DRAFT

AREA 3 FIELD SAMPLING PLAN

ADDENDUM TO REMEDIAL INVESTIGATION WORK PLAN FOR PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MA

NOVEMBER 2018

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New England District
Concord, Massachusetts

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Contract No.: W912WJ-18-C-0011

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Draft

Area 3 Field Sampling Plan

Addendum to the Remedial Investigation Work Plan

for Per- and Polyfluoroalkyl Substances (PFAS)

Former Fort Devens Army Installation

Devens, Massachusetts

November 2018

CERTIFICATION:

I hereby certify that the enclosed Report, shown and marked in this submittal, is that proposed to be incorporated with Contract Number W912WJ-18-C-0011. This document was prepared in accordance with the U.S. Army Corps of Engineers (USACE) Scope of Work and is hereby submitted for Government approval.

Reviewed By:

11/19/2018

KGS Project Manager **Date**

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USACE Project Manager **Date**

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ACRONYMS AND ABBREVIATIONS

AFFF	aqueous film-forming foam
AOC	Area of Contamination
bgs	below ground surface
CSM	conceptual site model
Devens	former Fort Devens Army Installation
DOC	dissolved organic carbon
DPT	direct push technology
DQO	data quality objective
FSP	Field Sampling Plan
ft	feet/foot
FTA	fire training area
HERA	Draft Baseline Human Health Risk Assessment and Screening Level Ecological Risk Assessment
IDW	investigation derived waste
KGS	KOMAN Government Solutions, LLC
LHA	lifetime health advisory
LTM	long-term monitoring
MAAF	Moore Army Airfield
MassDEP	Massachusetts Department of Environmental Protection
ng/L	nanograms per liter
PA	Preliminary Assessment
PCE	tetrachloroethene
PFAS	per-and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
RI	Remedial Investigation
SI	Site Inspection
SOP	standard operating procedure
SSL	site-specific screening level
TOC	total organic carbon
TOP	total oxidizable precursor
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
USACE	United States Army Corps of Engineers, New England District
USEPA	United States Environmental Protection Agency
WWTP	waste water treatment plant

1.0 INTRODUCTION AND BACKGROUND

This Field Sampling Plan (FSP) for Area 3 at Former Fort Devens Army Installation (Devens) located in Devens, Massachusetts has been prepared by KOMAN Government Solutions, LLC (KGS) on behalf of the United States Army Corps of Engineers, New England District (USACE) and has been generated as an addendum to the *Draft Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances (PFAS)* (KGS, 2018a). Area 3 consists of Areas of Contamination (AOC) 20, 21, 30, 31, and 50 (Figure 1). The other AOCs and areas of investigation for the Remedial Investigation (RI) will be addressed as part of Area 1 and Area 2 FSPs. Areas 1, 2, and 3 were designated for sequencing of field activities and do not represent prioritization.

A base-wide Preliminary Assessment (PA) for per- and polyfluoroalkyl substances (PFAS) was completed in 2017 (KGS, 2017) that identified several AOCs at Devens where aqueous film-forming foam (AFFF), which is a source of PFAS, was stored, used, or released. A Site Inspection (SI) (BERS-Weston, 2018) and a one-time sampling of existing long-term monitoring (LTM) wells (KGS, 2018b) concluded that PFAS are present in groundwater, surface water, sediment, and soil at several AOCs in Area 3. Therefore, the Army is conducting an RI under the Comprehensive Environmental Response, Compensation, and Liability Act to determine the nature and extent of PFAS in groundwater, soil, surface water, and sediment at AOCs 20, 21, 30, 31, and 50 at Devens to determine whether sources at Devens are impacting public water supply wells, and to evaluate whether PFAS are present in environmental media at Devens at concentrations that pose an unacceptable risk to human health or the environment.

2.0 OBJECTIVES

The purpose of this FSP is to provide the sampling design and rationale associated with each AOC for Area 3 and is intended to be used in conjunction with the RI Work Plan (KGS, 2018a) and the project Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) [Appendix A of the RI Work Plan (KGS, 2018a)]. This FSP has been developed to support the study goals, questions and decision statements summarized in Worksheet #11 (Data Quality Objectives) of the UFP-QAPP. The PFAS UFP-QAPP worksheets referenced in this FSP are provided in Appendix A. A conceptual site model (CSM) for the presence of PFAS in the environment at Devens and potential exposure pathways are provided in Section 3 of the RI Work Plan. AOC-specific CSM details are provided in Section 5.0 of this FSP.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The organizational structure for the PFAS RI at Devens is provided in combined Worksheet #3 and #5 (Project Organization and UFP-QAPP Distribution) of the UFP-QAPP. Personnel qualifications for key project personnel are summarized on combined Worksheet #4, #7, and #8 (Personnel Qualifications). Communication pathways are provided in Worksheet #6 (Communication Pathways).

4.0 GENERAL REMEDIAL INVESTIGATION APPROACH

This section provides a general overview of the RI approach at Area 3. A discussion of the CSM and data quality objectives (DQO) for PFAS at each AOC as well as figures and tables that provide the sampling plan for each AOC, are provided in Section 5.0 of this FSP. Requirements for collection of field quality control samples are discussed in Section 6.0. A listing of field standard operating procedures (SOP) applicable to the Area 3 investigation is provided in Section 7.0. Sample packaging and shipping requirements are summarized in Section 8.0. Management of investigation-derived waste (IDW) is summarized in Section 9.0 and processes for field assessment and corrective actions are presented in Section 10.0.

Field work in RI Area 3 will be conducted using an approach that will allow for timely collection, receipt, and review of data that will be incorporated into the CSM for each AOC and that will help guide additional field activities, if needed. The investigation program is intended to be dynamic such that the proposed activities will be completed, and the results provided and discussed with the U.S. Environmental Protection Agency (USEPA) and Massachusetts Department of Environmental Protection (MassDEP) to expedite selection and implementation of additional activities needed to achieve the study goals and DQOs specified in UFP-QAPP Worksheet #11 (Data Quality Objectives) at Area 3 (Appendix A). A scoping meeting was conducted on October 11, 2018 to discuss sampling locations with the stakeholders for Area 3.

4.1 Evaluation of Previous PFAS Results

The PFAS groundwater and soil data obtained during the SI (BERS-Weston, 2018) and a one-time sampling of existing LTM wells (KGS, 2018b), were used to develop the sampling plan for Area 3. Environmental media sampled for PFAS analysis within Area 3 during the SI and LTM sampling events consisted of groundwater samples that were collected from either existing monitoring wells or temporary well points installed at the water table and removed after sampling. Soil samples were collected from potential source areas associated with AOCs 20, 21, 30, 31, and 50. Two surface water and sediment samples were collected in Area 3. These samples were collected from a drainage swale located near AOC 50.

Historic PFAS groundwater results at Area 3 AOCs are compared to the USEPA Lifetime Health Advisory (LHA) of 70 nanograms per liter (ng/L) for the sum of perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA).

4.2 Groundwater Investigation

Groundwater monitoring wells from previous investigations are present at AOCs 20, 21, and 50. Whenever possible, existing monitoring wells will be utilized to provide data regarding the extent of PFAS in groundwater. The existing groundwater monitoring well network will be augmented with groundwater vertical profile sampling ("profiling") involving direct push technology (DPT) and/or possibly sonic drilling technology, both of which are proven to provide representative groundwater samples that will support the objectives of this RI, as outlined in Section 2.0 of the RI Workplan (KGS, 2018a). The groundwater vertical profiling will be conducted in conjunction with sampling of existing monitoring wells to delineate PFAS groundwater contamination vertically and laterally in the aquifer.

During the RI, piezometers will be installed at the water table and will be used to provide depth to water measurements to calculate local groundwater flow direction at areas of Area 3 that have little or no groundwater monitoring well coverage.

A detailed discussion of groundwater sampling activities planned within Area 3 is provided in Section 5.0 of this FSP.

4.3 Soil Investigation

Surface and subsurface soil samples will be collected for PFAS analysis from the unsaturated zone to identify and/or confirm the location of potential PFAS source areas that have been tentatively identified at AOCs 20, 21, 30, 31, and 50. The additional soil data collected during this RI will be reviewed to confirm the presence of soil contamination at potential Area 3 source areas. A detailed discussion of soil sampling activities planned in Area 3 is provided in Section 5.0 of this FSP.

4.4 Surface Water and Sediment Investigation

A network of collocated surface water and sediment samples has been developed for Area 3 aquatic settings. The locations and number of samples within each aquatic system were selected to determine if PFAS are present in areas most likely to be impacted by PFAS originating (either through groundwater discharge or overland flow of contaminated surface soils and/or AFFF) from the Area 3 AOCs.

If PFAS are detected in surface water and/or sediment at concentrations that represent a potential risk to human health and the environment (i.e., concentrations greater than the USEPA SSLs [USEPA, 2018] or ecological screening levels presented in the Draft Baseline Human Health Risk Assessment and Screening Level Ecological Risk Assessment (HERA) Work Plan [KGS, 2018d]), then additional sampling of surface water and sediment may be conducted near areas of potential risk that were identified. A detailed discussion of surface water and sediment samples to be collected within Area 3, as well as at background pond and river locations is provided in Section 5.0.

4.5 Initial Data Review

The results from groundwater vertical profiling, soil sampling, sampling of existing monitoring wells, and surface water and sediment sampling at Area 3 will be evaluated in coordination with USEPA and MassDEP to determine if the vertical and lateral extent of PFAS in environmental media have been adequately delineated. If significant data gaps are identified in order to delineate the extent of PFAS contamination, then additional field activities will be completed to address data gaps. If additional potential point sources or secondary sources, such as sewer lines and storm water drainage systems are identified through review of the results, then additional groundwater vertical profiling and/or soil sampling may be completed to further delineate the nature and extent of PFAS related to these potential sources.

4.6 Monitoring Well Installation

The Army plans to install overburden monitoring wells in Area 3 following a review of the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring wells, which will aid in determining the location and screen settings of the permanent monitoring wells. Potential well locations are identified on figures; however, final locations will be determined based on profiling data review and discussion with the regulatory agencies. The PFAS groundwater monitoring network will be designed to monitor PFAS concentrations within and bounding potential plumes identified through the groundwater vertical profiling and existing monitoring well sampling effort associated with this RI. The wells will be installed through drive and wash drilling.

During advancement of borings for permanent monitoring well installations, continuous soil cores from the water table to the bottom of the boring will be logged for field lithologic classification at select locations and select soil samples will be collected from the saturated zone. This logging/sampling will provide for further evaluation of hydrogeology and PFAS fate and transport. In addition to field descriptions of soil characteristics, a select subset of soil samples will be collected for grain size, total organic carbon (TOC), and total oxidizable precursor (TOP) assay analysis. These borings and well installations will be advanced using DPT, sonic, and/or drive and wash with split spoons drilling technology. These technologies provide for continuous soil logging and sampling, as needed during borehole advancement. A detailed discussion of soil samples to be collected during monitoring well installation is provided in Section 5.0 of this FSP.

4.7 Baseline Sampling of New Monitoring Wells

After new monitoring wells are installed, developed and surveyed, a synoptic water level measurement event will be conducted to evaluate groundwater flow in the vicinity of each Area 3 AOC. The synoptic water level event will involve measurements at a combination of new and existing monitoring wells. The specific wells for the synoptic water level event will be identified after the locations and screen settings of the new monitoring wells are determined. In addition, one round of groundwater samples will be collected from the new monitoring wells and analyzed for PFAS. A subset of samples from select wells in areas of high PFAS concentrations will also be sampled for dissolved organic carbon (DOC) and TOP assay analysis to assess the potential for total PFAS mass in each sample to biotransform into fully fluorinated PFAS compounds including PFOS and PFOA. These data will be used to assess the potential for continuing sources.

4.8 Sampling of Water Supply Wells

Sampling of public or private water supply wells may be completed in support of the RI, if during completion of the above RI activities, potential migration pathway to public or private water supply wells located beyond Devens is identified.

5.0 FIELD ACTIVITIES BY AREAS OF CONCERN

5.1 AOC 20/21

5.1.1 Introduction/ Conceptual Site Model Discussion

The Devens Waste Water Treatment Plant (WWTP) is situated in the former North Post area southwest of the Nashua River and former Moore Army Airfield (MAAF) (Figures 1 and 2). Municipal and industrial wastewater undergoes pretreatment in the WWTP before it is pumped to three Imhoff tanks, a dosing tank, and then applied to rapid infiltration beds (AOC 20). Waste water treated at the WWTP is derived primarily from domestic sources, with less than 1% of total flow derived from industrial sources such as, vehicle rack wash discharge, caustic radiator wash water, heating plant boiler blow down, swimming pool filter back wash and floor drains (KGS, 2017). There is no evidence that storm drains at the former MAAF were connected to the sanitary sewer system based on information reviewed on the subject (ADL, 1994; KGS, 2018a).

A detailed discussion of site history and operations for the Devens WWTP is provided in the RI Work Plan (KGS, 2018a). In general, treated water is returned to the glacial overburden aquifer through discharge to the plant infiltration beds, which are used on a rotational basis. Plant operations and maintenance did not consider PFAS in the past, therefore treatment plant effluent discharged to the infiltration beds may have contained dissolved phase PFAS (either as a steady state or in intermittent periods), which then migrated down through the vadose zone and entered

the groundwater beneath the infiltration beds. Infiltration rates at the WWTP beds are reportedly 25-28 meters/year (ANL, 1992). Infiltrated water likely creates a hydraulic mound, resulting in localized radial groundwater flow beneath the infiltration beds. However, infiltrated water ultimately migrates in the direction of regional groundwater flow, which is to the east/northeast, toward the Nashua River.

Sludge from the Imhoff tanks is drained to four uncovered drying beds (AOC 21) two to three times annually (KGS, 2018a). These drying beds were equipped with clay pipe underdrains that collected supernatant, which prior to 1982 was discharged to the east bank of the Nashua River. After 1985, supernatant was collected and pumped back to an infiltration basin (KGS, 2018a). However, the clay pipe underdrains have reportedly collapsed over the years and supernatant from the sludge drying beds currently infiltrates into the permeable subsurface beneath AOC 21 (KGS, 2018a), migrates downward through the vadose zone and enters the overburden aquifer to migrate to the east, toward the Nashua River.

No specific information related to the disposal of AFFF or cleaning of firefighting equipment to the sanitary sewer system was identified during the PA (KGS, 2017) and storm water sewers at the former MAAF are not connected to the sanitary sewer system (ADL, 1994). However, the Devens WWTP was identified as a potential source of Army PFAS due to the potential for past disposal of AFFF compounds via the municipal sewer system and the WWTP was not designed or operated to remove PFAS (KGS, 2017). Therefore, AOCs 20 and 21 were included in the SI (BERS-Weston, 2018).

5.1.2 Previous PFAS Sampling

Three soil samples collected from 0-5 feet (ft) below ground surface (bgs), six groundwater samples collected at the water table, and WWTP influent and effluent samples were collected for PFAS analysis during the SI (BERS-Weston, 2018). Groundwater samples were collected from the water table from three existing monitoring wells and from three temporary well points that were located downgradient and to the east of AOCs 20 and 21, between the WWTP infiltration beds and the Nashua River (Figure 2). The sum of PFAS in groundwater exceeded the USEPA LHA of 70 ng/L at all six locations. Influent and effluent water samples from the WWTP did not exceed the LHA.

No surface water or sediment samples were collected from surface water body features near AOCs 20 and 21 during the SI.

5.1.3 Remedial Investigation Approach/Sampling Plan

The remedial investigation for PFAS at AOCs 20 and 21 entails sampling existing monitoring wells located downgradient, upgradient and cross gradient to the Devens WWTP infiltration beds and sludge drying bed to delineate the extent of PFAS in groundwater. The existing monitoring well network will be augmented with groundwater vertical profile borings that will be advanced to better define the vertical and lateral extent of PFAS in groundwater at these AOCs. Soil borings will also be advanced to collect soil samples throughout the vadose zone (including within 2 ft of the water table) to determine if PFAS are present in vadose zone soils at concentrations that represent a risk to human health and the environment. Surface water and sediment samples will be collected from the Nashua River and nearby wetland water bodies. Details on the sampling plan for AOCs 20 and 21 are provided below.

5.1.3.1 Groundwater Sample Collection

A network of existing monitoring wells will be sampled for PFAS analysis to further define the vertical and lateral distribution of PFAS in groundwater. The locations of monitoring wells to be sampled for PFAS analysis are identified on Figure 2. A listing of existing wells at AOCs 20/21 to be sampled during the RI, including well construction information, is provided in Table 1. The sampling nomenclature and analytical scope for existing monitoring wells is provided in Table 2.

Groundwater samples will be collected from existing monitoring wells for PFAS analysis using standard operating procedures specified in Section 6.0 of this FSP and Worksheet #21 of the UFP QAPP (Appendix A). Field quality control samples, such as field duplicate and field blanks will be collected at a frequency as specified in Worksheet #20 of the UFP-QAPP (Appendix A).

5.1.3.2 Groundwater Vertical Profiling

Monitoring well data collection will be followed by groundwater vertical profiling. Twelve vertical profiles are planned at AOCs 20/21. The proposed locations are shown in Figure 2 and the rationale for each groundwater vertical profile boring is provided in Table 3.

Groundwater vertical profile samples will be collected in 10-ft intervals from water table to refusal or the bedrock surface. The depth to water will be measured in accordance with field procedure SOP-F002 (Worksheet # 21 of the UFP-QAPP, Appendix A) at nearby monitoring wells and depth to bedrock will be estimated based on the results of previous investigations at Devens. If refusal is encountered significantly shallower than the anticipated depth to bedrock, one 10-ft step out boring will be advanced. The sampling nomenclature, anticipated depths, and analytical scope for each groundwater vertical profile are summarized in Table 4.

Groundwater samples will be collected during advancement of the vertical profiling borings using field procedure SOP-F014 (Direct Push Technology) and SOP-F003 (Groundwater Sampling) and SOP-F009 (PFAS Sampling) as listed in Section 6.0 of this FSP and Worksheet #21 of the UFP QAPP. Field quality control samples, such as field duplicate and field blanks will be collected at a frequency as specified in Worksheet #20 of the UFP-QAPP (Appendix A).

Two piezometers will be installed at the water table to the west of AOC 20 to provide depth to water measurements to the west of AOC 20. The piezometers will be surveyed, and a synoptic water level survey along with existing monitoring wells at AOCs 20 and 21 will be performed. The synoptic water level survey will be used to assist in placement of monitoring wells, and additional vertical profiling locations if they are needed. The proposed location for the two new piezometers are shown on Figure 2.

5.1.3.3 Soil Sample Collection

Eleven soil borings will be advanced at AOCs 20/21 (Figure 2). Three soil borings will be advanced in the sludge drying beds (AOC 21) and eight soil borings will be advanced within the sand infiltration beds (AOC 20). Soil borings will be advanced to characterize the vertical and lateral extent of PFAS contamination in unsaturated soil within the footprint of each AOC (Figure 2).

