FINAL
Site Inspection Report
Camp Guernsey
Guernsey, Wyoming

Site Inspection for Perfluorooctanoic acid (PFOA), Perfluorooctanesulfonic acid (PFOS), Perfluorohexanesulfonic acid (PFHxS), Perfluorononanoic acid (PFNA), Hexafluoropropylene oxide dimer acid (HFPO-DA), and Perfluorobutanesulfonic acid (PFBS) at ARNG Installations, Nationwide

August 2023

Prepared for:

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Acronyms and Abbreviations

%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film-forming foam
AOI	Area of Interest
ARNG	Army National Guard
bgs	below ground surface
BLM	Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
CoC	chain of custody
CSM	conceptual site model
CSMS	Combined Support Maintenance Shop
DA	Department of the Army
DoD	Department of Defense
DQO	data quality objective
DUA	data usability assessment
ELAP	Environmental Laboratory Accreditation Program
EM	Engineer Manual
FedEx	Federal Express
FMS	Field Maintenance Shop
GPS	global positioning system
GPRS	Ground Penetrating Radar Systems
HDPE	high-density polyethylene
HFPO-DA	hexafluoropropylene oxide dimer acid
HSA	hollow stem auger
IDW	investigation-derived waste
ITRC	Interstate Technology Regulatory Council
LC/MS/MS	liquid chromatography with tandem mass spectrometry
MIL-SPEC	military specification
NELAP	National Environmental Laboratory Accreditation Program
ng/L	nanograms per liter
NTA	North Training Area
OSD	Office of the Secretary of Defense
PA	Preliminary Assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

PID	photoionization detector
PQAPP	Programmatic UFP-QAPP
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
SI	Site Inspection
SL	screening level
SOP	standard operating procedure
STA	South Training Area
TOC	total organic carbon
TPP	Technical Project Planning
UFP	Uniform Federal Policy
US	United States
USACE	United States Army Corps of Engineers
USACHPPM	United States Army Center for Health Promotion and Preventative Medicine
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTES	Unit Training Equipment Site
WSGS	Wyoming State Geological Survey
WYARNG	Wyoming Army National Guard
WYDEQ	Wyoming Department of Environmental Quality

Executive Summary

The Army National Guard (ARNG) G-9 is performing Preliminary Assessments (PAs) and Site Inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) dated 6 July 2022 (Assistant Secretary of Defense, 2022). The six compounds listed in the OSD memorandum include perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), hexafluoropropylene oxide dimer acid (HFPO-DA)[1], and perfluorobutanesulfonic acid (PFBS). These compounds are collectively referred to as "relevant compounds" throughout the document and the applicable screening levels (SLs) are provided in **Table ES-1**.

Four Areas of Interest (AOIs) were identified in the PA and during SI Quality Assurance Project Plan (QAPP) Addendum (AECOM, 2021) development where PFAS-containing materials may have been used, stored, disposed, or released historically (see **Table ES-2** for AOI locations). The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and SI QAPP Addendum and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on SLs for relevant compounds. This SI was completed at Camp Guernsey in Guernsey, Wyoming and determined further evaluation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is warranted for AOI 1 and AOI 4; no further evaluation is warranted for AOI 2 and AOI 3 at this time. Camp Guernsey will also be referred to as the "facility" throughout this document.

Camp Guernsey partially surrounds the towns of Guernsey and Hartville, in Platte County, Wyoming. The approximately 79,000-acre facility consists of the Cantonment Area, South Training Area (STA) and North Training Area (NTA). The Cantonment Area lies adjacent to the Town of Guernsey. The STA lies south and southwest of the Cantonment Area, while NTA is north of Guernsey State Park (AECOM Technical Services, Inc. [AECOM], 2020).

The four AOIs identified are within the Cantonment Area, which covers approximately 500 acres and contains facilities primarily for administrative, supply, and maintenance in support of training activities on Camp Guernsey. Facilities include, but are not limited to, training barracks, classrooms, warehouses, motor pools, maintenance facilities, a wastewater treatment plant, fuel storage, a heliport, and a paved airstrip/airfield. The Camp Guernsey Joint-Use Airfield, located in the eastern portion of the Cantonment Area and including the Camp Guernsey Army Airfield, is used by Camp Guernsey and the Town of Guernsey as their municipal/regional airport.

The PA and SI QAPP Addendum identified four AOIs for investigation during the SI phase. SI sampling results from the four AOIs were compared to OSD SLs. **Table ES-2** summarizes the SI results for each AOI. Based on the results of this SI, further evaluation under CERCLA is warranted in a Remedial Investigation (RI) for AOI 1 and AOI 4; no further evaluation is warranted for AOI 2 and AOI 3 at this time.

[1] Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model (CSM) developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of military specification (MIL-SPEC) aqueous film forming foam (AFFF) and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

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

Analyte[b]	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	19	250	6
PFOS	13	160	4
PFBS	1,900	25,000	601
PFHxS	130	1,600	39
PFNA	19	250	6

Notes:
bgs = below ground surface; µg/kg = micrograms per kilogram; ng/L = nanograms per liter

a.) Assistant Secretary of Defense, 2022. Risk Based Screening Levels in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 6 July 2022.

b.) Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Table ES-2: Summary of Site Inspection Findings and Recommendations

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Future Action
1	Camp Guernsey Airfield	◐	●	Proceed to RI
2	Current Firetruck Maintenance Areas	◐	◐	No further action
3	Historic Maintenance and Storage Areas	◐	◐	No further action
4	Outdoor Wash Rack	◐	●	Proceed to RI

Legend:
● = detected; exceedance of the screening levels
◐ = detected; no exceedance of the screening levels

1. Introduction

1.1 Project Authorization

The Army National Guard (ARNG) G-9 is the lead agency in performing Preliminary Assessments (PAs) and Site Inspections (SIs) on the current or potential historical use of per- and polyfluoroalkyl substances (PFAS) with a focus on the six compounds presented in the memorandum from the Office of the Secretary of Defense (OSD) dated 6 July 2022 (Assistant Secretary of Defense, 2022). The six compounds listed in the OSD memorandum will be referred to as "relevant compounds" throughout this document and include perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA), hexafluoropropylene oxide dimer acid (HFPO-DA)[1], and perfluorobutanesulfonic acid (PFBS) at ARNG facilities nationwide. The ARNG performed this SI at Camp Guernsey in Guernsey, Wyoming. Camp Guernsey is also referred to as the "facility" throughout this document.

The SI project elements were performed in compliance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; United States [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.

1.2 SI Purpose

A PA was performed at Camp Guernsey (AECOM Technical Services, Inc. [AECOM], 2020) that identified one Area of Interest (AOI) where PFAS-containing materials may have been used, stored, disposed, or released historically. Additionally, during the development of the SI Quality Assurance Project Plan (QAPP) Addendum, an additional three AOIs were added (AECOM, 2021), for a total of four AOIs. All four AOIs fall within the Cantonment area of Camp Guernsey. The objective of the SI is to identify whether there has been a release to the environment from the AOIs identified in the PA and during QAPP development and determine whether further investigation is warranted, a removal action is required to address immediate threats, or no further action is required based on screening levels (SLs) for the relevant compounds.

[1] Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the conceptual site model (CSM) developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of military specification (MIL-SPEC) aqueous film forming foam (AFFF) and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

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2. Facility Background

2.1 Facility Location and Description

Camp Guernsey partially surrounds the towns of Guernsey and Hartville, in Platte County, Wyoming. The approximately 79,000-acre facility consists of the Cantonment Area, South Training Area (STA) and North Training Area (NTA). The Cantonment Area lies adjacent to the Town of Guernsey. The STA lies south and southwest of the Cantonment Area, while NTA is north of Guernsey State Park (**Figure 2-1**). The four AOIs were identified within the Cantonment Area.

The historic buildings in the Cantonment Area of Camp Guernsey were constructed in 1938 and 1939 by the Works Projects Administration. The US Army leased 6,209 acres in 1943, during World War II, from the state of Wyoming (historically known as the STA). In 1944, approximately 4,500 acres of land within what is now Guernsey State Park were acquired from the Bureau of Land Management (BLM). Between 1943 and 1945, the US Army used the Camp Guernsey installation for bivouac and artillery maneuver training. In 1945, the lease with the US Army on the state land was terminated, and the buildings and improvements were transferred to the state of Wyoming. The 4,500 acres of former BLM land were declared excess by the Department of Defense in 1950 and returned to the Department of Interior. In 1951, the WYARNG took over management of the 6,209 acres of state property (Cantonment Area and STA). Through 1960, over 13,463 acres of land to the north were added to Camp Guernsey to establish an artillery range, impact area, and maneuver lands. These land acquisitions were completed through private land purchases and BLM patents (federal land withdrawals). Numerous private land acquisitions occurred from 2004 to 2012, adding 39,000 acres of land to the facility. These most recent acquisitions also encompassed an additional 3,000 acres of BLM land and 2,000 acres of State School Trust land.

The Cantonment Area covers approximately 500 acres and contains facilities primarily for administrative, supply, and maintenance in support of training activities on Camp Guernsey. Facilities include, but are not limited to, training barracks, classrooms, warehouses, motor pools, maintenance facilities, a wastewater treatment plant, fuel storage, a heliport, and a paved airstrip/airfield. The Camp Guernsey Joint-Use Airfield, located in the eastern portion of the Cantonment Area, is used by Camp Guernsey and the Town of Guernsey as their municipal/regional airport. During a review of historical photographs, it was observed that the runway has been extended over the years.

2.2 Facility Environmental Setting

Camp Guernsey lies within the High Plains section of the Great Plains physiographic province, near its western margin with the Rocky Mountains (US Geological Survey [USGS], 1960). The physiography of the NTA includes dissected plateaus, bluffs, and steep valley side-slopes. The physiography of the Cantonment and STA is much more subdued, given the proximity to the North Platte River. The STA is comprised primarily of irregular plains with moderate slope, and the Cantonment is situated on the floodplain and low plains adjacent to the North Platte River. The elevation at the Camp Guernsey Cantonment Area is between 4,300 and 4,400 feet above sea level. The Cantonment Area is mostly level, with slopes rising to the east towards the airfield. Surface water drains to the south and southeast towards the North Platte River (**Figure 2-2**).

The Cantonment Area is roughly 25 percent (%) covered with developed and paved surfaces. The majority of the unimproved lands are open fields surrounding the airfield and adjacent to the North Platte River. The town of Guernsey abuts the Camp Guernsey facility boundary to the west and north. Properties immediately surrounding the Cantonment Area include single-family residential structures, schools, and other public or municipal facilities to the west-northwest; the Guernsey

BNSF Railyard, a cemetery, and industrial facilities to the north-northeast; and agricultural land and rural residential properties to the east-southeast. Undeveloped land, a golf course, and the STA are located across the North Platte River to the south.

2.2.1 Geology

Camp Guernsey is roughly split into two geologic and geomorphic regimes. The NTA is located over Precambrian rocks exposed in the southwestern end of a fault known as the Hartville Uplift. The Hartville Uplift is a north-northeast trending structural arch (anticline) that separates the Denver Basin (to the southeast) from the Powder River Basin (to the northwest). The arch extends from the northeast end of the Laramie Range to the south end of the Black Hills, roughly 45 miles long and 15 miles wide - roughly between the communities of Glendo, Guernsey, Hartville, and Lusk. The Hartville Uplift has been subdued by erosion, with the current landscape showing little evidence of past tectonic activity. Along the anticline crest are exposed metavolcanic and granitic Precambrian age rocks surrounded by younger Pennsylvanian and Mississippian age sedimentary rocks of the Hartville Formation. The Hartville Uplift does not extend south of the North Platte River; however, a prominent ridge does run north to south down the middle of the STA (Wyoming ARNG [WYARNG], 2015). South of the North Platte River, the surface of Camp Guernsey is primarily mapped in Holocene sand and loess, as well as the Arikaree Formation of the Tertiary Period (Wyoming State Geological Survey [WSGS], 2005).

In the Cantonment Area, north of North Platte River, Camp Guernsey is mapped within Quaternary surficial deposits. Specifically, northwest of the river, the Cantonment Area is underlain by Holocene alluvial deposits consisting of silt, fine-grained sand, and some gravel. Northeast of the river, the Cantonment Area around the airfield is underlain by cemented Pleistocene gravel deposits consisting of boulder to pebble conglomerates. The Pleistocene gravel was deposited in a fluvial environment by the ancestral North Platte River. The Pleistocene gravel deposits occur as an upland deposit in the Guernsey and Guernsey Reservoir areas along the North Platte River (WSGS, 2005). At the Cantonment, the transition between the two Quaternary deposits is visible from the ground surface by a relatively abrupt, approximately 60-foot elevation change between the lower elevation Holocene alluvial deposits and the terrace formed by the Pleistocene gravel fluvial deposits. However, this transition is less apparent in areas that have been graded for construction. The Arikaree Formation present in outcrops across the river at the STA is buried beneath the majority of the Cantonment. Only the upper unit of the Arikaree Formation is present in the area, which is characterized as a fine-grained, soft to moderately hard, generally massive, tuffaceous sandstone (WSGS, 2005).

Hollow stem auger (HSA) soil borings were completed during the SI to depths ranging between 5.5 to 50 feet below ground surface (bgs). At AOI 1, refusal was encountered in multiple borings between 5.5 to 41 feet bgs, prior to encountering water bearing units. At nearby boring CG-01, associated with AOI 1, groundwater was encountered at approximately 40 feet bgs. Groundwater was encountered in borings at AOIs 2, 3, and 4 at depths between 25 to 50 feet bgs. The SI borings encountered poorly graded sand with varying amounts of silt and gravel.

AOI 1 borings located atop the terrace near the airfield (AOI01-03 and AOI01-04) contained greater amounts of gravel than borings completed elsewhere during the SI. Additionally, these two borings encountered refusal at a much shallower depth than other locations. These findings are consistent with the understood surficial geology at AOI 1 based on geologic maps that show these borings are located within the cemented gravel conglomerate. AOI 2 is mapped within the same gravel deposits; however, boring AOI02-01 contained predominantly finer-grained sandy deposits and did not hit refusal before groundwater. AOI 2 sits in a wide drainage basin, and the surface elevation of AOI02-01 was approximately 20 to 30 feet below the refusal elevations at AOI01-03 and AOI01-04. The lower elevation of AOI 2, in conjunction with the observed lithology,

indicates the resistant cemented gravel layer below AOI01-03 and AOI01-04 may have formerly been present above AOI 2 but has since been eroded away.

The observations made in the remainder of the SI borings show predominantly sandy deposits with varying amount of silt and some gravel, consistent with the Holocene alluvial deposits along the North Platte River floodplain. The underlying Arikaree Formation was not observed in SI borings.

Samples for grain size analyses were collected at two locations where finer grained deposits were observed, AOI01-01 (40 to 41 feet bgs) and AOI02-01 (30 to 32.5 feet bgs), and they were analyzed via American Society for Testing and Materials (ASTM) Method D-422. The results indicate that the soil samples are comprised primarily of fine-grained sand (46.57% to 46.58%), silt (36.62% to 37.84%), and clay (9.14 to 12.63%). Boring logs are presented in **Appendix E**, and grain size results are presented in **Appendix F**. The soils bordering the North Platte River are subject to periodic water saturation due to seasonal fluctuations in the water table and occasional flooding.

2.2.2 Hydrogeology

Four main aquifers underly the Guernsey area, including the alluvial aquifer, which is positioned within the Quaternary alluvial deposits associated with the North Platte River and underlying the Cantonment. Deeper bedrock aquifers lie within the Arikaree, Guernsey, or the Hartville formations (URS, 2014).

The alluvial aquifers tend to be located in valleys that contain sand and gravel deposits and are hydraulically connected to perennial streams that serve as sources of recharge. The alluvial aquifers in the Camp Guernsey area are heavily used for domestic and stock water production, as evidenced by the large number of wells located within the alluvial material limits (URS, 2014). The majority of the wells in the area draw water primarily from these alluvial aquifers. The largest alluvial aquifer in Wyoming is the alluvium along the North Platte River, which is used extensively for water storage, agricultural, municipal, industrial, and domestic water uses. Numerous bedrock aquifer wells installed in the Arikaree and Hartville formations are primarily used for domestic and livestock wells (URS, 2014).

Groundwater in the vicinity of Camp Guernsey was anticipated to be encountered at depths of approximately 40 feet bgs, and flow direction was anticipated to be predominantly southwest toward the North Platte River. In terrain such as that on Camp Guernsey, groundwater elevations tend to mimic the ground surface elevation. Therefore, groundwater elevations are generally greater in the highlands and lower in the lowlands. Because of the hydraulic connectivity between the groundwater and surface water in the alluvial aquifers, flow direction of the perennial water bodies, such as the North Platte River, often affects groundwater flow in the adjacent aquifers. Synoptic groundwater level measurements collected during the SI were found to range between 19.72 to 40.36 feet bgs. Groundwater elevations were calculated using depth to groundwater measurements and the surveyed ground surface elevation. Groundwater flow direction was observed to be generally to the southeast, consistent with the flow direction of the North Platte River (**Figure 2-4**).

Within the alluvial deposits, groundwater elevations were generally higher in the northwest Cantonment and decreased towards the southeast. Where the alluvial deposits transition to Pleistocene gravel deposits near the airfield, groundwater was not encountered prior to drilling refusal depths. On the terrace adjacent to the airfield, the absence of groundwater is likely a result of the limited storage capacity of the thin unconsolidated section atop cemented gravels. Thicker unconsolidated deposits were observed off the terrace at AOI01-01 and AOI01-02; however, groundwater was not observed prior to refusal. The refusal elevations in these borings were higher than the groundwater elevation in nearby boring CG-01, indicating that groundwater is likely

present within 5 to 10 feet below the terminal borehole depths. Within the gravel deposits, groundwater was only encountered in one boring, AOI02-01, located in an apparent drainage basin that may have formed where the overlying cemented gravel has eroded away. The groundwater elevation at AOI 2 was nearly 20 feet higher than in the other SI boring locations, suggesting the resistant unit observed at AOI 1 may act as a local shallow groundwater divide and separates this basin hydraulically from the Cantonment area west the airfield. The groundwater flow direction at AOI 2 is assumed to follow the south-southeast trace of the drainage basin, consistent with the overall flow direction for the investigation area.

Groundwater is the primary source of drinking water for the town of Guernsey, Camp Guernsey, and surrounding residential areas outside of the town limits (US Army Center for Health Promotion and Preventative Medicine [USACHPPM], 2001). The town of Guernsey is located within the Town of Guernsey Wellhead Protection Area and has several drinking water supply wells in operation that produce 220 million gallons per year (USACHPPM, 2003). Camp Guernsey also has drinking water supply wells that lie in the same alluvial gravel layer as the wells for the town of Guernsey. Numerous other potable wells are located within a 4-mile radius of the Cantonment (WSGS, 2019). The identified downgradient domestic wells are located across the North Platte River. Groundwater features are presented on **Figure 2-3**.

At Camp Guernsey, sampling was completed for eight drinking water sources and one blended water sample location prior to the entry point of the distribution system (Tetra Tech, Inc., 2017). On 15 May 2017, the water samples were collected from various spigots associated with the Camp Guernsey drinking water sources. The samples were analyzed for a subset of 18 compounds by USEPA Method 537 modified. These compounds include the relevant compounds (PFOA, PFOS, PFBS, PFHxS, and PFNA). PFOA was detected at a concentration of 0.753 JM nanograms per liter (ng/L) in a drinking water sample sourced from a location in the SI investigation area. No other detections of the relevant compounds were reported from single drinking water sources or the blended water sample location (Tetra Tech, Inc., 2017). In 2021, WYARNG collected an additional drinking water sample from a single location on the airfield for analysis of a subset of 18 compounds, including all relevant compounds, by USEPA Method 537.1. Results from the 2021 sample were non-detect for all compounds analyzed.

2.2.3 Hydrology

Camp Guernsey falls within the lower drainage of the North Platte River, a braided channel that flows through parts of the NTA from the northwest to the southeast. The Cantonment is immediately north of the North Platte River. Stormwater runoff over much of Camp Guernsey is conveyed overland by surface drainages and eventually discharges to the river. Wastewater captured by floor drains flows to the sanitary sewer, in some locations through an oil-water separator (OWS), and is then treated at the Town of Guernsey's permitted wastewater treatment facility located on Camp Guernsey. The treatment facility, operated by the Town of Guernsey on land leased from WYARNG, consists of several lined, aeration lagoons and a polishing lagoon located along the southern portion of the Cantonment Area, immediately north of the river. Treated wastewater is discharged from the facility to the North Platte River during part of the year, typically the summer months. In the winter, wastewater discharge is diverted to two infiltration basins located immediately adjacent to the treatment facility. Based on information provided by WYARNG, sludge was removed the ponds in the 1970s and around 1990; however, the disposition of the recovered sludge, whether on-facility or off-facility, is not known at this time. Surface water features are presented on **Figure 2-5**.

