	trans-1,2	PCE	TCE	cis-1,2
RG (µg/L)	5	5	70	10	2	5	5	70	5	5	70	5	5	70	5	5	70	5	5	70	10	5	5	70
February-00																						11.8		
July-00																						6.3		
October-00																						4.9		
March-01																						13.6		
October-01																						21.6		
March-02																						21.6		
July-02																						16.3		
October-02	10.9	39.5	42.6	0.60	0.8 U	57.7	8.6	8.4	59.1	6.8	5.5	9.4	5.7	36.6	7	0.6 U	0.5 U	8.2	5.9	14.8	0.5 U	27.5	4.3	4.4
April-03	2.4	26.8	51.5	0.90	0.8 U	66	6.8	7.0	79.4	7.7	7.0	6.5	4.8	33.3	3.2	0.6 U	1.1	4.6	4.2	13	0.5 U	22.2	2.3	2.3
July-03	1.1 U	22.1	57.6	0.80	0.8 U	57.4	6.7	6.0	66.1	7.4	6.8	5.3	3.2	31.5	4.0	0.6 U	0.5 U	5.8	3.0	10.2	0.5 U	17.1	2.2	1.5
October-03	1.5	24.4	73.9	0.90	0.8 U	50.6	8.1	7.2	39.3	5.5	4.6	4.1	3.4	20.7	3.1	0.6 U	0.5 U	3.0	4.1	14.7	0.5 U	12.3	1.5	1.6
April-04	1.1 U	17.8	51.5	0.90	0.8 U	60	7.7	7.5	46.4	5.5	5.1	4.1	2.6	16	2.6	0.6 U	0.5 U	1.9	2.9	8.0	0.5 U	9.9	1.3	1.9
August-04	1.1 U	12.4	77.9	1.10	0.8 U	53.3	7.5	7.1	53.5	6.7	6.9	1.1 U	1.1	18.6	1.8	0.6 U	0.5 U	2.0	2.0	5.9	0.5 U	9.3	0.9	0.9
April-05	0.5 U	6.6	97.8		0.5 U	62.6	8.4	7	59.6	8.1	7.4	2.7	1.6	84	0.8	0.5 U	0.5 U	1.3	2.3	7.4		3.9	0.5 U	0.5 U
August-05			84.2																					
October-05	0.5 U	5.3	74.3		0.5 U	45.3	6.8	7.1	51.5	6.8	7.9	1.5	1.2	14.3	3.6	0.5 U	0.5 U	1.0	1.4	7.0		10.3	1.0	0.8
March-06	0.5 U	3.5	83.3		0.5 U	42.1	5.1	5.4	50.5	8	11.9	2.4	1.4		2.5	0.5 U		1.3	1.4			13.7	1.2	
April/May-06	Downgradient of 2006 Pilot Study Area																							
October-06	1.1 U	2.0	84.3	1.2	0.8 U	33.4	5.1	4.7	45.1	8.3	9.1	1.1 U	0.6 U	11.4	2.3	0.6 U	0.5 U	1.3	3.1	7.9	0.5 U	11.1	1.8	0.7
January-07	1.1 U	1.8	84.9	1.5	0.8 U				56.5	9.1	9													
April-07	ND	1.3	110			56.4	8.4		56.4	7.1		1.5			ND			ND	1.7			5.1		
September-07			108						13.2															
April-08	ND	ND	99.8			4.9	0.9		6.6	2.5					22.0			ND	1.7			23.5		
April-09	ND	ND	98.9			2.0	0.7		2.1	ND					10.1			ND	1.4			9.2		
February-10	Downgradient of 2010 Pilot Study Area																							
June-10			83.5												2.2									
September-10			78.3																					
August-11	ND	ND	76.0	NA	NA																			
October-11	ND	0.33 J	78.0	NA	NA	3.2	0.94	NA	6.9	1.5	NA				13.0	NA	NA	ND	0.67 J	NA	NA	2.1	0.33 J	NA
April-12	1.0 U	1.0 U	76.0	1.3	1.0 U	3.4	1.4	1.9	11	2.1	3.4				18.0	2.0	2.1	1.0 U	0.66 J	4.8	1.0 U	1.9	0.42 J	0.98 J
May-13	0.32 U	0.31 U	83.9	1.6	0.44 U	25.5	3.8	4.8	27.5	3.7	5.5				6.4	0.68 J	0.65 J	0.32 U	1.3	7.8	0.23 U	6.6	0.96 J	1.6.4 3
April-14	0.26 U	0.30 U	74.4	2.2	0.57 J	22.3	3.9	6.0	22	3.7	5.8				3.2	0.30 U	0.633 U	NS	NS	NS	NS	8.2	1.2	1.3
May-15	0.50 U	0.50 U	62.1	2.6	0.50 U	21.0	4.3	5.9	23.3	2.9	4.0				1.3	0.50 U	0.50 U	1.1	0.95 J	4.2	0.23 J	3.8	0.43 J	0.31 J
May-16	0.50 U	0.50 U	66.6	1.9	0.45 J	12.4	2.7	2.8	18.5	2.9	4.3				6.2	0.38 J	0.50 U	0.53 J	0.84 J	3.6	0.50 U	11.0	2.1	2.3
May-17	0.50 U	0.50 U	61.6	2.0	0.50 U	3.2	0.82 J	1.3	9.8	2.1	4.0				17.7	2.4	3.0	0.60 J	1.0	5.2	0.50 U	5.4	0.95 J	1.5
May-18**	0.40 U	0.40 U	49.0	0.93 J	0.41 J	3.3	0.79 J	0.73 J	10	1.9	3.8				12.0	1.7	2.3	0.40 U	0.75 J	3.0	0.40 U	2.1	0.50 J	0.92 J
March-19	1.00 U	1.00 U	34.0	0.62 J	1.00 U	4.0	0.62 J	0.74 J	5.0 J	0.71 J	0.89 J				12.0 J	1.1 J	1.1 J	0.33 J	0.96 J	4.2 J	0.40 UJ	5.0 J	0.72 J	0.99 J
February and March-20 (Hydrasleeve© Results)	0.40 U	0.40 U	46.0	0.85 J	0.20 U	0.65 J	0.17 J	0.23 J	1.3	0.16 J	0.40 U				2.2	0.40 U	0.40 U	0.34 J***	0.37 J***	3.1***	0.40 U***	2.0	0.23 J	0.40 U
March-21	0.40 U	0.40 U	44.0	1.0	0.20 U	2.0	0.36 J	0.38 J	1.4	0.40 U	0.40 U				1.5	0.40 U	0.89 J	0.40 U	0.37 J	1.9	0.40 U	0.40 U	0.37 J	1.9

Notes:
All results are in µg/L
Data compiled from 2012, 2013 and 2014 Annual Groundwater Monitoring Reports (CTI, 2012; CTI, 2013; and CTI, 2014), Third Five-Year Review (USACE, 2012), spreadsheet of 1998-2007 data from USACE, and 2015 and 2016 sampling events.
When discrepancies in data were encountered the data presented in the 2014 Annual Groundwater Monitoring Report was used.
*Data for the following well pairs were combined in the Five-Year Review: DCF01-40 and DCF06-40; and DCF96-25 and DCF06-25.
**Data collected was from May 29 - June 8, 2018.
***Low-flow sample result

Blank = sample not collected or data not available
Bold = detection
Shaded = above RG, which is based on the MCL
cis-1,2 = cis-1,2-dichloroethene
J = The analyte was detected at the reported concentration; the quantiation is an estimate.

MCL = U.S. EPA Maximum Contaminant Level (May 2021)
µg/L = micrograms per liter
NA = not available
ND = not detected
PCE = tetrachloroethene

RG = remediation goal
trans-1,2 = trans-1,2-dichloroethene
TCE = trichloroethene
U = Not detected. The associated number indicates the analyte limit of detection.
VC = vinyl chloride

Table 2.4
Historical Analytical Results Summary - AOC 3 Pilot Study Area
2021 Annual Long-Term Monitoring Report
Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027)
Fort Riley, Kansas

Study Area	Treatment Area											Downgradient		
Well	DCF02-42				DCF96-25*			DCF06-25*				DCF02-46A		DCF02-46C
Date/Compound	PCE	TCE	cis-1,2	VC	PCE	TCE	cis-1,2	PCE	TCE	cis-1,2	trans-1,2	PCE	TCE	PCE
RG (µg/L)	5	5	70	2	5	5	70	5	5	70	2	5	5	5
February-00					48.3	3.3	3.0							
July-00					60.3	4.3	5.1							
October-00					56.4	4.3	4.9							
March-01					56.6	5.6	4.8							
October-01					68.6	5.8	6.3							
March-02					67.2	6.2	6.5							
July-02					58.5	5.2	6.6							
October-02	64.9	5.8	5.5	0.8 U	64.9	6.5	7.1					3.6	1.7	1.3
April-03					74.2	7.5	10.3					2.0	0.8	1.1 U
July-03	77.0	5.4	4.0	0.8 U	65.7	9.3	12.9					2.6	1.2	1.1 U
October-03	75.1	5.5	4.9	0.8 U	74.3	8.3	10.7					1.5	0.7	1.1 U
April-04	64.9	5.1	4.2	0.8 U	53.9	8.7	12.2					1.7	0.8	1.1 U
August-04	44.8	3.6	2.7	0.8 U	49.7	6.2	9.9					1.7	0.6 U	1.1 U
April-05	55.7	5.1	3.8	0.5 U	54.0	6.8	9.8					0.8	0.5 U	0.5 U
August-05	60.1				61.3									
October-05					58.3	6.6	10.7					1.5	0.7	0.5 U
March-06	58.9	2.8	1.4	0.5 U	62.4	6.8	10.3					0.5 U	0.6	0.5 U
Jan/Feb-06	2006 Sodium Permanganate Vadose Zone Pilot Study											Downgradient of 2006 Pilot Study		
April/May-06	2006 Potassium Permanganate Saturated Zone Pilot Study											Downgradient of 2006 Pilot Study		
October-06								61.2				1.2	0.8	1.1 U
January-07														
April-07												ND		ND
October-07	29.1							8.0						
April-08	12.6	0.6						32.9				ND		11.8
April-09	16.5	1.3						14.9				9.6		23.1
June-10	3.2							22.8				21.5		18.0
August-11								33.0				10.0		
October-11								25.0				7.9		2.6
April-12	6.3	0.28 J	1.0 U	0.29 J				27.0	2.7	3.0	1.0 U	3.9	0.80 J	0.64 J
May-13	NS	NS	NS	NS				39.5	5.5	8.5	0.25 J	3.9	1.2	0.33 J
April-14	NS	NS	NS	NS				37.6	3.9	5.2	0.34 U	0.26 U	0.30 U	0.93 J
May-15	22.2	2.3	2.7	0.50 U	31.9**	3.7**	4.1**	NS	NS	NS	NS	0.43 J	0.50 U	0.46 J
May-16	5.5	0.33 J	0.50 U	0.50 U				28.8	3.0	3.9	0.50 U	0.89 J	0.33 J	0.39 J
May-17	1.8	0.50 U	7..3 J	0.50 U				22.8	1.9	1.4	0.50 U	2.1	0.50 U	6.4
May-18***								21	2.1	3.1	0.40 U	6.1	1.2	2.2
March-19	3.2 J	0.40 UJ	0.40 UJ	0.20 UJ				18	1.4	1.2	0.40 U	1.3	0.26 J	0.65 J
February and March-20	3.4	0.40 U	0.40 U	0.20 U				7.4	0.65 J	0.63 J	0.40 U	9.4	1.7	5.5
March-21	13	1.1	1.5	0.20 U				15	1.2	1.3	0.40 U	10	1.8	9.6

Notes:
All results are in µg/L
Data compiled from 2012, 2013 and 2014 Annual Groundwater Monitoring Reports (CTI, 2012; CTI, 2013; and CTI, 2014), Third Five-Year Review (USACE, 2012), spreadsheet of 1998-2007 data from USACE, and 2015 and 2016 sampling events.
When discrepancies in data were encountered the data presented in the 2014 Annual Groundwater Monitoring Report was used.
*Data for the following well pairs were combined in the Five-Year Review and have been combined in this report: DCF01-40 and DCF06-40; and DCF96-25 and DCF06-25.
**It is believed that well DCF96-25, which was scheduled to be abandoned, may have been sampled instead of DCF06-25.
***Data collected was from May 29 - June 8, 2018.

Blank = sample not collected or data not available
Bold = detection
Shaded = above RG, which is based on the MCL
cis-1,2 = cis-1,2-dichloroethene
J = The analyte was detected at the reported concentration; the quantiation is an estimate.

MCL = U.S. EPA Maximum Contaminant Level (May 2021)
µg/L = micrograms per liter
ND = not detected

NS = well not sampled
PCE = tetrachloroethene
RG = remediation goal

TCE = trichloroethene
trans-1,2-DCE = trans-1,2-dichloroethene
VC = vinyl chloride

Table 2.5
Historical Analytical Results Summary - Pilot Study Area on the Island
2021 Annual Long-Term Monitoiring Report
Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027)
Fort Riley, Kansas

Study Area	**Treatment Area**			**Side Gradient**		
Well	**DCF02-49C**			**DCF00-34C**		
Date/Compound	**PCE**	**TCE**	**cis-1,2**	**PCE**	**TCE**	**cis-1,2**
MCL/RSK (µg/L)	**5**	**5**	**70**	**5**	**5**	**70**
February-00				1.1 U	0.6 U	
July-00				1.1 U	0.6 U	**1.2**
October-00				1.1 U	0.6 U	**1**
March-01				1.1 U	0.6 U	**0.7**
October-01				1.1 U	0.6 U	**0.5**
March-02				1.1 U	0.6 U	**1.3**
July-02				1.1 U	**1.2**	**1.4**
October-02	**5.4**	**1.8**	**3.2**	**1.1**	**1.1**	**2.4**
April-03	**10.5**	**2.5**	**3.8**	1.1 U	**0.9**	**2.6**
July-03	**13.3**	**2.9**	**3.7**	1.1 U	**1**	**2.1**
October-03	**12.6**	**2.9**	**4.1**	1.1 U	**0.7**	**2.3**
April-04	**22.7**	**3.7**	**4.3**	1.1 U	0.6 U	**1.7**
August-04	**16.8**	**4.6**	**6.9**	1.1 U	0.5 U	**1.6**
April-05	**24.5**	**4.6**	**6.8**	0.5 U	**0.5**	**1.4**
October-05	**26.3**	**4.3**		**0.5**	**0.5**	**1.5**
March-06	**30.4**	**4.9**	**6.1**	**0.5**		
September-06	2006 Pilot Study CAP18™					
October-06	**24.3**	**4**	**5.8**	1.1 U	0.6 U	**1**
January-07	**20.2**	**4.4**	**7.2**			
April-07	**17.2**	**6.3**				
April-08	**2.4**	**2.9**				
April-09	ND	**0.6**				
October-11	ND	**1.1**	NA	NA	NA	NA
April-12	1.0 U	1.0 U	**9.8**	**0.29 J**	**0.68 J**	**1.8**
May-13	0.32 U	0.31 U	**4.1**	0.32 U	0.31 U	**1.6**
April-14	0.26 U	0.30 U	**1.6**	0.26 U	0.30 U	**0.95 J**
May-15	0.5 U	**1.0**	**3.6**	0.50 U	0.50 U	**0.78 J**
May-17	**1.8**	0.50 U	0.50 U	0.50 U	0.50 U	**0.43 J**
*May-18	0.40 U	0.40 U	**9.4**	0.40 U	0.40 U	**0.49 J**
March-19	0.40 UJ	0.40 UJ	**5.2 J**	0.40 UJ	0.40 UJ	**0.37 J**
February and March-20	0.40 U	**0.40 J**	**5.2**			
March-21	**0.95 J**	**0.61 J**	**7.6**			

Notes:
All results are in µg/L
Data compiled from 2012, 2013 and 2014 Annual Groundwater Monitoring Reports (CTI, 2012; CTI, 2013; and CTI, 2014), Third Five-Year Review (USACE, 2012), spreadsheet of 1998-2007 data from USACE, and 2015 sampling event.
When discrepancies in data were encountered the data presented in the 2014 Annual Groundwater Monitoring Report was used.
*Data collected from May 29 - June 8, 2018.

