FINAL
Third Five-Year Review Report
Fort Belvoir
Fairfax County, Virginia

Prepared for:

U.S. Army Corps of Engineers
Omaha District

United States Army Environmental Command
Fort Sam Houston, Texas

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Third Five-Year Review Report
Fort Belvoir
Fairfax County, Virginia

Signature: _____ ***Date:*** _____

JOSEPH V. MESSINA
COL, AG
Commanding

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Executive Summary

Fort Belvoir is located in southeastern Fairfax County, 14 miles southwest of Washington, DC, and north of Richmond, Virginia. The installation consists of 7,694 acres of Main Post cantonment and 804 acres comprising the Fort Belvoir North Area (FBNA), formerly the Engineer Proving Ground (EPG). The Main Post is located on a peninsula along the north bank of the Potomac River and is bisected east-west by U.S. Highway 1. The FBNA is located approximately two miles north of the Main Post and is bordered by U.S. Interstate 95 and the Fairfax County Parkway. Vehicular access to the Main Post areas is controlled by gates and security personnel.

The U.S. Department of the Army (Army) began utilizing 1,500 acres of the Belvoir peninsula as an engineer training facility in 1915. The area was established as Camp Humphries in 1917 and grew to 6,000 acres by 1919. Approximately 50,000 enlisted engineer soldiers and 4,900 officer candidates were trained at Camp Humphries through 1918. Re-named Fort Humphrey's in 1922, the camp was designated a permanent post and was used to train engineer officers during the inter-war years. The installation was re-named Fort Belvoir in 1935 following a pre-war refurbishment of military bases. The outbreak of World War II in 1939 resulted in the acquisition of an additional 3,000 acres north of Route 1 to establish the Engineer Replacement Training Center (ERTC) on the Main Post. By the end of 1945, the ERTC at Fort Belvoir had trained roughly 147,000 engineer troops. Emphasis at Fort Belvoir in the 1950s shifted from training to research and development. Throughout the decade, the Engineer Research and Development Laboratories were involved in experimentation with a wide range of technical and military applications, many of which were on the EPG, including the development and testing of Army vehicles. Currently, Fort Belvoir is designated a Strategic Sustaining Base for the Department of Defense in the National Capital Region.

This statutory five-year review for Fort Belvoir was conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and the National Oil and Hazardous Substances Pollution Contingency Plan, more commonly known as the National Contingency Plan.

The purpose of a five-year review is to evaluate the implementation and performance of a remedy in order to determine if the remedy is protective of human health and the environment. Five-year reviews also identify issues found during the review, if any, and provide recommendations to address them. This five-year review has been prepared because hazardous substances, pollutants, or contaminants remain at the sites at levels that do not allow for unlimited use and unrestricted exposure. The sites included in this review are listed in the following table.

SWMU	MEDIA	HQAES ID	AEDB-R ID	AEDB-R NAME
M-26	Soil Groundwater	51105.1072	FTBL-68	M-26 Hydrocarbon Spill Area
M-27	Soil Groundwater	51105.10723	FTBL-69	M-27 Waste Ordnance Pit at Range 1
N/A	Soil Surface Water	51105.1089	FTBL-001-R-02	Infiltration Course
	Soil	51105.1049	FTBL-003-R-01	Combat Range Complex

SWMU	MEDIA	HQAES ID	AEDB-R ID	AEDB-R NAME
M-33	Groundwater	51105.1077	FTBL-005-R-05	Inert Mine Testing Area at Range 5
ND	Groundwater	51105.1141	FTBL-005-R-09	FBNA Soils and Groundwater at the Child Development Center
	Soil	51105.1053	FTBL-007-R-01	Grenade Court
	Soil	51105.1060	FTBL-014-R-01	Tracy Road Range
	Soil	51105.1090	FTBL-018-R-01	Demolition Area - 01
	Soil	51105.1081	FTBL-024-R-01	Booby Trap Site
	Soil	51105.1066	FTBL-025-R-01	Demolition Area - USACE
	Soil	51105.1082	FTBL-026-R-01	Mines and Booby Trap Area
	Soil	51105.1067	FTBL-027-R-01	T-16

AEDB-R – Army Environmental Database - Restoration
AOPC – Area of Potential Concern
HQAES – Headquarters Army Environmental System
ID – Identification
ND – Not Designated as a SWMU
SWMU – Solid Waste Management Unit
USACE – U.S. Army Corp of Engineers

The following summarizes the selected remedy and protectiveness statement, by Decision Document (DD) for the Fort Belvoir sites evaluated under this review.

FTBL-68 Hydrocarbon Spill Area

The components of the selected remedy identified in the 2007 DD include:

- Removal and disposal of contaminated soil.
- Long-term monitoring (LTM) of groundwater for natural attenuation.
- Land Use Controls (LUCs) [residential and groundwater use restrictions].

The remedy at FTBL-68 currently protects human health and the environment because groundwater use restrictions are in place to prohibit extraction of groundwater, excavation in the Fairfax County Parkway interchange requires Virginia Department of Transportation (VDOT) and Fort Belvoir dig permits, and LUCs are preventing human exposure to groundwater within the boundaries of the site. However, in order for the remedy to be protective in the long-term, the LTM network should be evaluated to monitor conditions downgradient of M26-LTM-01, FATTS-LTM-MW03, and FATTS-LTM-MW09.

FTBL-69 Waste Ordnance Pit at Range 1

The components of the selected remedy identified in the 2006 DD include:

- LTM of groundwater for natural attenuation.
- LUCs (residential land use and groundwater use restrictions).

The remedy for FTBL-69 is protective of human health and the environment.

LUCs are in place to restrict residential land use and groundwater use at the site. Monitoring of groundwater is being conducted in accordance with the 2021 LTM plan and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance or land use activity.

FTBL-001-R-02 Infiltration Course

The components of the selected remedy identified in the 2020 DD include:

- Removal of lead-impacted soils.
- Regrading and stabilization of a portion of the streambank.
- Ex-situ treatment of removed soils.
- LUCs (residential land use prohibited, restricted to recreational use only, and dig permit).

The remedy for FTBL-001-R-02 is protective of human health and the environment.

Lead contaminated soil exceeding the commercial/industrial (C/I) remedial goal of 1,235 mg/kg has been excavated and disposed of off-site at a permitted facility, and portions of the stream bank have been stabilized to reduce human and ecological exposure to copper and lead in surface water. LUCs are in place to prohibit residential land use and restrict to recreational use only, existing signage is maintained, and the Fort Belvoir dig permit process is established to prevent unauthorized land use or ground disturbance activity.

FTBL-003-R-01 Combat Range Complex

The components of the selected remedy identified in the 2017 DD include:

- Soil removal with off-site disposal.
- LUCs (residential land use prohibited, restricted to recreational use only, signage, and dig permit).

The remedy for FTB-003-R-01 is protective of human health and the environment.

Unexploded Ordnance (UXO) and munitions constituents (MC) removal has been completed, and direct contact with potential surface and subsurface munitions and explosives of concern (MEC) and exposure to MC in soil has been mitigated. Lead- and antimony-impacted soil exceeding remedial goals has been excavated and disposed of off-site at a permitted facility. LUCs are in place to prohibit residential land use and restrict area to recreational use only, existing signage and vehicular control is maintained, and the Fort Belvoir dig permit process is established to prevent unauthorized land use and ground disturbance activity.

FTBL-005-R-05 Inert Mine Testing Area at Range 5

The components of the selected remedy identified in the 2018 DD include:

- LTM of groundwater.
- LUCs (residential land use prohibited, groundwater use restrictions, and dig permit).

The remedy for FTBL-005-R-05 is protective of human health and the environment.

LUCs are in place to restrict residential land use and groundwater use at the site. Groundwater monitoring is being conducted in accordance with the 2021 LTM plan and the Fort Belvoir dig permit process is established to prevent unauthorized land use and ground disturbance activity.

FTBL-005-R-09 FBNA Soils and Groundwater at the Child Development Center

The components of the selected remedy identified in the 2020 DD include:

- LTM of groundwater.
- LUCs (residential land use restrictions and groundwater use prohibitions).

The remedy for FTBL-005-R-09 is protective of human health and the environment.

LUCs are in place to restrict residential land use and groundwater use at the site. Groundwater monitoring is being conducted in accordance with the 2021 LTM plan and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance or land use activity.

FTBL-007-R-01 Grenade Court, FTBL-018-R-01 Demolition Area - 01, FTBL-024-R-01 Booby Trap Site, and FTBL-027-R-01 T-16

The components of the selected remedy identified in 2018 DD include:

- LUCs (residential land use restrictions, signage, educational programs, dig permit, and UXO escort/clearance for construction activities).

The remedy for the four Munitions Response Sites (MRSs) is protective of human health and the environment.

LUCs are in place to restrict residential land use. Signage has been installed and maintained. An educational program and information warn installation personnel and contractors of the potential presence of MEC at the MRSs, and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

FTBL-014-R-01 Tracy Road Range

The components of the selected remedy identified in the 2017 DD include:

- LUCs (residential land use restrictions and dig permit).

The remedy for FTBL-014-R-01 is protective of human health and the environment.

LUCs are implemented to mitigate human exposure to lead contaminated soil at the site. Land use is restricted, and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

FTBL-025-R-01 Demolition Area—USACE

The components of the selected remedy identified in the 2020 DD include:

- LUCs (residential land use restrictions, signage, educational programs, and UXO escort for construction activities).

The remedy for FTBL-025-R-01 is protective of human health and the environment.

LUCs are in place to restrict residential land use. Signage has been installed and maintained. An educational program and information warn installation personnel and contractors of the potential presence of MEC at the site, and the Humphreys Engineer Center Support Activity (HECSA) dig permit process is established to prevent unauthorized ground disturbance and land use activity.

FTBL-026-R-01 Mines and Booby Trap

The components of the selected remedy identified in the 2020 DD include:

- Focused MEC removal.
- LUCs (residential land use restrictions, signage, educational programs, dig permit, and UXO escort for construction activities).

The remedy for FTBL-026-R-01 is protective of human health and the environment.

MEC removal was achieved at FTBL-026-R-01. LUCs are in place to restrict land use. Signage has been installed. An educational program and information warn installation personnel and contractors of the potential presence of MEC at the site, and the Fort Belvoir dig permit process is established to provide construction support and prevent unauthorized ground disturbance and land use activity.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Installation Name: Fort Belvoir		
USEPA ID: VA7213720082		
USEPA Region: 3	**State:** VA	**City/County:** Fairfax County
SITE STATUS		
NPL Status: Non-NPL		**Has the site achieved construction completion?** Yes
Multiple OUs? Yes		
REVIEW STATUS		
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** U.S. Army		
Author name (Federal State Project Manager): Christopher Manikas		
Author affiliation: Fort Belvoir Directorate of Public Works		
Review period: December 2, 2021 – TBD (Signature Date of Review)		
Date of site inspection: March 14-15, 2022		
Type of review: Statutory		
Review number: 3		
Triggering action date: October 4, 2007 **Initial baseline action**: Signature on FTBL-68 Decision Document		
Due date ***(five-year cycle after triggering action date)*****:** October 4, 2022		

Five-Year Review Summary Form (cont.)

ISSUES/RECOMMENDATIONS

Sites without Issues/Recommendations Identified in the Five-Year Review:

FTBL-69, FTBL-001-R-02, FTBL-003-R-01, FTBL-005-R-05, FTBL-005-R-09, FTBL-007-R-01, FTBL-018-R-01, FTBL-024-R-01, FTBL-027-R-01, FTBL-014-R-01, FTBL-025-R-01

Issues and Recommendations Identified in the Five-Year Review:

Site ID: FTBL-68	**Issue Category:** Monitoring			
	Issue: The LTM network is insufficient to monitor conditions downgradient of monitoring wells M26-LTM-01, FATTS-LTM-MW03, and FATTS-LTM-MW09.			
	Recommendation: Evaluate the LTM network to monitor conditions downgradient of M26-LTM-01, FATTS-LTM-MW03, and FATTS-LTM-MW09.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Fort Belvoir	VADEQ	October 2025

PROTECTIVENESS STATEMENT(S)

Site ID: FTBL-68	**Protectiveness Determination:** Short-term Protective	**Planned Addendum Completion Date:** October 2025

Protectiveness Statement:

The remedy at FTBL-68 currently protects human health and the environment because current land use is a highway interchange, groundwater use restrictions are in place to prohibit extraction of groundwater, excavation in the interchange requires VDOT and Fort Belvoir dig permits, and LUCs are preventing human exposure to groundwater within the boundaries of the site. However, in order for the remedy to be protective in the long-term, the LTM network should be evaluated to monitor conditions downgradient of M26-LTM-01, FATTS-LTM-MW03, and FATTS-LTM-MW09.

Five-Year Review Summary Form (cont.)

PROTECTIVENESS STATEMENT(S)		
Site ID: FTBL-69	**Protectiveness Determination:** Protective	**Planned Addendum Completion Date:** Not Applicable

Protectiveness Statement: The remedy for FTBL-69 is protective of human health and the environment.

LUCs are in place to restrict residential land use and groundwater use at the site. Monitoring of groundwater is being conducted in accordance with the 2021 LTM plan and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

PROTECTIVENESS STATEMENT(S)		
Site ID: FTBL-001-R-02	**Protectiveness Determination:** Protective	**Planned Addendum Completion Date:** Not Applicable

Protectiveness Statement: The remedy for FTBL-001-R-02 is protective of human health and the environment.

Lead contaminated soil exceeding the C/I remedial goal of 1,235 mg/kg has been excavated and disposed of off-site at a permitted facility, and portions of the stream bank have been stabilized to reduce human and ecological exposure to copper and lead in surface water. LUCs are in place to prohibit residential land use and restrict to recreational use only, existing signage is maintained, and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

PROTECTIVENESS STATEMENT(S)		
Site ID: FTBL-003-R-01	**Protectiveness Determination:** Protective	**Planned Addendum Completion Date:** Not Applicable

Protectiveness Statement: The remedy for FTBL-003-R-01 is protective of human health and the environment.

UXO and MC removal has been completed, and direct contact with potential surface and subsurface MEC and exposure to MC in soil has been mitigated. Lead and antimony impacted soil exceeding remedial goals has been excavated and disposed of off-site at a permitted facility. LUCs are in place to prohibit residential land use and restrict to recreational use only, existing signage is maintained, and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

Five-Year Review Summary Form (cont.)

PROTECTIVENESS STATEMENT(S)		
Site ID: FTBL-005-R-05	**Protectiveness Determination:** Protective	**Planned Addendum Completion Date:** Not Applicable

Protectiveness Statement: The remedy at FTBL-005-R-05 is protective of human health and the environment.

LUCs are in place to restrict residential land use and groundwater use at the site. Groundwater monitoring is being conducted in accordance with the 2021 LTM plan and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

PROTECTIVENESS STATEMENT(S)		
Site ID: FTBL-005-R-09	**Protectiveness Determination:** Protective	**Planned Addendum Completion Date:** Not Applicable

Protectiveness Statement: The remedy at FTBL-005-R-09 is protective of human health and the environment.

LUCs are in place to restrict residential land use and groundwater use at the site. Groundwater monitoring is being conducted in accordance with the 2021 LTM plan and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

PROTECTIVENESS STATEMENT(S)		
Site ID: FTBL-007-R-01, FTBL-018-R-01, FTBL-024-R-01, FTBL-027-R-01	**Protectiveness Determination:** Protective	**Planned Addendum Completion Date:** Not Applicable

Protectiveness Statement: The remedy for FTBL-007-R-01, FTBL-018-R-01, FTBL-024-R-01, and FTBL-027-R-01 is protective of human health and the environment.

LUCs are in place to restrict residential land use. Signage has been installed and maintained. An educational program and information warn installation personnel and contractors of the potential presence of MEC at the MRSs, and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

Five-Year Review Summary Form (cont.)

PROTECTIVENESS STATEMENT(S)		
Site ID: FTBL-014-R-01	**Protectiveness Determination:** Protective	**Planned Addendum Completion Date:** Not Applicable

Protectiveness Statement: The remedy for FTBL-014-R-01 is protective of human health and the environment.

LUCs are implemented to mitigate human exposure to lead contaminated soil at the site. Land use is restricted, and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

PROTECTIVENESS STATEMENT(S)		
Site ID: FTBL-025-R-01	**Protectiveness Determination:** Protective	**Planned Addendum Completion Date:** Not Applicable

Protectiveness Statement: The remedy for FTBL-025-R-01 is protective of human and the environment.

LUCs are in place to restrict residential land use. Signage has been installed and maintained. An educational program and information warn installation personnel and contractors of the potential presence of MEC at the site, and the HECSA dig permit process is established to prevent unauthorized ground disturbance and land use activity.

PROTECTIVENESS STATEMENT(S)		
Site ID: FTBL-026-R-01	**Protectiveness Determination:** Protective	**Planned Addendum Completion Date:** Not Applicable

Protectiveness Statement: The remedy for FTBL-026-R-01 is protective of human health and the environment.

MEC removal was achieved at FTBL-026-R-01. LUCs are in place to restrict land use. Signage has been installed. An educational program and information warn installation personnel and contractors of the potential presence of MEC at the site, and the Fort Belvoir dig permit process is established to provide construction support and prevent unauthorized ground disturbance and land use activity.

Five-Year Review Summary Form (cont.)

SITEWIDE PROTECTIVENESS STATEMENT(S)

Protectiveness Determination:	**Planned Addendum Completion Date:**
Short-term Protective	October 2025

The remedy at FTBL-68 currently protects human health and the environment because current land use is a highway interchange, groundwater use restrictions are in place to prohibit extraction of groundwater, excavation in the interchange requires VDOT and Fort Belvoir dig permits, and LUCs are preventing human exposure to groundwater within the boundaries of the site. However, in order for the remedy to be protective in the long-term, the LTM network should be evaluated to monitor conditions downgradient of M26-LTM-01, FATTS-LTM-MW03, and FATTS-LTM-MW09.

LUCs are in place to restrict residential land use and groundwater use at FTBL-69, FTBL-005-R-05, and FTBL-005-R-09. Monitoring of groundwater is being conducted in accordance with the 2021 LTM plan and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

Lead contaminated soil exceeding the C/I remedial goal of 1,235 mg/kg at FTBL-001-R-02 has been excavated and disposed of off-site at a permitted facility, and portions of the stream bank have been stabilized to reduce human and ecological exposure to copper and lead in surface water.

UXO and MC removal has been completed at FTB-003-R-01, and direct contact with potential surface and subsurface MEC and exposure to MC in soil has been mitigated. Lead and antimony impacted soil exceeding remedial goals has been excavated and disposed of off-site at a permitted facility.

MEC removal was achieved at FTBL-026-R-01.

LUCs are implemented to mitigate human exposure to lead contaminated soil at FTBL-014-R-01

LUCs are in place to restrict residential land use at the MSRs. Signage has been installed and maintained. An educational program and information warn installation personnel and contractors of the potential presence of MEC at the site, and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

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ACRONYMS AND ABBREVIATIONS

µg /L	micrograms per liter
§	Section
1,2-DCA	1,2-dichloroethane
2A-DNT	2-amino-4,6-dinitrotoluene
4A-DNT	4-amino-2,6-dinitrotoluene
AEDB-R	Army Environmental Database-Restoration
ALM	Adult Lead Model
amsl	Above Mean Sea Level
AOPC	Area of Potential Concern
AOPI	Area of Potential Interest
Army	U.S. Department of Army
AST	Aboveground Storage Tank
bgs	Below Ground Surface
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
C/I	Commercial/Industrial
COPC	Constituents of Potential Concern
COC	Contaminant of Concern
CRC	Combat Range Complex
DAAF	Davison Army Airfield
DD	Decision Document
DMM	Discarded Military Munition
DPW-ENRD	Directorate of Public Works Environmental and Natural Resources Division
DNT	2,4-dinitrotoluene
DoD	Department of Defense
EDB	Ethylene Dibromide
EE/CA	Engineering Evaluation/Cost Analysis
EPG	Engineer Proving Ground
ERA	Ecological Risk Assessment
ERTC	Engineer Replacement Training Center
ESD	Explanation of Significant Differences
FATTS	Former Aboveground Test Tank Site
FBNA	Fort Belvoir North Area
FS	Feasibility Study
ft	Feet
GIS	Geographic Information System
HE	High Explosive
HECSA	Humphrey's Engineer Center Support Activity
HGS	Hoʻolaulima Government Solutions, LLC

HI	Hazard Index
HQAES	Headquarters Army Environmental System
IC	Institutional Control
INFC	Infiltration Course
IRA	Interim Removal Action
J	Estimated Concentration
LTM	Long-Term Monitoring
LUCs	Land Use Controls
LUCIP	Land Use Control Implementation Plan
MBTA	Mines and Booby Trap Area
MC	Munitions Constituents
MCL	Maximum Contaminant Level
MD	Munitions Debris
MDAS	Material Documented as Safe
MEC	Munitions and Explosives of Concern
mg/kg	milligrams per kilogram
MILCON	Military Construction
MMRP	Military Munitions Response Program
MRA	Munitions Response Area
MRS	Munitions Response Site
NCP	National Oil and Hazardous Substances Pollution Contingency Plan, more commonly known as the National Contingency Plan
NFA	No Further Action
ng/L	nanograms per liter
OSD	Office of the Secretary of Defense
OU	Operable Unit
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbons
PFAS	Per- and Polyfluoroalkyl Substances
PFBS	Perfluorobutanesulfonic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
POC	Point of Contact
ppb	parts per billion
PRG	Preliminary Remedial Goal
RA	Removal Action
RAO	Remedial Action Objective
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RfD	Revised Reference Dose
RI	Remedial Investigation
RSL	Regional Screen Level
SDZ	Surface Danger Zone

SI	Site Investigation
SL	Screening Level
SSL	Soil Screening Levels
SWMU	Solid Waste Management Unit
SVOC	Semi-Volatile Organic Compound
TNT	2,4,6-trinitrotoluene
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Command
USAG-FB	U.S Army Garrison, Fort Belvoir
USEPA	U.S. Environmental Protection Agency
UXO	Unexploded Ordnance
VA WQS	Virginia Water Quality Standard
VADEQ	Virginia Department of Environmental Quality
VDOT	Virginia Department of Transportation
VISL	Vapor Intrusion Screening Level
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This is the third statutory five-year for Fort Belvoir, located in southeastern Fairfax County, Virginia. The U.S. Department of Army (Army) is responsible for the cleanup of releases from historical activities at Fort Belvoir in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and Executive Order 12580, as required by the U.S. Department of Defense (DoD) Defense Environmental Restoration Program (DERP). This review includes the sites presented in **Table 1**.

Table 1 – Fort Belvoir Five-Year Review Site Crosswalk

SWMU	MEDIA	HQAES ID	AEDB-R ID	AEDB-R NAME
M-26/ FATTS	Soil & Groundwater	51105.1072	FTBL-68	M-26 Hydrocarbon Spill Area
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AEDB-R – Army Environmental Database – Restoration
FATTS – Former Aboveground Test Tank Site
HQAES – Headquarters Army Environmental System
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SWMU – Solid Waste Management Unit
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This five-year presents the selected remedy and protectiveness statement, by Decision Document (DD) for the Fort Belvoir sites evaluated under this review.

1.1 PURPOSE

The purpose of the five-year review is to evaluate the implementation and performance of a remedy to determine if the remedy remains protective of human health and the environment. Five-year reviews also identify issues found during the review, if any, and provide

recommendations to address them. This five-year review has been prepared because hazardous substances, pollutants, or contaminants remain at the site at levels that do not allow for unlimited use and unrestricted exposure.

1.2 AUTHORITY

The U.S. Army Corp of Engineers (USACE), Omaha District, with assistance from Ho'olaulima Government Solutions, LLC (HGS), prepared this third five-year review on behalf of the U.S. Army Environmental Command (USAEC) pursuant to the CERCLA Section (§) 121, 42 U.S. Code (USC) § 9621, and the National Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) Part 300.

CERCLA § 121 I states the following:

> *"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 each five years after the initiation of such 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 NCP, at 40 CFR § 300.430(1 f)(4)(ii), states:

> *"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."*

The Army is the lead agency for Fort Belvoir, and the Virginia Department of Environmental Quality (VADEQ) is the state agency that provides regulatory oversight support concerning environmental investigations, risk management, and cleanup activities.

2.0 BACKGROUND

The U.S. Army began utilizing 1,500 acres of the Belvoir peninsula as an engineer training facility in 1915. The area was established as Camp Humphries in 1917 and grew to 6,000 acres by 1919. Approximately 50,000 enlisted engineer soldiers and 4,900 officer candidates were trained at Camp Humphries through 1918. Re-named Fort Humphrey's in 1922, the camp was designated a permanent post and was used to train engineer officers during the inter-war years. The installation was re-named Fort Belvoir in 1935, following a pre-war refurbishment of military bases. The outbreak of World War II in 1939 resulted in the acquisition of an additional 3,000 acres north of Route 1 to establish the Engineer Replacement Training Center (ERTC) on the Main Post. By the end of 1945, the ERTC at Fort Belvoir had trained roughly 147,000 engineer troops. Emphasis at Fort Belvoir in the 1950s shifted from training to research and development. Throughout the decade, the Engineer Research and Development Laboratories were involved in experimentation with a wide range of technical and military applications, many on the EPG, including the development and testing of Army vehicles.

Due to a shortage of land for training, the Engineer School re-located to Fort Leonard Wood in 1988. Currently, Fort Belvoir is designated a Strategic Sustaining Base for the DoD in the National Capital Region.

2.1 PHYSICAL CHARACTERISTICS

Fort Belvoir is located in southeastern Fairfax County, 14 miles southwest of Washington, DC, and north of Richmond, Virginia (**Figures 1 and 2**). The installation consists of 7,694 acres of Main Post cantonment and 804 acres comprising the Fort Belvoir North Area (FBNA), formerly the Engineer Proving Ground (EPG). The Main Post is located on a peninsula along the north bank of the Potomac River and is bisected east-west by U.S. Highway 1. The FBNA is located approximately two miles north of the Main Post and is bordered by U.S. Interstate 95 and the Fairfax County Parkway. Vehicular access to the Main Post areas is maintained through gated access control points and security personnel.

Accotink Creek is a 25-mile-long stream with a 51-square-mile watershed that flows through the center of Fairfax County. The stream flows to the southeast, including through the FBNA and between the Main Post cantonment and Southwest Training Area, to Accotink Bay, Gunston Cove, and to the tidal Potomac River. Dogue Creek is an 8.5-mile-long tributary of the Potomac River in Fairfax County that forms a tidal embayment of the Potomac to the east of the Fort Belvoir Main Post. The 1,200 acre Accotink Bay wildlife refuge is located west of the Main Post cantonment in the former Southwest Training Area.

2.2 GEOLOGY

Geologic conditions underlying Fort Belvoir are delineated along the Fall Line between the Appalachian Piedmont Upland Province and the Atlantic Coastal Plain Province. The fall line marks the geologic boundary of hard metamorphosed terrain and the sandy, relatively flat outwash plain of the upper continental shelf underlain by unconsolidated Cretaceous and Tertiary sediment. The Coastal Plan province in Virginia consists of an eastward-thickening

sedimentary wedge composed of unconsolidated gravels, sands, silts, and clays. The sediments can be over 6,000 feet (ft) thick, but thin to nearly zero thickness near the Fall Line. Numerous marine transgressions and regressions produced an assorted array of sediments, ranging from early Cretaceous to Holocene in age (USGS, 1988).

2.3 HYDROGEOLOGY

Groundwater aquifers located beneath Fort Belvoir consist of the lower Potomac, middle Potomac, and the Bacons Castle Formation. The Bacons Castle Formation consists of sandy layers separated by thinner clay beds of late Miocene and Pliocene ages (USGS, 1988). The Bacons Castle Formation is the shallowest of the aquifers, approximately 10 to 35 ft below ground surface (bgs) at the site and is recharged from and discharges to water bodies on the installation (CB&I Federal Services, 2016). Due to the impermeable confining clays in the formation, some areas have perched water tables (USGS, 1988).

The Middle Potomac aquifer is below the Bacons Castle aquifer and consists of interbedded layers of sand, silt, and clays of the late Early Cretaceous period. This aquifer crops out just east of the lower Potomac confining unit near the Fall Line (USGA, 1988); however, this confining unit is not present in the vicinity of Fort Belvoir (CB&I Federal Services, 2016). The middle Potomac aquifer reaches a maximum known thickness of approximately 1,000 ft and is capable of producing large quantities of high-quality water, supplying much of the water for smaller industrial, municipal, and domestic purposes in the area (USGS, 1988).

The Lower Potomac aquifer consists of thick, interbedded layers of coarse sands, clayey sands, and clays from the early to middle Early Cretaceous and rests entirely on the basement surface (USGS, 1988). The Lower Potomac is approximately 100 ft bgs and about 100 ft thick in the area of Fort Belvoir. It contains potable water and is the primary aquifer in eastern Fairfax County. The aquifer is recharged by surface infiltration and flows regionally to the southeast (CB&I Federal Services, 2016).

2.3.1 Surface Water

Fort Belvoir is located on the Potomac River and within the Potomac River drainage basin. The three main tributaries that pass through the installation are the Accotink Creak, Dogue Creek, and Pohick Creek, which drain the central, eastern, and western portions of the site respectively (Arcadis, 2020). Accotink Creek is fed by four unnamed streams and offers the most significant drainage at the site. Accotink Creek generally trends from the northwest to the southeast and discharges into the Accotink Bay (Arcadis, 2018)

2.4 LAND AND RESOURCE USE

Land use at Fort Belvoir is mixed recreational, residential, wildlife/wetland refuge and commercial/industrial (C/I) use. Fort Belvoir will be further developed to include professional, industrial, and training facilities, open space use, outdoor recreation, and a forested area. Site-specific groundwater restrictions are in place throughout the installation (Atkins, 2015).

3.0 FIVE-YEAR REVIEW PROCESS

3.1 ADMINISTRATIVE COMPONENTS

The Army initiated this third five-year review on December 2, 2021, with a kick-off meeting that included USACE Omaha District, USAEC, Fort Belvoir Points of Contact (POCs), and HGS personnel to discuss the sites to be evaluated under this review and items of interest pertaining to the protectiveness of the remedies currently in place. A review schedule was established that included:

- Community notification.
- Document review.
- Site inspection.
- Interviews.
- Five-year review report development and review.

3.2 PUBLIC NOTICE

A public notice was released in *The Washington Times* on January 13, 2022, notifying the public that the Army was initiating the Third Fort Belvoir Five-Year Review. Contact information was provided to the public to submit comments. The Public Notice affidavit is included in **Appendix A**.

The results of the review and the report will be made available at the site information repository locations at:

Directorate of Public Works 9430 Jackson Loop Fort Belvoir, VA 22060	Lorton Library 9520 Richmond Highway Lorton, VA 22079	Kingstowne Library 6500 Landsdowne Centre Drive Alexandria, VA 22315

Upon completion of the five-year review, a public notice will be placed in *The Washington Times* to announce availability of the report in the site information repository locations.

3.3 DOCUMENT AND DATA REVIEW

This five-year review included a review of relevant site documents, including, but not limited to, decision/remedy selection documents, design, implementation, and investigation reports, annual and related monitoring data, and regulatory documents. Documents reviewed are listed as references in Section 14.0 of this report.

3.4 SITE INSPECTION

The site inspection was performed on March 14–18, 2022. In attendance were Fort Belvoir DPW Restoration Program Manager Christopher Manikas, VADEQ CERCLA Remediation Project Manager Angela McGarvey, and Rob Norwillo and Bryce Zinckgraf from the HGS Third Five-Year Review Field Team.

Site inspections were conducted at the sites to obtain information about the status and to visually confirm and document land use and the conditions of the remedies, the installation, and the surrounding area. The site inspection checklists are presented in **Appendix B**. The photograph log is presented in **Appendix C**.

3.5 INTERVIEWS

During the five-year review, interviews were conducted to document any perceived issues or successes with the implemented remedies to date at Fort Belvoir. The HGS Field Team conducted an in-person interview with Christopher Manikas on March 17, 2022. Additionally, online interviews were conducted with the following individuals:

- Angela McGarvey, Remediation Project Manager, VADEQ, on March 18, 2022.
- Alexander Smith, Project Manager, HGL, on March 18, 2022.
- Andrew Solomon, Associate Manager/Geologist, HGL, on March 18, 2022.
- Francis Coulters, USAEC, on March 21, 2022.

During the interviews, site history, land use controls (LUCs), operations and maintenance (O&M), regulatory issues, and groundwater sampling were discussed. The interviewees agreed that there are no known issues with the sites and that the implemented remedies are working as designed according to the DDs. It was mentioned that the Geographic Information System (GIS) layers in the Installation Master Plan need to accurately reflect LUCs. Currently, the GIS system only contains LUC boundaries, and the Master Plan states that a copy of the LUCIP must be obtained to acquire the LUC details. In addition, Fort Belvoir Best Management Practices that require munitions clearance/munitions removal at former range sites and that also restrict groundwater usage on the Installation should be reflected in the Land Use Control Implementation Plans (LUCIPs).

A summary of the relevant information from the interviews is provided in the applicable sections for each area assessed in this review. The interview summaries are presented in **Appendix D**.

4.0 FTBL-68 HYDROCARBON SPILL AREA

4.1 SITE CHRONOLOGY

Site chronology for FTBL-68 is presented in **Table 2**.

Table 2 – FTBL-68 Site Chronology

Event	Date (Year)
FTBL-68 Operational as Aboveground Storage Tanks	1950s – 1968
Gasoline Released from Tank	August 1968
Site Investigations at M-26 Conducted	1995 – 2005
USEPA Unilateral Administrative Order Issued	September 2005
Site Investigation Conducted at Former Aboveground Test Tank Site	January 2006
SWMU M-26 Remediation Plan Executed	April 2006
Soil Gas Survey and Soil and Pipe Removal at FATTS Completed	April 2006
Phase I to IV Environmental Investigation Plan at FATTS	Feb 2007 – Aug 2007
FATTS Soil Remediation Report Completed	September 2007
Decision Document Signed	October 4, 2007
Long-Term Management Plan for FTBL-68 Completed	October 2007
Quarterly Groundwater Monitoring Conducted	June 2007 – Dec 2008
Site-Specific LUCIP Completed	July 2008
In-situ Waste Characterization Report	January 2010
Fairfax Parkway Soil Removal Conducted	May 2010
Groundwater Monitoring Conducted	June 2012 – Aug 2012
First Five-Year Review Signed	November 14, 2012
Long-Term Management Plan SWMU M-26/FATTS Addendum	May 2013
Groundwater Monitoring Conducted	April 2014 – July 2014
Installation-Wide LUCIP Completed	August 2016
USEPA Unilateral Administrative Order Rescinded	July 2017
Semi-Annual Groundwater Monitoring Conducted	May 2018 – October 2019
Second Five-Year Review Signed	March 27, 2019
Annual Groundwater Monitoring Conducted	November 2020
Construction Completion Report Finalized	January 2021

Note: The 2005 Unilateral Administrative Order required the Army to investigate SWMU areas of potential concern and other areas where releases containing hazardous constituents occurred. As a result of the action taken for the sites in the FBNA, USEPA determined that the Army had satisfactorily completed the requirements of the UAO, and terminated the UAO in July 2017 (USEPA, 2017).

4.2 PHYSICAL CHARACTERISTICS

FTBL-68 consists of former SWMUs M-26 and the Former Aboveground Test Tank Site (FATTS).

Former SWMU M-26 occupied an area north of Heller Road on the FBNA with a single tank located south of Heller Road below the present bridge abutment. The former FATTS tank farm occupied the southeast portion of the present Fairfax County Parkway interchange. Both tank farms were southeast of an unnamed tributary to Accotink Creek.

FTBL-68 is located in the southeastern corner of FBNA, south of Heller Road, and within a Fairfax County Parkway interchange (**Figure 3**). FTBL-68 is located 100 ft east of an intermittent tributary to Accotink Creek. FATTS is bisected by the Parkway and is grass-covered. M-26 is covered by tall grass and shrubs, with a small northern portion underneath an overpass.

Topography at FTBL-68 slopes from northeast to southwest, with drainage swales and ditches adjacent to the Parkway. Surface water flow generally follows the topography of the site and drains toward an unnamed tributary of Accotink Creek. A retention basin is located at the southern boundary of FATTS. The surface elevation at the study area ranges from approximately 193 ft above mean sea level (amsl) on the eastern portion of the site (near former FATTS-MW-04) to approximately 175 ft amsl (near FATTS-MW-08) in the southwestern portion of the site (AECOM, 2021).

4.3 HISTORY OF CONTAMINATION

Historical operations conducted at FTBL-68 that have resulted in contamination of soil and groundwater are summarized below:

- **M-26** was the location of large capacity aboveground storage tanks (ASTs) 05000A, 05000B, 05000C, and 05000D within individual protective berms, which were used in support of engineer and firefighting training activities. In August 1968, approximately 30,000 to 100,000 gallons of gasoline were released from AST 05000D and flowed over land into an unnamed tributary that drains into Accotink Creek (MACTEC, 2005). The gasoline ignited, burning and destroying a bridge over I-95 and nearby buildings. All four ASTs were variably removed or fell into disuse by 1990.
- **FATTS** consisted of five bermed ASTs, some of which were open-topped and were used to burn fuel as part of fire training exercises (TetraTech, 2007). The number of tanks declined as they were variably removed or fell into disuse between 1953 and 1997.

4.4 INITIAL RESPONSE

4.4.1 M-26

Fort Belvoir prepared and executed a Remediation Plan for SWMU M-26 in 2006. After three rounds of excavation and confirmation sampling, approximately 15,000 tons of impacted soil were excavated, managed, and recycled. The excavated areas were backfilled and seeded. Additionally, the removal of a 6-inch metal pipe and a 20 ft x 30 ft x 10 ft area of impacted soil was completed in concert according to the M-26 Remediation Plan (Tetra Tech, 2007).

4.4.2 FATTS

A Phase II Excavation Plan was executed in March 2007 to address remaining contaminants of concern (COCs) detected in the Phase I confirmation sampling. A total of 70,000 tons of impacted soils were remediated from the area. The initial limits of the Phase II excavation were completed in February 2007 (Tetra Tech, 2007).

During the Phase III Investigation, benzene was detected in a soil sample from soil boring SB-24. Eight groundwater monitoring wells were installed and sampled to delineate groundwater impacts on the eastern and southern side of FATTS (Tetra Tech, 2007).

A Phase IV Environmental Investigation Plan was executed in 2007 to delineate residual contamination in the area north/northwest of the Phase II excavation (Tetra Tech, 2007). The soil assessment indicated that while some low-level residual soil contamination remained at FATTS, the issue was isolated to the northern area and the southeast area identified during Phase III (Tetra Tech, 2007).

4.5 BASIS FOR TAKING ACTION

Site investigations (SIs) conducted at FTBL-68 between 1990 and 2005 confirmed the presence of benzene, methylene chloride, naphthalene, and 2-methylnaphthalene in the soil at a concentration greater than the USEPA Region 3 risk-based concentration (RBC) for soil screening levels for migration to groundwater. The SIs also confirmed the presence of benzene, methylene chloride, naphthalene, and 2-methylnaphthalene in the groundwater at concentrations greater than the USEPA Region 3 RBCs for drinking water, and/or Safe Drinking Water Act maximum contaminant levels (MCLs) (AECOM, 2021a).

4.6 REMEDIAL ACTION

4.6.1 Remedial Action Objectives

The Remedial Action Objectives (RAOs) established for groundwater and soil in the 2007 DD for FTBL-68 for M-26 are to:

- *"Attain the maximum contaminant level (MCL) of 5 parts per billion (ppb) for benzene and methylene chloride in groundwater.*
- *Attain the RBC of 6.5 ppb for naphthalene and 24 ppb for 2-methylnaphthalene in groundwater.*
- *Remove soil that contains contaminants greater than 14 ppb benzene, 77 ppb naphthalene, 11.5 ppb methylene chloride, and 2,200 ppb 2-methylnaphthalene."*

These levels in soil are considered protective of groundwater from contaminant leaching.

The RAOs established for soil and groundwater in the 2007 DD for FTBL-68 for the FATTS are to:

- *"Attain the MCL of 5 ppb for benzene, 5 ppb methylene chloride, 0.05 ppb ethylene dibromide, 5 ppb 1,2 dichloroethane, and 100 ppb chloroform in groundwater.*

- *Attain the RBC of 6.5 ppb for naphthalene and 24 ppb for 2-methylnaphthalene in groundwater.*
- *Remove soil that contains contaminants greater than 14 ppb benzene, 77 ppb naphthalene, 11.5 ppb methylene chloride, 2,200 ppb 2-methylnaphthalene, 0.285 ppb ethylene dibromide, 21 ppb 1,2 dichloroethane, and 800,000 ppb lead."*

These levels in soil are considered protective of groundwater from contaminant leaching.

The RAOs established in the 2007 DD for FTBL-68 are to:

- Prohibit the use of groundwater from SWMU M-26 and FATTS until remedial goals are met.
- Prevent human contact with the contaminated groundwater that could cause unacceptable risks.

The soil and groundwater COCs are presented in **Tables 3 and 4**.

Table 3 – FTBL-68 Contaminants of Concern for Soil

Contaminants of Concern	Remedial Goal (ppb)	Basis
M-26		
Benzene	14	USEPA Region 3 RBCs for Soil Screening Levels—Leaching to Groundwater
Methylene Chloride	11.5	
Naphthalene	77	
2-methylnaphthalene	2,200	
FATTS		
Benzene	14	USEPA Region 3 RBCs for Soil Screening Levels—Leaching to Groundwater
Methylene Chloride	11.5	
Ethylene Dibromide	0.285	
1,2 dichloroethane	21	
Naphthalene	77	
2-methylnaphthalene	2,200	
Lead	800,000	

FATTS – Former Aboveground Test Tank Site
ppb – parts per billion
RBC – Risk-Based Concentration
USEPA – U.S. Environmental Protection Agency

Table 4 – FTBL-68 Contaminants of Concern for Groundwater

Contaminants Group	Contaminants of Concern	Remedial Goal (µg/L)	Basis
M-26			
Volatile Organic Compounds (VOCs)	Benzene	5	USEPA MCLs
	Methylene Chloride	5	
Polycyclic Aromatic Hydrocarbons (PAHs)	Naphthalene	6.5	USEPA Region 3 RBCs for Tap Water
	2-methylnaphthalene	24	
FATTS			
Volatile Organic Compounds (VOCs)	Benzene	5	USEPA MCLs
	Methylene Chloride	5	
	Ethylene Dibromide	0.05	
	1,2 dichloroethane	5	
	Chloroform	100	
Polycyclic Aromatic Hydrocarbons (PAHs)	Naphthalene	6.5	USEPA Region 3 RBCs for Tap Water
	2-methylnaphthalene	24	

MCL – Maximum Contaminant Level
RBC – Risk-Based Concentration
µg/L – micrograms per liter
USEPA – U.S. Environmental Protection Agency

4.6.2 Remedial Action Selection

The components of the selected remedy include:

- Removal and disposal of contaminated soil.
- LTM of groundwater for natural attenuation.
- LUCs (restrict residential land use and groundwater use).

4.6.3 Remedial Action Implementation

4.6.3.1 Soil Removal

Between April and May 2010, approximately 3,550 tons of contaminated soil was removed from M-26 and hauled to offsite treatment/disposal facilities at Clean Earth; Soil Safe, Inc.; and The East End Landfill (TEEL). During confirmation sampling, discrete samples were collected from the excavation sidewalls and sampled until remedial endpoints were met, which established the vertical and horizontal excavation limits (EEE, 2010a).

Between March and April 2010, approximately 14,330 tons of contaminated soil was removed from FATTS and hauled to offsite treatment/disposal facilities at Soil Safe, Inc. and TEEL. During

confirmation sampling, discrete samples were collected from the excavation sidewalls and analyzed until remedial endpoints were met, which established the vertical and horizontal excavation limits (EEE, 2010b).

4.6.3.2 LTM

LTM of groundwater was initiated in October 2007, to document that chemical concentrations in the groundwater did not pose a threat to human health or the environment (Army, 2007). Six long-term monitoring wells at M-26 and eleven long-term monitoring wells at FATTs were sampled quarterly for two years. Quarterly sampling began in April 2007 and ended in December 2008. Groundwater samples were analyzed for Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs).

The 2007 LTM program was amended in 2013 to specify activities to continue the long-term monitoring of the impacted groundwater at M-26 and FATTS until remedial goals established in the DD have been achieved (USACE, 2013). All the M-26 LTM wells, except for monitoring well MW-39, were abandoned due to Base Realignment and Closure Commission construction activities. All the FATTS LTM wells were abandoned due to the Fairfax County Parkway construction and new wells were installed February 2013.

Following re-installation of monitoring wells, three rounds of sampling were conducted in June to August 2012, April 2014, and July 2014.

The 2013 LTM plan was superseded by the 2020 LTM plan. Six LTM wells were re-installed at M-26 and eight LTM wells installed at the FATTs were sampled semi-annually from May 2018 to October 2019. Annual monitoring began in 2020 and groundwater samples are analyzed for VOCs and SVOCs. The current groundwater monitoring well network is shown in **Figure 4**.

4.6.3.3 LUCs

LUCs have been implemented at the FTBL-68 site to prohibit residential land use and groundwater use until remedial goals are achieved. Groundwater use restrictions consist of prohibitions on groundwater consumption for domestic purposes, drinking water well installations, and the withdrawal or use of groundwater for agricultural/irrigation purposes. In addition, ground disturbance and land re-use activity are not allowed without the approval of the Army. The Virginia Department of Transportation (VDOT) controls activity involving actions within the parkway right of way.

A 2008 site-specific LUCIP was developed to establish responsibility, land use restrictions, and reporting and implementation of LUC mechanisms (Aerostar, 2016). LUC boundaries were noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities. The 2008 site-specific LUCIP was updated in 2016 with an Installation-wide LUCIP.

4.6.4 Operations and Maintenance

There were no O&M activities conducted at the site during this five-year review period, due to pending update of the LTM plan to include annual LUC inspections.

4.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The protectiveness statement for FTBL-68 from the prior five-year review is as follows:

"A protectiveness determination of the remedy at FTBL-68 cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: add this site to the PA to assess site history for evidence of the use of fire suppressants containing PFOA and PFOS and proceed with a Site Inspection at the locations in which the PA identifies as warranting further investigation to determine whether or not a release has occurred. It is expected that these actions will take approximately 2–3 years to complete, at which time a protectiveness determination will be made."

The issue and recommendation affecting protectiveness from the prior five-year review for FTBL-68 is listed in **Table 5**.

Table 5 – Recommendations Affecting Protectiveness from Prior Five-Year Review

Issue	Recommendation/ Follow-up Actions	Responsible Party	Actions Taken	Current Status
Given past use of the FATTS site, the emerging contaminants, PFOS and PFOA, may be present	Add this site to the Preliminary Assessment (PA) to determine if there is sufficient evidence to demonstrate the use of fire suppressants containing PFOA and PFOS.	Fort Belvoir	Conducted a PA into PFOS and PFOA.	The PFAS PA/SI determined no further action for FTBL-68; however, the decision was changed based on the updated July 2022 OSD screening levels. FTBL-68 will be evaluated under a PFAS RI.

FATTS – Former Aboveground Test Tank Site
OSD – Office of the Secretary of Defense
PA – Preliminary Assessment
PFAS – Per- and Polyfluoroalkyl Substances
PFOA – Perfluorooctanoic Acid
PFOS – Perfluorooctane Sulfonate
RI – Remedial Investigation
SI – Site Investigation

4.8 DATA REVIEW

Groundwater analytical data from 2018 to 2021 for FTBL-68 was evaluated during this review (AECOM, 2021a and 2021b). Data for FTBL-68 consists of LTM data for both the M-26 and FATTS sites. Groundwater elevation data from March 2021 indicates that groundwater flow at M-26 is

predominantly to the southwest toward an unnamed intermittent stream draining to Accotink Creek. Groundwater flow is radial at the FATTS site with groundwater flowing to the southwest at the west side of the site and to the southeast at the east side of the site. The groundwater flow directions are generally consistent with historical data despite the construction of the Fairfax County Parkway. Groundwater elevation contours are provided on **Figure 5**.

FTBL-68 was evaluated as an area of potential interest (AOPI) based on the potential historical use of per- and polyfluoroalkyl substances (PFAS) during a PA/SI for Fort Belvoir. Groundwater samples were collected in September 2020, from monitoring wells M26-LTM-06 and FATTS-LTM-MW08 for analysis for perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutane sulfonic acid (PFBS). Groundwater analytical data indicates that PFOS and PFOA were detected at M26-LTM-06 at concentrations of 1.9 and 4.5 nanograms per liter (ng/L), respectively; PFBS was not detected above the laboratory method detection limit of 3.6 ng/L. PFOA and PFBS were detected at FATTS-LTM-MW08 at concentrations of 2.9 ng/L and 5.3 ng/L, respectively; PFOS was not detected above the laboratory method detection limit of 3.6 ng/L. PFOS, PFOA, and PFBS were not detected above the Office of the Secretary of Defense risk-based screening levels for tap water of 4 ng/L for PFOS, 6 ng/L for PFOA, and 601 ng/L for PFBS (OSD, 2022). No further action was recommended for PFAS at FTBL-68 (Arcadis, 2021a). However, the decision was changed based on the updated July 2022 OSD screening levels. FTBL-68 has been added to the scope of a PFAS RI.

4.8.1 M-26

Groundwater analytical data generally indicate that groundwater impacts at M-26 are stable or shrinking. Benzene was detected slightly above its remedial goal of 5 micrograms per liter (µg/L) at concentrations ranging from 5.4 µg/L to 7.69 µg/L at monitoring well M26-LTM-01 between 2018 and 2021. No other COCs were detected above the remedial goals at M-26 during the five-year review period. A summary of exceedances of the remedial goals is provided in **Table 6**. The extent of groundwater contamination exceeding the remedial goals is illustrated on **Figure 6**.

Table 6 – COCs Exceeding Remedial Goals – FTBL-68 (M-26)

Sample Location	Sample Date	Benzene (µg/L)	Methylene Chloride (µg/L)	2-Methyl-naphthalene (µg/L)	Naphthalene (µg/L)
Remedial Goals		5	5	24	6.5
M26-LTM-01	5/30/2018	**6.22**	–	–	–
	10/4/2018	**7.69**	–	–	–
	5/21/2019	**6.6**	–	–	–
	10/29/2019	**7.3**	–	–	–
	11/5/2020	**5.57**	–	–	–
	3/2/2021	**5.40**	–	–	–

COC – Contaminant of Concern
µg/L – micrograms per liter
Note: – indicates the contaminant was not detected above the remedial goals.

Mann-Kendall analysis was conducted to evaluate trends in benzene concentrations at monitoring wells with analytical data from at least four sampling events and where benzene was detected in at least 50 percent of samples. The results of Mann-Kendall analysis indicate that concentrations of benzene exhibit decreasing trends or exhibit no apparent trend (indicating concentrations do not exhibit a statistically significant increasing trend). Concentrations of benzene exhibit no apparent trend at M26-LTM-01 from August 2012 to March 2021; however, a decreasing trend is observed from July 2014 to March 2021. The results of Mann-Kendall analysis generally indicate that groundwater impacts at M-26 are stable or shrinking. Historical analytical data are provided in **Appendix E**. The results of Mann-Kendall analysis are provided in **Appendix G**.

Linear regression analysis was performed to project the time to achieve the remedial goal for benzene at M26-LTM-01. A first-order attenuation rate was estimated by linear regression of the natural-logarithm-adjusted benzene concentrations between July 2014 and March 2021. The attenuation rate was used to project the time to achieve the remedial goal. Based on the results of the linear regression analysis, benzene is projected to achieve the remedial goal at M26-LTM-01 in approximately one year. The p-value (0.036) for benzene concentrations at M26-LTM-01 indicates that the linear regression trend line used to estimate the attenuation rate is statistically significant (p-value less than 0.05); however, the actual time to achieve the remedial goal at M26-LTM-01 may be extended as natural attenuation reaches asymptotic conditions. The results of the linear regression analysis are provided in **Appendix G**.

Groundwater geochemical data generally indicates that geochemical conditions at M-26 are favorable for anaerobic biodegradation (AECOM, 2021b). Dissolved oxygen concentrations and oxidation-reduction potential measurements generally indicate that conditions are anaerobic and reducing. Furthermore, elevated concentrations of methane provide evidence that methanogenic anaerobic biodegradation processes are actively occurring in groundwater.

4.8.2 FATTS

Groundwater analytical data, trend analysis, and geochemical conditions generally support the effectiveness of the LTM and natural attenuation remedy at M-26; however, the current LTM network is insufficient to monitor conditions downgradient of M26-LTM-01. Concentrations of benzene at MW26-LTM-01 (5.40 µg/L) only slightly exceed the remedial goal (5 µg/L); however, no monitoring well is present to delineate benzene impacts downgradient of MW26-LTM-01 because historical monitoring wells were destroyed during construction of the Fairfax County Parkway.

Groundwater analytical data indicates that 1,2-dichloroethane (1,2-DCA), benzene, ethylene dibromide (EDB), 2-methylnaphthalene, and naphthalene were detected above the remedial goals at the FATTS between 2018 and 2021. Benzene and EDB were detected above the remedial goals at monitoring wells FATTS-LTM-MW03, FATTS-LTM-MW09, and FATTS-LTM-MW11. Concentrations of 1,2-DCA, 2-methylnaphthalene, and naphthalene were also detected above the remedial goals at FATTS-LTM-MW09. A summary of monitoring wells where COCs exceeded the remedial goals is provided in **Table 7**. The extent of groundwater contamination exceeding the remedial goals is illustrated on **Figure 6**.

Table 7 – Summary of Exceedances of the Remedial Goals by Monitoring Well (2018–2021) – FTBL-68 (FATTS)

Sample Location	1,2-DCA	Benzene	Chloro-form	EDB	Methylene Chloride	2-Methyl-naphthalene	Naphthalene
Remedial Goals (µg/L)	5	5	100	0.05	5	24	6.5
FATTS-LTM-MW03	–	**X**	–	**X**	–	–	–
FATTS-LTM-MW08	–	–	–	–	–	–	–
FATTS-LTM-MW09	**X**	**X**	–	**X**	–	**X**	**X**
FATTS-LTM-MW10	–	–	–	–	–	–	–
FATTS-LTM-MW11	–	**X**	–	**X**	–	–	–
FATTS-LTM-MW12	–	–	–	–	–	–	–
FATTS-LTM-MW13	–	–	–	–	–	–	–
FATTS-LTM-MW14	–	–	–	–	–	–	–

Notes:
X indicates contaminant was detected above the remedial goal.
– indicates the contaminant was not detected above the remedial goal.

The area of groundwater concentrations exceeding the remedial goals at the FATTS extends to the southwest and to the southeast of the former source area northeast of FATTS-LTM-MW09 and west of FATTS-LTM-MW11 (AECOM, 2021a). The greatest concentrations of COCs were detected at FATTS-LTM-MW09, located within the Fairfax County Parkway interchange near the locations of former ASTs. Lower concentrations of COCs were detected at FATTS-LTM-MW11 and FATTS-LTM-MW03, located southeast of the former source area. A conceptual site model for the FATTS groundwater plume is illustrated on **Figure 7**.

Mann-Kendall analysis was conducted to evaluate trends in concentrations of COCs at monitoring wells with analytical data from at least four sampling events and where COCs were detected in at least 50 percent of samples. The results of Mann-Kendall analysis generally indicate that groundwater impacts at the FATTS are shrinking or stable. Concentrations of site COCs exhibit stable or decreasing trends or exhibit no apparent trend (indicating concentrations do not exhibit statistically significant increasing trends). Historical analytical data are provided in **Appendix E**. The results of Mann-Kendall analysis are provided in **Appendix F**.

1,2-DCA, benzene, and EDB have exhibited decreasing trends at FATTS-LTM-MW09 since August 2012. Concentrations of benzene at FATTS-LTM-MW09 have decreased from 4,300 µg/L in August 2012 to 916 µg/L in March 2021. Likewise, concentrations of 1,2-DCA decreased from 370 µg/L to 143 µg/L over the same period. Concentrations of EDB have decreased from 18.2 J µg/L in April 2014 to 3.36 µg/L in March 2021. Concentrations of 2-methylnaphthalene and naphthalene at FATTS-LTM-MW09 have fluctuated intermittently since August 2012 and are inversely correlated with groundwater elevations (AECOM, 2021a).

There is no apparent trend in concentrations of benzene or EDB at FATTS-LTM-MW11 since August 2012. FATTS-LTM-MW11 is located east of the former source area near historical soil boring SB-24 where some low-level residual soil contamination remains (Tetra Tech, 2007). Fluctuations in concentrations of COCs at FATTS-LTM-MW11 appear to be correlated with fluctuations in the water table interacting with the residual soil contamination (AECOM, 2021a and 2021b). Concentrations of benzene and EDB exhibit stable trends at FATTS-LTM-MW03, located downgradient of FATTS-LTM-MW11 near the southeast edge of the plume and the FBNA boundary.

Linear regression analysis was performed to project the time to achieve the remedial goals for monitoring wells where COCs were detected above the remedial goals in March 2021. A first-order attenuation rate was estimated by linear regression of the natural-logarithm-adjusted concentrations of COCs. The attenuation rate was used to project the time to achieve the remedial goals. Based on the results of the linear regression analysis, the projected time for concentrations of COCs to achieve the remedial goals ranges from approximately 7 years (FATTS-LTM-MW03) to approximately 30 years (FATTS-LTM-MW09). The time to achieve the remedial goals could not be projected for FATTS-LTM-MW11 due to the positive slopes of the linear regression trend lines for benzene and EDB; however, the high p-values (0.16 and 0.84, respectively) indicate that the trend lines are not statistically significant (p-value less than 0.05). The results of the linear regression analysis are provided in **Appendix G**.

Groundwater analytical data and trend analysis provide some evidence that natural attenuation is effectively reducing contaminant concentrations at the FATTS. Concentrations of methane in

FATTS-LTM-MW03, FATTS-LTM-MW09, and FATTS-LTM-MW11 provide further evidence that methanogenic anaerobic biodegradation processes are actively occurring near these wells (AECOM, 2021b). However, the LTM network is insufficient to monitor potential migration at the FATTS.

Based on the groundwater flow direction, monitoring wells FATTS-LTM-MW08 and FATTS-LTM-MW10 are not adequate to monitor downgradient conditions southwest of FATTS-LTM-MW09, where the greatest concentrations of COCs were detected. Furthermore, benzene and EDB have been consistently detected above the remedial goals at downgradient monitoring well FATTS-LTM-MW03, located near the southeast edge of the plume and the FBNA installation boundary. There is no monitoring well downgradient of FATTS-LTM-MW03 to monitor potential migration.

4.9 SITE INSPECTION

The Site Inspection team observed and took photos of the current conditions at Fort Belvoir. The site inspection checklists are presented in **Appendix B**. The site inspection photograph logs are presented in **Appendix C**. Observations consisted of the following:

- No evidence of disturbed soils was observed.
- Site access point was well maintained.
- Fencing and guardrails observed in areas inside of secure compound; however, they are not part of the remedy.
- No changes in land use were observed.
- Monitoring wells observed and in good condition.
- Stream observed with water present.

4.10 TECHNICAL ASSESSMENT

4.10.1 QUESTION A – Is the Remedy Functioning as Intended by the Decision Documents?

Yes, the remedy is functioning according to the 2007 DD by preventing human contact with soil and groundwater that may cause an unacceptable risk. The site inspection team confirmed that land use has not changed, residential use is restricted and there have been no intrusive ground disturbances. Groundwater use is prohibited as a potable water source and for industrial use. LUCs have been incorporated into the GIS system, LUCIP, and dig permit process.

Groundwater monitoring is being conducted in accordance with the LTM plan. Concentrations of benzene exceed its remedial goal in groundwater at M-26 and FATTS. Concentrations of 1,2-DCA, EDB, and naphthalene also exceed the remedial goals in groundwater at FATTS. Groundwater analytical data, trend analysis, and geochemical conditions generally support the effectiveness of the LTM and natural attenuation remedy at M-26 and FATTS; however, the current LTM network is insufficient to monitor conditions downgradient of M-26 and FATTS at FTBL-68.

Concentrations of benzene slightly exceed the remedial goal (MCL) at monitoring well MW26-LTM-01 and there is no downgradient monitoring well present to delineate benzene impacts near the unnamed stream draining to Accotink Creek. However, it is unlikely that there is currently an unacceptable risk because LUCs are preventing human exposure to groundwater within the

boundaries of the site. Furthermore, concentrations of benzene at M26-LTM-01 exhibit a decreasing trend and are projected to achieve the remedial goal in approximately one year.

Based on the current and historical groundwater flow direction, monitoring wells FATTS-LTM-MW08 and FATTS-LTM-MW10 are not adequate to monitor conditions downgradient of FATTS-LTM-MW09, where the greatest concentrations of 1,2-DCA, benzene, EDB, and naphthalene have been detected. Furthermore, benzene and EDB have been consistently detected above the remedial goals at monitoring well FATTS-LTM-MW03, located near the FBNA installation boundary. There is no monitoring well downgradient of FATTS-LTM-MW03 to monitor potential migration. However, it is unlikely that there is currently an unacceptable risk because LUCs are preventing human exposure to groundwater within the boundaries of the site and the location of the Fairfax County Parkway limits potential exposures to groundwater immediately downgradient of FATTS-LTM-MW03 and FATTS-LTM-MW09. Furthermore, groundwater impacts at FATTS-LTM-MW03 and FATTS-LTM-MW09 exhibit stable or decreasing trends and are projected to achieve the remedial goals in approximately 30 years.

4.10.2 QUESTION B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

Yes, changes in land use, and subsequent likely exposures, have not been observed. In addition, LUCs are in place that restrict both groundwater and land use. For groundwater, remedial goals were established for benzene, methylene chloride, naphthalene, 2-methylnaphthalene, ethylene dibromide, 1,2-dichloroethane, and chloroform. The 2007 remedial goals were set equal to the EPA MCL or the EPA Region 3 RBC for tap water for constituents that did not have a promulgated MCL (naphthalene and 2-methylnaphthalene). The 2007 remedial goals were compared to current MCLs or May 2022 regional screening levels (RSLs) for tap water (EPA, 2022a), which have superseded the 2007 Region 3 RBCs. The current RSLs integrate current toxicity data as well as exposure parameters. The toxicity criteria for naphthalene and 2-meyhylnaphthalene were reviewed, and while the criteria for 2-methylnaphthalene have not changed, the carcinogenic assessment of naphthalene was found to have changed from 2007 to 2022. As a result of the carcinogenic potential evaluation by the USEPA, the carcinogenic potential of naphthalene via the oral and dermal routes of exposure (current oral carcinogenic slope factor of 1.2E-1 mg/kg-day-1, as compared to no quantified oral slope factor at the time of the DD) has changed. The information at the time of the DD only considered naphthalene a carcinogen via the inhalation route of exposure.

The current RSLs also include the integration of the 2014 EPA modified standard default exposure factors, (USEPA, 2014. *Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors.* OSWER 9200.1-120). Examples of exposure factor modification include adult bodyweight (from 70 kg to 80 kg), and an adult inhalation rate (from 1.5 m3/hour to 1.75 m3/hour). Although the exposure assumptions have marginally changed, these changes do not impact the results of remedial goals. It is also noted that the USEPA's Risk Assessment Guidance for Superfund (RAGS) Part F (Supplemental Guidance for Inhalation Risk Assessment) was finalized in January 2009 (USEPA, 2009), which recommends concentrations of the chemical in air (e.g., mg/m3) be used to assess risk, rather than inhalation intake of a

contaminant in air based on inhalation rate and body weight (e.g., mg per kg body weight per day). This methodology change does not impact the remedial goals significantly. As shown in **Appendix G**, **Table 1**, the current values are either the same (no MCLs have changed since the DD), higher, or within the acceptable risk range for naphthalene and 2-methylnaphthalene, which do not have established MCLs.

Vapor intrusion can occur when volatile compounds in soil or groundwater migrate into occupied buildings. Until recently, this transport pathway was not routinely considered in Resource Conservation and Recovery Act (RCRA) or CERCLA investigations. Vapor intrusion is now a standard consideration during these investigations when structures exist or may exist in the future. This pathway was not considered in the original risk assessment. Exposure via the vapor intrusion pathway does not affect the current protectiveness of the remedy since there are no occupied structures within the area of affected groundwater (i.e., a complete exposure pathway does not exist).

If land title is anticipated to be transferred, the Department of Defense Manual (DoDM) Number 4715.20 Defense Environmental Restoration Management (DoD, 2012) identifies the following:

> DoDM 4715.20(6)(4)(–) — The DoD Component shall provide notice of potential vapor intrusion risks to non-DoD property owners in writing and, as appropriate, include such notice in DDs and transfer documents. And:
>
> DoDM 4715.20(6)(4)(–) — For DoD property, the DoD Component should address the potential for vapor intrusion in future structures in the design phase of the building construction and any necessary and appropriate mitigation measures shall be included as part of the construction cost.

4.10.3 QUESTION C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

There is no other information that calls into question the protectiveness of the remedy. There have been no impacts from natural disaster events or weather-related events that have affected the protectiveness of the remedy.

4.10.4 Technical Assessment Summary

LUCs are in place to prevent groundwater use and restrict residential use of the site. A dig permit process has been established to ensure there are no unauthorized ground activities. Groundwater monitoring is being conducted in accordance with the 2021 LTM. Groundwater analytical data, trend analysis, and geochemical conditions generally support the effectiveness of the LTM and natural attenuation remedy at M-26 and FATTS; however, the current LTM network is insufficient to monitor conditions downgradient of M-26 and FATTS at FTBL-68.

There is no monitoring well present to delineate benzene impacts downgradient of MW26-LTM-01, near the unnamed stream draining to Accotink Creek. However, it is unlikely that there is currently an unacceptable risk because LUCs are preventing human exposure to groundwater within the boundaries of the site. Furthermore, concentrations of benzene at M26-LTM-01

exhibit a decreasing trend and are projected to achieve the remedial goal in approximately one year.

Monitoring wells FATTS-LTM-MW08 and FATTS-LTM-MW10 are not adequately located to monitor conditions downgradient of FATTS-LTM-MW09, where the greatest concentrations of 1,2-DCA, benzene, EDB, and naphthalene have been detected, and there is no monitoring well downgradient of FATTS-LTM-MW03 to monitor potential migration. However, it is unlikely that there is currently an unacceptable risk because LUCs are preventing human exposure to groundwater within the boundaries of the site and the location of the Fairfax County Parkway limits potential exposures to groundwater immediately downgradient of FATTS-LTM-MW03 and FATTS-LTM-MW09. Furthermore, groundwater impacts at FATTS-LTM-MW03 and FATTS-LTM-MW09 exhibit stable or decreasing trends and are projected to achieve the remedial goals in approximately 30 years.

No significant changes have been observed with respect to the exposure assumptions used to base the RAOs. Although toxicity criteria for naphthalene have change since 2007, and standard default exposure factors have been modified by the USEPA in 2014, health-based remedial goals from 2007 are within an acceptable risk management range (i.e., $1x10^{-4}$ to $1x10^{-6}$). Although indoor air vapor intrusion was not evaluated in the original investigations, it is noted that the vapor intrusion pathway does not affect the current protectiveness of the remedy since there are no occupied structures within the area of affected groundwater (i.e., a complete exposure pathway does not exist). There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness.

4.11 ISSUES

Issues identified while preparing this five-year review are presented in **Table 8**.

Table 8 – FTBL-68 Issues

Issue Number	Issues	Affects Protectiveness (Yes/No)	
		Current	Future
1	The LTM network is insufficient to monitor conditions downgradient of monitoring wells M26-LTM-01, FATTS-LTM-MW03, and FATTS-LTM-MW09.	No	Yes

4.12 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations and follow-up actions are presented in **Table 9**.

Table 9 – FTBL-68 Recommendation and Follow-up Actions

Issue	Recommendation and Follow-up Action	Responsible Party	Oversight Agency	Milestone Date	Affects Protectiveness (Yes/No)	
					Current	Future
1	Evaluate the LTM network to monitor conditions downgradient of M26-LTM-01, FATTS-LTM-MW03, and FATTS-LTM-MW09.	Army	VADEQ	October 2025	No	Yes

4.13 PROTECTIVENESS STATEMENT

The remedy at FTBL-68 currently protects human health and the environment because groundwater use restrictions are in place to prohibit extraction of groundwater, excavation in the Fairfax County Parkway interchange requires VDOT and Fort Belvoir dig permits, and LUCs are preventing human exposure to groundwater within the boundaries of the site. However, in order for the remedy to be protective in the long-term, the LTM network should be evaluated to monitor conditions downgradient of M26-LTM-01, FATTS-LTM-MW03, and FATTS-LTM-MW09.

