FINAL PRELIMINARY ASSESSMENT AND SITE INSPECTION OF PER- AND POLYFLUOROALKYL SUBSTANCES

Fort Leonard Wood, Missouri

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Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances

Fort Leonard Wood, Missouri

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EXECUTIVE SUMMARY

The United States Army (Army) 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 perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanesulfonic acid (PFBS), at Army installations (installations) nationwide. The PA identifies areas of potential interest (AOPIs) where PFAS-containing materials were used, stored, and/or disposed, or areas where known or suspected releases to the environment occurred. The SI includes multi-media sampling at AOPIs 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. This Fort Leonard Wood (FLW) PA/SI was completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), National Oil and Hazardous Substances Pollution Contingency Plan, and Army/Department of Defense (DoD) policy and guidance.

FLW is located in the Ozarks region of south-central Missouri almost entirely within Pulaski County, approximately 120 miles southwest of St. Louis, Missouri. The installation occupies 61,410 acres (Malcolm Pirnie 2006, USAEC 2017), has a population of approximately 96,148 as of April 2020 (DoD Military OneSource Network 2020), and is used for basic military training purposes.

The FLW PA identified 32 AOPIs for investigation during the SI phase. SI sampling results from all 32 AOPIs were compared to risk-based screening levels calculated by the Office of the Secretary of Defense (OSD) for PFOS, PFOA, and PFBS. PFOS, PFOA, and/or PFBS were detected in groundwater and/or at 28 AOPIs; however, only nine of those 28 AOPIs had PFOS, PFOA, and/or PFBS present at concentrations greater than the risk-based screening levels. The FLW PA/SI identified the need for further study in a CERCLA remedial investigation. **Table ES-1** below summarizes the PA/SI sampling results and provides recommendations for further study in a remedial investigation or no action at this time at each AOPI.

Table ES-1. Summary of AOPIs Identified during the PA, PFOS, PFOA, and PFBS Sampling at FLW, and Recommendations

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/NA/ND/NS)				Recommendation
	GW	SO	SW	SE	
ARNG Hangars (Buildings 5010 and 5012)	NS	No	NS	NS	Supplemental groundwater sampling is recommended
DPW Old Fire Training Area (TA 210, FLW-028)	NS	No	NS	NS	Supplemental groundwater sampling is recommended
New Fire Training Area (TA 207, FLW-029)	NS	Yes	NS	NS	Further study in a remedial investigation
Old Fire Training Area at Landfill 3 (FLW-053)	Yes	Yes	NS	NS	Further study in a remedial investigation
Old Fire Training Area Runway End (FLW-054)	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Active Fire Station #1 (Building 580)	NS	Yes	NS	NS	Further study in a remedial investigation
Active Fire Station #2 (Building 5001)	NS	Yes	NS	NS	Further study in a remedial investigation
Former Fire Station #1 (Triangle Station)	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Former Fire Station #2 (Oklahoma Avenue)	No	ND	NS	NS	No action at this time
Former Fire Station #3 (Troop Trail)	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026)	NS	No	NA	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	Yes	Yes	NS	NS	Further study in a remedial investigation
Biosolids Application Field #17 (Landfill 15, FLW-020)	No	No	NS	NS	No action at this time
Biosolids Application Field #18 (Landfill 2, FLW-002)	ND	No	NS	NS	No action at this time
Biosolids Application Field #2 (Landfill 9, FLW-011)	NS	Yes	NS	NS	Further study in a remedial investigation
Biosolids Application Field #3 (Landfill 8, FLW-010)	NS	Yes	NS	NS	Further study in a remedial investigation

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/NA/ND/NS)				Recommendation
	GW	SO	SW	SE	
Biosolids Application Field #5 (Landfill 12, FLW-017)	Yes	No	NA	NA, ND	Further study in a remedial investigation
Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059)	No	No	NA	NA, ND	No action at this time
Biosolids Application Field #19 (Landfill on a Branch to Big Piney, FLW-060)	ND	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #6	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #7	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #8	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003)	Yes	Yes	NS	NS	Further study in a remedial investigation
Biosolids Application Field #11	NS	ND	NS	NS	No action at this time
Biosolids Application Field #12	NS	ND	NS	NS	No action at this time
Biosolids Application Field #13	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #14	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #15	NS	ND	NS	NS	No action at this time
Biosolids Application Field #16	NS	ND	NS	NS	No action at this time
Biosolids Application Field #20	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #21	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #27A	NS	No	NS	NS	Supplemental groundwater sampling is recommended

Notes:
Light gray shading – detection greater than the OSD risk screening level
GW – groundwater

NA – not applicable
ND – non-detect
NS – not sampled
SE – sediment
SO – soil
SW – surface water

1 INTRODUCTION

The United States (U.S.) Army (Army) 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 perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutanesulfonic acid (PFBS), at Army installations (installations) nationwide. The Army is the lead agency under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Executive Order 12580 and is conducting the PA/SI consistent with its authority under CERCLA, 42 United States Code §§ 9600, et seq. (as amended), and the Defense Environmental Restoration Program, 10 United States Code §§ 2701, et seq. The PFAS PA/SI included two distinct efforts. The PA identified locations that are areas of potential interest (AOPIs) at Fort Leonard Wood (FLW) based on the use, storage and/or disposal of PFAS-containing materials, in accordance with the 2018 Army Guidance for Addressing Releases of Per-and Polyfluoroalkyl Substances (Army 2018). The SI included multi-media sampling at AOPIs to determine whether or not a release has occurred, and the PFOS, PFOA, and PFBS results were compared to the Office of the Secretary of Defense (OSD) PFOS, PFOA, and PFBS risk screening levels to determine whether further investigation is warranted. This report provides the PA/SI for FLW and was completed in accordance with CERCLA and The National Oil and Hazardous Substances Pollution Contingency Plan.

1.1 Project Background

PFAS are a class of compounds that have been used in a wide range of industrial applications and commercial products due to their unique surface tension/leveling properties. Due to industry and regulatory concerns about the potential health effects and adverse environmental impacts, there has been a reduction in the manufacture and use of PFAS worldwide. In the U.S., significant reductions in the production, importation, and use of PFOS and PFOA (two individual compounds in the PFAS class) occurred between 2001 and 2015 (Interstate Technology Regulatory Council 2017). PFBS replaced PFOS in some applications and is currently used and manufactured in the U.S.

In 2016, the United States Environmental Protection Agency (USEPA) established a lifetime health advisory of 70 nanograms per liter (ng/L) in drinking water for PFOS or PFOA and for the sum of PFOS and PFOA when both are present (USEPA 2016). On 15 October 2019, the OSD provided guidance on the investigation of PFOS, PFOA, and PFBS at Department of Defense (DoD) restoration sites (OSD 2019). The DoD guidance provides risk screening levels for PFOS, PFOA, and PFBS in tap water or soil, calculated using the USEPA's Regional Screening Level (RSL) calculator for residential and industrial/commercial worker receptor scenarios. Following the issuance of the 2019 OSD memo, on 08 April 2021, USEPA published an updated toxicity assessment for PFBS (USEPA 2021). Based on the updated toxicity assessment for PFBS, the OSD issued a memorandum on 15 September 2021 to include updated PFBS risk screening levels. The September 2021 Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program is provided for reference as **Appendix A**. The OSD risk screening levels for tap water (also used to evaluate groundwater or surface water used as drinking water sources) are 40 ng/L for PFOS and PFOA, and 600 ng/L for PFBS. The PFOS and PFOA soil screening levels for the residential and industrial/commercial scenarios are 0.13 milligrams per kilogram (mg/kg) (residential) and 1.6 mg/kg (industrial/commercial). The soil

screening levels for PFBS are 1.9 mg/kg (residential) and 25 mg/kg (industrial/commercial). These screening criteria are discussed further in **Section 6.5**.

1.2 PA/SI Objectives

This PA/SI was conducted consecutively because the results of the PA yielded AOPIs that necessitated continuing onto the SI phase in accordance with CERCLA. Consequently, this report provides the combined objectives of both PA and SI reports.

1.2.1 PA Objectives

During the PA, investigators collect readily available information and conduct site reconnaissance. This PA will evaluate and document areas where PFAS-containing materials were used, stored, and/or disposed, so the Army can distinguish between sites that pose little or no threat to human health and the environment and sites that require further investigation.

1.2.2 SI Objectives

An SI is conducted when the PA determines an AOPI exists based on probable use, storage, and/or disposal of PFAS-containing materials. The SI includes multi-media sampling at AOPIs 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.

Installation-specific data quality objectives (DQOs) and the sampling design and rationale are summarized in **Sections 6.1** and **6.2**.

1.3 PA/SI Process Description

For FLW, PA and SI development processes are described below. **Section 3** provides a summary of the PA activities completed, and **Section 6** provides a summary of the SI activities completed for FLW. The PA and SI processes are documented in the PA/SI Quality Control Checklist included as **Appendix B**.

1.3.1 Pre-Site Visit

First, an installation kickoff teleconference was held between applicable points of contact (POCs) from United States Army Environmental Command (USAEC), United States Army Corps of Engineers (USACE), FLW, and Arcadis U.S., Inc. (Arcadis). The kickoff call occurred 09 November 2018, five weeks before the site visit to discuss the goals and scope of the PA, project scheduling, installation access, timeline for the site visit, access to installation-specific databases, and to request available records.

Records review was conducted before the site visit to obtain electronically available documents from the installation and external sources for review. The purpose of the records research was to identify any area on the installation that may have been a location where PFAS-containing materials were used, stored, and/or disposed, as well as gather information on the physical setting and site history at FLW.

A read-ahead package was prepared and submitted to the appropriate POCs two weeks before the site visit. The read-ahead package contains the following information:

- The Installation Management Command (IMCOM) operation order
- The Army PA Operations Security requirements package, which includes the antiterrorism/operations security review cover sheet (**Appendix C**)
- The PFAS PA kickoff call minutes
- An information paper on the PA portion of the Army's PFAS PA/SI
- Contact information for key POCs
- A list of the data sources requested and reviewed
- A list of preliminary locations identified during the kickoff call and pre-site visit records review to be evaluated for use, storage, and/or disposal of PFAS-containing materials, where additional information on those areas will be collected through personnel interviews, additional document review, and site reconnaissance.
- A list of roles for the installation POC to consider when recommending potential interviewees.

1.3.2 Preliminary Assessment Site Visit

The site visit was conducted on 10 to 12 December 2018. An in-brief meeting was held to provide installation staff with the objectives of the site visit and team introductions. **Section 3** includes information regarding personnel interviewed.

Personnel interviews were conducted with individuals having significant historical knowledge at FLW. The interviews focused on confirming information discussed in historical documents, collecting information that may have not been in historical documents, corroborating other interviewees' information.

Site reconnaissance included visual surveys that assessed the points of potential use, storage, and/or disposal of PFAS-containing materials, as well as potential secondary impacts, and the migration potential from each AOPI (e.g., stormwater drains, building drains and sumps, cracks in the floor/pavement). Physical attributes of the preliminary locations were documented, including local slope and ground and floor conditions (i.e., paved, unpaved, visual staining), surface water bodies and surface flow, potential receptors, and the distance to the installation boundary. Access to existing groundwater monitoring wells, if present, were also noted during the site reconnaissance in case the monitoring wells could be proposed for SI sampling. Photo documentation of the preliminary locations was collected, and access limitations or advantages related to potential future sampling activities were noted.

An exit briefing was offered to installation personnel at the conclusion of the site visit to raise any items identified during the site visit, discuss any follow-up items, and review the schedule for submitting deliverables. The exit briefing was conducted on 12 December 2018 with the installation, USAEC, and USACE to discuss preliminary findings of the PA site visit.

1.3.3 Post-Site Visit

Information collected before, during, and after the site visit was reviewed and corroborated by cross-referencing records and reviewing interview details and observations noted during site visit reconnaissance. A site visit trip report was completed and provided to the installation POC, applicable USAEC POCs, and USACE regional POCs following the site visit. The information collected during the pre-site visit and site visit activities was compiled to develop the installation-specific PA portion of the PA/SI report (**Section 3**). Site data obtained during the PA were used to develop preliminary conceptual site models (CSMs) for each AOPI, which serve as the basis for developing the SI scope of work presented in an installation-specific Quality Assurance Project Plan (QAPP) Addendum.

1.3.4 Site Inspection Planning and Field Work

The SI process was initiated at the installation to evaluate PFOS, PFOA, and PFBS presence or absence at each AOPI and determine whether further investigation is warranted. First, an SI kickoff teleconference was held between the Army PA team and FLW.

The objectives of the SI kickoff teleconference were to:

- discuss the AOPIs selected for sampling
- identify specific installation access requirements and potential schedule conflicts
- discuss general SI deliverable and field work schedule information and logistics

Following development of the SI sampling technical approach, an SI scoping teleconference was held to obtain concurrence on the SI sampling plan from USAEC, USACE, and the installation. Additional discussion topics included:

- discussion of proposed sampling locations at each AOPI
- gauge regulatory involvement (Missouri Department of Natural Resources and USEPA) requirements or preferences
- confirm the plan for investigation-derived waste (IDW) handling and disposal
- provide an updated SI deliverable and field work schedule.

A Programmatic Uniform Federal Policy-Quality Assurance Project Plan (PQAPP) was developed and finalized in October 2019 for the USAEC PFAS PA/SI (Arcadis 2019). The PQAPP details general planning processes for collecting data and describes the implementation of quality assurance (QA) and quality control (QC) activities for the SI portion for Army installations nationwide. Additionally, an installation-specific QAPP Addendum was developed to define the DQOs, present the sampling design and rationale, and provide qualifications for project personnel. The SI field work was completed in accordance with the PQAPP (Arcadis 2019) and the approved installation-specific QAPP Addendum. A Site Safety and Health Plan (SSHP) was also developed as an attachment to the QAPP Addendum to identify specific health and safety hazards that may be encountered at the installation during sampling. The SSHP was designed to supplement the Accident Prevention Plan (Arcadis 2018), which was developed for Army installations nationwide. The QAPP Addendum and SSHP were submitted to the installation and finalized before commencement of field work.

The DQOs, sampling design and rationale, and field methods employed for the SI are summarized from the QAPP Addendum developed for FLW (Arcadis 2020) in **Sections 6.1** through **6.3**.

After finalization of the QAPP Addendum and SSHP, field planning and coordination with the installation and subcontractors was completed. Once the schedule was determined, field teams mobilized to the installation to complete the scope of work defined in the QAPP Addendum.

1.3.5 Data Analysis, Validation, and Reporting

Environmental samples collected during the SI were submitted to a laboratory which is DoD Environmental Laboratory Accreditation Program (ELAP)-accredited for PFOS, PFOA, and PFBS analysis by liquid chromatography with tandem mass spectrometry and compliant with the DoD Quality Systems Manual (QSM) 5.3 (DoD and Department of Energy 2019). Laboratory analytical results were then validated and verified by a project chemist to assess the usability of the data collected. Validated analytical results were summarized in the context of OSD risk screening levels (defined in **Section 6.5**).

2 INSTALLATION OVERVIEW

The following subsections provide general information about FLW, including the location and layout, the installation mission(s) over time, a brief site history, current and projected land use, climate, topography, geology, hydrogeology, surface water hydrology, potable wells within a 5-mile radius of the installation, and applicable ecological receptors.

2.1 Site Location

FLW is situated in the Ozarks region of south-central Missouri almost entirely within Pulaski County, approximately 120 miles southwest of St. Louis, Missouri. **Figure 2-1** depicts the site location and **Figure 2-2** depicts the installation layout of FLW. The installation occupies 61,410 acres and is bordered by the Mark Twain National Forest to the south, east, and west and by the towns of St. Robert and Waynesville to the north (Malcolm Pirnie 2006, USAEC 2017). The installation is bordered on the west by Roubidoux Creek and on the east by the Big Piney River (USAEC 2017). The population of FLW was 96,148 as of April 2020 (DoD Military OneSource Network 2020). Most are retirees and family members of retirees (55,170) and family members of active-duty personnel (12,183). The total number of military personnel is 19,268; Department of the Army civilians numbered 3,825; and other civilians totaled 5,702. The towns of St. Robert and Waynesville, to the north, have an estimated combined population of 9,170 (DoD Military OneSource Network 2020).

2.2 Mission and Brief Site History

In 1940, the Army established FLW to serve as a basic training center. The installation's mission later evolved into the Maneuver Support Center of Excellence which aims to develop competent leaders of character and deliver Army engineering characteristics; chemical, biological, radiological, and nuclear; military police; and maneuver support capabilities to enable mission success across the range of military operations (USAEC 2017).

2.3 Current and Projected Land Use

FLW uses 53,594 acres for basic military training purposes (Malcom Pirnie 2006). ARID-GEO 2006 identified 252 ranges, including artillery/mortar ranges, impact areas, demolition ranges, grenade and grenade launcher ranges, engineering qualification ranges, mine warfare areas, small arms ranges, and training area (TA) sites. One of the ranges in the southwest corner of FLW is also used by the U.S. Air Force as an air-to-ground gunnery range where practice military munitions are expended. Administrative and commercial buildings are concentrated in the cantonment area in the north-central portion of the installation. The former Forney Army Airfield, which was renamed Waynesville - St. Robert Reginal Airport in 1998, is also located in the north-central portion of the installation and contains the Army National Guard (ARNG) Hangars (Buildings 5010 and 5012) AOPI. This airport is currently used by the military as well as the public. The installation hospital is located within the cantonment area and recreational areas, including the FLW golf course and the Stone Mill Spring Trout Fishing Area, are found in the northeast section of the installation, where training activities are limited. An old quarry also exists in this vicinity. Additionally, fishing is permitted within the operational area and at Bloodland Lake, which is in the middle

of FLW. A trout fishing location is found on Roubidoux Creek, north of the installation. This area is just downstream of Roubidoux Spring and the city of Waynesville.

FLW has an agreement with the U.S. Department of Agriculture for use of the on-installation portions of Mark Twain National Forest (Malcom Pirnie, 2006). These areas have been designated for military training purposes. Historically, FLW held permits for using off-installation forestland. These permits have expired, and two off-installation areas are former range sites that are now part of the Military Munitions Response Program.

2.4 Climate

FLW has a temperate climate with warm, humid summers and cool, wet winters (Malcolm Pirnie 2006). The long-term average monthly temperatures from the FLW weather station, located at the eastern side of the cantonment area at the intersection of Oklahoma Avenue, South Dakota Avenue, and Piney Hills Drive, range from 31.7 degrees Fahrenheit in January to 77.6 degrees Fahrenheit in July (High Plains Regional Climate Center 2020). The average annual precipitation is reported as approximately 47 inches (High Plains Regional Climate Center 2020).

2.5 Topography

FLW lies in the Salem Plateau of the Ozark Plateaus Physiographic Province, a region of rolling uplands that are dissected by narrow steep-walled valleys. Most of FLW is located on a broad upland ridge between the valleys formed by the Big Piney River and Roubidoux Creek (**Figure 2-3**). The relief at FLW is shaped by the uplift of the Ozark Dome in southern Missouri and local erosion of the uplifted strata from precipitation runoff and flow of surface water bodies, primarily stream incision. Regional elevation ranges from approximately 1,150 feet above mean sea level along the central ridge to 750 feet at the Big Piney River at the northeastern portion of the installation (United States Geological Survey [USGS] 1996).

2.6 Geology

FLW overlies between 1,500 and 2,000 feet of nearly flat-lying Paleozoic sedimentary bedrock (Imes and Emmett 1994). Of this thickness, approximately the upper 1,000 feet of rock belong to the regionally extensive Ozark Aquifer. At FLW, the Ozark Aquifer system includes five formations (from shallowest to deepest): Jefferson City Dolomite, Roubidoux Formation, Gasconade Dolomite, Eminence Dolomite, and Potosi Dolomite. Only the upper three formations (Jefferson City, Roubidoux, and Gasconade) are exposed at the surface at FLW. These three units are described as follows:

- **Jefferson City Dolomite,** present only at high elevations in south and central FLW, at thicknesses up to 49 feet. The unit is unsaturated but may locally restrict infiltration.
- **Roubidoux Formation**, totaling about 120 feet thick, including variable thicknesses of residuum formed of partially decomposed rock. The total thickness includes multiple layers of sandy clay, chert, sandstone, unconsolidated sand, and some dolomite. The Roubidoux surface is deeply eroded throughout most of the installation, and completely truncated in the river valleys.
- **Gasconade Dolomite**, totally about 300 feet thick, mostly composed of cherty dolomite. The Gasconade outcrops only in the valleys, often forming steep bluffs.

2.7 Hydrogeology

In the upland areas of FLW, the water table generally lies in the Roubidoux or Gasconade Formation at depths ranging from 130 to 300 feet. The Gasconade Dolomite hosts a mature karst aquifer, meaning it has developed networks of solution cavities that control groundwater flow much like a tributary stream network controls surface water runoff. Expressions of karst in the area include sinkholes, caves, voids observed in boreholes, large springs, and the absence of minor perennial streams. The absence of minor streams reflects the deep water table and the high bulk transmissivity of the karst drainage network, which acts to “pirate” surface flow.

Groundwater flow within FLW occurs in several discrete spring basins. Recharge within each basin is captured by a karst drainage network and discharged to surface water at springs on the Big Piney River or Roubidoux Creek (**Figure 2-2**). The dominant flow direction is northward; however, the directions vary in each basin. Dye trace studies completed by the USGS have mapped the approximate bounds of several spring basins under northwestern FLW (Schumacher and Imes 2000). The primary springs identified as potential groundwater discharge points for areas of FLW include Shanghai Spring (draining most of the cantonment area), Sandstone Spring and Miller Spring (draining the west central portion of FLW) and Roubidoux Spring (draining a portion of western FLW).

2.8 Surface Water Hydrology

The topography at FLW divides surface drainage into approximate eastern and western halves (**Figures 2-2 and 2-4**). The eastern side, which includes FLW’s cantonment area, lies within the Big Piney River watershed. The western side drains to Roubidoux Creek. Both watersheds flow northward, joining the Gasconade River a short distance north of Interstate 44.

The Big Piney River and Roubidoux Creek are fed by several ephemeral streams that are eroded into the upland areas of FLW. These channels are typically dry but will carry runoff during major storm events. Except in major storm events, runoff entering ephemeral streams infiltrates quickly to groundwater. The perennial streams such as the Big Piney River are largely fed by springs that discharge groundwater at discrete points in the river valleys. These groundwater-surface water interactions have been studied extensively by the USGS through dye tracer studies (USGS 1997, Malcolm Pirnie 2006).

2.9 Relevant Utility Infrastructure

The following subsections provide general information regarding the installation’s stormwater and wastewater management systems, as well as information on how the utility infrastructures may influence the fate and transport of PFAS constituents at FLW.

2.9.1 Stormwater Management System Description

Stormwater on FLW is mostly conveyed via natural tributaries to the Big Piney River or Roubidoux Creek. **Figure 2-4** illustrates a watershed topography map with sub-watersheds and identifies industrial and Municipal Separate Storm Sewer System permitted outfalls. According to the current FLW industrial stormwater permit, existing outfalls on **Figure 2-4** release to the watersheds as follows:

Big Piney River

- #006 (via tributary to Big Piney River)
- #007 (via tributary to Big Piney River)
- #018 (directly and via tributary to Big Piney River)
- #025 (via tributary to Big Piney River)
- #026 (via tributary to Big Piney River)
- #027 (via Demolition Hollow)
- #028 (via Quarry Hollow and tributary to Big Piney River)
- #029 (via Quarry Hollow and tributary to Big Piney River)

Roubidoux Creek

- #012 (via Hurd Hollow)
- #014 (via tributary to Roubidoux Creek)
- #015 (directly)
- #019 (via Smith Branch)
- #020 (via Smith Branch)
- #022 (via Hurd Hollow)
- #023 (via Hurd Hollow)
- #024 (via Smith Branch)

2.9.2 Sewer System Description

The Sewage Treatment Plant (STP) and Lagoons AOPI has historically treated and currently treats wastewater generated at FLW (see **Section 5.2.11** for AOPI details). The STP is in the northeastern portion of FLW approximately 0.5 mile from the installation boundary. The STP effluent discharges to Dry Creek, which flows north adjacent to the lagoons, and is a tributary of the Big Piney River. Under typical conditions, the STP effluent infiltrates within the Dry Creek streambed before reaching the Big Piney River. The former lagoon (FLW-026) received digester wastes from the STP from 1967 to 1986. Sludge removal and excavation of the former lagoons was completed in 1986.

The current lagoon is adjacent (northwest) to the former lagoons, less than 50 feet apart. The sludge from the current lagoon is used for biosolids application at FLW. Active fields with recent and historical application of biosolids potentially containing PFOS, PFOA, and/or PFBS include Biosolids Application Fields #1, #2, #3, #5, #9, #10, #13, #14, #17, #18, #19, #20, and #27A AOPIs (Arcadis 2020). Inactive fields with historical application of biosolids potentially containing PFOS, PFOA, and/or PFBS include Biosolids Application Fields #6, #7, #8, #11, #12, #15, #16, #21, and #22 AOPIs.

2.10 Potable Water Supply and Drinking Water Receptors

FLW has 17 on-post potable wells located throughout the installation (**Figure 2-2**). FLW receives more than 98 percent (%) of its water supply from a surface water intake on the Big Piney River, which may also be used by other entities downgradient from FLW, along the installation's eastern boundary. This is unique as most regional drinking water is derived from groundwater systems (Malcolm Pirnie 2006). FLW supplements its water supply during times of peak demand with water from the Indiana Street Well located in the cantonment area. This well is cased to 440 feet below ground surface (bgs) with a total depth of 1,025 feet bgs. The remaining 16 drinking water wells provide smaller quantities of water to isolated facilities and TAs. These wells each have their own treatment system and the water within is chlorinated; they range in casing depth from 30 to 488 feet bgs and in total depth from 120 to 1,025 feet bgs (Malcolm Pirnie 2006).

An Environmental Data Resources, Inc. (EDR) report includes search results from a variety of environmental, state, city, and other publicly available databases for a referenced property. An EDR report was generated for FLW, which along with state and county GIS provided by the installation identified an estimated 352 private wells (i.e., domestic, multi-family, and irrigation) within 5 miles of the installation boundary (**Figure 2-5**). Multiple off-post potable wells were identified in areas potentially downgradient of all identified AOPIs at FLW. The EDR report providing well search results is provided as **Appendix E**.

Off-installation, multiple public water supply wells are located to the north and northwest of FLW. St. Robert and Waynesville obtain drinking water from five wells and seven wells, respectively, within 5 miles of the installation boundary (Missouri Department of Natural Resources 2019). These wells are screened from approximately 800 to 1,200 feet bgs (USGS 1997, Malcolm Pirnie 2006).

2.11 Ecological Receptors

The PA team collected information regarding ecological receptors that was available in the installation documents reviewed during the PA process. The following information is provided for future reference should the Army decide to evaluate exposure pathways relevant to the ecological receptors.

2.11.1 Habitat Types

Hardwood forests provide the bulk of the habitat for wildlife at FLW (Malcom Pirnie 2006). Groundcover vegetation includes forest floor woody shrubs and herbaceous plants. Important surface water habitat is found in the Big Piney River and in Roubidoux Creek. The Big Piney River is a Missouri Class P stream (i.e., maintains permanent flow during drought conditions), is suitable for aquatic life, is a source of drinking water, and is used for recreation. Roubidoux Creek is a losing stream that is given a Class C designation due to its intermittence in the dry season. A Class C stream is suitable for all uses other than human consumption of the water. Roubidoux Creek can maintain aquatic life during dry periods due to the formation of small pools in the riverbed. FLW also provides habitat for Indiana and gray bats. Bats can forage in FLW hardwood uplands and roost in the caves provided by FLW karst geology.

2.11.2 Ecological Receptors

Ecological receptors include threatened and endangered species and sensitive environments. Wetlands are dispersed throughout FLW but are primarily associated with the Big Piney River and Roubidoux Creek, which form portions of the eastern and the western boundaries of the installation, respectively. These streams also contain high-quality trout fisheries. Perennial streams, small springs, seeps, and sinkhole ponds are also found at FLW. Ecological receptors south of the installation are generally not of concern because surface water and groundwater flow directions are generally away from this area.

Federal endangered species at FLW include the Indiana bat and the gray bat. FLW is a designated Indiana bat territory, with one major hibernaculum occurring in the center of the installation. Three smaller caves with known bat hibernacula also exist at FLW. Gray bats have one maternity and multiple transitory caves at FLW, located along Roubidoux Creek on the western side of the installation. The Indiana bat and the gray bat are also listed by the state as endangered species.

A federal threatened species at FLW is the American Bald Eagle, whose habitat is primarily along the Big Piney River, the southwest portion of the Roubidoux Creek, and in the Mark Twain National Forest northeast of the installation boundary. The American Bald Eagle is also listed by the state as an endangered species.

Two additional state-listed endangered animal species reside at FLW, the Ozark hellbender salamander and the eastern hellbender salamander. The Ozark hellbender salamander is a uniquely large salamander that requires clean gravel-bed stream habitat. It cannot tolerate turbidity and, thus, is highly sensitive to the effects of sediment loading caused by erosion. The Ozark hellbender salamander has been found just below Stone Mill Spring on the Big Piney River, as well as at off-installation locations downstream. The eastern hellbender salamander has been found on off-installation portions of the Big Piney River, south of its point of entry into FLW.

2.12 Previous PFAS Investigations

Previous (i.e., pre-PA) PFAS investigations relative to FLW, including both those conducted and not conducted by the Army, are summarized to provide full context of available PFAS data for FLW. However, only data collected by the Army will be used to make recommendations for further investigation. Historical sampling for PFOS, PFOA, and PFBS in the on-installation drinking water was conducted in 2013 per the Third Unregulated Contaminant Monitoring Rule (UCMR3; USEPA 2012) and in 2016 and 2019 per IMCOM Operations Order 16-088. All drinking water samples from 2013, 2016, and 2019 were non-detect for PFOS, PFOA, and PFBS except at the Golf Course Well and the TA 61 Well, as shown in **Table 2-1**. The Golf Course Well had a detection of PFBS at 3.7 ng/L in July 2016. The TA 61 Well had concentrations of PFOS at 1.9 J (the analyte was positively identified; however, the associated numerical value is an estimated concentration only) ng/L and PFBS at 2.6 ng/L in July 2016 and concentrations of PFOS at 3.5 ng/L and PFBS to 5.5 ng/L in June 2019. No historical PFAS results (e.g., from the UCMR3) are available for off-installation drinking water within a 5-mile radius of FLW.

Table 2-1. Historical PFOS, PFOA, and PFBS Analytical Results for FLW Drinking Water

Sampling Location	Sample Date[1,2]	PFOS (ng/L)	PFOA (ng/L)	PFBS (ng/L)
Water Treatment Plant Drinking Water (Post-Treatment)	08 July 2013	ND (<40)	ND (<20)	ND (<90)
	18 September 2013	ND (<40)	ND (<20)	ND (<90)
	11 December 2013	ND (<40)	ND (<20)	ND (<90)
	18 June 2019	ND (<1.7)	ND (<1.7)	ND (<1.7)
Water Treatment Plant Source Water (Pre-Treatment)	25 July 2016	ND (<2)	ND (<2)	NA
Golf Course Well	25 July 2016	ND (<2)	ND (<2)	3.7
TA 61 Well	25 July 2016	1.9 J	ND (<2)	2.6
	17 June 2019	3.5	ND (<1.8)	5.5
All Other On-Installation Drinking Water Supply Wells[3]	25 July 2016	ND (<2)	ND (<2)	NA
	17 to 18 June 2019	ND (<1.7 to 1.9)	ND (<1.7 to 1.9)	ND (<1.7 to 1.9)

Notes:

1. Samples were collected in 2013 per the UCMR3 [USEPA, 2012. Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems, Federal Register Vol. 77, No. 85, May 2.].
2. Samples were collected in 2016 and 2019 per IMCOM Operations Order 16-088.
3. Fifteen other drinking water supply wells were sampled for PFAS in 2016/2019 (per IMCOM Operations Order 16-088) with non-detect results for all PFAS compounds.

< = less than
J = estimated value
N/A = not available
ND = non-detect, value reported as less than the reporting limit
ng/L = nanograms per liter

3 SUMMARY OF PA ACTIVITIES

To document areas where any potential current and/or historical PFAS-containing materials were used, stored and/or disposed at FLW, data was collected from three principal sources of information:

1. Records review
2. Personnel interviews
3. Site reconnaissance.

These sources of data, along with their relative application to this PA, are discussed below. The specific findings of records review, personnel interviews, and site reconnaissance relevant to PFAS-containing materials at FLW are described in **Section 4**.

Preliminary locations of potential use, storage, and/or disposal of PFAS-containing materials were then evaluated in the PA (during records review, personnel interviews, and/or site reconnaissance) and were categorized as AOPIs or as areas not retained for further investigation at this time based on a combination of information collected (e.g., records reviewed, personnel interviews, internet searches). A summary of the observations made, and data collected through records reviews (**Appendix F**), installation personnel interviews (**Appendix G**), and site reconnaissance logs (**Appendix I**) during the PA process for FLW is presented in **Section 4**. Further discussion regarding rationale for not retaining areas for further investigation is presented in **Section 5.1**, and further discussion regarding categorizing areas as AOPIs is presented in **Section 5.2**.

3.1 Records Review

The records reviewed for this PA included, but were not limited to, various Installation Restoration Program (IRP) administrative record documents, compliance documents, FLW fire department documents, FLW directorate of public works (DPW) documents, and GIS files. Internet searches were also conducted to identify publicly available and other relevant information. A list of the specific documents reviewed for FLW is provided in **Appendix F**.

3.2 Personnel Interviews

Interviews were conducted during the site visit. If a previously identified interviewee was not available during the site visit, attempts were made to complete the interview via telephone before or following the site visit or by contacting an alternate interviewee identified by the installation POC.

The list of roles for the installation personnel interviewed during the PA process for FLW is presented below (affiliation is with FLW unless otherwise noted).

- Wildlife Biologist
- Pesticide Application Manager
- Branch Chief, Natural Resources
- Hazardous Waste Program Manager

- Environmental Chief
- Natural Resources Specialist
- Municipal Stormwater Specialist
- Water, Drinking and Wastewater Coordinator
- Industrial Stormwater Specialist
- Utilities Manager (affiliation: Tsay Professional Services, Inc.)
- Archaeologist
- IRP Manager (USACE)
- Deputy DPW Director
- Aviation Chief
- Building Construction Worker II (affiliation: ARNG)
- Fire Chief
- Assistant Fire Chief

The compiled interview logs provided in **Appendix G**.

3.3 Site Reconnaissance

Site reconnaissance and visual surveys were conducted at the preliminary locations identified at FLW during the records review process, the installation in-brief meeting, and/or during the installation personnel interviews. A photo log from the site reconnaissance is provided in **Appendix H**; photos were used to assist in verification of qualitative data collected in the field. The site reconnaissance logs are provided in **Appendix I**.

Access to existing groundwater monitoring wells, if present, were also noted during the site reconnaissance in case the monitoring wells could be proposed for SI sampling.

4 POTENTIAL PFAS USE, STORAGE, AND/OR DISPOSAL AREAS

FLW was evaluated for all potential current and historical use, storage, and/or disposal of PFAS-containing materials. There are a variety of PFAS-containing materials used in relation to current and historical Army operations. However, the use, storage, and/or disposal of aqueous film-forming foam (AFFF) is the most prevalent potential source of PFAS chemicals at DoD facilities. As such, this section is organized to summarize the AFFF-related uses first, and all remaining potential PFAS-containing materials in the subsequent section.

4.1 AFFF Use, Storage, and Disposal Areas

AFFF was developed in the mid-1960s in response to a need for firefighting foams better suited to extinguish Class B, fuel-based fires. AFFF formulations consist of water, an organic solvent, up to 5 percent (%) hydrocarbon surfactants, and 1 to 3% PFAS (Interstate Technology Regulatory Council 2020). AFFF concentrate is designed to be diluted with water to become a 1, 3, or 6% foam. AFFF releases at DoD facilities may have occurred during firefighter training, emergency response actions, equipment testing, or accidental releases. The military still primarily uses AFFF for Class B fires; however, the current formulations of AFFF contain significantly lower amounts of PFOS, PFOA, and their precursors, and significant operational changes have been implemented to restrict uncontrolled releases and non-essential use of PFAS-containing foams. Army installations may still house AFFF, commonly stored in closed containers (e.g., 55-gallon drums, 5-gallon buckets), within designated storage buildings or at firehouses.

Army-wide installation AFFF-inventory records were provided by USAEC and reviewed prior to the FLW site visit. The inventory file titled Master IMCOM FES Annex A to Operations Order 16-040 13 Apr 2016 recorded the reported amounts of AFFF in both vehicle and building storage at FLW. The inventory file recorded FLW having a total of 275 gallons of AFFF stored within four vehicles: 30 gallons stored within Engine 1, 30 gallons stored within Engine 2, 200 gallons stored within the Aircraft Rescue and Firefighting (ARFF) truck 1, and 15 gallons stored within Engine 4. According to the Assistant Chief of Staff for Installation Management inventory file titled IMCOM C-8/AFFF and Test Kit Data, FLW was reported to have 85 total gallons turned in and 485 gallons on hand. According to the 2017 IMCOM AFFF inventory file, FLW was reported to have 570 total gallons on hand, twelve 55-gallon drums, and 180 gallons within other bulk containers. No records were able to be obtained regarding AFFF use in relation to fire responses.

Additionally, AFFF is or was used, stored and/or disposed at several locations:

- One 900-gallon bladder tank of Ansulite 3% AFFF (AFC-3-A) concentrate is stored in each building at ARNG Hangars (Buildings 5010 and 5012) AOPI. AFFF leaked from the tank stored in Building 5010 in 2006 (broken gasket) and in 2009 (both pumps turned on and blew a valve). AFFF was actively dripping from piping from the AFFF storage tank inside the hangar during the PA site visit on 10 to 12 December 2018. AFFF leaked from the tank housed in Building 5012 in 2016 (broken gasket).
- During fire training operations from 1972 to 1988 at the DPW Old Fire Training Area (TA 210, FLW-028), which reportedly occurred twice each year, AFFF was suspected to be used in response to

roughly 150 gallons of aviation fuel placed and ignited on a concrete pad located in the center of the AOPI. On 09 June 2017, fire department response included use of alcohol resistant aqueous film-forming foam (AR-AFFF) to extinguish a vehicle fire with a breached gas tank at TA 210.

- The New Fire Training Area (TA 207, FLW-029, 29995.1029) was used for annual fire training exercises and nozzle testing of the ARFF truck from 1988 until 2016, both of which are suspected to have used AFFF. In 2016, two TRI-MAX 30 compressed air foam fire extinguishers from the airfield were emptied into this area. An in-ground concrete pad approximately 65 feet by 65 feet, observed during the PA site visit on 10 to 12 December 2018, was used for fire training and nozzle testing activities.
- Active Fire Station #1 (Building 580) has been in operation since approximately 2011. Nine 55-gallon drums of Chemguard 3%-6% AR-AFFF concentrate, and an approximately 20-gallon container of Class A foam were stored in the garage bay adjacent to the garage door without secondary containment. Fire trucks housed here, some of which have minor leaks according to interviews, include structural trucks with 30 gallons of AFFF each and a ladder truck with 15 gallons of AFFF. All foams in the trucks and storage are currently military specification compliant.
- Active Fire Station #2 (Building 5001) fire trucks, most of which have minor leaks, include a structural truck containing 30 gallons of AFFF, ARFF truck containing 210 gallons of AFFF and 450 pounds Purple-K foams. All the foams stored in the trucks are currently military specification compliant.
- Former Fire Station #1 (Triangle Station) was used to house fire trucks from the 1940s until an unknown time in the 1990s or 2000s, when it was demolished. AFFF was suspected to have been stored or leaked here from the trucks.
- Former Fire Station #2 (Oklahoma Avenue) fire trucks were housed at this location from an unknown initial date (historical aerial photos indicate circa mid-2000s) until it was demolished circa 2012. AFFF was suspected to have been stored or leaked here from the trucks.

AFFF was determined to not be used, stored and/or disposed at several locations where AFFF was originally suspected:

- Fuels, primarily gasoline and diesel, were ignited at the Old Fire Training Area Ball Field (FLW-055) on the ground for fire training exercises between 1952 and 1964. A secondary containment structure was around the burning area.
- The Current Explosive Ordnance Disposal Open Burn/Open Detonation Area Range 36 (FLW-031) was an open burn/open detonation site where diesel was used for open burns and hydrocarbon compounds have been detected in soil samples.
- Training Area 244 is used for heavy vehicle and equipment training but not for fire training excercises.
- Former Compressed Air Foam System (CAFS) Locations at Former Forney Army Field are designed to contain 30 gallons of foam solution that produces approximately 600 gallons of finished foam. The type of foam used in these extinguishers is unknown. Prior to 2016, there were at least two TRI-MAX 30 Wheeled CAFS located on the airfield. Occasionally, during maintenance of the extinguishers, they were tested/released into the New Fire Training Area (FTA) (TA 207, FLW-029). These fire

extinguishers were replaced with six 25 to 30-gallon pressurized tanks of Purple-K foam, per Federal Aviation Administration regulations, which are distributed around the airfield.

4.2 Other PFAS Use, Storage, and/or Disposal Areas

Following document research, personnel interviews, and site reconnaissance at FLW, STP and associated lagoons and biosolids application fields, landfills, general and pesticide storage areas, laundry facilities, print shop, and car wash facility were identified as preliminary locations for use, storage, and/or disposal of PFAS-containing materials. A summary of information gathered in the PA for each of these preliminary locations is described below. Specific discussion regarding areas not retained for further investigation is presented in **Section 5.1** and specific discussion regarding areas retained as AOPIs is presented in **Section 5.2**.

The current STP, included in the Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026) AOPI, has received digester waste in addition to wastewater from tank leaks at the ARNG hangars, wastewater from the New Fire Training Area (FLW-029), and leaks of foam from trucks washed down drains at the active fire stations. The sludge from the current lagoon, located within the Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026) AOPI, is used for biosolids applications at FLW. Biosolids are extracted from the lagoon, mixed into a homogenous blend, transported to the biosolids application fields, and applied evenly across the entire field. The Training Area 244 Sewage Lagoons (FLW-027) were used to treat sewage from buildings in the TA until 1995, and consisted of domestic sewage and effluent from maintenance area oil/water separators.

Landfills 4 and 6 were sanitary landfills operational from 1942 to 1970 that were determined to have no materials containing PFOS, PFOA, and or PFBS. Similarly, Landfills 5, 7, 13, and 14 were construction and demolition debris landfills operational from 1942 to 1970 that were determined to have no materials containing PFOS, PFOA, and or PFBS.

The Float Yard Storage Area was used prior to 1988 for temporary storage of containerized waste not proven to contain PFOS, PFOA, or PFBS. The Building 2331 Storage Area comprised a pad used from 1980 to 1986 as a 55-gallon "satellite accumulation" drum storage area for thinners, lacquers, and other paint related materials prior to storage in the Float Yard. The DEH Old Pesticide Storage Area (FLW-037), Building 2206 was used for pesticide storage and mixing from 1966 to 1981 and was demolished in 1996. Rinsate and pesticide impacted material was stored in drums at the site.

The Building 2300 Dry-Cleaning Shop and Laundry Facility (FLW-056) was a former dry-cleaning shop and laundry facility that operated from the mid-1940s until 1981 and was demolished in 1987. The Building 2352 Post Laundry Facility (CCFLW-001) was the post laundry facility, which included a dry-cleaning facility that was moved to Building 2352 from adjacent Building 2300 around 1980, and was demolished in Fiscal Year 2015. No evidence whether fabric waterproofing potentially containing PFOS, PFOA, and/or PFBS was performed at either of these laundry facilities.

The Former Print Shop (CCFLW-003) was located in Building 2350 from before 1952 until at least 1982, but not later than 2004. Equipment onsite included offset printing presses with photographic plate typesetting. Waste products from the photographic process were sent to the hospital at FLW for silver extraction. Tetrachloroethene and methylene chloride were used to deglaze the printing equipment. About 250 liters per year of total waste solvent were generated. Prior to 1981, the wastes are reported to have

been placed in a dumpster on the site, but the former location of the dumpster and the disposal facility are unknown. Print shop waste began to be disposed of in Landfill 2 (FLW-002) when it opened in 1981.

Two commercial car wash facilities currently exist on the installation, including the MWR Auto Wash at Auto Skills Center (Building 1383) and the Kwik Kar Express (Building 1605A). Products available for purchase and use in the car wash vending machines at the MWR Auto Wash include Black Jack Tire Cleaner, glass cleaner wipes, and Armor All Interior Cleaner. The products used at the Kwik Kar Express are unknown.

During a telephonic interview with the IMCOM Pest Management Consultant, it was noted that the larger group of pesticides are generally not of PFAS concern. Specifically, products containing Sulfluramid (i.e., associated with insecticides) may have contained PFAS and were phased out in 1996. During the PA records review, the IMCOM Pest Management Consultant provided records of pesticides used and stored at IMCOM installations, including FLW, and did not identify FLW as an installation having used or stored PFAS-containing pesticides/insecticides. Additionally, the PA team reviewed available pesticide use inventory documentation provided by the installation and did not identify PFAS-containing pesticides use, storage, or disposal.

4.3 Readily Identifiable Off-Post PFAS Sources

An exhaustive search to identify all potential off-post PFAS sources (i.e., not related to operations at FLW) is not part of the PA/SI. However, potential off-post PFAS sources within a 5-mile radius of the installation that were identified during the records search and site visit are described below.

Nearby community fire departments could potentially be off-post PFOS, PFOA, and/or PFBS sources within close proximity of FLW, if they use AFFF. The St. Robert Fire Department and Waynesville Fire Department are located northwest of FLW within 5 five miles of the installation boundary and their historical and current AFFF use, storage, and/or disposal is unknown.

5 SUMMARY AND DISCUSSION OF PA RESULTS

The preliminary locations evaluated for potential use, storage and/or disposal of PFAS-containing materials at FLW were further refined during the PA process and identified either as an area not retained for further investigation or as an AOPI. In accordance with the established process for the PA/SI, 32 areas have been identified as AOPIs. The process used for refining these areas is presented on **Figure 5-1**, below.

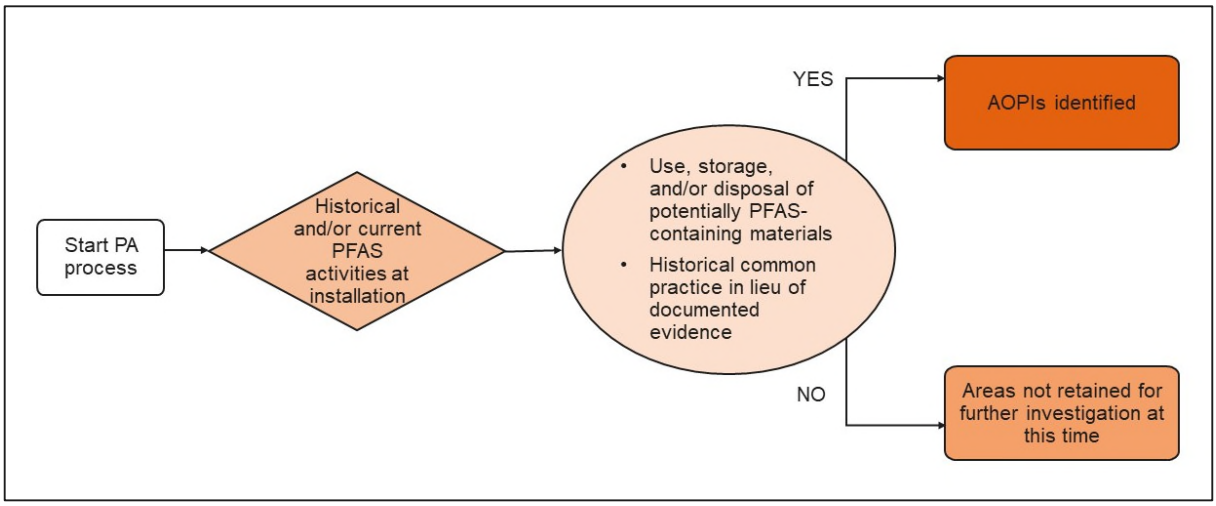

Figure 5-1: AOPI Decision Flowchart

The areas not retained for further investigation are presented in **Section 5.1**. The areas retained as AOPIs are presented in **Section 5.2**.

Data limitations for this PA/SI at FLW are presented in **Section 8**.

5.1 Areas Not Retained for Further Investigation

Through the evaluation of information obtained during records review, personnel interviews, and/or site reconnaissance, the areas described below were categorized as areas not retained for further investigation at this time.

A brief site history and rationale for areas not retained for further investigation are presented in **Table 5-1**, below.

Table 5-1. Installation Areas Not Retained for Further Investigation

Area Description	Dates of Operation	Relevant Site History	Rationale
Old Fire Training Area Ball Field (FLW-055)	1952 to 1964	Fuels, primarily gasoline and diesel, were ignited on the ground for fire training exercises between 1952 and 1964. A secondary containment structure was around the burning area. FLW-055 is no longer used for fire training activities. It is currently a recreational area, including soccer and softball fields covered with grass.	This fire TA was used prior to the development of AFFF in 1968. It is unknown whether fluoroprotein foams were used.
Landfill 4 (FLW-006)	1942 to 1970	This area was a closed, sanitary landfill.	No evidence of materials containing PFOS, PFOA, or PFBS used, stored, and/or disposed of at this landfill.
Landfill 5 (FLW-007)	1942 to 1970	This area was a construction and demolition debris landfill.	No evidence of materials containing PFOS, PFOA, or PFBS used, stored, and/or disposed of at this landfill.
Landfill 6 (FLW-008)	1942 to 1970	This area was a closed, sanitary landfill.	No evidence of materials containing PFOS, PFOA, or PFBS used, stored, and/or disposed of at this landfill.
Landfill 7 (FLW-009)	1942 to 1970	This area was a construction and demolition debris landfill.	No evidence of materials containing PFOS, PFOA, or PFBS used, stored, and/or disposed of at this landfill.
Landfill 13 (FLW-018)	1942 to 1970	This area was a construction and demolition debris landfill.	No evidence of materials containing PFOS, PFOA, or PFBS used, stored, and/or disposed of at this landfill.
Landfill 14 (FLW-019)	1942 to 1970	This area was a construction and demolition debris landfill.	No evidence of materials containing PFOS, PFOA, or PFBS used, stored, and/or disposed of at this landfill.

Area Description	Dates of Operation	Relevant Site History	Rationale
Current Explosive Ordnance Disposal Open Burn/Open Detonation Area Range 36 (FLW-031)	Unknown to Present	The 5-acre open burn/open detonation site is a cleared area approximately 1,000 feet long and 200 feet wide. In the past, diesel was used for open burns and hydrocarbon compounds have been detected in soil samples. Range 36 is now used for training.	No documented use of AFFF at this area. Water is used on wildfires. It is unknown whether flares or other Teflon components were burned at this site.
Training Area 244	Unknown to Present	Training Area 244 is used for heavy vehicle and equipment training.	Training area is not used for fire training exercises and AFFF has not been used at this site.
Training Area 244 Sewage Lagoons (FLW-027)	Unknown to 1995	These two, former sewage lagoons in the west-central portion of the installation (southwest of the FLW-026 lagoons) were used to treat sewage from buildings in the TA (see Training Area 244 above) and consisted of domestic sewage and effluent from maintenance area oil/water separators. Wastewater measuring 2,025,000 gallons was discharged to the STP. The lagoons have been drained, the sludge solidified or removed, and the sides pushed in.	No evidence that Training Area 244 sewage contained PFOS, PFOA, or PFBS.
Float Yard Storage Area	Prior to 1988	Temporary storage of containerized waste prior to 1988. No leaks reported.	No evidence of use, storage, and/or disposal of PFOS, PFOA, or PFBS at this site.
Storage Area (Building 2331)	1980 to 1986	The pad was used from 1980 to 1986 as a 55-gallon "satellite accumulation" drum storage area for thinners, lacquers, and other paint related materials prior to storage in the Float Yard.	No evidence of use, storage, and/or disposal of PFOS, PFOA, or PFBS at this site.

Area Description	Dates of Operation	Relevant Site History	Rationale
DEH Old Pesticide Storage Area (FLW-037), Building 2206	1966 to 1981	Building 2206 was used for pesticide storage and mixing. Rinsate and pesticide impacted material was stored in drums at the site. The site operated from 1966 to 1981 and was demolished in 1996. The site is currently a parking lot.	No documented use, storage, and/or disposal of pesticides containing PFOS, PFOA, or PFBS.
Former Dry-Cleaning Shop and Laundry Facility (FLW-056), Building 2300	mid-1940s to 1981	Building 2300 was a former dry-cleaning shop and laundry facility operated from the mid-1940s until 1981. It was demolished in 1987.	No evidence whether fabric waterproofing potentially containing PFOS, PFOA, and/or PFBS was performed at laundry facilities.
Former Post Laundry Facility (CCFLW-001), Building 2352	1970s to 2015	Building 2352 was the post laundry facility, which included a dry-cleaning facility that was moved to Building 2352 from adjacent Building 2300 around 1980. Building 2352 was demolished in Fiscal Year 2015.	No evidence whether fabric waterproofing potentially containing PFOS, PFOA, and/or PFBS was performed at laundry facilities.
Former Print Shop (CCFLW-003)	Prior to 1952 to 2004	A print shop located in Building 2350 from before 1952 until at least 1982, but not later than 2004. Equipment onsite included offset printing presses with photographic plate typesetting. Waste products from the photographic process were sent to the hospital at FLW for silver extraction. Tetrachloroethene and methylene chloride were used to deglaze the printing equipment. About 250 liters per year of total waste solvent were generated. Prior to 1981, the wastes are reported to have been placed in a dumpster on the	There is no documentation that PFOS, PFOA, or PFBS were used as a mist suppressant, stored, and/or disposed of at the photo processing facilities.