Blank = sample not collected or data not available
Bold = detection
Shaded = above MCL/RSK
cis-1,2-DCE = cis-1,2-dichloroethene
MCL = maximum contaminant level (May 2021)
µg/L = micrograms per liter

NA = not available
ND = not detected
PCE = tetrachloroethene
RSK = Risk-Based Standards for Kansas
TCE = trichloroethene

Table 2.6
Contaminant Concentration Trends
AOC 1 and AOC 2 Pilot Study Area
2021 Annual Long-Term Monitoring Report
Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027)
Fort Riley, Kansas

Treatment Area

Contaminant	Well		
	DCF92-05	DCF93-13	DCF06-40[1]
PCE	D	D	D
TCE	D	D	S
cis-1,2-DCE	D	NT	NT
trans-1,2-DCE	-	S	-
Vinyl Chloride	-	I	-

Side Gradient

Contaminant	Well	
	DCF93-19	DCF93-20
PCE	D	NT
TCE	D	D
cis-1,2-DCE	NT	D
trans-1,2-DCE	-	-
Vinyl Chloride	S	-

Downgradient

Contaminant	Well					
	DCF02-41	DCF02-44A	DCF02-44C	DCF02-47C	DCF02-48A	DCF02-48C
PCE	-	D	D	NT	D	D
TCE	D	D	D	NT	D	D
cis-1,2-DCE	PD	D	D	NT	D	D
trans-1,2-DCE	I	-	-	-	-	-
Vinyl Chloride	-	-	-	-	-	-

Notes:
Contaminants = sequential degradation product(s) from top to bottom
1 Data for the following well pairs were combined in the Five-Year Review: DCF01-40 and DCF06-40.
- = Mann-Kendall trend analysis not performed
cis-1,2 DCE = cis-1,2-dichloroethene
D = decreasing trend
I = increasing trend
NT = no trend
PD = probably decreasing
PI = probably increasing
S = stable
PCE = tetrachloroethene
trans-1,2-DCE = trans-1,2-dicloroethene
TCE = trichloroethene

Table 2.7
Post 2006 Pilot Study
Contaminant Concentration Trends - AOC 1 and AOC 2 Pilot Study Area
2021 Annual Long-Term Monitoring Report
Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027)
Fort Riley, Kansas

Treatment Area

Contaminant	Well		
	DCF92-05	DCF93-13	DCF06-40[1]
PCE	S	D	D
TCE	-	NT	S
cis-1,2-DCE	-	I	NT
trans-1,2-DCE	-	I	-
Vinyl Chloride	-	I	-

Side Gradient

Contaminant	Well	
	DCF93-19	DCF93-20
PCE	-	NT
TCE	-	D
cis-1,2-DCE	NT	S
trans-1,2-DCE	-	-
Vinyl Chloride	D	-

Downgradient

Contaminant	Well					
	DCF02-41	DCF02-44A	DCF02-44C	DCF02-47C	DCF02-48A	DCF02-48C
PCE	-	D	D	S	S	D
TCE	D	D	D	NT	D	PD
cis-1,2-DCE	D	D	D	S	D	S
trans-1,2-DCE	S	-	-	-	-	-
Vinyl Chloride	-	-	-	-	-	-

Notes:

Contaminants = sequential degradation product(s) from top to bottom

1 Data for the following well pairs were combined in the Five-Year Review: DCF01-40 and DCF06-40.

- = Mann-Kendall trend analysis not performed

cis-1,2 DCE = cis-1,2-dichloroethene

D = decreasing trend

I = increasing trend

NT = no trend

PD = probably decreasing

S = stable

PCE = tetrachloroethene

trans-1,2-DCE = trans-1,2-dicloroethene

TCE = trichloroethene

Table 2.8
Contaminant Concentration Trends
AOC 3 Pilot Study Area
2021 Annual Long-Term Monitoring Report
Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027)
Fort Riley, Kansas

Treatment Area

Contaminant	Well	
	DCF02-42	DCF06-25[1]
PCE	D	D
TCE	D	D
cis-1,2-DCE	D	PD
trans-1,2-DCE	-	-
Vinyl Chloride	-	-

Downgradient

Contaminant	Well	
	DCF02-46A	DCF02-46C
PCE	NT	PI
TCE	S	-
cis-1,2-DCE	-	-
trans-1,2-DCE	-	-
Vinyl Chloride	-	-

Notes:
Trends based on Mann-Kendall analysis (Appendix D) of current data and available historical data presented in Table 2.4.
Contaminants = sequential degradation product(s) from top to bottom
1 Data for the following well pairs were combined in the Five-Year Review: DCF96-25 and DCF06-25.
- = Mann-Kendall trend analysis not performed
cis-1,2 DCE = cis-1,2-dichloroethene
D = decreasing trend
PD = probably decreasing
PI = probably increasing
S = stable
PCE = tetrachloroethene
trans-1,2-DCE = trans-1,2-dicloroethene
TCE = trichloroethene

Table 2.9
Post 2006 Pilot Study
Contaminant Concentration Trends - AOC 3 Pilot Study Area
2021 Annual Long-Term Monitoring Report
Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027)
Fort Riley, Kansas

Treatment Area

Contaminant	Well	
	DCF02-42	DCF06-25[1]
PCE	D	D
TCE	D	D
cis-1,2-DCE	NT	D
trans-1,2-DCE	-	-
Vinyl Chloride	-	-

Downgradient

Contaminant	Well	
	DCF02-46A	DCF02-46C
PCE	NT	NT
TCE	NT	-
cis-1,2-DCE	-	-
trans-1,2-DCE	-	-
Vinyl Chloride	-	-

Notes:

Trends based on Mann-Kendall analysis (Appendix D) of current data and available historical data presented in Table 2.4.

Contaminants = sequential degradation product(s) from top to bottom

[1] Data for the following well pairs were combined in the Five-Year Review: DCF96-25 and DCF06-25.

- = Mann-Kendall trend analysis not performed

cis-1,2 DCE = cis-1,2-dichloroethene

D = decreasing trend

NT = no trend

PCE = tetrachloroethene

trans-1,2-DCE = trans-1,2-dicloroethene

TCE = trichloroethene

Table 2.10
Contaminant Concentration Trends - Pilot Study Area on the Island
2021 Annual Long-Term Monitoring Report
Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027)
Fort Riley, Kansas

All Data	
	Treatment Area
	Well
Contaminant	DCF02-49C
PCE	D
TCE	D
cis-1,2-DCE	NT
trans-1,2-DCE	-
Vinyl Chloride	-

Post 2006 Data	
	Treatment Area
	Well
Contaminant	DCF02-49C
PCE	D
TCE	D
cis-1,2-DCE	S
trans-1,2-DCE	-
Vinyl Chloride	-

Notes:
Trends based on Mann-Kendall analysis (Appendix D) of current data and available historical data presented in Table 2.5.
Contaminants = sequential degradation product(s) from top to bottom
[1] Data for the following well pairs were combined in the Five-Year Review: DCF96-25 and DCF06-25.
- = Mann-Kendall trend analysis not performed
cis-1,2 DCE = cis-1,2-dichloroethene
D = decreasing trend
NT = no trend
S = Stable
PCE = tetrachloroethene
trans-1,2-DCE = trans-1,2-dicloroethene
TCE = trichloroethene

Table 2.11
March 2021 Groundwater MNA Parameter Evaluation
2021 Annual Long-Term Monitoiring Report
Dry Cleaning Facilities Area Operable Unit 003 (FTRI-027)
Fort Riley, Kansas

Type		Field Measurement							Laboratory Analysis											
Parameter / Well ID / Units	Location	Temperature (^oC)	pH	Specific Conductivity (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Ferrous Iron (mg/L)	Methane (µg/L)	Ethene (µg/L)	Ethane (µg/L)	Alkalinity (Total as $CaCO_3$) (mg/L)	Chloride (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Sulfide (mg/L)	TOC (mg/L)	TCE (µg/L)	cis-1,2,-DCE (µg/L)	Vinyl Chloride (µg/L)
Side Upgradient Well																				
DCF92-01		**14.73**	**6.99**	**2.18**	**2.77**	**140**	**0.00**	**0.00**	2.00 U	1.40 U	1.50 U	**370**	**367**	**6.37**	**141**	1.90 U	**1.90**	0.40 U	0.40 U	0.20 U
AOC 1 and AOC 2 Pilot Study Area																				
DCF06-40	T	**14.79**	**6.58**	**2.19**	**2.58**	**-8.00**	**0.00**	**6.50**	**380**	1.40 U	1.50 U	**610**	**240**	**0.54**	**200**	1.90 U	**2.50**	**0.46 J**	**5.30**	0.20 U
DCF92-05	T	**15.26**	**6.72**	**2.08**	**0.00**	**153**	**0.00**	**0.00**	2.00 U	1.40 U	1.50 U	**400**	**440**	**4.90**	**140**	1.90 U	**2.20**	0.40 U	0.40 U	0.20 U
DCF93-13	T	**18.75**	**6.53**	**2.00**	**0.00**	**-75.0**	**6.10**	**5.50**	**360**	1.40 U	1.50 U	**440**	**380**	0.20 U	**170**	1.90 U	**2.40**	**2.30**	**95.0**	**5.80**
DCF93-19	S	**15.71**	**7.89**	**2.66**	**0.67**	**-60.0**	**0.00**	**3.50**	**1700**	1.40 U	1.50 U	**470**	**520**	0.20 U	**25.0**	**0.80 J**	**2.00**	0.40 U	**5.90**	**1.20 J**
DCF93-20	S	**14.76**	**7.04**	**2.28**	**3.54**	**17.0**	**2.50**	**0.00**	**30.0**	1.40 U	1.50 U	**300**	**350**	**0.42**	**390**	0.80 U	**1.90**	**1.70**	**19.0**	0.20 U
DCF02-41	D	**14.46**	**6.58**	**2.14**	**0.00**	**-116**	**2.00**	**7.00**	**20.0**	1.40 U	1.50 U	**520**	**360**	0.20 U	**190**	1.90 U	**1.60**	0.40 U	**44.0**	0.20 U
DCF02-44A	D	**16.72**	**6.61**	**1.93**	**0.00**	**85.0**	**0.00**	**0.00**	2.00 U	1.40 U	1.50 U	**430**	**400**	**2.70**	**110**	1.90 U	**2.20**	**0.36 J**	**0.38 J**	0.20 U
DCF02-44C	D	**15.32**	**6.58**	**1.68**	**0.00**	**81.0**	**0.00**	**0.00**	2.00 U	1.40 U	1.50 U	**390**	**320**	**2.60**	**88.0**	**0.80 J**	**1.50**	0.40 U	0.40 U	0.20 U
DCF02-47C	D	**14.29**	**6.72**	**1.53**	**0.00**	**110**	**49.7**	**0.00**	2.00 U	1.40 U	1.50 U	**330**	**270**	**1.20**	**140**	**0.80 J**	**1.50**	0.40 U	**0.89 J**	0.20 U
DCF02-48A	D	**14.70**	**6.66**	**2.26**	**0.00**	**2.00**	**10.9**	**0.00**	**2.10**	1.40 U	1.50 U	**440**	**500**	0.20 U	**260**	1.90 U	**3.00**	**0.37 J**	**1.90**	0.20 U
DCF02-48C	D	**14.18**	**6.77**	**1.64**	**0.00**	**63.0**	**25.9**	**0.00**	**3.50**	1.40 U	1.50 U	**320**	**310 J**	**1.20**	**144 J**	1.90 U	**1.70**	0.40 U	**0.23 J**	0.20 U
AOC 3 Pilot Study Area																				
DCF02-42	T	**16.61**	**6.03**	**2.23**	**2.24**	**152**	**4.90**	**0.00**	2.00 U	1.40 U	1.50 U	**400**	**350**	**7.20**	**150**	**0.80 J**	**1.40**	**1.10**	**1.50**	0.20 U
DCF06-25	T	**14.32**	**7.97**	**2.30**	**1.16**	**141**	**0.00**	**0.00**	2.00 U	1.40 U	1.50 U	**410**	**360**	**6.60**	**130**	**0.80 J**	**1.60**	**1.20**	**1.30**	0.20 U
DCF02-43	D	**13.76**	**8.07**	**1.38**	**1.46**	**145**	**41.2**	**0.00**	2.00 U	1.40 U	1.50 U	**363**	**120**	**3.90 J**	**120 J**	1.90 U	**1.20**	0.40 U	0.40 U	0.20 U
DCF02-46A	D	**15.39**	**6.57**	**2.32**	**0.00**	**138**	**0.00**	**0.00**	2.00 U	1.40 U	1.50 U	**460**	**370**	**5.50**	**280**	1.90 U	**3.40**	**1.80**	**1.20**	0.20 U
DCF02-46C	D	**15.18**	**6.62**	**1.80**	**0.00**	**131**	**5.10**	**0.00**	2.00 U	1.40 U	1.50 U	**370**	**310**	**4.60**	**160**	0.80 U	**1.50**	**0.60 J**	0.40 U	0.20 U
Pilot Study Area on The Island																				
DCF02-49C	T	**13.51**	**6.66**	**2.17**	**0.00**	**-111**	**13.2**	**2.50**	**340**	1.40 U	1.50 U	**490**	**370**	0.20 UJ	**250**	1.90 U	**2.70**	**0.61 J**	**7.60**	0.20 U
Screening Level[2]		<20	5 to 9	nsv	< 0.5	< 50	nsv	> 1	> 500	> 10	> 10	> 2x bck[1]	> 2x bck[1]	< 1	< 20	> 1	> 20	PCE daughter	TCE daughter	DCE daughter

Notes:

[1] using upgradient well DCF92-01 as background:
2x alkalinity = 756 mg/L (378 x 2) and
2x chloride = 568 mg/L (284 x 2)

[2] based on *Technical Protocol for the Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater* (EPA, 1988).