5.0 FTBL-69 WASTE ORDNANCE PIT AT RANGE 1

5.1 SITE CHRONOLOGY

Site chronology for FTBL-69 is presented in **Table 10**.

Table 10 – FTBL-69 Site Chronology

Event	Date (Year)
Site Inoperable for Destruction of Waste Ammunitions and Explosives	1950s
Unexploded Ordnance (UXO) Survey Completed	August 1989
Environmental Baseline Study Conducted	1990
SWMU M-27 Closure Plan Completed	March 2004
Phase I and II Investigations Conducted	2004
UXO Removal Action Completed	Spring 2005
USEPA Unilateral Administrative Order 3013 Issued	September 6, 2005
Phase III/Natural Attenuation Investigation Conducted	2006
Decision Document Signed	May 6, 2006
Quarterly Groundwater Sampling Conducted	April 2007 – Dec 2008
Installation-Wide LUCIP Completed	July 2008
Natural Attenuation Evaluation Conducted	November 2009
Human Health Risk Assessment SWMU M-27	October 2011
First Five-Year Review Signed	November 14, 2012
Installation-Wide LUCIP Completed	August 2016
USEPA Unilateral Administrative Order 3013 Rescinded	July 2017
Data Gap Investigation Phase I & II Completed	Nov 2018 – Mar 2019
Second Five-Year Review Signed	March 27, 2019
Explanation of Significant Differences Issued	June 2021
2021 Long-term Monitoring Plan Completed	August 2021
LTM Monitoring Conducted	August 2021 – Present

Note: The 2005 Unilateral Administrative Order required the Army to investigate SWMU areas of potential concern and other areas where releases containing hazardous constituents occurred. As a result of the action taken for the sites in the FBNA, USEPA determined that the Army had satisfactorily completed the requirements of the UAO, and terminated the UAO in July 2017 (USEPA, 2017).

5.2 PHYSICAL CHARACTERISTICS

FTBL-69 (SWMU M-27 Waste Ordnance Pits at Range 1) consists of 8.6 acres located east of the intersection of Barta Road and the Fairfax County Parkway off ramp, within the FBNA (**Figure 8**). The area is vegetated, with the limits of the site impact extending under Barta Road to the north, and the Fairfax County Parkway to the west. The National Geospatial Intelligence Agency truck inspection station bounds M-27 on the east (USACE, 2012).

5.3 HISTORY OF CONTAMINATION

FTBL-69 was operational in the 1950s and was formerly used to dispose of ammunition and explosives by burning. The site consisted of a primary pit approximately 20 ft in diameter and 5 ft deep and was later determined to consist of multiple pits (USACE, 2006a).

5.4 INITIAL RESPONSE

In 2002, Fort Belvoir Directorate of Public Works Environmental and Natural Resources Division prepared the SWMU M-27 Closure Plan, receiving conditional approval from the USEPA. Since receiving the USEPA's approval, three phases of groundwater investigations were completed between the spring of 2004 to January 2006. A UXO response was completed in 2005 by Conti Environmental & Infrastructure, Inc., in which multiple pits were delineated and identified ordnance and explosives (OE) were removed (USACE, 2006b). Two thousand seven hundred twenty-five OE items were removed, including MEC and MD, of which 72 were determined to be UXO. In addition, 648 pieces of munitions debris determined not to present an explosive hazard were removed. The material removed included. mine fuses, mines, mortars, and scrap metal (USACE, 2006a). The OE was presumed to be the most likely source of explosive contaminants in the groundwater at SWMU M-27. USEPA issued a Unilateral Administrative Order on the EPG property including SWMU M-27, which was effective September 12, 2005.

5.5 BASIS FOR TAKING ACTION

The OE was presumed to be the most likely source of explosive contaminants in the groundwater at SWMU M-27. Between the spring of 2004 and January 2006, three phases of groundwater investigations were conducted at FTBL-69 (M-27), which confirmed the presence of explosives contamination in groundwater samples at a concentration greater than the USEPA Region 3 RBC for tap water. (USACE, 2006a).

5.6 REMEDIAL ACTION

5.6.1 Remedial Action Objectives

The RAOs established for groundwater in the 2006 DD for FTBL-69 are to:

- Prohibit the use of groundwater until cleanup goals are met.
- Prevent human contact with the contaminated groundwater that could cause unacceptable risks.

The groundwater remedial goals are based on USEPA Region 3 RBC for tap water. The groundwater COCs are presented in **Table 11**.

Table 11 – FTBL-69 Original (2006) Contaminants of Concern for Groundwater

Contaminants Group	Contaminants of Concern	Remedial Goal (µg/L)	Basis
Explosives	2,4-Dinitrotoluene	0.098	USEPA Region 3 RBC for Tap Water
	2,6-Dinitrotoluene	0.098	
	2-Amino-4,6-Dinitrotoluene	0.098	
	4-Amino-2,6-Dinitrotoluene	0.098	
	2,4,6, Trinitrotoluene	2.2	
	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.61	

µg/L – micrograms per liter

5.6.2 Remedial Action Selection

The components of the selected remedy include:

- LTM of groundwater for natural attenuation.
- LUCs (groundwater use restrictions).

5.6.3 Remedial Action Implementation

5.6.3.1 LTM

Baseline groundwater monitoring was conducted in 2006. The monitoring program for the site consisted of 19 monitoring wells. Groundwater samples were analyzed for explosives and explosives-related COCs for two years. Following evaluation of groundwater sampling data from sampling events conducted between 2006 and 2008, it was determined that monitoring and natural attenuation was ineffective. A risk assessment submitted to the USEPA in October 2011, indicated that no human health risks associated with groundwater were present on-site. In 2011, groundwater monitoring was interrupted by construction of the FCP, which required the abandonment of monitoring wells MW06, MW07, MW10, MW13, MW14, and MW17 (Plexus, 2021a).

A two-phase Data Gap Investigation was conducted between 2018 and 2019 (Plexus 2020) to further delineate the extent of COCs in groundwater and provide additional information for the assessment of site remediation options. During the investigation, monitoring wells (MW22 to MW31) were installed, and groundwater, surface water, and seep samples were taken.

A 2021 Explanation of Significant Differences (ESD) was issued, which identified revisions to the groundwater monitoring standards outlined in the 2006 DD. The ESD outlined the following:

- Clarification of the RAOs. The revised RAOs established for groundwater in the 2021 ESD for FTBL-69 (M-27) are to: "*Prevent current and future use of the site's groundwater until such time that the use of groundwater for any purpose does not pose an unacceptable risk and return groundwater to its beneficial use, wherever practicable, within a timeframe that is reasonable, by meeting the revised groundwater clean-up goals for all COCs.*"

- Established a monitoring requirement for perchlorate to allow perchlorate to be incorporated as a COC into the LTM and natural attenuation remedy if it is found to pose an unacceptable risk. The revisions to remedial goals for FTBL-69 are presented in **Table 12**.
- Revised clean-up goals for the explosives and explosives-related COCs in groundwater.
- Required development of an updated LTM plan.

The Remedial goals that are protective of a cumulative excess lifetime cancer risk of 1E-04 and a Hazard Quotient of 1 were calculated for each of the COCs and approved by VADEQ (Plexus, 2021a). The revised groundwater COCs are presented in **Table 12**.

Table 12 – FTBL-69 Revised (2021) Contaminants of Concern for Groundwater

Contaminants Group	Contaminants of Concern	Remedial Goals[1] (µg/L)	Basis
Explosives	2,4-Dinitrotoluene	2.1	Site-specific cancer risk level developed with VADEQ input[1]
	2,6-Dinitrotoluene	2.1	
	2-Amino-4,6-Dinitrotoluene	0.5	
	4-Amino-2,6-Dinitrotoluene	0.5	
	2,4,6, Trinitrotoluene	2.5	
	RDX	19	
Inorganic compounds	Perchlorate	14	USEPA RSL for Tap Water[2]

µg/L – micrograms per liter

[1]Calculation of the remedial goals from which these clean-up goals were derived for all groundwater COCs is described in the Final Data Gap Investigation Report (Plexus, 2020).

[2]The Data Gap Investigation used the May 2020 USEPA update of the tap water RSLs.

The 2006 LTM plan was superseded by the 2021 LTM plan to comply with the 2006 DD and 2021 ESD (Plexus, 2021a). The new monitoring well network consists of 23 monitoring wells and one surface water sample location. Groundwater monitoring will be conducted semi-annually for two years (2022 to 2023), followed by annual sampling for four years (2024 to 2027), with biennial monitoring until cleanup goals are attained (Plexus, 2021b).

5.6.3.2 LUCs

LUCs have been implemented at the site to prohibit residential land use and groundwater use until remedial goals are achieved. Groundwater use restrictions consist of prohibitions on groundwater consumption for domestic purposes, drinking water well installations, and the withdrawal or use of groundwater for agricultural/irrigation purposes. In addition, ground disturbance activities are not allowed without the approval of the Army.

A 2016 installation-wide LUCIP was developed to establish responsibility, land use restrictions, and reporting and implementation of LUC mechanisms (Aerostar, 2016). LUC boundaries were noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities.

5.6.4 Operations and Maintenance

There were no O&M activities conducted at the site during this this five-year review period, due to pending update of the LTM plan to include annual LUC inspections.

5.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The protectiveness statement for FTBL-69 from the prior five-year review is as follows:

"The remedy at FTBL-69 currently protects human health and the environment because LUCs, including a prohibition on well installation for potable use, limitations on use of groundwater for potable purposes, and a restriction on any activities that could disturb the groundwater in these areas, prevent exposure. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: Resume groundwater monitoring until it can be demonstrated that cleanup levels have been attained."

The issue and recommendation affecting protectiveness from the prior five-year review for FTBL-69 are listed in **Table 13**.

Table 13 – Issue and Recommendation Affecting Protectiveness from Prior Five-Year Review

Issue	Recommendation/ Follow-up Actions	Responsible Party	Actions Taken	Current Status
Additional groundwater monitoring is necessary to demonstrate attainment of cleanup levels.	Resume groundwater monitoring until it can be demonstrated that cleanup levels have been attained.	Fort Belvoir	Additional groundwater monitoring was performed from 2018 to 2019.	Complete

5.8 DATA REVIEW

Groundwater and surface water analytical data from 2018 and 2019 for FTBL-69 (M-27) were evaluated during this review (Plexus, 2020). Analytical data from monitoring conducted after the preparation of the updated LTM plan, including monitoring for perchlorate, was not available at the time of this five-year review. Therefore, groundwater and surface water analytical data from 2018 and 2019, combined with historical data, were evaluated according to the revised remedial goals established in the 2021 ESD.

Ten monitoring wells (MW22 through MW31) were installed between November 2018 and March 2019 as part of the Data Gap Investigation to delineate COCs in groundwater at FTBL-69 (M-27) (Plexus, 2020). Groundwater samples were collected from 20 monitoring wells in December 2018 and three monitoring wells in March 2019. The groundwater samples were analyzed for explosives and inorganic compounds. Monitoring well locations are illustrated on **Figure 9**.

Groundwater elevation data from January and March 2019, indicates that groundwater flow is predominantly to the northwest toward an unnamed stream tributary at the northern boundary of the site, but exhibits some radial flow characteristics along the west side of the site where groundwater flows west and southwest toward a storm water retention pond south of the site. The construction of the Fairfax County Parkway west of the site appears to have influenced groundwater flow at the site. Groundwater historically flowed to the north and northeast without the southwest component observed in 2019 (Plexus, 2021b). Groundwater elevations in January 2019, were approximately 7 ft higher on average than in December 2008, before the construction of the Fairfax County Parkway. Groundwater elevation contours are provided on **Figure 10**.

Groundwater analytical data indicates that detections of 2,4,6-trinitrotoluene (TNT) above its revised clean-up goal of 2.5 µg/L were isolated to monitoring well MW11 (2.91 µg/L in the parent sample and 3.04 µg/L in the field duplicate) in December 2018. MW11 is located immediately downgradient from former storage bunker Building 5081. TNT degradation products 2-amino-4,6-dinitrotoluene (2A-DNT) and 4-amino-2,6-dinitrotoluene (4A-DNT) were sporadically detected above their revised remedial goals of 0.5 µg/L in monitoring wells MW04 (4A-DNT), MW22 (2A-DNT and 4A-DNT), and MW26 (4A-DNT) in December 2018. RDX was detected in 12 monitoring wells, but was not detected above the revised remedial goal of 19 µg/L. A summary of exceedances of the remedial goals is provided in **Table 14**. The extent of groundwater contamination exceeding the remedial goals is illustrated on **Figure 11**.

Table 14 – COCs Exceeding Remedial Goals – FTBL-69 (M-27)

Sample Location	Sample Date	2,4,6-TNT (µg/L)	2,4-DNT (µg/L)	2,6-DNT (µg/L)	2A-DNT (µg/L)	4A-DNT (µg/L)	RDX (µg/L)
Remedial Goals		**2.5**	**2.1**	**2.1**	**0.5**	**0.5**	**19**
MW04	12/10/2018	–	–	–	–	**3.49 J**	–
MW11	12/10/2018	**2.91**	–	–	–	–	–
	12/10/2018 (Duplicate)	**3.04**	--	--	--	--	--
MW22	12/07/2018	–	–	–	**0.881 J**	**1.32**	–
MW26	12/06/2018	–	–	–	–	**4.07 J**	–

Note: – indicates the contaminant was not detected above the clean-up goals.

Six surface water samples were collected from an unnamed stream at the northern boundary of the site (SW1, SW2, and SW3), a storm water retention pond south of the site (SW4 and SW5), and a seep uphill from the unnamed stream (SEEP1) as part of the Data Gap Investigation to delineate COCs in groundwater at FTBL-69 (M-27) (Plexus, 2020). The surface water and seep samples were analyzed for explosives and inorganic compounds. Surface water sampling locations are illustrated on **Figure 9**.

Surface water analytical data indicates that RDX was detected at a concentration of 1.72 µg/L in surface water sample SW4, collected at the northeast corner of the storm water retention pond south of the site, in February 2019. RDX was not detected in the field duplicate sample for SW4.

The detected concentration of RDX was two orders of magnitude less than the USEPA Region 3 Biological Technical Assistance Group (BTAG) freshwater screening benchmark of 360 µg/L. No other COCs were detected above laboratory method detection limits in surface water samples. A summary of surface water analytical results is provided in **Table 15**.

Table 15 – Surface Water Analytical Results – FTBL-69 (M-27)

Sample Location	Sample Date	2,4,6-TNT (µg/L)	2,4-DNT (µg/L)	2,6-DNT (µg/L)	2A-DNT (µg/L)	4A-DNT (µg/L)	RDX (µg/L)
USEPA Region 3 BTAG Freshwater Benchmarks		**100**	**44**	**81**	**1,480**	**NA**	**360**
SW1	2/26/2019	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U
SW2	2/26/2019	0.532 U	0.532 U	0.532 U	0.532 U	0.532 U	0.532 U
SW3	2/26/2019	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U
SW4	2/26/2019	0.574 U	0.574 U	0.574 U	0.574 U	0.574 U	**1.72**
	2/26/2019 (Duplicate)	0.544 U	0.544 U	0.544 U	0.544 U	0.544 U	0.544 U
SW5	3/22/2019	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U
SEEP1	2/26/2019	0.596 U	0.596 U	0.596 U	0.596 U	0.596 U	0.596 U

Note: U indicates the analyte was not detected above the reported method detection limit.

Mann-Kendall analysis was conducted to evaluate trends in concentrations of COCs at monitoring wells with analytical data from at least four sampling events and where COCs were detected in at least 50 percent of samples. The results of Mann-Kendall analysis generally indicate that groundwater impacts at FTBL-69 (M-27) are shrinking or stable. Concentrations of site COCs exhibit stable or decreasing trends or exhibit no apparent trend (indicating concentrations do not exhibit a statistically significant increasing trend). However, the value of the trend evaluation is constrained by the limited data available since 2008. Groundwater samples have been collected from site monitoring wells only once since 2008. Furthermore, 10 of the 23 site monitoring wells were installed between November 2018 and March 2019. Only one round of monitoring data is available for these monitoring wells. Historical analytical data are provided in **Appendix E**. The results of Mann-Kendall analysis are provided in **Appendix F**.

Further monitoring is necessary to evaluate the effectiveness of the remedy at FTBL-69 (M-27); however, this is expected at this stage of the remedy implementation based on the schedule of the 2021 ESD, the updated LTM plan, and this five-year review.

5.9 SITE INSPECTION

The Site Inspection team observed and took photos of the current conditions at Fort Belvoir. The site inspection checklists are presented in **Appendix B**. The site inspection photograph logs are presented in **Appendix C**. Observations consisted of the following:

- No evidence of disturbed soils was observed.

- Site access point was well maintained.
- UXO warning signage observed outside of site, signage is not part of the remedy.
- No changes in land use were observed.
- Monitoring wells observed and in good condition.
- Concrete debris was observed on ground surface.

5.10 TECHNICAL ASSESSMENT

5.10.1 QUESTION A – Is the Remedy Functioning as Intended by the Decision Documents?

Yes, the remedy is functioning according to the 2006 DD and 2021 ESD for FTBL-69 by preventing human exposure to groundwater that may cause unacceptable risk. The site inspection team confirmed that land use has not changed, residential use is restricted, and there have been no intrusive ground disturbances. Groundwater use is prohibited as a potable water source and for industrial use. Concentrations of 2,4,6-TNT, 2A-DNT, and 4A-DNT in groundwater exceed the revised remedial goals established in the 2021 ESD. Groundwater monitoring is being conducted in accordance with the 2021 LTM plan; however, due to the infancy of the monitoring program at the site, further monitoring is necessary to evaluate the effectiveness of the remedy with respect to attaining clean-up goals at FTBL-69. In addition, LUCs have been incorporated into the GIS system, LUCIP, and dig permit process.

5.10.2 QUESTION B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

Yes. The remedial goals incorporate standard exposure assumptions and toxicity data. For the Waste Ordnance Pit, the remedial goals were based on a target cumulative risk of $1x10^{-4}$ and a total noncarcinogenic hazard of 1 and approved by VADEQ. A comparison of the toxicity criteria used in the development of the revised remedial goals, stated in the 2021 ESD, and those presently available (USEPA, 2022a) identifies that they are the same (**Appendix H, Table 2**). The risk levels for the remedial goals were based on the understanding that LUCs make current and future use of groundwater unlikely, thus justifying a less stringent target risk level (Plexus, 2020).

5.10.3 QUESTION C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

There is no other information that calls into question the protectiveness of the remedy. There have been no impacts from natural disaster events or weather-related events that have affected the protectiveness of the remedy.

5.10.4 Technical Assessment Summary

LUCs in the form of institutional controls (ICs) and administrative mechanisms are in place to prevent groundwater use and restrict residential use of the site. A dig permit process has been established to ensure there are no unauthorized ground activities. Additionally, groundwater monitoring is being conducted in accordance with the 2021 LTM plan.

The remedial goals at FTBL-69 were found to be based on current toxicity and exposure assumptions. Conditions at FTBL-69 have not been observed to have changed. There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness.

5.11 ISSUES

No issues were identified that prevent the remedial action from being protective of human health and the environment, currently or in the future.

5.12 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No recommendations or follow-up actions are required since there are no issues identified during this five-year review that affect current or future protectiveness of the remedy.

5.13 OTHER FINDINGS

During the interviews it was noted that a new policy for the FBNA that requires munitions clearance/munitions removal at any former range site. This policy should be incorporated into the current LUCIP for FTBL-69.

5.14 PROTECTIVENESS STATEMENT

The remedy at FTBL-69 is protective of human health and the environment.

LUCs are in place to restrict residential land use and groundwater use at the site. Monitoring of groundwater is being conducted in accordance with the 2021 LTM plan and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

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6.0 FTBL-001-R-02 INFILTRATION COURSE

6.1 SITE CHRONOLOGY

Site chronology for FTBL-001-R-02 is presented in **Table 16**.

Table 16 – FTBL-001-R-02 Site Chronology

Event	Date (Year)
FTBL-001-R-02 Operational as Battle Indoctrination Course	1943–1956
Site Investigation Conducted	2008
Remedial Investigation Completed	2011
Remedial Investigation/Feasibility Study (RI/FS) Completed	January 2013
Installation-Wide LUCIP Completed	August 2016
Decision Document Signed	September 3, 2020
Site-Specific LUCIP Completed	April 2021
Remedial Action Completion Report Completed	August 2021
Annual LUC Inspections Conducted	2021 – Present

6.2 PHYSICAL CHARACTERISTICS

FTBL-001-R-02, the Infiltration Course Munitions Response Site (INFC MRS), is an approximately 5-acre site located on the FTBL Main Post 0.2 miles northwest of the Tulley security checkpoint on Pohick Road (**Figure 12**). The majority of the site is located within the Accotink Bay Wildlife Refuge, which includes a hiking path along its eastern border (Arcadis, 2020b).

6.3 HISTORY OF CONTAMINATION

Military training took place at the INFC MRS from 1943 through 1956. During this time, a variety of military munitions, small arms, and explosives and explosives components were used on-site. Items reportedly used included .30 caliber small arms rounds, electric and non-electric blasting caps, dynamite, signal flares, TNT or other explosives, cratering charges, time fuze, and detonating cord (Arcadis, 2020b and Shaw, 2013).

6.4 INITIAL RESPONSE

There were no pre-DD cleanup activities conducted at the site.

6.5 BASIS FOR TAKING ACTION

Investigations conducted at FTBL-001-R-02 between 2008 and 2013 confirmed the presence of lead and copper in the soil and surface water samples. A Human Health Risk Assessment and a Screening Level Ecological Risk Assessment were completed to evaluate potential risks within FTBL-001-R-02. The assessments identified lead in soil poses unacceptable non-cancer hazard risk to future adult workers through exposure to total soil by incidental ingestion, dermal absorption,

and inhalation of soil dust. In addition, copper and lead in sediment were considered a toxicity concern through direct contact and food chain bioaccumulation.

6.6 REMEDIAL ACTION

6.6.1 Remedial Action Objectives

The RAOs established for soil in the 2020 DD for FTBL-001-R-02 are:

- *"Achieve average COC concentrations in soil to levels that do not pose an unacceptable risk for worker exposure pathways."*
- Minimize the potential for migration of COCs from soil to achieve surface water and COC concentrations that do not pose an unacceptable risk to ecological receptors by attaining Virginia Water Quality Standard (VA WQS).
- *"Restrict future residential use of the INFC due to unacceptable exposure to the COCs in soil."*

Soils and Surface Water COCs are presented in **Tables 17 and 18**.

Table 17 – FTBL-001-R-02 Contaminant of Concern for Soils

Contaminant of Concern	Remedial Goal (mg/kg)	Basis
Lead	1,235	USEPA Adult Lead Model for a future C/I worker

mg/kg – milligram per kilogram

Table 18 – FTBL-001-R-02 Contaminants of Concern for Surface Water

Contaminants Group	Contaminants of Concern	Remedial Goal* (µg/L)	Basis
Metal	Lead	14	9 Virginia Administrative Code (VAC) 25-260 – VA WQS
	Copper	9	

µg/L – micrograms per liter
***Remedial Goal or concentrations consistent with background**

6.6.2 Remedial Action Selection

The components of the selected remedy include:

- Removal of lead-impacted soils.
- Regrading and stabilization of a portion of the streambank.
- Ex-situ treatment of removed soils.
- LUCs (residential land use prohibited, restricted to recreational use only, signage, and dig permit).

6.6.3 Remedial Action Implementation

6.6.3.1 Surgical Soil Removal and Streambank Stabilization

In April 2021, the streambank area was excavated to a total depth of approximately 3 ft bgs and a targeted soil excavation was completed in a second area. Between April and May 2021, approximately 70 tons of soil was disposed of off-site at Envirite of Pennsylvania, Inc. Post-excavation confirmation samples were collected from the expanded excavation sidewalls and excavation floor and sampled until lead-impacted soil with concentrations greater than 5,000 mg/kg had been removed (Arcadis, 2021d). The excavation of elevated lead concentrations greater than 5,000 mg/kg was conducted to achieve residual average lead concentrations in the remediated areas of less than 1,235 mg/kg over a half-acre decision unit (Arcadis, 2021d).

The streambank excavation was stabilized in accordance with the 2010 Work Plan. A geotextile fabric layer was secured into the base of the excavation area and covered to grade with class A1 rip-rap. The targeted excavation area was backfilled with stone to approximately 1 ft bgs and backfilled to grade with topsoil (Arcadis, 2021d).

6.6.3.2 LUCs

LUCs have been implemented at FTBL-001-R-02 to prohibit residential land use and to restrict recreational use. Unauthorized construction activities without the approval of USAG—Fort Belvoir through the established dig permit process is prohibited. Existing signage is posted to warn of the potential risk that may be encountered at the site. In addition, in the event soil is disturbed, it must be returned to the area or disposed of in accordance with land disposal restrictions.

A 2021 LUCIP was developed to establish responsibility, land use restrictions, and reporting and implementation of LUC mechanisms. LUC boundaries were noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities.

Annual LUC inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended. During the inspections, the following are verified:

- Soil disturbance activities are restricted.
- Unauthorized land use is restricted.
- Signage is in good condition.

6.6.4 Operations and Maintenance

During the Annual 2021 LUC inspection at FTBL-001-R-02, O&M contractors found no issues. It was observed that trees were added, and the trail was repaired as part of the site restoration plan for the FTBL-001-R-01 remedial action (Arcadis, 2021j). A Fort Belvoir dig permit was completed and approved for the intrusive work conducted as part of the remedial action (Arcadis, 2021d).

6.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review for FTBL-001-R-02.

6.8 DATA REVIEW

There are no sampling requirements for FTBL-001-R-02; thus, there is no data to review.

6.9 SITE INSPECTION

The Site Inspection team observed and took photos of the current conditions at Fort Belvoir. The site inspection checklists are presented in **Appendix B**. The site inspection photograph logs are presented in **Appendix C**. Observations consisted of the following:

- No evidence of disturbed soils was observed.
- Tree mitigation and Riprap recently added near site.
- Site access point was well maintained.
- No changes in land use were observed; site remains restricted to recreational use only.

6.10 TECHNICAL ASSESSMENT

6.10.1 QUESTION A – Is the Remedy Functioning as Intended by the Decision Documents?

Yes, the remedy is functioning according to the 2020 DD for site FTBL-001-R-02. Lead-contaminated soil exceeding the C/I remedial goal of 1,235 mg/kg has been excavated and disposed of off-site at a permitted facility, and the stream bank has been stabilized to reduce human and ecological exposure to copper and lead in surface water. ICs are in place at the site to prohibit residential land use and unauthorized soil disturbance. The site inspection team confirmed that land use has not changed and remains restricted to recreational use, and there have been no intrusive ground disturbances. LUC boundaries have been noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities and annual inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended.

6.10.2 QUESTION B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

Yes, the toxicity data and RAOs used at the time of remedy selection are still valid. The selected remedy for FTBL-001-R-02 for the soil and surface water was surgical soil removal and streambank stabilization. In addition, LUCs have been implemented to reduce human exposure to lead-contaminated soil. The LUCs will restrict future residential development of the property without additional assessment and possible remedial action (Arcadis, 2020a).

The remedial goal for lead in soil was based on the USEPA Adult Lead Model (ALM) (USEPA, 2017a). The ALM requires user input to define exposure parameters to derive a concentration in

soil that is predictive of a blood lead level to the fetus of a female adult worker. Since the derivation of the remedial goal in 2016, EPA has issued additional guidance for use in the ALM for the following parameters (USEPA, 2017b), which are compared to the values used in the remedial goal development, as shown in **Table 19**.

Table 19 – FTBL-001-R-02 Adult Lead Model Parameter Comparison

ALM Variable	Current Assumptions	2016 Assumptions
Geometric Standard Deviation (GSD)	1.8	2.1
Baseline Blood Lead Concentration (µg/dl)	0.6	1.5
Target Blood Lead Level (µg/dl)	5	10
Resulting Lead Remedial Goal (mg/kg)	1050	1235

The assumptions in the FS estimated a lead remedial goal of 1,235 mg/kg. Using the revised EPA parameters, a value of 1,050 mg/kg can be calculated (**Appendix G, Table 3**), which is marginally less than the remedial goal. Although less, it is noted that the remedial goal implies direct exposures to impacted soil, which is unlikely to occur since the excavation has been backfilled. Also, the area is used for recreational purposes and the footprint of the excavation is relatively small compared to the surrounding area that offers more attractive recreational opportunity.

To assess surface water, remedial goals were based on the VA WQS for lead and copper (Virginia Administrative Code 9VAC25-260-140. Criteria for Surface Water). A comparison of the remedial goals to current values is presented in **Table 20**.

Table 20 – FTBL-001-R-02 Comparison of Surface Water Quality Standards

Metals	2017 Remedial Goal (µg/L)	2022 Value (µg/L)
Lead	14	11
Copper	9	9

Although the current surface water value for lead is marginally less than that identified in the DD (Arcadis, 2020), surface water data obtained post-remediation indicated lead concentrations below 11 µg/L.

6.10.3 QUESTION C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

There is no other information that calls into question the protectiveness of the remedy. There have been no impacts from natural disaster events or weather-related events that have affected the protectiveness of the remedy.

6.10.4 Technical Assessment Summary

Lead-contaminated soil exceeding the C/I remedial goal of 1,235 mg/kg has been excavated and disposed of off-site at a permitted facility, and portions of the stream bank have been stabilized to reduce human and ecological exposure to copper and lead in surface water. LUC boundaries have been noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities and annual inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended. There were no issues reported during the 2017–2020 annual site inspections.

The FS established a lead remedial goal of 1,235 mg/kg. Using revised EPA parameters, a remedial goal of 1,050 mg/kg can be calculated, which is marginally less than the FS value. This revised remedial goal assumes direct exposures to impacted soil, which is unlikely to occur since the excavation has been backfilled. In addition, the current surface water quality standard for lead (11 µg/L) is marginally less than the remedial goal established in the DD (14 µg/L). However, surface water concentrations have not exceeded the updated surface water quality standard. There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness.

6.11 ISSUES

No issues were identified that prevent the remedial action from being protective of human health and the environment, currently or in the future.

6.12 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No recommendations or follow-up actions are required since there are no issues identified during this five-year review that affect current or future protectiveness of the remedy.

6.13 PROTECTIVENESS STATEMENT

The remedy for FTBL-001-R-02 is protective of human health and the environment.

Lead-contaminated soil exceeding the C/I remedial goal of 1,235 mg/kg has been excavated and disposed of off-site at a permitted facility, and portions of the stream bank have been stabilized to reduce human and ecological exposure to copper and lead in surface water. LUCs are implemented to mitigate human exposure to lead contaminated soil left at the site. LUCs are in place to prohibit residential land use and restrict to recreational use only, existing signage is maintained, and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

7.0 FTBL-003-R-01 COMBAT RANGE COMPLEX

7.1 SITE CHRONOLOGY

Site chronology for FTBL-003-R-01 is presented in **Table 21**.

Table 21 – FTBL-003-R-01 Site Chronology

Event	Date (Year)
FTBL-003-R-01 Operational as Combat Range Complex (CRC) Training	1930–1970
Remedial Investigation Work Plan Completed	September 2010
Installation-Wide LUCIP Completed	August 2016
Proposed Plan Completed	March 2017
Decision Document Signed	October 31, 2017
Soil Removal Action Completed	December 2017
Remedial Action Completion Report Finalized	February 2018
Site-Specific LUCIP Completed	2018
Annual LUC Inspections Conducted	2019 – Present

7.2 PHYSICAL CHARACTERISTICS

FTBL-003-R-01, the Combat Range Complex (CRC) is an approximately 320-acre site area located within Fort Belvoir's Southwest Training Area west of the Main Post cantonment and Accotink Bay (APTIM, 2017b) (**Figure 13**).

7.3 HISTORY OF CONTAMINATION

FTBL-003-R-01 was a combat training range used from 1930 through 1970 and consisting of range fans consolidated from adjacent portions of the Lorton Combat Range, Lorton Assault Course, Bayliss Range, and the Tracy Road Range. During this time, various small arms ammunition was fired at the ranges, as well as explosive rounds, including MKII fragmentation grenades, M9A1 rifle grenades, M6A1 rockets, and both 60mm and 81mm mortars (APTIM, 2017b).

7.4 INITIAL RESPONSE

There were no pre-DD cleanup activities conducted at the site.

7.5 BASIS FOR TAKING ACTION

Lead and antimony were identified at the site at concentrations above site-specific human health and ecological risk-based cleanup levels in soil from small arms use.

7.6 REMEDIAL ACTION

7.6.1 Remedial Action Objectives

The RAOs established for soil in the 2017 DD for FTBL-003-R-01 are to:

- *Reduce and prevent direct human contact with MEC on the surface and in subsurface soil.*
- *Reduce and prevent human receptors from unacceptable exposure to MC in soil.*
- *Reduce unacceptable exposure of wildlife receptors to MC in soil.*
- *Ensure lead does not migrate from the site at unacceptable levels.*
- *Minimize impacts to the environment, including habitat destruction during remediation.*
- *Minimize impacts to culturally sensitive sites during remediation.*

The remedial goals were developed, in collaboration with VADEQ, for the future worker who may routinely be at the MRS, and through a hazard analysis for ecological receptors (CB&I, 2016). Remedial goals described in the 2017 DD are presented in Table 22.

Table 22 – FTBL-003-R-01 Project Action Limits for Soils

Contaminants of Concern	Remedial Goal (mg/kg)	Basis
Lead	1,235	EPA Adult Lead Model for a future C/I worker
Antimony	19	Risk Based Ecological Project Action Limit[1]

EPA – Environmental Protection Agency
mg/kg – milligram per kilogram
[1]Ecological Project Action Limits were estimated in the FS (CB&I, 2016) for sensitive wildlife species, such as the shrew and American robin.

7.6.2 Remedial Action Selection

The components of the selected remedy include:

- Soil removal with off-site disposal.
- LUCs (residential land use prohibited, restricted to recreational use only, signage, and dig permit).

7.6.3 Remedial Action Implementation

7.6.3.1 Soil Removal with Off-Site Disposal

From October 17–October 25, 2018, UXO technicians swept 1.3 acres at FTBL-003-R-01 to remove surface and subsurface MEC. The removal action was completed as a traditional "mag & dig" removal using analog instruments. Upon completion of the removal action, the UXO Quality Control Specialist team confirmed performance requirements were met. Nine MEC, one MPPEH and one Discarded Military Munition (DMM) were found during the removal action. In total, 150 pounds of Material Documented as Safe (MDAS) were transported in one 55-gallon drum to

Montgomery Scrap Corporation in Rockville, Maryland, where the material was shredded and recycled as scrap metal. Non-munitions scrap metal was transported to the Fort Belvoir recycling facility.

Between October and December 2017, 70.93 tons of hazardous soil were removed for off-site disposal at MAX Environmental Technologies, Inc. landfill and 441.75 tons of non-hazardous soil was removed for off-site disposal at King & Queen Sanitary Landfill. Post-excavation confirmation samples were collected from the perimeter and bottom of the excavation area and analyzed for lead and antimony. All final laboratory confirmation sample results were below 1,235 mg/kg for lead and 19 mg/kg for antimony.

Excavation areas were restored to original grade using the imported backfill. A biodegradable erosion control blanket consisting of coir mat was deployed on the slopes near Accotink Bay. Straw mulch was spread on level areas at the site. Two bollards with a chain were installed to restrict vehicular access (APTIM, 2018d).

7.6.3.2 LUCs

LUCs have been implemented at FTBL-003-R-01 to prohibit residential land use and restrict to recreational use. Unauthorized construction activities without approval of USAG – Fort Belvoir through a dig permit process is prohibited. Existing signage is posted to warn of the potential risk that may be encountered at the site. In addition, in the event soil is disturbed, it must be returned to the area or disposed of in accordance with land disposal restrictions.

A 2018 site-specific LUCIP was developed to establish responsibility, land use restrictions, and reporting and implementation of LUC mechanisms. LUC boundaries were noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities.

Annual LUC inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended. During the inspections, the following are verified:

- Soil disturbance activities are restricted.
- Unauthorized land use is restricted.
- Signage is required.

7.6.4 Operations and Maintenance

During the Annual LUC inspections from 2019–2020 at FTBL-003-R-01, installation personnel and O&M contractors found no issues (HGL; 2019b, 2021).

7.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review for FTBL-003-R-01.

7.8 DATA REVIEW

There are no sampling requirements for FTBL-003-R-01; thus, there is no data to review.

7.9 SITE INSPECTION

The Site Inspection team observed and took photos of the current conditions at Fort Belvoir. The site inspection checklists are presented in **Appendix B**. The site inspection photograph logs are presented in **Appendix C**. Observations consisted of the following:

- No evidence of disturbed soils was observed.
- Site access point was well maintained.
- Signage was observed and well maintained, some installed facing the wrong direction.
- No changes in land use were observed. Site remains restricted to recreational use only.
- Secure chain observed at site entrance to prevent vehicle access.

7.10 TECHNICAL ASSESSMENT

7.10.1 QUESTION A – Is the Remedy Functioning as Intended by the Decision Documents?

Yes, the remedy is functioning according to the 2017 DD for site FTBL-003-R-01. UXO removal at the site reduced direct human contact with MEC on the surface and in the subsurface soil and reduced unacceptable exposure to human and wildlife to MC in soil. Lead and antimony impacted soil exceeding the C/I remedial goal of 1,235 mg/kg and 19 mg/kg, respectively, has been excavated and disposed of off-site at a permitted facility. ICs are in place at the site to prohibit residential land use and unauthorized soil disturbance. The site inspection team confirmed that land use has not changed and remains restricted to recreational use, and there have been no intrusive ground disturbances. LUC boundaries have been noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities and annual inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended.

7.10.2 QUESTION B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

Yes. The RAOs are intended to be protective of human health, under a nonresidential setting, and ecological receptors. At the time of the remedial action selection, future residential land use was not under consideration, which remains the current situation. Further, land use controls have been implemented prohibiting residential use of the property.

The remedial goals for lead and antimony were developed to be protective of human health and the environment. For lead, the remedial goal was an average concentration of less than 1,235 milligrams per kilogram (mg/kg) in soil in each ½ acre decision unit (DU). For antimony, the remedial goal was 19 mg/kg.

The remedial goal for lead was based on the USEPA ALM (USEPA, 2017a). The ALM requires user input to define exposure parameters to derive a concentration in soil that is predictive of a blood lead level to the fetus of a female adult worker. Since the derivation of the remedial goal in 2016, USEPA has issued additional guidance for use in the ALM for the following parameters (USEPA,

2017b), which are compared to the values used in the remedial goal development, as shown in **Table 23**.

Table 23 – FTBL-003-R-01 Adult Lead Model Parameter Comparison

ALM Variable	2017	FS
Geometric Standard Deviation (GSD)	1.8	2.1
Baseline Blood Lead Concentration (µg/dl)	0.6	1.5
Target Blood Lead Level (µg/dl)	5	10
Resulting Lead Remedial Goal (mg/kg)	1050	1235

The assumptions in the FS estimated a lead remedial goal of 1,235 mg/kg. Using the revised USEPA parameters, a value of 1,050 mg/kg can be calculated (**Appendix H, Table 3**), which is marginally less than the FS value. As reported in the Remedial Action Completion Report (APTIM, 2018d), confirmation sampling was performed on the excavation floors and sidewalls using XRF screening. When XRF readings were above 1,000 mg/kg, additional excavation was taken. When XRF levels were generally less than 800 mg/kg, confirmation samples were collected for laboratory analysis. Excavation confirmation samples were all below the remedial goal of 1,235 mg/kg.

Although the lead concentration value calculated using current assumptions is less than the remedial goal, it is noted that the value assumes direct exposures to impacted soil, which is unlikely to occur since the excavation has been backfilled using imported material from an off-site source. Also, the excavation confirmation protocols utilized an XRF reading of 1,000 mg/kg to determine the extent of excavation, which is a concentration less than the 1,050 mg/kg level.

The ecological remedial goal for antimony of 19 mg/kg was based on sensitive wildlife species, such as the shrew and American Robin. The basis for the antimony remedial goal was information from Ecological Soil Screening Levels for Antimony (USEPA 2005), which is currently a valid reference.

7.10.3 QUESTION C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

There is no other information that calls into question the protectiveness of the remedy. There have been no impacts from natural disaster events or weather-related events that have affected the protectiveness of the remedy.

7.10.4 Technical Assessment Summary

UXO removal mitigated direct contact with potential surface and subsurface MEC and reduced exposure to humans and wildlife to MC in soil. Lead- and antimony-impacted soil exceeding the C/I remedial goal of 1,235 mg/kg and PAL of 19 mg/kg, respectively, has been excavated and disposed of off-site at a permitted facility. LUC boundaries have been noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities and annual inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended. There were no issues reported during the 2019 and 2020 annual site inspections.

The remedial goal for lead was developed using the USEPA ALM. Since the development of the remedial goal in 2016, the EPA has modified input parameters to the model, which would result in a value less than the remedial goal (1,050 mg/kg vs 1,235 mg/kg). However, excavation confirmation protocols (excavation of concentrations exceeding 1,000 mg/kg) were less than the lead value calculated using current assumptions. There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness.

7.11 ISSUES

No issues were identified that prevent the remedial action from being protective of human health and the environment, currently or in the future.

7.12 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No recommendations or follow-up actions are required since there are no issues identified during this five-year review that affect current or future protectiveness of the remedy.

7.13 OTHER FINDINGS

It was observed during the site inspection that some of the signage was installed facing the wrong direction. It is recommended to change the orientation of the signage to face away from the site boundary to be visible to humans accessing the site.

7.14 PROTECTIVENESS STATEMENT

The remedy for FTBL-003-R-01 is protective of human health and the environment.

UXO and MC removal has been completed, and direct contact with potential surface and subsurface MEC and exposure to MC in soil has been mitigated. Lead- and antimony-impacted soil exceeding remedial goals has been excavated and disposed of off-site at a permitted facility. LUCs are in place to prohibit residential land use and restrict to recreational use only, existing signage is maintained, and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

8.0 FTBL-005-R-05 – INERT MINE TESTING AREA AT RANGE 5

8.1 SITE CHRONOLOGY

Site chronology for FTBL-005-R-05 is presented in **Table 24**.

Table 24 – FTBL-005-R-05 Site Chronology

Event	Date (Year)
FTBL-005-R-05 operational as Inert Mine Detection Training Area	1940s – 1960s
Soil Contamination RA Conducted at FTBL-005-R-08 (M-32)	1996
MEC Removal Action Conducted at FTBL-005-R-08 (M-32)	2008
Groundwater at FTBL-005-R-08 Transferred to FTBL-005-R-05	September 2009
Groundwater Investigations at FTBL-005-R-05 Conducted	2008–2010
Decision Document Signed	October 30, 2018
Long Term Monitoring Plan Completed	March 26, 2020
Site-Specific LUCIP Completed	March 2020
Semi-annual Groundwater Monitoring Initiated	March 2021

8.2 PHYSICAL CHARACTERISTICS

The FBNA is a larger Munitions Response Area (MRA) consisting of various MRSs, including FTBL-005-R-05 (M-33) and FTBL-005-R-08 (M-32) (Arcadis, 2020d). The FBNA, formerly known as the EPG, is an 820-acre tract of land located 1.5 miles northwest of the Main Post of Fort Belvoir (Arcadis, 2020d). FTBL-005-R-05 is the former Inert Mine Testing Area at Range 5 (M-33), located on the western portion of FBNA, and adjacent to FTBL-005-R-08 (M-32, Building 5091), which is located adjacent to the southwest boundary of former Range 5A in proximity to FTBL-005-R-05 (**Figure 14**).

8.3 HISTORY OF CONTAMINATION

FTBL-005-R-05 was operational from the 1940s to the late 1960s. The area was used for training of mine detection and incorporated 22-pound explosive charges. In 1992, six M20 mines were located and removed, but no further MEC/MD was identified for removal. The area has been characterized as having ferromagnetic minerals that can give false magnetic positive results (Arcadis, 2018).

8.4 INITIAL RESPONSE

Excavation and off-site disposal of 18 tons of lead- and RDX-contaminated soil was removed from building 5091 (formerly Building 2091) at FTBL-005-08 in 1996. Confirmation soil sampling concluded contaminated soil was removed from the former bunker. Due to the proximity of FTBL-005-R-08 and FTBL-005-R-05 and the similarity of compounds detected in groundwater, it was determined no further action was necessary for soils (Arcadis, 2018).

Due to the history at FTBL-005-R-05, HGL completed MEC clearance activities at the site. No disposal pits were found during the clearance activities (HGL, 2009a). The site was cleared of MEC in 2008 (Arcadis, 2018).

8.5 BASIS FOR TAKING ACTION

An environmental baseline study identified FTBL-005-R-08 as having the potential for metals and explosives contamination in soil, based on the use of small arms and explosives. The explosives RDX and 2,4- DNT were reported in the groundwater samples above their respective tap water RSL. Because FTBL-005-R-08 is adjacent to M-33 and groundwater originating from FTBL-005-R-08 flows toward FTBL-005-R-05, groundwater at FTBL-005-R-08 is being addressed as part of FTBL-005-R-05 (Arcadis, 2020c).

A Phase I environmental investigation was conducted for FTBL-005-R-05 between November 2006 and January 2007. As part of the investigation, six temporary wells were installed (M33-MW01 through M33-MW06). Groundwater samples were collected from the six temporary wells for metals and explosives analysis. RDX, 2,4-DNT, and 2,6- DNT were detected at a concentration greater than the USEPA Region 3 RBC for drinking water in wells M33-MW01, M33-MW04, and M33-MW05. Phase II environmental investigation was conducted from August 2008 to June 2010. Groundwater COCs identified for FTBL-005-R-05 consisted of 2,4-DNT, 2,6-DNT, and RDX, and are consistent with the COCs identified for FTBL-005-R-08 groundwater (2,4-DNT and RDX) (Arcadis, 2020c).

8.6 REMEDIAL ACTION

8.6.1 Remedial Action Objectives

The RAOs established for groundwater in the 2018 DD for FTBL-005-R-05 (M-33) are:

- "*Prevent current and future use of the FTBL-005-R-05 groundwater until such time that the use of groundwater for any purpose does not pose an unacceptable risk.*
- *Return usable groundwater to its beneficial use, wherever practicable, within a timeframe that is reasonable, by lowering COC concentrations to levels that result in attaining acceptable risk levels (below 1E-04 cancer risk levels and non-carcinogen target organ hazard index (HI) less than or equal to 1) for all site COCs.*"

Remedial goals for groundwater are based on exposure parameters and the requirement to be protective of a cumulative (i.e., all three COCs) excess lifetime cancer risk of 1E-04 or 1 in 10,000. The remedial goals for groundwater are protective of residential exposure via ingestion of and dermal contact with constituents in tap water (Arcadis, 2018).

The groundwater COCs described in the 2018 DD are presented in **Table 25**.

Table 25 – FTBL-005-R-05 Contaminants of Concern for Groundwater

Contaminants Group	Contaminants of Concern	Remedial Goal (µg/L)	Basis
Explosives	2,4-DNT/2,6-DNT (Mixture)	5.3	Remedial Goals derived using the USEPA Risk-Based Screening Level Calculator
	RDX	30	

µg /L – micrograms per liter

[1]The remedial goal for 2,4-DNT and 2,6-DNT is the minimum of the carcinogenic screening level (SL) for the 2,4-DNT/2,6-DNT mixture and the non-cancer SL for 2,4-DNT.

8.6.2 Remedial Action Selection

The components of the selected remedy include:

- LTM of groundwater.
- LUCs (residential land use prohibited, groundwater use restricted, and dig permit).

8.6.3 Remedial Action Implementation

8.6.3.1 LTM

LTM groundwater monitoring began in March 2021 to evaluate groundwater quality and document concentrations of COCs. Groundwater samples are analyzed for 2-4, DNT, 2,6-DNT, and RDX to monitor concentrations with respect to their respective remedial goals. The monitoring program includes 2 years of semi-annual groundwater monitoring, 6 years of annual monitoring, and 22 years of biennial sampling, for a total of 30 years (Arcadis 2020c). The LTM monitoring well network consists of eight monitoring wells: M32-MW02, M32-MW03, M33-MW01, M33-MW03, M33-MW05, M33-MW09, M33-MW11, and M33-MW12. Temporary monitoring wells were converted to permanent monitoring wells for long-term durability prior to LTM. The monitoring well network is shown in **Figure 15**.

8.6.3.2 LUCs

LUCs have been implemented at the site to prohibit residential land use and industrial use of groundwater until remedial goals are achieved. Groundwater use restrictions consist of prohibitions on groundwater consumption for domestic purposes, drinking water well installations, and the withdrawal or use of groundwater for agricultural/irrigation purposes. In addition, ground disturbance activities are not allowed without the approval of the Army.

A 2020 site-specific LUCIP was developed to establish responsibility, land use restrictions, and reporting and implementation of LUC mechanisms (APTIM, 2020d). LUC boundaries were noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities.

- Groundwater use is restricted.
- Unauthorized land use is restricted.

8.6.4 Operations and Maintenance

During the 2021 LUC inspection, O&M contractor identified that various items were left at the site and were presumed to be from the conversion of the temporary monitoring wells to permanent monitoring wells. The various items were metal, concrete and steel pipes, and unlabeled 55-gallon drums (Arcadis 2021e).

8.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review for FTBL-005-R-05.

8.8 DATA REVIEW

Groundwater analytical data from 2021 for FTBL-005-R-05 (M-33) was evaluated during this review (Arcadis, 2021i). References to groundwater conditions at FTBL-005-R-05 within this section include groundwater at FTBL-005-R-08. Groundwater monitoring at FTBL-005-R-05 began in March 2021, following approval of the LTM plan for FTBL-005-R-05 in February 2021 (Arcadis, 2021i). Groundwater analytical data for only one semi-annual groundwater monitoring event conducted during the five-year review period was available at the time of this five-year review.

Groundwater samples were collected from eight monitoring wells at FTBL-005-R-05 (M32-MW02, M32-MW03, M33-MW01, M33-MW03, M33-MW05, M33-MW09, M33-MW11, and M33-MW12) and analyzed for 2,4-DNT, 2,6-DNT, and RDX during the March 2021, semi-annual monitoring event. The groundwater flow direction in March 2021 was to the southeast and was generally consistent with historical data. Groundwater elevation contours are provided on **Figure 16**.

Groundwater analytical data indicates that isolated explosive compounds were detected above the remedial goals. The mixture of 2,4-DNT and 2,6-DNT was detected above the remedial goal of 5.3 µg/L at monitoring well M32-MW03 (8.2 µg/L in the parent sample and 8.1 µg/L in the field duplicate) during the March 2021 semi-annual monitoring event. RDX was detected above its remedial goal of 30 µg/L at monitoring well M33-MW12 at an estimated concentration (J) of 73 J µg/L. No other COCs were detected above the remedial goals at FTBL-005-R-05 during the March 2021, semi-annual monitoring event. A summary of exceedances of the remedial goals is provided in **Table 26**. The extent of groundwater contamination exceeding the remedial goals is illustrated on **Figure 17**.

Table 26 – COCs Exceeding Remedial Goals – FTBL-005-R-05 (M-33)

Sample Location	Sample Date	2,4-DNT/2,6-DNT (Mixture) (µg/L)	RDX (µg/L)
	Remedial Goal	**5.3**	**30**
M32-MW03	3/4/2021	**8.2**	–
M32-MW03	3/4/2021 (Duplicate)	**8.1**	–
M33-MW12	3/6/2021	–	**73 J**

Note: – indicates the contaminant was not detected above the remedial goal.

Mann-Kendall analysis was conducted to evaluate trends in concentrations of COCs at monitoring wells with analytical data from at least four sampling events and where COCs were detected in at least 50 percent of samples. The results of Mann-Kendall analysis indicate that concentrations of 2,4-DNT and 2,6-DNT (as a mixture) exhibit stable or decreasing trends or exhibit no apparent trend (indicating concentrations do not exhibit a statistically significant increasing trend). A decreasing trend is observed at M33-MW12 where concentrations of 2,4-DNT and 2,6-DNT (as a mixture) decreased to below the remedial goal in March 2021. Concentrations of RDX exhibit stable trends or exhibit no apparent trend except at M32-MW03. RDX concentrations exhibit an increasing trend at M32-MW03; however, concentrations remain below the remedial goal. The results of Mann-Kendall analysis generally indicate that groundwater impacts at MW-33 are stable or shrinking. Historical analytical data are provided in **Appendix E**. The results of Mann-Kendall analysis are provided in **Appendix F**.

Linear regression analysis was performed to project the time to achieve the remedial goals for monitoring wells where COCs were detected above the remedial goals during the March 2021, semi-annual monitoring event. A first-order attenuation rate was estimated by linear regression of the natural-logarithm-adjusted concentrations of COCs. The attenuation rate was used to project the time to achieve the remedial goals. Based on the results of the linear regression analysis, concentrations of 2,4-DNT and 2,6-DNT (as a mixture) are projected to achieve the remedial goal at M32-MW03 in 12 years. Concentrations of RDX are projected to achieve the remedial goal at M33-MW12 in 81 years, outside the 30-year time frame established in the DD. However, the high p-value (0.78) for the RDX regression at M33-MW12 indicates that the trend line used to estimate the attenuation rate is not statistically significant (p-value less than 0.05). The value of the trend evaluation is further constrained by the limited data available. Groundwater samples have been collected from site monitoring wells only four times since 2009. The results of the linear regression analysis are provided in **Appendix F**.

8.9 SITE INSPECTION

The Site Inspection team observed and took photos of the current conditions at Fort Belvoir. The site inspection checklists are presented in **Appendix B**. The site inspection photograph logs are presented in **Appendix C**.

Observations consisted of the following:

- No evidence of disturbed soils was observed.
- No changes in land use were observed. Site remains restricted to recreational use only.
- Investigation derived waste (IDW) storage drums were observed, indicating on-going LTM activities.
- Unlabeled, old drum was observed at site.
- Survey flagging was observed for planned construction, projected to start 2023.
- Site heavily vegetated.
- Monitoring wells observed and in good condition.
- Hunting tree stand observed at site. Hunting recreational use allowed at site.
- Fencing and signage were observed at the access to the FBNA (not part of selected remedy).

8.10 TECHNICAL ASSESSMENT

8.10.1 QUESTION A – Is the Remedy Functioning as Intended by the Decision Documents?

Yes, the remedy is functioning according to the 2018 DD for FTBL-005-R-05 by preventing human exposure to groundwater that may cause unacceptable risk. The site inspection team confirmed that land use has not changed and remains restricted to residential use, and there have been no intrusive ground disturbances. Groundwater use is prohibited as a potable water source and for industrial use. Concentrations of 2,4-DNT and 2,6-DNT (as a mixture) and RDX in groundwater exceed the remedial goals. Groundwater monitoring is being conducted in accordance with the 2021 LTM plan.

LUC boundaries have been noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities and annual inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended.

8.10.2 QUESTION B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

Yes, groundwater remedial goals established in the DD were calculated using the online RSL calculator current at the time. The RSL calculator integrates default exposure factors and current toxicity data. These screening levels were calculated using default exposure parameters, a target hazard quotient (THQ) of 1, and a target cancer risk (TCR) of 1E-04. The cancer slope factor for the mixture of 2,4-DNT/2,6-DNT was used to determine the carcinogenic screening level for the DNT isomers. Therefore, the carcinogenic screening levels were apportioned by dividing by two. No noncarcinogenic screening level is available for 2,6-DNT. Therefore, the noncarcinogenic screening levels were also apportioned by dividing by two. The lower of either the apportioned carcinogenic or child non-cancer screening level was chosen as the remedial goal for each individual constituent. Since the development of the remedial goals, the toxicity criteria for 2,4-DNT/2,6-DNT have not changed.

In 2018, USEPA published the Toxicological Review of Hexahydro-1,3,5-trinitro-1,3,5-triazine, which included a revised reference dose (RfD) of 4E-03 mg/kg for RDX (USEPA, 2018). This represents a 25% increase over the RfD (3E-03 mg/kg) used to develop the remedial goal for RDX, which would result in a proportionately higher remedial goal. In addition, the carcinogenic slope factor has been revised from 1.1E-01 $(mg/kg\text{-}day)^{-1}$ to 8.0E-02 $(mg/kg\text{-}day)^{-1}$, which would also result in a proportionately higher remedial goal. Using the current USEPA RSL calculator, a value can be recalculated using current toxicity criteria (**Appendix G**, **Tables 4 and 5**) (USEPA, 2022b). A review of the 2022 RSL calculation methods and those used in 2018 did not identify any differences other than the toxicity criteria change for RDX. A comparison of the RDX remedial goal and calculated values is provided in **Table 27**.

Table 27 – FTBL-005-R-05 RDX Regional Screening Level Comparison to 2018 Remediation Goals

Chemical	2018 Remedial Goal – Noncarcinogenic[1] (µg/L)	2022 Calculation – Carcinogenic[2] (µg/L)	2022 Calculation – Noncarcinogenic[2] (µg/L)
Hexahydro-1,3,5 trinitro-1,3,5 triazine (RDX)	30	48	40

[1]The remedial goal was selected based on noncarcinogenic health effects, as it was determined to also be protective of potential carcinogenic effects.

[2]Calculated values using 2022 assumptions were apportioned in a similar manner as those used in estimating the remedial goals.

Based on the calculated values, the revised toxicity data for RDX do not negatively impact the selected remedial goals. The application of the apportioning scheme identified in the DD would result in a health protective value for RDX of 40 µg/L compared to the remedial goal of 30 µg/L established in the DD.

The remedial goals were developed with the understanding that groundwater at the site is not used as a potable water source. The DD identified the implementation of LUCs to prohibit the use of groundwater at the site.

8.10.3 QUESTION C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

The areas of SWMUs FTBL-005-R-05 and FTBL-005-R-08 have been selected and approved for military construction (MILCON) redevelopment to be completed in 2024. Fort Belvoir Best Management Practice for munitions requires that all MRS areas must receive supplemental munitions clearance prior to any land re-use. Site preparation activities will include UXO clearance, tree removal, and removal of all monitoring wells and existing building structures.

8.10.4 Technical Assessment Summary

LUC boundaries, in the form of ICs and administrative mechanisms, have been noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit

process prevents unauthorized ground disturbance or land use activities and annual inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended. Groundwater monitoring is being conducted in accordance with the 2021 LTM plan and there were no issues reported during the 2021 annual site inspections.
There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness. Although the toxicity criteria for RDX has changed, the revised values are greater than those identified in the DD.

8.11 ISSUES

No issues were identified that prevent the remedial action from being protective of human health and the environment, currently or in the future.

8.12 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No recommendations or follow-up actions are required since there are no issues identified during this five-year review that affect current or future protectiveness of the remedy.

8.13 OTHER FINDINGS

An unlabeled, old drum was observed at the site. It is recommended the contents of the drum be identified, removed from the site, and disposed of appropriately along with metal, concrete, and steel pipes identified during the 2021 LUC inspection during MILCON development. Additionally, actions should be taken to prevent illegal dumping at the site.

In addition, it was noted during the interviews that a new policy for the FBNA requires munitions clearance/munitions removal at any former range site. This policy should be incorporated into the current LUCIP for FTBL-005-R-05.

8.14 PROTECTIVENESS STATEMENT

The remedy at FTBL-005-R-05 is protective of human health and the environment.

LUCs are in place to restrict residential land use and groundwater use at the site. Groundwater monitoring is being conducted in accordance with the 2021 LTM plan and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

9.0 FTBL-005-R-09 FBNA SOIL AND GROUNDWATER AT THE CHILD DEVELOPMENT CENTER

9.1 SITE CHRONOLOGY

Site chronology for FTBL-005-R-09 is presented in **Table 28**.

Table 28 – FTBL-005-R-09 Site Chronology

Event	Date (Year)
FTBL-005-09 operational as a Vehicle Test Track	1954–1980
Child Development Center development Initiated	2010
FTBL-005-09 operational as a Child Development Center	2014 – Present
MEC Clearance Event Conducted	2010
Phase I Remedial Investigation Completed	January 2011
Phase II Remedial Investigation Completed	January 2012
Contaminated Soil Excavation Plan (Interim Removal Action [IRA])	March 2012
RI/IRA and Focused FS Conducted	August 2013
Decision Document Signed	October 5, 2020
Long Term Monitoring Plan Completed	January 2021
Site-Specific LUCIP Completed	2021
Semi-annual Groundwater Monitoring	2021 – Present

9.2 PHYSICAL CHARACTERISTICS

FTBL-005-R-09, the FBNA Child Development Center is located on 11 acres in the northeastern corner of the FBNA (**Figure 18**). The Child Development Center consists of two 10,354 square-foot modular buildings surrounded by fenced recreation areas, and a one-acre parking lot. The site is bordered to the north by Barta Road, to the west by the former Heller Loop, and to the east by Heller Road. A stormwater retention pond is located three hundred and fifty ft to the south-southwest of FTBL-005-R-09 (Arcadis, 2020a).

9.3 HISTORY OF CONTAMINATION

A portion of FTBL-005-R-09 functioned as a vehicle test track between 1954 and 1980 to test methods and equipment for the deployment, detection, and neutralization of land mines. (Arcadis, 2020a).

9.4 INITIAL RESPONSE

Prior to the development of the Child Development Center in 2010, a MEC clearance was conducted. Six emplaced land mines containing energetic material were identified and removed. The land mines were encountered along the footprint of the former test track adjacent to a planned building structure (Tidewater, 2013).

A 2011 investigation identified PAHs and explosives as constituents of potential concern (COPCs) in soil and groundwater. A 2012 interim removal action (IRA) was performed to excavate the impacted soil. Due to the presence of large trees and an embedded concrete slab, the extent of the excavation area was restricted, and some contaminants could not be removed.

9.5 BASIS FOR TAKING ACTION

SIs conducted at FTBL-005-R-09 between 2011 and 2012 confirmed the presence of PAHs, SVOCs, and explosives in groundwater at concentrations greater than the USEPA's RSLs for tap water and USEPA's Drinking Water MCLs.

9.6 REMEDIAL ACTION

9.6.1 Remedial Action Objectives

The RAOs established for groundwater in the 2020 DD for FTBL-005-R-09 are to:

- "*Prevent current and future use of FTBL-005-R-09 groundwater until such time that the use of groundwater for any purpose does not pose an unacceptable risk, and*
- *Return groundwater to its beneficial use, wherever practicable, within a timeframe that is reasonable, by lowering COC concentrations to levels that result in attaining acceptable risk levels (below cumulative 1E-04 cancer risk levels and non-carcinogen target organ HI less than or equal to 1) for all site COCs*."

Remedial goals for groundwater are based on exposure parameters and the requirement to be protective of a cumulative (i.e., all COCs, except for benzo(a)pyrene and hexachlorobenzene) excess lifetime cancer risk of 1E-04 or 1 in 10,000. Benzo(a)pyrene and hexachlorobenzene remedial goals are set at the MCL. The remedial goals for groundwater are protective of residential exposure via ingestion of and dermal contact with constituents in tap water (Arcadis, 2020a).

The groundwater COCs described in the 2020 DD are presented in **Table 29**.

Table 29 – FTBL-005-R-09 Contaminants of Concern for Groundwater

Contaminants Group	Contaminants of Concern	Remedial Goal (µg/L)	Basis
Explosives	2,6-DNT	1.3	USEPA RSLs for Tap Water
PAH	Naphthalene	2.1	
	Benzo(a)anthracene	0.37	
	Benzo(a)pyrene	0.2	USEPA MCL
	Benzo(b)fluoranthene	3.1	EPA RSLs for Tap Water
	Dibenz(a,h)anthracene	0.31	
	Indeno(1,2,3-cd)pyrene	3.1	
SVOC	1,1'-Biphenyl	0.83	
	Hexachlorobenzene	1	USEPA MCL

µg /L – micrograms per liter

9.6.2 Remedial Action Selection

The components of the selected remedy include:

- LTM of groundwater.
- LUCs (residential land use prohibited, groundwater use restrictions, and dig permit).

9.6.3 Remedial Action Implementation

9.6.3.1 LTM

Baseline groundwater monitoring was conducted in 2021 to evaluate groundwater quality and document concentrations of COCs. The LTM program consists of four years of semi-annual groundwater monitoring followed by annual monitoring (Arcadis 2021f). Annual monitoring will continue until the remedial goals are achieved or until a residual risk assessment demonstrates the risk to receptors is considered acceptable.

The monitoring well network consists of seven monitoring wells—three existing monitoring wells (CDC-MW02, CDC-MW03, and CDC-MW04) and four new monitoring wells (CDC-MW05, CDC-MW06, CDC-MW07, and CDC-MW08) installed in March 2021 (**Figure 19**). Groundwater samples are analyzed for PAHs, SVOCs, and explosives to evaluate the progress of the remedy towards attaining the remedial goals presented in **Table 29**.

9.6.3.2 LUCs

LUCs have been implemented at the site to prohibit residential land use and industrial use of groundwater until remedial goals are achieved. Groundwater use restrictions consist of prohibitions on groundwater consumption for domestic purposes, drinking water well installations, and the withdrawal or use of groundwater for agricultural/irrigation purposes. In addition, ground disturbance activities are not allowed without the approval of the Army.

A 2021 site-specific LUCIP was developed to establish responsibility, land use restrictions, and reporting and implementation of LUC mechanisms (APTIM, 2021b). LUC boundaries were noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities.

Annual LUC inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended. During the inspections, the following are verified:

- Groundwater use is restricted.
- Unauthorized land use is restricted.

9.6.4 Operations and Maintenance

During the 2020 LUC inspection, O&M contractor identified one groundwater monitoring well (CDC-MW01) had been abandoned and four new wells were observed (Arcadis; 2020, 2021e).

9.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review for FTBL-005-R-09.

9.8 DATA REVIEW

Groundwater analytical data from 2021 for FTBL-005-R-09 was evaluated during this review (Arcadis, 2021h). Groundwater analytical data for only one semi-annual groundwater monitoring event conducted during the five-year review period was available at the time of this five-year review.

Groundwater samples were collected from seven monitoring wells (CDC-MW02, CDC-MW03, CDC-MW04, CDC-MW05, CDC-MW06, CDC-MW07, and CDC-MW08) at FTBL-005-R-09 during the March 2021 semi-annual monitoring event. The depth to groundwater was measured in each of the seven monitoring wells prior to groundwater sampling. The groundwater flow direction in March 2021 was to the southeast and was generally consistent with historical data. Groundwater elevation contours are provided on **Figure 20**.

Groundwater analytical data indicates that COCs were not detected above laboratory method detection limits at FTBL-005-R-09 during the March 2021 semi-annual monitoring event. There have been no exceedances of the remedial goals for COCs reported for monitoring wells within the LTM network. Historical analytical data are provided in **Appendix E**.

9.9 SITE INSPECTION

The Site Inspection team observed and took photos of the current conditions at Fort Belvoir. The site inspection checklists are presented in **Appendix B**. The site inspection photograph logs are presented in **Appendix C**. Observations consisted of the following:

- No evidence of disturbed soils was observed.
- Site access point was well maintained.
- No changes in land use were observed.
- Monitoring wells (flush mounts and stick-ups) observed and in good condition.

9.10 TECHNICAL ASSESSMENT

9.10.1 QUESTION A – Is the Remedy Functioning as Intended by the Decision Documents?

Yes, the remedy is functioning according to the 2020 DD for FTBL-005-R-09 by preventing exposure to groundwater that may cause unacceptable risk. The site inspection team confirmed that land use has not changed, residential land use remains restricted, and there have been no intrusive ground disturbances. Groundwater use is prohibited for potable and industrial use. Groundwater monitoring is being conducted in accordance with the 2021 LTM plan. There have been no exceedances of the remedial goals for monitoring wells within the LTM network.

LUC boundaries have been noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents installation of unauthorized wells and

annual inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended.

9.10.2 QUESTION B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

Yes, groundwater located on the FBNA property, including FTBL-005-R-09, is not currently used as a potable water source and is not anticipated to be used as such in the future. LUCs in the form of ICs and administrative mechanisms are in place to prevent groundwater use.

Remedial goals for groundwater were established in the DD and are based on either MCLs for benzo(a)pyrene and hexachlorobenzene, or RSLs (Arcadis, 2020). The MCLs for benzo(a)pyrene and hexachlorobenzene remain valid (USEPA, 2022c). For COCs with risk-based remedial goals, residential exposures were assumed and were based on the USEPA RSLs and modified to be protective of a cumulative excess lifetime cancer risk of 1E-04 or 1 in 10,000. It is also noted that the remedial goal for 2,6-DNT is based on the RSL for a 2,4-DNT/2,6-DNT mixture, which is consistent with how 2,6-DNT has been historically evaluated at the site (Arcadis, 2020b).