Area Description	Dates of Operation	Relevant Site History	Rationale
		site, but the former location of the dumpster and the disposal facility are unknown. Print shop waste began to be disposed of in Landfill 2 (FLW-002) when it opened in 1981.	
Commercial Car Wash Facilities	Unknown to Present	Two car wash facilities currently on-installation: 1) MWR Auto Wash at Auto Skills Center – Located at 7584 Nebraska Avenue Building 1383. Products available for purchase and use in the car wash vending machines include Black Jack Tire Cleaner, glass cleaner wipes, and Armor All Interior Cleaner. 2) Kwik Kar Express – Located at 7068A Nebraska Avenue Building 1605A.	The products available for purchase and use at the MWR Auto Wash do not contain PFOS, PFOA, and/or PFBS. The products used at the Kwik Kar Express are unknown.
Former CAFS Locations at Former Forney Army Field	Prior to 2016	Prior to 2016, there were at least two TRI-MAX 30 Wheeled CAFS located on the airfield. These CAFS are designed to contain 30 gallons of foam solution that produces approximately 600 gallons of finished foam. The type of foam used in these extinguishers is unknown. Occasionally, during maintenance of the extinguishers, they were tested/released into the New FTA (TA 207, FLW-029). There is no documented use/release of foam from these fire extinguishers outside of the New FTA. These fire extinguishers were replaced with six 25 to 30-gallon pressurized tanks of Purple-	No evidence of use, storage, and/or disposal of PFOS, PFOA, or PFBS from extinguishers at the airfield or at any other location outside of the Active (New) Fire Training Area. The Active (New) FTA (TA 207, FLW-029) is identified as an AOPI.

Area Description	Dates of Operation	Relevant Site History	Rationale
		K foam, per Federal Aviation Administration regulations, which are distributed around the airfield.	

5.2 AOPIs

Overviews for each AOPI identified during the PA process are presented in this section. Fourteen of the AOPIs overlap with FLW IRP sites and/or Headquarters Army Environmental System (HQAES) sites (**Figure 5-2**). The AOPI, overlapping IRP site identifier, HQAES number, and current site status are discussed within each AOPI subsection presented below. At the time of this PA, none of the FLW IRP sites have historically been investigated or are currently being investigated for the possible presence of PFAS-containing materials.

The AOPI locations are shown on **Figure 5-2**. Aerial photographs of each AOPI that also show the approximate extent of AFFF use (if applicable) are presented on **Figures 5-3** through **5-26** and include active monitoring wells in the vicinity of each AOPI.

5.2.1 ARNG Hangars (Buildings 5010 and 5012)

The ARNG Hangars (Buildings 5010 and 5012) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to storage and releases of AFFF concentrate (**Figure 5-3**). One 900-gallon bladder tank of Ansulite 3% AFFF (AFC-3-A) concentrate is stored in each building. Historical releases of AFFF concentrate stored in these tanks have occurred:

- AFFF concentrate leaked from the tank stored in Building 5010 in 2006 (broken gasket) and in 2009 (both pumps turned on and blew a valve). In addition, during the site visit on 10 to 12 December 2018, AFFF was observed dripping from piping of the AFFF storage tank inside the hangar.
- AFFF concentrate leaked from the tank housed in Building 5012 in 2016 (broken gasket).
- The bladders in the storage tanks were replaced in 2010 and 2015 for Building 5010 and Building 5012, respectively.

AFFF concentrate leaked to the grassy area in front of each tank storage room and drained to the STP via the sump within the tank room. A stormwater drain within the grassy area between the buildings (near sample FLW-ARNG-06-SO) discharges to Outfall 002 (National Pollution Discharge Elimination System Permit MO-R80F034), an ephemeral tributary to the Roubidoux Creek. AFFF concentrate leaked inside the hangars and drained to the STP via sewer drains. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.2 DPW Old Fire Training Area (TA 210, FLW-028)

The DPW Old Fire Training Area (TA 210, FLW-028) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to likely AFFF use in the former FTA from 1972 to 1988 and use of AR-AFFF on a vehicle fire in 2017 (**Figure 5-4**). The former FTA was used for emergency response fire training on a semi-annual basis from 1972 to 1988. Approximately 150 gallons of aviation fuel was placed and ignited on a concrete pad located in the center of the site. Discoloration within the area of the concrete pad that appears to be related to fire training activities is apparent in 1975 to 1976 and 1986 aerial photographs (Conti/CH2MHill 2009a). The concrete pad was reportedly removed in 1988 when the New Fire Training Area (FLW-029, see **Section 5.2.3**) was constructed (Conti/CH2MHill 2009a). In the late 1990s, the area was partially paved with a circular asphalt track and is currently used as a vehicle skid track for military police training during which large volumes of water are sprayed on the asphalt to simulate wet road conditions. This AOPI is located within the boundaries of active TA 210. Additionally, on 09 June 2017 the FLW Fire Department responded to a vehicle with a breached gas tank fire at TA 210 with the use of AR-AFFF. The exact location of the 2017 AR-AFFF use, storage, and/or disposal is not known.

The DPW Old Fire Training Area (FLW-028) AOPI is located in the central part of FLW, south of the former Forney Army Airfield and is roughly 100 feet by 400 feet. It is located on a wide ridge that transects the central part of the post from south to north. Surface water drainage flows radially away from the site. A riprap channel is present northwest of the site that drains to the Roubidoux Creek and a drainage ditch is located south of the site. Inside the paved vehicle skid track, where the former fire TA concrete pad was located, is a flat vegetated area with short grass. The area is bermed on three sides with earthen berms 6 feet high and 10 feet wide (Conti/CH2MHill 2009a). The current and future land use is industrial and the DPW Old Fire Training Area (FLW-028) CSM information is presented in **Section 5.3**. This AOPI has the same site boundary as IRP site FLW-028 (29995.1028).

5.2.3 New Fire Training Area (TA 207, FLW-029)

The New Fire Training Area (TA 207, FLW-029) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to AFFF use during former fire training and nozzle testing activities (**Figure 5-4**). The area was used for annual firefighting training exercises and annual nozzle testing of the ARFF truck from 1988 until 2016. Firefighting foam has not been used in fire training exercises at FLW since 2016. Additionally, in 2016 two TRI-MAX 30 CAFS fire extinguishers from the airfield were emptied into this area. An in-ground concrete pad approximately 65 feet by 65 feet, observed during the PA site visit (**Appendix I**), was used for fire training and nozzle testing activities. The concrete pit drains to an in-ground sump and oil/water separator, located in a concrete structure 4-6 feet deep, adjacent to the northeast corner of the pit.

The New Fire Training Area (FLW-029) AOPI, is located in the central part of FLW, south of the former Forney Army Airfield and approximately 500 feet north of the DPW Old Fire Training Area (FLW-028) AOPI. A flat vegetated area with short grass surrounds the concrete pit. Surface runoff drains primarily to the north-northwest where an ephemeral stream located approximately 400 feet from the TA flows to the Roubidoux Creek. The current and future land use is industrial and the New Fire Training Area (FLW-029) CSM information is presented in **Section 5.3**. This AOPI overlaps with closed IRP site FLW-029 (29995.1029).

5.2.4 Old Fire Training Area at Landfill 3 (FLW-053)

The Old Fire Training Area at Landfill 3 (FLW-053) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to potential AFFF use during former firefighter training activities (**Figure 5-5**). Between 1970 and 1973, the site was used for firefighter training. Gasoline, diesel fuel, JP-4 fuel and waste oil were burned in a 3-foot-deep, 30-foot-diameter pit. The use of AFFF at this fire TA is unknown; however, the timeframe of operation falls within historical use of AFFF for firefighter training. Historical aerial photos show an unvegetated site with a disturbed area in the middle of a bermed area in 1971 and a relatively flat and grassy site in 1975 to 1976. The disturbance visible in the 1971 aerial photo appears to be related to fire training activities, which appear to have ceased by 1975 to1976 (Conti/CH2MHill 2009b). The specific TA closure activities (e.g., filling and regrading) are not known. The current and future land use is industrial.

The Old Fire Training Area at Landfill 3 (FLW-053) AOPI is located in the central part of FLW within Landfill 3 (FLW-003). More specifically, it is within the northwest corner of the FLW-003B site, one of the three landfills that make up FLW-003. The site is currently a relatively flat grassy area and is located on a wide ridge that transects the central part of the installation from south to north. A groundwater divide runs through the eastern part the site. The majority of the site is located to the west of the groundwater divide; however, a portion of the site is east of the groundwater divide. The local groundwater flow beneath FLW-053 is to the west. Groundwater flow southeast of FLW-053 flows from west and northwest to east and southeast, whereas groundwater flow west of FLW-053 flows from east to west (Conti/CH2MHill 2009b). An ephemeral stream located to the east of the site is a tributary of the Big Piney River. The Old Fire Training Area at Landfill 3 (FLW-053) CSM information is presented in **Section 5.3**. This AOPI has the same site boundary as closed IRP site FLW-053 (29995.1061) and is within the boundary of open IRP site FLW-003 (29995.1003).

5.2.5 Old Fire Training Area Runway End (FLW-054)

The Old Fire Training Area Runway End (FLW-054) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to potential AFFF use during former firefighter training activities (**Figure 5-6**). Between 1965 and 1970, the site was used for firefighter training. Gasoline, diesel fuel, JP-4 fuel and waste oil were burned in a 6-inch-deep gravel-lined pit. The use of AFFF at this fire TA is unknown; however, the timeframe of operation falls within historical use of AFFF for firefighter training. Historical aerial photos show a pit area and little to no vegetation within the site boundary in 1967, and a vegetated area with no areas of disturbance indicative of ongoing fire training activities in 1971 (Conti/CH2MHill 2009b). The site was closed by filling the pit with dirt and seeding with grass. It is no longer used for fire training activities. The current and future land use is industrial.

The Old Fire Training Area Runway End (FLW-054) AOPI is located in the central part of FLW, approximately 2,000 feet northeast of the New Fire Training Area (FLW-029) AOPI. The site is currently a relatively flat area with trees, shrubs, and long grasses. A gravel parking lot constructed in 2006 extends onto the southwest corner of the site. It is located on a wide ridge that transects the central part of FLW from south to north. A surface water drainage channel is present to the south of the site, adjacent and parallel to the nearby dirt road. Although local surface runoff flows south then east, surface runoff in this area and at this AOPI ultimately flows to the Roubidoux Creek to the west. The Old Fire Training Area

Runway End (FLW-054) CSM information is presented in **Section 5.3**. This AOPI has the same site boundary as closed IRP site FLW-054 (29995.1062).

5.2.6 Active Fire Station #1 (Building 580)

The Active Fire Station #1 (Building 580) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to storage of AFFF and fire trucks containing AFFF (**Figure 5-7**). This fire station is located at Building 580, North Dakota Avenue. It is currently in operation and was constructed in 2011. At the time of the PA site visit on 10 to 12 December 2018, nine 55-gallons drums of Chemguard 3%-6% AR-AFFF concentrate and an approximately 20-gallon container of Class A foam was stored in the garage bay without secondary containment adjacent to the garage door. Fire trucks are housed here and include structural trucks with 30 gallons of AFFF each and a ladder truck with 15 gallons of AFFF. All foams in the trucks and storage were military specification compliant at the time of the site visit. It was reported by fire department personnel that most of the fire trucks have minor leaks. Drains located centrally in the building drain to an oil/water separator at the site and subsequently to the STP. There are no perimeter drains in the building to catch truck leaks/wash water. Concrete borders the building to the northeast while a relatively flat, grassy area surrounds the three other sides of the building. Surface runoff flows to the southeast towards the Roubidoux Creek in this area. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites. The Active Fire Station #1 (Building 580) CSM information is presented in **Section 5.3**.

5.2.7 Active Fire Station #2 (Building 5001)

The Active Fire Station #2 (Building 5001) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to storage of fire trucks containing AFFF (**Figure 5-8**). This fire station is currently in operation and located at Building 5001 at the former Forney Army Airfield, approximately 1,800 feet southwest of the ARNG Hangars (Buildings 5010 and 5012) AOPI. Fire trucks are housed here, including a structural truck containing 30 gallons of AFFF and an ARFF truck containing 210 gallons AFFF and 450 pounds Purple-K foams. All foams in the trucks and storage were military specification compliant at the time of the PA site visit on 10 to 12 December 2018. It was reported by fire department personnel that most of the fire trucks have minor leaks. The trucks are stored both inside and outside of the building. Indoor drains discharge to the STP. The building is on a flat surface with concrete to the north and west and some grassy areas to the south and east. Cracks are visible in the concrete in recent aerial imagery. Surface runoff flows to the southwest to Roubidoux Creek. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites. The Active Fire Station #2 (Building 5001) CSM information is presented in **Section 5.3**.

5.2.8 Former Fire Station #1 (Triangle Station)

The Former Fire Station #1 (Triangle Station) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to storage of fire trucks containing AFFF (**Figure 5-9**). This former fire station was located in the "triangle" area at Missouri Avenue and 1st Street. It was used to house fire trucks from the 1940s until an unknown time in the 1990s or 2000s, when it was demolished. The details of the demolition activities are unknown. Use and storage of AFFF at this fire TA is also unknown; however, the period of operation overlaps with the time during which AFFF was historically

used at fire TAs at FLW. Currently, this area is a maintained flat grassy area with some trees. Surface runoff likely flows to the northeast and/or northwest to ephemeral tributaries of Dry Creek. The site is within the Shanghai Spring Recharge Basin and groundwater generally flows northeast towards the Big Piney River. The Former Fire Station #1 (Triangle Station) CSM information is presented in **Section 5.3**. The current and future land use is industrial and this AOPI does not overlap with any open or closed IRP sites.

5.2.9 Former Fire Station #2 (Oklahoma Avenue)

The Former Fire Station #2 (Oklahoma Avenue) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to storage of fire trucks containing AFFF (**Figure 5-10**). This former fire station was located near the intersection of Oklahoma Avenue and Replacement Avenue and the details of the construction are unknown. The former fire station was used to house fire trucks until 2012, when it was demolished. Use and storage of AFFF at this fire TA is unknown; however, the period of operation overlaps with the time during which AFFF was historically used at fire TAs at FLW. Currently, a gravel pad is present, with some short grass and trees on the perimeter. There are several old mobile homes and trailers stored at the location. The area drains to a dry creek which flows northeast to the Big Piney River. The Former Fire Station #2 (Oklahoma Avenue) CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.10 Former Fire Station #3 (Troop Trail)

The Former Fire Station #3 (Troop Trail) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the possible storage of fire trucks containing AFFF (**Figure 5-11**). Former Fire Station #3 (Troop Trail) is currently a frequently mowed grass area with trees throughout. The AOPI is located on Iowa Avenue near Troop Trail across from the Starship Barracks, where Building 1028 and 1029 are currently located. The former fire station was reported to be present in 1991; however, the exact dates of operation and historical use and storage of AFFF is unknown. In addition, construction and demolition activities of the former fire station are unknown. The area currently lies relatively flat with surface runoff likely flowing northeast to ephemeral tributaries of Dry Creek. The site is within the Shanghai Spring Recharge Basin and groundwater generally flows northeast towards the Big Piney River. The Former Fire Station #3 (Troop Trail) CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.11 Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026)

The Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026) are identified as an AOPI following records research, personnel interviews, and site reconnaissance due to the STP receiving wastewater potentially containing AFFF from tank leaks at the ARNG hangars, wastewater from the New Fire Training Area (FLW-029), and leaks of foam from trucks washed down drains at the Active Fire Stations (**Figure 5-12**). The former lagoon (FLW-026) received digester wastes from the STP from 1967 to 1986. Sludge removal and excavation of the former lagoons was completed in 1986. The excavated soil was land-applied at the Biosolids Application Field #1 (Five STP Landfills, FLW-012) AOPI.

The current lagoon is located across the road from the former lagoon, which is currently a relatively flat area covered with grass and trees. The sludge from the current lagoon is used for biosolids applications at all biosolids application fields at FLW. The active STP currently discharges its effluent to Dry Creek, a tributary of the Big Piney River, and flows north adjacent to the lagoons. The Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026) CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI boundary overlaps with IRP sites FLW-024 (29995.1024) and FLW-026 (29995.1026).

5.2.12 Biosolids Application Field #1 (Five STP Landfills, FLW-012)

The Biosolids Application Field #1 (Five STP Landfills, FLW-012) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to excavated soil, potentially containing AFFF, from the former lagoons being land-applied to the five STP Landfills in 1986. Historical and recent application of STP sludge to the land surface was to encourage vegetation growth (**Figure 5-12**). The five sites were used as landfills from 1947 to the late 1960s. The landfills received a variety of wastes, predominantly household waste, along with residue from the open burning of waste and sludge from the STP. The five landfills are periodically mowed and are surrounded by trees. The landfills are located within an ephemeral stream valley and are bordered on one side by steep slopes and Dry Creek, and an unnamed tributary to Dry Creek on the other side. The ground surface of each landfill is relatively flat but slopes steeply along the edge of the filled areas or the ephemeral stream channels. Dry Creek was lined in 2010 and is covered in riprap. There are existing monitoring wells located throughout the area of FLW-012. The Biosolids Application Field #1 (Five STP Landfills, FLW-012) CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI has the same site boundary as IRP site FLW-012 (29995.1012).

5.2.13 Biosolids Application Field #17 (Landfill 15, FLW-020)

The Biosolid Application Field #17 (Landfill 15, FLW-020) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-13**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. The site is an active biosolids management area 70 acres in size. The area is a relatively flat, grassy area surrounded by trees. Surface runoff flows to the northwest to an adjacent ephemeral tributary of Roubidoux Creek. The site is within the Miller Spring Recharge Basin and groundwater generally flows to the east towards the Big Piney River. The Biosolid Application Field #17 (Landfill 15, FLW-020) CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI has the same site boundary as IRP site FLW-020 (29995.1020).

5.2.14 Biosolids Application Field #18 (Landfill 2, FLW-002)

The Biosolids Application Field #18 (Landfill 2, FLW-002) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-13**). The STP

received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. Landfill 2 was a biosolids management area with historical application of biosolids, but no biosolids have been applied since this PA began. It is unknown when the last biosolids application occurred. The active biosolids application field is 25.65 acres in size. Landfill 2 is a 34.4-acre, closed sanitary landfill that operated from 1981 to 1985 and was primarily used for disposal of household waste. The landfill is a relatively flat, grassy area. Surface runoff drains to an ephemeral tributary of Roubidoux Creek via a drainage channel that exits the landfill about 400 feet west of the northeast corner of the IRP site boundary. The site is within the Miller Spring Recharge Basin and groundwater generally flows to the east towards the Big Piney River. The Biosolids Application Field #18 (Landfill 2, FLW-002) CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI has the same site boundary as IRP site FLW-002 (29995.1002).

5.2.15 Biosolids Application Field #2 (Landfill 9, FLW-011)

The Biosolids Application Field #2 (Landfill 9, FLW-011) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-14**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. The site is an active biosolids management area 13.4 acres in size. The area is a relatively flat, grassy area surrounded by trees. Surface runoff flows to the southwest to an adjacent ephemeral tributary of Roubidoux Creek. The site is within the Roubidoux Spring Recharge Basin and groundwater generally flows northeast. The Biosolids Application Field #2 (Landfill 9, FLW-011) CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI has the same site boundary as IRP site FLW-011 (29995.1011).

5.2.16 Biosolids Application Field #3 (Landfill 8, FLW-010)

The Biosolids Application Field #3 (Landfill 8, FLW-010) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-14**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. Landfill 8 is a current biosolids management area with historical application of biosolids. Most recently, biosolids were applied four times from July to August 2018. The active biosolids application field is 7.47 acres in size. Landfill 8 is an 11.4-acre, closed demolition landfill that operated from 1942 to 1980. It was used for open burning with burial of the residue in the landfill. The site is currently a relatively flat, grassy area surrounded by trees. Surface runoff flows to the south to an adjacent ephemeral tributary of Roubidoux Creek. The site is within the Roubidoux Spring Recharge Basin and groundwater generally flows northeast. The Biosolids Application Field #3 (Landfill 8, FLW-010) CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI has the same site boundary as IRP site FLW-010 (29995.1010).

5.2.17 Biosolids Application Field #5 (Landfill 12, FLW-017)

The Biosolids Application Field #5 (Landfill 12, FLW-017) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-15**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. Landfill 12 was a biosolids management area with historical application of biosolids, but no biosolids have been applied recently. The inactive biosolids application field is 11.57 acres in size. Landfill 12 is a seven-acre, closed sanitary landfill that operated from 1958 to 1961 and was used for disposal of household waste. Polla Road, which runs through the site, was constructed in 2003 and fill material from the construction was placed over the site, creating a southwest slope towards Roubidoux Creek, which is located approximately 300 feet south of the landfill. The landfill is in the Roubidoux Creek drainage basin, located within 500 feet of the northern installation boundary. Groundwater is expected to flow west to northwest toward Roubidoux Creek or southwest to Roubidoux Spring. The Biosolids Application Field #5 (Landfill 12, FLW-017) CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI has the same site boundary as IRP site FLW-017 (29995.1017).

5.2.18 Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059)

The Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-16**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. The landfill is not a current biosolids management area; however, biosolids have been applied historically here. The inactive biosolids application field is 45.6 acres in size. This IRP site is a combination of three inactive municipal solid waste trench-and-fill landfills. Two landfills are combined as an IRP area within the Biosolids Application Field #22N boundary, and one landfill is within the Biosolids Application Field #22S boundary, all of which operated from 1958 to 1961. The landfills within the biosolids application field boundaries are 12.5 acres in size and heavily vegetated with small trees and brush. The surface area is uneven and has standing water in the low areas. The approximate boundaries of the landfill have been fenced, with signage; however, the actual boundaries of the landfill may extend beyond the fenced area. This AOPI is east of Roubidoux Creek, adjacent to and within the floodplain of the creek. Surface water generally flows west towards the adjacent creek and groundwater from this area generally flows north-northwest. The Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059) CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI has the same site boundary as IRP site FLW-059 (29995.1067).

5.2.19 Biosolids Application Field #19 (Landfill on a Branch to Big Piney, FLW-060)

The Biosolids Application Field #19 (Landfill on a Branch to Big Piney, FLW-060) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-17**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. The landfill was a biosolids management area with historical application of biosolids, but no biosolids have been applied since this PA began. It is unknown when the last biosolids application occurred. The inactive biosolids application field is 4.28 acres in size. This site is a 10.5-acre, closed sanitary landfill with unknown dates of operation. Based on historical aerial photos, the landfill may have been in operation from 1955 to 1971. It was likely used for the disposal of household waste, but no written records of the landfill exist. The site is currently flat and located within an ephemeral stream valley. It is bounded on the north and south by steep slopes. Unnamed ephemeral streams, which flow east and discharge to the Big Piney River, are located along the northern and southern boundaries of the site. Groundwater from this area generally flows to the east. The Biosolids Application Field #19 (Landfill on a Branch to Big Piney, FLW-060) CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI has the same site boundary as IRP site FLW-060 (29995.1068).

5.2.20 Biosolids Application Field #6

The Biosolids Application Field #6 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-18**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. The site is 71.4 acres in size and not an active biosolids management area. The site is a flat grassy area that is frequently mowed and used as a TA. Surface runoff flows to the northeast and southeast to two adjacent ephemeral tributaries of Roubidoux Creek. Groundwater from this area generally flows north. The Biosolids Application Field #6 CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.21 Biosolids Application Field #7

The Biosolids Application Field #7 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-19**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. This site is not an active biosolids management area. The inactive site is 31 acres in size and a relatively flat vegetated area with some low areas that can have standing water. Surface runoff flows to the southeast to an adjacent ephemeral tributary of the Big Piney River. The site is within the

Miller Spring Recharge Basin and groundwater generally flows northeast towards the Big Piney River. The Biosolids Application Field #7 CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.22 Biosolids Application Field #8

The Biosolids Application Field #8 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due historical application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-19**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. This site is not an active biosolids management area. The inactive site is 4.9 acres in size and relatively flat and includes grassy and wooded areas. Surface runoff flows to the northwest to an adjacent ephemeral tributary of the Big Piney River. The site is within the Miller Spring Recharge Basin and groundwater generally flows northeast towards the Big Piney River. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.23 Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003)

The Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003) is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-5**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. Landfill 3 was a biosolids management area with historical application of biosolids, but no biosolids have been applied since this PA began. It is unknown when the last biosolids application occurred. The inactive biosolids application fields are 77.7 acres in size. Landfill 3 was formerly administered as three separate IRP sites that are now managed as a single IRP site (FLW-003). It is an 82-acre, closed trench-and-fill municipal landfill that operated from 1965 to 1978 and was used primarily for disposal of household waste. A portion of the AOPI was once used as a fire TA, which was also identified as an AOPI (see **Section 5.2.4** Old Fire Training Area at Landfill 3 above). The site is currently a relatively flat grassy area. An ephemeral stream located to the east of the site is a tributary of the Big Piney River. Surface runoff flows east-southeast towards the Big Piney River. A groundwater divide is interpreted to run through the eastern part the site. Though the exact location of the divide is uncertain, groundwater west of the divide would flow towards the Roubidoux Creek and groundwater east of the divide would flow towards the Big Piney River. The Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003) CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI has the same site boundary as open IRP site FLW-003 (29995.1003).

5.2.24 Biosolids Application Field #11

The Biosolids Application Field #11 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-20**). The STP received wastewater potentially

containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. The site is not an active biosolids management area. The inactive site is 26.4 acres in size and a relatively flat vegetated area. This AOPI is adjacent to and within the floodplain of the Big Piney River, with surface runoff flowing north-northwest toward the river. Groundwater from this area generally flows north-northwest. The Biosolids Application Fields #11 CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.25 Biosolids Application Field #12

The Biosolids Application Field #12 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-21**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. The site is not an active biosolids management area. The inactive site was 9.3 acres in size. The site is a relatively flat grassy area. This AOPI is adjacent to and within the floodplain of the Big Piney River. Surface water flows northeast toward the river and groundwater from this area generally flows north. The Biosolids Application Fields #12 CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.26 Biosolids Application Field #13

The Biosolids Application Field #13 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-21**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF releases at the ARNG hangars, former fire TAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. The site is an active biosolids management area 33.34 acres in size. The site surrounds an aquatic TA with a man-made water feature and contains five areas, four of which are relatively flat grassy areas, and one that contains paved lots surrounded by grassy areas. This AOPI is adjacent to and within the floodplain of the Big Piney River. Surface water flows east toward the river and groundwater from this area generally flows east to northeast. The Biosolids Application Fields #13 CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.27 Biosolids Application Field #14

The Biosolids Application Field #14 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-22**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former FTAs, and fire stations; therefore, biosolids applied at this AOPI potentially

contain PFOS, PFOA, and/or PFBS. The site is an active biosolids management area 11.28 acres in size. This AOPI is adjacent to and within the floodplain of the Big Piney River. Groundwater from this area generally flows north. The Biosolids Application Fields #14 CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.28 Biosolids Application Field #15

The Biosolids Application Field #15 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-19**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF releases at the ARNG hangars, former FTAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. The site is not an active biosolids management area. The inactive site was 146.8 acres in size. The site is a relatively flat, vegetated area. Surface runoff flows to the northwest and southeast to adjacent ephemeral tributaries of the Big Piney River. The site is within the Miller Spring Recharge Basin and groundwater generally flows northeast towards the Big Piney River. The Biosolids Application Fields #15 CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.29 Biosolids Application Field #16

The Biosolids Application Field #16 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-23**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former FTAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. The site is not an active biosolids management area. The inactive site is 87.9 acres in size. The site is a relatively flat, grassy area located southwest of the Waynesville Regional Airport. Surface runoff flows to the southwest to an adjacent ephemeral tributary of the Big Piney River. The site is within the Shanghai Spring Recharge Basin and groundwater generally flows northeast towards the Big Piney River. The Biosolids Application Fields #16 CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.30 Biosolids Application Field #20

The Biosolids Application Field #20 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-24**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former FTAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. The site is an active biosolids management area 28.4 acres in size. The site is a relatively flat, grassy area surrounded by trees. Surface runoff flows to the northwest and southwest to adjacent ephemeral tributaries of the Big Piney River. Groundwater from this area generally

flows north. The Biosolids Application Fields #20 CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.31 Biosolids Application Field #21

The Biosolids Application Field #21 is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-25**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former FTAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. The site is not an active biosolids management area. The inactive site is 37.8 acres in size. The field is periodically mowed and surrounded by trees to the south and west. Surface runoff flows to the south-southeast to an adjacent ephemeral tributary of Roubidoux Creek. The site is within the Shanghai Spring Recharge Basin and groundwater generally flows northeast towards the Big Piney River. The Biosolids Application Fields #21 CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

5.2.32 Biosolids Application Field #27A

The Biosolids Application Field #27A is identified as an AOPI following records research, personnel interviews, and site reconnaissance due to historical and/or recent application of STP sludge (i.e., biosolids) to the land surface to encourage vegetation growth (**Figure 5-26**). The STP received wastewater potentially containing PFOS, PFOA, and/or PFBS from historical and recent AFFF leaks at the ARNG hangars, former FTAs, and fire stations; therefore, biosolids applied at this AOPI potentially contain PFOS, PFOA, and/or PFBS. The site is an active biosolids management area 35 acres in size. The field is periodically mowed and surrounded by trees. Surface runoff flows to the center of the site, then the northwest to an adjacent ephemeral tributary of Roubidoux Creek. Groundwater from this area generally flows north. The Biosolids Application Fields #27A CSM information is presented in **Section 5.3**. The current and future land use is industrial. This AOPI does not overlap with any open or closed IRP sites.

6 SUMMARY OF SI ACTIVITIES

Based on the results of the PA at FLW, an SI for PFOS, PFOA, and PFBS was conducted in accordance with CERCLA. SI sampling was completed at FLW at all AOPIs to evaluate presence or absence of PFOS, PFOA, and PFBS in comparison with the OSD risk screening levels. As such, an installation-specific QAPP Addendum (Arcadis 2020) was developed to supplement the general information provided in the PQAPP (Arcadis 2019) and to detail the site-specific proposed scopes of work for the SI. A preliminary CSM was prepared for each of the installation's AOPIs in accordance with the USACE Engineer Manual on Conceptual Site Models, EM 200-1-12 (USACE 2012). The preliminary CSMs identified potential human receptors and chemical exposure pathways based on current and/or reasonably anticipated future land uses. The preliminary CSMs identified soil, groundwater, surface water, and/or sediment pathways as potentially complete which guided the SI sampling. The QAPP Addendum details the sampling design and rationale based on each AOPI's preliminary CSM. The SI scope of work was completed in October 2020 through the collection of field data and analytical samples.

The SI field work was completed in accordance with the standard operating procedures (SOPs), technical guidance instructions (TGIs), sampling design, and QA/QC requirements as detailed in the QAPP Addendum (Arcadis 2020) and PQAPP (Arcadis 2019). The subsections below summarize the DQOs, sampling design and rationale, sampling activities and methods, and data analyses procedures for the SI phase at FLW. Non-conformances to the prescribed procedures in the PQAPP and QAPP Addendum are described in **Section 6.3.3**. Analytical results obtained through SI field activities are summarized in **Section 7**.

6.1 Data Quality Objectives

As identified during the DQO process and outlined in the site-specific QAPP Addendum (Arcadis 2020), the objective of the SI is to identify whether there has been a release to the environment at the AOPIs identified in the PA and to determine if further investigation is warranted. This SI evaluated groundwater, soil, surface water, and sediment for PFOS, PFOA, and PFBS presence or absence at each of the sampled AOPIs.

6.2 Sampling Design and Rationale

The rationale for sampling at each AOPI is illustrated on **Figure 6-1** below.

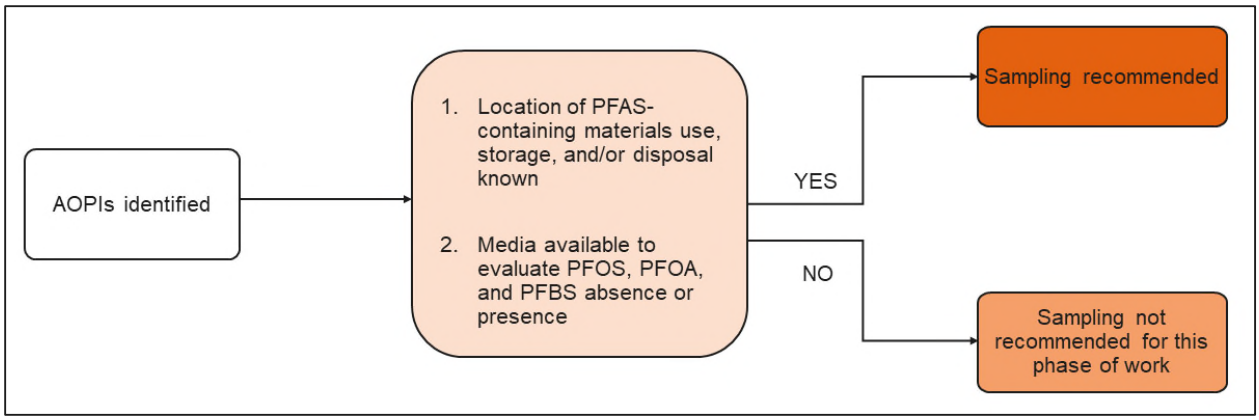

Figure 6-1: AOPI Sampling Decision Tree

The sampling design for SI sampling activities at FLW is detailed in Worksheet #17 of the QAPP Addendum (Arcadis 2020). Briefly, groundwater samples were collected to inform the interpretation of PFOS, PFOA, and PFBS presence and update the individual AOPI CSMs. Soil samples were collected to evaluate PFOS, PFOA, and PFBS presence or absence, to evaluate the potential for those areas to be sources to surface water and groundwater as an influence to drinking water, and to update the individual AOPI CSMs. Surface water samples were collected to inform the presence or absence of PFOS, PFOA, and PFBS at potential release areas or adjacent surface water bodies. Sediment samples were collected to evaluate PFOS, PFOA, and PFBS presence or absence, to evaluate the potential for those areas to be sources of to surface water and groundwater as an influence to drinking water, and to update the individual AOPI CSMs.

Due to the karst geology and depth to water at FLW (**Sections 2.6 and 2.7**), groundwater was not sampled at AOPIs that do not have existing monitoring wells. The sampling depths at existing monitoring wells were at approximately the center of the saturated screened interval. **Table 6-1** includes the monitoring well construction details for the wells sampled during the SI (if available).

6.3 Sampling Methods and Procedures

Environmental data were collected and analyzed in accordance with the PQAPP (Arcadis 2019), the SOPs and TGIs included as Appendix A to the PQAPP, the QA/QC requirements identified in Worksheet #20 of the PQAPP, the approved scope and sampling methods outlined in the site-specific QAPP Addendum (Arcadis 2020), and the safety procedures specified in the Accident Prevention Plan (Arcadis 2018) and SSHP (Arcadis 2020). The sampling methods described in the SOPs and TGIs establish equipment requirements, procedures for preparing equipment and containers before sampling, sampling procedures under various conditions, and procedures for storing samples to ensure that sample contamination does not occur during collection, and transport. In general, sampling techniques used in the SI were consistent with conventional sampling techniques used in the environmental industry, but special considerations were made regarding PFAS-containing materials and equipment and cross-contamination potential.

The sampling methods employed during the SI are detailed in the PQAPP (Arcadis 2019) and QAPP Addendum (Arcadis 2020). The subsections below provide a summary of the field methods and

procedures utilized to complete the SI scope of work. Field notes and field forms (i.e., soil boring logs, groundwater purging logs, equipment calibration forms, tailgate health and safety forms, and sample collection logs) documenting the SI sampling activities are included in **Appendices J** and **K**, respectively.

6.3.1 Field Methods

Generally, shallow soil borings (0 to 2 feet bgs) were advanced via hand auger within the potential source area and/or within drainage pathways (e.g., nearby ephemeral streams) at each AOPI. If the potential source media at an AOPI included subsurface soil, soil borings were advanced via sonic drilling to collect both shallow soil (0 to 2 feet bgs) and subsurface soil samples. Subsurface soil samples were collected from a 2-foot interval starting below the interpreted depth of a potential subsurface release (e.g., base of a former subgrade pit). At each soil boring location, shallow and/or subsurface soil was sampled for analysis of the PFAS constituents listed in Worksheet #15 of the Final UFP QAPP Addendum (Arcadis 2020). One shallow soil sample and one subsurface soil sample from each AOPI were also analyzed for total organic carbon (TOC), grain size, and pH, as applicable. Soil samples were collected from a total of 82 discrete shallow soil (hand auger) boring locations and 18 discrete shallow/subsurface soil (sonic) locations.

Groundwater samples were collected from 19 existing monitoring wells from approximately the center of the saturated screened interval, when known, using low-flow methods or Hydrasleeve™. If well construction details were not known, then the total well depth and groundwater depth were collected in the field and groundwater samples were collected from approximately the center of the groundwater column.

Surface water samples were collected from three locations using direct-fill methods just below the water surface and field parameters were recorded before sampling. Although surface water samples were proposed to be collected at six locations, many of the proposed locations are ephemeral and three were not flowing at the time of the sampling event. Therefore, at these locations, a shallow soil sample was collected within the spring run from 0 to 2 feet bgs.

Sediment samples were collected two locations from the upper 10 centimeters using a stainless-steel trowel; sediment samples were decanted before bottling for laboratory analysis.

Groundwater, surface water, and sediment were sampled for analysis of the PFAS constituents listed in Worksheet #15 of the Final UFP QAPP Addendum (Arcadis 2020). Coordinates for soil, surface water, and sediment sample locations were recorded using a handheld global positioning system locator. Decontamination procedures for non-dedicated equipment used during sampling are described in **Section 6.3.5**.

6.3.2 Quality Assurance/Quality Control

Worksheets #20 of the PQAPP and QAPP Addendum provide QA/QC requirements for field duplicates, matrix spike/matrix spike duplicates, equipment blanks (EBs), source blanks for water used in the decontamination of equipment, and field blanks for laboratory-supplied water used in the final decontamination step.

QA/QC samples were collected at the frequencies specified in the QAPP Addendum (Arcadis 2020), typically at a rate of 1 per 20 parent samples. Field duplicates and matrix spike/matrix spike duplicate

samples were collected for media sampled for PFOS, PFOA, PFBS, and TOC only. EBs were collected for media sampled for PFOS, PFOA, and PFBS at a frequency of one per piece of relevant equipment for each sampling event, as specified in the QAPP Addendum (Arcadis 2020). The decontaminated reusable equipment from which EBs were collected include bladder pump, water level meter, hand auger, drill casing, and Hydrasleeve™ weights and clips as applicable to the sampled media. Source blanks were collected from the water from the Indiana Street Well (Building 6505) and deionized water was used to decontaminate reusable equipment. Analytical results for blank samples are discussed in **Section 7.36**.

6.3.3 Dedicated Equipment Background

Dedicated equipment background (DEB) samples were collected from five pieces of unexpected, dedicated equipment found in monitoring wells: dedicated bladder pump system at MW-5904, string holding a passive diffusion bag (PDB) at MW-5604, string holding a PDB at MW-1202, string holding a PDB at MW-6002, and a compression fitting at MW-301A. Further DEB analysis is included in **Section 7.33**.

6.3.4 Field Change Reports

No instances of major scope modifications (i.e., those that may have had a significant impact on the project scope and/or data usability/quality, or required stop-work, and warranted discussion with USACE) were encountered during the FLW SI work.

In some cases, clarifications to the established scope of work may be needed but do not necessarily constitute a non-conformance from the sampling plans described in the QAPP Addendum. Minor modifications from and clarifications for the procedures and scope of work detailed in the QAPP Addendum and PQAPP and that did not affect DQOs are documented in Field Change Reports (FCRs) included as **Appendix L** and are summarized below:

FCR-FLW-01

- Groundwater monitoring wells at Landfill 3, Former Fire Station #2, Five STP Landfills, Landfill 15, and Landfill 2 were sampled using Hydrasleeves™ instead of the proposed bladder pump method due to depth of the wells.

FCR-FLW-02

- Well SG-02 at Landfill 2 was not sampled as it was a gas well and not a groundwater monitoring well.

FCR-FLW-03

- Monitoring well MW-301A could not be sampled due to materials from unexpected, dedicated equipment in the well. A Hydrasleeve™ was deployed at MW-301A but could not reach the water column due to the material obstructing the path above the water level.

FCR-FLW-04

- Additional QC samples were collected during the sampling event. DEB samples were collected from five pieces of unexpected, dedicated equipment found in the monitoring wells: dedicated bladder pump system at MW-5904, string holding a PDB at MW-5604, string holding a PDB at MW-1202, string holding a PDB at MW-6002, and a compression fitting at MW-301A. An additional EB was collected from the Hydrasleeves™, which were proposed after the sampling event had begun.

6.3.5 Decontamination

Non-dedicated reusable sampling equipment (e.g., Hydrasleeve™ weights and clips, hand augers, drill cutting shoes and casing, bladder pump, water-level meters) that came into direct contact with sampling media was decontaminated before first use, between sampling locations/intervals, and before demobilization in accordance with P-09, TGI - Groundwater and Soil Sampling Equipment Decontamination (Arcadis 2019; Appendix A).

6.3.6 Investigation-Derived Waste

IDW (including soil cuttings, groundwater purged during sampling, and water from decontamination of drill tooling), was containerized, stored at the 90-day storage yard, and characterized. IDW will be disposed of at an off-site facility in accordance with local and state regulations. Analytical results for IDW samples collected during the SI are discussed in **Section 7.34**.

6.4 Data Analysis

The subsections below summarize the laboratory analytical methods and the methodology used to evaluate data collected during the SI through data verification and usability assessments (as completed by a project chemist, independent of the project team).

6.4.1 Laboratory Analytical Methods

Analytical samples collected during the SI were submitted to Pace South Carolina (formerly Shealy Environmental Services, Inc.), an ELAP-accredited laboratory for PFAS analysis, including PFOS, PFOA, and PFBS, by liquid chromatography with tandem mass spectrometry. Laboratory analyses associated with the SI were completed in accordance with Worksheets #12.1 through #12.5 in the PQAPP (Arcadis 2019). Eighteen PFAS-related compounds, including PFOS, PFOA, and PFBS, were analyzed for in groundwater, soil, surface water, and sediment samples using an analytical method that is ELAP-accredited and compliant with QSM 5.3 (DoD and Department of Energy 2019), Table B-15.

Additionally, the following general chemistry and physical characteristic analyses were completed for select soil and sediment samples in accordance with Worksheet #18 of the QAPP Addendum (Arcadis 2020) by the analytical method noted:

- TOC by Solid Waste Test Method 846 9060A
- Grain size analysis by American Society for Testing and Materials D422-63
- pH by Solid Waste Test Method 846 9045D.

These data are collected as they may be useful in future fate and transport studies.

The laboratory limit of detection (LOD) is defined as “the lowest concentration for reliable reporting of a non-detect of a specific analyte in a specific matrix with a specific method at 99% confidence” (DoD 2017). The lowest concentration of a substance that produces a quantitative result within specified limits of precision and bias is known as the limit of quantitation (LOQ; DoD 2017). Concentrations detected between the LOD and LOQ, therefore, are considered estimates and are qualified as such on laboratory

analytical reports. Instrument-specific detection limits (e.g., the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence; DoD 2017), as provided for each analyte by the laboratory, are reported along with the LODs and LOQs in the laboratory analytical reports included in the Data Usability Summary Report (DUSR; **Appendix M**).

6.4.2 Data Validation

All analytical data generated during the SI, except grain size, were verified and validated in accordance with the data verification procedures described in Worksheets #34 through #36 of the PQAPP (Arcadis 2019). Each laboratory data package/sample delivery group underwent Stage 3 data validation in accordance with DoD QSM 5.3 (DoD and Department of Energy 2019). Additionally, 10% of the data underwent Stage 4 data validation. Copies of the data validation reports for each sample delivery group are included as attachments to the DUSR in **Appendix M**. The Level IV analytical reports are included within **Appendix M** in the final electronic deliverable only.

6.4.3 Data Usability Assessment and Summary

A data usability assessment was completed for all analytical data associated with SI sampling at FLW. Documentation generated during the data usability assessments, which were compiled into a DUSR (**Appendix M**), was prepared in accordance with the USACE Engineer Manual 200-1-10 (USACE 2005), the Final DoD General Data Validation Guidelines (DoD 2019) and the Final DoD Data Validation Procedure for Per-and Polyfluoroalkyl Substances Analysis by QSM Table B-15 (DoD 2020), that reviewed precision, accuracy, completeness, representativeness, comparability, and sensitivity. A statement of overall data usability is included in the DUSR.

Based on the final data usability assessment, the environmental data collected at FLW during the SI were found to be acceptable and usable for this SI evaluation with the qualifications documented in the DUSR and its associated data validation reports (**Appendix M**), and as indicated in the full analytical tables (**Appendix N**) provided for the SI results. These data are of sufficient quality to meet the objectives and requirements of the PQAPP (Arcadis 2019) and FLW QAPP Addendum (Arcadis 2020). Data qualifiers applied to laboratory analytical results for samples collected during the SI at FLW are provided in the data tables, data validation reports, and the Data Usability Summary Table located at the end of DUSR. Qualifiers for data shown on figures are defined in the notes of figures.

6.5 Office of the Secretary of Defense Risk Screening Levels

The OSD risk screening levels for PFOS, PFOA, and PFBS in groundwater (tap water) and soil were calculated using the USEPA's RSL calculator for residential and industrial/commercial worker receptor scenarios and current toxicity values. These risk screening levels are shown in **Table 6-2**.

Table 6-2 OSD Risk Screening Levels Calculated for PFOS, PFOA, PFBS in Tap Water and Soil Using USEPA's Regional Screening Level Calculator

Chemical	Residential Scenario Risk Screening Levels Calculated Using USEPA RSL Calculator		Industrial/Commercial Scenario Risk Screening Levels Calculated Using USEPA RSL Calculator
	Tap Water (ng/L or ppt) [1]	Soil (mg/kg or ppm) [1,2]	Soil (mg/kg or ppm) [1,2]
PFOS	40	0.13	1.6
PFOA	40	0.13	1.6
PFBS	600	1.9	25

Notes:

1. Risk screening levels for tap water and soil provided by the OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September 15 (**Appendix A**).
2. All soil and sediment data will be screened against both the Residential Scenario and Industrial/Commercial risk screening levels (if collected from less than 2 feet bgs), regardless of the current and projected land use of the AOPI. Soil samples collected from greater than 2 feet but less than 15 feet bgs will be compared to the Industrial/Commercial risk screening levels only, and soil samples collected from greater than 15 feet bgs will not be compared to either risk screening level.

mg/kg = milligram per kilogram
ng/L = nanograms per liter
ppm = parts per million
ppt = parts per trillion

The OSD residential tap water risk screening levels will be used to compare all groundwater data for this Army PFAS PA/SI. While the current and most likely future land uses of the AOPIs at FLW are industrial/commercial, both residential and industrial/commercial soil risk screening levels for PFOS, PFOA, and PFBS will be used to evaluate detected soil concentrations. The data from the SI sampling event are compared to the OSD risk screening levels in **Section 7**. If concentrations of PFOS, PFOA, or PFBS are detected greater than the applicable OSD risk screening levels, further study in a remedial investigation is recommended in **Section 8**.

7 SUMMARY AND DISCUSSION OF SI RESULTS

This section summarizes the analytical results obtained from samples collected during the SI at FLW (field duplicate results are provided in the associated tables). Sampled media and QA/QC samples were analyzed for the constituents prescribed per Worksheet #18 of the QAPP Addendum (Arcadis 2020). The sample results discussion below focuses on the PFOS, PFOA, and PFBS analytical results because they have OSD risk screening levels. The Army will make subsequent investigation decisions based on these constituents' concentrations relative to the OSD risk screening levels.

Tables 7-1 through **7-4** provide a summary of the groundwater, soil, surface water, and sediment analytical results for PFOS, PFOA, and PFBS only. **Table 7-5** summarizes AOPIs and whether their SI results exceed the OSD risk screening levels. **Appendix N** includes the full suite of analytical results for these media, as well as for the QA/QC samples. An overview of AOPIs at FLW with OSD risk screening level exceedances is depicted on **Figure 7-1**. **Figures 7-2** through **7-25** show the PFOS, PFOA, and PFBS analytical results in groundwater, soil, surface water and sediment for each AOPI. Non-detected results are reported as less than the LOQ. Detections of PFOS, PFOA, and/or PFBS greater than the applicable OSD risk screening levels are highlighted in summary tables and on figures. Final qualifiers applied to the data by the laboratory and the project chemist (as defined in **Section 6.4.3**) are presented on the analytical tables. Groundwater and surface water data collected during the SI are reported in ng/L, or parts per trillion, and soil and sediment data are reported in mg/kg, or parts per million. All surface water samples were collected downstream of the surface water intake on the Big Piney River. Therefore, these samples will not be compared to the OSD risk screening levels.

Field parameters measured for groundwater during low-flow purging and sample collection and for surface water during sample collection are provided on the field forms in **Appendix K**. Soil and sediment lithological descriptions are provided on the field forms in **Appendix K**. The results of the SI are grouped by AOPI and discussed for each medium as applicable.

Table 7-5 AOPIs and OSD Risk Screening Level Exceedances

AOPI Name	OSD Exceedances (Y/N)
ARNG Hangars (Buildings 5010 and 5012)	No
DPW Old Fire Training Area (TA 210, FLW-028)	No
New Fire Training Area (TA 207, FLW-029)	Yes
Old Fire Training Area at Landfill 3 (FLW-053)	Yes
Old Fire Training Area Runway End (FLW-054)	No
Active Fire Station #1 (Building 580)	Yes
Active Fire Station #2 (Building 5001)	Yes
Former Fire Station #1 (Triangle Station)	No
Former Fire Station #2 (Oklahoma Avenue)	No
Former Fire Station #3 (Troop Trail)	No

AOPI Name	OSD Exceedances (Y/N)
Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026)	No
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	Yes
Biosolids Application Field #17 (Landfill 15, FLW-020)	No
Biosolids Application Field #18 (Landfill 2, FLW-002)	No
Biosolids Application Field #2 (Landfill 9, FLW-011)	Yes
Biosolids Application Field #3 (Landfill 8, FLW-010)	Yes
Biosolids Application Field #5 (Landfill 12, FLW-017)	Yes
Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059)	No
Biosolids Application Field #19 (Landfill on a Branch to Big Piney, FLW-060)	No
Biosolids Application Field #6	No
Biosolids Application Field #7	No
Biosolids Application Field #8	No
Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003)	Yes
Biosolids Application Field #11	No
Biosolids Application Field #12	No
Biosolids Application Field #13	No
Biosolids Application Field #14	No
Biosolids Application Field #15	No
Biosolids Application Field #16	No
Biosolids Application Field #20	No
Biosolids Application Field #21	No
Biosolids Application Field #27A	No

7.1 ARNG Hangars (Buildings 5010 and 5012)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with ARNG Hangars (Buildings 5010 and 5012).

7.1.1 Soil

Soil samples were collected via hand auger from seven locations at ARNG Hangars (Buildings 5010 and 5012) (FLW-ARNG-01-SO, FLW-ARNG-02-SO, FLW-ARNG-03-SO, FLW-ARNG-04-SO, FLW-ARNG-05-SO, FLW-ARNG-06-SO, FLW-ARNG-07-SO; **Figure 7-2**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**.

PFOS and PFBS compounds were not detected in any of the soil samples. PFOA was detected in all samples except FLW-ARNG-05-SO below the residential OSD risk screening level of 0.13 mg/kg [FLW-ARNG-01-SO (0.0048 DJ [analyte was analyzed at dilution and the result is an estimated quantity] mg/kg), FLW-ARNG-02-SO (0.0054 mg/kg), FLW-ARNG-03-SO (0.0028 mg/kg), FLW-ARNG-04-SO (0.026 DJ mg/kg), FLW-ARNG-06-SO (0.086 DJ mg/kg), and FLW-ARNG-07-SO (0.0084 mg/kg)].

7.2 DPW Old Fire Training Area (TA 210, FLW-028)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with DPW Old Fire Training Area (TA 210, FLW-028).

7.2.1.1 Soil

Soil samples were collected from nine locations at DPW Old Fire Training Area (TA 210, FLW-028) (FLW-028-01-SO, FLW-028-02-SO, FLW-028-03-SO, FLW-028-04-SO, FLW-028-05-SO, FLW-028-06-SO, FLW-028-07-SO, FLW-028-08-SO, FLW-028-09-SO; **Figure 7-3**). Each boring included one surface soil sample collected via hand auger from approximately 0 to 2 feet bgs. In addition, two of the borings (FLW-028-01-SO and FLW-028-02-SO) were continued using sonic drilling and collected from approximately 2 to 4 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected in all soil samples. PFOS concentrations were below the residential OSD risk screening level of 0.13 mg/kg in surface soil samples (0.0024 to 0.041 mg/kg) and below the industrial/commercial OSD risk screening level of 1.6 mg/kg in subsurface soil samples (0.16 to 0.44 mg/kg). PFOA was detected below the residential OSD risk screening level of 0.13 mg/kg at FLW-028-04-SO (0.00083 J mg/kg) and FLW-028-07-SO (0.00077 J mg/kg). PFBS was detected below the industrial/commercial OSD risk screening level of 25 mg/kg at FLW-028-02-SO-2-4 (0.0086 mg/kg).

7.3 New Fire Training Area (TA 207, FLW-029)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with New Fire Training Area (TA 207, FLW-029).

7.3.1 Soil

Soil samples were collected from seven locations at New Fire Training Area (TA 207, FLW-029) (FLW-029-01-SO, FLW-029-02-SO, FLW-029-03-SO, FLW-029-04-SO, FLW-029-05-SO, FLW-029-06-SO, FLW-029-07-SO; **Figure 7-3**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). One of

the borings (FLW-029-01-SO) was continued using sonic drilling and collected from approximately 2 to 4 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected in all soil samples. PFOS concentrations were above the residential OSD risk screening level of 0.13 mg/kg at FLW-029-01-SO (0.14 mg/kg), FLW-029-05-SO (0.16 mg/kg), and FLW-029-07-SO (0.15 mg/kg), and above the OSD industrial/commercial risk screening level of 1.6 mg/kg at FLW-029-01-SO-2-4 (1.9 DJ mg/kg), FLW-029-03-SO (3.6 DJ mg/kg), and FLW-029-04-SO (2.3 DJ mg/kg). PFOA was detected below the residential OSD risk screening level of 0.13 mg/kg in all soil samples (0.0010-0.011 mg/kg). PFBS was detected below the residential OSD risk screening level of 1.9 mg/kg at FLW-029-03-SO (0.059 DJ mg/kg), FLW-029-04-SO (0.033 mg/kg), FLW-029-05-SO (0.0033 mg/kg), and FLW-029-07-SO (0.00078 J mg/kg). PFBS was detected below the industrial/commercial OSD risk screening level of 25 mg/kg at FLW-029-01-SO-2-4 (0.0026 mg/kg).

