FINAL
Site Inspection Report
Roy P. Benavidez National Guard Armory
El Campo, Texas

Perfluorooctane Sulfonic Acid (PFOS) and
Perfluorooctanoic Acid (PFOA) Impacted Sites
ARNG Installations, Nationwide

January 2022

Prepared for:

Army National Guard Bureau
111 S. George Mason Drive
Arlington, VA 22204

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Acronyms and Abbreviations

6:2 FTS	6:2 Fluorotelomer sulfonate
8:2 FTS	8:2 Fluorotelomer sulfonate
µg/Kg	micrograms per Kilogram
°F	degrees Fahrenheit
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
amsl	above mean sea level
AOI	Area of Interest
ARNG	Army National Guard
ASTM	American Society for Testing and Materials
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	cleaning, lubrication, and protection
CoC	chain of custody
CSM	conceptual site model
DA	Department of the Army
DO	dissolved oxygen
DoD	Department of Defense
DPT	direct-push technology
DQI	data quality indicator
DQO	data quality objective
DUA	data usability assessment
DVR	data validation report
EIS	extraction internal standards
ELAP	Environmental Laboratory Accreditation Program
EM	Engineers Manual
ERB	equipment rinsate blank
FedEx	Federal Express
FRB	field reagent blank
FTA	Fire Training Area
GAC	granular activated carbon
GWBU	groundwater-bearing units
GWTS	groundwater treatment system
HA	Health Advisory
HDPE	high-density polyethylene
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
LCS	laboratory control spike
LCSD	laboratory control spike duplicate
LOQ	limit of quantitation
MDL	method detection limit

mph	miles per hour
MS	matrix spike
MSD	matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid
ng/L	nanograms per liter
NGB	Army National Guard Bureau
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid
NOAA	National Oceanic and Atmospheric Administration
ORP	oxidation-reduction potential
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutyrate
PFBS	perfluorobutanesulfonic acid
PFCs	perfluorinated compounds
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid
PFTeDA	perfluorotetradecanoic acid
PFTrDA	perfluorotridecanoic acid
PFUdA	perfluoroundecanoic acid
PID	photoionization detector
ppt	parts per trillion
PQAPP	Programmatic UFP-QAPP
PVC	poly-vinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
rRPB	Roy P. Benavidez
RPD	relative percent differences
SI	Site Inspection
SL	screening level
SOP	Standard Operating Procedure
TCEQ	Texas Commission on Environmental Quality
TCRA	Time Critical Removal Action
TMD	Texas Military Department

TOC	total organic carbon
TPP	Technical Project Planning
TPWD	Texas Parks and Wildlife Department
TWDB SDR	Texas Water Development Board Submitted Drillers Reports
TXARNG	Texas Army National Guard
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
UFP	Uniform Federal Policy
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WRCC	Western Regional Climate Center

Executive Summary

The Army National Guard (ARNG) is performing Preliminary Assessments (PAs) and Site Inspections (SIs) at per- and polyfluoroalkyl substances (PFAS)-impacted sites at ARNG facilities nationwide. The objective of the SI at each facility is to identify whether there has been a release to the environment from the Areas of Interest (AOIs) identified in the PA and determine the presence or absence of perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and perfluorobutanesulfonic acid (PFBS) at or above screening levels (SLs). An SI was completed at the Roy P. Benavidez (RPB) National Guard Armory in El Campo, Texas (hereafter referred to as "RPB El Campo Armory" or "facility").

Drinking water from the facility's potable well was previously sampled for PFAS by the National Guard Bureau in April 2017. PFOA and PFOS were detected above the combined USEPA Health Advisory (HA) of 70 nanograms per liter (ng/L) (USEPA, 2016a). In response, RPB El Campo Armory switched to bottled water at that time, and in August 2018, a granular activated carbon (GAC) groundwater treatment system (GWTS) was installed to reduce the levels of PFOS and PFOA in the facility's drinking water. After groundwater was treated through the new GAC GWTS, detected concentrations of PFOS and PFOA were observed to be below the combined USEPA HA of 70 ng/L.

The exceedance of the USEPA HA for PFOA and PFOS in the facility's potable water well necessitated the performance of a PA and SI. During the PA for RPB El Campo Armory, three potential PFAS release areas were identified at the facility, each of which comprises an AOI (AECOM, 2020a). These AOIs include a weapons cleaning area, trash pit, and septic leach field where PFAS-containing media may have been disposed or dispersed in the past. Based on information gathered during the PA, there is no known record of aqueous film forming foam (AFFF) storage or use at the facility, nor any documented fire training activities. Each of the AOIs were investigated during the SI. SI field activities included soil and groundwater grab sampling from temporary monitoring wells from 24 to 28 August 2020.

To fulfill the project Data Quality Objectives (DQOs) set forth in the approved SI Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2020c), samples were collected and analyzed for a subset of 18 PFAS by liquid chromatography with tandem mass spectrometry (LC/MS/MS) compliant with Quality Systems Manual (QSM) 5.1 Table B-15. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.7** of this Report.

The Department of Defense (DoD) has adopted a policy to retain facilities in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process based on risk-based SLs for soil and groundwater, as described in a memorandum from the Office of the Secretary of Defense (OSD) dated 15 October 2019 (Assistant Secretary of Defense, 2019). The ARNG PFAS SIs follow this DoD policy and, should the maximum site concentration for sampled media exceed the SLs, the AOI will warrant further investigation. The SLs apply to three compounds, PFOA, PFOS, and PFBS, for both soil and groundwater, as presented in **Table ES-1**. All other results presented in this report are considered informational in nature and serve as an indication as to whether soil and groundwater contain or do not contain the 18 PFAS analyzed within the boundaries of the facility.

Sample chemical analytical concentrations were compared against the SLs as described in **Table ES-1**. A summary of the results of the SI data relative to the SLs is as follows:

- PFOS in groundwater at AOI 3: Septic Leach Field exceeded the individual SL of 40 nanograms per liter (ng/L), with a detected concentration of 56.5 ng/L at location AOI03-02. Based upon the state ownership status of the property, the state may consider the need for future investigation or follow-up action.

- The detected concentrations of PFOA, PFOS, and PFBS in soil samples from all AOIs were below the SLs. The results of the SI at AOI 3 are suggestive of an incomplete pathway; however, given the distance of the suspected source there is insufficient data to rule out this pathway at this time.
- PFOA, PFOS, and PFBS were not detected in groundwater at the upgradient facility boundary. These results suggest there may not be an off-facility source of PFAS potentially migrating on-facility.
- Data collected by the ARNG Bureau (NGB) in 2018 (NGB, 2018) as well as the Texas Military Department (TMD) (TMD, 2019; TMD, 2020) indicate that PFOS, PFOA, and PFBS are not present in treated groundwater at the facility.

Table ES-2 summarizes the SI results for soil and groundwater. Drinking water at RPB El Campo Armory is supplied by a Class I groundwater well with a GAC GWTS, approximately 100 to 120 feet deep, located at the facility for all potable water uses. The facility does not receive drinking water or sanitary sewer services from local utilities.

There is a potentially complete pathway between source and off-facility residential drinking water receptors. Surficial groundwater at the facility is encountered at approximately 29 to 33 feet below ground surface (bgs), where geological data collected during the SI indicate a relatively permeable and conductive deeper subsurface. Geological research indicates that the uppermost aquifer utilized for potable water, the Chicot Aquifer, is unconfined and therefore could potentially be impacted by PFAS migration from surficial groundwater. The Chicot Aquifer was not subject to investigation during this SI. Based on the conceptual site model (CSM) developed and revised in light of the SI findings, there is a potential for exposure to residential drinking water receptors caused by DoD activities at or adjacent to the facility.

Table ES-3 summarizes the rationale used to determine if an AOI should be considered for further investigation. Based upon the state ownership status of the property, the state may consider the need for future investigation or follow-up action.

Table ES-1: Screening Levels (Soil and Groundwater)

Analyte	Residential (Soil) (µg/kg)[a] 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a] 2-15 feet bgs	Tap Water (Groundwater) (ng/L)[a]
PFOA	130	1,600	40
PFOS	130	1,600	40
PFBS	130,000	1,600,000	40,000

Notes:

a.) Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. HQ=0.1. 15 October 2019.
bgs = below ground surface
ng/L = nanograms per liter
µg/kg= micrograms per kilogram

Table ES-2: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area
1	Weapons Cleaning Area	○	◒
2	Trash Pit	○	◒
3	Septic Leach Field	○	●
Upgradient Facility Boundary	Off-Facility, Unknown	○	○
Downgradient Facility Boundary	On-Facility, Unknown	○	◒

Legend:

● = PFOA, PFOS, and/or PFBS detected; exceedance(s) of the screening level(s)

◒ = PFOA, PFOS, and/or PFBS detected; no exceedance of the screening levels

○ = PFOA, PFOS, and PFBS not detected

Table ES-3: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	Weapons Cleaning Area	Detections in groundwater but no exceedances of SLs. No detections in soil.	No further action
2	Trash Pit	Detections in groundwater but no exceedances of SLs. No detections in soil.	No further action
3	Septic Leach Field	Exceedance of SL in groundwater at source area. No exceedances of SLs in soil.	Further investigation warranted
Upgradient Facility Boundary	Off-Facility, Unknown	No detections in groundwater or soil.	No further action
Downgradient Facility Boundary	On-Facility, Unknown	Detections in groundwater but no exceedances of SLs. No detections in soil.	No further action

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1. Introduction

1.1 Project Authorization

The Army National Guard (ARNG) G9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) at Impacted Sites, ARNG Installations, Nationwide. This work is supported by the United States (US) Army Corps of Engineers (USACE) Baltimore District and their contractor, AECOM Technical Services, Inc. (AECOM), under Contract Number W912DR-12-D-0014, Task Order W912DR17F0192, issued 11 August 2017. The ARNG performed this SI at the Roy P. Benavidez (RPB) National Guard Armory in El Campo, Texas. The Roy P. Benavidez National Guard Armory is referred to as the "RPB El Campo Armory" or "facility" throughout this document.

The SI project elements were performed in compliance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; US Environmental Protection Agency [USEPA], 1980), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations Part 300; USEPA, 1994), and in compliance with US Department of the Army (DA) requirements and guidance for field investigations including specific requirements for sampling for PFOA, PFOS, and perfluorobutanesulfonic acid (PFBS), and the group of related compounds known in the industry as per- and poly-fluoroalkyl substances (PFAS). The term PFAS is used throughout this report to encompass all PFAS chemicals being evaluated, including PFOA, PFOS, and PFBS, which are the key components of the suspected releases being evaluated, and the other 15 related compounds listed in the Task Order.

1.2 SI Purpose

Drinking water from RPB El Campo Armory's potable well was previously sampled for PFAS by the National Guard Bureau in April 2017. PFOA and PFOS were detected above the combined USEPA Health Advisory (HA) of 70 nanograms per liter (ng/L) (USEPA, 2016a). In response, RPB El Campo Armory switched to bottled water at that time, and in August 2018, a granular activated carbon (GAC) groundwater treatment system (GWTS) was installed to reduce the levels of PFOS and PFOA in the facility's drinking water. After groundwater was treated through the new GAC GWTS, detected concentrations of PFOS and PFOA were observed to be below the combined USEPA HA of 70 ng/L.

The exceedance of the USEPA HA for PFOA and PFOS in the facility's potable water well necessitated the performance of a PA and SI. A PA was performed that identified three potential PFAS release areas at the facility, which were grouped into three Areas of Interest (AOIs) (AECOM, 2020a). Two potential off-facility PFAS sources areas were identified adjacent to the facility. The objective of the SI is to identify whether there has been a release to the environment from the AOIs and determine the presence or absence of PFOA, PFOS, and PFBS at or above screening levels (SLs).

As stated in the *Federal Facilities Remedial Site Inspection Summary Guide* (USEPA, 2005), an SI has five goals:

1. Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment;
2. Determine the potential need for a removal action;
3. Collect or develop data to evaluate potential release;

4. Collect data to better characterize the release for more effective and rapid initiation of a Remedial Investigation (RI), if determined necessary; and

5. Collect data to determine whether the release is more than likely the result of activities associated with the Department of Defense (DoD).

In addition to the USEPA-identified goals of an SI, the ARNG SI also aims to identify whether there are potential off-facility PFAS sources by sampling near the facility boundary.

2. Facility Background

2.1 Facility Location and Description

The RPB El Campo Armory is located in Wharton County at 1552 County Road 406, El Campo, Texas, approximately 5 miles west of the Colorado River in southeast Texas (**Figure 2-1)**. The 20-acre facility is bordered on the north by residential properties, on the west by American Legion baseball fields, and undeveloped agricultural land surrounds the remainder of the facility.

The facility has been occupied by the Texas ARNG (TXARNG) since approximately 1959; prior to this time, the property was undeveloped. Historically, a portion of the RPB El Campo property was used as a small-arms firing range consisting of two firing platforms and a backstop/bermed area; however, the firing range is no longer in use. The facility has been used to muster troops, maintain vehicles, and clean weapons (Corrigan Consulting, Inc., 2005). The facility property is currently used primarily by a TXARNG engineering company.

2.2 Facility Environmental Setting

The RPB El Campo Armory is located in southeastern Texas, approximately 50 miles north of the Gulf of Mexico (**Figure 2-1**). The topography of the El Campo area is generally flat, with a gentle slope from west to east across the region (**Figure 2-2**). The Tres Palacios River is located approximately 0.25-miles east of the facility. Groundwater and surface water features are presented on **Figure 2-3** and **Figure 2-4**, respectively. Groundwater contours based on the SI synoptic gauging event and subsequent survey of temporary groundwater monitoring wells are presented on **Figure 2-5**.

2.2.1 Geology

RPB El Campo Armory is underlain by the distributary channel facies of the Pleistocene-aged Beaumont Formation, which is composed primarily of deltaic sands and silts (University of Texas at Austin, Bureau of Economic Geology, 1974; Moore and Wermund, 1993). These deposits include stream channel, point-bar, crevasse-splay, and natural levee ridge deposits with clayey fill in abandoned channels. The deposits in the distributary facies range from 3 to 10 meters (m) in thickness at outcrops but can be as thick as 100m in the subsurface (Moore and Wermund, 1993). Concretions and massive accumulations of calcium carbonate (caliche), iron oxide, and iron-manganese oxides are evident in the zone of weathering (Corrigan Consulting, Inc., 2005). The Beaumont Formation is underlain by the Lissie Formation (also called the Montgomery and Bentley formations), which consists of alluvial sand, silt, and clay (Moore and Wermund, 1993; Kasmarek and Rampage, 2017).

2.2.2 Hydrogeology

RPB El Campo Armory is underlain by a sequence of aquifers. The uppermost aquifer is the Chicot Aquifer, which is a major aquifer for the area. The Chicot aquifer is an unconfined aquifer consisting mainly of discontinuous layers of sand and clay of about equal thickness deposited during the Quaternary period. Stratigraphic units within the aquifer, from oldest to youngest, are as follows: Willis Sand, Bentley Formation, Montgomery Formation, Beaumont Clay, and Alluvium (US Geological Survey [USGS], 1988). The base of the Chicot aquifer extends to more than 1,100 feet below ground surface (bgs) in southern Wharton County. Based on data collected from local water wells, the hydraulic conductivity of the Chicot aquifer in the area of the site is 88 feet per day, and the average seepage velocity throughout Wharton County is 75 feet per year (Corrigan

Consulting, Inc., 2005).The Chicot aquifer is underlain by the Evangeline aquifer, which lacks an upper confining unit. The Jasper aquifer underlays the Evangeline aquifer and is confined by the Burkeville Confining System (USGS, 1988).

The groundwater flow direction at the facility is generally to the south and southwest (**Figure 2-3**). Observed groundwater elevations from the synoptic gauging event and corresponding contours are displayed on **Figure 2-5**. Land surface elevation at the facility is approximately 100 feet above mean sea level (amsl) (**Appendix B3**). According to well reports submitted to the Texas Water Development Board Submitted Drillers Reports (TWDB SDR), two domestic supply wells in the direct vicinity of the facility had groundwater levels of 35 feet bgs and 48 feet bgs. Site characterization work done to the west of the facility, in the vicinity of the Alcoa Aluminum Plant, has identified three generalized, coarse-grained, alluvial groundwater-bearing units (GWBUs) ranging from shallow to deep. These GWBUs are the “A-Zone”, which is present between approximately 32 and 50 feet bgs; the “B-Zone”, which is present between approximately 55 and 135 feet bgs; and the “C-Zone”, which is present between approximately 150 and 200 feet bgs. Groundwater elevations in the A-Zone ranged from 60.99 feet amsl to 65.55 feet amsl, and the direction of groundwater flow was to the south-southwest. Groundwater elevations in the B-Zone ranged from 54.42 feet amsl to 64.75 feet amsl, and the direction of groundwater flow was to the southwest and south. Groundwater elevations in the C-Zone ranged from 49.50 feet amsl to 45.32 feet amsl, and the direction of groundwater flow was generally to the southwest (Amec Foster Wheeler Environment & Infrastructure, Inc., March 2016).

A query of the TWDB SDR Database identified 12 environmental soil borings, 17 domestic wells, 2 stock wells, and one rig supply well, for a total of 32 wells within a 1-mile radius of the site. The wells range in depth from 4 to 250 feet (TWDB SDR Database, 2019).

The RPB El Campo Armory uses a Class I groundwater well approximately 100 to 120 feet deep for all potable water uses and does not receive drinking water or sanitary sewer services from local utilities. The facility has a septic system that includes a pre-treatment tank, a dosing tank, a treatment plant, and a holding tank. Details on the septic system design, as of 2002, can be found in the PA Report (AECOM, 2020a). The plans show four sprinkler heads in the northeast corner of the facility that are used to spray the area. The location of the old septic tanks (prior to 2002) as well as the new septic leach field (after 2002) can be found in the SI QAPP Addendum (AECOM, 2020c).