Bold = detection
Shaded = meets screening level
bck = background
^oC = degree Celsius
D = down gradient of treatment zone
DCE = dichloroethene
DO = dissolved oxygen
ID = identification
J = The analyte was detected at the reported concentration; the quantitation is an estimate.
µg/L = micrograms per liter
mg/L = milligrams per liter
mS/cm = millisiements per centimeter
mV = millivolt
nsv = no screening value
NTU = nephelometric turbidity unit
ORP = oxygen reduction potential
S = side gradient to treatment zone
T = treatment/most contaminated zone
TCE = trichloroethene
TOC = total organic carbon
U = not detected. The associated number indicates the analyte limit of detection.
UJ = not detected. The associated number indicates the LOD, which may be inaccurate.
R = rejected

Appendix E – Data Reports

Appendix E3

Operable Unit 005 (OU 005) 354 Area Solvent Detections (FRTI-031)

Report Reference	**Excerpted Data Included**	**Page Number**
Final Pre-Design Investigation Report Addendum, 354 Area Solvent Detections, Operable Unit 005, Fort Riley, Kansas. July 2021.	Quarterly 2020 Groundwater Sampling Data Tables and Mann-Kendall Analysis and Trend Plots	E3-1

Table 4-1
Summary of 2020 Groundwater Analytical Data for Contaminants of Concern
354 Area Solvent Detections OU 005
Fort Riley, Kansas

Monitoring Well ID: 354-01-26					Volatile Organic Compounds			
				Analyte:	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	Benzene
				Unit:	µg/L	µg/L	µg/L	µg/L
				PALs:	5	5	70	5
				Aquifer Screened:	Terrace Aquifer			
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**				
1238991	**354-01-26/GW01**	**Quarter 1**	**1/13/2020**		0.5 U	0.5 U	0.5 U	0.5 U
1316958	**354-01-26/GW02**	**Quarter 2**	**5/18/2020**		0.5 U	0.5 U	0.5 U	0.5 U
410-6880-1	**354-01-26/GW03**	**Quarter 3**	**7/6/2020**		0.5 U	0.5 U	0.5 U	0.5 U
410-16309-1	**354-01-26/GW04**	**Quarter 4**	**10/5/2020**		0.5 U	0.5 U	0.5 U	0.5 U

Monitoring Well ID: 354-01-27					Volatile Organic Compounds			
				Analyte:	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	Benzene
				Unit:	µg/L	µg/L	µg/L	µg/L
				PALs:	5	5	70	5
				Aquifer Screened:	Terrace Aquifer			
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**				
1239002	**354-01-27/GW01**	**Quarter 1**	**1/14/2020**		**5**	0.5 U	0.5 U	0.5 U
1239003	**354-01-27/GW11**	**Quarter 1**	**1/14/2020**	**Duplicate of 354-01-27/GW01**	**5**	0.5 U	0.5 U	0.5 U
1316955	**354-01-27/GW02**	**Quarter 2**	**5/18/2020**		**16**	0.5 U	0.5 U	0.5 U
1316956	**354-01-27/GW22**	**Quarter 2**	**5/18/2020**	**Duplicate of 354-01-27/GW02**	**16**	0.5 U	0.5 U	0.5 U
410-7089-2	**354-01-27/GW03**	**Quarter 3**	**7/7/2020**		**19**	0.5 U	0.5 U	0.5 U
410-7089-3	**354-01-27/GW33**	**Quarter 3**	**7/8/2020**	**Duplicate of 354-01-27/GW03**	**20**	0.5 U	0.5 U	0.5 U
410-16309-2	**354-01-27/GW04**	**Quarter 4**	**10/5/2020**		**4.5**	0.5 U	0.5 U	0.5 U
410-16309-3	**354-01-27/GW44**	**Quarter 4**	**10/5/2020**	**Duplicate of 354-01-27/GW04**	**5.7**	0.5 U	0.5 U	0.5 U

Table 4-1
Summary of 2020 Groundwater Analytical Data for Contaminants of Concern
354 Area Solvent Detections OU 005
Fort Riley, Kansas

Monitoring Well ID: 354-01-30c					**Volatile Organic Compounds**			
				Analyte:	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	Benzene
				Unit:	µg/L	µg/L	µg/L	µg/L
				PALs:	5	5	70	5
				Aquifer Screened:	Kansas River Alluvial Aquifer			
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**				
1238994	**354-01-30C/GW01**	**Quarter 1**	**1/14/2020**		0.5 U	0.5 U	0.5 U	0.5 U
1317592	**354-01-30C/GW02**	**Quarter 2**	**5/19/2020**		0.5 U	0.5 U	0.5 U	0.5 U
410-6880-5	**354-01-30C/GW03**	**Quarter 3**	**7/7/2020**		0.5 U	0.5 U	0.5 U	0.5 U
410-16309-13	**354-01-30C/GW04**	**Quarter 4**	**10/6/2020**		0.5 U	0.5 U	0.5 U	0.5 U

Monitoring Well ID: 354-19-32					**Volatile Organic Compounds**			
				Analyte:	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	Benzene
				Unit:	µg/L	µg/L	µg/L	µg/L
				PALs:	5	5	70	5
				Aquifer Screened:	Terrace Aquifer			
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**				
1239001	**354-19-32/GW01**	**Quarter 1**	**1/14/2020**		**0.4 J**	0.5 U	0.5 U	0.5 U
1317593	**354-19-32/GW02**	**Quarter 2**	**5/19/2020**		**0.3 J**	0.5 U	0.5 U	0.5 U
410-6880-8	**354-19-32/GW03**	**Quarter 3**	**7/7/2020**		**0.35 J**	0.5 U	0.5 U	0.5 U
410-16309-4	**354-19-32/GW04**	**Quarter 4**	**10/7/2020**		**0.29 J**	0.5 U	0.5 U	0.5 U

Table 4-1
Summary of 2020 Groundwater Analytical Data for Contaminants of Concern
354 Area Solvent Detections OU 005
Fort Riley, Kansas

Monitoring Well ID: 354-19-33					Volatile Organic Compounds			
				Analyte:	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	Benzene
				Unit:	µg/L	µg/L	µg/L	µg/L
				PALs:	5	5	70	5
				Aquifer Screened:	Terrace Aquifer			
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**				
1238999	**354-19-33/GW01**	**Quarter 1**	**1/14/2020**		0.5 U	0.5 U	0.5 U	0.5 U
1317589	**354-19-33/GW02**	**Quarter 2**	**5/19/2020**		0.5 U	0.5 U	0.5 U	0.5 U
410-6880-9	**354-19-33/GW03**	**Quarter 3**	**7/7/2020**		0.5 U	0.5 U	0.5 U	0.5 U
410-16309-5	**354-19-33/GW04**	**Quarter 4**	**10/5/2020**		0.5 U	0.5 U	0.5 U	0.5 U

Monitoring Well ID: 354-19-34					Volatile Organic Compounds			
				Analyte:	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	Benzene
				Unit:	µg/L	µg/L	µg/L	µg/L
				PALs:	5	5	70	5
				Aquifer Screened:	Terrace Aquifer			
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**				
1239000	**354-19-34/GW01**	**Quarter 1**	**1/14/2020**		**29**	**0.4 J**	0.5 U	0.5 U
1317590	**354-19-34/GW02**	**Quarter 2**	**5/19/2020**		**21**	**0.3 J**	0.5 U	0.5 U
410-6880-12	**354-19-34/GW03**	**Quarter 3**	**7/7/2020**		**24**	0.5 U	0.5 U	0.5 U
410-16309-6	**354-19-34/GW04**	**Quarter 4**	**10/5/2020**		**70**	**1.6**	**1.5**	0.5 U

Table 4-1
Summary of 2020 Groundwater Analytical Data for Contaminants of Concern
354 Area Solvent Detections OU 005
Fort Riley, Kansas

Monitoring Well ID: 354-19-35					**Volatile Organic Compounds**			
				Analyte:	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	Benzene
				Unit:	µg/L	µg/L	µg/L	µg/L
				PALs:	5	5	70	5
				Aquifer Screened:	Kansas River Alluvial Aquifer			
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**				
1238995	**354-19-35/GW01**	**Quarter 1**	**1/14/2020**		**4**	**0.6 J**	**0.6 J**	0.5 U
1317584	**354-19-35/GW02**	**Quarter 2**	**5/19/2020**		**3**	**0.8 J**	**2**	0.5 U
410-6880-4	**354-19-35/GW03**	**Quarter 3**	**7/6/2020**		**4.2 J**	**1.2 J**	**0.99 J**	0.5 U
410-16309-11	**354-19-35/GW04**	**Quarter 4**	**10/6/2020**		**2.9**	**0.7 J**	**1.3 J**	0.5 U

Notes:

[1] = PALs for groundwater samples are based on USEPA MCLs as documented in the Record of Decision.
Record of Decision, 354 Area Solvent Detections (Operable Unit 005) at Main Post, Fort Riley, Kansas (Burns & McDonnell, 2006).

Highlighted - Concentration is equal to or exceeds PAL

Bold - compound was detected

ID = identification

J = estimated value

MCL = maximum contaminant level

PAL = project action limit

U = compound was not detected

UJ = data was estimated at the reporting limit

UR = rejected at the reporting limit

USEPA = United States Environmental Protection Agency

µg/l = micrograms per liter

Table 4-2
Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data
354 Area Solvent Detections OU 005
Fort Riley, Kansas

		Monitoring Well ID:	TS0292-01	TS0292-01	TS0292-01	TS0292-01
		Sample ID:	TS0292-01/GW01	TS0292-01/GW11	TS0292-01/GW02	TS0292-01/GW22
		Date Sampled:	1/13/2020	1/13/2020	5/19/2020	5/19/2020
		Laboratory ID:	1238989	1238990	1317588	1317591
		Notes:		Duplicate of TS0292-01/GW01		Duplicate of TS0292-01/GW02
		Aquifer Screened:	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	μg/L	2 U	2 U	2.0 U	2.0 U
Ethene	>10	μg/L	2 U	2 U	2.0 U	2.0 U
Methane	>500	μg/L	**3.7 J**	**3.8 J**	**4.4 J**	**4.7 J**
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**314 J**	**315 J**	**332**	**403**
Total Nitrate (EPA 353.2)	<1	mg/L	**14.2**	**14.3 J**	**8.4**	**9.0**
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	NA	NA
Sulfate (EPA 300.0)	<20	mg/L	**108**	**99.1**	**124**	**127**
Total Organic Carbon (SM 5310)	>20	mg/L	**1.9**	**2.1**	**1.5**	**1.4**
Sulfide (SM 4500)	>1	mg/L	0.25 UJ	0.25 UJ	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**267 J**	**264 J**	**264 J**	**262 J**

Notes:
1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sample is presented.
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average values for chloride in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 1974). Average values for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDonnell, 2003). Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aquifer), respectively.
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average values for alkalinity as $CaCO_3$ in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg/L as $CaCO_3$ (Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L as $CaCO_3$, with a range of 376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River Alluvial Aquifer) and 816 mg/L (terrace aquifer), respectively.

Bold indicates detection.
Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)
$CaCO_3$ = calcium carbonate
EJ = estimated value due to instrument calibration exceedance
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
μg/L = micrograms per liter

Table 4-2
Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data
354 Area Solvent Detections OU 005
Fort Riley, Kansas

		Monitoring Well ID:	**TS0292-01**	**TS0292-01**	**TS0292-01**	**TS0292-01**
		Sample ID:	**TS0292-01/GW03**	**TS0292-01/GW33**	**TS0292-01/GW04**	**TS0292-01/GW44**
		Date Sampled:	**7/7/2020**	**7/7/2020**	**10/5/2020**	**10/5/2020**
		Laboratory ID:	**410-6880-10**	**410-6880-11**	**410-16309-7**	**410-16309-9**
		Notes:		**Duplicate of TS0292-01/GW03**		**Duplicate of TS0292-01/GW04**
		Aquifer Screened:	**Terrace Aquifer**	**Terrace Aquifer**	**Terrace Aquifer**	**Terrace Aquifer**
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	µg/L	2 U	2 U	2 U	2 U
Ethene	>10	µg/L	2 U	2 U	2 U	2 U
Methane	>500	µg/L	5.9 U	5.9 U	5.9 U	5.9 U
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**300**	**280**	**160**	**180**
Total Nitrate (EPA 353.2)	<1	mg/L	**9 J**	**9**	**5**	**5.5**
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	**8.8**	**7**	**5.5**	**6**
Sulfate (EPA 300.0)	<20	mg/L	**310 J**	**220 J**	**87**	**100**
Total Organic Carbon (SM 5310)	>20	mg/L	**1.5**	**1.4**	**0.81 J**	**0.78 J**
Sulfide (SM 4500)	>1	mg/L	0.25 U	0.25 U	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**290**	**270**	**250**	**250**

Notes:

1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197 for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg (Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L a: 376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River All 816 mg/L (terrace aquifer), respectively.

Bold indicates detection.

Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate
EJ = estimated value due to instrument calibration exceedance
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
µg/L = micrograms per liter

Table 4-2
Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data
354 Area Solvent Detections OU 005
Fort Riley, Kansas

		Monitoring Well ID:	TS0292-02	TS0292-02	TS0292-02	TS0292-02
		Sample ID:	TS0292-02/GW01	TS0292-02/GW02	TS0292-02/GW03	TS0292-02/GW04
		Date Sampled:	1/13/2020	5/18/2020	7/6/2020	10/6/2020
		Laboratory ID:	1238988	1317597	410-6880-3	410-16481-3
		Notes:				
		Aquifer Screened:	Kansas River Alluvial Aquifer	Kansas River Alluvail Aquifer	Kansas River Alluvial Aquifer	Kansas River Alluvial Aquifer
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	µg/L	**1.8 J**	2.0 U	2 U	2 U
Ethene	>10	µg/L	2 U	2.0 U	2 U	2 U
Methane	>500	µg/L	**280**	**20**	5.9 U	**100**
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**179 J**	**239**	**230**	**370**
Total Nitrate (EPA 353.2)	<1	mg/L	0.45 U	0.45 U	0.45 U	0.45 U
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	0.09 U	0.09 U
Sulfate (EPA 300.0)	<20	mg/L	**118**	**37.0**	**28**	**94**
Total Organic Carbon (SM 5310)	>20	mg/L	**3.9**	**3.1**	**2.8**	**3.2**
Sulfide (SM 4500)	>1	mg/L	**0.15 J**	0.25 U	0.25 U	0.25 UJ
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**496 J**	**431 J**	**400**	**460**

Notes:

1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197 for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg (Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L as 376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River All 816 mg/L (terrace aquifer), respectively.

Bold indicates detection.
Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)
$CaCO_3$ = calcium carbonate
EJ = estimated value due to instrument calibration exceedance
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
µg/L = micrograms per liter

Table 4-2
Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data
354 Area Solvent Detections OU 005
Fort Riley, Kansas

		Monitoring Well ID:	354-99-09	354-99-09	354-99-09	354-99-09
		Sample ID:	354-99-09/GW01	354-99-09/GW02	354-99-09/GW03	354-99-09/GW04
		Date Sampled:	1/13/2020	5/18/2020	7/6/2020	10/7/2020
		Laboratory ID:	1238987	1317598	410-6880-2	410-16309-8
		Notes:				
		Aquifer Screened:	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	µg/L	2 U	2.0 U	2 U	2 U
Ethene	>10	µg/L	2 U	2.0 U	2 U	2 U
Methane	>500	µg/L	5.9 U	5.9 U	5.9 U	5.9 U
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**533 J**	**656**	**610**	**790**
Total Nitrate (EPA 353.2)	<1	mg/L	**16.5 J**	**14.7**	**16 EJ**	**16 EJ**
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	**16**	**3**
Sulfate (EPA 300.0)	<20	mg/L	**113**	**130**	**270**	**140**
Total Organic Carbon (SM 5310)	>20	mg/L	**2.1**	**1.4**	**1.6**	**0.72 J**
Sulfide (SM 4500)	>1	mg/L	0.25 U	0.25 U	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**271 J**	**253 J**	**260**	**250**

Notes:
1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197 for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg (Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L as 376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River All 816 mg/L (terrace aquifer), respectively.