Vadose zone soil samples will be collected from the following depth intervals and submitted for PFAS analysis by isotope dilution (analyte list in QAPP Worksheet #15).

- 0-0.5 ft bgs
- 0.5-3 ft bgs
- 3-7 ft bgs
- 7-15 ft bgs

Soil samples will also be collected within 2 ft of the water table at three borings within AOC 20 and one boring within AOC 21 to provide additional data for evaluating a potential leaching threat to groundwater. The WWTP sludge was uniformly applied across the relatively small footprint of AOC 21 and likely resulted in a similar loading rate of PFAS to the vadose zone at this AOC. Additionally, PFAS from WWTP effluent are expected to have been uniformly distributed across the infiltration beds over time. Therefore, collection of a soil sample within 2 ft of water table sample at one location at AOC 21 and three locations at AOC 20 will provide PFAS data that is representative of conditions near the water table at each AOC.

If the water table is encountered at a depth less than 17 ft bgs in any of the soil borings, then the final soil sampling interval at the boring will be shortened by the appropriate amount to collect a separate 2-ft sample just above the water table to assess leaching threat to groundwater. The final depth of a soil sampling intervals will end at the water table at borings where the water table is less than 15 ft bgs. The sampling nomenclature, anticipated depths, and analytical scope for each soil boring planned at AOCS 20/21 are provided in Table 5.

Additional soil borings may be advanced after review of the groundwater and soil data to further delineate the nature and extent of PFAS contamination in the soil. Additional soil borings may also be advanced after review of the soil data in areas of high PFAS concentrations in soil to assist in the assessment of a potential continuing source of PFAS to groundwater. The location of additional soil borings, if needed, and the target depth of sample collection will be determined after review of the soil data.

5.1.3.4 Surface Water and Sediment Sampling

Surface water and sediment samples will be collected at AOCs 20 and 21. The surface water and sediment sampling plan for all of Area 3 is provided in Section 5.3 of this document.

5.1.3.5 Monitoring Well Installation

An overburden monitoring well network for PFAS will be developed for AOCs 20 and 21. The PFAS groundwater monitoring network at AOCs 20 and 21 will entail the use of existing monitoring wells that will be augmented with installation of new monitoring wells. For planning purposes, up to four new overburden monitoring wells will be installed at AOCs 20 and 21. The rationale for installing new monitoring wells at AOCs 20 and 21 is provided in Table 6. Tentative locations for the new monitoring wells are shown on Figure 2. However, monitoring well installation will be completed following a review of the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring wells; the final location and screen settings of the permanent monitoring wells will be reviewed with the USEPA and MassDEP and will be based on that data. The monitoring well network will be designed to monitor PFAS contamination in groundwater at AOCs 20 and 21 as well as provide bounding locations to demonstrate the limits of PFAS contamination in groundwater.

During advancement of the monitoring well borings, soil cores will be collected from the water table to the bottom of the boring for field lithologic classification at select locations and a subset of samples collected from potential screen setting elevations at new monitoring wells placed within the plume will be collected for grain size, TOC, and total oxidizable precursor (TOP) assay analysis (Table 7). Confirmation of the depth to the top of bedrock may also be conducted, where it is an identified data gap after review of the vertical profiling data and previous bedrock elevation data from other investigations.

5.1.3.6 Baseline Sampling of New Monitoring Wells

New monitoring wells will be sampled after installation. The samples will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15). Samples from selected wells (approximately two per AOC) located within areas of high PFAS concentrations will be analyzed for PFAS via the TOP assay and for DOC. The new monitoring wells to be sampled along with the sampling nomenclature and analytical scope are provided in Table 8.

As discussed in Section 4.7, after new monitoring wells are installed, developed and surveyed, a synoptic water level measurement event will be conducted to evaluate groundwater flow in the vicinity of AOCs 20 and 21. The synoptic water level event will consist of measuring depth to water at a combination of new and existing monitoring wells. The specific wells for the synoptic water level event will be identified after the locations and screen settings of the new monitoring wells are determined.

5.2 AOCS 30, 31, AND 50

5.2.1 Introduction/Conceptual Site Model Discussion/Previous PFS Sampling

There are several areas where AFFF may have been stored, applied, or released to the environment that have been identified at the former MAAF or where PFAS has been detected in soil, sediment, surface water and groundwater (BERS-Weston, 2018). Therefore, the RI will entail evaluating the nature and extent of PFAS in soil, groundwater, sediment, and surface water at the following areas shown on Figures 3 through 7. Figure 5 provides an overview of the entire former MAAF.

- AOC 30 – Former Drum Storage Areas
- AOC 31 – Former Fire Training Area
- AOC 50 tetrachloroethene (PCE) plume and associated source area
- Former airfield hangars (Buildings 3813 and 3815)
- Former Devens Fire Station
- Former sludge application areas
- Downgradient of areas listed above

A discussion of the history is provided in the RI Workplan (KGS, 2018a). A brief description of AFFF usage, the CSM and previous PFAS sampling results associated with the former MAAF is provided below. The remedial approach and sampling plan is provided in Section 5.2.2 of this document.

AOC 30 – Former Drum Storage Areas

The former Drum Storage Area located in the former North Post area at the former MAAF is comprised of two locations north of the main airfield runway (Figure 3). Interviews conducted with people associated with previous site activities indicated that AFFF may have potentially been stored in 55-gallon drums and used for firefighting training at AOC 31 (KGS 2017).

PFAS originating from spills or leakage from drums may have entered the vadose zone soils and migrated to groundwater. Due to a lack of monitoring wells at this AOC, groundwater direction has not been measured, but based on a review of site topography and proximity to the Nashua River, is assumed to the north/northwest, toward the Nashua River.

Six groundwater samples were collected from the water table at temporary points advanced at AOC 30 during the SI (BERS-Weston, 2018). The sum of PFOS and PFOA exceeded the USEPA LHA at five of the six locations (Figure 3). Soil samples were collected from 0-5 ft bgs at each of the temporary points advanced during the SI (Figure 3). No surface water or sediment samples were collected from the Nashua River during the SI.

AOC 31 – Fire Training Area

AFFF was historically used during firefighting training exercises conducted between 1975 and 1986 within a bermed area at the end of an abandoned runway (KGS, 2018a). The fire training area (FTA) consists of a 50 x 50-ft asphalt covered concrete pad that is approximately 8-inches thick. The pad is surrounded by a 12-inch high by 24-inch wide earthen containment berm (Figure 4).

AFFF that was released to the ground during fire training exercises may have migrated through the vadose zone to groundwater. Due to the lack of monitoring wells at this AOC, groundwater direction at AOC 31 has not been measured, but based on a review of the site topography and proximity to the Nashua River, is assumed to be to the west/southwest, toward the Nashua River.

Groundwater samples were collected during the SI and during LTM sampling (KGS, 2018b) at one temporary well point installed within the FTA, at five locations potentially downgradient of the FTA, and at four monitoring wells (associated with the AOC 50 LTM program) crossgradient and potentially downgradient of the FTA (Figure 4). The sum of PFOS and PFOA exceeded the LHA at nine locations with a maximum sum of PFOS and PFOA reported within the footprint of the former FTA. Soil samples were collected from 0-5 ft bgs at five locations within the former FTA. No surface water or sediment samples were collected from the Nashua River during the SI.

AOC 50 PCE Plume Area, Former MAAF, Former Devens Fire Station and Hanger Buildings

In addition to AOCs 30 and 31, other areas within the former MAAF were identified during the PA (KGS, 2017) that may have had storage, use, or releases of AFFF. These other areas at the former MAAF include the former Devens Fire Station, Hangar Buildings 3818 and 3813, and historic airfield operations as described below. Also, sludge from the Devens WWTP was applied to portions of the former MAAF (Figure 5).

- Although there were no documented airplane crashes (or associated responses with AFFF) on the main runway, it is noted that the main airfield runway may have been foamed during firefighting and crash training exercises (KGS, 2018a).

- There is no documentation of AFFF being used in the fire suppression systems at the former hangar buildings (Buildings 3813 and 3818). However, AFFF may have been stored in the former hangar area during the operational period of the airfield (KGS, 2018a).
- AFFF concentrate was also reportedly stored in 5-gallon pails and within firefighting equipment stored at the former MAAF Fire Station.
- Dried sludge from the Devens WWTP (AOC 21) was periodically spread on the ground surface at AOC 50. The area of historic sludge disposal to the ground surface at former MAAF was reportedly along the southwestern side of the main runway and in a triangular area of grass located in the center of the airfield.
- While there was no documented usage or storage of AFFF at the AOC 50 PCE plume source area identified during the PA (KGS, 2017) or SI (BERS-Weston, 2018), a one-time sampling of select existing monitoring wells for PFAS was conducted (KGS, 2018b).

Groundwater flow direction under the former MAAF is generally toward the Nashua River, which is the main surface water body that occupies the topographic low in the region (i.e., Nashua River drainage basin). In the vicinity of the AOC 50 PCE plume and the former hangar buildings, groundwater flow has been routinely measured to be to the southwest between State Route 2A and the Nashua River (ARCADIS, 2004 and KGS, 2018c) (Figure 5). Groundwater flow direction has not been measured in the other areas of the former MAAF due to a lack of monitoring wells in those areas. However, based on a review of site topography and proximity to the Nashua River, groundwater flow in the southeastern portion of the former MAAF is assumed to be to the southwest while groundwater flow direction to the west of AOC 50 plume and former hangar buildings is assumed to be to the west/northwest toward the Nashua River.

Groundwater and soil samples were collected near the former hangers, former Fort Devens Fire Station, as well as locations around the flight line during the SI (BERS-Weston, 2018) and the one-time sampling of existing LTM wells (KGS, 2018b) located in the same areas and near AOC 31. Of the 28 locations sampled for groundwater, 16 locations had a sum of PFOS and PFOA that exceeded that USEPA LHA. A maximum sum of PFOS and PFOA was detected in groundwater near the former air field hanger Building 3818 (Figure 7). Soil samples were collected from 0-5 ft bgs at seventeen locations, including five of the flight line storm water outfalls. Collocated surface water and sediment samples were collected from two locations at an unnamed stream that drains the wetland located to the west of the former MAAF (Figure 4).

5.2.2 Remedial Investigation Approach/Sampling Plan

Due to the close proximity of potential sources of AFFF it is likely that PFAS groundwater contamination from one or more of these potential source areas resulted in a single, commingled area of PFAS groundwater contamination. Therefore, the remedial investigation approach at the former MAAF is to define the extent of PFAS contaminated groundwater around the edge of the airfield with some groundwater and soil sampling to be completed near the potential source areas to confirm the presence of potential sources within the former MAAF. Surface water and sediment sampling will also be completed to assess if PFAS are present in the wetland located to the west of the former MAAF and along the Nashua River that is adjacent to the former MAAF. A PFAS groundwater monitoring network will be developed based on the results of the RI sampling. Details on the sampling plan for AOCs 30, 31, and 50 at the former MAAF are provided below.

5.2.2.1 Groundwater Sample Collection

A network of monitoring wells has been selected within the AOC 50 PCE plume and associated source area for sampling for PFAS. The locations of monitoring wells to be sampled at AOC 50 are shown on Figures 4 through 7. A listing of monitoring wells to be sampled at AOC 50 along with the sampling nomenclature and analytical scope are summarized in Table 2 and well construction information is provided in Table 9.

Groundwater samples will be collected from existing monitoring wells for PFAS analysis using standard operating procedures specified in Section 6.0 of this FSP and Worksheet #21 of the UFP QAPP. Field quality control samples, such as field duplicate and field blanks will be collected at a frequency as specified in Worksheet #20 of the UFP-QAPP (Appendix A). Groundwater samples will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15). The sampling nomenclature and analytical scope for existing monitoring wells is provided in Table 2.

5.2.2.2 Groundwater Vertical Profiling

Monitoring well data collection will be augmented by groundwater vertical profiling at new locations. Nineteen groundwater vertical profiles are planned for the former MAAF. The locations of the groundwater vertical profiles are shown on Figures 3 through 7. Due to the close proximity (i.e., former hangar and fire department buildings) and/or overlapping nature of potential source areas (i.e., sludge disposal over portions of the airfield) at the former MAAF it is likely that a single commingled area of PFAS groundwater contamination is present beneath the former MAAF. Therefore, locations of groundwater vertical profile borings were selected to primarily provide data on the vertical and lateral extent of PFAS in groundwater along and downgradient of the edge of the former MAAF. Locations were also selected to provide PFAS data in groundwater at and downgradient of one or more potential source areas identified within the former MAAF in an effort to determine if these areas are potential sources of PFAS groundwater contamination observed at the former MAAF.

Figures 3 through 7 show proposed vertical profile locations at the former MAAF. The rationale for each groundwater vertical profile boring is provided in Table 3. A generalized rational for boring placement is provided below.

- Four vertical profiles are planned in the vicinity of AOC 30 (Figure 3). The locations of these groundwater vertical profile borings at AOC 30 were selected to provide PFAS data in groundwater within, downgradient and cross gradient of the former drum storage areas. Groundwater samples will be collected in 10-ft intervals from the water table to bedrock.
- Eight vertical profiles are planned near AOC 31 (Figures 4 and 5). One profile will be advanced within the FTA, three profiles will be advanced along a transect that is generally perpendicular to groundwater flow downgradient of the FTA at the edge of the airfield and one will be advanced on the west side of the Nashua River to determine if PFAS are present in groundwater on the west side of the river. Groundwater vertical profiling at these five locations will be completed in 10-ft intervals from the water table to bedrock. Three groundwater vertical profiles will also be advanced east of the Nashua River in the flood

plain[1]. Groundwater vertical profiling at these three locations will be completed in 10-ft intervals from the water table to refusal.

- Two vertical profiles are planned east of AOC 31 and west of the AOC 50 PCE plume (G6M-18-01 and -02) (Figures 4 and 5). These two profiles were conducted as part of the AOC 50 LTM program in October 2018 and samples were split for PFAS analysis. Groundwater vertical profiling at these two locations were completed in 10-ft intervals from the water table to bedrock.
- Thirteen groundwater vertical profile borings are planned for other areas of the former MAAF (Figures 5 through 7).
  - Three groundwater vertical profiles (50VP-19-01 through -03) will be advanced to the north of the AOC 50 PCE plume source area to determine the vertical extent of PFAS in groundwater north of the PCE plume source area. Samples will be collected in 10-ft intervals from the water table to bedrock (Figure 6).
  - Three vertical profiles (50VP-19-04 through -06) will be advanced along an anticipated groundwater flow path at locations that are upgradient of, within and downgradient of the former hangar buildings and fire station. Groundwater samples will be collected in 10-ft intervals from the water table to bedrock (Figure 7).
  - Two vertical profiles will be advanced in the downgradient area of AOC 50 (50VP-19-07 and -08). Borings will be advanced near existing monitoring wells with screens located at the bottom of the overburden aquifer. Therefore, vertical profiling at these two locations will be in 10-ft intervals from the water table to the top of existing monitoring well screens (Figure 4).
  - Four vertical profiles (50VP-18-09 through -12) are planned for the southeastern portion of the former MAAF. One of the locations is within the former sludge application area (50VP-19-10) and three are located along the eastern perimeter of the former MAAF and are expected to serve as potential bounding locations for PFAS groundwater contamination at the former MAAF (Figure 5).
  - One vertical profile is planned for the western portion of the former MAAF (50VP-19-13), generally between AOCs 30 and 31 (Figure 5).

During groundwater vertical profiling, the depth to water will be measured in accordance with field procedure SOP-F002 (Worksheet # 21 of the UFP-QAPP, Appendix A) at nearby monitoring wells and depth to bedrock will be estimated based on the results of previous remedial

[1] Due to steep topography and presence of sensitive wetland habitats, access to the floodplain area between airfield and the Nashua River with a drill rig would be extremely difficult. Therefore, the three groundwater vertical profile borings located on the eastern side the Nashua River in the flood plain will be advanced using hand-held tooling, such as an air-percussion hammer drill or similar. Vertical profiling of groundwater to bedrock will not likely be achieved using hand-held drilling technology, however it is anticipated that this technology can achieve adequate depth to determine if PFAS are present in shallow groundwater adjacent to the Nashua River. This data, in conjunction with the groundwater vertical profiling completed on the airfield and on the west side of the river, will provide sufficient data to characterize PFAS in groundwater that is downgradient of AOC 31 in the vicinity of the Nashua River. The rods will be left in place at the maximum depth achieved for use as a groundwater monitoring point in the future if needed.

investigations completed at AOC 50. The locations that will be conducted to bedrock, if refusal is encountered significantly shallower than the anticipated depth to bedrock, one 10-ft step out boring will be advanced. The sampling nomenclature, anticipated depths, and analytical scope are summarized in Table 4.

Groundwater samples will be collected during advancement of the vertical profiling using field procedure SOP-F014 (Direct Push Technology) and SOP-F003 (Groundwater Sampling) and SOP-F009 (PFAS Sampling) as listed in Section 6.0 of this FSP and Worksheet #21 of the UFP QAPP. Field quality control samples, such as field duplicate and field blanks will be collected at a frequency as specified in Worksheet #20 of the UFP-QAPP (Appendix A).

At nine of the vertical profiling locations (Table 3), piezometers will be set at the water table. The locations of the piezometers are shown on Figures 3, 4, 5 and 7 and were selected to provide depth to water measurements in areas of the former MAAF with limited coverage with existing monitoring wells (i.e., west and east of the AOC 50 PCE plume). The depth to water measurements collected at the new piezometers, along with depth to water measurements obtained at existing monitoring wells at AOC 50, will provide data to confirm groundwater flow direction beneath the areas of the former MAAF located to the west and east of the AOC 50 PCE plume. The piezometers will be surveyed, and a synoptic water level survey along with select existing monitoring wells at AOC 50 will be performed. The synoptic water level survey will be used to assist in placement of monitoring wells and additional vertical profiling locations if they are needed.

5.2.2.3 Soil Sampling

Soil sampling will be conducted at locations within and near suspected AFFF discharge/storage areas at the former MAAF, including the former drum storage areas (AOC 30), former FTA (AOC 31), former Devens Fire Station/Hangar Buildings, and historic sludge disposal areas adjacent to the flight line (Figures 3 through7). The rationale for soil borings placement at the former MAAF is included in Table 3. The sampling nomenclature, anticipated depths, and analytical scope are summarized in Table 4.

The soil sampling locations were selected in consideration of reported AFFF use and storage at the former MAAF as well as the PFAS soil and groundwater sampling results obtained during the SI (BERS-Weston, 2018). A discussion of the soil sampling approach at each area is provided below.

<u>AOC 30 – Former Drum Storage Areas</u>

During the SI, PFAS were reported in shallow soil (0-5 ft bgs) at AOC 30. The RI soil sampling program at AOC 30 is designed to identify/confirm the location of soil source area at AOC 30. Six soil borings will be advanced (three at each drum storage area) at locations near or upgradient of groundwater contamination reported during the SI (Figure 3). Soil samples from all six borings will be collected for PFAS analysis from 0-0.5, 0.5-3, 3-7, 7-15 ft bgs to provide data to support a human health and ecological risk evaluation. In addition, a sample will be collected from within 2 ft of the water table at two borings (one within each drum storage area) (30SB-19-01 and 30SB-19-04) to provide data to assess leaching potential to groundwater. The sampling nomenclature, anticipated depths, and analytical scope for each soil boring at AOC 30 are summarized in Table 5.