The width of the North Platte River channel in this area is approximately 300 feet, with a typical centerline depth ranging from 0 to 8 feet depending on discharges from the Glendo and Guernsey Reservoirs (WYARNG, 2015). Water depths and flow rates are variable from season to season. Discharge from the Guernsey Reservoir to the North Platte River is typically limited to a short,

several week period during the summer to flush silt from the reservoir and maintain downstream irrigation reserves. The average annual flow is approximately 1,000 cubic feet per second (cfs), with extremes ranging from as low as 0 cfs during times of low flow (November through March) to a maximum of up to 30,000 cfs during times of extreme precipitation or reservoir drainage (late June and early July). The North Platte River is primarily used for water transport for agricultural uses (USACHPPM, 2003). The river also serves as a valuable fishery upstream from Camp Guernsey; however, it is not recognized as such in the stretch near the Cantonment, based on information received from WYARNG. A popular activity for Guernsey residents is to float the North Platte River on inner tubes.

2.2.4 Climate

The climate of east-central Wyoming is a dry, mid-latitude, steppe climate, and it is characterized by cold winters, hot summers, and low humidity (Commission for Environmental Cooperation, 2011). Wheatland, the county seat of Platte County, is less than 10 miles southwest of the facility. The average temperature in Wheatland is 49.55 degrees Fahrenheit (°F). In winter, average low temperatures reach a minimum of 18°F. In summer, the average high temperatures reach a maximum of 89°F. The area receives an average of 13.7 inches of rain and 37 inches of snow per year (World Climate, 2022).

2.2.5 Current and Future Land Use

Camp Guernsey is a National Guard Bureau Level 2 Joint Training Center that exists to facilitate and support realistic combat training for current and future American fighting forces (WYARNG, 2021). Camp Guernsey can be divided into four distinct training areas:

- NTA – 51,000 acres of live fire and maneuver areas, north of Guernsey State Park;
- STA – various training ranges, south and southwest of the Cantonment Area;
- Camp Guernsey Army Airfield – airfield for rotary and fixed wing aircraft with crash fire rescue capability, located within the Cantonment and used by Camp Guernsey and the Town of Guernsey as their municipal/regional airport; and
- Cantonment – Dining facility and billeting, east of the Town of Guernsey.

Numerous residential, commercial, and recreational structures are located to the west/northwest of the Cantonment Area. Industrial use properties, including a BNSF Railyard, are located immediately north and northeast of the facility. The Platte River and a golf course are located to the south of the Cantonment Area. Reasonably anticipated future land use is not expected to change from the current land use described above.

2.2.6 Sensitive Habitat and Threatened/ Endangered Species

The following birds, plants, insects, and mammals are federally endangered, threatened, proposed, and/ or are listed as candidate species in Platte County, Wyoming (US Fish and Wildlife Service [USFWS], 2022).

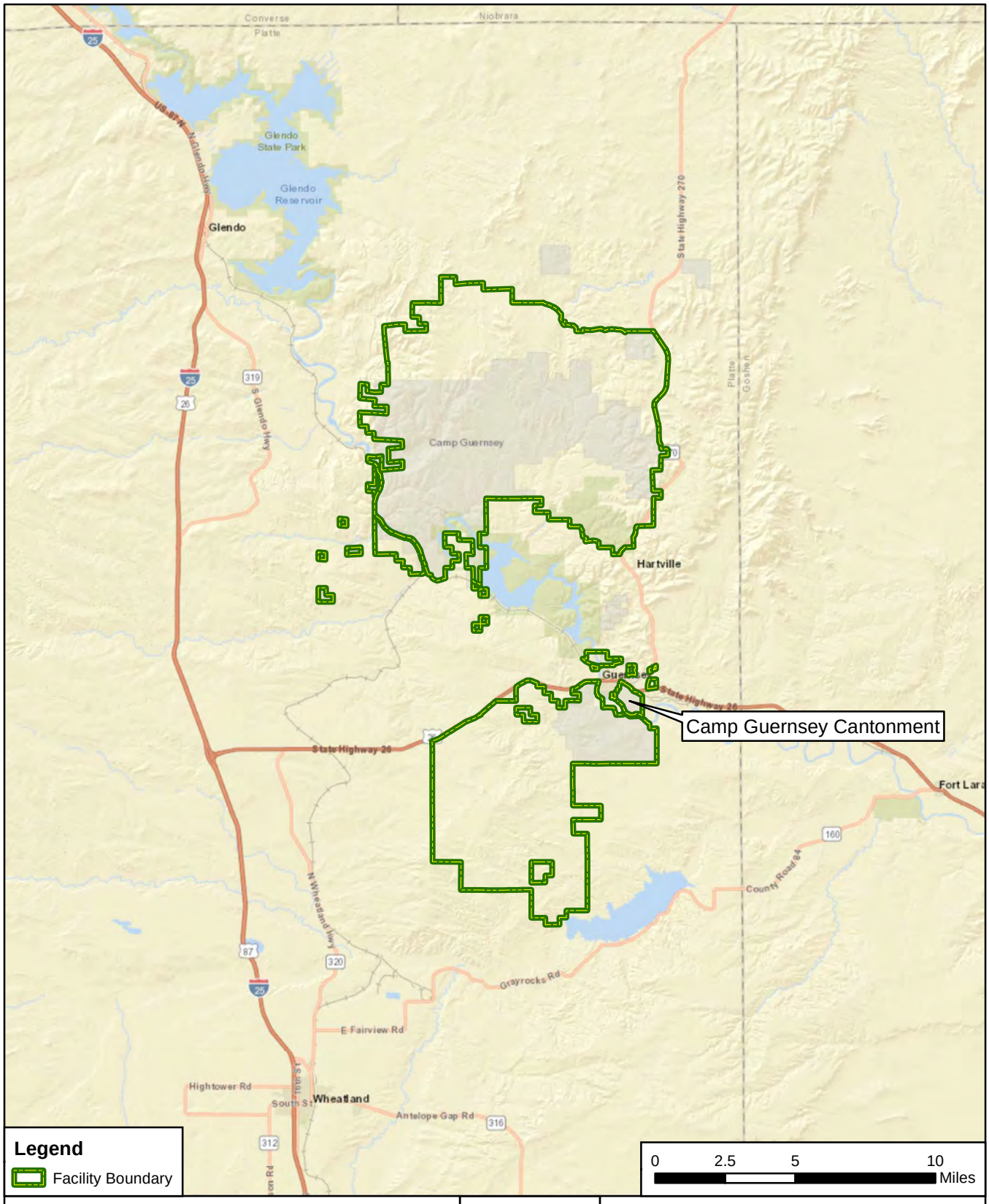
- **Birds:** Whooping crane, *Grus americana* (endangered); Piping Plover, *Charadrius melodus* (threatened)
- **Flowering Plants:** Western prairie fringed Orchid, *Platanthera praeclara* (threatened); Ute ladies'-tresses, *Spiranthes diluvialis* (threatened)

- **Insects:** Monarch butterfly, *Danaus plexippus* (candidate); Regal fritillary, *Speyeria idalia* (under review)
- **Mammals**: Tricolored bat, *Perimyotis subflavus* (proposed endangered); Little brown bat, *Myotis lucifugus* (under review); Preble's meadow jumping mouse, *Zapus hudsonius preblei* (threatened); Gray wolf, *Canis lupus* (under review)

2.3 History of PFAS Use

Four AOIs were identified in the PA and SI QAPP Addendum where AFFF may have been used, stored, disposed, or released historically at Camp Guernsey (AECOM, 2020 and AECOM, 2021). These AOIs include:

- AOI 1: Camp Guernsey Airfield: Every 2 years between approximately 1990 to 2004, fire training activities occurred at the Camp Guernsey Airfield. AFFF was reportedly released during these events. Aerial imagery provided by WYARNG suggests additional fire training activities or other releases of AFFF have occurred as recently as 2013. In addition, AFFF is stored in bulk containers and in firefighting equipment within a warehouse next to the Airfield Operations.
- AOI 2: Current Firetruck Maintenance Areas: From 2001 to present, firetruck maintenance has been completed at the current Unit Training Equipment Site (UTES), Combined Support Maintenance Shop (CSMS), and Field Maintenance Shop (FMS) #5. No documented releases have occurred at AOI 2, as it is unknown if AFFF were stored in the firetrucks during maintenance.
- AOI 3: Historic Maintenance and Storage Areas: Prior to 2001, firetruck storage and/or maintenance occurred at five areas on the west side of the Cantonment: Building #11, Building #106, Building #603, Building #16-FROG, and the Cold Storage building. There are no documented releases at AOI 3.
- AOI 4: Outdoor Wash Rack: At the outdoor wash rack, firetruck washing was observed at least once since 2009. There are no documented releases at AOI 4.



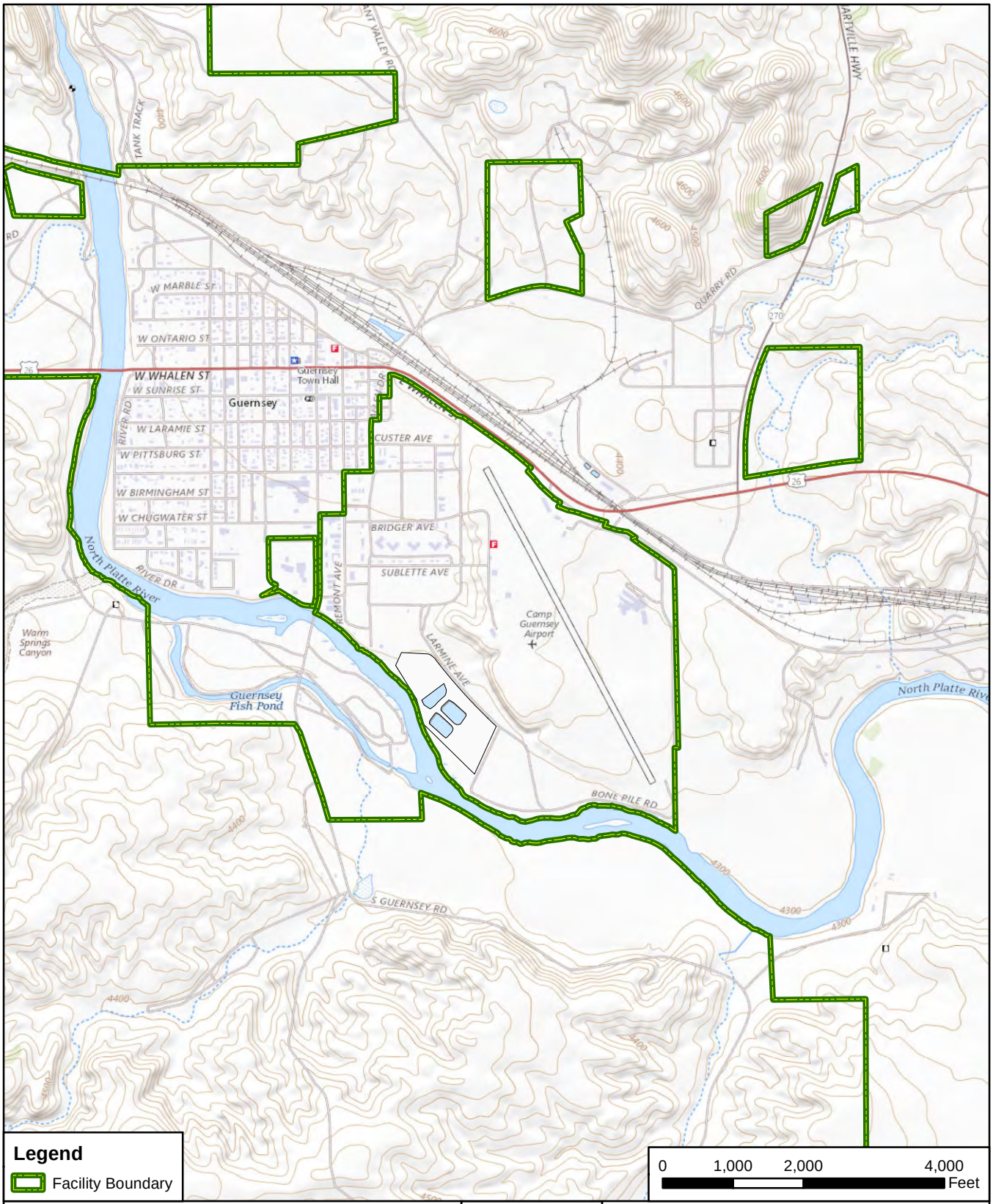
CLIENT	ARNG			
PROJECT	Site Inspection at Camp Guernsey, WY			
REVISED	1/25/2023	GIS BY	MS	1/25/2023
SCALE	1:316,800	CHK BY	AG	1/25/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	1/25/2023

N

Facility Location

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1



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PROJECT	Site Inspection at Camp Guernsey, WY			
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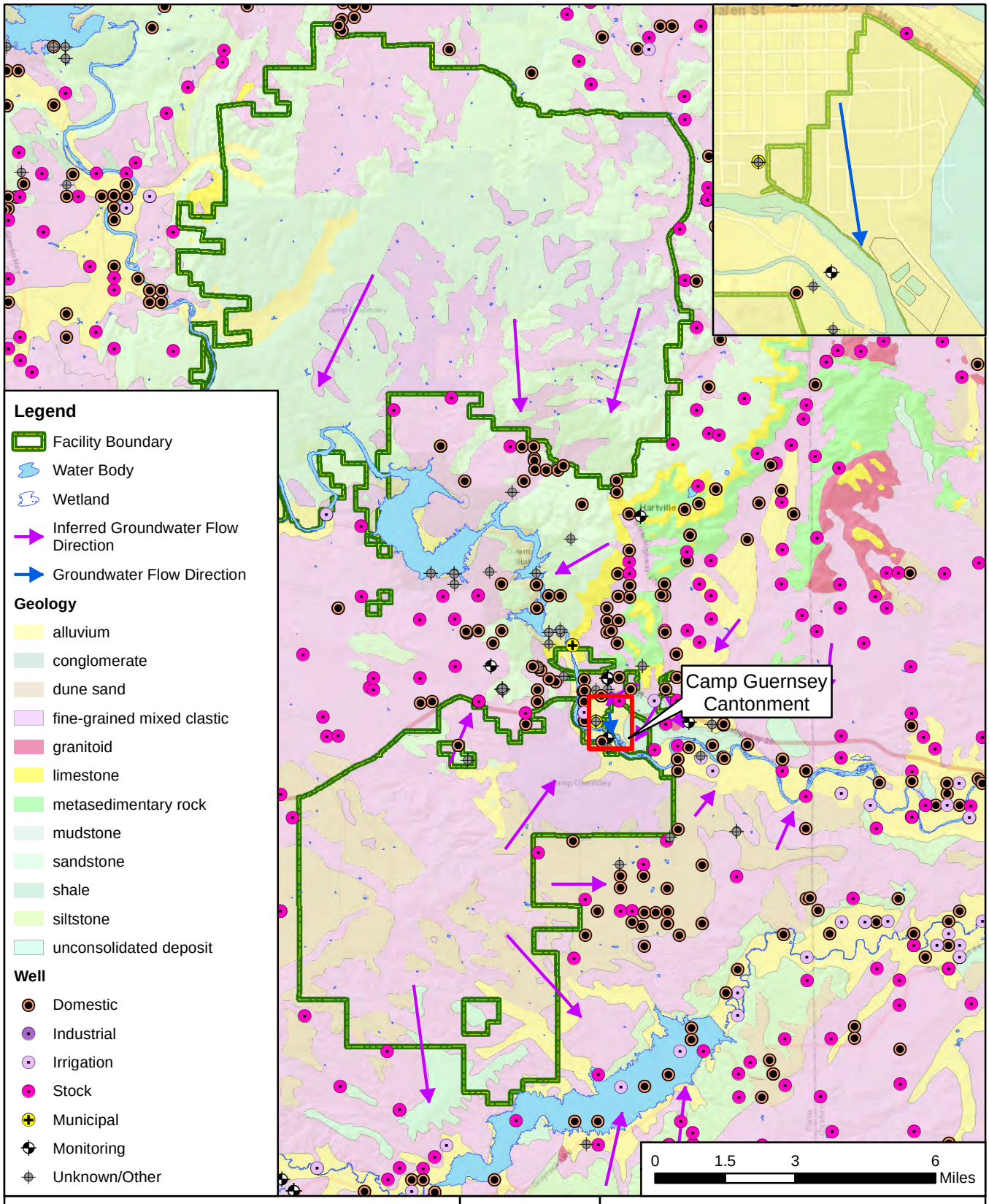
SCALE	1:24,000	CHK BY	AG	3/3/2023
Base Map: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program,		PM	CM	3/3/2023

Facility Topography

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-2



CLIENT	ARNG			
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Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	3/6/2023

Groundwater Features

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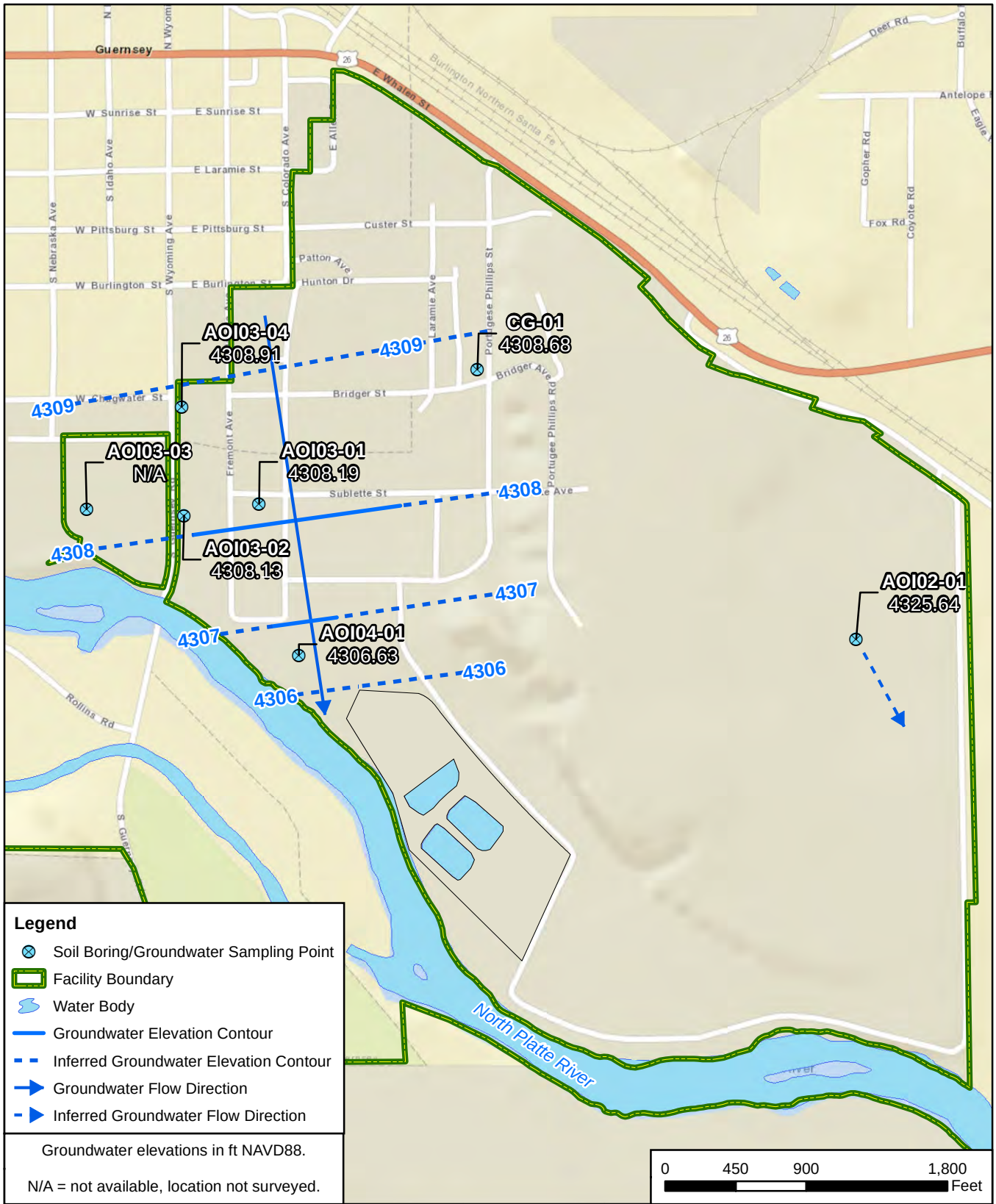
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-3



CLIENT	ARNG			
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SCALE	1:10,800	CHK BY	AD	3/3/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	3/3/2023