Bold indicates detection.
Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)
$CaCO_3$ = calcium carbonate
EJ = estimated value due to instrument calibration exceedance
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
µg/L = micrograms per liter

Table 4-2
Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data
354 Area Solvent Detections OU 005
Fort Riley, Kansas

		Monitoring Well ID:	354-99-12c	354-99-12c	354-99-12c	354-99-12c
		Sample ID:	354-99-12C/GW01	354-99-12C/GW02	354-99-12C/GW03	354-99-12C/GW04
		Date Sampled:	1/13/2020	5/18/2020	7/7/2020	10/6/2020
		Laboratory ID:	1238986	1317596	410-6880-7	410-16309-10
		Notes:				
		Aquifer Screened:	Kansas River Alluvial Aquifer	Kansas River Alluvial Aquifer	Kansas River Alluvial Aquifer	Kansas River Alluvial Aquifer
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	µg/L	2 U	2.0 U	2 U	2 U
Ethene	>10	µg/L	2 U	2.0 U	2 U	2 U
Methane	>500	µg/L	5.9 U	**3.3 J**	5.9 U	**3.9 J**
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**446 J**	**521**	**540**	**730 EJ**
Total Nitrate (EPA 353.2)	<1	mg/L	0.45 U	0.45 U	0.45 U	0.45 U
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	0.09 U	0.09 U
Sulfate (EPA 300.0)	<20	mg/L	**146**	**165**	**280 J**	**180 EJ**
Total Organic Carbon (SM 5310)	>20	mg/L	**2.2**	**1.9**	**1.9**	**1**
Sulfide (SM 4500)	>1	mg/L	0.25 U	0.25 U	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**387 J**	**382 J**	**380**	**390**

Notes:
1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197 for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg (Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L as 376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River All 816 mg/L (terrace aquifer), respectively.

Bold indicates detection.
Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)
$CaCO_3$ = calcium carbonate
EJ = estimated value due to instrument calibration exceedance
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
µg/L = micrograms per liter

Table 4-2
Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data
354 Area Solvent Detections OU 005
Fort Riley, Kansas

		Monitoring Well ID:	354-99-13c	354-99-13c	354-99-13c	354-99-13c
		Sample ID:	354-99-13C/GW01	354-99-13C/GW02	354-99-13C/GW03	354-99-13C/GW04
		Date Sampled:	1/13/2020	5/18/2020	7/7/2020	10/6/2020
		Laboratory ID:	1238985	1316954	410-6880-6	410-16309-13
		Notes:				
		Aquifer Screened:	Kansas River Alluvial Aquifer	Kansas River Alluvial Aquifer	Kansas River Alluvial Aquifer	Kansas River Alluvial Aquifer
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	µg/L	2 U	2.0 U	2 U	2 U
Ethene	>10	µg/L	2 U	2.0 U	2 U	2 U
Methane	>500	µg/L	**9.6**	**11**	8 U	**6.3 J**
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**50.7 J**	**124**	**160 J**	**74**
Total Nitrate (EPA 353.2)	<1	mg/L	0.45 U	0.45 U	0.45 U	0.45 U
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	0.09 U	0.09 U
Sulfate (EPA 300.0)	<20	mg/L	**118**	**122**	**240 J**	**120**
Total Organic Carbon (SM 5310)	>20	mg/L	**2.5**	**2.1**	**2.3**	**1.2**
Sulfide (SM 4500)	>1	mg/L	0.25 U	0.25 U	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**396 J**	**346 J**	**340**	**400**

Notes:

1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197 for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg (Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L a: 376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River All 816 mg/L (terrace aquifer), respectively.

Bold indicates detection.

Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate
EJ = estimated value due to instrument calibration exceedance
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
µg/L = micrograms per liter

Table 4-2

Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data

354 Area Solvent Detections OU 005

Fort Riley, Kansas

		Monitoring Well ID:	354-00-10	354-00-10	354-00-10	354-00-10
		Sample ID:	354-00-10/GW01	354-00-10/GW02	354-00-10/GW03	354-00-10/GW04
		Date Sampled:	11/13/2020	5/18/2020	7/7/2020	10/6/2020
		Laboratory ID:	1238992	1316957	410-7089-1	410-16481-2
		Notes:				
		Aquifer Screened:	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	µg/L	2 U	2 U	2 U	2 U
Ethene	>10	µg/L	2 U	2 U	2 U	2 U
Methane	>500	µg/L	5.9 U	4.0 J	5.9 U	**4 J**
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**9.7 J**	**10.5**	**9.3**	**11**
Total Nitrate (EPA 353.2)	<1	mg/L	0.45 UJ	0.45 U	**0.27 J**	**0.34 J**
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	0.09 U	0.09 U
Sulfate (EPA 300.0)	<20	mg/L	**518**	**599**	**510**	**630**
Total Organic Carbon (SM 5310)	>20	mg/L	**0.83 J**	0.90 U	0.9 U	0.9 U
Sulfide (SM 4500)	>1	mg/L	0.25 UJ	0.25 U	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**203 J**	**209 J**	**210**	**210**

Notes:

1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197 for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg (Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L as 376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River All 816 mg/L (terrace aquifer), respectively.

Bold indicates detection.

Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate

EJ = estimated value due to instrument calibration exceedance

EPA = Environmental Protection Agency

ID = identification

J = estimated value

mg/L = milligrams per liter

NA = not analyzed

R = data was rejected

U = compound was not detected

UJ = estimated at the reporting limit

UR = estimated at reporting limit, data was rejected

µg/L = micrograms per liter

Table 4-2

Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data

354 Area Solvent Detections OU 005

Fort Riley, Kansas

		Monitoring Well ID:	**354-01-26**	**354-01-26**	**354-01-26**	**354-01-26**
		Sample ID:	**354-01-26/GW01**	**354-01-26/GW02**	**354-01-26/GW03**	**354-01-26/GW04**
		Date Sampled:	**1/13/2020**	**5/18/2020**	**7/7/2020**	**10/5/2020**
		Laboratory ID:	**1238991**	**1316958**	**410-6880-1**	**410-16309-1**
		Notes:				
		Aquifer Screened:	**Terrace Aquifer**	**Terrace Aquifer**	**Terrace Aquifer**	**Terrace Aquifer**
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	μg/L	2 U	2.0 U	2 U	2 U
Ethene	>10	μg/L	2 U	2.0 U	2 U	2 U
Methane	>500	μg/L	5.9 U	5.9 U	5.9 U	5.9 U
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**215 J**	**353**	**320**	**330**
Total Nitrate (EPA 353.2)	<1	mg/L	**3.1**	**2.2**	**2.3**	**2.4 J**
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	**2.3**	**2.1**
Sulfate (EPA 300.0)	<20	mg/L	**70**	**62.7**	**63**	**67**
Total Organic Carbon (SM 5310)	>20	mg/L	**1.7**	**1.3**	**1.4**	0.9 U
Sulfide (SM 4500)	>1	mg/L	0.25 UJ	0.25 U	NA	0.25 UJ
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**262 J**	**271 J**	**270**	**270**

Notes:

1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197 for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg (Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L as 376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River All 816 mg/L (terrace aquifer), respectively.

Bold indicates detection.

Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate

EJ = estimated value due to instrument calibration exceedance

EPA = Environmental Protection Agency

ID = identification

J = estimated value

mg/L = milligrams per liter

NA = not analyzed

R = data was rejected

U = compound was not detected

UJ = estimated at the reporting limit

UR = estimated at reporting limit, data was rejected

μg/L = micrograms per liter

Table 4-2
Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data
354 Area Solvent Detections OU 005
Fort Riley, Kansas

		Monitoring Well ID:	354-01-27	354-01-27	354-01-27	354-01-27
		Sample ID:	354-01-27/GW01	354-01-27/GW11	354-01-27/GW02	354-01-27/GW22
		Date Sampled:	1/14/2020	1/14/2020	5/18/2020	5/18/2020
		Laboratory ID:	1239002	1239003	1316955	1316956
		Notes:		Duplicate of 354-01-27/GW01		Duplicate of 354-01-27/GW02
		Aquifer Screened:	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	μg/L	2 U	2 U	2.0 U	2.0 U
Ethene	>10	μg/L	2 U	2 U	2.0 U	2.0 U
Methane	>500	μg/L	5.9 U	5.9 U	5.9 U	5.9 U
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**8.7 J**	**8.6 J**	**13.1**	**11.1**
Total Nitrate (EPA 353.2)	<1	mg/L	**3**	**2.7**	**3.6**	**3.5**
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	NA	NA
Sulfate (EPA 300.0)	<20	mg/L	**14.1**	**13.5**	**18.5**	**17.4**
Total Organic Carbon (SM 5310)	>20	mg/L	**1.4**	**1.5**	**1.1**	**1.1**
Sulfide (SM 4500)	>1	mg/L	0.25 UJ	0.25 UJ	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**206 J**	**206 J**	**208 J**	**212 J**

Notes:

1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197 for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg (Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L as 376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River Al 816 mg/L (terrace aquifer), respectively.

Bold indicates detection.

Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate

EJ = estimated value due to instrument calibration exceedance

EPA = Environmental Protection Agency

ID = identification

J = estimated value

mg/L = milligrams per liter

NA = not analyzed

R = data was rejected

U = compound was not detected

UJ = estimated at the reporting limit

UR = estimated at reporting limit, data was rejected

μg/L = micrograms per liter

Table 4-2
Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data
354 Area Solvent Detections OU 005
Fort Riley, Kansas

		Monitoring Well ID:	354-01-27	354-01-27	354-01-27	354-01-27
		Sample ID:	354-01-27/GW03	354-01-27/GW33	354-01-27/GW04	354-01-27/GW44
		Date Sampled:	7/7/2020	7/8/2020	10/5/2020	10/5/2020
		Laboratory ID:	410-7089-2	410-7089-3	410-16309-2	410-16309-3
		Notes:		Duplicate of 354-01-27/GW03		Duplicate of 354-01-27/GW04
		Aquifer Screened:	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	μg/L	3 U	3 U	2 U	2 U
Ethene	>10	μg/L	3 U	3 U	2 U	2 U
Methane	>500	μg/L	6.9 U	6.9 U	5.9 U	5.9 U
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**14**	**14**	**8.6**	**13**
Total Nitrate (EPA 353.2)	<1	mg/L	**3.6 J**	**3.6 J**	**3.2 J**	**3.5 J**
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	**3.9**	**3.8**	**3.3**	**3.4**
Sulfate (EPA 300.0)	<20	mg/L	**15**	**18**	**13**	**18**
Total Organic Carbon (SM 5310)	>20	mg/L	**1.2**	**1.2**	0.9 U	0.9 U
Sulfide (SM 4500)	>1	mg/L	0.25 U	0.25 U	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**210**	**210**	**200**	**210**

Notes:

1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197 for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg (Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L as 376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River All 816 mg/L (terrace aquifer), respectively.

Bold indicates detection.
Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)
$CaCO_3$ = calcium carbonate
EJ = estimated value due to instrument calibration exceedance
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
μg/L = micrograms per liter

Table 4-2

Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data

354 Area Solvent Detections OU 005

Fort Riley, Kansas

		Monitoring Well ID:	354-01-30c	354-01-30c	354-01-30c	354-01-30c
		Sample ID:	354-01-30C/GW01	354-01-30C/GW02	354-01-30C/GW03	354-01-30C/GW04
		Date Sampled:	1/14/2020	5/19/2020	7/7/2020	10/6/2020
		Laboratory ID:	1238994	1317592	410-6880-5	410-16309-12
		Notes:				
		Aquifer Screened:	Kansas River Alluival Aquifer	Kansas River Alluival Aquifer	Kansas River Alluival Aquifer	Kansas River Alluival Aquifer
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	µg/L	2 U	2.0 U	2 U	2 U
Ethene	>10	µg/L	2 U	2.0 U	2 U	2 U
Methane	>500	µg/L	**55**	**6.8**	**4 J**	**6.3 J**
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**53.6**	**59.5**	**100 J**	**74**
Total Nitrate (EPA 353.2)	<1	mg/L	0.45 U	0.45 U	0.45 U	0.45 U
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	0.09 U	0.09 U
Sulfate (EPA 300.0)	<20	mg/L	**118**	**120**	**270 J**	**120**
Total Organic Carbon (SM 5310)	>20	mg/L	**3**	**2.6**	**2.5**	**1.2**
Sulfide (SM 4500)	>1	mg/L	0.25 UJ	0.25 U	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**396 J**	**406 J**	**400**	**400**

Notes:

1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197 for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg (Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L a: 376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River Al 816 mg/L (terrace aquifer), respectively.

Bold indicates detection.

Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate

EJ = estimated value due to instrument calibration exceedance

EPA = Environmental Protection Agency

ID = identification

J = estimated value

mg/L = milligrams per liter

NA = not analyzed

R = data was rejected

U = compound was not detected

UJ = estimated at the reporting limit

UR = estimated at reporting limit, data was rejected

µg/L = micrograms per liter

Table 4-2
Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data
354 Area Solvent Detections OU 005
Fort Riley, Kansas

		Monitoring Well ID:	**354-19-32**	**354-19-32**	**354-19-32**	**354-19-32**
		Sample ID:	**354-19-32/GW01**	**354-19-32/GW02**	**354-19-32/GW03**	**354-19-32/GW04**
		Date Sampled:	**1/14/2020**	**5/19/2020**	**7/7/2020**	**10/7/2020**
		Laboratory ID:	**1239001**	**1317593**	**410-6880-8**	**410-16309-4**
		Notes:				
		Aquifer Screened:	**Terrace Aquifer**	**Terrace Aquifer**	**Terrace Aquifer**	**Terrace Aquifer**
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	µg/L	2 U	2.0 U	2 U	2 U
Ethene	>10	µg/L	2 U	2.0 U	2 U	2 U
Methane	>500	µg/L	5.9 U	5.9 U	5.9 U	5.9 U
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**290 J**	**336**	**280**	**270**
Total Nitrate (EPA 353.2)	<1	mg/L	**11**	**9.3**	**9.7**	**9.9**
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	**8.6**	**9.9**
Sulfate (EPA 300.0)	<20	mg/L	**173**	**150**	**270 J**	**160**
Total Organic Carbon (SM 5310)	>20	mg/L	**1.8**	**1.8**	**1.4**	**0.76 J**
Sulfide (SM 4500)	>1	mg/L	0.25 UJ	0.25 U	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**324 J**	**340 J**	**290**	**280**

Notes:
1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu
in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197
for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo
Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu
in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg
(Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L as
376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River All
816 mg/L (terrace aquifer), respectively.