The RSLs identified in the DD were compared to those currently available from the USEPA and are the same except for the RSL for naphthalene (2022a). For naphthalene, the current carcinogenic RSL is 1.2 µg/L, compared to 1.7 µg/L identified in the DD (both values representing a target cancer risk of 1E-05). These changes are the result of the carcinogenic potential evaluation by the USEPA that quantified the carcinogenic potential of naphthalene via the oral and dermal routes of exposure (current oral carcinogenic slope factor of 1.2E-1 mg/kg-day^{-1}, as compared to no quantified oral slope factor at the time of the DD). The information at the time of the DD only considered naphthalene a carcinogen via the inhalation route of exposure.

The 2020 RSLs integrate the current exposure parameters, including the integration of the 2014 EPA modified standard default exposure factors (USEPA, 2014. *Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors.* OSWER 9200.1-120). These assumptions are current and valid.

Even though the carcinogenic RSL for naphthalene has slightly decreased, the remedial goal established in 2020 for naphthalene is not affected, as the remedial goal was selected to be protective of noncarcinogenic effects. The remedial goal for naphthalene of 1.5 µg/L is protective of both noncarcinogenic effects and the target cancer risk level of 1E-04.

9.10.3 QUESTION C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

There is no other information that calls into question the protectiveness of the remedy. There have been no impacts from natural disaster events or weather-related events that have affected the protectiveness of the remedy.

9.10.4 Technical Assessment Summary

LUC boundaries, in the form of ICs and administrative mechanisms, have been noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents installation of unauthorized wells and annual inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended. Groundwater monitoring is being conducted in accordance with the 2021 LTM plan and there were no issues reported during the 2020 and 2021 annual site inspections.

There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness. For the naphthalene remedial goal in groundwater, recent EPA values protective of human health have changed, but the remedial goal selected is currently protective of both noncarcinogenic effects and the target cancer risk level of 1E-04.

9.11 ISSUES

No issues were identified that prevent the remedial action from being protective of human health and the environment, currently or in the future.

9.12 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No recommendations or follow-up actions are required since there are no issues identified during this five-year review that affect current or future protectiveness of the remedy.

9.13 OTHER FINDINGS

The method detection limit for hexachlorobenzene for samples collected on March 8, 2021, was above the vapor intrusion screening level (VISL) target groundwater concentration. However, historical data indicates that hexachlorobenzene has not been previously detected in groundwater at FTBL-005-09. Historical method detection limits were less than the VISL target groundwater concentration. Analytical sensitivity limit for COCs should be less than the VISL target groundwater concentration in future sampling events.

In addition, it was noted during the interviews that a new policy for the FBNA requires munitions clearance/munitions removal at any former range site. This policy should be incorporated into the current LUCIP for FTBL-005-R-09.

9.14 PROTECTIVENESS STATEMENT

The remedy at FTBL-005-R-09 is protective of human health and the environment.

LUCs are in place to restrict residential land use and groundwater use at the site. Groundwater monitoring is being conducted in accordance with the 2021 LTM plan and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

10.0 FTBL-007-R-01 GRENADE COURT, FTBL-018-R-01 DEMOLITION AREA-01, FTBL-024-R-01 BOOBY TRAP SITE, & FTBL-027-R-01 T-16

10.1 SITE CHRONOLOGY

Site chronology for FTBL-007-R-01, FTBL-018-R-01, FTBL-024-R-01, and FTBL-027-R-01 is presented in **Table 30**.

Table 30 – Four Munitions Response Sites Chronology

Event	Date (Year)
MRSs Operational	1926–1989
Historic Record Review for all Four MRSs	2006
Site Inspection Completed	2008
FTBL-024-R-01 Remedial Action Work Plan Completed	November 2009
FTBL-024-R-01 Site-Specific Removal Action Report Completed	April 2010
Remedial Investigation Work Plan for all Four MRSs	September 2010
FTBL-027-R-01 Remedial Investigation Report Completed	July 2011
Interim LUCs Implemented	2016
Proposed Plan Completed	September 2016
FTBL-018-R-01 Interim Removal Action Completed	October 2016
Decision Document Signed	February 14, 2018
Remedial Action Completed	2018
Site-Specific LUCIP Completed	2018
Annual LUC Inspections Conducted	2019 – Present

10.2 PHYSICAL CHARACTERISTICS

Descriptions of the four MRSs are below (HGL, 2021a):

- **FTBL-007-R-01** – Grenade Court is approximately 100 acres, located within the Southwest Training Area on the south bank of Accotink Creek along Poe Road (**Figure 21**). The former site consisted of an inner rectangular Grenade Court and an outer surface danger zone (SDZ) (APTIM, 2018c). One building is present in the northernmost portion of the SDZ outside the FTBL fence line. All but a small portion of the Grenade Court and SDZ lie within the Accotink Bay Wildlife Refuge.
- **FTBL-018-R-01** – Demolition Area-01 is approximately 312 acres, located in the northeastern portion of the Fort Belvoir Main Post (**Figure 22**). The developed site area includes residential housing, administrative buildings, roads associated with Woodlawn Village, and undeveloped land surrounding Woodlawn Village. The site is adjacent to the Mchaughton Ball Fields (Fairfax County) and the Jackson Miles Abbott Wetland Refuge (undeveloped land).
- **FTBL-024-R-01** – Booby Trap Site is approximately 13 acres, located in the southern portion of the Fort Belvoir Main Post. The site area originally covered approximately 4

acres and was expanded to address an adjacent trailer park area (APTIM, 2018c) (**Figure 23**). FTBL-024-R-01 is currently undeveloped property and is protected from development as a former munitions site and environmentally sensitive area.

- **FTBL-027-R-01** – T-16 Range is approximately 232 acres, located in the northeastern portion of the Fort Belvoir Main Post. Jeff Todd Way, a north-south connector road is constructed through the MRS, just east of center (APTIM, 2018c) (**Figure 24**). Land mines were recovered along the road alignment. The wooded site is primarily undeveloped, with the exception of the communications facility located in the western portion of the site. There are also three non-munitions related SWMUs located within FTBL-027-R-01: the Kingman Road Landfill (A-06), Mulligan Road Landfill (A-07), and the Suspected Sanitary/Debris Landfill (A-25)

10.3 HISTORY OF CONTAMINATION

Historical operations conducted from the 1940s to the 1990s resulted in contamination of surface and subsurface soil. Specific operations associated with the four MRSs are summarized below (APTIM, 2017a).

- **FTBL-007-R-01** was operational from 1941 to 1949 for training with practice grenades and later for practice land mine emplacement and detection. It is suspected that High Explosive (HE) grenades may have been used, due to sandbag fortifications depicted in aerial photos, though no evidence of HE grenade use has been found. Practice grenades and land mines have been removed from the site.
- **FTBL-018-R-01** was operational from 1940 through 1951, used for training Army engineers in the use of demolition materials and techniques. According to historical records review, demolition may have occurred on the surface, with steel pits, or below ground. Investigations indicate that munitions training did take place. While no evidence of HE or fragmenting munitions has been found during investigations, non-explosive MD has been found on site. These items include small arms, inert practice training mines, and expended illumination and smoke signaling devices.
- **FTBL-024-R-01** was operational from 1983 through 1989. Historical records indicate that the site was used for the practice of arming and disarming common firing devices and booby traps. During construction of a fence between the MRS and a planned RV Travel Camp, landmines were located outside of the MRS within FTBL-024-R-01. Upon further investigation, non-explosive MD was found, including practice landmines, firing devices, and expended smoke signaling devices.
- **FTBL-027-R-01** was operational from 1926 through 1987 for munitions training activities, limited to ground-based training of soldiers. Investigations at the range have indicated that the site was used for munitions training, though no MEC was found. Items found included non-explosive MD in the form of small arms, inert practice training mines, an expended rocket motor, and expended illumination and smoke-signaling devices.

10.4 INITIAL RESPONSE

The findings of a site investigation performed in 2008 and an RI in 2012 at the four MRSs confirmed each of the sites were priorly used for munitions training. Beginning in 2009, interim remedial actions were conducted to remove non-explosive MD in the form of inert practice training mines and other potential munitions at FTBL-007-01, FTBL-018-R-01, FTBL-024-R-01, and FTBL-027-R-01. No source of MEC or MC was found during the RI that would pose an unacceptable risk to human health or the environment (APTIM, 2017a).

From May to October 2016, UXO technicians swept 45.5 acres of FTBL-018-R-01 to remove surface and subsurface MEC. The removal action was completed as a traditional "mag & dig" removal using analog instruments. Upon completion of the removal action, the UXO Quality Control Specialist team confirmed performance requirements were met. No MEC was found during the RA at FTBL-018-R-01 (CB&I, 2017).

A full summary of munitions found is listed below:

- 149 Fuzes, Mine, Anti-Tank (AT), practice, M1.
- 1 Grenade, rifle, smoke, Model Unknown.
- 1 Grenade, rifle, smoke, M20.
- 1 Firing device, pressure.
- 41 Flare, expended.
- 2 Mines, Anti-Personnel (APERS), training, M2.
- 1 Mine, APERS, training, M3.
- 164 Mines, AT, practice, M1.
- 1 Mine, AT, practice, M12 series.
- 2 Mines, AT, practice, M1B1.
- 12 Ordnance components (spider plate).

All material was demilitarized, certified inert, and recycled (CB&I, 2017).

10.5 BASIS FOR TAKING ACTION

The RI determined that residual MEC potentially remains at the four MRSs. The MEC density and probability for exposure is low; however, complete pathways exist for all receptors with access to the MRS (APTIM, 2017a).

10.6 REMEDIAL ACTION

10.6.1 Remedial Action Objective

The RAO established in the 2017 DD for the four MRSs is to, "*prevent human exposure to MEC found on the surface and in the subsurface.*"

10.6.2 Remedial Action Selection

The components of the selected remedy include:

- LUCs (residential land use restrictions, signage, educational programs, dig permit, and UXO escort for construction activities).

10.6.3 Remedial Action Implementation

10.6.3.1 LUCs

LUCs have been implemented at the four MRSs to reduce human exposure to MEC include the prohibition of residential land use, including leased residential developments, the installation of signage to warn of MEC hazards, the provision of UXO construction support for intrusive activities, and public and facility staff education materials regarding the potential existence of MEC (APTIM, 2017a).

A 2018 LUCIP was developed to establish responsibility, land use restrictions, and reporting and implementation of LUC mechanisms (APTIM, 2018c). LUC boundaries were noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities.

Annual LUC inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended. During the inspections, the following are verified:

- Soil disturbance activities are restricted.
- Unauthorized land use is restricted.
- Signage is present and in good condition.

10.6.4 Operations and Maintenance

During the 2019 Annual LUC inspection of the four MRSs, O&M contractors identified missing signs along the eastern boundary of FTBL-018-R-01. In 2020, three newly installed LUCs signs were observed along the eastern boundary. Additionally, details of redevelopment in the area were discussed in the 2019 and 2021 LUC inspection reports. It was confirmed with Army personnel that the plans for future construction near FTBL-018-R-01 were halted and moved to another location on post, near the old commissary building (HGL; 2019b, 2021a).

10.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review for the four MRSs.

10.8 DATA REVIEW

There are no sampling requirements for the four MRSs; thus, there is no data to review.

10.9 SITE INSPECTION

The Site Inspection team observed and took photos of the current conditions at Fort Belvoir. The site inspection checklists are presented in **Appendix B**. The site inspection photograph logs are presented in **Appendix C**. Observations at each site consisted of the following:

FTBL-007-R-01:

- Site access point was well maintained.
- Site heavily vegetated.
- No evidence of disturbed soils was observed.
- Signage was observed and well maintained.
- No changes in land use were observed. Site remains restricted to recreational use only.
- Fencing was observed on access point but not part of the remedy. Site still accessible by pedestrians.

FTBL-018-R-01:

- Site access point was well maintained.
- Site heavily vegetated.
- No evidence of disturbed soils was observed.
- Signage was observed and well maintained but facing the wrong direction.
- No changes in land use were observed.
- Fencing observed and damaged in areas but not part of the remedy.

FTBL-024-R-01:

- Site access point was well maintained.
- Site heavily vegetated.
- No evidence of disturbed soils was observed.
- Signage was observed and well maintained. Some signs are installed facing the wrong direction.
- No changes in land use were observed.
- Fencing observed but not part of the remedy.

FTBL-027-R-01:

- Site access point was well maintained.
- Site heavily vegetated.
- No evidence of disturbed soils was observed.
- Signage was observed and well maintained.
- No changes in land use were observed.

10.10 TECHNICAL ASSESSMENT

10.10.1 QUESTION A – Is the Remedy Functioning as Intended by the Decision Documents?

Yes, the remedies are functioning according to the 2017 DD for the four MSRs by preventing human exposure to MEC. Warning signage posted around the boundary of the MRSs is well maintained, and educational materials and information are provided to installation personnel and contractors to warn of possible MEC present at the site. The site inspection team confirmed

that land use has not changed and continues to prohibit residential use of the MSR, and there have been no intrusive ground disturbances. LUC boundaries have been noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities and annual inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended.

10.10.2 QUESTION B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

The exposure assumptions and RAOs used at the time of remedy selection for the four MRSs are still valid. The RAO to protect the public health or welfare from the potential for military munitions to remain on the surface and in the subsurface at the four MRSs has been met with the implementation of LUCs. There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness.

10.10.3 QUESTION C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

There is no other information that calls into question the protectiveness of the remedy. There have been no impacts from natural disaster events or weather-related events that have affected the protectiveness of the remedy.

10.10.4 Technical Assessment Summary

LUCs to restrict land use to residential and prohibit intrusive ground disturbances are inspected on an annual basis and are functioning as intended. LUC boundaries have been noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities along with educational programs and information provided to warn of the potential hazards of MEC present at a site. There were no issues reported during the 2019–2020 annual site inspections.

There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness.

10.11 ISSUES

No issues were identified that prevent the remedial action from being protective of human health and the environment, currently or in the future.

10.12 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No recommendations or follow-up actions are required since there are no issues identified during this five-year review that affect current or future protectiveness of the remedy.

10.13 OTHER FINDINGS

The Real Property Master Plan only contains the Landfill boundaries for FTBL-027-R-01. It is recommended the Plan is updated to reflect the entire LUC boundary.

It was observed during the site inspection that some of the signage at FTBL-018-R-01 and FTBL-024-R-01 was installed facing the wrong direction. It is recommended to change the orientation of the signage to face away from the site boundary to be visible to personnel accessing the site.

10.14 PROTECTIVENESS STATEMENT

The remedy for the four MRSs is protective of human health and the environment.

LUCs are in place to restrict residential land use. Signage has been installed and maintained. An educational program and information warn installation personnel and contractors of the potential presence of MEC at the MRSs, and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

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11.0 FTBL-014-R-01 TRACY ROAD RANGE

11.1 SITE CHRONOLOGY

Site chronology for FTBL-014-R-01 is presented in **Table 31**.

Table 31 – FTBL-014-R-01 Site Chronology

Event	Date (Year)
FTBL-014-R-01 operational as Firing Range	1930–1956
Site Inspection Completed	January 2008
Remedial Investigation Completed	2013
Interim LUCs Implemented	June 2014
Site-Specific LUCIP Completed	November 2016
Decision Document Signed	January 13, 2017
First Five-Year Review Signed	March 27, 2019
Annual LUC Inspections Conducted	2014 – Present

11.2 PHYSICAL CHARACTERISTICS

FTBL-014-R-01, Tracy Road Range is an approximately 33-acre area on the southeastern portion of the Main Post (**Figure 25**). It consists of roads, buildings, parking lots, and former target berms. The berms are aligned with the eastern and partial western edges of the Theote Road Construction & Demolition Debris Landfill and consist of a 10-foot-high concrete wall with an earthen berm constructed in front of the wall. (CB&I, 2016a).

11.3 HISTORY OF CONTAMINATION

FTBL-014-R-01 was constructed in 1930 and operational until 1956, as a rifle training area with three firing lines. Aerial photography dated 1937 showed two distinct staggered target berms, one on the southwest and on the northeast of the range. (CB&I, 2016a).

The types of munitions used at the Tracy Road Range were not specified in historical documentation. It was presumed .30-cal ammunition was used, similar to other Fort Belvoir small arms ranges from this timeframe (CB&I, 2016a).

11.4 INITIAL RESPONSE

In 2014, the Army established interim LUCs as a non-time critical removal action that included signage, gates, restrictions on land use, notation in the Master Plan, excavation permitting, monitoring, and enforcement (CB&I, 2016a).

11.5 BASIS FOR TAKING ACTION

During a 2008 SI, expended small arms rounds were observed. In addition, a single discrete soil sample was collected from the eastern berm and analyzed for lead. Lead concentrations of the

sample and duplicate, 697 mg/kg and 707 mg/kg, respectively, exceeded the BTAG benchmark, USEPA Region 9 remedial goal, and the documented range of background levels for lead.

The 2013 RI identified potential hazards to a future child resident exposed to lead in soil through direct contact and incidental ingestion of soil. Additionally, future construction activities could potentially bring contaminated subsurface soils to the surface.

11.6 REMEDIAL ACTION

11.6.1 Remedial Action Objective

The RAO established for soil in the 2016 DD for FTBL-014-R-01 is to, "*prevent child resident exposure to soil with lead exceeding 400 mg/kg*."

The acceptable exposure level for lead in the soil is based on the Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (CB&I, 2016a).

11.6.2 Remedial Action Selection

The components of the selected remedy include:

- LUCs (residential land use restrictions and dig permit).

11.6.3 Remedial Action Implementation

LUCs have been implemented at FTBL-014-R-01 to prohibit land use for residential housing, hospitals, schools, childcare facilities, and/or playgrounds. In addition, unauthorized soil disturbance is prohibited in the berm areas and the 50-foot buffer surrounding the berms without the approval of the Army through the dig permit process. In the event soil is disturbed, it must be returned to the area or disposed of in accordance with land disposal restrictions (CB&I, 2016e).

A 2016 LUCIP was developed to establish responsibility, land use restrictions, and reporting and implementation of LUC mechanisms. LUC boundaries were noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities.

Annual LUC inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended.

During the inspections, the following are verified:

- Soil disturbance activities are restricted.
- Soil use is restricted.
- Unauthorized land use is restricted.

11.6.4 Operations and Maintenance

During the Annual LUC inspections from 2017–2020 at FTBL-014-R-01, installation personnel and O&M contractors found no issues (USAG-FB, 2018; HGL, 2019b, 2020).

11.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The protectiveness statement for FTBL-014-R-01 from the prior five-year review is as follows:

"The remedy at FTBL-014-R-01 is protective of human health and the environment. LUCs ensure that there is no unacceptable exposure to site-related contaminants."

There were no recommendations not affecting protectiveness from the prior five-year review for FTBL-014-R-01.

11.8 DATA REVIEW

There are no sampling requirements for this site under CERCLA; thus, there is no data to review. However, this landfill is monitored as SWMU-012 under RCRA.

11.9 SITE INSPECTION

The Site Inspection team observed and took photos of the current conditions at Fort Belvoir. The site inspection checklists are presented in **Appendix B**. The site inspection photograph logs are presented in **Appendix C**. Observations consisted of the following:

- No evidence of disturbed soils was observed.
- No visible signs of erosion were observed.
- Site access point was well maintained with access gate; however, access gate is not part of the remedy.
- No changes in land use were observed. Site allows recreational use. Hunting tree stand observed.
- Site well vegetated. Vegetative cover well maintained.
- Historic monitoring wells observed and in good condition.

11.10 TECHNICAL ASSESSMENT

11.10.1 QUESTION A – Is the Remedy Functioning as Intended by the Decision Documents?

Yes, the remedy is functioning according to the 2016 DD for site FTBL-014-R-01 by preventing child resident exposure to soil exceeding lead concentration of 400 mg/kg. ICs are in place at the site to prohibit residential housing, hospitals, schools, childcare facilities, and/or playgrounds land use and unauthorized soil disturbance. The site inspection team confirmed that land use has not changed and remains restricted to recreational use, and there have been no intrusive ground disturbances. LUC boundaries have been noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground

disturbance or land use activities and annual inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended.

11.10.2 QUESTION B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

The exposure assumptions, toxicity data, and RAOs used at the time of remedy selection are still valid. The Human Health Risk Assessment developed as part of the RI/FS process for FTBL-014-R-01 identified that the presence of lead in soil represented unacceptable health risks to residential children. This determination was based on site soil concentrations exceeding the USEPA screening value of 400 mg/kg (CB&I, 2016). Currently, the USEPA screening level for lead in soil under a residential use scenario remains 400 mg/kg (USEPA, 2022a).

The RAO to prohibit residential land use remains, and LUC inspections identified no evidence of site use for residential, childcare, elementary school, or playground facilities; the site consists of only grass and trees, and the area is free of signs of disturbance (HGL, 2021a). There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness.

11.10.3 QUESTION C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

There is no other information that calls into question the protectiveness of the remedy. There have been no impacts from natural disaster events or weather-related events that have affected the protectiveness of the remedy.

11.10.4 Technical Assessment Summary

LUCs to restrict land use to recreational use and prohibit intrusive ground disturbances are inspected on an annual basis and are functioning as intended. LUC boundaries have been noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities. There were no issues reported during the 2018–2020 annual site inspections.

There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness.

11.11 ISSUES

No issues were identified that prevent the remedial action from being protective of human health and the environment, currently or in the future.

11.12 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No recommendations or follow-up actions are required since there are no issues identified during this five-year review that affect current or future protectiveness of the remedy.

11.13 OTHER FINDINGS

It was observed during the site inspection that some of the signage was installed facing the wrong direction. It is recommended to change the orientation of the signage to face away from the site boundary to be visible to humans accessing the site.

11.14 PROTECTIVENESS STATEMENT

The remedy for FTBL-014-R-01 is protective of human health and the environment.

LUCs are implemented to mitigate human exposure to lead-contaminated soil at the site. Land use is restricted, and the Fort Belvoir dig permit process is established to prevent unauthorized ground disturbance and land use activity.

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12.0 FTBL-025-R-01 DEMOLITION AREA – USACE

12.1 SITE CHRONOLOGY

Site chronology for FTBL-025-R-01 is presented in **Table 32**.

Table 32 – FTBL-025-R-01 Site Chronology

Event	Date (Year)
FTBL-025-R-01 operation as Demolition Training Area	1940–1951
Historical Record Review Completed	March 2006
Site Inspection Completed	January 2008
Remedial Investigation Completed	2012
Proposed Plan Completed	September 2016
Decision Document Signed	July 11, 2020
Site-Specific LUCIP Completed	July 2020
Annual LUC Inspections Conducted	2020 – Present

12.2 PHYSICAL CHARACTERISTICS

FTBL-025-R-01, Demolition Area – USACE, is located within the Humphreys Engineer Center Support Activity (HECSA) area on approximately 489 acres adjacent to the northern section of the Fort Belvoir Main Post (**Figure 26**). The site is bounded by Jeff Todd Way to the west, Kingman Road to the south, Telegraph Road to the north, the former Demolition Training Area DA-01, to the southeast, and the Hayfield neighborhood and Huntley Meadows Park to the northeast. The developed portion of the HECSA is fenced with controlled access checkpoints.

12.3 HISTORY OF CONTAMINATION

FTBL-025-R-01 was operational as a demolition training area from 1940 to 1951. The former demolition area was used to train Army engineers in the use of demolition and practice demolition materials and techniques. Land mine emplacement, detection, and removal training were also conducted on and adjacent to the site. Demolition operations may have occurred on the surface, within steel pits, or below ground. Investigations have shown that munitions training did occur on site. Non-explosive MD has been found in the form of small arms, dozens of inert practice training mines, and expended illumination and smoke signaling devices (USAG-FB, 2020).

The property was formerly part of Fort Belvoir but has been transitioned to USACE ownership.

12.4 INITIAL RESPONSE

There were no pre-DD cleanup activities conducted at the site.

12.5 BASIS FOR TAKING ACTION

During the 2008 SI and 2012 RI, non-explosive MD were found, including small arms, inert practice training mines, and expended illumination and smoke signaling devices. No evidence of HE or fragmenting munitions usage was found at the Demolition Areas during the investigations or in development of the sites; therefore, the probability for encountering MEC is considered low. However, complete pathways exist for receptors with access to the MRS (ERB DPW, 2020).

12.6 REMEDIAL ACTION

12.6.1 Remedial Action Objective

The RAO established in the 2020 DD for FTBL-025-R-01 is to, "*prevent human exposure to MEC found on the surface and in the subsurface.*"

12.6.2 Remedial Action Selection

The components of the selected remedy include:

- LUCs (residential land use restrictions, signage, educational programs, dig permit, and UXO escort for construction activities).

12.6.3 Remedial Action Implementation

LUCs have been implemented at FTBL-025-R-01 to prohibit residential use and any intrusive ground activities without approval by the HECSA. Explosive ordnance disposal personnel or UXO qualified personnel are required to be present during construction activities. Warning signs have been installed in the undeveloped portions of the site that notify site personnel and visitors of the former use of the property and the potential hazards and advise what to do if potential munitions are discovered.

Additionally, the HECSA provides educational programs and information to inform and educate installation personnel and contractors of any MEC hazards present at the site. **Appendix I** presents the 3Rs Explosive Safety Guide, educational posters, and messaging.

A 2020 site-specific LUCIP was developed to establish responsibility, land use restrictions, and reporting and implementation of LUC mechanisms.

Annual LUC inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended. During the inspections, the following are verified:

- Soil disturbance activities are restricted.
- Unauthorized land use is restricted, prohibits residential use.
- Warning signs are present and in good condition.

12.6.4 Operations and Maintenance

During the Annual LUC inspections from 2019–2020 at FTBL-025-R-01, O&M contractors identified the southwestern signage along Jeff Todd Way was missing. A new sign was observed during the 2020 inspection (HGL, 2020, 2021).

12.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review for FTBL-025-R-01.

12.8 DATA REVIEW

There are no sampling requirements for this site; thus, there is no data to review.

12.9 SITE INSPECTION

The Five-Year Review Site Inspection team observed and took photos of the current conditions at FTBL-025-R-01. The site inspection checklists are presented in **Appendix B**. The site inspection photograph log is presented in **Appendix C**.

Observations consisted of the following:

- No evidence of disturbed soils was observed.
- Site access point was well maintained.
- Signs were visible, well labeled, and maintained.
- Site heavily vegetated.
- No changes in land use were observed.

12.10 TECHNICAL ASSESSMENT

12.10.1 QUESTION A – Is the Remedy Functioning as Intended by the Decision Documents?

Yes, the remedy is functioning according to the 2020 DD by preventing human exposure to MEC. Warning signage posted around the boundary of the site is well maintained, and educational materials and information are provided to installation personnel and contractors to warn of possible MEC present at the site. The site inspection team confirmed that land use has not changed and remains restricted to C/I use only, and there have been no intrusive ground disturbances. LUCs have been incorporated into the LUCIP and dig permit process, and annual inspections are conducted to ensure LUC mechanisms and land use restrictions in place are working as intended.

12.10.2 QUESTION B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

Yes, the exposure assumptions and RAOs used at the time of remedy selection are still valid. The RAO to protect the public health or welfare from the potential for military munitions to remain

on the surface and in the subsurface at FTBL-025-R-01 has been met with the implementation of LUCs. There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness.

12.10.3 QUESTION C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

There is no other information that calls into question the protectiveness of the remedy. There have been no impacts from natural disaster events or weather-related events that have affected the protectiveness of the remedy.

12.10.4 Technical Assessment Summary

LUCs to restrict land use to C/I and prohibit intrusive ground disturbances are inspected on an annual basis and are functioning as intended. A dig permit process has been established, along with educational programs and information provided to warn of the potential hazards of MEC present at the site. There were no issues reported during the 2019–2020 annual site inspections.

There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness.

12.11 ISSUES

No issues were identified that prevent the remedial action from being protective of human health and the environment, currently or in the future.

12.12 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No recommendations or follow-up actions are required since there are no issues identified during this five-year review that affect current or future protectiveness of the remedy.

12.13 OTHER FINDINGS

LUC boundaries for FTBL-025-R-01 were not verified in the Real Property Master Plan. The HECSA has its own Master Plan separate from Fort Belvoir's Master Plan and it has been requested for review.

12.14 PROTECTIVENESS STATEMENT

The remedy for FTBL-025-R-01 is protective of human health and the environment.

LUCs are in place to restrict residential land use. Signage has been installed and maintained. An educational program and information warn installation personnel and contractors of the potential presence of MEC at the site, and the HECSA dig permit process is established to prevent unauthorized ground disturbance and land use activity.

13.0 FTBL-026-R-01 MINES AND BOOBY TRAP AREA

13.1 SITE CHRONOLOGY

Site chronology for FTBL-026-R-01 is presented in **Table 33**.

Table 33 – FTBL-026-R-01 Site Chronology

Event	Date (Year)
Site Operational for Landmine and Booby Trap Training	1943–1947
Site Inspection Completed	2008
USACE UXO Survey	2010
USACE OE Clearance at Construction Site	March 2016
Installation-wide LUCIP Completed	August 2016
Construction of Skills Training Facility	February 2017
Remedial Investigation Completed	2017
Decision Document Signed	October 31, 2019
Remedial Action Work Plan Completed	August 2020
Remedial Action Completed	November 2020

13.2 PHYSICAL CHARACTERISTICS

FTBL-026-R-01, the Mines and Booby Trap Area (MBTA), consists of 145.5 wooded acres on the northwestern portion of Fort Belvoir adjacent to the Davison Army Airfield (DAAF). The MRS is located northeast of the DAAF and southwest of the Fairfax County Parkway (**Figure 27**). Farrar Road traverses the MRS north-to-south, and a security checkpoint is located along Farrar Road prior to entry to the airfield. A Skills Training Facility is at the intersection of Farrar Road and Santjer Road. The Mosby Center is located on the property adjacent to the FCP. The MRS is traversed from northeast to southwest by Accotink Creek.

13.3 HISTORY OF CONTAMINATION

FTBL-026-R-01 was operational from 1943 through 1947. The area was used in training of Army engineers in deployment, removal, arming, and disarming of a variety of landmines, demolition firing devices, and booby traps. Recovered munitions have been inert and weathered training rounds that have not been classified as MEC due to having no explosives or chemical constituents presenting an explosive hazard at the site (HGL, 2019b).

13.4 INITIAL RESPONSE

A non-explosive training landmine was found on FTBL-026-R-01 by a hunter in 2010, and Fort Belvoir requested USACE UXO safety specialists to perform a transect survey (HGL, 2019b). During the investigation, USACE found approximately 11 training landmines in the area, which prompted the Army to re-evaluate potential munitions contamination and led to an RI in 2017.

Construction of the Skills Training Facility on the southeast portion of FTBL-026-R-01 began in February 2017. In March 2016, USACE performed a clearance within the construction footprint and recovered 66 training mines (HGL, 2019b) over a period of two days.

13.5 BASIS FOR TAKING ACTION

DoD military munitions found at the site consisted of practice mines and grenades. Although the density of MEC potentially present is considered low, there is potential for additional military munitions to remain at the MRS in unsearched areas. Complete pathways exist for all receptors with access to the MRS (HGL, 2019b).

13.6 REMEDIAL ACTION

13.6.1 Remedial Action Objective

The RAO established in the 2020 DD for FTBL-026-R-01 MRS is to, *"minimize direct human contact with any DoD military munitions potentially present on the surface and in the subsurface of the MBTA MRS."*

13.6.2 Remedial Action Selection

The components of the selected remedy include:

- Focused MEC removal.
- LUCs (residential land use restrictions, signage, educational programs, dig permit, and UXO escort for construction activities).

13.6.3 Remedial Action Implementation

13.6.3.1 Focused MEC Removal

From September 8 to November 2, 2020, a sweep team consisting of two UXO technicians used Schonstedt Model GA-52CX magnetometers to systematically perform mag and dig methods on approximately 33 acres at FTBL-026-R-01 and excavated all encountered anomalies (HGL, 2021b).

A total of 2,284 MD items weighing 4,462 pounds were removed from the MRS, including inert practice landmines, practice hand grenades, practice rockets, and firing devices. In addition, approximately 2,120 MD items were recovered from burial pits on the site. All 2,284 MD items recovered were demilitarized in the field by cutting/cracking the MD items open or otherwise eliminating the functional capability of the item, then certified as MDAS by the Senior UXO Supervisor and Unexploded Ordnance Safety Officer. A total of 4,472 pounds of MDAS was transported to an approved facility, Demil Metals, Inc., in sealed containers (HGL.2021b).

13.6.3.2 LUCs

LUCs have been implemented to address hazards remaining after the implementation of surface and subsurface remediation action. LUCs that were established at FTBL-026-R-01 include warning

signage and construction support for personnel performing ground disturbing construction activities on the property.

Educational information is provided to reduce the risk to the public from unexpected exposure to hazards. In addition, a Recognition Safety Training is required by USAG-FB to instruct staff and contractors to avoid military munitions. **Appendix I** presents the 3Rs Explosive Safety Guide, educational posters, and messaging.

A 2016 installation-wide LUCIP was developed to establish responsibility, land use restrictions, and reporting and implementation of LUC mechanisms at FTBL-026-R-01 MRS before a DD was established (Aerostar, 2016).

13.6.4 Operations and Maintenance

There were no Annual Inspection Reports leading to this five-year review.

13.7 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review for FTBL-026-R-01.

13.8 DATA REVIEW

There are no sampling requirements for FTBL-026-R-01.

13.9 SITE INSPECTION

The Site Inspection team observed and took photos of the current conditions at Fort Belvoir. The site inspection checklists are presented in **Appendix B**. The site inspection photograph logs are presented in **Appendix C**. Observations consisted of the following:

- No evidence of disturbed soils was observed.
- Site access is uncontrolled and the access trail was clear.
- No changes in land use were observed, land use designation is wildlife/wetland refuge.
- Concrete and wood debris were observed.
- Pin flags were observed, likely from MEC clearance event.
- Site heavily vegetated.

13.10 TECHNICAL ASSESSMENT

13.10.1 QUESTION A – Is the Remedy Functioning as Intended by the Decision Documents?

Yes, the remedy is functioning according to the 2020 DD for FTBL-026-R-01 by preventing human exposure to MEC. Surface and subsurface MEC was removed from the MSR, demilitarized, certified inert, and recycled. Warning signage was posted around the boundary of the MRSs, and educational materials and information are provided to installation personnel and contractors to warn of possible MEC present at the site. The site inspection team confirmed that land use has

not changed and continues to prohibit residential use of the MSR, and there have been no intrusive ground disturbances.

13.10.2 QUESTION B – Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

The exposure assumptions and RAOs used at the time of remedy selection are still valid. To mitigate exposure to the potential presence of MEC, focused surface and subsurface removal of DoD munitions has occurred. LUCs have been implemented that restrict property activities and uses. These actions were taken to be protective of human health, as possible human receptors include authorized personnel, visitors/contractors, hunters, and trespassers. There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness.

13.10.3 QUESTION C – Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

There is no other information that calls into question the protectiveness of the remedy. There have been no impacts from natural disaster events or weather-related events that have affected the protectiveness of the remedy.

13.10.4 Technical Assessment Summary

MEC removal was completed at FTBL-026-R-01. LUCs to restrict land use to residential and prohibit intrusive ground disturbances are implemented in the LUCIP. The Fort Belvoir dig permit process is established, along with educational programs and information provided to warn of the potential hazards of MEC present at the site. There are no changes to exposure pathways or land use and no new human or ecological routes of exposure identified. There are no site conditions that would impact the RAOs and remedy protectiveness.

13.11 ISSUES

No issues were identified that prevent the remedial action from being protective of human health and the environment, currently or in the future.

13.12 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No recommendations or follow-up actions are required since there are no issues identified during this five-year review that affect current or future protectiveness of the remedy.

13.13 OTHER FINDINGS

LUC boundaries for FTBL-026-R-01 could not be verified in the Real Property Master Plan. It is recommended that the boundaries are included in the Plan and documented in the GIS.

13.14 PROTECTIVENESS STATEMENT

The remedy for FTBL-026-R-01 is protective of human health and the environment.

MEC removal was achieved at FTBL-026-R-01. LUCs are in place to restrict land use. Signage has been installed. An educational program and information warn installation personnel and contractors of the potential presence of MEC at the site, and the Fort Belvoir dig permit process is established to provide construction support and prevent unauthorized ground disturbance and land use activity.

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14.0 NEXT REVIEW

The next Five-Year Review will be due November 14, 2027.

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15.0 REFERENCES

AECOM, 2021a. *Final FTBL-68: Solid Waste Management Unit M-26 and Former Aboveground Test Tank Site, Construction Completion Report.* January.

AECOM, 2021b. *Final FTBL-68: 2021 Annual Groundwater Monitoring Report. Installation Restoration Program. Fort Belvoir, Virginia.* May

Aerostar, 2016. *Final Land Use Control Implementation Plan Fort Belvoir, Virginia.* August.

Aptim Federal Services, LLC. (APTIM), 2017a. *Decision Document for Four Munitions Response Sites, T-16 Range (FTBL-027-R-01), Demolition Area – 01 (FTBL-018-R-01), Grenade Court (FRTBL-007-R-01), Booby Trap Site (FTBL-024-R-01), Fort Belvoir, Virginia.* December.

APTIM, 2017b. *Final Decision Document for Combat Range Complex Munitions Response Site, Fort Belvoir Virginia.* October.

APTIM, 2017c. *Final Remedial Action Work Plan, Combat Range Complex, Fort Belvoir, Virginia.* October.

APTIM, 2017d. *Final Remedial Investigation/ Feasibility Study Report for Mine and Booby Trap Area Fort Belvoir, Virginia.* October.

APTIM, 2018a. *Final Decision Document for Five Munitions Response Sites: T-16 Training Area (FTBL-027-R-01), Demolition Area – 01 (FTBL-018-R-01), Demolition Area – USACE TD (FTBL-025-R-01), Grenade Court (FTBL-007-R-01), Booby Trap Site (FTBL-024-R-01), Fort Belvoir, Virginia.* February.

APTIM, 2018b. *Final Land Use Control Implementation Plan for Combat Range Complex (FTBL-003-R-01/51105/1049) Munitions Response Site, Fort Belvoir, Virginia.* February.

APTIM, 2018c. *Land Use Control Implementation Plan for Four Munitions Response Sites, T-16 Range (FTBL-027-R-01/51105.1067), Demolition Area – 01 (FTBL-018-R-01/51105.1090), Grenade Court (FRTBL-007-R-01/51105.1053), Booby Trap Site (FTBL-024-R-01/51105.1081), Fort Belvoir, Virginia.* February.

APTIM, 2018d. *Remedial Action Completion Report Combat Range Complex (FTBL-003-R-01/51105.1049), Fort Belvoir, Virginia.* February.

Arcadis, 2018e. *Final M-33 Decision Document Fort Belvoir North Area at Fort Belvoir, Virginia.* September.

Arcadis, 2019a. *Addendum to Final Infiltration Course Munitions Response Site (FTBL-001-R-02) Focused Feasibility Study, January 2013 HQAES ID: 51105.1089, Fort Belvoir, Fairfax County, Virginia.* January.

Arcadis, 2019b. *Final Proposed Plan for the Infiltration Course Munitions Response Site FTBL-001-R-002, HQAES ID: 51105.1089.* November.

Arcadis, 2020a. *Final Decision Document for Groundwater at FTBL-005-R-09 FBNA Soils and Groundwater at the FBNA Child Development Center U.S. Army Garrison Fort Belvoir, Virginia, HQAES ID: 51105.1141.* September.

Arcadis, 2020b. *Final Decision Document for the Infiltration Course Munitions Response Site FTBL-001-R-002, HQAES ID: 51105.1089.* September.

Arcadis, 2020c. *Final Long-Term Monitoring Plan M-33 Groundwater (FTBL-005-R-05; HQAES No. 51105.1077), Fort Belvoir Virginia.* March.

Arcadis 2020d. *Final M-33 Groundwater Land Use Control Implementation Plan HQAES No. 51105.1077, Fort Belvoir, Virginia.* March.

Arcadis, 2021a. *Draft Final Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances. Fort Belvoir, Virginia.* November.

Arcadis, 2021b. *Final Child Development Center (CDC) (FTBL-005-R-09) Groundwater Land Use Control Implementation Plan HQAES No. 51105.1141, Fort Belvoir, Virginia*. January.

Arcadis, 2021c. *Final Infiltration Course (INFC) (FTBL-001-R-002) Land Use Control Implementation Plan, HQAES NO. 551105.1089. Fort Belvoir, Virginia.* April.

Arcadis, 2021d. *Final Infiltration Course Munition Response Site (FTBL-001-R-02) Remedial Action Completion Report, Fort Belvoir, Fairfax County, Virginia.* August.

Arcadis, 2021e. *Final Infiltration Course Munitions Response Site Remedial Design / Remedial Action Work Plan and Quality Assurance Project Plan, FTBL-001-R-002, HQAES ID: 51105.1089.* April.

Arcadis, 2021f. *Final Long-Term Monitoring Plan Child Development Center (CDC) Groundwater (FTBL-005-R-09; HQAES No. 51105.1141), Fort Belvoir Virginia.* January.

Arcadis, 2021g. *M-33 Site Land Use Control Inspection Report U.S. Army Garrison-Fort Belvoir, Virginia (Contract No. W912DR-15-D-0018 / Delivery Order No. 0002).* June.

Arcadis, 2021h. *Semi-Annual Groundwater Monitoring Fort Belvoir North Area (FBNA) Child Development Center (CDC) Groundwater (SWMU FTBL-005-R-09) HQAES No. 51105.1141, Fort Belvoir, Virginia.* July.

Arcadis, 2021i. *Semi-Annual Groundwater Monitoring Report – SWMUs M-32 (FTBL-005-R-08) and M-33 (FTBL-005-R-05) HQAES Nos. 51105.1080 (M-32) and 51105.1077 (M-33), Fort Belvoir, Virginia.* July.

Arcadis, 2021j. *2021 Infiltration Course Site Land Use Control Inspection Report U.S. Army Garrison-Fort Belvoir, Virginia.* June.

Atkins, 2015. *Fort Belvoir, Virginia, Real Property Master Plan, Installation Vision and Development Plan.* May.

CB&I Federal Services, LLC (CB&I), 2014. *Final 2014 Groundwater Sampling Report FTBL-068. Fort Belvoir, Virginia.* September.

CB&I, 2016a. *Decision Document for Tracey Road Range Munitions Response Site (FTBL-014-R-01), Fort Belvoir, Virginia, Final Document.* November.

CB&I, 2016b. *Feasibility Study Report for Five Munitions Response Sites: T-16 Training Area (FTBL-027-R-01), Demolition Area – 01 (FTBL-018-R-01), Demolition Area – USACE TD (FTBL-025-R-01), Grenade Court (FRTBL-007-R-01), Booby Trap Site (FTBL-024-R-01), Fort Belvoir, Virginia, Military Munitions Response Program*. January.

CB&I, 2016c. *Final Feasibility Study Report for Combat Range Complex, Fort Belvoir Virginia Military Munition Response Program.* November.

CB&I, 2016d. *Final Remedial Investigation Work Plan for Mine and Booby Trap Area at Fort Belvoir, Virginia.*

CB&I, 2016e. *Land Use Control Implementation Plan for Tracy Road Range Munitions Response Site (FTBL-014-R-01), Fort Belvoir, Virginia, Final Document.* November.

CB&I, 2016f. *Proposed Plan for Military Munitions Response Program, Five Munitions Response Sites, Fort Belvoir.* September.

CB&I, 2017. *Final Removal Action Completion Report Demolition Area – 01 (FTBL-018-R-01) Fort Belvoir, Virginia.* March.

Department of Defense (DoD), 2012. *Department of Defense Manual Number 4715.20, Defense Environmental Restoration Program (DERP) Management*. March 9.

DoD, 2014. *Memorandum regarding Five-Year Review Procedures – Update to DoD Manual (DoDM) 4715.20, "Defense Environmental Restoration Program (DERP) Management".* March 9.

Department of the Army, U.S Army Garrison, Fort Belvoir (USAG-FB), Directorate of Public Works (FTBL DPW), 2017. *Land Use Control (LUC) Annual Inspection Checklist, Tracy Road Range Munitions Response Site (FTBL-014-R-01 Virginia.* December.

Department of the Army, U.S Army Garrison, Fort Belvoir (USAG-FB), Directorate of Public Works (FTBL DPW), 2018. *Land Use Control (LUC) Annual Inspection Checklist, Tracy Road Range Munitions Response Site (FTBL-014-R-01 Virginia.* November.

Department of the Army, U.S Army Garrison, Fort Belvoir (USAG-FB), Directorate of Public Works (FTBL DPW), 2019. *Land Use Control (LUC) Annual Inspection Checklist, Tracy Road Range Munitions Response Site (FTBL-014-R-01 Virginia.* December.

Department of the Army, U.S Army Garrison, Fort Belvoir (USAG-FB), Directorate of Public Works (FTBL DPW), 2020. *Decision Document for Demolition Area – USACE TD (FTBL-025-R-01/51105.1006) Munitions Response Site, Humphreys Engineer Center, Virginia.* January.

EEE Consulting, Inc. (EEE), 2010a. *Contaminated Soil Removal and Construction Water Management at M-26, Fairfax County Parkway, Fairfax County, Virginia.* August.

EEE Consulting, Inc. (EEE), 2010b. *Contaminated Soil Removal and Construction Water Management at FATTS, Fairfax County Parkway, Fairfax County, Virginia.* August.

Environmental Restoration Branch Department of Public Works (ERB DPW), 2020. *Land Use Control Implementation Plan for Demolition Area – USACE TD (FTBL-025-R-01/51105.1066) Humphreys Engineer Center, Alexandria, Virginia. Revised Final Document.* July.

HydroGeoLogic, Inc. (HGL), 2009a. *Final Phase II Environmental Investigation Plan Solid Waste Management Unit M-33, Engineering Proving Ground, Fort Belvoir, Virginia.* February.

HGL, 2009b. *Final Sampling and Analysis Plan Environmental Remediation Services for Seven Sites Engineer Proving Ground at Fort Belvoir, Virginia.* June.

HGL, 2015. *Final Decision Document for Chemical Contamination, Seven Sites in the Fort Belvoir North Area, U.S. Army Garrison, Fort Belvoir, Virginia.* February.

HGL, 2019a. *Fort Belvoir, Proposed Plan for Mine and Booby Trap Area, Military Munitions Response Program. Final.* March.

HGL, 2019b. *Final 2019 MMRP Land Use Control Inspection Report, Fort Belvoir, Virginia.* October.

HGL, 2019c. *Mine and Booby Trap Area Decision Document. Fort Belvoir Fairfax County, Virginia. Final.* October.

HGL, 2020a. *Data Submittal for the Mine and Booby Trap Area Remedial Action, Fort Belvoir, VA. Contract W912DR-15-D-0016, Delivery Order W912DR-18-F-0476. Letter.* November.

HGL, 2020b. *Remedial Action Work Plan, Mine and Booby Trap Area (FTBL-026-R-01/51105.1082), Fort Belvoir, Virginia. Final.* August.

HGL, 2021a. *2020 MMRP Land Use Control Inspection Report, U.S. Army Garrison-Fort Belvoir, Virginia*. June.

HGL, 2021b. *Final Remedial Action Completion Report Mine and Booby Trap Area (FTBL-026-R-01/51105/1082), Fort Belvoir, Virginia*. October.

Mactec Engineering and Consulting, Inc. (Mactec), 2007. First Quarter 2007 Groundwater Monitoring Report *Solid Waste Management Unit M-27 Engineer Proving Ground, U.S Army Garrison Fort Belvoir, Fairfax County, Virginia.* July.

Malcolm Pirnie, Inc. 2008. *Site Inspection Report, Fort Belvoir Fairfax County, Virginia. Final.* January.

Office of the Secretary of Defense (OSD), 2022. Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. July 6.

Plexus Scientific Corporation (Plexus), 2020. Data Gap Investigation Report *FTBL-69: Waste Ordnance Pit at Range 1 (Solid Waste Management Unit [SWMU] M27), Groundwater U.S. Army Garrison Fort Belvoir, Virginia.* August.

Plexus, 2021a. *Explanation of Significant Differences FTBL-69: Waste Ordnance Pit at Range 1 (Solid Waste Management Unit [SWMU] M27), U.S. Army Garrison Fort Belvoir, Virginia.* June.

Plexus, 2021b. *Final Long Term Monitoring Plan FTBL-69: Waste Ordnance Pit at Range 1 (Solid Waste Management Unit [SWMU] M27). U.S. Army Garrison Fort Belvoir, Virginia.* August.

Shaw Environmental, Inc. (Shaw), 2010. *Final Remedial Investigation Work Plan for Seven Military Munitions Response Program Sites: Demolition Area – 01, Demolition Area – USACE TD, T-16 Range, Combat Range Complex, Grenade Court, Infiltration Course, Booby Trap Site, at Fort Belvoir.* September.

Shaw, 2013. *Remedial Investigation/Feasibility Study Report for the Infiltration Course and Tracy Road Range.* January.

Tetra Tech, 2007. *Decision Document Solid Waste Management Unit M-26 (SWMU M-26) Hydrocarbon Spill Area and Former Aboveground Test Tank Site (FATTS) at Engineering Proving Ground.* October.

Tidewater, 2012. *Contaminated Soil Excavation Plan, Child Care Development Center at Fort Belvoir North Area, Fort Belvoir, Virginia.* March.

Tidewater, 2013. *Final Remedial Investigation/Interim Removal Action Report and Focused Feasibility Study at Proposed Child Care Development Center (Site ID: FTBL-005-R-09) at Fort Belvoir North Area, U.S. Army Garrison, Fort Belvoir, Virginia.* August.

USACE, 2006a. *Decision Document Solid Waste Management Unit M-27 Waste Ordnance Pits at Range 1. U.S Army Garrison Fort Belvoir Engineer Proving Ground, Fort Belvoir, Virginia.* April.

USACE, 2006b. *Long Term Monitoring Plan Solid Waste Management Unit M-27 Waste Ordnance Pits at Range 1. U.S Army Garrison Fort Belvoir Engineer Proving Ground, Fort Belvoir, Virginia.* April.

USACE, 2007. *Long Term Monitoring Plan, Solid Waste Management Unit M-26 (SWMU M-26) Hydrocarbon Spill Area and Former Aboveground Test Tank Site (FATTS).* October.

USACE, 2012. *Five-Year Review Report, Fort Belvoir, Fairfax County, Virginia.* October.

USACE, 2013. *Long Term Monitoring Plan Addendum, Former Solid Waste Management Unit M-26 (SWMU M-26) Hydrocarbon Spill Area and Former Aboveground Test Tank Site (FATTS), Fort Belvoir Restoration Site FTBL-68.* May.

USACE, 2019. *Final 2017 Five-Year Review Report Fort Belvoir, Fairfax County, Virginia.* March

USEPA, 2009. *U.S. EPA Acceptance Letter of M-32, M-34, AOPC-17/18 and AOPC -19 No Further Action Recommendations.* September.

USEPA, 2017. Unilateral Administrative Order, U.S. EPA Docket No: RCRA-03-2005-0116AM, Letter. July.

USGS, 1988. *Hydrogeologic Framework of the Virginia Coastal Plain, Regional Aquifer-System Analysis, U.S. Geological Survey Professional Paper 1404-C.*

FIGURES

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FIGURE 1
INSTALLATION LOCATION MAP
FORT BELVOIR, VIRGINIA

Legend:

Installation Boundary

INSTALLATION LOCATION MAP (NOT TO SCALE)

N

0 4,500 Feet

1 inch = 4,500 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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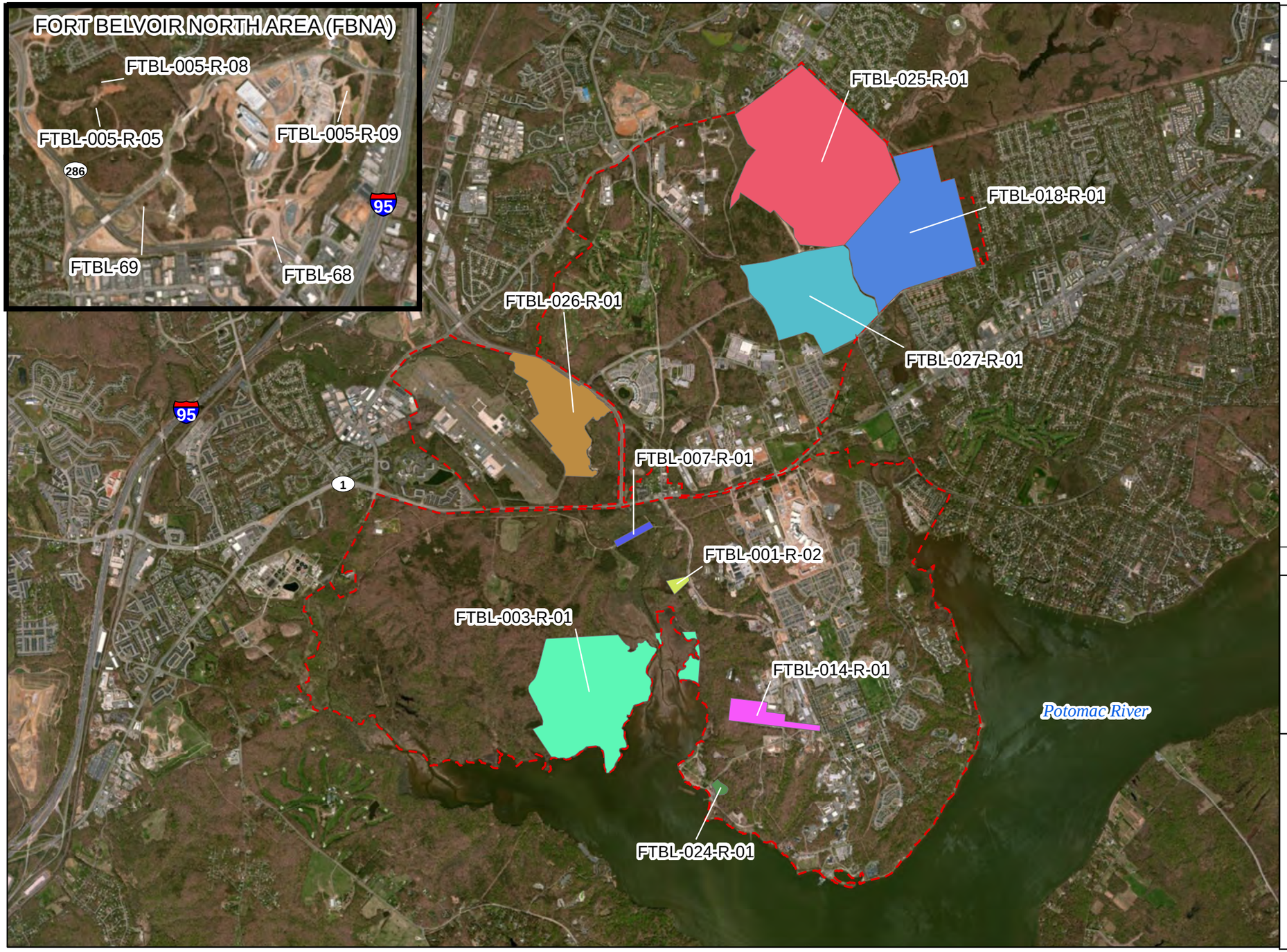
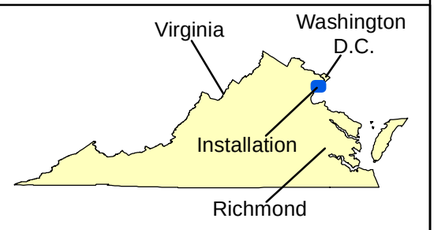


FIGURE 2
SITE LOCATION MAP
FORT BELVOIR, VIRGINIA

Legend:

- Installation Boundary
- FTBL-001-R-02
- FTBL-003-R-01
- FTBL-005-R-05
- FTBL-005-R-08
- FTBL-005-R-09
- FTBL-007-R-01
- FTBL-014-R-01
- FTBL-018-R-01
- FTBL-024-R-01
- FTBL-025-R-01
- FTBL-026-R-01
- FTBL-027-R-01
- FTBL-68
- FTBL-69

INSTALLATION LOCATION MAP (NOT TO SCALE)



N

0 4,500 Feet

1 inch = 4,500 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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FIGURE 3
FTBL-68 – M-26 Hydrocarbon Spill Area
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)

N

0 250 Feet

1 inch = 250 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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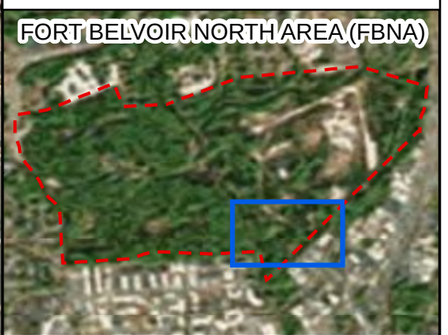
FIGURE 4
FTBL-68 GROUNDWATER MONITORING WELL NETWORK
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Monitoring Well
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)



N

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1 inch = 250 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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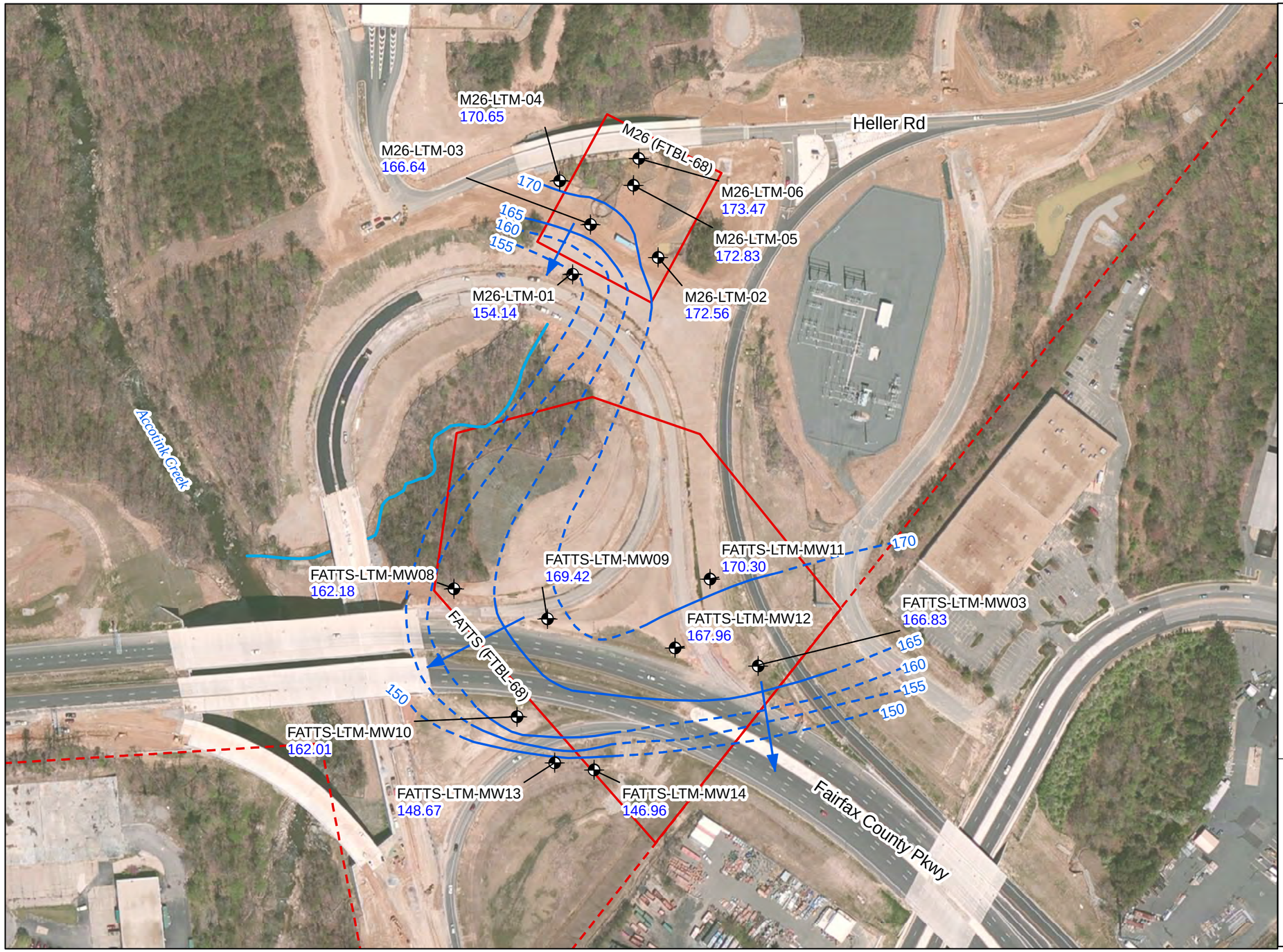
FIGURE 5
FTBL-68 GROUNDWATER ELEVATION CONTOURS (MARCH 2021)
FORT BELVOIR, VIRGINIA



Legend:

- Site Boundary (Approximate)
- Installation Boundary
- Monitoring Well
- Groundwater Elevation Contour (Dashed Where Inferred)
- Groundwater Flow Direction
- Unamed Stream (Approximate)
- 230.97 Groundwater Elevation (ft amsl)

Notes:
ft amsl = feet above mean sea level
Groundwater elevation contours based on March 2021 groundwater elevation data.

N

0 250 Feet

1 inch = 250 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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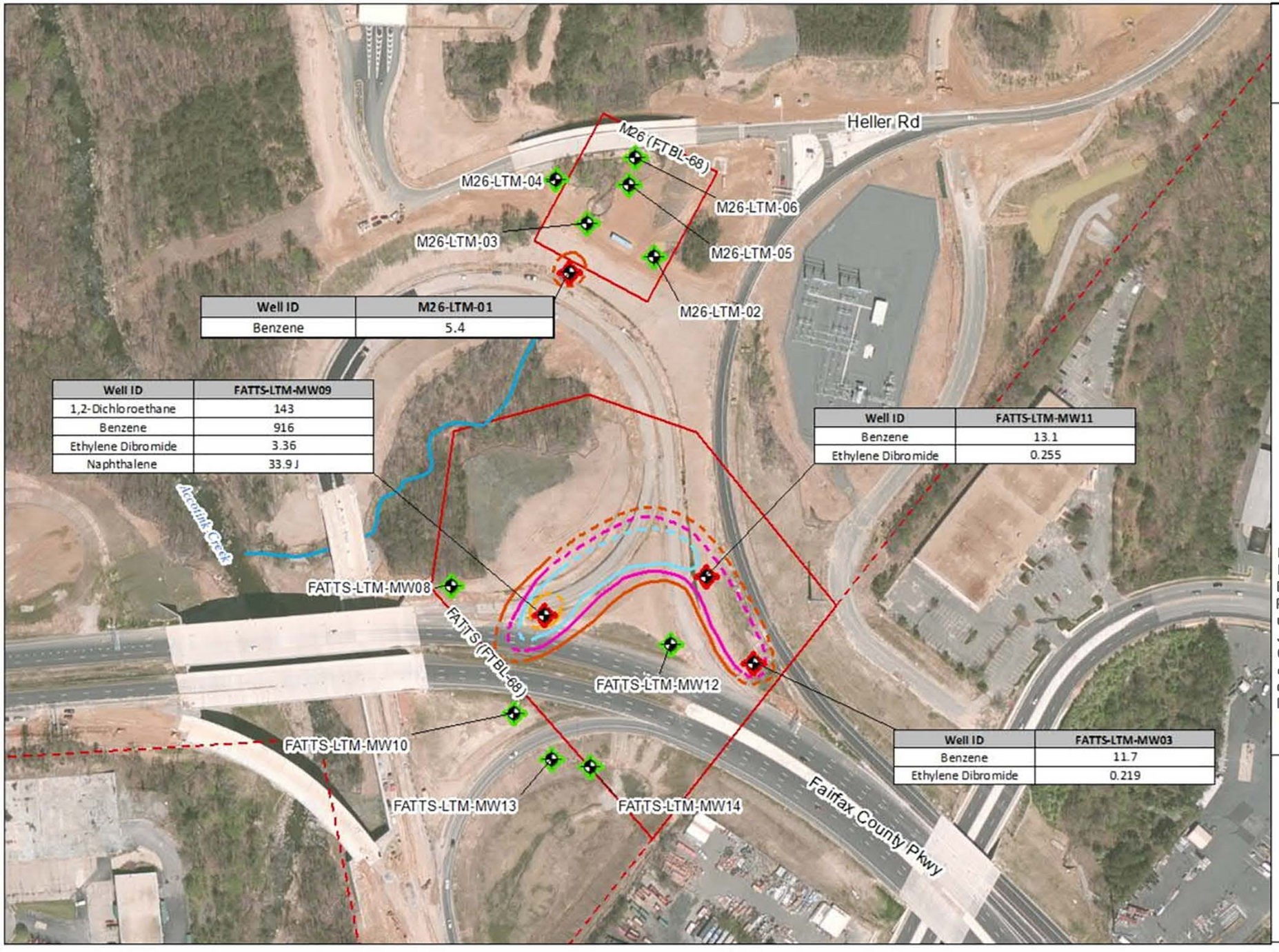
FIGURE 6
FTBL-68 EXTENT OF GROUNDWATER CONTAMINATION (MARCH 2021)
FORT BELVOIR, VIRGINIA



Well ID	M26-LTM-01
Benzene	5.4

Well ID	FATTS-LTM-MW09
1,2-Dichloroethane	143
Benzene	916
Ethylene Dibromide	3.36
Naphthalene	33.9 J

Well ID	FATTS-LTM-MW11
Benzene	13.1
Ethylene Dibromide	0.255

Well ID	FATTS-LTM-MW03
Benzene	11.7
Ethylene Dibromide	0.219

Legend:
- Site Boundary (Approximate)
- Installation Boundary
- Monitoring Well Without Exceedance
- Monitoring Well With Exceedance
- Unamed Stream (Approximate)
- 1.2-DCA Contour (5 ug/L) (dashed where inferred)
- Benzene Contour (5 ug/L) (dashed where inferred)
- EDB Contour (0.05 ug/L) (dashed where inferred)
- Naphthalene Contour (6.5 ug/L) (dashed where inferred)

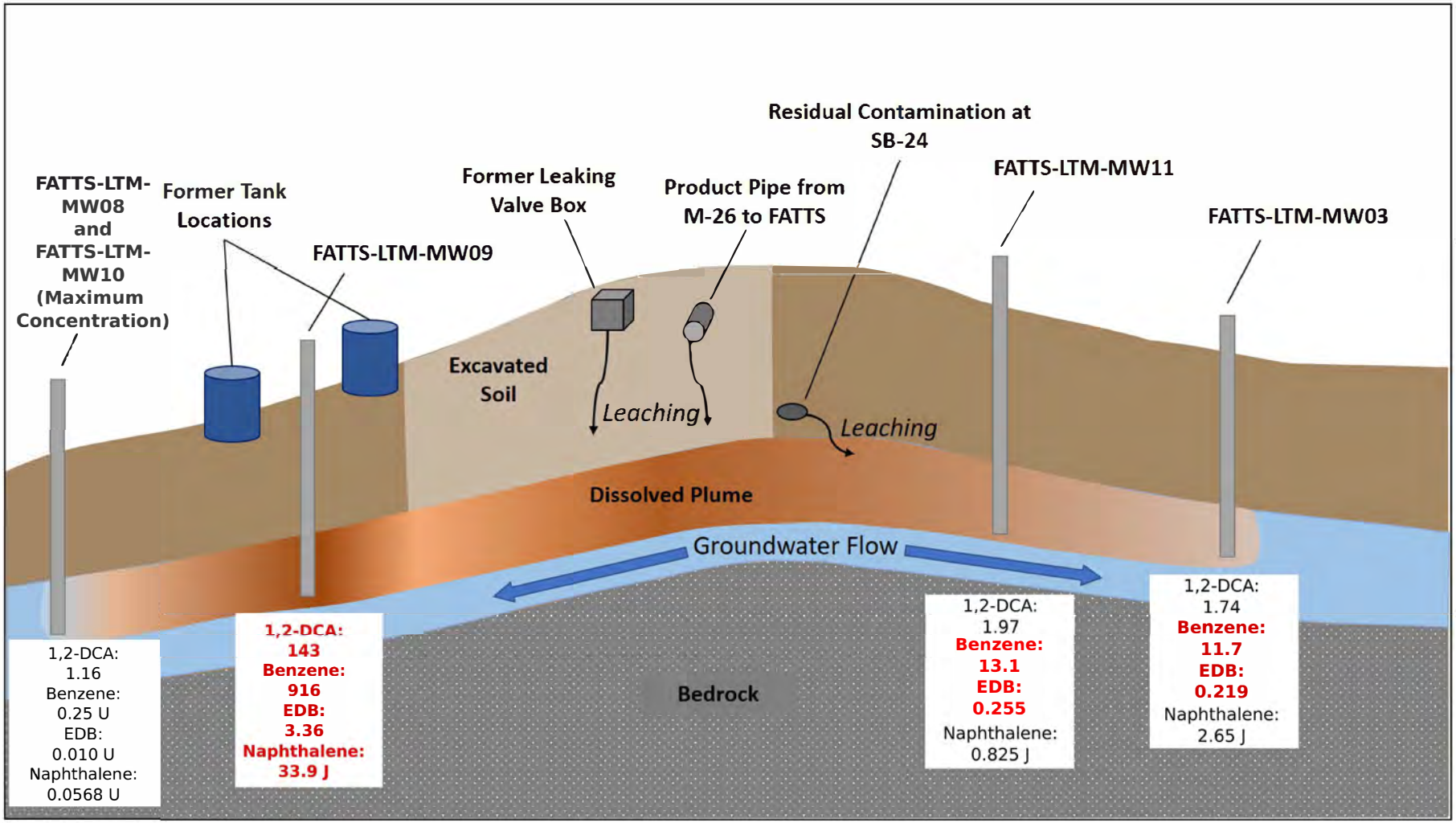
Notes:
DCA = Dichloroethane
EDB = Ethylene dibromide
RG = Remedial Goal (Tetra Tech, 2007)
ug/L = micrograms per liter
J = Estimated result
Groundwater data represents concentrations exceeding the RGs in March 2021. All concentrations reported in micrograms per liter.