7.4 Old Fire Training Area at Landfill 3 (FLW-053)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Old Fire Training Area at Landfill 3 (FLW-053) and the groundwater PFOS, PFOA, and PFBS analytical results associated with Old Fire Training Area at Landfill 3 (FLW-053) and Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003). This is due to the Old Fire Training Area at Landfill 3 (FLW-053) AOPI being located within the Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003) AOPI.

7.4.1 Soil

Soil samples were collected from three locations at Old Fire Training Area at Landfill 3 (FLW-053) (FLW-053-01-SO, FLW-053-02-SO, FLW-053-03-SO; **Figure 7-4**). Each boring included one surface soil sample collected via hand auger from approximately 0 to 2 feet bgs and subsurface soil sample collected using sonic drilling from approximately 2 to 4 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected in all soil samples and above the residential OSD risk screening level of 0.13 mg/kg at FLW-053-02-SO (0.39 DJ mg/kg) and FLW-053-03-SO (0.14 mg/kg). PFOA was detected in all surface soil samples but below the residential OSD risk screening level of 0.13 mg/kg (0.0024 to 0.019 mg/kg). PFOA was detected in all subsurface soil samples but below the industrial/commercial OSD risk screening level of 1.6 mg/kg (0.0018 to 0.014 mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg at FLW-053-02-SO (0.00086 J mg/kg). PFBS was detected but below the industrial/commercial OSD risk screening level of 25 mg/kg at FLW-053-02-SO-2-4 (0.018 mg/kg), and FLW-053-03-SO-2-4 (0.00078 J mg/kg).

7.4.2 Groundwater

Groundwater data exists for the Old Fire Training Area at Landfill 3 (FLW-053) AOPI but the AOPI boundary is contained by the Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003) AOPI boundary. Therefore, the results are presented collectively in **Section 7.23.2** below.

7.5 Old Fire Training Area Runway End (FLW-054)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Old Fire Training Area Runway End (FLW-054).

7.5.1 Soil

Soil samples were collected from four locations at Old Fire Training Area Runway End (FLW-054) (FLW-054-01-SO, FLW-054-02-SO, FLW-054-03-SO, FLW-054-04-SO; **Figure 7-5**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg in all soil samples (0.00057 to 0.0013 mg/kg). PFOA and PFBS were not detected in any soil samples.

7.6 Active Fire Station #1 (Building 580)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Active Fire Station #1 (Building 580).

7.6.1 Soil

Soil samples were collected from four locations at Active Fire Station #1 (Building 580) (FLW-AFS1-01-SO, FLW-AFS1-02-SO, FLW-AFS1-03-SO, FLW-AFS1-04-SO; **Figure 7-6**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected in all soil samples and above the residential OSD risk screening level of 0.13 mg/kg at FLW-AFS1-01-SO (0.49 DJ mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-AFS1-01-SO (0.0013 mg/kg) and FLW-AFS1-03-SO (0.0007 J mg/kg). PFBS was not detected in any soil samples.

7.7 Active Fire Station #2 (Building 5001)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Active Fire Station #2 (Building 5001).

7.7.1 Soil

Soil samples were collected from four locations at Active Fire Station #2 (Building 5001) (FLW-AFS2-01-SO, FLW-AFS2-02-SO, FLW-AFS2-03-SO, FLW-AFS2-04-SO; **Figure 7-7**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected in all soil samples and above the residential OSD risk screening level of 0.13 mg/kg at FLW-AFS2-01-SO (0.49 DJ mg/kg), FLW-AFS2-03-SO (0.21 mg/kg), and FLW-AFS2-04-SO (1.1 DJ mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg in all soil samples (0.00094 to 0.0091 mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg at FLW-AFS2-03-SO (0.0013 mg/kg) and FLW-AFS2-04-SO (0.001 mg/kg).

7.8 Former Fire Station #1 (Triangle Station)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Former Fire Station #1 (Triangle Station).

7.8.1 Soil

Soil samples were collected from three locations at Former Fire Station #1 (Triangle Station) (FLW-FFS1-01-SO, FLW-FFS1-02-SO, FLW-FFS1-03-SO; **Figure 7-8**). Each boring included one surface soil sample collected via hand auger from approximately 0 to 2 feet bgs and one subsurface soil sample collected using sonic drilling from 2 to 4 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg for all surface soil samples (0.0020 to 0.019 mg/kg) and below the industrial/commercial OSD risk screening level of 1.6 mg/kg for all subsurface soil samples (0.0042 to 0.059 mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-FFS1-02-SO (0.00069 J mg/kg). PFOA was detected above the residential OSD risk screening level but below the industrial/commercial OSD risk screening level of 1.6 mg/kg at FLW-FFS1-02-SO-2-4 (0.011 mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg at FLW-FFS1-02-SO (0.0011 mg/kg). PFBS was detected above the residential OSD risk screening level but below the industrial/commercial OSD risk screening level of 25 mg/kg at FLW-FFS1-02-SO-2-4 (0.0023 mg/kg).

7.9 Former Fire Station #2 (Oklahoma Avenue)

The subsections below summarize the soil and groundwater PFOS, PFOA, and PFBS analytical results associated with Former Fire Station #2 (Oklahoma Avenue).

7.9.1 Soil

Soil samples were collected from three locations at Former Fire Station #2 (Oklahoma Avenue) (FLW-FFS2-01-SO, FLW-FFS2-02-SO, FLW-FFS2-03-SO; **Figure 7-9**). Each boring included one surface soil sample collected via hand auger from approximately 0 to 2 feet bgs and one subsurface soil sample collected using sonic drilling from 2 to 4 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and PFBS were not detected in any soil samples.

7.9.2 Groundwater

Groundwater samples were collected from two locations at existing monitoring wells between approximately 800 to 900 feet from the Former Fire Station #2 (Oklahoma Avenue) AOPI in the inferred

downgradient direction (FLW-MW-5604 and FLW-MW-5609; **Figure 7-9**). Each groundwater sample was taken from the middle of the screened interval using a bladder pump (MW-5604) and Hydrasleeve™ (MW-5609). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. PFOS, PFOA, and/or PFBS were detected in all samples collected.

PFOS was detected but below the OSD risk screening level of 40 ng/L in both groundwater samples (11 to 26 ng/L). PFOA was detected but below the OSD risk screening level of 40 ng/L at FLW-MW-5604 (5.1 ng/L). PFBS was detected but below the OSD risk screening level of 600 ng/L at FLW-MW-5604 (3.7 ng/L).

7.10 Former Fire Station #3 (Troop Trail)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Former Fire Station #3 (Troop Trail).

7.10.1 Soil

Soil samples were collected from three locations at Former Fire Station #3 (Troop Trail) (FLW-FFS3-01-SO, FLW-FFS3-02-SO, FLW-FFS3-03-SO; **Figure 7-10**). Each boring included one surface soil sample collected via hand auger from approximately 0 to 2 feet bgs and one subsurface soil sample collected using sonic drilling from approximately 2 to 4 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg for all surface soil samples (0.0055 to 0.013 mg/kg) and below the industrial/commercial OSD risk screening level of 1.6 mg/kg for all subsurface soil samples (0.021 to 0.031 mg/kg). PFOA was detected but below the industrial/commercial OSD risk screening level of 1.6 mg/kg at FLW-FFS3-01-SO-2-4 (0.00066 J mg/kg), FLW-FFS3-02-SO-2-4 (0.00054 J mg/kg), and FLW-FFS3-03-SO-2-4 (0.00073 J mg/kg). PFBS was not detected in any soil samples.

7.11 Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026)

The subsections below summarize the soil and surface water PFOS, PFOA, and PFBS analytical results associated with Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026).

7.11.1 Soil

Soil samples were collected from three locations at Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026) AOPI within the northern portion of the former lagoons (FLW-026) area, which was the only portion accessible (FLW-026-01-SO, FLW-026-02-SO, FLW-026-03-SO; **Figure 7-11**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). Subsurface soil samples were collected using sonic drilling from approximately 2 to 4 feet bgs. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg for all surface soil samples (0.012 to 0.023 mg/kg) and below the industrial/commercial OSD risk screening level of 1.6

mg/kg for all subsurface soil samples (0.00071 to 0.0048 mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-026-01-SO (0.00097 J mg/kg), FLW-026-02-SO (0.0013 J- [the result is an estimated quantity and may be biased low] mg/kg), and FLW-026-03-SO (0.0007 J mg/kg). PFOA was detected but below the industrial/commercial OSD risk screening level of 1.6 mg/kg at FLW-026-03-SO-2-4 (0.00062 J mg/kg). PFBS was not detected in any soil samples.

7.11.2 Surface Water

One surface water sample was collected from a location at Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026) (FLW-026-01-SW; **Figure 7-11**). This surface water sample was collected mid-point of the water column. The sample location was downstream of the system effluent, and at the time of the sampling event, the system effluent was the only water in the stream. A summary of PFOS, PFOA, and PFBS water analytical results is provided in **Table 7-3**.

PFOS, PFOA, and PFBS were detected at FLW-026-01-SW at 8.8 ng/L, 4.2 ng/L, and 9.5 ng/L, respectively.

7.12 Biosolids Application Field #1 (Five STP Landfills, FLW-012)

The subsections below summarize the soil and groundwater PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #1 (Five STP Landfills, FLW-012). Soil samples within the Biosolids Application Field #1 are grouped by STP landfill number:

STP Landfill 10A (FLW-012-13-SO; FLW-012-14-SO; FLW-012-15-SO)

STP Landfill 10B (FLW-012-10-SO; FLW-012-11-SO; FLW-012-12-SO)

STP Landfill 11A (FLW-012-01-SO; FLW-012-02-SO; FLW-012-03-SO; FLW-012-04-SO)

STP Landfill 11B (FLW-012-05-SO; FLW-012-06-SO)

STP Landfill 11C (FLW-012-07-SO; FLW-012-08-SO; FLW-012-09-SO)

7.12.1 Soil

Soil samples were collected from 15 locations at the Biosolids Application Field #1 (Five STP Landfills, FLW-012) (FLW-012-01-SO, FLW-012-02-SO, FLW-012-03-SO, FLW-012-04-SO, FLW-012-05-SO, FLW-012-06-SO, FLW-012-07-SO, FLW-012-08-SO, FLW-012-09-SO, FLW-012-10-SO, FLW-012-11-SO, FLW-012-12-SO, FLW-012-13-SO, FLW-012-14-SO, FLW-012-15-SO; **Figure 7-11**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples except FLW-012-14-SO.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg in 11 of 15 samples and detected above the residential OSD risk screening level of 0.13 mg/kg at FLW-012-05-SO (0.24 mg/kg), FLW-012-07-SO (0.39 DJ mg/kg), and FLW-012-09-SO (0.62 DJ mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg in 10 of 15 samples (0.00067 to 0.030 mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg at FLW-012-

05-SO (0.001 J mg/kg), FLW-012-07-SO (0.002 mg/kg), FLW-012-08-SO (0.0022 mg/kg), and FLW-012-09-SO (0.0017 mg/kg).

7.12.2 Groundwater

Groundwater samples were collected from five locations at existing monitoring wells between approximately 50 to 1,000 feet from the Biosolids Application Field #1 (Five STP Landfills, FLW-012) AOPI in the inferred downgradient direction (FLW-MW-1201, FLW-MW-1202, FLW-MW-1203, FLW-MW-1204, FLW-MW-1205; **Figure 7-11**). Each groundwater sample was taken from the middle of the screened interval utilizing a bladder pump (FLW-MW-1202, FLW-MW-1203, FLW-MW-1204), Hydrasleeve™ (FLW-MW-1201), and peristaltic pump (FLW-MW-1205). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. PFOS, PFOA, and/or PFBS were detected at four of five monitoring wells.

PFOS was detected in four of five wells (not detected at FLW-MW-1203). Furthermore, the sample collected from FLW-MW-1205 contained PFOS at a concentration above the OSD risk screening level of 40 ng/L (160 ng/L). PFOA was detected but below the OSD risk screening level of 40 ng/L in all groundwater samples (2.1 to 22 ng/L). PFBS was detected but below the OSD risk screening level of 600 ng/L at FLW-MW-1204 (2.0 J ng/L) and FLW-MW-1205 (7.3 ng/L).

7.13 Biosolids Application Field #17 (Landfill 15, FLW-020)

The subsections below summarize the soil and groundwater PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #17 (Landfill 15, FLW-020).

7.13.1 Soil

Soil samples were collected from four locations at Biosolids Application Field #17 (Landfill 15, FLW-020) (FLW-020-01-SO, FLW-020-02-SO, FLW-020-03-SO, FLW-020-04-SO; **Figure 7-12**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS and PFOA were detected but below the residential OSD risk screening level of 0.13 mg/kg in all soil samples (0.00063 to 0.089 mg/kg and 0.00064 to 0.0054 mg/kg). PFBS was detected at all samples, except FLW-020-04-SO, but below the residential OSD risk screening level of 1.9 mg/kg.

7.13.2 Groundwater

Groundwater samples were collected from two locations at existing monitoring wells between approximately 50 to 500 feet from the Biosolids Application Field #17 (Landfill 15, FLW-020) AOPI in the inferred downgradient direction (FLW-MW-214 and FLW-MW-216; **Figure 7-12**). Each groundwater sample was taken from the middle of the screened interval utilizing a bladder pump (FLW-MW-216) and Hydrasleeve™ (FLW-MW-214). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. PFOS, PFOA, and PFBS were detected at FLW-MW-216 but not at FLW-MW-214.

PFOS was detected but below the OSD risk screening level of 40 ng/L at FLW-MW-216 (5.3 ng/L). PFOA was detected but below the OSD risk screening level of 40 ng/L at FLW-MW-216 (7.3 ng/L). PFBS was detected but below the OSD risk screening level of 600 ng/L at FLW-MW-216 (28 ng/L).

7.14 Biosolids Application Field #18 (Landfill 2, FLW-002)

The subsections below summarize the soil and groundwater PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #18 (Landfill 2, FLW-002).

7.14.1 Soil

Soil samples were collected from four locations at the Biosolids Application Field #18 (Landfill 2, FLW-002) (FLW-002-01-SO, FLW-002-02-SO, FLW-002-03-SO, FLW-002-04-SO; **Figure 7-12**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS and PFOA were detected but below the residential OSD risk screening level of 0.13 mg/kg in all soil samples (0.00081 to 0.018 mg/kg and 0.0017 to 0.0035 mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg at FLW-002-01-SO (0.00087 J mg/kg) and FLW-002-04-SO (0.00052 J mg/kg).

7.14.2 Groundwater

Groundwater samples were collected from three locations at existing monitoring wells within the AOPI to approximately 300 feet from the Biosolids Application Field #18 (Landfill 2, FLW-002) AOPI in the inferred upgradient direction (FLW-MW-201R; **Figure 7-12**) or downgradient direction (FLW-MW-210, FLW-MW-212; **Figure 7-12**). Each groundwater sample was taken from the middle of the screened interval utilizing a bladder pump (FLW-MW-210) and Hydrasleeves™ (FLW-MW-201R, FLW-MW-212). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. PFOS, PFOA, and PFBS were detected at FLW-MW-212 but not at FLW-MW-201R and FLW-MW-210.

PFOS was detected but below the OSD risk screening level of 40 ng/L at FLW-MW-212 (5.1 ng/L). PFOA was detected but below the OSD risk screening level of 40 ng/L at FLW-MW-212 (21 ng/L). PFBS was detected but below the OSD risk screening level of 600 ng/L at FLW-MW-212 (35 ng/L).

7.15 Biosolids Application Field #2 (Landfill 9, FLW-011)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #2 (Landfill 9, FLW-011).

7.15.1 Soil

Soil samples were collected from four locations at Biosolids Application Field #2 (Landfill 9, FLW-011) (FLW-011-01-SO, FLW-011-02-SO, FLW-011-03-SO, FLW-011-04-SO; **Figure 7-13**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical

results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples except FLW-011-04-SO.

PFOS was not detected at FLW-011-04-SO, detected at FLW-011-01-SO (0.0095 mg/kg) and FLW-011-02-SO (0.086 mg/kg), and detected above the residential OSD risk screening level of 0.13 mg/kg at FLW-011-03-SO (0.43 DJ mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-011-01-SO (0.0013 mg/kg), FLW-011-02-SO (0.0035 mg/kg), and FLW-011-03-SO (0.0049 mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg at FLW-011-03-SO (0.00083 mg/kg) and FLW-011-04-SO (0.00064 mg/kg).

7.16 Biosolids Application Field #3 (Landfill 8, FLW-010)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #3 (Landfill 8, FLW-010).

7.16.1 Soil

Soil samples were collected from six locations at Biosolids Application Field #3 (Landfill 8, FLW-010) (FLW-010-01-SO, FLW-010-02-SO, FLW-010-03-SO, FLW-010-04-SO, FLW-010-05-SO, FLW-010-06-SO; **Figure 7-13**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in four of the six samples collected.

PFOS was not detected at FLW-010-05-SO or FLW-010-06-SO, detected at FLW-010-01-SO, FLW-010-03-SO, and FLW-010-04-SO, and detected above the residential OSD risk screening level of 0.13 mg/kg at FLW-010-02-SO (0.38 DJ mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-010-01-SO (0.00093 J mg/kg), FLW-010-02-SO (0.0066 DJ mg/kg), FLW-010-03-SO (0.0021 mg/kg), and FLW-010-04-SO (0.0029 J- mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg at FLW-010-04-SO (0.0005 J- mg/kg).

7.17 Biosolids Application Field #5 (Landfill 12, FLW-017)

The subsections below summarize the soil, groundwater, surface water, and sediment PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #5 (Landfill 12, FLW-017).

7.17.1 Soil

Soil samples were collected from four locations at Biosolids Application Field #5 (Landfill 12, FLW-017) (FLW-017-01-SO, FLW-017-02-SO, FLW-017-03-SO, FLW-017-04-SO; **Figure 7-14**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg in all soil samples (0.0020 to 0.018 mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13

mg/kg in all soil samples (0.00099 to 0.0024 mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg in all soil samples (0.00071 to 0.0014 mg/kg).

7.17.2 Groundwater

One groundwater sample was collected from one monitoring well location at Biosolids Application Field #5 (Landfill 12, FLW-017) (FLW-MW-1701; **Figure 7-14**). This groundwater sample was taken from the middle of the screened interval utilizing a peristaltic pump. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. PFOS, PFOA, and PFBS were detected at FLW-MW-1701.

PFOS was detected above the OSD risk screening level of 40 ng/L at FLW-MW-1701 (59 ng/L). PFOA was detected above the OSD risk screening level of 40 ng/L at FLW-MW-1701 (45 J+ [result is an estimated quantity; the result may be biased high] ng/L). PFBS was detected but below the OSD risk screening level of 600 ng/L at FLW-MW-1701 (46 J+ ng/L).

7.17.3 Surface Water

One surface water sample was collected from a location at Biosolids Application Field #5 (Landfill 12, FLW-017) (FLW-017-01-SW; **Figure 7-14**). This surface water sample was taken from the midpoint of the water column. A summary of PFOS, PFOA, and PFBS water analytical results is provided in **Table 7-3**. PFOS was detected at FLW-017-01-SW.

PFOS was detected at FLW-017-01-SW (6.1 ng/L). PFOA and PFBS were not detected.

7.17.4 Sediment

A sediment sample was collected from one location at Biosolids Application Field #5 (Landfill 12, FLW-017) (FLW-017-01-SE; **Figure 7-14**). The sediment sample was taken from the 0 to 10-centimeter interval from the bottom of Roubidoux Creek. A summary of PFOS, PFOA, and PFBS sediment analytical results is provided in **Table 7-4**. PFOS, PFOA, and PFBS were not detected in the sediment sample.

7.18 Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059)

The subsections below summarize the soil, groundwater, surface water, and sediment PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059).

7.18.1 Soil

Soil samples were collected from six locations at Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059) (FLW-059-01-SO, FLW-059-02-SO, FLW-059-03-SO, FLW-059-04-SO, FLW-059-05-SO, FLW-059-06-SO; **Figure 7-15**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**.

PFOS was not detected in any of the soil samples. PFOA was detected at a concentration below the residential OSD risk screening level of 0.13 mg/kg at FLW-059-03-SO (0.00052 J mg/kg). PFBS was not detected.

7.18.2 Groundwater

Groundwater samples were collected from three monitoring well locations at Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059) (FLW-MW-5901, FLW-MW-5904, FLW-MW-5905; **Figure 7-15**). Each groundwater sample was taken from the middle of the screened interval utilizing a peristaltic pump. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. PFOS, PFOA, and/or PFBS were detected at all monitoring wells.

PFOS was detected but below the OSD risk screening level of 40 ng/L in all groundwater samples (3.8 to 17 ng/L). PFOA was detected but below the OSD risk screening level of 40 ng/L at FLW-MW-5904 (5.4 ng/L). PFBS was detected but below the OSD risk screening level of 600 ng/L at FLW-MW-5901 (2.2 J ng/L) and FLW-MW-5904 (2.5 J ng/L).

7.18.3 Surface Water

One surface water sample was collected from one location at Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059) (FLW-059-01-SW; **Figure 7-15**). This surface water sample was taken from the midpoint of the water column. A summary of PFOS, PFOA, and PFBS water analytical results is provided in **Table 7-3**. PFOS was detected at FLW-026-01-SW.

PFOS was detected at FLW-026-01-SW (5.3 J+ ng/L). PFOA and PFBS were not detected.

7.18.4 Sediment

A sediment sample was collected from one location at Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059) (FLW-059-01-SE; **Figure 7-15**). The sediment sample was taken from the 0 to 10-centimeter interval. A summary of PFOS, PFOA, and PFBS sediment analytical results is provided in **Table 7-4**. PFOS, PFOA, and PFBS were not detected in the sediment sample.

7.19 Biosolids Application Field #19 (Landfill on a Branch to Big Piney, FLW-060)

The subsections below summarize the soil and groundwater PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #19 (Landfill on a Branch to Big Piney, FLW-060).

7.19.1 Soil

Soil samples were collected from four locations at Biosolids Application Field #19 (Landfill on a Branch to Big Piney, FLW-060) (FLW-060-01-SO, FLW-060-02-SO, FLW-060-03-SO, FLW-060-04-SO; **Figure 7-16**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and

PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in three of the five samples collected.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-060-01-SO (0.0021 mg/kg), FLW-060-03-SO (0.0056 mg/kg), and FLW-060-04-SO (0.00097 J mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-060-01-SO (0.00058 J mg/kg) and FLW-060-03-SO (0.0015 mg/kg). PFBS was not detected in any soil samples.

7.19.2 Groundwater

Groundwater samples were collected from two locations at existing monitoring wells approximately 250 to 450 feet from the Biosolids Application Field #19 (Landfill on a Branch to Big Piney, FLW-060) AOPI in the inferred downgradient direction (FLW-060-MW-6001 and FLW-060-MW-6002; **Figure 7-16**). Each groundwater sample was taken from the middle of the screened interval utilizing a peristaltic pump. A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. PFOS, PFOA, and PFBS were not detected in of the groundwater samples collected from either of the monitoring wells.

7.20 Biosolids Application Field #6

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #6.

7.20.1 Soil

Soil samples were collected from five locations at Biosolids Application Field #6 (FLW-BAF6-01-SO, FLW-BAF6-02-SO, FLW-BAF6-03-SO, FLW-BAF6-04-SO, FLW-BAF6-05-SO; **Figure 7-17**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS and PFOA were detected at FLW-BAF6-02-SO.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-BAF6-02-SO (0.017 mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-BAF6-02-SO (0.0015 mg/kg). PFBS was not detected in any soil samples.

7.21 Biosolids Application Field #7

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #7.

7.21.1 Soil

Soil samples were collected from four locations at Biosolids Application Field #7 (FLW-BAF7-01-SO, FLW-BAF7-02-SO, FLW-BAF7-03-SO, FLW-BAF7-04-SO; **Figure 7-18**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg in all soil samples (0.0046 to 0.013 mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg in all soil samples (0.0018 to 0.0077 mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg at FLW-BAF7-02-SO (0.0015 mg/kg) and FLW-BAF7-03-SO (0.0023 mg/kg).

7.22 Biosolids Application Field #8

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #8.

7.22.1 Soil

Soil samples were collected from three locations at Biosolids Application Field #8 (FLW-BAF8-01-SO, FLW-BAF8-02-SO, FLW-BAF8-03-SO; **Figure 7-18**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected at FLW-BAF8-01-SO and FLW-BAF8-02-SO.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-BAF8-01-SO (0.00074 J mg/kg) and FLW-BAF8-02-SO (0.013 mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-BAF8-02-SO (0.0026 mg/kg). PFBS was not detected in any soil samples.

7.23 Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003)

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003) and the groundwater PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003) and Old Fire Training Area at Landfill 3 (FLW-053). This is due to the Old Fire Training Area at Landfill 3 (FLW-053) AOPI being located within the Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003) AOPI.

7.23.1 Soil

Soil samples were collected from eleven locations at Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003) (FLW-003-01-SO, FLW-003-02-SO, FLW-003-03-SO, FLW-003-04-SO, FLW-003-05-SO, FLW-003-06-SO, FLW-003-07-SO, FLW-003-08-SO, FLW-003-09-SO, FLW-003-10-SO, FLW-003-11-SO; **Figure 7-4**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). Soil samples FLW-003-01-SO and FLW-003-01-SO were proposed to be sediment samples co-located with two surface water samples, provided seeps anticipated to be present at these locations contained water. The seeps were visually identified but were not flowing at the time of the field event, so soil samples were collected where the seep appeared to discharge onto the surface. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected in all soil samples and above the residential OSD risk screening level of 0.13 mg/kg at FLW-003-04-SO (0.24 mg/kg), FLW-003-05-SO (0.24 DJ mg/kg), and FLW-003-05-SO (0.17 mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg in all soil samples (0.00093 to 0.032 mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg in nine of 11 samples (not detected in FLW-003-02-SO or FLW-003-10-SO).

7.23.2 Groundwater

Groundwater samples were collected from eight monitoring well locations at Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003) (FLW-MW-303, FLW-MW-303A, FLW-MW-304, FLW-MW-306, FLW-MW-311, FLW-MW-401, FLW-MW-503, FLW-MW-505; **Figure 7-4**). A groundwater sample could not be collected from MW-301 due to obstructions in the well. As stated in **Section 7.4** above, the Old Fire Training Area at Landfill 3 (FLW-053) AOPI is located within this AOPI and the results may reflect one or both AOPIs. Each groundwater sample was taken from the middle of the screened interval utilizing a bladder pump (MW-303A) and Hydrasleeves™ (MW-303, MW-304, MW-306, MW-311, MW-401, MW-503, MW-505). A summary of PFOS, PFOA, and PFBS groundwater analytical results is provided in **Table 7-1**. PFOS, PFOA, and/or PFBS were detected in seven of eight monitoring wells.

PFOS was not detected at FLW-MW-311 and FLW-MW-505, was detected below the OSD risk screening level of 40 ng/L at FLW-MW-303, FLW-MW-303A, FLW-MW-304, and FLW-MW-503, and was detected above the OSD risk screening level of 40 ng/L at FLW-MW-306 (780 ng/L) and FLW-MW-401 (140 ng/L). PFOA was not detected at FLW-MW-505, was detected below the OSD risk screening level of 40 ng/L at FLW-MW-303, FLW-MW-303A, FLW-MW-304, FLW-MW-311, and FLW-MW-503, and was detected above the OSD risk screening level of 40 ng/L at FLW-MW-306 (53 ng/L) and FLW-MW-401 (55 ng/L). PFBS was detected at concentrations below the OSD risk screening level of 600 ng/L at FLW-MW-303 (15 ng/L), FLW-MW-303A (3.5 ng/L), FLW-MW-304 (18 ng/L), FLW-MW-306 (48 ng/L), FLW-MW-401 (56 ng/L), and FLW-MW-503 (30 ng/L).

7.24 Biosolids Application Field #11

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #11.

7.24.1 Soil

Soil samples were collected from four locations at Biosolids Application Field #11 (FLW-BAF11-01-SO, FLW-BAF11-02-SO, FLW-BAF11-03-SO, FLW-BAF11-04-SO; **Figure 7-19**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and PFBS were not detected in any of the soil samples.

7.25 Biosolids Application Field #12

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #12.

7.25.1 Soil

Soil samples were collected from three locations at Biosolids Application Field #12 (FLW-BAF12-01-SO, FLW-BAF12-02-SO, FLW-BAF12-03-SO; **Figure 7-20**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and PFBS were not detected in any of the soil samples.

7.26 Biosolids Application Field #13

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #13.

7.26.1 Soil

Soil samples were collected from four locations at Biosolids Application Field #13 (FLW-BAF13-01-SO, FLW-BAF13-02-SO, FLW-BAF13-03-SO, FLW-BAF13-04-SO; **Figure 7-20**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg in all soil samples (0.0012 to 0.023 mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-BAF13-01-SO (0.004 mg/kg), FLW-BAF13-02-SO (0.0018 mg/kg), and FLW-BAF13-04-SO (0.0042 mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg at FLW-BAF13-01-SO (0.0015 mg/kg), FLW-BAF13-02-SO (0.00085 J mg/kg), and FLW-BAF13-04-SO (0.00052 J mg/kg).

7.27 Biosolids Application Field #14

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #14.

7.27.1 Soil

Soil samples were collected from three locations at Biosolids Application Field #14 (FLW-BAF14-01-SO, FLW-BAF14-02-SO, FLW-BAF14-03-SO; **Figure 7-21**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected in all samples.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg in all soil samples (0.054 to 0.10 mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg in all soil samples (0.0046 to 0.0058 mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg at FLW-BAF14-01-SO (0.0011 mg/kg).

7.28 Biosolids Application Field #15

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #15.

7.28.1 Soil

Soil samples were collected from five locations at Biosolids Application Field #15 (FLW-BAF15-01-SO, FLW-BAF15-02-SO, FLW-BAF15-03-SO, FLW-BAF15-04-SO, FLW-BAF15-05-SO; **Figure 7-18**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and PFBS were not detected in any of the soil samples.

7.29 Biosolids Application Field #16

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #16.

7.29.1 Soil

Soil samples were collected from four locations at Biosolids Application Field #16 (FLW-BAF16-01-SO, FLW-BAF16-02-SO, FLW-BAF16-03-SO, FLW-BAF16-04-SO; **Figure 7-22**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and PFBS were not detected in any of the soil samples.

7.30 Biosolids Application Field #20

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #20.

7.30.1 Soil

Soil samples were collected from six locations at Biosolids Application Field #20 (FLW-BAF20-01-SO, FLW-BAF20-02-SO, FLW-BAF20-03-SO, FLW-BAF20-04-SO, FLW-BAF20-05-SO, FLW-BAF20-06-SO; **Figure 7-23**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). Due to an error by the analytical laboratory, samples FLW-BAF20-03-SO and FLW-BAF20-05-SO were disposed of before analysis began. A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected at FLW-BAF20-01-SO and FLW-BAF20-02-SO but may also be present at FLW-BAF20-03-SO and FLW-BAF20-05-SO.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-BAF20-01-SO (0.0016 mg/kg) and FLW-BAF20-02-SO (0.0039 mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-BAF20-01-SO (0.0016 mg/kg) and FLW-

BAF20-02-SO (0.0032 mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg at FLW-BAF20-02-SO (0.002 mg/kg).

7.31 Biosolids Application Field #21

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #21.

7.31.1 Soil

Soil samples were collected from four locations at Biosolids Application Field #21 (FLW-BAF21-01-SO, FLW-BAF21-02-SO, FLW-BAF21-03-SO, FLW-BAF21-04-SO; **Figure 7-24**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and PFBS were detected at FLW-BAF21-03-SO.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-BAF21-03-SO (0.0014 mg/kg). PFOA was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-BAF21-03-SO (0.0012 mg/kg). PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg at FLW-BAF21-03-SO (0.00094 J mg/kg).

7.32 Biosolids Application Field #27A

The subsections below summarize the soil PFOS, PFOA, and PFBS analytical results associated with Biosolids Application Field #27A.

7.32.1 Soil

Soil samples were collected from four locations at Biosolids Application Field #27A (FLW-BAF27A-01-SO, FLW-BAF27A-02-SO, FLW-BAF27A-03-SO, FLW-BAF27A-04-SO; **Figure 7-25**). Each boring included one surface soil sample collected via hand auger within the 0 to 2 feet bgs interval (composite of the soil from the surface to 2 feet bgs or refusal). A summary of PFOS, PFOA, and PFBS soil analytical results is provided in **Table 7-2**. PFOS, PFOA, and/or PFBS were detected at FLW-BAF27A-02-SO and FLW-BAF27A-04-SO.

PFOS was detected but below the residential OSD risk screening level of 0.13 mg/kg at FLW-BAF27A-02-SO (0.00062 J mg/kg) and FLW-BAF27A-04-SO (0.0022 mg/kg). PFOA was not detected in any soil samples. PFBS was detected but below the residential OSD risk screening level of 1.9 mg/kg at FLW-BAF27A-04-SO (0.00067 J mg/kg).

7.33 Dedicated Equipment Background Samples

A total of five DEBs were collected, including FLW-DEB-01, FLW-EB-06, FLW-EB-07, FLW-EB-08, and FLW-EB-09. Detections of PFOS, PFOA, and PFBS constituents are summarized below for DEB samples:

FLW-DEB-01

- This sample was collected from a piece of unexpected, dedicated equipment (bladder pump system) inside MW-5904 at the Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059) AOPI on 05 October 2020. PFOS, PFOA, and PFBS were detected below the OSD risk screening level at 16 ng/L, 13 J ng/L, and 2.4 J ng/L, respectively. The EB sample FLW-DEB-01-100520 was collected on dedicated equipment but it was determined the dedicated equipment could not be used to sample the wells, which were then collected via Hydrasleeve™. No samples qualified for blank contamination.

FLW-EB-06

- This sample was collected from a piece of unexpected, dedicated equipment (string holding a PDB) inside MW-5604 on 29 September 2020. PFOA was detected below the OSD risk screening level at 5.5 ng/L. The EB sample was collected on dedicated equipment, but it was determined the dedicated equipment could not be used to sample the wells, which were then collected via Hydrasleeve™. No samples qualified for blank contamination.

FLW-EB-07

- This sample was collected from a piece of unexpected, dedicated equipment (string holding a PDB) inside MW-1202 on 01 October 2020. PFOS, PFOA, and PFBS were not detected.

FLW-EB-08

- This sample was collected from a piece of unexpected, dedicated equipment (string holding a PDB) inside MW-6002 on 05 October 2020. PFOS, PFOA, and PFBS were not detected

FLW-EB-09

- This sample was collected from a piece of unexpected, dedicated equipment (compression fitting) inside MW-301A on 06 October 2020. PFOS, PFOA, and PFBS were not detected.

The full analytical results for blank samples collected during the SI are included in **Appendix N**.

7.34 Investigation Derived Waste

Composite samples of the soil and the purge and decontamination wastewater were collected from the 55-gallon drums currently in storage at the 90-day storage yard. The results indicated the following concentrations in the soil: 0.063 mg/kg PFOS, 0.005 mg/kg PFOA, and 0.002 PFBS. The PFOS, PFOA, and PFBS concentrations observed in the soil did not exceed the OSD risk screening levels. The results indicated the following concentrations in the wastewater: 240 ng/L PFOS, 13 ng/L PFOA, and 12 ng/L PFBS. The PFOS concentrations observed in the wastewater exceeded the OSD risk screening levels and the PFOA and PFBS concentrations did not exceed the OSD risk screening levels. The IDW will be disposed at an off-post facility that accepts PFAS-containing waste via incineration, as agreed upon by the installation. The IDW disposal plan will be coordinated with FLW. The full analytical results (i.e., for all constituents analyzed) for IDW samples collected during the SI are included in **Appendix N**.

7.35 TOC, pH, and Grain Size

In addition to sampling soil for PFOS, PFOA, and PFBS, one soil sample per AOPI was analyzed for TOC, pH, moisture content, and grain size data as they may be useful in future fate and transport studies. The TOC in the soil samples ranged from 439 to 86,000 mg/kg. The majority of the TOC measurements at FLW were within range of typical topsoil observations: 5,000 to 30,000 mg/kg. The combined percentage of fines (i.e., silt and clay) in soils at FLW ranged from 9.7 to 95.9% with an average of 45.6%. In general, PFAS constituents tend to be more mobile in soils with less than 20% fines (silt and clay) and lower TOC. The percent moisture of the soil 12.8% was typical for loam (0 to 12%) to clay (0 to 20%). The pH of the soil was neutral with an average of 6.7 standard units. Based on these geochemical and physical soil characteristics (i.e., high percentage of fines and TOC) observed underlying the installation during the SI, PFAS constituents are expected to be relatively less mobile at FLW than in soils with lower percentages of fines and TOC.

7.36 Blank Samples

Detections of PFOS, PFOA, and PFBS constituents are summarized below for blank samples. Most detected concentrations were low-level. Other than those noted below, concentrations of PFOS, PFOA, PFBS in all other blank samples were not detected.

FLW-SB-01

- This sample was collected from the source water provided at FLW on 18 September 2020. PFOS and PFOA were detected below the OSD risk screening level at 5.4 ng/L and 2.3 J ng/L, respectively. These detections did not affect any samples because this water was not used. The water that was used had non-detections for PFOS, PFOA, and/or PFBS.

The full analytical results for blank samples collected during the SI are included in **Appendix N**.

7.37 Conceptual Site Models

The preliminary CSMs presented in the QAPP Addendum (Arcadis 2020) were re-evaluated and updated, if necessary, based on the SI sampling results. The CSMs presented on **Figures 7-26** through **7-34** and in this section therefore represent the current understanding of the potential for human exposure. For some AOPIs, the CSM is the same and thus shown on the same figure.

Many of the PFAS constituents found in AFFF are surfactants (which do not volatilize) and are found in a charged or ionic state at environmentally-relevant pH (i.e., pH 5 to 9 standard units). PFOS, PFOA, and PFBS are each negatively charged at environmentally-relevant pH. The media potentially affected by PFOS, PFOA, PFBS releases at Army installations are soil, groundwater, surface water, and sediment. Once released to the environment, a primary factor that inhibits the movement of PFAS constituents is the presence of organic matter and organic co-constituents in soils and sediments. Generally, PFAS constituents are mobile in the potentially affected media, and they are not known to be fully broken down by natural processes.

Based on the use, storage, and/or disposal of PFAS-containing materials at the AOPIs, affected media are likely to consist of soil, groundwater, surface water, and sediment.

Release and transport mechanisms include dissolution/desorption from soil to groundwater, transport via sediment carried in and dissolution to stormwater and surface water, discharge/recharge between groundwater and surface water, and adsorption/desorption between surface water and sediment. Generic categories of potential human receptors and their associated exposure scenarios that are typically evaluated in a CERCLA human health risk assessment were considered and include on-installation site workers (e.g., industrial/commercial workers, utility workers, or future construction workers who could be exposed to chemicals in soil at an AOPI or to chemicals in tap water in an industrial/commercial building), on-installation residents (e.g., adults and children who could be exposed to chemicals in tap water in a residence), and on-installation recreational users (e.g., hikers or hunters who could be exposed to chemicals in waterways at an installation). Off-installation receptor types could include drinking water receptors (i.e., commercial/industrial workers or residents) and recreational users.

Human exposure pathways are shown as “complete, “potentially complete”, or “incomplete” on the CSM figures. A complete exposure pathway consists of a constituent source and release mechanism, a transport or retention medium, an exposure point where human contact with the contaminated medium could occur, and an exposure route at the exposure point. If any of these elements is missing, the exposure pathway is incomplete. Pathways are “potentially complete” where data are insufficient to conclude the pathway is either “complete” or “incomplete”. Additionally, the CSMs do not include ecological receptors and exposure pathways. The potential for ecological exposures to PFOS, PFOA, and PFBS may be evaluated at a future date if those pathways warrant further consideration.

CSMs were developed for each individual AOPI and were combined where source media, potential migration pathways and exposure media, and human exposure pathway determinations are congruent. The following exposure pathway determinations apply to multiple CSMs:

- The AOPIs are not residential or recreational sites and are wholly located within the installation boundaries. Therefore, the soil exposure pathways for on-installation residents and recreational users and for off-installation receptors are incomplete at all AOPIs.
- Recreational users are not likely to contact groundwater during outdoor recreational activities. Therefore, the groundwater exposure pathway for on-installation recreational users is incomplete at all AOPIs.
- Groundwater originating from Biosolids Application Fields #11, #12, #13, and #14 AOPIs is expected to discharge to Big Piney River on-installation and is not expected to flow off-installation. Therefore, the groundwater exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is incomplete. Groundwater originating from all other AOPIs potentially flows off-installation. Therefore, unless otherwise noted, the groundwater exposure pathway for off-installation drinking water receptors is potentially complete.
- Surface water runoff at most AOPIs flows toward ephemeral tributaries within the Roubidoux Creek or Big Piney River watersheds. Neither Roubidoux Creek nor Big Piney River are known to be used for drinking water off-installation. However, considering the known potable use of surface water (Big Piney River) at FLW, the surface water exposure pathway (via drinking water ingestion and dermal contact) for off-installation receptors is potentially complete to account for potential future use of surface water as a potable water source. Additionally, recreational users off-installation could contact constituents in surface water and sediment through incidental ingestion and dermal contact. Therefore, unless otherwise noted, the surface water and sediment exposure pathways for off-installation recreational users are potentially complete.

Additional exposure pathway descriptions for each CSM are listed below by figure.

Figure 7-26 shows the CSM for nine AOPIs: ARNG Hangars (Buildings 5010 and 5012), DPW Old Fire Training Area (TA 210, FLW-028), New Fire Training Area (TA 207, FLW-029), Active Fire Station #1 (Building 580), Biosolids Application Field #17 (Landfill 15, FLW-020), Biosolids Application Field #18 (Landfill 2, FLW-002), Biosolids Application Field #2 (Landfill 9, FLW-011), Biosolids Application Field #3 (Landfill 8, FLW-010), and Biosolids Application Field #8. At ARNG Hangars (Buildings 5010 and 5012), DPW Old Fire Training Area (TA 210, FLW-028), New Fire Training Area (TA 207, FLW-029), and Active Fire Station #1 (Building 580), AFFF historically flowed to soil and/or paved surfaces from AFFF stored in tanks, drums, and/or fire trucks or during fire training exercises. At the biosolids application areas, STP sludge potentially containing PFOS, PFOA, and/or PFBS was land-applied to promote vegetative growth on the land surface.

- PFOS, PFOA, and/or PFBS were detected in soil at these AOPIs, and site workers could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- PFOS, PFOA, and/or PFBS were detected in groundwater at Biosolids Application Field #17 (Landfill 15, FLW-020) and Biosolids Application Field #18 AOPIs. Groundwater samples were not collected at the other AOPIs, however PFOS, PFOA, and/or PFBS detected in soil could migrate to groundwater. The AOPIs are potentially upgradient of the Indiana Street Well, which is used to supply potable water during times of peak demand at FLW. Additionally, Biosolids Application Field #17 (Landfill 15, FLW-020), Biosolids Application Field #18 (Landfill 2, FLW-002), and Biosolids Application Field #8 AOPIs are potentially upgradient or in the vicinity of one or more on-installation wells used to supply potable water at an individual training facility which has temporary rotations of military personnel (site workers). Therefore, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete.
- PFOS, PFOA, and/or PFBS could migrate to surface water via surface runoff or shallow groundwater discharge. Ephemeral streams adjacent to these AOPIs flow west to Roubidoux Creek which is not used for drinking water. On-installation residents are unlikely to contact surface water or sediment; therefore, these exposure pathways are incomplete. Site workers could contact surface water and sediment (via incidental ingestion and dermal contact) during maintenance or construction activities at Roubidoux Creek and/or its tributaries on-installation. Additionally, recreational users could contact constituents in Roubidoux Creek through incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for on-installation site workers and recreational users are potentially complete.

Figure 7-27 shows the CSM for six AOPIs: Old Fire Training Area at Landfill 3 (FLW-053), Old Fire Training Area Runway End (FLW-054), Active Fire Station #2 (Building 5001), Biosolids Application Field #7, Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003), and Biosolids Application Field #21. At the Old Fire Training Area at Landfill 3 (FLW-053), Old Fire Training Area Runway End (FLW-054), and Active Fire Station #2 (Building 5001) AOPIs, AFFF historically flowed to soil and/or paved surfaces from AFFF stored in tanks, drums, and/or fire trucks or during fire training exercises. At the biosolids application areas, STP sludge potentially containing PFOS, PFOA, and/or PFBS was land-applied to promote vegetative growth on the land surface.

- PFOS, PFOA, and/or PFBS were detected in soil at these AOPIs, and site workers could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- PFOS, PFOA, and/or PFBS were detected in groundwater at Old Fire Training Area at Landfill 3 (FLW-053) and Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003) AOPIs. Groundwater samples were not collected at the other AOPIs, however PFOS, PFOA, and/or PFBS detected in soil could migrate to groundwater. Old Fire Training Area at Landfill 3 (FLW-053), Old Fire Training Area Runway End (FLW-054), Active Fire Station #2 (Building 5001), Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003), and Biosolids Application Field #21 are potentially upgradient of the Indiana Street Well at FLW. Biosolids Application Field #7 is potentially upgradient or in the vicinity of one or more on-installation wells used to supply potable water at an individual training facility which has temporary rotations of military personnel (site workers). Therefore, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete.
- PFOS, PFOA, and/or PFBS could migrate to surface water via surface runoff or shallow groundwater discharge. Ephemeral streams adjacent to these AOPIs flow east to Big Piney River. Groundwater at these AOPIs may discharge to the Big Piney River upstream or adjacent to the FLW drinking water intake at the Sandstone Spring Pumping Station. Therefore, the surface water exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete. On-installation residents are unlikely to contact sediment; therefore, this exposure pathway is incomplete. Site workers could contact surface water and sediment (via incidental ingestion and dermal contact) during maintenance or construction activities at Big Piney River and/or its tributaries on-installation. Additionally, recreational users could contact constituents through incidental ingestion and dermal contact. Therefore, the surface water and sediment exposure pathways for on-installation site workers and recreational users are potentially complete.

Figure 7-28 shows the CSM for the Former Fire Station #1 (Triangle Station), Former Fire Station #3 (Troop Trail), and Biosolids Application Field #1 (Five STP Landfills, FLW-012). At the Former Fire Station #1 (Triangle Station) and Former Fire Station #3 (Troop Trail) AOPIs, AFFF historically flowed to soil and/or paved surfaces from AFFF stored in tanks, drums, and/or fire trucks. At the Biosolids Application Field #1 (Five STP Landfills, FLW-012) AOPI, STP sludge potentially containing PFOS, PFOA, and/or PFBS was land-applied to promote vegetative growth on the surface of the five former landfills included in this AOPI (Landfills 10A, 10B, 11A, 11B, and 11C).

- PFOS, PFOA, and/or PFBS were detected in soil at these AOPIs, and site workers could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- PFOS, PFOA, and/or PFBS were detected in groundwater at Biosolids Application Field #1 (Five STP Landfills, FLW-012) AOPI. Groundwater samples were not collected at the other AOPIs, however PFOS, PFOA, and/or PFBS detected in soil could migrate to groundwater. Former Fire Station #1 (Triangle Station) and Former Fire Station #3 (Troop Trail) AOPIs are potentially upgradient of the Indiana Street Well at FLW. Therefore, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete.
- Biosolids Application Fields #1 (Five STP Landfills, FLW-012) AOPI is downgradient of the existing drinking water well at FLW. However, the groundwater exposure pathways (via drinking water

ingestion and dermal contact) for on-installation site workers and residents are potentially complete to account for potential future use of the downgradient on-post groundwater.

- These AOPIs are adjacent to Dry Creek and/or its tributaries that discharge to Big Piney River off-installation and downstream of the FLW drinking water intake. Therefore, the surface water exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are incomplete. On-installation residents are not expected to otherwise contact surface water and sediment; therefore, these exposure pathways are incomplete. Dry Creek is a losing stream and generally dry during the year except during high rain events. Therefore, on-installation site workers and recreational users are not expected to contact (via incidental ingestion and dermal contact) surface water or sediment at Dry Creek, and these exposure pathways are incomplete.

Figure 7-29 shows the CSM for the Former Fire Station #2 (Oklahoma Avenue). At this AOPI, AFFF historically flowed to soil and/or paved surfaces from AFFF stored in tanks, drums, and/or fire trucks.

- PFOS, PFOA, and PFBS were not detected in soil at this AOPI. Therefore, the soil exposure pathway for on-installation site workers is incomplete.
- PFOS, PFOA, and/or PFBS were detected in groundwater samples from monitoring wells between approximately 800-900 feet from the Former Fire Station #2 (Oklahoma Avenue) AOPI in the inferred downgradient direction. The AOPI is potentially upgradient of the Indiana Street Well at FLW. Therefore, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete.
- PFOS, PFOA, and/or PFBS could migrate to surface water via shallow groundwater discharge. Ephemeral streams adjacent to the AOPI flow via Dry Creek towards Big Piney River off-installation and downstream of the FLW drinking water intake. Therefore, the surface water exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are incomplete. On-installation residents are not expected to otherwise contact surface water and sediment; therefore, these exposure pathways are incomplete. Dry Creek is a losing stream and generally dry during the year except during high rain events. Therefore, on-installation site workers and recreational users are not expected to contact (via incidental ingestion and dermal contact) surface water or sediment at Dry Creek, and these exposure pathways are incomplete.

Figure 7-30 shows the CSM for the Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026), where wastewater potentially containing AFFF was received due to historical discharges to the sewer system. Treated wastewater (effluent) potentially containing PFOS, PFOA, and/or PFBS was discharged to surface water (Dry Creek) at the STP outfall. STP sludge potentially containing PFOS, PFOA, and/or PFBS was discharged to and dried in the current and former lagoons.

- PFOS, PFOA, and/or PFBS were detected in soil at this AOPI, and site workers could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- Groundwater samples were not collected, however PFOS, PFOA, and/or PFBS detected in soil could migrate to groundwater. The AOPI is downgradient of the existing drinking water well at FLW. However, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete to account for potential future use of the on-post groundwater downgradient of the AOPI.

- PFOS, PFOA, and/or PFBS were detected in a surface water sample collected downstream of the system effluent. Sediment samples were not collected, however PFOS, PFOA, and/or PFBS detected in surface water could partition to sediment. Therefore, the surface water exposure pathway (via incidental ingestion and dermal contact) is complete, and the sediment exposure pathway is potentially complete for on-installation site workers.
- Near this AOPI, Dry Creek is primarily composed of the STP outfall water, which infiltrates rapidly to groundwater. Dry Creek flows to Big Piney River off-installation and downstream of the FLW drinking water intake. Therefore, the surface water exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are incomplete. On-installation residents are not expected to otherwise contact surface water and sediment; therefore, these exposure pathways are incomplete. Dry Creek is a losing stream and generally dry during the year except during high rain events. Therefore, on-installation site workers and recreational users are not expected to contact (via incidental ingestion and dermal contact) surface water or sediment at Dry Creek, and these exposure pathways are incomplete.

Figure 7-31 shows the CSM for Biosolids Application Fields #11, #12, #15, and #16. At these AOPIs, STP sludge potentially containing PFOS, PFOA, and/or PFBS was land-applied to promote vegetative growth on the land surface.

- PFOS, PFOA, and PFBS were not detected in soil at these AOPIs. Therefore, the soil exposure pathway for on-installation site workers is incomplete.
- Groundwater, surface water and sediment samples were not collected at these AOPIs. However, based on the non-detect soil sample results, it is inferred there is no source of PFOS, PFOA, and/or PFBS at these AOPIs and the exposure pathways for all receptors are incomplete.

Figure 7-32 shows the CSM for the Biosolids Application Field #5 (Landfill 12, FLW-017) and Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059). At these AOPIs, STP sludge potentially containing PFOS, PFOA, and/or PFBS was land-applied to promote vegetative growth on the surface of the former landfills.

- PFOS, PFOA, and/or PFBS were detected in soil at these AOPIs, and site workers could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- PFOS, PFOA, and/or PFBS were detected in groundwater at these AOPIs. The AOPIs are downgradient of the existing drinking water well at FLW. However, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are potentially complete to account for potential future use of the downgradient on-post groundwater.
- PFOS, PFOA, and/or PFBS were detected in surface water but were not detected in sediment samples collected at these AOPIs. Because PFOS, PFOA, and/or PFBS were detected in surface water, it could partition to sediment. Roubidoux Creek runs adjacent to and receives surface runoff from these AOPIs. On-installation residents are not expected to contact surface water and sediment; therefore, these exposure pathways are incomplete. On-installation site workers and recreational users could contact surface water and sediment in Roubidoux Creek through incidental ingestion and dermal contact. Therefore, the surface water exposure pathways are complete, and the sediment exposure pathways are potentially complete for on-installation site workers and recreational users.

Figure 7-33 shows the CSM for four AOPIs: Biosolids Application Field #6, Biosolids Application Field #19 (Landfill on a Branch to Big Piney, FLW-060), Biosolids Application Field #20, and Biosolids Application Field #27A. At these AOPIs, STP sludge potentially containing PFOS, PFOA, and/or PFBS was land-applied to promote vegetative growth on the land surface.