AOC 31 – Former Fire Training Area

During the SI, PFAS were reported in shallow soil (0-5 ft bgs) at AOC 31. The RI soil sampling program at AOC 31 is designed to delineate the extent of PFAS contaminated soil within and immediately downgradient of the FTA. Five soil borings will be advanced within the former FTA (Figure 4). The ground surface within the former FTA is reportedly covered by asphalt and 8-inch thick concrete associated with the former runway. During a site walk conducted in October 2018, the asphalt and concrete within the FTA appears to be cracked and fragmented with small trees growing within the FTA footprint. At borings advanced within the FTA, soil sampling will begin below the concrete (31SB-19-01 through -05). Soil samples from all five borings will be collected for PFAS analysis from 0-0.5, 0.5-3, 3-7, 7-15 ft bgs to provide data to support a human health and ecological risk evaluation. A soil sample will also be collected within 2 ft of the water table at one of the borings (31SB-19-01) to assess leaching potential to groundwater. A concrete sample will also be collected at one of the borings to determine if PFAS from the AFFF have sorbed to the concrete.

Two soil borings will also be advanced outside the bermed area to evaluate if overspray of AFFF occurred during training exercises (31SB-19-06 and -07). Soil samples will be collected for PFAS analysis from 0 to 1 ft bgs and 3-7 ft bgs to provide data needed to evaluate if PFAS are present in soils outside the FTA. The sampling nomenclature, anticipated depths, and analytical scope for each soil boring at AOC 31 are summarized in Table 5.

Former Fort Devens Fire Station and Hangar Buildings

During the SI, PFAS were reported in shallow soil (0-5 ft bgs) at both the former Fort Devens Fire Station and Hangar Buildings. The RI soil sampling program at the former Devens Fire Station and Hangar Building is designed to assess if soils are present in this area at concentrations that represent a risk to human health and the environment. Five soil borings will be advanced in this area (50SB-19-01 through -05) (Figure 7). The locations were selected in consideration of groundwater results reported during the SI (BERS-Weston, 2018) and a review of historic as-builts to identify the location of potential receiving structures, such as the former dry well and oil water separator located to the north of Hangar Building 3818 and former flammable storage building and fuel oil tank located to the south of Hangar Building 3818 (USACE, 1942, 1958, and 1960).

Soil samples from all five borings will be collected for PFAS analysis from 0-0.5, 0.5-3, 3-7, 7-15 ft bgs to provide data to support a human health and ecological risk evaluation. In addition, a sample will be collected from within 2 ft of the water table at two borings (one at the fire station and one at the hangar buildings) to provide data to assess leaching potential to groundwater. The sampling nomenclature, anticipated depths, and analytical scope for each soil boring are summarized in Table 5.

Sludge Disposal Areas at the Former MAAF

Sludge from the Devens WWTP (AOC 20) was reportedly spread on grassed areas along the southern side of the flight line (Figure 5). Five soil borings will be advanced in the areas that formerly received sludge from the Devens WWTP (50SB-19-06 through -10) (Figure 5). Soil samples from all five borings will be collected for PFAS analysis from 0-0.5, 0.5-3, 3-7, 7-15 ft bgs to provide data to support a human health and ecological risk evaluation. In addition, a sample will be collected from within 2 ft of the water table at one boring to provide data to assess leaching potential to groundwater. Depth to groundwater beneath the former MAAF is greater than 17 ft.

However, if the water table is encountered at a depth less than 17 ft bgs in any of the soil borings then the final soil sampling interval at the boring will be shortened by the appropriate amount to collect a separate sample just above the water table to assess leaching threat to groundwater. The final depth of a soil sampling intervals will end at the water table at borings where the water table is less than 15 ft bgs. The sampling nomenclature, anticipated depths, and analytical scope for each soil boring are summarized in Table 5.

Soil borings will be advanced at the former MAAF using DPT and the samples will be analyzed for PFAS by isotopic dilution analyte list in QAPP Worksheet #15 (Appendix A). If PFAS contamination is confirmed in soils at the former MAAF source areas, additional soil sampling may be needed to determine the nature and extent of PFAS contamination in soil, to support a human health and ecological risk assessment, and to collect data for the assessment of the source as a continuing source of PFAS to groundwater. The location of additional soil borings, if needed, and the target depth of sample collection will be determined after review of the soil data.

5.2.2.4 Surface Water and Sediment Sampling

Surface water and sediment samples will be collected at the former MAAF. The surface water and sediment sampling plan for all of Area 3 is provided in Section 5.3 of this document.

5.2.2.5 Monitoring Well Installation

An overburden monitoring well network for PFAS will be developed for the former MAAF. The PFAS groundwater monitoring network at the former MAAF will entail the use of existing monitoring wells that will be augmented with installation of new monitoring wells. For planning purposes up to ten new monitoring wells will be installed at the former MAAF. The rationale for installing new monitoring wells is provided in Table 6. Tentative locations for the new monitoring wells are shown on Figures 3 through 7. Monitoring well installation will be completed following a review of the PFAS data obtained from groundwater vertical profiling, soil sampling, and existing monitoring wells; the final location and screen settings of the permanent monitoring wells will be reviewed with the USEPA and MassDEP and will be based on that data. The monitoring well network will be designed to monitor PFAS contamination in groundwater as well as provide bounding locations to demonstrate the limits of PFAS contamination in groundwater.

During advancement of the monitoring well borings, soil cores may be collected from the water table to the bottom of the boring for field lithologic classification at select locations and a subset of samples collected from potential screen setting elevations at new monitoring wells placed within the plume will be collected for grain size, TOC, and TOP assay analysis (Table 7). Confirmation of the depth to the top of bedrock may also be conducted, where it is an identified data gap after review of the vertical profiling data and previous bedrock elevation data from AOC 50. After the new wells are installed, an Area 3 synoptic water level survey will be conducted.

5.2.2.6 Baseline Sampling of New Monitoring Wells

New monitoring wells will be sampled after installation. The samples will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15). Samples from selected wells (approximately two per AOC) located within areas of high PFAS concentrations will be analyzed for PFAS via the TOP assay and for DOC. The new monitoring wells to be sampled along with the sampling nomenclature and analytical scope are provided in Table 8.

As discussed in Section 4.7, after new monitoring wells are installed, developed and surveyed, a synoptic water level measurement event will be conducted to evaluate groundwater flow across

the MAAF. The synoptic water level event will consist of monitoring water levels at a combination of new and existing monitoring wells. The specific wells for the synoptic water level event will be identified after the locations and screen settings of the new monitoring wells are determined.

5.3 SURFACE WATER AND SEDIMENT SAMPLING – AREA 3

The Nashua River and associated wetland areas are the primary surface water settings within Area 3. The Nashua River and associated floodplain bisect all of Area 3 with AOCs 20 and 21 abutting the Nashua River to the west and the former MAAF abutting the Nashua River to the east. Surface water and sediment samples were collected for PFAS analysis at only two locations within Area 3 during the SI (BERS-Weston, 2018). Two locations were sampled at the outlet stream from the unnamed wetland that is adjacent to the former MAAF. PFAS were detected in surface water and sediment collected at this stream. The results are presented in Section 5.2.1 of this document. Additional surface water and sediment sampling is needed to determine if PFAS have impacted surface water bodies at Area 3, beyond the small stream that was sampled during the SI.

Surface water and shallow sediment samples, involving cores (0-6 inches), will be collected from 17 locations at Area 3. Locations were selected to determine if PFAS are present in surface water and sediment in surface water bodies that likely receive groundwater discharge and/or sediment transport from overland flow originating from Area 3. The surface water/sediment sample locations are shown on Figures 2 through 5.

- Thirteen collocated surface water/sediment sampling locations have been selected for the Nashua River. One location is situated upstream of any potential inputs from Area 3. Six locations (adjacent to AOCs 20 and 21) are located on the west bank of the river channel, five locations (adjacent to the former MAAF) are located on the east bank of the river channel, and one location is downstream of potential inputs from Devens (north of State Route 2A).
- Two locations have been identified on the eastern bank of the unnamed air field wetland that is adjacent to the former MAAF.
- One location has been identified in the unnamed pond located to the north of AOC 20.
- One location has been identified in an unnamed stream to the east of AOC 20.

If a potential for human health and/or ecological risks are identified (i.e., PFAS are present at concentrations greater than USEPA SSLs [USEPA, 2018] or ecological screening values presented in the HERA Work Plan [KGS, 2018d]), additional surface water and sediment sampling may be needed to identify which area is contributing the greatest potential risk.

Surface water and sediment samples will be analyzed for PFAS by isotope dilution (analyte list in QAPP Worksheet #15), TOC, and grain size. The sampling nomenclature for each surface water and sediment location and the quality control samples are provided in Table 10. Sample collection procedures are provided in Worksheet #21. Field quality control samples will be collected at a frequency specified by Worksheet #20 of the UFP-QAPP (Appendix A).

6.0 FIELD QUALITY CONTROL SAMPLES

Collection of field quality control samples, including field duplicates, equipment blanks, field reagent blanks, matrix spikes, and matrix spike duplicates, associated with groundwater, soil, surface water, and sediment sampling efforts are required. A summary of the types and frequency

of field quality control samples to be collected is provided in Worksheet #20 (Field Quality Control Sample Summary) of the UFP-QAPP (Appendix A).

7.0 FIELD PROCEDURES

The field SOP associated with the project are listed in Worksheet #21 of the UFP-QAPP and the field equipment calibration, maintenance, testing and inspection requirements are listed in Worksheet #22 of the UFP-QAPP, which are both provided in Attachment A of the UFP-QAPP (Appendix A). The field SOPs are summarized below.

- Groundwater vertical profile borings will be conducted in accordance with the procedure specified in Worksheet #17 and #17a of the UFP-QAPP, SOP-F014 (Direct Push Technology), and the SP16 SOP.
- Soil samples will be collected in accordance with SOP-F015 (Soil Sampling – Surface and Shallow Depth) and SOP-F009 (PFAS Sampling).
- Surface water and sediment samples will be collected in accordance with SOP-F004 (Sediment-Surface Water Sampling) and SOP-F009 (PFAS Sampling).
- Groundwater samples will be collected in accordance with SOP-F003 (Groundwater Sampling) and SOP-F009 (PFAS Sampling).
- Water quality parameters: dissolved oxygen, oxidation reduction potential, specific conductance, temperature, and pH will be collected in accordance with SOP-F003 (Groundwater Sampling).
- Static depth to groundwater measurements will be measured in accordance with SOP-F002 (Evaluation of Existing Monitoring Wells and Water Level Measurements).
- New groundwater monitoring wells will be constructed and developed in accordance with SOP-F017 (Monitoring Well Construction and Development).
- Soil samples and soil cores will be described in the field in accordance with SOP-F018 (Soil Description).
- Private water supply wells will be purged and samples in accordance with SOP-F016 (Private and Water Supply Well Sampling).

8.0 SAMPLING PACKAGING AND SHIPPING REQUIREMENTS

Sample volume, containers, preservation, and holding time requirements are provided in combined Worksheet #19 and #30 (Sample Containers, Preservation and Hold Times) of the UFP-QAPP (Appendix A). Procedures for field sample handling, packing and shipment are detailed in SOP-F008 (Sample Handling), which is listed in Worksheet #21 of the UFP-QAPP (Appendix A). Sampling handling, custody and disposal requirements are provided in Worksheet #26 and 27 of the UFP-QAPP and provided in Attachment A of the UFP-QAPP (Appendix A).

9.0 INVESTIGATION-DERIVED WASTE

IDW management procedures are presented in Worksheet #17 of the UFP-QAPP and will be managed in accordance with SOP-F011 (IDW Management), which is listed in Worksheet #21 of the UFP-QAPP and provided in Attachment A of the UFP-QAPP (Appendix A).

10.0 FIELD ASSESSMENT PROCEDURES AND CORRECTIVE ACTIONS

Periodic assessments will be performed during the course of the project so that the planned project activities are implemented in accordance with the UFP-QAPP. The type, frequency, and responsible parties of planned assessment activities to be performed for the project as well as any corrective action measures, are provided in Combined Worksheet #31, 32, and 33 (Assessment and Corrective Actions) of the UFP-QAPP (Appendix A).

11.0 REFERENCES

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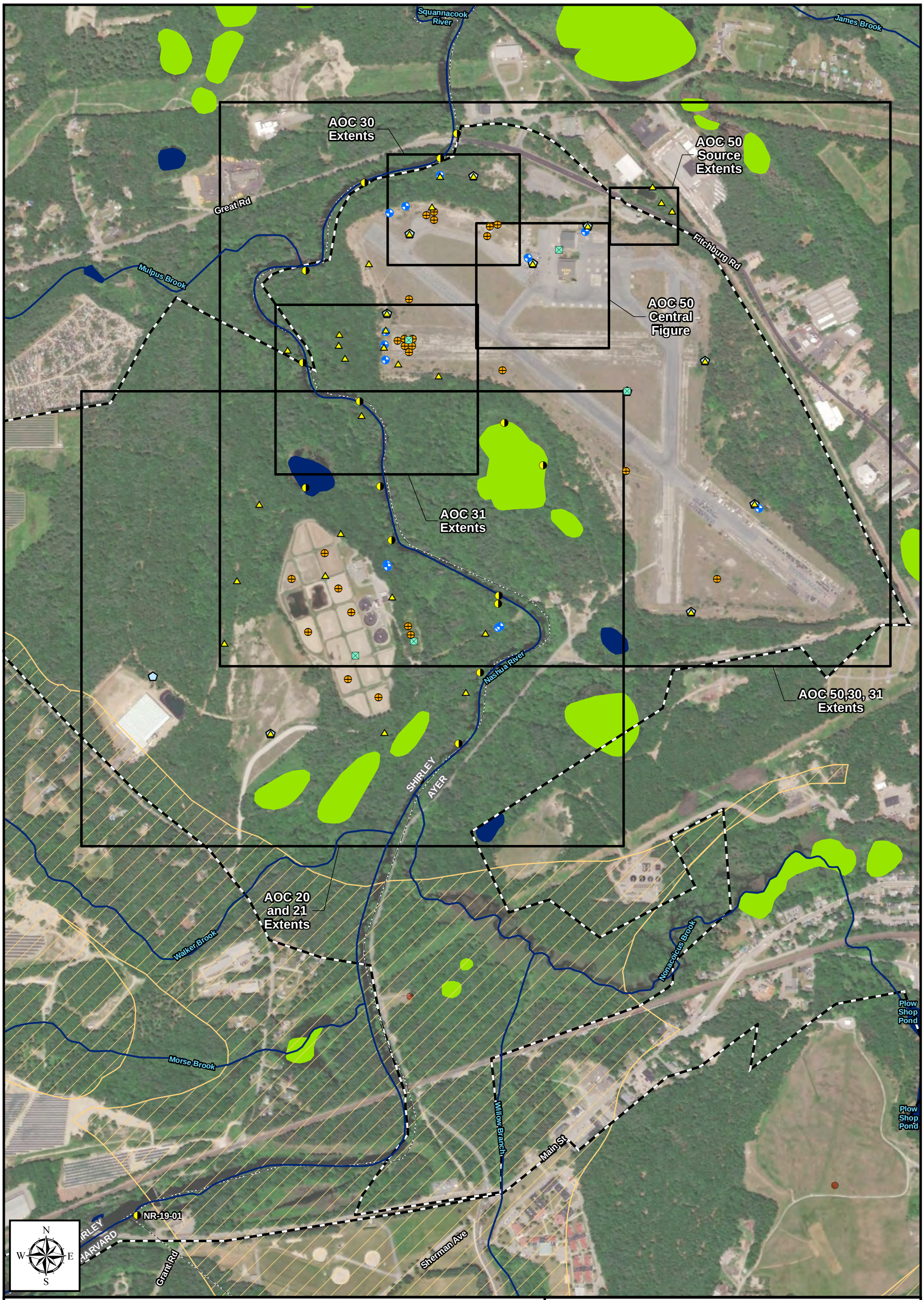
FIGURES



Legend

- Proposed Soil Boring and Vertical Profiling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- Proposed Surface Water and Sediment Sampling Location
- Proposed Piezometer
- Tentative Overburden Monitoring Well
- Stream/River
- Lake/Pond
- Swamp/Marsh
- MassDEP Zone II Wellhead Protection Area
- City/Town Boundary
- Former Fort Devens Boundary

Area 3 Figure Extents
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

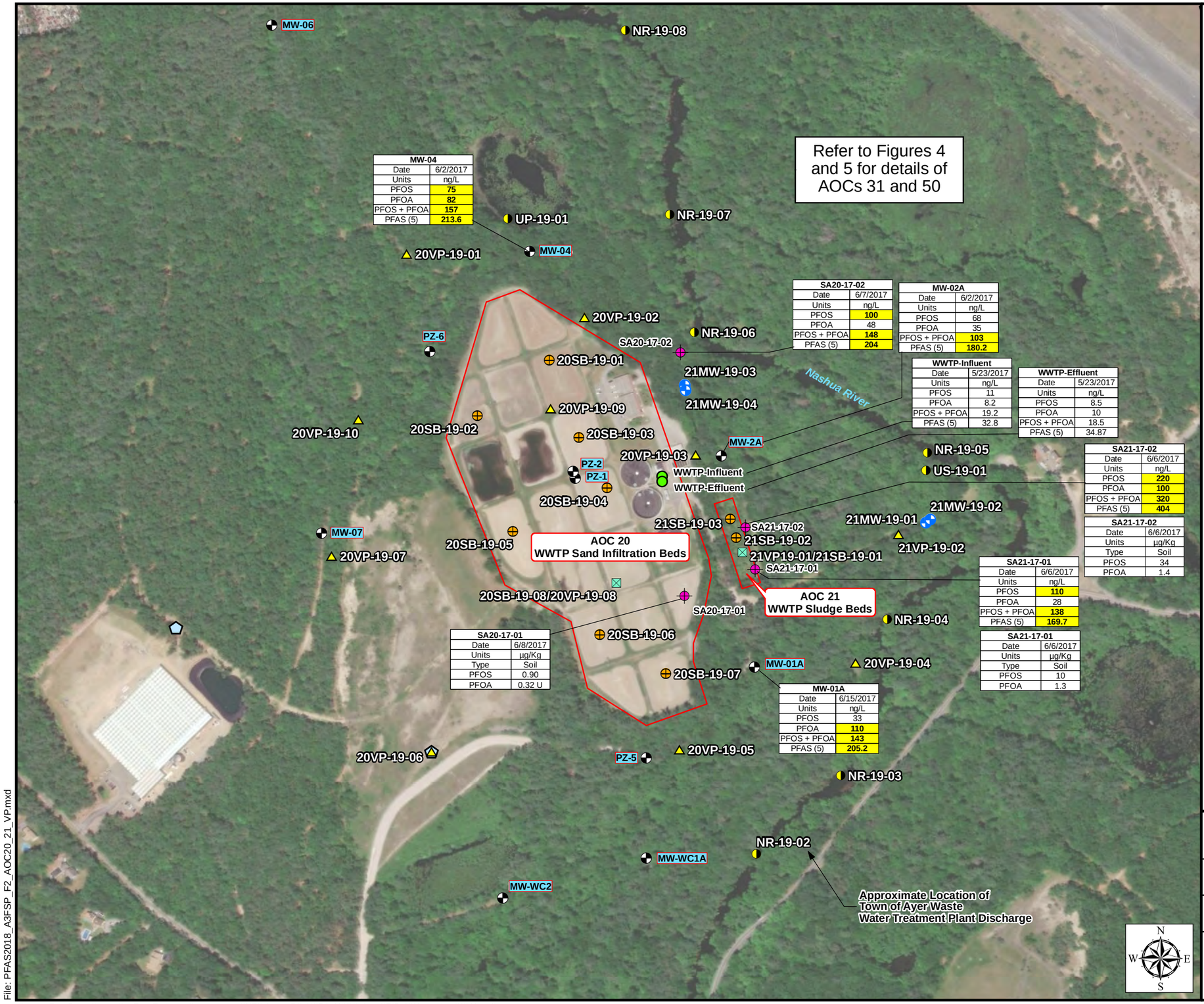
0 400 800
Feet

Date: 11/19/2018

Figure 1

File: PFAS2018_A3FSP_F1_Extents_VPL.mxd

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



SA20-17-02	
Date	6/7/2017
Units	ng/L
PFOS	100
PFOA	48
PFOS + PFOA	148
PFAS (5)	204