Groundwater Elevations, May 2022

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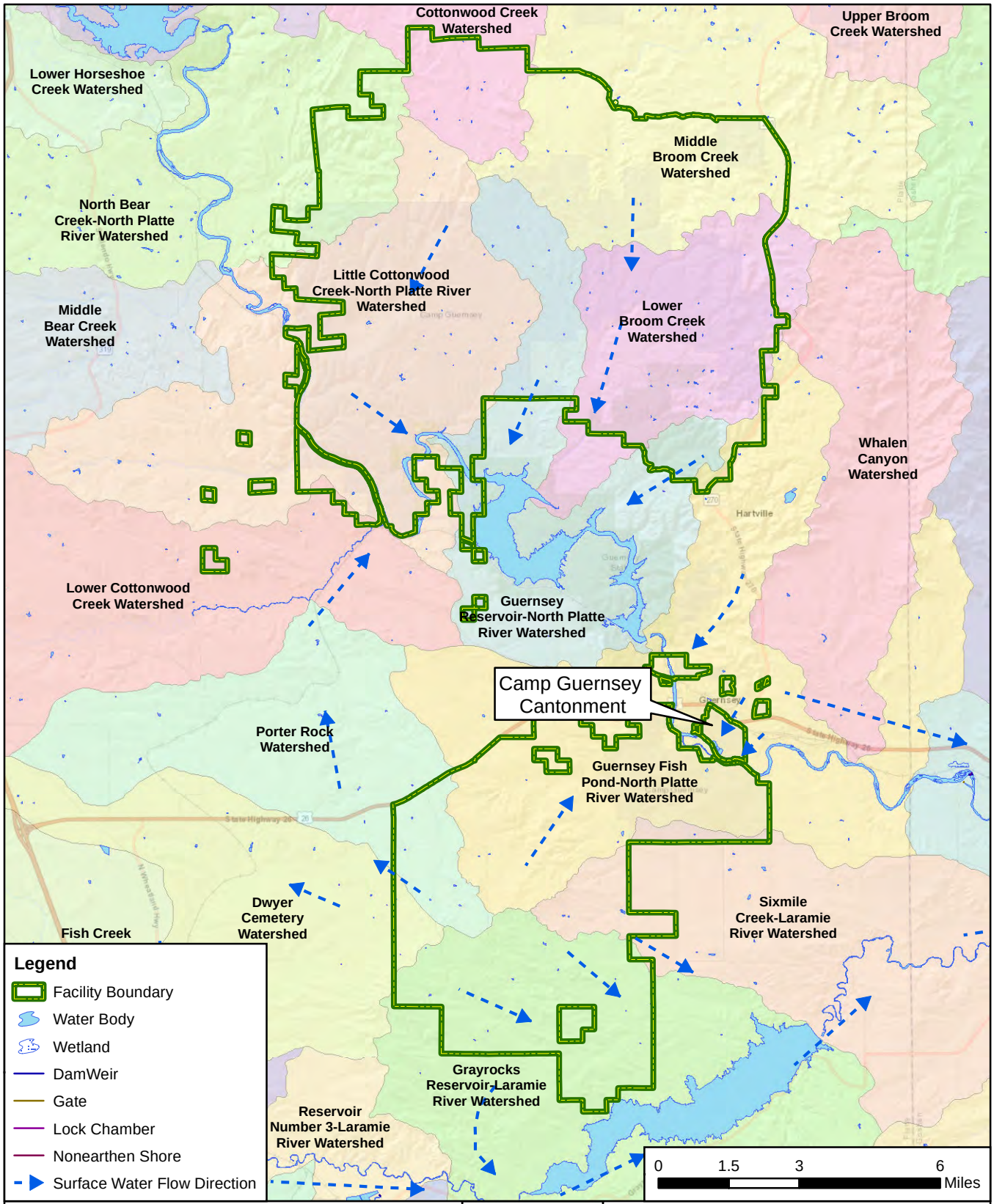
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-4



CLIENT	ARNG			
PROJECT	Site Inspection at Camp Guernsey, WY			
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SCALE	1:190,080	CHK BY	MC	3/3/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	3/3/2023

Surface Water Features

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Germantown, MD 20876

Figure 2-5

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3. Summary of Areas of Interest

The PA evaluated areas where PFAS-containing materials may have been used, stored, disposed, or released historically. The PA originally identified only AOI 1: Camp Guernsey Airfield as a potential release area. However, the ARNG G-9 subsequently adopted a more conservative approach that identified any AFFF storage area, whether a known release occurred or not, as a potential release area. Based on the PA and evolving approach during the SI QAPP development, twelve potential release areas were identified at Camp Guernsey and grouped into four AOIs (AECOM, 2020 and AECOM, 2021). The potential release areas are shown on **Figure 3-1**.

No off-facility sources adjacent to Camp Guernsey were identified during the PA (AECOM, 2020). However, as the widespread nature of the use of PFAS-containing materials becomes better understood, other areas not previously identified, both on- and off-facility, may be considered. The former Town of Guernsey landfill is located less than 1-mile to the northwest of the Camp Guernsey Cantonment and is likely connected hydrogeologically to the alluvial deposits beneath Camp Guernsey (Wyoming Department of Environmental Quality [WYDEQ], 2017). Landfills are not usually a primary source of PFAS; however, PFAS-containing materials disposed of in landfills may leach the compounds into the environment over time. The Town of Guernsey landfill was in operation from the 1950s until it closed in 1999. In addition to waste from Camp Guernsey, the landfill received wastes from municipal, industrial, and other sources. There are no confirmed releases or disposals of PFAS-containing materials at the landfill; however, records of the type and management of waste disposed at the facility are unavailable for most of the history of the landfill because access was unrestricted and landfill operations were unmonitored before 1987 (USACHPPM, 2001). The Town of Guernsey currently operates a yard waste disposal area immediately north of the former landfill. According to WYARNG, the yard waste at this location is managed through periodic burns during which the Camp Guernsey fire department must be present. It is not known whether Camp Guernsey personnel have ever used foam at this location. The locations of the landfill and yard waste area are shown in **Figure 3-1** for informational purposes but were not evaluated as part of this SI.

3.1 AOI 1 Camp Guernsey Airfield

AOI 1 is the Camp Guernsey Airfield. Located on Bridger Avenue, the Camp Guernsey Airfield includes multiple buildings, a landing strip, and taxiway. The Camp Guernsey Airfield and the Guernsey Municipal Airport is a Joint Use Airfield.

Firetrucks are generally stationed at Fire House #1 (Building #107), which is co-located at the air traffic control tower, or at the fire station parking annex, adjacent to the large aircraft parking apron. The fire house was built in 1988 and has been used to store firetrucks and maintain state-owned firetrucks since that time. Firetrucks were also cleaned periodically in the fire house, and wastewater generated from these activities reportedly drained to an oil water separator. The oil water separator has an 8,000-gallon containment tank that is pumped and disposed offsite. Wastewater is treated at the Town of Guernsey wastewater treatment facility located on the Camp Guernsey Cantonment.

According to an interview in 2016 with the former Camp Guernsey Fire Chief, the fire department trained with AFFF every 2 years on the airfield, as the AFFF expired every 2 years. The training occurred approximately five times in the 1990s. In 2004, Camp Guernsey ceased this operation when the current Camp Guernsey Fire Chief arrived. The specific location of the events was unknown; however, AFFF was reportedly used exclusively at the airfield. The type, amount, and concentration of AFFF used during the training activities are also unknown. Additionally, it is unknown if all three firetrucks were used every event and how the AFFF was released during the training events. The information from the former Camp Guernsey Fire Chief and the period of his

service cannot be corroborated, nor can additional details be gathered, as the interviewee passed away after the 2016 interview, and no records were found regarding the concentration or amount of AFFF used for training in the 1990s. Aerial imagery dated from 2013 was provided by WYARNG after SI field activities were completed and shows what appears to be foam and wet pavement at the south end of the airfield, suggesting additional fire training or other release of AFFF may have occurred at AOI 1 as recently as 2013.

In addition, AFFF is stored within a warehouse next to the Airfield Operations. At the time of the PA, AFFF was stored in eight 55-gallon drums (6% concentration) and in four Airport Rescue Firefighter vehicles; one Airport Rescue Firefighter vehicle has a 160-gallon tank, and three have 380-gallon tanks. Aircraft are re-fueled on the aircraft parking aprons with a 5,000-gallon fuel truck. Fire extinguishers with Purple-K are also co-located on the parking aprons and on the fuel truck. Information provided by WYARNG since SI field activities indicates that bulk AFFF is stored in thirteen (13) 55-gallon drums and six 5-gallon containers.

The airfield ramp is gently sloped with an apex occurring in the middle. Access roads, including Bridger Avenue, which ends at Fire House #1, climb the terrace from the west side of the airfield. Several stormwater infiltration basins are located to the south and east of the airfield, and the Platte River is located to the south. Releases at AOI 1 may have occurred directly onto surface soil or pavement but may also have infiltrated to the subsurface soil via runoff, cracks in pavement, or joints between areas that are paved with different materials. The access roads leading up from the Cantonment to the west side of the airfield may convey runoff downslope during heavy precipitation events. Releases in buildings and nearby on parts of the airfield would drain to floor drains. These drains would convey AFFF with wastewater to the sanitary sewer and then to the wastewater treatment facility located on Camp Guernsey.

3.2 AOI 2 Current Firetruck Maintenance Areas

AOI 2 comprises an area east of the runway where firetruck maintenance is reported to occur and includes the current UTES, CSMS, and FMS #5. Federally owned firetrucks are maintained on Camp Guernsey at either the UTES or CSMS. State-owned vehicles are maintained either at FMS #5, Camp Guernsey fire station by either ARNG mechanics or contracted mechanics, or the vehicle is taken off-facility to a commercial maintenance shop.

The UTES, CSMS, and FMS #5 buildings were constructed in 2001 and have been the site of firetruck maintenance since that time. In addition, firetrucks may have used the interior wash racks within the CSMS and FMS #5 buildings. It is unknown if AFFF were in the firetrucks during maintenance, if AFFF were potentially released during maintenance, and if firetrucks cleaned at the wash rack had residual AFFF on the exterior of the trucks. During the PA, interviewees indicated that the firetrucks were cleaned periodically, and wastewater generated from these activities went to the oil water separator, which discharges to the sanitary sewer and then flows to the wastewater treatment facility.

All firetruck maintenance and washing occurred inside the building; however, due to the potential for undocumented releases of AFFF, the area was conservatively added as an AOI. Any AFFF releases would have occurred on paved/concrete areas. AFFF released to the pavement or concrete could have infiltrated subsurface soil via cracks in pavement/concrete or joints between areas that are paved with different materials.

3.3 AOI 3 Historic Maintenance and Storage Areas

AOI 3 includes five areas on the west side of the Cantonment where firetruck maintenance and/or AFFF storage were known to occur: Building #11, Building #106, Building #603, Building #16-FROG, and the Cold Storage building.

Building #11 is located along the northern boundary of AOI 3 and operated as the CSMS prior to 2001. It is assumed that firetruck maintenance was conducted in this building. In addition, a truck wash sump is located within the building.

Building #106 is located along the eastern boundary of AOI 3 and operated as the UTES prior to 2001. It is assumed that firetruck maintenance was conducted in this building, and the building is currently a training center with classrooms.

Building #603 is located along the eastern boundary of AOI 3, south of Building #106. Building #16-FROG is located in the southern portion of AOI 3. Buildings #603 and #16-FROG were used to store firetrucks before 1988. In addition, the fire department has stored firetrucks in both buildings during the winter in recent years.

The Cold Storage building is located on the western boundary of AOI 3. This building may have stored firetrucks here prior to 1988.

There are no documented releases at these five areas; however, due to the potential for undocumented releases of AFFF in the buildings, the locations were conservatively added as an AOI. Any AFFF releases would have occurred on paved/concrete areas. AFFF released to the pavement or concrete could have runoff to unpaved areas or infiltrated subsurface soil via cracks in pavement/concrete or in joints between areas that are paved with different materials. Releases in buildings or wash facilities may drain with wastewater to the sanitary sewer and then flow to the wastewater treatment facility.

3.4 AOI 4 Outdoor Wash Rack

AOI 4 comprises the outdoor wash rack west of the airfield. Firetrucks are not permitted to be washed in the outdoor wash rack area; however, firetrucks were observed being washed there at least once since 2009. Based on the potential for undocumented releases, the area was conservatively added as an AOI. Releases at AOI 4 may have occurred directly onto surface soil or pavement but may also have infiltrated to the subsurface soil via cracks in pavement or joints between areas that are paved with different materials. Releases captured by the wash rack drain would convey to the sanitary sewer and then flow to the wastewater treatment facility.

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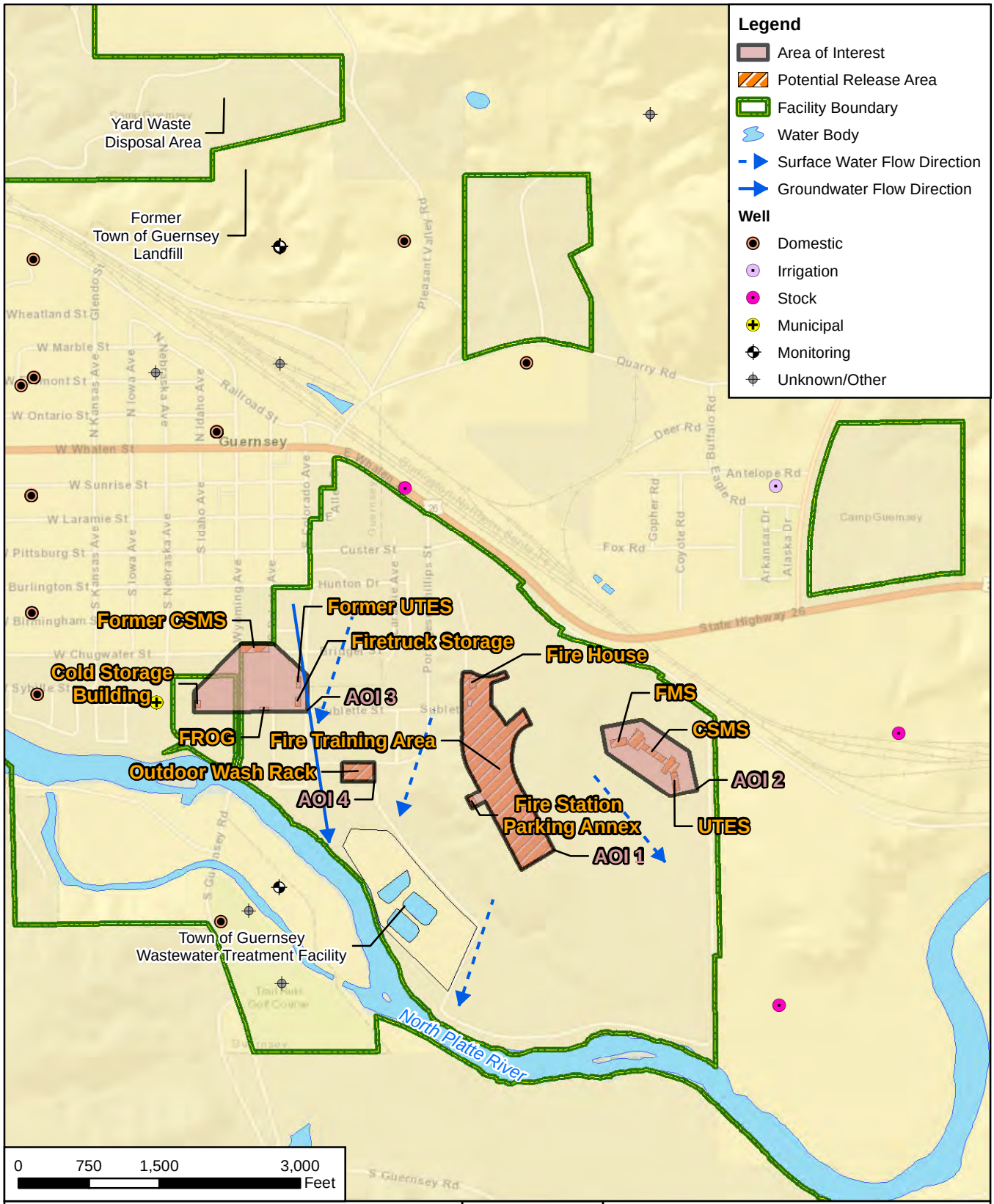

CLIENT	ARNG			
PROJECT	Site Inspection at Camp Guernsey, WY			
REVISED	3/6/2023	GIS BY	MS	3/6/2023
SCALE	1:18,000	CHK BY	AG	3/6/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	3/6/2023

Area of Interest

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 3-1

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4. Project Data Quality Objectives

As identified during the Data Quality Objective (DQO) process and outlined in the SI QAPP Addendum (AECOM, 2021), the objective of the SI is to identify whether there has been a release to the environment at the AOIs identified in the PA and SI QAPP Addendum. For each AOI, ARNG determines if further investigation is warranted, a removal action is required to address immediate threats, or whether no further action is warranted. This SI evaluated groundwater and soil for presence or absence of relevant compounds at each of the sampled AOIs.

4.1 Problem Statement

ARNG will recommend an AOI for Remedial Investigation (RI) if related soil and/or groundwater samples have concentrations of the relevant compounds above the OSD risk-based SLs. The SLs are presented in **Section 6.1** of this report.

4.2 Information Inputs

Primary information inputs included:

- The PA for Camp Guernsey (AECOM, 2020);
- Analytical data collected as part of ARNG drinking water sampling efforts around the facility (Tetra Tech, Inc., 2017);
- Analytical data from groundwater and soil samples collected as part of this SI in accordance with the site-specific Uniform Federal Policy (UFP)-QAPP Addendum (AECOM, 2021); and
- Field data collected during the SI, including groundwater elevation and water quality parameters measured at the time of sampling.

4.3 Study Boundaries

The scope of the SI was bounded by the property limits of the facility (**Figure 2-2**). 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). The SI scope was bounded vertically by the depth of groundwater and HSA drilling refusal. Temporal boundaries were limited to the spring season, which was the earliest available time field resources were available to complete the study.

4.4 Analytical Approach

Samples were analyzed by Pace Analytical Gulf Coast, accredited under the Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP; Accreditation Number 74960) and the National Environmental Laboratory Accreditation Program (NELAP; Certificate Number 01955). Data were compared to applicable SLs within this document and decision rules as defined in the SI QAPP Addendum (AECOM, 2021). Pace Gulf Coast performed the following methods listed on their certifications: PFAS by *PFAS by LCMSMS Compliant with QSM 5.3 Table B-15*, TOC by *SW-846 EPA 9060A*, and *pH by 9045D*.

4.5 Data Usability Assessment

The Data Usability Assessment (DUA), which is provided in **Appendix A**, 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 facility-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, 2019a; DoD, 2019b; USEPA, 2017).

Based on the DUA, the environmental data collected during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUA and its associated data validation reports. These data are of sufficient quality to meet the objectives and requirements of the SI QAPP Addendum (AECOM, 2021).

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 (PQAPP)* dated March 2018 (AECOM, 2018a);
- *Final Programmatic Accident Prevention Plan* dated July 2018 (AECOM, 2018b);
- *Final Preliminary Assessment Report, Camp Guernsey, Guernsey, Wyoming* dated March 2020 (AECOM, 2020);
- *Final Site Inspection Uniform Federal Policy-Quality Assurance Project Plan Addendum, Camp Guernsey, Guernsey, Wyoming* dated November 2021 (AECOM, 2021); and
- *Final Site Safety and Health Plan, Camp Guernsey, Guernsey, Wyoming* dated May 2022 (AECOM, 2022).

The SI field activities were conducted from 9 March, 21 April to 6 May, and 3 June 2022 and consisted of decontamination source water sample collection, utility clearance, HSA borings, soil sample collection, groundwater sampling point installation, low-flow groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2021), except as noted in **Section 5.8**.

The following samples were collected during the SI and analyzed for a subset of 18 compounds by liquid chromatography with tandem mass spectrometry (LC/MS/MS) compliant with Quality Systems Manual (QSM) 5.3 Table B-15 to fulfill the project DQOs:

- Fifty-one (51) soil samples from thirty-one (31) locations;
- Seven (7) low-flow groundwater samples from seven (7) permanent groundwater sampling points; and
- Twenty-seven (27) quality assurance (QA)/quality control (QC) samples.

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 was completed throughout the SI field activities, which is provided in **Appendix B1**. Sampling forms are provided in **Appendix B2**, Field Change Request forms are provided in **Appendix B3**, Nonconformance and Corrective Action Reports (NCRs) are provided in **Appendix B4**, land survey data are provided in **Appendix B5**, and investigation-derived waste (IDW) polygons are provided in **Appendix B6**. 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 US Army Corps of Engineers (USACE) TPP Process, Engineer 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 DQOs, and formulating a sampling approach to address the AOIs identified in the PA and SI QAPP Addendum.

A combined TPP Meeting 1 and 2 was held on 27 May 2021, prior to SI field activities. The combined TPP Meeting 1 and 2 was conducted in general accordance with EM 200-1-2. The stakeholders for this SI include the ARNG, WYARNG, USACE, and WYDEQ. 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, 2021).

A TPP Meeting 3 was held on 25 May 2023 to discuss the results of the SI. Meeting minutes for TPP 3 are included in **Appendix D** of this report. Future TPP meetings will provide an opportunity to discuss the results and findings, and future actions, where warranted.

5.1.2 Utility Clearance

Both AECOM and their drilling contractor, Cascade Technical Services, LLC, contacted One Call of Wyoming (Wyoming 811), the utility clearance contractor, prior to mobilization to notify them of intrusive work. Because Wyoming 811 locators do not locate private utilities, such as those belonging to Camp Guernsey, AECOM contracted Ground Penetrating Radar Systems, LLC. (GPRS) to perform utility clearance for private utilities at all boring locations. GPRS performed the utility clearance under the oversight of the AECOM field team on 21 and 22 April 2022 using industry standard methods in addition to ground-penetrating radar. Additionally, the first 5 feet of the direct-push borings were advanced using hand augering methods to visually verify utility clearance in the shallow subsurface where utilities would typically be encountered.