Bold indicates detection.
Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)
$CaCO_3$ = calcium carbonate
EJ = estimated value due to instrument calibration exceedance
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
µg/L = micrograms per liter

Table 4-2

Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data

354 Area Solvent Detections OU 005

Fort Riley, Kansas

		Monitoring Well ID:	354-19-33	354-19-33	354-19-33	354-19-33
		Sample ID:	354-19-33/GW01	354-19-33/GW02	354-19-33/GW03	354-19-33/GW04
		Date Sampled:	1/14/2020	5/19/2020	7/7/2020	10/5/2020
		Laboratory ID:	1238999	1317589	410-6880-9	410-16309-5
		Notes:				
		Aquifer Screened:	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	μg/L	2 U	2.0 U	2 U	2 U
Ethene	>10	μg/L	2 U	2.0 U	2 U	2 U
Methane	>500	μg/L	5.9 U	5.9 U	5.9 U	5.9 U
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**262**	**276**	**300**	**250**
Total Nitrate (EPA 353.2)	<1	mg/L	**10.5**	**9.8**	**13**	**11**
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	**10**	**10**
Sulfate (EPA 300.0)	<20	mg/L	**182**	**156**	**290 J**	**170**
Total Organic Carbon (SM 5310)	>20	mg/L	**1.8**	**1.8**	**1.6**	**0.68 J**
Sulfide (SM 4500)	>1	mg/L	0.25 UJ	0.25 U	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**312 J**	**321 J**	**310**	**320**

Notes:

1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197 for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg (Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L as 376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River All 816 mg/L (terrace aquifer), respectively.

Bold indicates detection.

Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate

EJ = estimated value due to instrument calibration exceedance

EPA = Environmental Protection Agency

ID = identification

J = estimated value

mg/L = milligrams per liter

NA = not analyzed

R = data was rejected

U = compound was not detected

UJ = estimated at the reporting limit

UR = estimated at reporting limit, data was rejected

μg/L = micrograms per liter

Table 4-2
Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data
354 Area Solvent Detections OU 005
Fort Riley, Kansas

		Monitoring Well ID:	354-19-34	354-19-34	354-19-34	354-19-34
		Sample ID:	354-19-34/GW01	354-19-34/GW02	354-19-34/GW03	354-19-34-GW04
		Date Sampled:	1/14/2020	5/19/2020	7/7/2020	10/5/2020
		Laboratory ID:	1239000	1317590	410-6880-12	410-16309-6
		Notes:				
		Aquifer Screened:	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer	Terrace Aquifer
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	µg/L	2 U	2.0 U	2 U	2 U
Ethene	>10	µg/L	2 U	2.0 U	2 U	2 U
Methane	>500	µg/L	5.9 U	5.9 U	5.9 U	5.9 U
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**216 J**	**331**	**240**	**230**
Total Nitrate (EPA 353.2)	<1	mg/L	**14.3**	**13.0**	**12**	**12**
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	**8.3**	**13**
Sulfate (EPA 300.0)	<20	mg/L	**114**	**117**	**230 J**	**120**
Total Organic Carbon (SM 5310)	>20	mg/L	**1.6**	**1.3**	**1.2**	0.9 U
Sulfide (SM 4500)	>1	mg/L	0.25 UJ	0.25 U	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**294 J**	**289 J**	**280**	**290**

Notes:
1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu
in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197
for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo
Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu
in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg
(Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L as
376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River Al
816 mg/L (terrace aquifer), respectively.

Bold indicates detection.
Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)
$CaCO_3$ = calcium carbonate
EJ = estimated value due to instrument calibration exceedance
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
µg/L = micrograms per liter

Table 4-2

Groundwater Monitored Natural Attenuation Indicator Parameter Analytical Data

354 Area Solvent Detections OU 005

Fort Riley, Kansas

		Monitoring Well ID:	354-19-35	354-19-35	354-19-35	354-19-35
		Sample ID:	354-19-35/GW01	354-19-35/GW02	354-19-35/GW03	354-19-35/GW03
		Date Sampled:	1/14/2020	5/19/2020	7/6/2020	10/6/2020
		Laboratory ID:	1238995	1317584	410-6880-4	410-16309-11
		Notes:				
		Aquifer Screened:	Kansas River Alluvial Aquifer	Kansas River Alluvial Aquifer	Kansas River Alluvial Aquifer	Kansas River Alluvial Aquifer
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>100	μg/L	2 UJ	2.0 U	2 U	2 U
Ethene	>10	μg/L	2 U	2.0 U	2 U	2 U
Methane	>500	μg/L	5.9 UJ	5.9 U	5.9 U	5.9 U
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2] >56 or 86	mg/L	**637 J**	**784**	**810 J**	**1400 EJ**
Total Nitrate (EPA 353.2)	<1	mg/L	**5.1**	**1.5**	**5.1**	**4.2 J**
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	**4.7**	**3.9 J**
Sulfate (EPA 300.0)	<20	mg/L	**184**	**227**	**240**	**400 EJ**
Total Organic Carbon (SM 5310)	>20	mg/L	**2.3**	**2.1**	**2.3**	**2.4**
Sulfide (SM 4500)	>1	mg/L	0.25 UJ	0.25 U	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[3] >680 or 816	mg/L as $CaCO_3$	**357 J**	**372 J**	**360**	**370**

Notes:

1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sampl
2. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 28 mg/L, with a range of 3.0 - 84 mg/L (Fader, 197 for chloride in groundwater from the terrace aquifer is 43 mg/L, with a range of 6 - 130 mg/L (Burns & McDo Therefore, twice the average values are 56 mg/L (Kansas River Alluvial Aquifer) and 86 mg//L (Terrace Aqu
3. These values represent two times the background value as per MNA protocol (USEPA, 1998). Average valu in groundwater from the Kansas River alluvial deposits is 340 mg/L as $CaCO_3$, with a range of 170 - 470 mg (Fader, 1974) Average values for alkalinity as $CaCO_3$ in groundwater from the terrace aquifer is 408 mg/L as 376 - 454 mg/L as $CaCO_3$ (LBA, 1996). Therefore, twice the average values are 680 mg/L (Kansas River Al 816 mg/L (terrace aquifer), respectively.

Bold indicates detection.

Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate

EJ = estimated value due to instrument calibration exceedance

EPA = Environmental Protection Agency

ID = identification

J = estimated value

mg/L = milligrams per liter

NA = not analyzed

R = data was rejected

U = compound was not detected

UJ = estimated at the reporting limit

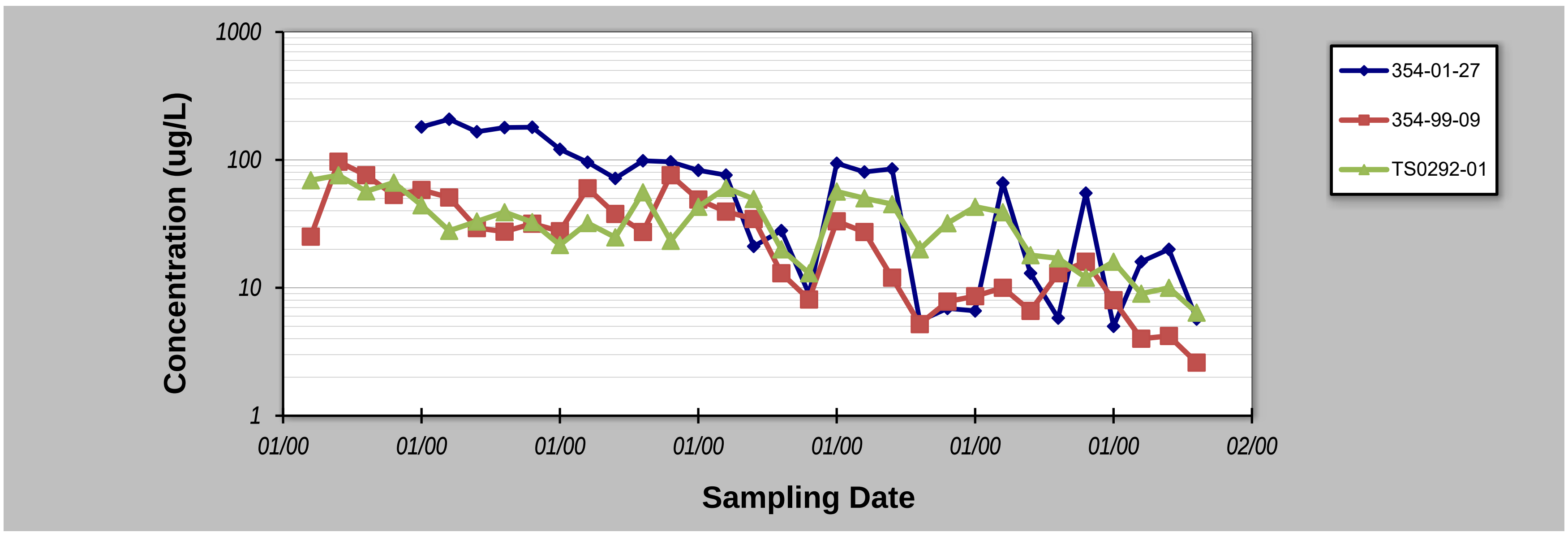
UR = estimated at reporting limit, data was rejected

μg/L = micrograms per liter

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	9-Feb-21	Job ID:	
Facility Name:	354 Area Solvent Detections	Constituent:	PCE
Conducted By:	Justin Carter	Concentration Units:	ug/L

Sampling Event	Sampling Date	354-01-27	354-99-09	TS0292-01				
	Sampling Point ID:	PCE CONCENTRATION (ug/L)						
1	Feb 00		25.1	69.3				
2	Jul 00		96.8	75.9				
3	Oct 00		75.9	56.8				
4	Mar 01		53.2	66.5				
5	Oct 01	181	58.2	44.2				
6	Jan 02	208	50.8	27.9				
7	Apr 02	166	29.3	33				
8	Jul 02	179	27.5	39				
9	Mar 03	180	31.7	32.6				
10	Sep 03	121	27.7	21.6				
11	Apr 04	95.9	60	32.1				
12	Oct 04	71.7	37.8	24.8				
13	Apr 05	98.5	27.3	55.8				
14	Sep 06	96.6	75.9	23.3				
15	Apr 07	82.9	49	43				
16	Mar 08	76.1	39.4	60.4				
17	Mar 09	21.1	34.5	49.5				
18	Aug 11	28	13	20				
19	Apr 12	8.9	8.1	13				
20	Mar 14	94.1	33.1	56.6				
21	Jul 14	80.5	27.3	50.1				
22	May 16	85	12	45.1				
23	Aug 16	5.5	5.2	20				
24	Nov 16	6.9	7.8	32				
25	Feb 17	6.6	8.6	43				
26	May 17	66	10	39				
27	Aug 17	13	6.6	18				
28	Nov 17	5.8	13	17				
29	Feb 18	55	16	12				
30	Jan 20	5	8	16				
31	May 20	16	4	9				
32	Jul 20	20	4.2	10				
33	Oct 20	5.7	2.6	6.4				
34								
35								
	Coefficient of Variation:	0.88	0.81	0.54				
	Mann-Kendall Statistic (S):	-272	-327	-279				
	Confidence Factor:	>99.9%	>99.9%	>99.9%				
	Concentration Trend:	Decreasing	Decreasing	Decreasing				



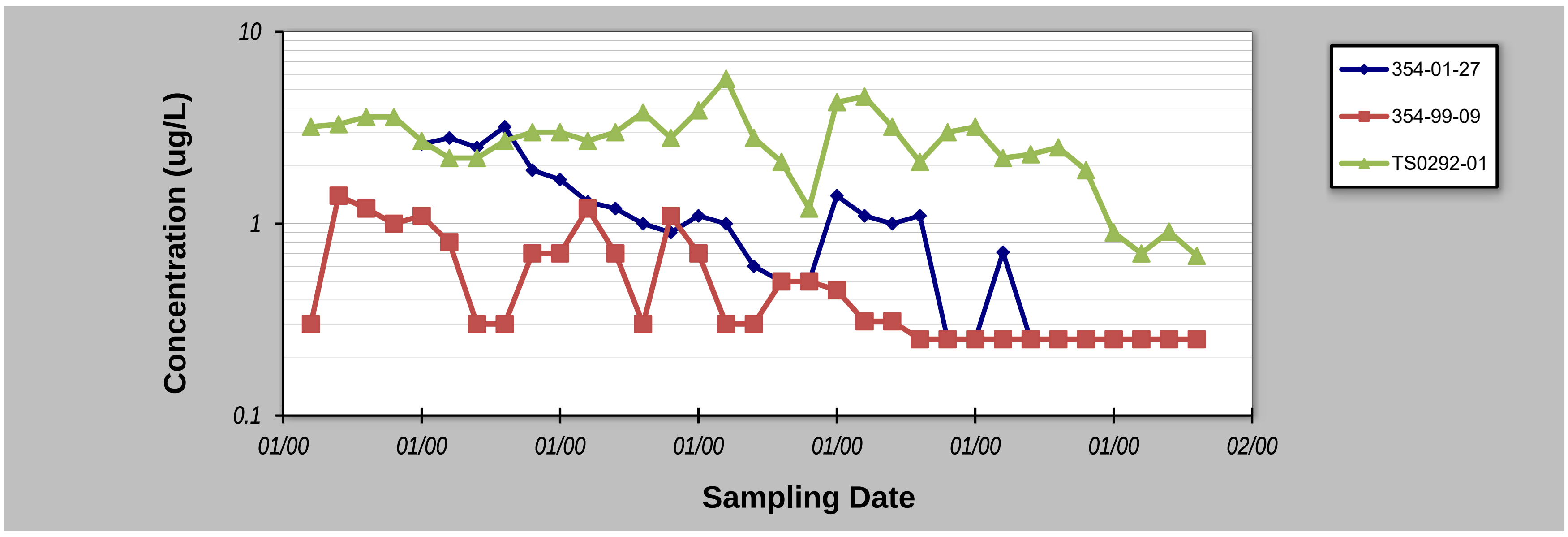
Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **9-Feb-21**
Facility Name: **354 Area Solvent Detections**
Conducted By: **Justin Carter**
Job ID:
Constituent: **TCE**
Concentration Units: **ug/L**

Sampling Event	Sampling Date	354-01-27	354-99-09	TS0292-01				
		TCE CONCENTRATION (ug/L)						
1	Feb 00		0.3	3.2				
2	Jul 00		1.4	3.3				
3	Oct 00		1.2	3.6				
4	Mar 01		1	3.6				
5	Oct 01	2.6	1.1	2.7				
6	Jan 02	2.8	0.8	2.2				
7	Apr 02	2.5	0.3	2.2				
8	Jul 02	3.2	0.3	2.7				
9	Mar 03	1.9	0.7	3				
10	Sep 03	1.7	0.7	3				
11	Apr 04	1.3	1.2	2.7				
12	Oct 04	1.2	0.7	3				
13	Apr 05	1	0.3	3.8				
14	Sep 06	0.9	1.1	2.8				
15	Apr 07	1.1	0.7	3.9				
16	Mar 08	1	0.3	5.7				
17	Mar 09	0.6	0.3	2.8				
18	Aug 11	0.5	0.5	2.1				
19	Apr 12	0.5	0.5	1.2				
20	Mar 14	1.4	0.45	4.3				
21	Jul 14	1.1	0.31	4.6				
22	May 16	1	0.31	3.2				
23	Aug 16	1.1	0.25	2.1				
24	Nov 16	0.25	0.25	3				
25	Feb 17	0.25	0.25	3.2				
26	May 17	0.71	0.25	2.2				
27	Aug 17	0.25	0.25	2.3				
28	Nov 17	0.25	0.25	2.5				
29	Feb 18	0.25	0.25	1.9				
30	Jan 20	0.25	0.25	0.9				
31	May 20	0.25	0.25	0.7				
32	Jul 20	0.25	0.25	0.91				
33	Oct 20	0.25	0.25	0.68				
34								
35								
Coefficient of Variation:		0.81	0.68	0.41				
Mann-Kendall Statistic (S):		-287	-316	-178				
Confidence Factor:		>99.9%	>99.9%	99.7%				
Concentration Trend:		Decreasing	Decreasing	Decreasing				