MW-02A	
Date	6/2/2017
Units	ng/L
PFOS	68
PFOA	35
PFOS + PFOA	103
PFAS (5)	180.2

WWTP-Influent	
Date	5/23/2017
Units	ng/L
PFOS	11
PFOA	8.2
PFOS + PFOA	19.2
PFAS (5)	32.8

WWTP-Effluent	
Date	5/23/2017
Units	ng/L
PFOS	8.5
PFOA	10
PFOS + PFOA	18.5
PFAS (5)	34.87

SA21-17-02	
Date	6/6/2017
Units	ng/L
PFOS	220
PFOA	100
PFOS + PFOA	320
PFAS (5)	404

SA21-17-02	
Date	6/6/2017
Units	µg/Kg
Type	Soil
PFOS	34
PFOA	1.4

SA21-17-01	
Date	6/6/2017
Units	ng/L
PFOS	110
PFOA	28
PFOS + PFOA	138
PFAS (5)	169.7

SA21-17-01	
Date	6/6/2017
Units	µg/Kg
Type	Soil
PFOS	10
PFOA	1.3

SA20-17-01	
Date	6/8/2017
Units	µg/Kg
Type	Soil
PFOS	0.90
PFOA	0.32 U

MW-01A	
Date	6/15/2017
Units	ng/L
PFOS	33
PFOA	110
PFOS + PFOA	143
PFAS (5)	205.2

Legend

- MW-04 — Proposed Wells to be Sampled
- Proposed Surface Water and Sediment Sampling Location
- Proposed Soil Boring and Vertical Profiling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- Proposed Piezometer
- Tentative Overburden Monitoring Well
- Temporary Well Location from SI
- Monitoring Well Location
- Sample Location
- Area of Contamination

Notes:

ng/L = nanograms per Liter
µg/Kg = micrograms per Kilogram
Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohepatanoic Acid (PFHpA)

J = estimated result
U = non-detect

AOCs 20 and 21 Sampling Locations
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

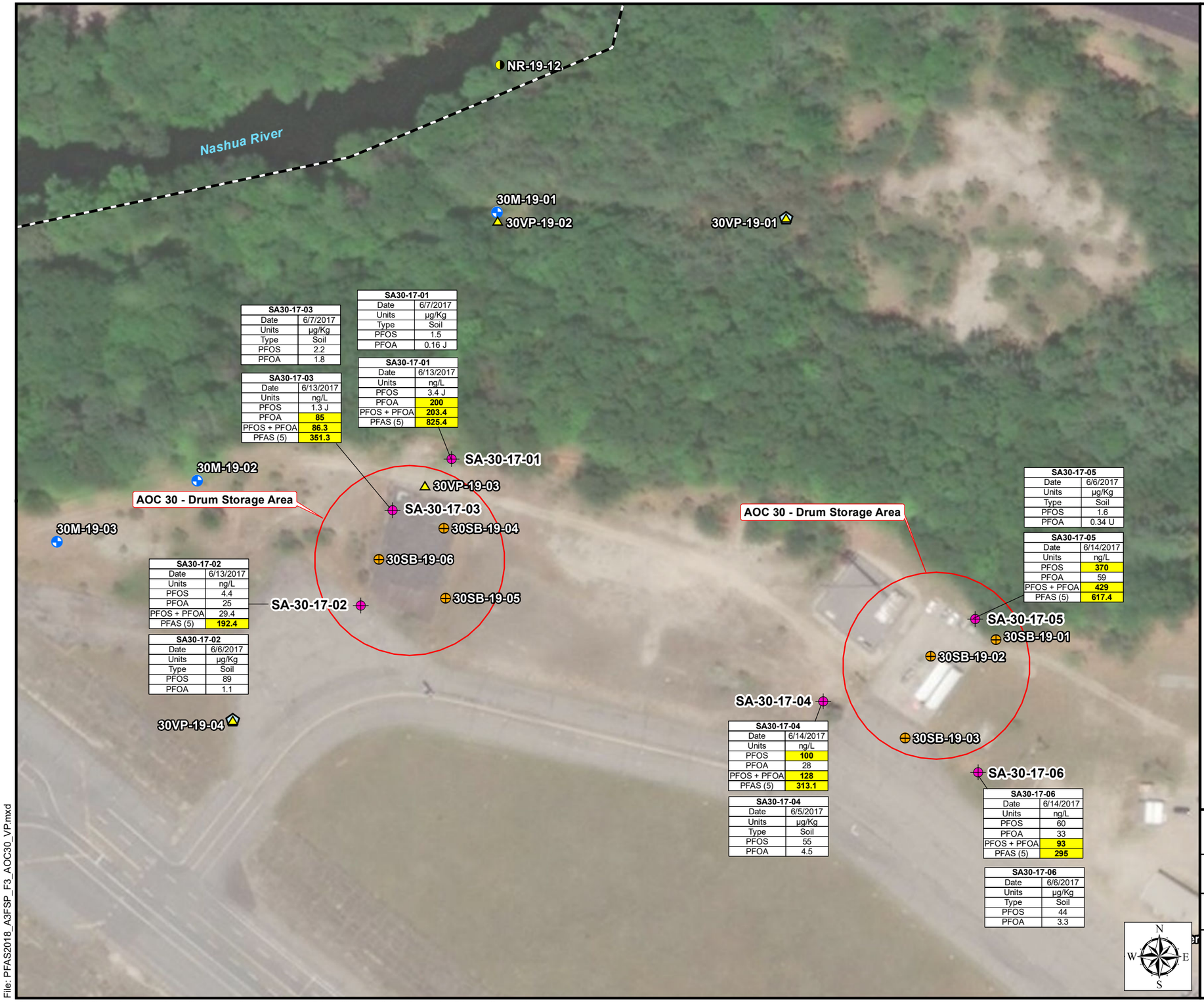
0 200 400
Feet

Date: 10/18/2018

Figure 2

File: PFAS2018_A3FSP_F2_AOC20_21_VP.mxd

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



Legend

- Proposed Surface Water and Sediment Sampling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- Proposed Piezometer
- Tentative Overburden Monitoring Well
- Temporary Well Location from SI
- Area of Contamination (AOC)
- Former Fort Devens Boundary

Notes:

Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohepatanoic Acid (PFHpA)

ng/L = nanograms per liter
J = estimated result
U = non-detect

µg/Kg = micrograms per Kilogram
There is no established criteria for PFOS or PFOA in soil.

AOC 30 Vertical Profiling and Soil Boring Locations
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

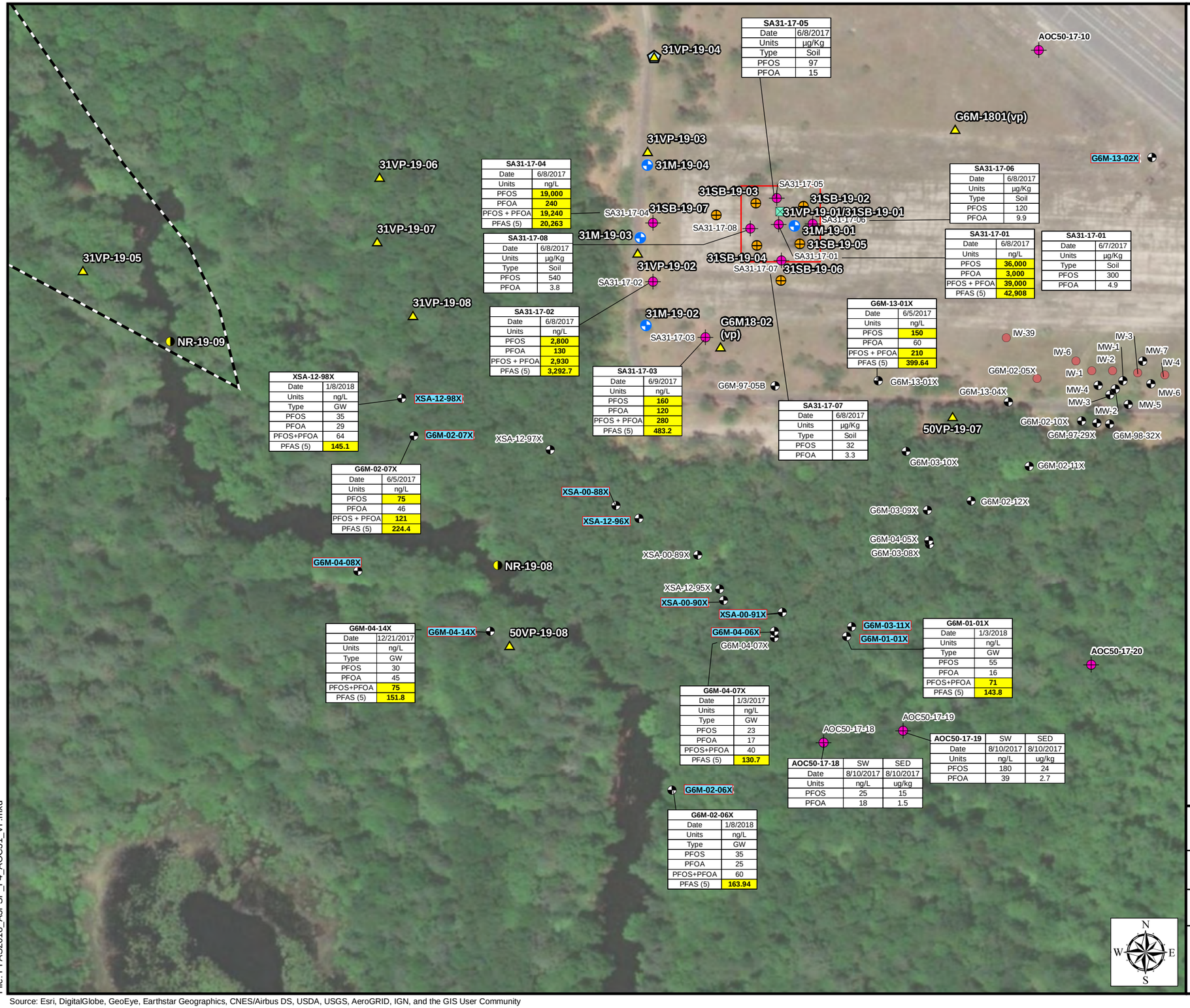
0 50 100
Feet

Date: 10/18/2018

Figure 3

File: PFAS2018_A3FSP_F3_AOC30_VP.mxd

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



SA31-17-05	
Date	6/8/2017
Units	µg/Kg
Type	Soil
PFOS	97
PFOA	15

SA31-17-04	
Date	6/8/2017
Units	ng/L
PFOS	**19,000**
PFOA	**240**
PFOS + PFOA	**19,240**
PFAS (5)	**20,263**

SA31-17-08	
Date	6/8/2017
Units	µg/Kg
Type	Soil
PFOS	540
PFOA	3.8

SA31-17-06	
Date	6/8/2017
Units	µg/Kg
Type	Soil
PFOS	120
PFOA	9.9

SA31-17-01	
Date	6/8/2017
Units	ng/L
PFOS	**36,000**
PFOA	**3,000**
PFOS + PFOA	**39,000**
PFAS (5)	**42,908**

SA31-17-01	
Date	6/7/2017
Units	µg/Kg
Type	Soil
PFOS	300
PFOA	4.9

SA31-17-02	
Date	6/8/2017
Units	ng/L
PFOS	**2,800**
PFOA	**130**
PFOS + PFOA	**2,930**
PFAS (5)	**3,292.7**

G6M-13-01X	
Date	6/5/2017
Units	ng/L
PFOS	**150**
PFOA	60
PFOS + PFOA	**210**
PFAS (5)	**399.64**

SA31-17-03	
Date	6/9/2017
Units	ng/L
PFOS	**160**
PFOA	**120**
PFOS + PFOA	**280**
PFAS (5)	**483.2**

SA31-17-07	
Date	6/8/2017
Units	µg/Kg
Type	Soil
PFOS	32
PFOA	3.3

XSA-12-98X	
Date	1/8/2018
Units	ng/L
Type	GW
PFOS	35
PFOA	29
PFOS+PFOA	64
PFAS (5)	**145.1**

G6M-02-07X	
Date	6/5/2017
Units	ng/L
PFOS	**75**
PFOA	46
PFOS + PFOA	**121**
PFAS (5)	**224.4**

G6M-04-14X	
Date	12/21/2017
Units	ng/L
Type	GW
PFOS	30
PFOA	45
PFOS+PFOA	**75**
PFAS (5)	**151.8**

G6M-04-07X	
Date	1/3/2017
Units	ng/L
Type	GW
PFOS	23
PFOA	17
PFOS+PFOA	40
PFAS (5)	**130.7**

G6M-01-01X	
Date	1/3/2018
Units	ng/L
Type	GW
PFOS	55
PFOA	16
PFOS+PFOA	**71**
PFAS (5)	**143.8**

AOC50-17-18	SW	SED
Date	8/10/2017	8/10/2017
Units	ng/L	ug/kg
PFOS	25	15
PFOA	18	1.5

AOC50-17-19	SW	SED
Date	8/10/2017	8/10/2017
Units	ng/L	ug/kg
PFOS	180	24
PFOA	39	2.7

G6M-02-06X	
Date	1/8/2018
Units	ng/L
Type	GW
PFOS	35
PFOA	25
PFOS+PFOA	60
PFAS (5)	**163.94**

Legend

- **G6M-04-06X** — Proposed Wells to be Sampled
- Proposed Surface Water and Sediment Sampling Location
- Proposed Piezometer
- Tentative Overburden Monitoring Well
- Proposed Soil Boring and Vertical Profiling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- **(vp)** — Vertical profile to be advanced for AOC 50 LTM, splits will be collected for PFAS
- Temporary Well Location from SI
- Monitoring Well
- Injection Well
- Area of Contamination (AOC)
- Former Fort Devens Boundary

Notes:

Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohepatanoic Acid (PFHpA)

ng/L = nanograms per liter
J = estimated result
U = non-detect

µg/Kg = micrograms per Kilogram
There is no established criteria for PFOS or PFOA in soil.

AOC 31 and AOC 50 Locations
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

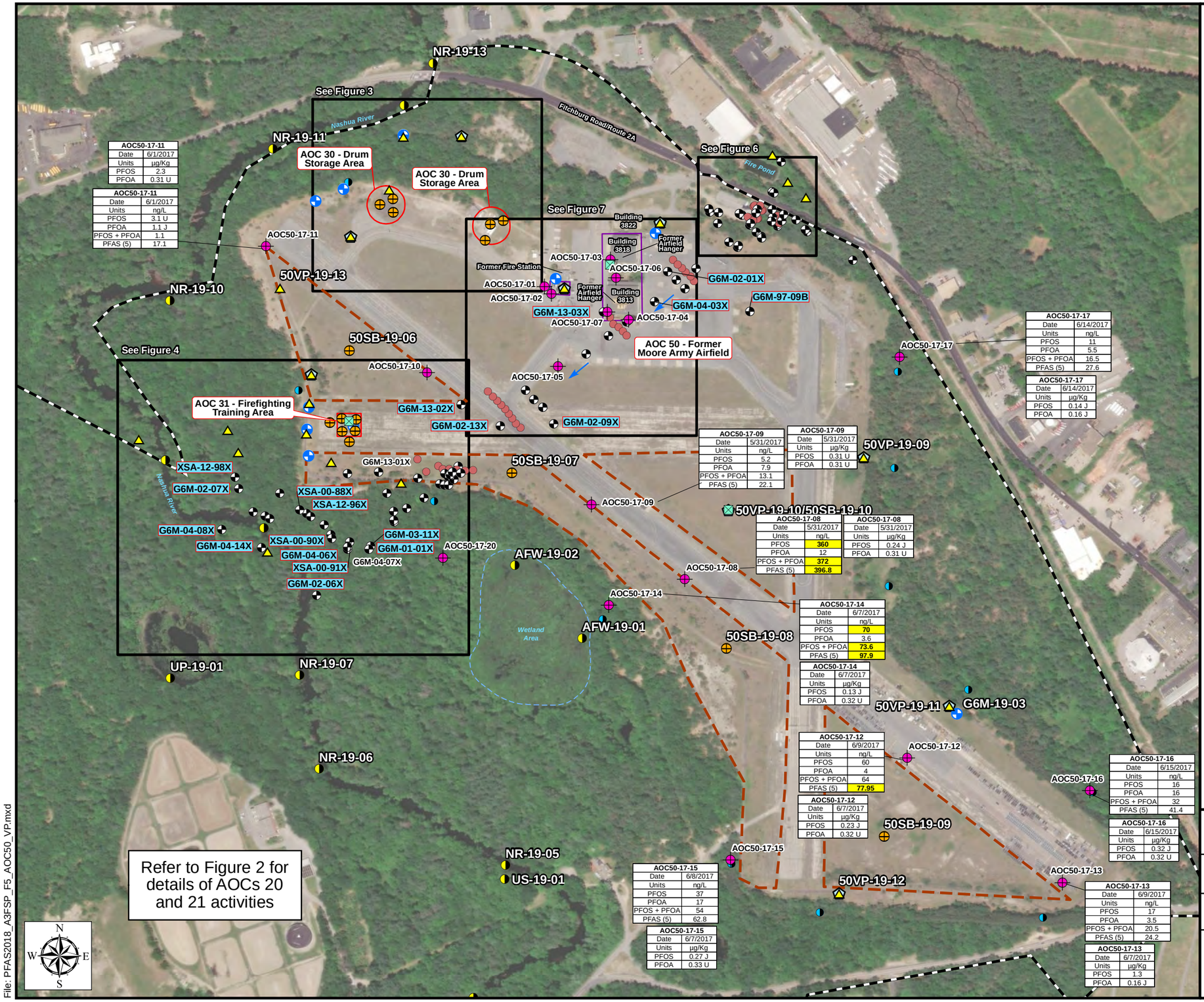
0 75 150 Feet

Date: 11/16/2018

Figure 4

File: PFAS2018_A3FSP_F4_AOC31_VP.mxd

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



AOC50-17-11	
Date	6/1/2017
Units	µg/Kg
PFOS	2.3
PFOA	0.31 U

AOC50-17-11	
Date	6/1/2017
Units	ng/L
PFOS	3.1 U
PFOA	1.1 J
PFOS + PFOA	1.1
PFAS (5)	17.1