- PFOS, PFOA, and/or PFBS were detected in soil at these AOPIs, and site workers could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- PFOS, PFOA, and PFBS were not detected in groundwater at Biosolids Application Field #19 (Landfill on a Branch to Big Piney, FLW-060). Groundwater samples were not collected at the other three AOPIs. However, it was assumed for all four AOPIs that PFOS, PFOA, and/or PFBS detected in soil could migrate to groundwater. The AOPIs are potentially upgradient or in the vicinity of one or more on-installation wells used to supply potable water at an individual training facility which has temporary rotations of military personnel (site workers). Although the drinking water from these wells is not currently used for residential drinking water supply at FLW, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for both site workers and residents are potentially complete to account for potential future use of the on-post groundwater downgradient of the AOPIs.
- PFOS, PFOA, and/or PFBS could migrate to surface water via surface runoff or shallow groundwater discharge. Ephemeral streams adjacent to Biosolids Application Field #19 discharge to Big Piney River downstream of the FLW drinking water intake, and ephemeral streams adjacent to Biosolids Application Fields #6, #20, and #27A discharge to Roubidoux Creek. Therefore, the surface water exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are incomplete. On-installation residents are not expected to otherwise contact surface water or sediment; therefore, these exposure pathways are also incomplete. Site workers could contact surface water and sediment during maintenance or construction activities at Big Piney River, Roubidoux Creek, and/or their tributaries on-installation. Recreational users could contact surface water and sediment at Big Piney River or Robidoux Creek. Therefore, the surface water and sediment exposure pathways (via incidental ingestion and dermal contact) for on-installation site workers and recreational users are potentially complete.

Figure 7-34 shows the CSM for Biosolids Application Field #13 and Biosolids Application Field #14. At these AOPIs, STP sludge potentially containing PFOS, PFOA, and/or PFBS was land-applied to promote vegetative growth on the land surface.

- PFOS, PFOA, and/or PFBS were detected in soil at these AOPIs, and site workers could contact constituents in soil via incidental ingestion, dermal contact, and inhalation of dust. Therefore, the soil exposure pathway for on-installation site workers is complete.
- Groundwater samples were not collected, however PFOS, PFOA, and/or PFBS detected in soil could migrate to groundwater. The AOPIs are potentially upgradient of or in the vicinity of one or more on-installation wells used to supply potable water at an individual training facility which has temporary rotations of military personnel (site workers). Although the drinking water from these wells is not currently used for residential drinking water supply at FLW, the groundwater exposure pathways (via drinking water ingestion and dermal contact) for both site workers and residents are potentially complete to account for potential future use of the downgradient on-post groundwater.

- PFOS, PFOA, and/or PFBS could migrate to surface water via surface runoff or shallow groundwater discharge. Big Piney River runs adjacent to and potentially receives surface runoff from Biosolids Application Field #13 and Biosolids Application Field #14 downstream of the FLW drinking water intake. Therefore, the surface water exposure pathways (via drinking water ingestion and dermal contact) for on-installation site workers and residents are incomplete. On-installation residents are not expected to otherwise contact surface water or sediment; therefore, these exposure pathways are also incomplete. Site workers could contact surface water and sediment during maintenance or construction activities, and recreational users could contact surface water and sediment at Big Piney River. Therefore, the surface water and sediment exposure pathways (via incidental ingestion and dermal contact) for on-installation site workers and recreational users are potentially complete.

8 CONCLUSIONS AND RECOMMENDATIONS

The PFAS PA/SI included two distinct efforts. The PA identified AOPIs at FLW based on the use, storage, and/or disposal of PFAS-containing materials, in accordance with the 2018 Army Guidance for Addressing Releases of Per-and Polyfluoroalkyl Substances (Army 2018). The SI included multi-media sampling at AOPIs to determine whether or not a release of PFOS, PFOA, and PFBS to the environment occurred.

OSD provided residential risk screening levels based on the USEPA oral reference dose for PFOS, PFOA, and PFBS in soil and groundwater (tap water) and industrial/commercial risk screening levels for PFOS, PFOA, and PFBS in soil (Appendix A). A combination of document review, internet searches, interviews with installation personnel, and an installation site visit were used to identify specific areas of suspected PFOS, PFOA, and PFBS use, storage, and/or disposal at FLW. Following the evaluation, 32 AOPIs were identified.

FLW has 17 on-post potable wells located throughout the installation and receives more than 98% of its water supply from the surface water intake on the Big Piney River. FLW supplements its water supply during times of peak demand with water from the Indiana Street Well located in the cantonment area. The remaining 16 drinking water wells each have their own treatment system and provide smaller quantities of water to isolated facilities and TAs.

Historical sampling for PFOS, PFOA, and PFBS of the on-installation drinking water was conducted in 2013 per the UCMR3 and in 2016 and 2019 per IMCOM Operations Order 16-088. All drinking water samples from 2013, 2016, and 2019 were non-detect for PFOS, PFOA, and PFBS except at the Golf Course Well and the TA 61 Well. The Golf Course Well had a detection of PFBS at 3.7 ng/L in July 2016. The TA 61 Well had concentrations of PFOS ranging from 1.9 J (estimated value) ng/L to 3.5 ng/L and PFBS ranging from 2.6 ng/L to 5.5 ng/L in July 2016 and June 2019. No historical PFAS results are available for off-installation drinking water within a 5-mile radius of FLW.

All AOPIs were sampled during the SI at FLW to identify presence or absence of PFOS, PFOA, and PFBS at each AOPI. The SI scope of work was completed in accordance with the Final PQAPP (Arcadis 2019) and the FLW QAPP Addendum (Arcadis 2020).

Seven AOPIs had detections of PFOS, PFOA, and/or PFBS in groundwater and four AOPIs exceeded OSD risk screening levels. Samples were not collected at each AOPI due to the depth of groundwater, as well as the complexity of the heavily karstified geology, which limits certainty in determining the source of PFOS, PFOA, and/or PFBS. The presence of PFOS, PFOA, and/or PFBS was identified in seven of eight AOPIs. The highest PFOS, PFOA, and PFBS concentrations in groundwater were observed at the Biosolids Application Fields #9 and #10 AOPI at 780 ng/L, 55 ng/L, and 56 ng/L, respectively. In total, three AOPIs had groundwater exceedances above the OSD risk screening levels for PFOS (40 ng/L) and/or PFOA (40 ng/L). PFBS did not exceed OSD risk screening levels in any groundwater samples.

27 AOPIs had detections of PFOS, PFOA, and/or PFBS in soil and eight AOPIs exceeded OSD risk screening levels. The presence of PFOS, PFOA, and/or PFBS was identified in 27 of 32 AOPIs. The highest PFOS and PFBS concentrations in soil were observed at the New Fire Training Area (TA 207, FLW-029) AOPI at 3.6 DJ mg/kg and 0.59 DJ mg/kg, respectively. The highest PFOA concentrations in soil were observed at the ARNG Hangars (Buildings 5010 and 5012) AOPI at 0.086 DJ mg/kg. In total,

nine AOPIs had soil exceedances above OSD risk screening levels for PFOS (0.13 mg/kg for residential and 1.6 for industrial/commercial). PFOA and PFBS did not exceed OSD risk screening levels in any soil samples.

Surface water samples were collected at three AOPIs. The presence of PFOS, PFOA, and/or PFBS was identified in all three AOPIs. The highest PFOS, PFOA, and PFBS concentrations in surface water were observed at the Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026) AOPI at 8.8 ng/L, 4.2 ng/L and 9.5 ng/L, respectively.

Sediment samples were collected at two AOPIs. PFOS, PFOA, and PFBS were not detected in any sediment samples.

Following the SI sampling, all 32 AOPIs were considered to have complete or potentially complete exposure pathways for one or more potential exposure media.

The following exposure pathways are complete or potentially complete:

- The soil exposure pathways for on-installation site workers are complete at 27 AOPIs where PFOS, PFOA, and/or PFBS were detected.
- The groundwater exposure pathways (via drinking water ingestion and dermal contact) are potentially complete for on-installation site workers and residents at 28 AOPIs and off-installation receptors at 26 AOPIs.
- The surface water exposure pathways (via drinking water ingestion and dermal contact) are potentially complete for on-installation site workers and residents at six AOPIs.
- The surface water exposure pathways (via incidental ingestion and dermal contact) are complete for on-installation site workers at three AOPIs and potentially complete at 21 AOPIs and complete for on-installation recreational users at two AOPIs and potentially complete at 22 AOPIs.
- The sediment exposure pathways (via incidental ingestion and dermal contact) are potentially complete for on-installation site workers at 24 AOPIs and on-installation recreational users at 24 AOPIs.
- The surface water and sediment exposure pathways are potentially complete for off-installation receptors at 28 AOPIs.

Although the CSMs indicate complete or potentially complete exposure pathways may exist, the recommendation for future study in a remedial investigation or no action at this time is based on the comparison of the SI analytical results for PFOS, PFOA, and PFBS to the OSD risk screening levels (**Table 6-2**). **Table 8-1** below summarizes the AOPIs identified at FLW, PFOS, PFOA, and PFBS sampling and recommendations for each AOPI; further investigation is warranted at FLW. In accordance with CERCLA, site-specific risk will be assessed during a future phase to evaluate whether remedial actions are required.

Table 8-1. Summary of AOPIs Identified during the PA, PFOS, PFOA, and PFBS Sampling at FLW, and Recommendations

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/NA/ND/NS)				Recommendation
	GW	SO	SW	SE	
ARNG Hangars (Buildings 5010 and 5012)	NS	No	NS	NS	Supplemental groundwater sampling is recommended
DPW Old Fire Training Area (TA 210, FLW-028)	NS	No	NS	NS	Supplemental groundwater sampling is recommended
New Fire Training Area (TA 207, FLW-029)	NS	Yes	NS	NS	Further study in a remedial investigation
Old Fire Training Area at Landfill 3 (FLW-053)	Yes	Yes	NS	NS	Further study in a remedial investigation
Old Fire Training Area Runway End (FLW-054)	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Active Fire Station #1 (Building 580)	NS	Yes	NS	NS	Further study in a remedial investigation
Active Fire Station #2 (Building 5001)	NS	Yes	NS	NS	Further study in a remedial investigation
Former Fire Station #1 (Triangle Station)	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Former Fire Station #2 (Oklahoma Avenue)	No	ND	NS	NS	No action at this time
Former Fire Station #3 (Troop Trail)	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026)	NS	No	NA	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	Yes	Yes	NS	NS	Further study in a remedial investigation
Biosolids Application Field #17 (Landfill 15, FLW-020)	No	No	NS	NS	No action at this time
Biosolids Application Field #18 (Landfill 2, FLW-002)	ND	No	NS	NS	No action at this time
Biosolids Application Field #2 (Landfill 9, FLW-011)	NS	Yes	NS	NS	Further study in a remedial investigation
Biosolids Application Field #3 (Landfill 8, FLW-010)	NS	Yes	NS	NS	Further study in a remedial investigation
Biosolids Application Field #5 (Landfill 12, FLW-017)	Yes	No	NA	NA, ND	Further study in a remedial investigation

AOPI Name	PFOS, PFOA, and/or PFBS detected greater than OSD Risk Screening Levels? (Yes/No/NA/ND/NS)				Recommendation
	GW	SO	SW	SE	
Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059)	No	No	NA	NA, ND	No action at this time
Biosolids Application Field #19 (Landfill on a Branch to Big Piney, FLW-060)	ND	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #6	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #7	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #8	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003)	Yes	Yes	NS	NS	Further study in a remedial investigation
Biosolids Application Field #11	NS	ND	NS	NS	No action at this time
Biosolids Application Field #12	NS	ND	NS	NS	No action at this time
Biosolids Application Field #13	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #14	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #15	NS	ND	NS	NS	No action at this time
Biosolids Application Field #16	NS	ND	NS	NS	No action at this time
Biosolids Application Field #20	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #21	NS	No	NS	NS	Supplemental groundwater sampling is recommended
Biosolids Application Field #27A	NS	No	NS	NS	Supplemental groundwater sampling is recommended

Notes:
Light gray shading – detection greater than the OSD risk screening level
GW – groundwater
N – no
NA – not applicable
NS – not sampled
SE – sediment

SO – soil
SW – surface water
Y – yes

Data collected during the PA (**Section 3**, **Section 4**, **and Section 5**) and SI (**Section 6 and Section 7**) were sufficient to draw conclusions and recommendations summarized above. The data limitations relevant to the development of this PA/SI for PFOS, PFOA, and PFBS at FLW are discussed below.

Records gathered for the use, storage and/or disposal of PFAS-containing materials were reviewed during the PA process. Documentation specific to AFFF may have been limited (e.g., each AFFF use; procurement records, documentation of AFFF used during crash responses or fire training activities) due to lack of recordkeeping requirements for the full timeline of common AFFF practices. Anecdotal accounts of AFFF use (and therefore likely PFOS, PFOA, and PFBS use) were limited to available installation personnel, whose knowledge of AFFF use may have been restricted by their time spent at the installation or previous roles held that limited their relevant knowledge of potential AFFF (or other PFAS-containing material) use.

A comprehensive well survey was not completed as part of this PA; therefore, the information reviewed regarding off-post wells is limited to what is contained in the off-post well search results (**Appendix E**).

The searches for ecological receptors and off-post PFOS, PFOA, and PFBS sources were not exhaustive and were limited to easily identifiable and readily available information evaluated during the relevant documents research, installation personnel interviews, and site reconnaissance.

Finally, the available PFOS, PFOA, and PFBS analytical data is limited to groundwater samples from existing monitoring wells at or proximal to AOPIs, soil samples at 22 of 32 AOPIs, and on-installation drinking water reports from 2013 per the UCMR3 and 2016 and 2019 per IMCOM Operations Order 16-088. Available, existing monitoring wells within or proximal to AOPIs were sampled during the SI sampling event. Groundwater samples were collected at 8 of 32 AOPIs but were not collected at each AOPI due to the depth of groundwater, as well as the complexity of the heavily karstified geology, which limits certainty in determining the source of PFOS, PFOA, and PFBS. During the SI sampling event, groundwater was commonly first encountered at depths over 200 feet bgs and occasionally over 300 feet bgs. Available data, including PFOS, PFOA, and PFBS, is listed in **Appendix N**, which were analyzed per the selected analytical method.

Results from this PA/SI indicate further study in a remedial investigation is warranted at FLW in accordance with the guidance provided by the OSD.

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ACRONYMS

%	percent
AFFF	aqueous film-forming foam
AOPI	area of potential interest
Arcadis	Arcadis U.S., Inc.
AR-AFFF	alcohol resistant aqueous film-forming foam
ARFF	Aircraft Rescue and Firefighting
Army	United States Army
ARNG	Army National Guard
bgs	below ground surface
CAFS	compressed air foam system
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CSM	conceptual site model
DEB	dedicated equipment background
DJ	The analyte was analyzed at dilution and the result is an estimated quantity
DoD	Department of Defense
DPW	Directorate of Public Works
DQO	data quality objective
DUSR	Data Usability Summary Report
EB	equipment blank
EDR	Environmental Data Resources, Inc.
ELAP	Environmental Laboratory Accreditation Program
FCR	field change report
FLW	Fort Leonard Wood
FTA	fire training area
GIS	geographic information system
GW	groundwater
HQAES	Headquarters Army Environmental System
IDW	investigation-derived waste
IMCOM	Installation Management Command

installation	U.S. Army or Reserve installation
IRP	Installation Restoration Program
J	The analyte was positively identified; however, the associated numerical value is an estimated concentration only.
J+	The result is an estimated quantity; the result may be biased high.
J-	The result is an estimated quantity; the result may be biased low.
LOD	limit of detection
LOQ	limit of quantitation
mg/kg	milligrams per kilogram (parts per million)
NA	not applicable
N/A	not available
ND	non-detect
ng/L	nanograms per liter (parts per trillion)
NS	not sampled
OSD	Office of the Secretary of Defense
PA	preliminary assessment
PDB	passive diffusion bag
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
POC	point of contact
ppm	parts per million
ppt	parts per trillion
PQAPP	Programmatic Uniform Federal Policy-Quality Assurance Project Plan
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RSL	Regional Screening Level
SE	sediment

SI	site inspection
SO	soil
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
STP	Sewage Treatment Plant
SW	surface water
TA	Training Area
TGI	technical guidance instruction
TOC	total organic carbon
UCMR3	Third Unregulated Contaminant Monitoring Rule
U.S.	United States
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

TABLES

Table 6-1 - Monitoring Well Construction Details
USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, Missouri

Area of Potential Interest	Sampling Location ID	Total Well Depth (ft bgs)	Measuring Point Elevation (ft amsl)	Measuring Point	Depth to Groundwater from Measuring Point (ft)	Groundwater Elevation (ft amsl)	Screened Interval (ft bgs)	Casing Diameter (inches)	Dedicated Equipment (Y/N)
Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003) and Old Fire Training Area at Landfill 3 (FLW-053)	FLW-MW-301A	340	1136.9	TOC	NA	NA	90.2 - 100.2	NA	Y
	FLW-MW-303	280	1121.3	TOC	246.7	874.59	243.4 - 263.4	NA	N
	FLW-MW-303A	103	1124.8	TOC	87.7	1037.13	69 - 89	NA	N
	FLW-MW-304	278	1099.8	TOC	221.6	878.19	219 - 239	NA	N
	FLW-MW-306	320	1144.3	TOC	NA	NA	280.1 - 310.1	NA	Y
	FLW-MW-311	320	1109.1	TOC	NA	NA	249.5 - 279.5	NA	N
	FLW-MW-401	240	1073.0	TOC	194.5	878.52	202 - 222	NA	N
	FLW-MW-503	229.5	1069.0	TOC	202.7	866.3	205 - 225	NA	N
	FLW-MW-505	260	1093.1	TOC	246.7	846.39	235 - 255	NA	N
Former Fire Station #2 (Oklahoma Avenue)	FLW-MW-5604	210	NA	TOC	181.2	NA	NA	NA	N
	FLW-MW-5609	NA	NA	TOC	NA	NA	NA	NA	N
Biosolids Application Field #1 (Five Sewage Treatment Plant Landfills, FLW-012)	FLW-MW-1201	374	1086.42	TOC	NA	NA	344 - 374	NA	N
	FLW-MW-1202	147	887.73	TOC	90.5	797.3	23.5 - 147	NA	N
	FLW-MW-1203	115	907.52	TOC	91.0	816.6	82.5 - 115	NA	N
	FLW-MW-1204	46.5	925	TOC	38.8	886.2	36 - 46	NA	N
	FLW-MW-1205	21.8	910.45	TOC	21.3	889.2	10 - 20	NA	N
Biosolids Application Field #17 (Landfill 15, FLW-020)	MW-214	240	1142.93	TOC	213.2	929.7	199.5 - 229.5	NA	N
	MW-216	197	1111.03	TOC	151.0	960.0	168 - 198	NA	N
Biosolids Application Field #18 (Landfill 2, FLW-002)	MW-201R	254	1148.09	TOC	231.4	916.7	217.5 - 247.5	NA	N
	MW-210	210	1122.21	TOC	178.4	943.8	186 - 196	NA	N
	MW-212	204	1125.78	TOC	195.3	930.5	191 - 201	NA	N
	SG-02	NA	NA	TOC	NA	NA	NA	NA	N
Biosolids Application Field #5 (Landfill 12, FLW-017)	MW-1701	38	814.5	TOC	25.1	789.4	20 - 30	NA	N
Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059)	MW-5901	12.6	NA	TOC	11.2	NA	NA	NA	Y
	MW-5904	32.8	NA	TOC	17.8	NA	NA	NA	Y
	MW-5905	21.4	NA	TOC	18.5	NA	NA	NA	Y
Biosolids Application Field #19 (Landfill on a Branch to Big Piney, FLW-060)	MW-6001	80	886.71	TOC	17.9	868.8	39.2 - 80	NA	N
	MW-6002	78	862.2	TOC	3.7	858.5	29.3 - 70	NA	N

Acronyms/Abbreviations:

amsl - above mean sea level
bgs - below ground surface
ft - feet
FLW - Fort Leonard Wood
GS - ground surface
ID - identification
NA - not available
TOC - top of casing

Sources:

1. USACE, Fort Leonard Wood
2. Fort Leonard Wood September-October 2020 SI event

Table 7-1 - Groundwater PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, Missouri

AOPI	Location	Sample/ Parent ID	Sample Date	Analyte	PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
				OSD Tapwater Risk Screening Level	40		40		600	
				Sample Type	Result	Qual	Result	Qual	Result	Qual
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-MW-1202	FLW-MW-1202-100120	10/01/2020	N	**9.5**		**3.1**	J	3.7	U
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-MW-1202	FLW-FD-1-GW-100120 / FLW-MW-1202-100120	10/01/2020	FD	**9.2**		**3.4**	J	3.6	U
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-MW-1203	FLW-MW-1203-100120	10/01/2020	N	4.0	U	**2.1**	J	4.0	U
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-MW-1204	FLW-MW-1204-100120	10/01/2020	N	**11**		**2.8**	J	**2.0**	J
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-MW-1205	FLW-MW-1205-100220	10/02/2020	N	**160**	J+	**22**		**7.3**	
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-MW-1201	FLW-MW-1201-100920	10/09/2020	N	**3.7**	J	**4.4**		3.9	U
Biosolids Application Field #5 (Landfill 12, FLW-017)	FLW-MW-1701	FLW-MW-1701-100720	10/07/2020	N	**59**		**45**	J+	**46**	J+
Biosolids Application Fields #9 and #10 (FLW-003 and FLW-053)	FLW-MW-303	FLW-MW-303-101020	10/10/2020	N	**34**		**12**	J	**15**	
Biosolids Application Fields #9 and #10 (FLW-003 and FLW-053)	FLW-MW-303A	FLW-MW-303A-100220	10/02/2020	N	**9.1**		**5.4**		**3.5**	
Biosolids Application Fields #9 and #10 (FLW-003 and FLW-053)	FLW-MW-304	FLW-MW-304-101020	10/10/2020	N	**7.2**		**16**	J	**18**	
Biosolids Application Fields #9 and #10 (FLW-003 and FLW-053)	FLW-MW-306	FLW-MW-306-101020	10/10/2020	N	**780**	DJ	**53**		**48**	
Biosolids Application Fields #9 and #10 (FLW-003 and FLW-053)	FLW-MW-306	FLW-FD-3-GW-100720 / FLW-MW-306-101020	10/07/2020	FD	**63**		**45**		**48**	
Biosolids Application Fields #9 and #10 (FLW-003 and FLW-053)	FLW-MW-311	FLW-MW-311-101020	10/10/2020	N	3.9	U	**3.0**	J	3.9	U
Biosolids Application Fields #9 and #10 (FLW-003 and FLW-053)	FLW-MW-401	FLW-MW-401-101020	10/10/2020	N	**140**		**55**		**56**	
Biosolids Application Fields #9 and #10 (FLW-003 and FLW-053)	FLW-MW-503	FLW-MW-503-101020	10/10/2020	N	**33**		**38**		**30**	
Biosolids Application Fields #9 and #10 (FLW-003 and FLW-053)	FLW-MW-505	FLW-MW-505-101020	10/10/2020	N	3.9	U	3.9	UJ	3.9	U
Former Fire Station #2 (Oklahoma Avenue)	FLW-MW-5604	FLW-MW-5604-100520	10/05/2020	N	**26**		**5.1**		**3.7**	
	FLW-MW-5609	FLW-MW-5609-101020	10/10/2020	N	**11**		3.7	U	3.7	U
Biosolids Application Field #17 (Landfill 15, FLW-020)	FLW-MW-216	FLW-MW-216-100620	10/06/2020	N	**5.3**		**7.3**		**28**	
Biosolids Application Field #17 (Landfill 15, FLW-020)	FLW-MW-212	FLW-MW-212-101020	10/10/2020	N	**5.1**		**21**		**35**	
Biosolids Application Field #17 (Landfill 15, FLW-020)	FLW-MW-214	FLW-MW-214-101020	10/10/2020	N	3.9	U	3.9	UJ	3.9	U
Biosolids Application Field #18 (Landfill 2, FLW-002)	FLW-MW-210	FLW-MW-210-100520	10/05/2020	N	3.7	U	3.7	U	3.7	U
Biosolids Application Field #18 (Landfill 2, FLW-002)	FLW-MW-201R	FLW-MW-201R-101020	10/10/2020	N	4.0	U	4.0	UJ	4.0	U
Biosolids Application Field #19 (FLW-060)	FLW-MW-6001	FLW-060-MW-6001-100120	10/01/2020	N	3.4	U	3.4	U	3.4	U
Biosolids Application Field #19 (FLW-060)	FLW-MW-6001	FLW-FD-2-GW-100120 / FLW-060-MW-6001-100120	10/01/2020	FD	3.4	U	3.4	U	3.4	U
Biosolids Application Field #19 (FLW-060)	FLW-MW-6002	FLW-060-MW-6002-100120	10/01/2020	N	3.4	U	3.4	U	3.4	U
Biosolids Application Field #22 (FLW-059)	FLW-MW-5901	FLW-MW-5901-100520	10/05/2020	N	**3.8**		3.8	U	**2.2**	J
Biosolids Application Field #22 (FLW-059)	FLW-MW-5904	FLW-MW-5904-100520	10/05/2020	N	**17**		**5.4**		**2.5**	J
Biosolids Application Field #22 (FLW-059)	FLW-MW-5905	FLW-MW-5905-100520	10/05/2020	N	**5.8**		4.0	U	4.0	U

Notes:
1. **Bolded** values indicate the result was detected greater than the limit of detection

2. Grey shaded values indicate the result was detected greater than the Office of the Secretary of Defense (OSD) risk screening levels for tap water (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September.).

Acronyms/Abbreviations:
AOPI = area of potential interest
FD = field duplicate sample
FLW = Fort Leonard Wood
ID = identification
N = primary sample
ng/L = nanograms per liter (parts per trillion)
OSD = Office of the Secretary of Defense
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutane sulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonic acid
Qual = qualifier
SI = site inspection
USAEC = U.S. Army Environmental Command

Qualifiers:
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only.
J+ = The result is an estimated quantity; the result may be biased high.
U = The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
UJ = The analyte was analyzed for but was not detected. The reported LOQ is approximate and may be inaccurate or imprecise.
DJ = The analyte was analyzed at dilution and the result is an estimated quantity

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, Missouri

AOPI	Location	Sample/Parent ID	Sample Date	Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
				OSD Industrial/Commercial Risk Screening Level	1.6		1.6		25	
				OSD Residential Risk Screening Level	0.13		0.13		1.9	
				Sample Type	Result	Qual	Result	Qual	Result	Qual
ARNG Hangars (Buildings 5010 and 5012)	FLW-ARNG-01	FLW-ARNG-01-SO-0-1-101320	10/13/2020	N	0.0094	U	**0.0048**	DJ	0.0094	U
ARNG Hangars (Buildings 5010 and 5012)	FLW-ARNG-02	FLW-ARNG-02-SO-0-1-101320	10/13/2020	N	0.00094	U	**0.0054**		0.00094	U
ARNG Hangars (Buildings 5010 and 5012)	FLW-ARNG-03	FLW-ARNG-03-SO-0-1-101320	10/13/2020	N	0.0010	U	**0.0028**		0.0010	U
ARNG Hangars (Buildings 5010 and 5012)	FLW-ARNG-04	FLW-ARNG-04-SO-0-1-101320	10/13/2020	N	0.023	U	**0.026**	DJ	0.023	U
ARNG Hangars (Buildings 5010 and 5012)	FLW-ARNG-05	FLW-ARNG-05-SO-0-1-101320	10/13/2020	N	0.046	U	0.046	U	0.046	U
ARNG Hangars (Buildings 5010 and 5012)	FLW-ARNG-06	FLW-ARNG-06-SO-0-1-101320	10/13/2020	N	0.10	U	**0.086**	DJ	0.10	U
ARNG Hangars (Buildings 5010 and 5012)	FLW-ARNG-07	FLW-ARNG-07-SO-0-1-101320	10/13/2020	N	0.0068	U	**0.0084**		0.0068	U
Active Fire Station #2 (Building 5001)	FLW-AFS2-01	FLW-AFS2-01-SO-0-1-100920	10/09/2020	N	**0.49**	DJ	**0.0032**		0.0011	U
Active Fire Station #2 (Building 5001)	FLW-AFS2-02	FLW-AFS2-02-SO-0-1-100920	10/09/2020	N	**0.017**		**0.00094**	J	0.00096	U
Active Fire Station #2 (Building 5001)	FLW-AFS2-03	FLW-AFS2-03-SO-0-1-100920	10/09/2020	N	**0.21**		**0.0091**		**0.0013**	
Active Fire Station #2 (Building 5001)	FLW-AFS2-04	FLW-AFS2-04-SO-0-1-100920	10/09/2020	N	**1.1**	DJ	**0.0014**		**0.0010**	
Active Fire Station #1 (Building 580)	FLW-AFS1-01	FLW-AFS1-01-SO-0-1.2-100120	10/01/2020	N	**0.49**	DJ	**0.0013**		0.0013	U
Active Fire Station #1 (Building 580)	FLW-AFS1-02	FLW-AFS1-02-SO-0-1.3-100120	10/01/2020	N	**0.057**		0.0013	U	0.0013	U
Active Fire Station #1 (Building 580)	FLW-AFS1-03	FLW-AFSI-03-SO-0-1.100120	10/01/2020	N	**0.045**		**0.00070**	J	0.0011	U
Active Fire Station #1 (Building 580)	FLW-AFS1-04	FLW-AFS1-04-SO-0-1-100120	10/01/2020	N	**0.014**		0.0011	U	0.0011	U
Biosolids Application Field #11	FLW-BAF11-01	FLW-BAF11-01-SO-0-1-101220	10/12/2020	N	0.00098	U	0.00098	U	0.00098	U
Biosolids Application Field #11	FLW-BAF11-02	FLW-BAF11-02-SO-0-1-101220	10/12/2020	N	0.00097	U	0.00097	U	0.00097	U
Biosolids Application Field #11	FLW-BAF11-02	FLW-FD-7-SO-101220 / FLW-BAF11-02-SO-0-1-101220	10/12/2020	FD	0.0011	U	0.0011	U	0.0011	U
Biosolids Application Field #11	FLW-BAF11-03	FLW-BAF11-03-SO-0-1-101220	10/12/2020	N	0.00090	U	0.00090	U	0.00090	U
Biosolids Application Field #11	FLW-BAF11-04	FLW-BAF11-04-SO-0-2-101220	10/12/2020	N	0.0011	U	0.0011	U	0.0011	U
Biosolids Application Field #12	FLW-BAF12-01	FLW-BAF12-01-SO-0-2-101220	10/12/2020	N	0.00098	U	0.00098	U	0.00098	U
Biosolids Application Field #12	FLW-BAF12-02	FLW-BAF12-02-SO-1-101220	10/12/2020	N	0.00096	U	0.00096	U	0.00096	U
Biosolids Application Field #12	FLW-BAF12-03	FLW-BAF12-03-SO-0-1-101220	10/12/2020	N	0.00099	U	0.00099	U	0.00099	U
Biosolids Application Field #13	FLW-BAF13-01	FLW-BAF13-01-SO-0-1-101220	10/12/2020	N	**0.021**		**0.0040**		**0.0015**	
Biosolids Application Field #13	FLW-BAF13-02	FLW-BAF13-02-SO-0-2-101220	10/12/2020	N	**0.0023**		**0.0018**		**0.00085**	J
Biosolids Application Field #13	FLW-BAF13-03	FLW-BAF13-03-SO-0-1-101220	10/12/2020	N	**0.0012**		0.0010	U	0.0010	U
Biosolids Application Field #13	FLW-BAF13-04	FLW-BAF13-04-SO-0-1-101220	10/12/2020	N	**0.023**		**0.0042**		**0.00052**	J
Biosolids Application Field #14	FLW-BAF14-01	FLW-BAF14-01-SO-0-1-101220	10/12/2020	N	**0.071**		**0.0058**		**0.0011**	
Biosolids Application Field #14	FLW-BAF14-02	FLW-BAF14-02-SO-0-1-101220	10/12/2020	N	**0.10**		**0.0046**		0.0011	U
Biosolids Application Field #14	FLW-BAF14-03	FLW-BAF14-03-SO-0-1-101220	10/12/2020	N	**0.054**		**0.0046**		0.0012	U
Biosolids Application Field #15	FLW-BAF15-01	FLW-BAF15-01-SO-0-1-101320	10/13/2020	N	0.0011	U	0.0011	U	0.0011	U
Biosolids Application Field #15	FLW-BAF15-02	FLW-BAF15-02-0-2-101820	10/18/2020	N	0.0013	U	0.0013	U	0.0013	U
Biosolids Application Field #15	FLW-BAF15-03	FLW-BAF15-03-0-2-101820	10/18/2020	N	0.0011	U	0.0011	U	0.0011	U
Biosolids Application Field #15	FLW-BAF15-04	FLW-BAF15-04-0-1-101820	10/18/2020	N	0.0011	U	0.0011	U	0.0011	U

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, Missouri

AOPI	Location	Sample/Parent ID	Sample Date	Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
				OSD Industrial/Commercial Risk Screening Level	1.6		1.6		25	
				OSD Residential Risk Screening Level	0.13		0.13		1.9	
				Sample Type	Result	Qual	Result	Qual	Result	Qual
Biosolids Application Field #15	FLW-BAF15-05	FLW-BAF15-05-0-2-101820	10/18/2020	N	0.00095	U	0.00095	U	0.00095	U
Biosolids Application Field #16	FLW-BAF16-01	FLW-BAF16-01-SO-0-1-101320	10/13/2020	N	0.0012	U	0.0012	U	0.0012	U
Biosolids Application Field #16	FLW-BAF16-02	FLW-BAF16-02-SO-0-1-101320	10/13/2020	N	0.00097	U	0.00097	U	0.00097	U
Biosolids Application Field #16	FLW-BAF16-03	FLW-BAF16-03-SO-0-1-101320	10/13/2020	N	0.0015	U	0.0015	U	0.0015	U
Biosolids Application Field #16	FLW-BAF16-04	FLW-BAF16-04-SO-0-1-101320	10/13/2020	N	0.0011	U	0.0011	U	0.0011	U
Biosolids Application Field #20	FLW-BAF20-01	FLW-BAF20-01-SO-0-1-101320	10/13/2020	N	**0.0016**		**0.0016**		0.00098	U
Biosolids Application Field #20	FLW-BAF20-02	FLW-BAF20-02-SO-0-1-101320	10/13/2020	N	**0.0039**		**0.0032**		**0.0020**	
Biosolids Application Field #20	FLW-BAF20-02	FLW-FD-9-SO-101320 / FLW-BAF20-02-SO-0-1-101320	10/13/2020	FD	**0.0055**		**0.0032**		**0.0021**	
Biosolids Application Field #20	FLW-BAF20-04	FLW-BAF20-04-SO-0-1-101320	10/13/2020	N	0.0012	U	0.0012	U	0.0012	U
Biosolids Application Field #20	FLW-BAF20-06	FLW-BAF20-06-SO-01-101320	10/13/2020	N	0.00097	U	0.00097	U	0.00097	U
Biosolids Application Field #21	FLW-BAF21-01	FLW-BAF21-01-SO-0-0.5-101320	10/13/2020	N	0.0010	U	0.0010	U	0.0010	U
Biosolids Application Field #21	FLW-BAF21-02	FLW-BAF21-02-SO-0-1-101320	10/13/2020	N	0.00091	U	0.00091	U	0.00091	U
Biosolids Application Field #21	FLW-BAF21-03	FLW-BAF21-03-SO-0-1-101320	10/13/2020	N	**0.0014**		**0.0012**		**0.00094**	J
Biosolids Application Field #21	FLW-BAF21-04	FLW-BAF21-04-SO-0-1-101320	10/13/2020	N	0.0012	U	0.0012	U	0.0012	U
Biosolids Application Field #27A	FLW-BAF27A-01	FLW-BAF27A-01-SO-0-1-101320	10/13/2020	N	0.00090	U	0.00090	U	0.00090	U
Biosolids Application Field #27A	FLW-BAF27A-02	FLW-BAF27A-02-SO-0-2-101320	10/13/2020	N	**0.00062**	J	0.0010	U	0.0010	U
Biosolids Application Field #27A	FLW-BAF27A-03	FLW-BAF27A-03-SO-0-2-101320	10/13/2020	N	0.0014	U	0.0014	U	0.0014	U
Biosolids Application Field #27A	FLW-BAF27A-04	FLW-BAF27A-04-SO-0-2-101320	10/13/2020	N	**0.0022**		0.0010	U	**0.00067**	J
Biosolids Application Field #6	FLW-BAF6-01	FLW-BAF6-01-SO-0-1-100820	10/08/2020	N	0.0011	U	0.0011	U	0.0011	U
Biosolids Application Field #6	FLW-BAF6-02	FLW-BAF6-02-SO-0-1-100820	10/08/2020	N	**0.017**		**0.0015**		0.0011	U
Biosolids Application Field #6	FLW-BAF6-02	FLW-FD-1-SO-100720 / FLW-BAF6-02-SO-0-1-100820	10/07/2020	FD	**0.014**	J	**0.0031**		**0.00075**	J
Biosolids Application Field #6	FLW-BAF6-03	FLW-BAF6-03-SO-0-1-100820	10/08/2020	N	0.00097	U	0.00097	U	0.00097	U
Biosolids Application Field #6	FLW-BAF6-04	FLW-BAF6-04-SO-0-1-100820	10/08/2020	N	0.0012	U	0.0012	U	0.0012	U
Biosolids Application Field #6	FLW-BAF6-05	FLW-BAF6-05-SO-0-1-100820	10/08/2020	N	0.0012	U	0.0012	U	0.0012	U
Biosolids Application Field #7	FLW-BAF7-01	FLW-BAF7-01-SO-0-1-101320	10/13/2020	N	**0.0046**		**0.0018**		0.0011	U
Biosolids Application Field #7	FLW-BAF7-02	FLW-BAF7-02-SO-0-1-101320	10/13/2020	N	**0.0093**		**0.0038**		**0.0015**	
Biosolids Application Field #7	FLW-BAF7-02	FLW-FD-08-SO-101320 / FLW-BAF7-02-SO-0-1-101320	10/13/2020	FD	**0.015**		**0.0039**		**0.0015**	
Biosolids Application Field #7	FLW-BAF7-03	FLW-BAF7-03-SO-0-1-101320	10/13/2020	N	**0.013**		**0.0077**		**0.0023**	
Biosolids Application Field #7	FLW-BAF7-04	FLW-BAF7-04-SO-0-1-101320	10/13/2020	N	**0.0047**		**0.0036**		0.0012	U
Biosolids Application Field #8	FLW-BAF8-01	FLW-BAF8-01-SO-0-1-101320	10/13/2020	N	**0.00074**	J	0.0010	U	0.0010	U
Biosolids Application Field #8	FLW-BAF8-02	FLW-BAF8-02-SO-0-1-101320	10/13/2020	N	**0.013**		**0.0026**		0.00097	U
Biosolids Application Field #8	FLW-BAF8-03	FLW-BAF8-03-SO-0-1-101320	10/13/2020	N	0.0011	U	0.0011	U	0.0011	U
Former Fire Station #1 (Triangle Station)	FLW-FFS1-01	FLW-FFS1-01-SO-0-2-093020	09/30/2020	N	**0.0020**		0.00087	U	0.00087	U
Former Fire Station #1 (Triangle Station)	FLW-FFS1-01	FLW-FFS1-01-SO-2-4-093020	09/30/2020	N	**0.018**		0.0012	U	0.0012	U

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytical Results
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Fort Leonard Wood, Missouri

AOPI	Location	Sample/Parent ID	Sample Date	Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
				OSD Industrial/Commercial Risk Screening Level	1.6		1.6		25	
				OSD Residential Risk Screening Level	0.13		0.13		1.9	
				Sample Type	Result	Qual	Result	Qual	Result	Qual
Former Fire Station #1 (Triangle Station)	FLW-FFS1-02	FLW-FFS1-02-SO-0-2-093020	09/30/2020	N	**0.019**		**0.00069**	J	**0.0011**	
Former Fire Station #1 (Triangle Station)	FLW-FFS1-02	FLW-FFS1-02-SO-2-4-093020	09/30/2020	N	**0.059**		**0.011**		**0.0023**	
Former Fire Station #1 (Triangle Station)	FLW-FFS1-03	FLW-FFS1-03-SO-0-2-093020	09/30/2020	N	**0.0027**		0.0012	U	0.0012	U
Former Fire Station #1 (Triangle Station)	FLW-FFS1-03	FLW-FFS1-03-SO-2-4-093020	09/30/2020	N	**0.0042**		0.0013	U	0.0013	U
Former Fire Station #2 (Oklahoma Avenue)	FLW-FFS2-01	FLW-FFS2-01-SO-0-2(09292020)	09/29/2020	N	0.00094	U	0.00094	U	0.00094	U
Former Fire Station #2 (Oklahoma Avenue)	FLW-FFS2-01	FLW-FFS2-01-SO-2-4(09292020)	09/29/2020	N	0.0010	UJ-	0.0010	UJ-	0.0010	UJ-
Former Fire Station #2 (Oklahoma Avenue)	FLW-FFS2-02	FLW-FFS2-02-SO-0-2(09292020)	09/29/2020	N	0.0010	U	0.0010	U	0.0010	U
Former Fire Station #2 (Oklahoma Avenue)	FLW-FFS2-02	FLW-FFS2-02-SO-0-2-4(09292020)	09/29/2020	N	0.0011	U	0.0011	U	0.0011	U
Former Fire Station #2 (Oklahoma Avenue)	FLW-FFS2-03	FLW-FFS2-03-SO-0-2-093020	09/30/2020	N	0.0011	U	0.0011	U	0.0011	U
Former Fire Station #2 (Oklahoma Avenue)	FLW-FFS2-03	FLW-FFS2-03-SO-2-4-093020	09/30/2020	N	0.0011	U	0.0011	U	0.0011	U
Former Fire Station #3 (Troop Trail)	FLW-FFS3-01	FLW-FFS3-01-SO-0-2-093020	09/30/2020	N	**0.013**		0.0012	U	0.0012	U
Former Fire Station #3 (Troop Trail)	FLW-FFS3-01	FLW-FFS3-01-SO-2-4-093020	09/30/2020	N	**0.027**		**0.00066**	J	0.0010	U
Former Fire Station #3 (Troop Trail)	FLW-FFS3-02	FLW-FFS3-02-SO-0-2-093020	09/30/2020	N	**0.0055**		0.00097	U	0.00097	U
Former Fire Station #3 (Troop Trail)	FLW-FFS3-02	FLW-FFS3-02-SO-2-4-093020	09/30/2020	N	**0.021**		**0.00054**	J	0.0010	U
Former Fire Station #3 (Troop Trail)	FLW-FFS3-03	FLW-FFS3-03-SO-0-2-093020	09/30/2020	N	**0.0059**		0.00096	U	0.00096	U
Former Fire Station #3 (Troop Trail)	FLW-FFS3-03	FLW-FFS3-03-SO-2-4-093020	09/30/2020	N	**0.031**		**0.00073**	J	0.00089	U
Biosolids Application Field #18 (Landfill 2, FLW-002)	FLW-002-01	FLW-002-01-SO-0-1-100920	10/09/2020	N	**0.018**	J	**0.0035**	J+	**0.00087**	J
Biosolids Application Field #18 (Landfill 2, FLW-002)	FLW-002-01	FLW-FD-4-SO-100920 / FLW-002-01-SO-0-1-100920	10/09/2020	FD	**0.032**	J	**0.0051**		**0.0012**	
Biosolids Application Field #18 (Landfill 2, FLW-002)	FLW-002-02	FLW-002-02-SO-0-1-100920	10/09/2020	N	**0.018**		**0.0019**		0.0011	U
Biosolids Application Field #18 (Landfill 2, FLW-002)	FLW-002-03	FLW-002-03-SO-0-1-100920	10/09/2020	N	**0.00081**	J	**0.0017**		0.0012	U
Biosolids Application Field #18 (Landfill 2, FLW-002)	FLW-002-04	FLW-002-04-SO-0-1-100920	10/09/2020	N	**0.0074**		**0.0023**		**0.00052**	J
Biosolids Application Field #3 (Landfill 8, FLW-010)	FLW-010-01	FLW-010-01-SO-0-2-100820	10/08/2020	N	**0.014**		**0.00093**	J	0.00096	U
Biosolids Application Field #3 (Landfill 8, FLW-010)	FLW-010-02	FLW-010-02-SO-0-1-100820	10/08/2020	N	**0.38**	DJ	**0.0066**	DJ	0.0053	U
Biosolids Application Field #3 (Landfill 8, FLW-010)	FLW-010-03	FLW-010-03-SO-0-1-100820	10/08/2020	N	**0.015**		**0.0021**		0.00095	U
Biosolids Application Field #3 (Landfill 8, FLW-010)	FLW-010-04	FLW-010-04-SO-0-1-100820	10/08/2020	N	**0.012**	J-	**0.0029**	J-	**0.00050**	J-
Biosolids Application Field #3 (Landfill 8, FLW-010)	FLW-010-05	FLW-010-05-SO-0-1-100820	10/08/2020	N	0.00096	U	0.00096	U	0.00096	U
Biosolids Application Field #3 (Landfill 8, FLW-010)	FLW-010-06	FLW-010-06-SO-0-1-100820	10/08/2020	N	0.0013	U	0.0013	U	0.0013	U
Biosolids Application Field #2 (Landfill 9, FLW-011)	FLW-011-01	FLW-011-01-SO-0-1-100820	10/08/2020	N	**0.0095**		**0.0013**		0.00096	U
Biosolids Application Field #2 (Landfill 9, FLW-011)	FLW-011-02	FLW-011-02-SO-0-1-100820	10/08/2020	N	**0.086**		**0.0035**		**0.00083**	J
Biosolids Application Field #2 (Landfill 9, FLW-011)	FLW-011-03	FLW-011-03-SO-0-1-100820	10/08/2020	N	**0.43**	DJ	**0.0049**		**0.00064**	J
Biosolids Application Field #2 (Landfill 9, FLW-011)	FLW-011-04	FLW-011-04-SO-0-1-100820	10/08/2020	N	0.00097	U	0.00097	U	0.00097	U
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-01	FLW-012-01-SO-0-1-100620	10/06/2020	N	**0.0083**		0.0012	U	0.0012	U
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-02	FLW-012-02-SO-0-1.1-100620	10/06/2020	N	**0.017**	J	**0.00089**	J-	0.0010	UJ
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-02	FLW-FD-2-SO-100220 / FLW-012-02-SO-0-1.1-100620	10/02/2020	FD	**0.015**		**0.0010**		0.00096	U

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Fort Leonard Wood, Missouri

AOPI	Location	Sample/Parent ID	Sample Date	Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
				OSD Industrial/Commercial Risk Screening Level	1.6		1.6		25	
				OSD Residential Risk Screening Level	0.13		0.13		1.9	
				Sample Type	Result	Qual	Result	Qual	Result	Qual
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-03	FLW-012-03-SO-0-1-100620	10/06/2020	N	**0.0034**		**0.00078**	J	0.0012	U
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-04	FLW-012-04-SO-0-0.5-100620	10/06/2020	N	**0.0097**		**0.0014**		0.0013	U
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-05	FLW-012-05-SO-0-2-100620	10/06/2020	N	**0.24**		**0.0039**		**0.0010**	J
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-06	FLW-012-06-SO-0-1.5-100620	10/06/2020	N	**0.0011**		**0.00067**	J	0.0010	U
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-07	FLW-012-07-SO-0-1-100620	10/06/2020	N	**0.39**	DJ	**0.030**		**0.0020**	
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-08	FLW-012-08-SO-0-1-100620	10/06/2020	N	**0.037**		**0.0047**		**0.0022**	
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-09	FLW-012-09-SO-0-1-100620	10/06/2020	N	**0.62**	DJ	**0.015**		**0.0017**	
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-10	FLW-012-10-SO-0-0.5-100620	10/06/2020	N	**0.0031**		0.0011	U	0.0011	U
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-11	FLW-012-11-SO-0-1-100620	10/06/2020	N	**0.0020**		0.00091	U	0.00091	U
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-12	FLW-012-12-SO-0-1.8-100620	10/06/2020	N	**0.037**		**0.0016**		0.0013	U
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-13	FLW-012-13-SO-0-2-100620	10/06/2020	N	**0.0014**		0.00098	U	0.00098	U
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-14	FLW-012-14-SO-0-0.5-100620	10/06/2020	N	0.0012	U	0.0012	U	0.0012	U
Biosolids Application Field #1 (Five STP Landfills, FLW-012)	FLW-012-15	FLW-012-15-SO-0-1-100620	10/06/2020	N	**0.023**		0.00096	U	0.00096	U
Biosolids Application Field #5 (Landfill 12, FLW-017)	FLW-017-01	FLW-017-01-SO-0-0.5-100720	10/07/2020	N	**0.0048**		**0.0018**		**0.00071**	J
Biosolids Application Field #5 (Landfill 12, FLW-017)	FLW-017-02	FLW-017-02-SO-0-1-100720	10/07/2020	N	**0.018**		**0.0024**		**0.0014**	
Biosolids Application Field #5 (Landfill 12, FLW-017)	FLW-017-03	FLW-017-03-SO-0-1-100720	10/07/2020	N	**0.0020**		**0.00099**	J	**0.00099**	J
Biosolids Application Field #5 (Landfill 12, FLW-017)	FLW-017-04	FLW-017-04-SO-0-1-100720	10/07/2020	N	**0.0048**		**0.0011**		**0.00084**	J
Biosolids Application Field #17 (Landfill 15, FLW-020)	FLW-020-01	FLW-020-01-SO-0-1-100820	10/08/2020	N	**0.037**		**0.0054**		**0.0017**	
Biosolids Application Field #17 (Landfill 15, FLW-020)	FLW-020-02	FLW-020-02-SO-0-1-100820	10/08/2020	N	**0.089**		**0.0051**		**0.0022**	
Biosolids Application Field #17 (Landfill 15, FLW-020)	FLW-020-03	FLW-020-03-SO-0-1-100820	10/08/2020	N	**0.054**		**0.0052**	J-	**0.00075**	J
Biosolids Application Field #17 (Landfill 15, FLW-020)	FLW-020-03	FLW-FD-5-SO-100820 / FLW-020-03-SO-0-1-100820	10/08/2020	FD	**0.056**		**0.0043**		**0.00068**	J
Biosolids Application Field #17 (Landfill 15, FLW-020)	FLW-020-04	FLW-020-04-SO-0-2-100820	10/08/2020	N	**0.00063**	J	**0.00064**	J	0.0011	U
Sewage Treatment Plant/Lagoons (FLW-024 /FLW-026)	FLW-026-01	FLW-026-01-SO-0-2-100220	10/02/2020	N	**0.013**		**0.00097**	J	0.00099	U
Sewage Treatment Plant/Lagoons (FLW-024 /FLW-026)	FLW-026-01	FLW-026-01-SO-2-4-100220	10/02/2020	N	**0.0012**		0.0012	U	0.0012	U
Sewage Treatment Plant/Lagoons (FLW-024 /FLW-026)	FLW-026-02	FLW-026-02-SO-0-2-100220	10/02/2020	N	**0.023**		**0.0013**	J-	0.0011	U
Sewage Treatment Plant/Lagoons (FLW-024 /FLW-026)	FLW-026-02	FLW-026-02-SO-2-4-100220	10/02/2020	N	**0.00071**	J	0.0011	U	0.0011	U
Sewage Treatment Plant/Lagoons (FLW-024 /FLW-026)	FLW-026-03	FLW-026-03-SO-0-2-100220	10/02/2020	N	**0.012**		**0.00070**	J	0.00098	U
Sewage Treatment Plant/Lagoons (FLW-024 /FLW-026)	FLW-026-03	FLW-026-03-SO-2-4-100220	10/02/2020	N	**0.0048**		**0.00062**	J	0.0011	U
DPW Old Fire Training Area (TA 210, FLW-028)	FLW-028-01	FLW-028-01-SO-0-2-100120	10/01/2020	N	**0.019**		0.0011	U	0.0011	U
DPW Old Fire Training Area (TA 210, FLW-028)	FLW-028-01	FLW-028-01-SO-2-4-100120	10/01/2020	N	**0.44**	DJ	**0.0018**		0.00097	U
DPW Old Fire Training Area (TA 210, FLW-028)	FLW-028-02	FLW-028-02-SO-0-2-100120	10/01/2020	N	**0.0072**		0.00091	U	0.00091	U
DPW Old Fire Training Area (TA 210, FLW-028)	FLW-028-02	FLW-028-02-SO-2-4-100120	10/01/2020	N	**0.16**		**0.025**		**0.0086**	
DPW Old Fire Training Area (TA 210, FLW-028)	FLW-028-03	FLW-028-03-SO-0-0.5-100120	10/01/2020	N	**0.0056**		0.0013	U	0.0013	U
DPW Old Fire Training Area (TA 210, FLW-028)	FLW-028-04	FLW-028-04-SO-0-0.5-100120	10/01/2020	N	**0.023**		**0.00083**	J	0.0012	U

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AOPI	Location	Sample/Parent ID	Sample Date	Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
				OSD Industrial/Commercial Risk Screening Level	1.6		1.6		25	
				OSD Residential Risk Screening Level	0.13		0.13		1.9	
				Sample Type	Result	Qual	Result	Qual	Result	Qual
DPW Old Fire Training Area (TA 210, FLW-028)	FLW-028-05	FLW-028-05-SO-0-1-100120	10/01/2020	N	**0.0024**		0.0010	U	0.0010	U
DPW Old Fire Training Area (TA 210, FLW-028)	FLW-028-06	FLW-028-06-SO-0-1-100120	10/01/2020	N	**0.0064**		0.0011	U	0.0011	U
DPW Old Fire Training Area (TA 210, FLW-028)	FLW-028-07	FLW-028-07-SO-0-2-100120	10/01/2020	N	**0.041**		**0.00077**	J	0.0012	U
DPW Old Fire Training Area (TA 210, FLW-028)	FLW-028-08	FLW-028-08-SO-0-2-100120	10/01/2020	N	**0.0024**		0.0013	U	0.0013	U
DPW Old Fire Training Area (TA 210, FLW-028)	FLW-028-09	FLW-028-09-SO-0-0.5-100120	10/01/2020	N	**0.0041**		0.0013	U	0.0013	U
New Fire Training Area (TA 207, FLW-029)	FLW-029-01	FLW-029-01-SO-0-2-093020	09/30/2020	N	**0.14**		**0.0011**	J	0.0012	U
New Fire Training Area (TA 207, FLW-029)	FLW-029-01	FLW-029-01-SO-2-4-093020	09/30/2020	N	***1.9***	DJ	**0.0036**		**0.0026**	
New Fire Training Area (TA 207, FLW-029)	FLW-029-02	FLW-029-02-SO-0-0.9-10020	10/01/2020	N	**0.031**		**0.0010**		0.00099	U
New Fire Training Area (TA 207, FLW-029)	FLW-029-03	FLW-029-03-SO-0-0.9-100120	10/01/2020	N	***3.6***	DJ	**0.011**	DJ	**0.059**	DJ
New Fire Training Area (TA 207, FLW-029)	FLW-029-04	FLW-029-04-SO-0-0.9-100120	10/01/2020	N	***2.3***	DJ	**0.0074**		**0.033**	
New Fire Training Area (TA 207, FLW-029)	FLW-029-05	FLW-029-05-SO-0-0.9-100120	10/01/2020	N	**0.16**		**0.0011**		**0.0033**	
New Fire Training Area (TA 207, FLW-029)	FLW-029-06	FLW-029-06-SO-0-0.6-100120	10/01/2020	N	**0.075**		**0.0013**		0.0010	U
New Fire Training Area (TA 207, FLW-029)	FLW-029-07	FLW-029-07-SO-0-1-100120	10/01/2020	N	**0.15**		**0.0023**		**0.00078**	J
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-003-01	FLW-003-01-SO-0-1-100720	10/07/2020	N	**0.018**		**0.0024**		**0.00099**	J
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-003-02	FLW-003-02-SO-0-1-100720	10/07/2020	N	**0.0073**	J	**0.0023**	J-	0.0012	U
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-003-03	FLW-003-03-SO-0-1-100720	10/07/2020	N	**0.071**		**0.0069**		**0.0027**	
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-003-04	FLW-003-04-SO-0-1-100720	10/07/2020	N	**0.24**		**0.011**		**0.0033**	
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-003-05	FLW-003-05-SO-0-1-100720	10/07/2020	N	**0.24**	DJ	**0.0055**		**0.0022**	
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-003-06	FLW-003-06-SO-0-1-100720	10/07/2020	N	**0.046**		**0.0076**		**0.0026**	
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-003-07	FLW-003-07-SO-0-1-100720	10/07/2020	N	**0.024**		**0.0040**		**0.0013**	J
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-003-08	FLW-003-08-SO-0-2-100720	10/07/2020	N	**0.064**		**0.0075**		**0.00085**	J
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-003-09	FLW-003-09-SO-0-1-100720	10/07/2020	N	**0.17**		**0.032**		**0.0024**	
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-003-10	FLW-003-10-SO-0-1-100720	10/07/2020	N	**0.013**		**0.00093**	J	0.00098	U
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-003-11	FLW-003-11-SO-0-1-100720	10/07/2020	N	**0.024**		**0.0035**		**0.0010**	J
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-053-01	FLW-053-01-SO-0-2-100220	10/02/2020	N	**0.0037**		**0.0024**		0.0011	U
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-053-01	FLW-053-01-SO-2-4-100220	10/02/2020	N	**0.00085**	J	**0.0018**		0.0010	U
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-053-01	FLW-FD-3-SO-100620 / FLW-053-01-SO-2-4-100220	10/06/2020	FD	**0.061**	J	**0.0018**		0.0013	U
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-053-02	FLW-053-02-SO-0-2-100220	10/02/2020	N	**0.39**	DJ	**0.019**		**0.00086**	J
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-053-02	FLW-053-02-SO-2-4-100220	10/02/2020	N	**0.024**		**0.014**		**0.0018**	
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-053-03	FLW-053-03-SO-0-2-100220	10/02/2020	N	**0.14**		**0.0076**		0.0012	U
Biosolids Application Fields #9 and #10 (FLW-003)/(FLW-053)	FLW-053-03	FLW-053-03-SO-2-4-100220	10/02/2020	N	**0.048**		**0.0044**		**0.00078**	J
Old Fire Training Area Runway End (FLW-054)	FLW-054-01	FLW-054-01-SO-0-1.5-100720	10/07/2020	N	**0.00073**	J	0.0011	U	0.0011	U
Old Fire Training Area Runway End (FLW-054)	FLW-054-02	FLW-054-02-SO-0-1-100720	10/07/2020	N	**0.0013**		0.0011	U	0.0011	U
Old Fire Training Area Runway End (FLW-054)	FLW-054-03	FLW-054-03-SO-0-1-100720	10/07/2020	N	**0.00057**	J	0.00089	U	0.00089	U

Table 7-2 - Soil PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, Missouri

AOPI	Location	Sample/Parent ID	Sample Date	Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
				OSD Industrial/Commercial Risk Screening Level	1.6		1.6		25	
				OSD Residential Risk Screening Level	0.13		0.13		1.9	
				Sample Type	Result	Qual	Result	Qual	Result	Qual
Old Fire Training Area Runway End (FLW-054)	FLW-054-04	FLW-054-04-SO-0-1-100720	10/07/2020	N	**0.00089**	J	0.0012	U	0.0012	U
Biosolids Application Field #22 FLW-059	FLW-059-01	FLW-059-01-SO-0-2-100820	10/08/2020	N	0.0011	U	0.0011	U	0.0011	U
Biosolids Application Field #22 FLW-059	FLW-059-02	FLW-059-02-SO-0-1-100820	10/08/2020	N	0.0011	U	0.0011	U	0.0011	U
Biosolids Application Field #22 FLW-059	FLW-059-03	FLW-059-03-SO-0-1-100820	10/08/2020	N	0.00097	U	**0.00052**	J	0.00097	U
Biosolids Application Field #22 FLW-059	FLW-059-04	FLW-059-04-SO-0-1-100820	10/08/2020	N	0.0012	U	0.0012	U	0.0012	U
Biosolids Application Field #22 FLW-059	FLW-059-05	FLW-059-05-SO-0-1-100820	10/08/2020	N	0.0011	U	0.0011	U	0.0011	U
Biosolids Application Field #22 FLW-059	FLW-059-06	FLW-059-06-SO-0-1-100820	10/08/2020	N	0.0012	U	0.0012	U	0.0012	U
Biosolids Application Field #19 FLW-060	FLW-060-01	FLW-060-01-SO-0-1-101220	10/12/2020	N	**0.0021**		**0.00058**	J	0.00094	U
Biosolids Application Field #19 FLW-060	FLW-060-02	FLW-060-02-SO-0-1-101220	10/12/2020	N	0.00092	U	0.00092	U	0.00092	U
Biosolids Application Field #19 FLW-060	FLW-060-02	FLW-FD-6-SO-101220 / FLW-060-02-SO-0-1-101220	10/12/2020	FD	0.00091	U	0.00091	U	0.00091	U
Biosolids Application Field #19 FLW-060	FLW-060-03	FLW-060-03-SO-0-1-101220	10/12/2020	N	**0.0056**		**0.0015**		0.00092	U
Biosolids Application Field #19 FLW-060	FLW-060-04	FLW-060-04-SO-0-1-101220	10/12/2020	N	**0.00097**	J	0.0011	U	0.0011	U

Notes:
1. **Bolded** values indicate the result was detected greater than the limit of detection
2. Data are compared to the Office of the Secretary of Defense (OSD) risk screening levels for both the residential as well as the industrial/commercial scenarios (OSD. 2021. Memorandum: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program. September.).
3. Grey shaded values indicate the result was detected greater than the residential scenario risk screening levels (OSD 2021).
4. Grey shaded and italicized values indicate the result was detected greater than the industrial/commercial scenario (i.e., and therefore greater than the residential scenario) risk screening levels (OSD 2021).