5.1.3 Source Water and Sampling Equipment Acceptability

One potable water source at Camp Guernsey was sampled on 9 March 2022 to assess usability for decontamination of drilling equipment. Results of the sample collected (CG-DECON-03092022) confirmed this source to be acceptable for use in this investigation; therefore, it was used throughout the field activities. An additional decontamination water source sample (CG-PW-1) was collected on 2 May 2022 from the same source water after it passed through the drillers equipment and confirmed the source's usability. Specifically, the samples were analyzed by LC/MS/MS compliant with QSM 5.3 Table B-15, and usability was defined as source water concentrations less than or equal to 1/5 SL for any relevant compound. The results of the decontamination water samples associated with the source used during the SI are provided in **Appendix F**. A discussion of the results is presented in the DUA (**Appendix A**).

Materials that were used within the sampling zone were confirmed as acceptable for use in the sampling environment. The checklist of acceptable materials for use in the sampling environment was provided in the Standard Operating Procedures (SOPs) appendix to the SI QAPP Addendum (AECOM, 2021). Prior to the start of field work each day, a 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 HSA methods, in accordance with the SI QAPP Addendum (AECOM, 2021). A Mobile Drill B59 split spoon sampling system was used to collect soil cores to the target depth. A hand auger was used to collect soil from the top 5 feet of the boring, in accordance with AECOM utility clearance procedures. The soil boring locations are shown on

Figure 5-1, and depths are provided **Table 5-1**. Several boring locations were relocated for reasons including drill rig access, utility avoidance, and difficult lithology, as indicated in **Section 5.8**.

In general, three discrete soil samples were collected from the vadose zone for chemical analysis from each HSA soil boring: one surface soil sample (0 to 2 feet bgs), one subsurface soil sample approximately 1 foot above the observed groundwater table, and one subsurface soil sample at the mid-point between the surface and the groundwater table. Due to early refusal or recovery limitations, two discrete soil samples were collected at borings AOI01-03, AOI01-04, AOI01-18, AOI01-19, AOI03-01, and AOI03-02. To supplement the drilled boring locations, additional surface soil samples were collected at other locations using a hand auger.

The soil cores were continuously logged for lithological descriptions by an AECOM 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). 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**.

HSA soil borings were completed during the SI to depths ranging between 5.5 to 50 feet bgs. At AOI 1, refusal was encountered between 5.5 to 41 feet bgs at all HSA borings, prior to encountering water bearing units. Groundwater was encountered in borings at AOI 2, 3, and 4 at depths between 25 to 50 feet bgs. The SI borings encountered poorly graded sand with varying quantities of silt and gravel. Higher amounts of gravel were observed in borings on top of the terrace, near the airfield, where only a thin section of unconsolidated deposits was present before refusal was encountered 6- to 10-feet bgs in the underlying cemented gravel conglomerate. Refusal encountered at other locations not on this terrace was likely the result of large cobbles or boulders present within the alluvium. These findings are consistent with the understood surficial geology within the Cantonment as noted in **Section 2.2.1**.

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 by LC/MS/MS compliant with QSM 5.3 Table B-15, total organic carbon (TOC) (USEPA Method 9060A), pH (USEPA Method 9045D), and grain size (ASTM Method D-422) in accordance with the SI QAPP Addendum (AECOM, 2021).

Field duplicate samples were collected at a rate of 10% and analyzed for the same parameters as the accompanying samples. Matrix spike/matrix spike duplicates (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.

HSA borings were installed in unpaved areas, where able, to avoid disturbing concrete or asphalt surfaces. Where groundwater was encountered, HSA borings were converted to permanent groundwater sampling points, in accordance with the SI QAPP Addendum (AECOM, 2021).

5.3 Permanent Groundwater Sampling Point Installation and Groundwater Sampling

During the SI, seven permanent groundwater sampling points were installed at or downgradient of potential source areas. The locations of the sample points are shown on **Figure 5-1**.

A Mobile Drill B59 drill rig was used to install seven 2-inch diameter groundwater sampling points. The groundwater sampling points were constructed with Schedule 40 PVC, flush threaded 10-foot sections of riser, 0.010-inch slotted screen, and a threaded bottom cap. The target screen interval for each location was the top of the groundwater table. A filter pack of 10/20 silica sand was installed in the annulus around the screen to a minimum of 2 feet above the screen. A 2-foot-thick bentonite seal was placed above the filter sand and hydrated with potable water. Bentonite chips were then placed in the borehole annulus from the top of the bentonite seal to 6 inches bgs. The remaining space was filled with concrete to just below the ground surface. The sample points were allowed to set for at least 24 hours prior to development in accordance with the SI QAPP Addendum (AECOM, 2021). All groundwater sampling points were completed at the surface with a sealing gripper cap and flush mount vault with bolt-down lids. The screen interval of each of the groundwater sample points is provided in **Table 5-2**.

Development and sampling of points were completed in accordance with the SI QAPP Addendum (AECOM, 2021). The newly installed groundwater sampling points were developed no sooner than 24 hours following installation by pumping and surging using a variable speed submersible pump. Samples were collected no sooner than 24 hours following development via low-flow sampling methods using a Geotech Geosub 2 bladder pump with disposable PFAS-free, HDPE tubing. New tubing was used at each sampling point, and the pumps were decontaminated between each location. The sample points were purged at a rate determined in the field to reduce draw down prior to sampling. Water quality parameters (e.g., temperature, specific conductance, pH, dissolved oxygen, and oxidation-reduction potential) were measured using a water quality meter and recorded on the field sampling form (**Appendix B2**). Water levels were measured to the nearest 0.01 inch and recorded. Additionally, a subsample of each groundwater sample was collected in a separate container, and a shaker test was completed to identify if there were 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 by LC/MS/MS compliant with QSM 5.3 Table B-15 in accordance with the SI QAPP Addendum (AECOM, 2021).

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. Because non-dedicated sampling equipment was required due to the use of a bladder pump, equipment rinsate blanks were collected at a rate of 5% and analyzed for the same parameters as the groundwater samples. One field reagent blank was collected in accordance with the PQAPP (AECOM, 2018a). A temperature blank was placed in each cooler to ensure that samples were preserved at or below 6°C during shipment.

5.4 Synoptic Water Level Measurements

A synoptic groundwater gauging event was performed on 5 May 2022. Groundwater elevation measurements were collected from the seven new permanent groundwater sampling points. Water level measurements were taken from the northern side of the sample point casing. Depths to water measured at the permanent groundwater sampling points ranged from 19.72 to 40.36 feet bgs. A groundwater flow contour map is provided in **Figure 2-4**. Groundwater elevation data are provided in **Table 5-3**.

5.5 Surveying

The northern side of each groundwater sampling point casing was surveyed by Wyoming-licensed land surveyors following guidelines provided in the SOPs provided in the SI QAPP Addendum (AECOM, 2021) except as noted in **Section 5.8**. Survey data from the newly installed points on the facility were collected on 3 June 2022 in the Wyoming State Plane Coordinates East Zone 1983 North American Datum (2011) (horizontal) and North American Vertical Datum 1988 (vertical). The surveyed groundwater sampling point data are provided in **Appendix B5**.

5.6 Investigation-Derived Waste

As of the date of this report, the disposal of IDW is not regulated federally. IDW generated during the SI is considered non-hazardous waste and was managed in accordance with the SI QAPP Addendum (AECOM, 2021) and with the DA Guidance for Addressing Releases of PFAS, Q18 (DA, 2018).

Non-hazardous solid IDW (i.e., soil cuttings) generated during SI activities was left in place at the point of the source. The soil cuttings were distributed on the downgradient side of the borehole. The IDW was not sampled and assumes the PFAS characteristics of the associated soil samples collected from that source location.

Liquid IDW generated during SI activities (i.e., purge water and decontamination fluids) was discharged directly to the ground surface slightly downgradient of the source of generation in accordance with USEPA Management of IDW (USEPA, 2014). This IDW was not sampled and assumes the characteristics of the associated groundwater samples collected from that source location.

Geographic coordinates were collected using a global Positioning System (GPS) around each location where IDW was placed (i.e., an IDW polygon). The IDW polygons are displayed on the figure in **Appendix B6**.

Other solids such as spent personal protective equipment, plastic sheeting, tubing, rope, unused 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 by LC/MS/MS compliant with QSM 5.3 Table B-15 at Pace Analytical Gulf Coast in Baton Rouge, Louisiana, a DoD ELAP and NELAP certified laboratory. Soil samples were also analyzed for TOC using USEPA Method 9060A and pH by USEPA Method 9045D.

5.8 Deviations from SI QAPP Addendum

Three deviations from the SI QAPP Addendum were identified during review of the field documentation. The deviations are noted below and is documented in Field Change Request (FCR) Forms (**Appendix B3**) and an NCR (**Appendix B4**):

- Multiple sample locations were relocated due to the presence of utilities or subsurface conditions encountered. The original surface soil location AOI02-03 was found to be in concrete, so a new sample location was offset 50 feet north. During the hand clearance of boring location AOI01-01, concrete refusal was hit at 2.5 feet, and so the boring location was relocated over 100 feet west of the original location. During the utility locate at boring location AOI01-02, it was determined that the terrain in the area was not conducive for the rig to safely access; therefore, the sample location was relocated approximately 100 feet

west. A new surface soil sample (AOI01-17) was proposed to sample the potential fire station release area where AOI01-02 was originally located. These actions were documented in FCR001 provided in **Appendix B3**.

- During the drilling activities at AOI 1, refusal was encountered at all four boring locations due to the geology near the airfield. There were no additional areas to step out to the east or west at the revised boring locations for AOI01-01 and AOI01-02 (as discussed in FCR001). Per discussions with ARNG and USACE, two additional boring locations were completed downgradient of AOI 1 (AOI01-18 and AOI01-19) in an effort to collect groundwater samples. The additional boring locations were placed off the terrace in locations approved by ARNG, USACE, and WYARNG. This action was documented in FCR002 provided in **Appendix B3**. Both relocated borings encountered refusal prior to groundwater.

- Upon review of the groundwater sampling point survey data provided by the subcontracted licensed surveyor, it was found that data for one permanent groundwater sampling point (AOI03-03) were not recorded. The remaining groundwater sampling points were correctly surveyed, and the measured water level data were used to develop the groundwater elevation contour. The groundwater flow direction DQO was met using the available data and suggests a southeast flow direction. This action was documented in NCR001 provided in **Appendix B4**.

- During HSA drilling activities, the mid-point subsurface soil sample was collected from 15 to 20 feet bgs at boring AOI03-04 (AOI03-04-SB-15-20). The approved SI QAPP Addendum states that mid-point subsurface soil samples would be collected from 13 to 15 feet bgs if depth to water were greater than 30 feet bgs. Water was encountered at approximately 32 feet bgs during drilling, and the mid-point samples were inadvertently collected at depths greater than 15 feet bgs. Mid-point soil samples were correctly collected at AOI 3 at three boring locations (AOI03-01, AOI03-02, and AOI03-03). Consequently, the analytical results of the mid-point sample collected at AOI03-04 (15 to 20 feet bgs), as well as the correctly collected mid-point soil samples at AOI 3, were used to make conservative assumptions for the CSM. This action was documented in NCR002 provided in **Appendix B4**.

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Camp Guernsey, Guernsey, Wyoming

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Soil Samples							
AOI01-01-SB-(0-2)	4/29/2022 1405	0 - 2	x				
AOI01-01-SB-(0-2)-D	4/29/2022 1405	0 - 2	x				Duplicate
AOI01-01-SB-(13-15)	4/29/2022 1500	13 - 15	x				
AOI01-01-SB-(38-40)	4/29/2022 1550	38 - 40	x				
AOI01-01-SB-(40-41)	4/29/2022 1600	40 - 41				x	
AOI01-02-SB-(0-2)	4/29/2022 1110	0 - 2	x	x	x		
AOI01-02-SB-(13-15)	4/29/2022 1335	13 - 15	x				
AOI01-02-SB-(28-30)	4/29/2022 1340	28 - 30	x				
AOI01-02-SB-(28-30)-MS	4/29/2022 1340	28 - 30	x				MS/MSD
AOI01-02-SB-(28-30)-MSD	4/29/2022 1340	28 - 30	x				MS/MSD
AOI01-03-SB-(0-2)	4/26/2022 1135	0 - 2	x				
AOI01-03-SB-(9-11)	5/02/2022 0930	9 - 11	x				
AOI01-03-SB-(9-11)-MS	5/02/2022 0930	9 - 11	x				MS/MSD
AOI01-03-SB-(9-11)-MSD	5/02/2022 0930	9 - 11	x				MS/MSD
AOI01-04-SB-(0-2)	4/26/2022 1215	0 - 2	x				
AOI01-04-SB-(4-5)	5/02/2022 1025	4 - 5	x				
AOI01-04-SB-(4-5)-D	5/02/2022 1025	4 - 5	x				Duplicate
AOI01-05-SB-(0-2)	4/26/2022 1130	0 - 2	x				
AOI01-06-SB-(0-2)	4/26/2022 1155	0 - 2	x				
AOI01-07-SB-(0-2)	4/26/2022 1205	0 - 2	x				
AOI01-08-SB-(0-2)	4/26/2022 1455	0 - 2	x				
AOI01-09-SB-(0-2)	4/26/2022 1445	0 - 2	x				
AOI01-10-SB-(0-2)	4/26/2022 1440	0 - 2	x				
AOI01-11-SB-(0-2)	4/26/2022 1430	0 - 2	x				
AOI01-12-SB-(0-2)	4/26/2022 1405	0 - 2					
AOI01-13-SB-(0-2)	4/26/2022 1357	0 - 2	x				
AOI01-14-SB-(0-2)	4/26/2022 1100	0 - 2	x				
AOI01-15-SB-(0-2)	4/26/2022 1110	0 - 2	x				
AOI01-16-SB-(0-2)	4/26/2022 1120	0 - 2	x				
AOI01-17-SB-(0-2)	5/02/2022 1100	0 - 2	x				
AOI01-18-SB-(0-2)	5/04/2022 1345	0 - 2	x				
AOI01-18-SB-(13-15)	5/04/2022 1505	13 - 15	x				
AOI01-19-SB-(0-2)	5/04/2022 1525	0 - 2	x				
AOI01-19-SB-(10-11)	5/04/2022 1620	10 - 11	x				
AOI02-01-SB-(0-2)	4/25/2022 1410	0 - 2	x				
AOI02-01-SB-(12.5-15)	4/27/2022 1330	12.5 - 15	x	x	x		
AOI02-01-SB-(25-27.5)	4/27/2022 1335	25 - 27.5	x				
AOI02-01-SB-(25-27.5)-D	4/27/2022 1335	25 - 27.5	x				Duplicate
AOI02-01-SB-(30-32.5)	4/27/2022 1336	30 - 32.5				x	
AOI02-02-SB-(0-2)	4/25/2022 1430	0 - 2	x				
AOI02-03-SB-(0-2)	4/25/2022 1435	0 - 2	x				
AOI02-04-SB-(0-2)	4/25/2022 1450	0 - 2	x				

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Camp Guernsey, Guernsey, Wyoming

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
AOI03-01-SB-(0-2)	4/25/2022 1240	0 - 2	x				
AOI03-01-SB-(0-2)-D	4/25/2022 1240	0 - 2	x				Duplicate
AOI03-01-SB-(13-15)	4/29/2022 0916	13 - 15	x				
AOI03-02-SB-(0-2)	4/25/2022 1315	0 - 2	x	x	x		
AOI03-02-SB-(10-12.5)	4/27/2022 1655	10 - 12.5	x				
AOI03-02-SB-(10-12.5)-MS	4/27/2022 1655	10 - 12.5	x				MS/MSD
AOI03-02-SB-(10-12.5)-MSD	4/27/2022 1655	10 - 12.5	x				MS/MSD
AOI03-03-SB-(0-2)	4/28/2022 1050	0 - 2	x				
AOI03-03-SB-(13-15)	4/28/2022 1205	13 - 15	x				
AOI03-03-SB-(25-27)	4/28/2022 1215	25 - 27	x				
AOI03-04-SB-(0-2)	4/25/2022 1330	0 - 2	x				
AOI03-04-SB-(0-2)-D	4/25/2022 1330	0 - 2	x				Duplicate
AOI03-04-SB-(15-20)	4/28/2022 0940	15 - 20	x				
AOI03-04-SB-(25-30)	4/28/2022 0945	25 - 30	x				
AOI03-05-SB-(0-2)	4/25/2022 1330	0 - 2	x				
AOI04-01-SB-(0-2)	4/25/2022 1215	0 - 2	x				
AOI04-01-SB-(10-15)	4/27/2022 0930	10 - 15	x	x	x		
AOI04-01-SB-(10-15)-D	4/27/2022 0930	10 - 15		x	x		Duplicate
AOI04-01-SB-(10-15)-MS	4/27/2022 0930	10 - 15		x	x		MS/MSD
AOI04-01-SB-(10-15)-MSD	4/27/2022 0930	10 - 15		x	x		MS/MSD
AOI04-01-SB-(15-20)	4/27/2022 0935	15 - 20	x				
AOI04-01-SB-(15-20)-D	4/27/2022 0935	15 - 20	x				Duplicate
AOI04-02-SB-(0-2)	4/25/2022 1200	0 - 2	x				
AOI04-02-SB-(0-2)-MS	4/25/2022 1200	0 - 2	x				MS/MSD
AOI04-02-SB-(0-2)-MSD	4/25/2022 1200	0 - 2	x				MS/MSD
AOI04-03-SB-(0-2)	4/25/2022 1231	0 - 2	x				
CG-01-SB-(0-2)	4/25/2022 1643	0 - 2	x				
CG-01-SB-(13-15)	4/28/2022 1545	13 - 15	x				
CG-01-SB-(38-40)	4/28/2022 1550	38 - 40	x				

Table 5-1
Site Inspection Samples by Medium
Site Inspection Report, Camp Guernsey, Guernsey, Wyoming

Sample Identification	Sample Collection Date/Time	Sample Depth (feet bgs)	LC/MS/MS compliant with QSM 5.3 Table B-15	TOC (USEPA Method 9060A)	pH (USEPA Method 9045D)	Grain Size (ASTM D-422)	Comments
Groundwater Samples							
AOI02-01-GW	5/05/2022 1255	NA	x				
AOI02-01-GW-D	5/05/2022 1255	NA	x				Duplicate
AOI03-01-GW	5/06/2022 0820	NA	x				
AOI03-02-GW	5/05/2022 1520	NA	x				
AOI03-03-GW	5/05/2022 0940	NA	x				
AOI03-04-GW	5/05/2022 1410	NA	x				
AOI04-01-GW	5/05/2022 1210	NA	x				
AOI04-01-GW-D	5/05/2022 1210	NA	x				Duplicate
CG-01-GW	5/06/2022 0855	NA	x				
CG-01-GW-MS	5/06/2022 0855	NA	x				MS/MSD
CG-01-GW-MSD	5/06/2022 0855	NA	x				MS/MSD
Quality Control Samples							
CG-DECON-03092022	3/09/2022 1045	NA	x				Decon Source
CG-ERB-01	4/26/2022 1145	NA	x				Hand Auger
CG-ERB-02	4/27/2022 1400	NA	x				Drilling Equipment
CG-ERB-03	4/28/2022 0900	NA	x				Drilling Equipment
CG-ERB-04	4/28/2022 1055	NA	x				Hand Auger
CG-ERB-05	5/05/2022 1215	NA	x				Bladder Pump
CG-ERB-06	5/05/2022 1515	NA	x				Bladder Pump
CG-PW-1	5/02/2022 0940	NA	x				Decon Source
CG-FRB-01	5/02/2022 0900	NA	x				Reagent Blank

Notes:
ASTM = American Society for Testing and Materials
bgs = below ground surface
ERB = equipment rinsate blank
FRB = field reagent blank
LC/MS/MS = Liquid Chromatography Mass Spectrometry
MS/MSD = matrix spike/ matrix spike duplicate
QSM = Quality Systems Manual
TOC = total organic carbon
USEPA = United States Environmental Protection Agency

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Table 5-2
Soil Boring Depths and Permanent Groundwater Sample Point Screen Intervals
Site Inspection Report, Camp Guersney, Wyoming

Area of Interest	Boring Location	Groundwater Sampling Point ID	Soil Boring Depth (feet bgs)	Groundwater Sampling Point Screen Interval (feet bgs)
1	CG-01	CG-01	50	40-50
2	AOI02-01	AOI02-01	35	25-35
3	AOI03-01	AOI03-01	35	25-35
	AOI03-02	AOI03-02	32.5	20-30
	AOI03-03	AOI03-03	35	23-33
	AOI03-04	AOI03-04	40	25-35
4	AOI04-01	AOI04-01	25	15-25

Notes:
AOI = Area of Interest
bgs = below ground surface
CG = Camp Guernsey
ID = identification

Table 5-3
Permanent Groundwater Sample Point Screen Intervals, and Groundwater Elevations
Site Inspection Report, Camp Guernsey, Guernsey, Wyoming