AOC50-17-17	
Date	6/14/2017
Units	ng/L
PFOS	11
PFOA	5.5
PFOS + PFOA	16.5
PFAS (5)	27.6

AOC50-17-17	
Date	6/14/2017
Units	µg/Kg
PFOS	0.14 J
PFOA	0.16 J

AOC50-17-09	
Date	5/31/2017
Units	ng/L
PFOS	5.2
PFOA	7.9
PFOS + PFOA	13.1
PFAS (5)	22.1

AOC50-17-09	
Date	5/31/2017
Units	µg/Kg
PFOS	0.31 U
PFOA	0.31 U

AOC50-17-08	
Date	5/31/2017
Units	ng/L
PFOS	**360**
PFOA	12
PFOS + PFOA	**372**
PFAS (5)	**396.8**

AOC50-17-08	
Date	5/31/2017
Units	µg/Kg
PFOS	0.24 J
PFOA	0.31 U

AOC50-17-14	
Date	6/7/2017
Units	ng/L
PFOS	**70**
PFOA	3.6
PFOS + PFOA	**73.6**
PFAS (5)	**97.9**

AOC50-17-14	
Date	6/7/2017
Units	µg/Kg
PFOS	0.13 J
PFOA	0.32 U

AOC50-17-12	
Date	6/9/2017
Units	ng/L
PFOS	60
PFOA	4
PFOS + PFOA	64
PFAS (5)	**77.95**

AOC50-17-12	
Date	6/7/2017
Units	µg/Kg
PFOS	0.23 J
PFOA	0.32 U

AOC50-17-16	
Date	6/15/2017
Units	ng/L
PFOS	16
PFOA	16
PFOS + PFOA	32
PFAS (5)	41.4

AOC50-17-16	
Date	6/15/2017
Units	µg/Kg
PFOS	0.32 J
PFOA	0.32 U

AOC50-17-15	
Date	6/8/2017
Units	ng/L
PFOS	37
PFOA	17
PFOS + PFOA	54
PFAS (5)	62.8

AOC50-17-15	
Date	6/7/2017
Units	µg/Kg
PFOS	0.27 J
PFOA	0.33 U

AOC50-17-13	
Date	6/9/2017
Units	ng/L
PFOS	17
PFOA	3.5
PFOS + PFOA	20.5
PFAS (5)	24.2

AOC50-17-13	
Date	6/7/2017
Units	µg/Kg
PFOS	1.3
PFOA	0.16 J

Legend

- G6M-04-06X — Proposed Wells to be Sampled
- Proposed Soil Boring and Vertical Profiling Location
- Proposed Vertical Profiling Location
- Proposed Soil Boring Location
- Proposed Piezometer
- Tentative Overburden Monitoring Well
- Proposed Surface Water and Sediment Sampling Location
- Temporary Well Location from SI
- Monitoring Well
- Injection Well
- Runway Stormwater Drain Outlet
- Groundwater Flow Direction
- Area of Contamination (AOC)
- Site Inspection Study Area Boundary
- Approximate Areas of Sludge Disposal
- Former Fort Devens Boundary

Notes:

Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohepatanoic Acid (PFHpA)

µg/Kg = micrograms per Kilogram
ng/L = nanograms per liter
J = estimated result
U = non-detect

There is no established criteria for PFOS or PFOA in Soil.

AOCs 50, 30 and 31 Sampling Location Overview
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

0 250 500 Feet

Date: 11/16/2018

Figure 5

File: PFAS2018_A3FSP_F5_AOC50_VP.mxd

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

Legend

- G6M-02-08X — Proposed Wells to be Sampled
- Proposed Vertical Profiling Location
- Monitoring Well
- Injection Well
- Former Dry Well
- Floor Drain
- Janitor Sink
- Floor Drain Piping
- Former Feature
- Building Footprint
- Former Fort Devens Boundary

Notes:
Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohepatanoic Acid (PFHpA)

ng/L = nanograms per liter
J = estimated result
U = non-detect

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

AOC 50 Locations Near Route 2A
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

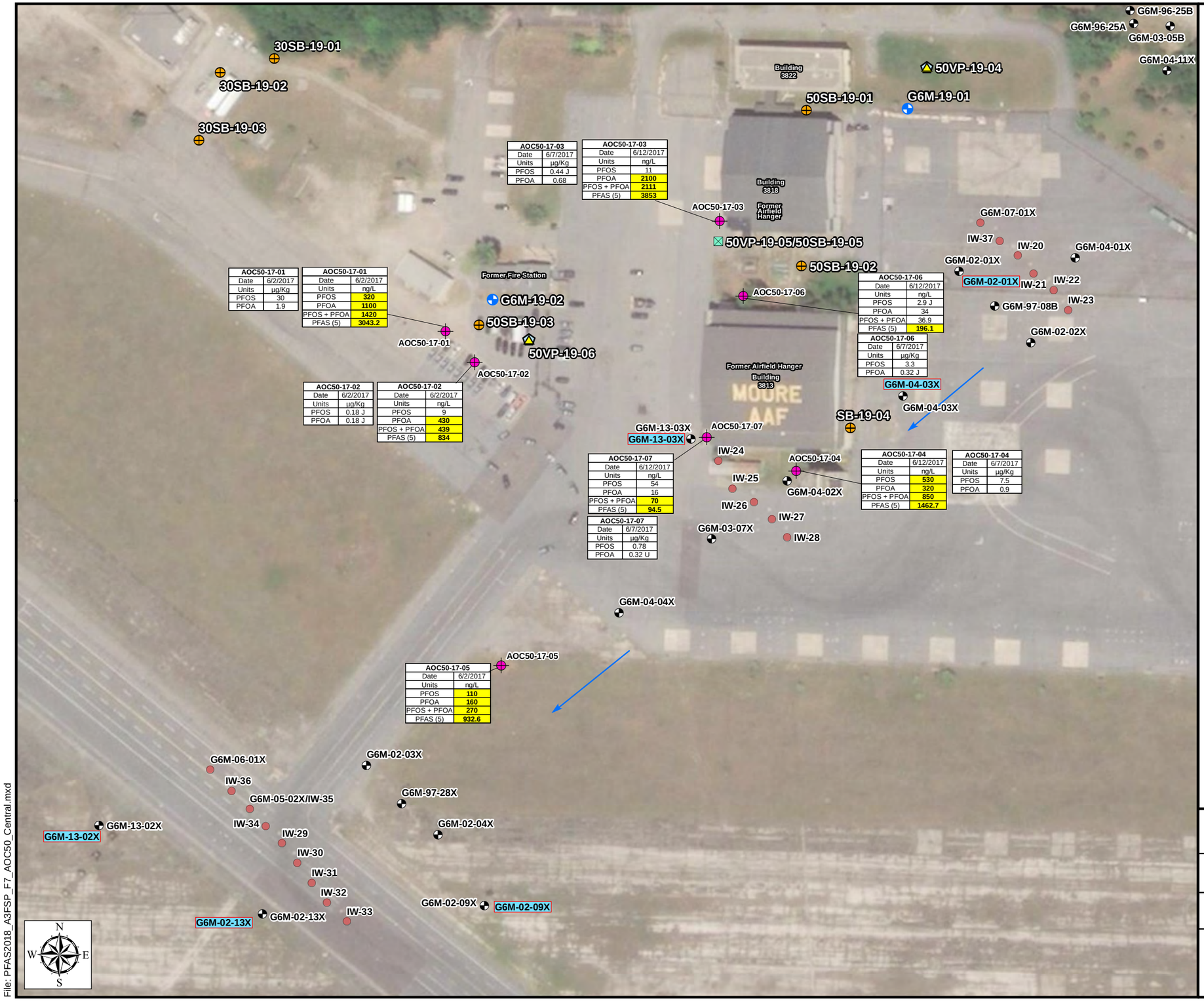
KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

0 25 50
Feet

Date: 10/15/2018

Figure 6

File: PFAS2018_A3FSP_F6_AOC50_Source.mxd



Legend

G6M-04-06X	Proposed Wells to be Sampled
	Proposed Soil Boring and Vertical Profiling Location
	Proposed Vertical Profiling Location
	Proposed Soil Boring Location
	Proposed Piezometer
	Tentative Overburden Monitoring Well
	Temporary Well Location from SI
	Monitoring Well
	Injection Well
	Groundwater Flow Direction

Notes:

Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohepatanoic Acid (PFHpA)

µg/Kg = micrograms per Kilogram
ng/L = nanograms per liter
J = estimated result
U = non-detect

There is no established criteria for PFOS or PFOA in Soil.

AOCs 50 Central Area Locations
Devens PFAS RI WP - Area 3 FSP Addendum

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

0 60 120
Feet

Date: 10/21/2018

Figure 7

File: PFAS2018_A3FSP_F7_AOC50_Central.mxd

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

TABLES

Table 1
Area 3 Existing Monitoring Well Construction Information - AOCs 20 and 21
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Well ID	Screen Interval (ft bgs)	Ground Surface Elevation (ft NGVD29)	Top of Casing Elevation (ft)
PZ-1	70.00 - 75.00	272.90	UKN
PZ-2	95.00 - 100.00	272.90	UKN
PZ-5	25.00 - 30.00	225.10	228.0
PZ-6	15.00 - 20.00	219.70	222.6
MW-01A	18 - 33	UKN	222.2
MW-WC1A	6.45 - 17.95	UKN	213.3
MW-2A	18 - 33	UKN	226.1
MW-WC2	UKN	UKN	217.9
MW-04	7 - 22	UKN	218.1
MW-6	14 - 29	UKN	234.7
MW-7	20.5 - 35.5	UKN	243.3

bgs = below ground surface
ft = feet
NGVD29 = National Geodetic Vertical Datum 29
UKN = unknown
Wells designated to be sampled in RI

Table 2
Area 3 Existing Monitoring Well Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Sample Type**
AOC 20/21	MW-01A	MW-01A-MONYY	Native Sample
	MW-2A	MW-2A-MONYY	Native Sample
	MW-04	MW-04-MONYY	Native Sample
	MW-06	MW-06-MONYY	Native Sample
	MW-07	MW-07-MONYY	Native Sample
	MW-WC1A	MW-WC1A-MONYY	Native Sample
	MW-WC2	MW-WC2-MONYY	Native Sample
	PZ-1	PZ-1-MONYY	Native Sample
	PZ-2	PZ-2-MONYY	Native Sample
	PZ-5	PZ-5-MONYY	Native Sample
	PZ-6	PZ-6-MONYY	Native Sample
AOC 50 (Source Area)	G6M-02-08X	G6M-02-08X-MONYY	Native Sample
	G6M-04-10X	G6M-04-10X-MONYY	Native Sample
	G6M-04-11X	G6M-04-11X-MONYY	Native Sample
	G6M-04-12X	G6M-04-12X-MONYY	Native Sample
	G6M-04-13X	G6M-04-13X-MONYY	Native Sample
	66M-92-10X	66M-92-10X-MONYY	Native Sample
	G6M-93-13X	G6M-93-13X-MONYY	Native Sample
	G6M-95-20X	G6M-95-20X-MONYY	Native Sample
	G6M-96-22A	G6M-96-22A-MONYY	Native Sample
	G6M-96-22B	G6M-96-22B-MONYY	Native Sample
	G6M-96-24B	G6M-96-24B-MONYY	Native Sample
	G6M-96-25A	G6M-96-25A-MONYY	Native Sample
	G6M-96-25B	G6M-96-25B-MONYY	Native Sample
	G6M-96-26A	G6M-96-26A-MONYY	Native Sample
	G6M-96-26B	G6M-96-26B-MONYY	Native Sample
AOC 50 (Plume Area)	G6M-01-01X	G6M-01-01X-MONYY	Native Sample
	G6M-02-01X	G6M-02-01X-MONYY	Native Sample
	G6M-02-06X	G6M-02-06X-MONYY	Native Sample
	G6M-02-07X	G6M-02-07X-MONYY	Native Sample
	G6M-02-09X	G6M-02-09X-MONYY	Native Sample
	G6M-02-13X	G6M-02-13X-MONYY	Native Sample
	G6M-03-11X	G6M-03-11X-MONYY	Native Sample
	G6M-04-03X	G6M-04-03X-MONYY	Native Sample
	G6M-04-06X	G6M-04-06X-MONYY	Native Sample
	G6M-04-08X	G6M-04-08X-MONYY	Native Sample
	G6M--04-14X	G6M--04-14X-MONYY	Native Sample
	G6M-13-02X	G6M-13-02X-MONYY	Native Sample
	G6M-13-03X	G6M-13-03X-MONYY	Native Sample
	XSA-00-91X	XSA-00-91X-MONYY	Native Sample
	XSA-00-90X	XSA-00-90X-MONYY	Native Sample
	XSA-00-88X	XSA-00-88X-MONYY	Native Sample
	XSA-12-96X	XSA-12-96X-MONYY	Native Sample
	XSA-12-98X	XSA-12-98X-MONYY	Native Sample

Table 2
Area 3 Existing Monitoring Well Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Sample Type**
QC Samples**	MW-2A	A3-MW-DUP-MMDDYY	Field Duplicate
	G6M-04-10X	A3-MW-DUP-MMDDYY	Field Duplicate
	G6M-96-25A	A3-MW-DUP-MMDDYY	Field Duplicate
	G6M-03-11X	A3-MW-DUP-MMDDYY	Field Duplicate
	MW-2A	MW-2A-MONYY	MS/MSD
	G6M-96-25A	G6M-96-25A-MONYY	MS/MSD
	XSA-00-88X	XSA-00-88X-MONYY	MS/MSD
	NA	A3-MW-EB-MMDDYY	Equipment Blank
	NA	A3-MW-FRB-MDDYY	Field Blank

Notes:

All samples will be analyzed for PFAS via isotope dilution. Analyte list is specified in UFP-QAPP Worksheet #15.

* = The sample name will consist of the well identifier followed by the month and the year the sample was collected. The month will be represented by three letters and the year by two numbers.

** Field Quality Control Samples (FD, MS/MSD, EBs and Field Reagent Blanks) will be collected at a frequency specified in UFP-QAPP worksheet #20. The FD will be collected at a 10% frequency, MS/MSD will be collected at a 5% frequency, EB will be collected at least once a week per piece of equipment, the FRB will be collected is at least once during each sampling event. The frequency will be applied to all of Area 3. The QC samples IDs are approximated and can change based on field conditions. Equipment blanks only collected if non-disposal equipment is used. Only one EB and FRB sample IDs are shown, but the appropriate number will be collected.

AOC = area of contamination
EB = equipment rinsate blank
FRB = field reagant blank
FD = field duplicate
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control

Table 3
Area 3 Groundwater Vertical Profiling/Soil Boring Locations and Rationale
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Proposed Location	Rationale	Sampling intervals
Area of Concern 20		
20VP-19-01	Determine if PFAS contamination is present in groundwater to the north of AOC 20.	Water table to refusal
20VP-19-02	Define extent of PFAS contamination in groundwater to the east of AOC 20, between the sand infiltration beds and the Nashua River.	Water table to refusal
20VP-19-03	Define extent of PFAS contamination in groundwater to the east of AOC 20, between the sand infiltration beds and the Nashua River.	Water table to refusal
20VP-19-04	Define extent of PFAS contamination in groundwater to the southeast of AOC 20, between the sand infiltration beds and the Nashua River.	Water table to refusal
20VP-19-05	Determine if PFAS contamination in groundwater to the south of AOC 20, between the sand infiltration beds and the Nashua River.	Water table to refusal
20VP-19-06 *	Determine if PFAS contamination is present in groundwater to the west of AOC 20.	Water table to refusal
20VP-19-07	Determine if PFAS contamination is present in groundwater to the west of AOC 20.	Water table to refusal
20VP-19-08/20SB19-08	Determine if PFAS contamination is present in groundwater and soil within a sand infiltration bed.	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
20VP-19-09	Determine if PFAS contamination is present in groundwater beneath the sand infiltration beds.	Water table to refusal
20VP-19-10	Determine if PFAS contamination is present in groundwater to the west of AOC 20.	Water table to refusal
20SB-19-01 through 19-07	Determine if PFAS contamination is present in soil associated with sand infiltration beds.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and 2 samples two feet above the water table
Area of Concern 21		
21VP-19-01/ 21SB-19-01	Define extent of PFAS contamination in groundwater and soil within AOC 21.	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
21VP-19-02	Define extent of PFAS in groundwater to the east of AOCs 20 and 21	Water table to refusal
21SB-19-02	Define extent of PFAS in soil at sludge drying beds.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
21SB-19-03	Define extent of PFAS in soil at sludge drying beds.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
Area of Concern 30		
30VP-19-01*	Determine if PFAS contamination is present in groundwater to the north of AOC 30.	Water table to refusal
30VP-19-02	Determine if PFAS contamination is present in groundwater to the north of AOC 30.	Water table to refusal
30VP-19-03	Define the extent of PFAS contamination in groundwater within an area of known groundwater contamination at former drum storage areas.	Water table to refusal
30VP-19-04*	Determine if PFAS contamination is present in groundwater to the southwest of AOC 30.	Water table to refusal
30SB-19-01	Determine if PFAS contamination is present in soil at a former drum storage area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
30SB-19-02	Determine if PFAS contamination is present in soil at a former drum storage area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
30SB-19-03	Determine if PFAS contamination is present in soil at a former drum storage area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
30SB-19-04	Determine if PFAS contamination is present in soil at a former drum storage area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
30SB-19-05	Determine if PFAS contamination is present in soil at a former drum storage area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
30SB-19-06	Determine if PFAS contamination is present in soil at a former drum storage area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
Area of Concern 31		
31VP-19-01/ 31SB-19-01	Define the extent of PFAS contamination in groundwater and soil within former fire training area.	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
31VP-19-02	Define extent of PFAS in groundwater within an area of known PFAS contamination downgradient of former fire training area.	Water table to refusal
31VP-19-03	Define extent of PFAS in groundwater within an area of known PFAS contamination downgradient of former fire training area.	Water table to refusal
31VP-19-04	Determine if PFAS contamination is present in groundwater to the north of former fire training area.	Water table to refusal