Acronyms/Abbreviations:
AOPI = Area of Potential Interest
FD = field duplicate sample
FLW = Fort Leonard Wood
ID = identification
mg/kg = milligrams per kilogram (parts per million)
N = primary sample
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutane sulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonic acid
Qual = qualifier

Qualifiers:
DJ = The analyte was analyzed at dilution and the result is an estimated quantity
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only
J+ = The result is an estimated quantity; the result may be biased high.
J- = The result is an estimated quantity; the result may be biased low.
U = The analyte was analyzed for but the result was not detected above the limit of quantitation (LOQ).
UJ- = The analyte was analyzed for but was not detected. The LOQ is approximate and may be inaccurate or imprecise

Table 7-3 - Surface Water PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, Missouri

AOPI	Location	Sample/Parent ID	Sample Date	Analyte	PFOS (ng/L)		PFOA (ng/L)		PFBS (ng/L)	
				Sample Type	Result	Qual	Result	Qual	Result	Qual
Biosolids Application Field #22 (FLW-059)	FLW-059-01	FLW-059-01-SW-093020	09/30/2020	N	**5.3**	J+	3.5	U	3.5	U
Biosolids Application Field #22 (FLW-059)	FLW-059-01	FLW-FD-1-SW-093020 / FLW-059-01-SW-093020	09/30/2020	FD	**4.2**		3.5	U	3.5	U
Sewage Treatment Plant/Lagoons (FLW-024 /FLW-026)	FLW-026-01	FLW-026-01-SW-093020	09/30/2020	N	**8.8**		**4.2**		**9.5**	
Biosolids Application Field #5 (Landfill 12, FLW-017)	FLW-017-01	FLW-017-01-SW-100120	10/01/2020	N	**6.1**		3.4	U	3.4	U

Notes:
1. **Bolded** values indicate the result was detected greater than the limit of detection
2. No concentrations of PFBS, PFOS, or PFOA exceeded the OSD risk screening levels.

Acronyms/Abbreviations:
AOPI = Area of Potential Interest
USAEC = U.S. Army Environmental Command
FD = field duplicate sample
FLW = Fort Leonard Wood
ID = identification
N = primary sample
ng/L = nanograms per liter (parts per trillion)
OSD = Office of the Secretary of Defense
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutane sulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonic acid
Qual = qualifier
SW = Surface water

Qualifiers:
U = The analyte was analyzed for but the result was not detected above thelimit of quantitation (LOQ).

Table 7-4 - Sediment PFOS, PFOA, and PFBS Analytical Results
USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, Missouri

AOPI	Location	Sample/Parent ID	Sample Date	Analyte	PFOS (mg/kg)		PFOA (mg/kg)		PFBS (mg/kg)	
				Sample Type	Result	Qual	Result	Qual	Result	Qual
Biosolids Application Field #5 (Landfill 12, FLW-017)	FLW-017-01	FLW-017-01-SE-100120	10/01/2020	N	0.0012	U	0.0012	U	0.0012	U
Biosolids Application Field #22 FLW-059	FLW-059-01	FLW-059-01-SE-100120	10/01/2020	N	0.00096	U	0.00096	U	0.00096	U
Biosolids Application Field #22 FLW-059	FLW-059-01	FLW-FD-1-SE-100120 / FLW-059-01-SE-100120	10/01/2020	FD	0.0016	U	0.0016	U	0.0016	U

Notes:
1. **Bolded** values indicate the result was detected greater than the limit of detection

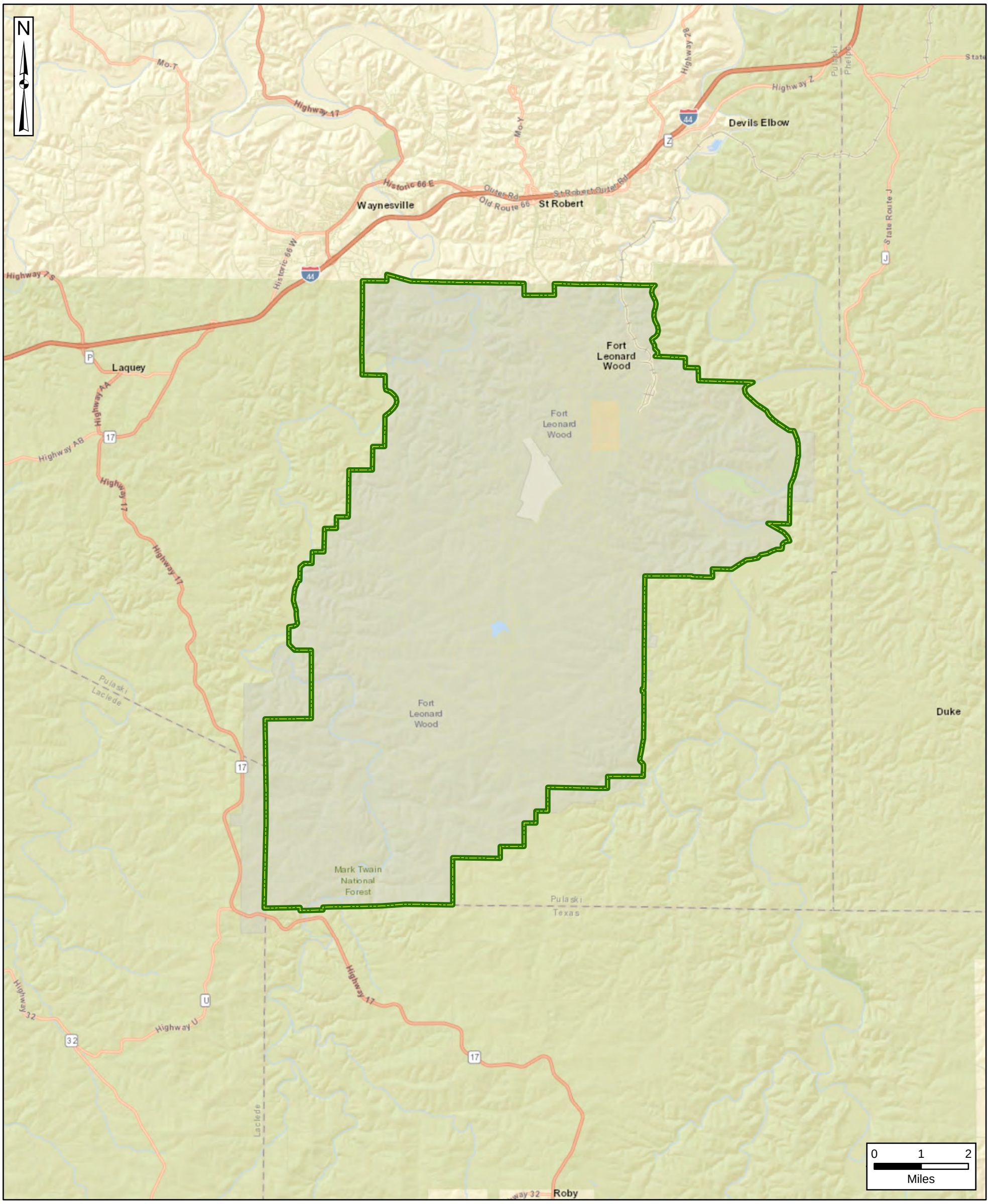
Acronyms/Abbreviations:
AOPI = area of potential interest
USAEC = U.S. Army Environmental Command
FD = field duplicate sample
FLW = Fort Leonard Wood
ID = identification
mg/kg = milligrams per kilogram (parts per million)
N = primary sample
a
PFAS = per- and polyfluoroalkyl substances
PFBS = perfluorobutane sulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonic acid
Qual = qualifier

Qualifiers:
U = The analyte was analyzed for but the result was not detected above thelimit of quantitation (LOQ).

FIGURES

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 2-1
Site Location



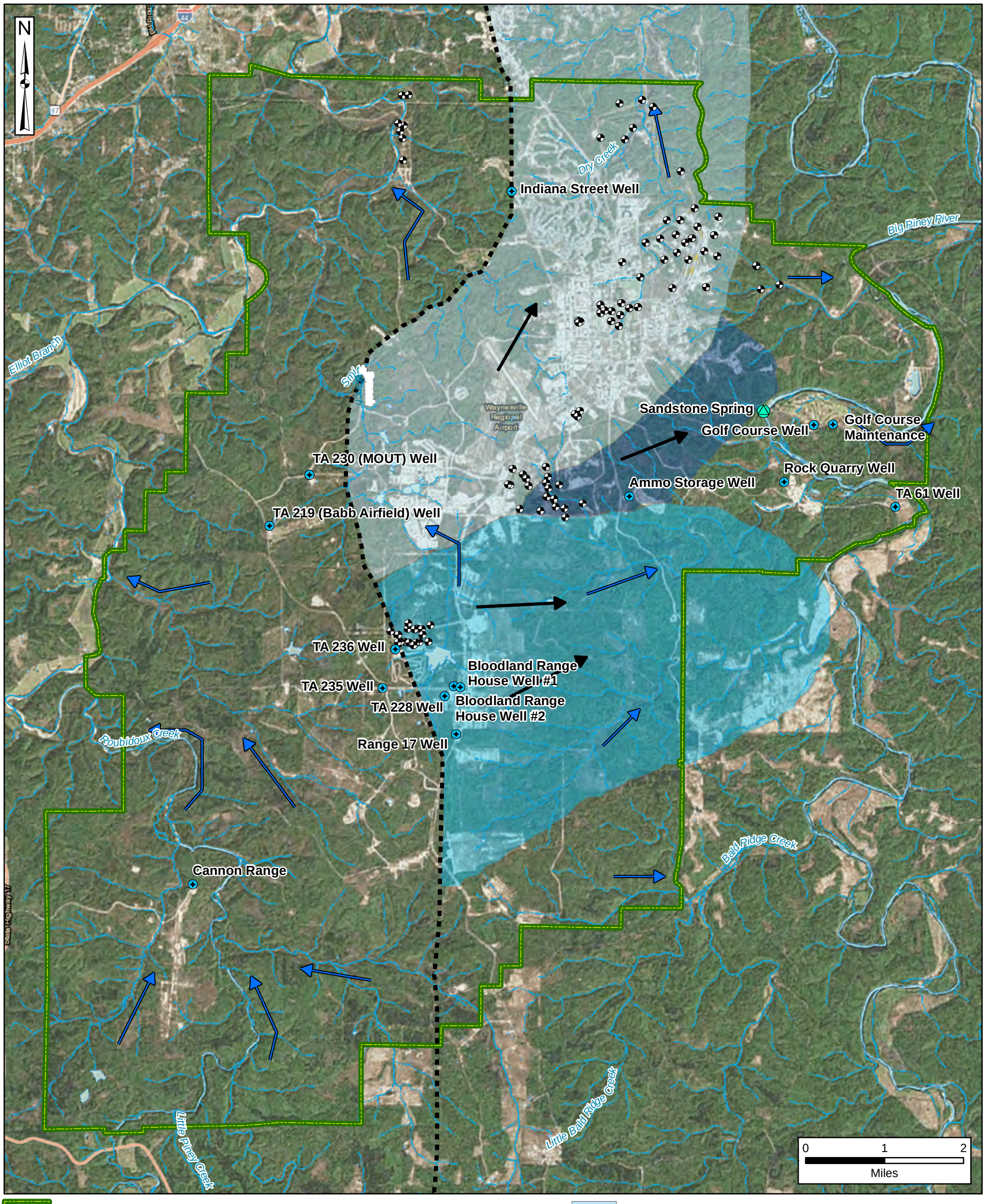
Installation Boundary

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, StreetMap Data

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 2-2
Site Layout

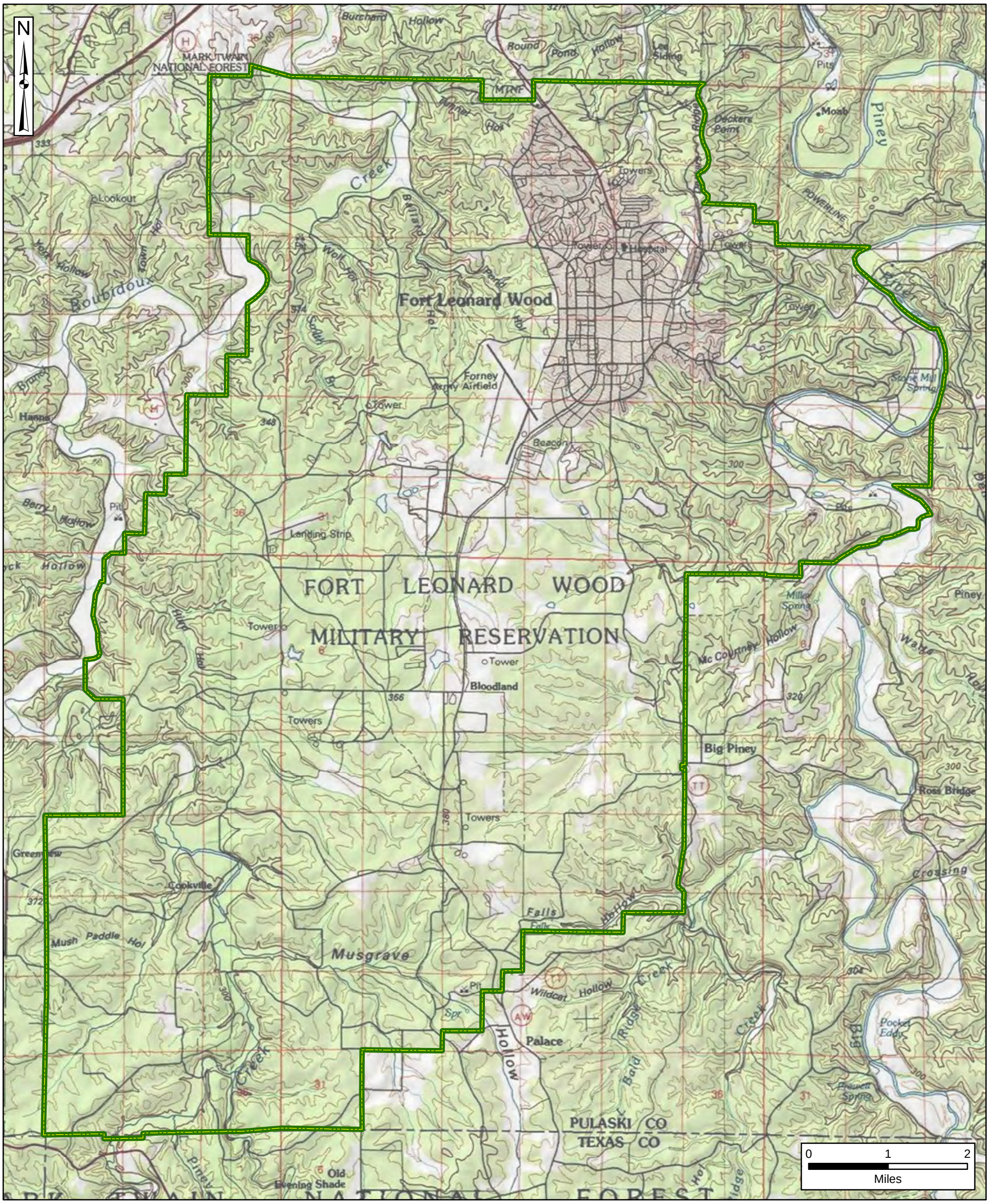


Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 2-3
Site Topography



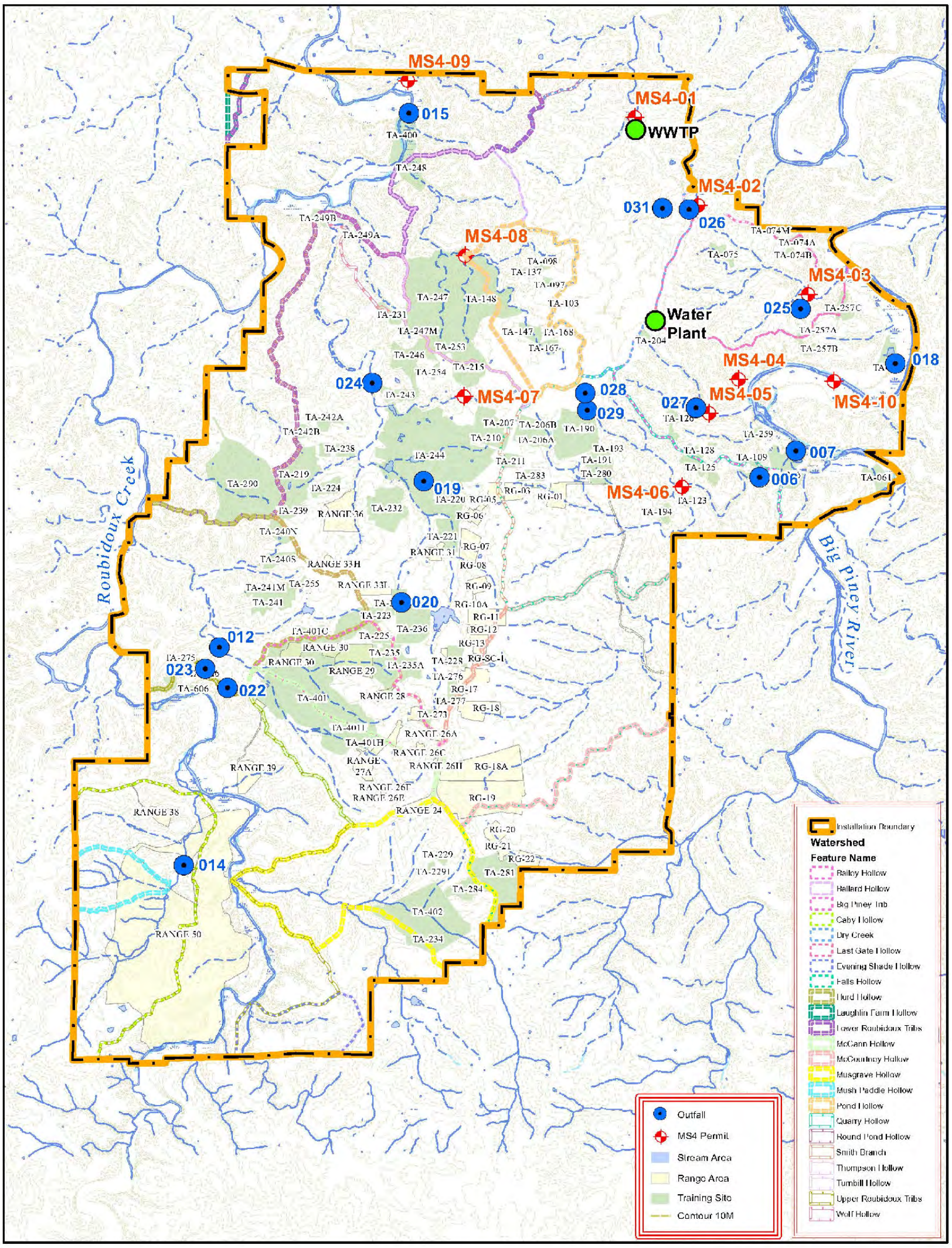
Installation Boundary

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, USGS Topo Map

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 2-4
Fort Leonard Wood Outfall Map



Notes:
1. MS4 outfalls are representative boundary outfalls and intended to capture a sub-watershed.
2. Industrial outfalls are based on the point sources of industrial activities.

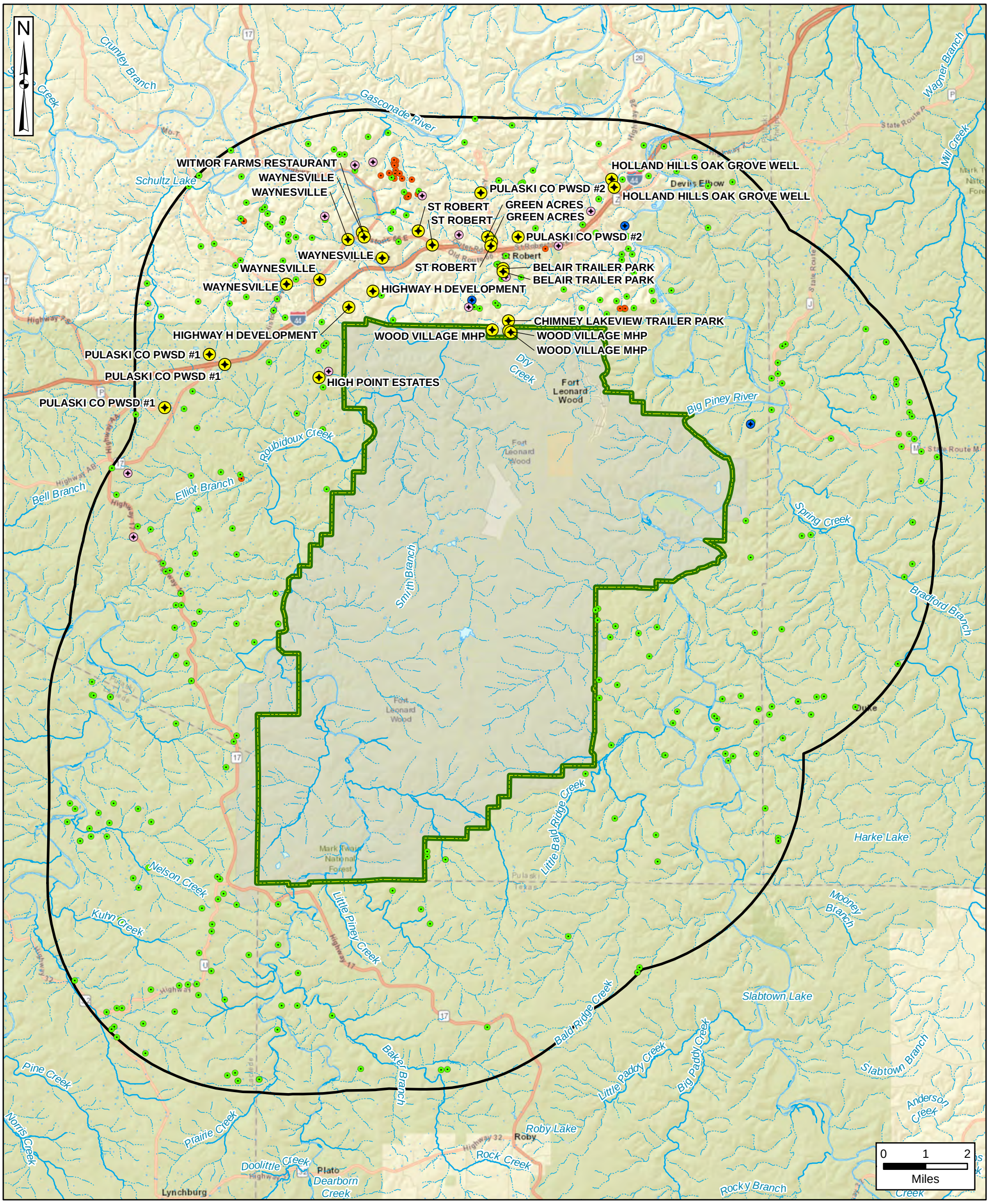
WWTP = wastewater treatment plant

Data Sources:
USACE GIS Data, 2021
Fort Leonard Wood sub-meter GPS data

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 2-5
Off-Post Potable Supply Wells



- Installation Boundary
- 5-Mile Radius
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Public Water Supply System Well
- Other Public Supply Well (Community)
- Other Public Supply Well (Non-Community)
- Multi-Family Well
- Domestic Well

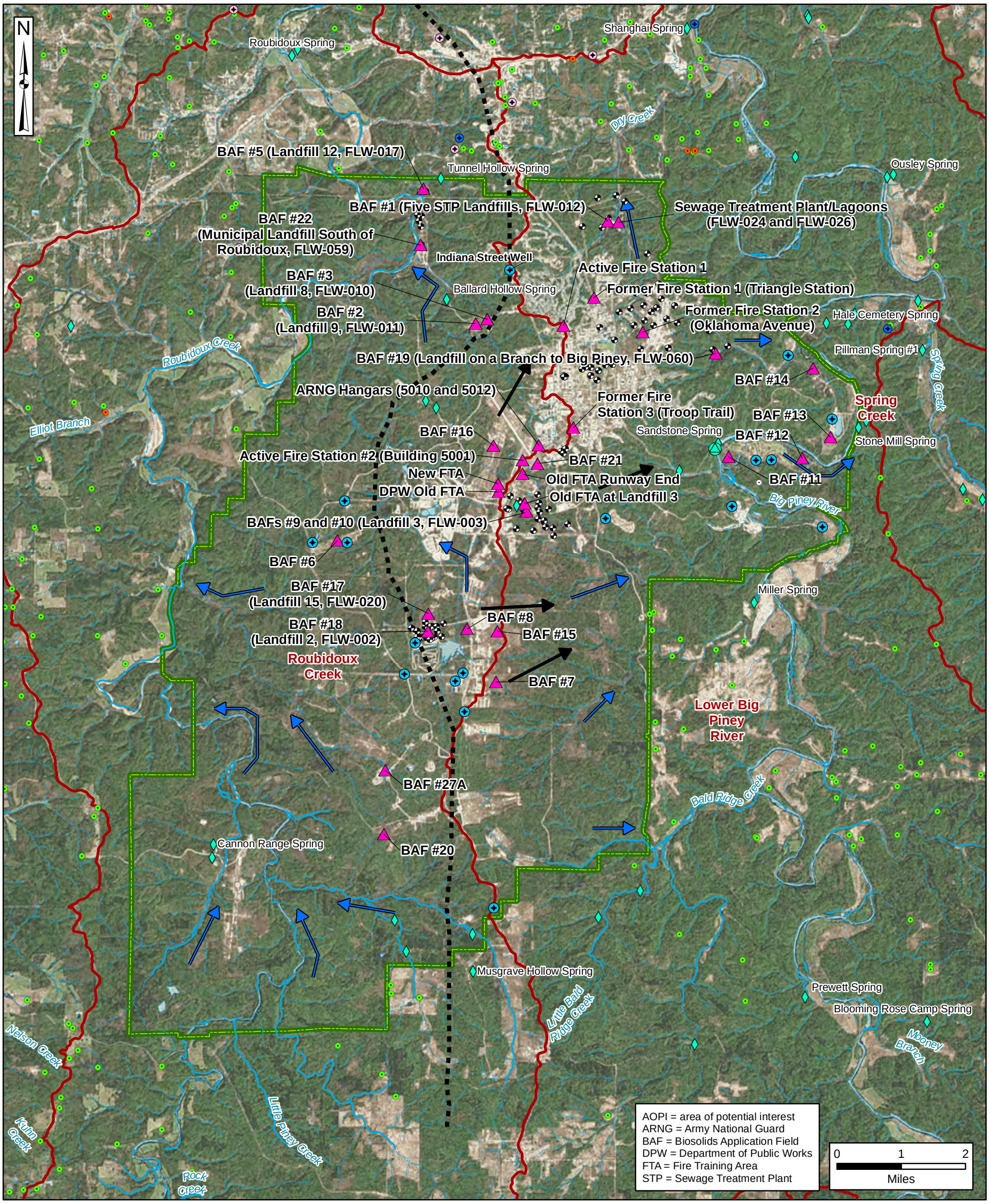
MHP = mobile home park
PWSD = public water supply district

Data Sources:
Ft Leonard Wood, GIS Data, 2019
EDR Well Data, 2018
MO DNR Well Data, 2019
ESRI ArcGIS Online, Street Map

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 5-2
AOPI Locations



Data Sources:
ORAP Phase I Data, 2008
EDR Well Data, 2019
MO DNR Well Data, 2019
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

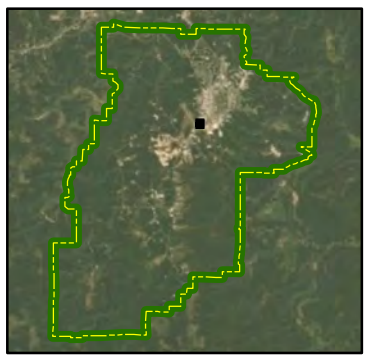
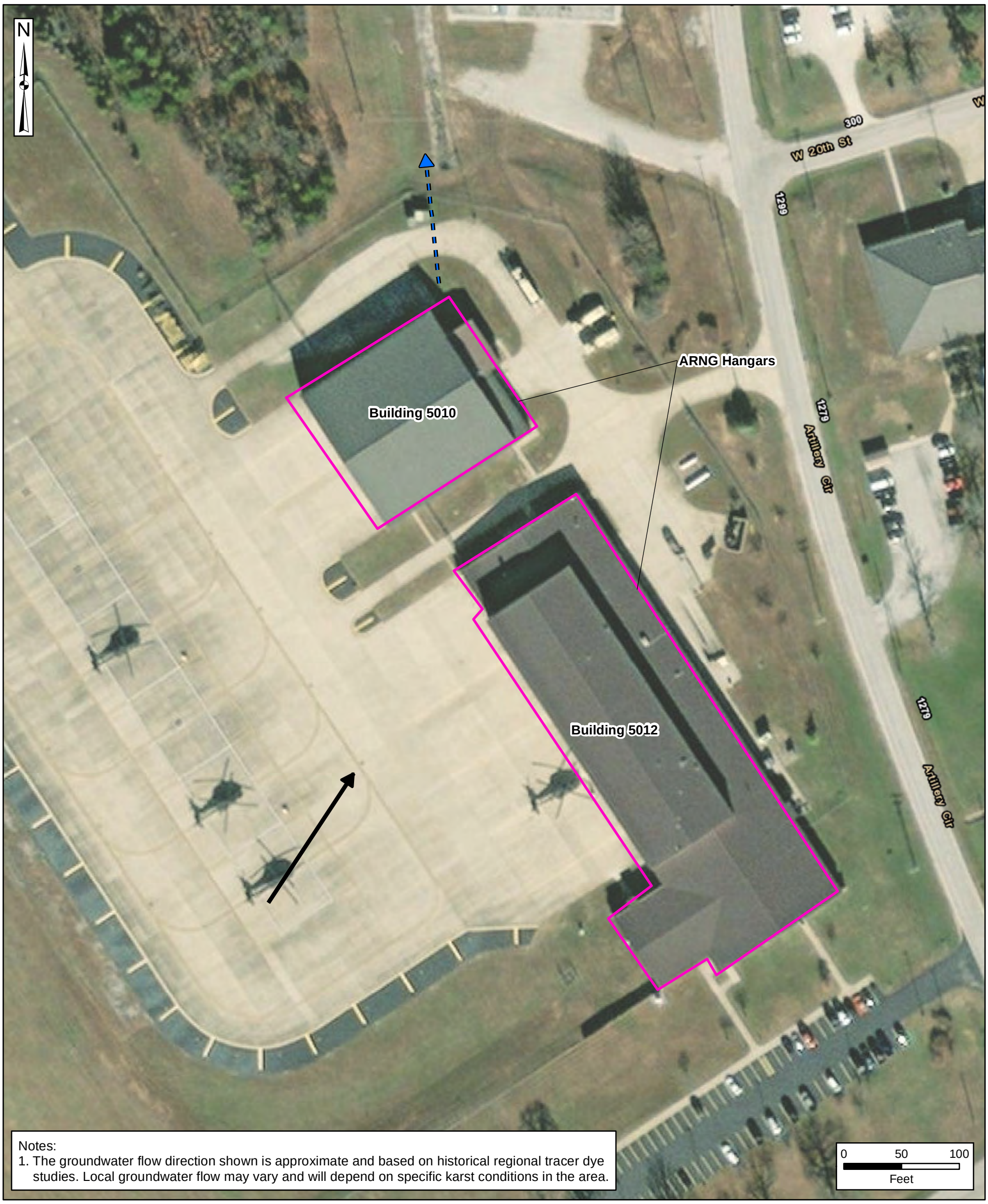


Figure 5-3
Aerial Photo of
ARNG Hangars (Buildings 5010 and 5012)



Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary

AOPI

Approximate Groundwater Flow Direction

Approximate Surface Runoff Flow Direction

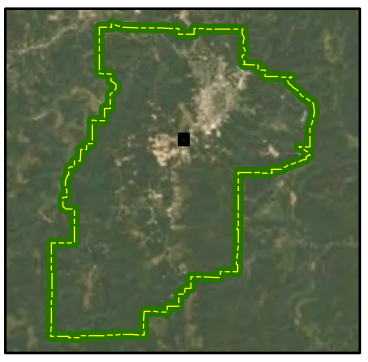
AOPI = area of potential interest
ARNG = Army National Guard

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 5-4
Aerial Photo of
DPW Old Fire Training Area (TA 210, FLW-028) and
New Fire Training Area (TA 207, FLW-029)



Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary
AOPI
Former Buried Concrete Pad
Approximate Groundwater Flow Direction
Approximate Surface Runoff Flow Direction

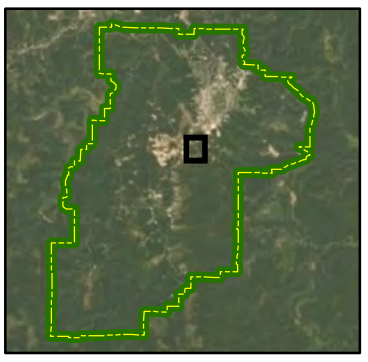
AOPI = area of potential interest
DPW = Department of Public Works

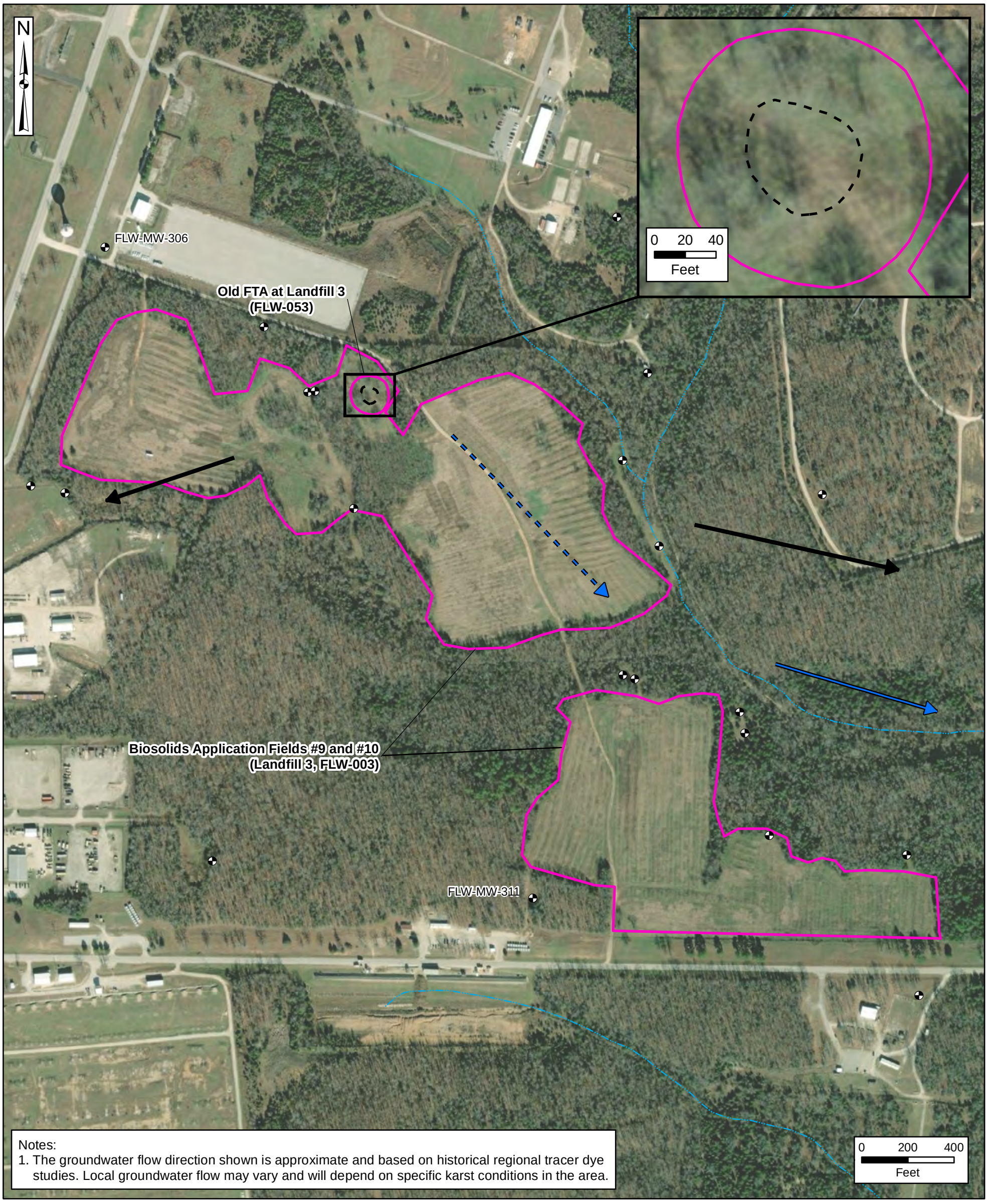
Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 5-5
Aerial Photo of
Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003)
and Old Fire Training Area at Landfill 3 (FLW-053)





Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary
AOPI
Former Pit
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
Monitoring Well

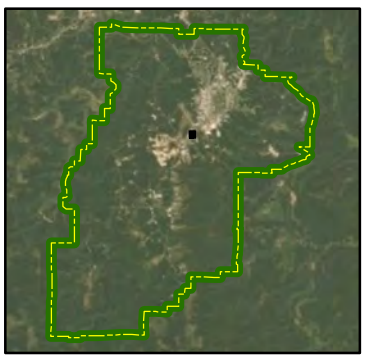
AOPI = area of potential interest
FTA = fire training area

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 5-6
Aerial Photo of
Old Fire Training Area Runway End (FLW-054)



Installation Boundary
AOPI
Approximate Location of Former Pit
Approximate Groundwater Flow Direction
Approximate Surface Runoff Flow Direction

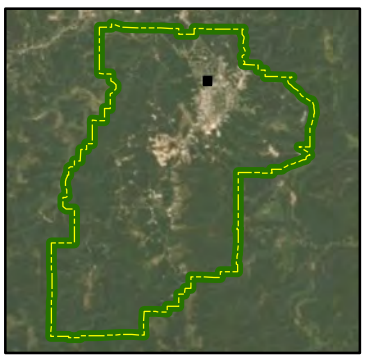
AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 5-7
Aerial Photo of
Active Fire Station #1 (Building 580)



Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary

AOPI

Approximate Groundwater Flow Direction

Approximate Surface Runoff Flow Direction

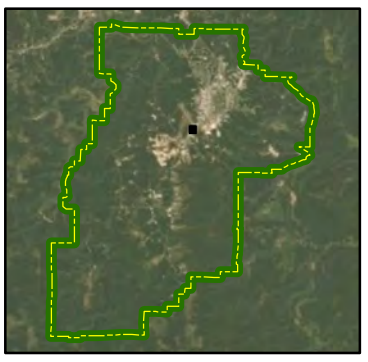
AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 5-8
Aerial Photo of
Active Fire Station #2 (Building 5001)



Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary

AOPI

Approximate Groundwater Flow Direction

Approximate Surface Runoff Flow Direction

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

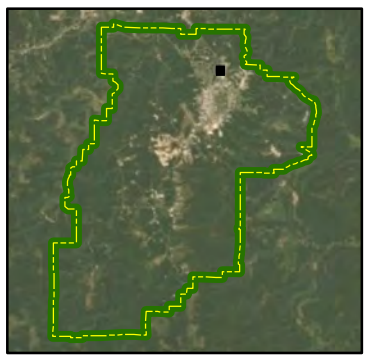


Figure 5-9
Aerial Photo of
Former Fire Station #1 (Triangle Station)

Installation Boundary
AOPI
Historical Building Footprint
Approximate Groundwater Flow Direction
Approximate Surface Runoff Flow Direction

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

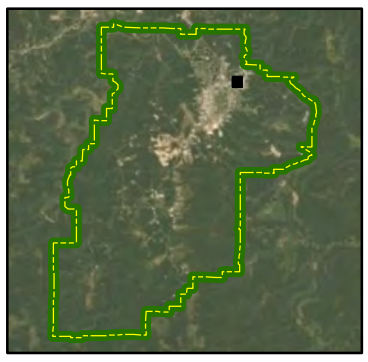


Figure 5-10
Aerial Photo of
Former Fire Station #2 (Oklahoma Avenue)

Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary
AOPI
Historical Building Footprint
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
Monitoring Well

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

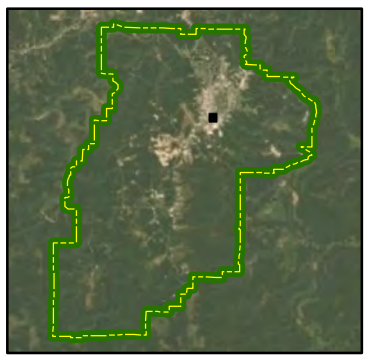


Figure 5-11
Aerial Photo of
Former Fire Station #3 (Troop Trail)

Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary
AOPI
Historical Building Footprint
Approximate Groundwater Flow Direction
Approximate Surface Runoff Flow Direction

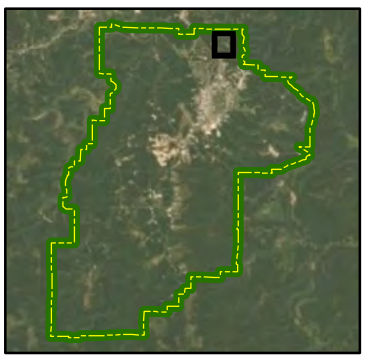
AOPI = area of potential interest

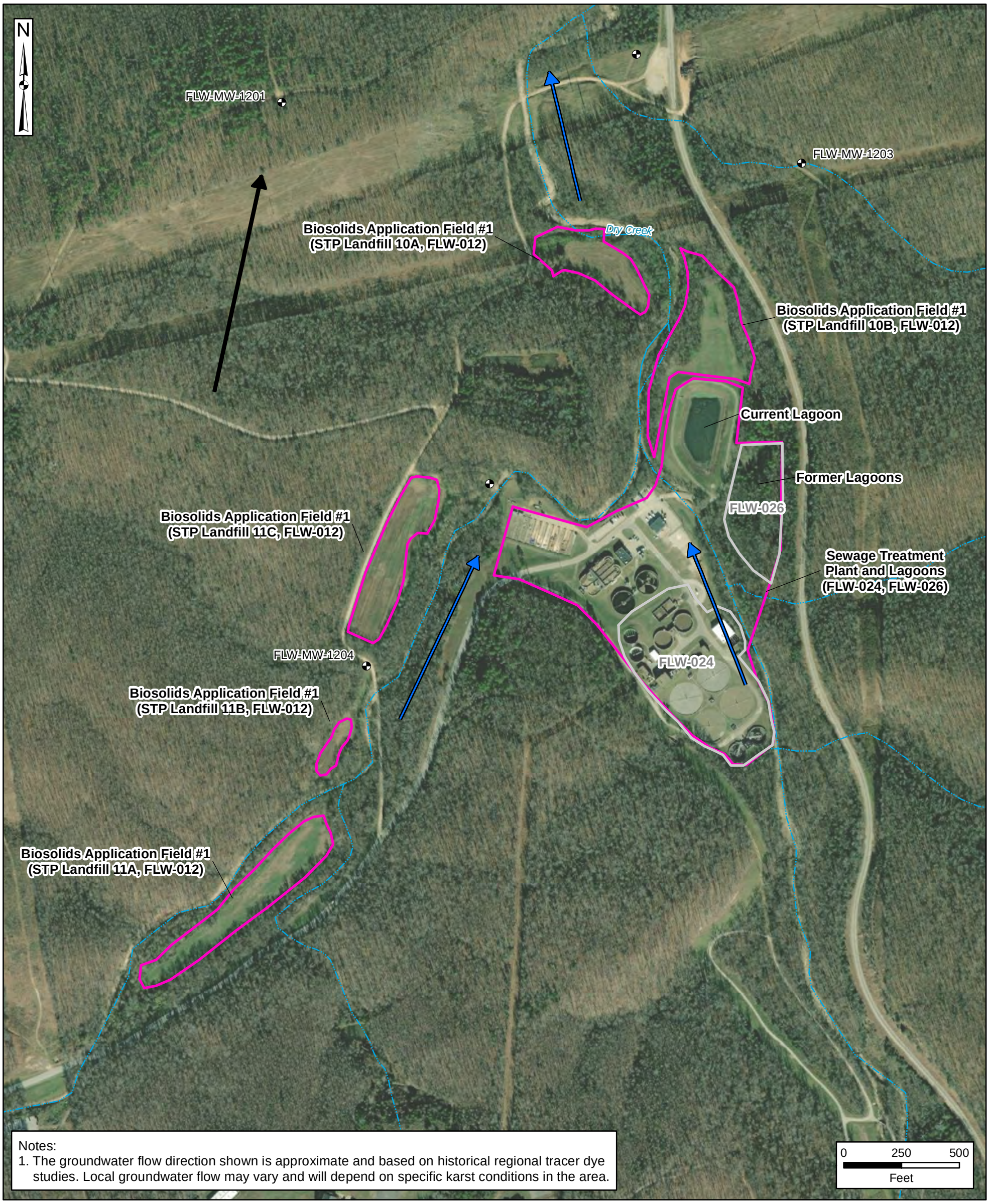
Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 5-12
Aerial Photo of Biosolids Application Field #1
(Five STP Landfills, FLW-012) and Sewage Treatment Plant/Lagoons (FLW-024 and FLW-026)





Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary
AOPI
IRP Site
River/Stream (Perennial)
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Monitoring Well

AOPI = area of potential interest
IRP = Installation Restoration Program
STP = Sewage Treatment Plant