Area of Interest	Boring Location	Soil Boring Depth (feet bgs)	Groundwater Sampling Point Screen Interval (feet bgs)	Top of Casing Elevation (feet NAVD88)	Ground Surface Elevation (feet NAVD88)	Depth to Water (feet btoc)	Depth to Water (feet bgs)	Groundwater Elevation (feet NAVD88)
1	AOI01-01	41	-	-	4352.47	-	-	-
	AOI01-02	30	-	-	4348.83	-	-	-
	AOI01-03	11	-	-	4391.88	-	-	-
	AOI01-04	5.5	-	-	4372.24	-	-	-
	AOI01-18	16	-	-	4328.07	-	-	-
	AOI01-19	11	-	-	4320.40	-	-	-
	CG-01	50	40-50	4348.73	4349.04	40.05	40.36	4308.68
2	AOI02-01	35	25-35	4348.07	4348.37	22.43	22.73	4325.64
3	AOI03-01	35	25-35	4336.36	4336.57	28.17	28.38	4308.19
	AOI03-02	32.5	20-30	4333.61	4333.91	25.48	25.78	4308.13
	AOI03-03*	35	23-33	-	-	27.08	-	-
	AOI03-04	40	25-35	4338.67	4339.07	29.76	30.16	4308.91
4	AOI04-01	25	15-25	4325.59	4326.35	18.96	19.72	4306.63

Notes:

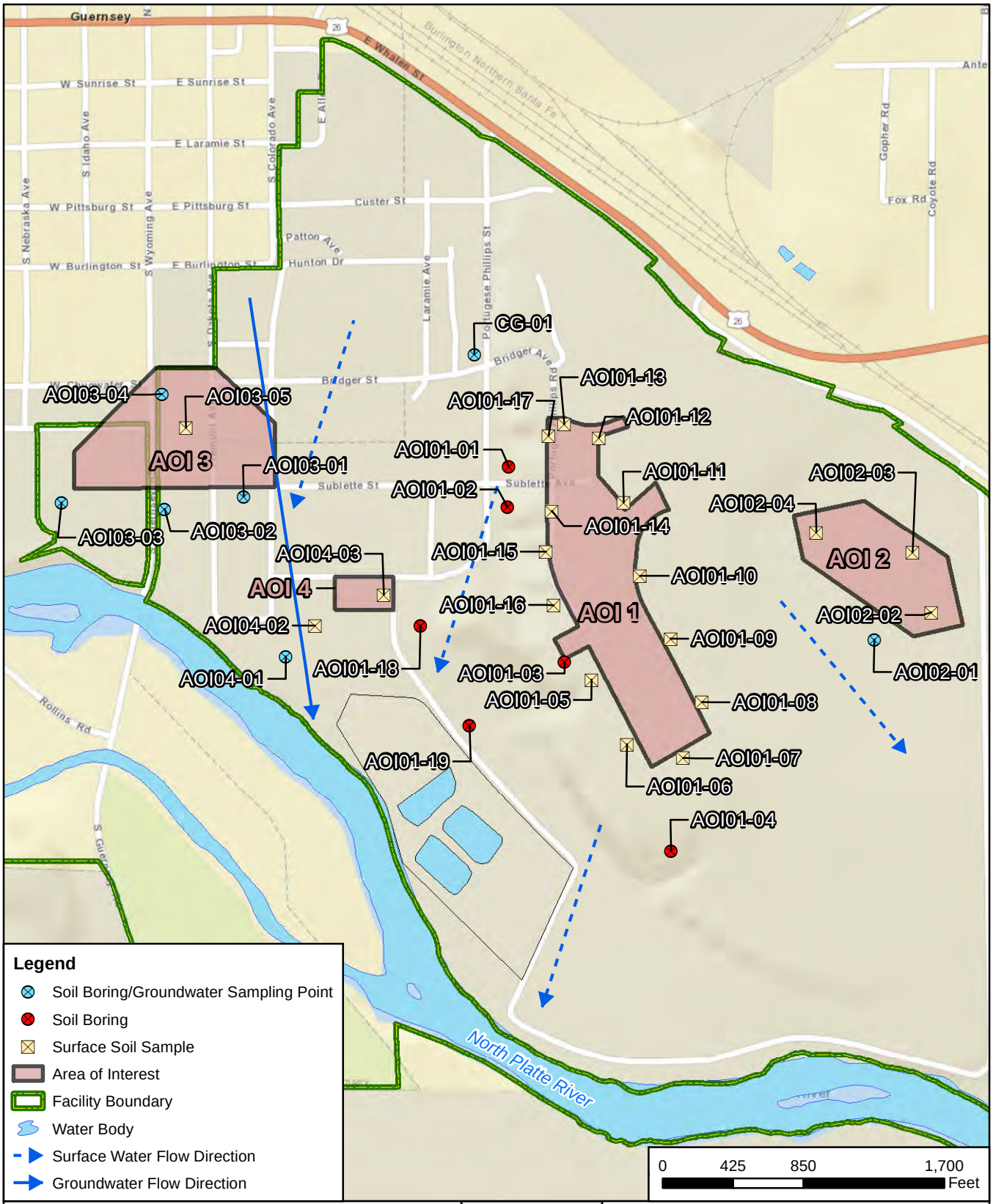
* = Survey data was not collected for this location

bgs = below ground surface

btoc = below top of casing

NA = not applicable

NAVD88 = North American Vertical Datum 1988



CLIENT	ARNG			
PROJECT	Site Inspection at Camp Guernsey, WY			
REVISED	3/6/2023	GIS BY	MS	3/6/2023
SCALE	1:10,200	CHK BY	AG	3/6/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	CM	3/6/2023

Site Inspection Sample Locations

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

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6. Site Inspection Results

This section presents the analytical results of the SI. 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 6.5**. **Table 6-2** through **Table 6-5** present results in soil or groundwater for the relevant compounds. Tables that contain all results are provided in **Appendix F**, and the laboratory reports are provided in **Appendix G**.

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 6 July 2022 (Assistant Secretary of Defense, 2022). 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 the five compounds presented on **Table 6-1** below.

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

Analyte[b]	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	19	250	6
PFOS	13	160	4
PFBS	1,900	25,000	601
PFHxS	130	1,600	39
PFNA	19	250	6

Notes:
bgs = below ground surface; µg/kg = micrograms per kilogram; ng/L = nanograms per liter

a.) Assistant Secretary of Defense, 2022. Risk Based Screening Levels in Groundwater and Soil using United States Environmental Protection Agency's (USEPA's) Regional Screening Level Calculator. Hazard Quotient (HQ) = 0.1. 6 July 2022.

b.) Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

The data in the subsequent sections are compared against the SLs presented in **Table 6-1**. The SLs for groundwater are based on direct ingestion. The SLs for soil are based on incidental ingestion and are applied to the depth intervals reasonably anticipated to be encountered by the receptors identified at the facility: the residential scenario is applied to surface soil results (0 to 2 feet bgs), and the industrial/commercial worker scenario is applied to shallow subsurface soil results (2 to 15 feet bgs). The SLs are not applied to deep subsurface soil results (>15 feet bgs) because 15 feet is the anticipated limit of construction activities.

6.2 Soil Physicochemical Analyses

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

The data collected in this investigation will be used in subsequent investigations, where appropriate, to assess fate and transport. According to the Interstate Technology Regulatory Council (ITRC), several important 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 (K_{oc} 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 in comparison to SLs for AOI 1: Camp Guernsey Airfield. The soil results are summarized on **Table 6-2** through **Table 6-4**. Soil results are presented on **Figure 6-1** through **Figure 6-7**.

6.3.1 AOI 1 Soil Analytical Results

Surface soil was sampled from 0 to 2 feet bgs at boring locations AOI01-01 through AOI01-19 and CG-01. Soil was also sampled from shallow subsurface soil (4 to 15 feet bgs) at boring locations AOI01-1 through AOI01-03, AOI01-18, AOI01-19, and CG-01, and deep subsurface soil intervals (25 to 40 feet bgs) at boring locations AOI01-01, AOI01-02, and CG-01. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** through **Table 6-4** summarize the soil results.

PFOA, PFOS, PFBS, PFHxS, and PFNA were detected in surface soil at concentrations below the residential SLs. Detections were observed at sample locations surrounding the AOI and were generally highest near the paved areas and in the direction of expected surface water flow. The maximum detected concentration of these compounds in surface soil was PFHxS, at 13.7 micrograms per kilogram (µg/kg) at AOI01-06.

In shallow subsurface soil, PFOS and PFHxS were detected below the industrial/commercial SLs. The maximum detected concentration of these compounds was PFHxS, at 0.794 J µg/kg at AOI01-01 (13 to 15 feet bgs). PFOA, PFBS, and PFNA were not detected in shallow subsurface soil.

In deep subsurface soil PFBS and PFHxS were detected. The maximum detected concentration was PFHxS, at 0.138 J µg/kg at AOI01-01 (38 to 40 feet bgs). PFOA, PFOS, and PFNA were not detected in deep subsurface soil. There are no SLs for deep subsurface soil.

6.3.2 AOI 1 Groundwater Analytical Results

Groundwater was sampled from permanent groundwater sampling point CG-01, located outside the boundary of AOI 1, but near the base of the terrace on which AOI 1 is situated. CG-01 is located at the bottom of Bridger Avenue before it climbs up to Fire House #1 and the north end of the AOI. This location was identified to evaluate groundwater upgradient from the source areas based on the understanding of the CSM during SI planning. SI findings suggest conditions in

groundwater at CG-01 may reflect potential unknown upgradient sources on- or off-facility, or the northern part of the airfield. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

The following exceedances were detected in groundwater at CG-01:

- PFOA was detected above the 6 ng/L SL, at a concentration of 79.2 ng/L.
- PFHxS was detected above the 39 ng/L SL, at a concentration of 438 J ng/L.

PFOS and PFBS were detected below the SLs at AOI 1, at concentrations of 1.13 J ng/L and 128 ng/L. PFNA was not detected.

6.3.3 AOI 1 Conclusions

Based on the results of the SI, PFOA, PFOS, PFBS, PFHxS, and PFNA were detected in soil below the SLs. PFOA and PFHxS were detected in groundwater, above the SLs. Based on the exceedances of the SLs in groundwater, further evaluation at AOI 1 is warranted.

6.4 AOI 2

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 2: Current Firetruck Maintenance Areas. The results in soil and groundwater are summarized on **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.4.1 AOI 2 Soil Analytical Results

Surface soil was sampled from 0 to 2 feet bgs at boring locations AOI02-01 through AOI02-04. Soil was also sampled from shallow subsurface soil (12.5 to 15 feet bgs) and deep subsurface soil intervals (25 to 27.5 feet bgs) at boring location AOI02-01. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** through **Table 6-4** summarize the soil results.

PFOA, PFOS, PFHxS, and PFNA were detected in surface soil below the residential SLs. The maximum detected concentration of these compounds was PFOS at 0.896 J µg/kg at AOI02-02. PFBS was not detected in surface soil.

PFOA, PFOS, PFBS, PFHxS, and PFNA were not detected in shallow or deep subsurface soil.

6.4.2 AOI 2 Groundwater Analytical Results

Groundwater was sampled from permanent groundwater sampling point AOI2-01. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

PFOA, PFOS, PFBS, and PFHxS were detected in groundwater below their SLs. PFNA was not detected at AOI 2. A summary of results is provided below:

- PFOA was detected below the 6 ng/L SL, at a concentration of 0.726 J ng/L.
- PFOS was detected below the 4 ng/L SL, at a concentration of 0.517 J ng/L.
- PFBS was detected below the 601 ng/L SL, at a concentration of 18.9 ng/L.
- PFHxS was detected below the 39 ng/L SL, at a concentration of 8.55 ng/L.

6.4.3 AOI 2 Conclusions

Based on the results of the SI, PFOA, PFOS, PFHxS, and PFNA were detected in soil at concentrations below their SLs. PFOA, PFOS, PFBS, and PFHxS were detected in groundwater at concentrations below their SLs. Therefore, further evaluation at AOI 2 is not warranted at this time.

6.5 AOI 3

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 3: Historic Maintenance and Storage Areas. The results in soil and groundwater are presented in **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.5.1 AOI 3 Soil Analytical Results

Surface soil was sampled from 0 to 2 feet bgs at boring locations AOI03-01 through AOI03-05. Soil was also sampled from shallow subsurface soil (10 to 15 feet bgs) at boring locations AOI03-1 through AOI03-03, and deep subsurface soil intervals (15 to 40 feet bgs) at boring locations AOI03-03 and AOI03-04. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** through **Table 6-4** summarize the soil results.

PFOA, PFOS, PFBS, PFHxS, and PFNA were detected in surface soil below the residential SLs. The maximum detected concentration of these compounds was PFOS at 2.14 µg/kg at AOI03-02.

PFOA, PFOS, PFBS, PFHxS, and PFNA were not detected in shallow subsurface soil. In deep subsurface soil, PFOA, PFOS, PFHxS, and PFNA were detected. The maximum detected concentration was PFOS at 1.90 µg/kg at AOI03-04 (25 to 30 feet bgs). PFBS was not detected in deep subsurface soil.

6.5.2 AOI 3 Groundwater Analytical Results

Groundwater was sampled from permanent groundwater sampling points AOI03-01 through AOI03-04. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

PFOA, PFOS, PFBS, and PFHxS were detected in groundwater below their SLs. PFNA was not detected at AOI 3. A summary of detected results is provided below:

- PFOA was detected below the 6 ng/L SL, at a maximum concentration of 0.606 J ng/L at AOI03-04.
- PFOS was detected below the 4 ng/L SL, at a maximum concentration of 1.34 J ng/L at AOI03-03.
- PFBS was detected below the 601 ng/L, SL at a maximum concentration of 11.9 ng/L at AOI03-01.
- PFHxS was detected below the 39 ng/L, SL at a maximum concentration of 5.24 ng/L at AOI03-01.

6.5.3 AOI 3 Conclusions

Based on the results of the SI, PFOA, PFOS, PFBS, PFHxS, and PFNA were detected in soil, at concentrations below their SLs. PFOA, PFOS, PFBS, and PFHxS were detected in groundwater,

at concentrations below their SLs. Therefore, further evaluation at AOI 3 is not warranted at this time.

6.6 AOI 4

This section presents the analytical results for soil and groundwater in comparison to SLs for AOI 4: Outdoor Wash Rack. The results in soil and groundwater are presented in **Table 6-2** through **Table 6-5**. Soil and groundwater results are presented on **Figure 6-1** through **Figure 6-7**.

6.6.1 AOI 4 Soil Analytical Results

Surface soil was sampled from 0 to 2 feet bgs at boring locations AOI04-01 through AOI04-03. Soil was also sampled from shallow subsurface soil (10 to 15 feet bgs) and deep subsurface soil intervals (15 to 20 feet bgs) at boring location AOI04-01. **Figure 6-1** through **Figure 6-5** present the ranges of detections in soil. **Table 6-2** through **Table 6-4** summarize the soil results.

PFOA, PFOS, and PFHxS were detected in surface soil below the residential SLs. The maximum detected concentration of these compounds was PFOS, at 0.933 J µg/kg at AOI04-01. PFBS and PFNA were not detected in surface soil.

PFOA, PFOS, PFBS, PFHxS, and PFNA were not detected in shallow subsurface soil. In deep subsurface soil, only PFBS and PFHxS were detected, with a maximum detected concentration of 0.123 J µg/kg for PFHxS at AOI04-01 (15 to 20 feet bgs).

6.6.2 AOI 4 Groundwater Analytical Results

Groundwater was sampled from permanent groundwater sampling point AOI04-01. This location was identified to evaluate AOI 4 based on the inferred groundwater flow direction during SI planning. SI findings suggest AOI04-01 may be downgradient of several potential release areas, including the wash rack. Therefore, groundwater results at AOI04-01 may reflect one or more source areas but are used here for evaluation of AOI 4 only. This data gap will be addressed during the RI. **Figure 6-6** and **Figure 6-7** present the ranges of detections in groundwater. **Table 6-5** summarizes the groundwater results.

The following exceedance of the SLs was measured at AOI04-01:

- PFOS was detected above the 4 ng/L, at a concentration of 4.21 ng/L.

PFOA, PFBS, and PFHxS were detected at concentrations below their SLs. PFNA was not detected at AOI 4.

6.6.3 AOI 4 Conclusions

Based on the results of the SI, PFOA, PFOS, and PFHxS were detected in soil below their SLs. PFOS was detected in groundwater at a concentration above the SL. Based on the exceedance of the PFOS SL in groundwater, further evaluation at AOI 4 is warranted.

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Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Camp Guernsey

Area of Interest		AOI01																			
Sample ID		AOI01-01-SB-(0-2)		AOI01-01-SB-(0-2)-D		AOI01-02-SB-(0-2)		AOI01-03-SB-(0-2)		AOI01-04-SB-(0-2)		AOI01-05-SB-(0-2)		AOI01-06-SB-(0-2)		AOI01-07-SB-(0-2)		AOI01-08-SB-(0-2)		AOI01-09-SB-(0-2)	
Sample Date		04/29/2022		04/29/2022		04/29/2022		04/26/2022		04/26/2022		04/26/2022		04/26/2022		04/26/2022		04/26/2022		04/26/2022	
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		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**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	0.021	J	ND	U	ND	U	ND	U
PFHxS	130	0.035	J	0.034	J	0.044	J	0.175	J	0.146	J	0.123	J	13.7		0.595	J	0.120	J	ND	U
PFNA	19	0.048	J	0.043	J	ND	U	ND	U	ND	U	ND	U	ND	U	0.054	J	0.043	J	0.040	J
PFOA	19	ND	U	ND	U	ND	U	0.140	J	0.177	J	0.170	J	3.00		0.454	J	ND	U	ND	U
PFOS	13	3.03		2.68		0.096	J	0.466	J	0.235	J	0.205	J	4.00		1.30		1.17		0.589	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on residential scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AOI	Area of Interest
CG	Camp Guernsey
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Camp Guernsey

Area of Interest		AOI01																			
Sample ID		AOI01-10-SB-(0-2)		AOI01-11-SB-(0-2)		AOI01-12-SB-(0-2)		AOI01-13-SB-(0-2)		AOI01-14-SB-(0-2)		AOI01-15-SB-(0-2)		AOI01-16-SB-(0-2)		AOI01-17-SB-(0-2)		AOI01-18-SB-(0-2)		AOI01-19-SB-(0-2)	
Sample Date		04/26/2022		04/26/2022		04/26/2022		04/26/2022		04/26/2022		04/26/2022		04/26/2022		05/02/2022		05/04/2022		05/04/2022	
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		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**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	ND	U	ND	U	ND	U	0.044	J	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	130	0.121	J	0.046	J	4.64		4.37		0.239	J	0.066	J	0.273	J	ND	U	0.166	J	0.056	J
PFNA	19	ND	U	ND	U	0.507	J	0.096	J	0.027	J	0.052	J	0.028	J	ND	U	ND	U	0.029	J
PFOA	19	0.088	J	ND	U	0.707	J	0.856	J	0.270	J	0.128	J	0.293	J	ND	U	0.140	J	0.109	J
PFOS	13	0.459	J	0.166	J	5.09		1.78		0.965	J	1.11		2.30		0.548	J	0.096	J	1.31	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on residential scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

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Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AOI	Area of Interest
CG	Camp Guernsey
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Camp Guernsey

Area of Interest		AOI01		AOI02								AOI03									
Sample ID		CG-01-SB-(0-2)		AOI02-01-SB-(0-2)		AOI02-02-SB-(0-2)		AOI02-03-SB-(0-2)		AOI02-04-SB-(0-2)		AOI03-01-SB-(0-2)		AOI03-01-SB-(0-2)-D		AOI03-02-SB-(0-2)		AOI03-03-SB-(0-2)		AOI03-04-SB-(0-2)	
Sample Date		04/25/2022		04/25/2022		04/25/2022		04/25/2022		04/25/2022		04/25/2022		04/25/2022		04/25/2022		04/28/2022		04/25/2022	
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		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	Result	Qual
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	1900	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	UJ
PFHxS	130	0.079	J	0.167	J	0.158	J	ND	U	0.046	J	0.114	J	0.105	J	0.094	J	0.034	J	0.079	J
PFNA	19	0.025	J	0.023	J	0.043	J	0.038	J	ND	U	0.051	J	0.050	J	0.130	J	ND	U	0.037	J
PFOA	19	ND	U	0.122	J	0.144	J	ND	U	ND	U	0.087	J	ND	UJ	0.149	J	ND	U	0.117	J
PFOS	13	0.484	J	0.270	J	0.896	J	0.231	J	0.267	J	0.806	J	0.790	J	2.14		0.113	J	0.610	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on residential scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

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Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AOI	Area of Interest
CG	Camp Guernsey
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-2
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Surface Soil
Site Inspection Report, Camp Guernsey

Area of Interest		AOI03				AOI04					
Sample ID		AOI03-04-SB-(0-2)-D		AOI03-05-SB-(0-2)		AOI04-01-SB-(0-2)		AOI04-02-SB-(0-2)		AOI04-03-SB-(0-2)	
Sample Date		04/25/2022		04/25/2022		04/25/2022		04/25/2022		04/25/2022	
Depth		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**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)											
PFBS	1900	0.025	J	ND	U	ND	U	ND	U	ND	U
PFHxS	130	0.107	J	0.036	J	0.724	J	0.079	J	0.147	J
PFNA	19	0.038	J	0.154	J	ND	U	ND	U	ND	U
PFOA	19	0.136	J	0.254	J	0.449	J	ND	U	0.224	J
PFOS	13	0.595	J	1.08		0.933	J	0.157	J	0.772	J

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on residential scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AOI	Area of Interest
CG	Camp Guernsey
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-3
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, Camp Guernsey

Area of Interest		AOI01																AOI02		AOI03	
Sample ID		AOI01-01-SB-(13-15)		AOI01-02-SB-(13-15)		AOI01-03-SB-(9-11)		AOI01-04-SB-(4-5)		AOI01-04-SB-(4-5)-D		AOI01-18-SB-(13-15)		AOI01-19-SB-(10-11)		CG-01-SB-(13-15)		AOI02-01-SB-(12.5-15)		AOI03-01-SB-(13-15)	
Sample Date		04/29/2022		04/29/2022		05/02/2022		05/02/2022		05/02/2022		5/4/2022		5/4/2022		04/28/2022		04/27/2022		04/29/2022	
Depth		13-15 ft		13-15 ft		9-11 ft		4-5 ft		4-5 ft		13-15 ft		10-11 ft		13-15 ft		12.5-15 ft		13-15 ft	
Analyte	**OSD Screening Level [a]**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																					
PFBS	25000	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	1600	0.794	J	ND	U	ND	U	ND	UJ	0.041	J	ND	U	0.099	J	ND	U	ND	U	ND	U
PFNA	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOA	250	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOS	160	ND	U	ND	U	ND	U	0.053	J	0.077	J	ND	U	0.072	J	0.110	J	ND	U	ND	U

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AOI	Area of Interest
CG	Camp Guernsey
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-3
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Shallow Subsurface Soil
Site Inspection Report, Camp Guernsey

Area of Interest		AOI03				AOI04	
Sample ID		AOI03-02-SB-(10-12.5		AOI03-03-SB-(13-15)		AOI04-01-SB-(10-15)	
Sample Date		04/27/2022		04/28/2022		04/27/2022	
Depth		10-12.5 ft		13-15 ft		10-15 ft	
Analyte	OSD Screening Level [a]			Result	Qual	Result	Qual
Soil, LCMSMS compliant E537M							
PFBS	25000	ND	UJ	ND	U	ND	U
PFHxS	1600	ND	UJ	ND	U	ND	U
PFNA	250	ND	UJ	ND	U	ND	U
PFOA	250	ND	UJ	ND	U	ND	U
PFOS	160	ND	UJ	ND	U	ND	U

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022. Soil screening levels based on industrial/commercial composite worker scenario for incidental ingestion of contaminated soil.