Table 3
Area 3 Groundwater Vertical Profiling/Soil Boring Locations and Rationale
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Proposed Location	Rationale	Sampling intervals
31VP-19-05	Determine if PFAS contamination is present in groundwater to the west of former fire training area, on west side of Nashua River.	Water table to refusal
31VP-19-06	Determine if PFAS contamination is present in groundwater to the west of former fire training area, on east side of the Nashua River.	Water table to refusal
31VP-19-07	Determine if PFAS contamination is present in groundwater to the west of former fire training area, on east side of the Nashua River.	Water table to refusal
31VP-19-08	Determine if PFAS contamination is present in groundwater to the west of former fire training area, on east side of the Nashua River.	Water table to refusal
G6M-18-01	Define extent of PFAS contamination in groundwater to the northeast of former fire training area. Vertical profile to be installed under AOC 50 LTM program. Splits will be collected and submitted for PFAS analysis. To be performed in October 2018.	Water table to refusal
G6M-18-02	Define extent of PFAS contamination in groundwater to the southwest of fire training area. Vertical profile to be installed under AOC 50 LTM program. Splits will be collected and submitted for PFAS analysis. To be perfomred in October 2018.	Water table to refusal
31SB-19-02	Define the extent of PFAS soil contamination within former fire training area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
31SB-19-03	Define the extent of PFAS soil contamination within former fire training area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
31SB-19-04	Define the extent of PFAS soil contamination within former fire training area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
31SB-19-05	Define the extent of PFAS soil contamination within former fire training area.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
31SB-19-06	Determine if PFAS contamination is present in soil downgradient of former fire training area.	0-1, 3-7 ft bgs
31SB-19-07	Determine if PFAS contamination is present in soil downgradient of former fire training area.	0-1, 3-7 ft bgs
Area of Concern 50		
50VP-19-01	Determine if PFAS are present in groundwater to the north of Route 2A.	Water table to refusal
50VP-19-02	Determine if PFAS are present in groundwater to the north of Route 2A.	Water table to refusal
50VP-19-03	Determine if PFAS are present in groundwater to the north of Route 2A.	Water table to refusal
50VP-19-04*	Determine if PFAS are present in groundwater to the northeast of former hangar buildings.	Water table to refusal
50VP-19-05	Define extent of PFAS within an area of known PFAS groundwater contamination at former airfield hanger.	Water table to refusal
50VP-19-06*	Define extent of PFAS within an area of known PFAS groundwater contamination at former airfield hanger.	Water table to refusal
50VP-19-07	Define the extent of PFAS in groundwater within area of known PFAS groundwater contamination.	VP to top of nearby monitoring well screen
50VP-19-08	Define the extent of PFAS in groundwater on the west side of the Nashua River.	VP to top of nearby monitoring well screen
50VP-19-09*	Determine if PFAS are present in groundwater to the east of the airfield.	Water table to refusal
50VP-19-10* / 50SB-19-10	Determine if PFAS are present in soil and groundwater in an area of the airfield that historically received sludge from the Devens WWTP.	Water table to refusal/ 0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
50VP-19-11*	Determine if PFAS are present in groundwater to the east of the airfield.	Water table to refusal
50VP-19-12*	Determine if PFAS are present in groundwater to the east of the airfield.	Water table to refusal
50VP-19-13*	Determine if PFAS are present in groundwater to the west of the airfield.	Water table to refusal
50SB-19-01 through 50SB-19-05	Determine if PFAS are present in soil at potential source area (Former Airfield Hanger and Fire Station).	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs and two feet above the water table
50SB-19-06	Determine if PFAS are present in soil in area of the airfield the historically received sludge from the Devens WWTP.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
50SB-19-07	Determine if PFAS are present in soil in area of the airfield the historically received sludge from the Devens WWTP.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
50SB-19-08	Determine if PFAS are present in soil in area of the airfield the historically received sludge from the Devens WWTP.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
50SB-19-09	Determine if PFAS are present in soil in area of the airfield the historically received sludge from the Devens WWTP.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs
50SB-19-10	Determine if PFAS are present in soil in area of the airfield the historically received sludge from the Devens WWTP.	0-0.5, 0.5-3, 3-7, and 7-15 ft bgs

Notes:
* Location where a piezometer will be installed at the water table after groundwater vertical profiling.

AOC = Area of Contamination
LTM = Long-Term Monitoring
ft bgs = feet below ground surface
WWTP = Water Water Treatment Plant

Table 4
Area 3 Groundwater Vertical Profiling Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name	Maximum Target Boring Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs) **	Proposed Sample Depth (ft bgs) **	Sample Type***
AOC 20	20VP-19-01	20VP-19-01-XX-XX	156	35	35-39	Native Sample
		20VP-19-01-XX-XX	156	35	45-49	Native Sample
		20VP-19-01-XX-XX	156	35	55-59	Native Sample
		20VP-19-01-XX-XX	156	35	65-69	Native Sample
		20VP-19-01-XX-XX	156	35	75-79	Native Sample
		20VP-19-01-XX-XX	156	35	85-89	Native Sample
		20VP-19-01-XX-XX	156	35	95-99	Native Sample
		20VP-19-01-XX-XX	156	35	105-109	Native Sample
		20VP-19-01-XX-XX	156	35	115-119	Native Sample
		20VP-19-01-XX-XX	156	35	125-129	Native Sample
		20VP-19-01-XX-XX	156	35	135-139	Native Sample
		20VP-19-01-XX-XX	156	35	145-149	Native Sample
	20VP-19-02	20VP-19-02-XX-XX	135	15	15-19	Native Sample
		20VP-19-02-XX-XX	135	15	25-29	Native Sample
		20VP-19-02-XX-XX	135	15	35-39	Native Sample
		20VP-19-02-XX-XX	135	15	45-49	Native Sample
		20VP-19-02-XX-XX	135	15	55-59	Native Sample
		20VP-19-02-XX-XX	135	15	65-69	Native Sample
		20VP-19-02-XX-XX	135	15	75-79	Native Sample
		20VP-19-02-XX-XX	135	15	85-89	Native Sample
		20VP-19-02-XX-XX	135	15	95-99	Native Sample
		20VP-19-02-XX-XX	135	15	105-109	Native Sample
		20VP-19-02-XX-XX	135	15	115-119	Native Sample
		20VP-19-02-XX-XX	135	15	125-129	Native Sample
	20VP-19-03	20VP-19-03-XX-XX	135	15	15-19	Native Sample
		20VP-19-03-XX-XX	135	15	25-29	Native Sample
		20VP-19-03-XX-XX	135	15	35-39	Native Sample
		20VP-19-03-XX-XX	135	15	45-49	Native Sample
		20VP-19-03-XX-XX	135	15	55-59	Native Sample
		20VP-19-03-XX-XX	135	15	65-69	Native Sample
		20VP-19-03-XX-XX	135	15	75-79	Native Sample
		20VP-19-03-XX-XX	135	15	85-89	Native Sample
		20VP-19-03-XX-XX	135	15	95-99	Native Sample
		20VP-19-03-XX-XX	135	15	105-109	Native Sample
		20VP-19-03-XX-XX	135	15	115-119	Native Sample
		20VP-19-03-XX-XX	135	15	125-129	Native Sample
	20VP-19-04	20VP-19-04-XX-XX	135	15	15-19	Native Sample
		20VP-19-04-XX-XX	135	15	25-29	Native Sample
		20VP-19-04-XX-XX	135	15	35-39	Native Sample
		20VP-19-04-XX-XX	135	15	45-49	Native Sample
		20VP-19-04-XX-XX	135	15	55-59	Native Sample
		20VP-19-04-XX-XX	135	15	65-69	Native Sample
		20VP-19-04-XX-XX	135	15	75-79	Native Sample
		20VP-19-04-XX-XX	135	15	85-89	Native Sample
		20VP-19-04-XX-XX	135	15	95-99	Native Sample
		20VP-19-04-XX-XX	135	15	105-109	Native Sample
		20VP-19-04-XX-XX	135	15	115-119	Native Sample
		20VP-19-04-XX-XX	135	15	125-129	Native Sample
	20VP-19-05	20VP-19-05-XX-XX	135	15	15-19	Native Sample
		20VP-19-05-XX-XX	135	15	25-29	Native Sample
		20VP-19-05-XX-XX	135	15	35-39	Native Sample
		20VP-19-05-XX-XX	135	15	45-49	Native Sample
		20VP-19-05-XX-XX	135	15	55-59	Native Sample
		20VP-19-05-XX-XX	135	15	65-69	Native Sample
		20VP-19-05-XX-XX	135	15	75-79	Native Sample
		20VP-19-05-XX-XX	135	15	85-89	Native Sample
		20VP-19-05-XX-XX	135	15	95-99	Native Sample
		20VP-19-05-XX-XX	135	15	105-109	Native Sample
		20VP-19-05-XX-XX	135	15	115-119	Native Sample
		20VP-19-05-XX-XX	135	15	125-129	Native Sample
	20VP-19-06	20VP-19-06-XX-XX	145	25	25-29	Native Sample
		20VP-19-06-XX-XX	145	25	35-39	Native Sample
		20VP-19-06-XX-XX	145	25	45-39	Native Sample
		20VP-19-06-XX-XX	145	25	55-59	Native Sample
		20VP-19-06-XX-XX	145	25	65-69	Native Sample
		20VP-19-06-XX-XX	145	25	75-79	Native Sample
		20VP-19-06-XX-XX	145	25	85-89	Native Sample
		20VP-19-06-XX-XX	145	25	95-99	Native Sample
		20VP-19-06-XX-XX	145	25	95-99	Native Sample
		20VP-19-06-XX-XX	145	25	105-109	Native Sample
		20VP-19-06-XX-XX	145	25	115-119	Native Sample

Table 4
Area 3 Groundwater Vertical Profiling Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name	Maximum Target Boring Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs) **	Proposed Sample Depth (ft bgs) **	Sample Type***
AOC 20		20VP-19-06-XX-XX	145	25	125-129	Native Sample
		20VP-19-06-XX-XX	145	25	135-139	Native Sample
	20VP-19-07	20VP-19-07-XX-XX	165	45	45-49	Native Sample
		20VP-19-07-XX-XX	165	45	55-59	Native Sample
		20VP-19-07-XX-XX	165	45	65-69	Native Sample
		20VP-19-07-XX-XX	165	45	75-79	Native Sample
		20VP-19-07-XX-XX	165	45	85-89	Native Sample
		20VP-19-07-XX-XX	165	45	95-99	Native Sample
		20VP-19-07-XX-XX	165	45	105-109	Native Sample
		20VP-19-07-XX-XX	165	45	115-125	Native Sample
		20VP-19-07-XX-XX	165	45	135-145	Native Sample
		20VP-19-07-XX-XX	165	45	155-165	Native Sample
	20VP-19-08	20VP-19-08-XX-XX	190	60	60-64	Native Sample
		20VP-19-08-XX-XX	190	60	70-74	Native Sample
		20VP-19-08-XX-XX	190	60	80-84	Native Sample
		20VP-19-08-XX-XX	190	60	90-94	Native Sample
		20VP-19-08-XX-XX	190	60	100-104	Native Sample
		20VP-19-08-XX-XX	190	60	110-114	Native Sample
		20VP-19-08-XX-XX	190	60	120-124	Native Sample
		20VP-19-08-XX-XX	190	60	130-134	Native Sample
		20VP-19-08-XX-XX	190	60	140-144	Native Sample
		20VP-19-08-XX-XX	190	60	150-154	Native Sample
		20VP-19-08-XX-XX	190	60	160-164	Native Sample
		20VP-19-08-XX-XX	190	60	170-174	Native Sample
		20VP-19-08-XX-XX	190	60	180-184	Native Sample
	20VP-19-09	20VP-19-09-XX-XX	190	60	60-64	Native Sample
		20VP-19-09-XX-XX	190	60	70-74	Native Sample
		20VP-19-09-XX-XX	190	60	80-84	Native Sample
		20VP-19-09-XX-XX	190	60	90-94	Native Sample
		20VP-19-09-XX-XX	190	60	100-104	Native Sample
		20VP-19-09-XX-XX	190	60	110-114	Native Sample
		20VP-19-09-XX-XX	190	60	120-124	Native Sample
		20VP-19-09-XX-XX	190	60	130-134	Native Sample
		20VP-19-09-XX-XX	190	60	140-144	Native Sample
		20VP-19-09-XX-XX	190	60	150-154	Native Sample
		20VP-19-09-XX-XX	190	60	160-164	Native Sample
		20VP-19-09-XX-XX	190	60	170-174	Native Sample
		20VP-19-09-XX-XX	190	60	180-184	Native Sample
	20VP-19-10	20VP-19-10-XX-XX	155	35	35-39	Native Sample
		20VP-19-10-XX-XX	155	35	45-49	Native Sample
		20VP-19-10-XX-XX	155	35	55-59	Native Sample
		20VP-19-10-XX-XX	155	35	65-69	Native Sample
		20VP-19-10-XX-XX	155	35	75-79	Native Sample
		20VP-19-10-XX-XX	155	35	85-89	Native Sample
		20VP-19-10-XX-XX	155	35	95-99	Native Sample
		20VP-19-10-XX-XX	155	35	105-109	Native Sample
		20VP-19-10-XX-XX	155	35	115-119	Native Sample
		20VP-19-10-XX-XX	155	35	125-129	Native Sample
		20VP-19-10-XX-XX	155	35	135-139	Native Sample
		20VP-19-10-XX-XX	155	35	145-149	Native Sample
AOC 21	21VP-19-01	21VP-19-01-XX-XX	150	30	30-34	Native Sample
		21VP-19-01-XX-XX	150	30	40-44	Native Sample
		21VP-19-01-XX-XX	150	30	50-54	Native Sample
		21VP-19-01-XX-XX	150	30	60-64	Native Sample
		21VP-19-01-XX-XX	150	30	70-74	Native Sample
		21VP-19-01-XX-XX	150	30	80-84	Native Sample
		21VP-19-01-XX-XX	150	30	90-94	Native Sample
		21VP-19-01-XX-XX	150	30	100-104	Native Sample
		21VP-19-01-XX-XX	150	30	110-114	Native Sample
		21VP-19-01-XX-XX	150	30	120-124	Native Sample
		21VP-19-01-XX-XX	150	30	130-134	Native Sample
		21VP-19-01-XX-XX	150	30	140-144	Native Sample
	21VP-19-02	21VP-19-02-XX-XX	135	15	15-19	Native Sample
		21VP-19-02-XX-XX	135	15	25-29	Native Sample
		21VP-19-02-XX-XX	135	15	35-39	Native Sample
		21VP-19-02-XX-XX	135	15	45-49	Native Sample
		21VP-19-02-XX-XX	135	15	55-59	Native Sample
		21VP-19-02-XX-XX	135	15	65-69	Native Sample
		21VP-19-02-XX-XX	135	15	75-79	Native Sample
		21VP-19-02-XX-XX	135	15	85-89	Native Sample
		21VP-19-02-XX-XX	135	15	95-99	Native Sample

Table 4
Area 3 Groundwater Vertical Profiling Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name	Maximum Target Boring Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs) **	Proposed Sample Depth (ft bgs) **	Sample Type***
AOC 21		21VP-19-02-XX-XX	135	15	105-109	Native Sample
		21VP-19-02-XX-XX	135	15	115-119	Native Sample
		21VP-19-02-XX-XX	135	15	125-129	Native Sample
AOC 30	30VP-19-01	30VP-19-01-XX-XX	70	20	20-24	Native Sample
		30VP-19-01-XX-XX	70	20	30-34	Native Sample
		30VP-19-01-XX-XX	70	20	40-44	Native Sample
		30VP-19-01-XX-XX	70	20	50-54	Native Sample
		30VP-19-01-XX-XX	70	20	60-64	Native Sample
	30VP-19-02	30VP-19-02-XX-XX	70	20	20-24	Native Sample
		30VP-19-02-XX-XX	70	20	30-34	Native Sample
		30VP-19-02-XX-XX	70	20	40-44	Native Sample
		30VP-19-02-XX-XX	70	20	50-54	Native Sample
		30VP-19-02-XX-XX	70	20	60-64	Native Sample
	30VP-19-03	30VP-19-03-XX-XX	115	65	65-69	Native Sample
		30VP-19-03-XX-XX	115	65	75-79	Native Sample
		30VP-19-03-XX-XX	115	65	85-89	Native Sample
		30VP-19-03-XX-XX	115	65	95-99	Native Sample
		30VP-19-03-XX-XX	115	65	105-109	Native Sample
		30VP-19-03-XX-XX	115	65	110-114	Native Sample
	30VP-19-04	30VP-19-04-XX-XX	115	65	65-69	Native Sample
		30VP-19-04-XX-XX	115	65	75-79	Native Sample
		30VP-19-04-XX-XX	115	65	85-89	Native Sample
		30VP-19-04-XX-XX	115	65	95-99	Native Sample
		30VP-19-04-XX-XX	115	65	105-109	Native Sample
		30VP-19-04-XX-XX	115	65	110-114	Native Sample
AOC 31	31VP-19-01	31VP-19-01-XX-XX	185	65	65-69	Native Sample
		31VP-19-01-XX-XX	185	65	75-79	Native Sample
		31VP-19-01-XX-XX	185	65	85-89	Native Sample
		31VP-19-01-XX-XX	185	65	95-99	Native Sample
		31VP-19-01-XX-XX	185	65	105-109	Native Sample
		31VP-19-01-XX-XX	185	65	115-119	Native Sample
		31VP-19-01-XX-XX	185	65	125-129	Native Sample
		31VP-19-01-XX-XX	185	65	135-139	Native Sample
		31VP-19-01-XX-XX	185	65	145-149	Native Sample
		31VP-19-01-XX-XX	185	65	155-159	Native Sample
		31VP-19-01-XX-XX	185	65	165-169	Native Sample
		31VP-19-01-XX-XX	185	65	175-179	Native Sample
	31VP-19-02	31VP-19-02-XX-XX	185	65	65-69	Native Sample
		31VP-19-02-XX-XX	185	65	75-79	Native Sample
		31VP-19-02-XX-XX	185	65	85-89	Native Sample
		31VP-19-02-XX-XX	185	65	95-99	Native Sample
		31VP-19-02-XX-XX	185	65	105-109	Native Sample
		31VP-19-02-XX-XX	185	65	115-119	Native Sample
		31VP-19-02-XX-XX	185	65	125-129	Native Sample
		31VP-19-02-XX-XX	185	65	135-139	Native Sample
		31VP-19-02-XX-XX	185	65	145-149	Native Sample
		31VP-19-02-XX-XX	185	65	155-159	Native Sample
		31VP-19-02-XX-XX	185	65	165-169	Native Sample
		31VP-19-02-XX-XX	185	65	175-179	Native Sample
	31VP-19-03	31VP-19-03-XX-XX	185	65	65-69	Native Sample
		31VP-19-03-XX-XX	185	65	75-79	Native Sample
		31VP-19-03-XX-XX	185	65	85-89	Native Sample
		31VP-19-03-XX-XX	185	65	95-99	Native Sample
		31VP-19-03-XX-XX	185	65	105-109	Native Sample
		31VP-19-03-XX-XX	185	65	115-119	Native Sample
		31VP-19-03-XX-XX	185	65	125-129	Native Sample
		31VP-19-03-XX-XX	185	65	135-139	Native Sample
		31VP-19-03-XX-XX	185	65	145-149	Native Sample
		31VP-19-03-XX-XX	185	65	155-159	Native Sample
		31VP-19-03-XX-XX	185	65	165-169	Native Sample
		31VP-19-03-XX-XX	185	65	175-179	Native Sample
	31VP-19-04	31VP-19-04-XX-XX	185	65	65-69	Native Sample
		31VP-19-04-XX-XX	185	65	75-79	Native Sample
		31VP-19-04-XX-XX	185	65	85-89	Native Sample
		31VP-19-04-XX-XX	185	65	95-99	Native Sample
		31VP-19-04-XX-XX	185	65	105-109	Native Sample
		31VP-19-04-XX-XX	185	65	115-119	Native Sample
		31VP-19-04-XX-XX	185	65	125-129	Native Sample
		31VP-19-04-XX-XX	185	65	135-139	Native Sample
		31VP-19-04-XX-XX	185	65	145-149	Native Sample
		31VP-19-04-XX-XX	185	65	155-159	Native Sample