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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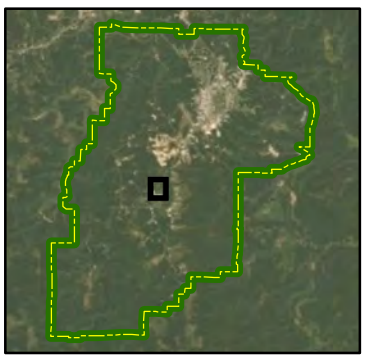
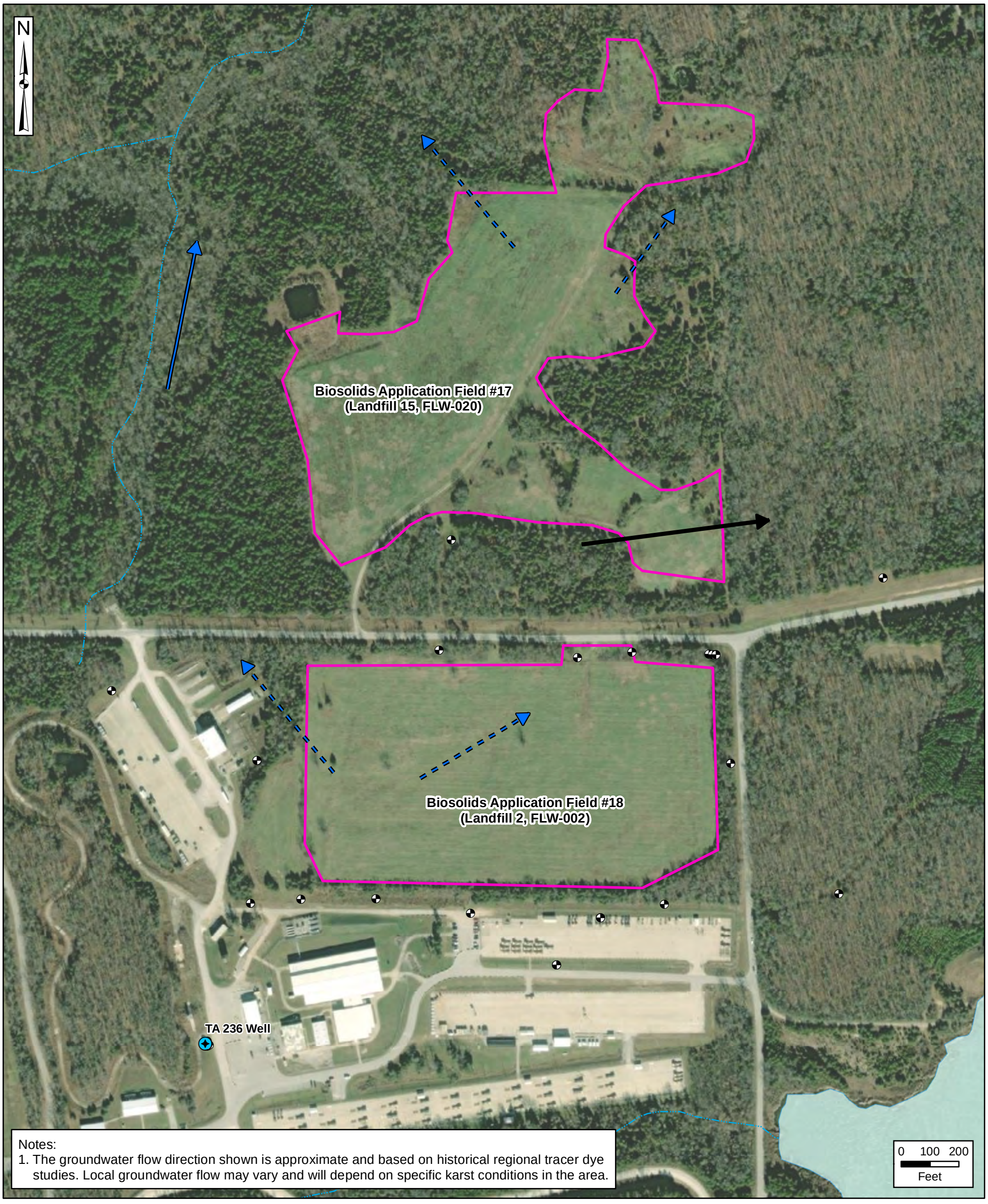
Fort Leonard Wood, MO

Figure 5-13
Aerial Photo of
Biosolids Application Fields #17 (Landfill 15, FLW-020)
and #18 (Landfill 2, FLW-002)





Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

- Installation Boundary
- AOPI
- Stream (Intermittent)
- Water Body
- Approximate Groundwater Flow Direction
- Surface Water Flow Direction
- Approximate Surface Runoff Flow Direction
- On-Post Potable Water Well
- Monitoring Well

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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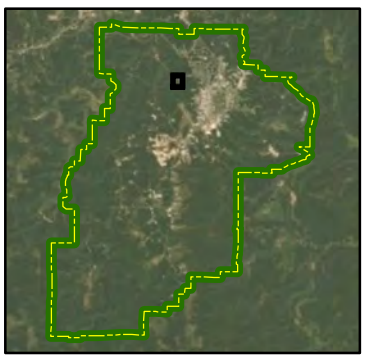
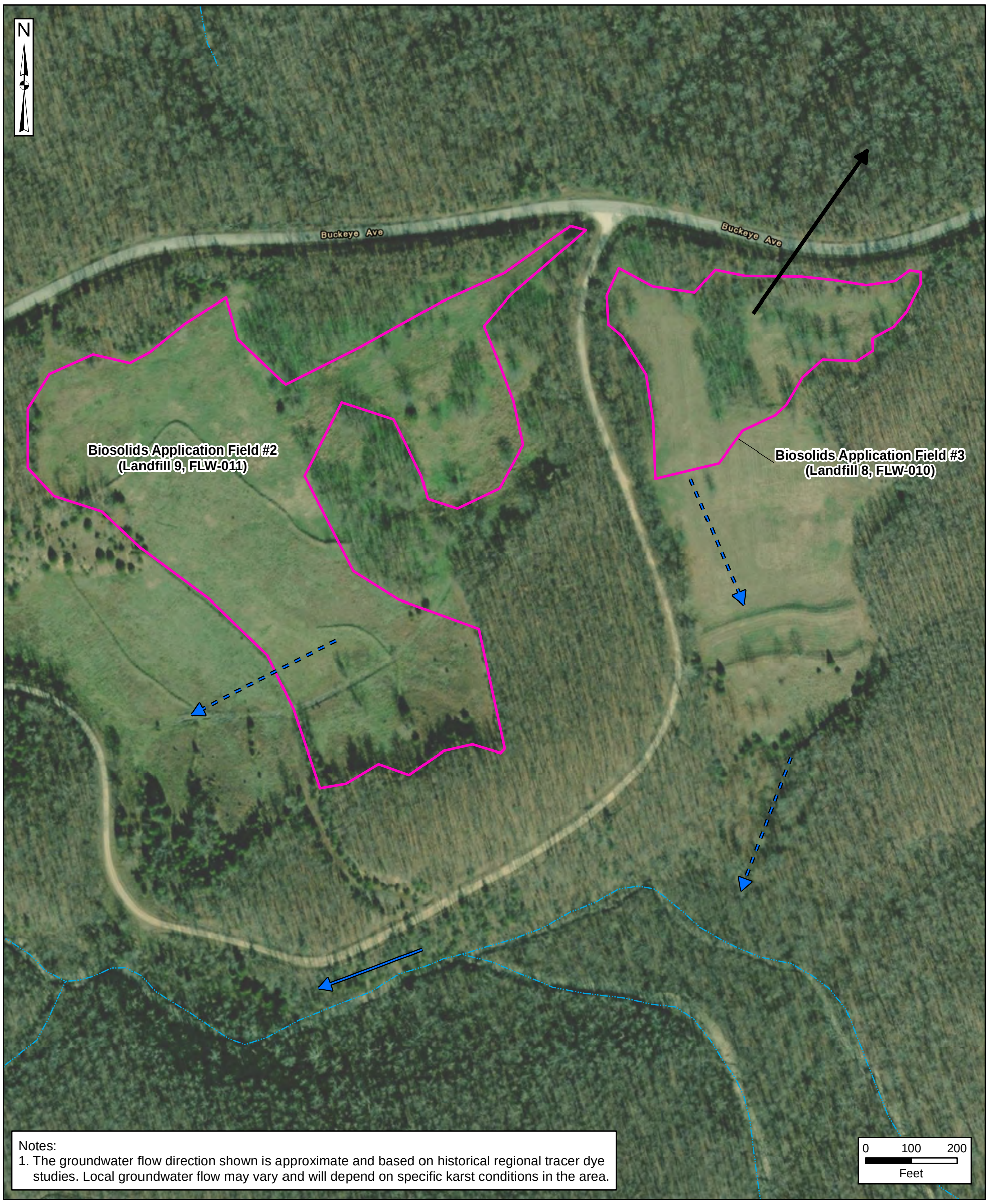
Fort Leonard Wood, MO

Figure 5-14
Aerial Photo of
Biosolids Application Fields #2 (Landfill 9, FLW-011) and #3 (Landfill 8, FLW-010)





Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary
AOPI
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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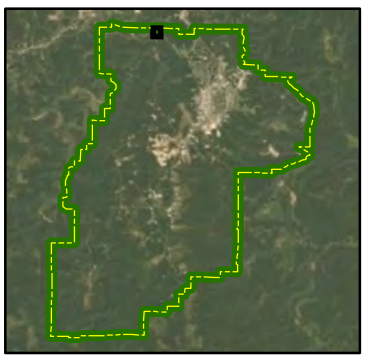
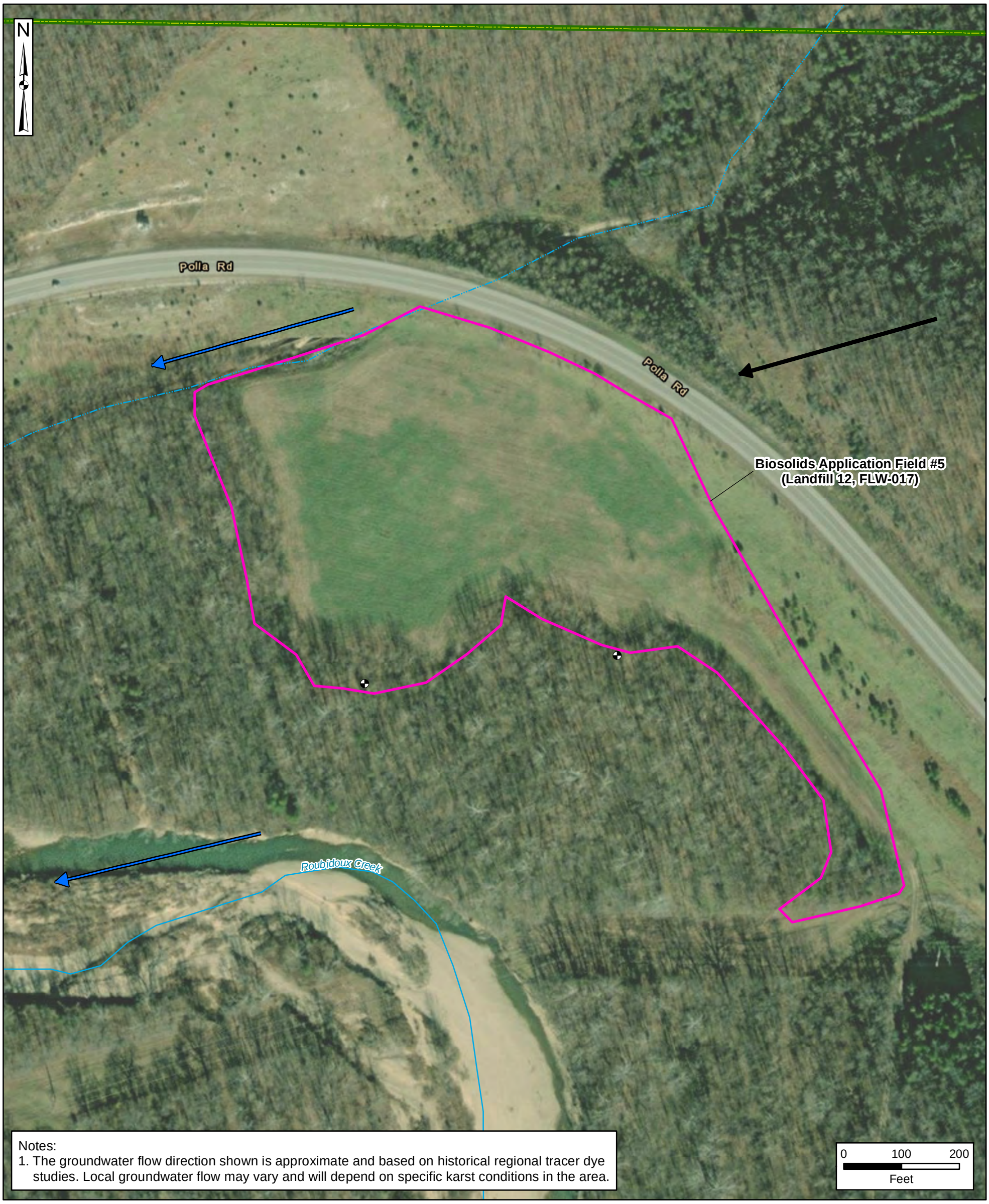
Fort Leonard Wood, MO

Figure 5-15
Aerial Photo of
Biosolids Application Field #5
(Landfill 12, FLW-017)





Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary
AOPI
River/Stream (Perennial)
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Monitoring Well

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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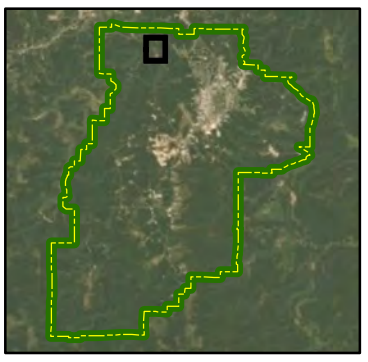
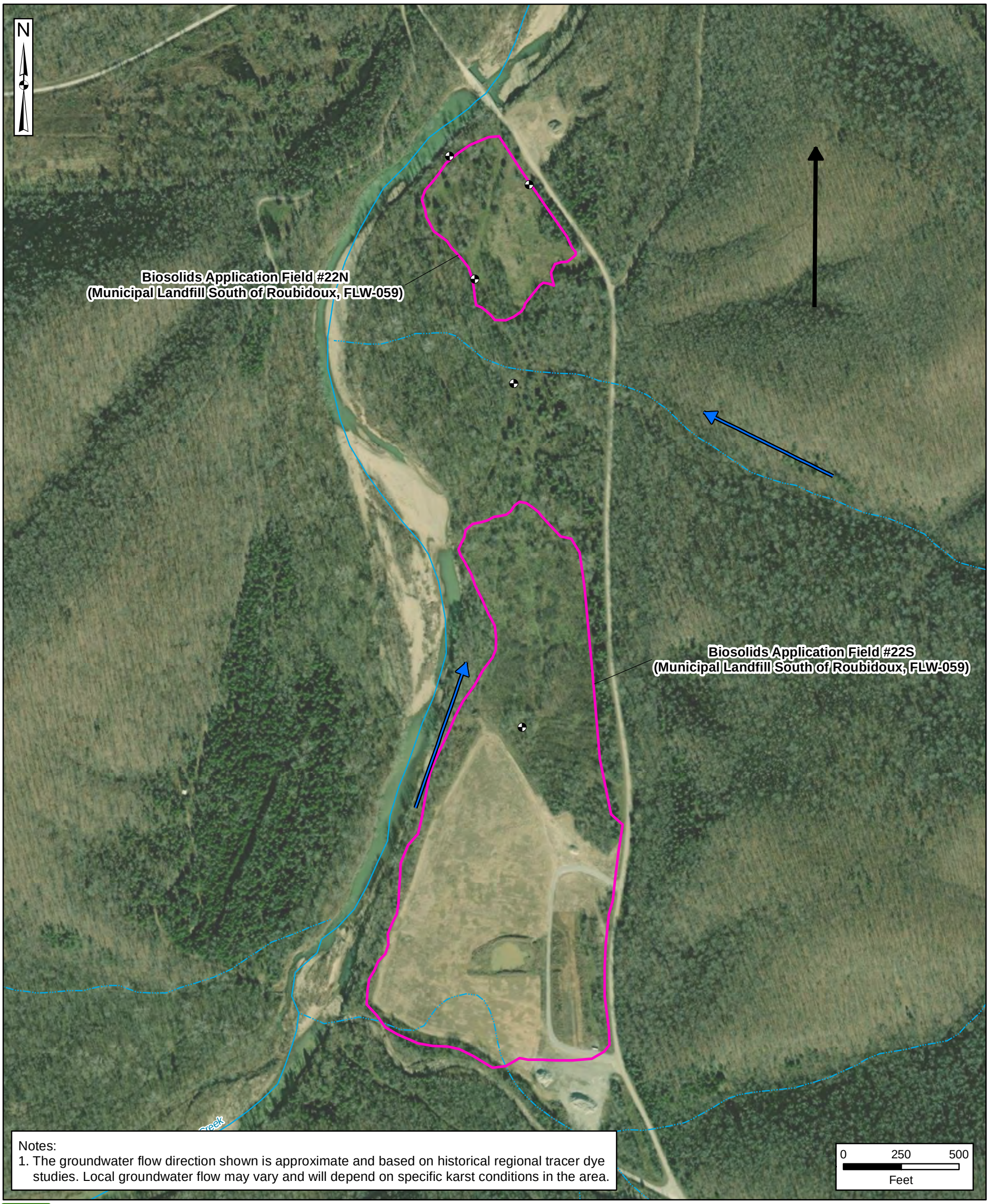
Fort Leonard Wood, MO

Figure 5-16
Aerial Photo of
Biosolids Application Field #22
(Municipal Landfill South of Roubidoux, FLW-059)





Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary
AOPI
River/Stream (Perennial)
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Monitoring Well

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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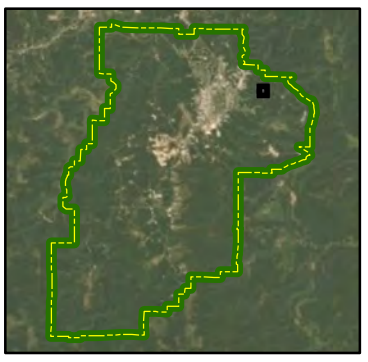
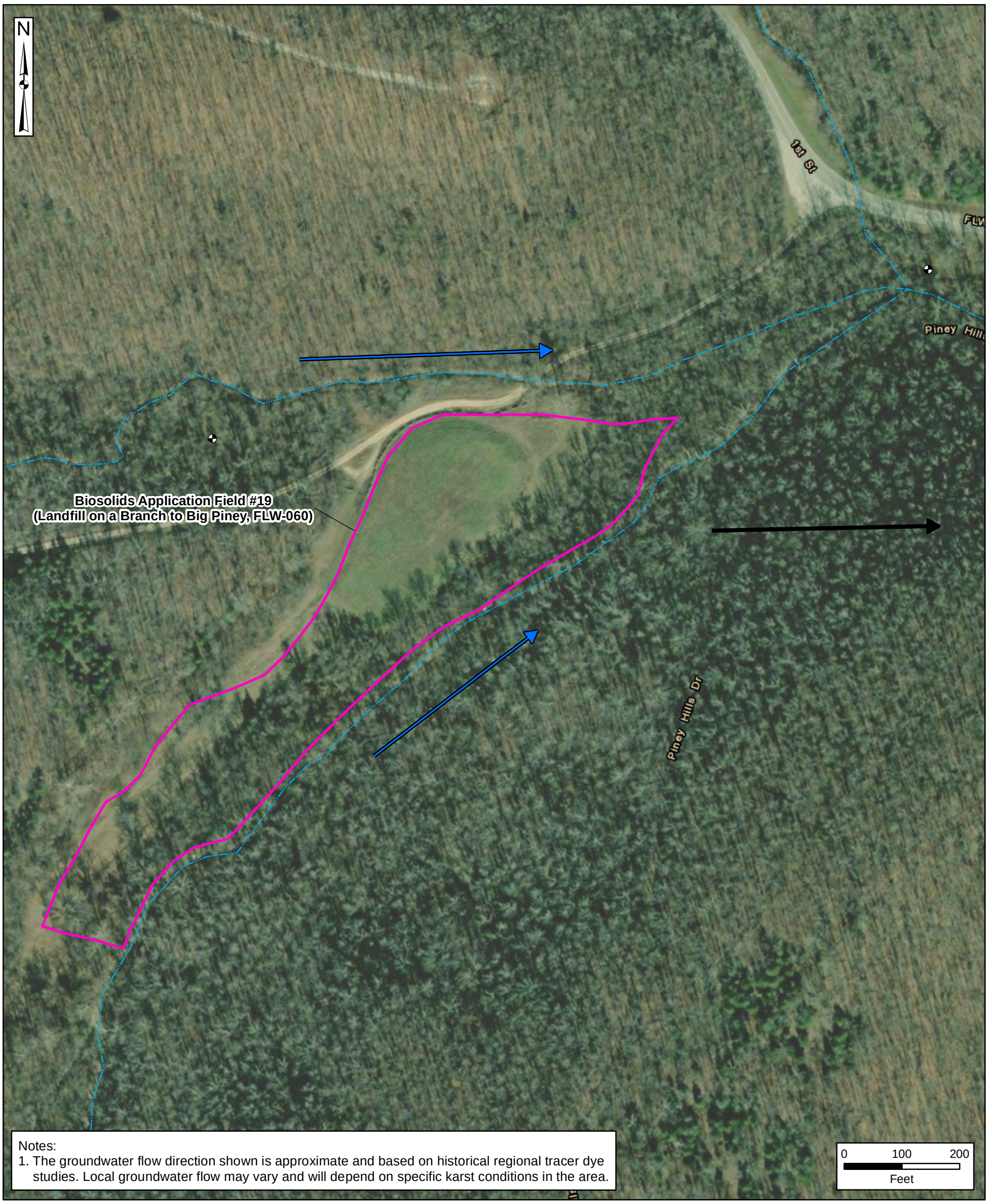
Fort Leonard Wood, MO

Figure 5-17
Aerial Photo of
Biosolids Application Field #19
(Landfill on a Branch to Big Piney, FLW-060)





Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary
AOPI
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Monitoring Well

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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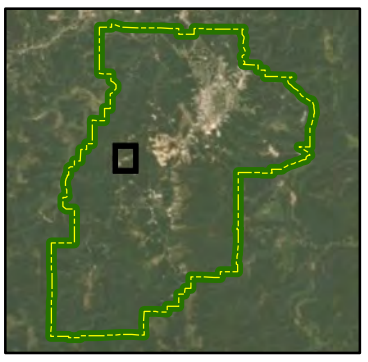
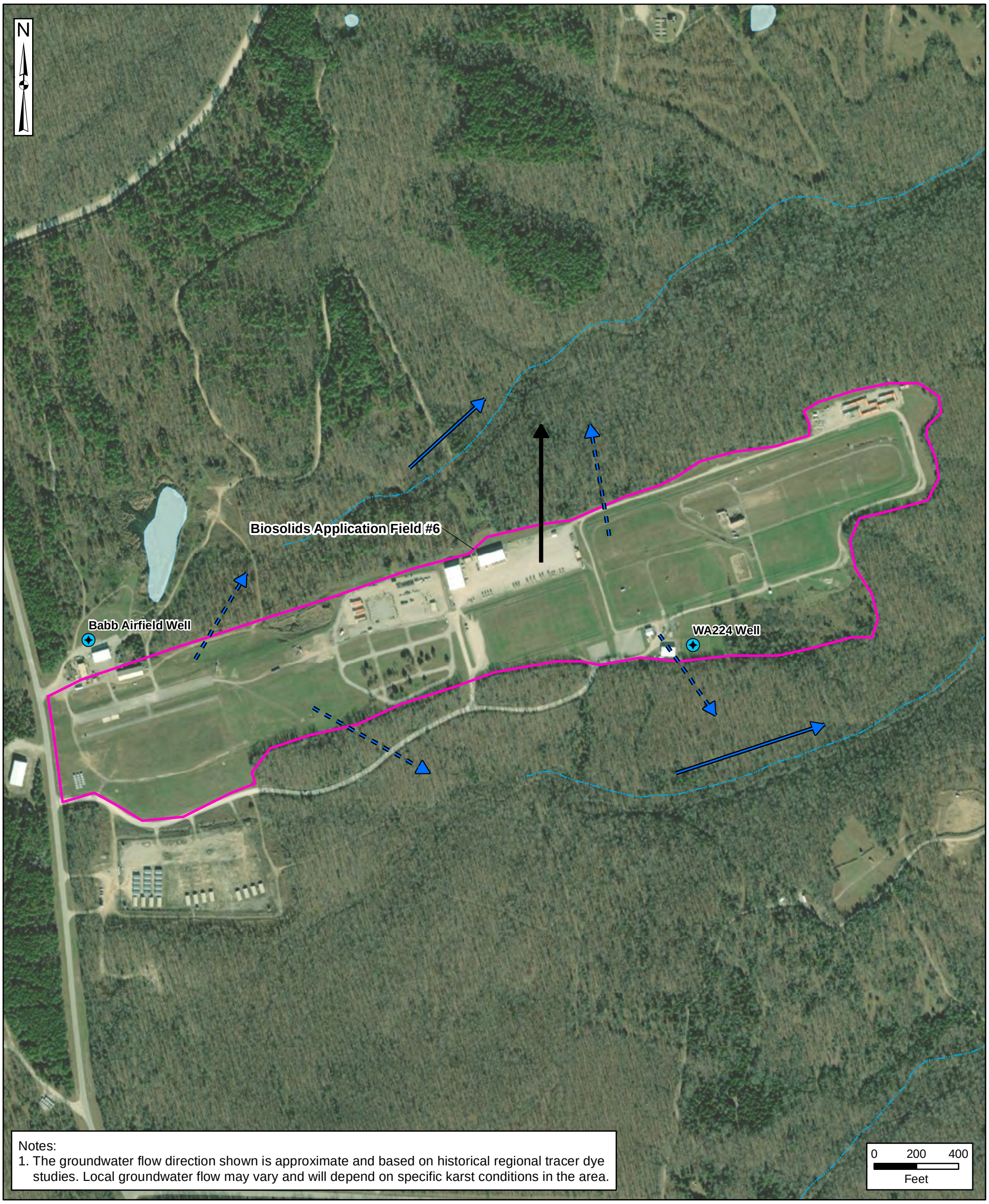
Figure 5-18
Aerial Photo of
Biosolids Application Field #6





Installation Boundary
AOPI
Stream (Intermittent)
Water Body
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
On-Post Potable Water Well

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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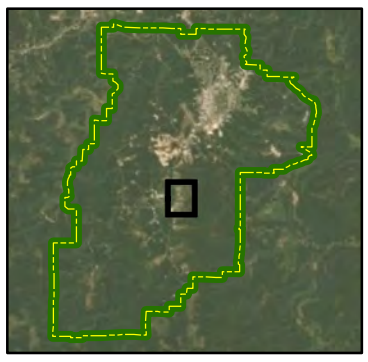
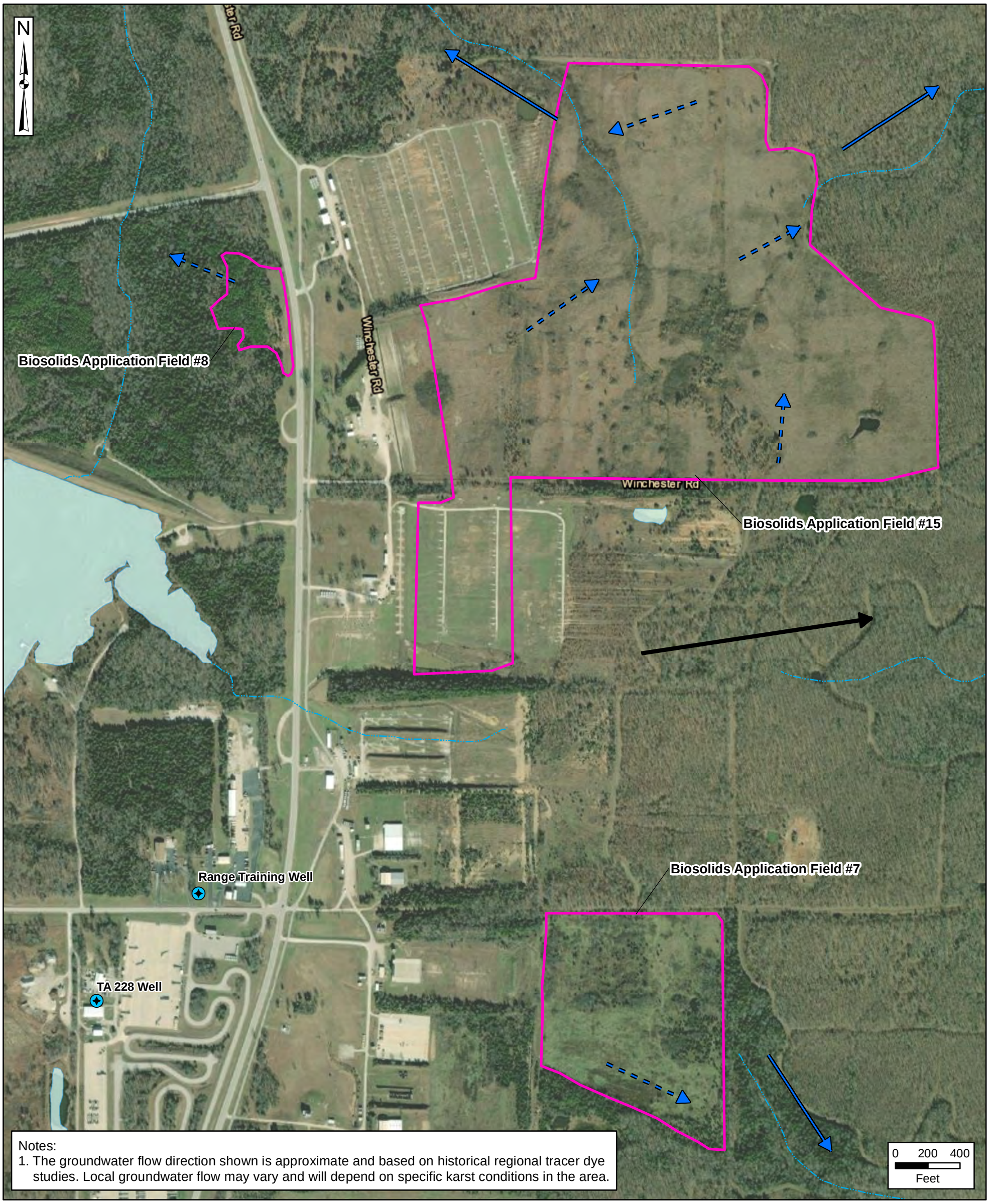


Figure 5-19
Aerial Photo of
Biosolids Application Fields #7, #8, and #15



Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary
AOPI
Stream (Intermittent)
Water Body
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
On-Post Potable Water Well

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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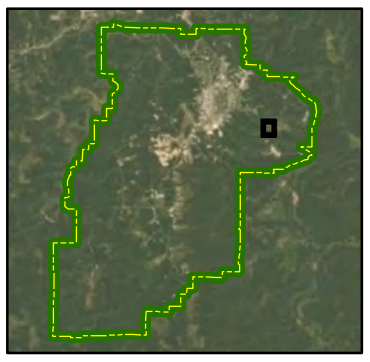
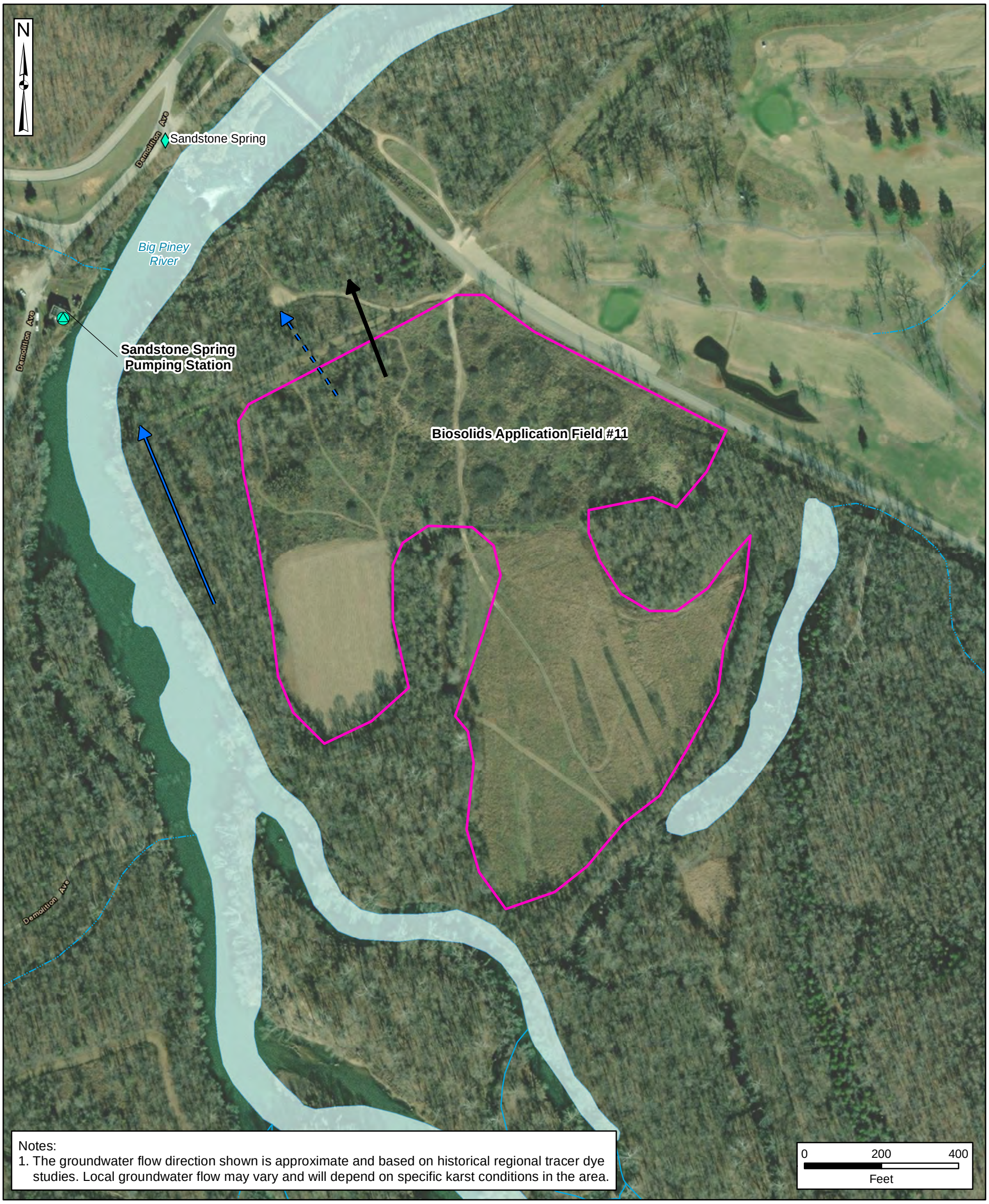


Figure 5-20
Aerial Photo of
Biosolids Application Field #11



Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary
AOPI
River/Stream (Perennial)
Stream (Intermittent)
Water Body
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
Spring

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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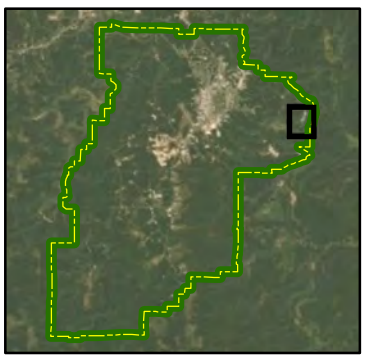
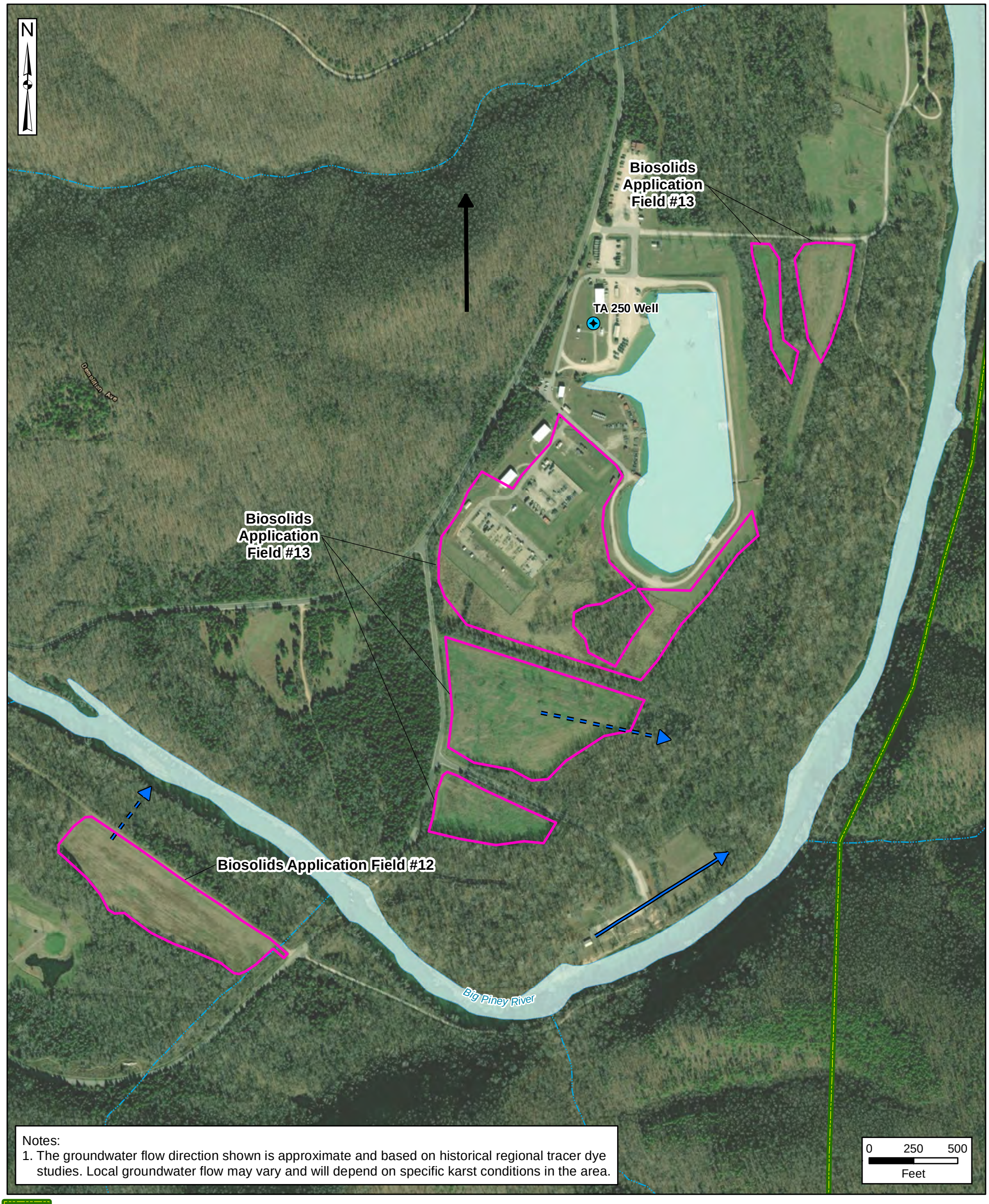
Fort Leonard Wood, MO

Figure 5-21
Aerial Photo of
Biosolids Application Fields #12 & #13





Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

- Installation Boundary
- AOPI
- Stream (Intermittent)
- Water Body
- Approximate Groundwater Flow Direction
- Surface Water Flow Direction
- Approximate Surface Runoff Flow Direction
- On-Post Potable Water Well

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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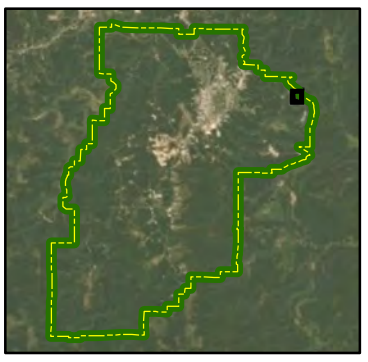
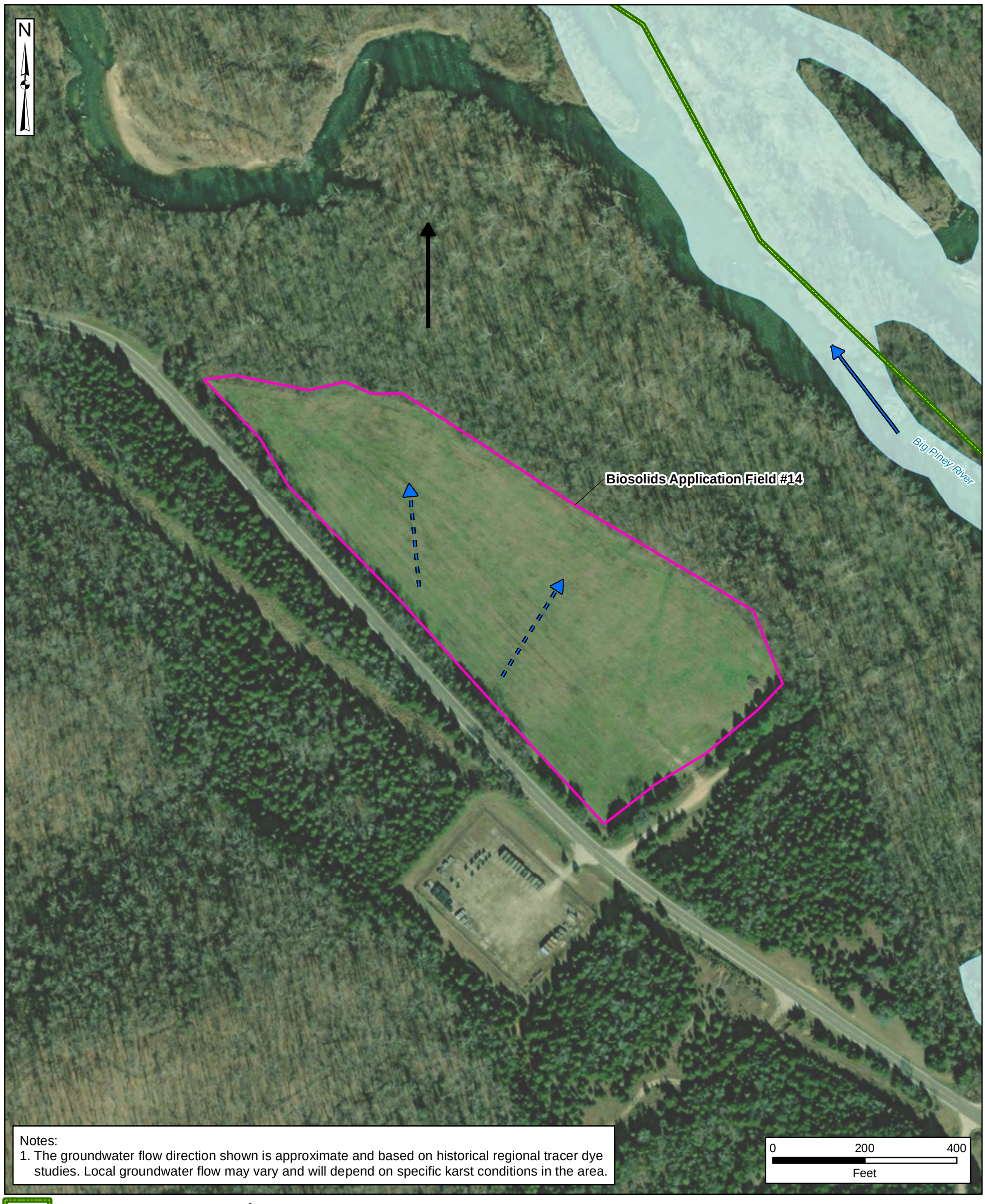
Fort Leonard Wood, MO

Figure 5-22
Aerial Photo of
Biosolids Application Field #14





Installation Boundary
AOPI
Water Body
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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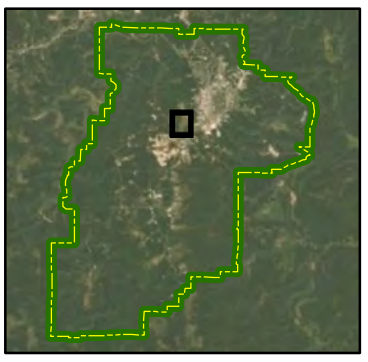
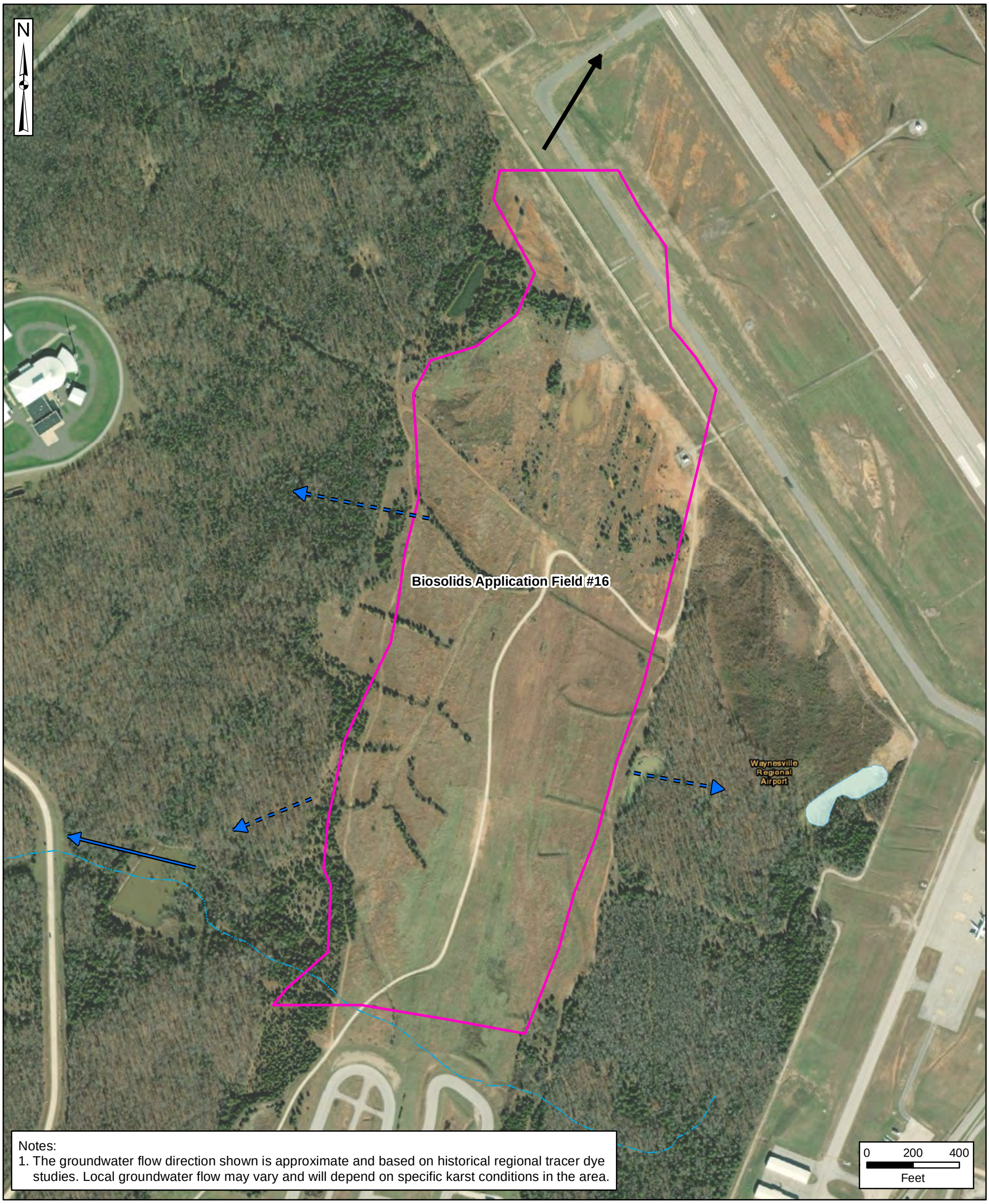
Fort Leonard Wood, MO

Figure 5-23
Aerial Photo of
Biosolids Application Field #16





Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary
AOPI
Stream (Intermittent)
Water Body
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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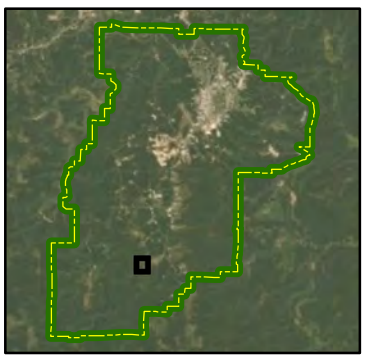
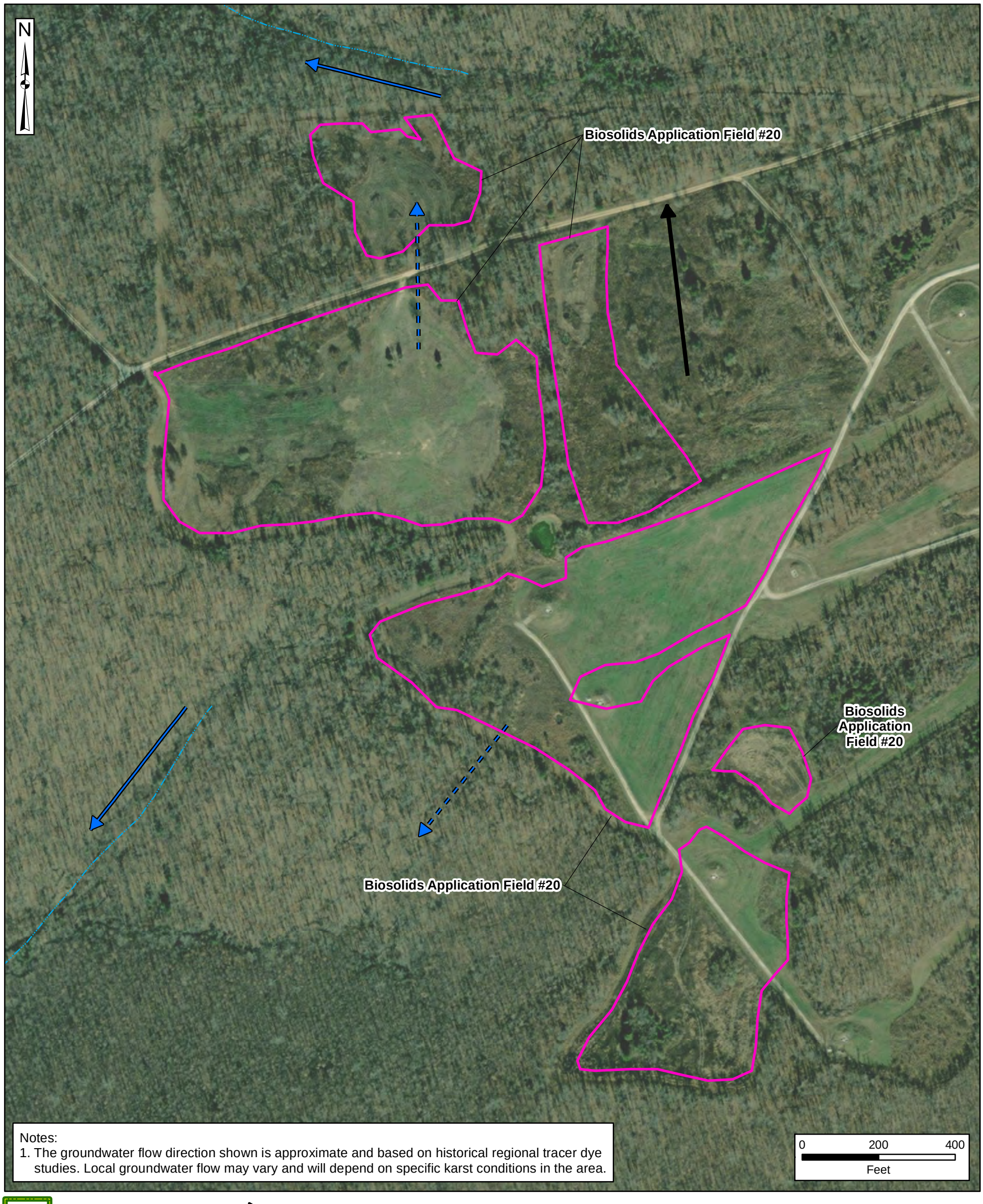
Fort Leonard Wood, MO

Figure 5-24
Aerial Photo of
Biosolids Application Field #20





Installation Boundary
AOPI
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction

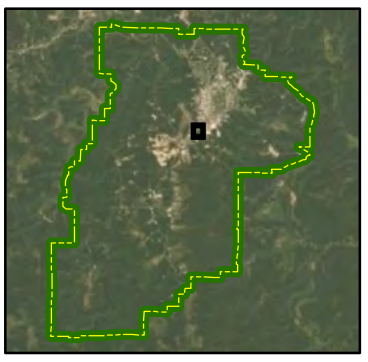
AOPI = area of potential interest

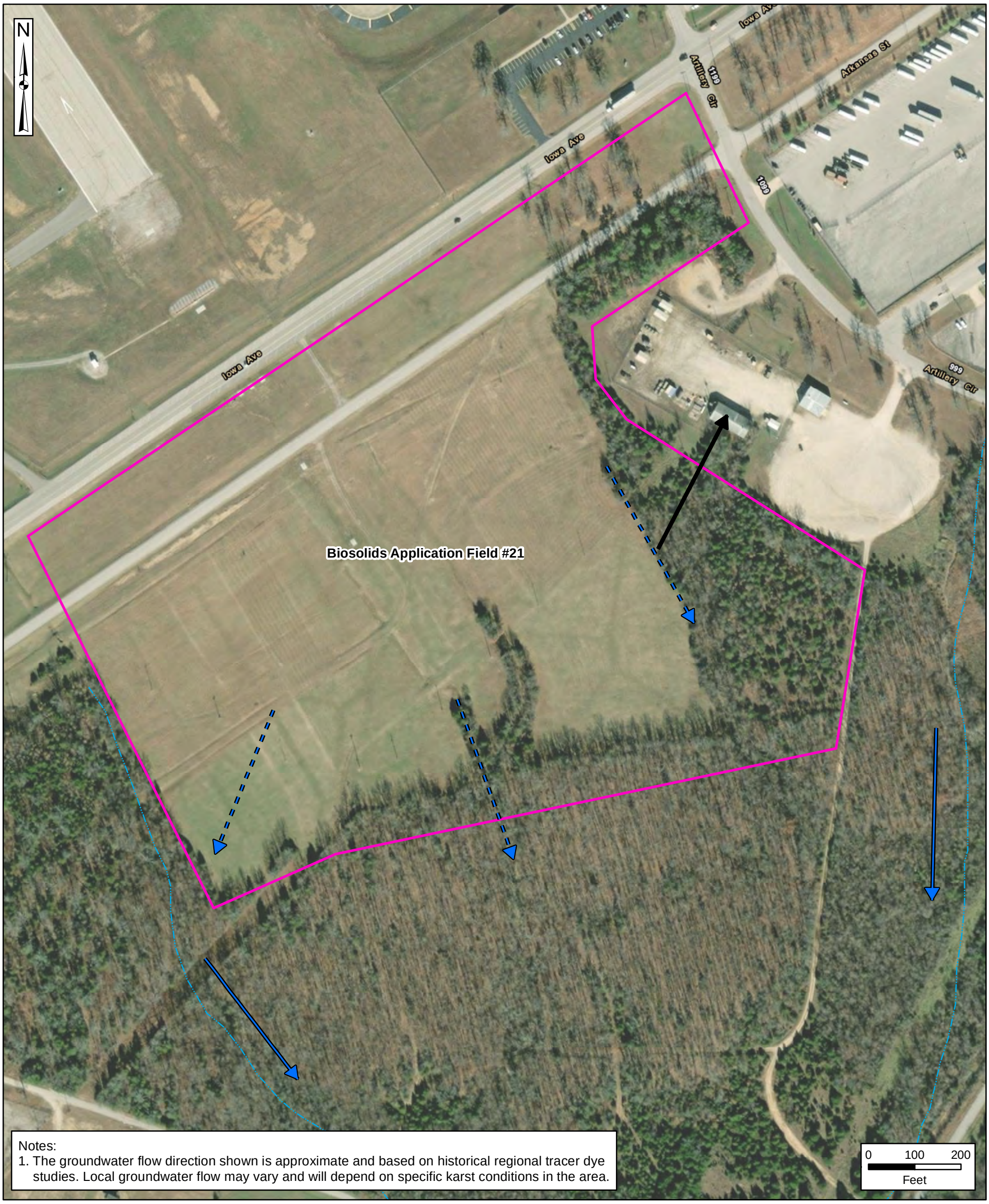
Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 5-25
Aerial Photo of
Biosolids Application Field #21