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AOI	Area of Interest
CG	Camp Guernsey
D	duplicate
DL	detection limit
ft	feet
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
USEPA	United States Environmental Protection Agency
µg/kg	micrograms per kilogram

Table 6-4
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, Camp Guernsey

Area of Interest	AOI01						AOI02				AOI03					
Sample ID	AOI01-01-SB-(38-40)		AOI01-02-SB-(28-30)		CG-01-SB-(38-40)		AOI02-01-SB-(25-27.5)		AOI02-01-SB-(25-27.5)-D		AOI03-03-SB-(25-27)		AOI03-04-SB-(15-20)		AOI03-04-SB-(25-30)	
Sample Date	04/29/2022		04/29/2022		04/28/2022		04/27/2022		04/27/2022		04/28/2022		04/28/2022		04/28/2022	
Depth	38-40 ft		28-30 ft		38-40 ft		25-27.5 ft		25-27.5 ft		25-27 ft		15-20 ft		25-30 ft	
Analyte	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**	**Result**	**Qual**
Soil, LCMSMS compliant with QSM 5.3 Table B-15 (µg/kg)																
PFBS	0.034	J	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFHxS	0.138	J	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	0.228	J
PFNA	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	0.028	J
PFOA	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	0.078	J
PFOS	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	1.90	

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AOI	Area of Interest
CG	Camp Guernsey
D	duplicate
DL	detection limit
ft	feet
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
µg/kg	micrograms per kilogram

Table 6-4
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Deep Subsurface Soil
Site Inspection Report, Camp Guernsey

Area of Interest	AOI04			
Sample ID	AOI04-01-SB-(15-20)		AOI04-01-SB-(15-20)-D	
Sample Date	04/27/2022		04/27/2022	
Depth	15-20 ft		15-20 ft	
Analyte	Result	Qual	Result	Qual
Soil, LCMSMS complian E537M				
PFBS	0.020	J	ND	UJ
PFHxS	0.123	J	0.106	J
PFNA	ND	U	ND	U
PFOA	ND	U	ND	U
PFOS	ND	U	ND	U

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

UJ = The analyte was not detected at a level greater than or equal to the adjusted DL. However, the reported adjusted DL is approximate and may be inaccurate or imprecise.

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AOI	Area of Interest
CG	Camp Guernsey
D	duplicate
DL	detection limit
ft	feet
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
QSM	Quality Systems Manual
Qual	interpreted qualifier
SB	soil boring
µg/kg	micrograms per kilogram

Table 6-5
PFOA, PFOS, PFBS, PFNA, and PFHxS Results in Groundwater
Site Inspection Report, Camp Guernsey

Area of Interest		AOI01		AOI02				AOI03								AOI04			
Sample ID		CG-01-GW		AOI02-01-GW		AOI02-01-GW-D		AOI03-01-GW		AOI03-02-GW		AOI03-03-GW		AOI03-04-GW		AOI04-01-GW		AOI04-01-GW-D	
Sample Date		05/06/2022		05/05/2022		05/05/2022		05/06/2022		05/05/2022		05/05/2022		05/05/2022		05/05/2022		05/05/2022	
Analyte	OSD Screening Level [a]	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Water, LCMSMS compliant with QSM 5.3 Table B-15 (ng/l)																			
PFBS	601	128		18.9		16.5		11.9		ND	U	0.969	J	1.46	J	4.24		3.95	
PFHxS	39	438	J	8.55		7.78		5.24		ND	U	2.49		1.15	J	28.5		25.4	
PFNA	6	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U
PFOA	6	79.2		0.726	J	0.666	J	ND	U	ND	U	ND	U	0.606	J	1.86	J	1.65	J
PFOS	4	1.13	J	0.517	J	0.421	J	0.618	J	ND	U	1.34	J	1.06	J	4.21		3.77	

Grey Fill — Detected concentration exceeded OSD Screening Levels

References

a. Assistant Secretary of Defense, July 2022. Risk Based Screening Levels Calculated for PFOA, PFOS, PFBS, PFHxS, and PFNA in Groundwater or Soil using USEPA's Regional Screening Level Calculator. HQ=0.1, May 2022 Groundwater screening levels based on residential scenario for direct ingestion of groundwater.

Interpreted Qualifiers

J = Estimated concentration

U = The analyte was not detected at a level greater than or equal to the adjusted DL

Notes

ND = Analyte not detected above the LOD. LOD values are presented in Appendix F.

Chemical Abbreviations

PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid

Acronyms and Abbreviations

AOI	Area of Interest
CG	Camp Guernsey
D	duplicate
DL	detection limit
GW	groundwater
HQ	hazard quotient
ID	identification
LCMSMS	liquid chromatography with tandem mass spectrometry
LOD	limit of detection
ND	analyte not detected above the LOD
OSD	Office of the Secretary of Defense
QSM	Quality Systems Manual
Qual	interpreted qualifier
USEPA	United States Environmental Protection Agency
ng/l	nanogram per liter

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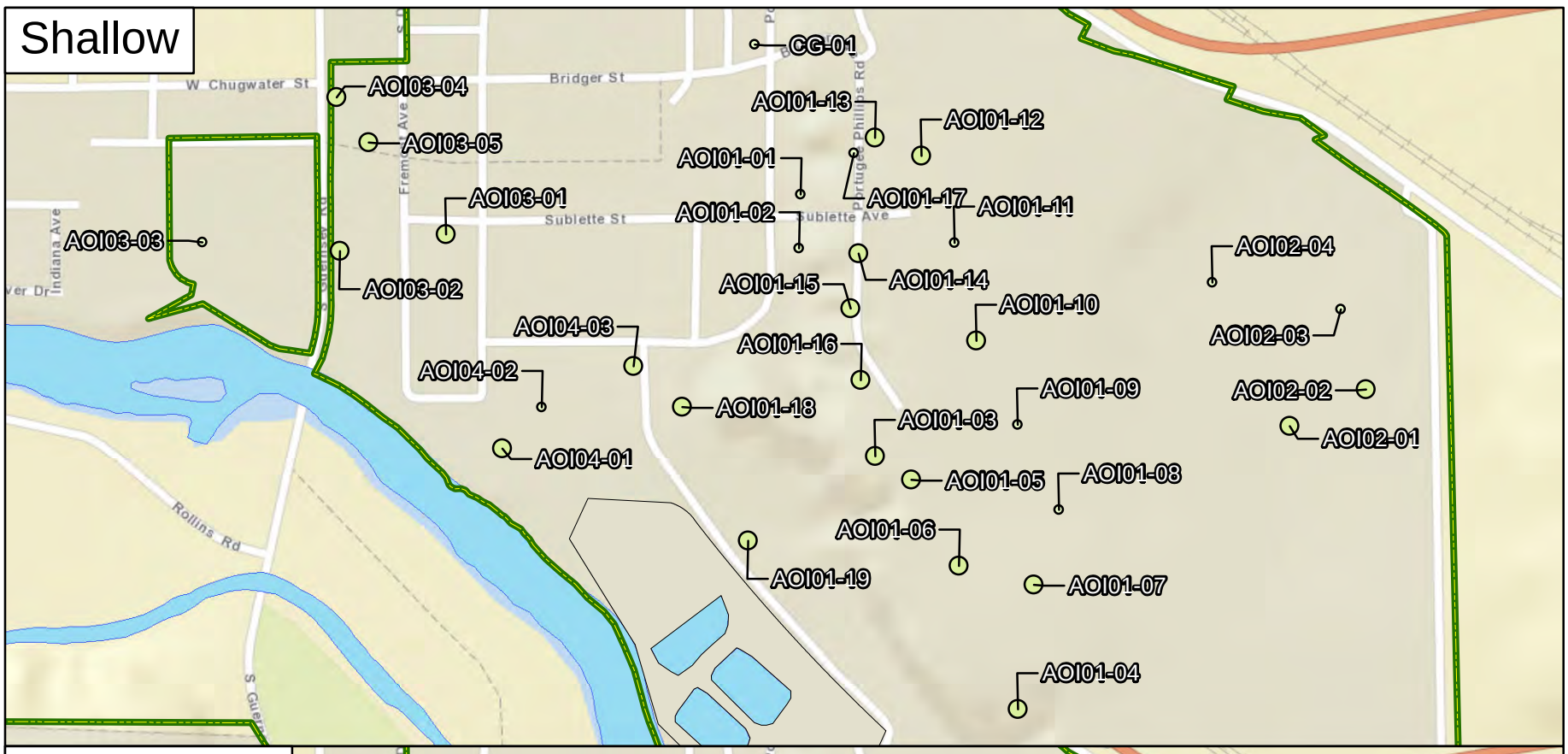

Legend

- Facility Boundary
- Water Body

PFOA Results (µg/Kg)

- ND
- >ND - 19
- >19 - 250
- >250 - 2,500
- >2,500

N

0 370 740 1,480 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFOA Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Camp Guernsey, WY			
REVISED	3/3/2023	GIS BY	MS	3/3/2023
SCALE	1:8,880	CHK BY	AG	3/3/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	3/3/2023

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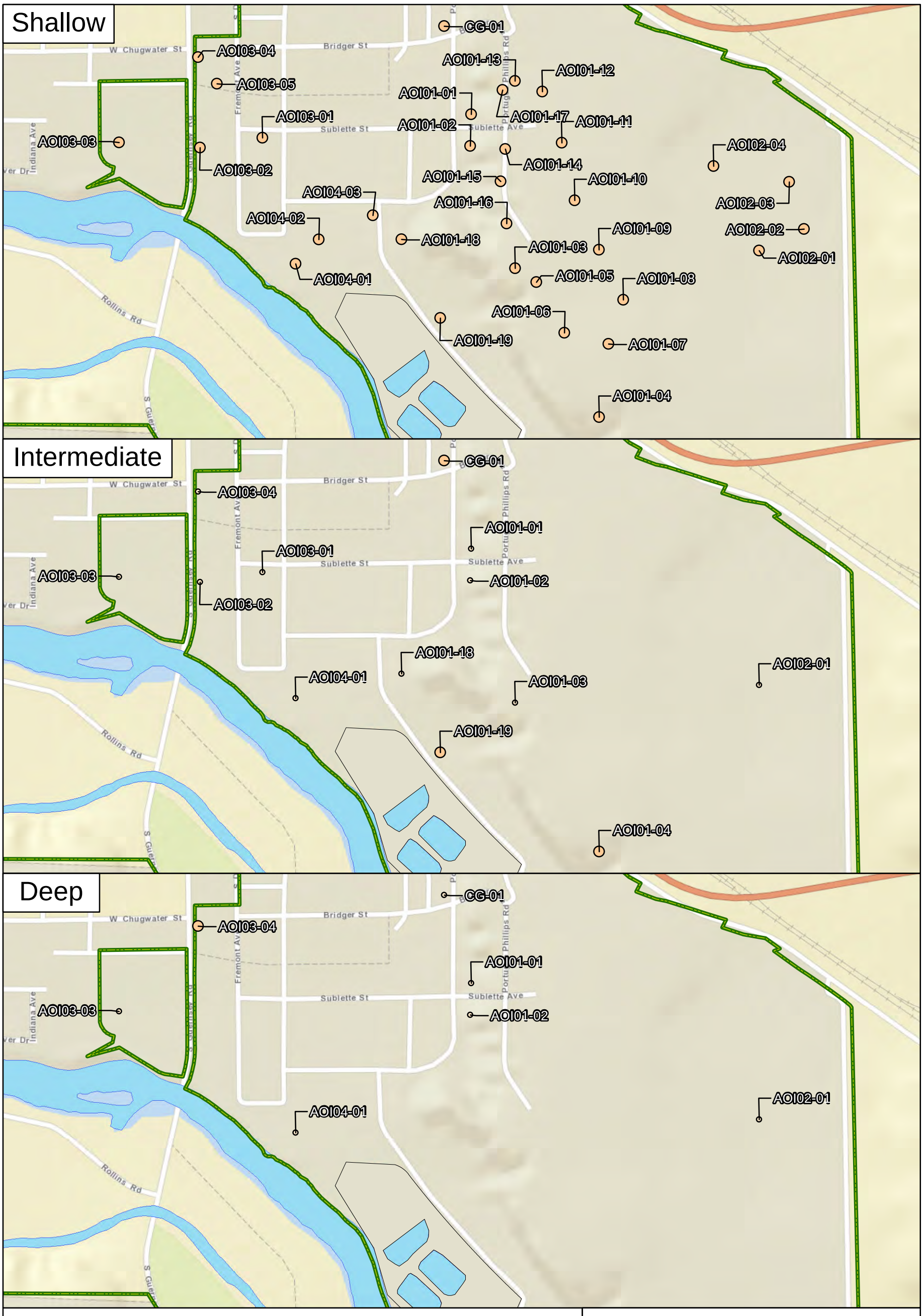
Figure 6-1



Legend

- Facility Boundary
- Water Body

PFOS Results (µg/Kg)

- ND
- >ND - 13
- >13 - 160
- >160 - 1,600
- >1,600

N

0 370 740 1,480 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFOS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Camp Guernsey, WY			
REVISED	3/3/2023	GIS BY	MS	3/3/2023
SCALE	1:8,880	CHK BY	AG	3/3/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	3/3/2023

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Figure 6-2

Legend

- Facility Boundary
- Water Body

PFBS Results (µg/Kg)

- ND
- >ND - 10
- >10 - 1,900
- >1,900 - 25,000
- >25,000

N

0 370 740 1,480 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFBS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Camp Guernsey, WY			
REVISED	3/3/2023	GIS BY	MS	3/3/2023
SCALE	1:8,880	CHK BY	AG	3/3/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	3/3/2023

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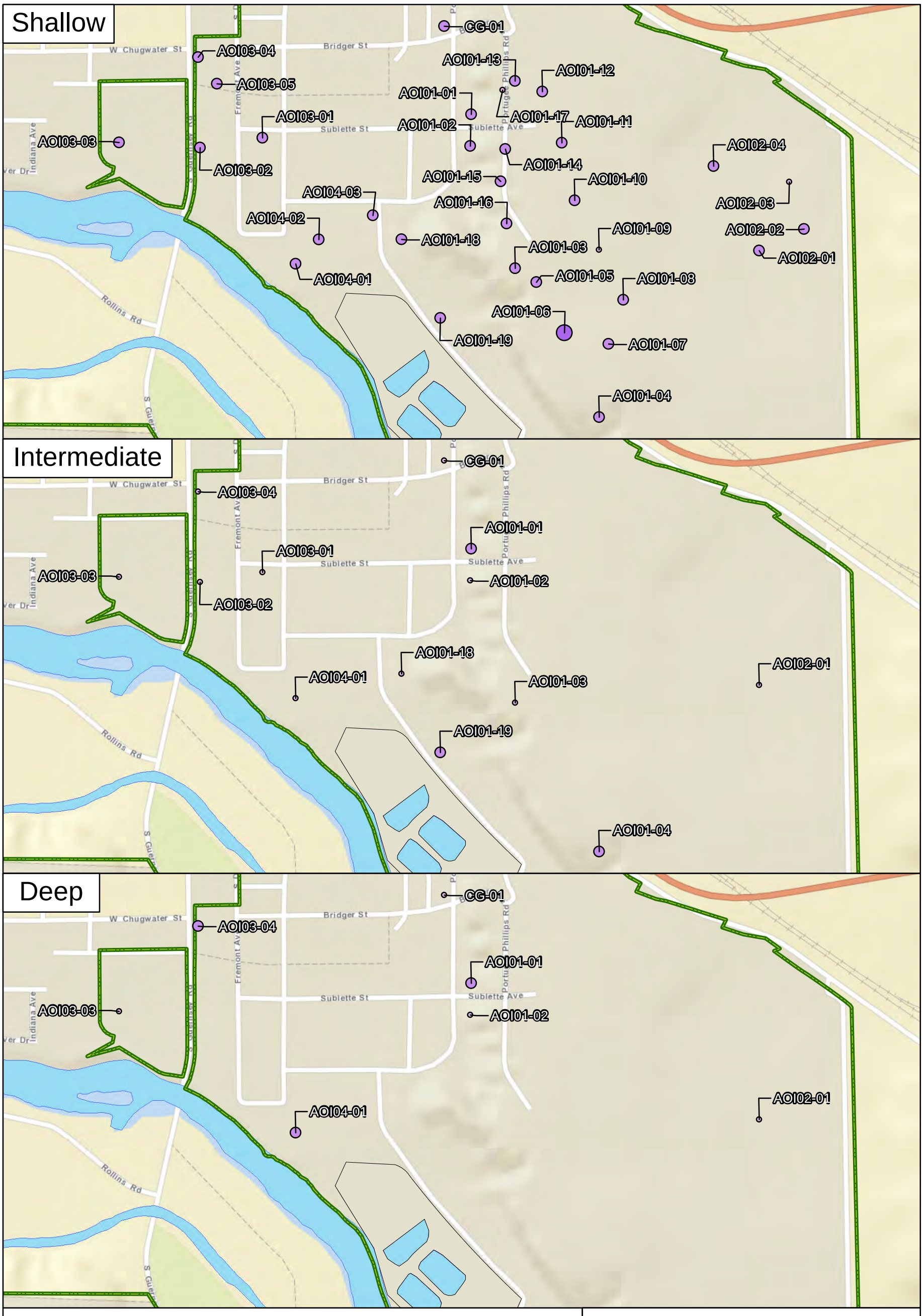
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-3



Legend

- Facility Boundary
- Water Body

PFHxS Results (µg/Kg)

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

N

0 370 740 1,480 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFHxS Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Camp Guernsey, WY			
REVISED	3/3/2023	GIS BY	MS	3/3/2023
SCALE	1:8,880	CHK BY	AG	3/3/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	3/3/2023

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Figure 6-4

Legend

- Facility Boundary
- Water Body

PFNA Results (µg/Kg)

- ND
- >ND - 19
- >19 - 250
- >250 - 2,500
- >2,500

N

0 370 740 1,480 Feet

Exceedances of the OSD SL are depicted with a yellow halo.
Depth intervals shown represent respective sampling position within a given soil boring location.