2.2.3 Hydrology

Overland flow of surface water at RPB El Campo Armory flows primarily across paved or grassy areas and collects near the northeast corner of the primary office building and in a manmade pond in the southeast corner of the facility. There is no stormwater drainage system at the facility; surface flow collects in low-lying areas (**Figure 2-4**). Surface water that falls to the east of the facility generally flows to the southeast.

The nearest surface water body is the Tres Palacios River, located less than 0.25 miles east of the facility property.

2.2.4 Climate

Reported climate data for the neighboring City of Wharton, Texas include an average winter temperature of approximately 50 degrees Fahrenheit (°F), and an average summer temperature of approximately 85°F; total precipitation was 37.15 inches, with the majority of rainfall occurring between June and December (National Oceanic and Atmospheric Administration [NOAA], 2020).

Historically, El Campo has an average annual minimum temperature of 59.8°F and an average annual maximum temperature of 82.7°F. The historical average for total annual precipitation in El Campo is 48.5 inches. It very rarely snows in the area (Western Regional Climate Center [WRCC], 2020).

2.2.5 Current and Future Land Use

The RPB El Campo Armory has been occupied by the TXARNG since approximately 1959. Prior to this time, the site was undeveloped. The site currently includes approximately 1 acre of developed area used for vehicle/equipment storage and administrative activities. The site also includes a parking lot, a maintenance building, two office buildings, a water well, and approximately 13 acres of undeveloped grassland. Historically, a portion of the property was used as a small-arms firing range consisting of two firing platforms and a backstop/ bermed area; however, the firing range is no longer in use (Corrigan Consulting, Inc., 2005). The facility has been used to muster troops, maintain vehicles, and clean weapons. Cattle have historically been allowed to graze on the undeveloped portion of the property. Currently, the facility is used primarily by an engineering company. No future changes to the current use were noted during personnel interviews.

2.2.6 Critical Habitat and Threatened/ Endangered Species

The following amphibians, birds, and mollusks are federally endangered, threatened, proposed, and/ or are listed as candidate species in Wharton County, Texas (US Fish and Wildlife Service [USFWS], 2020; Texas Parks and Wildlife Department [TPWD], 2020).

- **Amphibians:** Houston toad, *Anaxyrus houstonensis* (endangered)
- **Birds**: Attwater's Greater Prairie Chicken, *Tympanuchus cupido attwateri* (endangered)
    - Black Rail, *Laterallus jamaicensis* (proposed threatened)
    - Least Tern, *Sterna antillarum* (endangered)
    - Piping Plover, *Charadrius melodus* (threatened)
    - Red Knot, *Calidris canutus rufa* (threatened)
    - Whooping Crane, *Grus americana* (endangered)
- **Mollusks**: Texas Fawnsfoot, *Truncilla macrodon* (candidate); Texas Pimpleback, *Quadrula petrina* (candidate)

There are no critical habitats listed at RPB El Campo Armory (USFWS, 2020).

2.3 History of Potential PFAS Sources

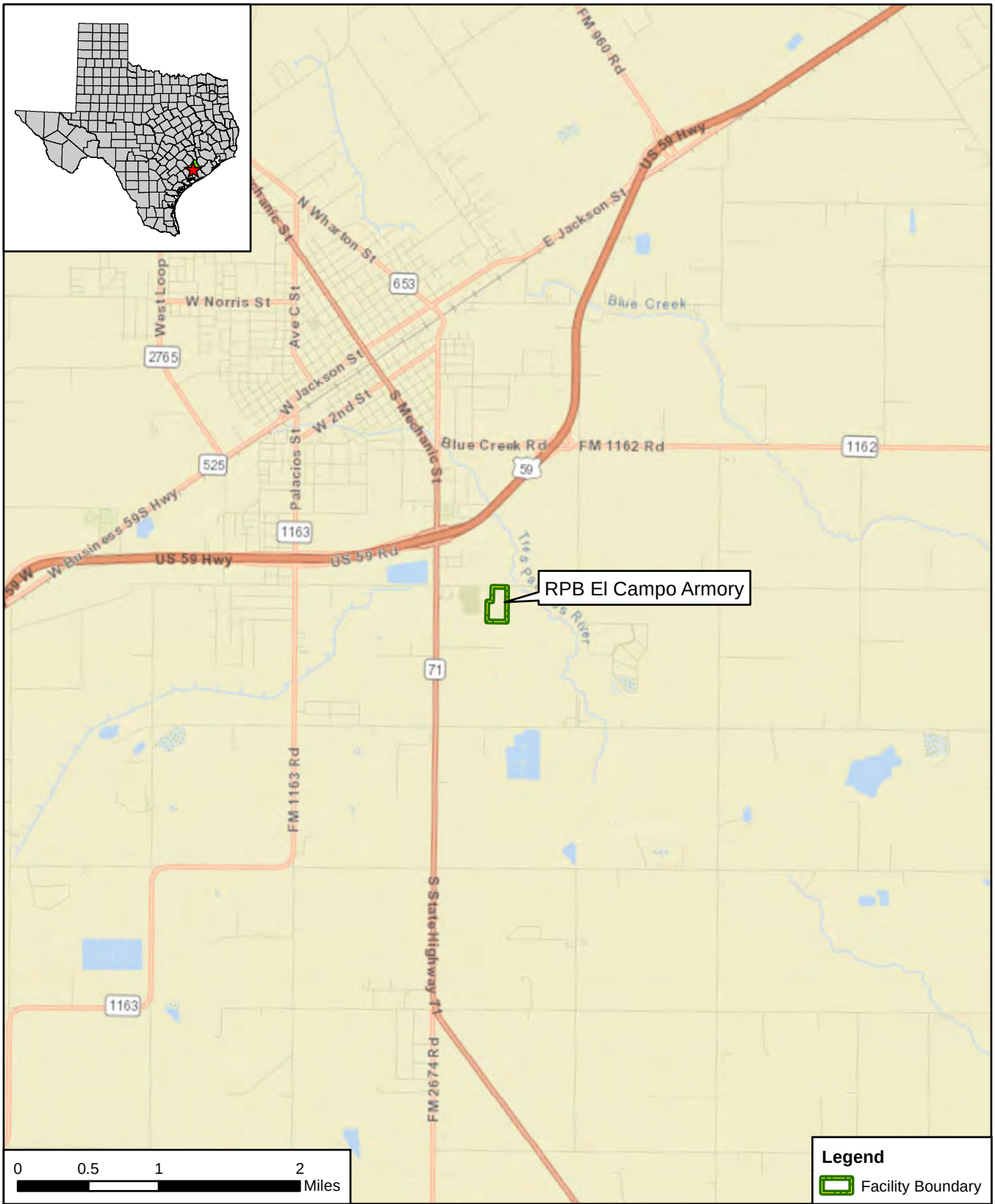
There are no fire training areas (FTAs) at the RPB El Campo Armory, and no aqueous film forming foam (AFFF) was identified or has historically been located at the facility. Three AOIs were identified during the PA, all of which are non-FTAs (AECOM, 2020a). A description of each AOI is presented in **Section 3**.

Two potential off-site PFAS sources adjacent to the RPB El Campo Armory were identified during the PA (AECOM, 2020a). The first potential source, located approximately 2 miles west-northwest of the facility, is a closed aluminum extrusion plant currently owned by Alcoa. This property was actively used from 1963 until 2001. The second potential source is the El Campo Volunteer Fire Department, located 3 miles northwest of the facility. AFFF is reportedly stored on site and has

been historically used in firefighting trucks for emergency firefighting. Fire training activities are not conducted with AFFF.

2.4 Other PFAS Investigations

Drinking water from the potable well at RBP El Campo Armory was previously sampled by the ARNG Bureau (NGB) in 2017 and 2018, and the Texas Military Department (TMD) in 2019 and 2020. In April 2017, PFAS were found above the combined USEPA Health Advisory (HA) of 70 nanograms per liter (ng/L) (USEPA, 2016a). Specifically, the combined concentration of PFOA and PFOS was 79.6 ng/L (NGB, 2017); therefore, the facility switched to bottled water at that time (Texas Military Department [TMD], 2017). In August 2018, a GWTS was installed to reduce the levels of PFOS and PFOA in the facility's drinking water to below 70 ng/L. The GWTS consists of pumping groundwater into a holding tank and then through a GAC vessel. After groundwater was treated through the new GAC GWTS, analytical results for PFOS and PFOA were all observed to be below the USEPA HA in drinking water of 70 ng/L (NGB, 2018; TMD, 2019; TMD, 2020). PFOS was detected in treated groundwater at 27.9 ng/L from a sample collected on 5 March 2020 (see **Appendix G**), suggesting potential PFAS breakthrough of the GAC GWTS. However, the GWTS GAC filter media was changed in late March 2020, and subsequent treated groundwater samples collected on 31 March 2020 were non-detect for all PFAS.



CLIENT	ARNG			
NOTES	Site Inspection for PFAS at RPB El Campo Armory, TX			
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SCALE	1:63,360	CHK BY	JW	5/11/2021
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	5/11/2021

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

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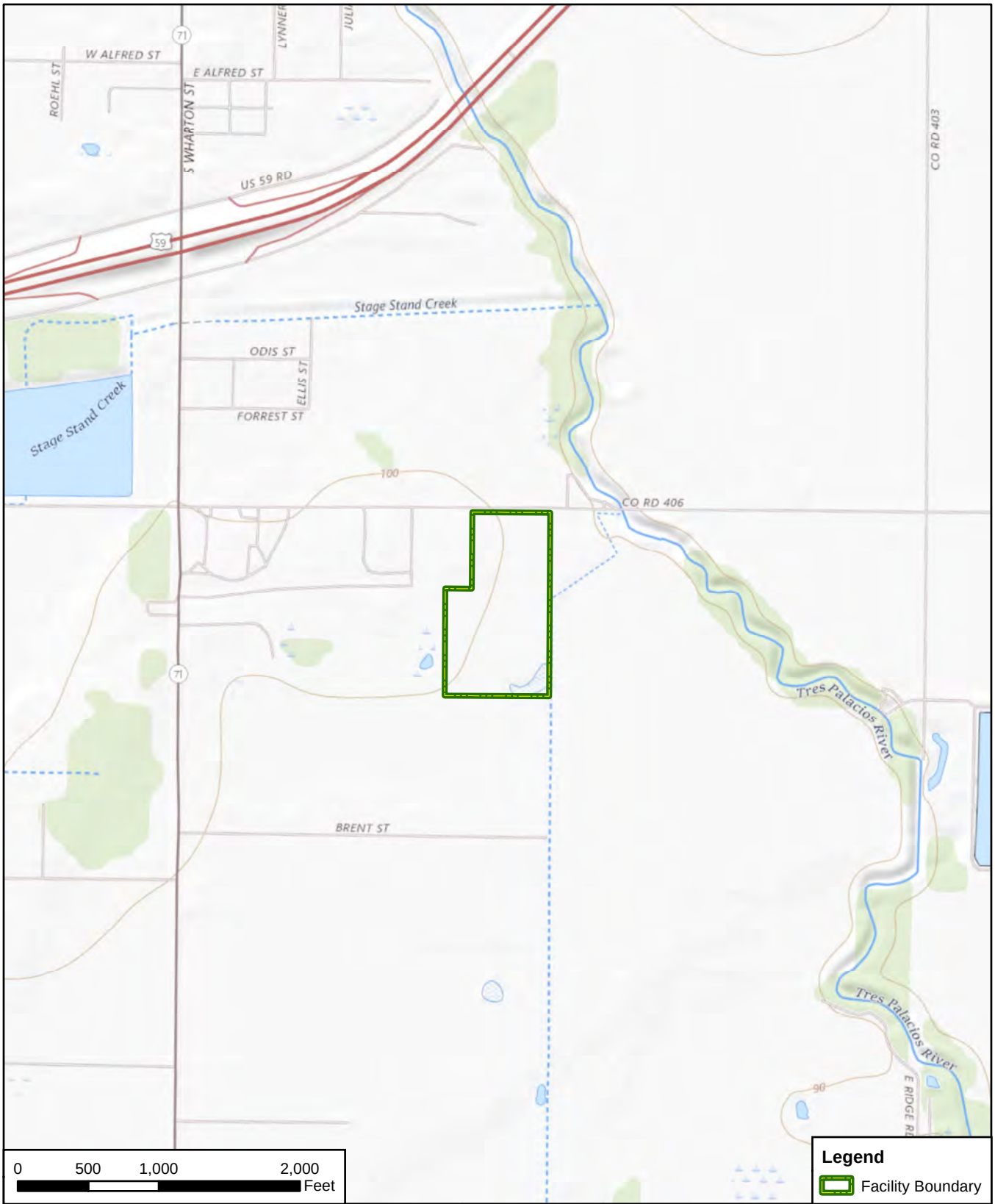

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at RPB El Campo Armory, TX			
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SCALE	1:12,000	CHK BY	JW	5/11/2021
Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	CM	5/11/2021

N

Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2

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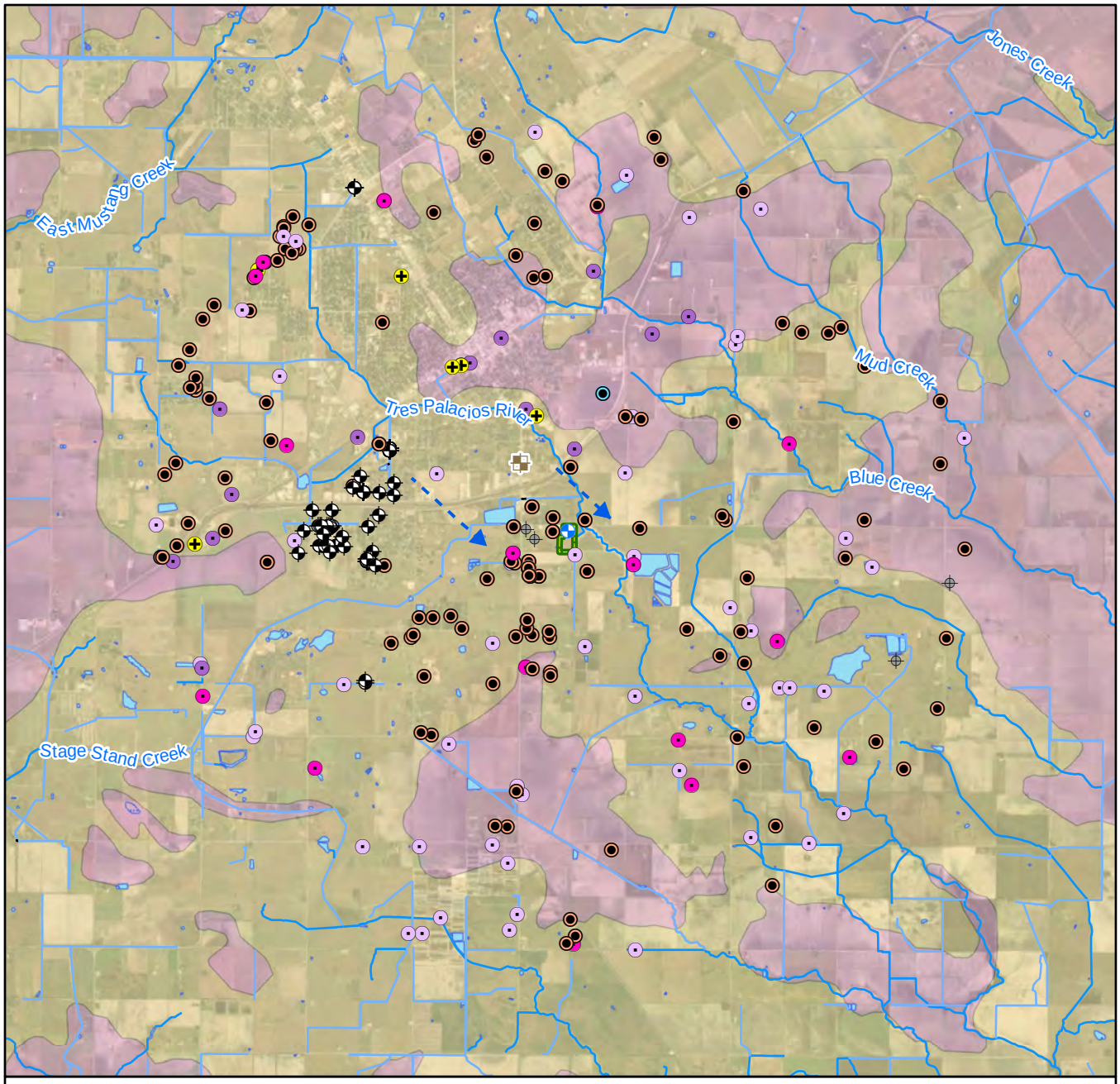

Facility Boundary
Water Body
Wetland
River/Stream
Canal/Ditch
Pipeline
Inferred Groundwater Flow Direction

Geology

Quaternary/Late Pleistocene Clay and Silt
Quaternary/Late Pleistocene Sand and Silt

Wells

Domestic Well
Commercial Well
Irrigation Well
Agricultural Well
Industrial Well
Public Supply Well
Environmental Soil Boring
Monitoring Well
Other/Unknown Well
Water Supply Well

0 0.75 1.5 3 Miles

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at RPB El Campo Armory, TX			
REVISED	5/11/2021	GIS BY	MS	5/11/2021
SCALE	1:95,040	CHK BY	JW	5/11/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	5/11/2021