0 250 Feet
1 inch = 250 feet
N

HGS

HGS
HO'OLAULIMA GOVERNMENT SOLUTIONS, LLC

Figure 7
FTBL-68 FATTS Conceptual Site Model
Fort Belvoir



Notes:

DCA = Dichloroethane
EDB = Ethylene dibromide
RG = Remedial Goal (Tetra Tech, 2007)
ug/L = micrograms per liter
J = Estimated result
U = Not Detected

Groundwater data represents concentrations reported March 2021. All concentrations reported in micrograms per liter. Concentrations greater than the RG are reported in bold red font.

Source Credit:
Conceptual site model base illustration sourced from Final FTBL-68: Solid Waste Management Unit M-26 and Former Aboveground Test Tank Site Construction Completion Report (AECOM, 2021).

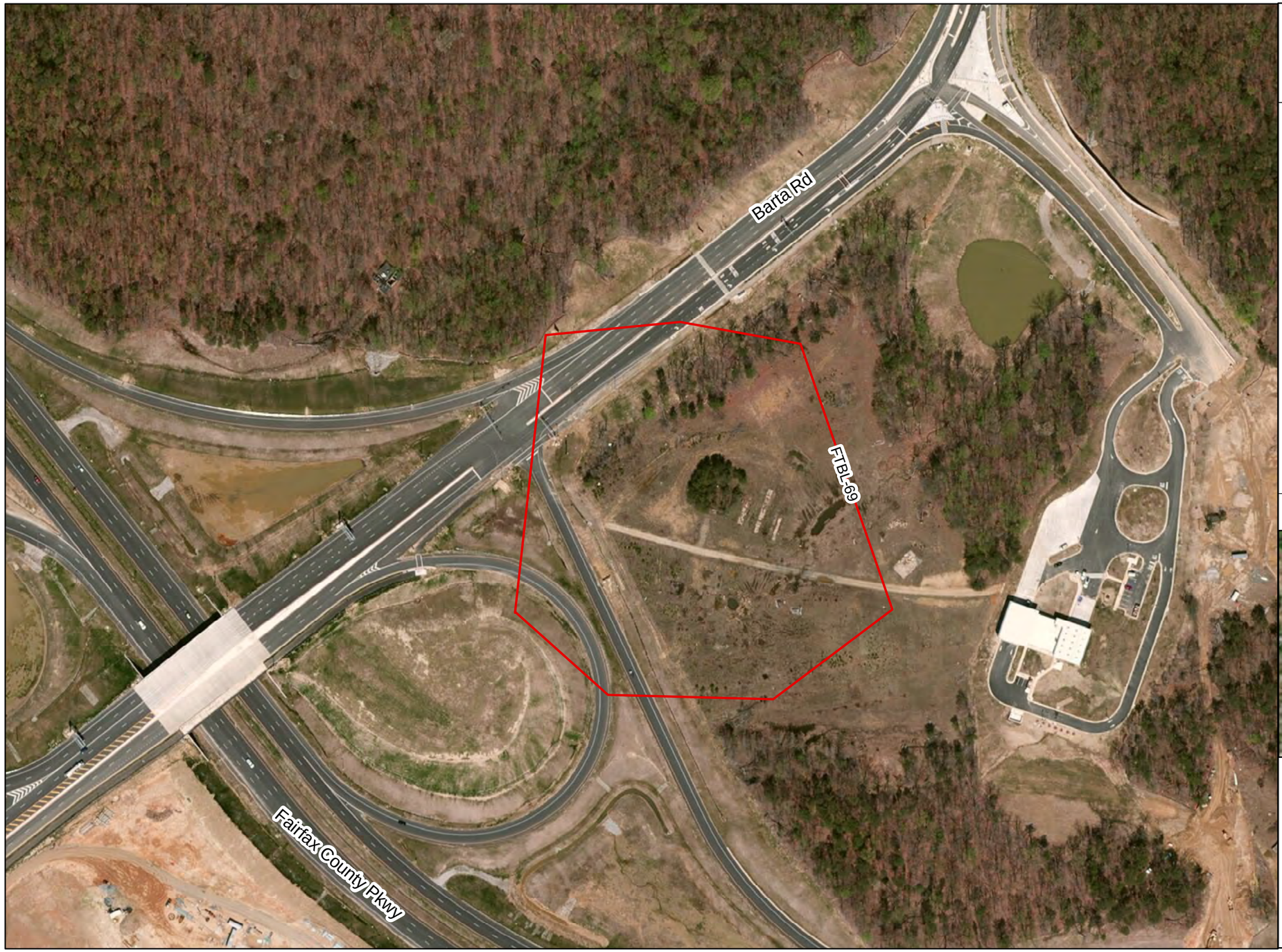


FIGURE 8
FTBL-69 – M-27 Waste Ordnance Pit at Range 1
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)

0 250 Feet

1 inch = 250 feet

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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FIGURE 9
FTBL-69 GROUNDWATER MONITORING WELL NETWORK AND SURFACE WATER SAMPLING LOCATIONS
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Monitoring Well
- Surface Water Sample Location
- Unamed Stream (Approximate)
- Retention Basin (Approximate)

0 240 Feet

1 inch = 240 feet

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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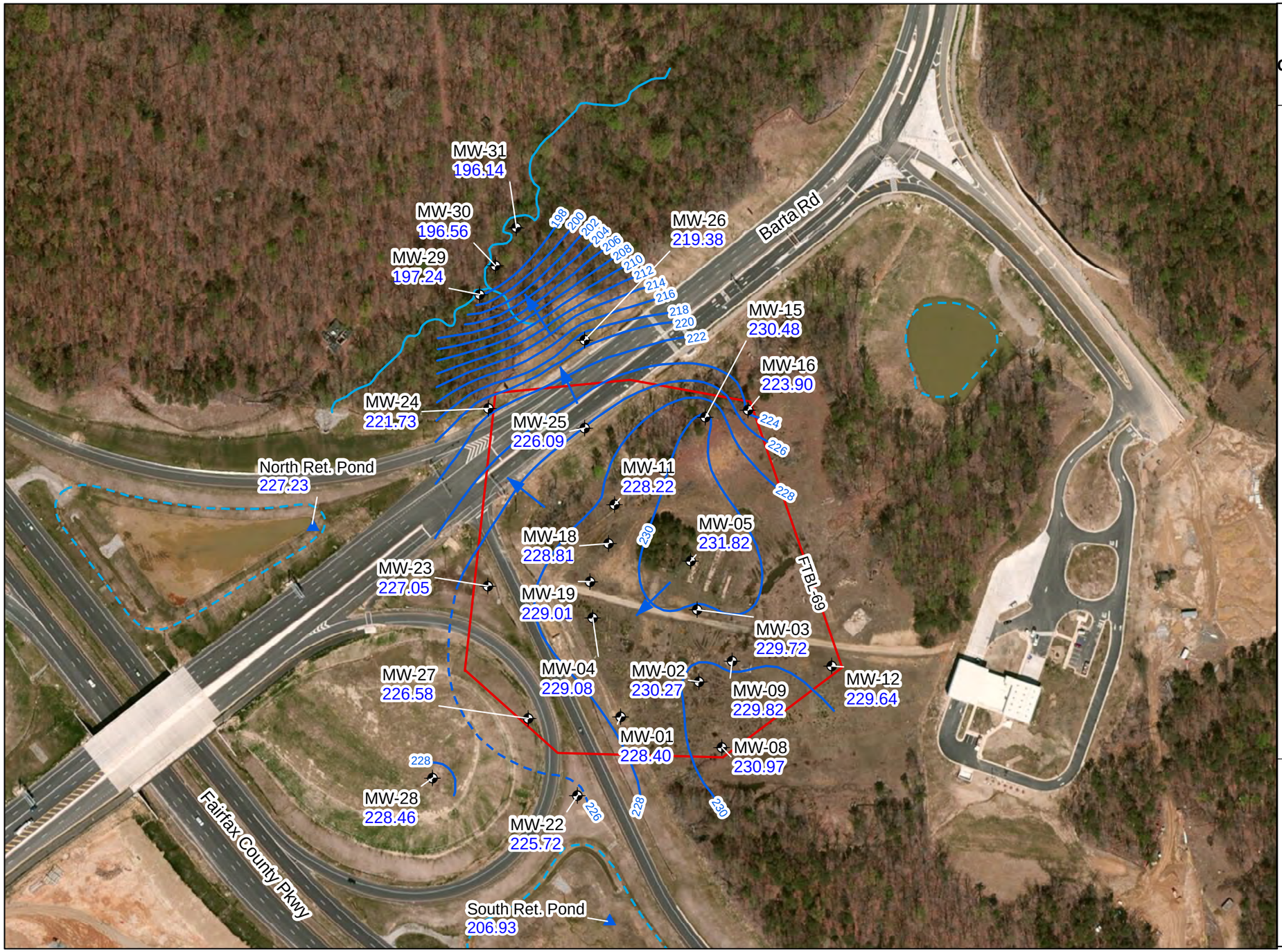

FIGURE 10
FTBL-69 GROUNDWATER ELEVATION CONTOURS (JANUARY AND MARCH 2021)
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Monitoring Well
- Retention Pond Point
- Groundwater Elevation Contour (Dashed Where Inferred)
- Groundwater Flow Direction
- Unamed Stream (Approximate)
- Retention Basin (Approximate)
- 230.97 Groundwater Elevation (feet NAVD88)

Notes:
NAVD88 = North American Vertical Datum of 1988
Groundwater elevation contours based on January and March 2021 groundwater elevation data.
Groundwater elevation contours generated using Surfer from Golden Software LLC and dashed where inferred.

N

0 250 Feet

1 inch = 250 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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HO'OLAULIMA GOVERNMENT SOLUTIONS

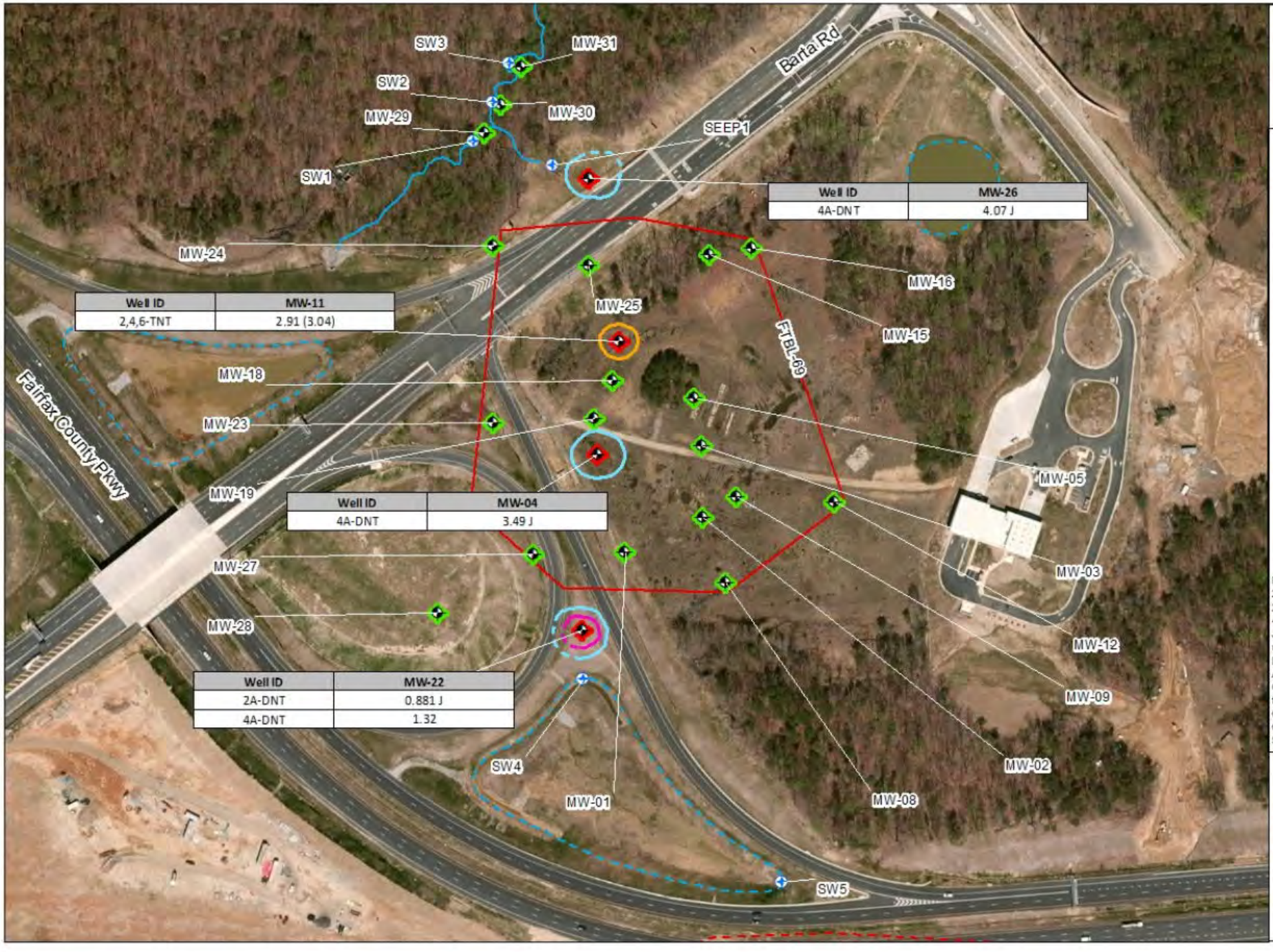

FIGURE 11
FTBL-69 EXTENT OF GROUNDWATER CONTAMINATION (DECEMBER 2018 AND MARCH 2019)

FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Monitoring Well Without Exceedance
- Monitoring Well With Exceedance
- Surface Water Sample Location (No Exceedances)
- Unamed Stream (Approximate)
- Retention Basin (Approximate)
- 2,4,6-TNT Contour (2.5 ug/L) (dashed where inferred)
- 2A-DNT (0.5 ug/L) (dashed where inferred)
- 4A-DNT (0.5 ug/L) (dashed where inferred)

Notes:
2,4,6-TNT = 2,4,6-Trinitrotoluene
2A-DNT = 2-Amino-4,6-Dinitrotoluene
4A-DNT = 4-Amino-2,6-Dinitrotoluene
J = Estimated result
ug/L = micrograms per liter.
Duplicate results reported in paretheses.
All concentrations reported in micrograms per liter.
Groundwater data represents concentrations exceeding the Clean-up Goals in December 2018 or March 2021.
Contours are drawn at concentrations representing the Clean-up Goals established in the Explanation of Significant Differences for FTBL-69 (Plexus, 2021).

0 250 Feet

1 inch = 250 feet

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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FIGURE 12
FTBL-001-R-02 - Infiltration Course
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)

N

0 250 Feet

1 inch = 250 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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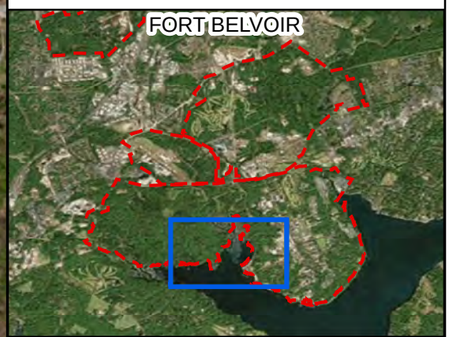
FIGURE 13
FTBL-003-R-01 – Combat Range Complex
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)



N

0 1,000 Feet

1 inch = 1,000 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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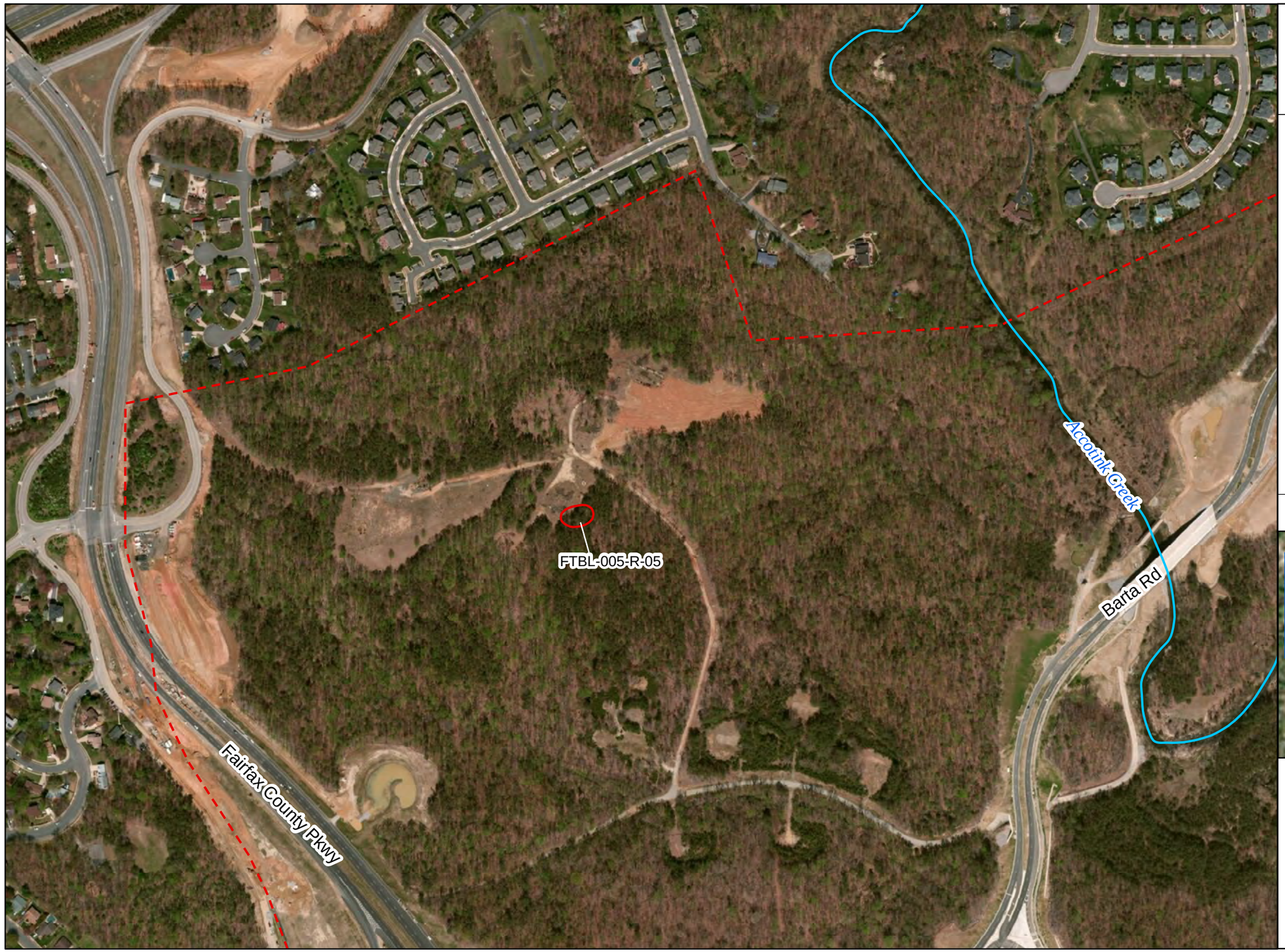

FIGURE 14
FTBL-005-R-05 – Inert Mine Testing Area at Range 5
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)

N

0 500 Feet

1 inch = 500 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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FIGURE 15
FTBL-005-R-05 GROUNDWATER MONITORING WELL NETWORK
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Monitoring Well
- Installation Boundary

N

0 100 Feet

1 inch = 100 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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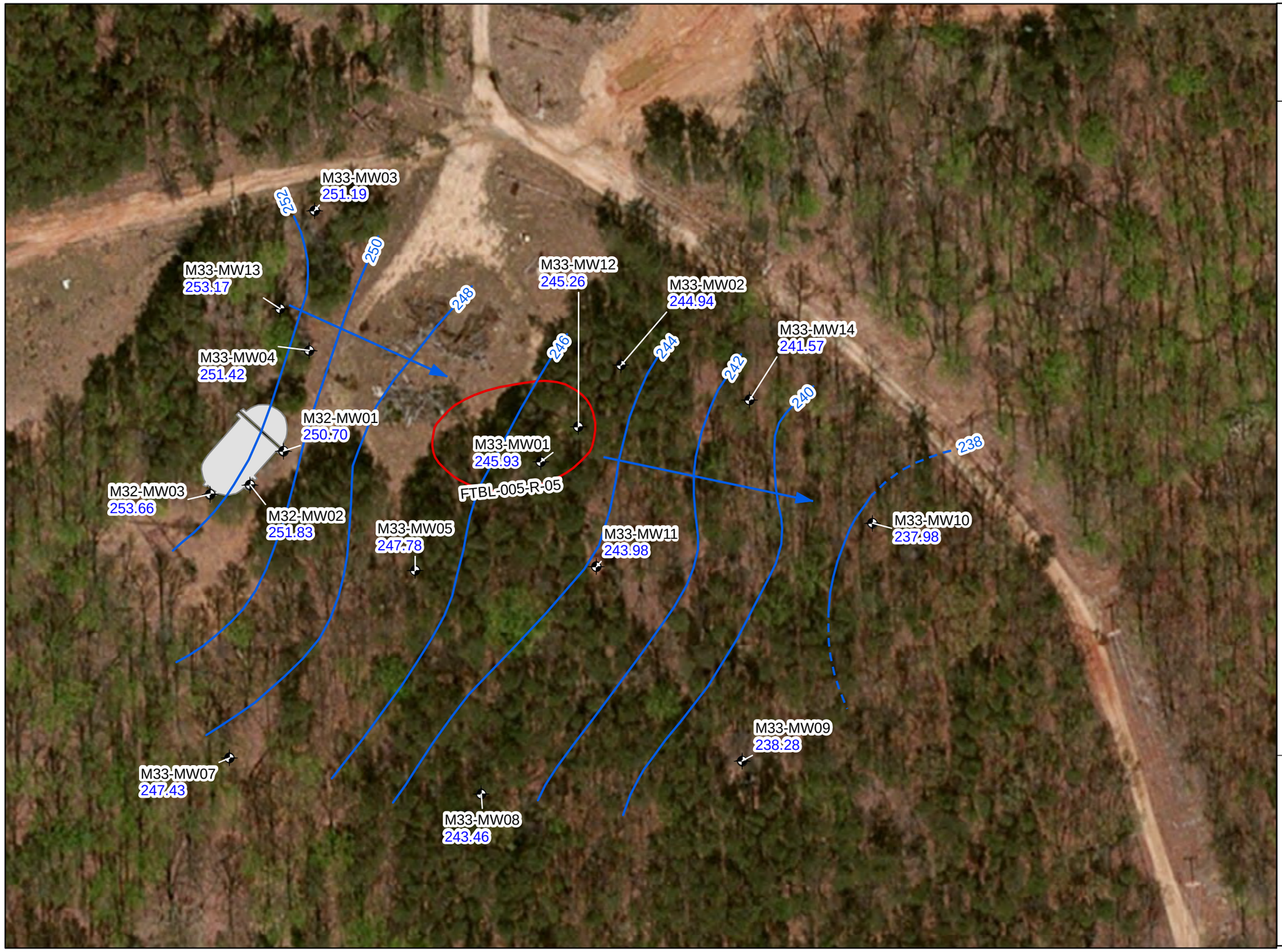

FIGURE 16
FTBL-005-R-05 (M-33) GROUNDWATER ELEVATION CONTOURS (MARCH 2021)
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Historical Bunker
- Monitoring Well
- Groundwater Elevation Contour (Dashed Where Inferred)
- Groundwater Flow Direction
- 198.06 Groundwater Elevation (ft amsl)

Notes:
ft amsl = feet above mean sea level
Groundwater elevation contours based on March 2021 groundwater elevation data.

N

0 100 Feet

1 inch = 100 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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FIGURE 17
FTBL-005-R-05 (M-33) EXTENT OF GROUNDWATER CONTAMINATION (MARCH 2021)
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Historical Bunker
- Monitoring Well (Not Sampled)
- Monitoring Well Without Exceedance
- Monitoring Well With Exceedance
- RDX Contour (30 ug/L) (dashed where inferred)
- 2,4-DNT/2,6-DNT Mixture Contour (5.3 ug/L) (dashed where inferred)

Notes:
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
DNT = Dinitrotoluene
ug/L = micrograms per liter
J = Estimated result
Groundwater data represents concentrations exceeding the remedial goals in March 2021.
All concentrations reported in micrograms per liter.

N

0 100 Feet

1 inch = 100 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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FIGURE 18
FTBL-005-R-09 – FBNA Soils and Groundwater at the Child Development Center (CDC)
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)

N

0 250 Feet

1 inch = 250 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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FIGURE 19
FTBL-005-R-09 GROUNDWATER MONITORING WELL NETWORK
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Monitoring Well
- Installation Boundary

0 150 Feet

1 inch = 150 feet

N

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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FIGURE 20
FTBL-005-R-09 GROUNDWATER ELEVATION CONTOURS (MARCH 2021)

FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Monitoring Well
- Groundwater Elevation Contour (Dashed Where Inferred)
- Groundwater Flow Direction
- 198.06 Groundwater Elevation (ft amsl)

Notes:
ft amsl = feet above mean sea level
Groundwater elevation contours based on March 2021 groundwater elevation data.

N

0 150 Feet

1 inch = 150 feet

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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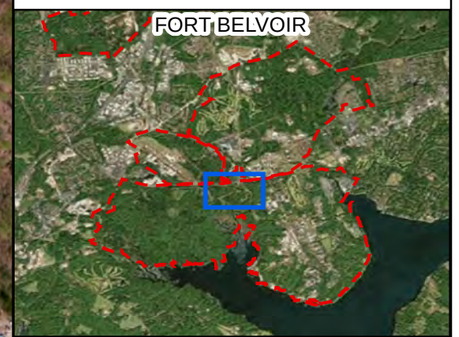
FIGURE 21
FTBL-007-R-01 – Grenade Court
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)



N

0 500 Feet

1 inch = 500 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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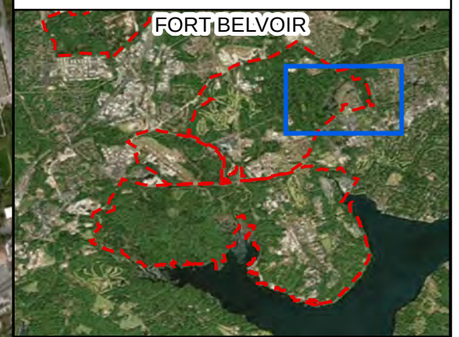
FIGURE 22
FTBL-018-R-01 – Demolition Area - 01
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)



N

0 1,000 Feet

1 inch = 1,000 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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FIGURE 23
FTBL-024-R-01 – Booby Trap Site
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)

N

0 250 Feet

1 inch = 250 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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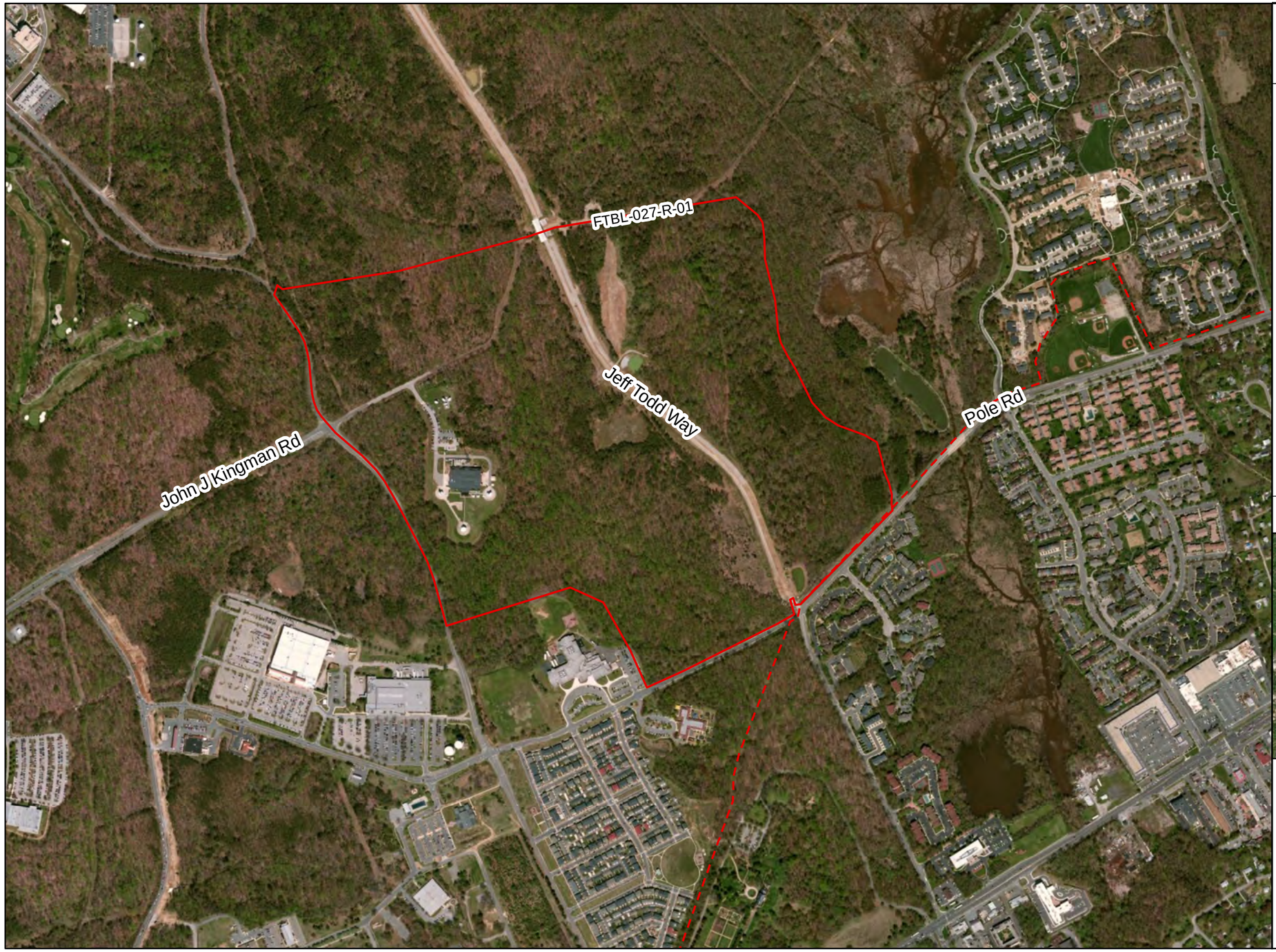
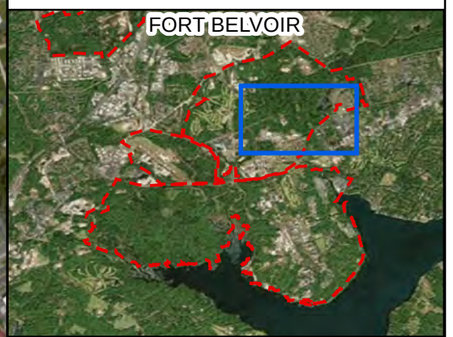


FIGURE 24
FTBL-027-R-01 – T-16
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)



N

0 1,000 Feet

1 inch = 1,000 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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FIGURE 25
FTBL-014-R-01 – Tracy Road Range
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)

N

0 500 Feet

1 inch = 500 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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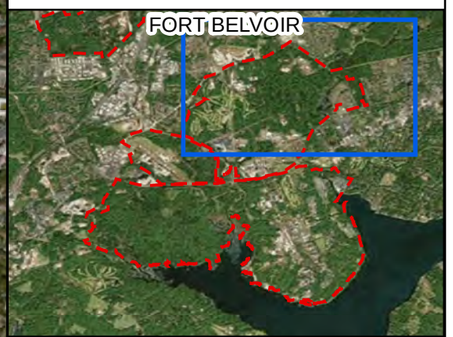
FIGURE 26
FTBL-025-R-01 – Demolition Area - USACE
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)



N

0 2,000 Feet

1 inch = 2,000 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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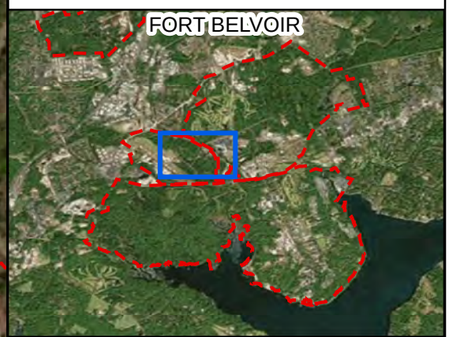
FIGURE 27
FTBL-026-R-01 – Mines and Booby Trap Area
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)



N

0 650 Feet

1 inch = 650 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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HO'OLAULIMA GOVERNMENT SOLUTIONS

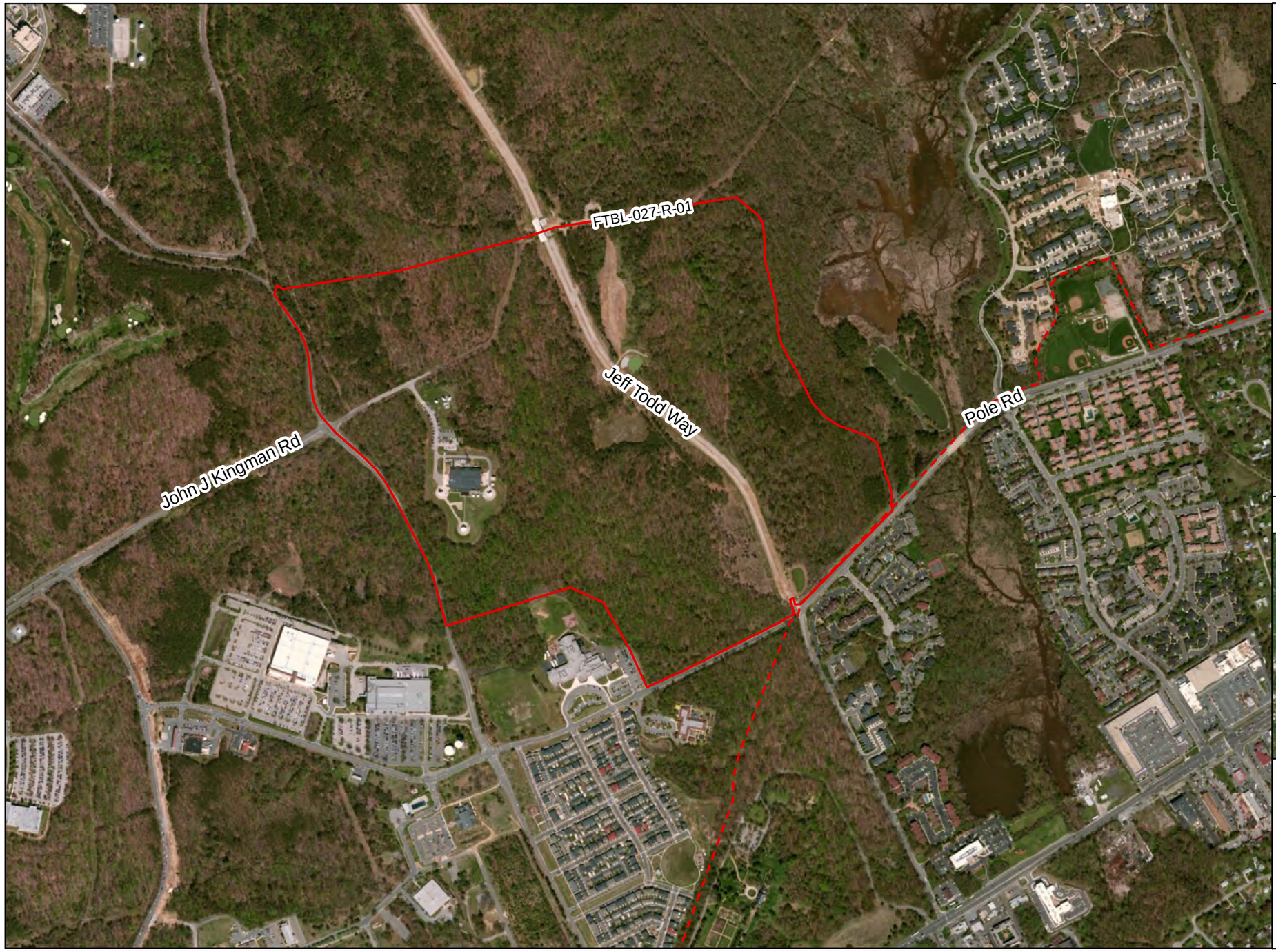
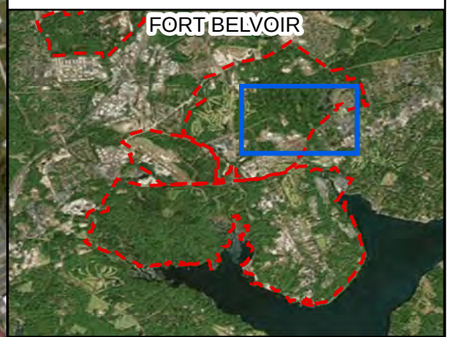


FIGURE 28
FTBL-027-R-01 – T-16
FORT BELVOIR, VIRGINIA

Legend:

- Site Boundary
- Installation Boundary
- Inset Map Extent Indicator

SITE LOCATION MAP (NOT TO SCALE)



N

0 1,000 Feet

1 inch = 1,000 feet

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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APPENDIX A
PUBLIC NOTICE

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Affidavit of Publication

AD # 00057085

STATE OF Virginia
COUNTY OF Fairfax

To Wit:

I hereby certify that on the 13th day of January 2022, before me, the subscriber, Ulonda Perkins, a notary public, that the matters of facts set forth are true. Shalique Jones, who being duly sworn according to law, and oath says that she is an authorized agent of The Washington Times, L.L.C., publisher of

The Washington Times

Circulated daily, in the State of Virginia, County of Fairfax, and that the advertisement, of which the annexed is a true copy, was published in said newspaper 1 time(s) on the following

January 13, 2022

Total Cost: $359.04

As witness, my hand and notarial seal.

ULONDA A. PERKINS
NOTARY PUBLIC DISTRICT OF COLUMBIA
My Commission Expires December 14, 2023

Third Five-Year Review for Fort Belvoir, Virginia

The U.S. Army, in cooperation with the Virginia Department of Environmental Quality (VADEQ), is conducting a third five-year review of fourteen environmental sites at Fort Belvoir located in Fairfax, Virginia as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan. Selected remedies at the sites consist of source removals, Land Use Controls (LUCs) including construction and excavation restrictions, groundwater use prohibition, signage, land use constraints, and long-term management consisting of annual inspections and groundwater monitoring.

The purpose of this five-year review is to determine whether the selected remedy at a site remains protective of human health and the environment. If there are issues that impact the remedial actions' protectiveness, the five-year review report will provide recommendations to address them. The review evaluates the protectiveness of the remedies for the fourteen sites pursuant to 2006, 2007, 2015, 2017, 2018, and 2020 Decision Documents (DD) and a 2021 Explanation of Significant Differences (ESD). The site areas to be evaluated under the 2021 Third Fort Belvoir Five-Year Review are: M-26 Hydrocarbon Spill Area, M-27 Waste Ordnance Pit at Range 1, Infiltration Course, Combat Range Complex, Inert Mine Testing Area at Range 5, Fort Belvoir North Area Soils and Groundwater site, Fort Belvoir North Area Munitions Response Area, Grenade Court, Tracy Road Range, Demolition Area - 01, Booby Trap Site, Demolition Area - US Army Corps of Engineers, Mines and Booby Trap Area, and the T-16 Range.

The Third Fort Belvoir Five-Year Review Report is anticipated to be completed in October 2022. The final report will be available on the Fort Belvoir web page at: **https://home.army.mil/belvoir/index.php**

The final report will also be available in the information repositories located at:

Directorate of Public Works
9430 Jackson Loop
Room 203
Fort Belvoir, VA 22060

Lorton Library
9520 Richmond Highway
Lorton, VA 22079

Kingstowne Library
6500 Landsdowne Centre Drive
Alexandria, VA 22315

Members of the community with questions or comments about the Fort Belvoir five-year review process or interest in additional site information, should contact Wilamena G. Harback at (703) 806-3193 or at **Wilamena.G.Harback.civ@army.mil**.

January 13, 2022 Ad#57085

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APPENDIX B
SITE INSPECTION CHECKLISTS

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Five-Year/Periodic Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Fort Belvoir – FTBL-68 M-26 Hydrocarbon Spill Area	**Date of inspection:** March 14, 2022
Location and Region: Fort Belvoir, VA	**EPA ID:**
Agency, office, or company leading the five-year review: Ho'olaulima Government Solutions (HGS)	**Weather/temperature:** Clear, 55ºF

Remedy Includes: (Check all that apply.)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☑ Other (Describe below.)
- ☑ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☐ Surface water collection and treatment

Soil Removal

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

1. O&M site manager

Chris Manikas	MMRP/IRP Program Manager	3/17/2022
Name	Title	Date

Interviewed ☑ at site ☑ at office ☐ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

2. O&M staff

Alexander Smith	Environmental Project Manager at HGL	3/18/2022
Name	Title	Date

Interviewed ☐ at site ☐ at office ☑ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

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: Virginia Department of Environmental Quality Phone Number: _____

Contact: Angela McGarvey	Project Manager CERCLA Sites	3/18/2022
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____

Contact: _____	_____	_____
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

4. Other interviews (optional) ☑ Report attached. Andrew Solomon (Associate Manager/Geologist at HGL)
Francis Coulters (Environmental Support Manager at U.S. Army Environmental Command)

III. ON-SITE 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 (Describe below.)

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 (Describe below.)

3. O&M and OSHA Training Records ☐ Readily available ☐ Up to date ☐ N/A

Remarks (Describe below.)

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 (Describe below.)

5. Gas Generation Records ☐ Readily available ☐ Up to date ☑ N/A

Remarks (Describe below.)

6. Settlement Monument Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

7. Groundwater Monitoring Records ☑ Readily available ☑ Up to date ☐ N/A
Remarks (Describe below.)

8. Leachate Extraction Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

9. Discharge Compliance Records
☐ Air ☐ Readily available ☐ Up to date ☑ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

10. Daily Access/Security Logs ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

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 (Describe below.)

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 _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons below:

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☐ Gates secured ☑ N/A

Remarks (Describe below.)

B. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☑ N/A

Remarks (Describe below.)

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented	☐ Yes	☑ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☑ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Self-Reporting

Frequency: Annual

Responsible Party/Agency: U.S. Army Phone Number:

Contact: Chris Manikas (Name) MMRP/IRP Program Manager (Title) 3/17/2022 (Date)

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
Violations have been reported	☐ Yes	☐ No	☑ N/A

Other problems or suggestions (Describe below.) ☐ Report attached

2. Adequacy ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks (Describe below.)

D. General

1. Vandalism/trespassing ☐ Location shown on site map ☑ No vandalism evident

Remarks

2. Land use changes on site ☑ N/A

Remarks

No changes in land use were observed.

3. Land use changes off site ☑ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☑ Roads are adequate ☐ N/A

Remarks

Site access roads were accessible and well maintained. Southern areas of the site were unable to be accessed due to high-speed vehicle traffic on the Fairfax County Parkway offramp and interchange.

B. Other Site Conditions

Remarks

Site is heavily vegetated with a stream running through it.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

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

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

Areal extent _____

Remarks

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay

Remarks

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay

Remarks

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay

Remarks

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 and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement

Areal extent _____ Depth _____

Remarks

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal extent _____
Remarks

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks

5. Obstructions ☐ Location shown on site map ☐ No obstructions
Type _____ Size _____
Remarks

6. Excessive Vegetative Growth ☐ No evidence of excessive growth
Type _____
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

2. Gas Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. Leachate Extraction Wells

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance

Remarks

2. Gas Collection Wells, Manifolds and Piping

☐ Good condition ☐ Needs Maintenance

Remarks

3. Gas Monitoring Facilities (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation ☐ Siltation not evident ☐ N/A

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

3. Outlet Works ☐ Functioning ☐ N/A
Remarks

4. Dam ☐ Functioning ☐ N/A
Remarks

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks

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 ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Performance Monitoring Type of monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____

Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☑ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. Collection Structures, Pumps, and Electrical

☐ Good condition ☐ Needs Maintenance

Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☑ N/A

1. Treatment Train (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters _____
☐ Additive (*e.g.*, chelation agent, flocculent) _____
☐ Others _____
☐ Good condition_____
☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually _____
☐ Quantity of surface water treated annually _____

Remarks

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

3. Tanks, Vaults, Storage Vessels ☐ N/A

☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks

4. Discharge Structure and Appurtenances ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

5. Treatment Building(s) ☐ N/A

☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

D. Monitoring Data

1. Monitoring Data

☑ Is routinely submitted on time ☑ Is of acceptable quality

2. Monitoring data suggests:

☐ Groundwater plume is effectively contained ☑ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☑ Properly secured/locked ☑ Functioning ☑ Routinely sampled ☑ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

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.).

The site inspection determined that the selected remedies appear to be functioning as designed. The site is heavily vegetated. No evidence of unauthorized ground disturbance or land use was observed. Site access point was accessible and well maintained. Southern areas of the site were unable to be accessed due to vehicle traffic on the Fairfax County parkway offramp and interchange; these areas of the site were viewed only from accessible northern areas of the site.

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.

The site inspection team did not identify any issues of observations related to the implementation of O&M procedures.

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.

The site inspection team did not identify any issues or observations that suggest that the protectiveness or the remedy may be compromised in the future.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The site inspection team did not identify any opportunities for optimization of the remedy.

Site Inspection Team Roster:

Chris Manikas (U.S. Army, MMRP/IRP Program Manager)
Bryce Zinckgraf (HGS, Environmental Engineer)
Rob Norwillo (HGS, Environmental Scientist III)

Five-Year/Periodic Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Fort Belvoir – FTBL-69 – M-27 Waste Ordnance Pit at Range 1	**Date of inspection:** March 14, 2022
Location and Region: Fort Belvoir, Virginia	**EPA ID:**
Agency, office, or company leading the five-year review: Ho'olaulima Government Solutions (HGS)	**Weather/temperature:** Clear, 55ºF

Remedy Includes: (Check all that apply.)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Other (Describe below.)
- ☑ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☐ Surface water collection and treatment

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

1. O&M site manager

Chris Manikas	MMRP/IRP Program Manager	3/17/2022
Name	Title	Date

Interviewed ☑ at site ☑ at office ☐ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

2. O&M staff

Alexander Smith	Environmental Project Manager at HGL	3/18/2022
Name	Title	Date

Interviewed ☐ at site ☐ at office ☑ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

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: Virginia Department of Environmental Quality Phone Number: _____

Contact: Angela McGarvey	Project Manager CERCLA Sites	3/18/2022
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____

Contact: _____	_____	_____
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

4. Other interviews (optional) ☑ Report attached. Andrew Solomon (Associate Manager/Geologist at HGL)
Francis Coulters (Environmental SupportManager at U.S. Army Environmental Command)

III. ON-SITE 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 (Describe below.)

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 (Describe below.)

3. O&M and OSHA Training Records ☐ Readily available ☐ Up to date ☐ N/A

Remarks (Describe below.)

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 (Describe below.)

5. Gas Generation Records ☐ Readily available ☐ Up to date ☑ N/A

Remarks (Describe below.)

6. Settlement Monument Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

7. Groundwater Monitoring Records ☑ Readily available ☑ Up to date ☐ N/A
Remarks (Describe below.)

8. Leachate Extraction Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

9. Discharge Compliance Records
☐ Air ☐ Readily available ☐ Up to date ☑ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

10. Daily Access/Security Logs ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

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 (Describe below.)

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 _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons below:

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☐ Gates secured ☑ N/A

Remarks (Describe below.)

B. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☑ N/A

Remarks (Describe below.)

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented	☐ Yes	☑ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☑ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Self-Reporting

Frequency: Annual

Responsible Party/Agency: U.S. Army Phone Number:

Contact: Chris Manikas (Name) MMRP/IRP Program Manager (Title) 3/17/2022 (Date)

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
Violations have been reported	☐ Yes	☐ No	☑ N/A

Other problems or suggestions (Describe below.) ☐ Report attached

2. Adequacy ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks (Describe below.)

D. General

1. Vandalism/trespassing ☐ Location shown on site map ☑ No vandalism evident

Remarks

2. Land use changes on site ☑ N/A

Remarks

No changes in land use were observed.

3. Land use changes off site ☑ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☐ Roads are adequate ☐ N/A

Remarks

Site access roads were accessible and well maintained.

B. Other Site Conditions

Remarks

Site is heavily vegetated. Concrete debris (traffic barriers) observed on site.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

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

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

Areal extent _____

Remarks

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay

Remarks

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay

Remarks

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay

Remarks

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 and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement

Areal extent _____ Depth _____

Remarks

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal extent _____
Remarks

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks

5. Obstructions ☐ Location shown on site map ☐ No obstructions
Type _____ Size _____
Remarks

6. Excessive Vegetative Growth ☐ No evidence of excessive growth
Type _____
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

2. Gas Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. Leachate Extraction Wells

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance

Remarks

2. Gas Collection Wells, Manifolds and Piping

☐ Good condition ☐ Needs Maintenance

Remarks

3. Gas Monitoring Facilities (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation ☐ Siltation not evident ☐ N/A

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

3. Outlet Works ☐ Functioning ☐ N/A
Remarks

4. Dam ☐ Functioning ☐ N/A
Remarks

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks

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 ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Performance Monitoring Type of monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____

Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☑ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. Collection Structures, Pumps, and Electrical

☐ Good condition ☐ Needs Maintenance

Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☑ N/A

1. Treatment Train (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters _____
☐ Additive (*e.g.*, chelation agent, flocculent) _____
☐ Others _____
☐ Good condition_____
☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually _____
☐ Quantity of surface water treated annually _____

Remarks

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

3. Tanks, Vaults, Storage Vessels ☐ N/A

☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks

4. Discharge Structure and Appurtenances ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

5. Treatment Building(s) ☐ N/A

☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

D. Monitoring Data

1. Monitoring Data

☑ Is routinely submitted on time ☑ Is of acceptable quality

2. Monitoring data suggests:

☑ Groundwater plume is effectively contained ☑ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☑ Properly secured/locked ☑ Functioning ☑ Routinely sampled ☑ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

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.).

The site inspection determined that the selected remedies appear to be functioning as designed. The site is heavily vegetated. No evidence of unauthorized ground disturbance or land use was observed. Site access point was accessible and well maintained. UXO signage was observed, but it is not part of the remedy.

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.

The site inspection team did not identify any issues of observations related to the implementation of O&M procedures.

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.

The site inspection team did not identify any issues or observations that suggest that the protectiveness or the remedy may be compromised in the future.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The site inspection team did not identify any opportunities for optimization of the remedy.

Site Inspection Team Roster:

Chris Manikas (U.S. Army, MMRP/IRP Program Manager)
Bryce Zinckgraf (HGS, Environmental Engineer)
Rob Norwillo (HGS, Environmental Scientist III)

Five-Year/Periodic Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Fort Belvoir – FTBL-001-R-02 – Infiltration Course	**Date of inspection:** March 14, 2022
Location and Region: Fort Belvoir, Virginia	**EPA ID:**
Agency, office, or company leading the five-year review: Ho'olaulima Government Solutions (HGS)	**Weather/temperature:** Clear, 55ºF

Remedy Includes: (Check all that apply.)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☑ Other (Describe below.)
- ☑ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☐ Surface water collection and treatment

Surgical soil removal and streambank stabilization

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

1. O&M site manager

Chris Manikas	MMRP/IRP Program Manager	3/17/2022
Name	Title	Date

Interviewed ☑ at site ☑ at office ☐ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

2. O&M staff

Alexander Smith	Environmental Project Manager at HGL	3/18/2022
Name	Title	Date

Interviewed ☐ at site ☐ at office ☑ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

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: Virginia Department of Environmental Quality Phone Number: _____

Contact: Angela McGarvey	Project Manager CERCLA Sites	3/18/2022
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____

Contact: _____	_____	_____
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

4. Other interviews (optional) ☑ Report attached. Andrew Solomon (Associate Manager/Geologist at HGL)
Francis Coulters (Environmental Support Manager at U.S. Army Environmental Command)

III. ON-SITE 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 (Describe below.)

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 (Describe below.)

3. O&M and OSHA Training Records ☐ Readily available ☐ Up to date ☐ N/A

Remarks (Describe below.)

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 (Describe below.)

5. Gas Generation Records ☐ Readily available ☐ Up to date ☑ N/A

Remarks (Describe below.)

6. Settlement Monument Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

7. Groundwater Monitoring Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

8. Leachate Extraction Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

9. Discharge Compliance Records
☐ Air ☐ Readily available ☐ Up to date ☑ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

10. Daily Access/Security Logs ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

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 (Describe below.)

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 _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons below:

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☐ Gates secured ☑ N/A

Remarks (Describe below.)

B. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☑ N/A

Remarks (Describe below.)

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented	☐ Yes	☑ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☑ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Self-Reporting

Frequency: Annual

Responsible Party/Agency: U.S. Army Phone Number:

Contact: Chris Manikas (Name) MMRP/IRP Program Manager (Title) 3/17/2022 (Date)

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
Violations have been reported	☐ Yes	☐ No	☑ N/A

Other problems or suggestions (Describe below.) ☐ Report attached

2. Adequacy ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks (Describe below.)

D. General

1. Vandalism/trespassing ☐ Location shown on site map ☑ No vandalism evident

Remarks

2. Land use changes on site ☑ N/A

Remarks

No changes in land use were observed.

3. Land use changes off site ☑ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☐ Roads are adequate ☐ N/A

Remarks

Site access roads were accessible and well maintained.

B. Other Site Conditions

Remarks

Site is well vegetated.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

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

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

Areal extent _____

Remarks

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay

Remarks

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay

Remarks

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay

Remarks

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 and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement

Areal extent _____ Depth _____

Remarks

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal extent _____
Remarks

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks

5. Obstructions ☐ Location shown on site map ☐ No obstructions
Type _____ Size _____
Remarks

6. Excessive Vegetative Growth ☐ No evidence of excessive growth
Type _____
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

2. Gas Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. Leachate Extraction Wells

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance

Remarks

2. Gas Collection Wells, Manifolds and Piping

☐ Good condition ☐ Needs Maintenance

Remarks

3. Gas Monitoring Facilities (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation ☐ Siltation not evident ☐ N/A

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

3. Outlet Works ☐ Functioning ☐ N/A
Remarks

4. Dam ☐ Functioning ☐ N/A
Remarks

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks

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 ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Performance Monitoring Type of monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____

Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☑ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☑ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical

☑ Good condition ☐ Needs Maintenance

Remarks

Riprap for streambank stabilization is installed and in good condition.

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☑ N/A

1. Treatment Train (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters _____
☐ Additive (*e.g.*, chelation agent, flocculent) _____
☐ Others _____
☐ Good condition_____
☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually _____
☐ Quantity of surface water treated annually _____

Remarks

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

3. Tanks, Vaults, Storage Vessels ☐ N/A

☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks

4. Discharge Structure and Appurtenances ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

5. Treatment Building(s) ☐ N/A

☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

D. Monitoring Data

1. Monitoring Data

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

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.).

The site inspection determined that the selected remedies appear to be functioning as designed. The site is heavily vegetated. No evidence of unauthorized ground disturbance or land use was observed. Site access point was accessible and well maintained. Riprap for streambank stabilization is installed and in good condition.

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.

The site inspection team did not identify any issues of observations related to the implementation of O&M procedures.

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.

The site inspection team did not identify any issues or observations that suggest that the protectiveness or the remedy may be compromised in the future.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The site inspection team did not identify any opportunities for optimization of the remedy.

Site Inspection Team Roster:

Chris Manikas (U.S. Army, MMRP/IRP Program Manager)
Bryce Zinckgraf (HGS, Environmental Engineer)
Rob Norwillo (HGS, Environmental Scientist III)

Five-Year/Periodic Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Fort Belvoir – FTBL-003-R-01 – Combat Range Complex	**Date of inspection:** March 14, 2022
Location and Region: Fort Belvoir, Virginia	**EPA ID:**
Agency, office, or company leading the five-year review: Ho'olaulima Government Solutions (HGS)	**Weather/temperature:** Clear, 55°F

Remedy Includes: (Check all that apply.)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☑ Other (Describe below.)
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☐ Surface water collection and treatment

Soil removal with off-site disposal.

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

1. O&M site manager

Chris Manikas	MMRP/IRP Program Manager	3/17/2022
Name	Title	Date

Interviewed ☑ at site ☑ at office ☐ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

2. O&M staff

Alexander Smith	Environmental Project Manager at HGL	3/18/2022
Name	Title	Date

Interviewed ☐ at site ☐ at office ☑ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

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: Virginia Department of Environmental Quality Phone Number: _____

Contact: Angela McGarvey	Project Manager CERCLA Sites	3/18/2022
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____

Contact: _____	_____	_____
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

4. Other interviews (optional) ☑ Report attached. Andrew Solomon (Associate Manager/Geologist at HGL)
Francis Coulters (Environmental Support Manager at U.S. Army Environmental Command)

III. ON-SITE 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 (Describe below.)

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 (Describe below.)

3. O&M and OSHA Training Records ☐ Readily available ☐ Up to date ☐ N/A

Remarks (Describe below.)

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 (Describe below.)

5. Gas Generation Records ☐ Readily available ☐ Up to date ☑ N/A

Remarks (Describe below.)

6. Settlement Monument Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

7. Groundwater Monitoring Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

8. Leachate Extraction Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

9. Discharge Compliance Records
☐ Air ☐ Readily available ☐ Up to date ☑ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

10. Daily Access/Security Logs ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

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 (Describe below.)

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 _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons below:

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☑ Gates secured ☐ N/A

Remarks (Describe below.)

Secure chain observed at site entrance to prevent vehicle access.

B. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☑ N/A

Remarks (Describe below.)

Signage was observed and well maintained. Some signage was installed facing the wrong direction.

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented	☐ Yes	☑ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☑ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Self-Reporting

Frequency: Annual

Responsible Party/Agency: U.S. Army Phone Number:

Contact: Chris Manikas (Name) MMRP/IRP Program Manager (Title) 3/17/2022 (Date)

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
Violations have been reported	☐ Yes	☐ No	☑ N/A

Other problems or suggestions (Describe below.) ☐ Report attached

2. Adequacy ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks (Describe below.)

D. General

1. Vandalism/trespassing ☐ Location shown on site map ☑ No vandalism evident

Remarks

2. Land use changes on site ☑ N/A

Remarks

No changes in land use were observed.

3. Land use changes off site ☑ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☐ Roads are adequate ☐ N/A

Remarks

Site access roads were accessible and well maintained.

B. Other Site Conditions

Remarks

Site is heavily vegetated.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

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

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

Areal extent _____

Remarks

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay

Remarks

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay

Remarks

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay

Remarks

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 and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement

Areal extent _____ Depth _____

Remarks

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal extent _____
Remarks

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks

5. Obstructions ☐ Location shown on site map ☐ No obstructions
Type _____ Size _____
Remarks

6. Excessive Vegetative Growth ☐ No evidence of excessive growth
Type _____
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

2. Gas Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. Leachate Extraction Wells

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance

Remarks

2. Gas Collection Wells, Manifolds and Piping

☐ Good condition ☐ Needs Maintenance

Remarks

3. Gas Monitoring Facilities (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation ☐ Siltation not evident ☐ N/A

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

3. Outlet Works ☐ Functioning ☐ N/A
Remarks

4. Dam ☐ Functioning ☐ N/A
Remarks

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks

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 ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Performance Monitoring Type of monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____

Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☑ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical

☐ Good condition ☐ Needs Maintenance

Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters _____
☐ Additive (*e.g.*, chelation agent, flocculent) _____
☐ Others _____
☐ Good condition_____
☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually _____
☐ Quantity of surface water treated annually _____

Remarks

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

3. Tanks, Vaults, Storage Vessels ☐ N/A

☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks

4. Discharge Structure and Appurtenances ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

5. Treatment Building(s) ☐ N/A

☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

D. Monitoring Data

1. Monitoring Data

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

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.).

The site inspection determined that the selected remedies appear to be functioning as designed. The site is heavily vegetated. No evidence of unauthorized ground disturbance or land use was observed. Site access point was accessible and well maintained. Signage was observed and well maintained. Secure chain observed at site entrance to prevent vehicle access but not part of the remedy.

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.

The site inspection team did not identify any issues of observations related to the implementation and scope of O&M procedures.

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.

The site inspection team noted that some of the signage was installed facing the wrong directions and should be corrected.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The site inspection team did not identify any opportunities for optimization of the remedy.

Site Inspection Team Roster:

Chris Manikas (U.S. Army, MMRP/IRP Program Manager)
Bryce Zinckgraf (HGS, Environmental Engineer)
Rob Norwillo (HGS, Environmental Scientist III)

Five-Year/Periodic Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Fort Belvoir – FTBL-005-R-05 – Inert Mine Testing Area at Range 5 & FTBL-005-R-08 – Range 5 (Building 5091)	**Date of inspection:** March 14, 2022
Location and Region: Fort Belvoir, Virginia	**EPA ID:**
Agency, office, or company leading the five-year review: Ho'olaulima Government Solutions (HGS)	**Weather/temperature:** Clear, 55°F

Remedy Includes: (Check all that apply.)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Other (Describe below.)
- ☑ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☐ Surface water collection and treatment

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

1. O&M site manager

Chris Manikas	MMRP/IRP Program Manager	3/17/2022
Name	Title	Date

Interviewed ☑ at site ☑ at office ☐ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

2. O&M staff

Alexander Smith	Environmental Project Manager at HGL	3/18/2022
Name	Title	Date

Interviewed ☐ at site ☐ at office ☑ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

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: Virginia Department of Environmental Quality Phone Number: _____

Contact: Angela McGarvey	Project Manager CERCLA Sites	3/18/2022
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____

Contact: _____	_____	_____
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

4. Other interviews (optional) ☑ Report attached. Andrew Solomon (Associate Manager/Geologist at HGL)
Francis Coulters (Environmental Support Manager at U.S. Army Environmental Command)

III. ON-SITE 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 (Describe below.)

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 (Describe below.)

3. O&M and OSHA Training Records ☐ Readily available ☐ Up to date ☐ N/A

Remarks (Describe below.)

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 (Describe below.)

5. Gas Generation Records ☐ Readily available ☐ Up to date ☑ N/A

Remarks (Describe below.)

6. Settlement Monument Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

7. Groundwater Monitoring Records ☑ Readily available ☑ Up to date ☐ N/A
Remarks (Describe below.)

8. Leachate Extraction Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

9. Discharge Compliance Records
☐ Air ☐ Readily available ☐ Up to date ☑ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

10. Daily Access/Security Logs ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

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 (Describe below.)

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 _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons below:

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☑ Gates secured ☐ N/A

Remarks (Describe below.)

Fencing was observed around site, but it is not part of site remedy. Fencing was damaged by fallen trees in several locations. Access gate was secured and well maintained.

B. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☐ N/A

Remarks (Describe below.)

Signage was observed and well maintained.

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented ☐ Yes ☑ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☑ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Self-Reporting

Frequency: Annual

Responsible Party/Agency: U.S. Army Phone Number:

Contact: Chris Manikas (Name) MMRP/IRP Program Manager (Title) 3/17/2022 (Date)

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

Violations have been reported ☐ Yes ☐ No ☑ N/A

Other problems or suggestions (Describe below.) ☐ Report attached

2. Adequacy ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks (Describe below.)

D. General

1. Vandalism/trespassing ☐ Location shown on site map ☐ No vandalism evident

Remarks

Waste tires observed near site access gate indicative of illegal dumping activities.

2. Land use changes on site ☑ N/A

Remarks

No changes in land use were observed. Future construction is planned at the site. Surveying trails and flagging associated with future construction were observed.

3. Land use changes off site ☑ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☑ Roads are adequate ☐ N/A

Remarks

Site access roads were accessible and well maintained.

B. Other Site Conditions

Remarks

Site is heavily vegetated.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

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

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

Areal extent _____

Remarks

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay

Remarks

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay

Remarks

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay

Remarks

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 and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement

Areal extent _____ Depth _____

Remarks

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal extent _____
Remarks

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks

5. Obstructions ☐ Location shown on site map ☐ No obstructions
Type _____ Size _____
Remarks

6. Excessive Vegetative Growth ☐ No evidence of excessive growth
Type _____
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

2. Gas Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. Leachate Extraction Wells

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance

Remarks

2. Gas Collection Wells, Manifolds and Piping

☐ Good condition ☐ Needs Maintenance

Remarks

3. Gas Monitoring Facilities (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation ☐ Siltation not evident ☐ N/A

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

3. Outlet Works ☐ Functioning ☐ N/A
Remarks

4. Dam ☐ Functioning ☐ N/A
Remarks

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks

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 ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Performance Monitoring Type of monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____

Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☑ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. Collection Structures, Pumps, and Electrical

☐ Good condition ☐ Needs Maintenance

Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☑ N/A

1. Treatment Train (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters _____
☐ Additive (*e.g.*, chelation agent, flocculent) _____
☐ Others _____
☐ Good condition_____
☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually _____
☐ Quantity of surface water treated annually _____

Remarks

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

3. Tanks, Vaults, Storage Vessels ☐ N/A

☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks

4. Discharge Structure and Appurtenances ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

5. Treatment Building(s) ☐ N/A

☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

D. Monitoring Data

1. Monitoring Data

☑ Is routinely submitted on time ☑ Is of acceptable quality

2. Monitoring data suggests:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☑ Properly secured/locked ☑ Functioning ☑ Routinely sampled ☑ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

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.).

The site inspection determined that the selected remedies appear to be functioning as designed. The site is heavily vegetated. No evidence of unauthorized ground disturbance or land use was observed. Site access point was accessible and well maintained. Signage and groundwater wells were observed and well maintained. Investigation-derived waste (IDW) storage drums were observed. Waste tires observed near site access gate indicative of illegal dumping activities.

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.

The site inspection team did not identify any issues of observations related to the implementation and scope of O&M procedures.

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.

The site inspection team observed survey flagging in the area associated with planned future construction. Dig permits should be submitted before any soil disturbing construction activities begin.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The site inspection team did not identify any opportunities for optimization of the remedy.

Site Inspection Team Roster:

Chris Manikas (U.S. Army, MMRP/IRP Program Manager)
Bryce Zinckgraf (HGS, Environmental Engineer)
Rob Norwillo (HGS, Environmental Scientist III)

Five-Year/Periodic Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Fort Belvoir – FTBL-005-R-09 – FNBA Soils and Groundwater at the Child Development Center (CDC)	**Date of inspection:** March 14, 2022
Location and Region: Fort Belvoir, Virginia	**EPA ID:**
Agency, office, or company leading the five-year review: Ho'olaulima Government Solutions (HGS)	**Weather/temperature:** Clear, 55°F

Remedy Includes: (Check all that apply.)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Other (Describe below.)
- ☑ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☐ Surface water collection and treatment

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

1. O&M site manager

Chris Manikas (Name) | MMRP/IRP Program Manager (Title) | 3/17/2022 (Date)

Interviewed ☑ at site ☑ at office ☐ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

2. O&M staff

Alexander Smith (Name) | Environmental Project Manager at HGL (Title) | 3/18/2022 (Date)

Interviewed ☐ at site ☐ at office ☑ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

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: Virginia Department of Environmental Quality Phone Number: _____

Contact: Angela McGarvey (Name) | Project Manager CERCLA Sites (Title) | 3/18/2022 (Date)

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____

Contact: _____ (Name) | _____ (Title) | _____ (Date)

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

4. Other interviews (optional) ☑ Report attached. Andrew Solomon (Associate Manager/Geologist at HGL)
Francis Coulters (Environmental Support Manager at U.S. Army Environmental Command)

III. ON-SITE 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 (Describe below.)

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 (Describe below.)