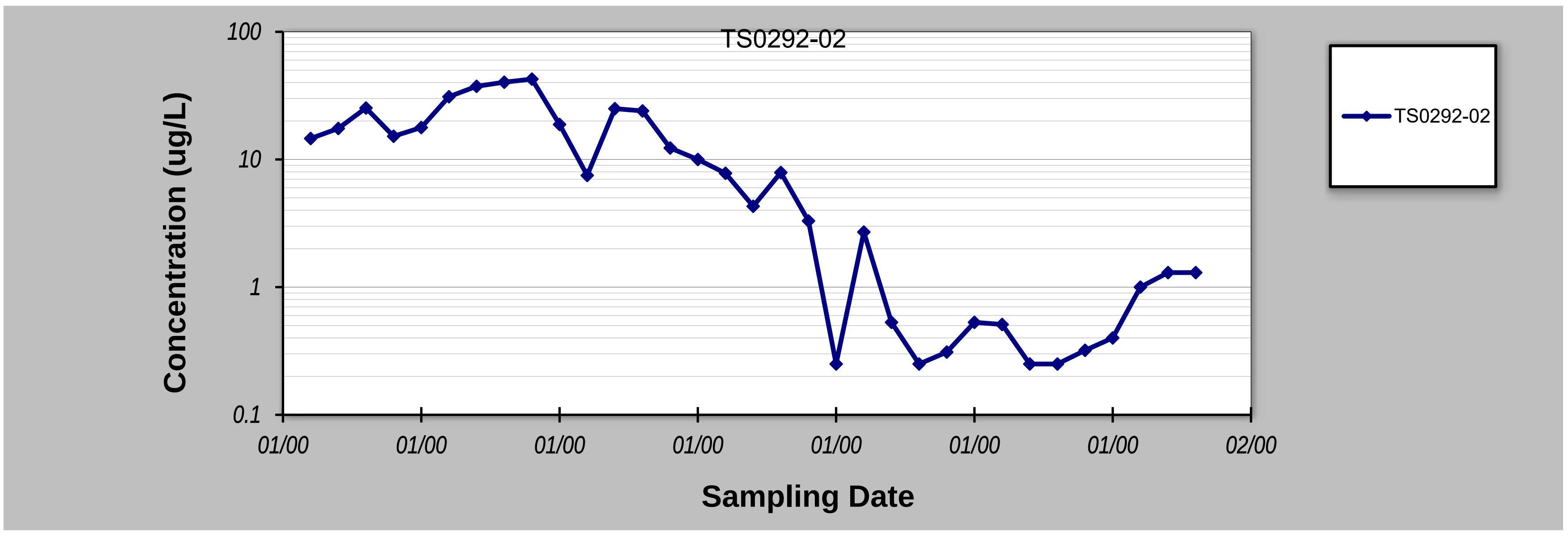
Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 9-Feb-21
Facility Name: 354 Area Solvent Detections
Conducted By: Justin Carter
Job ID:
Constituent: Benzene
Concentration Units: ug/L

Sampling Event	Sampling Date	BENZENE CONCENTRATION (ug/L)						
	Sampling Point ID:	TS0292-02						
1	Feb 00	14.6						
2	Jul 00	17.5						
3	Oct 00	25.3						
4	Mar 01	15.2						
5	Oct 01	17.8						
6	Jan 02	31						
7	Apr 02	37.4						
8	Jul 02	40.3						
9	Mar 03	42.6						
10	Sep 03	18.8						
11	Apr 04	7.5						
12	Oct 04	25						
13	Apr 05	24						
14	Sep 06	12.3						
15	Apr 07	10						
16	Mar 08	7.8						
17	Mar 09	4.3						
18	Aug 11	7.9						
19	Apr 12	3.3						
20	Mar 14	0.25						
21	Jul 14	2.7						
22	May 16	0.53						
23	Aug 16	0.25						
24	Nov 16	0.31						
25	Feb 17	0.53						
26	May 17	0.51						
27	Aug 17	0.25						
28	Nov 17	0.25						
29	Feb 18	0.32						
30	Jan 20	0.4						
31	May 20	1						
32	Jul 20	1.3						
33	Oct 20	1.3						
34								
35								
	Coefficient of Variation:	1.14						
	Mann-Kendall Statistic (S):	-304						
	Confidence Factor:	>99.9%						
	Concentration Trend:	Decreasing						



Notes:
1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

Appendix E – Data Reports

Appendix E4

Operable Unit 006 (OU 006) Open Burning/Open Detonation Grounds (Range 16)

Report Reference	Excerpted Data Included	Page Number
Final Annual Summary Report, Year 1 Groundwater and Surface Water Long-Term Monitoring; Open Burning/Open Detonation Ground (Range 16) Operable Unit 006, Fort Riley, Kansas. August 2021.	2020 Groundwater and Surface Water Sampling Data Tables	E4-1

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-12-15D					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Weathered Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-12-15D/GW05	**9962813**	**Baseline**	**1/6/2019**		0.5 U	**0.4 J**	0.2 U	10 U	0.2 U
OB-12-15D/GW06	**1125358**	**Year 1 - Q1**	**8/14/2019**		0.5 U	**0.4 J**	0.2 U	10 U	0.2 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-12-16					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Regolith				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-12-16/GW05	**9962810**	**Baseline**	**1/6/2019**		0.5 U	**3**	0.2	10 U	0.2 U
OB-12-16/GW06	**1125352**	**Year 1 - Q1**	**8/13/2019**		0.5 U	**2**	0.2	10 U	0.2 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-12-17					Volatile Organic Compounds		Semivolatile Organic Compounds		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Regolith				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-12-17/GW05	**9962833**	**Baseline**	**1/7/2019**		0.5 U	**5**	0.2 U	10 U	0.2 U
OB-12-17/GW06	**1126592**	**Year 1 - Q1**	**8/15/2019**		**0.3 J**	**3**	0.2 UJ	10 UJ	0.2 UJ
OB-12-17/GW07	**1227294**	**Year 1 - Q2**	**12/17/2019**		0.5 U	**2**	**0.1 J**	10 U	0.2 U
FD121714	**1227296**	**Year 1 - Q2**	**12/17/2019**	**Duplicate of OB-12-17/GW07**	0.5 U	**2**	0.2 U	10 U	0.2 U
OB-12-17/GW08	**1316542**	**Year 1 - Q3**	**5/15/2020**		0.5 U	**1 J**	0.2 U	10 U	0.2 U
OB-12-17/GW09	**410-8078-7**	**Year 1 - Q4**	**7/15/2020**		0.5 U	**0.94 J**	0.23 U	11 U	0.23 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-12-18					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Regolith				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-12-18/GW05	**9963719**	**Baseline**	**1/8/2019**		**7**	**64**	0.2 U	10 U	0.2 U
OB-12-18/GW06	**1127801**	**Year 1 - Q1**	**8/15/2019**		**6**	**28**	0.2 U	10 U	0.2 U
OB-12-18/GW07	**1228798**	**Year 1 - Q2**	**12/18/2019**		**1**	**15**	0.2 U	10 U	0.2 U
OB-12-18/GW08	**1316549**	**Year 1 - Q3**	**5/15/2020**		**3**	**15**	0.2 U	12 U	0.2 U
OB-12-18/GW09	**410-8078-2**	**Year 1 - Q4**	**7/15/2020**		**0.95 J**	**9.9**	0.2 U	10 U	0.2 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-12-19D					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	Ethylhexyl)phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Lower Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-12-19D/GW05	**9962812**	**Baseline**	**1/6/2019**		0.5 U	**0.5 J**	0.2 U	10 U	0.2 U
OB-12-19D/GW06	**1125356**	**Year 1 - Q1**	**8/13/2019**		0.5 U	**0.4 J**	0.2 U	10 U	0.2 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-12-20D					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Lower Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-12-20D/GW05	**9962811**	**Baseline**	**1/6/2019**		0.5 U	**0.4 J**	0.2 U	10 U	0.2 U
OB-12-20D/GW06	**1125351**	**Year 1 - Q1**	**8/13/2019**		0.5 U	**0.2 J**	0.2 U	10 U	0.2 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-18-22					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Regolith				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-18-22/GW05	**9962829**	**Baseline**	**1/7/2019**		**12**	**310**	0.2 U	10 U	0.2 U
OB-18-22/GW06	**1125355**	**Year 1 - Q1**	**8/13/2019**		**3**	**120**	0.2 U	10 U	0.2 U
OB-18-22/GW66	**1125364**	**Year 1 - Q1**	**8/13/2019**	**Duplicate of OB-18-22/GW06**	3 U	**120**	0.2 U	10 U	0.2 U
OB-18-22/GW07	**1228793**	**Year 1 - Q2**	**12/18/2019**		**15**	**120**	0.2 U	10 U	0.2 U
OB-18-22/GW08	**1316538**	**Year 1 - Q3**	**5/14/2020**		**4**	**60**	0.2 U	11 U	0.2 U
OB-18-22/GW09	**410-8078-13**	**Year 1 - Q4**	**7/16/2020**		**3.9**	**76**	0.22 U	11 U	0.22 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-18-23					Volatile Organic Compounds		Semivolatile Organic Compounds		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Regolith				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-18-23/GW05	**9962831**	**Baseline**	**1/7/2019**		0.5 U	**7**	0.2 U	11 U	0.2 U
OB-18-23/GW06	**1127799**	**Year 1 - Q1**	**8/15/2019**		0.5 U	**6**	0.2 U	10 U	0.2 U
OB-18-23/GW07	**1227291**	**Year 1 - Q2**	**12/17/2019**		0.5 U	**6**	0.2 U	10 U	0.2 U
OB-18-23/GW08	**1316539**	**Year 1 - Q3**	**5/14/2020**		0.5 U	**5**	0.2 U	10 U	0.2 U
OB-18-23/GW09	**410-8078-1**	**Year 1 - Q4**	**7/15/2020**		0.5 U	**4.7**	0.22 U	11 U	0.22 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-18-24D					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Lower Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-18-24D/GW05	**9962832**	**Baseline**	**1/7/2019**		0.5 U	**1**	0.2 U	10 U	0.2 U
OB-18-24D/GW06	**1127800**	**Year 1 - Q1**	**8/15/2019**		0.5 U	**2**	0.2 U	10 U	0.2 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-18-25					Volatile Organic Compounds		Semivolatile Organic Compounds		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Regolith				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-18-25/GW05	**9962837**	**Baseline**	**1/7/2019**		**2**	**2**	0.2 U	10 U	0.2 U
OB-18-25/GW06	**1126586**	**Year 1 - Q1**	**8/14/2019**		**0.3** J	**2**	0.2 U	10 U	0.2 U

Table 4-1

Summary of Groundwater Analytical Data for Contaminants of Concern

OB/OD Range 16 OU 006

Fort Riley, Kansas

Monitoring Well ID: OB-18-26D					Volatile Organic Compounds		Semivolatile Organic Compounds		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Lower Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-18-26D/GW05	**9962823**	**Baseline**	**1/7/2019**		0.5 U	**5**	0.2 U	10 U	0.2 U
OB-18-26D/GW06	**1126585**	**Year 1 - Q1**	**8/14/2019**		0.5 U	**4**	0.2 U	10 U	0.2 U
OB-18-26D/GW07	**1227292**	**Year 1 - Q2**	**12/17/2019**		0.5 U	**4**	0.2 U	10 U	**0.1 J**
OB-18-26D/GW08	**1316536**	**Year 1 - Q3**	**5/14/2020**		0.5 U	**4**	0.2 U	11 U	0.2 U
OB-18-26D/GW09	**410-8078-8**	**Year 1 - Q4**	**7/15/2020**		0.5 U	**3.3**	0.23 U	11 U	0.23 U