N

Groundwater Features

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3

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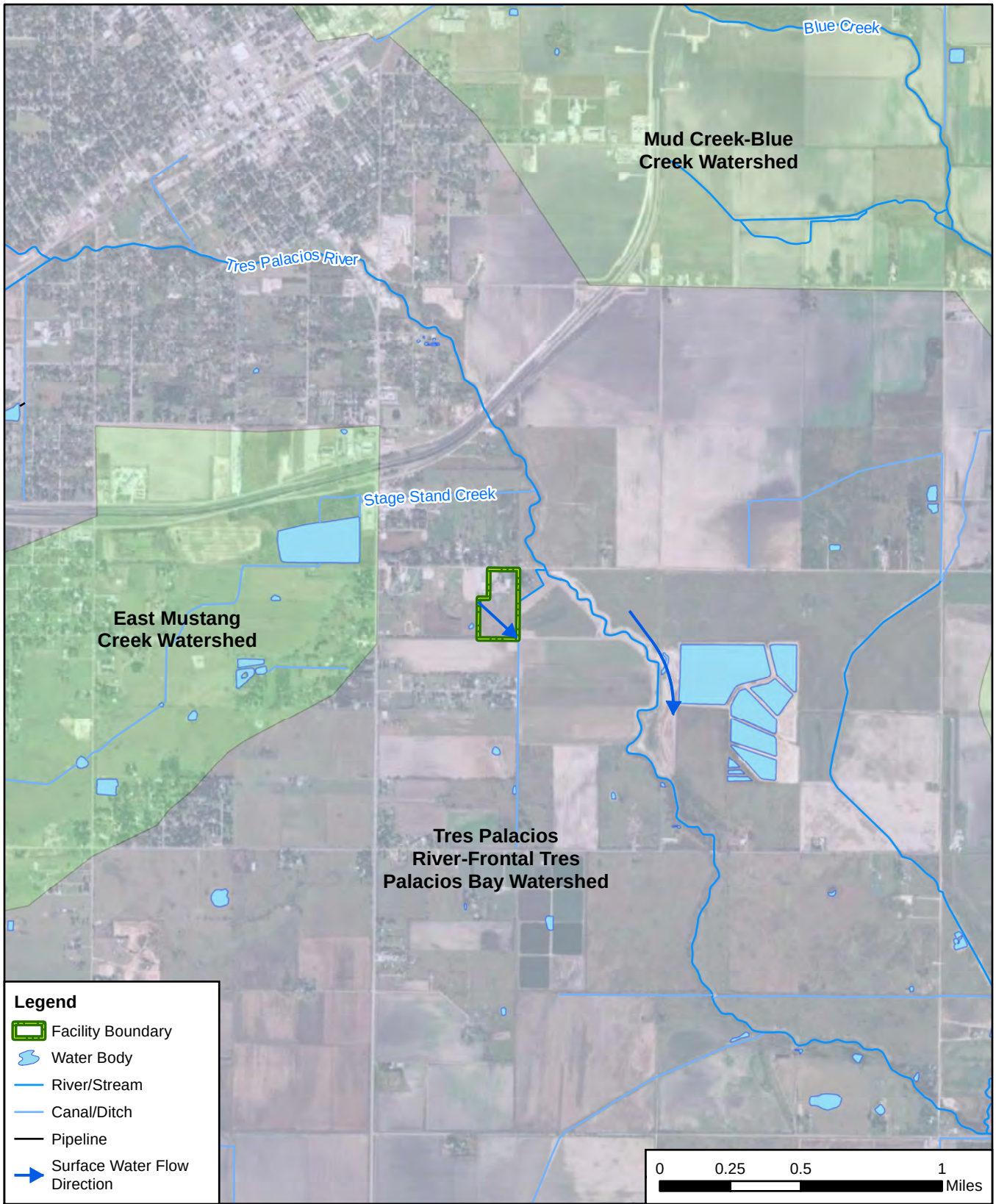

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at RPB El Campo Armory, TX			
REVISED	5/11/2021	GIS BY	MS	5/11/2021
SCALE	1:31,680	CHK BY	JW	5/11/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	5/11/2021

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Surface Water Features

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Figure 2-4

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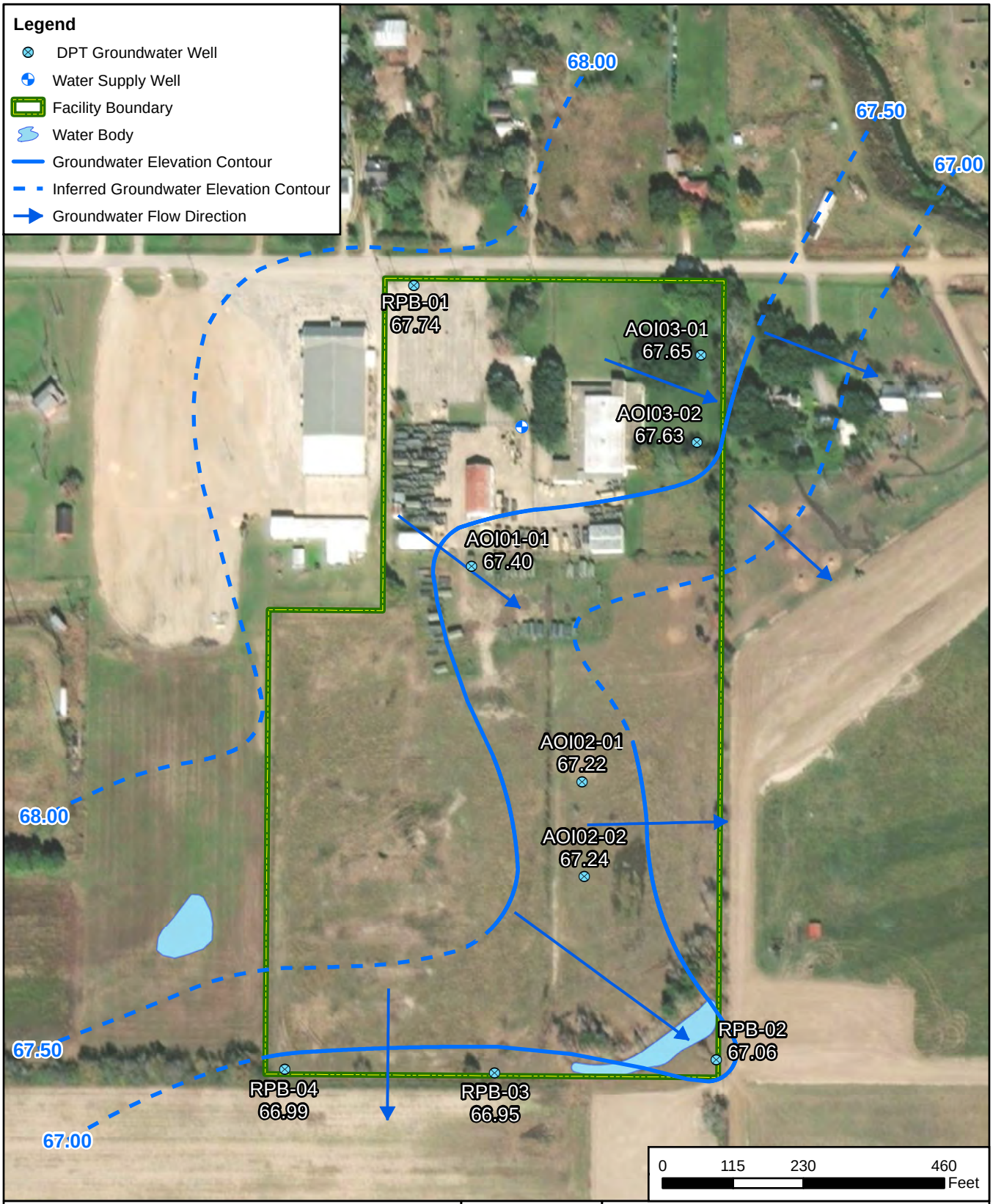

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at RPB El Campo Armory, TX			
REVISED	5/11/2021	GIS BY	MS	5/11/2021
SCALE	1:2,760	CHK BY	JW	5/11/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	5/11/2021

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Groundwater Contours

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Figure 2-5

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3. Summary of Areas of Interest

This section presents a summary of each potential PFAS release area by AOI. The potential PFAS release areas were grouped into three AOIs based on proximity and direction of groundwater flow (**Figure 3-1**). Two additional potential off-facility PFAS release areas, the Alcoa aluminum extrusion plant and the El Campo Volunteer Fire Department, are also shown in **Figure 3-1** for informational purposes. Both locations are adjacent within a 4-mile radius to the RPB El Campo Armory but do not share boundaries with the facility. Therefore, these two potential adjacent release areas were not evaluated as part of this SI.

3.1 AOI 1

AOI 1 consists of one potential PFAS release area, as described below.

3.1.1 Weapons Cleaning Area

An unknown cleaning, lubrication, and protection (CLP) product was historically used by troops for weapons cleaning exercises at RPB El Campo Armory. Teflon, which contains PFAS, may be a component of the CLP product that was used; the manufacturer and quantity of CLP product historically used at the facility are unknown. Typically, the main waste from weapons cleaning is the rags used to wipe down firearms with CLP product. A small amount of CLP product is applied to a rag, which is used to wipe down the firearm for routine maintenance. The rags are then disposed of. According to interviews conducted as part of the PA Report (AECOM, 2020a), most weapons cleaning activities took place at the Weapons Cleaning Area building (**Figure 3-1)**. Old and excess CLP® would have been wiped from the weapons that were being cleaned and then disposed. In addition to any releases at the building where the weapons cleaning was conducted, the rags may have been disposed in the AOI 2 Trash Pit, discussed in **Section 3.2**.

3.2 AOI 2

AOI 2 consists of one potential PFAS release area, as described below.

3.2.1 Trash Pit

The Trash Pit is located in the undeveloped grassy portion of the RPB El Campo Armory south-southeast of AOI 1 (**Figure 3-1**). This AOI may have been used to dispose of PFAS-containing materials originating on- and off-facility. In addition to potential releases at the Weapons Cleaning Area building, where a CLP product was likely used, the rags containing CLP product may have been disposed of in the Trash Pit. Rags containing CLP product may have been exposed to precipitation and weathering, allowing PFAS to desorb from the rags and infiltrate into the surface soil, subsurface soil, and into shallow groundwater.

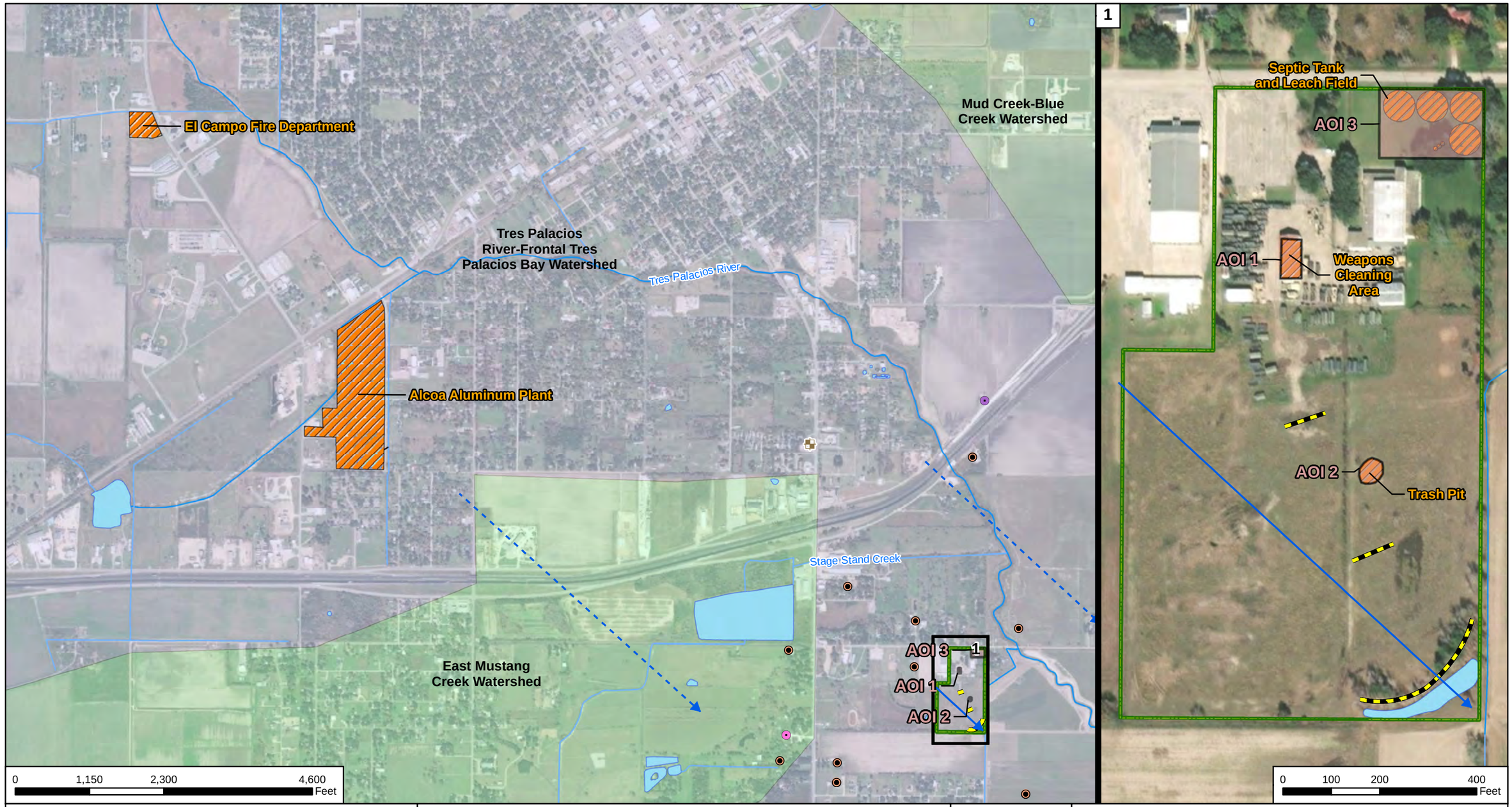
3.3 AOI 3

AOI 3 consists of one potential PFAS release area, as described below.

3.3.1 Septic Leach Field

Substances containing PFAS, like CLP product, could have been poured down the Weapons Cleaning Area drains at the RPB El Campo Armory and entered the septic system. Wastewater that enters the septic system is eventually sprayed in the northeast corner of the facility through four sprinkler heads. **Figure 3-1** shows the location of the septic leach field. Any PFAS-containing

liquids that were dumped down the drains and eventually sprayed over the leach field could potentially migrate from surface soil to subsurface soil and eventually to groundwater.



CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at RPB El Campo Armory, TX			
REVISED	5/11/2021	GIS BY	MS	5/11/2021
SCALE	1:18,000	CHK BY	JW	5/11/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	5/11/2021

- Former Firing Range Features
- Area of Interest
- Potential PFAS Release
- Facility Boundary
- Water Body
- River/Stream
- Canal/Ditch
- Pipeline
- Surface Water Flow Direction
- Groundwater Flow Direction
- Domestic Well
- Agricultural Well
- Industrial Well
- Environmental Soil Boring

N

Potential Source Areas and Areas of Interest

AECOM 12420 Milestone Center Drive Germantown, MD 20876

Figure 3-1

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4. Project Data Quality Objectives

Project Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data and define the level of certainty required to support project decision-making process. The specific DQOs established for this facility are described below. These DQOs were developed in accordance with the USEPA's seven-step iterative process (USEPA, 2006).

4.1 Problem Statement

The following problem statement was developed during project planning:

The presence of PFAS, which may pose a risk to human health or the environment, in environmental media at the facility is currently unknown. PFAS are classified as emerging environmental contaminants that are garnering increasing regulatory interest due to their potential risks to human health and the environment. The regulatory framework for managing PFAS at both the federal and state level continues to evolve.

The DoD has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the Office of the Secretary of Defense (OSD) dated 15 October 2019 (Assistant Secretary of Defense, 2019). The ARNG program under which this SI was performed follows this DoD policy. Should the maximum site concentration for sampled media exceed the SLs established in the OSD memorandum, the AOI will proceed to the next phase under CERCLA. The SLs established in the OSD memorandum apply to three compounds: PFOS, PFOA, and PFBS. The SLs are presented in **Section 6.1** of this Report.

The following quotes from the DA policy documents form the basis for this project (DA, 2016; DA, 2018):

- "The Army will research and identify locations where PFOS- and/or PFOA-containing products, such as AFFF, are known or suspected to have been used. Installations shall coordinate with installation/facility fire response or training offices to identify AFFF use or storage locations. The Army will consider FTAs, AFFF storage locations, hangars/buildings with AFFF suppression systems, fire equipment maintenance areas, and areas where emergency response operations required AFFF use as possible source areas. In addition, metal plating operations, which used certain PFOS-containing mist suppressants, shall be considered possible source areas."
- "Based on a review of site records…determine whether a CERCLA PA is appropriate for identifying PFOS/PFOA release sites. If the PA determines a PFOS/PFOA release may have occurred, a CERCLA SI shall be conducted to determine presence/absence of contamination."
- "Identify sites where perfluorinated compounds are known or suspected to have been released, with the priority being those sites within 20 miles of the public systems that tested above USEPA HA levels" (USEPA, 2016a; USEPA, 2016b).

4.2 Goals of the Study

The following goals were established for this SI during project planning:

1. Determine the presence or absence of PFOA, PFOS, and PFBS contamination at RPB El Campo Armory at or above SLs.

2. Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment.
3. Determine the potential need for a Time Critical Removal Action (TCRA) (applies to drinking water only). The primary actions that will be considered include provision of alternative water supplies or wellhead treatment.
4. Collect or develop data to better characterize the release areas for more effective and rapid initiation of an RI.
5. Identify, within 4 miles of the installation, other potential AFFF sources (fire stations, major manufacturers, other DoD facilities) and receptors, including both groundwater and surface water receptors, in order to determine whether the ARNG is the likely source of PFAS or whether there is an off-facility source of PFAS responsible for installation detections of PFAS (USEPA, 2005).
6. Determine whether a potentially complete pathway exists between the source and potential receptors and whether ARNG is the likely source of the contamination.