PFNA Detections in Soil

CLIENT	ARNG			
PROJECT	Site Inspection at Camp Guernsey, WY			
REVISED	3/3/2023	GIS BY	MS	3/3/2023
SCALE	1:8,880	CHK BY	AG	3/3/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	3/3/2023

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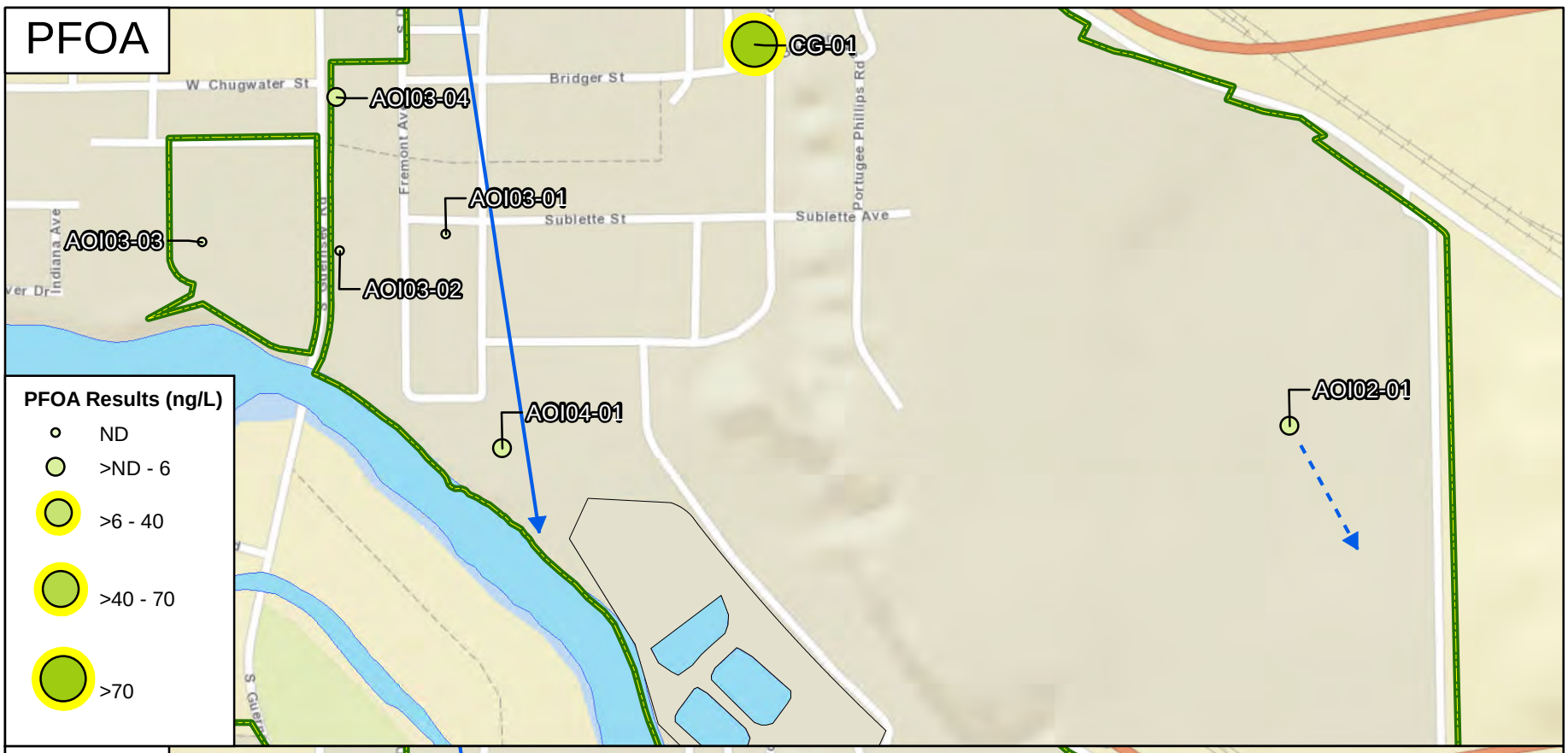
Figure 6-5



Legend

- Facility Boundary
- Water Body
- Groundwater Flow Direction
- Inferred Groundwater Flow Direction

N

0 370 740 1,480 Feet

Exceedances of the OSD SL are depicted with a yellow halo.

PFOA, PFOS, PFBS Detections in Groundwater

CLIENT	ARNG			
PROJECT	Site Inspection at Camp Guernsey, WY			
REVISED	3/6/2023	GIS BY	MS	3/6/2023
SCALE	1:8,880	CHK BY	AG	3/6/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	3/6/2023

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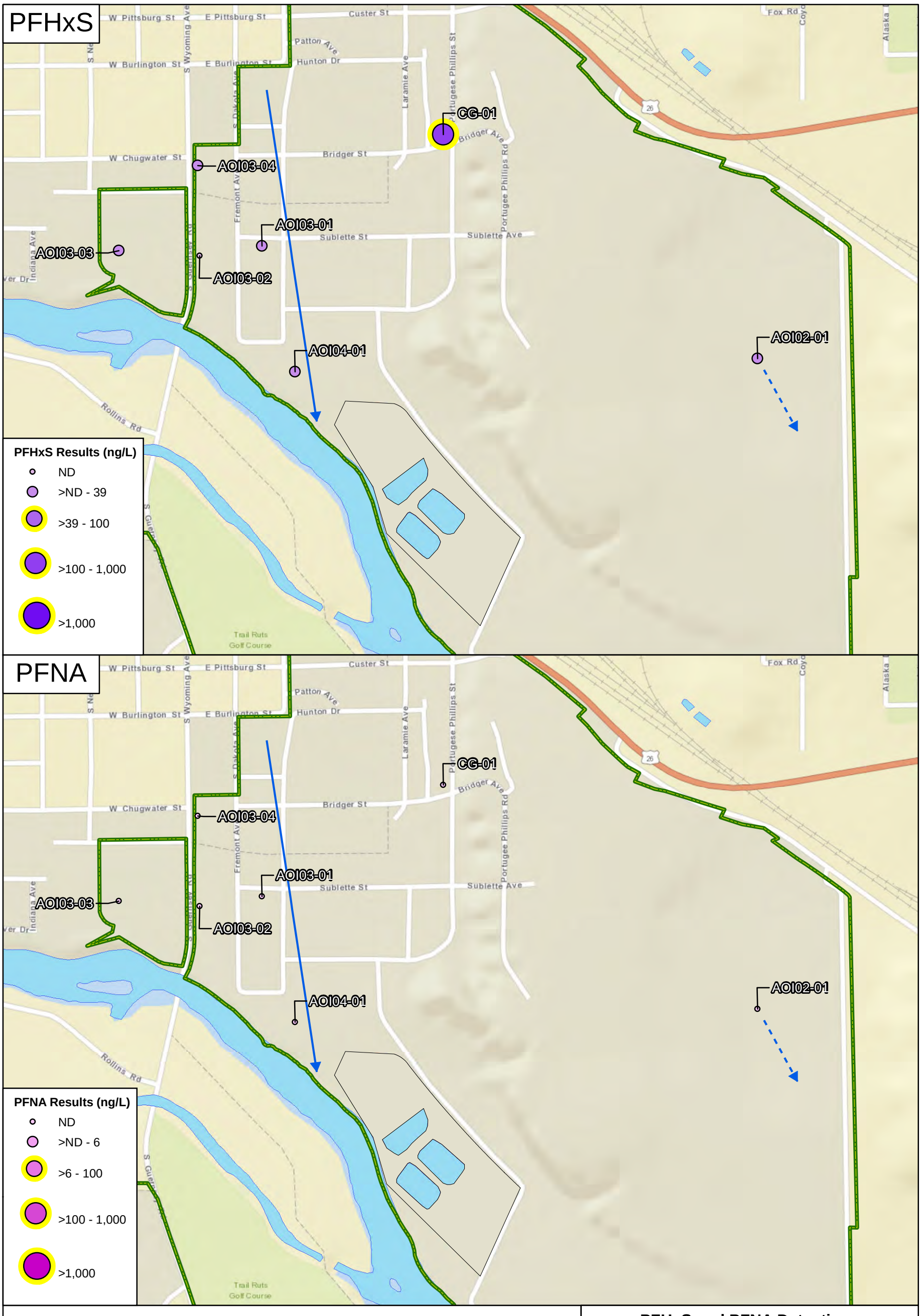
Figure 6-6



Exceedances of the OSD SL are depicted with a yellow halo.

PFHxS and PFNA Detections in Groundwater

CLIENT	ARNG			
PROJECT	Site Inspection at Camp Guernsey, WY			
REVISED	3/6/2023	GIS BY	MS	3/6/2023
SCALE	1:8,880	CHK BY	AG	3/6/2023
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong		PM	CM	3/6/2023

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Figure 6-7

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7. Exposure Pathways

The CSMs for each AOI, revised based on the SI findings, are presented on **Figure 7-1** through **Figure 7-4**. Please note that while the CSM discussion assists in determining if a receptor may be impacted, the decision to move from SI to RI or interim action is determined based upon exceedances of the SLs for the relevant compounds and whether the release is more than likely attributable to the DoD. A CSM presents the current understanding of the site conditions with respect to known and suspected sources, potential transport mechanisms and migration pathways, and potentially exposed human receptors. A human exposure pathway is considered potentially complete when the following conditions are present:

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

If any of these elements are missing, the pathway is incomplete. The CSM figures use an empty circle symbol to represent an incomplete exposure pathway. Areas with an incomplete pathway generally warrant no further action. However, the pathway is considered potentially complete if the relevant compounds are detected, in which case the CSM figure uses a half-filled circle symbol to represent a potentially complete exposure pathway. Additionally, a completely filled circle symbol is used to indicate when a potentially complete exposure pathway has detections of relevant compounds above the SLs. Areas with an identified potentially complete pathway that have detections of the relevant compounds above the SLs may warrant further investigation. Although the CSMs indicate whether potentially complete exposure pathways may exist, the recommendation for future study in an RI or no action at this time is based on the comparison of the SI analytical results for the relevant compounds to the SLs.

In general, the potential routes of exposure to the relevant compounds 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 toxicological study. The receptors evaluated are consistent with those listed in USEPA guidance for risk screening (USEPA, 2001). Receptors at the facility include site workers (e.g., facility staff and visiting soldiers), construction workers, trespassers, residents outside the facility boundary, and recreational users outside of the facility boundary.

7.1 Soil Exposure Pathway

The SI results in soil were used to determine whether a potentially complete pathway exists between the source and potential receptors at AOI 1, AOI 2, AOI 3, and AOI 4 based on the aforementioned criteria.

7.1.1 AOI 1

AOI 1 consists of Camp Guernsey Airfield, where controlled AFFF releases through familiarization training have occurred every 2 years beginning as early as the 1990s until 2004. Additional fire training or releases of AFFF may have occurred as recently as 2013 based on WYARNG provided aerial imagery. Firetrucks have been stationed at Fire House #1 or at the fire station parking annex. Fire House #1 was constructed in 1988 and is also used for firetruck cleaning. Additionally,

AFFF is stored in a warehouse next to Airfield Operations. Releases at AOI 1 may have occurred directly onto surface soil but may also have run off to surface soil or infiltrated to the subsurface soil via cracks in pavement or joints between areas that are paved with different materials.

Relevant compounds were detected below the SLs in surface soil at AOI 1. Site workers and construction workers could contact these constituents in surface soil via incidental ingestion and inhalation of dust. No ongoing construction was observed at the facility during the SI; therefore, the surface soil exposure pathway for site workers and future construction workers are potentially complete. The incidental ingestion and inhalation of dust exposure pathways for the trespasser receptor are considered potentially complete due to the potential for unauthorized access on Camp Guernsey. Residential structures are not located in the vicinity of AOI 1; therefore, the incidental ingestion and inhalation of dust exposure pathways for the residential receptors are considered incomplete. The industrial/commercial worker exposure scenario assumes excavation occurs at depths at or above 15 feet bgs. Relevant compounds were detected below the SLs in shallow subsurface soil (defined as 2 to 15 feet bgs) at AOI 1. Construction workers could contact constituents in shallow subsurface soil via incidental ingestion; therefore, the subsurface soil exposure pathway for future construction workers is potentially complete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.1.2 AOI 2

AOI 2 comprises an area east of the runway, where firetruck maintenance is reported to occur. This area includes the current UTES, CSMS, and FMS #5, which were constructed in 2001. Firetrucks may have used the interior wash racks within the CSMS and FMS #5 buildings. It is unknown if AFFF were in the firetrucks during maintenance or washing, if AFFF were potentially released during maintenance, and if firetrucks cleaned at the wash rack had residual AFFF on the exterior of the trucks. Any AFFF releases would have occurred on paved/concrete areas. AFFF released to the pavement or concrete could have run off to surface soil or infiltrated subsurface soil via cracks in pavement/concrete or joints between areas that are paved with different materials.

Relevant compounds were detected below the SLs in surface soil at AOI 2. Site workers and future construction workers could contact these constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathway for these receptors is potentially complete. The incidental ingestion and inhalation of dust exposure pathways for trespassers are considered potentially complete due to the potential for unauthorized access on Camp Guernsey. Residential structures are not located in the vicinity of AOI 2; therefore, the incidental ingestion and inhalation of dust exposure pathways for residential receptors are considered incomplete. Relevant compounds were not detected in shallow subsurface soil at AOI 2. Therefore, the subsurface soil exposure pathway for future construction workers is considered incomplete. The CSM for AOI 2 is presented on **Figure 7-2**.

7.1.3 AOI 3

AOI 3 consists of five areas on the west side of the facility where firetruck maintenance and/or AFFF storage were known to occur from prior to 1988 to present-day. Any AFFF releases would have occurred on paved/concrete areas. AFFF released to the pavement or concrete could have run off to surface soil or infiltrated subsurface soil via cracks in pavement/concrete or joints between areas that are paved with different materials.

Relevant compounds were detected below the SLs in surface soil at AOI 3. Site workers and future construction workers could contact these constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathways for site workers and future construction workers are potentially complete. The incidental ingestion and inhalation of dust

exposure pathways for trespassers are considered potentially complete due to the potential for unauthorized access on Camp Guernsey. AOI 3 is located at the facility boundary near a residential neighborhood and school with athletic fields. Therefore, the incidental ingestion and inhalation of dust exposure pathways for the residential and recreational user receptors are considered potentially complete. Relevant compounds were not detected in shallow subsurface soil at AOI 3. Shallow subsurface soil was not collected from one boring (AOI03-04); however, relevant compounds were not detected from the mid-point soil sample (15 to 20 feet bgs) collected at this location. Therefore, based on the results of the three shallow subsurface soil samples, the subsurface soil exposure pathway for future construction workers is considered incomplete. The CSM for AOI 3 is presented on **Figure 7-3**.

7.1.4 AOI 4

AOI 4 comprises the outdoor wash rack west of the airfield. Firetrucks are not permitted to be washed in the outdoor wash rack area; however, firetrucks were observed being washed there at least once since 2009. Releases at AOI 1 may have occurred directly onto surface soil but may also have infiltrated to the subsurface soil via cracks in pavement or joints between areas that are paved with different materials.

Relevant compounds were detected below the SLs in surface soil at AOI 4. Site workers and future construction workers could contact these constituents in surface soil via incidental ingestion and inhalation of dust. Therefore, the surface soil exposure pathway for site workers and future construction workers are potentially complete. The incidental ingestion and inhalation of dust exposure pathways for the trespasser is also considered potentially due to the potential for unauthorized access on Camp Guernsey. Residential structures are not located in the vicinity of AOI 4; therefore, the incidental ingestion and inhalation of dust exposure pathways for the residential receptors are considered incomplete. Relevant compounds were not detected in shallow subsurface soil at AOI 4. Therefore, the subsurface soil exposure pathway for future construction workers is incomplete. The CSM for AOI 4 is presented on **Figure 7-4**.

7.2 Groundwater Exposure Pathway

The SI results in groundwater were used to determine whether a potentially complete pathway exists between the source and potential receptors based on the aforementioned criteria.

7.2.1 AOI 1

Relevant compounds were detected above their SLs in groundwater sampled at CG-01. This location is in the observed upgradient direction of the AOI 1 footprint and may be indicative of potential unknown on- or off-facility sources; however, groundwater may also be affected by infiltration from the north end of the airfield or potentially by runoff that may convey downslope from the airfield and AOI 1 during heavy precipitation. Therefore, detections in CG-01 are considered potentially attributable to AOI 1. Public, domestic, and facility drinking water is provided by supply wells located in the alluvial aquifer along the North Platte River, some of which are located within the facility boundary. PFOA was detected in a drinking water sample collected at Camp Guernsey. Based on the presence of the drinking water supply wells and completion depths within the unconfined alluvial aquifer, the direct ingestion exposure pathway for site worker, trespasser, off-facility residential, and off-facility recreational user receptors is considered potentially complete. Depth to water measured at CG-01 in May 2022 during the SI was measured at 40.36 feet bgs. The industrial/commercial worker exposure scenario assumes excavation occurs at depths at or above 15 feet bgs. Based on the depth to groundwater at AOI 1, groundwater would likely not be encountered by construction workers, and the incidental ingestion

exposure pathway for future construction workers is considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.2.2 AOI 2

Relevant compounds were detected below their SLs in groundwater samples collected at AOI 2. The direct ingestion exposure pathway for site worker, trespasser, off-facility residential, and off-facility recreational user receptors is considered potentially complete for the same reasons established for AOI 1. Depth to water measured at AOI 2 in May 2022 during the SI was measured at 22.73 feet bgs; therefore, groundwater would likely not be encountered by construction workers, and the incidental ingestion exposure pathway for future construction workers is considered incomplete. The CSM for AOI 2 is presented on **Figure 7-2**.

7.2.3 AOI 3

Relevant compounds were detected below their SLs in groundwater samples collected at AOI 3. The direct ingestion exposure pathway for site worker, trespasser, off-facility residential, and off-facility recreational user receptors is considered potentially complete for the same reasons established for the other AOIs; therefore, the incidental ingestion exposure pathway for future construction workers is considered incomplete. The CSM for AOI 3 is presented on **Figure 7-3**.

7.2.4 AOI 4

PFOS was detected above the SL in groundwater AOI 4. The direct ingestion exposure pathway for site worker, trespasser, off-facility residential, and off-facility recreational user receptors is considered potentially complete for the same reasons established for the other AOIs. Depth to water measured at AOI 4 in May 2022 during the SI was measured at 19.72 feet bgs; therefore, the incidental ingestion exposure pathway for future construction workers is considered incomplete. The CSM for AOI 4 is presented on **Figure 7-4**.

7.3 Surface Water and Sediment Exposure Pathway

Surface water and sediment samples were not collected during the SI field mobilization at Camp Guernsey. The SI results in soil and groundwater, in combination with knowledge of the fate and transport properties of PFAS, were used to determine whether a potentially complete pathway exists between the source and potential receptors.

7.3.1 AOI 1

Relevant compounds were detected in soil at AOI 1 and in soil and groundwater at nearby associated sample location CG-01. Several stormwater infiltration basins are located to the south and east of the airfield and the North Platte River is located to the south. PFAS are water soluble and can migrate readily from soil to surface water and sediment via leaching and run-off. It is possible the compounds detected in soil may have migrated to the infiltration basins or off-facility to the North Platte River via over land surface water flow or infiltration; therefore, the surface water and sediment exposure pathways via incidental ingestion for the site worker, future construction worker, trespasser, and off-facility recreational user receptors are considered potentially complete. Surface water from North Platte River is not directly used as drinking water in the vicinity, so the surface water ingestion exposure pathway for residents is considered incomplete. The CSM for AOI 1 is presented on **Figure 7-1**.

7.3.2 AOI 2

Relevant compounds were detected in soil and groundwater at AOI 2. A stormwater infiltration basin is located just south of AOI 2, and drainage ditches may also channel water southeast from AOI 2 toward the North Platte River. Due to the water-soluble property of PFAS, it is possible the compounds detected in the surface soil at AOI 2 may have migrated via surface runoff or infiltration to the basin or the North Platte River. Therefore, the surface water and sediment ingestion exposure pathway for site worker, future construction worker, trespasser, or off-facility recreational users are considered potentially complete. The surface water exposure pathway for residents is considered incomplete for the same reasons established for AOI 1. The CSM for AOI 2 is presented on **Figure 7-2**.

7.3.3 AOI 3 and 4

Relevant compounds were detected in soil and groundwater at AOI 3 and AOI 4. It is possible that compounds detected in soil at these AOIs may have migrated via surface runoff or infiltration to the North Platte River, located to the south. The surface water and sediment exposure pathways via incidental ingestion for the site worker, future construction worker, trespasser, and off-facility recreational user receptors are considered potentially complete for the same reasons established for the other AOIs. The surface water exposure pathway for residents is considered incomplete for the same reasons established for the other AOIs. The CSMs for AOI 3 and AOI 4 are presented on **Figure 7-3** and **Figure 7-4**, respectively.