Table 4-1

Summary of Groundwater Analytical Data for Contaminants of Concern

OB/OD Range 16 OU 006

Fort Riley, Kansas

Monitoring Well ID: OB-18-27D					Volatile Organic Compounds		Semivolatile Organic Compounds		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Lower Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-18-27D/GW05	**9962821**	**Baseline**	**1/6/2019**		0.5 U	**3**	0.2 U	10 U	0.2 U
OB-18-27D/GW06	**1126587**	**Year 1 - Q1**	**8/14/2019**		0.5 U	**3**	0.2 U	10 U	0.2 U
OB-18-27D/GW07	**1227290**	**Year 1 - Q2**	**12/17/2019**		0.5 U	**3**	0.2 U	10 U	0.2 U
OB-18-27D/GW08	**1316537**	**Year 1 - Q3**	**5/14/2020**		0.5 U	**2**	0.2 U	10 U	0.2 U
OB-18-27D/GW09	**410-8078-5**	**Year 1 - Q4**	**7/15/2020**		0.5 U	**1.9**	0.20 U	10 U	0.2 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-18-28D					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Lower Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-18-28D/GW05	**9962818**	**Baseline**	**1/6/2019**		0.5 U	0.5 U	0.2 U	10 U	0.2 U
OB-18-28D/GW55	**9962820**	**Baseline**	**1/6/2019**	**Duplicate of OB-18-28D/GW05**	0.5 U	0.5 U	0.2 U	10 U	0.2 U
OB-18-28D/GW06	**1126591**	**Year 1 - Q1**	**8/15/2019**		0.5 U	**1**	0.2 U	10 U	0.2 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-93-01					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Weathered Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-93-01/GW05	**9962819**	**Baseline**	**1/6/2019**		0.5 U	0.5 U	0.2 U	10 U	0.2 U
OB-93-01/GW06	**1127795**	**Year 1 - Q1**	**8/16/2019**		0.5 U	0.5 U	0.2 U	10 U	0.2 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-93-02					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Weathered Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-93-02/GW05	**9962817**	**Baseline**	**1/6/2019**		0.5 U	0.5 U	0.2 U	10 U	0.2 U
OB-93-02/GW06	**1125353**	**Year 1 - Q1**	**8/13/2019**		0.5 U	0.5 U	0.2 U	10 U	0.2 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-93-03					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Lower Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-93-03/GW05	**9963718**	**Baseline**	**1/8/2019**		0.5 U	**0.9 J**	0.2 U	10 U	0.2 U
OB-93-03/GW06	**1126590**	**Year 1 - Q1**	**8/15/2019**		0.5 U	**0.6 J**	0.2 U	10 U	0.2 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-93-04					Volatile Organic Compounds		Semivolatile Organic Compounds		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Lower Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-93-04/GW05	**9963720**	**Baseline**	**1/8/2019**		0.5 U	**6**	0.2 U	10 U	0.2 U
OB-93-04/GW06	**1126584**	**Year 1 - Q1**	**8/14/2019**		0.5 U	**5**	0.2 U	10 U	0.2 U
OB-93-04/GW07	**1228794**	**Year 1 - Q2**	**12/18/2019**		0.5 U	**5**	0.2 U	10 U	0.2 U
FD121919	**1228802**	**Year 1 - Q2**	**12/18/2019**	**Duplicate of OB-93-04/GW07**	0.5 U	**5**	0.2 UJ	10 UJ	0.2 UJ
OB-93-04/GW08	**1316547**	**Year 1 - Q3**	**5/15/2020**		0.5 U	**4**	0.2 U	10 U	0.2 U
OB-93-04/GW09	**410-8078-9**	**Year 1 - Q4**	**7/16/2020**		0.5 U	**4.1**	0.21 U	10 U	0.21 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-97-05					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Lower Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-97-05/GW05	**9962828**	**Baseline**	**1/7/2019**		0.5 U	**0.3 J**	0.2 U	10 U	0.2 U
OB-97-05/GW06	**1127794**	**Year 1 - Q1**	**8/16/2019**		0.5 U	**0.4 J**	0.2 U	10 U	0.2 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-97-06					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Weathered Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-97-06/GW05	**9963728**	**Baseline**	**1/7/2019**		0.5 U	0.5 U	0.2 U	10 U	0.2 U
OB-97-06/GW06	**1126588**	**Year 1 - Q1**	**8/15/2019**		0.5 U	0.5 U	0.2 U	10 U	0.2 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-97-07					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Weathered Bedrock				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-97-07/GW05	**9962825**	**Baseline**	**1/7/2019**		**1**	**70**	0.2 U	10 U	0.2 U
OB-97-07/GW55	**9962826**	**Baseline**	**1/7/2019**	**Duplicate of OB-97-07/GW05**	**1**	**66**	0.2 U	10 U	0.2 U
OB-97-07/GW06	**1125365**	**Year 1 - Q1**	**8/14/2019**		0.5 U	**20**	0.2 U	10 U	0.2 U
OB-97-07/GW07	**1228795**	**Year 1 - Q2**	**12/18/2019**		0.5 U	**11**	0.2 U	10 U	0.2 U
OB-97-07/GW08	**1316541**	**Year 1 - Q3**	**5/15/2020**		0.5 U	**20**	0.2 U	10 U	0.2 U
OB-97-07/GW88	**1316548**	**Year 1 - Q3**	**5/15/2020**	**Duplicate of OB-97-07/GW08**	0.5 U	**20**	0.2 U	10 U	0.2 U
OB-97-07/GW09	**410-8078-10**	**Year 1 - Q4**	**7/16/2020**		0.5 U	**8.6**	0.21 U	11 U	0.21 U
OB-97-07/GW99	**410-8078-11**	**Year 1 - Q4**	**7/16/2020**	**Duplicate of OB-97-07/GW09**	0.5 U	**8.3**	0.20 U	10 U	0.20 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-97-08					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Regolith				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-97-08/GW05	**9962830**	**Baseline**	**1/7/2019**		**2**	**9**	0.2 U	11 U	0.2 U
OB-97-08/GW06	**1125354**	**Year 1 - Q1**	**8/13/2019**		**0.3 J**	**0.9 J**	0.2 U	10 U	0.2 U
OB-97-08/GW07	**1227289**	**Year 1 - Q2**	**12/17/2019**		**0.2 J**	**0.4 J**	0.2 U	10 U	0.2 U
OB-97-08/GW08	**1316540**	**Year 1 - Q3**	**5/14/2020**		0.5 U	0.5 U	0.2 U	12 U	0.2 U
OB-97-08/GW09	**410-8078-3**	**Year 1 - Q4**	**7/15/2020**		0.5 U	**0.72 J**	0.22 U	11 U	0.22 U

Table 4-1
Summary of Groundwater Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Monitoring Well ID: OB-97-14					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**		
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene	bis(2-Ethylhexyl) phthalate	Naphthalene
				Unit:	µg/L	µg/L	µg/L	µg/L	µg/L
				PALs:	2.55	5	0.2	6	2.61
				Aquifer Screened:	Regolith				
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**					
OB-97-14/GW05	**9962827**	**Baseline**	**1/7/2019**		**4**	**31**	0.2 U	10 U	0.2 U
OB-97-14/GW06	**1125362**	**Year 1 - Q1**	**8/14/2019**		**0.5** J	**6** J	0.2 U	**6** J	0.2 U
OB-97-14/GW07	**1228796**	**Year 1 - Q2**	**12/18/2019**		0.5 U	**4**	0.2 U	11 U	0.2 U
OB-97-14/GW08	**1316550**	**Year 1 - Q3**	**5/15/2020**		0.5 U	**3**	0.2 U	11 U	0.2 U
OB-97-14/GW09	**410-8078-12**	**Year 1 - Q4**	**7/16/2020**		0.5 U	**2.9**	0.22 U	11 U	0.2 U

Notes:

[1] = PALs for groundwater samples are based on project-specific RGs and/or USEPA MCLs.

Highlighted - Concentration is equal to or exceeds PAL

Bold - compound was detected

ID = identification

J = estimated value

MCL = maximum contaminant level

PAL = project action limit

Q = quarter

RG = remedial goal

U = compound was not detected

UJ = data was estimated at the reporting limit

USEPA = United States Environmental Protection Agency

µg/l = micrograms per liter

Table 4-2
Summary of Groundwater Monitored Natural Attenuation Indicator Parameters
OB/OD Range 16 OU 006
Fort Riley, Kansas

		Monitoring Well ID:	OB-05-15	OB-12-15D	OB-12-16	OB-12-17
		Sample ID:	OB-05-15/GW06	OB-12-15D/GW06	OB-12-16/GW06	OB-12-17/GW06
		Date Sampled:	8/14/2019	8/14/2019	8/13/2019	8/15/2019
		Laboratory ID:	1125357	1125358	1125352	1126592
		Notes:	Year 1 - Event 1	Year 1 - Event 1	Year 1 - Event 1	Year 1 - Event 1
		Aquifer Screened:	Regolith	Weathered Bedrock	Regolith	Regolith
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>10	µg/L	2 U	2 U	2 U	2 U
Ethene	>10	µg/L	2 U	2 U	2 U	2 U
Methane	>500	µg/L	**7.7**	**4.8 J**	**26**	5.9 U
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2]	mg/L	**5.7**	**5.1**	**5.9**	**6.3**
Total Nitrate (EPA 353.2)	<1	mg/L	**0.32 J**	0.45 U	0.45 U	0.45 U
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	NA	NA
Sulfate (EPA 300.0)	<20	mg/L	**29.9 J**	**29.6**	**21.9**	**17.9**
Total Organic Carbon (SM 5310)	>20	mg/L	0.9 U	0.9 U	0.9 U	**1.6**
Sulfide (SM 4500)	>1	mg/L	0.25 U	0.25 U	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[2]	mg/L as $CaCO_3$	**315**	**304 J**	**355**	**309**

Notes:
1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sample is presented.
2. For the purpose of this evaluation, monitoring wells were compared to the respective upgradient monitoring well for each aquifer:
   Regolith/Weathered Bedrock Aquifer: OB-93-02; 2x the concentration of chloride and alkalinity detected in OB-93-02 = 8 mg/L and 674 mg/L as $CaCO_3$, respectively.
   Lower Bedrock Aquifer: OB-97-05; 2x the concentration of chloride and alkalinity detected in OB-97-05 = 14.4 mg/L and 666 mg/L as $CaCO_3$, respectively.
3. Groundwater samples analyzed for total nitrate/nitrite as corrective action due to holding time exceedances for total nitrate analysis.

Bold indicates detection.
Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
µg/L = micrograms per liter

Table 4-2
Summary of Groundwater Monitored Natural Attenuation Indicator Parameters
OB/OD Range 16 OU 006
Fort Riley, Kansas

		Monitoring Well ID:	OB-12-18	OB-12-19D	OB-12-20D	OB-12-22
		Sample ID:	OB-12-18/GW06	OB-12-19D/GW06	OB-12-20D/GW06	OB-12-22/GW06
		Date Sampled:	8/15/2019	8/13/2019	8/13/2019	8/13/2019
		Laboratory ID:	1127801	1125356	1125351	1125355
		Notes:	Year 1 - Event 1	Year 1 - Event 1	Year 1 - Event 1	Year 1 - Event 1
		Aquifer Screened:	Regolith	Lower Bedrock	Lower Bedrock	Regolith
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>10	µg/L	2 U	2 U	2 U	2 U
Ethene	>10	µg/L	2 U	2 U	2 U	2 U
Methane	>500	µg/L	**15**	5.9 U	**6.1**	5.9 U
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2]	mg/L	**9.4 J**	**6.2**	**5.1**	**6.2**
Total Nitrate (EPA 353.2)	<1	mg/L	0.45 UR	**0.36 J**	0.45 U	**0.45 J**
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	0.09 UJ	NA	NA	NA
Sulfate (EPA 300.0)	<20	mg/L	**19.4 J**	**47.1**	**20.9**	**24.7**
Total Organic Carbon (SM 5310)	>20	mg/L	**1.8**	0.9 U	0.9 U	0.9 U
Sulfide (SM 4500)	>1	mg/L	0.25 U	0.25 U	0.5 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[2]	mg/L as $CaCO_3$	**352 J**	**321 J**	**227**	**360**

Notes:
1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sample is presented.
2. For the purpose of this evaluation, monitoring wells were compared to the respective upgradient monitoring well for each aquifer:
   Regolith/Weathered Bedrock Aquifer: OB-93-02; 2x the concentration of chloride and alkalinity detected in OB-93-02 = 8 mg/L and 674 mg/L as $CaCO_3$, respectively.
   Lower Bedrock Aquifer: OB-97-05; 2x the concentration of chloride and alkalinity detected in OB-97-05 = 14.4 mg/L and 666 mg/L as $CaCO_3$, respectively.
3. Groundwater samples analyzed for total nitrate/nitrite as corrective action due to holding time exceedances for total nitrate analysis.

Bold indicates detection.
Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
µg/L = micrograms per liter

Table 4-2
Summary of Groundwater Monitored Natural Attenuation Indicator Parameters
OB/OD Range 16 OU 006
Fort Riley, Kansas

		Monitoring Well ID:	OB-12-23	OB-12-24D	OB-12-25
		Sample ID:	OB-12-23/GW06	OB-12-24D/GW06	OB-12-25/GW06
		Date Sampled:	8/15/2019	8/15/2019	8/14/2019
		Laboratory ID:	1127799	1127800	1126586
		Notes:	Year 1 - Event 1	Year 1 - Event 1	Year 1 - Event 1
		Aquifer Screened:	Regolith	Lower Bedrock	Regolith
Analyte	**Evaluation Criteria**	**Units**			
Dissolved Gases by RSK SOP-175					
Ethane	>10	μg/L	2 U	2 U	2 U
Ethene	>10	μg/L	2 U	2 U	2 U
Methane	>500	μg/L	5.9 U	5.9 U	**9.5**
Inorganics by noted method					
Chloride (EPA 300.0)	>2x background[2]	mg/L	**10.4 J**	**6.4 J**	**9.2**
Total Nitrate (EPA 353.2)	<1	mg/L	0.38 R	0.45 UR	0.45 U
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	0.09 UJ	0.09 UJ	NA
Sulfate (EPA 300.0)	<20	mg/L	**205 J**	**50.5 J**	**18.7**
Total Organic Carbon (SM 5310)	>20	mg/L	**1.1**	**1.3**	**1.9**
Sulfide (SM 4500)	>1	mg/L	0.25 U	0.25 UJ	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[2]	mg/L as $CaCO_3$	**352 J**	**342 J**	**315**

Notes:
1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sample is presented.
2. For the purpose of this evaluation, monitoring wells were compared to the respective upgradient monitoring well for each aquifer:
   Regolith/Weathered Bedrock Aquifer: OB-93-02; 2x the concentration of chloride and alkalinity detected in OB-93-02 = 8 mg/L and 674 mg/L as $CaCO_3$, respectively.
   Lower Bedrock Aquifer: OB-97-05; 2x the concentration of chloride and alkalinity detected in OB-97-05 = 14.4 mg/L and 666 mg/L as $CaCO_3$, respectively.
3. Groundwater samples analyzed for total nitrate/nitrite as corrective action due to holding time exceedances for total nitrate analysis.

Bold indicates detection.
Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
μg/L = micrograms per liter

Table 4-2
Summary of Groundwater Monitored Natural Attenuation Indicator Parameters
OB/OD Range 16 OU 006
Fort Riley, Kansas

		Monitoring Well ID:	**OB-12-26D**	**OB-12-27D**	**OB-12-28D**	**OB-93-01**
		Sample ID:	**OB-12-26D/GW06**	**OB-12-27D/GW06**	**OB-12-28D/GW06**	**OB-93-01/GW06**
		Date Sampled:	**8/14/2019**	**8/14/2019**	**8/15/2019**	**8/16/2019**
		Laboratory ID:	**1126585**	**1126587**	**1126591**	**1127795**
		Notes:	**Year 1 - Event 1**	**Year 1 - Event 1**	**Year 1 - Event 1**	**Year 1 - Event 1**
		Aquifer Screened:	**Lower Bedrock**	**Lower Bedrock**	**Lower Bedrock**	**Weathered Bedrock**
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>10	µg/L	2 U	2 U	2 U	2 U
Ethene	>10	µg/L	2 U	2 U	2 U	2 U
Methane	>500	µg/L	5.9 U	5.9 U	5.9 U	5.9 U
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2]	mg/L	**6.2**	**6.5**	**6.1**	**7.0 J**
Total Nitrate (EPA 353.2)	<1	mg/L	0.45 U	0.45 U	0.45 U	0.45 UR
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	NA	0.09 UJ
Sulfate (EPA 300.0)	<20	mg/L	**46.6**	**81.8**	**25.2**	**24.7 J**
Total Organic Carbon (SM 5310)	>20	mg/L	**1.5**	**1.4**	**1.3**	**1.6**
Sulfide (SM 4500)	>1	mg/L	0.25 U	0.25 U	0.25 U	0.25 UJ
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[2]	mg/L as $CaCO_3$	**361**	**320**	**338**	**356 J**

Notes:
1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sample is presented.
2. For the purpose of this evaluation, monitoring wells were compared to the respective upgradient monitoring well for each aquifer:
   Regolith/Weathered Bedrock Aquifer: OB-93-02; 2x the concentration of chloride and alkalinity detected in OB-93-02 = 8 mg/L and 674 mg/L as $CaCO_3$, respectively.
   Lower Bedrock Aquifer: OB-97-05; 2x the concentration of chloride and alkalinity detected in OB-97-05 = 14.4 mg/L and 666 mg/L as $CaCO_3$, respectively.
3. Groundwater samples analyzed for total nitrate/nitrite as corrective action due to holding time exceedances for total nitrate analysis.

Bold indicates detection.

Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
µg/L = micrograms per liter

Table 4-2
Summary of Groundwater Monitored Natural Attenuation Indicator Parameters
OB/OD Range 16 OU 006
Fort Riley, Kansas

		Monitoring Well ID:	**OB-93-02**	**OB-93-03**	**OB-93-04**	**OB-97-05**
		Sample ID:	**OB-93-02/GW06**	**OB-93-03/GW06**	**OB-93-04/GW06**	**OB-97-05/GW06**
		Date Sampled:	**8/13/2019**	**8/15/2019**	**8/14/2019**	**8/16/2019**
		Laboratory ID:	**1125353**	**1126590**	**1126584**	**1127794**
		Notes:	**Year 1 - Event 1**	**Year 1 - Event 1**	**Year 1 - Event 1**	**Year 1 - Event 1**
		Aquifer Screened:	**Weathered Bedrock**	**Lower Bedrock**	**Lower Bedrock**	**Lower Bedrock**
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>10	µg/L	2 U	2 U	2 U	2 U
Ethene	>10	µg/L	2 U	2 U	2 U	2 U
Methane	>500	µg/L	5.9 U	**3.5 J**	5.9 U	**3.6 J**
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2]	mg/L	**4.0**	**29.8**	**11.2**	**7.2 J**
Total Nitrate (EPA 353.2)	<1	mg/L	**0.97**	0.45 U	0.45 UJ	0.45 UR
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	NA	0.09 UJ
Sulfate (EPA 300.0)	<20	mg/L	**27.9**	**538**	**248**	**101 J**
Total Organic Carbon (SM 5310)	>20	mg/L	0.9 U	**1.3**	**1.4**	**1.3**
Sulfide (SM 4500)	>1	mg/L	0.25 UJ	0.25 U	0.25 U	0.25 UJ
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[2]	mg/L as $CaCO_3$	**337 J**	**294**	**341**	**333 J**

Notes:
1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sample is presented.
2. For the purpose of this evaluation, monitoring wells were compared to the respective upgradient monitoring well for each aquifer:
   Regolith/Weathered Bedrock Aquifer: OB-93-02; 2x the concentration of chloride and alkalinity detected in OB-93-02 = 8 mg/L and 674 mg/L as $CaCO_3$, respectively.
   Lower Bedrock Aquifer: OB-97-05; 2x the concentration of chloride and alkalinity detected in OB-97-05 = 14.4 mg/L and 666 mg/L as $CaCO_3$, respectively.
3. Groundwater samples analyzed for total nitrate/nitrite as corrective action due to holding time exceedances for total nitrate analysis.

Bold indicates detection.
Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
µg/L = micrograms per liter

Table 4-2
Summary of Groundwater Monitored Natural Attenuation Indicator Parameters
OB/OD Range 16 OU 006
Fort Riley, Kansas

		Monitoring Well ID:	OB-97-06	OB-97-07	OB-97-08	OB-97-14
		Sample ID:	OB-97-06/GW06	OB-97-07/GW06	OB-97-08/GW06	OB-97-14/GW06
		Date Sampled:	8/15/2019	8/14/2019	8/13/2019	8/14/2019
		Laboratory ID:	1126588	1125365	1125354	1125362
		Notes:	Year 1 - Event 1	Year 1 - Event 1	Year 1 - Event 1	Year 1 - Event 1
		Aquifer Screened:	Weathered Bedrock	Weathered Bedrock	Regolith	Regolith
Analyte	**Evaluation Criteria**	**Units**				
Dissolved Gases by RSK SOP-175						
Ethane	>10	µg/L	2 U	2 U	2 U	2 U
Ethene	>10	µg/L	2 U	2 U	2 U	2 U
Methane	>500	µg/L	**3.6 J**	**3.2 J**	**12**	**1400**
Inorganics by noted method						
Chloride (EPA 300.0)	>2x background[2]	mg/L	**4.5**	**5.6**	**9.9**	**7.8**
Total Nitrate (EPA 353.2)	<1	mg/L	**0.38 J**	0.45 U	**0.47 J**	0.45 U
Total Nitrate/Nitrite (353.2)[3]	<1	mg/L	NA	NA	NA	NA
Sulfate (EPA 300.0)	<20	mg/L	**16.6**	**18.1**	**22.2**	**17.5**
Total Organic Carbon (SM 5310)	>20	mg/L	**1.5**	0.9 U	0.9 U	0.9 U
Sulfide (SM 4500)	>1	mg/L	0.25 U	0.25 U	0.25 U	0.25 U
Total Alkalinity to pH 4.5 (SM 2320)	>2x background[2]	mg/L as $CaCO_3$	**333**	**355**	**264**	**353 J**

Notes:
1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sample is presented.
2. For the purpose of this evaluation, monitoring wells were compared to the respective upgradient monitoring well for each aquifer:
   Regolith/Weathered Bedrock Aquifer: OB-93-02; 2x the concentration of chloride and alkalinity detected in OB-93-02 = 8 mg/L and 674 mg/L as $CaCO_3$, respectively.
   Lower Bedrock Aquifer: OB-97-05; 2x the concentration of chloride and alkalinity detected in OB-97-05 = 14.4 mg/L and 666 mg/L as $CaCO_3$, respectively.
3. Groundwater samples analyzed for total nitrate/nitrite as corrective action due to holding time exceedances for total nitrate analysis.

Bold indicates detection.

Shaded indicates reducing conditions or reductive pathway is possible (USEPA, 1998)

$CaCO_3$ = calcium carbonate
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
R = data was rejected
U = compound was not detected
UJ = estimated at the reporting limit
UR = estimated at reporting limit, data was rejected
µg/L = micrograms per liter

Table 4-6
Summary of Surface Water Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Sample Point ID: Seep					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene
				Unit:	µg/L	µg/L	µg/L
				PALs:	236	613	0.0374
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**			
Seep-01/GW05	**9963726**	**Baseline**	**1/8/2019**		0.5 U	0.5 U	0.2 U
Seep 01/SW06	**NA**	**Year 1 - Q1**	**NS**		NS	NS	NS
Seep 01/SW07	**NA**	**Year 1 - Q2**	**NS**		NS	NS	NS
Seep 01/SW08	**NA**	**Year 1 - Q3**	**NS**		NS	NS	NS
Seep 01/SW09	**NA**	**Year 1 - Q4**	**NS**		NS	NS	NS

Table 4-6
Summary of Surface Water Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Sample Point ID: Spring 01					Volatile Organic Compounds		Semivolatile Organic Compounds
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene
				Unit:	µg/L	µg/L	µg/L
				PALs:	236	613	0.0374
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**			
Spring-01/GW05	**9963721**	**Baseline**	**1/8/2019**		**6**	**55**	0.2 U
Spring 01/SW06	**1126593**	**Year 1 - Q1**	**8/15/2019**		**4 J**	**12 J**	0.2 U
Spring 01/SW07	**1228797**	**Year 1 - Q2**	**12/18/2019**		**9**	**38**	0.2 U
Spring 01/SW08	**1316551**	**Year 1 - Q3**	**5/15/2020**		**1**	**5**	0.3 U
Spring 01/SW09	**NA**	**Year 1 - Q4**	**NS**		NS	NS	NS

Table 4-6
Summary of Surface Water Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Sample Point ID: Spring 02					**Volatile Organic Compounds**		**Semivolatile Organic Compounds**
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene
				Unit:	µg/L	µg/L	µg/L
				PALs:	236	613	0.0374
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**			
Spring-02/GW05	**9963722**	**Baseline**	**1/8/2019**		**5**	**46**	0.2 U
Spring 02/SW06	**NA**	**Year 1 - Q1**	**NS**		NS	NS	NS
Spring 02/SW07	**NA**	**Year 1 - Q2**	**NS**		NS	NS	NS
Spring 02/SW08	**NA**	**Year 1 - Q3**	**NS**		NS	NS	NS
Spring 02/SW09	**NA**	**Year 1 - Q4**	**NS**		NS	NS	NS

Table 4-6
Summary of Surface Water Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Sample Point ID: Surface Water 01					Volatile Organic Compounds		Semivolatile Organic Compounds
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene
				Unit:	µg/L	µg/L	µg/L
				PALs:	236	613	0.0374
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**			
SW-01/GW05	**9963724**	**Baseline**	**1/8/2019**		0.5 U	0.5 U	0.2 U
Surface Water-01/GW06	**NA**	**Year 1 - Q1**	**NS**		NS	NS	NS
Surface Water-01/GW07	**NA**	**Year 1 - Q2**	**NS**		NS	NS	NS
Surface Water-01/GW08	**1316553**	**Year 1 - Q3**	**5/15/2020**		0.5 U	0.5 U	0.2 U
Surface Water-01/GW09	**NA**	**Year 1 - Q4**	**NS**		NS	NS	NS

Table 4-6
Summary of Surface Water Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Sample Point ID: Surface Water 02					Volatile Organic Compounds		Semivolatile Organic Compounds
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene
				Unit:	µg/L	µg/L	µg/L
				PALs:	236	613	0.0374
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**			
SW-02/GW05	**9963723**	**Baseline**	**1/8/2019**		**0.3 J**	**4**	0.2 U
Surface Water-02/SW06	**1126589**	**Year 1 - Q1**	**8/14/2019**		**1**	**5**	0.2 U
Surface Water-02/SW66	**1126594**	**Year 1 - Q1**	**8/14/2019**	**Duplicate of Surface Water-02/SW66**	**1**	**5**	0.2 U
Surface Water-02/SW07	**NA**	**Year 1 -Q2**	**NS**		NS	NS	NS
Surface Water-02/SW08	**1316552**	**Year 1 - Q3**	**5/15/2020**		**0.2 J**	**1**	0.2 U
Surface Water-02/GW09	**410-8087-18**	**Year 1 - Q4**	**7/16/2020**		0.5 U	**3.9**	0.24 U

Table 4-6
Summary of Surface Water Analytical Data for Contaminants of Concern
OB/OD Range 16 OU 006
Fort Riley, Kansas

Sample Point ID: East Stream					Volatile Organic Compounds		Semivolatile Organic Compounds
				Analyte:	1,1,2,2-Tetrachloroethane	Trichloroethene	Benzo(a)pyrene
				Unit:	µg/L	µg/L	µg/L
				PALs:	236	613	0.0374
Laboratory ID	**Sample ID**	**Event**	**Sample Date**	**Notes**			
East Stream/GW05	**9963725**	**Baseline**	**1/8/2019**		0.5 U	0.5 U	0.2 U
East Stream/SW06	**1127802**	**Year 1 - Q1**	**8/15/2019**		0.5 U	0.5 U	0.2 U
East Stream/SW07	**NA**	**Year 1 - Q2**	**NS**		NS	NS	NS
East Stream/SW08	**1316554**	**Year 1 - Q3**	**5/15/2020**		0.5 U	0.5 U	0.2 U
East Stream/GW09	**410-8087-17**	**Year 1 - Q4**	**7/16/2020**		0.5 U	0.5 U	0.25 U

Notes:

[1] - PALs for surface water samples are based on project-specific RGs.

Highlighted - Concentration exceeds PALs

Bold - compound was detected

ID = identification

J = estimated value

NA = not available

NS = not sampled, surface water sample location was dry.

PAL = project action limit

Q = quarter

U = compound was not detected

µg/L = micrograms per liter

Table 4-7
Summary of Surface Water Monitored Natural Attenuation Indicator Parameters
OB/OD Range 16 OU 006
Fort Riley, Kansas

	Sample Location ID:	Seep	Spring 01	Spring 02
	Sample ID:	NA	Spring-01/SW-06	NA
	Date Sampled:	NS	8/15/2019	NS
	Laboratory ID:	NA	1126593	NA
	Notes:	Year 1 - Event 1	Year 1 - Event 1	Year 1 - Event 1
Analyte	**Units**			
Dissolved Gases by RSK SOP-175				
Ethane	µg/L	NA	2 UJ	NA
Ethene	µg/L	NA	2 UJ	NA
Methane	µg/L	NA	5.9 UJ	NA
Inorganics by noted method				
Chloride (EPA 300.0)	mg/L	NA	**11.7**	NA
Total Nitrate (EPA 353.2)	mg/L	NA	0.45 U	NA
Sulfate (EPA 300.0)	mg/L	NA	**20.9**	NA
Total Organic Carbon (SM5310)	mg/L	NA	**2.3**	NA
Sulfide (SM 4500)	mg/L	NA	0.25 U	NA
Total Alkalinity to pH 4.5 (SM 2320)	mg/L as $CaCO_3$	NA	**342**	NA

Notes:
1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sample is presented.

Bold indicates detection.

$CaCO_3$ = calcium carbonate
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
NS = not sampled, surface water location was dry.
U = compound was not detected
UJ = estimated at the reporting limit
UR = not detected result was rejected at the reporting limit
µg/L = micrograms per liter

Table 4-7
Summary of Surface Water Monitored Natural Attenuation Indicator Parameters
OB/OD Range 16 OU 006
Fort Riley, Kansas

	Sample Location ID:	Surface Water 01	Surface Water 02	East Stream
	Sample ID:	NA	SW02/SW66	East Stream/SW06
	Date Sampled:	NS	8/14/2019	8/15/2019
	Laboratory ID:	NA	1126594	1127802
	Notes:	Year 1 - Event 1	Year 1 - Event 1	Year 1 - Event 1
Analyte	**Units**			
Dissolved Gases by RSK SOP-175				
Ethane	µg/L	NA	2 U	2 U
Ethene	µg/L	NA	2 U	2 U
Methane	µg/L	NA	**4.5 J**	**5.6 J**
Inorganics by noted method				
Chloride (EPA 300.0)	mg/L	NA	**10.3**	**7.3 J**
Total Nitrate (EPA 353.2)	mg/L	NA	0.45 U	0.45 UR
Sulfate (EPA 300.0)	mg/L	NA	**19.4**	**27.2 J**
Total Organic Carbon (SM5310)	mg/L	NA	**1.8**	**2.1 J**
Sulfide (SM 4500)	mg/L	NA	0.25 U	0.25 UJ
Total Alkalinity to pH 4.5 (SM 2320)	mg/L as $CaCO_3$	NA	**334**	**372 J**

Notes:
1. Results for duplicate analyses not shown. Higher detection between the parent sample and duplicate sample is presented.

Bold indicates detection.

$CaCO_3$ = calcium carbonate
EPA = Environmental Protection Agency
ID = identification
J = estimated value
mg/L = milligrams per liter
NA = not analyzed
NS = not sampled, surface water location was dry.
U = compound was not detected
UJ = estimated at the reporting limit
UR = not detected result was rejected at the reporting limit
µg/L = micrograms per liter

Appendix E – Data Reports

Appendix E5

Operable Unit 008 (OU 008) Sherman Heights Small Arms Range

Report Reference	Excerpted Data Included	Page Number
Final Summary Technical Memorandum, Composite Surface Soil Sampling Event, Sherman Heights Small Arms Range (SHSAR) Impact Slope, Fort Riley, Kansas. December 2020.	2020 Soil Sampling Data Tables	E5-1

Appendix C — Laboratory Data Summary Table
Composite Surface Soil Sampling Event
Sherman Heights Small Arms Range Impact Slope, Fort Riley, Kansas

Analyte	RSL	Units	SHSAR/SP17/ SS02/0-0.5'	SHSAR/SP38/ SS02/0-0.5'	SHSAR/SP39/ SS02/0-0.5'	SHSAR/SP17/ SS02/0-0.5' (SS02 DUP)
Lead by Method SW6020A						
Lead mg/kg	400	mg/Kg	105	2,530	415	106

Notes:

mg/kg = milligrams per kilogram

Shaded = Exceeds RSL