4.3 Information Inputs:

Primary information inputs included:

- The PA for El Campo, Texas (AECOM, 2020a);
- Third Unregulated Contaminant Monitoring Rule Data;
- Analytical data collected in 2017 and 2018 as part of NGB PFAS sampling of potable water;
- Analytical data collected in 2019 and 2020 as part of TMD PFAS sampling of potable water;
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2020c); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling using a multi-parameter water quality meter.

4.4 Study Boundaries

The scope of the SI was bounded by the property limits of the facility (**Figure 2-1**). Off-facility sampling was not included in the scope of this SI. If future off-facility sampling is required, the proper stakeholders will be notified, and necessary rights of entry will be obtained by ARNG with property owner(s).

4.5 Analytical Approach

Samples were analyzed by Pace Analytical Gulf Coast, accredited under the DoD Environmental Laboratory Accreditation Program (DoD ELAP; Accreditation Number 74960) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 01955). Data were compared to applicable SLs and decision rules as defined in the SI QAPP Addendum (AECOM, 2020c). These rules governed response actions based on the results of the SI sampling effort.

The decision rules described in the **Table 4-1** and **Table 4-2** at the end of this subsection identify actions based on the following:

Groundwater:

- Is there a human receptor within 4 miles of the facility?
- What is the concentration of PFOA, PFOS, and PFBS at the potential release areas?
- What is the concentration of PFOA, PFOS, and PFBS at the facility boundary upgradient and downgradient of the potential release areas?
- What does the conceptual site model (CSM) suggest in terms of source, pathway and receptor?

Soil:

- What is the concentration of PFOA, PFOS, and PFBS in shallow surface soil (0 to 2 feet bgs)?
- What is the concentration of PFOA, PFOS, and PFBS in deep soil (i.e., capillary fringe [saturated to partially saturated soil zone between the unsaturated soil zone and water table])?
- What does the CSM suggest in terms of source, pathway, and receptor?

Soil and groundwater samples were collected from each of the potential release areas. Groundwater was encountered at approximately 29 to 33 feet bgs.

Table 4-1: Groundwater Decision Rules

Scenario	PFAS Detected Concentration Range	Response Action (Off-facility human receptor within 4 miles)	Response Action (No off-facility human receptor within 4 miles)
Scenario 1	ND	No further action required during SI phase.	No further action required during SI phase.
Scenario 2	> ND (any positive detection) And <SLs	1.) Assess CSM including: - Data reliability and bias - Migration via groundwater flow (i.e., groundwater flow towards potential receptors) - Flow to surface water bodies, drinking water intakes - Distance from boundary to receptor - Aquifer where drinking water well(s) are screened - Estimated timeframe of release(s) 2.) No further action during SI Phase at this time. ARNG may consider need for additional evaluation in the future for groundwater.	1.) Assess CSM as described. 2.) No further action during SI Phase at this time. ARNG may consider need for additional evaluation in the future for groundwater.
Scenario 3	> SLs	1.) Assess CSM as described above and: - Potential off-facility alternative PFAS sources 2.) If exceedance of SLs is near facility boundary and the assessment of the CSM implies unacceptable risk to human health caused by a PFAS release attributable to ARNG activities, ARNG may initiate off-facility sampling protocol. 3.) Proceed to RI.	1.) Assess CSM as described. 2.) Proceed to RI.

Notes:

< = less than
> = greater than
ARNG = Army National Guard
CSM = conceptual site model
ND = non-detect
OSD = Office of the Secretary of Defense
PFAS = per- and polyfluoroalkyl substances
RI = Remedial Investigation
SI= Site Inspection
SL= screening level

Table 4-2: Soil Data Decision Rules

Scenario	Data Location (depth)	PFAS Concentration Range	Response Action
Scenario 1	Surface/Shallow	ND	No further action during SI Phase.
	Deep (capillary fringe)	ND	
Scenario 2	Surface/Shallow	> ND (any positive detection)	1. Assess CSM including: - Potential for particulate runoff (i.e., transport via surface water) - Nearby receptors and land use at the source location (i.e., is anyone in direct contact?) - Depth to groundwater; distance to nearby surface water body - Comparison of soil concentrations to groundwater concentrations at the source or nearby surface water body - Data reliability and bias 2. ARNG to consider need for additional evaluation.
	Deep (capillary fringe)	ND	
Scenario 3	Surface/Shallow	> OSD screening level	1. Assess CSM as above and: - Comparison of soil concentrations to groundwater concentrations at the source and downgradient at the boundary - Comparison of soil concentrations to surface water concentrations at or near the source and downstream at the boundary 2. If OSD screening levels are exceeded; proceed to RI.

Notes:
ARNG = Army National Guard
CSM = Conceptual Site Model
ND = non-detect
OSD = Office of the Secretary of Defense
PFAS = per- and polyfluoroalkyl substances
SI = Site Inspection

4.6 Data Usability Assessment

The Data Usability Assessment (DUA) is an evaluation at the conclusion of data collection activities that uses the results of both data verification and validation in the context of the overall project decisions or objectives. Using both quantitative and qualitative methods, the assessment determines whether project execution and the resulting data have met installation-specific DQOs. Both sampling and analytical activities are considered to assess whether the collected data are of the right type, quality, and quantity to support the decision-making (DoD, 2018a; DoD, 2018b; USEPA, 2017).

Data Quality Indicators (DQIs) (Precision, Accuracy, Representativeness, Comparability, Completeness and Sensitivity) are important components in assessing data usability. These DQIs were evaluated in the subsequent sections and demonstrate that the data presented in this SI report are of high quality. Although the SI data are considered reliable, some degree of uncertainty can be associated with the data collected. Specific factors that may contribute to the uncertainty of the data evaluation are described below. The Data Validation Report (DVR) (**Appendix A**) presents explanations for all qualified data in greater detail.

The following data qualifiers applied to sample analytical results are defined below:

- J = Estimated concentration
- U = The analyte was not detected at a level greater than or equal to the adjusted detection limit

4.6.1 Precision

Precision is the degree of agreement among repeated measurements of the same characteristic on the same sample or on separate samples collected as close as possible in time and place. Field sampling precision is measured with the field duplicate relative percent differences (RPD); laboratory precision is measured with calibration verification, internal standard recoveries, laboratory control spike (LCS) and matrix spike (MS) duplicate RPD.

Extraction internal standards (EIS) were added by the laboratory during sample extraction to measure relative responses of target analytes and used to correct for bias associated with matrix interferences and sample preparation efficiencies, injection volume variances, mass spectrometry ionization efficiencies, and other associated preparation and analytical anomalies. The sample results associated with EIS area counts outside of the quality control (QC) limits were all QC samples. Data qualifying action was not required based on EIS anomalies of QC samples; therefore, the associated field sample results should be considered usable as reported.

LCS/LCS duplicate (LCSD) pairs were prepared by addition of known concentrations of each analyte in a matrix-free media known to be free of target analytes. LCS/LCSD pairs were analyzed for every analytical batch to demonstrate the ability of the laboratory to detect similar concentrations of a known quantity in matrix-free media. The LCS/LCSD samples were within the project established precision limits presented in the QAPP Addendum (AECOM, 2020c).

MS/MS duplicate (MSD) samples were prepared, analyzed, and reported for all preparation batches. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested. MS/MSD samples were submitted to the laboratory for analysis at a rate of 5%. The MS/MSD samples were within the project established precision limits presented in the QAPP Addendum (AECOM,2020c).

Field duplicate samples were collected at a rate of 10% to assess the overall sampling and measurement precision for this sampling effort. The field duplicate samples were analyzed for

PFAS and general chemistry parameters. The field duplicate samples were within the project established precision limits presented in the QAPP Addendum (AECOM, 2020c).

4.6.2 Accuracy

Accuracy is a measure of confidence in a measurement. The smaller the difference between the measurement of a parameter and its "true" or expected value, the more accurate the measurement. The more precise or reproducible the result, the more reliable or accurate the result. Accuracy is measured through percent recoveries in the LCS/LCSD, MS/MSD, and surrogates.

LCS/LCSD samples were prepared by addition of known concentrations of each analyte in a matrix free media known to be free of target analytes. LCS/LCSD samples were analyzed for every analytical batch and demonstrated that the analytical system was in control during sample preparation and analysis. The LCS/LCSD samples were within the project established accuracy limits presented in the QAPP Addendum (AECOM, 2020c).

MS/MSD samples were prepared, analyzed, and reported at a rate of 5%. MS/MSD samples demonstrated that the analytical system was in control for the matrix being tested, with one exception. The MS/MSD samples were within the project established accuracy limits presented in the QAPP Addendum (AECOM, 2020c).

Calibration verifications were performed routinely to ensure that instrument responses for all calibrated analytes were within established QC criteria. The calibration verifications were within the project established precision limits presented in the QAPP addendum (AECOM, 2020c).

4.6.3 Representativeness

Representativeness qualitatively expresses the degree to which data accurately reflect site conditions. Factors that affect the representativeness of analytical data include appropriate sample population definitions, proper sample collection and preservation techniques, analytical holding times, use of standard analytical methods, and determination of matrix or analyte interferences.

Relating to the use of standard analytical methods, the laboratory followed the method as established in PFAS by liquid chromatography with tandem mass spectrometry (LC/MS/MS) Compliant with Quality Systems Manual (QSM) 5.1 Table B-15, including the specific preparation requirements (i.e. ENVI-Carb or equivalent used), mass calibration, spectra, all the ion transitions identified in Table B-15 were monitored, standards that contained both branch and linear isomers when available were used, and isotopically labeled standards were used for quantitation.

Field QC samples were collected to assess the representativeness of the data collected. Field duplicates were collected at a rate of 10% for all field samples, while MS/MSD samples were collected at a rate of 5%. All preservation techniques were followed by the field staff, and all technical and analytical holding times were met by the laboratory. The laboratory used approved standard methods in accordance with the QAPP Addendum (AECOM, 2020c) for all analyses.

Instrument blanks and method blanks were prepared by the laboratory in each batch as a negative control. Instrument blank, 22003012_A18.d, was non-detect for all target analytes with the following exceptions: perfluorobutyrate (PFBA), PFBS, perfluorohexanoic acid (PFHxA), and perfluoropentanoic acid **(**PFPeA) were above the detection limits. Several positive associated field sample results that displayed concentrations less than five times the detections found in the blank were qualified “U” and the associated numerical result was elevated to the quantitation limit. The results are usable as qualified but should be considered false positives and treated as non-detect.

Equipment blanks and field blanks were also collected for groundwater and soil samples. The equipment blank sample RPB-EB-02-082420 displayed detections for several target analytes. The positive field sample results associated field sample results that displayed concentrations less than five times the detections found in the blank were qualified "U", and the associated numerical result was elevated to the quantitation limit. The results are usable as qualified but should be considered false positives and treated as non-detect.

Two groundwater samples from the RPB El Campo Armory's potable water well were collected on 5 March 2020 during the TPP Meeting 1 and 2 (see **Appendix G**). One raw groundwater sample (sample RPB-PW-01) and one GAC-treated groundwater sample (sample RPB-PW-02) were collected. This GAC-treated groundwater was planned to be used for drill rig decontamination during the SI field effort; however, PFOS was detected in GAC-treated groundwater at a concentration of 27.9 ng/L, rendering this water source unusable for decontamination water during the SI. AECOM proceeded to sample an alternate off-facility potable water source (sample DECON WATER) for PFAS to determine acceptability for decontamination use during the SI. PFOS was also detected in this off-facility alternate potable water source at a concentration of 16.5 ng/L, rendering it unusable for decontamination water. Therefore, laboratory-grade American Society for Testing and Materials (ASTM) Type II PFAS-free deionized water was purchased and used for drill rig decontamination during the SI field effort.

Field samples were extracted and analyzed within the appropriate holding time in order to qualitatively express the degree to which data accurately reflect site conditions with limited exceptions. The holding time for pH analysis is "immediate", all field samples analyzed for pH were qualified "J" and should be considered usable as estimated values.

Overall, the data are usable for evaluating the presence or absence of PFAS at the facility. Sufficient usable data were obtained to meet the objectives of the SI and to complete the risk assessment.

4.6.4 Comparability

Comparability is the extent to which data from one study can be compared directly to either past data from the current project or data from another study. Using standardized sampling and analytical methods, units of reporting, and site selection procedures help ensure comparability. Standard field sampling and typical laboratory protocols were used during the SI and are considered comparable to ongoing investigations.

4.6.5 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount of data expected under normal conditions. The laboratory provided data meeting system QC acceptance criteria for all samples tested. Project completeness was determined by evaluating the planned versus actual quantities of data. Percent completeness per parameter is as follows and reflects the exclusion of any "X" flagged data, if applicable:

- PFAS in groundwater by USEPA Method 537 Modified at 100%
- PFAS in soil by USEPA Method 537 Modified at 100%
- pH in soil by USEPA Method 9045D at 100%
- TOC by USEPA Method 9060 at 100%

4.6.6 Sensitivity

Sensitivity is the capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. Examples of QC measures for determining sensitivity include laboratory fortified blanks, a method detection limit (MDL) study, and calibration standards at the limit of quantitation (LOQ). In order to meet the needs of the data users, project data must meet the measurement performance criteria for sensitivity and project LOQs specified in the QAPP Addendum (AECOM, 2020c). The laboratory provided the requested MDL studies and provided applicable calibration standards at the LOQ. In order to achieve the DQOs for sensitivity outlined in the QAPP Addendum (AECOM, 2020c), the laboratory reported all field sample results at the lowest possible dilution. Additionally, any analytes detected below the LOQ and above the MDL were reported and qualified “J” as estimated values by the laboratory.

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5. Site Inspection Activities

This section describes the environmental investigation and sampling activities that occurred as part of the SI. The SI sampling approach was based on the findings of the PA and implemented in accordance with the following approved documents:

- *Final Site Inspection Programmatic Uniform Federal Policy-Quality Assurance Project Plan dated March 2018* (AECOM, 2018a);
- *Final Programmatic Accident Prevention Plan dated July 2018* (AECOM, 2018b);
- *Final Preliminary Assessment Report, Roy P. Benavidez National Guard Armory, El Campo, Texas dated January 2020* (AECOM, 2020a);
- *Final Site Safety and Health Plan, Roy P. Benavidez National Guard Armory, El Campo, Texas dated August 2020* (AECOM, 2020b); and
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Roy P. Benavidez National Guard Armory, El Campo, Texas dated September 2020* (AECOM, 2020c).

SI field activities included soil and groundwater grab sampling from 24 August to 28 August 2020; the survey of sample locations was completed on 25 September 2020. Field activities were conducted in accordance with the QAPP Addendum (AECOM, 2020c), except as noted in **Section 5.8**.

The following samples were collected during the SI and analyzed for a subset of 18 PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15 to fulfill the project DQOs:

- Twenty-seven (27) soil grab samples from nine boring locations; and
- Nine groundwater grab samples from nine temporary well locations.

Figure 5-1 provides the sample locations for all media across the facility. **Table 5-1** presents the list of samples collected for each media. Field documentation is provided in **Appendix B**. A Log of Daily Notice of Field Activity, which is provided in **Appendix B1**, was completed throughout the SI field activities. Sampling forms are provided in **Appendix B2.** Survey data are provided in **Appendix B3**. A copy of the Field Notebook is provided in **Appendix B4**. Additionally, a photographic log of field activities is provided in **Appendix C**.

5.1 Pre-Investigation Activities

In preparation for the SI field activities, project team members participated in Technical Project Planning (TPP) meetings, performed utility clearance, and sampled decontamination source water. Details for each of these activities are presented below.

5.1.1 Technical Project Planning

The USACE TPP Process, Engineers Manual (EM) 200-1-2 (USACE, 2016) defines four phases to project planning: 1.) defining the project phase; 2.) determining data needs; 3.) developing data collection strategies; and 4.) finalizing the data collection plan. The process encourages stakeholder involvement in the SI, beginning with defining overall project objectives, including quantitative and qualitative DQOs, and formulating a sampling approach to address the AOIs identified in the PA.

A combined TPP Meeting 1 and 2 was held on 5 March 2020, prior to SI field activities. Meeting minutes are provided in **Appendix D**. TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2.

The stakeholders for this SI include the ARNG, TXARNG, USACE, Texas Commission on Environmental Quality, and representatives familiar with the facility, the regulations, and the community. Stakeholders were provided the opportunity to make comments on the technical sampling approach and methods at the combined TPP Meeting 1 and 2. The outcome of the combined TPP Meeting 1 and 2 was memorialized in the SI QAPP Addendum (AECOM, 2020c). Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

Utility clearance was conducted by AECOM with input from the TXARNG and RBP El Campo Armory staff. AECOM's drilling subcontractor, Cascade Technical Services, LLC, contacted "Texas811", the one-call utility clearance contractor to notify them of intrusive work. Additionally, the first 5 feet of each boring were advanced using hand augering methods to verify utility clearance in shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and PFAS Sampling Equipment Acceptability

Prior to the TPP Meeting 1 and 2, potable water drawn from the GAC GWTS at RPB El Campo Armory was planned to be used for decontamination water for drilling equipment; however, a sample of this water source collected during the SI TPP Meeting 1 and 2 revealed that it was not PFAS-free. PFOS was detected in treated groundwater at a concentration of 27.9 ng/L from this sample collected on 5 March 2020 (sample ID RPB-PW-02). AECOM proceeded to sample an alternate off-facility potable water source (sample DECON WATER) for PFAS to determine acceptability for decontamination water use during the SI. PFOS was also detected in this off-facility alternate water sample at a concentration of 16.5 ng/L, rendering it unusable for decontamination water. Therefore, laboratory grade ASTM Type II PFAS-free deionized water was purchased and shipped to the facility via totes for use during the SI field effort. The results of the potable well samples collected following the TPP Meeting 1 and 2, as well as water samples collected from an alternate source, are provided in **Appendix G**. A discussion of the results is presented in **Section 4.6.3**.