Table 4
Area 3 Groundwater Vertical Profiling Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name	Maximum Target Boring Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs) **	Proposed Sample Depth (ft bgs) **	Sample Type***
AOC 31		31VP-19-04-XX-XX	185	65	165-169	Native Sample
		31VP-19-04-XX-XX	185	65	175-179	Native Sample
	31VP-19-05	31VP-19-05-XX-XX	125	5	5-9	Native Sample
		31VP-19-05-XX-XX	125	5	15-19	Native Sample
		31VP-19-05-XX-XX	125	5	25-29	Native Sample
		31VP-19-05-XX-XX	125	5	35-39	Native Sample
		31VP-19-05-XX-XX	125	5	45-49	Native Sample
		31VP-19-05-XX-XX	125	5	55-59	Native Sample
		31VP-19-05-XX-XX	125	5	65-69	Native Sample
		31VP-19-05-XX-XX	125	5	75-79	Native Sample
		31VP-19-05-XX-XX	125	5	85-89	Native Sample
		31VP-19-05-XX-XX	125	5	95-99	Native Sample
		31VP-19-05-XX-XX	125	5	105-109	Native Sample
		31VP-19-05-XX-XX	125	5	115-119	Native Sample
	31VP-19-06 ****	31VP-19-06-XX-XX	40	5	5-9	Native Sample
		31VP-19-06-XX-XX	40	5	15-19	Native Sample
		31VP-19-06-XX-XX	40	5	25-29	Native Sample
		31VP-19-06-XX-XX	40	5	35-39	Native Sample
	31VP-19-07 ****	31VP-19-07-XX-XX	40	5	5-9	Native Sample
		31VP-19-07-XX-XX	40	5	15-19	Native Sample
		31VP-19-07-XX-XX	40	5	25-29	Native Sample
		31VP-19-07-XX-XX	40	5	35-39	Native Sample
	31VP-19-08 ****	31VP-19-08-XX-XX	40	5	5-9	Native Sample
		31VP-19-08-XX-XX	40	5	15-19	Native Sample
		31VP-19-08-XX-XX	40	5	25-29	Native Sample
		31VP-19-08-XX-XX	40	5	35-39	Native Sample
AOC 50	50VP-19-01	50VP-19-01-XX-XX	65	5	5-9	Native Sample
		50VP-19-01-XX-XX	65	5	15-19	Native Sample
		50VP-19-01-XX-XX	65	5	25-29	Native Sample
		50VP-19-01-XX-XX	65	5	35-39	Native Sample
		50VP-19-01-XX-XX	65	5	45-49	Native Sample
		50VP-19-01-XX-XX	65	5	55-59	Native Sample
	50VP-19-02	50VP-19-02-XX-XX	65	5	5-9	Native Sample
		50VP-19-02-XX-XX	65	5	15-19	Native Sample
		50VP-19-02-XX-XX	65	5	25-29	Native Sample
		50VP-19-02-XX-XX	65	5	35-39	Native Sample
		50VP-19-02-XX-XX	65	5	45-49	Native Sample
		50VP-19-02-XX-XX	65	5	55-59	Native Sample
	50VP-19-03	50VP-19-03-XX-XX	65	5	5-9	Native Sample
		50VP-19-03-XX-XX	65	5	15-19	Native Sample
		50VP-19-03-XX-XX	65	5	25-29	Native Sample
		50VP-19-03-XX-XX	65	5	35-39	Native Sample
		50VP-19-03-XX-XX	65	5	45-49	Native Sample
		50VP-19-03-XX-XX	65	5	55-59	Native Sample
	50VP-19-04	50VP-19-04-XX-XX	115	55	55-59	Native Sample
		50VP-19-04-XX-XX	115	55	65-69	Native Sample
		50VP-19-04-XX-XX	115	55	75-79	Native Sample
		50VP-19-04-XX-XX	115	55	85-89	Native Sample
		50VP-19-04-XX-XX	115	55	95-99	Native Sample
		50VP-19-04-XX-XX	115	55	105-109	Native Sample
	50VP-19-05	50VP-19-05-XX-XX	115	55	55-59	Native Sample
		50VP-19-05-XX-XX	115	55	65-69	Native Sample
		50VP-19-05-XX-XX	115	55	75-79	Native Sample
		50VP-19-05-XX-XX	115	55	85-89	Native Sample
		50VP-19-05-XX-XX	115	55	95-99	Native Sample
		50VP-19-05-XX-XX	115	55	105-109	Native Sample
	50VP-19-06	50VP-19-06-XX-XX	115	55	55-59	Native Sample
		50VP-19-06-XX-XX	115	55	65-69	Native Sample
		50VP-19-06-XX-XX	115	55	75-79	Native Sample
		50VP-19-06-XX-XX	115	55	85-89	Native Sample
		50VP-19-06-XX-XX	115	55	95-99	Native Sample
		50VP-19-06-XX-XX	115	55	105-109	Native Sample
	50VP-19-07 *****	50VP-19-07-XX-XX	125	65	65-69	Native Sample
		50VP-19-07-XX-XX	125	65	75-79	Native Sample
		50VP-19-07-XX-XX	125	65	85-89	Native Sample
		50VP-19-07-XX-XX	125	65	95-99	Native Sample
		50VP-19-07-XX-XX	125	65	105-109	Native Sample
		50VP-19-07-XX-XX	125	65	115-119	Native Sample
	50VP-19-08*****	50VP-19-08-XX-XX	80	5	5-9	Native Sample
		50VP-19-08-XX-XX	80	5	15-19	Native Sample
		50VP-19-08-XX-XX	80	5	25-29	Native Sample

Table 4
Area 3 Groundwater Vertical Profiling Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name	Maximum Target Boring Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs) **	Proposed Sample Depth (ft bgs) **	Sample Type***
AOC 50		50VP-19-08-XX-XX	80	5	35-39	Native Sample
		50VP-19-08-XX-XX	80	5	45-49	Native Sample
		50VP-19-08-XX-XX	80	5	55-59	Native Sample
		50VP-19-08-XX-XX	80	5	65-69	Native Sample
		50VP-19-08-XX-XX	80	5	75-79	Native Sample
	50VP-19-09	50VP-19-09-XX-XX	100	50	50-54	Native Sample
		50VP-19-09-XX-XX	100	50	60-64	Native Sample
		50VP-19-09-XX-XX	100	50	70-74	Native Sample
		50VP-19-09-XX-XX	100	50	80-84	Native Sample
		50VP-19-09-XX-XX	100	50	90-94	Native Sample
	50VP-19-10	50VP-19-10-XX-XX	105	50	50-54	Native Sample
		50VP-19-10-XX-XX	105	50	60-64	Native Sample
		50VP-19-10-XX-XX	105	50	70-74	Native Sample
		50VP-19-10-XX-XX	105	50	80-84	Native Sample
		50VP-19-10-XX-XX	105	50	90-94	Native Sample
		50VP-19-10-XX-XX	105	50	100-104	Native Sample
	50VP-19-11	50VP-19-11-XX-XX	105	50	50-54	Native Sample
		50VP-19-11-XX-XX	105	50	60-64	Native Sample
		50VP-19-11-XX-XX	105	50	70-74	Native Sample
		50VP-19-11-XX-XX	105	50	80-84	Native Sample
		50VP-19-11-XX-XX	105	50	90-94	Native Sample
		50VP-19-11-XX-XX	105	50	100-104	Native Sample
	50VP-19-12	50VP-19-12-XX-XX	105	50	50-54	Native Sample
		50VP-19-12-XX-XX	105	50	60-64	Native Sample
		50VP-19-12-XX-XX	105	50	70-74	Native Sample
		50VP-19-12-XX-XX	105	50	80-84	Native Sample
		50VP-19-12-XX-XX	105	50	90-94	Native Sample
		50VP-19-12-XX-XX	105	50	100-104	Native Sample
	50VP-19-13	50VP-19-13-XX-XX	115	65	65-69	Native Sample
		50VP-19-13-XX-XX	115	65	75-79	Native Sample
		50VP-19-13-XX-XX	115	65	85-89	Native Sample
		50VP-19-13-XX-XX	115	65	95-99	Native Sample
		50VP-19-13-XX-XX	115	65	105-109	Native Sample
QC Samples ***	20VP-19-XX	A3-VP-DUP-MMDDYY	NA	NA	NA	Field Duplicate
	20VP-19-XX	20VP-19-XX-XX	NA	NA	NA	MS/MSD
	NA	A3-VP-DUP-MMDDYY	NA	NA	NA	Equipment Blank
	NA	A3-VP-FRB-MMDDYY	NA	NA	NA	Field Blank

Notes:

All samples will be analyzed for PFAS via isotope dilution. Analyte list is specified in UFP-QAPP Worksheet #15.

If additional groundwater vertical profiles are advanced at an AOC, the location identifiers, sample identifiers and QC sample identifiers will be sequential to the locations provided in the table above.

Vertical profiling at G6M-18-01 and G6M-18-02 is not included as it was conducted in October 2018 in support of the AOC 50 LTM program.

* Groundwater samples will be collected from the water table to refusal, except at 50VP-19-07 and -08 as indicated in Table 3 . Maximum target depth is anticipated depth to bedrock/glacial till based on depth to bedrock reported at AOC 50 (KGS, 2018d). The actual depths and number of sampling intervals at a given location may be more or less than anticipated, depending on field conditions observed during profiling.

** Approximate depth to groundwater and proposed sample depths are for planning purposes and are estimated from depth to water measurements at nearby temporary wells or long-term monitoring wells sampled during the SI (BERS-Weston, 2018a) or LTM monitoring (KGS, 2018b). Actual depth to water will be measured during advancement of the groundwater vertical profile borings and sample depths and sample nomenclature will be adjusted to reflect actual conditions measured at the time of groundwater vertical profiling.

*** Field Quality Control Samples (FD, MS/MSD, EBs and Field Reagent Blanks) will be collected at a frequency specified in UFP-QAPP worksheet #20. The FD will be collected at a 10% frequency, MS/MSD will be collected at a 5% frequency, EB will be collected at least once a week per piece of equipment, the FRB will be collected is at least once during the event. The frequency will be applied to all of Area 3. The QC samples IDs are approximated and can change based on field conditions. Equipment blanks only collected if non-disposal equipment is used.

**** Due to inaccessibility of this area with a direct-push rig, vertical profile to be advanced to the maximum depth possible using a hand-held air percussion hammer to advance sampling rods. Final depth will be dependent on subsurface conditions encountered in the field.

***** 50VP-19-07 will be advanced adjacent to existing monitoring well G6M-13-04X. Vertical profiling at this boring will be completed to 125 ft bgs, which is the depth to the top of the monitoring well screen at G6M-13-04X. 50VP-19-08 will be advance adjacent to existing monitoring well G6M-04-14X. Vertical profiling at this boring will be completed to 80 ft bgs, which is the depth to the top of the monitoring well screen at G6M-04-14X.

XX = Final sample name to be determined in the field. For the native samples XX-XX will represent the depth relative to ground surface of the sample interval. For the QC samples XX respresents the sample number and will be incremented as each sample is collected. MS/MSD samples will be identified in the notes of the chain of custody (i.e., a unique field sample identifier will not be used to denote a MS/MSD sample).

AOC = area of contamination
EB = equipment rinsate blank
FRB = field reagent blank
FD = field duplicate
ft bgs = feet below ground surface
LTM = long-term monitoring program
MS/MSD = matrix spike/matrix spike duplicate
NA = not applicable
QC = quality control
SI = site inspection

Table 5
Area 3 Soil Boring Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Proposed Sample Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs)**	Sample Type
AOC 20	20SB-19-01	20SB-19-01-0-0.5	0-0.5	60	Native Sample
		20SB-19-01-0.5-3	0.5-3	60	Native Sample
		20SB-19-01-3-7	3-7	60	Native Sample
		20SB-19-01-7-15	7-15	60	Native Sample
	20SB-19-02	20SB-19-02-0-0.5	0-0.5	60	Native Sample
		20SB-19-02-0.5-3	0.5-3	60	Native Sample
		20SB-19-02-3-7	3-7	60	Native Sample
		20SB-19-02-7-15	7-15	60	Native Sample
		20SB-18-02-58-60	58-60	60	Native Sample
	20SB-19-03	20SB-19-03-0-0.5	0-0.5	60	Native Sample
		20SB-19-03-0.5-3	0.5-3	60	Native Sample
		20SB-19-03-3-7	3-7	60	Native Sample
		20SB-19-03-7-15	7-15	60	Native Sample
	20SB-19-04	20SB-19-04-0-0.5	0-0.5	60	Native Sample
		20SB-19-04-0.5-3	0.5-3	60	Native Sample
		20SB-19-04-3-7	3-7	60	Native Sample
		20SB-19-04-7-15	7-15	60	Native Sample
		20SB-18-04-58-60	58-60	60	Native Sample
	20SB-19-05	20SB-19-05-0-0.5	0-0.5	60	Native Sample
		20SB-19-05-0.5-3	0.5-3	60	Native Sample
		20SB-19-05-3-7	3-7	60	Native Sample
		20SB-19-05-7-15	7-15	60	Native Sample
	20SB-19-06	20SB-19-06-0-0.5	0-0.5	60	Native Sample
		20SB-19-06-0.5-3	0.5-3	60	Native Sample
		20SB-19-06-3-7	3-7	60	Native Sample
		20SB-19-06-7-15	7-15	60	Native Sample
	20SB-19-07	20SB-19-07-0-0.5	0-0.5	60	Native Sample
		20SB-19-07-0.5-3	0.5-3	60	Native Sample
		20SB-19-07-3-7	3-7	60	Native Sample
		20SB-19-07-7-15	7-15	60	Native Sample
	20SB-19-08	20SB-19-08-0-0.5	0-0.5	60	Native Sample
		20SB-19-08-0.5-3	0.5-3	60	Native Sample
		20SB-19-08-3-7	3-7	60	Native Sample
		20SB-19-08-7-15	7-15	60	Native Sample
		20SB-18-08-58-60	58-60	60	Native Sample
AOC 21	21SB-19-01	21SB-19-01-0-0.5	0-0.5	30	Native Sample
		21SB-19-01-0.5-3	0.5-3	30	Native Sample
		21SB-19-01-3-7	3-7	30	Native Sample
		21SB-19-01-7-15	7-15	30	Native Sample
	21SB-19-02	21SB-19-02-0-0.5	0-0.5	30	Native Sample
		21SB-19-02-0.5-3	0.5-3	30	Native Sample
		21SB-19-02-3-7	3-7	30	Native Sample
		21SB-19-02-7-15	7-15	30	Native Sample
		21SB-19-02-28-30	28-30	30	Native Sample
	21SB-19-03	21SB-19-03-0-0.5	0-0.5	30	Native Sample
		21SB-19-03-0.5-3	0.5-3	30	Native Sample
		21SB-19-03-3-7	3-7	30	Native Sample
		21SB-19-03-7-15	7-15	30	Native Sample
AOC 30	30SB-19-01	30SB-19-01-0-0.5	0-0.5	65	Native Sample
		30SB-19-01-0.5-3	0.5-3	65	Native Sample
		30SB-19-01-3-7	3-7	65	Native Sample
		30SB-19-01-7-15	7-15	65	Native Sample
		30SB-19-01-63-65	63-65	65	Native Sample

Table 5
Area 3 Soil Boring Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Proposed Sample Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs)**	Sample Type
AOC 30	30SB-19-02	30SB-19-02-0-0.5	0-0.5	65	Native Sample
		30SB-19-02-0.5-3	0.5-3	65	Native Sample
		30SB-19-02-3-7	3-7	65	Native Sample
		30SB-19-02-7-15	7-15	65	Native Sample
	30SB-19-03	30SB-19-03-0-0.5	0-0.5	65	Native Sample
		30SB-19-03-0.5-3	0.5-3	65	Native Sample
		30SB-19-03-3-7	3-7	65	Native Sample
		30SB-19-03-7-15	7-15	65	Native Sample
	30SB-19-04	30SB-19-04-0-0.5	0-0.5	65	Native Sample
		30SB-19-04-0.5-3	0.5-3	65	Native Sample
		30SB-19-04-3-7	3-7	65	Native Sample
		30SB-19-04-7-15	7-15	65	Native Sample
		30SB-19-04-68-70	63-65	65	Native Sample
	30SB-19-05	30SB-19-05-0-0.5	0-0.5	65	Native Sample
		30SB-19-05-0.5-3	0.5-3	65	Native Sample
		30SB-19-05-3-7	3-7	65	Native Sample
		30SB-19-05-7-15	7-15	65	Native Sample
	30SB-19-06	30SB-19-06-0-0.5	0-0.5	65	Native Sample
		30SB-19-06-0.5-3	0.5-3	65	Native Sample
		30SB-19-06-3-7	3-7	65	Native Sample
		30SB-19-06-7-15	7-15	65	Native Sample
AOC 31	31SB-19-01	31SB-19-01-0-0.5	0-0.5	65	Native Sample
		31SB-19-01-0.5-3	0.5-3	65	Native Sample
		31SB-19-01-3-7	3-7	65	Native Sample
		31SB-19-01-7-15	7-15	65	Native Sample
		31SB-19-01-63-65	63-65	65	Native Sample
	31SB-19-02	31SB-19-02-0-0.5	0-0.5	65	Native Sample
		31SB-19-02-0.5-3	0.5-3	65	Native Sample
		31SB-19-02-3-7	3-7	65	Native Sample
		31SB-19-02-7-15	7-15	65	Native Sample
	31SB-19-03	31SB-19-03-0-0.5	0-0.5	65	Native Sample
		31SB-19-03-0.5-3	0.5-3	65	Native Sample
		31SB-19-03-3-7	3-7	65	Native Sample
		31SB-19-03-7-15	7-15	65	Native Sample
	31SB-19-04	31SB-19-04-0-0.5	0-0.5	65	Native Sample
		31SB-19-04-0.5-3	0.5-3	65	Native Sample
		31SB-19-04-3-7	3-7	65	Native Sample
		31SB-19-04-7-15	7-15	65	Native Sample
	31SB-19-05	31SB-19-05-0-0.5	0-0.5	65	Native Sample
		31SB-19-05-0.5-3	0.5-3	65	Native Sample
		31SB-19-05-3-7	3-7	65	Native Sample
		31SB-19-05-7-15	7-15	65	Native Sample
	31SB-19-06	31SB-19-06-0-1	0-1	65	Native Sample
		31SB-19-06-3-7	3-7	65	Native Sample
	31SB-19-07	31SB-19-05-0-1	0-1	65	Native Sample
		31SB-19-05-3-7	3-7	65	Native Sample
AOC 50	50SB-19-01	50SB-19-01-0-0.5	0-0.5	55	Native Sample
		50SB-19-01-0.5-3	0.5-3	55	Native Sample
		50SB-19-01-3-7	3-7	55	Native Sample
		50SB-19-01-7-15	7-15	55	Native Sample
	50SB-19-02	50SB-19-02-0-0.5	0-0.5	55	Native Sample
		50SB-19-02-0.5-3	0.5-3	55	Native Sample
		50SB-19-02-3-7	3-7	55	Native Sample
		50SB-19-02-7-15	7-15	55	Native Sample