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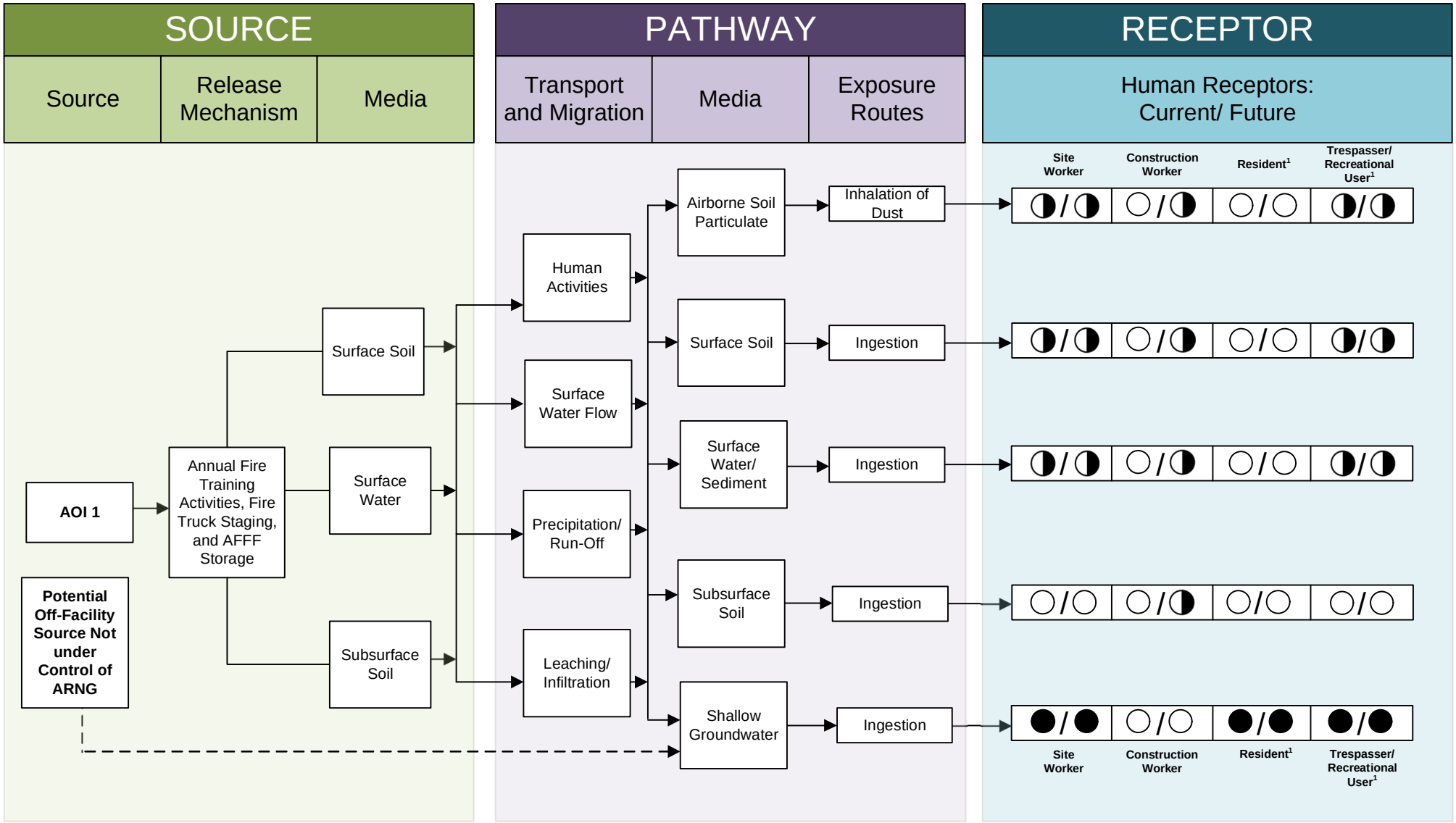


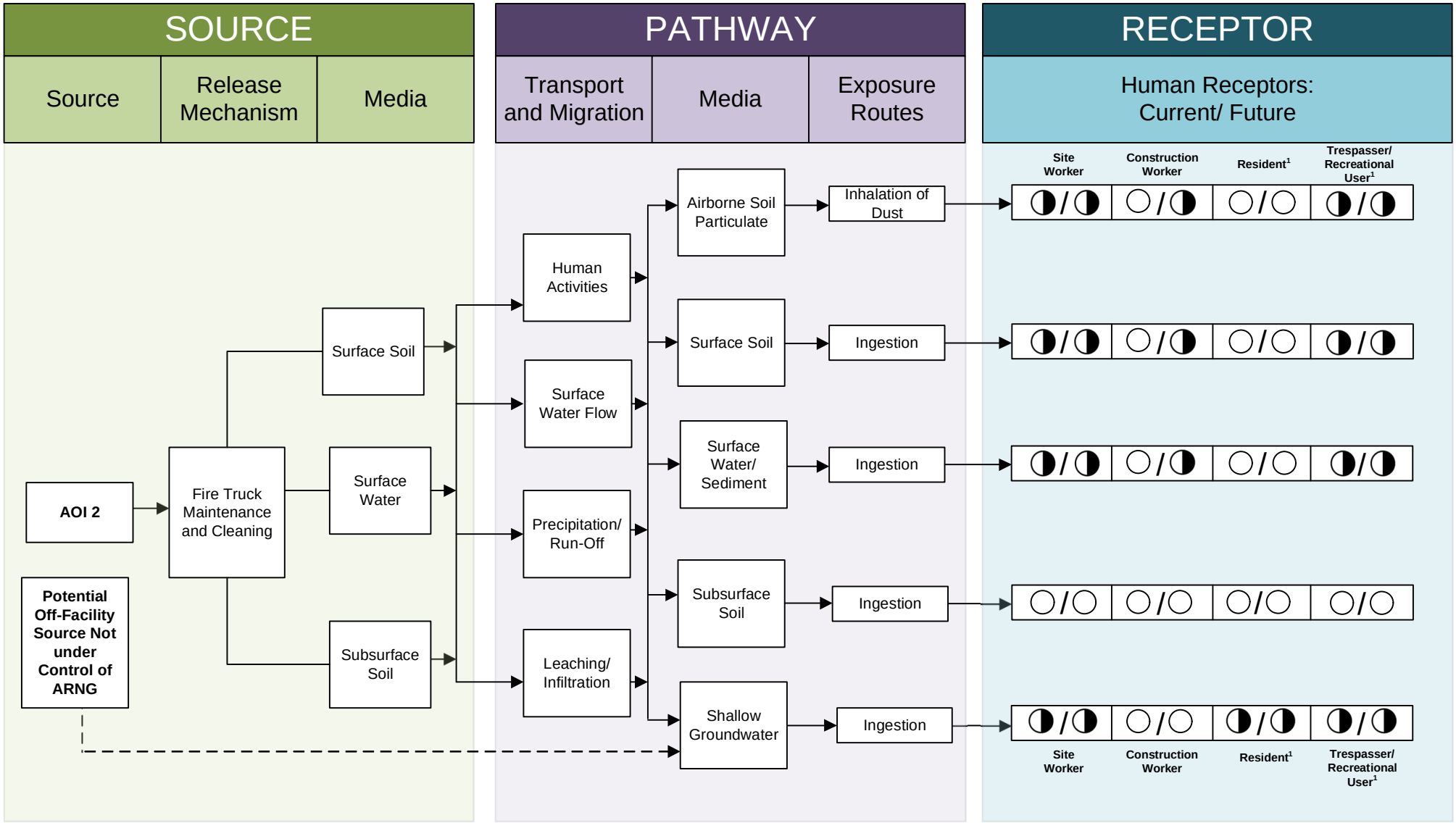
LEGEND

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

NOTES

1. The recreational users refer to off-site receptors. Residential users refers to both on-site and off-site receptors.
2. No active construction was observed at the AOI during the SI field event.

Figure 7-1
Conceptual Site Model, AOI 1
Camp Guernsey, Guernsey, Wyoming



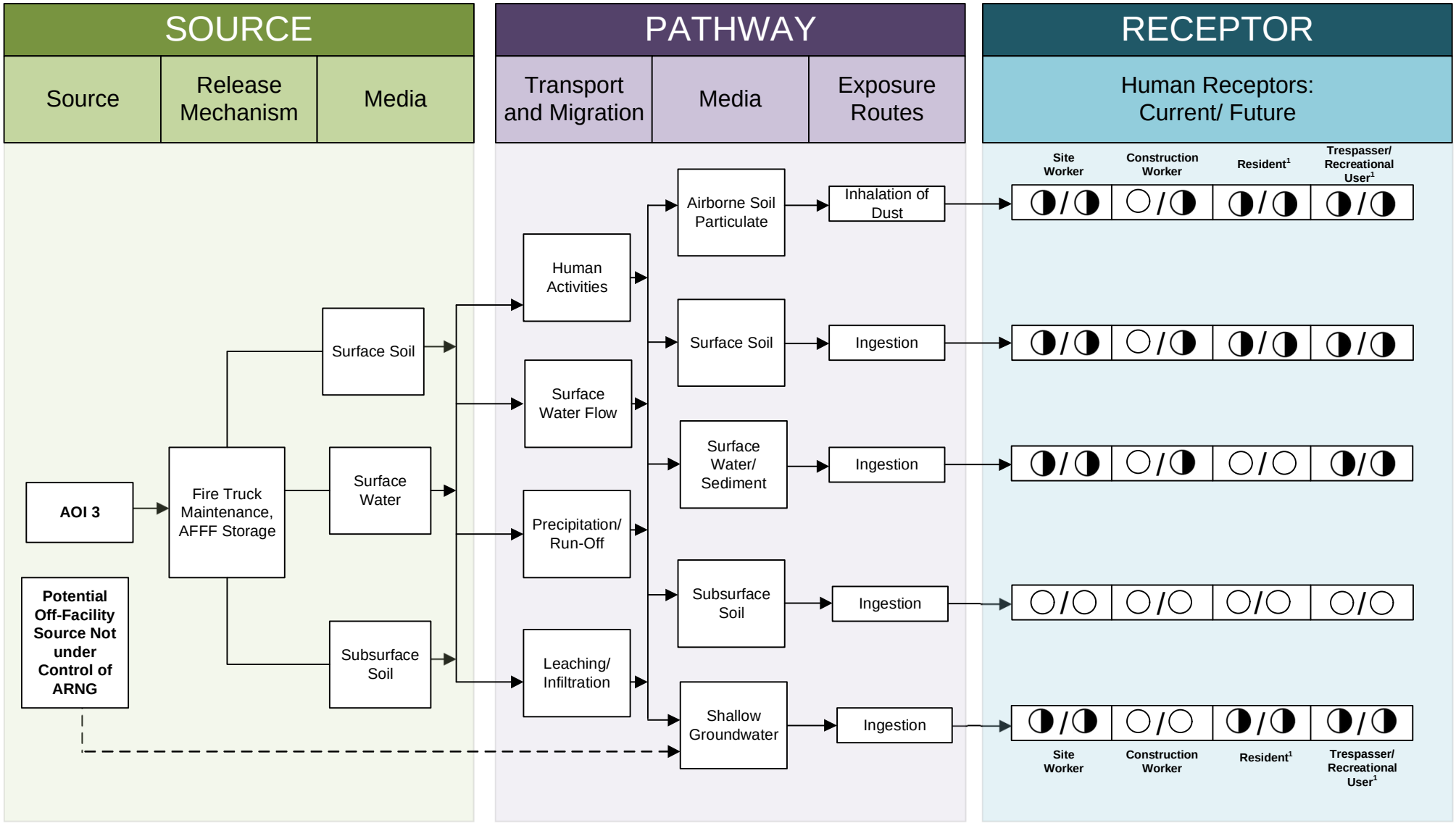
LEGEND

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

NOTES

1. The recreational users refer to off-site receptors. Residential users refers to both on-site and off-site receptors.
2. No active construction was observed at the AOI during the SI field event.

Figure 7-2
Conceptual Site Model, AOI 2
Camp Guernsey, Guernsey, Wyoming



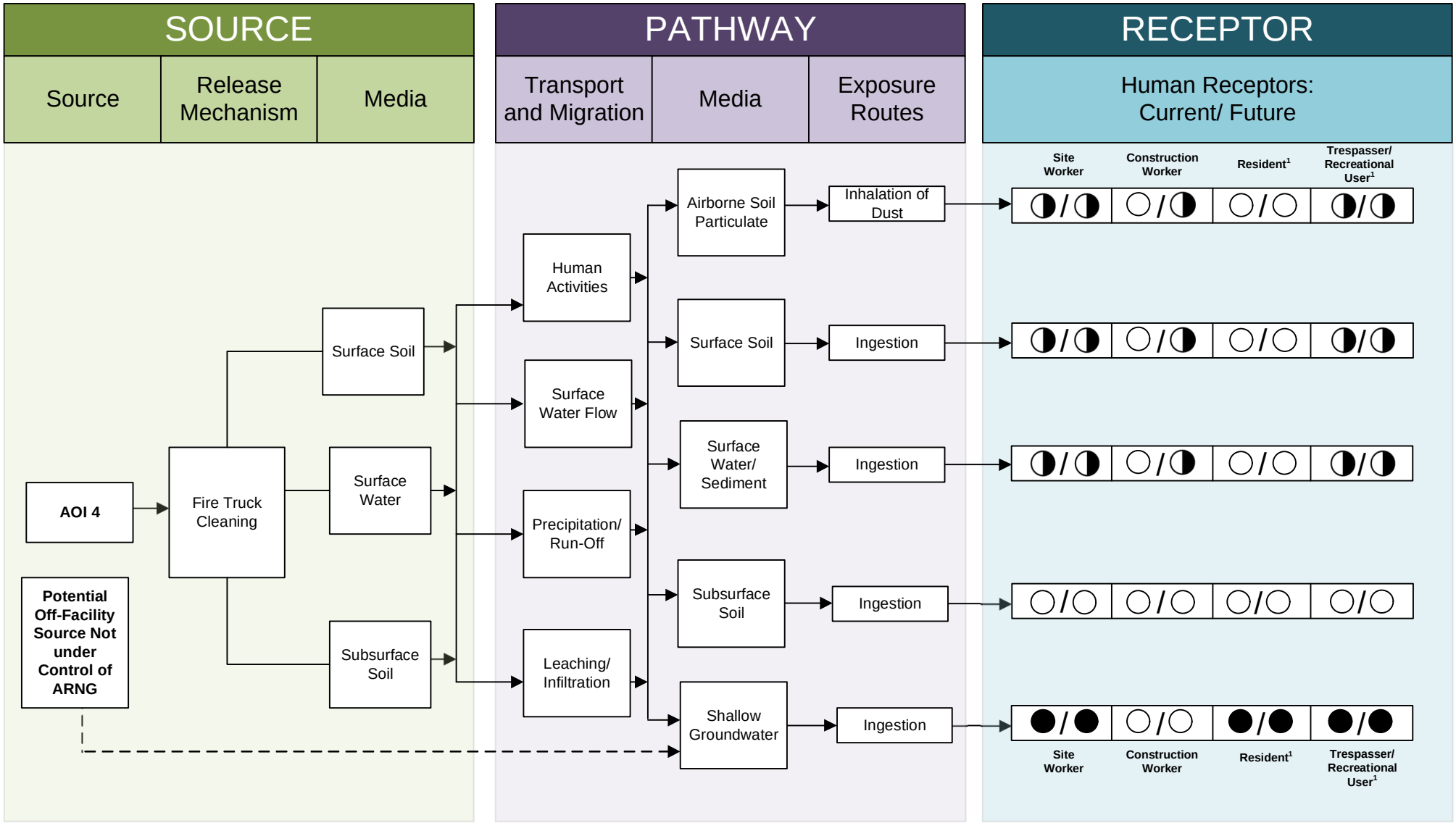
LEGEND

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

NOTES

1. The recreational users refer to off-site receptors. Residential users refers to both on-site and off-site receptors.
2. No active construction was observed at the AOI during the SI field event.

Figure 7-3
Conceptual Site Model, AOI 3
Camp Guernsey, Guernsey, Wyoming



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 recreational users refer to off-site receptors. Residential users refers to both on-site and off-site receptors.
2. No active construction was observed at the AOI during the SI field event.

Figure 7-4
Conceptual Site Model, AOI 4
Camp Guernsey, Guernsey, Wyoming

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

The SI field activities were conducted from 9 March, 21 April to 6 May, and 3 June 2022 and consisted of source water sample collection, utility clearance, HSA borings, soil sample collection, permanent groundwater sampling point installation, low-flow groundwater sample collection, and land surveying. Field activities were conducted in accordance with the SI QAPP Addendum (AECOM, 2021), except as noted in **Section 5.8**.

To fulfill the project DQOs set forth in the approved SI QAPP Addendum (AECOM, 2021), samples were collected and analyzed for a subset of 18 compounds by LC/MS/MS compliant with QSM 5.3 Table B-15 as follows.

- Fifty-one (51) soil samples from thirty-one (31) locations;
- Seven (7) grab groundwater samples from seven (7) permanent groundwater sampling points; and
- Twenty-seven (27) quality assurance QA/QC samples.

An SI is conducted when the PA determines an AOI exists based on probable use, storage, and/or disposal of PFAS-containing materials. The SI includes multi-media sampling at AOIs to determine whether or not a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required. Additionally, the CSMs were refined to assess whether a potentially complete pathway exists between the source and potential receptors for potential exposure at the AOIs, which are described in **Section 7**.

8.2 Outcome

Based on the results of this SI, further evaluation under CERCLA is warranted in an RI for AOI 1 and AOI 4; no further evaluation is warranted for AOI 2 and AOI 3 at this time (see **Table 8-1**). Based on the CSMs developed and revised in light of the SI findings, there is potential for exposure to site worker and residential drinking water receptors from AOI 1, AOI 2, AOI 3, and AOI 4 from sources on the facility resulting from historical DoD activities. Sample analytical concentrations collected during the SI were compared against the project SLs in soil and groundwater, as described in **Table 6-1**. A summary of the results of the SI data relative to the SLs is as follows:

- At AOI 1:
    - The detected concentrations of PFOA, PFOS, PFBS, PFHxS, and PFNA in soil were below their SLs.
    - PFOA and PFHxS in groundwater exceeded their SLs. PFOA exceeded the 6 ng/L SL, at a concentration of 79.2 ng/L at CG-01. PFHxS exceeded the 39 ng/L SL, at a concentration of 438 J ng/L at CG-01. PFOS and PFBS were detected below their SLs, and PFNA was not detected.

    - Based on the results of the SI, further evaluation of AOI 1 is warranted in an RI.
- At AOI 2:
    - The detected concentrations of PFOA, PFOS, PFBS, PFHxS, and PFNA in soil were below their SLs.
    - In groundwater, PFOA, PFOS, PFBS, and PFHxS were detected below their SLs. The maximum detected concentration of the relevant compounds was PFBS at 18.9 ng/L. PFNA was not detected in groundwater.
    - Based on the results of the SI, no further evaluation of AOI 2 is warranted at this time.
- At AOI 3:
    - The detected concentrations of PFOA, PFOS, PFBS, PFHxS, and PFNA in soil were below their SLs.
    - In groundwater, PFOA, PFOS, PFBS and PFHxS were detected below their SLs. The maximum detected concentration of the relevant compounds was PFBS at 11.9 ng/L. PFNA was not detected in groundwater.
    - Based on the results of the SI, no further evaluation of AOI 3 is warranted at this time.
- At AOI 4:
    - The detected concentrations of PFOA, PFOS, PFBS, PFHxS, and PFNA in soil were below their SLs.
    - PFOS in groundwater exceeded the 4 ng/L SL, at a concentration of 4.21 ng/L at AOI04-01. PFOS, PFBS, and PFHxS were detected below their SLs. PFNA was not detected.
    - Based on the results of the SI, further evaluation of AOI 4 is warranted in an RI.

Groundwater flow direction in the vicinity of Camp Guernsey was inferred to be predominantly southwest, toward the North Platte River. This inferred flow direction was used to determine SI sampling locations; however, the SI findings show an overall southeasterly groundwater flow direction throughout the Cantonment. Some uncertainty exists in the source of groundwater SL exceedances currently attributed to AOI 1 and AOI 4 as a result of the difference between the inferred and observed groundwater flow directions. The RI will address data gaps by refining the understood groundwater flow direction to help evaluate whether impacts observed during the SI may be attributable to other known or unknown release areas.

AFFF was reportedly used during training activities exclusively at the Camp Guernsey Airfield (AOI 1), but the mechanism of release and specific release locations of the training activities is unknown. The position of AOI 1 atop a terrace, as well as the resistant cemented gravel unit encountered during SI drilling, suggest that infiltration in the area may be limited and that releases at AOI 1 may transport via runoff to lower-lying areas during heavy precipitation events. This runoff may be the source of relevant PFAS compounds observed in groundwater at CG-01. However, uncertainty in the source exists due to the groundwater flow direction noted above, which suggests that potentially unidentified on- or off-facility sources may be another contributing factor. It is anticipated that the RI will address this data gap by evaluating areas upgradient from CG-01.

Of the six PFAS compounds presented in the 6 July 2022 OSD memorandum, HFPO-DA (commonly referred to as GenX) was not included as an analyte at the time of this SI. Based on the CSM developed during the PA and revised based on SI findings, the presence of HFPO-DA is not anticipated at the facility because HFPO-DA is generally not a component of MIL-SPEC

AFFF and based on its history including distribution limitations that restricted use of GenX, it is generally not a component of other products the military used. In addition, it is unlikely that GenX would be an individual chemical of concern in the absence of other PFAS.

Table 8-1 summarizes the SI results for soil and groundwater used to determine if an AOI should be considered for further investigation under CERCLA and undergo an RI.

Table 8-1: Summary of Site Inspection Findings and Recommendations

AOI	Potential Release Area	Soil – Source Area	Groundwater – Source Area	Future Action
1	Camp Guernsey Airfield	◐	●	Proceed to RI
2	Current Firetruck Maintenance Areas	◐	◐	No further action
3	Historic Maintenance and Storage Areas	◐	◐	No further action
4	Outdoor Wash Rack	◐	●	Proceed to RI

Legend:

● = detected; exceedance of the screening levels

◐ = detected; no exceedance of the screening levels

9. References

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