Installation Boundary
AOPI
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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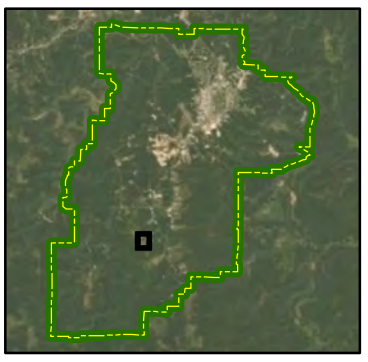
Figure 5-26
Aerial Photo of
Biosolids Application Field #27A



Notes:
1. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Installation Boundary
AOPI
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction

AOPI = area of potential interest

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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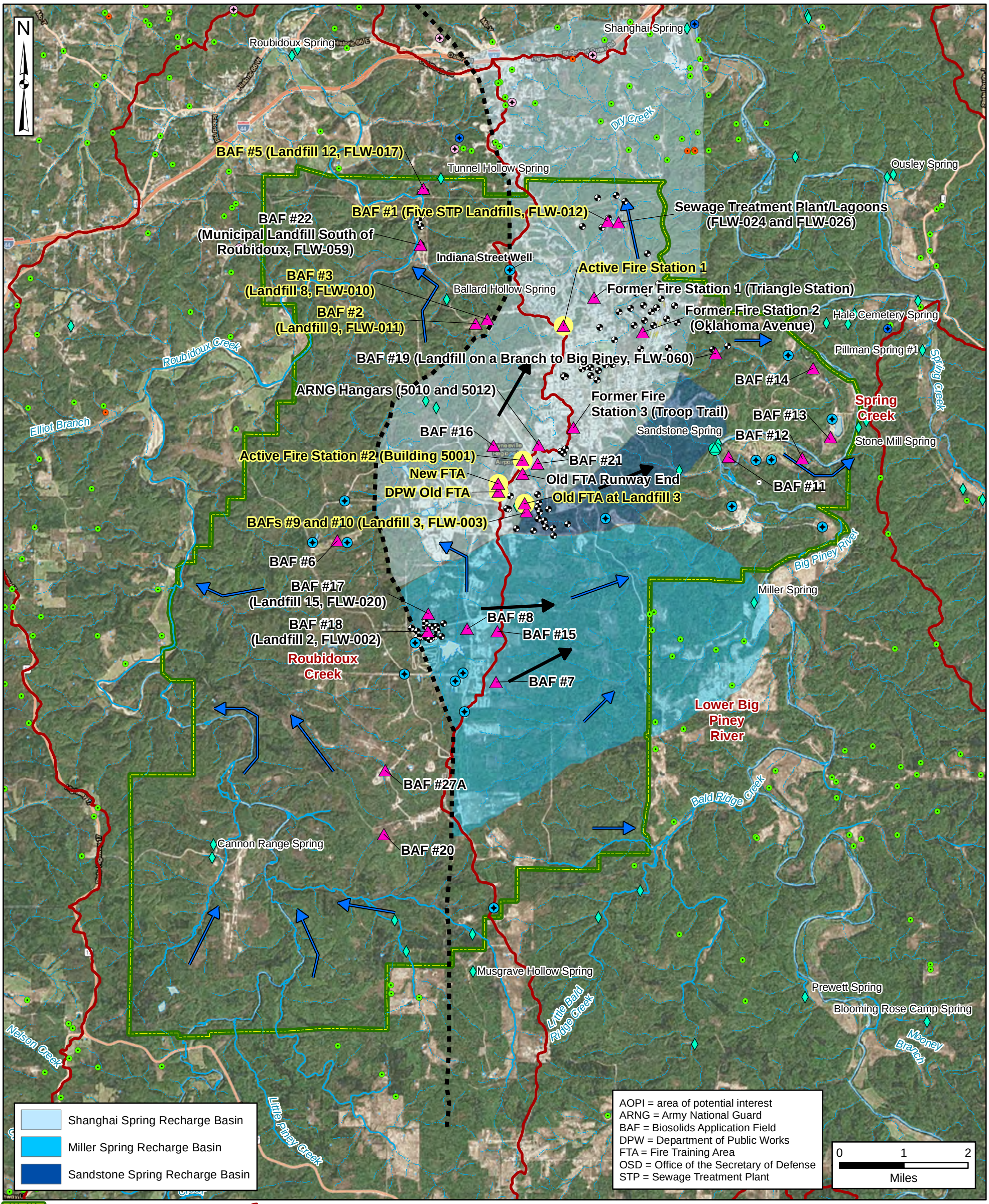
Fort Leonard Wood, MO

Figure 7-1
AOPI Locations and OSD
Risk Screening Level Exceedances



- Installation Boundary
- AOPI
- AOPI with OSD Risk Screening Level Exceedance
- River/Stream (Perennial)
- Stream (Intermittent)
- Water Body
- Watershed Boundary
- Groundwater Divide
- Approximate Groundwater Flow Direction
- Surface Water Flow Direction
- Spring
- Surface Water Intake at Sandstone Spring Pumping Station
- Monitoring Well
- On-Post Potable Water Well
- Other Public Supply Well (Community)
- Other Public Supply Well (Non-Community)
- Multi-Family Well
- Domestic Well
- Irrigation Well

Data Sources:
ORAP Phase I Data, 2008
EDR Well Data, 2019
MO DNR Well Data, 2019
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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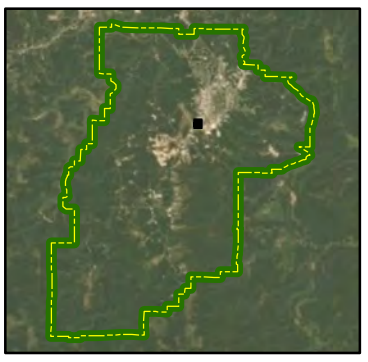


Figure 7-2
ARNG Hangars (Buildings 5010 and 5012) AOPI
PFOS, PFOA, and PFBS Analytical Results

FLW-ARNG-07-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.0068 U
PFOA	**0.0084**
PFOS	0.0068 U

FLW-ARNG-06-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.10 U
PFOA	**0.086 DJ**
PFOS	0.10 U

FLW-ARNG-05-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.046 U
PFOA	0.046 U
PFOS	0.046 U

FLW-ARNG-04-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.023 U
PFOA	**0.026 DJ**
PFOS	0.023 U

FLW-ARNG-01-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.0094 U
PFOA	**0.0048 J**
PFOS	0.0094 U

FLW-ARNG-02-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.00094 U
PFOA	**0.0054**
PFOS	0.00094 U

FLW-ARNG-03-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.0010 U
PFOA	**0.0028**
PFOS	0.0010 U

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Bolded values indicate detections.
3. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
D = The reported value is from a dilution.
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Installation Boundary
AOPI
Approximate Groundwater Flow Direction
Approximate Surface Runoff Flow Direction
Shallow Soil Sampling Location (Hand Auger)

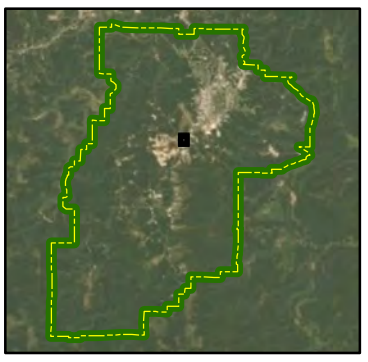
AOPI = area of potential interest
ARNG = Army National Guard
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

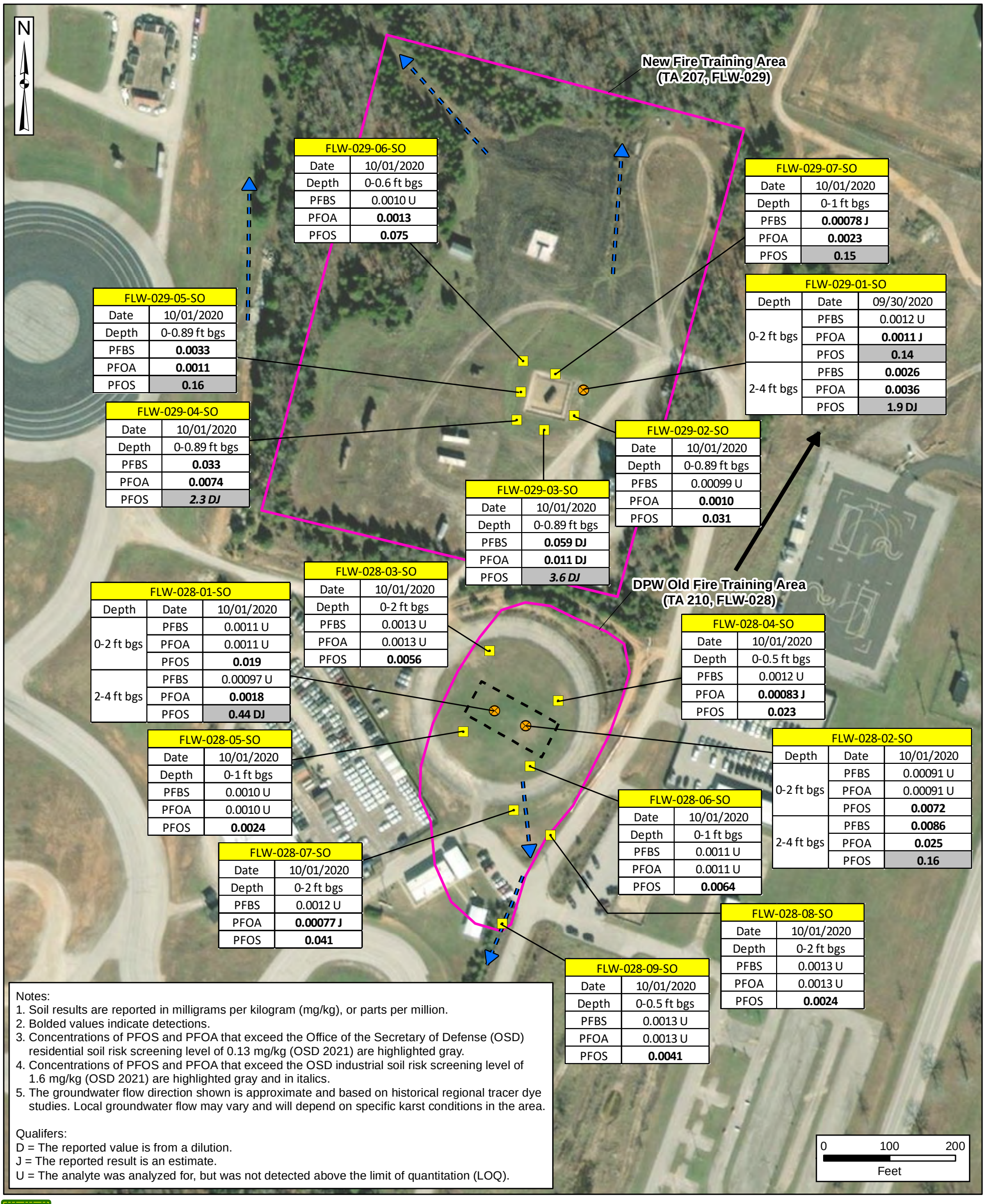
Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 7-3
DPW Old Fire Training Area (TA 210, FLW-028) and New Fire Training Area (TA 207, FLW-029) AOPIs PFOS, PFOA, and PFBS Analytical Results





FLW-029-06-SO	
Date	10/01/2020
Depth	0-0.6 ft bgs
PFBS	0.0010 U
PFOA	**0.0013**
PFOS	**0.075**

FLW-029-07-SO	
Date	10/01/2020
Depth	0-1 ft bgs
PFBS	**0.00078 J**
PFOA	**0.0023**
PFOS	**0.15**

FLW-029-01-SO		
Depth	Date	09/30/2020
0-2 ft bgs	PFBS	0.0012 U
	PFOA	**0.0011 J**
	PFOS	**0.14**
2-4 ft bgs	PFBS	**0.0026**
	PFOA	**0.0036**
	PFOS	**1.9 DJ**

FLW-029-05-SO	
Date	10/01/2020
Depth	0-0.89 ft bgs
PFBS	**0.0033**
PFOA	**0.0011**
PFOS	**0.16**

FLW-029-04-SO	
Date	10/01/2020
Depth	0-0.89 ft bgs
PFBS	**0.033**
PFOA	**0.0074**
PFOS	***2.3 DJ***

FLW-029-02-SO	
Date	10/01/2020
Depth	0-0.89 ft bgs
PFBS	0.00099 U
PFOA	**0.0010**
PFOS	**0.031**

FLW-029-03-SO	
Date	10/01/2020
Depth	0-0.89 ft bgs
PFBS	**0.059 DJ**
PFOA	**0.011 DJ**
PFOS	***3.6 DJ***

FLW-028-03-SO	
Date	10/01/2020
Depth	0-2 ft bgs
PFBS	0.0013 U
PFOA	0.0013 U
PFOS	**0.0056**

FLW-028-01-SO		
Depth	Date	10/01/2020
0-2 ft bgs	PFBS	0.0011 U
	PFOA	0.0011 U
	PFOS	**0.019**
2-4 ft bgs	PFBS	0.00097 U
	PFOA	**0.0018**
	PFOS	**0.44 DJ**

FLW-028-04-SO	
Date	10/01/2020
Depth	0-0.5 ft bgs
PFBS	0.0012 U
PFOA	**0.00083 J**
PFOS	**0.023**

FLW-028-05-SO	
Date	10/01/2020
Depth	0-1 ft bgs
PFBS	0.0010 U
PFOA	0.0010 U
PFOS	**0.0024**

FLW-028-02-SO		
Depth	Date	10/01/2020
0-2 ft bgs	PFBS	0.00091 U
	PFOA	0.00091 U
	PFOS	**0.0072**
2-4 ft bgs	PFBS	**0.0086**
	PFOA	**0.025**
	PFOS	**0.16**

FLW-028-06-SO	
Date	10/01/2020
Depth	0-1 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	**0.0064**

FLW-028-07-SO	
Date	10/01/2020
Depth	0-2 ft bgs
PFBS	0.0012 U
PFOA	**0.00077 J**
PFOS	**0.041**

FLW-028-08-SO	
Date	10/01/2020
Depth	0-2 ft bgs
PFBS	0.0013 U
PFOA	0.0013 U
PFOS	**0.0024**

FLW-028-09-SO	
Date	10/01/2020
Depth	0-0.5 ft bgs
PFBS	0.0013 U
PFOA	0.0013 U
PFOS	**0.0041**

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Bolded values indicate detections.
3. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
4. Concentrations of PFOS and PFOA that exceed the OSD industrial soil risk screening level of 1.6 mg/kg (OSD 2021) are highlighted gray and in italics.
5. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
D = The reported value is from a dilution.
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Installation Boundary
AOPI
Former Buried Concrete Pad
Approximate Groundwater Flow Direction
Approximate Surface Runoff Flow Direction

Shallow Soil Sampling Location (Hand Auger)
Shallow and Subsurface Soil Sampling Location (Sonic)

AOPI = area of potential interest
DPW = Department of Public Works
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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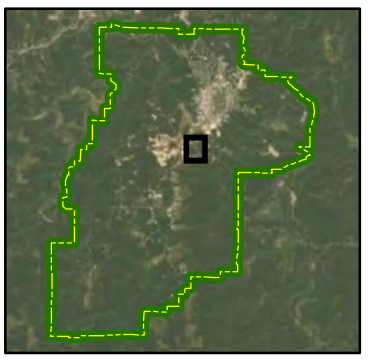
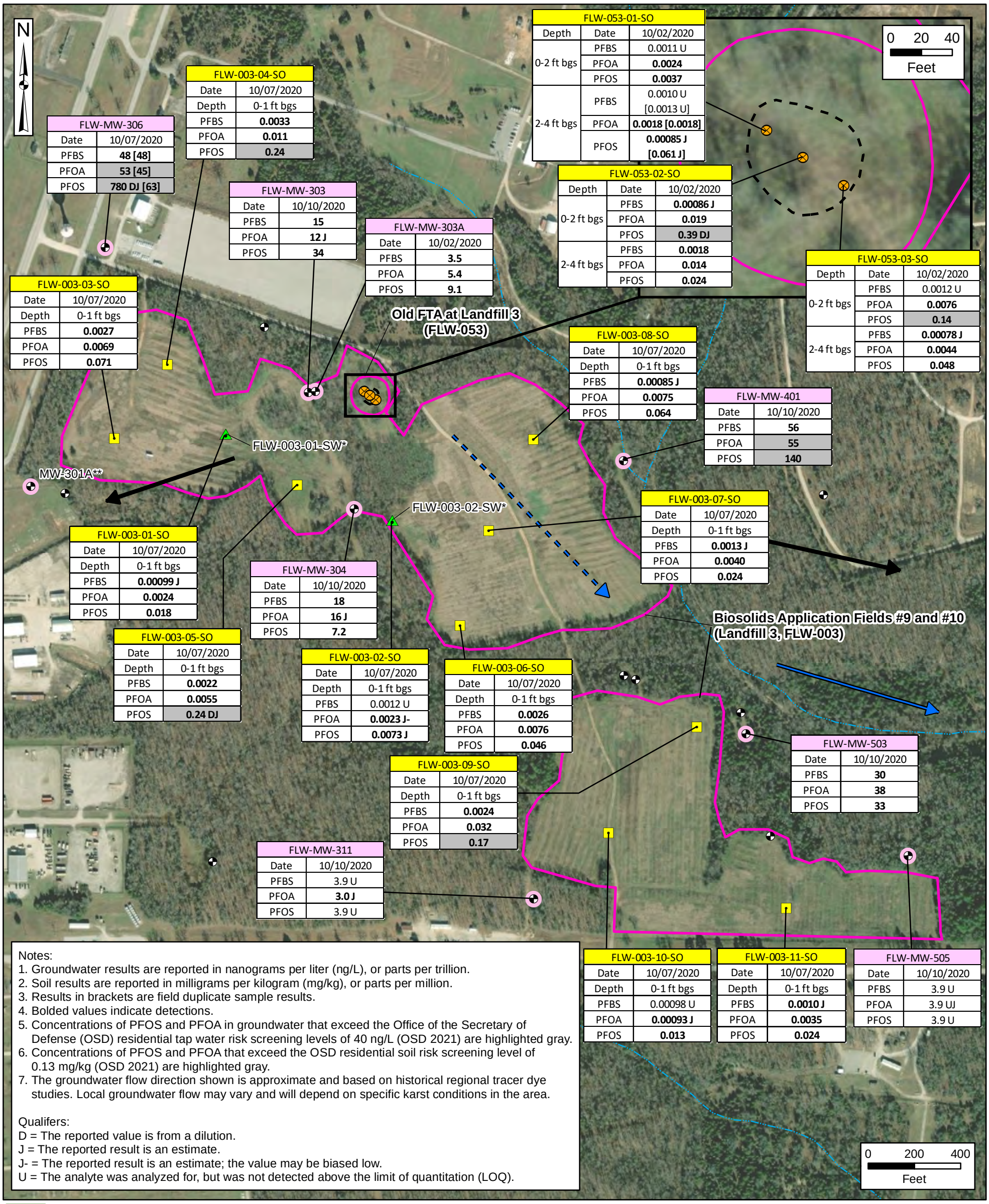
Fort Leonard Wood, MO

Figure 7-4
Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003) and Old Fire Training Area at Landfill 3 (FLW-053) AOPIs PFOS, PFOA, and PFBS Analytical Results





Notes:
1. Groundwater results are reported in nanograms per liter (ng/L), or parts per trillion.
2. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
3. Results in brackets are field duplicate sample results.
4. Bolded values indicate detections.
5. Concentrations of PFOS and PFOA in groundwater that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening levels of 40 ng/L (OSD 2021) are highlighted gray.
6. Concentrations of PFOS and PFOA that exceed the OSD residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
7. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
D = The reported value is from a dilution.
J = The reported result is an estimate.
J- = The reported result is an estimate; the value may be biased low.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

- Installation Boundary
- AOPI
- Former Pit
- Stream (Intermittent)
- Approximate Groundwater Flow Direction
- Surface Water Flow Direction
- Approximate Surface Runoff Flow Direction
- Monitoring Well
- Shallow Soil Sampling Location (Hand Auger)
- Shallow and Subsurface Soil Sampling Location (Sonic)
- Seep Sampling Location (Shallow Soil and Surface Water)
- Groundwater Sampling Location (Existing Well)

AOPI = area of potential interest
FTA = fire training area
ft bgs = feet below ground surface
MW = monitoring well
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil
SW = surface water

* FLW-003-01-SW and FLW-003-02-SW could not be sampled because the surface was dry.
** MW-301A was not able to be sampled due to obstructions in the well, including dedicated equipment and other materials that previously fell down the well.

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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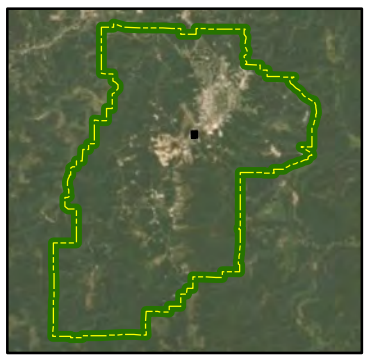

Figure 7-5
Old Fire Training Area Runway End (FLW-054) AOPI
PFOS, PFOA, and PFBS Analytical Results

N

FLW-054-01-SO	
Date	10/07/2020
Depth	0-1.5 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	**0.00073 J**

FLW-054-02-SO	
Date	10/07/2020
Depth	0-1 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	**0.0013**

FLW-054-03-SO	
Date	10/07/2020
Depth	0-1 ft bgs
PFBS	0.00089 U
PFOA	0.00089 U
PFOS	**0.00057 J**

FLW-054-04-SO	
Date	10/07/2020
Depth	0-1 ft bgs
PFBS	0.0012 U
PFOA	0.0012 U
PFOS	**0.00089 J**

Old Fire Training Area
Runway End (FLW-054)

0 25 50
Feet

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Bolded values indicate detections.
3. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Installation Boundary
AOPI
Approximate Location of Former Pit
Approximate Groundwater Flow Direction
Approximate Surface Runoff Flow Direction
Shallow Soil Sampling Location (Hand Auger)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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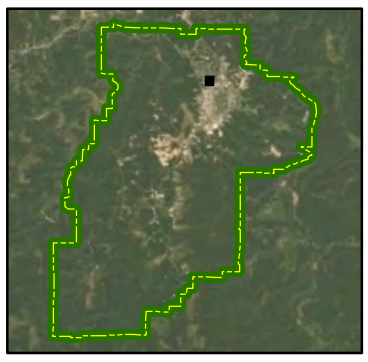
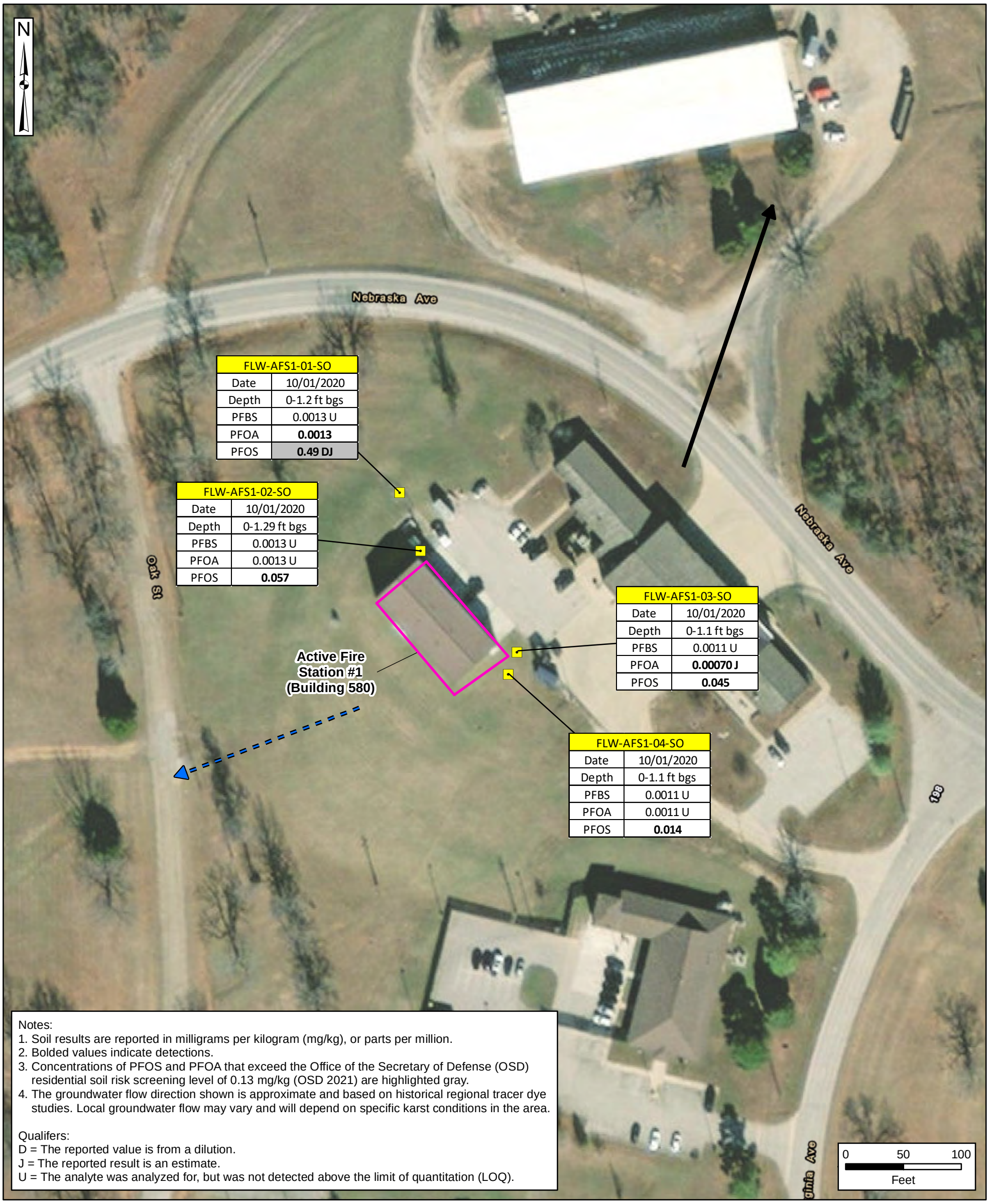


Figure 7-6
Active Fire Station #1 (Building 580) AOPI
PFOS, PFOA, and PFBS Analytical Results



Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Bolded values indicate detections.
3. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
4. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
D = The reported value is from a dilution.
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Installation Boundary
AOPI
Approximate Groundwater Flow Direction
Approximate Surface Runoff Flow Direction
Shallow Soil Sampling Location (Hand Auger)

AFS1 = Active Fire Station #1
AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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Fort Leonard Wood, MO

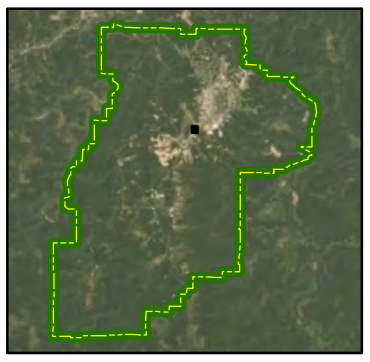

Figure 7-7
Active Fire Station #2 (Building 5001) AOPI
PFOS, PFOA, and PFBS Analytical Results

FLW-AFS2-04-SO	
Date	10/09/2020
Depth	0-1 ft bgs
PFBS	**0.0010**
PFOA	**0.0014**
PFOS	**1.1 DJ**

FLW-AFS2-03-SO	
Date	10/09/2020
Depth	0-1 ft bgs
PFBS	**0.0013**
PFOA	**0.0091**
PFOS	**0.21**

Active Fire Station #2
(Building 5001)

FLW-AFS2-02-SO	
Date	10/09/2020
Depth	0-1 ft bgs
PFBS	0.00096 U
PFOA	**0.00094 J**
PFOS	**0.017**

FLW-AFS2-01-SO	
Date	10/09/2020
Depth	0-1 ft bgs
PFBS	0.0011 U
PFOA	**0.0032**
PFOS	**0.49 DJ**

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Bolded values indicate detections.
3. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
4. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
D = The reported value is from a dilution.
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Iowa Ave

0 25 50
Feet

Installation Boundary
AOPI
Approximate Groundwater Flow Direction
Approximate Surface Runoff Flow Direction
Shallow Soil Sampling Location (Hand Auger)

AFS2 = Active Fire Station #2
AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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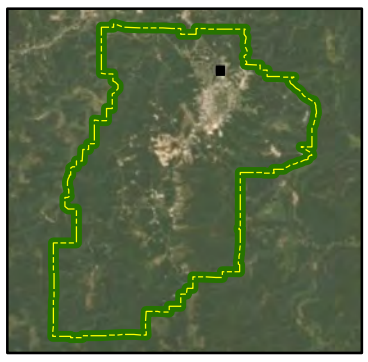

Figure 7-8
Former Fire Station #1 (Triangle Station) AOPI
PFOS, PFOA, and PFBS Analytical Results

N

I-44-SPUR N

I-44-SPUR S

FLW-FFS1-01-SO		
Depth	Date	09/30/2020
0-2 ft bgs	PFBS	0.00087 U
	PFOA	0.00087 U
	PFOS	**0.0020**
2-4 ft bgs	PFBS	0.0012 U
	PFOA	0.0012 U
	PFOS	**0.018**

FLW-FFS1-02-SO		
Depth	Date	09/30/2020
0-2 ft bgs	PFBS	**0.0011**
	PFOA	**0.00069 J**
	PFOS	**0.019**
2-4 ft bgs	PFBS	**0.0023**
	PFOA	**0.011**
	PFOS	**0.059**

Former Fire Station #1
(Triangle Station)

FLW-FFS1-03-SO		
Depth	Date	09/30/2020
0-2 ft bgs	PFBS	0.0012 U
	PFOA	0.0012 U
	PFOS	**0.0027**
2-4 ft bgs	PFBS	0.0013 U
	PFOA	0.0013 U
	PFOS	**0.0042**

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Bolded values indicate detections.
3. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

0 50 100
Feet

Installation Boundary
AOPI
Historical Building Footprint
Approximate Groundwater Flow Direction
Approximate Surface Runoff Flow Direction
Shallow and Subsurface Soil Sampling Location (Sonic)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

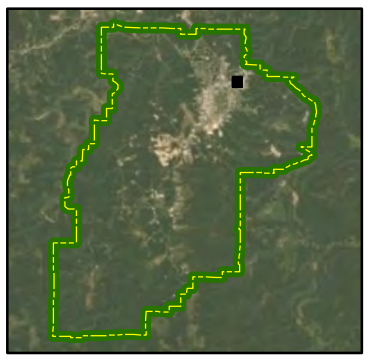

Figure 7-9
Former Fire Station #2 (Oklahoma Avenue) AOPI
PFOS, PFOA, and PFBS Analytical Results

FLW-MW-5604	
Date	10/05/2020
PFBS	**3.7**
PFOA	**5.1**
PFOS	**26**

FLW-MW-5609	
Date	10/10/2020
PFBS	3.7 U
PFOA	3.7 U
PFOS	**11**

FLW-FFS2-02-SO		
Depth	Date	09/29/2020
0-2 ft bgs	PFBS	0.0010 U
	PFOA	0.0010 U
	PFOS	0.0010 U
2-4 ft bgs	PFBS	0.0011 U
	PFOA	0.0011 U
	PFOS	0.0011 U

FLW-FFS2-01-SO		
Depth	Date	09/29/2020
0-2 ft bgs	PFBS	0.00094 U
	PFOA	0.00094 U
	PFOS	0.00094 U
2-4 ft bgs	PFBS	0.0010 UJ-
	PFOA	0.0010 UJ-
	PFOS	0.0010 UJ-

FLW-FFS2-03-SO		
Depth	Date	09/30/2020
0-2 ft bgs	PFBS	0.0011 U
	PFOA	0.0011 U
	PFOS	0.0011 U
2-4 ft bgs	PFBS	0.0011 U
	PFOA	0.0011 U
	PFOS	0.0011 U

Former Fire Station #2 (Oklahoma Avenue)

Notes:
1. Groundwater results are reported in nanograms per liter (ng/L), or parts per trillion.
2. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
3. Bolded values indicate detections.
4. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).
UJ- = The analyte was analyzed for but was not detected. The LOQ is approximate and may be inaccurate or imprecise.

0 50 100 Feet

Installation Boundary
AOPI
Historical Building Footprint
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
Monitoring Well
Shallow and Subsurface Soil Sampling Location (Sonic)
Groundwater Sampling Location (Existing Well)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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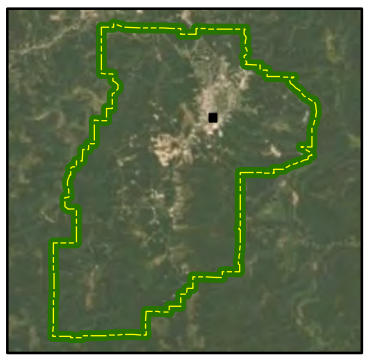
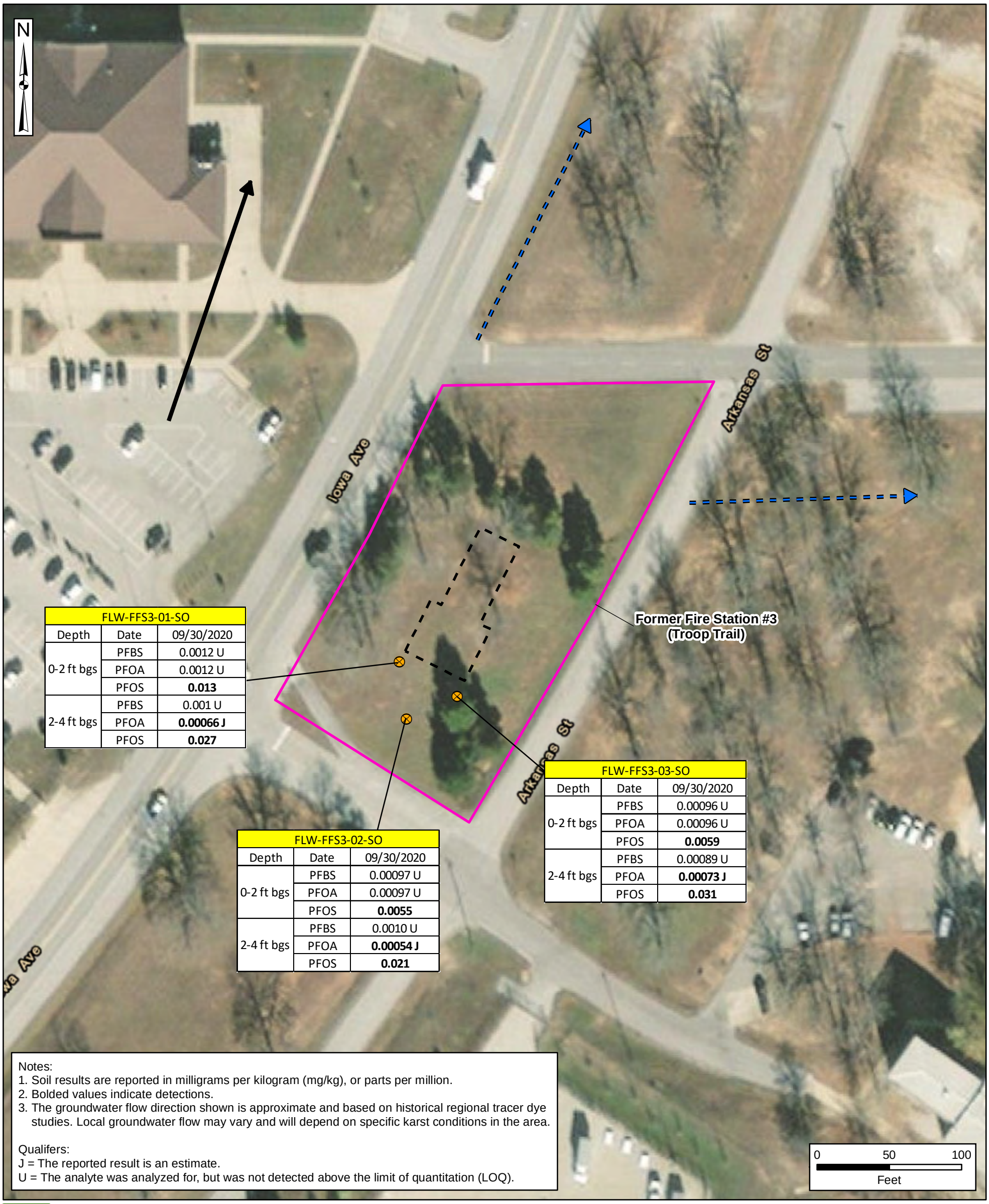


Figure 7-10
Former Fire Station #3 (Troop Trail) AOPI
PFOS, PFOA, and PFBS Analytical Results



FLW-FFS3-01-SO		
Depth	Date	09/30/2020
0-2 ft bgs	PFBS	0.0012 U
	PFOA	0.0012 U
	PFOS	**0.013**
2-4 ft bgs	PFBS	0.001 U
	PFOA	**0.00066 J**
	PFOS	**0.027**

FLW-FFS3-02-SO		
Depth	Date	09/30/2020
0-2 ft bgs	PFBS	0.00097 U
	PFOA	0.00097 U
	PFOS	**0.0055**
2-4 ft bgs	PFBS	0.0010 U
	PFOA	**0.00054 J**
	PFOS	**0.021**

FLW-FFS3-03-SO		
Depth	Date	09/30/2020
0-2 ft bgs	PFBS	0.00096 U
	PFOA	0.00096 U
	PFOS	**0.0059**
2-4 ft bgs	PFBS	0.00089 U
	PFOA	**0.00073 J**
	PFOS	**0.031**

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Bolded values indicate detections.
3. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Installation Boundary
AOPI
Historical Building Footprint
Approximate Groundwater Flow Direction
Approximate Surface Runoff Flow Direction
Shallow and Subsurface Soil Sampling Location (Sonic)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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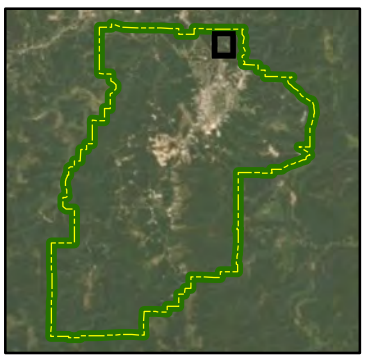
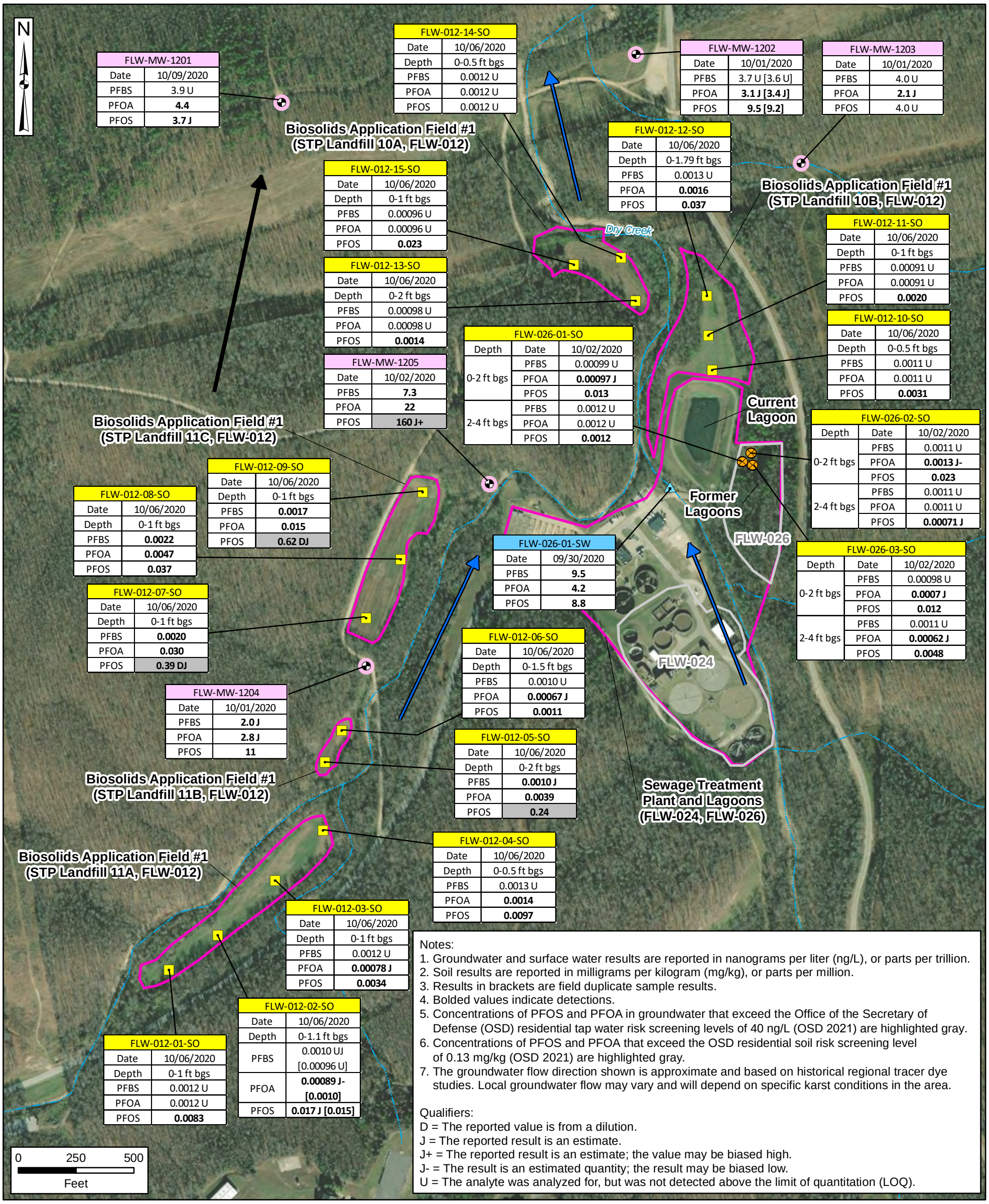
Fort Leonard Wood, MO

Figure 7-11
Biosolids Application Field #1 (Five STP Landfills, FLW-012) and Sewage Treatment Plant/Lagoons (FLW-024 and FLW-026) AOPIs PFOS, PFOA, and PFBS Analytical Results





Notes:
1. Groundwater and surface water results are reported in nanograms per liter (ng/L), or parts per trillion.
2. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
3. Results in brackets are field duplicate sample results.
4. Bolded values indicate detections.
5. Concentrations of PFOS and PFOA in groundwater that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening levels of 40 ng/L (OSD 2021) are highlighted gray.
6. Concentrations of PFOS and PFOA that exceed the OSD residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
7. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifiers:
D = The reported value is from a dilution.
J = The reported result is an estimate.
J+ = The reported result is an estimate; the value may be biased high.
J- = The result is an estimated quantity; the result may be biased low.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Installation Boundary
AOPI
IRP Site
River/Stream (Perennial)
Stream (Intermittent)
Monitoring Well
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Shallow Soil Sampling Location (Hand Auger)
Shallow and Subsurface Soil Sampling Location (Sonic)
Surface Water Sampling Location
Groundwater Sampling Location (Existing Well)

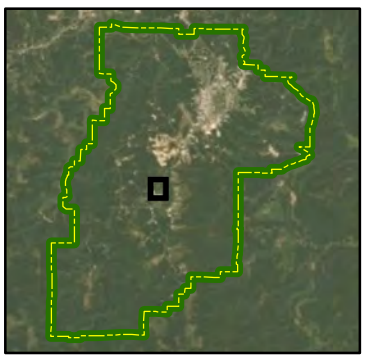
AOPI = area of potential interest
IRP = Installation Restoration Program
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil
STP = Sewage Treatment Plant

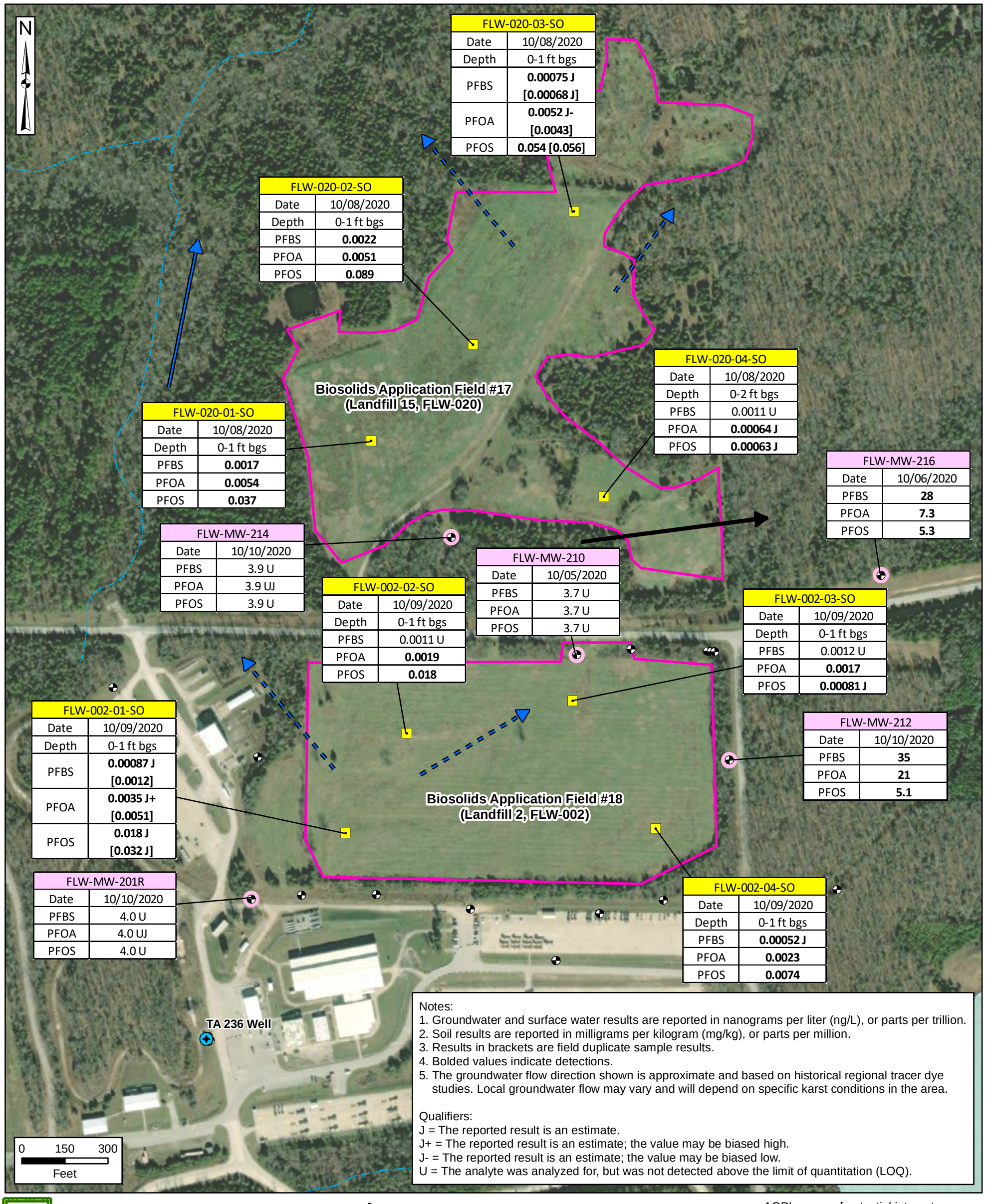
Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 7-12
Biosolids Application Fields #17 (Landfill 15, FLW-020) and #18 (Landfill 2, FLW-002) AOPIs
PFOS, PFOA, and PFBS Analytical Results





Notes:
1. Groundwater and surface water results are reported in nanograms per liter (ng/L), or parts per trillion.
2. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
3. Results in brackets are field duplicate sample results.
4. Bolded values indicate detections.
5. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifiers:
J = The reported result is an estimate.
J+ = The reported result is an estimate; the value may be biased high.
J- = The reported result is an estimate; the value may be biased low.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

- Installation Boundary
- AOPI
- Stream (Intermittent)
- Water Body
- Approximate Groundwater Flow Direction
- Surface Water Flow Direction
- Approximate Surface Runoff Flow Direction
- On-Post Potable Water Well
- Monitoring Well
- Shallow Soil Sampling Location (Hand Auger)
- Groundwater Sampling Location (Existing Well)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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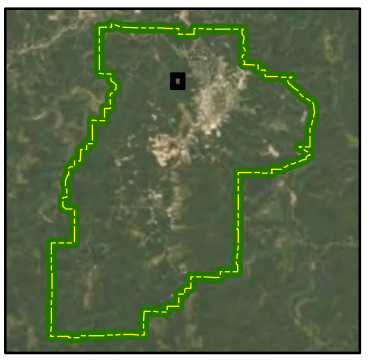
Fort Leonard Wood, MO

Figure 7-13
Biosolids Application Fields #2 (Landfill 9, FLW-011) and #3 (Landfill 8, FLW-010) AOPIs PFOS, PFOA, and PFBS Analytical Results



FLW-011-01-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.00096 U
PFOA	**0.0013**
PFOS	**0.0095**

FLW-011-02-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	**0.00083 J**
PFOA	**0.0035**
PFOS	**0.086**

FLW-010-03-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.00095 U
PFOA	**0.0021**
PFOS	**0.015**

FLW-010-01-SO	
Date	10/08/2020
Depth	0-2 ft bgs
PFBS	0.00096 U
PFOA	**0.00093 J**
PFOS	**0.014**

Buckeye Ave

Biosolids Application Field #3 (Landfill 8, FLW-010)

Biosolids Application Field #2 (Landfill 9, FLW-011)

FLW-010-02-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.0053 U
PFOA	**0.0066 DJ**
PFOS	**0.38 DJ**

FLW-010-04-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	**0.00050 J-**
PFOA	**0.0029 J-**
PFOS	**0.012 J-**

FLW-011-03-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	**0.00064 J**
PFOA	**0.0049**
PFOS	**0.43 DJ**

FLW-011-04-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.00097 U
PFOA	0.00097 U
PFOS	0.00097 U

FLW-010-05-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.00096 U
PFOA	0.00096 U
PFOS	0.00096 U

FLW-010-06-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.0013 U
PFOA	0.0013 U
PFOS	0.0013 U

N

0 100 200
Feet

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Bolded values indicate detections.
3. Concentrations of PFOS and PFOA that exceed the Office of the Secretary of Defense (OSD) residential soil risk screening level of 0.13 mg/kg (OSD 2021) are highlighted gray.
4. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
D = The reported value is from a dilution.
J = The reported result is an estimate.
J- = The reported result is an estimate; the value may be biased low.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Installation Boundary
AOPI
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
Shallow Soil Sampling Location (Hand Auger)

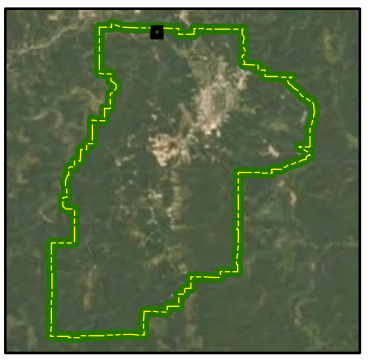
AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