3. O&M and OSHA Training Records ☐ Readily available ☐ Up to date ☐ N/A

Remarks (Describe below.)

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 (Describe below.)

5. Gas Generation Records ☐ Readily available ☐ Up to date ☑ N/A

Remarks (Describe below.)

6. Settlement Monument Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

7. Groundwater Monitoring Records ☑ Readily available ☑ Up to date ☐ N/A
Remarks (Describe below.)

8. Leachate Extraction Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

9. Discharge Compliance Records
☐ Air ☐ Readily available ☐ Up to date ☑ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

10. Daily Access/Security Logs ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

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 (Describe below.)

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 _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons below:

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☐ Gates secured ☑ N/A

Remarks (Describe below.)

B. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☑ N/A

Remarks (Describe below.)

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented	☐ Yes	☑ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☑ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Self-Reporting

Frequency: Annual

Responsible Party/Agency: U.S. Army Phone Number:

Contact: Chris Manikas (Name) MMRP/IRP Program Manager (Title) 3/17/2022 (Date)

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
Violations have been reported	☐ Yes	☐ No	☑ N/A

Other problems or suggestions (Describe below.) ☐ Report attached

2. Adequacy ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks (Describe below.)

D. General

1. Vandalism/trespassing ☐ Location shown on site map ☑ No vandalism evident

Remarks

2. Land use changes on site ☑ N/A

Remarks

No changes in land use were observed.

3. Land use changes off site ☑ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☑ Roads are adequate ☐ N/A

Remarks

Site access roads were accessible and well maintained.

B. Other Site Conditions

Remarks

Site is occupied by the Child Development Center (CDC) facility.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

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

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

Areal extent _____

Remarks

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay

Remarks

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay

Remarks

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay

Remarks

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 and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement

Areal extent _____ Depth _____

Remarks

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal extent _____
Remarks

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks

5. Obstructions ☐ Location shown on site map ☐ No obstructions
Type _____ Size _____
Remarks

6. Excessive Vegetative Growth ☐ No evidence of excessive growth
Type _____
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

2. Gas Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. Leachate Extraction Wells

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance

Remarks

2. Gas Collection Wells, Manifolds and Piping

☐ Good condition ☐ Needs Maintenance

Remarks

3. Gas Monitoring Facilities (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation ☐ Siltation not evident ☐ N/A

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

3. Outlet Works ☐ Functioning ☐ N/A
Remarks

4. Dam ☐ Functioning ☐ N/A
Remarks

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks

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 ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Performance Monitoring Type of monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____

Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☑ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☑ N/A

1. Collection Structures, Pumps, and Electrical

☐ Good condition ☐ Needs Maintenance

Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☑ N/A

1. Treatment Train (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters _____
☐ Additive (*e.g.*, chelation agent, flocculent) _____
☐ Others _____
☐ Good condition_____
☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually _____
☐ Quantity of surface water treated annually _____

Remarks

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

3. Tanks, Vaults, Storage Vessels ☐ N/A

☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks

4. Discharge Structure and Appurtenances ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

5. Treatment Building(s) ☐ N/A

☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

D. Monitoring Data

1. Monitoring Data

☑ Is routinely submitted on time ☑ Is of acceptable quality

2. Monitoring data suggests:

☑ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☑ Properly secured/locked ☑ Functioning ☑ Routinely sampled ☑ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

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.).

The site inspection determined that the selected remedies appear to be functioning as designed. No evidence of unauthorized ground disturbance or land use was observed. The CDC facility was observed at the site. Site access point was accessible and well maintained. Monitoring wells were observed and in good condition.

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.

The site inspection team did not identify any issues of observations related to the implementation and scope of O&M procedures.

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.

The site inspection team did not identify any issues or observations suggesting the protectiveness of the remedy may be compromised in the future.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The site inspection team did not identify any opportunities for optimization of the remedy.

Site Inspection Team Roster:

Chris Manikas (U.S. Army, MMRP/IRP Program Manager)
Bryce Zinckgraf (HGS, Environmental Engineer)
Rob Norwillo (HGS, Environmental Scientist III)

Five-Year/Periodic Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Fort Belvoir – FTBL-007-R-01 – Grenade Court	**Date of inspection:** March 14, 2022
Location and Region: Fort Belvoir, Virginia	**EPA ID:**
Agency, office, or company leading the five-year review: Ho'olaulima Government Solutions (HGS)	**Weather/temperature:** Clear, 55°F

Remedy Includes: (Check all that apply.)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Other (Describe below.)
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☐ Surface water collection and treatment

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

1. O&M site manager

Chris Manikas	MMRP/IRP Program Manager	3/17/2022
Name	Title	Date

Interviewed ☑ at site ☑ at office ☐ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

2. O&M staff

Alexander Smith	Environmental Project Manager at HGL	3/18/2022
Name	Title	Date

Interviewed ☐ at site ☐ at office ☑ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

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: Virginia Department of Environmental Quality Phone Number: _____

Contact: Angela McGarvey	Project Manager CERCLA Sites	3/18/2022
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____

Contact: _____	_____	_____
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

4. Other interviews (optional) ☑ Report attached. Andrew Solomon (Associate Manager/Geologist at HGL)
Francis Coulters (Environmental Support Manager at U.S. Army Environmental Command)

III. ON-SITE 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 (Describe below.)

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 (Describe below.)

3. O&M and OSHA Training Records ☐ Readily available ☐ Up to date ☐ N/A

Remarks (Describe below.)

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 (Describe below.)

5. Gas Generation Records ☐ Readily available ☐ Up to date ☑ N/A

Remarks (Describe below.)

6. Settlement Monument Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

7. Groundwater Monitoring Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

8. Leachate Extraction Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

9. Discharge Compliance Records
☐ Air ☐ Readily available ☐ Up to date ☑ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

10. Daily Access/Security Logs ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

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 (Describe below.)

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 _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons below:

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☐ Gates secured ☑ N/A

Remarks (Describe below.)

B. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☑ N/A

Remarks (Describe below.)

Signage was observed and in good condition.

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented	☐ Yes	☑ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☑ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Self-Reporting

Frequency: Annual

Responsible Party/Agency: U.S. Army Phone Number:

Contact: Chris Manikas (Name) MMRP/IRP Program Manager (Title) 3/17/2022 (Date)

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
Violations have been reported	☐ Yes	☐ No	☑ N/A

Other problems or suggestions (Describe below.) ☐ Report attached

2. Adequacy ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks (Describe below.)

D. General

1. Vandalism/trespassing ☐ Location shown on site map ☑ No vandalism evident

Remarks

2. Land use changes on site ☑ N/A

Remarks

No changes in land use were observed.

3. Land use changes off site ☑ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☐ Roads are adequate ☐ N/A

Remarks

Site access roads were accessible and well maintained.

B. Other Site Conditions

Remarks

Site is heavily vegetated. Pedestrian hiking trails observed.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

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

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

Areal extent _____

Remarks

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay

Remarks

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay

Remarks

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay

Remarks

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 and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement

Areal extent _____ Depth _____

Remarks

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal extent _____
Remarks

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks

5. Obstructions ☐ Location shown on site map ☐ No obstructions
Type _____ Size _____
Remarks

6. Excessive Vegetative Growth ☐ No evidence of excessive growth
Type _____
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

2. Gas Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. Leachate Extraction Wells

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance

Remarks

2. Gas Collection Wells, Manifolds and Piping

☐ Good condition ☐ Needs Maintenance

Remarks

3. Gas Monitoring Facilities (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation ☐ Siltation not evident ☐ N/A

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

3. Outlet Works ☐ Functioning ☐ N/A
Remarks

4. Dam ☐ Functioning ☐ N/A
Remarks

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks

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 ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Performance Monitoring Type of monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____

Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☑ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical

☐ Good condition ☐ Needs Maintenance

Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters _____
☐ Additive (*e.g.*, chelation agent, flocculent) _____
☐ Others _____
☐ Good condition_____
☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually _____
☐ Quantity of surface water treated annually _____

Remarks

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

3. Tanks, Vaults, Storage Vessels ☐ N/A

☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks

4. Discharge Structure and Appurtenances ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

5. Treatment Building(s) ☐ N/A

☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

D. Monitoring Data

1. Monitoring Data

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

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.).

The site inspection determined that the selected remedies appear to be functioning as designed. No evidence of unauthorized ground disturbance or land use was observed. Site access point was accessible and well maintained. Signage was observed and in good condition.

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.

The site inspection team did not identify any issues of observations related to the implementation and scope of O&M procedures.

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.

The site inspection team did not identify any issues or observations suggesting the protectiveness of the remedy may be compromised in the future.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The site inspection team did not identify any opportunities for optimization of the remedy.

Site Inspection Team Roster:

Chris Manikas (U.S. Army, MMRP/IRP Program Manager)
Bryce Zinckgraf (HGS, Environmental Engineer)
Rob Norwillo (HGS, Environmental Scientist III)

Five-Year/Periodic Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Fort Belvoir – FTBL-014-R-01 – Tracy Road Range	**Date of inspection:** March 15, 2022
Location and Region: Fort Belvoir, Virginia	**EPA ID:**
Agency, office, or company leading the five-year review: Ho'olaulima Government Solutions (HGS)	**Weather/temperature:** Clear, 55°F

Remedy Includes: (Check all that apply.)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Other (Describe below.)
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☐ Surface water collection and treatment

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

1. O&M site manager

Chris Manikas	MMRP/IRP Program Manager	3/17/2022
Name	Title	Date

Interviewed ☑ at site ☑ at office ☐ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

2. O&M staff

Alexander Smith	Environmental Project Manager at HGL	3/18/2022
Name	Title	Date

Interviewed ☐ at site ☐ at office ☑ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

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: Virginia Department of Environmental Quality Phone Number: _____

Contact: Angela McGarvey	Project Manager CERCLA Sites	3/18/2022
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____

Contact: _____	_____	_____
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

4. Other interviews (optional) ☑ Report attached. Andrew Solomon (Associate Manager/Geologist at HGL)
Francis Coulters (Environmental Support Manager at U.S. Army Environmental Command)

III. ON-SITE 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 (Describe below.)

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 (Describe below.)

3. O&M and OSHA Training Records ☐ Readily available ☐ Up to date ☐ N/A

Remarks (Describe below.)

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 (Describe below.)

5. Gas Generation Records ☐ Readily available ☐ Up to date ☑ N/A

Remarks (Describe below.)

6. Settlement Monument Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

7. Groundwater Monitoring Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

8. Leachate Extraction Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

9. Discharge Compliance Records
☐ Air ☐ Readily available ☐ Up to date ☑ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

10. Daily Access/Security Logs ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

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 (Describe below.)

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 _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons below:

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☐ Gates secured ☑ N/A

Remarks (Describe below.)

B. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☑ N/A

Remarks (Describe below.)

Signage was observed and in good condition.

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented	☐ Yes	☑ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☑ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Self-Reporting

Frequency: Annual

Responsible Party/Agency: U.S. Army Phone Number:

Contact: Chris Manikas (Name) MMRP/IRP Program Manager (Title) 3/17/2022 (Date)

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
Violations have been reported	☐ Yes	☐ No	☑ N/A

Other problems or suggestions (Describe below.) ☐ Report attached

2. Adequacy ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks (Describe below.)

D. General

1. Vandalism/trespassing ☐ Location shown on site map ☐ No vandalism evident

Remarks

Site allows recreational use.

2. Land use changes on site ☑ N/A

Remarks

No changes in land use were observed.

3. Land use changes off site ☑ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☐ Roads are adequate ☐ N/A

Remarks

Site access roads were accessible and well maintained.

B. Other Site Conditions

Remarks

Site is heavily vegetated.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

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

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

Areal extent _____

Remarks

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay

Remarks

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay

Remarks

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay

Remarks

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 and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement

Areal extent _____ Depth _____

Remarks

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal extent _____
Remarks

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks

5. Obstructions ☐ Location shown on site map ☐ No obstructions
Type _____ Size _____
Remarks

6. Excessive Vegetative Growth ☐ No evidence of excessive growth
Type _____
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

2. Gas Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. Leachate Extraction Wells

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance

Remarks

2. Gas Collection Wells, Manifolds and Piping

☐ Good condition ☐ Needs Maintenance

Remarks

3. Gas Monitoring Facilities (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation ☐ Siltation not evident ☐ N/A

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

3. Outlet Works ☐ Functioning ☐ N/A
Remarks

4. Dam ☐ Functioning ☐ N/A
Remarks

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks

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 ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Performance Monitoring Type of monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____

Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☑ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical

☐ Good condition ☐ Needs Maintenance

Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters _____
☐ Additive (*e.g.*, chelation agent, flocculent) _____
☐ Others _____
☐ Good condition_____
☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually _____
☐ Quantity of surface water treated annually _____

Remarks

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

3. Tanks, Vaults, Storage Vessels ☐ N/A

☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks

4. Discharge Structure and Appurtenances ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

5. Treatment Building(s) ☐ N/A

☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

D. Monitoring Data

1. Monitoring Data

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

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.).

The site inspection determined that the selected remedies appear to be functioning as designed. The site is heavily vegetated. No evidence of unauthorized ground disturbance or land use was observed. Site access point was accessible and well maintained.

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.

The site inspection team did not identify any issues of observations related to the implementation and scope of O&M procedures.

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.

The site inspection team did not identify any issues or observations suggesting the protectiveness of the remedy may be compromised in the future.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The site inspection team did not identify any opportunities for optimization of the remedy.

Site Inspection Team Roster:

Chris Manikas (U.S. Army, MMRP/IRP Program Manager)
Bryce Zinckgraf (HGS, Environmental Engineer)
Rob Norwillo (HGS, Environmental Scientist III)

Five-Year/Periodic Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Fort Belvoir – FTBL-018-R-01 – Demolition Area – 01	**Date of inspection:** March 14, 2022
Location and Region: Fort Belvoir, Virginia	**EPA ID:**
Agency, office, or company leading the five-year review: Ho'olaulima Government Solutions (HGS)	**Weather/temperature:** Clear, 55°F

Remedy Includes: (Check all that apply.)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Other (Describe below.)
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☐ Surface water collection and treatment

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

1. O&M site manager

Chris Manikas	MMRP/IRP Program Manager	3/17/2022
Name	Title	Date

Interviewed ☑ at site ☑ at office ☐ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

2. O&M staff

Alexander Smith	Environmental Project Manager at HGL	3/18/2022
Name	Title	Date

Interviewed ☐ at site ☐ at office ☑ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

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: Virginia Department of Environmental Quality Phone Number: _____

Contact: Angela McGarvey	Project Manager CERCLA Sites	3/18/2022
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____

Contact: _____	_____	_____
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

4. Other interviews (optional) ☑ Report attached. Andrew Solomon (Associate Manager/Geologist at HGL)
Francis Coulters (Environmental Support Manager at U.S. Army Environmental Command)

III. ON-SITE 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 (Describe below.)

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 (Describe below.)

3. O&M and OSHA Training Records ☐ Readily available ☐ Up to date ☐ N/A

Remarks (Describe below.)

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 (Describe below.)

5. Gas Generation Records ☐ Readily available ☐ Up to date ☑ N/A

Remarks (Describe below.)

6. Settlement Monument Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

7. Groundwater Monitoring Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

8. Leachate Extraction Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

9. Discharge Compliance Records
☐ Air ☐ Readily available ☐ Up to date ☑ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

10. Daily Access/Security Logs ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

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 (Describe below.)

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 _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons below:

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☐ Gates secured ☑ N/A

Remarks (Describe below.)

B. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☑ N/A

Remarks (Describe below.)

Signage was observed and in good condition. Signage was installed facing the wrong direction.

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented	☐ Yes	☑ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☑ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Self-Reporting

Frequency: Annual

Responsible Party/Agency: U.S. Army Phone Number:

Contact: Chris Manikas (Name) MMRP/IRP Program Manager (Title) 3/17/2022 (Date)

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
Violations have been reported	☐ Yes	☐ No	☑ N/A

Other problems or suggestions (Describe below.) ☐ Report attached

2. Adequacy ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks (Describe below.)

D. General

1. Vandalism/trespassing ☐ Location shown on site map ☑ No vandalism evident

Remarks

2. Land use changes on site ☑ N/A

Remarks

No changes in land use were observed.

3. Land use changes off site ☑ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☐ Roads are adequate ☐ N/A

Remarks

Site access roads were accessible and well maintained.

B. Other Site Conditions

Remarks

Site is heavily vegetated.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

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

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

Areal extent _____

Remarks

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay

Remarks

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay

Remarks

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay

Remarks

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 and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement

Areal extent _____ Depth _____

Remarks

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal extent _____
Remarks

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks

5. Obstructions ☐ Location shown on site map ☐ No obstructions
Type _____ Size _____
Remarks

6. Excessive Vegetative Growth ☐ No evidence of excessive growth
Type _____
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

2. Gas Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. Leachate Extraction Wells

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance

Remarks

2. Gas Collection Wells, Manifolds and Piping

☐ Good condition ☐ Needs Maintenance

Remarks

3. Gas Monitoring Facilities (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation ☐ Siltation not evident ☐ N/A

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

3. Outlet Works ☐ Functioning ☐ N/A
Remarks

4. Dam ☐ Functioning ☐ N/A
Remarks

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks

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 ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Performance Monitoring Type of monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____

Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☑ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical

☐ Good condition ☐ Needs Maintenance

Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters _____
☐ Additive (*e.g.*, chelation agent, flocculent) _____
☐ Others _____
☐ Good condition_____
☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually _____
☐ Quantity of surface water treated annually _____

Remarks

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

3. Tanks, Vaults, Storage Vessels ☐ N/A

☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks

4. Discharge Structure and Appurtenances ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

5. Treatment Building(s) ☐ N/A

☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

D. Monitoring Data

1. Monitoring Data

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

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.).

The site inspection determined that the selected remedies appear to be functioning as designed. The site is heavily vegetated. No evidence of unauthorized ground disturbance or land use was observed. Site access point was accessible and well maintained. Signage was observed and in good condition, but installed facing the wrong direction. Fencing was observed, but it is not part of the remedy.

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.

The site inspection team did not identify any issues of observations related to the implementation and scope of O&M procedures.

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.

The site inspection team identified signage that was installed facing the wrong direction and should be fixed.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The site inspection team did not identify any opportunities for optimization of the remedy.

Site Inspection Team Roster:

Chris Manikas (U.S. Army, MMRP/IRP Program Manager)
Bryce Zinckgraf (HGS, Environmental Engineer)
Rob Norwillo (HGS, Environmental Scientist III)

Five-Year/Periodic Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Fort Belvoir – FTBL-024-R-01 – Booby Trap Site	**Date of inspection:** March 14, 2022
Location and Region: Fort Belvoir, Virginia	**EPA ID:**
Agency, office, or company leading the five-year review: Ho'olaulima Government Solutions (HGS)	**Weather/temperature:** Clear, 55°F

Remedy Includes: (Check all that apply.)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Other (Describe below.)
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☐ Surface water collection and treatment

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

1. O&M site manager

Chris Manikas	MMRP/IRP Program Manager	3/17/2022
Name	Title	Date

Interviewed ☑ at site ☑ at office ☐ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

2. O&M staff

Alexander Smith	Environmental Project Manager at HGL	3/18/2022
Name	Title	Date

Interviewed ☐ at site ☐ at office ☑ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

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: Virginia Department of Environmental Quality Phone Number: _____

Contact: Angela McGarvey	Project Manager CERCLA Sites	3/18/2022
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____

Contact: _____	_____	_____
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

4. Other interviews (optional) ☑ Report attached. Andrew Solomon (Associate Manager/Geologist at HGL)
Francis Coulters (Environmental Suppport Manager at U.S. Army Environmental Command)

III. ON-SITE 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 (Describe below.)

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 (Describe below.)

3. O&M and OSHA Training Records ☐ Readily available ☐ Up to date ☐ N/A

Remarks (Describe below.)

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 (Describe below.)

5. Gas Generation Records ☐ Readily available ☐ Up to date ☑ N/A

Remarks (Describe below.)

6. Settlement Monument Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

7. Groundwater Monitoring Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

8. Leachate Extraction Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

9. Discharge Compliance Records
☐ Air ☐ Readily available ☐ Up to date ☑ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

10. Daily Access/Security Logs ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

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 (Describe below.)

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 _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons below:

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks (Describe below.)

Fencing was observed, but it is not part of the remedy.

B. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☑ N/A

Remarks (Describe below.)

Signage was observed and in good condition. Signage was installed facing the wrong direction.

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented	☐ Yes	☑ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☑ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Self-Reporting

Frequency: Annual

Responsible Party/Agency: U.S. Army Phone Number:

Contact: Chris Manikas (Name) MMRP/IRP Program Manager (Title) 3/17/2022 (Date)

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
Violations have been reported	☐ Yes	☐ No	☑ N/A

Other problems or suggestions (Describe below.) ☐ Report attached

2. Adequacy ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks (Describe below.)

D. General

1. Vandalism/trespassing ☐ Location shown on site map ☑ No vandalism evident

Remarks

2. Land use changes on site ☑ N/A

Remarks

No changes in land use were observed.

3. Land use changes off site ☑ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☐ Roads are adequate ☐ N/A

Remarks

Site access roads were accessible and well maintained.

B. Other Site Conditions

Remarks

Site is heavily vegetated.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

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

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

Areal extent _____

Remarks

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay

Remarks

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay

Remarks

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay

Remarks

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 and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement

Areal extent _____ Depth _____

Remarks

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal extent _____
Remarks

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks

5. Obstructions ☐ Location shown on site map ☐ No obstructions
Type _____ Size _____
Remarks

6. Excessive Vegetative Growth ☐ No evidence of excessive growth
Type _____
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

2. Gas Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. Leachate Extraction Wells

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance

Remarks

2. Gas Collection Wells, Manifolds and Piping

☐ Good condition ☐ Needs Maintenance

Remarks

3. Gas Monitoring Facilities (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation ☐ Siltation not evident ☐ N/A

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

3. Outlet Works ☐ Functioning ☐ N/A
Remarks

4. Dam ☐ Functioning ☐ N/A
Remarks

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks

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 ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Performance Monitoring Type of monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____

Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☑ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical

☐ Good condition ☐ Needs Maintenance

Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters _____
☐ Additive (*e.g.*, chelation agent, flocculent) _____
☐ Others _____
☐ Good condition_____
☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually _____
☐ Quantity of surface water treated annually _____

Remarks

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

3. Tanks, Vaults, Storage Vessels ☐ N/A

☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks

4. Discharge Structure and Appurtenances ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

5. Treatment Building(s) ☐ N/A

☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

D. Monitoring Data

1. Monitoring Data

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

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.).

The site inspection determined that the selected remedies appear to be functioning as designed. The site is heavily vegetated. No evidence of unauthorized ground disturbance or land use was observed. Site access point was accessible and well maintained. Signage was observed and in good condition, but some are installed facing the wrong direction. Fencing was observed, but it is not part of the remedy.

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.

The site inspection team did not identify any issues of observations related to the implementation and scope of O&M procedures.

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.

The site inspection team identified signage that was installed facing the wrong direction and should be fixed.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The site inspection team did not identify any opportunities for optimization of the remedy.

Site Inspection Team Roster:

Chris Manikas (U.S. Army, MMRP/IRP Program Manager)
Bryce Zinckgraf (HGS, Environmental Engineer)
Rob Norwillo (HGS, Environmental Scientist III)

Five-Year/Periodic Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Fort Belvoir – FTBL-025-R-01 – Demolition Area – USACE	**Date of inspection:** March 14, 2022
Location and Region: Fort Belvoir, Virginia	**EPA ID:**
Agency, office, or company leading the five-year review: Ho'olaulima Government Solutions (HGS)	**Weather/temperature:** Clear, 55°F

Remedy Includes: (Check all that apply.)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Other (Describe below.)
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☐ Surface water collection and treatment

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

1. O&M site manager

Chris Manikas	MMRP/IRP Program Manager	3/17/2022
Name	Title	Date

Interviewed ☑ at site ☑ at office ☐ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

2. O&M staff

Alexander Smith	Environmental Project Manager at HGL	3/18/2022
Name	Title	Date

Interviewed ☐ at site ☐ at office ☑ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

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: Virginia Department of Environmental Quality Phone Number: _____

Contact: Angela McGarvey	Project Manager CERCLA Sites	3/18/2022
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____

Contact: _____	_____	_____
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

4. Other interviews (optional) ☑ Report attached. Andrew Solomon (Associate Manager/Geologist at HGL)
Francis Coulters (Environmental Support Manager at U.S. Army Environmental Command)

III. ON-SITE 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 (Describe below.)

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 (Describe below.)

3. O&M and OSHA Training Records ☐ Readily available ☐ Up to date ☐ N/A

Remarks (Describe below.)

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 (Describe below.)

5. Gas Generation Records ☐ Readily available ☐ Up to date ☑ N/A

Remarks (Describe below.)

6. Settlement Monument Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

7. Groundwater Monitoring Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

8. Leachate Extraction Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

9. Discharge Compliance Records
☐ Air ☐ Readily available ☐ Up to date ☑ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

10. Daily Access/Security Logs ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

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 (Describe below.)

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 _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons below:

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☐ Gates secured ☑ N/A

Remarks (Describe below.)

B. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☐ N/A

Remarks (Describe below.)

Signage was observed and well maintained.

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented	☐ Yes	☑ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☑ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Self-Reporting

Frequency: Annual

Responsible Party/Agency: U.S. Army Phone Number:

Contact: Chris Manikas (Name) MMRP/IRP Program Manager (Title) 3/17/2022 (Date)

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
Violations have been reported	☐ Yes	☐ No	☑ N/A

Other problems or suggestions (Describe below.) ☐ Report attached

2. Adequacy ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks (Describe below.)

D. General

1. Vandalism/trespassing ☐ Location shown on site map ☑ No vandalism evident

Remarks

2. Land use changes on site ☑ N/A

Remarks

No changes in land use were observed.

3. Land use changes off site ☑ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☐ Roads are adequate ☐ N/A

Remarks

Site access roads were accessible and well maintained.

B. Other Site Conditions

Remarks

Site is heavily vegetated.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

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

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

Areal extent _____

Remarks

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay

Remarks

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay

Remarks

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay

Remarks

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 and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement

Areal extent _____ Depth _____

Remarks

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal extent _____
Remarks

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks

5. Obstructions ☐ Location shown on site map ☐ No obstructions
Type _____ Size _____
Remarks

6. Excessive Vegetative Growth ☐ No evidence of excessive growth
Type _____
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

2. Gas Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. Leachate Extraction Wells

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance

Remarks

2. Gas Collection Wells, Manifolds and Piping

☐ Good condition ☐ Needs Maintenance

Remarks

3. Gas Monitoring Facilities (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation ☐ Siltation not evident ☐ N/A

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

3. Outlet Works ☐ Functioning ☐ N/A
Remarks

4. Dam ☐ Functioning ☐ N/A
Remarks

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks

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 ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Performance Monitoring Type of monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____

Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☑ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical

☐ Good condition ☐ Needs Maintenance

Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters _____
☐ Additive (*e.g.*, chelation agent, flocculent) _____
☐ Others _____
☐ Good condition_____
☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually _____
☐ Quantity of surface water treated annually _____

Remarks

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

3. Tanks, Vaults, Storage Vessels ☐ N/A

☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks

4. Discharge Structure and Appurtenances ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

5. Treatment Building(s) ☐ N/A

☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

D. Monitoring Data

1. Monitoring Data

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

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.).

The site inspection determined that the selected remedies appear to be functioning as designed. The site is heavily vegetated. No evidence of unauthorized ground disturbance or land use was observed. Site access point was accessible and well maintained. Signage was observed and well maintained.

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.

The site inspection team did not identify any issues of observations related to the implementation and scope of O&M procedures.

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.

The site inspection team did not identify any issues or observations that suggest that the protectiveness of the remedy may be compromised in the future.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The site inspection team did not identify any opportunities for optimization of the remedy.

Site Inspection Team Roster:

Chris Manikas (U.S. Army, MMRP/IRP Program Manager)
Bryce Zinckgraf (HGS, Environmental Engineer)
Rob Norwillo (HGS, Environmental Scientist III)

Five-Year/Periodic Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Fort Belvoir – FTBL-026-R-01 – Mines and Booby Trap Area	**Date of inspection:** March 14, 2022
Location and Region: Fort Belvoir, Virginia	**EPA ID:**
Agency, office, or company leading the five-year review: Ho'olaulima Government Solutions (HGS)	**Weather/temperature:** Clear, 55°F

Remedy Includes: (Check all that apply.)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☑ Other (Describe below.)
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☐ Surface water collection and treatment

Focused MEC removal.

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

1. O&M site manager

Chris Manikas	MMRP/IRP Program Manager	3/17/2022
Name	Title	Date

Interviewed ☑ at site ☑ at office ☐ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

2. O&M staff

Alexander Smith	Environmental Project Manager at HGL	3/18/2022
Name	Title	Date

Interviewed ☐ at site ☐ at office ☑ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

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: Virginia Department of Environmental Quality Phone Number: _____

Contact: Angela McGarvey	Project Manager CERCLA Sites	3/18/2022
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____

Contact: _____	_____	_____
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

4. Other interviews (optional) ☑ Report attached. Andrew Solomon (Associate Manager/Geologist at HGL)
Francis Coulters (Environmental Support Manager at U.S. Army Environmental Command)

III. ON-SITE 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 (Describe below.)

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 (Describe below.)

3. O&M and OSHA Training Records ☐ Readily available ☐ Up to date ☐ N/A

Remarks (Describe below.)

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 (Describe below.)

5. Gas Generation Records ☐ Readily available ☐ Up to date ☑ N/A

Remarks (Describe below.)

6. Settlement Monument Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

7. Groundwater Monitoring Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

8. Leachate Extraction Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

9. Discharge Compliance Records
☐ Air ☐ Readily available ☐ Up to date ☑ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

10. Daily Access/Security Logs ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

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 (Describe below.)

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 _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons below:

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☐ Gates secured ☑ N/A

Remarks (Describe below.)

B. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☐ N/A

Remarks (Describe below.)

Signage was observed and in good condition.

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented	☐ Yes	☑ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☑ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Self-Reporting

Frequency: Annual

Responsible Party/Agency: U.S. Army Phone Number:

Contact: Chris Manikas (Name) MMRP/IRP Program Manager (Title) 3/17/2022 (Date)

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
Violations have been reported	☐ Yes	☐ No	☑ N/A

Other problems or suggestions (Describe below.) ☐ Report attached

2. Adequacy ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks (Describe below.)

D. General

1. Vandalism/trespassing ☐ Location shown on site map ☑ No vandalism evident

Remarks

2. Land use changes on site ☑ N/A

Remarks

No changes in land use were observed.

3. Land use changes off site ☑ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☐ Roads are adequate ☐ N/A

Remarks

Site access roads were accessible and well maintained.

B. Other Site Conditions

Remarks

Site is heavily vegetated.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

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

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

Areal extent _____

Remarks

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay

Remarks

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay

Remarks

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay

Remarks

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 and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement

Areal extent _____ Depth _____

Remarks

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal extent _____
Remarks

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks

5. Obstructions ☐ Location shown on site map ☐ No obstructions
Type _____ Size _____
Remarks

6. Excessive Vegetative Growth ☐ No evidence of excessive growth
Type _____
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

2. Gas Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. Leachate Extraction Wells

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance

Remarks

2. Gas Collection Wells, Manifolds and Piping

☐ Good condition ☐ Needs Maintenance

Remarks

3. Gas Monitoring Facilities (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation ☐ Siltation not evident ☐ N/A

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

3. Outlet Works ☐ Functioning ☐ N/A
Remarks

4. Dam ☐ Functioning ☐ N/A
Remarks

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks

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 ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Performance Monitoring Type of monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____

Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☑ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical

☐ Good condition ☐ Needs Maintenance

Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters _____
☐ Additive (*e.g.*, chelation agent, flocculent) _____
☐ Others _____
☐ Good condition_____
☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually _____
☐ Quantity of surface water treated annually _____

Remarks

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

3. Tanks, Vaults, Storage Vessels ☐ N/A

☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks

4. Discharge Structure and Appurtenances ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

5. Treatment Building(s) ☐ N/A

☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

D. Monitoring Data

1. Monitoring Data

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

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.).

The site inspection determined that the selected remedies appear to be functioning as designed. The site is heavily vegetated. No evidence of unauthorized ground disturbance or land use was observed. Site access point was accessible and well maintained. Signage was observed and well maintained. Pin flags were observed, likely from MEC clearance event. Concrete and wood debris observed on site.

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.

The site inspection team did not identify any issues of observations related to the implementation and scope of O&M procedures.

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.

The site inspection team did not identify any issues or observations that suggest that the protectiveness of the remedy may be compromised in the future.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The site inspection team did not identify any opportunities for optimization of the remedy.

Site Inspection Team Roster:

Chris Manikas (U.S. Army, MMRP/IRP Program Manager)
Bryce Zinckgraf (HGS, Environmental Engineer)
Rob Norwillo (HGS, Environmental Scientist III)

Five-Year/Periodic Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Fort Belvoir – FTBL-027-R-01 – T-16	**Date of inspection:** March 14, 2022
Location and Region: Fort Belvoir, Virginia	**EPA ID:**
Agency, office, or company leading the five-year review: Ho'olaulima Government Solutions (HGS)	**Weather/temperature:** Clear, 55°F

Remedy Includes: (Check all that apply.)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☑ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Other (Describe below.)
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☐ Surface water collection and treatment

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS

1. O&M site manager

Chris Manikas	MMRP/IRP Program Manager	3/17/2022
Name	Title	Date

Interviewed ☑ at site ☑ at office ☐ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

2. O&M staff

Alexander Smith	Environmental Project Manager at HGL	3/18/2022
Name	Title	Date

Interviewed ☐ at site ☐ at office ☑ by phone Phone no. _____

Problems, suggestions (Describe below.); ☐ Report attached

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: Virginia Department of Environmental Quality Phone Number: _____

Contact: Angela McGarvey	Project Manager CERCLA Sites	3/18/2022
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____

Contact: _____	_____	_____
Name	Title	Date

Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

Agency: _____ Phone Number: _____
Contact: _____ _____ _____
Name Title Date
Problems, suggestions (Describe below.); ☐ Report attached

4. Other interviews (optional) ☑ Report attached. Andrew Solomon (Associate Manager/Geologist at HGL)
Francis Coulters (Environmental Support Manager at U.S. Army Environmental Command)

III. ON-SITE 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 (Describe below.)

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 (Describe below.)

3. O&M and OSHA Training Records ☐ Readily available ☐ Up to date ☐ N/A

Remarks (Describe below.)

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 (Describe below.)

5. Gas Generation Records ☐ Readily available ☐ Up to date ☑ N/A

Remarks (Describe below.)

6. Settlement Monument Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

7. Groundwater Monitoring Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

8. Leachate Extraction Records ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

9. Discharge Compliance Records
☐ Air ☐ Readily available ☐ Up to date ☑ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

10. Daily Access/Security Logs ☐ Readily available ☐ Up to date ☑ N/A
Remarks (Describe below.)

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 (Describe below.)

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 _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

From _____ To _____ _____ ☐ Breakdown attached
Date Date Total Cost

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons below:

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. Fencing damaged ☐ Location shown on site map ☐ Gates secured ☑ N/A

Remarks (Describe below.)

B. Other Access Restrictions

1. Signs and other security measures ☐ Location shown on site map ☐ N/A

Remarks (Describe below.)

Signage was observed and in good condition.

C. Institutional Controls (ICs)

1. Implementation and enforcement

Site conditions imply ICs not properly implemented	☐ Yes	☑ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☑ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Self-Reporting

Frequency: Annual

Responsible Party/Agency: U.S. Army Phone Number:

Contact: Chris Manikas (Name) MMRP/IRP Program Manager (Title) 3/17/2022 (Date)

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
Violations have been reported	☐ Yes	☐ No	☑ N/A

Other problems or suggestions (Describe below.) ☐ Report attached

2. Adequacy ☑ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks (Describe below.)

D. General

1. Vandalism/trespassing ☐ Location shown on site map ☑ No vandalism evident

Remarks

2. Land use changes on site ☑ N/A

Remarks

No changes in land use were observed.

3. Land use changes off site ☑ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. Roads damaged ☐ Location shown on site map ☐ Roads are adequate ☐ N/A

Remarks

Site access roads were accessible and well maintained.

B. Other Site Conditions

Remarks

Site is heavily vegetated.

VII. LANDFILL COVERS ☐ Applicable ☑ N/A

A. Landfill Surface

1. Settlement (Low spots) ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

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

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

Areal extent _____

Remarks

B. Benches ☐ Applicable ☐ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay

Remarks

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay

Remarks

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay

Remarks

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 and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement

Areal extent _____ Depth _____

Remarks

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal extent _____
Remarks

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks

5. Obstructions ☐ Location shown on site map ☐ No obstructions
Type _____ Size _____
Remarks

6. Excessive Vegetative Growth ☐ No evidence of excessive growth
Type _____
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. Gas Vents ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

2. Gas Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. Leachate Extraction Wells

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance

Remarks

2. Gas Collection Wells, Manifolds and Piping

☐ Good condition ☐ Needs Maintenance

Remarks

3. Gas Monitoring Facilities (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. Siltation ☐ Siltation not evident ☐ N/A

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

3. Outlet Works ☐ Functioning ☐ N/A
Remarks

4. Dam ☐ Functioning ☐ N/A
Remarks

H. Retaining Walls ☐ Applicable ☐ N/A

1. Deformations ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks

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 ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☑ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Performance Monitoring Type of monitoring _____ ☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____

Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☑ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical

☐ Good condition ☐ Needs Maintenance

Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☐ Good condition ☐ Needs Maintenance

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. Treatment Train (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters _____
☐ Additive (*e.g.*, chelation agent, flocculent) _____
☐ Others _____
☐ Good condition_____
☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually _____
☐ Quantity of surface water treated annually _____

Remarks

2. Electrical Enclosures and Panels (properly rated and functional) ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

3. Tanks, Vaults, Storage Vessels ☐ N/A

☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks

4. Discharge Structure and Appurtenances ☐ N/A

☐ Good condition ☐ Needs Maintenance

Remarks

5. Treatment Building(s) ☐ N/A

☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks

D. Monitoring Data

1. Monitoring Data

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A

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.).

The site inspection determined that the selected remedies appear to be functioning as designed. The site is heavily vegetated. No evidence of unauthorized ground disturbance or land use was observed. Site access point was accessible and well maintained. Signage was observed and in good condition.

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.

The site inspection team did not identify any issues of observations related to the implementation and scope of O&M procedures.

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.

The site inspection team did not identify any issues or observations that suggest that the protectiveness of the remedy may be compromised in the future.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The site inspection team did not identify any opportunities for optimization of the remedy.

Site Inspection Team Roster:

Chris Manikas (U.S. Army, MMRP/IRP Program Manager)
Bryce Zinckgraf (HGS, Environmental Engineer)
Rob Norwillo (HGS, Environmental Scientist III)

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APPENDIX C
SITE INSPECTION PHOTOGRAPH LOG

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FORT BELVOIR
Photograph Log

Photo 1	**SITE ID:** FTBL-68	**SITE NAME:** M-26 Hydrocarbon Spill Area	**DATE:** 3/14/2022	**DIRECTION:** SW	**COMMENTS:** Heavy vegetation observed at the site.	
Photo 2	**SITE ID:** FTBL-68	**SITE NAME:** M-26 Hydrocarbon Spill Area	**DATE:** 3/14/2022	**DIRECTION:** SE	**COMMENTS:** Fairfax County Parkway interchange present at the site.	
Photo 3	**SITE ID:** FTBL-68	**SITE NAME:** M-26 Hydrocarbon Spill Area	**DATE:** 3/14/2022	**DIRECTION:** SE	**COMMENTS:** Monitoring wells were secured and appear to be well maintained.	

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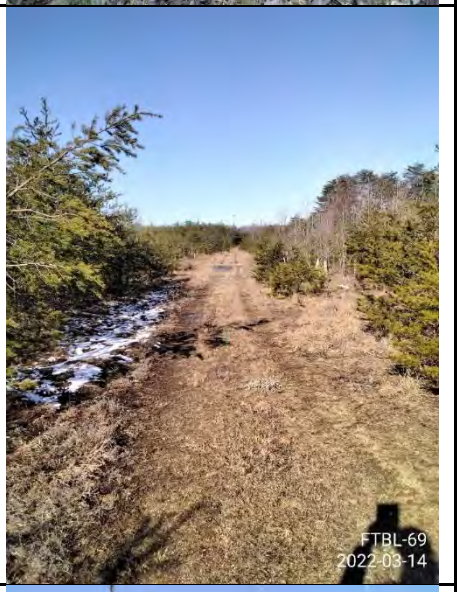
Photo 4	**SITE ID:** FTBL-68	**SITE NAME:** M-26 Hydrocarbon Spill Area	**DATE:** 3/14/2022	**DIRECTION:** SE	**COMMENTS:** Small unnamed stream observed at the site.	
Photo 5	**SITE ID:** FTBL-69	**SITE NAME:** M-27 Waste Ordnance Pit at Range 1	**DATE:** 3/14/2022	**DIRECTION:** W	**COMMENTS:** Site access path was well maintained. Moderate vegetation was observed throughout site.	
Photo 6	**SITE ID:** FTBL-69	**SITE NAME:** M-27 Waste Ordnance Pit at Range 1	**DATE:** 3/14/2022	**DIRECTION:** N	**COMMENTS:** Monitoring wells were secured and appear to be well maintained. Moderate vegetation was observed throughout site.	

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Photo 7	**SITE ID:** FTBL-69	**SITE NAME:** M-27 Waste Ordnance Pit at Range 1	**DATE:** 3/14/2022	**DIRECTION:** NW	**COMMENTS:** Signage was posted and well maintained.	
Photo 8	**SITE ID:** FTBL-69	**SITE NAME:** M-27 Waste Ordnance Pit at Range 1	**DATE:** 3/14/2022	**DIRECTION:** N	**COMMENTS:** Former Building 2081 was observed at the site.	
Photo 9	**SITE ID:** FTBL-69	**SITE NAME:** M-27 Waste Ordnance Pit at Range 1	**DATE:** 3/14/2022	**DIRECTION:** NW	**COMMENTS:** Concrete debris (traffic barriers) observed at the site.	

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Photo 10	**SITE ID:** FTBL-69	**SITE NAME:** M-27 Waste Ordnance Pit at Range 1	**DATE:** 3/14/2022	**DIRECTION:** NW	**COMMENTS:** Concrete pad and debris observed at the site.	
Photo 11	**SITE ID:** FTBL-001-R-02	**SITE NAME:** Infiltration Course	**DATE:** 3/14/2022	**DIRECTION:** NW	**COMMENTS:** Warning sign at access path to site. Access path is a recreational trail accessible to the public. Signage and access path were well maintained.	
Photo 12	**SITE ID:** FTBL-001-R-02	**SITE NAME:** Infiltration Course	**DATE:** 3/14/2022	**DIRECTION:** W	**COMMENTS:** Heavy vegetation observed at the site. No signs of soil disturbing activities were observed.	

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Photo 13	**SITE ID:** FTBL-001-R-02	**SITE NAME:** Combat Range Complex	**DATE:** 3/14/2022	**DIRECTION:** W	**COMMENTS:** Trees mitigation on site and riprap installed on side slope.	
Photo 14	**SITE ID:** FTBL-003-R-01	**SITE NAME:** Combat Range Complex	**DATE:** 3/14/2022	**DIRECTION:** SE	**COMMENTS:** Warning signage posted at access point to site from unnamed road. Vehicle access was restricted by a secured chain.	
Photo 15	**SITE ID:** FTBL-003-R-01	**SITE NAME:** Combat Range Complex	**DATE:** 3/14/2022	**DIRECTION:** S	**COMMENTS:** Warning signage was posted and well maintained at the site. Signs for recreational trails were also observed.	

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Photo 16	**SITE ID:** FTBL-003-R-01	**SITE NAME:** Combat Range Complex	**DATE:** 3/14/2022	**DIRECTION:** S	**COMMENTS:** Heavy vegetation observed at the site.	
Photo 17	**SITE ID:** FTBL-005-R-05 & FTBL-005-R-08	**SITE NAME:** Inert Mine Testing Area at Range 5 & Range 5 (Building 5091)	**DATE:** 3/14/2022	**DIRECTION:** E	**COMMENTS:** Access gate off Rolling Road was secured and well maintained. Educational signage was posted on the gate.	
Photo 18	**SITE ID:** FTBL-005-R-05 & FTBL-005-R-08	**SITE NAME:** Inert Mine Testing Area at Range 5 & Range 5 (Building 5091)	**DATE:** 3/14/2022	**DIRECTION:** E	**COMMENTS:** No Trespassing sign posted on tree near site access gate. Site is heavily vegetated.	

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Photo 19	**SITE ID:** FTBL-005-R-05 & FTBL-005-R-08	**SITE NAME:** Inert Mine Testing Area at Range 5 & Range 5 (Building 5091)	**DATE:** 3/14/2022	**DIRECTION:** W	**COMMENTS:** Monitoring wells were secured and appear to be well maintained.	
Photo 20	**SITE ID:** FTBL-005-R-05 & FTBL-005-R-08	**SITE NAME:** Inert Mine Testing Area at Range 5 & Range 5 (Building 5091)	**DATE:** 3/14/2022	**DIRECTION:** NW	**COMMENTS:** Monitoring well M32-MW02 adjacent to the former bunker (Building 2091).	
Photo 21	**SITE ID:** FTBL-005-R-05 & FTBL-005-R-08	**SITE NAME:** Inert Mine Testing Area at Range 5 & Range 5 (Building 5091)	**DATE:** 3/14/2022	**DIRECTION:** SW	**COMMENTS:** Heavy vegetation observed at the site near the former bunker (Building 2091).	

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Photo 22	**SITE ID:** FTBL-005-R-05 & FTBL-005-R-08	**SITE NAME:** Inert Mine Testing Area at Range 5 & Range 5 (Building 5091)	**DATE:** 3/14/2022	**DIRECTION:** N	**COMMENTS:** Investigation-derived waste (IDW) drums and secondary containment pad associated with groundwater monitoring activities at the site.	
Photo 23	**SITE ID:** FTBL-005-R-05 & FTBL-005-R-08	**SITE NAME:** Inert Mine Testing Area at Range 5 & Range 5 (Building 5091)	**DATE:** 3/14/2022	**DIRECTION:** SE	**COMMENTS:** Unlabeled drum observed near the former bunker (Building 2091).	
Photo 24	**SITE ID:** FTBL-005-R-05 & FTBL-005-R-08	**SITE NAME:** Inert Mine Testing Area at Range 5 & Range 5 (Building 5091)	**DATE:** 3/14/2022	**DIRECTION:** SW	**COMMENTS:** Fort Belvoir North Area northern installation boundary fencing damaged by fallen trees near the site.	

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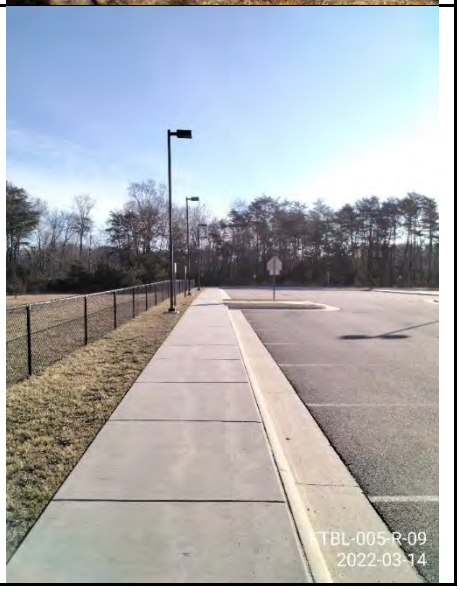
Photo 25	**SITE ID:** FTBL-005-R-05 & FTBL-005-R-08	**SITE NAME:** Inert Mine Testing Area at Range 5 & Range 5 (Building 5091)	**DATE:** 3/14/2022	**DIRECTION:** S	**COMMENTS:** Waste tires observed near site access gate indicative of illegal dumping activities.	
Photo 26	**SITE ID:** FTBL-005-R-05 & FTBL-005-R-08	**SITE NAME:** Inert Mine Testing Area at Range 5 & Range 5 (Building 5091)	**DATE:** 3/14/2022	**DIRECTION:** E	**COMMENTS:** Tree stand indicative of recreational use of the site.	
Photo 27	**SITE ID:** FTBL-005-R-09	**SITE NAME:** FBNA Soils and Groundwater	**DATE:** 3/14/2022	**DIRECTION:** NE	**COMMENTS:** Perimeter fence and parking lot of Fort Belvoir North Area Child Development Center (CDC) located at the site.	

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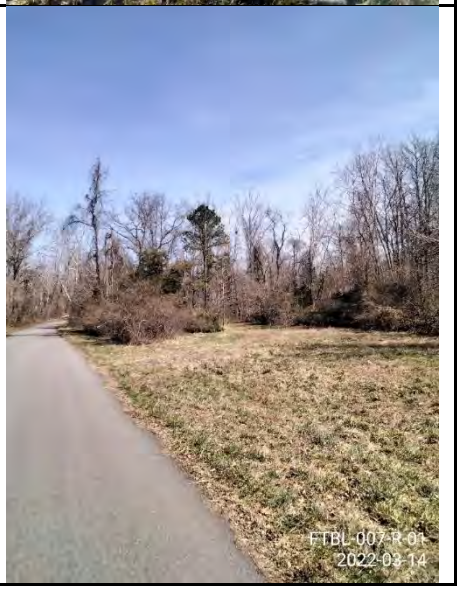
Photo 28	**SITE ID:** FTBL-005-R-09	**SITE NAME:** FBNA Soils and Groundwater	**DATE:** 3/14/2022	**DIRECTION:** E	**COMMENTS:** Stick-up monitoring wells were secured and appear to be well maintained.	
Photo 29	**SITE ID:** FTBL-005-R-09	**SITE NAME:** FBNA Soils and Groundwater	**DATE:** 3/14/2022	**DIRECTION:** SE	**COMMENTS:** Flush-mount monitoring wells were secured and appear to be well maintained.	
Photo 30	**SITE ID:** FTBL-007-R-01	**SITE NAME:** Grenade Court	**DATE:** 3/14/2022	**DIRECTION:** NE	**COMMENTS:** Site access road (Poe Road) was well maintained. Heavy vegetation was observed at the site.	

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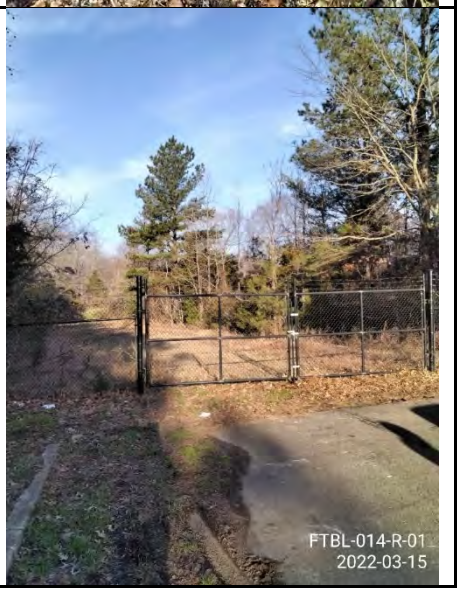
Photo 31	**SITE ID:** FTBL-007-R-01	**SITE NAME:** Grenade Court	**DATE:** 3/14/2022	**DIRECTION:** SE	**COMMENTS:** Warning sign posted at the site near recreational trail accessible to the public.	
Photo 32	**SITE ID:** FTBL-007-R-01	**SITE NAME:** Grenade Court	**DATE:** 3/14/2022	**DIRECTION:** E	**COMMENTS:** Signage was posted and well maintained.	
Photo 33	**SITE ID:** FTBL-014-R-01	**SITE NAME:** Tracy Road Range	**DATE:** 3/15/2022	**DIRECTION:** W	**COMMENTS:** Access gate off Tracy Loop was secured and well maintained.	

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Photograph Log

Photo 34	**SITE ID:** FTBL-014-R-01	**SITE NAME:** Tracy Road Range	**DATE:** 3/15/2022	**DIRECTION:** NE	**COMMENTS:** Concrete wall backstop associated with the historical western berm.	
Photo 35	**SITE ID:** FTBL-014-R-01	**SITE NAME:** Tracy Road Range	**DATE:** 3/15/2022	**DIRECTION:** W	**COMMENTS:** Tree stand indicative of recreational use of the site.	
Photo 36	**SITE ID:** FTBL-014-R-01	**SITE NAME:** Tracy Road Range	**DATE:** 3/15/2022	**DIRECTION:** NE	**COMMENTS:** Western concrete wall**.**	

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Photograph Log

Photo 37	**SITE ID:** FTBL-018-R-01	**SITE NAME:** Demolition Area - 01	**DATE:** 3/14/2022	**DIRECTION:** S	**COMMENTS:** Signage posted on fencing on Plantation Drive.	
Photo 38	**SITE ID:** FTBL-018-R-01	**SITE NAME:** Demolition Area - 01	**DATE:** 3/14/2022	**DIRECTION:** NW	**COMMENTS:** Signage posted near Dogue Creek. Site is heavily vegetated. .	
Photo 39	**SITE ID:** FTBL-018-R-01	**SITE NAME:** Demolition Area - 01	**DATE:** 3/14/2022	**DIRECTION:** NE	**COMMENTS:** Fencing damaged by fallen trees along Plantation Drive.	

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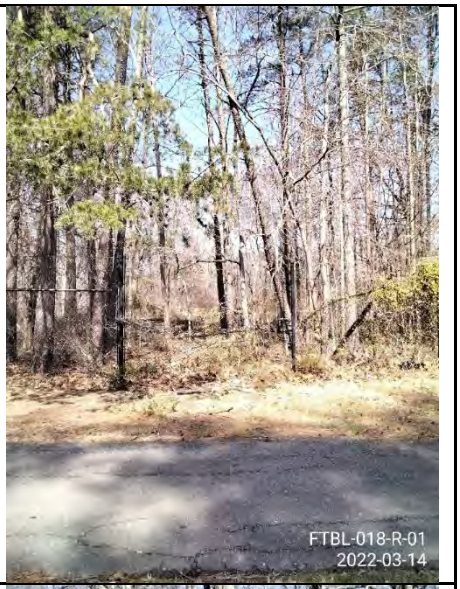
Photograph Log

Photo 40	**SITE ID:** FTBL-018-R-01	**SITE NAME:** Demolition Area - 01	**DATE:** 3/14/2022	**DIRECTION:** N	**COMMENTS:** Fencing damaged by fallen trees and recreation trail along Plantation Drive.	
Photo 41	**SITE ID:** FTBL-024-R-01	**SITE NAME:** Booby Trap Site	**DATE:** 3/14/2022	**DIRECTION:** NE	**COMMENTS:** Signage posted and well maintained on fencing along Johnston Road.	
Photo 42	**SITE ID:** FTBL-025-R-01	**SITE NAME:** Demolition Area - USACE	**DATE:** 3/14/2022	**DIRECTION:** NE	**COMMENTS:** Signage was posted and well maintained near Kingman Road.	

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Photograph Log

Photo 43	**SITE ID:** FTBL-026-R-01	**SITE NAME:** Mines and Booby Trap Area	**DATE:** 3/14/2022	**DIRECTION:** SW	**COMMENTS:** Site access point off Farrar Drive.	
Photo 44	**SITE ID:** FTBL-026-R-01	**SITE NAME:** Mines and Booby Trap Area	**DATE:** 3/14/2022	**DIRECTION:** NW	**COMMENTS:** Heavy vegetation and concrete debris observed at the site.	
Photo 45	**SITE ID:** FTBL-027-R-01	**SITE NAME:** T-16	**DATE:** 3/14/2022	**DIRECTION:** N	**COMMENTS:** Signage posted adjacent to Woodlawn Road.	

FORT BELVOIR
Photograph Log

	SITE ID:	SITE NAME:	DATE:	DIRECTION:	COMMENTS:	
Photo 46	FTBL-027-R-01	T-16	3/14/2022	E	Signage posted and well maintained. Site is heavily vegetated.	

APPENDIX D
INTERVIEW SUMMARIES

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INTERVIEW RECORD

Site Name: Fort Belvoir		**EPA ID No.:**
Subject: Five-Year Review		**Time:** **Date**: 03/17/2022
Type: □ Telephone X Visit □ Other **Location of Visit:** Fort Belvoir		□ Incoming □ Outgoing
Contact Made By:		
Name: Rob Norwillo	**Title:** Environmental Scientist III	**Organization:** HGS
Individual Contacted:		
Name: Chris Manikas	**Title:** MMRP/IRP Manager	**Organization:** Fort Belvoir DPW
Telephone No: **Fax No:** **E-mail Address:**	**Street Address:** **City, State, Zip:**	

Summary of Conversation

Operations and Maintenance

1. **What is your overall impression of the project?**

For the 14 sites evaluated under the FYR, they are predominantly military munitions sites, and they are all functioning according to their remedy requirements. Many of them are in long-term monitoring; so they are either being monitored for groundwater or land use.

2. **Is the remedy functioning as expected? How are they performing?**

The groundwater remedies (LTM, MNA, etc.) have shown concentrations are declining. A lot of the properties are planned to be developed for future use. So those are performing very well.

3. **What does the monitoring data show? Are there any trends showing contaminant levels are decreasing?**

Yes, there are trends, and we are actually below our remedial goals at many of the sites. We are hoping to be able to close those sites out early and not have to continue monitoring them for 30 years. We are very encouraged by the five-year sites.

4. **Is there a continuous on-site 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.**

There is not a continuous on-site presence for many of the FYR sites. All of the sites are inspected annually and for sites with groundwater monitoring they are inspected quarterly or semi-annually, depending on the decision document requirements. HGL may seem like a continuous presence because there are so many sites, but they aren't on a single site continuously.

5. **Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years?**

I haven't been here since start-up, but since we have started the monitoring programs, the schedules have been the same. There hasn't been any change. Once we meet our remedial goals, we are hoping for massive changes to close out a lot of these sites for future development.

6. Do any of these maintenance schedules affect the effectiveness of the remedies?

No.

7. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details.

No. We have a really good report with the state representatives who are partners on these sites under CERCLA. So, there is a lot of communication and there aren't changes to requirements.

8. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings, or improved efficiency.

Where we can, we chop down the analyte list if we have pretty good historical data. We don't want to keep analyzing for things that we aren't detecting. So, we do make optimizations in those areas. But for the most part, everything is very straight forward.

9. Do you have any comments, suggestions, or recommendations regarding the project?

I review all the documents that come through, and I'm notorious for having many comments. Overall though, I think we are doing everything we need to do in accordance with how it should be done.

Institutional Controls

1. Have any breaches of the ICs occurred, complaints been filed, or unusual activities been noted at the site (e.g., citizens are consuming fish at a contaminated sediment site)?

All of our sites are secured, particularly the munitions sites. They do allow hunting in these areas, but it's very controlled. We know when and where the hunters are on site. But generally, there are no opportunities for the public to interact within the sites, such as with fishing.

2. Has the federal agency or federal facility site reported status of the ICs or LUCs as required?

No. We aren't an NPL site; so, EPA isn't really involved. This is a state-lead facility, so there aren't any federal reporting requirements or any reporting on their part.

3. What type of monitoring is currently being conducted or has been conducted to determine IC compliance?

We do annual inspections to verify signage and land use. We evaluate sites that have monitoring wells to ensure they are in good shape. And sites, depending on the decision document have different requirements for inspections, be it quarterly or semi-annually.

4. Are ICs being enforced? What is the enforcement plan in the case of an IC breach?

Yes. In the case of an IC breach, it wouldn't be so egregious as to have a military or police presence on site. We do try to keep people out of areas that are posted and fenced. We have had occasions where people steal the signs from our sites, but if we find an issue at any of our sites, we have a procedure in place to have the police on site. We did have an incident where a neighbor to one of the sites actually scaled the fence and got in because he was concerned that we were about to develop a property right next to his, and he wanted to know what was going on. But the police were informed to take care of the situation and send him back to his house.

5. Are there any new developments, either constructed or planned, in the area of which the entity is aware?

Yes, nothing has been constructed, as of yet. But there are a couple of areas of very large 150-acre swaths of property, particularly in the north area, where developments are going in. I cannot discuss the developments since they are secure. Those are in the planning stages and surveys are currently taking place for those developments.

6. Has land use changed or is it anticipated to change (e.g., housing developments, either constructed or planned, exist in the area)?

Yes, land use will be changing at some of our areas to include some housing that's planned. But I'm not sure what the schedule is for that.

7. Does the entity have an IC tracking system or other applicable databases to keep information about the ICs?

We try to keep track of it through Master Planning and their GIS department. It's a little glitchy as far as keeping things up to date. We actually developed a GIS layer on our own to show all the LUCs for each of the sites because that was something that the state wanted to see routinely. So, we did that on our own in the Environmental department and gave that to the GIS department to import into the system.

8. Can the ICs or engineering controls be registered in the states one-call system?

When we issue dig permits, they're responsible for calling Miss Utility, which is local utility locator and off-post call system, to come in prior to digs and make sure they don't have something that we don't know about on the facility even for sites on post because there are private utilities that have operations on post.

9. How has the IC process been working and are there any suggestions for improvement?

The IC process I think is working very well as long as we can maintain our signage and keep control of the property access. The only area I could see improvement with is integrating more with the GIS and the Master Planning office.

INTERVIEW RECORD

Site Name: Fort Belvoir		**EPA ID No.:**
Subject: Five-Year Review		**Time:** **Date**: 03/17/2022
Type: x Telephone □ Visit □ Other **Location of Visit:** Fort Belvoir		□ Incoming □ Outgoing
Contact Made By:		
Name: Bryce Zinckgraf	**Title:** Environmental Engineer	**Organization:** HGS
Individual Contacted:		
Name: Angela McGarvey	**Title:** Project Manager for Fort Belvoir CERCLA sites	**Organization:** Virginia Department of Environmental Quality
Telephone No: **Fax No:** **E-mail Address:**	**Street Address:** **City, State, Zip:**	

Summary of Conversation

State and Local Representatives

1. **What is your overall impression of the project?**

The Army's Environmental clean-up program for Fort Belvoir is managed under the CERCLA framework and regulations continue to be successful to investigate and clean-up historical contamination both effectively and efficiently.

2. **Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.**

DEQ participates in a monthly call with Fort Belvoir Tier 1 partnering team where we review the status of site's remedies and identify action items needed by members. DEQ also participates in quarterly Tier 1 partnering meetings where a facilitator leads more in depth discussions on topics needing to advance sites through the CERCLA process. DEQ also manages dates for site visits during remedial activities. Since the last five-year review, sites that I've seen undertake remedial activities were the Demolition Area 01, Combat Range Complex, Infiltration Course, and the Booby Trap Site.

3. **Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.**

No. DEQ reviews reports and provides comments as needed to raise our concerns. The Army works with DEQ to resolve any concerns. Currently DEQ is seeking additional clarification from the Army to be sure that the land use controls at former munitions sites are properly implemented during site construction.

4. **Do you feel well informed about the site's activities and progress?**

Yes. Through regular meetings and email communication, DEQ is kept well informed.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

The management of site operations becomes complicated with properties that are not under direct management by the Army. We see this at the Demolition Area - USAEC property, and we're working with the Army to ensure the facilities are properly transferred. Also, future development during site construction is always a concern to make sure the proper munitions clearances are done, and the findings are shared with DPW, as well as DEQ. It is likely that many former ranges are developed over the next five-years at Fort Belvoir given its current anticipated future development. The Army should continue to evaluate the effectiveness of the dig permit process to make any modifications in the process through the LUCIPs as needed. Lastly, the process through which the GIS and base Master Plan are updated in the future needs to be reviewed to ensure future updates are timely. The GIS layer needs to accurately reflect land use controls. The base Master Plan could be updated and improved to better describe status.

INTERVIEW RECORD

Site Name: Fort Belvoir	**EPA ID No.:**	
Subject: Five-Year Review	**Time:**	**Date**: 03/18/2022
Type: x Telephone □ Visit □ Other **Location of Visit:** Fort Belvoir	□ Incoming □ Outgoing	

Contact Made By:

Name: Rob Norwillo	**Title:** Environmental Scientist III	**Organization:** HGS

Individual Contacted:

Name: Alexander Smith	**Title:** Project Manager	**Organization:** HGL

Telephone No: **Fax No:** **E-mail Address:**	**Street Address:** **City, State, Zip:**

Summary of Conversation

Operations and Maintenance Operators

1. Can you give a brief introduction?

I'm a project manager for several different task orders for Fort Belvoir and have been working on these projects since about 2009.

2. What is your overall impression of the project?

I think the project is doing well. I think that the Army is working well with the state, particularly on these CERCLA sites. I think the state is very engaged on all these sites. The Army has started a partnering meeting group with the state and meets quarterly and HGL speaks with the state once a month. I think the sites are moving along well; some of the sites are in the final stages and some still need a little work to go to get to the remedy. But I think it's overall a good project.

3. Is the remedy functioning as expected? How well is the remedy performing?

The remedies for these sites are typically land use controls, and they are performing well. They're under annual inspections. FTBL-68 and FTBL-69, the groundwater sites, and there are a few more, just have groundwater monitoring starting. They're functioning as expected.

4. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

The groundwater sites here have just had groundwater monitoring begun within the last 6 months. So we don't have a long record of post-remedy groundwater sampling. But what we are seeing in general is that the sites have had concentrations declining since the investigation stage, and with the long-term monitoring (LTM), we are seeing general declines, partly due to an active removal of contaminated soil. I think we are seeing general contaminant declines here.

5. Is there a continuous on-site 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.

There's no active O&M going on or staff on site at all times. The remedies are groundwater sampling annually or semi-annually for groundwater sites. The munitions sites have land use controls, and we do annual inspections for those.

6. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

In general, there are no changes. I will say that some of these sites are at the Fort Belvoir North area where there is a relatively new requirement for construction activities, that whoever is doing the construction do a munitions removal action on the munitions sites. And that's a new policy from the Army that came into place under what was originally called Policy Memorandum 28. They've since revised that. It essentially says that if you're going to do any construction at any former range, you need to do a munitions clearance/munitions removal. That conflicts a little bit with the land use control implementation plans (LUCIPS) that we've written for those sites. So, we're in a process now to align the LUCIPS with this current new policy.

7. Have there been unexpected O&M difficulties or costs at the sites since start-up or in the last five years? If so, please give details.

The difficulties are all associated with construction taking place at the Fort Belvoir North area. When they were doing the investigation phase for many of the groundwater sites, they installed monitoring wells and evaluated the sites. Then construction projects come in, since a large section of the Fort Belvoir North area is being redeveloped, and wells get lost and abandoned. So, these monitoring points go missing and have to be replaced. For both FTBL-68 and FTBL-69, I believe they had to put in new monitoring systems. So getting the existing monitoring wells to match up with the historical data and reestablishing what the contaminant plumes look like at this site has been a little bit challenging. Really the only difficulty is the construction projects that have overlapped the environmental sites.

8. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings, or improved efficiency.

I think it's early. I believe this is the first five-year review. The construction projects have probably delayed some of the LTM sampling. I don't there is a lot of data to demonstrate optimization of the sampling programs could be done. And there are no active remedies for optimization. There really haven't been any opportunities yet to optimize.

9. Do you have any comments, suggestions, or recommendations regarding the project?

Nothing I can think of.

Institutional controls (ICs)

1. Have any breaches of the ICs occurred, complaints been filed, or unusual activities been noted at the site (e.g., citizens are consuming fish at a contaminated sediment site)? If so, how were they addressed?

To my knowledge, no. There isn't any fencing that precludes someone accessing an area; so those kinds of breaches aren't an issue. All these sites you can access. There are warning signs advising you about the site and what hazards may be present. But I can't think of any construction projects that have gone on without being run through the DPW dig permit process. Not aware of any breaches.

2. Has the federal agency (for a federal facility site) reported on the status of the ICs or LUCs as required?

Yes. I believe the Army has a very good relationship with the state regulator at the site. So for any annual inspection we do for LUCs and LUCIPS we develop, the reports go to the state for review. And that would be the only agency I can think of that the Army would need to report to and they've been doing so.