Materials that were used within the sampling zone were confirmed as acceptable for use in the PFAS sampling environment. The checklist of acceptable materials for use in the PFAS sampling environment was provided in the Standard Operating Procedures (SOPs) appendix to the QAPP Addendum (AECOM, 2020c). Prior to the start of field work each day, a PFAS Sampling Checklist was completed as an additional layer of control. The checklist served as a daily reminder to each field team member regarding the allowable materials within the sampling environment.

5.2 Soil Borings and Soil Sampling

Soil samples were collected via direct-push technology (DPT) in accordance with the SI QAPP Addendum (AECOM, 2020c). A GeoProbe® 7822DT dual-tube sampling system was used to collect continuous soil cores to the target depth. A hand auger was used to collect surface soil from the top five feet of the boring to be compliant with utility clearance procedures.

Three discrete soil samples were collected from the vadose zone for chemical analysis from each soil boring. One subsurface soil sample approximately 1 foot above the groundwater table, and

one subsurface soil sample at the mid-point between the ground surface and the groundwater table, were collected at each boring using DPT.

The soil boring locations are shown on **Figure 5-1,** and depths are provided **Table 5-1**. The soil boring locations were selected based on the AOI information as agreed on through TPP and QAPP Addendum review.

The soil cores were continuously logged for lithological descriptions by a field geologist using the Unified Soil Classification System (USCS). A photoionization detector (PID) was used to screen the breathing zone during boring activities as part of personal safety requirements. Observations and measurements were recorded on sampling forms (**Appendix B2**) and in a non-treated field logbook (i.e., composition notebook) (**Appendix B4**). Depth interval, recovery thickness, PID concentrations, moisture, relative density, color (using a Munsell soil color chart), and texture (using the USCS) were recorded. The boring logs are provided in **Appendix E**.

Each soil sample was collected into laboratory-supplied PFAS-free high-density polyethylene (HDPE) bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via Federal Express (FedEx) under standard chain of custody (CoC) procedures to the laboratory and analyzed for PFAS (LC/MS/MS compliant with QSM 5.1 Table B-15), TOC (USEPA Method 9060A) and pH (USEPA Method 9045D) in accordance with the QAPP Addendum (AECOM, 2020c).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. In instances when non-dedicated sampling equipment was used, such as a hand auger for the shallow soil samples, equipment rinsate blanks were collected at a rate of 5% and analyzed for the same parameters as the soil samples. A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6 degrees Celsius (°C) during shipment.

DPT borings were converted to temporary wells, which were subsequently abandoned in accordance with the QAPP Addendum (AECOM, 2020c) using wetted bentonite chips at completion of sampling activities. Where possible, borings were installed in grassy areas to avoid disturbing concrete or asphalt surfaces.

5.3 Temporary Well Installation and Groundwater Grab Sampling

Temporary wells were installed using a GeoProbe® 7822DT dual-tube sampling system. Once the borehole was advanced to the desired depth, wherever conditions allowed, a temporary well was constructed of a 5-foot section of 1-inch Schedule 40 poly-vinyl chloride (PVC) screen with sufficient casing to reach ground surface. New PVC pipe and screen were used to eliminate any potential cross contamination between locations. The screen intervals for the temporary wells are provided in **Table 5-2**.

The temporary wells were purged for 5 minutes after installation before collection of groundwater samples. After the purge period, groundwater samples were collected using a peristaltic pump with PFAS-free HDPE tubing. Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. The temporary wells were purged at a rate determined in the field to reduce turbidity and draw down prior to sampling. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen [DO], and oxidation-reduction potential [ORP]) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**) after each grab sample was collected. Additionally, a subsample of each groundwater sample was collected in a separate container and a shaker test was

completed to identify if there was any foaming. No foaming was noted in any of the groundwater samples.

Each sample was collected into laboratory-supplied PFAS-free HDPE bottles and labeled using a PFAS-free marker or pen. Samples were packaged on ice and transported via FedEx under standard CoC procedures to the laboratory and analyzed for PFAS by LC/MS/MS Compliant with QSM 5.1 Table B-15 in accordance with the QAPP Addendum (AECOM, 2020c).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. MS/MSDs were collected at a rate of 5% and analyzed for the same parameters as the accompanying samples. One field reagent blank was collected in accordance with the Programmatic UFP-QPAP (PQAPP) (AECOM, 2018a). A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6°C during shipment.

Temporary wells were abandoned in accordance with the QAPP Addendum (AECOM, 2020c) by removing the PVC and backfilling the hole with wetted bentonite chips. Where possible, temporary wells were installed in grassy areas to avoid disturbing concrete or asphalt.

5.4 Synoptic Water Level Measurements

Synoptic groundwater gauging was performed on 24 to 28 August 2020. Groundwater elevation measurements were collected from the nine temporary groundwater monitoring wells. Water level measurements were taken from the northern side of the well casing. A groundwater flow contour map is provided in **Figure 2-5**, and groundwater elevation data are provided in **Table 5-3**.

5.5 Surveying

The northern side of each well casing was surveyed by LandTech, Inc., a Texas-licensed land surveyor, following guidelines provided in the SOPs as part of the SI QAPP Addendum (AECOM, 2020c). Survey data from the newly installed temporary groundwater wells on the facility were collected on 25 September 2020 in the Universal Transverse Mercator South Central Zone projection with World Geodetic System 84 datum. The surveyed well data are provided in **Appendix B3**.

5.6 Investigation-Derived Waste

As of the date of this report, the disposal of PFAS investigation-derived waste (IDW) is not regulated federally. PFAS IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the QAPP Addendum (AECOM, 2020c) and with the Army Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Soil IDW (i.e., soil cuttings) and liquid IDW (i.e. purge water, development water, and decontamination fluids) generated during the SI activities were containerized in separate 55-gallon drums, labeled, and stored on the facility in a secure location designated by the TXARNG. The soil and liquid IDW was not sampled and assumes the PFAS characteristics of the associated soil and groundwater samples collected from that source location.

Other solids such as spent personal protective equipment, plastic sheeting, tubing, rope, unused monitoring well construction materials, and other environmental media generated during the field activities were disposed of at a licensed solid waste landfill.

5.7 Laboratory Analytical Methods

Samples were analyzed for a subset of 18 PFAS by LC/MS/MS compliant with QSM 5.1 Table B-15 at Pace Analytical Gulf Coast in Baton Rouge, Louisiana, a DoD ELAP and NELAP certified laboratory. The 18 PFAS analyzed as part of the ARNG SI program include the following:

- 6:2 fluorotelomer sulfonate (6:2 FTS)
- 8:2 fluorotelomer sulfonate (8:2 FTS)
- N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)
- N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)
- Perfluorobutyrate (PFBA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluorodecanoic acid (PFDA)
- Perfluorododecanoic acid (PFDoA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorohexanoic acid (PFHxA)
- Perfluorohexanesulfonic acid (PFHxS)
- Perfluorononanoic acid (PFNA)
- Perfluorooctanoic acid (PFOA)
- Perfluorooctanesulfonic acid (PFOS)
- Perfluoropentanoic acid (PFPeA)
- Perfluorotetradecanoic acid (PFTeDA)
- Perfluorotridecanoic acid (PFTrDA)
- Perfluoroundecanoic acid (PFUdA)

Soil samples were also analyzed for TOC using USEPA Method 9060A, pH by USEPA Method 9045D, and grain size/ clay content by ASTM D-422.

5.8 Deviations from QAPP Addendum

There were no deviations from the QAPP Addendum that occurred during the SI field effort.

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Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Roy P. Benavidez National Guard Armory, El Campo, Texas

Sample Identification	Sample Collection Date	Sample Depth (feet bgs)	PFAS (LC/MS/MS compliant with QSM 5.1 Table B-15)	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size Analysis (ASTM D-422)	Comments
Soil Samples							
AOI01-01-SB-0-2	8/26/2020	0 - 2	x	x	x		
AOI01-01-SB-0-2-FD	8/26/2020	0 - 2		x	x		Field Duplicate
AOI01-01-SB-15-17	8/26/2020	15 - 17	x			x	
AOI01-01-SB-15-17-MS	8/26/2020	15 - 17	x				MS/MSD
AOI01-01-SB-15-17-MSD	8/26/2020	15 - 17	x				MS/MSD
AOI01-01-SB-31-33	8/26/2020	31 - 33	x				
AOI02-01-SB-0-2	8/25/2020	0 - 2	x				
AOI02-01-SB-0-2-FD	8/28/2020	0 - 2		x	x		
AOI02-01-SB-15-17	8/25/2020	15 - 17	x				
AOI02-01-SB-15-17-FD	8/25/2020	15 - 17	x				Field Duplicate
AOI02-01-SB-29-31	8/25/2020	29 - 31	x				
AOI02-02-SB-0-2	8/25/2020	0 - 2	x				
AOI02-02-SB-15-17	8/25/2020	15 - 17	x			x	
AOI02-02-SB-29-31	8/25/2020	29 - 31	x				
AOI03-01-SB-0-2	8/28/2020	0 - 2	x				
AOI03-01-SB-15-17	8/28/2020	15 - 17	x				
AOI03-01-SB-28-30	8/28/2020	28 - 30	x	x			
AOI03-02-SB-0-2	8/28/2020	0 - 2	x			x	
AOI03-02-SB-15-17	8/28/2020	15 - 17	x				
AOI03-02-SB-28-30	8/28/2020	28 - 30	x				
AOI03-02-SB-28-30-FD	8/28/2020	28 - 30	x				Field Duplicate
RPB-01-SB-0-2	8/28/2020	0 - 2	x	x	x		
RPB-01-SB-0-2-MS	8/28/2020	0 - 2	x	x	x		MS/MSD
RPB-01-SB-0-2-MSD	8/28/2020	0 - 2	x	x	x		MS/MSD
RPB-01-SB-15-17	8/28/2020	15 - 17	x			x	
RPB-01-SB-31-33	8/28/2020	31 - 33	x				
RPB-02-SB-0-2	8/24/2020	0 - 2	x				
RPB-02-SB-15-17	8/24/2020	15 - 17	x				
RPB-02-SB-32-34	8/24/2020	32 - 34	x				
RPB-03-SB-0-2	8/24/2020	0 - 2	x				
RPB-03-SB-15-17	8/24/2020	15 - 17	x				
RPB-03-SB-15-17-FD	8/24/2020	15 - 17	x				Field Duplicate
RPB-03-SB-30-32	8/24/2020	30 - 32	x				
RPB-04-SB-0-2	8/25/2020	0 - 2	x				
RPB-04-SB-15-17	8/25/2020	15 - 17	x				
RPB-04-SB-30-32	8/25/2020	30 - 32	x				
Groundwater Samples							
AOI01-01-GW	8/26/2020	30 - 40	x				
AOI02-01-GW	8/26/2020	30 - 40	x				
AOI02-01-GW-MS	8/26/2020	30 - 40	x				MS/MSD
AOI02-01-GW-MSD	8/26/2020	30 - 40	x				MS/MSD
AOI02-02-GW	8/25/2020	30 - 40	x				
AOI02-02-GW-FD	8/25/2020	30 - 40	x				Field Duplicate
AOI03-01-GW	8/28/2020	30 - 40	x				
AOI03-02-GW	8/28/2020	30 - 40	x				
RPB-01-GW	8/28/2020	30 - 40	x				
RPB-02-GW	8/24/2020	30 - 40	x				
RPB-03-GW	8/25/2020	30 - 40	x				
RPB-04-GW	8/25/2020	30 - 40	x				
Blank Samples							
RPB-EB-01-082420	8/24/2020	---	x				Equipment Rinsate Blank
RPB-EB-02-082420	8/24/2020	---	x				Equipment Rinsate Blank
RPB-EB-03-082820	8/28/2020	---	x				Equipment Rinsate Blank
RPB-EB-04-082820	8/28/2020	---	x				Equipment Rinsate Blank
RPB-FRB-01-082620	8/24/2020	---	x				Field Reagent Blank
RPB-PW-01	3/5/2020	---	x				Decontamination Water*
RPB-PW-01-FD	3/5/2020	---	x				Decontamination Water*
RPB-PW-02	3/5/2020	---	x				Decontamination Water*
RPB-FRB-01	3/5/2020	---	x				Field Reagent Blank
DECON WATER	7/1/2020	---	x				Decontamination Water*

Notes:
* Decontamination water source not used during SI field effort due to detected PFAS concentrations.

AOI = Area of Interest
ft = feet
MS/MSD = matrix spike/ matrix spike duplicate
PFAS = per- and polyfluoroalkyl substances
pH = potential for hydrogen
TOC = total organic carbon
RPB = Roy P. Benavidez
USEPA = United States Environmental Protection Agency

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Table 5-2
Soil Boring Depths and Temporary Well Screen Intervals
Site Inspection Report, Roy P. Benavidez National Guard Armory, El Campo, Texas

Area of Interest	Soil Boring ID	Soil Boring Depth (feet bgs)	Temporary Well Screen Interval (feet bgs)
AOI 1	AOI01-01-SB	40	30 - 40
AOI 2	AOI02-01-SB	40	30 - 40
	AOI02-02-SB	40	30 - 40
AOI 3	AOI03-01-SB	40	30 - 40
	AOI03-02-SB	40	30 - 40
Upgradient Facility Boundary	RPB-01-SB	40	30 - 40
Downgradient Facility Boundary	RPB-02-SB	40	30 - 40
	RPB-03-SB	40	30 - 40
	RPB-04-SB	40	30 - 40

Notes:
AOI = Area of Interest
bgs = below ground surface
RPB = Roy P. Benavidez
SB = soil boring

Table 5-3
Groundwater Elevations at Temporary Groundwater Monitoring Wells
Site Inspection Report, Roy P. Benavidez National Guard Armory, El Campo, Texas

Temporary Groundwater Monitoring Well ID	Ground Surface Elevation (ft amsl)	Depth to Water (ft bgs)	Groundwater Elevation (ft amsl)
AOI01-01	100.37	32.97	67.40
AOI02-01	98.68	31.46	67.22
AOI02-02	98.57	31.33	67.24
AOI03-01	97.49	29.84	67.65
AOI03-02	98.07	30.44	67.63
RPB-01	100.51	32.77	67.74
RPB-02	97.89	30.83	67.06
RPB-03	98.81	31.86	66.95
RPB-04	99.39	32.40	66.99

Notes:
AOI = area of interest
amsl = above mean sea level
bgs = below ground surface
ft = feet
RPB = Roy P. Benavidez

CLIENT	ARNG			
NOTES	Site Inspection for PFAS at RPB El Campo Armory, TX			
REVISED	5/11/2021	GIS BY	MS	5/11/2021
SCALE	1:2,400	CHK BY	JW	5/11/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	CM	5/11/2021

N

Site Inspection Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

C:\Users\stankevichm\OneDrive - AECOM Directory\ARNG_PFAS_GIS_60552172\MXDs\TX\El_Campo_PA_Figures\SI_Figures\SI_Report\Fig_5-1_El_Campo_SI_Sample_Locations.mxd

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6. Site Inspection Results

This section presents the analytical results of the SI for each AOI. The SLs used in this evaluation are presented in **Section 6.1**. A discussion of the results for each AOI is provided in **Section 6.3** through **Section 6.7**. **Table 6-2** through **Table 6-4** present PFAS results for samples with detections in soil or groundwater; only constituents detected in one or more samples are included. Tables that contain all results are provided in **Appendix G**, and the laboratory reports are provided in **Appendix H**.

6.1 Screening Levels

The DoD has adopted a policy to retain facilities in the CERCLA process based on risk-based SLs for soil and groundwater, as described in a memorandum from the OSD dated 15 October 2019 (Assistant Secretary of Defense, 2019). The ARNG program under which this SI was performed follows this DoD policy. Should the maximum concentration for sampled media exceed the SLs established in the OSD memorandum, the AOI will proceed to a RI, the next phase under CERCLA. The SLs apply to three compounds, PFOA, PFOS, and PFBS, for both soil and groundwater, as presented in **Table 6-1**.

All other results presented in this report are considered informational in nature and serve as an indication as to whether soil and groundwater contain or do not contain PFAS within the boundaries of the facility.

Table 6-1: Screening Levels (Soil and Groundwater)

Analyte	Residential (Soil) (µg/kg)[a] 0-2 feet bgs	Industrial/ Commercial Composite Worker (Soil) (µg/kg)[a] 2-15 feet bgs	Tap Water (Groundwater) (ng/L)[a]
PFOA	130	1,600	40
PFOS	130	1,600	40
PFBS	130,000	1,600,000	40,000

Notes:
a.) Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. HQ=0.1. 15 October 2019.
bgs = below ground surface
ng/L = nanograms per liter
µg/kg= micrograms per kilogram µg/kg= micrograms per kilogram

6.2 Soil Physicochemical Analyses

To provide basic soil parameter information, soil samples were analyzed for TOC and pH, which are important for evaluating transport through the soil medium. **Appendix G** contains the results of the TOC and pH sampling.

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport of PFAS contaminants. According to the Interstate Technology Regulatory Council (ITRC), several important PFAS partitioning mechanisms include hydrophobic and lipophobic effects, electrostatic interactions, and interfacial behaviors. At relevant environmental pH values, certain PFAS are present as organic anions and are therefore relatively mobile in groundwater (Xiao et al., 2015), but tend to associate with the organic carbon

fraction that may be present in soil or sediment (Higgins and Luthy 2006; Guelfo and Higgins, 2013). When sufficient organic carbon is present, organic carbon normalized distribution coefficients (Koc values) can help in evaluating transport potential, though other geochemical factors (for example, pH and presence of polyvalent cations) may also affect PFAS sorption to solid phases (ITRC, 2018).