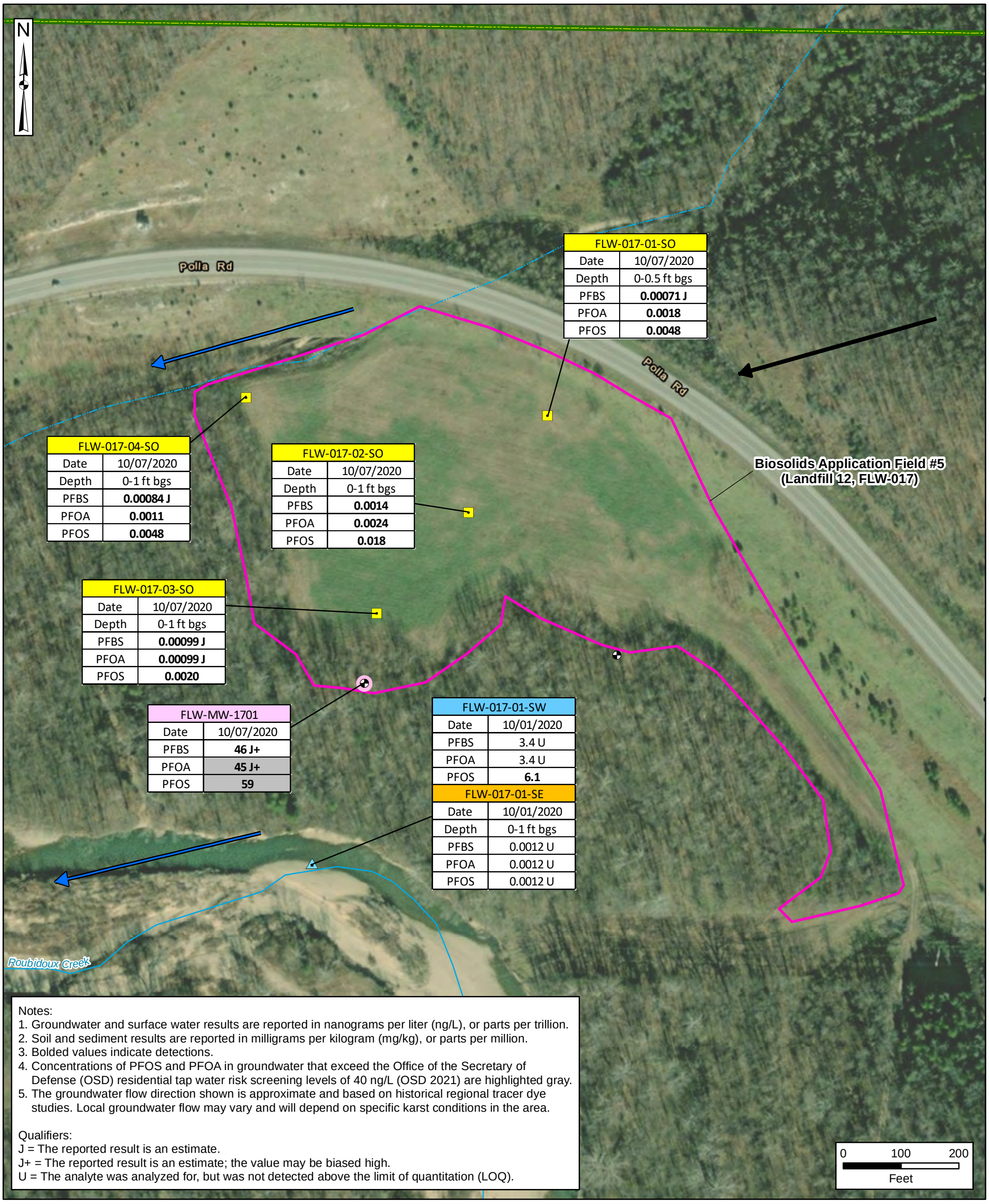
Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 7-14
Biosolids Application Field #5 (Landfill 12, FLW-017) AOPI
PFOS, PFOA, and PFBS Analytical Results





FLW-017-01-SO	
Date	10/07/2020
Depth	0-0.5 ft bgs
PFBS	**0.00071 J**
PFOA	**0.0018**
PFOS	**0.0048**

FLW-017-04-SO	
Date	10/07/2020
Depth	0-1 ft bgs
PFBS	**0.00084 J**
PFOA	**0.0011**
PFOS	**0.0048**

FLW-017-02-SO	
Date	10/07/2020
Depth	0-1 ft bgs
PFBS	**0.0014**
PFOA	**0.0024**
PFOS	**0.018**

FLW-017-03-SO	
Date	10/07/2020
Depth	0-1 ft bgs
PFBS	**0.00099 J**
PFOA	**0.00099 J**
PFOS	**0.0020**

FLW-MW-1701	
Date	10/07/2020
PFBS	**46 J+**
PFOA	**45 J+**
PFOS	**59**

FLW-017-01-SW	
Date	10/01/2020
PFBS	3.4 U
PFOA	3.4 U
PFOS	**6.1**

FLW-017-01-SE	
Date	10/01/2020
Depth	0-1 ft bgs
PFBS	0.0012 U
PFOA	0.0012 U
PFOS	0.0012 U

Notes:
1. Groundwater and surface water results are reported in nanograms per liter (ng/L), or parts per trillion.
2. Soil and sediment results are reported in milligrams per kilogram (mg/kg), or parts per million.
3. Bolded values indicate detections.
4. Concentrations of PFOS and PFOA in groundwater that exceed the Office of the Secretary of Defense (OSD) residential tap water risk screening levels of 40 ng/L (OSD 2021) are highlighted gray.
5. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifiers:
J = The reported result is an estimate.
J+ = The reported result is an estimate; the value may be biased high.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

- Installation Boundary
- AOPI
- River/Stream (Perennial)
- Stream (Intermittent)
- Monitoring Well
- Approximate Groundwater Flow Direction
- Surface Water Flow Direction
- Shallow Soil Sampling Location (Hand Auger)
- Surface Water/Sediment Sampling Location
- Groundwater Sampling Location (Existing Well)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SE = sediment
SO = soil
SW = surface water

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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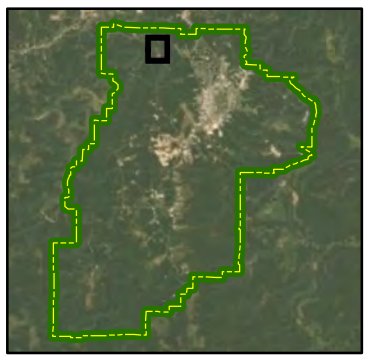
Fort Leonard Wood, MO

Figure 7-15
Biosolids Application Field #22
(Municipal Landfill South of Roubidoux, FLW-059) AOPI
PFOS, PFOA, and PFBS Analytical Results



FLW-059-01-SW	
Date	09/30/2020
PFBS	3.5 U [3.5 U]
PFOA	3.5 U [3.5 U]
PFOS	**5.3 J+ [4.2]**

FLW-059-01-SE	
Date	10/01/2020
Depth	0-1 ft bgs
PFBS	0.00096 U [0.0016 U]
PFOA	0.00096 U [0.0016 U]
PFOS	0.00096 U [0.0016 U]

FLW-MW-5905	
Date	10/05/2020
PFBS	4.0 U
PFOA	4.0 U
PFOS	**5.8**

FLW-059-02-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	0.0011 U

FLW-059-01-SO	
Date	10/08/2020
Depth	0-2 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	0.0011 U

FLW-MW-5904	
Date	10/05/2020
PFBS	**2.5 J**
PFOA	**5.4**
PFOS	**17**

FLW-059-03-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.00097 U
PFOA	**0.00052 J**
PFOS	0.00097 U

Biosolids Application Field #22N
(Municipal Landfill South of Roubidoux, FLW-059)

FLW-059-04-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.0012 U
PFOA	0.0012 U
PFOS	0.0012 U

Biosolids Application Field #22S
(Municipal Landfill South of Roubidoux, FLW-059)

FLW-MW-5901	
Date	10/05/2020
PFBS	**2.2 J**
PFOA	3.8 U
PFOS	**3.8**

FLW-059-05-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	0.0011 U

FLW-059-06-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.0012 U
PFOA	0.0012 U
PFOS	0.0012 U

Notes:
1. Groundwater and surface water results are reported in nanograms per liter (ng/L), or parts per trillion.
2. Soil and sediment results are reported in milligrams per kilogram (mg/kg), or parts per million.
3. Results in brackets are field duplicate sample results.
4. Bolded values indicate detections.
5. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifiers:
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

0 250 500
Feet

Installation Boundary
AOPI
River/Stream (Perennial)
Stream (Intermittent)
Monitoring Well
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Shallow Soil Sampling Location (Hand Auger)
Surface Water/Sediment Sampling Location
Groundwater Sampling Location (Existing Well)

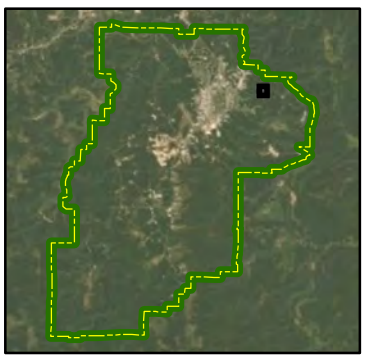
AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SE = sediment
SO = soil
SW = surface water

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

Figure 7-16
Biosolids Application Field #19
(Landfill on a Branch to Big Piney, FLW-060) AOPI
PFOS, PFOA, and PFBS Analytical Results



FLW-MW-6002	
Date	10/01/2020
PFBS	3.4 U
PFOA	3.4 U
PFOS	3.4 U

FLW-MW-6001	
Date	10/01/2020
PFBS	3.4 U [3.4 U]
PFOA	3.4 U [3.4 U]
PFOS	3.4 U [3.4 U]

FLW-060-03-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	0.00092 U
PFOA	**0.0015**
PFOS	**0.0056**

FLW-060-04-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	**0.00097 J**

FLW-060-02-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	0.00092 U [0.00091 U]
PFOA	0.00092 U [0.00091 U]
PFOS	0.00092 U [0.00091 U]

FLW-060-01-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	0.00094 U
PFOA	**0.00058 J**
PFOS	**0.0021**

Biosolids Application Field #19
(Landfill on a Branch to Big Piney, FLW-060)

1st St
Piney Hills Dr
Piney Hills

0 100 200
Feet

Notes:
1. Groundwater results are reported in nanograms per liter (ng/L), or parts per trillion.
2. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
3. Results in brackets are field duplicate sample results.
4. Bolded values indicate detections.
5. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifiers:
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Installation Boundary
AOPI
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Monitoring Well
Shallow Soil Sampling Location (Hand Auger)
Groundwater Sampling Location (Existing Well)

AOPI = area of potential interest
ft bgs = feet below ground surface
MW = monitoring well
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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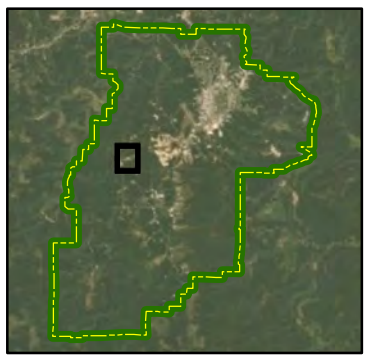

Figure 7-17
Biosolids Application Field #6 AOPI
PFOS, PFOA, and PFBS Analytical Results

N

FLW-BAF6-05-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.0012 U
PFOA	0.0012 U
PFOS	0.0012 U

FLW-BAF6-04-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.0012 U
PFOA	0.0012 U
PFOS	0.0012 U

FLW-BAF6-03-SO	
Date	10/08/2020
Depth	0-1 ft bgs
PFBS	0.00097 U
PFOA	0.00097 U
PFOS	0.00097 U

Biosolids Application Field #6

Babb Airfield Well

WA224 Well

FLW-BAF6-01-SO	
Date	10/08/2020
Depth	0-2 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	0.0011 U

FLW-BAF6-02-SO	
Date	10/08/2020 [10/07/2020]
Depth	0-1 ft bgs
PFBS	0.0011 U **[0.00075 J]**
PFOA	**0.0015 [0.0031]**
PFOS	**0.017 [0.014 J]**

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Results in brackets are field duplicate sample results.
3. Bolded values indicate detections.
4. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifiers:
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

0 200 400
Feet

Installation Boundary
AOPI
Stream (Intermittent)
Water Body
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
On-Post Potable Water Well
Shallow Soil Sampling Location (Hand Auger)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

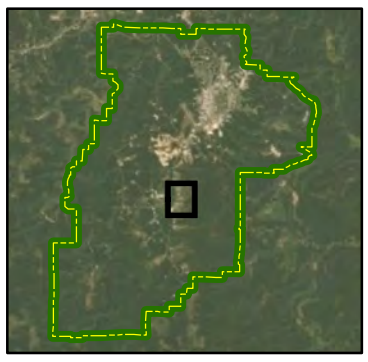

Figure 7-18
Biosolids Application Fields #7, #8, and #15 AOPIs
PFOS, PFOA, and PFBS Analytical Results

FLW-BAF8-01-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.0010 U
PFOA	0.0010 U
PFOS	**0.00074 J**

FLW-BAF15-01-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	0.0011 U

FLW-BAF15-03-SO	
Date	10/18/2020
Depth	0-2 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	0.0011 U

FLW-BAF15-02-SO	
Date	10/18/2020
Depth	0-2 ft bgs
PFBS	0.0013 U
PFOA	0.0013 U
PFOS	0.0013 U

Biosolids Application Field #15

FLW-BAF8-02-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.00097 U
PFOA	**0.0026**
PFOS	**0.013**

Biosolids Application Field #8

FLW-BAF8-03-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	0.0011 U

Winchester Rd

FLW-BAF15-04-SO	
Date	10/18/2020
Depth	0-1 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	0.0011 U

FLW-BAF15-05-SO	
Date	10/18/2020
Depth	0-2 ft bgs
PFBS	0.00095 U
PFOA	0.00095 U
PFOS	0.00095 U

Biosolids Application Field #7

FLW-BAF7-01-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.0011 U
PFOA	**0.0018**
PFOS	**0.0046**

FLW-BAF7-02-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	**0.0015 [0.0015]**
PFOA	**0.0038 [0.0039]**
PFOS	**0.0093 [0.015]**

Range Training Well

TA 228 Well

FLW-BAF7-03-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	**0.0023**
PFOA	**0.0077**
PFOS	**0.013**

FLW-BAF7-04-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.0012 U
PFOA	**0.0036**
PFOS	**0.0047**

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Results in brackets are field duplicate sample results.
3. Bolded values indicate detections.
4. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

0 200 400
Feet

Installation Boundary
AOPI
Stream (Intermittent)
Water Body
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
On-Post Potable Water Well
Shallow Soil Sampling Location (Hand Auger)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

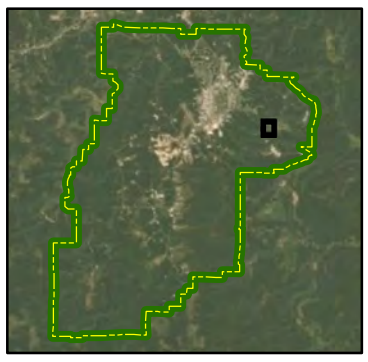

Figure 7-19
Biosolids Application Field #11 AOPI
PFOS, PFOA, and PFBS Analytical Results

N

Demolition Ave

Sandstone Spring

Big Piney River

Sandstone Spring Pumping Station

Biosolids Application Field #11

FLW-BAF11-04-SO	
Date	10/12/2020
Depth	0-2 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	0.0011 U

FLW-BAF11-01-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	0.00098 U
PFOA	0.00098 U
PFOS	0.00098 U

FLW-BAF11-02-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	0.00097 U [0.0011 U]
PFOA	0.00097 U [0.0011 U]
PFOS	0.00097 U [0.0011 U]

FLW-BAF11-03-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	0.00090 U
PFOA	0.00090 U
PFOS	0.00090 U

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Results in brackets are field duplicate sample results.
3. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

0 200 400
Feet

Installation Boundary
AOPI
River/Stream (Perennial)
Stream (Intermittent)
Water Body
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
Spring
Shallow Soil Sampling Location (Hand Auger)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

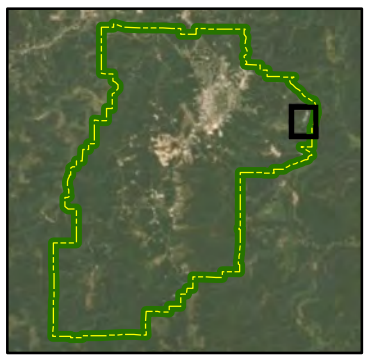

Figure 7-20
Biosolids Application Fields #12 & #13 AOPIs
PFOS, PFOA, and PFBS Analytical Results

N

Biosolids Application Field #13

TA 250 Well

Demolition Ave

FLW-BAF13-04-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	**0.00052 J**
PFOA	**0.0042**
PFOS	**0.023**

Biosolids Application Field #13

FLW-BAF13-03-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	0.0010 U
PFOA	0.0010 U
PFOS	**0.0012**

FLW-BAF12-01-SO	
Date	10/12/2020
Depth	0-2 ft bgs
PFBS	0.00098 U
PFOA	0.00098 U
PFOS	0.00098 U

FLW-BAF12-02-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	0.00096 U
PFOA	0.00096 U
PFOS	0.00096 U

FLW-BAF13-02-SO	
Date	10/12/2020
Depth	0-2 ft bgs
PFBS	**0.00085 J**
PFOA	**0.0018**
PFOS	**0.0023**

FLW-BAF12-03-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	0.00099 U
PFOA	0.00099 U
PFOS	0.00099 U

FLW-BAF13-01-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	**0.0015**
PFOA	**0.0040**
PFOS	**0.021**

Biosolids Application Field #12

Big Piney River

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Bolded values indicate detections.
3. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

0 200 400
Feet

Installation Boundary
AOPI
Stream (Intermittent)
Water Body
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
On-Post Potable Water Well
Shallow Soil Sampling Location (Hand Auger)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

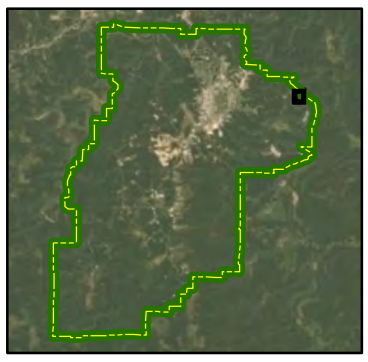

Figure 7-21
Biosolids Application Field #14 AOPI
PFOS, PFOA, and PFBS Analytical Results

N

FLW-BAF14-01-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	**0.0011**
PFOA	**0.0058**
PFOS	**0.071**

FLW-BAF14-02-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	0.0011 U
PFOA	**0.0046**
PFOS	**0.10**

FLW-BAF14-03-SO	
Date	10/12/2020
Depth	0-1 ft bgs
PFBS	0.0012 U
PFOA	**0.0046**
PFOS	**0.054**

Biosolids Application Field #14

Big Piney River

0 100 200
Feet

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Bolded values indicate detections.
3. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Installation Boundary
AOPI
Water Body
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
Shallow Soil Sampling Location (Hand Auger)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

USAEC PFAS Preliminary Assessment/Site Inspection
Fort Leonard Wood, MO

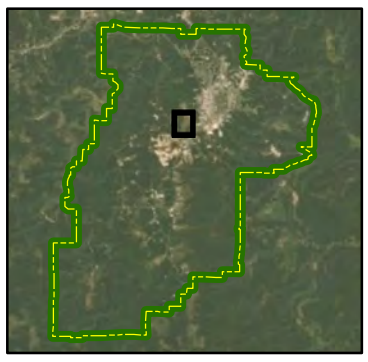

Figure 7-22
Biosolids Application Field #16 AOPI
PFOS, PFOA, and PFBS Analytical Results

N

FLW-BAF16-01-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.0012 U
PFOA	0.0012 U
PFOS	0.0012 U

Biosolids Application Field #16

FLW-BAF16-02-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.00097 U
PFOA	0.00097 U
PFOS	0.00097 U

Waynesville Regional Airport

FLW-BAF16-03-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.0015 U
PFOA	0.0015 U
PFOS	0.0015 U

FLW-BAF16-04-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.0011 U
PFOA	0.0011 U
PFOS	0.0011 U

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

0 200 400
Feet

Installation Boundary
AOPI
Stream (Intermittent)
Water Body
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
Shallow Soil Sampling Location (Hand Auger)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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Fort Leonard Wood, MO

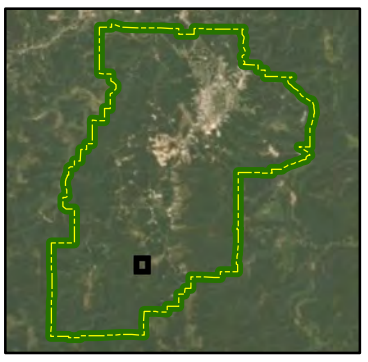
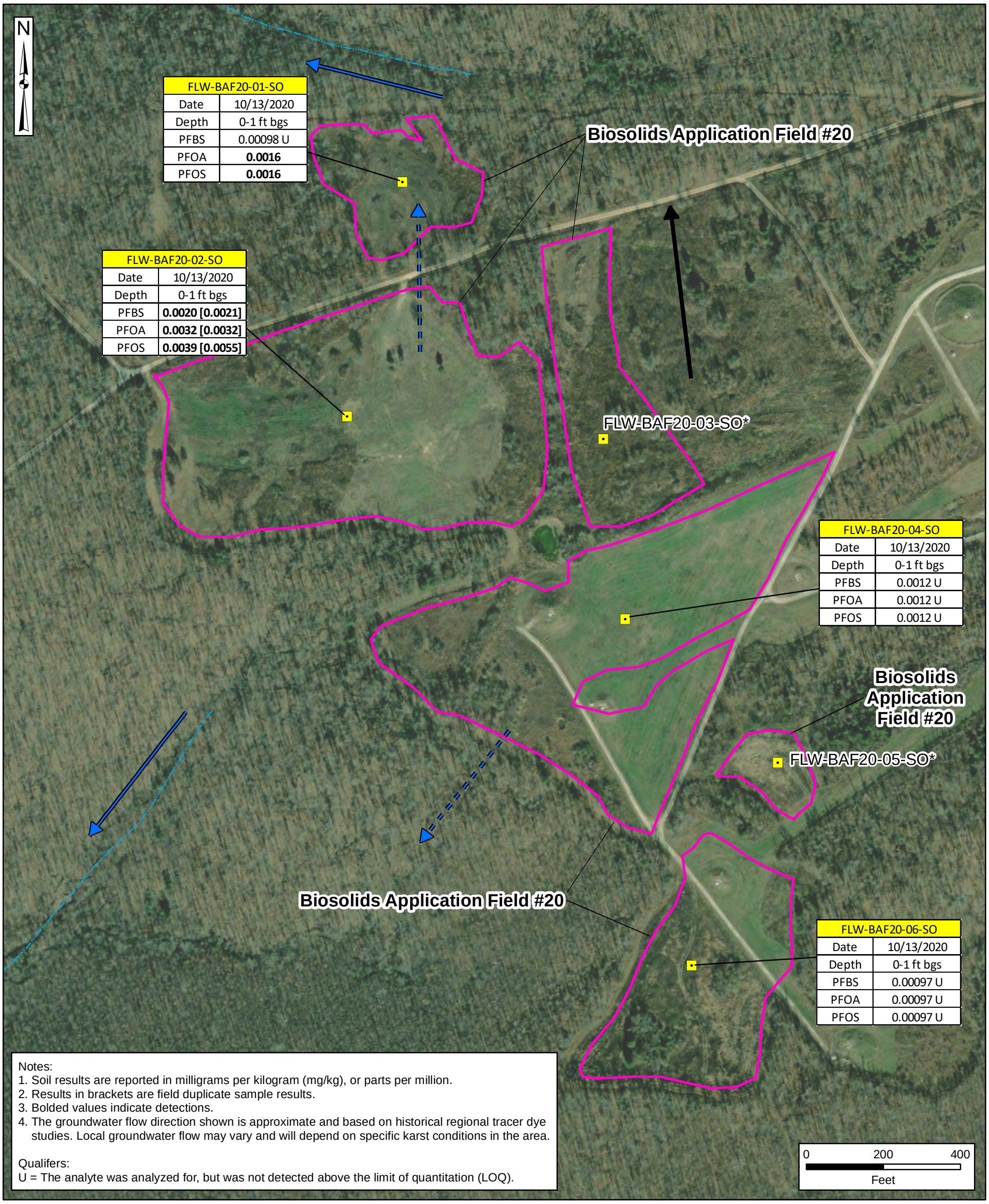


Figure 7-23
Biosolids Application Field #20 AOPI
PFOS, PFOA, and PFBS Analytical Results



Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Results in brackets are field duplicate sample results.
3. Bolded values indicate detections.
4. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

Installation Boundary
AOPI
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
Shallow Soil Sampling Location (Hand Auger)

* FLW-BAF-20-03-SO and FLW-BAF-20-05-SO were sampled and received by the lab. However, the lab accidentally disposed of the samples before recording analytical results.

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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Fort Leonard Wood, MO

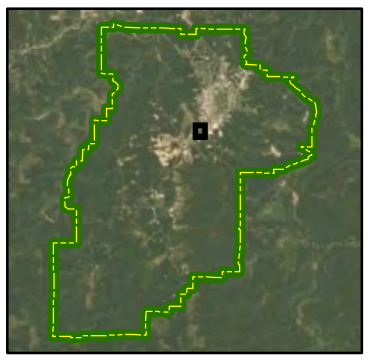

Figure 7-24
Biosolids Application Field #21 AOPI
PFOS, PFOA, and PFBS Analytical Results

FLW-BAF21-01-SO	
Date	10/13/2020
Depth	0-0.5 ft bgs
PFBS	0.0010 U
PFOA	0.0010 U
PFOS	0.0010 U

FLW-BAF21-03-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	**0.00094 J**
PFOA	**0.0012**
PFOS	**0.0014**

FLW-BAF21-02-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.00091 U
PFOA	0.00091 U
PFOS	0.00091 U

FLW-BAF21-04-SO320	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.0012 U
PFOA	0.0012 U
PFOS	0.0012 U

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Bolded values indicate detections.
3. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

0 100 200
Feet

Installation Boundary
AOPI
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
Shallow Soil Sampling Location (Hand Auger)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North

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Fort Leonard Wood, MO

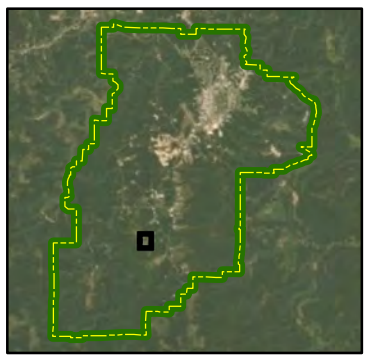


Figure 7-25
Biosolids Application Field #27A AOPI
PFOS, PFOA, and PFBS Analytical Results

FLW-BAF27A-02-SO	
Date	10/13/2020
Depth	0-2 ft bgs
PFBS	0.0010 U
PFOA	0.0010 U
PFOS	**0.00062 J**

FLW-BAF27A-01-SO	
Date	10/13/2020
Depth	0-1 ft bgs
PFBS	0.00090 U
PFOA	0.00090 U
PFOS	0.00090 U

Biosolids Application Field #27A

FLW-BAF27A-04-SO	
Date	10/13/2020
Depth	0-2 ft bgs
PFBS	**0.00067 J**
PFOA	0.0010 U
PFOS	**0.0022**

FLW-BAF27A-03-SO	
Date	10/13/2020
Depth	0-2 ft bgs
PFBS	0.0014 U
PFOA	0.0014 U
PFOS	0.0014 U

Notes:
1. Soil results are reported in milligrams per kilogram (mg/kg), or parts per million.
2. Bolded values indicate detections.
3. The groundwater flow direction shown is approximate and based on historical regional tracer dye studies. Local groundwater flow may vary and will depend on specific karst conditions in the area.

Qualifers:
J = The reported result is an estimate.
U = The analyte was analyzed for, but was not detected above the limit of quantitation (LOQ).

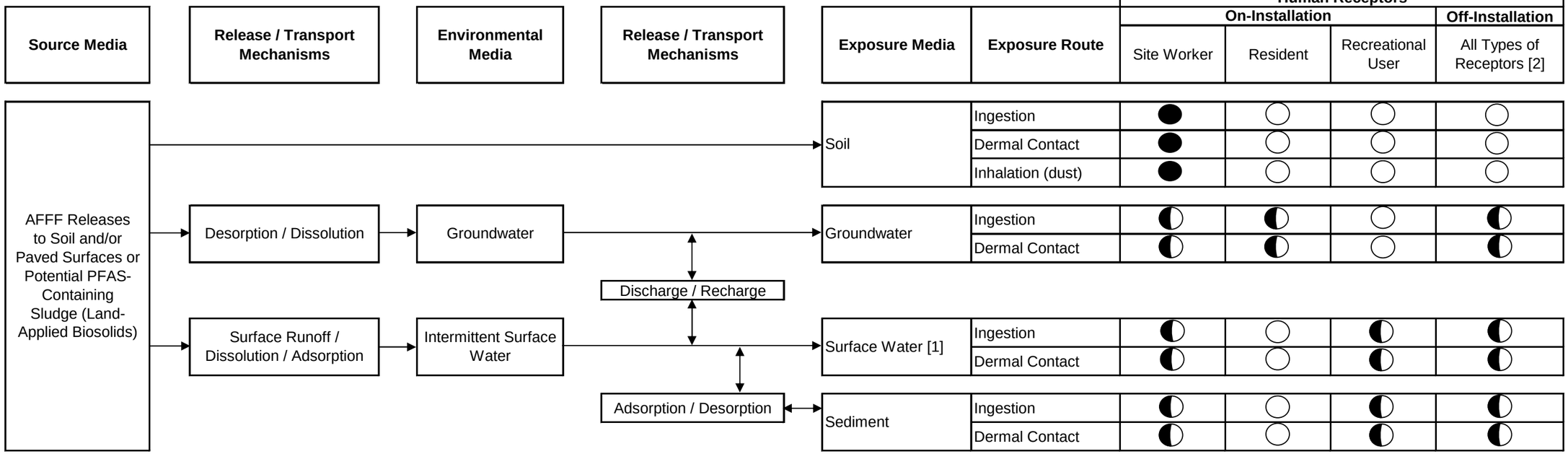
0 200 400
Feet

Installation Boundary
AOPI
Stream (Intermittent)
Approximate Groundwater Flow Direction
Surface Water Flow Direction
Approximate Surface Runoff Flow Direction
Shallow Soil Sampling Location (Hand Auger)

AOPI = area of potential interest
ft bgs = feet below ground surface
PFBS = perfluorobutanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctane sulfonate
SO = soil

Data Sources:
Ft Leonard Wood, GIS Data, 2019
ESRI ArcGIS Online, Aerial Imagery

Coordinate System:
WGS 1984, UTM Zone 15 North



Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Acronyms:
AFFF = aqueous film-forming foam
AOPI = area of potential interest
PFAS = per- and polyfluoroalkyl substances

Notes:
The nine AOPIs addressed by this CSM are: ARNG Hangars (Buildings 5010 and 5012), DPW Old Fire Training Area (TA 210, FLW-028), New Fire Training Area (TA 207, FLW-029), Active Fire Station #1 (Building 580), Biosolids Application Field #17 (Landfill 15, FLW-020), Biosolids Application Field #18 (Landfill 2, FLW-002), Biosolids Application Field #2 (Landfill 9, FLW-011), Biosolids Application Field #3 (Landfill 8, FLW-010), and Biosolids Application Field #8.
[1] Surface water exposure pathway for Residents describes a drinking water scenario and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario. Surface water exposure pathway for Site Workers could describe a drinking water scenario and/or incidental ingestion and dermal contact during work activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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Conceptual Site Model for ARNG Hangars (Buildings 5010 and 5012), DPW Old Fire Training Area (TA 210, FLW-028), New Fire Training Area (TA 207, FLW-029), Active Fire Station #1 (Building 580), Biosolids Application Field #17 (Landfill 15, FLW-020), Biosolids Application Field #18 (Landfill 2, FLW-002), Biosolids Application Field #2 (Landfill 9, FLW-011), Biosolids Application Field #3 (Landfill 8, FLW-010), and Biosolids Application Field #8 AOPIs

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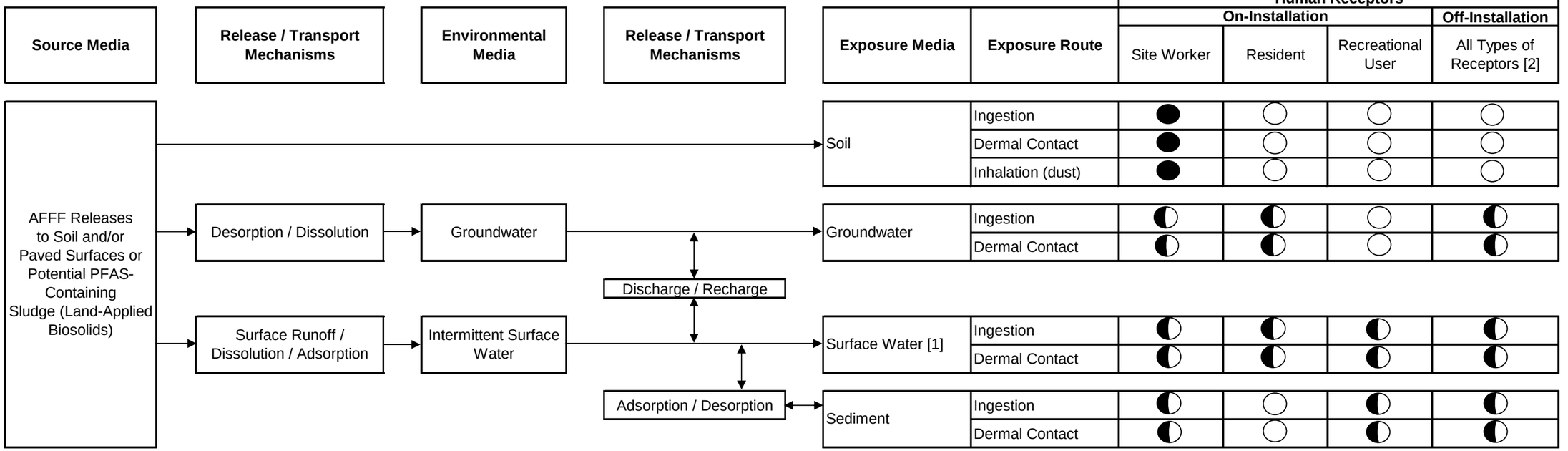
Figure 7-26



Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Acronyms:
AFFF = aqueous film-forming foam
AOPI = area of potential interest
PFAS = per- and polyfluoroalkyl substances

Notes:
The six AOPIs addressed by this CSM are: Old Fire Training Area at Landfill 3 (FLW-053), Old Fire Training Area Runway End (FLW-054), Active Fire Station #2 (Building 5001), Biosolids Application Field #7, Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003), and Biosolids Application Field #21.
[1] Surface water exposure pathway for Residents describes a drinking water scenario and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario. Surface water exposure pathway for Site Workers could describe a drinking water scenario and/or incidental ingestion and dermal contact during work activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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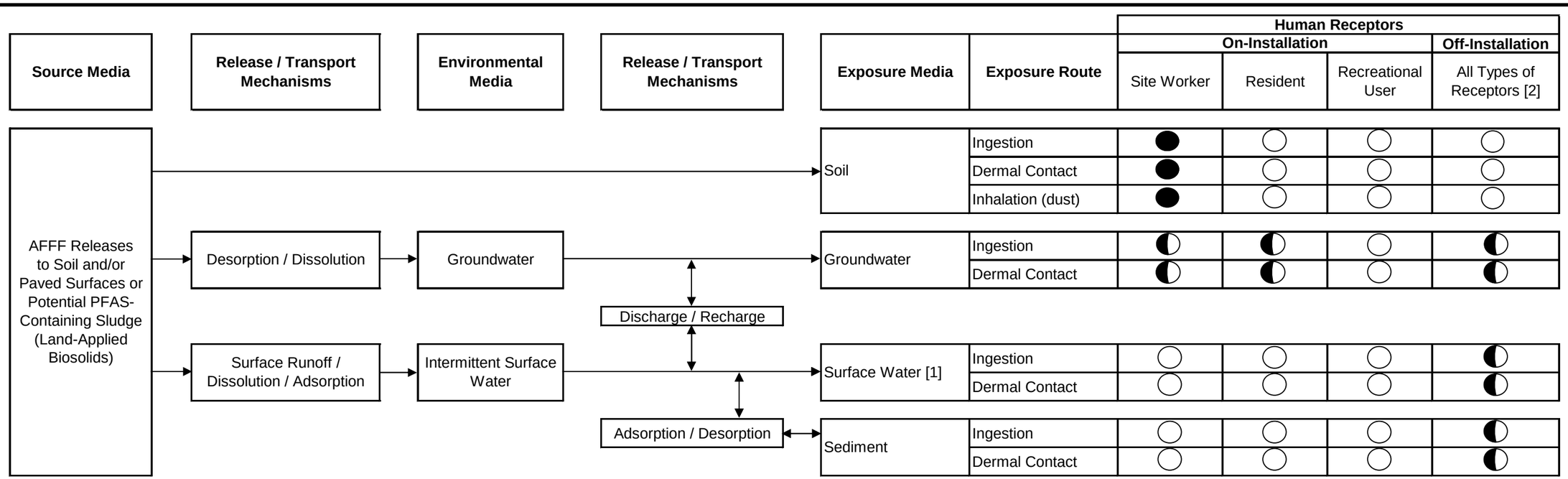
Conceptual Site Model for for Old Fire Training Area at Landfill 3 (FLW-053), Old Fire Training Area Runway End (FLW-054), Active Fire Station #2 (Building 5001), Biosolids Application Field #7, Biosolids Application Fields #9 and #10 (Landfill 3, FLW-003), and Biosolids Application Field #21 AOPIs
USAEC PFAS Preliminary Assessment / Site Inspection

Figure 7-27



Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Acronyms:
AFFF = aqueous film-forming foam
AOPI = area of potential interest
PFAS = per- and polyfluoroalkyl substances

Notes:
[1] Surface water exposure pathway for Residents describes a drinking water scenario and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario. Surface water exposure pathway for Site Workers could describe a drinking water scenario and/or incidental ingestion and dermal contact during work activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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Conceptual Site Model for Former Fire Station #1 (Triangle Station), Former Fire Station #3 (Troop Trail), and Biosolids Application Field #1 (Five STP Landfills, FLW-012) AOPIs
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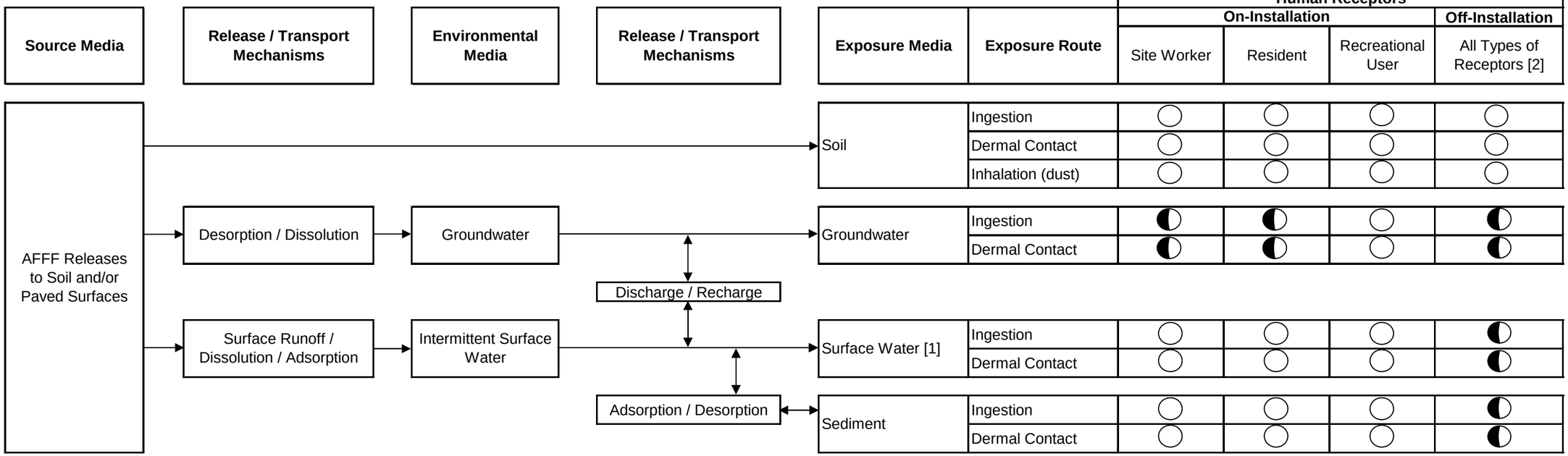
Figure 7-28



Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Acronyms:
AFFF = aqueous film-forming foam
AOPI = area of potential interest

Notes:
[1] Surface water exposure pathway for Residents describes a drinking water scenario and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario. Surface water exposure pathway for Site Workers could describe a drinking water scenario and/or incidental ingestion and dermal contact during work activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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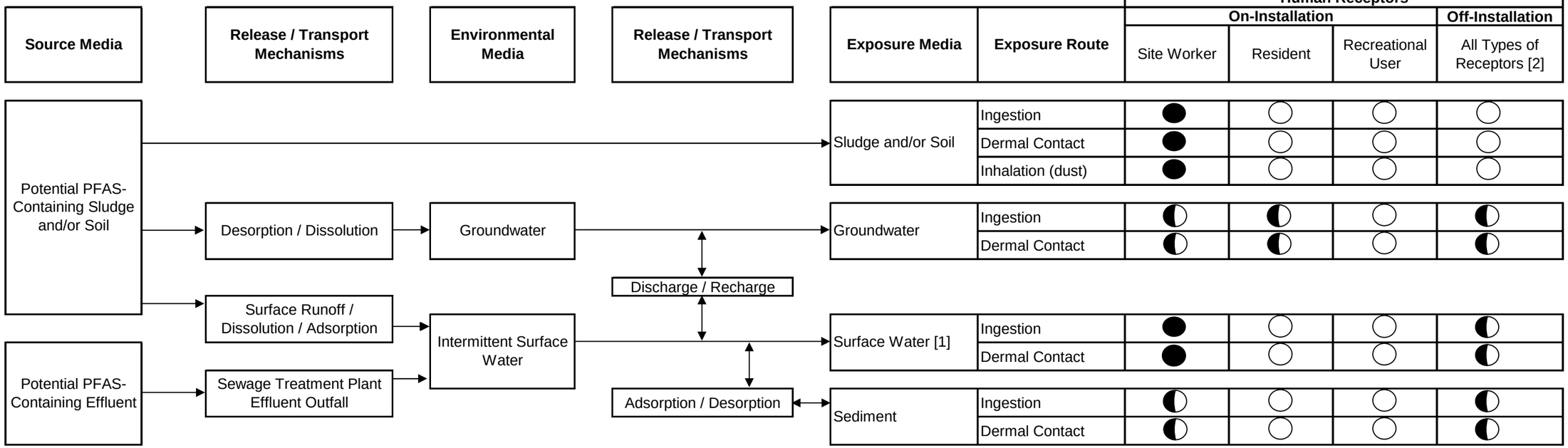
Conceptual Site Model for Former Fire Station #2 (Oklahoma Avenue) AOPI
USAEC PFAS Preliminary Assessment / Site Inspection
Fort Leonard Wood, Missouri

Figure 7-29



Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Acronyms:
AOPI = area of potential interest
PFAS = per- and polyfluoroalkyl substances

Notes:
[1] Surface water exposure pathway for Residents describes a drinking water scenario and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario. Surface water exposure pathway for Site Workers could describe a drinking water scenario and/or incidental ingestion and dermal contact during work activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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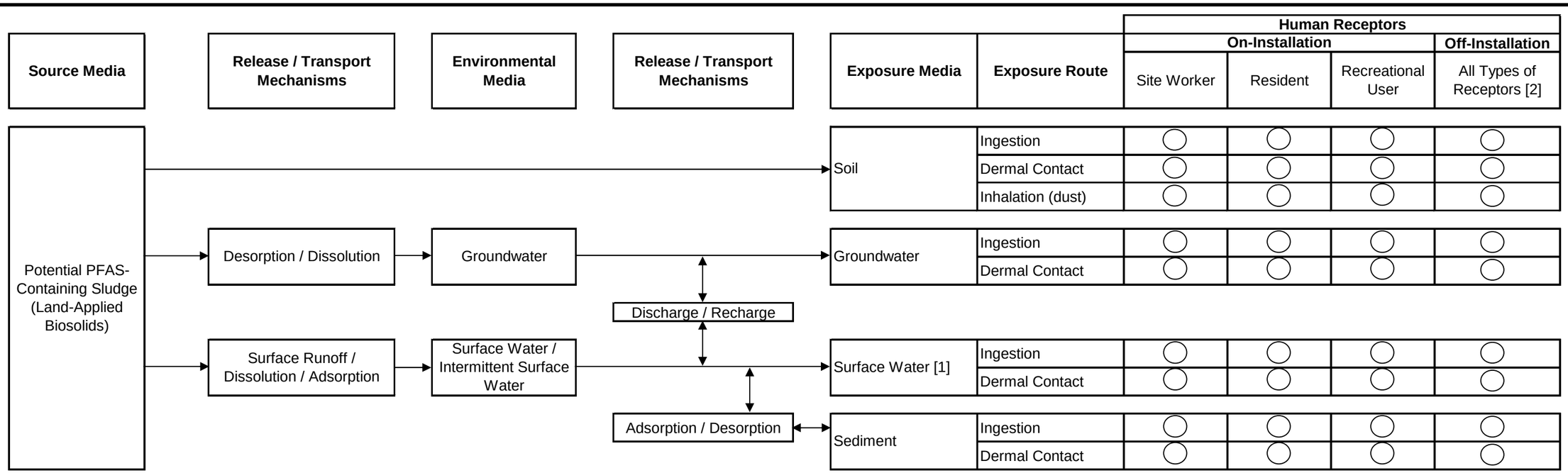
Conceptual Site Model for Sewage Treatment Plant and Lagoons (FLW-024 and FLW-026) AOPI
USAEC PFAS Preliminary Assessment / Site Inspection
Fort Leonard Wood, Missouri

Figure 7-30



Legend:

- = Complete Exposure Pathway
- = Potentially Complete Exposure Pathway
- = Incomplete Exposure Pathway

Acronyms:
AOPI = area of potential interest
PFAS = per- and polyfluoroalkyl substances

Notes:
[1] Surface water exposure pathway for Residents describes a drinking water scenario and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario. Surface water exposure pathway for Site Workers could describe a drinking water scenario and/or incidental ingestion and dermal contact during work activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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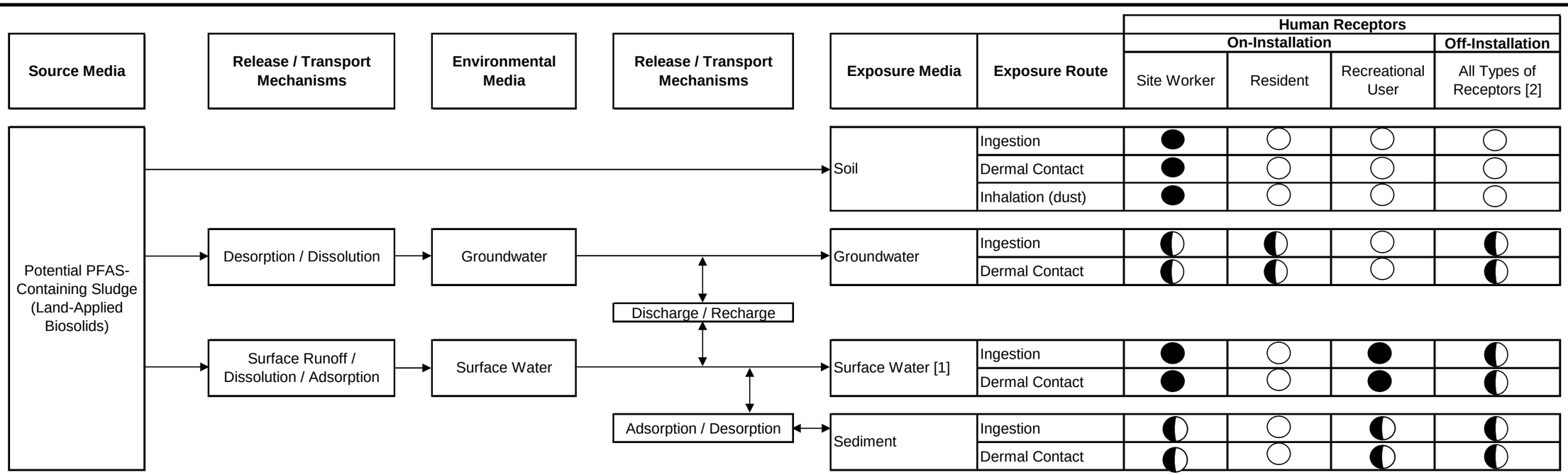
Conceptual Site Model for Biosolids Application Fields #11, #12, #15, and #16 AOPIs
USAEC PFAS Preliminary Assessment / Site Inspection
Fort Leonard Wood, Missouri

Figure 7-31



Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Acronyms:
AOPI = area of potential interest
PFAS = per- and polyfluoroalkyl substances

Notes:
[1] Surface water exposure pathway for Residents describes a drinking water scenario and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario. Surface water exposure pathway for Site Workers could describe a drinking water scenario and/or incidental ingestion and dermal contact during work activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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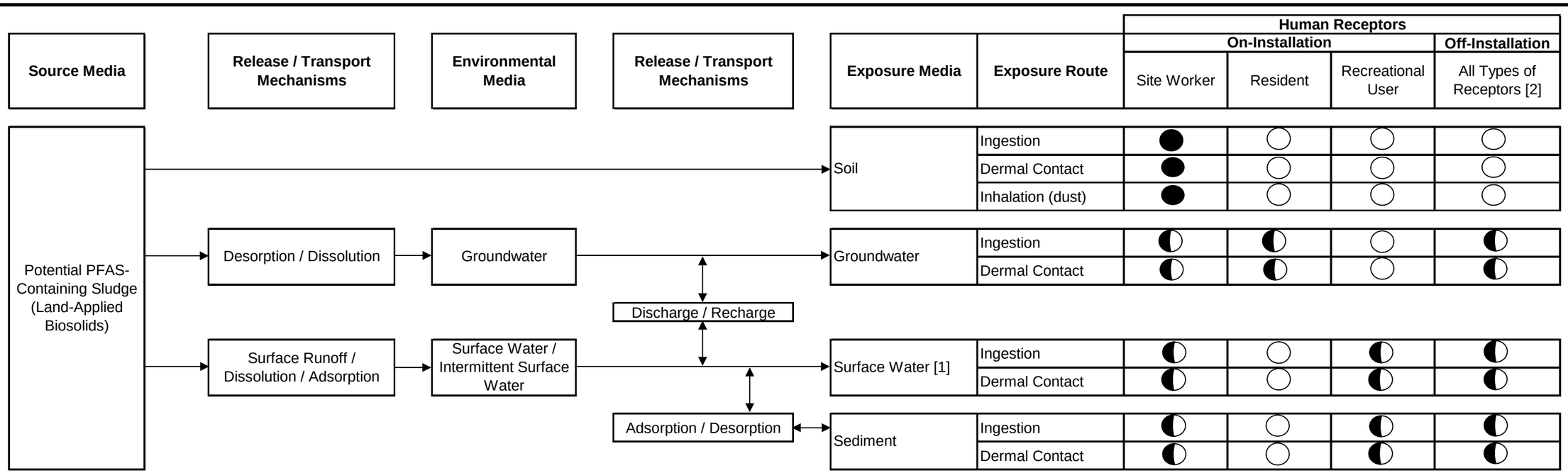
Conceptual Site Model for Biosolids Application Field #5 (Landfill 12, FLW-017) and Biosolids Application Field #22 (Municipal Landfill South of Roubidoux, FLW-059) AOPIs
USAEC PFAS Preliminary Assessment / Site Inspection

Figure 7-32



Legend:

- = Complete Exposure Pathway
- = Potentially Complete Exposure Pathway
- = Incomplete Exposure Pathway

Acronyms:
AOPI = area of potential interest
PFAS = per- and polyfluoroalkyl substances

Notes:
[1] Surface water exposure pathway for Residents describes a drinking water scenario and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario. Surface water exposure pathway for Site Workers could describe a drinking water scenario and/or incidental ingestion and dermal contact during work activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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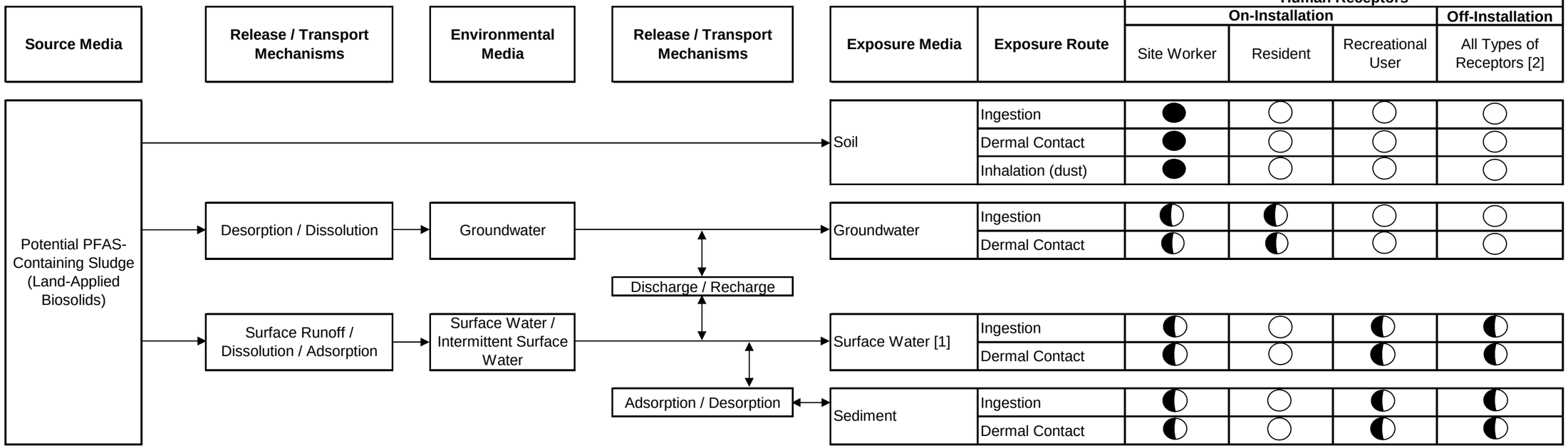
Conceptual Site Model - Biosolids Application Fields #6, #19, #20, and #27A AOPIs
USAEC PFAS Preliminary Assessment / Site Inspection

Figure 7-33



Legend:

● = Complete Exposure Pathway

◐ = Potentially Complete Exposure Pathway

○ = Incomplete Exposure Pathway

Acronyms:
AOPI = area of potential interest
PFAS = per- and polyfluoroalkyl substances

Notes:
[1] Surface water exposure pathway for Residents describes a drinking water scenario and for Recreational Users describes incidental ingestion and dermal contact during an outdoor recreational scenario. Surface water exposure pathway for Site Workers could describe a drinking water scenario and/or incidental ingestion and dermal contact during work activities.
[2] All types of off-installation human receptors include drinking water receptors and recreational users.

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Conceptual Site Model - Biosolids Application Field #13 and Biosolids Application Field #14 AOPIs
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Figure 7-34

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