3. What type of monitoring is currently being conducted or has been conducted to determine IC compliance (e.g., follow-up inspections)?

For the munitions sites, we do annual inspections of signage and annual inspections of the dig permit process. There are some groundwater restrictions for the groundwater sites. HGL has not done our first inspections yet, since those sites are new to us. But those will likely be rolled into an annual inspection to make sure nobody is consuming groundwater which is not an issue.

4. Are ICs being enforced? What is the enforcement plan in the event of an IC breach?

They are being enforced by the Army. If there was a breach, I would assume they would correct the problem and notify the state regulator. The enforcement plan is the dig permitting process that the DPW uses.

5. Are there any new developments, either constructed or planned, in the area of which the entity is aware?

Yes. The Fort Belvoir North area is where some of these sites are and is undergoing a lot of redevelopment. There are at least two new agencies that are building rather large campuses. So, those are in the works. I think they will be breaking ground within the next two years. I know the Army is taking precautions to ensure that they address the LUC requirements. There are other sites on the main post, former ranges, that I'm not aware of any construction for. The Demolition Area USACE site, which is not owned by Fort Belvoir, but by the Corps of Engineers, is being monitored by the Corps themselves. Some portions of these sites are rented to an agency that has a housing complex. But as far as future construction, I'm not aware of any except for at the sites mentioned.

6. Has land use changed or is it anticipated to change (e.g., housing developments, either constructed or planned, exist in the area)?

I'm not aware of that. Fort Belvoir North has all gone industrial, no residential and that's not going to change. And for the sites on the main post, they've already established either industrial or residential use. Some may come up for construction, but I don't foresee any drastic change in land use.

7. Does the entity have an IC tracking system or other applicable database (e.g., GIS maps) to keep information about ICs?

Yes. They have a GIS system at the DPW and there's a requirement to apply for a dig permit before any construction projects break ground. So there's a process in place, and that process alerts the Environmental portion of DPW when a construction project overlaps an environmental site. So the Environmental group can check to make sure what LUCs are needed.

8. Can the ICs or engineering controls be registered in the state's one-call system?

I suppose they could be, but since DPW has its own system, I don't see the need to duplicate that information. The Army is in a much better position to control the LUCs and requirements than the blanket one-call system.

9. How has the IC process been working and are there any suggestions for improvement?

I think it's generally been working pretty well. There were some issues with the GIS system they were using that was not providing all the necessary information within the GIS. It was a kind of two-step thing where you had to

go to the GIS, but then you had to go to other documents to find the requirements. There was an effort to incorporate all the requirements into the GIS, but I'm not sure how that has progressed. But that's definitely something to make it more efficient. But the IC process has been working.

INTERVIEW RECORD

Site Name: Fort Belvoir	**EPA ID No.:**	
Subject: Five-Year Review	**Time:**	**Date**: 03/18/2022
Type: x Telephone □ Visit □ Other **Location of Visit:** Fort Belvoir	□ Incoming □ Outgoing	

Contact Made By:

Name: Bryce Zinckgraf	**Title:** Environmental Engineer	**Organization:** HGS

Individual Contacted:

Name: Andrew Solomon	**Title:** Associate Manager/Geologist	**Organization:** HGL

Telephone No:	**Street Address:**
Fax No:	**City, State, Zip:**
E-mail Address:	

Summary of Conversation

Operations and Maintenance Operators

1. **What is your overall impression of the project?**

It's a well-run project and a pretty good team working with the Corps and Fort Belvoir, with Chris Manikas being the main point of contact for most Belvoir sites. I have a positive overall view of the project.

2. **Is the remedy functioning as expected? How well is the remedy performing?**

Each site has its own remedy, and each remedy has its own challenges. Overall, the remedies are performing as intended.

3. **What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?**

Speaking to the M-32 and M-33 site, we did the first round of sampling last fall and concentrations seemed to be pretty constant with no apparent increasing or decreasing trends for the explosive analytes that we are looking for.

4. **Is there a continuous on-site 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.**

There aren't continuous staff for these five-year review sites that I'm aware of. I believe our frequency is semi-annual for groundwater sampling at the M-32 and M-33 sites and LUC inspections are annual.

5. **Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.**

We are sticking with the long-term monitoring plan established by the previous contractor for the M-32 and M-33 sites. And there have been no changes for those sites.

6. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details.

There isn't really any O&M at these sites. I'm not familiar with the other sites on the list beside M-32 and M-33, so I can't speak for those.

7. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings, or improved efficiency.

Not yet. We've only sampled the M-32/M-33 site once. We're always looking for ways to optimize by reducing the number of wells, analyte list, or frequency of sampling, but at this moment no optimization has occurred.

8. Do you have any comments, suggestions, or recommendations regarding the project?

Not for these sites.

Institutional controls (ICs)

1. Have any breaches of the ICs occurred, complaints been filed, or unusual activities been noted at the site (e.g., citizens are consuming fish at a contaminated sediment site)? If so, how were they addressed?

For M-32/M33, no breaches have occurred. At this time, the Army is planning some construction for some buildings, parking lots, and other things. So, they will certainly have to abide by the ICs, but at this point no issues.

2. Has the federal agency (for a federal facility site) reported on the status of the ICs or LUCs as required?

I'm not sure.

3. What type of monitoring is currently being conducted or has been conducted to determine IC compliance (e.g., follow-up inspections)?

Annual LUC inspections at M-32/M33 site. The next inspection will occur in Spring 2022.

4. Are ICs being enforced? What is the enforcement plan in the event of an IC breach?

They are being enforced. We would notify Chris Manikas at the base in the event we found any breaches of ICs.

5. Are there any new developments, either constructed or planned, in the area of which the entity is aware?2

Yes, for a general area north of M-32/M-33 there is planned construction by the Army beginning in about a year beginning with vegetation clearing.

6. Has land use changed or is it anticipated to change (e.g., housing developments, either constructed or planned, exist in the area)?

Based on the anticipated construction activities, land use will change.

7. Does the entity have an IC tracking system or other applicable database (e.g., GIS maps) to keep information about ICs?

It does, but I'm not sure what the exact name of the database is.

8. Can the ICs or engineering controls be registered in the state's one-call system?

I'm unfamiliar with the one-call system.

9. How has the IC process been working and are there any suggestions for improvement?

The ICs for these sites are working well and are pretty straight forward. I have no recommendations at this time.

INTERVIEW RECORD

Site Name: Fort Belvoir	**EPA ID No.:**	
Subject: Five-Year Review	**Time:**	**Date**: 03/21/2022
Type: x Telephone □ Visit □ Other **Location of Visit:** Fort Belvoir	□ Incoming □ Outgoing	

Contact Made By:

Name: Bryce Zinckgraf	**Title:** Environmental Engineer	**Organization:** HGS

Individual Contacted:

Name: Francis Coulters	**Title:** Environmental Support Manager	**Organization:** U.S. Army Environmental Command

Telephone No: (210)-466-1094	**Street Address:** 2450 Connell Road
Fax No:	**City, State, Zip:** Fort Sam Houston, Texas 78234
E-mail Address:	

Summary of Conversation

Operations and Maintenance Operators

1. What is your overall impression of the project?

Generally speaking, Fort Belvoir does a nice job managing the program for the FYR sites. Looking at the list of sites under this review, they currently all have land use controls. Fort Belvoir has a lot of sites that have land use controls because of the best management practices (BMPs) for Fort Belvoir: number one, not using groundwater for drinking water purposes; and land use controls when they do dig permits anywhere on Fort Belvoir North and Fort Belvoir.

2. Is the remedy functioning as expected? How well is the remedy performing?

The remedies for the five-year review sites are working out well. All of the sites have land use controls in some shape or fashion.

3. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

I think FTBL-69 is the only one in question. The rest of the sites are just land use controls for dig permitting stuff. FTBL-69, the Waste Ordnance Pit, that site we had a little uptick years ago, but it's been consistently going lower and we're hoping to get a monitored natural attenuation without an active remedy at the site.

4. Is there a continuous on-site 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.

The on-site staff would be Chris Manikas right now who is a Department of the Army civilian, but we have contractors who make many trips to the facility because we have so many sites, most under remedial action operations (RA-O) or long-term monitoring (LTM) phases. They also have other active remedy sites that are in the remedial investigation feasibility study (RI/FS) and remedial action construction (RAC) and design phases. We have contractors out there constantly.

5. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

The only thing we've experienced on site is the more active state regulatory engagement. They're heavily pushing the unexploded ordnance (UXO) part of it. We don't find a lot of UXO there; most of what they've found are training rounds. But there aren't any changes that have significantly impacted activities at the five-year review sites.

6. Have there been unexpected O&M difficulties or costs at the sites since start-up or in the last five years? If so, please give details.

No. None. We don't have any real O&M difficulties at the five-year review sites. Once they move on to the Record of Decisions (RODs) and Decision Documents (DDs), the state regulators, who are primarily regulatory agency, they'll be looking for additional things we can do.

7. Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings, or improved efficiency.

I don't see anything that significantly changes our O&M activities at the site.

8. Do you have any comments, suggestions, or recommendations regarding the project?

I do not for the purpose of the five-year review.

Institutional controls (ICs)

1. Have any breaches of the ICs occurred, complaints been filed, or unusual activities been noted at the site (e.g., citizens are consuming fish at a contaminated sediment site)? If so, how were they addressed?

I'm not aware of any for the five-year review sites. As far as breaches, I would have been notified, but I haven't heard about anything unusual for these sites.

2. Has the federal agency (for a federal facility site) reported on the status of the ICs or LUCs as required?

Yes. Depending on the frequency, they do the land use inspections that are needed at Fort Belvoir for the five-year review sites, and we have contractors doing that.

3. What type of monitoring is currently being conducted or has been conducted to determine IC compliance (e.g., follow-up inspections)?

All of them have land use controls (LUCs), so they do land use inspections every year. The only outlier is the Demolition Area U.S. Army Corps of Engineers (USACE) site, which we include in the five-year review but is not mandated to follow the dig permit process, but we still do the land use controls inspections for it. But to answer the question, yes, we do inspections to ensure IC compliance at all the sites.

4. Are ICs being enforced? What is the enforcement plan in the event of an IC breach?

They are being enforced and we haven't had any breaches. The installation DPW is increasingly getting the environmental office more involved in planning activities when they identify future construction projects; so it's going well as far as ICs being enforced.

5. Are there any new developments, either constructed or planned, in the area of which the entity is aware?

Yes. The Fort Belvoir North area has pending construction activities and DPW is coordinating within their organization to include the environmental team in planning. We're also getting the Virginia Department of Environmental Quality more involved when these construction activities are going to impact any of our sites at the Fort Belvoir North area.

6. Has land use changed or is it anticipated to change (e.g., housing developments, either constructed or planned, exist in the area)?

Neither. However, at the Demolition Area-01 site, I think they were planning some new housing units. Chris Manikas would have more information on that. I saw it when I was there for the site visit a couple weeks ago. That's all I can think of for planned construction activities. However, the construction activities that I've seen are within the current housing area footprint which would be different than going outside of that footprint. There are no construction activities planned for outside of that footprint that I'm aware of.

7. Does the entity have an IC tracking system or other applicable database (e.g., GIS maps) to keep information about ICs?

Yes. They have GIS.

8. Can the ICs or engineering controls be registered in the state's one-call system?

No. It's already covered under Fort Belvoir's GIS system.

9. How has the IC process been working and are there any suggestions for improvement?

I think it works pretty well and it works better than it used to.

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APPENDIX E
ANALYTICAL DATA

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APPENDIX E

Historical Groundwater Analytical Data for FTBL-68 (M-26)

FIVE YEAR REVIEW

FORT BELVOIR, VIRGINIA

Sample Location	Sample Date	Benzene (µg/L)	Methylene Chloride (µg/L)	2-Methyl-naphthalene (µg/L)	Naphthalene (µg/L)
	RGs	5	5	24	6.5
M26-LTM-01	8/1/2012	**3.4 J**	NA	**1.5**	**1.8**
	4/24/2014	**3.8**	4.0 U	**1.0**	**2.0**
	7/15/2014	**8.3**	2.0 U	**1.5**	**3.2**
	5/30/2018	**6.22**	0.5 U	**0.522**	**1.58**
	10/4/2018	**7.69**	0.5 U	**0.418**	**1.42**
	5/21/2019	**6.6**	0.5 U	**0.503**	**1.34**
	10/29/2019	**7.3**	0.5 U	**1.09**	**3.19**
	11/5/2020	**5.57**	0.5 U	**0.995**	**2.33**
	3/2/2021	**5.40**	0.500 U	**0.700 J**	**1.80 J**
M26-LTM-02	8/1/2012	0.11 U	NA	0.012 U	0.014 U
	5/14/2018	0.25 U	0.5 U	0.0556 UJ	0.0556 UJ
	10/3/2018	0.25 U	0.5 U	0.055 U	**0.0318 J**
	5/23/2019	0.25 U	0.5 U	0.0562 U	0.0562 U
	10/30/2019	0.25 U	0.5 U	0.0568 U	**0.101 J**
	11/5/2020	0.25 U	0.5 U	0.0556 U	0.0556 U
	3/3/2021	0.250 U	0.500 U	0.0500 U	0.0500 U
M26-LTM-03	8/1/2012	**0.96 J**	NA	0.012 U	**0.076 J**
	4/24/2014	**1.6**	1.0 U	**0.1 J**	**0.2**
	7/16/2014	0.5 U	1.0 U	0.1 U	**0.07 J**
	5/30/2018	**0.261 J**	0.5 U	0.0724 U	**0.0535 J**
	10/4/2018	0.25 U	0.5 U	**0.0411 J**	**0.0644 J**
	5/23/2019	0.25 U	0.5 U	**0.0722 J**	**3.71**
	10/30/2019	**0.246 J**	0.5 U	**0.0456 J**	**0.106 J**
	11/4/2020	0.25 U	0.5 U	0.0515 U	0.0515 U
	3/4/2021	0.250 U	0.500 U	**0.0264 J**	**0.0843 J**
M26-LTM-04	8/1/2012	**2.60**	NA	0.012 U	0.014 U
	8/1/2012 (Dup)	**2.60**	NA	0.012 U	0.014 U
	4/23/2014	**2.3**	1.0 U	0.1 U	**0.05 J**
	4/23/2014 (Dup)	**2.2**	1.0 U	0.1 U	0.1 U
	7/16/2014	**2.1**	2.0 U	0.1 U	**0.07 J**
	7/16/2014 (Dup)	**2.2**	1.0 U	0.1 U	**0.07 J**
	5/14/2018	**1.55**	0.5 U	0.055 UJ	0.055 UJ
	10/5/2018	**1.68**	0.5 U	0.0544 U	0.0544 U
	10/5/2018 (Dup)	**1.68**	0.5 U	0.0544 U	0.0544 U
	5/21/2019	**1.48**	0.5 U	0.0562 U	0.0562 U
	5/21/2019 (Dup)	**1.56**	0.5 U	0.0532 U	0.0532 U
	10/29/2019	**1.60**	0.5 U	0.0544 U	0.0544 U
	10/29/2019 (Dup)	**1.53**	0.5 U	0.0538 U	0.0538 U
	11/5/2020	**1.2**	0.5 U	0.0515 U	0.0515 U
	11/5/2020 (Dup)	**1.15**	0.5 U	0.0538 U	0.0538 U
	3/4/2021	**1.25**	0.500 U	0.0568 U	**0.0477 J**
	3/4/2021 (Dup)	**0.896**	0.500 U	0.0532 U	**0.0355 J**

APPENDIX E
Historical Groundwater Analytical Data for FTBL-68 (M-26)
FIVE YEAR REVIEW
FORT BELVOIR, VIRGINIA

Sample Location	Sample Date	Benzene (µg/L)	Methylene Chloride (µg/L)	2-Methyl-naphthalene (µg/L)	Naphthalene (µg/L)
	RGs	5	5	24	6.5
M26-LTM-05	8/1/2012	**4.8**	NA	**0.3**	**0.87**
	4/25/2014	**11.2 J**	2.7 U	**0.5 J**	**4.6 J**
	7/15/2014	**11.6**	2.0 U	**1.9**	**7.0**
	5/31/2018	**3.08**	0.5 U	**0.0638 J**	**0.392**
	10/3/2018	0.25 U	0.5 U	**0.159**	**0.137**
	5/20/2019	**2.66**	0.5 U	**0.314**	**0.319**
	10/29/2019	0.25 U	0.5 U	**0.0317 J**	**0.0627 J**
	11/3/2020	0.25 U	0.5 U	0.0556 U	**0.028 J**
	3/3/2021	0.250 U	0.500 U	0.0549 U	**0.0358 J**
M26-LTM-06	8/1/2012	0.11 U	NA	0.012 U	0.014 U
	4/25/2014	0.5 UJ	1.0 U	0.1 UJ	0.1 UJ
	7/16/2014	0.5 U	1.0 U	0.1 U	0.1 U
	5/14/2018	0.25 U	0.5 U	0.0556 UJ	0.0556 UJ
	10/12/2018	0.25 U	**0.317 J**	0.0556 U	0.0556 U
	5/22/2019	0.25 U	0.5 U	0.0556 U	0.0556 U
	10/29/2019	0.25 U	0.5 U	0.0532 U	0.0532 U
	11/3/2020	0.25 U	0.5 U	0.0505 U	0.0505 U
	3/2/2021	0.250 U	0.500 U	0.0500 U	**0.0302 J**

Notes:

1. RG indicates Remedial Goal.
2. µg/L indicates micrograms per liter.
3. Dup indicates duplicate sample.
4. U indicates the analyte was not detected above the reported method detection limit.
5. J indicates the reported result is estimated.
6. Bold text indicates the analyte was detected.
7. Shaded cells with bold text indicate the analyte was detected above its RG.
8. RGs established in the Decision Document for M-26 (Tetra Tech, 2007).

APPENDIX E

Historical Groundwater Analytical Data for FTBL-68 (FATTS)

FIVE YEAR REVIEW

FORT BELVOIR, VIRGINIA

Sample Location	Sample Date	1,2-DCA (µg/L)	Benzene (µg/L)	Chloroform (µg/L)	EDB (µg/L)	Methylene Chloride (µg/L)	2-Methyl-naphthalene (µg/L)	Naphthalene (µg/L)
	RGs	5	5	100	0.05	5	24	6.5
FATTS-LTM-MW03	8/1/2012	**5.3**	**35**	**0.32 J**	**0.64 J**	NA	**0.046 J**	**1.4**
	5/17/2018	**2.04**	**13.1**	0.25 U	**0.197 J**	0.5 U	**0.0517 J**	**2.59**
	10/2/2018	**2.25**	**14.2**	0.25 U	**0.192**	0.5 U	**0.0545 J**	**2.95**
	5/23/2019	**2.55**	**16.1**	0.25 U	**0.272 J**	0.5 U	**0.0356 J**	0.0538 U
	10/30/2019	**2.52**	**17.8**	**0.126 J**	**0.271**	0.5 U	**0.0892 J**	**4.2**
	10/30/2019 (Dup)	**2.74**	**17.7**	0.25 UJ	**0.27**	0.5 U	**0.0979 J**	**4.35**
	11/3/2020	0.5 U	**0.73**	0.25 U	**0.032 J**	0.5 U	0.0549 U	**0.212**
	3/2/2021	**1.74**	**11.7**	0.250 U	**0.219**	0.5 U	**0.0337 J**	**2.65 J**
FATTS-LTM-MW08	8/1/2012	**2.3**	0.11 U	0.17 U	0.18 U	NA	0.012 U	0.014 U
	4/24/2014	**2.9**	0.5 U	0.5 U	0.5 U	1.0 U	0.1 U	0.1 U
	7/15/2014	**3.1**	0.5 U	0.5 U	0.5 U	1.0 U	0.1 U	0.1 U
	5/16/2018	**1.51**	0.25 U	0.25 U	0.0222 UJ	0.5 U	0.0618 U	0.0618 U
	10/5/2018	**1.6**	0.25 U	0.25 U	0.0218 U	0.5 U	0.055 U	0.055 U
	5/24/2019	**1.68**	0.25 U	0.25 U	**0.0136 J**	0.5 U	0.0574 U	0.0574 U
	10/28/2019	**2.17**	0.25 U	0.25 U	0.0218 U	0.5 U	0.0782 U	0.0782 U
	11/4/2020	0.5 U	0.25 U	0.25 U	0.01 U	0.5 U	0.0556 U	0.0556 U
	3/3/2021	**1.16**	0.25 U	0.25 U	0.010 U	0.5 U	0.0568 U	0.0568 U
FATTS-LTM-MW09	8/1/2012	**370**	**4300**	50 U	50 U	NA	**3.6**	**32 J**
	4/24/2014	**228**	**3830**	25 U	**18.2 J**	50 U	**18.1 J**	**52.8 J**
	7/15/2014	**219**	**3960**	10 U	**24.5**	20 U	**6.0**	**37.7**
	5/16/2018	**180**	**1380**	**1.33**	**7.63 J**	**0.637 J**	**15.8**	**73.3**
	10/5/2018	**121**	**653**	**1.14 J**	**4.71**	5.0 U	0.0526 UJ	0.0526 UJ
	5/22/2019	**185**	**1420**	**1.06 J**	**6.23 J**	2.5 U	**7.71 J**	**40.7 J**
	10/31/2019	**133**	**1190**	2.5 U	**5.81**	5 U	**26.5**	**103**
	11/4/2020	**113**	**1480**	**0.83**	**3.76**	0.5 U	**8.94 J**	**37.3**
	3/3/2021	**143**	**916**	**0.723**	**3.36**	**0.871 J**	**4.42 J**	**33.9 J**

APPENDIX E

Historical Groundwater Analytical Data for FTBL-68 (FATTS)

FIVE YEAR REVIEW

FORT BELVOIR, VIRGINIA

Sample Location	Sample Date	1,2-DCA (µg/L)	Benzene (µg/L)	Chloroform (µg/L)	EDB (µg/L)	Methylene Chloride (µg/L)	2-Methyl-naphthalene (µg/L)	Naphthalene (µg/L)
	RGs	5	5	100	0.05	5	24	6.5
FATTS-LTM-MW10	8/1/2012	**5.2**	0.11 U	0.17 U	0.18 U	NA	0.012 U	0.013 U
	4/24/2014	**4.0**	0.5 U	0.5 U	0.5 U	1.0 U	0.1 U	0.1 U
	7/16/2014	**1.8**	0.5 U	0.5 U	0.5 U	1.0 U	0.1 U	0.1 U
	5/16/2018	**2.01**	0.25 U	0.25 U	0.0228 UJ	0.5 U	0.0626 U	**0.059 J**
	10/1/2018	**1.34**	0.25 U	0.25 U	0.0224 U	0.5 U	0.055 U	0.055 U
	5/24/2019	**0.621 J**	0.25 U	0.25 U	0.022 U	0.5 U	0.051 U	0.051 U
	10/28/2019	**1.49**	0.25 U	0.25 U	0.022 U	0.5 U	0.0574 U	0.0574 U
	11/5/2020	**1.00**	0.25 U	0.25 U	0.01 U	0.5 U	0.0543 U	0.0543 U
	3/4/2021	**0.666 J**	0.25 U	0.25 U	0.010 U	0.5 U	0.0538 U	0.0538 U
FATTS-LTM-MW11	8/1/2012	**1.2**	**5.3**	0.2 U	**0.22 J**	NA	0.029 U	**0.079 J**
	5/30/2018	**1.81**	**13.3**	0.25 U	**0.141**	0.5 U	0.0568 U	**0.959**
	10/2/2018	**1.97**	**17.6**	0.25 U	**0.168**	0.5 U	**0.0292 J**	**1.16**
	5/23/2019	**3.58**	**34.9**	**0.129 J**	**0.457 J**	0.5 U	**0.0273 J**	**3.03**
	10/30/2019	**3.54**	**33.5**	**0.16 J**	**0.412**	0.5 U	**0.0434 J**	**2.82**
	11/3/2020	**1.03**	**10.3**	0.25 U	**0.142**	0.5 U	0.11 U	**0.846**
	3/2/2021	**1.97**	**13.1**	0.25 U	**0.255**	0.5 U	0.0543 U	**0.825 J**
FATTS-LTM-MW12	8/1/2012	0.3 U	**1.4**	0.2 U	0.2 U	NA	0.031 U	0.042 U
	5/30/2018	0.5 U	**0.463 J**	0.25 U	0.0214 U	0.5 U	0.0562 U	**0.0725 J**
	5/30/2018 (Dup)	0.5 U	**0.483 J**	0.25 U	0.0212 U	0.5 U	0.0516 U	**0.0647 J**
	10/5/2018	0.5 U	**0.196 J**	0.25 U	0.0216 U	0.5 U	0.0516 U	**0.0434 J**
	10/5/2018 (Dup)	0.5 U	**0.178 J**	0.25 U	0.0222 U	0.5 U	0.0516 U	**0.0504 J**
	5/22/2019	0.5 U	0.25 U	0.25 U	0.0222 UJ	0.5 U	0.0544 U	0.0544 U
	10/29/2019	0.5 U	0.25 U	0.25 U	0.0218 U	0.5 U	0.0556 U	**0.0279 J**
	11/4/2020	0.5 U	0.25 U	0.25 U	0.01 U	0.5 U	0.0549 U	**0.0342 J**
	3/1/2021	0.5 U	0.25 U	0.25 U	0.010 U	0.5 U	0.0526 U	0.0526 U

APPENDIX E
Historical Groundwater Analytical Data for FTBL-68 (FATTS)
FIVE YEAR REVIEW
FORT BELVOIR, VIRGINIA

Sample Location	Sample Date	1,2-DCA (µg/L)	Benzene (µg/L)	Chloroform (µg/L)	EDB (µg/L)	Methylene Chloride (µg/L)	2-Methyl-naphthalene (µg/L)	Naphthalene (µg/L)
	RGs	5	5	100	0.05	5	24	6.5
FATTS-LTM-MW13	8/1/2012	0.21 U	0.11 U	0.31 J	0.18 U	NA	0.012 U	0.014 U
	4/23/2014	0.5 U	0.5 U	0.5 U	0.5 U	1.0 U	0.1 U	0.1 U
	7/14/2014	0.5 U	0.5 U	0.5 U	0.5 U	1.0 U	0.1 U	0.1 U
	7/14/2014 (Dup)	0.5 U	0.5 U	0.5 U	0.5 U	1.0 U	0.1 U	0.1 U
	5/16/2018	0.5 U	0.25 U	0.25 U	0.0222 UJ	0.5 U	0.0544 U	0.0544 U
	10/4/2018	0.5 U	0.25 U	**0.133 J**	0.022 U	0.5 U	0.05 U	0.05 U
	5/21/2019	0.5 U	0.25 U	**0.152 J**	0.0216 UJ	0.5 U	0.0544 U	0.0544 U
	10/31/2019	0.5 U	0.25 U	**0.141 J**	0.0222 U	0.5 U	0.0556 U	**0.0302 J**
	11/2/2020	0.5 U	0.25 U	0.25 U	0.01 U	0.5 U	0.0543 U	0.0543 U
	3/1/2021	0.5 U	0.25 U	0.25 U	0.010 U	0.5 U	0.0562 U	0.0562 U
FATTS-LTM-MW14	8/1/2012	0.21 U	**0.22 J**	0.71 J	0.18 U	NA	0.012 U	0.059 J
	4/23/2014	0.5 U	0.5 U	0.5 U	0.5 U	1.0 U	0.1 U	0.1 U
	7/14/2014	0.5 U	0.5 U	0.5 U	0.5 U	1.0 U	0.1 U	0.1 U
	5/31/2018	0.5 U	0.25 U	0.25 U	0.0216 U	0.5 U	0.0532 U	0.0532 U
	5/31/2018 (Dup)	0.5 U	0.25 U	0.25 U	0.0222 U	0.5 U	0.0526 U	0.0526 U
	10/4/2018	0.5 U	0.25 U	0.25 U	0.0216 U	0.5 U	0.0538 U	0.0538 U
	5/21/2019	0.5 U	0.25 U	0.25 UJ	0.0222 UJ	0.5 U	0.052 U	0.052 U
	5/21/2019 (Dup)	0.5 U	0.25 U	**0.136 J**	0.0216 UJ	0.5 U	0.0526 UJ	0.0526 UJ
	10/31/2019	0.5 U	0.25 U	0.25 U	0.0222 U	0.5 U	0.055 U	0.055 U
	11/2/2020	0.5 U	0.25 U	0.25 U	0.01 U	0.5 U	0.0538 U	0.0538 U
	11/2/2020 (Dup)	0.5 U	0.25 U	0.25 U	0.01 U	0.5 U	0.0556 U	0.0556 U
	3/1/2021	0.5 U	0.25 U	0.25 U	0.010 U	0.5 U	0.0562 U	0.0562 U
	3/1/2021 (Dup)	0.5 U	0.25 U	0.25 U	0.010 U	0.5 U	0.0543 U	0.0543 U

Notes:

1. DCA indicates dichloroethane.
2. EDB indicates ethylene dibromide.
3. RG indicates Remedial Goal.
4. µg/L indicates micrograms per liter.
5. Dup indicates duplicate sample.
6. U indicates the analyte was not detected above the reported method detection limit.
7. J indicates the reported result is estimated.
8. Bold text indicates the analyte was detected.
9. Shaded cells with bold text indicate the analyte was detected above its RG.
10. RGs established in the Decision Document for FATTS (Tetra Tech, 2007).

APPENDIX E
Historical Groundwater Analytical Data for FTBL-69 (M-27)
FIVE YEAR REVIEW
FORT BELVOIR, VIRGINIA

Sample Location	Sample Date	2,4,6-TNT (µg/L)	2,4-DNT (µg/L)	2,6-DNT (µg/L)	2A-DNT (µg/L)	4A-DNT (µg/L)	RDX (µg/L)
	Remedial Goals	**2.5**	**2.1**	**2.1**	**0.5**	**0.5**	**19**
MW01	2/5/2005	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	11/30/2005	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	4/9/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	6/11/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	6/11/2007 (Dup)	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/11/2007	0.26 U	**0.15 J**	**0.24 J**	0.26 U	0.26 U	0.52 U
	12/10/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.37 J**
	4/9/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.32 J**
	6/10/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/2/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.18 J**
	12/2/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	12/6/2018	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	**1 J**
MW02	2/5/2005	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	**4.1 J**
	11/30/2005	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	**1.2 B**
	4/9/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	**8.4**
	6/11/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**4.6 J**
	9/11/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	12/11/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**2.6 J**
	4/9/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**8.0 K**
	6/10/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**6.0 J**
	9/2/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**8.1**
	12/2/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**4.9 K**
	12/6/2018	0.54 U	0.54 U	0.54 U	0.54 U	0.54 U	**0.598 J**
MW03	2/5/2005	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	12/2/2005	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	4/9/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	6/11/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/11/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	**0.15 J**
	12/10/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.33 J**
	12/10/2007 (Dup)	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	4/9/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	6/10/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/2/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	12/1/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	12/5/2018	0.54 U	0.54 U	0.54 U	0.54 U	0.54 U	0.54 U

APPENDIX E
Historical Groundwater Analytical Data for FTBL-69 (M-27)
FIVE YEAR REVIEW
FORT BELVOIR, VIRGINIA

Sample Location	Sample Date	2,4,6-TNT (µg/L)	2,4-DNT (µg/L)	2,6-DNT (µg/L)	2A-DNT (µg/L)	4A-DNT (µg/L)	RDX (µg/L)
	Remedial Goals	**2.5**	**2.1**	**2.1**	**0.5**	**0.5**	**19**
MW04	2/5/2005	**2.4**	**0.37**	**0.17 J**	**0.89**	**1.1**	**24 J**
	12/1/2005	**2.9**	**0.63**	**0.43**	**0.96**	**1.2**	**22**
	4/9/2007	**2.1**	**0.64**	**0.26 J**	**0.83**	**0.92**	**17**
	6/11/2007	**1.4 J**	0.2 U	**0.23**	0.2 U	**0.66 J**	**11 J**
	9/11/2007	**4.6**	**0.61**	**0.5**	**0.92**	**0.91**	**20**
	9/11/2007 (Dup)	**4.4**	**0.58**	**0.52**	**0.88**	**0.87**	**19**
	12/10/2007	**0.8 J**	0.2 U	**0.061 J**	**0.26**	**0.24 J**	**6.7 J**
	12/10/2007 (Dup)	**1 J**	0.2 U	**0.082 J**	**0.34 J**	**0.34 J**	**9.1 J**
	4/9/2008	**0.29**	0.2 U	0.2 U	**0.15 J**	**0.18 J**	**5.5**
	6/10/2008	**1.9**	0.2 U	0.2 U	**0.60 J**	**0.69 J**	**13**
	9/3/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	12/1/2008	**1.2**	**0.31**	**0.21**	**0.40 J**	**0.48**	**11**
	12/10/2018	0.54 U	0.54 U	0.54 U	0.54 U	**3.49 J**	**2.58**
MW05	5/18/2005	**0.5 J**	**0.36 J**	**0.68**	**0.67**	**0.75**	**3.5**
	12/1/2005	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	**1.2 B**
	4/6/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	6/11/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/10/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	12/10/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	4/10/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.23 J**
	6/11/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/3/2008	**2.3**	**0.58**	**0.29 J**	**0.90**	**1.0**	**16**
	12/1/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	12/5/2018	0.54 U	0.54 U	0.54 U	0.54 U	0.54 U	0.54 U
MW08	5/18/2005	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	11/30/2005	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	4/10/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	6/12/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/11/2007	**1.2**	**0.11 J**	0.26 U	**0.81**	**1.2**	**2.2**
	12/10/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	4/9/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	6/10/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/2/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
	12/2/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	12/6/2018	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U

APPENDIX E

Historical Groundwater Analytical Data for FTBL-69 (M-27)

FIVE YEAR REVIEW

FORT BELVOIR, VIRGINIA

Sample Location	Sample Date	2,4,6-TNT (µg/L)	2,4-DNT (µg/L)	2,6-DNT (µg/L)	2A-DNT (µg/L)	4A-DNT (µg/L)	RDX (µg/L)
	Remedial Goals	**2.5**	**2.1**	**2.1**	**0.5**	**0.5**	**19**
MW09	5/18/2005	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	**5.2**
	11/30/2005	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	4/10/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	**2.5**
	6/11/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**1.7 J**
	9/11/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	**0.13 J**
	12/10/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	4/9/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.80**
	6/10/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/2/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**1.3**
	12/1/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.31 J**
	12/6/2018	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	**1.86**
MW11	12/1/2005	**8.9**	**0.56**	**0.4**	**1**	**1.1**	**27**
	4/6/2007	**6.5**	**0.36**	**0.31**	**0.59 J**	**0.78**	**20**
	6/12/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**3.2**
	9/10/2007	**5.5**	**0.38**	**0.25 J**	**0.64**	**0.54 J**	**17**
	9/10/2007 (Dup)	**5.2**	**0.37**	**0.24 J**	**0.61**	**0.53**	**16**
	12/11/2007	**9 J**	**0.47 J**	**0.27 J**	**0.76**	**0.55 J**	**29 J**
	4/10/2008	**6.7**	**0.50**	**0.35 J**	**0.65**	**0.69**	**18**
	6/11/2008	**6.3**	**0.56 J**	0.2 U	**0.58 J**	**0.64 J**	**17**
	9/3/2008	**0.26 K**	0.2 U	0.2 U	0.2 U	0.2 U	**1.3 J**
	9/3/2008 (Dup)	0.2 U	0.2 U	0.2 U	**1.1**	0.2 U	**26**
	12/1/2008	**8.4 K**	**0.64 K**	**0.45 K**	**0.80 K**	**1.0**	**28 K**
	12/1/2008 (Dup)	**8.7 K**	**0.65 K**	**0.47 K**	**0.85 K**	**1.0**	**30 K**
	12/10/2018	**2.91**	**0.485 J**	**1.1 J**	**0.306 J**	0.59 U	**18**
	12/10/2018 (Dup)	**3.04**	**0.51 J**	**1.16**	**0.324 J**	0.56 U	**18.6**
MW12	12/2/2005	0.26 U	**0.19 J**	**0.39**	0.26 U	0.26 U	0.52 U
	4/10/2007	0.26 U	0.26 U	**0.39**	0.26 U	0.26 U	0.52 U
	4/10/2007 (Dup)	0.26 U	0.26 U	**0.44**	0.26 U	0.26 U	0.52 U
	6/12/2007	0.2 U	0.2 U	**2.1 K**	0.2 U	0.2 U	0.4 U
	9/11/2007	0.26 U	0.26 U	0.26 U	**0.073 J**	**0.08 J**	**1.3**
	12/10/2007	0.2 U	**0.83 J**	**9.3 J**	0.2 U	0.2 U	0.4 U
	4/9/2008	0.2 U	**0.25 K**	**1.2 K**	0.2 U	0.2 U	0.4 U
	6/10/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/2/2008	0.2 U	**0.13 J**	**0.74**	0.2 U	0.2 U	0.4 U
	9/2/2008 (Dup)	0.2 U	**0.21**	**0.87**	0.2 U	0.2 U	0.4 U
	12/1/2008	0.2 U	**0.80**	**0.50 J**	0.2 U	0.2 U	0.4 U
	12/1/2008 (Dup)	0.2 U	**0.74**	**0.46**	0.2 U	0.2 U	0.4 U
	12/6/2018	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U

APPENDIX E

Historical Groundwater Analytical Data for FTBL-69 (M-27)

FIVE YEAR REVIEW

FORT BELVOIR, VIRGINIA

Sample Location	Sample Date	2,4,6-TNT (µg/L)	2,4-DNT (µg/L)	2,6-DNT (µg/L)	2A-DNT (µg/L)	4A-DNT (µg/L)	RDX (µg/L)
	Remedial Goals	**2.5**	**2.1**	**2.1**	**0.5**	**0.5**	**19**
MW15	4/6/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	6/12/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/10/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	12/11/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.71 J**
	4/10/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	6/10/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/3/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	12/2/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	12/5/2018	0.54 U	0.54 U	0.54 U	0.54 U	0.54 U	0.54 U
MW16	4/9/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	6/12/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/10/2007	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.52 U
	12/11/2007	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	4/10/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	6/10/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	9/3/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	12/1/2008	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4 U
	12/5/2018	0.52 U	0.52 U	0.52 U	0.52 U	0.52 U	0.52 U
MW18	4/10/2007	**1.5**	**0.28**	0.26 U	**0.34 J**	**0.5**	**19**
	6/12/2007	**1.5 K**	**0.22 K**	**0.27 K**	**0.39 J**	**0.5 K**	**14 K**
	9/10/2007	**1.1**	**0.27 J**	**0.28**	**0.2 J**	**0.39**	**16**
	12/10/2007	**1.5 J**	**0.27 J**	**0.22 J**	**0.32 J**	**0.48 J**	**25 J**
	4/10/2008	**0.39 J**	**0.082 J**	**0.12 J**	**0.13 J**	**0.19 J**	**6.1 J**
	4/10/2008 (Dup)	**1 J**	**0.20 J**	**0.22 J**	**0.28 J**	**0.36 J**	**13 J**
	6/11/2008	**0.49**	0.2 U	0.2 U	0.2 U	0.2 U	**4.6**
	9/2/2008	**2.8 K**	**0.43**	**0.39**	**0.61 J**	**0.71**	**24**
	12/1/2008	**0.5**	0.2 U	0.2 U	**0.12 J**	**0.16 J**	**5.5**
	12/6/2018	**0.484 J**	0.53 U	0.53 U	0.53 U	0.53 U	**7.12**
MW19	4/10/2007	**8.4**	**0.34 J**	0.26 U	**0.56**	**0.88**	**12**
	6/12/2007	**6.4 J**	**0.25**	0.2 U	**0.30 J**	**0.42 J**	**8.3**
	6/12/2007 (Dup)	**9.2 J**	**0.33 J**	**0.23 J**	**0.45 J**	**0.68 J**	**11**
	9/10/2007	**22**	**0.56**	**0.3**	**0.83**	**1.2**	**20**
	12/10/2007	**8.5 J**	**0.2 J**	0.2 U	**0.5 J**	**0.75 J**	**8.7 J**
	4/9/2008	**2.4**	0.2 U	0.2 U	**0.17 J**	**0.32**	**4.8 J**
	6/10/2008	**0.83**	0.2 U	0.2 U	0.2 U	**0.24 J**	**2.8 J**
	6/10/2008 (Dup)	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**1 J**
	9/2/2008	**3.4 K**	0.2 U	**0.059 J**	**0.31 J**	**0.46**	**6.0**
	12/1/2008	**7.0**	**0.25 J**	**0.15 J**	**0.35 J**	**0.73 J**	**12 J**
	12/10/2018	0.51 U	0.51 U	0.51 U	0.51 U	0.51 U	0.51 U

APPENDIX E
Historical Groundwater Analytical Data for FTBL-69 (M-27)
FIVE YEAR REVIEW
FORT BELVOIR, VIRGINIA

Sample Location	Sample Date	2,4,6-TNT (µg/L)	2,4-DNT (µg/L)	2,6-DNT (µg/L)	2A-DNT (µg/L)	4A-DNT (µg/L)	RDX (µg/L)
	Remedial Goals	**2.5**	**2.1**	**2.1**	**0.5**	**0.5**	**19**
MW22	12/7/2018	**0.548 J**	0.55 U	0.55 U	**0.881 J**	**1.32**	**9.5**
MW23	12/6/2018	0.55 U	0.55 U	0.55 U	0.55 U	**0.31 J**	**4.33**
MW24	12/6/2018	0.63 U	0.63 U	0.63 U	0.63 U	0.63 U	**0.805 J**
MW25	12/7/2018	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	**2.97**
	12/7/2018 (Dup)	0.51 U	0.51 U	0.51 U	0.51 U	0.51 U	**2.86**
MW26	12/6/2018	0.54 U	0.54 U	**0.289 J**	0.54 U	**4.07 J**	**6.04 J**
MW27	12/7/2018	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	**4.7**
MW28	12/7/2018	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U	0.56 U
MW29	3/22/2019	0.59 U	0.59 U	0.59 U	0.59 U	0.59 U	0.59 U
MW30	3/22/2019	0.62 UJ	0.62 U	0.62 U	0.62 U	0.62 U	0.62 U
MW31	3/22/2019	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U

Notes:

1. TNT indicates trinitrotoluene.
2. DNT indicates dinitrotoluene.
3. 2A-DNT indicates 2-amino-4,6-dinitrotoluene.
4. 4A-DNT indicates 4-amino-2,6-dinitrotoluene.
5. RDX indicates hexahydro-1,3,5-trinitro-1,3,5-triazine.
6. µg/L indicates micrograms per liter.
7. Dup indicates duplicate sample.
8. U indicates the analyte was not detected above the reported method detection limit.
9. J indicates the reported result is estimated.
10. B indicates the reported value is not substantially different than the value for the associated method blank.
11. K indicates the reported value may be biased high.
12. Bold text indicates the analyte was detected.
13. Shaded cells with bold text indicate the analyte was detected above its remedial goal.
14. Remedial goals established in the FTBL-69 Explanation of Significant Differences (Plexus, 2021).

APPENDIX E
Historical Groundwater Analytical Data for FTBL-005-R-05 (M-33)
FIVE YEAR REVIEW
FORT BELVOIR, VIRGINIA

Sample Location	Sample Date	2,4-DNT/2,6-DNT (Mixture) (µg/L)	RDX (µg/L)
	Remedial Goal	**5.3**	**30**
M32-MW01	Feb-09	0.35 J	4.9
	Feb-09 (Dup)	0.31 J	4.5
	Jun-10	0.39 U	7.7
	Jun-14	0.051 J	14
M32-MW02	Feb-09	3.7	11
	Jun-10	3.9	19
	Jun-14	3.7	22
	Mar-21	2.3	4.1
M32-MW03	Feb-09	**14**	0.16 U
	Jun-10	**15**	0.29 U
	Jun-14	**11**	5.4 J
	Mar-21	**8.2**	6.1
	Mar-21 (Dup)	**8.1**	6.2
M33-MW01	Jun-10	0.31 U	3.2
	Jun-14	1.12	16
	Mar-21	0.12 U	3.4 J
M33-MW02	Feb-09	0.89	16
	Jun-10	1.0	16
	Jun-10 (Dup)	0.94	16
	Jun-14	0.7	21
M33-MW03	Feb-09	0.4 U	0.21 U
	Jun-10	0.38 U	0.2 U
	Jun-14	ND	ND
	Mar-21	0.12 U	0.12 U
M33-MW04	Feb-09	1.6	6.2
	Jun-10	1.4	3.7
	Jun-14	1.2	3.4 J
M33-MW05	Feb-09	3.9	13 J
	Jun-10	4.32	11
	Jun-14	1.84	14
	Mar-21	0.8	10
M33-MW06	Feb-09	0.31 U	0.16 U
M33-MW07	Feb-09	0.42 U	0.22 U
	Jun-10	0.31 U	0.16 U
	Jun-14	ND	ND
M33-MW08	Mar-09	0.4 U	2.4 J
	Jun-10	0.36 U	1.3
	Jun-14	0.032 J	6.3 J
M33-MW09	Mar-09	0.31 U	0.2 J
	Jun-10	0.33 U	0.17 U
	Jun-14	ND	ND
	Mar-21	0.12 U	0.12 U
M33-MW10	Feb-09	1.6	1.8 J
	Jun-10	0.35 J	0.37 U
	Jun-14	0.198 J	0.69

APPENDIX E
Historical Groundwater Analytical Data for FTBL-005-R-05 (M-33)
FIVE YEAR REVIEW
FORT BELVOIR, VIRGINIA

Sample Location	Sample Date	2,4-DNT/2,6-DNT (Mixture) (µg/L)	RDX (µg/L)
	Remedial Goal	5.3	30
M33-MW11	Mar-09	2.0	8.7 J
	Jun-10	2.21	7.6
	Jun-14	**7.26**	15
	Mar-21	2.88	22 J
M33-MW12	Mar-09	**75**	**90 J**
	Jun-10	**72**	**80**
	Jun-14	**13.18**	**130**
	Mar-21	1.2	**73 J**
M33-MW13	Mar-09	0.77 J	1.5 J
	Mar-09 (Dup)	0.78 J	1.6 J
	Jun-10	0.7	1.3
	Jun-14	0.8	2.9
M33-MW14	Feb-09	0.31 U	1.0 J
	Feb-09 (Dup)	0.4 U	1.6 J
	Jun-10	0.31 U	0.37
	Jun-10 (Dup)	0.31 U	0.37
	Jun-14	ND	7.1 J

Notes:

1. DNT indicates dinitrotoluene.
2. RDX indicates hexahydro-1,3,5-trinitro-1,3,5-triazine.
3. µg/L indicates micrograms per liter.
4. Dup indicates duplicate sample.
5. ND indicates not detected (detection limit not available).
6. U indicates the analyte was not detected above the reported method detection limit.
7. J indicates the reported result is estimated.
8. Shaded cells with bold text indicate the analyte was detected above its remedial goal.
9. Remedial goals established in the FTBL-005-R-05 Decision Document (USAEC, 2018).

APPENDIX E
Historical Groundwater Analytical Data for FTBL-005-R-09 (Child Development Center)
FIVE YEAR REVIEW
FORT BELVOIR, VIRGINIA

Sample Location	Sample Date	2,6-DNT (µg/L)	1,1'-Biphenyl (µg/L)	Hexachloro-benzene (µg/L)	Naphthalene (µg/L)	Benzo(a)-anthracene (µg/L)	Benzo(b)-fluoranthene (µg/L)	Benzo(a)pyrene (µg/L)	Indeno(1,2,3-cd)-pyrene (µg/L)	Dibenz(a,h)-anthracene (µg/L)
	Remedial Goal	**1.3**	**0.83**	**1**	**2.1**	**0.37**	**3.1**	**0.2**	**3.1**	**0.31**
CDC-MW01	2/8/2011	0.048 U	0.096 U	0.029 U	0.029 U	0.029 U	0.096 U	0.029 U	0.029 U	0.029 U
	3/14/2011	0.048 U	0.096 U	0.029 U	0.029 U	0.029 U	0.096 U	0.029 U	0.029 U	0.029 U
CDC-MW02	2/8/2011	0.048 U	0.096 U	0.029 U	0.029 U	**0.049 J**	**0.092 J**	**0.039 J**	**0.081 J**	**0.063 J**
	2/8/2011 (Dup)	0.048 U	0.096 U	0.029 U	0.029 U	0.029 U	0.096 U	0.029 U	0.029 U	0.029 U
	3/14/2011	0.048 U	0.096 U	0.029 U	0.029 U	0.028 U	0.094 U	0.028 U	0.028 U	0.028 U
	3/8/2021	0.25 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
	3/8/2021 (Dup)	0.25 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CDC-MW03	2/8/2011	0.048 U	0.094 U	0.028 U	0.029 U	0.28 U	0.094 U	0.28 U	0.028 U	0.028 U
	3/14/2011	0.048 U	0.096 U	0.029 U	0.029 U	0.029 U	0.096 U	0.029 U	0.029 U	0.029 U
	3/8/2021	0.25 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CDC-MW04	2/9/2011	0.048 U	0.094 U	0.028 U	0.029 U	0.28 U	0.094 U	0.28 U	0.028 U	0.028 U
	3/14/2011	0.048 U	0.095 U	0.028 U	0.029 U	0.28 U	0.094 U	0.28 U	0.028 U	0.028 U
	3/8/2021	0.25 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CDC-MW05	3/8/2021	0.25 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CDC-MW06	3/8/2021	0.25 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CDC-MW07	3/8/2021	0.25 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CDC-MW08	3/8/2021	0.25 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

Notes:
1. DNT indicates dinitrotoluene.
2. µg/L indicates micrograms per liter.
3. Dup indicates duplicate sample.
4. U indicates the analyte was not detected above the reported method detection limit.
5. J indicates the reported result is estimated.
6. Bold text indicates the analyte was detected.
7. Shaded cells with bold text indicate the analyte was detected above its remedial goal.
8. Remedial goals established in the FTBL-005-09 Decision Document (USAEC, 2020).

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APPENDIX F
DATA TREND ANALYSIS

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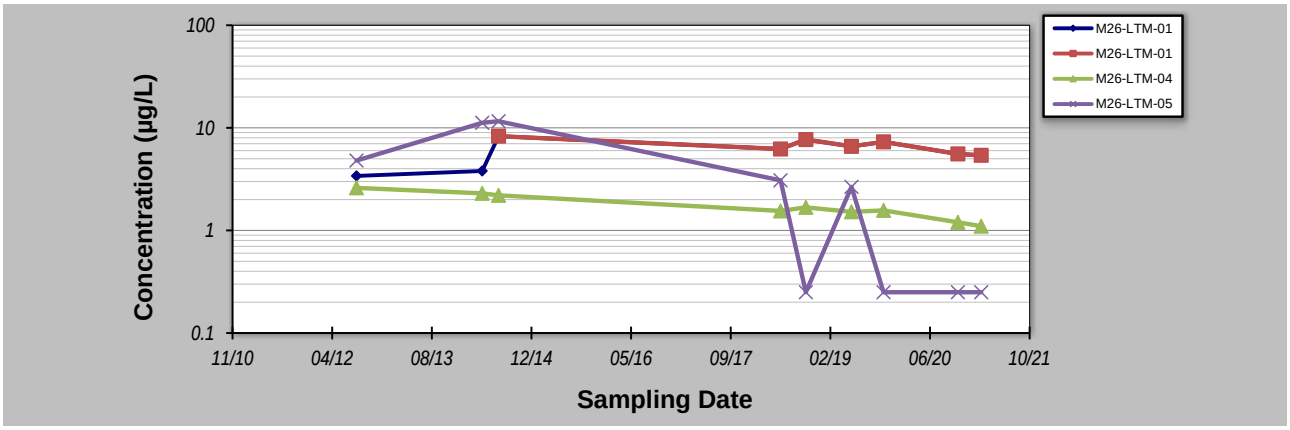
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 4-Mar-22
Facility Name: FTBL-68 (M-26)
Conducted By: Bryce Zinckgraf, P.E.

Job ID: Five Year Review, Fort Belvoir, Virginia
Constituent: Benzene
Concentration Units: µg/L

Sampling Point ID:	M26-LTM-01	M26-LTM-01	M26-LTM-04	M26-LTM-05			
Sampling Event	Sampling Date	BENZENE CONCENTRATION (µg/L)						
1	Aug-12	3.4		2.6	4.8			
2	Apr-14	3.8		2.3	11.2			
3	Jul-14	8.3	8.3	2.2	11.6			
4	May-18	6.22	6.22	1.55	3.08			
5	Oct-18	7.69	7.69	1.68	0.25			
6	May-19	6.6	6.6	1.52	2.66			
7	Oct-19	7.3	7.3	1.57	0.25			
8	Nov-20	5.57	5.57	1.2	0.25			
9	Mar-21	5.4	5.4	1.1	0.25			
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.28	0.16	0.29	1.20			
Mann-Kendall Statistic (S):		2	-13	-30	-22			
Confidence Factor:		54.0%	96.5%	100.0%	98.8%			
Concentration Trend:		No Trend	Decreasing	Decreasing	Decreasing			



Notes:

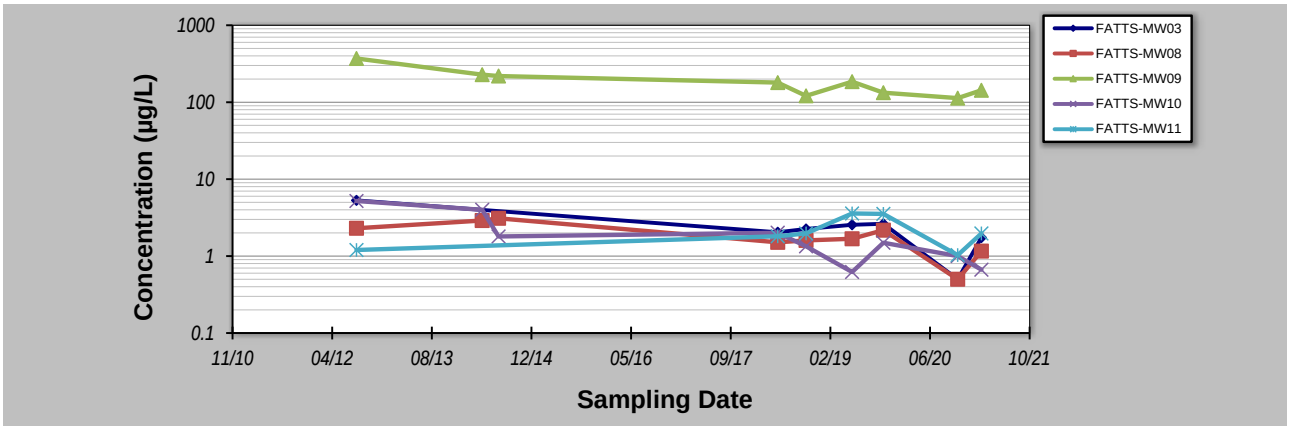
1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably 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: 7-Mar-22
Facility Name: FTBL-68 (FATTS)
Conducted By: Bryce Zinckgraf, P.E.

Job ID: Five Year Review, Fort Belvoir, Virginia
Constituent: 1,2-DCA
Concentration Units: µg/L

Sampling Point ID:	FATTS-MW03	FATTS-MW08	FATTS-MW09	FATTS-MW10	FATTS-MW11		
Sampling Event	Sampling Date	1,2-DCA CONCENTRATION (µg/L)						
1	Aug-12	5.3	2.3	370	5.2	1.2		
2	Apr-14		2.9	228	4.0			
3	Jul-14		3.1	219	1.8			
4	May-18	2.04	1.51	180	2.01	1.81		
5	Oct-18	2.25	1.6	121	1.34	1.97		
6	May-19	2.55	1.68	185	0.621	3.58		
7	Oct-19	2.63	2.17	133	1.49	3.54		
8	Nov-20	0.5	0.5	113	1.0	1.03		
9	Mar-21	1.74	1.16	143	0.666	1.97		
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.60	0.44	0.42	0.78	0.48		
Mann-Kendall Statistic (S):		-7	-16	-24	-26	4		
Confidence Factor:		80.9%	94.0%	99.4%	99.7%	66.7%		
Concentration Trend:		Stable	Prob. Decreasing	Decreasing	Decreasing	No Trend		



Notes:

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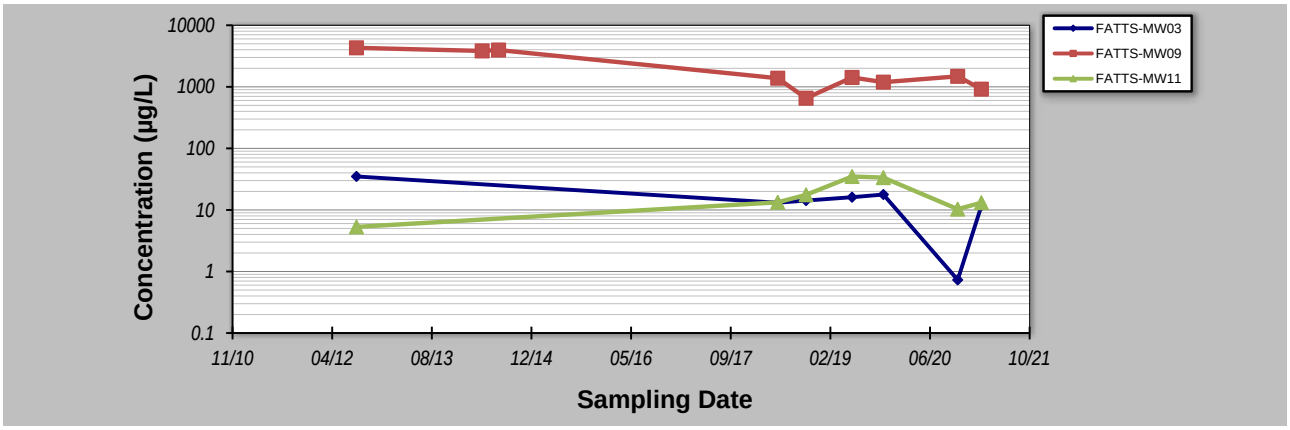
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology 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: 7-Mar-22
Facility Name: FTBL-68 (FATTS)
Conducted By: Bryce Zinckgraf, P.E.

Job ID: Five Year Review, Fort Belvoir, Virginia
Constituent: Benzene
Concentration Units: µg/L

Sampling Point ID:	FATTS-MW03	FATTS-MW09	FATTS-MW11				
Sampling Event	Sampling Date	BENZENE CONCENTRATION (µg/L)						
1	Aug-12	35	4300	5.3				
2	Apr-14		3830					
3	Jul-14		3960					
4	May-18	13.1	1380	13.3				
5	Oct-18	14.2	653	17.6				
6	May-19	16.1	1420	34.9				
7	Oct-19	17.8	1190	33.5				
8	Nov-20	0.73	1480	10.3				
9	Mar-21	11.7	916	13.1				
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.66	0.69	0.63				
Mann-Kendall Statistic (S):		-7	-18	3				
Confidence Factor:		80.9%	96.2%	61.4%				
Concentration Trend:		Stable	Decreasing	No Trend				



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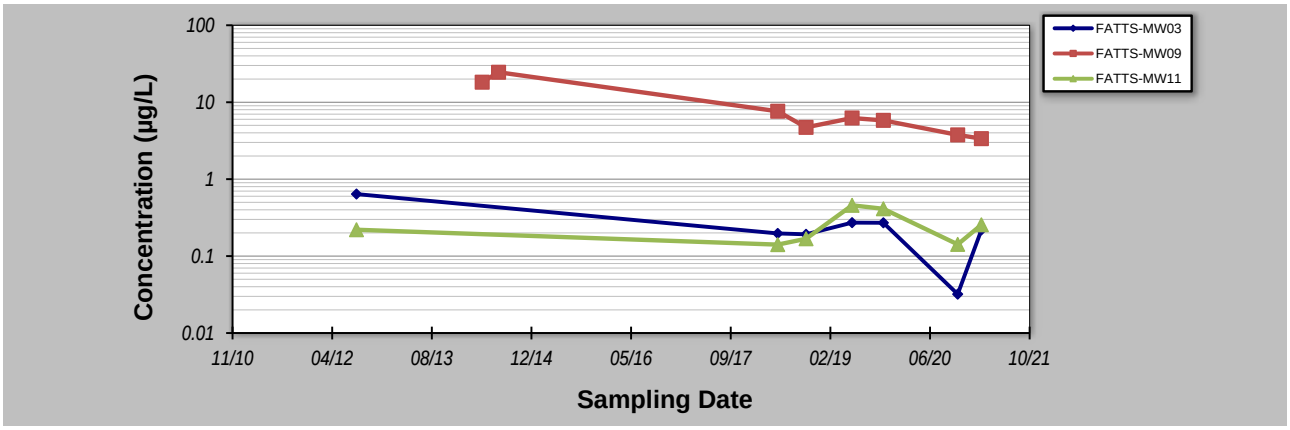
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 7-Mar-22
Facility Name: FTBL-68 (FATTS)
Conducted By: Bryce Zinckgraf, P.E.

Job ID: Five Year Review, Fort Belvoir, Virginia
Constituent: EDB
Concentration Units: µg/L

Sampling Point ID:	FATTS-MW03	FATTS-MW09	FATTS-MW11				
Sampling Event	Sampling Date	EDB CONCENTRATION (µg/L)						
1	Aug-12	0.64		0.22				
2	Apr-14		18.2					
3	Jul-14		24.5					
4	May-18	0.197	7.63	0.141				
5	Oct-18	0.192	4.71	0.168				
6	May-19	0.272	6.23	0.457				
7	Oct-19	0.271	5.81	0.412				
8	Nov-20	0.032	3.76	0.142				
9	Mar-21	0.219	3.36	0.255				
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.71	0.84	0.50				
Mann-Kendall Statistic (S):		-7	-22	3				
Confidence Factor:		80.9%	99.8%	61.4%				
Concentration Trend:		Stable	Decreasing	No Trend				



Notes:

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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.

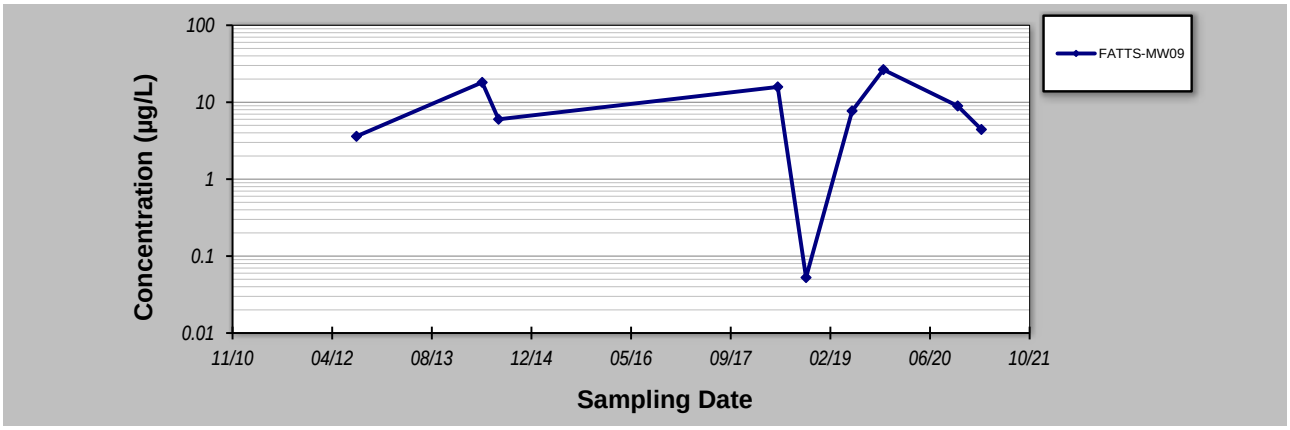
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **7-Mar-22**
Facility Name: **FTBL-68 (FATTS)**
Conducted By: **Bryce Zinckgraf, P.E.**

Job ID: **Five Year Review, Fort Belvoir, Virginia**
Constituent: **2-Methylnaphthalene**
Concentration Units: **µg/L**

Sampling Point ID: **FATTS-MW09**

Sampling Event	Sampling Date	2-METHYLNAPHTHALENE CONCENTRATION (µg/L)
1	Aug-12	3.6
2	Apr-14	18.1
3	Jul-14	6
4	May-18	15.8
5	Oct-18	0.0526
6	May-19	7.71
7	Oct-19	26.5
8	Nov-20	8.94
9	Mar-21	4.42
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Coefficient of Variation:		0.83
Mann-Kendall Statistic (S):		2
Confidence Factor:		54.0%
Concentration Trend:		No Trend



Notes:

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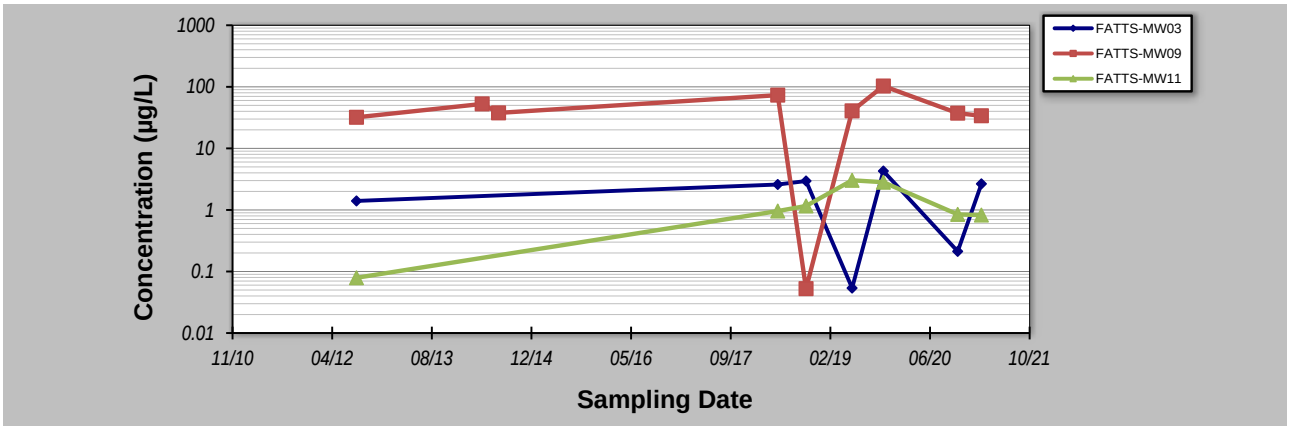
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 7-Mar-22
Facility Name: FTBL-68 (FATTS)
Conducted By: Bryce Zinckgraf, P.E.

Job ID: Five Year Review, Fort Belvoir, Virginia
Constituent: Naphthalene
Concentration Units: µg/L

Sampling Point ID:	FATTS-MW03	FATTS-MW09	FATTS-MW11				
Sampling Event	Sampling Date	NAPHTHALENE CONCENTRATION (µg/L)						
1	Aug-12	1.4	32	0.079				
2	Apr-14		52.8					
3	Jul-14		37.7					
4	May-18	2.59	73.3	0.959				
5	Oct-18	2.95	0.0526	1.16				
6	May-19	0.0538	40.7	3.03				
7	Oct-19	4.28	103	2.82				
8	Nov-20	0.212	37.3	0.846				
9	Mar-21	2.65	33.9	0.825				
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.76	0.63	0.79				
Mann-Kendall Statistic (S):		3	0	1				
Confidence Factor:		61.4%	46.0%	50.0%				
Concentration Trend:		No Trend	Stable	No Trend				



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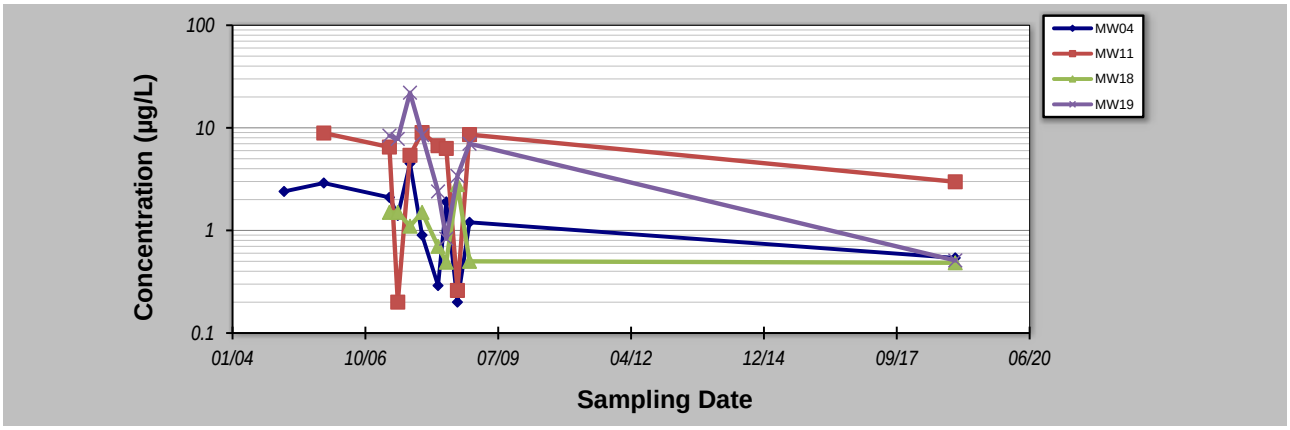
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 2-Mar-22
Facility Name: FTBL-69 (M-27)
Conducted By: Bryce Zinckgraf, P.E.