6.3 AOI 1

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 1, which includes one potential PFAS release area: Weapons Cleaning Area. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOS and PFOA in soil and groundwater are presented on **Figure 6-1** through **Figure 6-3**.

6.3.1 AOI 1 Soil Analytical Results

Soil was sampled at AOI 1 from three depth intervals at boring location AOI01-01 during the SI: shallow (0 to 2 feet bgs), shallow subsurface (15 to 17 feet bgs), and deep (31 to 33 feet bgs). PFOA, PFOS, and PFBS were not detected in these three samples.

6.3.2 AOI 1 Groundwater Analytical Results

One groundwater sample was collected from a temporary monitoring well installed at AOI01-01 during the SI (AOI01-01-GW). Detected concentrations of PFOA, PFOS, and PFBS in groundwater were all below the SLs, with concentrations of 5.22 J ng/L, 2.83 J ng/L, and 2.21 J ng/L, respectively.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOA, PFOS, and PFBS were not detected in soil at AOI 1. PFOA, PFOS, and PFBS were detected in groundwater at concentrations below the individual SLs. Based on the detected concentrations of PFOA, PFOS, and PFBS in groundwater, no further action is warranted at the Weapons Cleaning Area.

6.4 AOI 2

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 2, which includes one potential PFAS release area: Trash Pit. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOS and PFOA in soil and groundwater are presented on **Figure 6-1** through **Figure 6-3**.

6.4.1 AOI 2 Soil Analytical Results

Soil was sampled at AOI 2 from three depth intervals at boring locations AOI02-01 and AOI02-02 during the SI: shallow (0 to 2 feet bgs), shallow subsurface (15 to 17 feet bgs), and deep (29 to 31 feet bgs). PFOA, PFOS, and PFBS were not detected in these samples.

6.4.2 AOI 2 Groundwater Analytical Results

Groundwater samples were collected from temporary monitoring wells installed at AOI02-01 and AOI02-02 during the SI (AOI02-01-GW and AOI02-02-GW). Detected concentrations of PFOA, PFOS, and PFBS in groundwater from these samples were all below their respective SLs. At AOI02-01, PFOA was detected at a concentration of 12.5 ng/L, PFOS was detected at an

estimated concentration of 2.46 J ng/L, and PFBS was detected at an estimated concentration of 5.01 J ng/L. At AOI02-02, PFOA and PFBS were detected estimated concentrations of 9.87 J ng/L and 5.44 J ng/L, respectively. PFOS was not detected in groundwater at AOI02-02.

6.4.3 AOI 2 Conclusions

Based on the results of the SI, PFOA, PFOS, and PFBS were not detected in soil at AOI 2. PFOA, PFOS, and PFBS were detected in groundwater at concentrations below the individual SLs. Based on the detected concentrations of PFOA, PFOS, and PFBS in groundwater, no further action is warranted at the Trash Pit.

6.5 AOI 3

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 3, which includes one potential PFAS release area: Septic Leach Field. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOS and PFOA in soil and groundwater are presented on **Figure 6-1** through **Figure 6-3**.

6.5.1 AOI 3 Soil Analytical Results

Soil was sampled at AOI 3 from three depth intervals at boring locations AOI03-01 and AOI03-02 during the SI: shallow (0 to 2 feet bgs), shallow subsurface (15 to 17 feet bgs), and deep (28 to 30 feet bgs). PFOA, PFOS, and PFBS were not detected in these samples.

6.5.2 AOI 3 Groundwater Analytical Results

Groundwater samples were collected from temporary monitoring wells installed at AOI03-01 and AOI03-02 during the SI (AOI03-01-GW and AOI03-02-GW). The detected concentration of PFOS in groundwater at AOI03-02 exceeded the individual SL for PFOS of 40 ng/L with a concentration of 56.5 ng/L. PFOA and PFBS were detected at AOI03-01 below the individual SLs at concentrations of 20.3 ng/L and 18.8 ng/L, respectively. At AOI03-01, PFOS was detected in groundwater at a concentration of 39.3 ng/L, slightly below the individual SL of 40 ng/L. PFOA and PFBS were detected at AOI03-01 below the individual SLs at concentrations of 15.7 ng/L and 17.1 ng/L, respectively.

6.5.3 AOI 3 Conclusions

Based on the results of the SI, PFOA, PFOS, and PFBS were not detected in soil at AOI 3. PFOS was detected in groundwater at a concentration exceeding the individual SL of 40 ng/L. The detected concentrations of PFOA and PFBS in groundwater were below the individual SLs. Based on the exceedance of the SL for PFOS in groundwater, further evaluation at AOI 3 is warranted.

6.6 Upgradient Facility Boundary

This section presents the analytical results for soil and groundwater in comparison to SLs for the Upgradient Facility Boundary, which was sampled to examine potential off-facility sources of PFAS located upgradient of RBP El Campo Armory. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOS and PFOA in soil and groundwater are presented on **Figure 6-1** through **Figure 6-3**.

6.6.1 Upgradient Facility Boundary Soil Analytical Results

Soil was sampled at the Upgradient Facility Boundary from three depth intervals at boring location RPB-01 during the SI: shallow (0 to 2 feet bgs), shallow subsurface (15 to 17 feet bgs), and deep (31 to 33 feet bgs). PFOA, PFOS, and PFBS were not detected in these samples.

6.6.2 Upgradient Facility Boundary Groundwater Analytical Results

One groundwater sample was collected from a temporary monitoring well installed at RPB-01 during the SI (RPB-01-GW). PFOA, PFOS, and PFBS were not detected in the groundwater sample collected at this location.

6.6.3 Upgradient Facility Boundary Conclusions

Based on the results of the SI, PFOA, PFOS, and PFBS were not detected in soil or groundwater at RPB-01. Therefore, further evaluation of the facility's northwestern Upgradient Facility Boundary is not warranted.

6.7 Downgradient Facility Boundary

This section presents the analytical results for soil and groundwater in comparison to SLs for the Downgradient Facility Boundary, which was sampled to examine potential migration of PFAS off-facility from unknown sources of PFAS located at RBP El Campo Armory. The detected compounds in soil and groundwater are summarized on **Table 6-2** through **Table 6-4**. The detections of PFOS and PFOA in soil and groundwater are presented on **Figure 6-1** through **Figure 6-3**.

6.7.1 Downgradient Facility Boundary Soil Analytical Results

Soil was sampled at the Downgradient Facility Boundary from three depth intervals at boring locations RPB-02, RPB-03, and RPB-04 during the SI: shallow (0 to 2 feet bgs), shallow subsurface (15 to 17 feet bgs), and deep (30 to 34 feet bgs). PFOA, PFOS, and PFBS were not detected in these samples.

6.7.2 Downgradient Facility Boundary Groundwater Analytical Results

Groundwater samples were collected from temporary monitoring wells installed at RPB-02, RPB-03, and RPB-04 along the southern facility boundary during the SI (RPB-02-GW, RPB-03-GW, and RPB-04-GW). PFOS, PFOA, and PFBS were detected in groundwater at RPB-02 below the individual SLs, at concentrations of 2.10 J ng/L, 3.49 J ng/L, and 5.40 J ng/L, respectively. PFOS and PFOA were detected in groundwater at RPB-03 below the individual SLs, at concentrations of 2.24 J and 7.58 J ng/L, respectively. PFBS was not detected in groundwater at RPB-03. PFOA, PFOS, and PFBS were not detected in groundwater at RPB-04.

6.7.3 Downgradient Facility Boundary Conclusions

Based on the results of the SI, PFOA, PFOS, and PFBS were not detected in soil samples collected at the Downgradient Facility Boundary. However, PFOA, PFOS, and PFBS were detected below the individual SLs in groundwater at the Downgradient Facility Boundary. Based on the detected concentrations of PFOA, PFOS, and PFBS in groundwater, no further action is warranted at the Downgradient Facility Boundary.

Table 6-2
PFAS Detections in Surface Soil
Site Inspection Report, Roy P. Benavidez El Campo Armory, Texas

Area of Interest		AOI 1		AOI 2				AOI 3				Upgradient Facility Boundary		Downgradient Facility Boundary					
Sample ID		AOI01-01-SB-0-2		AOI02-01-SB-0-2		AOI02-02-SB-0-2		AOI03-01-SB-0-2		AOI03-02-SB-0-2		RPB-01-SB-0-2		RPB-02-SB-0-2		RPB-03-SB-0-2		RPB-04-SB-0-2	
Sample Date		08/26/2020		08/25/2020		08/25/2020		08/28/2020		08/28/2020		08/28/2020		08/24/2020		08/24/2020		08/25/2020	
Depth		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft		0 - 2 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/kg)																			
PFBA	-	0.155	J	0.183	J	0.155	J	ND		ND		ND		0.139	J	ND		ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Soil screening levels based on residential scenario for direct ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

PFBA	perfluorobutanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
ft	feet
HQ	Hazard quotient
ID	identifier
LCMSMS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
OSD	Office of the Secretary of Defense
PFAS	per- and polyfluoroalkyl substances
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
RPB	Roy P. Benavidez
SB	Soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram
-	Not applicable

Table 6-3
PFAS Detections in Deep Subsurface Soil
Site Inspection Report, Roy P. Benavidez El Campo Armory, Texas

Area of Interest	AOI 1				AOI 2										AOI 3			
Sample ID	AOI01-01-SB-15-17		AOI01-01-SB-31-33		AOI02-01-SB-15-17		AOI02-01-SB-15-17-FD		AOI02-01-SB-29-31		AOI02-02-SB-15-17		AOI02-02-SB-29-31		AOI03-01-SB-15-17		AOI03-01-SB-28-30	
Sample Date	08/26/2020		08/26/2020		08/25/2020		08/25/2020		08/25/2020		08/25/2020		08/25/2020		08/28/2020		08/28/2020	
Depth	15 - 17 ft		31 - 33 ft		15 - 17 ft		15 - 17 ft		29 - 31 ft		15 - 17 ft		29 - 31 ft		15 - 17 ft		28 - 30 ft	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/kg)																		
PFBA	ND		ND		ND		ND		ND		ND		ND		ND		ND	

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

PFBA	perfluorobutanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
FD	Field duplicate
ft	feet
ID	identifier
LCMSMS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
PFAS	per- and polyfluoroalkyl substances
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
RPB	Roy P. Benavidez
SB	Soil boring
µg/kg	micrograms per kilogram

Table 6-3
PFAS Detections in Deep Subsurface Soil
Site Inspection Report, Roy P. Benavidez El Campo Armory, Texas

Area of Interest	AOI 3						Upgradient Facility Boundary				Downgradient Facility Boundary							
Sample ID	AOI03-02-SB-15-17		AOI03-02-SB-28-30		AOI03-02-SB-28-30-FD		RPB-01-SB-15-17		RPB-01-SB-31-33		RPB-02-SB-15-17		RPB-02-SB-32-34		RPB-03-SB-15-17		RPB-03-SB-15-17-FD	
Sample Date	08/28/2020		08/28/2020		08/28/2020		08/28/2020		08/28/2020		08/24/2020		08/24/2020		08/24/2020		08/24/2020	
Depth	15 - 17 ft		28 - 30 ft		28 - 30 ft		15 - 17 ft		31 - 33 ft		15 - 17 ft		32 - 34 ft		15 - 17 ft		15 - 17 ft	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/kg)																		
PFBA	ND		ND		ND		ND		ND		0.140	J	ND		0.171	J	ND	

Interpreted Qualifiers
J = Estimated concentration

Chemical Abbreviations

PFBA	perfluorobutanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
FD	Field duplicate
ft	feet
ID	identifier
LCMSMS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
PFAS	per- and polyfluoroalkyl substances
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
RPB	Roy P. Benavidez
SB	Soil boring
µg/kg	micrograms per kilogram

Table 6-3
PFAS Detections in Deep Subsurface Soil
Site Inspection Report, Roy P. Benavidez El Campo Armory, Texas

Area of Interest	Downgradient Facility Boundary					
Sample ID	RPB-03-SB-30-32		RPB-04-SB-15-17		RPB-04-SB-30-32	
Sample Date	08/24/2020		08/25/2020		08/25/2020	
Depth	30 - 32 ft		15 - 17 ft		30 - 32 ft	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (µg/kg)						
PFBA	ND		ND		ND	

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

PFBA	perfluorobutanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
FD	Field duplicate
ft	feet
ID	identifier
LCMSMS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
PFAS	per- and polyfluoroalkyl substances
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
RPB	Roy P. Benavidez
SB	Soil boring
µg/kg	micrograms per kilogram

Table 6-4
PFAS Detections in Groundwater
Site Inspection Report, Roy P. Benavidez El Campo Armory, Texas

Area of Interest		AOI 1		AOI 2						AOI 3				Upgradient Facility Boundary		Downgragient Facility Boundary			
Sample ID		AOI01-01-GW		AOI02-01-GW		AOI02-02-GW		AOI02-02-GW-FD		AOI03-01-GW		AOI03-02-GW		RPB-01-GW		RBP-02-GW		RBP-03-GW	
Sample Date		08/26/2020		08/26/2020		08/25/2020		08/25/2020		08/28/2020		08/28/2020		08/28/2020		08/24/2020		08/25/2020	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)																			
6:2 FTS	-	ND		ND		ND		ND		ND		ND		2.44	J	3.06	J	2.17	J
8:2 FTS	-	ND		ND		ND		ND		ND		ND		ND		ND		1.68	J
PFBA	-	5.86	J	7.33	J	8.20	J	8.60	J	8.72	J	8.07	J	3.10	J	6.01	J	4.90	J
PFBS	40000	2.21	J	5.01	J	4.50	J	5.44	J	17.1		18.8		ND		5.40	J	ND	
PFHpA	-	3.44	J	3.58	J	4.81	J	6.04	J	5.60	J	6.44	J	ND		3.94	J	2.63	J
PFHxA	-	6.38	J	7.06	J	8.42	J	7.54	J	12.4		12.3		ND		10.3		4.64	J
PFHxS	-	4.44	J	7.87	J	4.98	J	5.08	J	4.49	J	21.1		ND		4.03	J	4.14	J
PFNA	-	ND		ND		ND		ND		2.20	J	ND		ND		ND		ND	
PFOA	40	5.22	J	12.5		9.87	J	9.34	J	15.7		20.3		ND		3.49	J	7.58	J
PFOS	40	2.83	J	2.46	J	ND		ND		39.3		56.5		ND		2.10	J	2.24	J
PFPeA	-	4.20	J	7.90	J	11.3		12.0		15.4		13.6		ND		13.3		3.92	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

Acronyms and Abbreviations

AOI	Area of Interest
FD	Field duplicate
GW	Groundwater
HQ	Hazard quotient
ID	Identifier
LCMSMS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
ng/L	nanogram per liter
OSD	Office of the Secretary of Defense
PFAS	per- and polyfluoroalkyl substances
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
RPB	Roy P. Benavidez
USEPA	United States Environmental Protection Agency
-	Not applicable

Table 6-4
PFAS Detections in Groundwater
Site Inspection Report, Roy P. Benavidez El Campo Armory, Texas

	Area of Interest	Downgradient Facility Boundary	
	Sample ID	RBP-04-GW	
	Sample Date	08/25/2020	
Analyte	OSD Screening Level [a]	Result	Qual
Water, PFAS by LCMSMS Compliant with QSM 5.1 Table B-15 (ng/L)			
6:2 FTS	-	ND	
8:2 FTS	-	ND	
PFBA	-	2.78	J
PFBS	40000	ND	
PFHpA	-	ND	
PFHxA	-	2.06	J
PFHxS	-	ND	
PFNA	-	ND	
PFOA	40	ND	
PFOS	40	ND	
PFPeA	-	ND	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, 2019. Risk Based Screening Levels Calculated for PFOS, PFOA, PFBS in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1. 15 October 2019. Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

Interpreted Qualifiers

J = Estimated concentration

Chemical Abbreviations

6:2 FTS	6:2 fluorotelomer sulfonate
8:2 FTS	8:2 fluorotelomer sulfonate
PFBA	perfluorobutanoic acid
PFBS	perfluorobutanesulfonic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFPeA	perfluoropentanoic acid

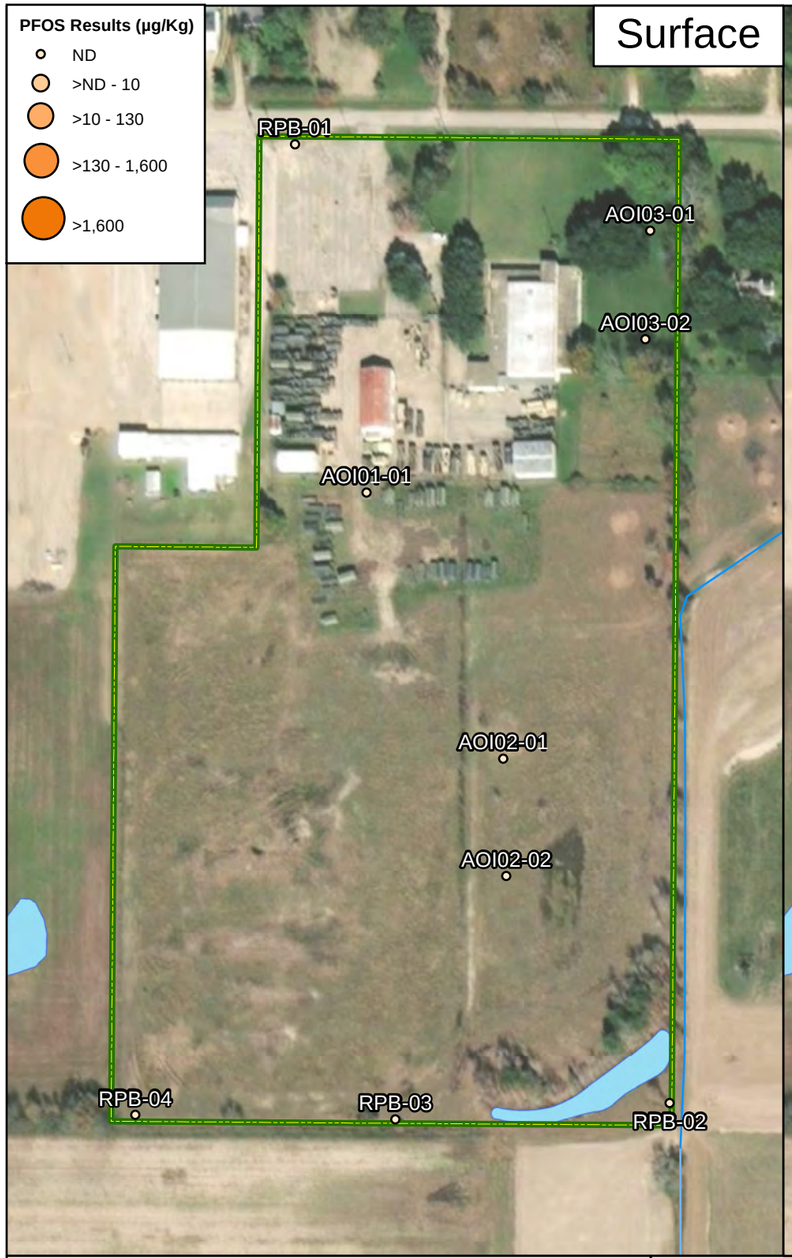
Acronyms and Abbreviations

AOI	Area of Interest
FD	Field duplicate
GW	Groundwater
HQ	Hazard quotient
ID	Identifier
LCMSMS	Liquid Chromatography Mass Spectrometry
LOD	Limit of Detection
ND	Analyte not detected above the LOD
ng/L	nanogram per liter
OSD	Office of the Secretary of Defense
PFAS	per- and polyfluoroalkyl substances
QSM	Quality Systems Manual
Qual	Interpreted Qualifier
RPB	Roy P. Benavidez
USEPA	United States Environmental Protection Agency
-	Not applicable

PFOS Results (µg/Kg)

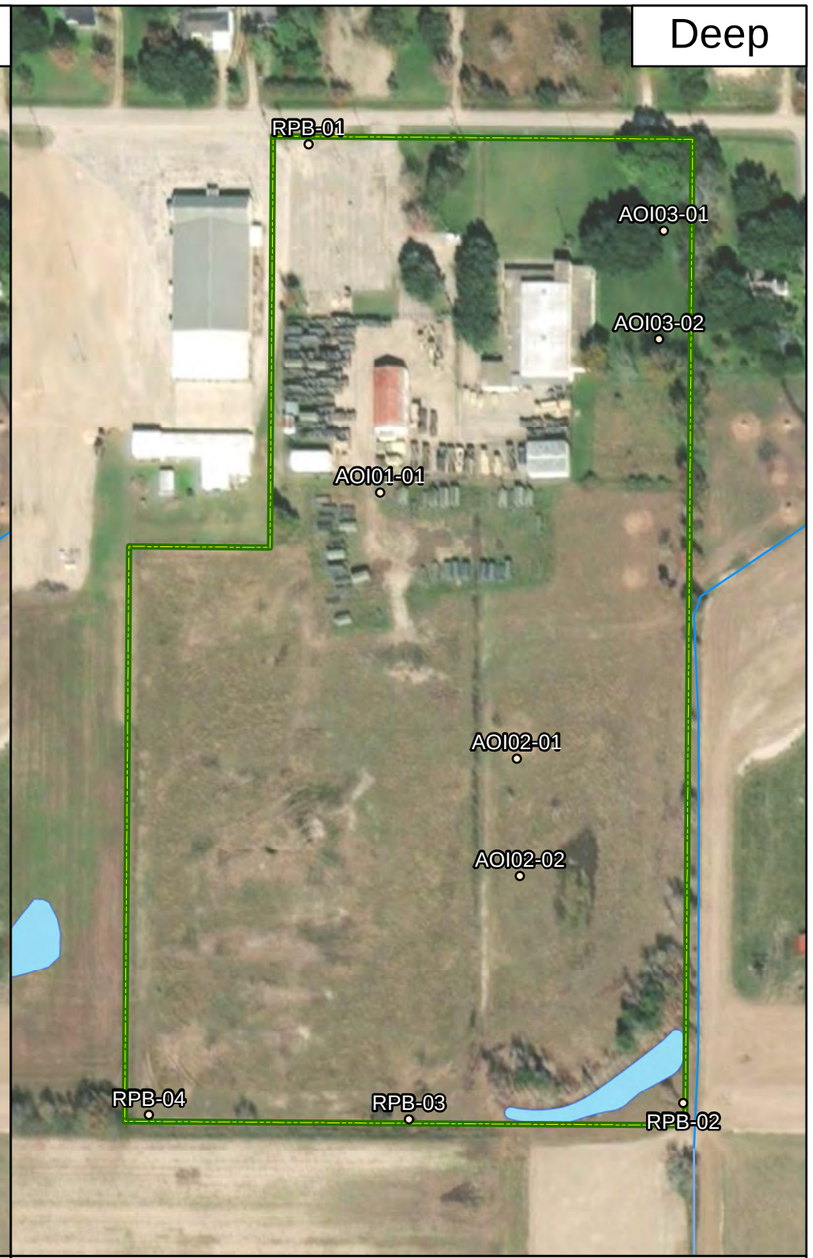
- ND
- >ND - 10
- >10 - 130
- >130 - 1,600
- >1,600

Surface



Intermediate

Deep



CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at RPB El Campo Armory, TX			
REVISED	5/11/2021	GIS BY	MS	5/11/2021
SCALE	1:2,400	CHK BY	JW	5/11/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	5/11/2021

Legend

- Facility Boundary
- Water Body
- River/Stream
- Canal/Ditch

0 100 200 400 Feet

N

PFOS Soil Results

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-1

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CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at RPB El Campo Armory, TX			
REVISED	5/11/2021	GIS BY	MS	5/11/2021
SCALE	1:2,400	CHK BY	JW	5/11/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	5/11/2021

Legend

- Facility Boundary
- Water Body
- River/Stream
- Canal/Ditch

0 100 200 400 Feet

N

PFOA Soil Results

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-2

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PFOS

PFOA

RPB-01
AOI03-01
AOI03-02
AOI01-01
AOI02-01
AOI02-02
RPB-04
RPB-03
RPB-02

PFOS Results (ng/L)
- ND - 10
- >10 - 40
- >40 - 70
- >70 - 400
- >400

PFOA Results (ng/L)
- ND - 10
- >10 - 40
- >40 - 70
- >70 - 400
- >400

CLIENT	ARNG			
PROJECT	Site Inspection for PFAS at RPB El Campo Armory, TX			
REVISED	5/11/2021	GIS BY	MS	5/11/2021
SCALE	1:2,400	CHK BY	JW	5/11/2021
Base Map: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community		PM	CM	5/11/2021

Facility Boundary
Water Body
River/Stream
Canal/Ditch
Groundwater Flow Direction
Water Supply Well

0 100 200 400 Feet

N

PFOS and PFOA Detections in Groundwater

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-3

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7. Exposure Pathways

A human exposure pathway is considered potentially complete when the following conditions are present:

1. Contaminant source;
2. Environmental transport media;
3. Exposure point;
4. Exposure route; and
5. Potentially exposed populations.

If any of these elements are missing, the pathway is incomplete; however, the pathway is considered potentially complete if PFOA, PFOS, or PFBS are detected in media below the SLs or detected in media with no SL. Areas with an identified potentially complete pathway may warrant further investigation. Areas with no identified complete pathway generally warrant no further action unless there is an exceedance of the SLs.

In general, the potential PFAS exposure pathways are ingestion and inhalation. Human exposure via the dermal contact pathway may occur, and current risk practice suggests it is an insignificant pathway compared to ingestion; however, exposure data for dermal pathways are sparse and continue to be the subject of PFAS toxicological study. The receptors evaluated are consistent with those listed in USEPA guidance for risk screening (USEPA, 2019). Receptors at the Site include site workers (e.g., facility staff and visiting soldiers), construction workers, full-time and part-time residents outside the facility boundary, and recreational users outside of the facility boundary. The CSMs for each AOI, revised based on the SI findings, are presented on **Figure 7-1** through **Figure 7-3**.

7.1 Soil Exposure Pathway

The SI results for PFOA, PFOS, and PFBS in soil were used to determine whether a potentially complete pathway exists between the source and potential receptors at each AOI based on the individual soil SLs.

7.1.1 AOI 1

An unknown CLP product was historically used by troops for weapons cleaning exercises at RPB El Campo Armory. Teflon, which contains PFAS, may be a component of the CLP product that was used; the manufacturer and quantity of CLP product historically used at the facility are unknown. Typically, the main waste from weapons cleaning is the rags used to wipe down firearms with CLP product. A small amount of CLP product is applied to a rag, which is used to wipe down the firearm for routine maintenance. The rags are then disposed of. It is suspected that most historical weapons cleaning activities took place at the Weapons Cleaning Area building. Old and excess CLP product would have been wiped from the weapons that were being cleaned and then disposed of by the facility. It is unknown how the used rags containing CLP product were historically disposed. CLP product may have been rinsed into surrounding surface soil via precipitation and migrated into groundwater.

PFOA, PFOS, and PFBS were not detected in soil at AOI 1. Based on the results of the SI at AOI 1, the surface soil and subsurface soil exposure pathways via incidental ingestion and inhalation

are incomplete for the site worker, construction worker, resident, and trespasser/ recreational user. The CSM for AOI 1 is presented on **Figure 7-1**.

7.1.2 AOI 2

This AOI may have been used to dispose of PFAS-containing materials originating on- and off-facility. In addition to potential releases at the Weapons Cleaning Area building, where CLP product was likely used, the rags containing CLP product may have been disposed of in the Trash Pit. Rags containing CLP product may have been exposed to precipitation and weathering, allowing PFAS to desorb from the rags and migrate into surface soil, subsurface soil, and shallow groundwater.

PFOA, PFOS, and PFBS were not detected in soil at AOI 2. Based on the results of the SI at AOI 2, the surface soil and subsurface soil exposure pathways via incidental ingestion and inhalation are incomplete for the site worker, construction worker, resident, and trespasser/ recreational user. The CSM for AOI 2 is presented on **Figure 7-2**.

7.1.3 AOI 3

Substances or wastewater containing PFAS, such as CLP product, household or industrial cleaners, floor waxes, or wastewater containing these products could have entered the drains at the RPB El Campo Armory and contributed to PFAS in the septic system. Wastewater that enters the septic system is eventually sprayed in the northeast corner of the facility through four sprinkler heads. Any PFAS-containing liquids that were rinsed or poured down facility drains would eventually be sprayed over the leach field, and could potentially migrate into surface soil, subsurface soil, and shallow groundwater.

PFOA, PFOS, and PFBS were not detected in soil at AOI 3. The results of the SI at AOI 3 are suggestive of an incomplete exposure pathway via incidental ingestion and inhalation of surface and subsurface soil for the site worker, construction worker, resident, and trespasser/ recreational user. However, given the proximity to the suspected PFAS source, there may be insufficient data to eliminate this potential exposure pathway at this time. The CSM for AOI 3 is presented on **Figure 7-3**.

7.2 Groundwater Exposure Pathway

The RPB El Campo Armory uses a Class I groundwater well for all potable water uses and does not receive drinking water or sanitary sewer services from local utilities. Drinking water from the facility's potable well was previously sampled for PFAS by the National Guard Bureau in April 2017. PFOA and PFOS were detected above the combined USEPA Health Advisory (HA) of 70 nanograms per liter (ng/L) (USEPA, 2016a). In response, RPB El Campo Armory switched to bottled water at that time, and in August 2018, a GAC GWTS was installed to reduce the levels of PFOS and PFOA in the facility's drinking water. After groundwater was treated through the new GAC GWTS, detected concentrations of PFOS and PFOA were observed to be below the combined USEPA HA of 70 ng/L. Data collected by the NGB in 2018 (NGB, 2018) as well as the TMD (TMD, 2019; TMD, 2020) indicated that PFOS, PFOA, and PFBS are not present in treated groundwater at the facility.

The SI results for PFOA, PFOS, and PFBS in groundwater were used to determine whether a potentially complete exposure pathway exists between the source and future construction workers at each AOI, as well as off-facility residents, based on the individual groundwater SLs.

7.2.1 AOI 1

PFOA, PFOS, and PFBS were detected in groundwater from one temporary monitoring well at AOI 1, confirming the presence of PFAS in groundwater at AOI 1. The detected concentrations for each compound were all below the individual SLs. The construction worker exposure scenario assumes trench work occurs at depths of less than or equal to 15 feet bgs. Surficial groundwater at AOI 1 was encountered at approximately 33 feet bgs. Therefore, the incidental groundwater exposure pathway is considered incomplete for future construction workers during trenching activities at AOI 1, as it is unlikely this receptor would encounter surficial groundwater during trench work at AOI 1. The exposure pathway is potentially complete for off-facility residential drinking water receptors. The CSM for AOI 1 is presented on **Figure 7-1**.

7.2.2 AOI 2

PFOA, PFOS, and PFBS were detected in groundwater from two temporary monitoring wells at AOI 2, confirming the presence of PFAS in groundwater at AOI 2. The detected concentrations for each compound were all below the individual SLs. The construction worker exposure scenario assumes trench work occurs at depths of less than or equal to 15 feet bgs. Surficial groundwater at AOI 2 was encountered at approximately 32 feet bgs. Therefore, the incidental groundwater exposure pathway is considered incomplete for future construction workers during trenching activities at AOI 2, as it is unlikely this receptor would encounter surficial groundwater during trench work at AOI 2. The exposure pathway is potentially complete for off-facility residential drinking water receptors. The CSM for AOI 2 is presented on **Figure 7-2**.

7.2.3 AOI 3

PFOA, PFOS, and PFBS were detected in groundwater from two temporary monitoring wells at AOI 3, confirming the presence of PFAS in groundwater at AOI 3. The detected concentration of PFOS at AOI03-02 exceeded the individual SL. Detected concentrations of PFOA and PFBS were below their respective SLs. The construction worker exposure scenario assumes trench work occurs at depths of less than or equal to 15 feet bgs. Surficial groundwater at AOI 3 was encountered at approximately 30 feet bgs. Therefore, the incidental groundwater exposure pathway is considered incomplete for future construction workers during trenching activities at AOI 3, as it is unlikely this receptor would encounter surficial groundwater during trench work at AOI 3. The exposure pathway is potentially complete for off-facility residential drinking water receptors. The CSM for AOI 3 is presented on **Figure 7-3**.