Job ID: Five Year Review, Fort Belvoir, Virginia
Constituent: 2,4,6-TNT
Concentration Units: µg/L

Sampling Point ID:	MW04	MW11	MW18	MW19			
Sampling Event	Sampling Date	2,4,6-TNT CONCENTRATION (µg/L)						
1	Feb-05	2.4						
2	Dec-05	2.9	8.9					
3	Apr-07	2.1	6.5	1.5	8.4			
4	Jun-07	1.4	0.2	1.5	7.8			
5	Sep-07	4.5	5.4	1.1	22			
6	Dec-07	0.9	9	1.5	8.5			
7	Apr-08	0.3	6.7	0.7	2.4			
8	Jun-08	1.90	6.3	0.49	0.83			
9	Sep-08	0.2	0.26	2.8	3.4			
10	Dec-08	1.2	8.6	0.5	7			
11	Dec-18	0.54	2.98	0.484	0.5			
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.77	0.60	0.64	0.97			
Mann-Kendall Statistic (S):		-29	-7	-17	-18			
Confidence Factor:		98.7%	70.0%	95.1%	96.2%			
Concentration Trend:		Decreasing	Stable	Decreasing	Decreasing			



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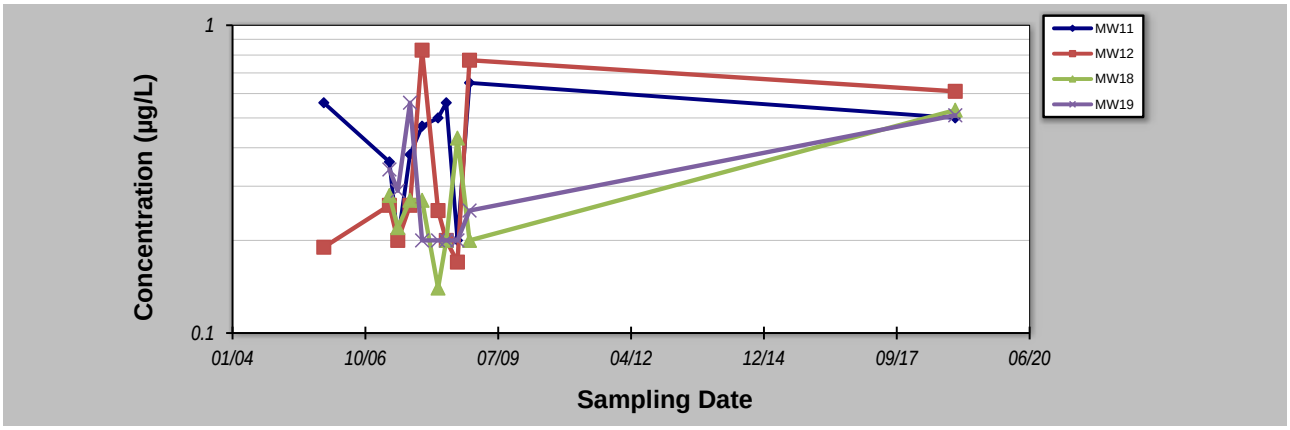
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 2-Mar-22
Facility Name: FTBL-69 (M-27)
Conducted By: Bryce Zinckgraf, P.E.

Job ID: Five Year Review, Fort Belvoir, Virginia
Constituent: 2,4-DNT
Concentration Units: µg/L

Sampling Point ID:	MW11	MW12	MW18	MW19			
Sampling Event	Sampling Date	2,4-DNT CONCENTRATION (µg/L)						
1	Dec-05	0.56	0.19					
2	Apr-07	0.36	0.26	0.28	0.34			
3	Jun-07	0.2	0.2	0.22	0.29			
4	Sep-07	0.38	0.26	0.27	0.56			
5	Dec-07	0.47	0.83	0.27	0.2			
6	Apr-08	0.5	0.25	0.14	0.2			
7	Jun-08	0.56	0.2	0.2	0.2			
8	Sep-08	0.20	0.17	0.43	0.2			
9	Dec-08	0.65	0.77	0.2	0.25			
10	Dec-18	0.5	0.61	0.53	0.51			
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.35	0.69	0.44	0.46			
Mann-Kendall Statistic (S):		12	7	2	-4			
Confidence Factor:		83.2%	70.0%	54.0%	61.9%			
Concentration Trend:		No Trend	No Trend	No Trend	Stable			



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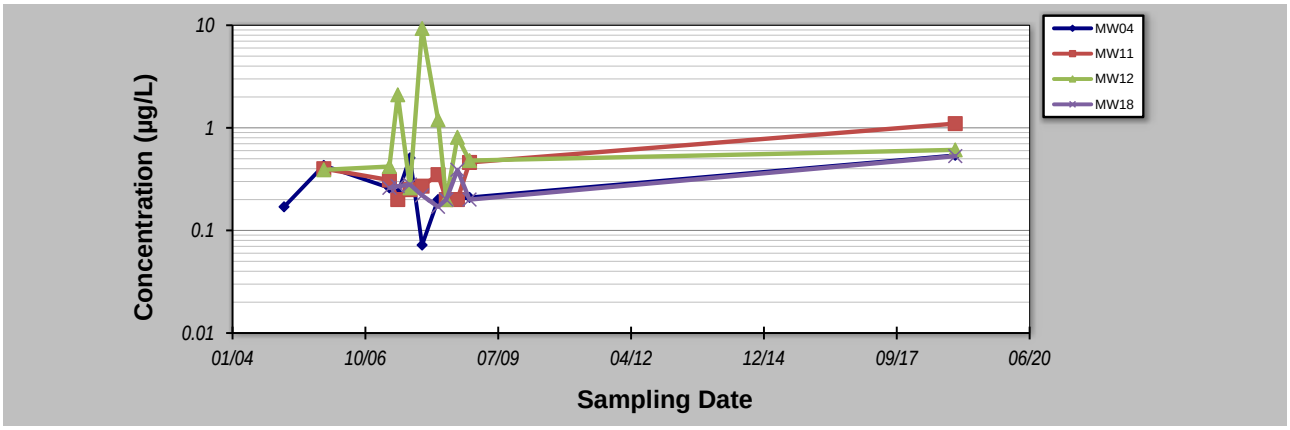
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 2-Mar-22
Facility Name: FTBL-69 (M-27)
Conducted By: Bryce Zinckgraf, P.E.

Job ID: Five Year Review, Fort Belvoir, Virginia
Constituent: 2,6-DNT
Concentration Units: µg/L

Sampling Point ID:	MW04	MW11	MW12	MW18			
Sampling Event	Sampling Date	2,6-DNT CONCENTRATION (µg/L)						
1	Feb-05	0.17						
2	Dec-05	0.43	0.4	0.39				
3	Apr-07	0.26	0.31	0.42	0.26			
4	Jun-07	0.23	0.2	2.1	0.27			
5	Sep-07	0.51	0.25	0.26	0.28			
6	Dec-07	0.072	0.27	9.3	0.22			
7	Apr-08	0.2	0.35	1.2	0.17			
8	Jun-08	0.2	0.2	0.20	0.2			
9	Sep-08	0.2	0.2	0.81	0.39			
10	Dec-08	0.21	0.46	0.48	0.2			
11	Dec-18	0.54	1.1	0.61	0.53			
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.55	0.72	1.76	0.41			
Mann-Kendall Statistic (S):		4	6	1	3			
Confidence Factor:		59.0%	66.8%	50.0%	58.0%			
Concentration Trend:		No Trend	No Trend	No Trend	No Trend			



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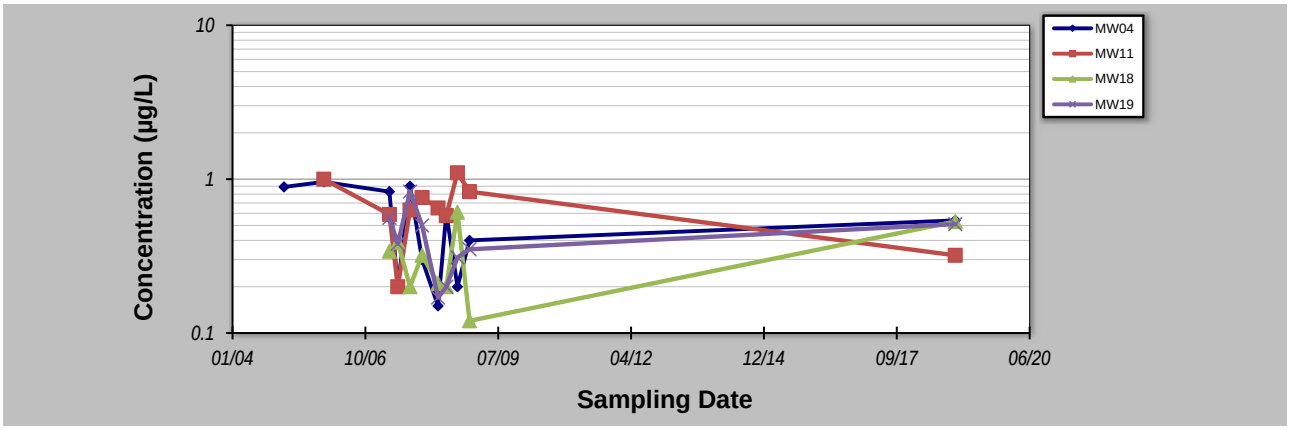
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Mar-22	Job ID:	Five Year Review, Fort Belvoir, Virginia
Facility Name:	FTBL-69 (M-27)	Constituent:	2A-DNT
Conducted By:	Bryce Zinckgraf, P.E.	Concentration Units:	µg/L

Sampling Point ID:	MW04	MW11	MW18	MW19			
Sampling Event	Sampling Date	2A-DNT CONCENTRATION (µg/L)						
1	Feb-05	0.89						
2	Dec-05	0.96	1					
3	Apr-07	0.83	0.59	0.34	0.56			
4	Jun-07	0.2	0.2	0.39	0.38			
5	Sep-07	0.90	0.63	0.2	0.83			
6	Dec-07	0.30	0.76	0.32	0.5			
7	Apr-08	0.15	0.65	0.21	0.17			
8	Jun-08	0.60	0.58	0.2	0.2			
9	Sep-08	0.2	1.1	0.61	0.31			
10	Dec-08	0.40	0.83	0.12	0.35			
11	Dec-18	0.54	0.32	0.53	0.51			
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.58	0.41	0.50	0.48			
Mann-Kendall Statistic (S):		-18	1	-3	-6			
Confidence Factor:		90.5%	50.0%	58.0%	69.4%			
Concentration Trend:		Prob. Decreasing	No Trend	Stable	Stable			



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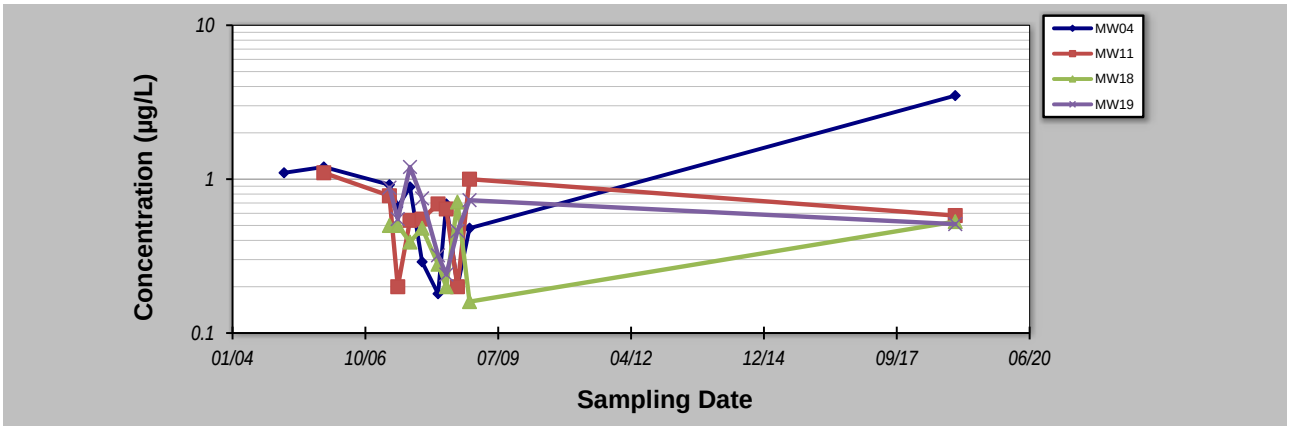
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 2-Mar-22
Facility Name: FTBL-69 (M-27)
Conducted By: Bryce Zinckgraf, P.E.

Job ID: Five Year Review, Fort Belvoir, Virginia
Constituent: 4A-DNT
Concentration Units: µg/L

Sampling Point ID:	MW04	MW11	MW18	MW19			
Sampling Event	Sampling Date	4A-DNT CONCENTRATION (µg/L)						
1	Feb-05	1.1						
2	Dec-05	1.2	1.1					
3	Apr-07	0.92	0.78	0.5	0.88			
4	Jun-07	0.66	0.2	0.5	0.55			
5	Sep-07	0.89	0.54	0.39	1.2			
6	Dec-07	0.29	0.55	0.48	0.75			
7	Apr-08	0.18	0.69	0.28	0.32			
8	Jun-08	0.69	0.64	0.2	0.24			
9	Sep-08	0.2	0.2	0.71	0.46			
10	Dec-08	0.48	1.0	0.16	0.73			
11	Dec-18	3.49	0.58	0.53	0.51			
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		1.00	0.47	0.42	0.48			
Mann-Kendall Statistic (S):		-17	-4	-7	-12			
Confidence Factor:		89.1%	60.3%	72.8%	87.0%			
Concentration Trend:		No Trend	Stable	Stable	Stable			



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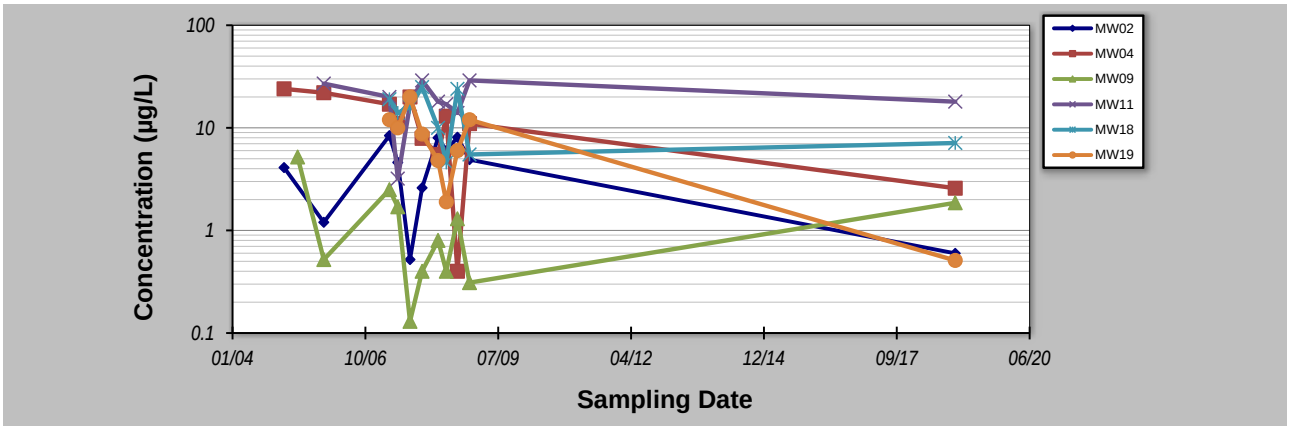
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	2-Mar-22	Job ID:	Five Year Review, Fort Belvoir, Virginia
Facility Name:	FTBL-69 (M-27)	Constituent:	RDX
Conducted By:	Bryce Zinckgraf, P.E.	Concentration Units:	µg/L

Sampling Point ID:	MW02	MW04	MW09	MW11	MW18	MW19	
Sampling Event	Sampling Date	RDX CONCENTRATION (µg/L)						
1	Feb-05	4.1	24					
2	May-05			5.2				
3	Dec-05	1.2	22	0.52	27			
4	Apr-07	8.4	17	2.5	20	19	12	
5	Jun-07	4.6	11	1.7	3.2	14	10	
6	Sep-07	0.52	20	0.13	17	16	20	
7	Dec-07	2.6	7.9	0.4	29	25	8.7	
8	Apr-08	8.0	5.5	0.80	18	10	4.8	
9	Jun-08	6	13	0.4	17	4.6	1.9	
10	Sep-08	8.1	0.4	1.3	14	24	6.0	
11	Dec-08	4.9	11	0.31	29	5.5	12	
12	Dec-18	0.598	2.58	1.86	18	7.12	0.51	
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.67	0.64	1.08	0.41	0.55	0.71	
Mann-Kendall Statistic (S):		3	-36	-12	-2	-12	-17	
Confidence Factor:		56.0%	99.8%	79.9%	53.5%	87.0%	95.1%	
Concentration Trend:		No Trend	Decreasing	No Trend	Stable	Stable	Decreasing	



Notes:

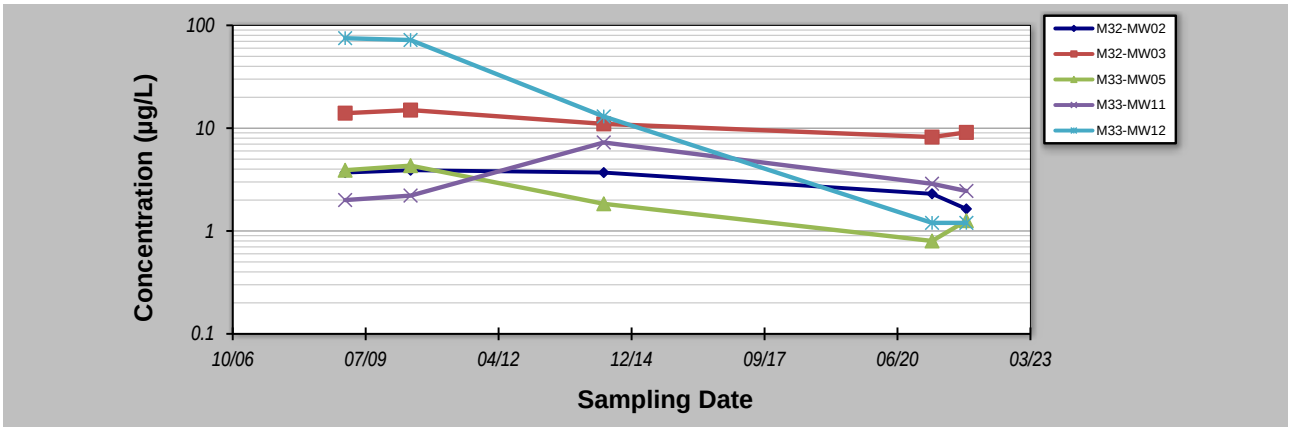
1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably 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: **28-Apr-22**
Facility Name: **FTBL-005-R-05 (M-33)**
Conducted By: **Bryce Zinckgraf, P.E.**

Job ID: **Five Year Review, Fort Belvoir, Virginia**
Constituent: **2,4-DNT/2,6-DNT (Mixture)**
Concentration Units: **µg/L**

Sampling Point ID:	M32-MW02	M32-MW03	M33-MW05	M33-MW11	M33-MW12		
Sampling Event	Sampling Date	2,4-DNT/2,6-DNT (MIXTURE) CONCENTRATION (µg/L)						
1	Feb-09	3.7	14	3.9	2	75		
2	Jun-10	3.9	15	4.32	2.21	72		
3	Jun-14	3.7	11	1.84	7.26	13		
4	Mar-21	2.3	8.2	0.8	2.88	1.2		
5	18-Nov-21	1.64	9.1	1.26	2.45	1.2		
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.33	0.26	0.66	0.66	1.16		
Mann-Kendall Statistic (S):		-7	-6	-6	4	-9		
Confidence Factor:		92.1%	88.3%	88.3%	75.8%	97.5%		
Concentration Trend:		Prob. Decreasing	Stable	Stable	No 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.
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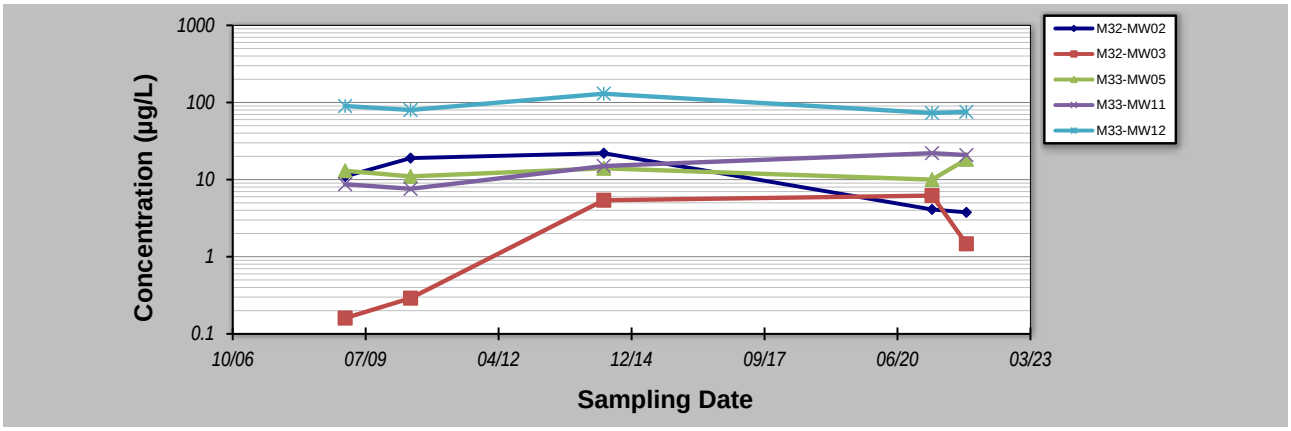
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 28-Apr-22
Facility Name: FTBL-005-R-05 (M-33)
Conducted By: Bryce Zinckgraf, P.E.

Job ID: Five Year Review, Fort Belvoir, Virginia
Constituent: RDX
Concentration Units: µg/L

Sampling Point ID:	M32-MW02	M32-MW03	M33-MW05	M33-MW11	M33-MW12		
Sampling Event	Sampling Date	RDX CONCENTRATION (µg/L)						
1	Feb-09	11	0.16	13	8.7	90		
2	Jun-10	19	0.29	11	7.6	80		
3	Jun-14	22	5.4	14	15	130		
4	Mar-21	4.1	6.2	10	22	73		
5	18-Nov-21	3.76	1.47	18.3	20.8	75.5		
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.70	1.07	0.24	0.45	0.26		
Mann-Kendall Statistic (S):		-4	6	2	6	-4		
Confidence Factor:		75.8%	88.3%	59.2%	88.3%	75.8%		
Concentration Trend:		Stable	No Trend	No Trend	No Trend	Stable		



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 F

Summary of Trend Analysis for FTBL-68 (M-26)
Five-Year Review
Fort Belvoir, Virginia

Monitoring Well	Contaminant of Concern	RG (µg /L)	Most Recent Concentration (µg /L)	Most Recent Sampling Date	Mann-Kendall Analysis			Linear Regression Analysis				
					Trend	Mann-Kendall Statistic (S)	Confidence Factor	Attenuation Rate (per day)	R Squared Value	P Value	Projected Time to Achieve RG (Years)	Projected Year to Achieve RG
M26-LTM-01	Benzene	5	**5.40**	3/2/2021	Decreasing	-13	96.5%	2.0E-04	0.62	0.036	1.1	2022
M26-LTM-02		5	0.250 U	3/3/2021	NA	NA	NA	NA	NA	NA	Achieved	Achieved
M26-LTM-03		5	0.250 U	3/4/2021	NA	NA	NA	NA	NA	NA	Achieved	Achieved
M26-LTM-04		5	**1.25**	3/4/2021	Decreasing	-30	100.0%	NA	NA	NA	Achieved	Achieved
M26-LTM-05		5	0.250 U	3/3/2021	Decreasing	-22	98.8%	NA	NA	NA	Achieved	Achieved
M26-LTM-06		5	0.250 U	3/2/2021	NA	NA	NA	NA	NA	NA	Achieved	Achieved

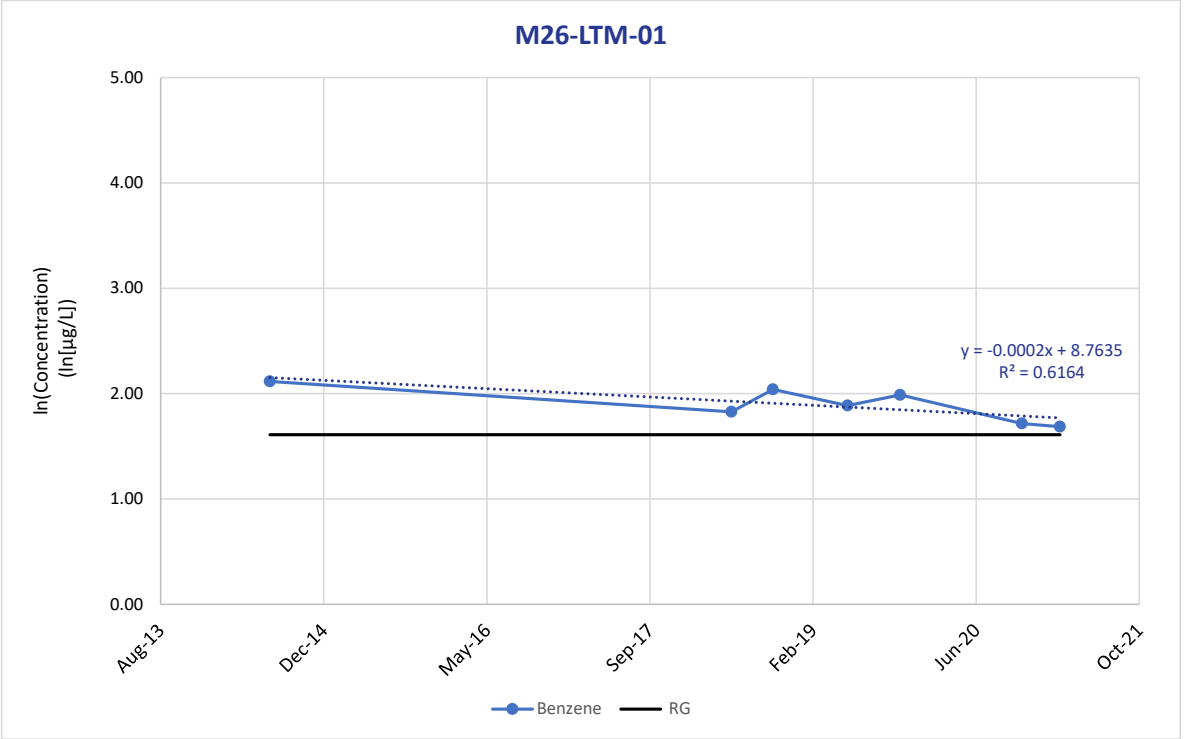
Notes:

1. RG indicates Remedial Goal.
2. µg /L indicates micrograms per liter.
3. Bold text indicates the contaminant was detected. Shaded cells indicate the contaminant was detected above the RG.
4. The attenuation rate was estimated by linear regression of natural log adjusted concentrations (first-order decay).
5. R-squared and p-values were generated by regression statistical analysis using the data analysis plug-in for Microsoft Excel.
6. P-values less than 0.05 generally indicate statistical significance of linear regression trend lines.
7. The projected time to reach the remedial goal was calculated by the first-order decay equation using the most recent contaminant concentration and the estimated attenuation rate.
8. Mann-Kendall analysis was not performed if the contaminant was detected in less than 50% of samples.
9. Linear regression analysis was not performed if the contaminant concentration was below the remedial goal (i.e achieved remedial goal).

APPENDIX F

Linear Regression Trend Analysis for FTBL-68 (M-26)
Five Year Review
Fort Belvoir, Virgina

Well ID	Sample Date	Benzene
RG		5 µg /L
M26-LTM-01	Jul-14	**8.3**
	May-18	**6.22**
	Oct-18	**7.69**
	May-19	**6.6**
	Oct-19	**7.3**
	Nov-20	**5.57**
	Mar-21	**5.4**



Notes:

1. RG indicates Remedial Goal.
2. µg /L indicates micrograms per liter.
3. Bold text indicates the contaminant exceeds the remedial goal.
4. Estimated values are reported without qualifiers.
5. Non-detected values are reported at the limit of detection.
6. The average value of duplicate samples are reported.
7. Linear regression performed for natural log adjusted data.
8. Regression statistics calculated by Excel data analysis plug-in.

Regression Statistics	
Multiple R	0.785123257
R Square	0.616418529
Adjusted R Square	0.539702235
Standard Error	0.110173387
Observations	7

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.0975307	0.0975307	8.03504049	0.036476396
Residual	5	0.0606909	0.0121382		
Total	6	0.1582216			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	8.763455404	2.42353939	3.615973992	0.0152841	2.5335491	14.993362	2.53354907	14.99336174
Date	-0.00015804	5.57544E-05	-2.8346147	0.0364764	-0.0003014	-1.472E-05	-0.00030136	-1.4721E-05

APPENDIX F

Summary of Trend Analysis for FTBL-68 (FATTS)
Five-Year Review
Fort Belvoir, Virginia

Monitoring Well	Contaminant of Concern	RG (µg /L)	Most Recent Concentration (µg /L)	Most Recent Sampling Date	Mann-Kendall Analysis			Linear Regression Analysis				
					Trend	Mann-Kendall Statistic (S)	Confidence Factor	Attenuation Rate (per day)	R Squared Value	P Value	Projected Time to Achieve RG (Years)	Projected Year to Achieve RG
FATTS-LTM-MW03	1,2-DCA	5	**1.74**	3/2/2021	Stable	-7	80.9%	NA	NA	NA	Achieved	Achieved
	Benzene	5	**11.7**	3/2/2021	Stable	-7	80.9%	-7.0E-04	0.31	0.19	3.3	2024
	EDB	0.05	**0.219**	3/2/2021	Stable	-7	80.9%	-6.0E-04	0.43	0.11	6.7	2027
	Naphthalene	6.5	**2.65**	3/2/2021	No Trend	3	61.4%	NA	NA	NA	Achieved	Achieved
FATTS-LTM-MW08	1,2-DCA	5	**1.16**	3/3/2021	Prob. Decreasing	-16	94.0%	NA	NA	NA	Achieved	Achieved
FATTS-LTM-MW09	1,2-DCA	5	**143**	3/3/2021	Decreasing	-24	99.4%	-3.0E-04	0.79	0.001	31	2051
	Benzene	5	**916**	3/3/2021	Decreasing	-18	96.2%	-5.0E-04	0.76	0.002	29	2049
	EDB	0.05	**3.36**	3/3/2021	Decreasing	-22	99.8%	-7.0E-04	0.94	7.E-05	16	2037
	2-Methylnaphthalene	24	**4.42**	3/3/2021	No Trend	2	54.0%	NA	NA	NA	Achieved	Achieved
	Naphthalene	6.5	**33.9**	3/3/2021	Stable	0	46.0%	-2.0E-04	0.0067	0.83	23	2043
FATTS-LTM-MW10	1,2-DCA	5	**0.666**	3/4/2021	Decreasing	-26	99.7%	NA	NA	NA	Achieved	Achieved
FATTS-LTM-MW11	1,2-DCA	5	**1.97**	3/2/2021	No Trend	4	66.7%	NA	NA	NA	Achieved	Achieved
	Benzene	5	**13.1**	3/2/2021	No Trend	3	61.4%	4.0E-04	0.35	0.16	NA	NA
	EDB	0.05	**0.255**	3/2/2021	No Trend	3	61.4%	4.0E-05	0.008	0.84	NA	NA
	Naphthalene	6.5	**0.825**	3/2/2021	No Trend	1	50.0%	NA	NA	NA	Achieved	Achieved

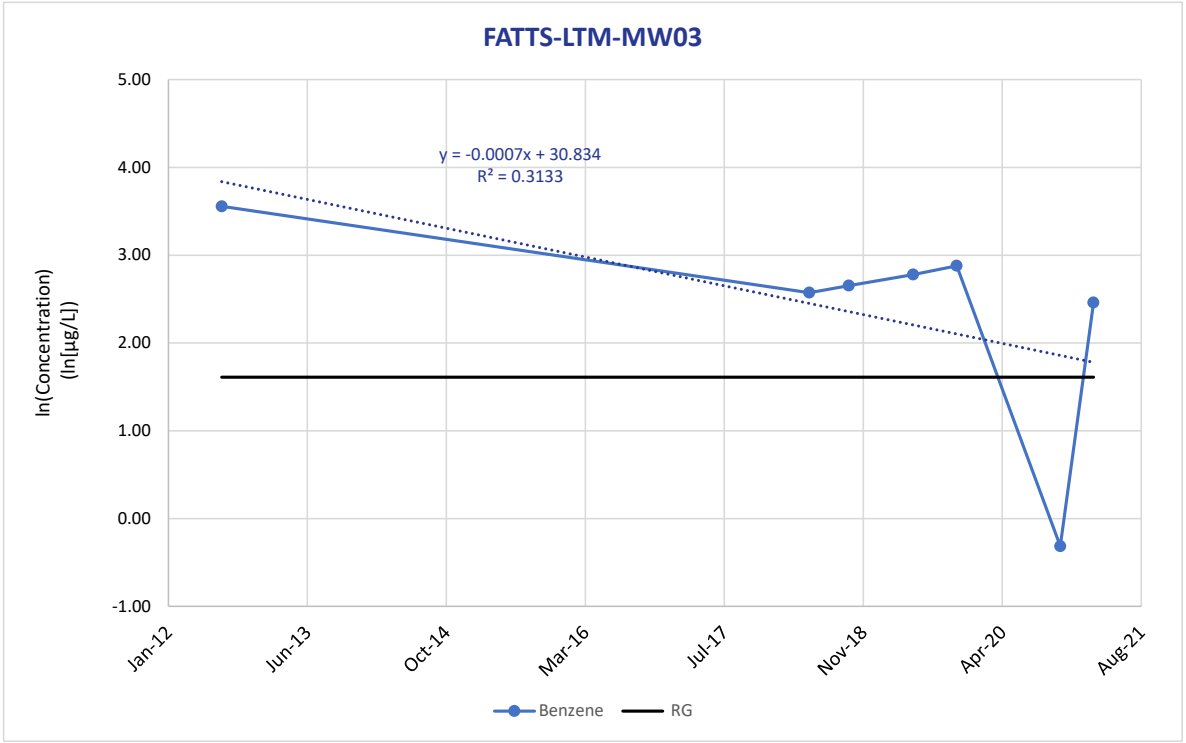
Notes:

1. DCA indicates dichloroethane.
2. EDB indicates ethylene dibromide.
3. RG indicates Remedial Goal.
4. µg /L indicates micrograms per liter.
5. Bold text indicates the contaminant was detected. Shaded cells indicate the contaminant was detected above the RG.
6. The attenuation rate was estimated by linear regression of natural log adjusted concentrations (first-order decay).
7. R-squared and p-values were generated by regression statistical analysis using the data analysis plug-in for Microsoft Excel.
8. P-values less than 0.05 generally indicate statistical significance of linear regression trend lines.
9. The projected time to reach the remedial goal was calculated by the first-order decay equation using the most recent contaminant concentration and the estimated attenuation rate. The time to reach the remedial goal was unable to be calculated for contaminants with positive (i.e. increasing) linear regression trend lines.
10. Mann-Kendall analysis was not performed if the contaminant was detected in less than 50% of samples.
11. Linear regression analysis was not performed if the contaminant concentration was below the remedial goal (i.e achieved remedial goal).

APPENDIX F

Linear Regression Trend Analysis for FTBL-68 (FATTS)
Five Year Review
Fort Belvoir, Virgina

Well ID	Sample Date	Benzene
RG		5 µg /L
FATTS-LTM-MW03	Aug-12	**35**
	May-18	**13.1**
	Oct-18	**14.2**
	May-19	**16.1**
	Oct-19	**17.8**
	Nov-20	0.73
	Mar-21	**11.7**



Notes:

1. RG indicates Remedial Goal.
2. µg /L indicates micrograms per liter.
3. Bold text indicates the contaminant exceeds the remedial goal.
4. Estimated values are reported without qualifiers.
5. Non-detected values are reported at the limit of detection.
6. The average value of duplicate samples are reported.
7. Linear regression performed for natural log adjusted data.
8. Regression statistics calculated by Excel data analysis plug-in.

Regression Statistics	
Multiple R	0.559725135
R Square	0.313292227
Adjusted R Square	0.175950673
Standard Error	1.122144103
Observations	7

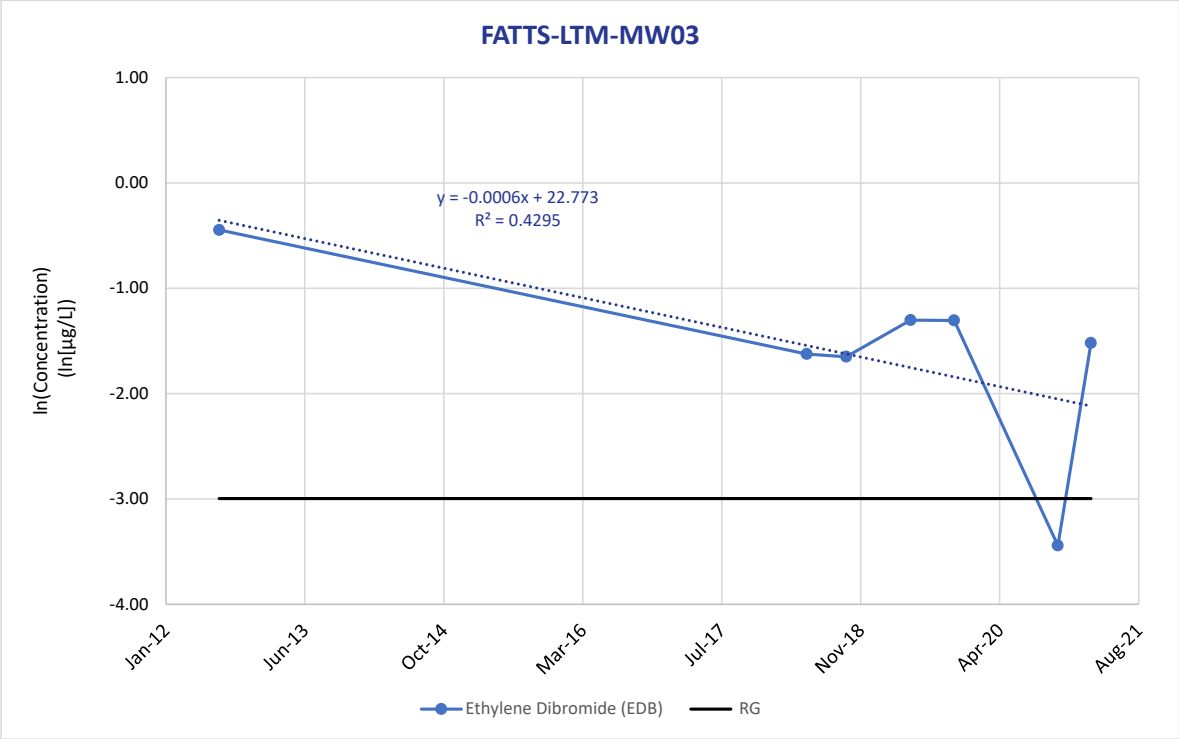
ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	2.8724	2.8724	2.28111753	0.191345896
Residual	5	6.2960369	1.2592074		
Total	6	9.168437			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	30.83433203	18.85167621	1.635628137	0.1628447	-17.625444	79.294108	-17.6254444	79.29410845
Date	-0.00065651	0.000434678	-1.51033689	0.1913459	-0.0017739	0.0004609	-0.00177389	0.000460865

APPENDIX F

Linear Regression Trend Analysis for FTBL-68 (FATTS)
Five Year Review
Fort Belvoir, Virgina

Well ID	Sample Date	Ethylene Dibromide (EDB)
RG		0.05 µg /L
FATTS-LTM-MW03	Aug-12	**0.64**
	May-18	**0.197**
	Oct-18	**0.192**
	May-19	**0.272**
	Oct-19	**0.271**
	Nov-20	0.032
	Mar-21	**0.219**



Notes:

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2. µg /L indicates micrograms per liter.
3. Bold text indicates the contaminant exceeds the remedial goal.
4. Estimated values are reported without qualifiers.
5. Non-detected values are reported at the limit of detection.
6. The average value of duplicate samples are reported.
7. Linear regression performed for natural log adjusted data.
8. Regression statistics calculated by Excel data analysis plug-in.

Regression Statistics	
Multiple R	0.655365002
R Square	0.429503285
Adjusted R Square	0.315403943
Standard Error	0.748344174
Observations	7

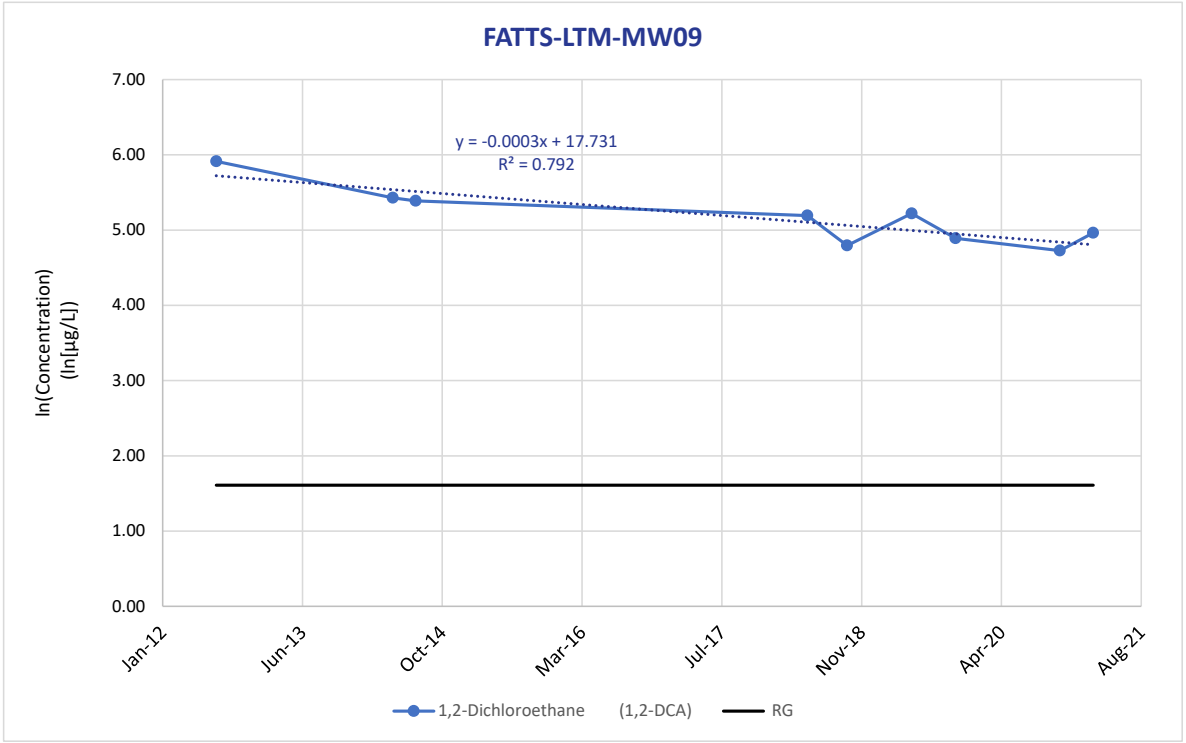
ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	2.1080753	2.1080753	3.76429237	0.110045697
Residual	5	2.800095	0.560019		
Total	6	4.9081703			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	22.77288644	12.57195223	1.811404149	0.1298375	-9.5443456	55.090118	-9.54434562	55.09011849
Date	-0.00056242	0.000289882	-1.94017844	0.1100457	-0.0013076	0.0001827	-0.00130759	0.000182742

APPENDIX F

Linear Regression Trend Analysis for FTBL-68 (FATTS)
Five Year Review
Fort Belvoir, Virgina

Well ID	Sample Date	1,2-Dichloroethane (1,2-DCA)
RG		5 µg /L
FATTS-LTM-MW09	Aug-12	**370**
	Apr-14	**228**
	Jul-14	**219**
	May-18	**180**
	Oct-18	**121**
	May-19	**185**
	Oct-19	**133**
	Nov-20	**113**
	Mar-21	**143**



Notes:

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2. µg /L indicates micrograms per liter.
3. Bold text indicates the contaminant exceeds the remedial goal.
4. Estimated values are reported without qualifiers.
5. Non-detected values are reported at the limit of detection.
6. The average value of duplicate samples are reported.
7. Linear regression performed for natural log adjusted data.
8. Regression statistics calculated by Excel data analysis plug-in.

Regression Statistics	
Multiple R	0.889927565
R Square	0.791971071
Adjusted R Square	0.762252652
Standard Error	0.183104187
Observations	9

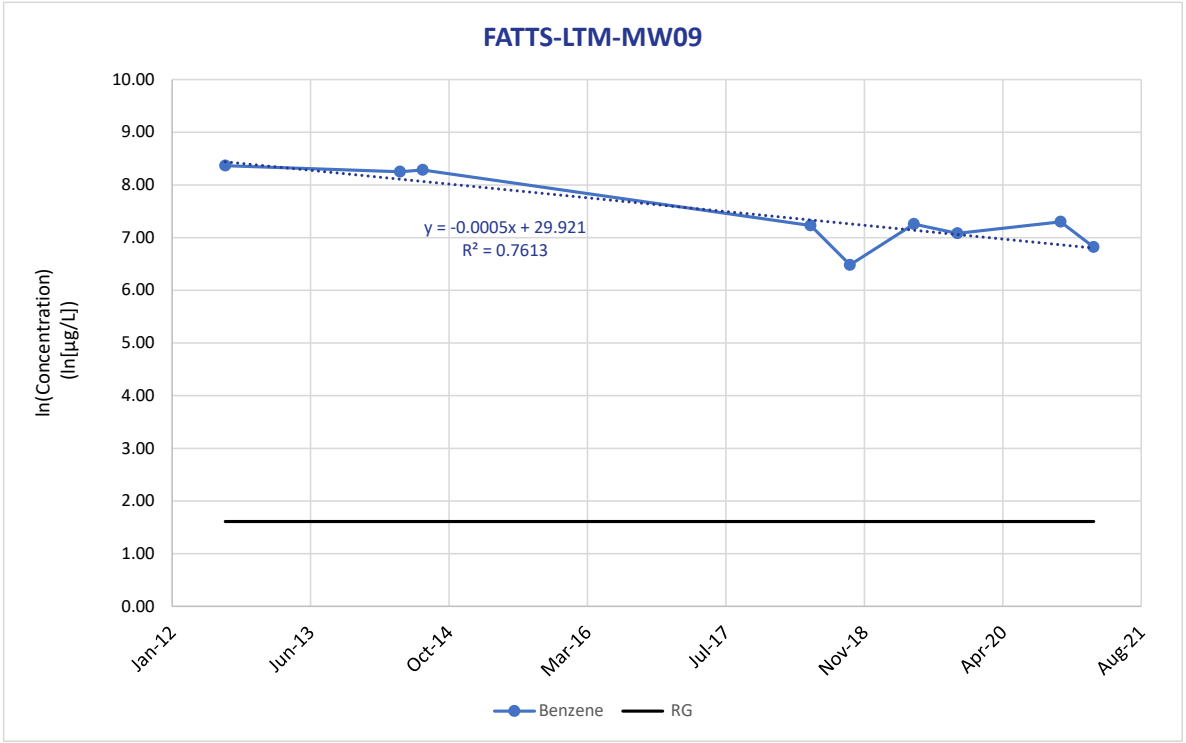
ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.8934704	0.8934704	26.6491661	0.001306161
Residual	7	0.23469	0.0335271		
Total	8	1.1281604			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	17.73098403	2.43416866	7.28420521	0.000165	11.97509	23.486878	11.9750898	23.48687828
Date	-0.00029207	5.65767E-05	-5.16228304	0.0013062	-0.0004258	-0.0001583	-0.00042585	-0.000158282

APPENDIX F

Linear Regression Trend Analysis for FTBL-68 (FATTS)
Five Year Review
Fort Belvoir, Virgina

Well ID	Sample Date	Benzene
RG		5 µg /L
FATTS-LTM-MW09	Aug-12	**4300**
	Apr-14	**3830**
	Jul-14	**3960**
	May-18	**1380**
	Oct-18	**653**
	May-19	**1420**
	Oct-19	**1190**
	Nov-20	**1480**
	Mar-21	**916**



Notes:

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2. µg /L indicates micrograms per liter.
3. Bold text indicates the contaminant exceeds the remedial goal.
4. Estimated values are reported without qualifiers.
5. Non-detected values are reported at the limit of detection.
6. The average value of duplicate samples are reported.
7. Linear regression performed for natural log adjusted data.
8. Regression statistics calculated by Excel data analysis plug-in.

Regression Statistics	
Multiple R	0.872541392
R Square	0.761328481
Adjusted R Square	0.727232549
Standard Error	0.357780946
Observations	9

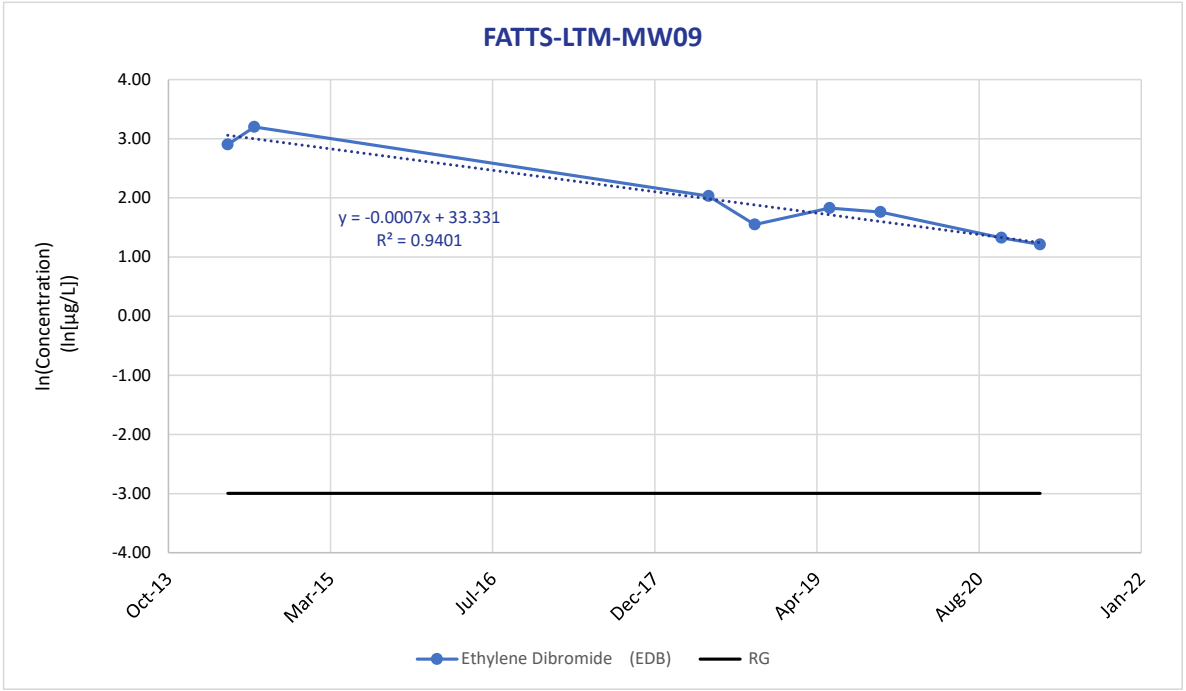
ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	2.8582745	2.8582745	22.3290126	0.002144114
Residual	7	0.8960504	0.1280072		
Total	8	3.7543249			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	29.92065699	4.756303947	6.29073695	0.0004078	18.673785	41.167529	18.6737853	41.16752865
Date	-0.00052239	0.00011055	-4.72535846	0.0021441	-0.0007838	-0.000261	-0.00078379	-0.000260978

APPENDIX F

Linear Regression Trend Analysis for FTBL-68 (FATTS)
Five Year Review
Fort Belvoir, Virgina

Well ID	Sample Date	Ethylene Dibromide (EDB)
RG		0.05 µg /L
	Apr-14	**18.2**
	Jul-14	**24.5**
	May-18	**7.63**
	Oct-18	**4.71**
	May-19	**6.23**
	Oct-19	**5.81**
	Nov-20	**3.76**
	Mar-21	**3.36**



Notes:

1. RG indicates Remedial Goal.
2. µg /L indicates micrograms per liter.
3. Bold text indicates the contaminant exceeds the remedial goal.
4. Estimated values are reported without qualifiers.
5. Non-detected values are reported at the limit of detection.
6. The average value of duplicate samples are reported.
7. Linear regression performed for natural log adjusted data.
8. Regression statistics calculated by Excel data analysis plug-in.

Regression Statistics	
Multiple R	0.969571304
R Square	0.940068514
Adjusted R Square	0.930079933
Standard Error	0.189967808
Observations	8

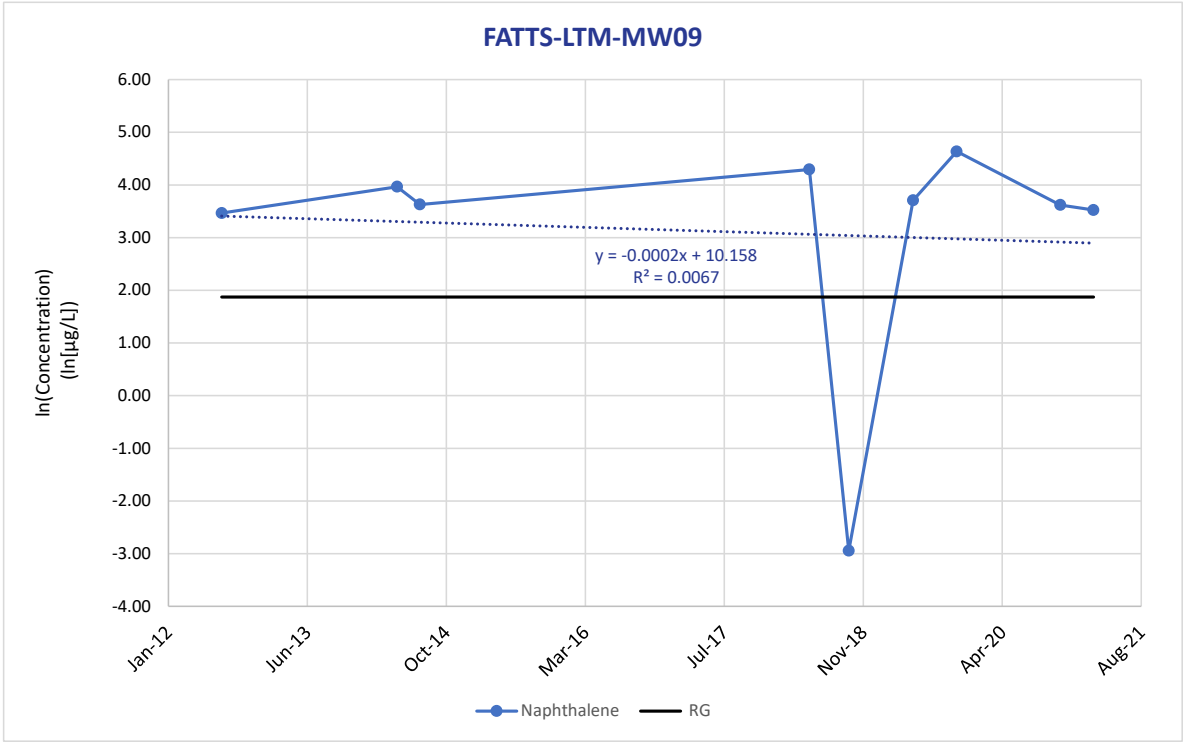
ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.3963758	3.3963758	94.1143204	6.88376E-05
Residual	6	0.2165266	0.0360878		
Total	7	3.6129024			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	33.33062504	3.232726144	10.31037693	4.864E-05	25.420429	41.240821	25.4204291	41.24082096
Date	-0.00072502	7.47346E-05	-9.70125355	6.884E-05	-0.0009079	-0.0005422	-0.00090789	-0.00054215

APPENDIX F

Linear Regression Trend Analysis for FTBL-68 (FATTS)
Five Year Review
Fort Belvoir, Virgina

Well ID	Sample Date	Naphthalene
RG		6.5 µg /L
FATTS-LTM-MW09	Aug-12	**32**
	Apr-14	**52.8**
	Jul-14	**37.7**
	May-18	**73.3**
	Oct-18	0.0526
	May-19	**40.7**
	Oct-19	**103**
	Nov-20	**37.3**
	Mar-21	**33.9**



Notes:

1. RG indicates Remedial Goal.
2. µg /L indicates micrograms per liter.
3. Bold text indicates the contaminant exceeds the remedial goal.
4. Estimated values are reported without qualifiers.
5. Non-detected values are reported at the limit of detection.
6. The average value of duplicate samples are reported.
7. Linear regression performed for natural log adjusted data.
8. Regression statistics calculated by Excel data analysis plug-in.

Regression Statistics	
Multiple R	0.081656721
R Square	0.00666782
Adjusted R Square	-0.13523678
Standard Error	2.450191385
Observations	9

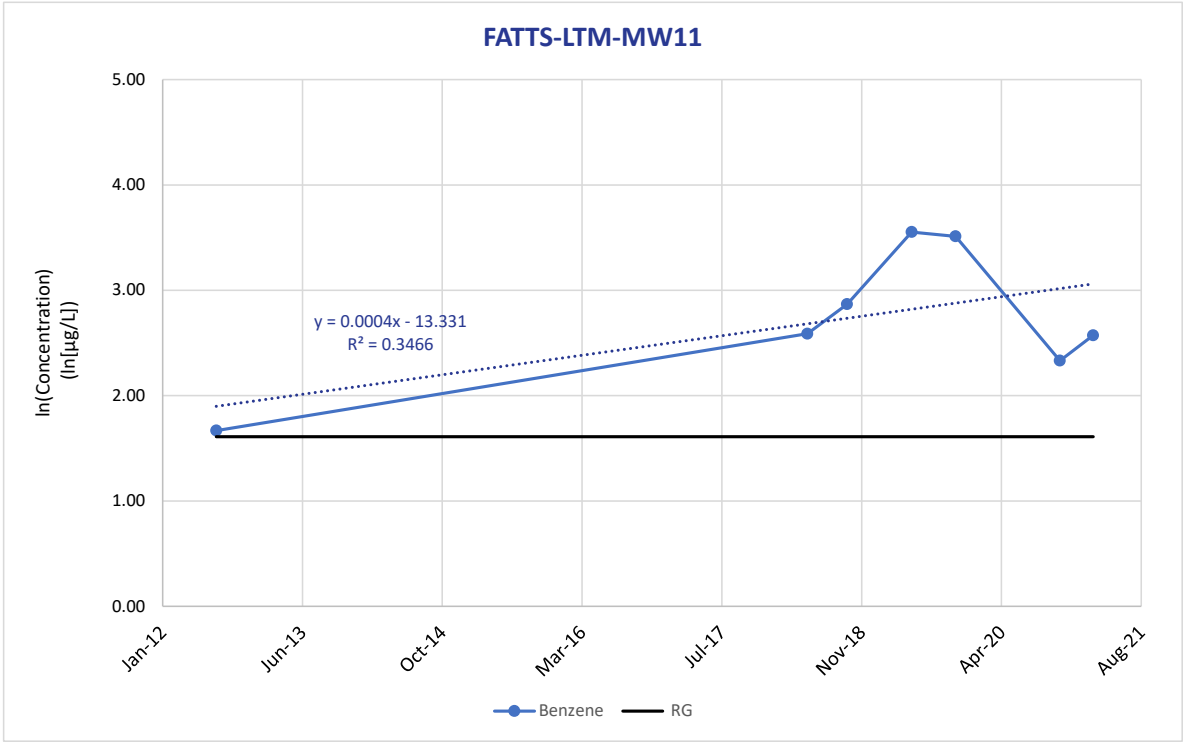
ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.2820898	0.2820898	0.04698805	0.834571847
Residual	7	42.024065	6.0034378		
Total	8	42.306155			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	10.15787477	32.57259811	0.311853379	0.7642354	-66.864081	87.17983	-66.8640807	87.1798302
Date	-0.00016411	0.000757076	-0.21676727	0.8345718	-0.0019543	0.0016261	-0.00195431	0.001626092

APPENDIX F

Linear Regression Trend Analysis for FTBL-68 (FATTS)
Five Year Review
Fort Belvoir, Virgina

Well ID	Sample Date	Benzene
RG		5 µg /L
FATTS-LTM-MW11	Aug-12	**5.3**
	May-18	**13.3**
	Oct-18	**17.6**
	May-19	**34.9**
	Oct-19	**33.5**
	Nov-20	**10.3**
	Mar-21	**13.1**



Notes:

1. RG indicates Remedial Goal.
2. µg /L indicates micrograms per liter.
3. Bold text indicates the contaminant exceeds the remedial goal.
4. Estimated values are reported without qualifiers.
5. Non-detected values are reported at the limit of detection.
6. The average value of duplicate samples are reported.
7. Linear regression performed for natural log adjusted data.
8. Regression statistics calculated by Excel data analysis plug-in.

Regression Statistics	
Multiple R	0.58868816
R Square	0.34655375
Adjusted R Square	0.2158645
Standard Error	0.587164149
Observations	7

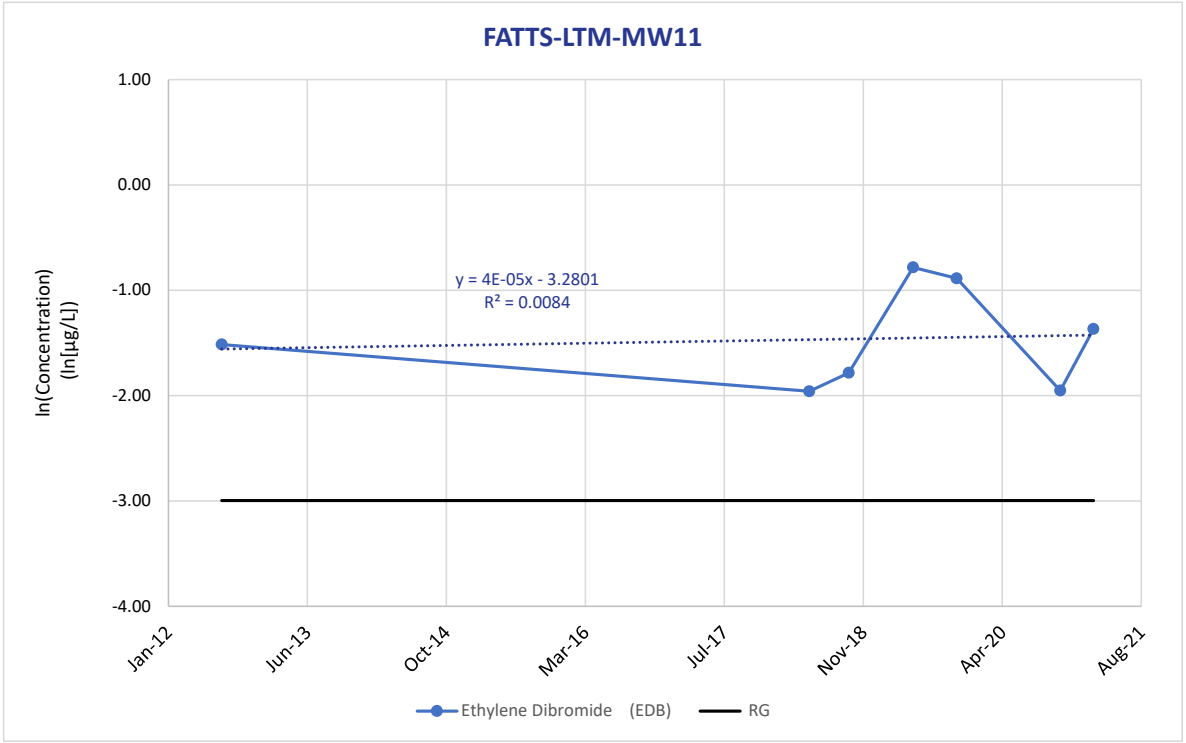
ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.9142181	0.9142181	2.65173876	0.164365446
Residual	5	1.7238087	0.3447617		
Total	6	2.6380267			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-13.3314674	9.864177315	-1.35150322	0.23446	-38.688142	12.025208	-38.6881425	12.0252076
Date	0.000370377	0.000227446	1.628416027	0.1643654	-0.0002143	0.000955	-0.00021429	0.000955046

APPENDIX F

Linear Regression Trend Analysis for FTBL-68 (FATTS)
Five Year Review
Fort Belvoir, Virgina

Well ID	Sample Date	Ethylene Dibromide (EDB)
RG		0.05 µg /L
FATTS-LTM-MW11	Aug-12	**0.22**
	May-18	**0.141**
	Oct-18	**0.168**
	May-19	**0.457**
	Oct-19	**0.412**
	Nov-20	**0.142**
	Mar-21	**0.255**



Notes:

1. RG indicates Remedial Goal.
2. µg /L indicates micrograms per liter.
3. Bold text indicates the contaminant exceeds the remedial goal.
4. Estimated values are reported without qualifiers.
5. Non-detected values are reported at the limit of detection.
6. The average value of duplicate samples are reported.
7. Linear regression performed for natural log adjusted data.
8. Regression statistics calculated by Excel data analysis plug-in.

Regression Statistics	
Multiple R	0.091593128
R Square	0.008389301
Adjusted R Square	-0.18993284
Standard Error	0.525848801
Observations	7

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.0116971	0.0116971	0.04230138	0.845158095
Residual	5	1.3825848	0.276517		
Total	6	1.3942819			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-3.28006681	8.834098318	-0.37129616	0.7256304	-25.988839	19.428706	-25.9888395	19.42870586
Date	4.18945E-05	0.000203695	0.205673004	0.8451581	-0.0004817	0.0005655	-0.00048172	0.000565509

APPENDIX F

Summary of Trend Analysis for FTBL-005-R-05 (M-33)
Five-Year Review
Fort Belvoir, Virginia

Monitoring Well	Contaminant of Concern	Remedial Goal (µg /L)	Most Recent Concentration (µg /L)	Most Recent Sampling Date	Mann-Kendall Analysis			Linear Regression Analysis				
					Trend	Mann-Kendall Statistic (S)	Confidence Factor	Attenuation Rate (per day)	R Squared Value	P Value	Projected Time to Achieve Remedial Goal (Years)	Projected Year to Achieve Remedial Goal
M32-MW02	2,4-DNT/2,6-DNT	5.3	2.3	3/5/2021	Stable	-3	72.9%	NA	NA	NA	Achieved	Achieved
	RDX	30	4.1	3/5/2021	Stable	0	37.5%	NA	NA	NA	Achieved	Achieved
M32-MW03	2,4-DNT/2,6-DNT	5.3	**8.2**	3/4/2021	Stable	-4	83.3%	1.0E-04	0.95	0.024	12	2033
	RDX	30	6.1	3/4/2021	Increasing	6	95.8%	NA	NA	NA	Achieved	Achieved
M33-MW05	2,4-DNT/2,6-DNT	5.3	0.8	3/5/2021	Stable	-4	83.3%	NA	NA	NA	Achieved	Achieved
	RDX	30	10	3/5/2021	Stable	-2	62.5%	NA	NA	NA	Achieved	Achieved
M33-MW11	2,4-DNT/2,6-DNT	5.3	2.88	3/5/2021	No Trend	4	83.3%	NA	NA	NA	Achieved	Achieved
	RDX	30	22	3/5/2021	No Trend	4	83.3%	NA	NA	NA	Achieved	Achieved
M33-MW12	2,4-DNT/2,6-DNT	5.3	1.2	3/6/2021	Decreasing	-6	95.8%	NA	NA	NA	Achieved	Achieved
	RDX	30	**73**	3/6/2021	Stable	-2	62.5%	3.0E-05	0.05	0.78	81	2102

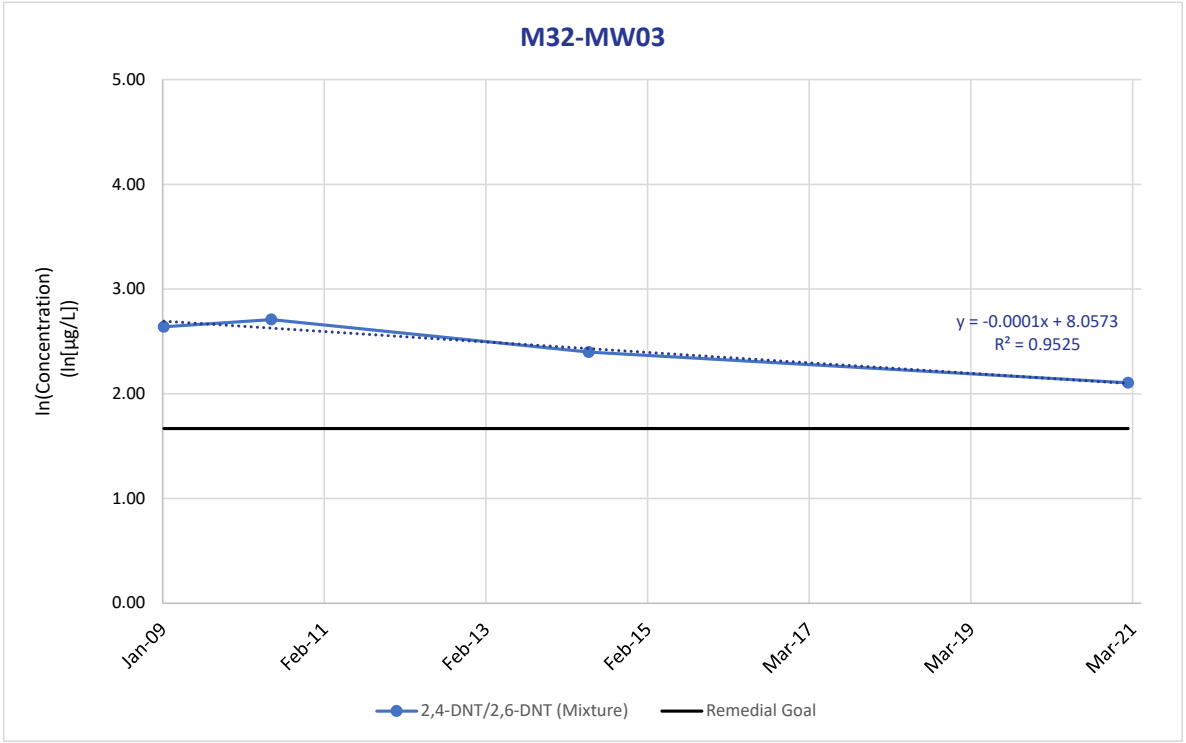
Notes:

1. DNT indicates dinitrotoluene.
2. RDX indicates hexahydro-1,3,5-trinitro-1,3,5-triazine.
3. µg /L indicates micrograms per liter.
4. Bold text indicates the contaminant was detected above its remedial goal.
5. The attenuation rate was estimated by linear regression of natural log adjusted concentrations (first-order decay).
6. R-squared and p-values were generated by regression statistical analysis using the data analysis plug-in for Microsoft Excel.
7. P-values less than 0.05 generally indicate statistical significance of linear regression trend lines.
8. The projected time to reach the remedial goal was calculated by the first-order decay equation using the most recent contaminant concentration and the estimated attenuation rate.
9. Linear regression analysis was not performed if the contaminant concentration was below the remedial goal (i.e achieved remedial goal).

APPENDIX F

Linear Regression Trend Analysis for FTBL-005-R-05 (M-33)
Five Year Review
Fort Belvoir, Virgina

Well ID	Sample Date	2,4-DNT/2,6-DNT (Mixture)
Remedial Goal		5.3 µg /L
M32-MW03	Feb-09	**14**
	Jun-10	**15**
	Jun-14	**11**
	Mar-21	**8.2**



Notes:

1. DNT indicates dinitrotoluene.
2. µg /L indicates micrograms per liter.
3. Bold text indicates the contaminant exceeds the remedial goal.
4. Estimated values are reported without qualifiers.
5. Non-detected values are reported at the limit of detection.
6. The average value of duplicate samples are reported.
7. Linear regression performed for natural log adjusted data.
8. Regression statistics calculated by Excel data analysis plug-in.

Regression Statistics	
Multiple R	0.975940693
R Square	0.952460237
Adjusted R Square	0.928690355
Standard Error	0.072979774
Observations	4

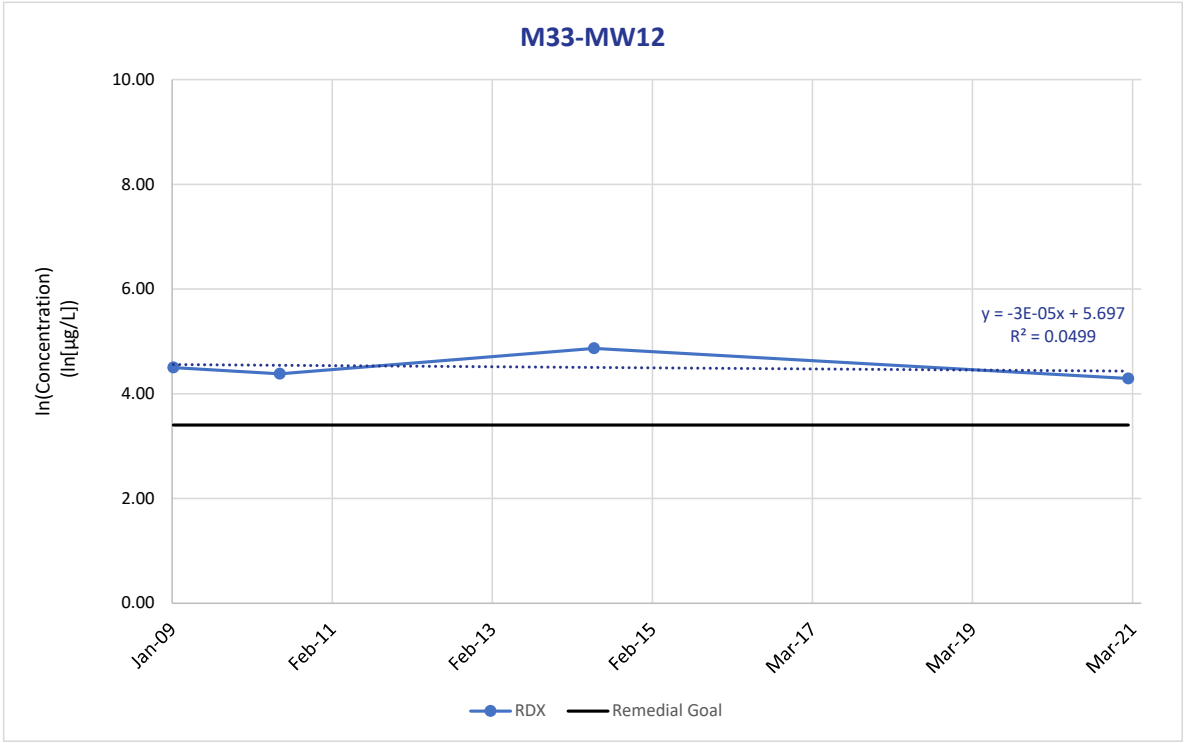
ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.213415	0.213415	40.0700456	0.024059307
Residual	2	0.0106521	0.005326		
Total	3	0.2240671			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	8.057345855	0.884636251	9.108089172	0.0118407	4.2510633	11.863628	4.25106328	11.86362843
Date	-0.00013463	2.12683E-05	-6.33009049	0.0240593	-0.0002261	-4.312E-05	-0.00022614	-4.31201E-05

APPENDIX F

Linear Regression Trend Analysis for FTBL-005-R-05 (M-33)
Five Year Review
Fort Belvoir, Virgina

Well ID	Sample Date	RDX
Remedial Goal		30 µg /L
M33-MW12	Feb-09	**90**
	Jun-10	**80**
	Jun-14	**130**
	Mar-21	**73**



Notes:

1. RDX indicates hexahydro-1,3,5-trinitro-1,3,5-triazine.
2. µg /L indicates micrograms per liter.
3. Bold text indicates the contaminant exceeds the remedial goal.
4. Estimated values are reported without qualifiers.
5. Non-detected values are reported at the limit of detection.
6. The average value of duplicate samples are reported.
7. Linear regression performed for natural log adjusted data.
8. Regression statistics calculated by Excel data analysis plug-in.

Regression Statistics	
Multiple R	0.223385781
R Square	0.049901207
Adjusted R Square	-0.42514819
Standard Error	0.302409886
Observations	4

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.0096065	0.0096065	0.10504425	0.776614219
Residual	2	0.1829035	0.0914517		
Total	3	0.19251			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	5.697022735	3.665710846	1.554138603	0.2603822	-10.075258	21.469304	-10.075258	21.46930352
Date	-2.8564E-05	8.81304E-05	-0.32410531	0.7766142	-0.0004078	0.0003506	-0.00040776	0.000350631

APPENDIX G
HUMAN HEALTH RISK ASSESSMENT

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TABLE G-1
Comparison of 2007 Remediation Goals to 2022 Levels

Groundwater Contaminant	2007 Remediation Goals µg/L	2007 Source	2022 Values µg/L	2022 Source
Benzene	5	MCL	5	MCL
Methylene Chloride	5	MCL	5	MCL
Ethylene Dibromide	0.05	MCL	0.05	MCL
1,2-Dichloroethane	5	MCL	5	MCL
Chloroform*	100	MCL	80	MCL
Naphthalene	6.5	RBC	0.117-11.7	RSL
2-methylnaphthalene	24	RBC	36	RSL

Soil Contaminant	2007 Remediation Goals µg/kg	2007 Source	2022 Values µg/kg	2017 Source
Benzene	14	SSL	26	RSLcalc
Methylene Chloride	11.5	SSL	13	RSLcalc
Ethylene Dibromide	0.285	SSL	0.14	RSLcalc
1,2-Dichloroethane	21	SSL	14	RSLcalc
Naphthalene	77	SSL	3.85-385	RSLcalc
2-Methylnaphthalene	2200	SSL	1850	RSLcalc
Lead**	800	RBC	800	RSL

Notes:

*Value listed is MCL for total trihalomethanes.

**Lead values are in mg/kg.

RBC – 2007 USEPA Region III Risk Based Concentration.

SSL – Site Specific Soil Screening Level derived following USEPA Region III memorandum on calculating soil to groundwater SSLs.

RSL – May 2022, USEPA Regional Screening Levels for tapwater (Non-Cancer HI = 1.0; Cancer Risk $1x10^{-6}$ to $1x10^{-4}$)

RSLcalc – EPA Regional Screening Level Online Calculator. https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

MCL – Safe Drinking Water Act Maximum Contaminant Level

Table G-2
Toxicity Criteria Used to Generate Remediation Goals
FTBL-69 M-27 Waste Ordnance Pit at Range 1

Chemical	CAS Number	Toxicity Criteria Used to Develop Revised RGs (Plexus, 2020)				Current Toxicity Criteria (USEPA, 2022)			
		Oral Carcinogenic Slope Factor	Inhalaiton Unit Risk	Oral Reference Dose	Inhalation Reference Concentration	Oral Carcinogenic Slope Factor	Inhalaiton Unit Risk	Oral Reference Dose	Inhalation Reference Concentration
		SF_o(mg/kg-day)$^{-1}$	IUR (ug/m^3)$^{-1}$	RfD (mg/kg-day)	RfC (mg/m^3)	SF_o(mg/kg-day)$^{-1}$	IUR (ug/m^3)$^{-1}$	RfD (mg/kg-day)	RfC (mg/m^3)
Dinitrotoluene Mixture, 2,4/2,6-	NA	6.80E-01	-	-	-	6.80E-01	-	-	-
Dinitrotoluene, 2,4-	121-14-2	3.10E-01	8.90E-05	2.00E-03	-	3.10E-01	8.90E-05	2.00E-03	-
Dinitrotoluene, 2,6-	606-20-2	1.50E+00	-	3.00E-04	-	1.50E+00	-	3.00E-04	-
Dinitrotoluene, 2-Amino-4,6-	35572-78-2	-	-	1.00E-04	-	-	-	1.00E-04	-
Dinitrotoluene, 4-Amino-2,6-	19406-51-0	-	-	1.00E-04	-	-	-	1.00E-04	-
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	8.00E-02	-	4.00E-03	-	8.00E-02	-	4.00E-03	-
Trinitrotoluene, 2,4,6-	118-96-7	3.00E-02	-	5.00E-04	-	3.00E-02	-	5.00E-04	-

Output generated 20MAY2022:14:45:48

Table G-3
Estimation of Lead PRG in Soil
Using Current Recommendations
FTBL-001-R-02 Infiltration Course and FTBL-003-R-01 Combat Range Complex

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 2009-2014
$PbB_{fetal,\ 0.95}$	Target PbB in fetus (e.g., 2-8 µg/dL)	µg/dL	5
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	0.6
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050
$AF_{S,\ D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S,\ D}$	Exposure frequency (same for soil and dust)	days/yr	219
$AT_{S,\ D}$	Averaging time (same for soil and dust)	days/yr	365
PRG in Soil for no more than 5% probability that fetal PbB exceeds target PbB		**ppm**	**1,050**

USEPA, 2017. *Adult Lead Model - Calculations of Blood Lead Concentrations (PbBs) and Risk in Nonresidential Areas* . Version dated June 14, 2017.

Table G-4
Input Parameters to Estimate Soil to Groundwater Remediation Goals
FTBL-005-R-05

Variable	Value
THQ (target hazard quotient) unitless	1
TR (target risk) unitless	0.0001
LT (lifetime) years	70
K (volatilization factor of Andelman) L/m^3	0.5
l_{sc} (apparent thickness of stratum corneum) cm	0.001
ED_{res} (exposure duration - resident) years	26
$ED_{res\text{-}c}$ (exposure duration - child) years	6
$ED_{res\text{-}a}$ (exposure duration - adult) years	20
$ED_{0\text{-}2}$ (mutagenic exposure duration first phase) years	2
$ED_{2\text{-}6}$ (mutagenic exposure duration second phase) years	4
$ED_{6\text{-}16}$ (mutagenic exposure duration third phase) years	10
$ED_{16\text{-}26}$ (mutagenic exposure duration fourth phase) years	10
EF_{res} (exposure frequency) days/year	350
$EF_{res\text{-}c}$ (exposure frequency - child) days/year	350
$EF_{res\text{-}a}$ (exposure frequency - adult) days/year	350
$EF_{0\text{-}2}$ (mutagenic exposure frequency first phase) days/year	350
$EF_{2\text{-}6}$ (mutagenic exposure frequency second phase) days/year	350
$EF_{6\text{-}16}$ (mutagenic exposure frequency third phase) days/year	350
$EF_{16\text{-}26}$ (mutagenic exposure frequency fourth phase) days/year	350
$ET_{event\text{-}res\text{-}adj}$ (age-adjusted exposure time) hours/event	0.67077
$ET_{event\text{-}res\text{-}madj}$ (mutagenic age-adjusted exposure time) hours/event	0.67077
ET_{res} (exposure time) hours/day	24
$ET_{res\text{-}c}$ (dermal exposure time - child) hours/event	0.54
$ET_{res\text{-}a}$ (dermal exposure time - adult) hours/event	0.71
$ET_{res\text{-}c}$ (inhalation exposure time - child) hours/day	24
$ET_{res\text{-}a}$ (inhalation exposure time - adult) hours/day	24
$ET_{0\text{-}2}$ (mutagenic inhalation exposure time first phase) hours/day	24
$ET_{2\text{-}6}$ (mutagenic inhalation exposure time second phase) hours/day	24
$ET_{6\text{-}16}$ (mutagenic inhalation exposure time third phase) hours/day	24
$ET_{16\text{-}26}$ (mutagenic inhalation exposure time fourth phase) hours/day	24
$ET_{0\text{-}2}$ (mutagenic dermal exposure time first phase) hours/event	0.54
$ET_{2\text{-}6}$ (mutagenic dermal exposure time second phase) hours/event	0.54
$ET_{6\text{-}16}$ (mutagenic dermal exposure time third phase) hours/event	0.71
$ET_{16\text{-}26}$ (mutagenic dermal exposure time fourth phase) hours/event	0.71
$BW_{res\text{-}a}$ (body weight - adult) kg	80
$BW_{res\text{-}c}$ (body weight - child) kg	15
$BW_{0\text{-}2}$ (mutagenic body weight) kg	15
$BW_{2\text{-}6}$ (mutagenic body weight) kg	15
$BW_{6\text{-}16}$ (mutagenic body weight) kg	80
$BW_{16\text{-}26}$ (mutagenic body weight) kg	80

Table G-4
Input Parameters to Estimate Soil to Groundwater Remediation Goals
FTBL-005-R-05

Variable	Value
$IFW_{res\text{-}adj}$ (adjusted intake factor) L/kg	327.95
$IFW_{res\text{-}adj}$ (adjusted intake factor) L/kg	327.95
$IFWM_{res\text{-}adj}$ (mutagenic adjusted intake factor) L/kg	1019.9
$IFWM_{res\text{-}adj}$ (mutagenic adjusted intake factor) L/kg	1019.9
$IRW_{res\text{-}c}$ (water intake rate - child) L/day	0.78
$IRW_{res\text{-}a}$ (water intake rate - adult) L/day	2.5
$IRW_{0\text{-}2}$ (mutagenic water intake rate) L/day	0.78
$IRW_{2\text{-}6}$ (mutagenic water intake rate) L/day	0.78
$IRW_{6\text{-}16}$ (mutagenic water intake rate) L/day	2.5
$IRW_{16\text{-}26}$ (mutagenic water intake rate) L/day	2.5
$EV_{res\text{-}a}$ (events - adult) per day	1
$EV_{res\text{-}c}$ (events - child) per day	1
$EV_{0\text{-}2}$ (mutagenic events) per day	1
$EV_{2\text{-}6}$ (mutagenic events) per day	1
$EV_{6\text{-}16}$ (mutagenic events) per day	1
$EV_{16\text{-}26}$ (mutagenic events) per day	1
$DFW_{res\text{-}adj}$ (age-adjusted dermal factor) cm^2-event/kg	2610650
$DFWM_{res\text{-}adj}$ (mutagenic age-adjusted dermal factor) cm^2-event/kg	8191633
$SA_{res\text{-}c}$ (skin surface area - child) cm^2	6365
$SA_{res\text{-}a}$ (skin surface area - adult) cm^2	19652
$SA_{0\text{-}2}$ (mutagenic skin surface area) cm^2	6365
$SA_{2\text{-}6}$ (mutagenic skin surface area) cm^2	6365
$SA_{6\text{-}16}$ (mutagenic skin surface area) cm^2	19652
$SA_{16\text{-}26}$ (mutagenic skin surface area) cm^2	19652

Output generated 24MAY2022:09:00:26

Table G-5
Soil to Groundwater Remediation Goal Output
Site FTBL 005-R-05

Default

Resident Risk-Based Regional Screening Levels (RSL) for Tap Water

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	No	No	Organics	8.00E-02	I	-		4.00E-03	I	-

Notes:
I = IRIS
P = PPRTV
O = OPP
A = ATSDR
C = Cal EPA
X = PPRTV Screening Level
H = HEAST
D = OW
W = TEF applied
E = RPF applied
G = see user's guide
U = user provided
ca = cancer
nc = noncancer
* = where: nc SL < 100X ca SL
** = where nc SL < 10X ca SL
SSL values are based on DAF=1
max = ceiling limit exceeded
sat = Csat exceeded

Table G-5
Soil to Groundwater Remedation Goal Output
Site FTBL 005-R-05

Chemical	RfC Ref	GIABS	K_p (cm/hr)	MW	B (unitless)	t^* (hr)	τ_{event} (hr/event)	FA (unitless)	In EPD?	DA_{event} (ca)	DA_{event} (nc child)
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)		1.00E+00	3.36E-04	2.22E+02	1.93E-03	4.43E+00	1.84E+00	1.00E+00	Yes	1.22E-02	9.83E-03

Notes:
I = IRIS
P = PPRTV
O = OPP
A = ATSDR
C = Cal EPA
X = PPRTV Screening Level
H = HEAST
D = OW
W = TEF applied
E = RPF applied
G = see user's guide
U = user provided
ca = cancer
nc = noncancer
* = where: nc SL < 100X ca SL
** = where nc SL < 10X ca SL
SSL values are based on DAF=1
max = ceiling limit exceeded
sat = Csat exceeded

Table G-5
Soil to Groundwater Remedation Goal Output
Site FTBL 005-R-05

Chemical	DA_{event} (nc adult)	MCL (ug/L)	Ingestion SL TR=0.0001 (ug/L)	Dermal SL TR=0.0001 (ug/L)	Inhalation SL TR=0.0001 (ug/L)	Carcinogenic SL TR=0.0001 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	Inhalation SL Child THQ=1 (ug/L)
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.70E-02	-	9.74E+01	1.18E+04	-	9.66E+01	8.02E+01	1.06E+04	-

Notes:
I = IRIS
P = PPRTV
O = OPP
A = ATSDR
C = Cal EPA
X = PPRTV Screening Level
H = HEAST
D = OW
W = TEF applied
E = RPF applied
G = see user's guide
U = user provided
ca = cancer
nc = noncancer
* = where: nc SL < 100X ca SL
** = where nc SL < 10X ca SL
SSL values are based on DAF=1
max = ceiling limit exceeded
sat = Csat exceeded

Table G-5
Soil to Groundwater Remedation Goal Output
Site FTBL 005-R-05

Chemical	Noncarcinogenic SL Child THI=1 (ug/L)	Ingestion SL Adult THQ=1 (ug/L)	Dermal SL Adult THQ=1 (ug/L)	Inhalation SL Adult THQ=1 (ug/L)	Noncarcinogenic SL Adult THI=1 (ug/L)	Screening Level (ug/L)
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	7.96E+01	1.33E+02	1.60E+04	-	1.32E+02	7.96E+01 nc

Notes:

I = IRIS
P = PPRTV
O = OPP
A = ATSDR
C = Cal EPA
X = PPRTV Screening Level
H = HEAST
D = OW
W = TEF applied
E = RPF applied
G = see user's guide
U = user provided
ca = cancer
nc = noncancer
* = where: nc SL < 100X ca SL
** = where nc SL < 10X ca SL
SSL values are based on DAF=1
max = ceiling limit exceeded
sat = Csat exceeded

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APPENDIX H
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

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TABLE 1
Remedial Goals for Groundwater/Soil
FTBL-68, Fort Belvoir, Fairfax County, Virginia

SWMU	Contaminants Group	Groundwater Contaminant	2007 Decision Document (DD) Federal Cleanup Levels (µg/L)	DD Source	2017 Federal Cleanup Levels (µg/L)	2017 Source	2022 Federal Cleanup Levels (µg/L)	2022 Source	Change Remedial Goals?**
		Benzene	5	MCL	5	MCL	5	MCL	No
		Methylene Chloride	5	MCL	5	MCL	5	MCL	No
		Ethylene Dibromide	0.05	MCL	0.05	MCL	0.05	MCL	No
		1,2-Dichloroethane	5	MCL	5	MCL	5	MCL	No
		Chloroform	100	MCL	80	MCL	80	MCL	No
		Naphthalene	6.5	RBC	0.17 - 17	RSL	0.117 - 11.7	RSL2	No
		2-Methylnaphthalene	24	RBC	36	RSL	36	RSL2	No

SWMU	Contaminants Group	Soil Contaminant	2007 Decision Document (DD) Federal Cleanup Levels (ppb)	DD Source	2017 Federal Cleanup Levels (ppb)	2017 Source	2022 Federal Cleanup Levels (ppb)	2022 Source	Change Remedial Goals?**
		Benzene	14	SSL	26	SSL2	26	RSLcalc	No
		Methylene Chloride	11.5	SSL	13	SSL2	13	RSLcalc	No
		Ethylene Dibromide	0.285	SSL	0.14	SSL2	0.14	RSLcalc	No
		1,2-Dichloroethane	21	SSL	14	SSL2	14	RSLcalc	No
		Naphthalene	77	SSL	5.4	SSL2	3.85-385	RSLcalc	No
		2-Methylnaphthalene	2200	SSL	1900	SSL2	1850	RSLcalc	No
		Lead***	800	RBC	800	RBC	800	RSL	No

Notes:

* = Value listed is MCL for total trihalomethanes. Chloroform has an MCLG of 70 ug/L, but no MCL. MCL = Safe Drinking Water Act Maximum Contaminant Level.

** = Recommendation to change Remedial Goals - Yes or No based on risk analysis presented in Question B sections.

***= Lead values are in mg/kg

MCL = Safe Drinking Water Act Maximum Contaminant Level

RBC = 2007 USEPA Region III Risk Basked Concentration.

RSL = November 2017 USEPA Regional Screening Levels for tapwater (Non-Cancer HI = 1.0; Cancer Risk 1 x 10-6 to 1 x 10-4)

RSL2 = May 2022 Regional Screening Levels (RSLs) for tap water (EPA, 2022a).

RSLcalc = EPA Regional Screening Level Online Calculator. https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

SSL = Site Specific Soil Screening Level derived following USEPA Region III memorandum on calculating soil to groundwater SSLs.

SSL2 = Risk-based protection of groundwater soil screening level presented in November 2017 RSL table and adjusted for dilution attenuation factor of 10.

SWMU = solid waste management unit

TABLE 2
Remedial Goals for Groundwater/Soil
FTBL-69, Fort Belvoir, Fairfax County, Virginia

SWMU	Contaminants Group	Groundwater Contaminant	2020 ESD Federal Cleanup Levels (µg/L)	2020 ESD Source	2022 Federal Cleanup Levels (µg/L)	2022 Source	Change Remedial Goals?**
M-27	Explosives	2,4-Dinitrotoluene	0.24	RSLcalc	0.24	RSLcalc2	No
		2,6-Dinitrotoluene	0.049	RSLcalc	0.049	RSLcalc2	No
		2-Amino-4,6-Dinitrotoluene	0.19	RSLcalc	0.19	RSLcalc2	No
		4-Amino-2,6-Dinitrotoluene	0.19	RSLcalc	0.19	RSLcalc2	No
		2,4,6, Trinitrotoluene	0.98	RSLcalc	0.98	RSLcalc2	No
		Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.97	RSLcalc	0.97	RSLcalc2	No

Notes:

* = Value is for a mixture of DNT constituents.

** = Recommendation to change Remedial Goals - Yes or No based on risk analysis presented in Question B sections.

DD = Decision Document

ESD = Explanation of Significant Differences (Plexus, 2021)

TABLE 3
Remedial Goals for Groundwater/Soil
FTBL-005-R-05, Fort Belvoir, Fairfax County, Virginia

SWMU	Contaminants Group	Groundwater Contaminant	2018 Decision Document (DD) Federal Cleanup Levels (µg/L)	DD Source	2022 Federal Cleanup Levels (µg/L)	2022 Source	Change Remedial Goals?**
M-33	Explosives	2,4-DNT/2,6-DNT*	5.3	RSLcalc	5.3	RSLcalc2	No
		Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	30	RSLcalc	40	RSLcalc2	No

Notes:

* = Selected RGs for 2,4-DNT and 2,6-DNT are the minimum of the carcinogenic screening level (SL) for the 2,4-/2,6-DNT mixture and the

** = Recommendation to change Remedial Goals - Yes or No based on risk analysis presented in Question B sections.

DD = decision document

MCL = maximum contaminant level

RSLcalc = USEPA Risk-Based Remedial Goals calculated using the 2018 USEPA online RSL calculator.

RSLcalc2 = USEPA Risk-Based Remedial Goals calculated using the 2022 USEPA online RSL calculator with updated toxicity criteria.

SWMU = solid waste management unit

TABLE 4
Remedial Goals for Groundwater/Soil
FTBL-005-R-09, Fort Belvoir, Fairfax County, Virginia

SWMU	Contaminants Group	Groundwater Contaminant	2020 Decision Document (DD) Federal Cleanup Levels (µg/L)	DD Source	2022 Federal Cleanup Levels (µg/L)	2022 Source	Change Remedial Goals?**
N/A	Explosives	2,6-DNT	1.1	RSL	1.1	RSL	No
	PAH	Naphthalene	1.7	RSL	1.2	RSL	No
		Benzo(a)anthracene	0.3	RSL	0.3	RSL	No
		Benzo(a)pyrene	0.25/6	MCL	0.25/6	MCL	No
		Benzo(b)fluoranthene	2.5	RSL	2.5	RSL	No
		Dibenz(a,h)anthracene	0.25	RSL	0.25	RSL	No
		Indeno(1,2,3-cd)pyrene	2.5	RSL	2.5	RSL	No
	SVOC	1,1'-Biphenyl	0.83	RSL	0.83	RSL	No
		Hexachlorobenzene	0.1/16	MCL	0.1/16	MCL	No

Notes:

* = Value listed is MCL for total trihalomethanes. Chloroform has an MCLG of 70 ug/L, but no MCL.

** = Recommendation to change Remedial Goals - Yes or No based on risk analysis presented in Question B sections.

MCL = Safe Drinking Water Act Maximum Contaminant Level

N/A = not applicable

PAH = polyaromatic hydrocarbons

RSL = November 2017 USEPA Regional Screening Levels for tapwater (Non-Cancer HI = 1.0; Cancer Risk 1 x 10-6 to 1 x 10-4)

SVOC = semivolatile organic compounds

SWMU = solid waste management unit

TABLE 5
ARARs and TBC Guidance for Groundwater
FTBL-68, Fort Belvoir, Virginia

Authority	Requirement	Synopsis of Requirement	ARAR Status per DD (2016 DD)	Analysis
Office of Solid Waste and Emergency Response [OSWER] Directive 9355.4-12, July 14, 1994	Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities	The acceptable exposure level for lead in soil for a child is 400 mg/kg.	**TBC Guidance**	This exposure level is still applicable because the human health risk assesment was evaluated for potential future child residents.
40 CFR § 300.430(a)(1)(iii)(D)	Land Use Controls	Required when waste is left in place at site.	**Applicable**	Remains applicable for the protection of human health from groundwater COCs under FTBL; which have yet to meet their respective cleanup criteria to protect human health.
Policy for Assuring Land Use Controls at Federal Facilities (EPA, 1998b)	Land Use Controls	Required when waste is left in place at site.	**TBC Guidance**	To be considered guidance for the protection of human health from groundwater COCs under FTBL; which have yet to meet their respective cleanup criteria to protect human health.

Notes:
1. Action-specific applicable or relevant and appropriate requirements (ARARs) are the substantive requirements of the regulations presented above.
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
ROD – Record of Decision
RCRA – Resource Conservation and Recovery Act
TBC - To be considered

TABLE 6
ARARs and TBC Guidance for Groundwater
FTBL-69, Fort Belvoir, Virginia

Authority	Requirement	Synopsis of Requirement	ARAR Status per DD (2016 DD)	Analysis
40 CFR § 300.430(a)(1)(iii)(D)	Land Use Controls	Required when waste is left in place at site.	**Applicable**	Remains applicable for the protection of human health from groundwater COCs under FTBL; which have yet to meet their respective cleanup criteria to protect human health.
Policy for Assuring Land Use Controls at Federal Facilities (EPA, 1998b)	Land Use Controls	Required when waste is left in place at site.	**TBC Guidance**	To be considered guidance for the protection of human health from groundwater COCs under FTBL; which have yet to meet their respective cleanup criteria to protect human health.

Notes:
1. Action-specific applicable or relevant and appropriate requirements (ARARs) are the substantive requirements of the regulations presented above.
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
ROD – Record of Decision
RCRA – Resource Conservation and Recovery Act
TBC - To be considered

TABLE 7
ARARs and TBC Guidance for Groundwater FTBL-001-R-02,
Fort Belvoir, Virginia

Authority	Requirement	Synopsis of Requirement	ARAR Status per DD (2020 DD)	Analysis
9 VAC 25-260, Virginia WQS	WQS (Virginia)	Determines on a case-by-case basis the effluent discharge limits which any groundwater decontamination water or other material may be discharged to surface waters.	**Relevant and Appropriate Chemical-Specific**	This requirement is still applicable as the stream is expected to support biologically significant populations of aquatic biota. The Virginia WQS have been considered in developing RGs for the site's surface water.
RSLs (USEPA)	USEPA RSL Table, November 2019	Provides soil concentrations that are associated with a cancer risk range of 1x10-4 to 1x10-6 or a non-cancer hazard quotient of 1 for a standard resident exposure (residential soil RSLs) or industrial worker exposure (industrial soil RSLs). This table provides toxicological information that can be used in the development of RGs to protect human health. At the INFC MRS, the lead RSL was considered in developing the RG for the site soil.	**TBC Chemical-Specific**	This requirement is still applicable because RSLs were used in the development of RGs for the site's soil.
State Water Control Law (Code of Virginia Title 62.1 – 44.15:20) Virginia Administrative Code Regulations 9VAC25-660 et seq.	Clean Water Act (CWA) 33 USC Section 1344	The stream would be temporarily redirected during the remedial action.	**Relevant and appropriate**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.
Chapter 188 of the Code of the County of Fairfax (1181	Fairfax County Chesapeake Bay Preservation Ordinance	The recommended alternative would encroach upon the stream and wetlands transition area.	**TBC Guidance**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.
40 CFR 261, Subparts A, B, C D-40 CFR 136, App A, B, C, and D	Resource Conservation and Recovery Act (RCRA)	It is assumed that the excavated soils will fail TCLP analysis and require treatment prior to off-site disposal.	**Relevant and appropriate**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.
Fort Belvoir Directorate of Public Works Environmental and Natural Resources Division (DPWENRD)	Fort Belvoir Tree Policy	These requirements will be considered during the development of a work plan based upon the selected remedy.	**TBC Gudiance**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.
Va. Code Ann. §§ 10.11400 to 1457 (2004); 9 VAC 20-60-12 to 1505; 9 VAC 20-80-10 to 790; and 9 VAC 20-110-10 to 130	Virginia Waste Management Act; Virginia Hazardous Waste Management Regulations; Solid Waste Management Regulations; Regulations Governing the Transportation of Hazardous Materials	It is assumed that soil removal will be performed as part of the selected remedy.	**Relevant and appropriate**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.
Va. Code Ann. §§ 10.11300 to 1326 (1998); 9 VAC 5-30-10 to 80; 9 VAC 5-50-60 to 120; 9 VAC 5-60-60 to 80; and 9 VAC 5-60-300 to 370	Air Pollution Control Board; Ambient Air Quality Standards; Standards of Performance for Visible Emissions and Fugitive Dust/Emissions [Rule 5-1]; Environmental Protection Agency National Emission Standards for Hazardous Air Pollutants [Rule 6-1]; and the Emission Standards for Toxic Pollutants from New and Modified Sources [Rule 6-5]	It is assumed that soil excavation will be performed as part of the selected remedy.	**Relevant and appropriate**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.

Notes:
1. Action-specific applicable or relevant and appropriate requirements (ARARs) are the substantive requirements of the regulations presented above.
INFC – Infiltration Course
MRS – Munitions Response Site
ROD – Record of Decision
RGs – remedial goals
RSLs – Regional Screening Levels
TBC - To be considered
USEPA – U.S. Environmental Protection Agency
VAC – Virginia Administative Code
WQS – Water Quality Standard

TABLE 8
ARARs and TBC Guidance for Groundwater
FTBL-003-R-01, Fort Belvoir, Virginia

Authority	Requirement	Synopsis of Requirement	ARAR Status per DD (2017 DD)	Analysis
16 USC § 1538 (a) 50 CFR 17.40(o)(1)	Endangered Species Act	Prohibits Federal actions from taking endangered species and critical habitat during Federal activities. Prohibits the taking of a Northern Long-Eared Bat as well as actions altering their environment and behavioral patterns. Two endangered species, the Indiana Bat and the Northern Long-Eared bat are known to occur at the CRC.	**Applicable**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.
16 USC 703(a)	Migratory Bird Treaty Ac	Prohibits the take, capture, or sale of migratory birds, nests, and eggs. Vegetation clearance activities should occur outside the nesting seasons for migratory birds. Migratory birds are known to occur in the area.	**Applicable**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.
Clean Water Act 33 United States Code Section 1344	40 CFR 230.10(a)(1)(2) and (3) – Dredge and Fill Regulation	No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. Active remediation may occur in wetland areas at the CRC or in areas adjacent to wetlands. The activities will be performed in a manner to minimize impacts to the wetlands. The activities will be performed such that no net loss of wetlands occurs.	**Applicable**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.
4 VAC 20-390-40	Wetlands Mitigation Compensation Policy and Supplemental Guidelines	Provides criteria and guidelines for an action which may impact wetlands including measures to minimize wetlands loss or disturbance and demonstration of the need for the project.	**Relevant and Appropriate**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.
16 U.S.C. §§ 470ee sections (a) and (b)	Archaeological Resources Protection Act	A Federal activity is prohibited from removal, alteration, damage, or trafficking of archaeological resources.	**Applicable**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.

Notes:
1. Action-specific applicable or relevant and appropriate requirements (ARARs) are the substantive requirements of the regulations presented above.
CFR – Code of Federal Regulations
CRC – Combat Range Complex
ROD – Record of Decision
USC – United States Code

TABLE 9
ARARs and TBC Guidance for Groundwater
FTBL-005-R-05, Fort Belvoir, Virginia

Authority	Requirement	Synopsis of Requirement	ARAR Status per DD (2018 DD)	Analysis
40 CFR 141.11, 141.61, and 141.62	MCLs	MCLs are enforceable standards for public drinking water supply systems which have at least 15 service connections or are used by at least 25 persons.	**Relevant and appropriate**	These requirements are not directly applicable since groundwater in the vicinity of the site is not used for drinking water supply. However, MCLs were considered in developing RGs for the site's groundwater.
USEPA RSL Table, November 2018	RSLs (USEPA)	Provides groundwater concentrations that are associated with a cancer risk of 1x10-5 (1E-05) or a non-cancer hazard quotient of 1 for a standard resident exposure (residential soil RSLs) or industrial worker exposure (industrial soil RSLs). This table provides toxicological information that can be used in the development of RGs to protect human health. Remedial actions will focus on upholding the objectives of this act by restoring groundwater quality at the site.	**TBC Guidance**	This requirement is still applicable because RSLs were used in the development of RGs for the site's groundwater.
Underground Injection Control (UIC) Program	Federal Safe Drinking Water Act	Injection wells are regulated by the UIC under Federal Safe Drinking Water Act. EPA directly implements the UIC programs in Virginia. Injection wells incidental to aquifer remediation and experimental technologies are designated as Class V under the UIC program. Class V wells covered by the Federal UIC program are authorized by rule and do not require a separate UIC permit.	**TBC Guidance**	This requirement is not applicable. The selected remedy does not require underground injections.
Code of Virginia Section 62.144.15(3a)	Virginia State Water Control Law	Virginia State Water Control Law mandates the protection of existing high-quality state waters and provides for the restoration of all other state waters so they will permit reasonable public use and will support the growth of aquatic life.	**Potentially Applicable**	This requirement is still potentially applicable. Remedial actions will focus on upholding the objectives of this act by restoring groundwater quality at the site.
40 CFR § 300.430(a)(1)(iii)(D)	Land Use Controls	Required when waste is left in place at site.	**Applicable**	Remains applicable for the protection of human health from groundwater COCs under FTBL; which have yet to meet their respective cleanup criteria to protect a hypothetical resident.
Policy for Assuring Land Use Controls at Federal Facilities (EPA, 1998b)	Land Use Controls	Required when waste is left in place at site.	**TBC Guidance**	To be considered guidance for the protection of human health from groundwater COCs under FTBL; which have yet to meet their respective cleanup criteria to protect a hypothetical resident.

Notes:
1. Action-specific applicable or relevant and appropriate requirements (ARARs) are the substantive requirements of the regulations presented above.
CFR - Code of Federal Regulations
MCL – Maximum Contaminant Level
ROD – Record of Decision
RGs – remedial goals
RSLs – Regional Screening Levels
TBC - To be considered
USEPA – U.S. Environmental Protection Agency

TABLE 10
ARARs and TBC Guidance for Groundwater
FTBL-005-R-09, Fort Belvoir, Virginia

Authority	Requirement	Synopsis of Requirement	ARAR Status per DD (2020 DD)	Analysis
40 CFR 141.11, 141.61, and 141.62	MCLs	MCLs are enforceable standards for public drinking water supply systems which have at least 15 service connections or are used by at least 25 persons.	**Relevant and appropriate**	These requirements are not directly applicable since groundwater in the vicinity of the site is not used for drinking water supply. However, MCLs were considered in developing RGs for the site's groundwater.
USEPA RSL Table, November 2018	RSLs (USEPA)	Provides groundwater concentrations that are associated with a cancer risk of 1x10-5 (1E-05) or a non-cancer hazard quotient of 1 for a standard resident exposure (residential soil RSLs) or industrial worker exposure (industrial soil RSLs). This table provides toxicological information that can be used in the development of RGs to protect human health. At CDC site, the RSLs were considered in derivation of the RGs.	**TBC Guidance**	This requirement is still applicable because RSLs were used in the development of RGs for the site's groundwater.
40 CFR § 300.430(a)(1)(iii)(D)	Land Use Controls	Required when waste is left in place at site.	**Applicable**	Remains applicable for the protection of human health from groundwater COCs under FTBL; which have yet to meet their respective cleanup criteria to protect a hypothetical resident.
Policy for Assuring Land Use Controls at Federal Facilities (EPA, 1998b)	Land Use Controls	Required when waste is left in place at site.	**TBC Guidance**	To be considered guidance for the protection of human health from groundwater COCs under FTBL; which have yet to meet their respective cleanup criteria to protect a hypothetical resident.

Notes:
1. Action-specific applicable or relevant and appropriate requirements (ARARs) are the substantive requirements of the regulations presented above.
CFR - Code of Federal Regulations
MCL – Maximum Contaminant Level
ROD – Record of Decision
RGs – remedial goals
RSLs – Regional Screening Levels
TBC - To be considered
USEPA – U.S. Environmental Protection Agency

TABLE 11
ARARs and TBC Guidance for Groundwater
FTBL-007-R-01, FTBL-018-R-01, FTBL-024-R-01, FTBL-027-R-01 Fort Belvoir, Virginia

Authority	Requirement	Synopsis of Requirement	ARAR Status per DD (2017 DD)	Analysis
40 CFR 230.10(a) – Dredge and Fill Regulations	Clean Water Act 33 USC Section 1344	No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. Active remediation may occur in wetland areas or in areas adjacent to wetlands. The activities will be performed in a manner to minimize impacts to the wetlands. The activities will be performed such that no net loss of wetlands occurs.	**Applicable**	This requirement is no longer applicable because the removal action part of the remedy at FTBL-018-R-01 has been completed and there are no more site disturbance activities. FTBL-007-R-01, FTBL-024-R-01, and FTBL-027 did not have removal actions as part of their selected remedies.
9 VAC 25-840-40 (9VAC-25-870-54F)	Erosion and Sediment Control Regulations Storm Water Management Program (VSMP) Regulation	Establishes minimum standards for the control of soil erosion, sediment deposition, and runoff for activities that disturb the land over 2,500 square feet in size. Specific requirements include: minimum standards for sediment basins and traps; soil stabilization procedures; and protection of waterways and properties from erosion, sediment deposition, and damage due to increased volume, velocity, or peak flow rate of storm water runoff. May be applicable if clearing activities over an area greater than 2,500 square feet are recommended.	**Applicable**	This requirement is no longer applicable because the removal action part of the remedy at FTBL-018-R-01 has been completed and there are no more site disturbance activities. FTBL-007-R-01, FTBL-024-R-01, and FTBL-027 did not have removal actions as part of their selected remedies.
40 CFR Part 266.203(a) and 205(a)(1	Resource Conservation and Recovery Act	Regulates storage and transportation of recovered military munitions in accordance with DoD Explosive Safety Board standards. May be applicable if a Removal Action is recommended resulting in the discovery of MEC which may be transported off site.	**Applicable**	This requirement is no longer applicable because the removal action part of the remedy at FTBL-018-R-01 has been completed and there are no more site disturbance activities. FTBL-007-R-01, FTBL-024-R-01, and FTBL-027 did not have removal actions as part of their selected remedies.
40 CFR 50.6 and 60.7 and Appendix K, Section 2.3	Clean Air Act National Ambient Air Quality Standards Particulates	Establishes maximum concentrations for particulates and fugitive dust emissions. Applicable for on-site activities which would generate particulate matter and fugitive dust emissions from construction vehicles and equipment	**Applicable**	This requirement is no longer applicable because the removal action part of the remedy at FTBL-018-R-01 has been completed and there are no more site disturbance activities. FTBL-007-R-01, FTBL-024-R-01, and FTBL-027 did not have removal actions as part of their selected remedies.

Notes:
1. Action-specific applicable or relevant and appropriate requirements (ARARs) are the substantive requirements of the regulations presented above.
INFC – Infiltration Course
MRS – Munitions Response Site
ROD – Record of Decision
RGs – remedial goals
RSLs – Regional Screening Levels
TBC - To be considered
USEPA – U.S. Environmental Protection Agency
VAC – Virginia Administative Code
WQS – Water Quality Standard

TABLE 12
ARARs and TBC Guidance for Groundwater
FTBL-014-R-01, Fort Belvoir, Virginia

Authority	Requirement	Synopsis of Requirement	ARAR Status per DD (2016 DD)	Analysis
Office of Solid Waste and Emergency Response [OSWER] Directive 9355.4-12, July 14, 1994	Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities	The acceptable exposure level for lead in soil for a child is 400 mg/kg.	**TBC Guidance**	This exposure level is still applicable because the human health risk assesment was evaluated for potential future child residents.

Notes:

1. Action-specific applicable or relevant and appropriate requirements (ARARs) are the substantive requirements of the regulations presented above.

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
ROD – Record of Decision
RCRA – Resource Conservation and Recovery Act
TBC - To be considered

TABLE 13
ARARs and TBC Guidance for Groundwater
FTBL-025-R-01, Fort Belvoir, Virginia

Authority	Requirement	Synopsis of Requirement	ARAR Status per DD (2020 DD)	Analysis
40 CFR 230.10(a) – Dredge and Fill Regulations	Clean Water Act 33 USC Section 1344	No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. Active remediation may occur in wetland areas or in areas adjacent to wetlands. The activities will be performed in a manner to minimize impacts to the wetlands. The activities will be performed such that no net loss of wetlands occurs.	**Potentially Applicable**	Not applicable because the selected remedy is only LUCs. A removal action was not selected as part of the DD.
9 VAC 25-840-40 (9VAC-25-870-54F)	Erosion and Sediment Control Regulations Storm Water Management Program (VSMP) Regulation	Establishes minimum standards for the control of soil erosion, sediment deposition, and runoff for activities that disturb the land over 2,500 square feet in size. Specific requirements include: minimum standards for sediment basins and traps; soil stabilization procedures; and protection of waterways and properties from erosion, sediment deposition, and damage due to increased volume, velocity, or peak flow rate of storm water runoff. May be applicable if clearing activities over an area greater than 2,500 square feet are recommended.	**Potentially Applicable**	Not applicable because the selected remedy is only LUCs. A removal action was not selected as part of the DD.
40 CFR Part 266.203(a) and 205(a)(1	Resource Conservation and Recovery Act	Regulates storage and transportation of recovered military munitions in accordance with DoD Explosive Safety Board standards. May be applicable if a Removal Action is recommended resulting in the discovery of MEC which may be transported off site.	**Potentially Applicable**	Not applicable because the selected remedy is only LUCs. A removal action was not selected as part of the DD.
40 CFR 50.6 and 60.7 and Appendix K, Section 2.3	Clean Air Act National Ambient Air Quality Standards Particulates	Establishes maximum concentrations for particulates and fugitive dust emissions. Applicable for on-site activities which would generate particulate matter and fugitive dust emissions from construction vehicles and equipment	**Potentially Applicable**	Not applicable because the selected remedy is only LUCs. A removal action was not selected as part of the DD.

Notes:

1. Action-specific applicable or relevant and appropriate requirements (ARARs) are the substantive requirements of the regulations presented above.

INFC – Infiltration Course
MRS – Munitions Response Site
ROD – Record of Decision
RGs – remedial goals
RSLs – Regional Screening Levels
TBC - To be considered
USEPA – U.S. Environmental Protection Agency
VAC – Virginia Administative Code
WQS – Water Quality Standard

TABLE 14
ARARs and TBC Guidance for Groundwater
FTBL-026-R-01, Fort Belvoir, Virginia

Authority	Requirement	Synopsis of Requirement	ARAR Status per DD (2020 DD)	Analysis
40 CFR 230.10(a) – Dredge and Fill Regulations 40 CFR 230.5 – General Procedures to be Followed	Clean Water Act 33 USC Section 1344	No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. Active remediation may occur in wetland areas or in areas adjacent to wetlands. The activities will be performed in a manner to minimize impacts to the wetlands. The activities will be performed such that no net loss of wetlands occurs. Potentially applicable to the substantive permit requirements if clearing and/or excavation activities are recommended.	**Potentially Applicable**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.
4 VAC 20-390-40 to 50	Wetlands Mitigation-Compensation Policy and Supplemental Guidelines	Provides criteria and guidelines for an action which may impact wetlands including measures to minimize wetlands loss or disturbance, demonstration of the need for the project, and guidelines for consideration of compensation plan if required. Applicable to the substantive requirements the remedial action impacts wetlands	**Applicable**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.
40 CFR Part 266.203(a) and 205(a)(1	Resource Conservation and Recovery Act	Regulates storage and transportation of recovered military munitions in accordance with DoD Explosive Safety Board standards. May be applicable if a Removal Action is recommended resulting in the discovery of MEC which may be transported off site.	**Applicable**	This requirement is no longer applicable because the removal action part of the remedy has been completed and there are no more site disturbance activities.

Notes:
1. Action-specific applicable or relevant and appropriate requirements (ARARs) are the substantive requirements of the regulations presented above.
INFC – Infiltration Course
MRS – Munitions Response Site
ROD – Record of Decision
RGs – remedial goals
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APPENDIX I
3RS EXPLOSIVE SAFETY GUIDE

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3Rs Explosives Safety Guide

Construction Industry

Recognize
Retreat
Report

THE UNITED STATES HAS ALWAYS MAINTAINED A HIGHLY TRAINED AND READY FORCE TO PROTECT ITS NATIONAL INTERESTS.

After both world wars and recently with force realignment and modernization efforts, the Department of Defense (DoD) closed a number of military installations and training areas, and returned other lands previously used for military-related activities to public use. Because of the live-fire training and testing required to maintain this force, millions of acres in the United States are known or suspected to contain military munitions in the form of unexploded ordnance (UXO), or discarded military munitions (DMM). In some cases, munitions constituents (e.g., TNT) may also exist in high enough concentrations to present an explosive (detonation) hazard. Although DoD routinely made an effort to remove any explosive hazards present before releasing land from its control, some may remain. These explosive hazards may be found on the surface or in the subsurface.

Munitions are designed to injure, maim or kill people, or to destroy equipment or structures. Consider any encounter with a known or suspected munition as an extremely dangerous situation.

During construction work (e.g. clearing vegetation, grubbing, grading, or excavation), munitions may be encountered. This is particularly true for areas known to have once been used by the military for munitions-related activities (e.g., live-fire training and testing, and munitions demilitarization).

Military munitions operating buildings (e.g., munitions production and demilitarization facilities) and any installed equipment may contain explosives residue in high enough concetrations to present an explosive hazard. Building features (e.g., floors, walls, drains, internal and external piping, and ventilation systems), in which explosives residues could accumulate and present an explosive hazard, are of particular concern. Industrial equipment, particularly equipment with internal cavities, from facilities used in munitions production or demilitarization operations (e.g., cast loading, milling, or steam-out) that generated explosive residues (e.g., dust or vapors) is also of concern.

WILL YOU KNOW WHAT TO DO IF YOU ENCOUNTER A MUNITION?

Areas at which DoD conducted munitions-related activities include, but are not limited to operational and former ranges, and areas used for munitions demilitarization. The types of explosive hazards present may differ between areas. As an example, a former impact area may contain UXO, while a former maneuver area may only contain DMM.

Munitions can also be found in areas where combat operations once occurred. Even cannon balls found on Civil War battlefields present a potential explosive hazard. However, for a variety of reasons (unauthorized disposals, discarded souvenirs) munitions may be encountered almost anywhere.

Prior to working in areas with a history of military use, even areas where DoD has completed an environmental response to remove any hazards detected, it is important to familiarize yourself with the site history and potential hazards. This can be provided through site-specific safety training. In some cases, safety officials may determine that on-site or on-call construction support by UXO-qualified personnel is necessary to help ensure the safety of construction workers, particularly during ground disturbing or intrusive activities.

MUNITIONS ARE DESIGNED TO BE DANGEROUS

Remember that munitions:

- Come in many shapes and sizes.
  - They could look like a:
    - Pointed pipe
    - Soda can
    - Baseball
    - Car muffler
  - They may:
    - Look new or old
    - Be found alone or in clusters
- Should be considered extremely dangerous regardless of size or age
- Munitions often become more dangerous with age, not safer

Munitions may be:

- Found almost anywhere
- Clearly visible on the surface
- Buried at depths of inches to many feet
- Partially or completely hidden by dirt or vegetation
- Found under paved areas (roads, parking lots) or building slabs
- Underwater, in lakes, streams, or the ocean
- Exposed by natural phenomena (e.g., tides)
- Easy or difficult to recognize

While munitions are most likely to be encountered during construction in areas where DoD conducted munitions-related activities, they may be encountered anywhere. To protect yourself and your co-workers, know whether munitions-related activities ever occurred at your work site, and learn to follow the 3Rs: Recognize, Retreat, Report.

Recognize

Recognizing that you may have encountered a munition is one of the most important steps in reducing the potential risk of injury or death. Because munitions pose a potential explosive hazard, they should never be touched, moved or disturbed (handled).

WILL YOU DO THE RIGHT THING WHEN THE TIME COMES?

In 1993, a construction worker digging a trench unearthed what looked like large bullets. He recognized the potential danger, stopped digging and notified his supervisor. Local authorities were called. As a result of this worker's actions, nearly 150 high explosive tank shells were recovered from a former WWI training area.

Remember, whether complete or in pieces, any munition or suspect munition encountered should be considered extremely dangerous. Do the right thing! immediately stop all operations in the area; do not touch, move or disturb it, and notify your supervisor or local authorities.

Retreat

If you encounter or suspect you may have encountered a munition, do not touch, move or disturb it. Instead, carefully retreat from the area by retracing your steps.

- Immediately stop all construction activities in the area, warning others of the potential danger.
- Do not approach the munition or a suspect munition. (Some fuzes are sensitive to changes in temperature, movement or pressure.)
- Move away from the area and keep others away from it!

Unfortunately, munitions are often popular, but potentially deadly souvenirs. Taking a munition for a keepsake presents an immediate and real danger to you. Bringing one home endangers your family, your friends, and your community. Don't be tempted.

Report

If you encounter or suspect you have encountered a munition, do not touch, move or disturb it. Instead, immediately stop construction activities and move away from the area and report what you saw.

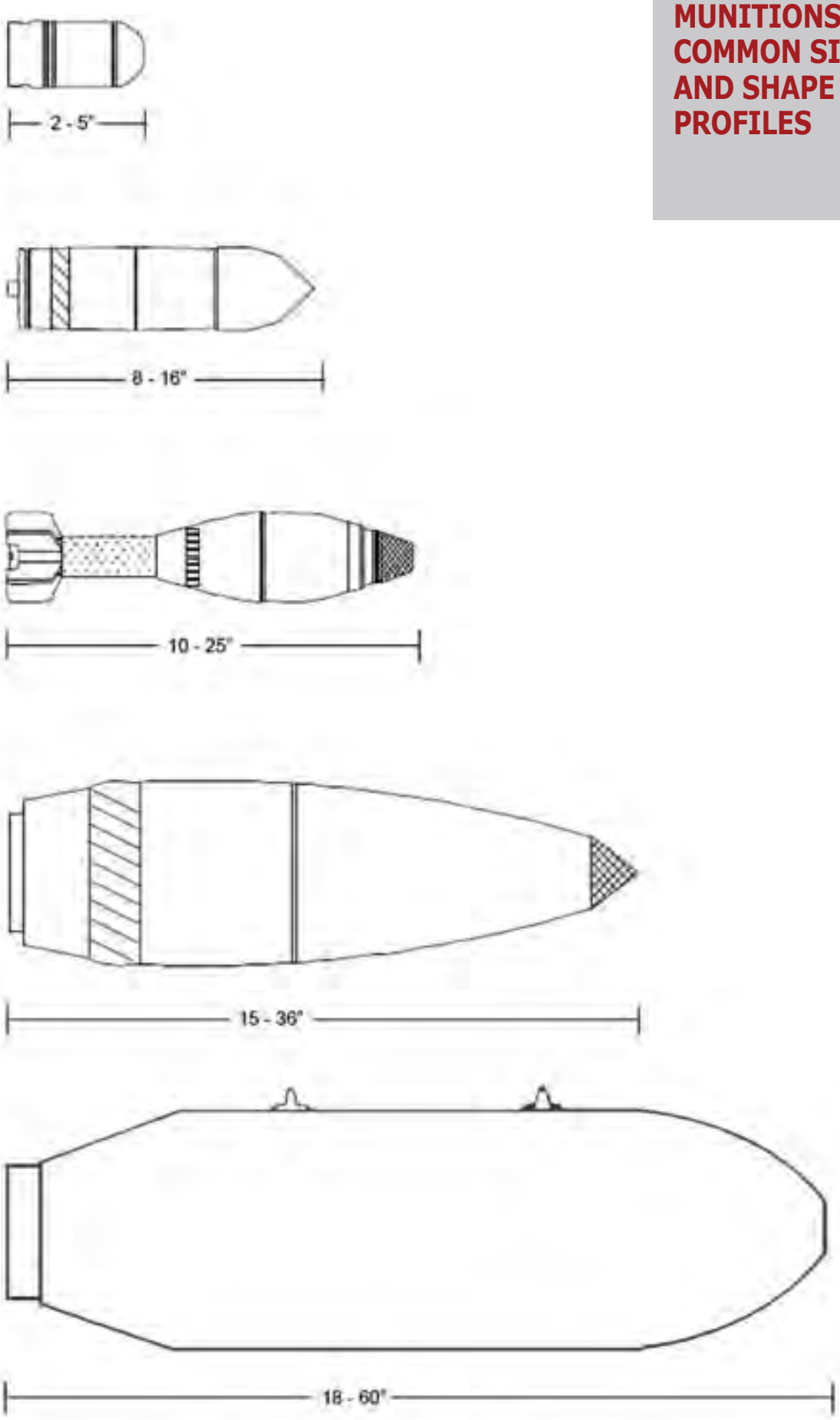
Protect yourself, your co-workers, and the public by immediately reporting any munitions or suspect munitions encountered to your foreman, site supervisor, or by calling 911.

Provide as much information as possible about what you saw and where you saw it. This will help the police and explosive ordnance disposal personnel (usually referred to as EOD personnel) find, evaluate and address the situation.

If you believe you may have encountered a munition, report the following:

- The area where you encountered it.
- A general description of the munition, to include:
  - Its size
  - Its shape
  - Any readily visible markings--do not approach or handle the munition to see the markings

MUNITIONS COMMON SIZE AND SHAPE PROFILES



Don't Forget

- Munitions are dangerous and may not be easily recognizable!
- The history of your work site--know when you are working on a former military range or disposal area!
- Never touch, move or disturb a munition!

Follow the 3Rs

Recognize

When you may have encountered a munition.

Retreat

Do not touch, move or disturb it, but carefully leave the area.

Report

Immediately notify the police if on land,
or the U.S. Coast Guard if at sea.

Emergency contacts:

- On land: Call 911
- At sea: Use Channel 16 (156.800 MHz)

For additional information call
U.S. Army Technical Center for Explosives Safety
at (918) 420-8919
or see

the US Army's UXO Safety Education website
https://www.denix.osd.mil/uxosafety

FEBRUARY 2010

APPENDIX J
REGULATORY REVIEW COMMENTS

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Commonwealth of Virginia

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

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Michael S. Rolband, PE, PWD, PWS Emeritus
Director
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March 20, 2023

Mr. Chris Manikas
Directorate of Public Works/Environmental Division
9430 Jackson Loop
Fort Belvoir, VA 22060

RE: Draft Final Third Five-Year Review
Fort Belvoir, Virginia

Dear Mr. Manikas:

The Virginia Department of Environmental Quality (DEQ) Office of Remediation Programs, CERCLA Program appreciates the opportunity to review the ***Draft Final, Third Five-Year Review (FYR), Fort Belvoir, Virginia***. The report is undated and was received by DEQ on February 9, 2023.

This Five-Year Review was conducted for CERCLA sites that have been issued a Decision Document and where hazardous substances, pollutants, or contaminants remain at the sites at levels that do not allow for unlimited use or unrestricted exposure. This FYR consists of 11 Military Munitions Response Program sites and 2 Installation Restoration Program sites. The report was well-written and included updated figures and comprehensive data summary tables with statistics.

Subject to DEQ's internal review, we have the following comments for the Army's consideration when finalizing this report:

1. The Annual Land Use Control (LUC) Inspection Reports have identified a need to improve GIS LUC layers. Please clarify if this need was considered during the findings and/or recommendations sections for the FYR. From DEQ's perspective, each site's LUC boundary should be illustrated in the GIS and should indicate there is a LUC on that parcel. DEQ understands that Ft. Belvoir's GIS cannot provide the details of the LUC in the GIS. DEQ acknowledges it is a two-step process: step 1: identify there is a LUC for a parcel and step 2: obtain a copy of the Land Use Control Implementation Plan (LUCIP) for the details. Reiterating this process throughout the FYR report seems important for future users to understand.

2. FTBL-68. Section 4.7 Progress since the Last Five-Year Review. Table 5 – Recommendations Affecting Protectiveness from Prior Five-Year Reviews. The FYR should acknowledge that the PFAS PA/SI determined no further action for FTBL-68, but that this decision was changed based on the updated July 2022 Office of the Secretary of Defense screening levels. FTBL-68 will be carried forward in the PFAS RI.

3. FTBL-69 Waste Ordnance Pit at Range 1. Section 5.8 Data Review. This section only reported on data collected in 2018 and 2019. If possible, it would be helpful to explain what data was collected since 2019 and incorporate it into this section. At a minimum, it seems appropriate to discuss the perchlorate groundwater data collected in March 2022.

4. Demo-Area 01. Verify with Army personnel the construction work planned and/or completed for this area. As of Feb. 2022, there were two dig permits for new construction of homes with some or all of them as "in-fill" within the old Woodlawn neighborhood. This redevelopment was initially described in the 2021 LUC Inspection Report. Additionally, DEQ notified the Army of potential concerns of MMRP outside the current Demo-Area-01 boundaries and within the Huntley Meadows Park. It is DEQ's understanding that a future munitions investigation is underway.

5. Section 7.6.1 FTBL-003-R-01 Combat Range Complex, Table 22 – FTBL-003-R-01 Project Action Limits for Soils: The table incorrectly refers to the "VADEQ Adult Lead Model." DEQ does not use its own model and instead uses EPA's ALM. Please correct the reference in the table.

6. Section 9.13 Other Findings: The section notes that during one sampling event the MDL for hexochlorobenzene did not achieve the EPA VISL screening levels. The section should include a brief explanation of why this did not impact the protectiveness statement.

DEQ will continue to work with Fort Belvoir Environmental Partnering Team to complete the recommendations and address other findings from this review. If you have any questions regarding this letter or the project in general, please feel free to call me at 804-774-9026.

Sincerely,

Angie O. McGarvey
CERCLA Project Manager

cc: Brett Fisher – DEQ, CO
Kyle Newman – DEQ, CO
Richard Doucette – DEQ, NRO

FORT BELVOIR THIRD FIVE-YEAR REVIEW
REGULATORY REVIEW COMMENTS MATRIX

	SECTION	PAGE #	LINE #	COMMENT MADE BY	COMMENT	RECOMMENDATION	RESPONSE
1	3.5	6	47	AM	The Annual Land Use Control (LUC) Inspection Reports have identified a need to improve GIS LUC layers. Please clarify if this need was considered during the findings and/or recommendations sections for the FYR. From DEQ's perspective, each site's LUC boundary should be illustrated in the GIS and should indicate there is a LUC on that parcel. DEQ understands that Ft. Belvoir's GIS cannot provide the details of the LUC in the GIS. DEQ acknowledges it is a two-step process: step 1: identify there is a LUC for a parcel and step 2: obtain a copy of the Land Use Control Implementation Plan (LUCIP) for the details.	Reiterating this process throughout the FYR report seems important for future users to understand.	Concur. Sections that reference the GIS and Master Plan have been revised to state, "LUC boundaries have been noted in the Real Property Master Plan with LUC details in the LUCIP. Additionally, the Fort Belvoir dig permit process prevents unauthorized ground disturbance or land use activities." Additionally, section 3.5 was updated to state, "Currently, the GIS system only contains LUC boundaries, and the Master Plan states that a copy of the LUCIP must be obtained to acquire the LUC details."
2	4.7	13	156	AM	FTBL-68. Section 4.7 Progress since the Last Five-Year Review. Table 5 – Recommendations Affecting Protectiveness from Prior Five-Year Reviews. The FYR should acknowledge that the PFAS PA/SI determined no further action for FTBL-68, but that this decision was changed based on the updated July 2022 Office of the Secretary of Defense screening levels. FTBL-68 will be carried forward in the PFAS RI.	The FYR should acknowledge that the PFAS PA/SI determined no further action for FTBL-68, but that this decision was changed based on the updated July 2022 Office of the Secretary of Defense screening levels.	Concur. Section 4.7, Table 5 has been updated to state the following, "The PFAS PA/SI determined no further action for FTBL-68; however, the decision was changed based on the updated July 2022 OSD screening levels. FTBL-68 will be evaluated under a PFAS RI. "
3	5.8	26	109	AM	FTBL-69 Waste Ordnance Pit at Range 1. Section 5.8 Data Review. This section only reported on data collected in 2018 and 2019.	If possible, it would be helpful to explain what data was collected since 2019 and incorporate it into this section. At a minimum, it seems appropriate to discuss the perchlorate groundwater data collected in March 2022.	The perchlorate groundwater data collected in March 2021 (report dated 2022) was outside the data review period (2017–2021); thus, was not included in the review.

	SECTION	PAGE #	LINE #	COMMENT MADE BY	COMMENT	RECOMMENDATION	RESPONSE
4	10.6.4	68		AM	Demo-Area 01. Verify with Army personnel the construction work planned and/or completed for this area. As of Feb. 2022, there were two dig permits for new construction of homes with some or all of them as “in-fill” within the old Woodlawn neighborhood. This redevelopment was initially described in the 2021 LUC Inspection Report. Additionally, DEQ notified the Army of potential concerns of MMRP outside the current Demo-Area-01 boundaries and within the Huntley Meadows Park. It is DEQ’s understanding that a future munitions investigation is underway.	Verify with Army personnel the construction work planned and/or completed for this area.	It was verified with Army peronnel that the plans for future construction in the area of Demo-Area 01 (FTBL-018-R-01) were halted and construction has been moved to another location on post, near the old commissary building. Redevelopment of this area was also mentioned in the 2019 LUC inspection report under the site description where the RA, which was completed in 2015, is dicussed. Additionally, the following has been added to section 10.6.4., "Additionally, details of redevelopment in the area were discussed in the 2019 and 2021 LUC inspection reports. It was confirmed with Army personnel that the plans for future construction near FTBL-018-R-01 were halted and moved to another location on post, near the old commissary building (HGL; 2019b, 2021)."
5	7.6.1	38	32	AM	Section 7.6.1 FTBL-003-R-01 Combat Range Complex, Table 22 – FTBL-003-R-01 Project Action Limits for Soils: The table incorrectly refers to the “VADEQ Adult Lead Model.” DEQ does not use its own model and instead uses EPA’s ALM.	Please correct the reference in the table.	Concur. Table 22 has been updated to state, "EPA Adult Lead Model for a future C/I worker".
6	9.13	56	169	AM	Section 9.13 Other Findings: The section notes that during one sampling event the MDL for hexochlorobenzene did not achieve the EPA VISL screening levels.	The section should include a brief explanation of why this did not impact the protectiveness statement.	Concur. Section 9.13 has been updated to explain why the elevated MDL for hexachlorobenzene did not impact the protectiveness statement. Hexachlorobenzene has not been historically detected in groundwater at FTBL-005-09. Historical method detection limits were less than the VISL target groundwater concentration.