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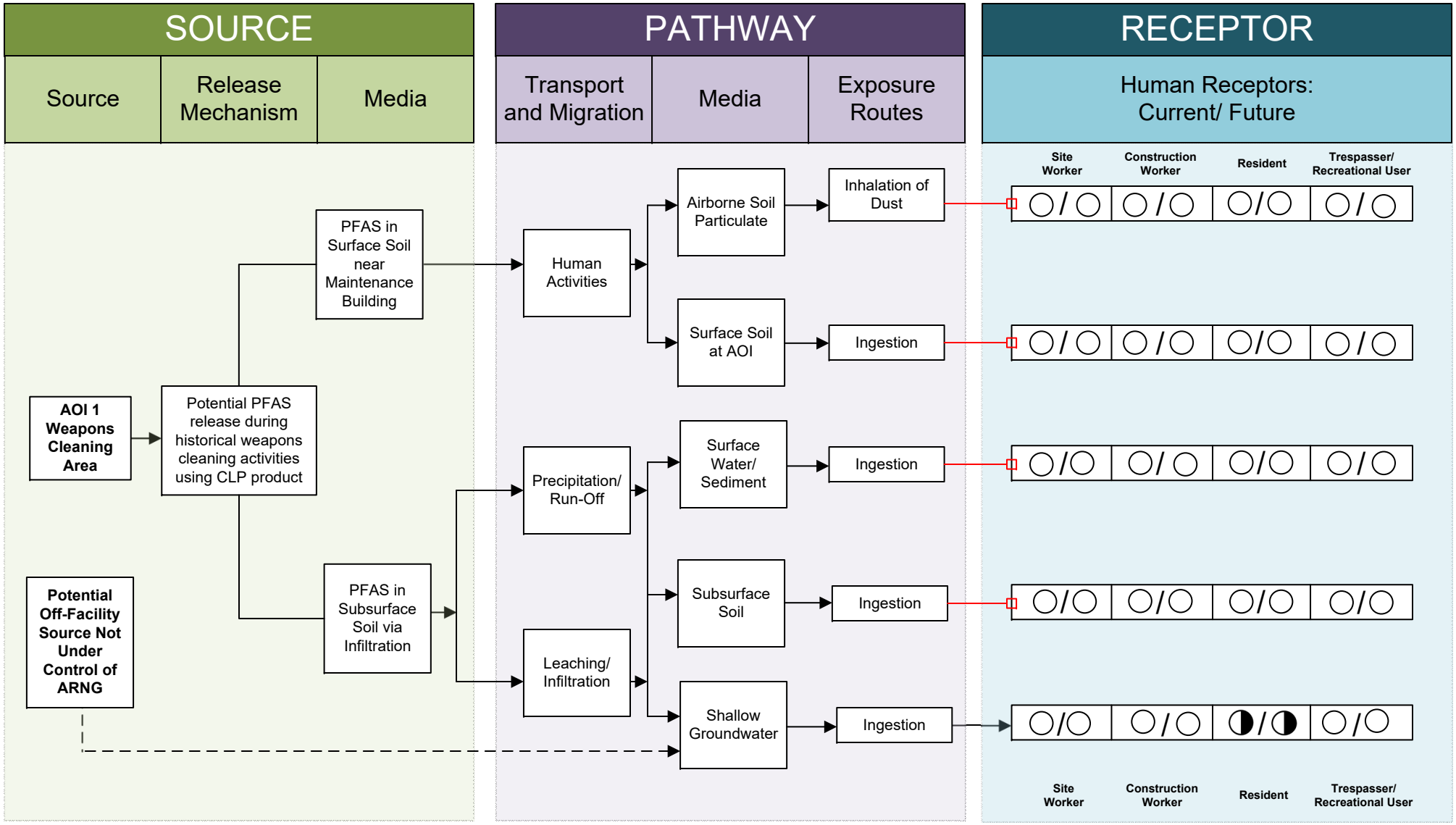
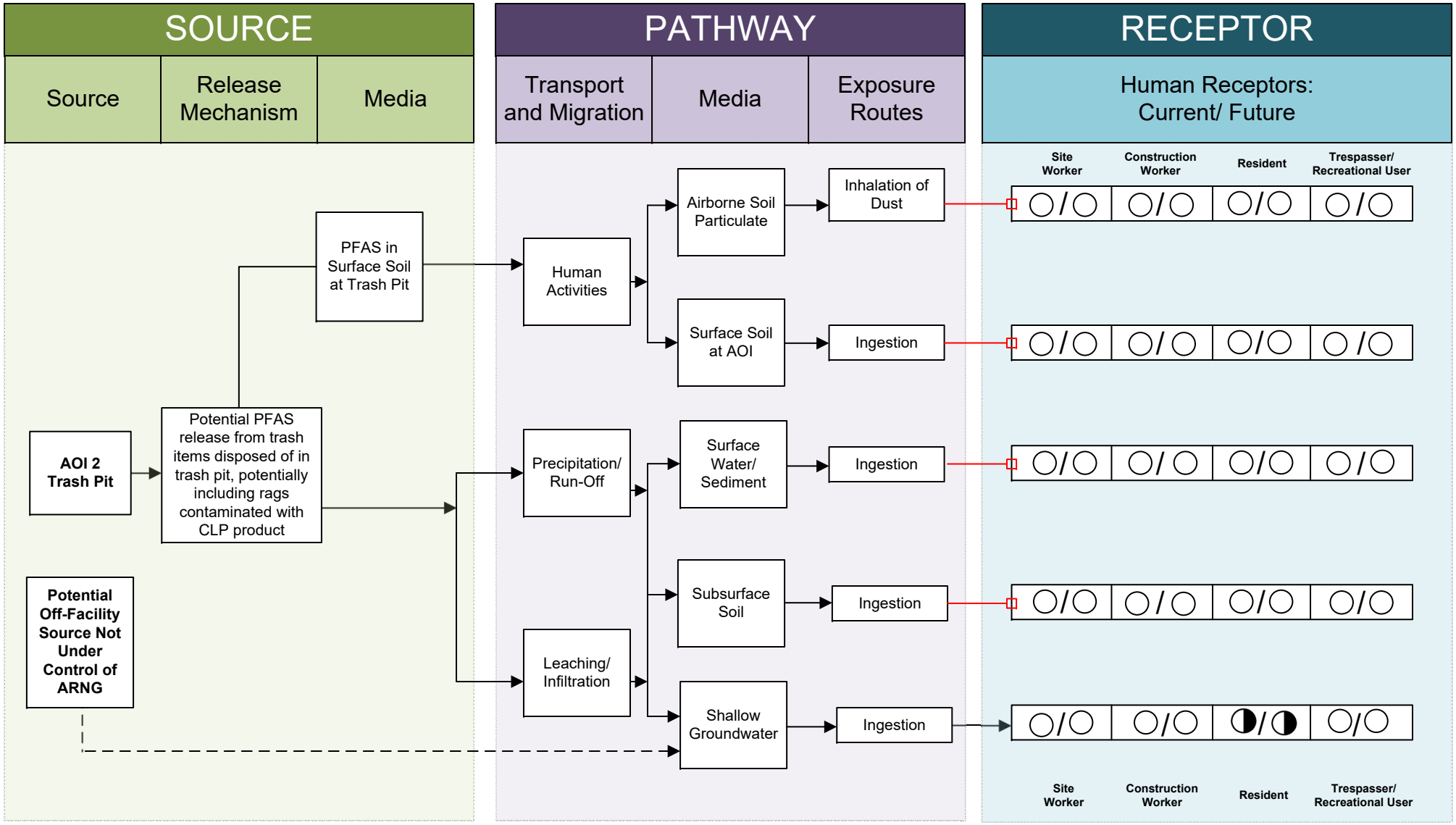


LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Potentially Complete Pathway with Exceedance of SL

Notes:
1. The resident and trespasser/ recreational user receptors refer to off-facility receptors.
2. Dermal contact exposure pathway is incomplete for PFAS.

Figure 7-1
AOI 1 Conceptual Site Model
Roy P. Benavidez National Guard Armory, El Campo, TX

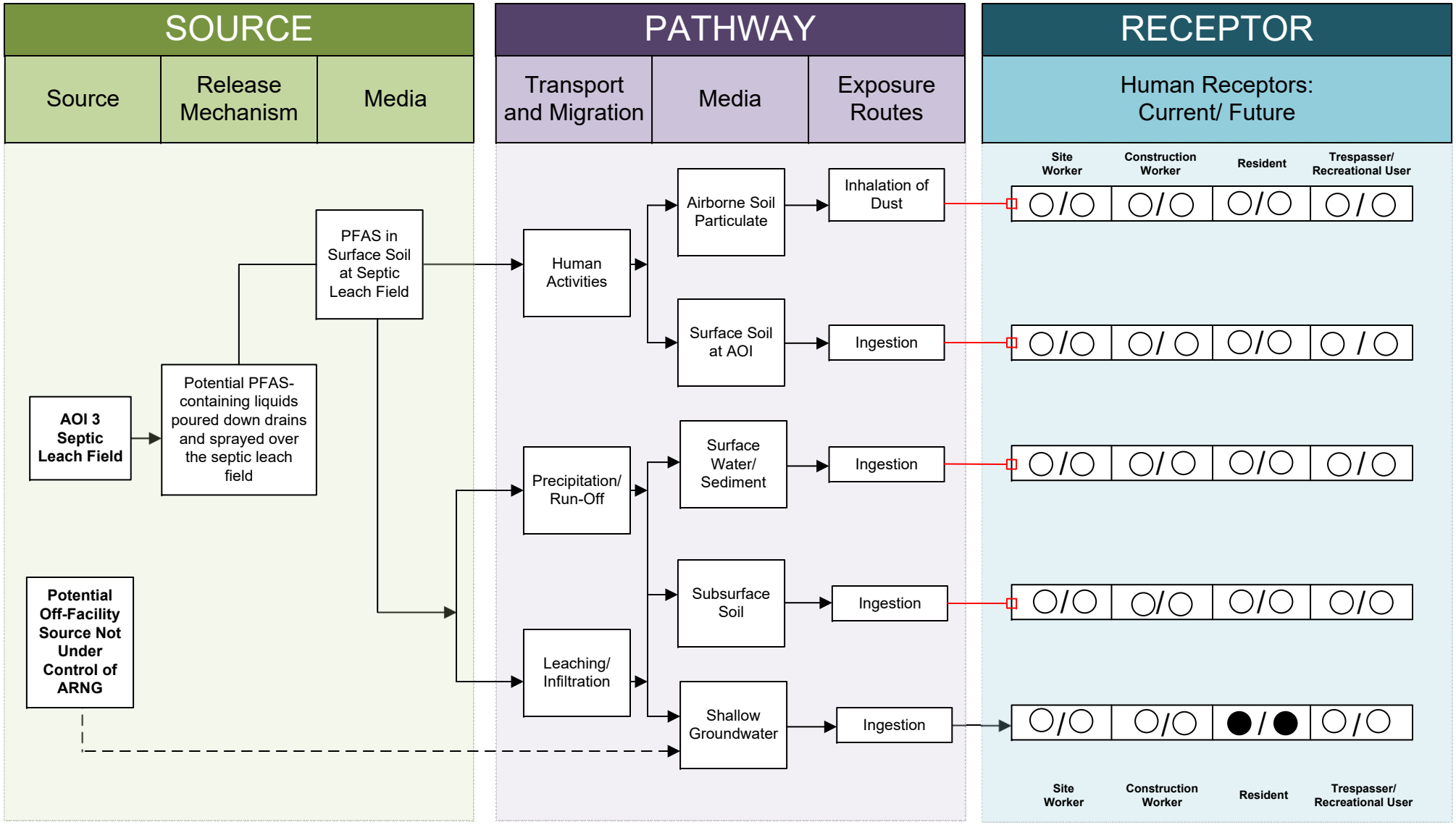


LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Potentially Complete Pathway with Exceedance of SL

Notes:
1. The resident and trespasser/ recreational user receptors refer to off-facility receptors.
2. Dermal contact exposure pathway is incomplete for PFAS.

Figure 7-2
AOI 2 Conceptual Site Model
Roy P. Benavidez National Guard Armory, El Campo, TX



LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Potentially Complete Pathway with Exceedance of SL

Notes:
1. The resident and trespasser/ recreational user receptors refer to off-facility receptors.
2. Dermal contact exposure pathway is incomplete for PFAS.

Figure 7-3
AOI 3 Conceptual Site Model
Roy P. Benavidez National Guard Armory, El Campo, TX

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8. Summary and Outcome

This section summarizes SI activities and findings. The most significant findings are summarized in this section and are reproduced directly or abstracted from information contained in this report. The outcome provides general and comparative interpretations of the findings relative to the SLs.

8.1 SI Activities

SI field activities included soil and groundwater grab sampling from 24 August to 28 August 2020; the survey of sample locations was completed on 25 September 2020. Field activities were conducted in accordance with the QAPP Addendum (AECOM, 2020c).

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2020c), samples were collected and analyzed for a subset of 18 PFAS by LC/MS/MS compliant with QSM Table B-15 as follows. The 18 PFAS analyzed as part of the ARNG SI program are specified in **Section 5.7** of this Report.

- Twenty-seven (27) soil grab samples from nine boring locations;
- Nine groundwater grab samples from nine temporary well locations;
- Twenty-two (22) Quality Assurance (QA) samples collected.

The information gathered during this investigation was used to determine if PFOA, PFOS, and/or PFBS were present at or above SLs. Additionally, the CSMs were refined to assess whether a complete pathway exists between the source and potential receptors for potential exposure to PFOA, PFOS, and PFBS at the AOIs, which are described in **Section 7**.

8.2 SI Goals Evaluation

As described in **Section 4.2**, the SI activities were designed to achieve six main goals or DQOs. This section describes the SI goals and the conclusions that can be made for each based on the data collected during this investigation.

1. *Determine the presence or absence of PFOA, PFOS, and PFBS at or above SLs.*

   PFOA, PFOS, and PFBS were detected at the facility in groundwater. PFOA, PFOS, and PFBS were detected at the suspected source areas, and at the Downgradient Facility Boundary between suspected source areas and potential drinking water receptors below the individual SLs. PFOS in groundwater at AOI 3: Septic Leach Field exceeded the individual SL of 40 ng/L. PFOA, PFOS, and PFBS were not detected in soil samples collected from each AOI.

2. *Develop information to potentially eliminate a release from further consideration because it is determined that it poses no significant threat to human health or the environment.*

   Four potential PFAS release areas were removed from further consideration based on the groundwater and soil data collected during this SI: the Upgradient Facility Boundary; Weapons Cleaning Area in AOI 1; Trash Pit in AOI 2; and the Downgradient Facility Boundary. PFOA, PFOS, and PFBS were not detected in groundwater and/ or soil above the SLs in any of these areas.

3. *Determine the potential need for a removal action.*

   Drinking water from the facility's potable well was originally sampled for PFAS by the NGB in April 2017. PFOA and PFOS were detected above the combined USEPA Health Advisory (HA) of 70 nanograms per liter (ng/L) (USEPA, 2016a). In response, RPB El Campo Armory switched to bottled water at that time, and in August 2018, a GAC GWTS was installed to reduce the levels of PFOS and PFOA in the facility's drinking water. After groundwater was treated through the new GAC GWTS, detected concentrations of PFOS and PFOA were observed to be below the combined USEPA HA of 70 ng/L.

   Based on the data collected during this SI, there is not a potentially complete pathway between source and on-facility drinking water receptors. Drinking water at RPB El Campo Armory is supplied by a Class I groundwater well approximately 100 to 120 feet deep for all potable water uses; the facility does not receive drinking water or sanitary sewer services from local utilities. Data collected by the NGB in 2018 (NGB, 2018) as well as the TMD (TMD, 2019; TMD, 2020) indicate that PFOS, PFOA, and PFBS are not present in treated groundwater at the facility.

   There is a potentially complete pathway between source and off-facility residential drinking water receptors. Surficial groundwater at the facility is encountered at approximately 29 to 33 feet bgs, where geological data collected during the SI indicate a relatively permeable and conductive deeper subsurface. Geological research indicates that the uppermost aquifer utilized for potable water, the Chicot Aquifer, is unconfined and therefore could potentially be impacted by PFAS migration from surficial groundwater. The Chicot Aquifer was not subject to investigation during this SI. Based on the CSM developed and revised in light of the SI findings, there is a potential for exposure to residential drinking water receptors caused by DoD activities at or adjacent to the facility. The results of the SI indicate there is not a need for a removal action at this time. A removal action will be further evaluated if the facility proceeds with future investigations.

4. *Collect data to better characterize the release areas for more effective and rapid initiation of a RI.*

   The geological data collected as part of the SI indicate a relatively impermeable and low conductivity shallow subsurface (approximately 0 to 20 feet bgs), with soils dominated by silt and clay, and a relatively permeable and conductive deeper subsurface. Geologic boreholes drilled during the SI indicate the transition between the shallow subsurface and deeper subsurface ranges between 19 and 30 feet bgs. These observations are consistent with the distributary channel facies of the Beaumont Formation. The sands and silts have deltaic origins, whereas the clay deposits represent channel fill as the rivers migrated and abandoned former channel flow paths or, in some cases, lagoonal clay.

   Depth to water at RPB El Campo Armory ranges from approximately 29 to 33 feet bgs. Groundwater flow direction at the facility is generally southeast towards the Tres Palacios River. These geologic and hydrogeologic observations inform development of technical approach for future investigations.

5. *Identify within 4 miles of the installation other potential PFAS sources (fire stations, major manufacturers, other DoD facilities) and receptors, including both groundwater and surface water receptors, to determine whether the ARNG is the likely source of PFAS, or whether there is an off-facility source of PFAS responsible for installation detections of PFAS (USEPA, 2005).*

   Based upon the evaluation of groundwater and soil results in comparison to SLs, in combination with the groundwater flow direction analysis, the results of the SI indicate that

the source of detected concentrations of PFOA, PFOS, and PFBS at the facility is likely attributable to ARNG activities.

6. *Determine whether a complete pathway exists between the source and potential receptors and whether ARNG is the likely source of the contamination.*

   Detections of PFOA, PFOS, and PFBS in groundwater at source areas and the Downgradient Facility Boundary indicate there is a potentially complete pathway between source and off-facility drinking water receptors.

8.3 Outcome

Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure to residential drinking water receptors from PFAS sources on the facility resulting from historical DoD activities. Sample chemical analytical concentrations collected during the SI were compared against the SLs for PFOA, PFOS, and PFBS in soil and groundwater, as described in **Table 6-1**. The following bullets summarize the SI results:

- PFOS in groundwater at AOI 3: Septic Leach Field exceeded the individual SL of 40 ng/L, with a detected concentration of 56.5 ng/L at location AOI03-02. Based upon the state ownership status of the property, the state may consider the need for future investigation or follow-up action.
- The detected concentrations of PFOA, PFOS, and PFBS in soil samples from all AOIs were below the SLs. The results of the SI at AOI 3 are suggestive of an incomplete pathway; however, given the distance of the suspected source there is insufficient data to rule out this pathway at this time.
- PFOA, PFOS, and PFBS were not detected in groundwater at the upgradient facility boundary. These results suggest there may not be an off-facility source of PFAS potentially migrating on-facility.
- Data collected by the NGB in 2018 (NGB, 2018) as well as the TMD (TMD, 2019; TMD, 2020) indicate that PFOS, PFOA, and PFBS are not present in treated groundwater at the facility.

Table 8-1 summarizes the SI results for soil and groundwater. Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure to residential drinking water receptors caused by DoD activities at or adjacent to the facility.

Table 8-2 summarizes the rationale used to determine if an AOI should be considered for further investigation. Based upon the state ownership status of the property, the state may consider the need for future investigation or follow-up action.

Table 8-1: Summary of Site Inspection Findings

AOI	Potential PFAS Release Area	Soil – Source Area	Groundwater – Source Area
1	Weapons Cleaning Area	○	◐
2	Trash Pit	○	◐
3	Septic Leach Field	○	●
Upgradient Facility Boundary	Off-Facility, Unknown	○	○
Downgradient Facility Boundary	On-Facility, Unknown	○	◐

Legend:

● = PFOA, PFOS, and/or PFBS detected; exceedance(s) of the screening level(s)

◐ = PFOA, PFOS, and/or PFBS detected; no exceedance of the screening levels

○ = PFOA, PFOS, and PFBS not detected

Table 8-2: Site Inspection Recommendations

AOI	Description	Rationale	Future Action
1	Weapons Cleaning Area	Detections in groundwater but no exceedances of SLs. No detections in soil.	No further action
2	Trash Pit	Detections in groundwater but no exceedances of SLs. No detections in soil.	No further action
3	Septic Leach Field	Exceedance of SL in groundwater at source area. No exceedances of SLs in soil.	Further investigation warranted
Upgradient Facility Boundary	Off-Facility, Unknown	No detections in groundwater or soil.	No further action
Downgradient Facility Boundary	On-Facility, Unknown	Detections in groundwater but no exceedances of SLs. No detections in soil.	No further action

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