Table 5
Area 3 Soil Boring Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Proposed Sample Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs)**	Sample Type
	50SB-19-03	50SB-19-03-0-0.5	0-0.5	55	Native Sample
		50SB-19-03-0.5-3	0.5-3	55	Native Sample
		50SB-19-03-3-7	3-7	55	Native Sample
		50SB-19-03-7-15	7-15	55	Native Sample
	50SB-19-04	50SB-19-04-0-0.5	0-0.5	55	Native Sample
		50SB-19-04-0.5-3	0.5-3	55	Native Sample
		50SB-19-04-3-7	3-7	55	Native Sample
		50SB-19-04-7-15	7-15	55	Native Sample
	50SB-19-05	50SB-19-05-0-0.5	0-0.5	55	Native Sample
		50SB-19-05-0.5-3	0.5-3	55	Native Sample
		50SB-19-05-3-7	3-7	55	Native Sample
		50SB-19-05-7-15	7-15	55	Native Sample
	50SB-19-06	50SB-19-06-0-0.5	0-0.5	55	Native Sample
		50SB-19-06-0.5-3	0.5-3	55	Native Sample
		50SB-19-06-3-7	3-7	55	Native Sample
		50SB-19-06-7-15	7-15	55	Native Sample
		50SB-19-06-53-55	53-55	55	Native Sample
	50SB-19-07	50SB-19-07-0-0.5	0-0.5	55	Native Sample
		50SB-19-07-0.5-3	0.5-3	55	Native Sample
		50SB-19-07-3-7	3-7	55	Native Sample
		50SB-19-07-7-15	7-15	55	Native Sample
	50SB-19-08	50SB-19-08-0-0.5	0-0.5	55	Native Sample
		50SB-19-08-0.5-3	0.5-3	55	Native Sample
		50SB-19-08-3-7	3-7	55	Native Sample
		50SB-19-08-7-15	7-15	55	Native Sample
	50SB-19-09	50SB-19-09-0-0.5	0-0.5	55	Native Sample
		50SB-19-09-0.5-3	0.5-3	55	Native Sample
		50SB-19-09-3-7	3-7	55	Native Sample
		50SB-19-09-7-15	7-15	55	Native Sample
	50SB-19-10	50SB-19-10-0-0.5	0-0.5	55	Native Sample
		50SB-19-10-0.5-3	0.5-3	55	Native Sample
		50SB-19-10-3-7	3-7	55	Native Sample
		50SB-19-10-7-15	7-15	55	Native Sample
		50SB-19-10-53-55	53-55	55	Native Sample
QC Samples ***	20SB-19-01	A3-SB-SUP-MMDDYY	NA	NA	Field Duplicate
	20SB-19-02	20SB-19-02-3-7	NA	NA	MS/MSD
	NA	A3-SB-EB-MMDDYY	NA	NA	Equipment Blank
	NA	A3-SB-FRB-MMDDYY	NA	NA	Field Blank

Notes:

All samples analyzed for PFAS via isotope dilution. Select samples may be analyzed for total oxidizable precussor assay and total organic carbon.

If additional soil sampling locations are established at an AOC, the location identifiers, sample identifiers and QC sample identifiers will be sequential to the locations provided in the table above.

* Sample name may be modified in the field depending on sample depth.

** Approximate depth to groundwater is for planning purposes and is estimated from the water table elevations observed at nearby temporary wells or long-term monitoring wells sampled during the SI and LTM activities. Actual depth to water will be measured during advancement of the soil borings and the final depth of soil sampling intervals will end at the water table at locations where the water table is less than 15 feet. If the water table is encountered at a depth less than 17 ft bgs then the final soil sampling interval at the boring will be shortened by the appropriate amount to collect a separate 2-foot sample just above the water table to assess leaching threat to groundwater.

Table 5
Area 3 Soil Boring Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Proposed Sample Depth (ft bgs) *	Approximate Depth to Groundwater (ft bgs)**	Sample Type

**** Field Quality Control Samples (FD, MS/MSD, EBs and Field Reagent Blanks) will be collected at a frequency specified in UFP-QAPP worksheet #20. The FD will be collected at a 10% frequency, MS/MSD will be collected at a 5% frequency, EB will be collected at least once a week, the FRB will be collected is at least once during each sampling event. The frequency will be applied to all of Area 3. The QC samples IDs are approximated and can change based on field conditions. Equipment blanks only collected if non-disposal equipment is used. Field quality control samples will not be collected for total oxidizable precussor analysis.

AOC = area of contamination
ft bgs = feet below ground surface
LTM = long-term monitoring
MS/MSD = matrix spike/matrix spike duplicate
NA = not applicable
QC = quality control
SI = site inspection

XX = Final sample name to be determined in the field. For the QC samples XX respresents the sample number and will be incremented as each sample is collected. MS/MSD samples will be identified in the notes of the chain of custody (i.e., a unique field sample identifier will not be used to denote a MS/MSD sample).

Table 6
Area 3 New Monitoring Well Rationale
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Number of New Monitoring Wells	Rationale	Field Lithologic Classification	Screen Settings	TOC in Soil	Grain-Size Analysis
AOCs 20/21					
2	Installation of up to two new piezometers screened at the water table is planned. These piezometers will be used to measure depth to water and calculate groundwater flow direction to the west of AOC 20. The locations of piezometers were selected to support calculation of groundwater flow direction and may or may not be used as a potential groundwater monitoring location for PFAS.	No	TBD	No	No
4	Installation of up to four new overburden wells is planned to augment the existing monitoring well network. Locations will be based on a review of vertical profile data. The groundwater monitoring well network will be designed to monitor groundwater within the PFAS plume as well as provide bounding wells upgradient, cross gradient and downgradient of the plume.	Yes - at select locations from the water table to the bottom of the boring.	TBD	Soil samples collected at select locations will be submitted for TOC analysis.	Soil samples collected from select intervals at select locations will be submitted for grain-size analysis.
AOCs 30, 31, 50					
9	Installation of up to nine new piezometers screened at the water table is planned. These piezometers will be used to measure depth to water and calculate groundwater flow direction in the northwestern and southeastern portions of the MAAF. The locations of piezometers were selected to support calculation of groundwater flow direction and may or may not be used as a potential groundwater monitoring location for PFAS.	No	TBD	No	No
10	Installation of up to ten new overburden monitoring wells is planned. Locations will be based on a review of vertical profile data. The groundwater monitoring well network at the MAAF will be designed to monitor the groundwater within the PFAS plume as well as provide bounding wells upgradient, cross gradient and downgradient of the plume.	Yes - at select locations from the water table to the bottom of the boring.	TBD	Soil samples collected at select locations will be submitted for TOC analysis.	Soil samples collected from select intervals at select locations will be submitted for grain-size analysis.

Notes:
AOC = area of contamination
TBD = to be determined. Screen settings will be determined in consultation with the stakeholders after a review of the groundwater data.
TOC = total organic carbon

Table 7
Area 3 Soil Sampling During New Monitoring Well Installation Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Proposed Sample Depth (ft bgs)**	Sample Type**
AOC 20/21	21MW-19-01X	21MW-19-01X-SO-XX-XX	TBD	Native Sample
	21MW-19-02X	21MW-19-02X-SO-XX-XX	TBD	Native Sample
	21MW-19-03X	21MW-19-03X-SO-XX-XX	TBD	Native Sample
	21MW-19-04X	21MW-19-04X-SO-XX-XX	TBD	Native Sample
AOCs 31, 31, and 50	G6M-19-01X	G6M-19-01X-SO-XX-XX	TBD	Native Sample
	G6M-19-02X	G6M-19-02X-SO-XX-XX	TBD	Native Sample
	G6M-19-03X	G6M-19-03X-SO-XX-XX	TBD	Native Sample
	30M-19-01X	30M-19-01X-SO-XX-XX	TBD	Native Sample
	30M-19-02X	30M-19-02X-SO-XX-XX	TBD	Native Sample
	30M-19-03X	30M-19-03X-SO-XX-XX	TBD	Native Sample
	31M-19-01X	31M-19-01X-SO-XX-XX	TBD	Native Sample
	31M-19-02X	31M-19-02X-SO-XX-XX	TBD	Native Sample
	31M-19-03X	31M-19-03X-SO-XX-XX	TBD	Native Sample
	31M-19-04X	31M-19-04X-SO-XX-XX	TBD	Native Sample
QC Samples**	21MW-19-02	A3-MW-SO-DUP-MMDDYY		Field Duplicate
	31M-19-03	A3-MW-SO-DUP-MMDDYY		Field Duplicate
	21MW-19-02	21MW-19-02X-SO-XX-XX		Matrix Spike Duplicate
	NA	A3-MW-SO-EB-MMDDYY		Equipment Blank
	NA	A3-MW-SO-FRB-MMDDYY		Field Reagent Blank

Notes:

Selected samples will be analzyed for total organic carbon, and grain size.

* It is estimated locations at each area of investigation will be drilled during monitoring well installation and soil samples may be collected at that time. The exact locations are not known. The locations where samples will be collected will be determined before the locations are drilled.

** Sample name will be determined in the field depending on sample depth. The sample depth will be determined before the locations are drilled.

*** Field Quality Control Samples (FD, MS/MSD, EBs and Field Reagent Blanks) will be collected at a frequency specified in UFP-QAPP worksheet #20. The FD will be collected at a 10% frequency, MS/MSD will be collected at a 5% frequency, EB will be collected at least once a week per piece of equipment, the FRB will be collected is at least once during each sampling event. The frequency will be applied to all of Area 3. Equipment blanks only collected if non-disposal equipment is used. Field quality control samples will not be collected for total oxidizable precussor analysis.

AOC = area of contamination
EB = equipment blank
FD = field duplicate
FRB = field reagant blank
MS/MSD = matrix spike/matrix spike duplicate
TBD = to be determined
QC = quality control

XX = Final sample name to be determined in the field. MS/MSD samples will be identified in the notes of the chain of custody (i.e., a unique field sample identifier will not be used to denote a MS/MSD sample).

Table 8
Area 3 New Monitoring Well Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name*	Sample Type**
AOC 20/21	21MW-19-01X	21MW-19-01-MONYY	Native Sample
	21MW-19-02X	21MW-19-02-MONYY	Native Sample
	21MW-19-03X	21MW-19-03-MONYY	Native Sample
	21MW-19-04X	21MW-19-04-MONYY	Native Sample
MAAF (AOCs 31, 31, and 50)	G6M-19-01X	G6M-19-01-MONYY	Native Sample
	G6M-19-02X	G6M-19-02-MONYY	Native Sample
	G6M-19-03X	G6M-19-03-MONYY	Native Sample
	30M-19-01X	30M-19-01-MONYY	Native Sample
	30M-19-02X	30M-19-02-MONYY	Native Sample
	30M-19-03X	30M-19-03-MONYY	Native Sample
	31M-19-01X	31M-19-01-MONYY	Native Sample
	31M-19-02X	31M-19-02-MONYY	Native Sample
	31M-19-03X	31M-19-03-MONYY	Native Sample
	31M-19-04X	31M-19-04-MONYY	Native Sample
QC Samples**	21MW-19-02X	A3-MW-DUP-MMDDYY	Field Duplicate
	31M-19-03X	A3-MW-DUP-MMDDYY	Field Duplicate
	21MW-19-02X	21MW-19-02X-MONYY	Matrix Spike Duplicate
	NA	A3-MW-EB-MMDDYY	Equipment Blank
	NA	A3-MW-FRB-MMDDYY	Field Reagent Blank

Notes:

Notes:

All samples will be analyzed for PFAS via isotope dilution. Select samples will be analyzed for total oxidizable precursor assay and dissolved organic carbon.

* = The sample name will consist of the well identifier followed by the month and the year the sample was collected. The month will be represented by three letters and the year by two numbers.

** Field Quality Control Samples (FD, MS/MSD, EBs and Field Reagent Blanks) will be collected at a frequency specified in UFP-QAPP worksheet #20. The FD will be collected at a 10% frequency, MS/MSD will be collected at a 5% frequency, EB will be collected at least once a week per piece of equipment, the FRB will be collected is at least once during each sampling event per AOC. The frequency will be applied to all of Area 3. The QC samples IDs are approximated and can change based on field conditions. Equipment blanks only collected if non-disposal equipment is used. Field quality control samples will not be collected for total oxidizable precursor analysis.

AOC = area of contamination
EB = equipment blank
FD = field duplicate
FRB = field reagent blank
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control

Table 9
Area 3 Existing Monitoring Well Construction Information - AOC 50
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Well ID	Well Screen Interval (ft bgs)	Well Screen Elevation (ft NGVD29)	Top of Casing Elevation (ft NGVD29)
Monitoring Wells			
G6M-92-10X	9-19	218.2-208.2	225.88
G6M-92-11X	8.5-18.5	214.7-204.7	225.69
G6M-93-13X	9-19	214.7-204.7	225.63
G6M-94-15A	33-43	218.5-208.5	253.68
G6M-95-19X	48-58	174.8-164.8	224.69
G6M-95-20X	18-23	205.0-200.0	225.41
G6M-96-13B	52.3-62.3	171.5-161.5	225.78
G6M-96-22A	40-50	176.3-166.3	218.39
G6M-96-22B	65.5-70.5	150.9-145.9	218.36
G6M-96-24B	56.7-61.7	159.1-154.1	217.96
G6M-96-25A	9-18.7	215.1-205.4	226.32
G6M-96-25B	48-58	176-166	226.44
G6M-96-26A	8-18	215.7-205.7	225.36
G6M-96-26B	68-78	155.3-145.3	225.20
G6M-97-05B	130-135	136.4-131.4	268.88
G6M-97-08B	89.5-94.5	174.7-169.7	263.85
G6M-97-09B	71.5-81.5	186.6-176.6	260.85
G6M-97-27X	25-30	197.8-192.8	225.30
G6M-97-28X	100-105	163.9-158.9	266.49
G6M-97-29X	179-189	85.9-75.9	266.95
G6M-98-30X	60-65	161-156	223.54
G6M-98-32X	130-135	135-130	267.21
G6M-01-01X	130-150	134.1-114.1	266.47
G6M-02-01X	80-95	183.8-168.8	263.24
G6M-02-02X	80-95	184.1-169.1	263.78
G6M-02-03X	90-105	174.4-159.4	263.83
G6M-02-04X	90-105	173.6-158.6	265.72
G6M-02-05X	120-135	145.4-130.4	266.50
G6M-02-06X	55-65	153.5-143.5	210.53
G6M-02-07X	30-40	179.5-169.5	211.52
G6M-02-08X	60-70	163.2-153.2	225.03
G6M-02-09X	90-105	175.6-160.6	264.90
G6M-02-10X	125-135	152.2-142.2	266.57
G6M-02-11X	125-135	140-130	264.73
G6M-02-12X	125-135	138.4-128.4	263.26
G6M-02-13X	110-120	154.8-144.8	264.41
G6M-02-31BR	85-95	179.1-169.1	256.51
G6M-03-01X	50-70	173.3-153.3	225.89
G6M-03-02X	28-43	173.2-158.2	225.11
G6M-03-04X	15-30	208.3-193.3	226.00
G6M-03-05B	UKN	UKN	UKN

Table 9
Area 3 Existing Monitoring Well Construction Information - AOC 50
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Well ID	Well Screen Interval (ft bgs)	Well Screen Elevation (ft NGVD29)	Top of Casing Elevation (ft NGVD29)
G6M-03-07X	80-90	183.6-173.6	263.46
G6M-03-08X	125-140	132.2-117.2	259.40
G6M-03-09X	125-140	132.4-117.4	259.69
G6M-03-10X	120-135	144.2-129.2	266.61
G6M-03-11X	115-130	149.5-134.5	266.42
G6M-04-01X	82-92	180.49-170.49	261.95
G6M-04-02X	80-90	184.49-174.98	267.35
G6M-04-03X	85-95	180.61-170.61	265.09
G6M-04-04X	94-104	159.67-169.67	263.46
G6M-04-05X	100-110	157.33-147.33	258.93
G6M-04-06X	95-105	168.07-158.07	264.77
G6M-04-07X	120-130	142.68-132.68	264.62
G6M-04-08X	80-90	130.7-120.7	210.35
G6M-04-09X	55-65	188.46-178.46	243.46
G6M-04-10X	52-62	170.92-160.92	225.02
G6M-04-10A	30-40	193.02-183.02	224.82
G6M-04-11X	35-45	193.42-183.42	230.27
G6M-04-12X	54-64	170.66-160.66	226.41
G6M-04-13X	30-40	194.71-184.71	226.68
G6M-04-14X	80-90	131.56-121.56	211.41
G6M-04-15X	70-80	182.45-172.45	254.03
G6M-04-22X	74-84	180.75-170.75	256.69
G6M-04-31X	68-78	186.83-176.83	256.71
G6M-05-02X	109-129	Not surveyed	Not surveyed
G6M-06-01X	106-126	Not surveyed	Not surveyed
G6M-07-01X	78-98	Not surveyed	Not surveyed
G6M-07-02X	22.5-27.5	200	Not surveyed
G6M-13-01X	125-135	140.15-130.15	267.65
G6M-13-02X	115-125	149.62-139.62	264.62
G6M-13-03X	80-90	185.19-175.17	265.17
G6M-13-04X	125-135	139.61-129.61	267.11
G6M-13-05X	45-55	178.30-168.30	225.8
G6M-13-06X	50-60	172.67-162.67	225.17
MW-1	126-136	138.9-128.9	267.10
MW-2	126-136	140.9-130.9	266.92
MW-3	126-137	138.7-128.7	266.55
MW-4	126-136	139.0-129.0	266.99
MW-5	126-136	138.2-128.2	266.46
MW-6	125-135	129.6-119.6	266.00
MW-7	125-135	139.7-129.7	265.77
Injection Wells			
IW-38/ G6M-94-18X	22.5-27.5	201.1-191.1	225.85

Table 9
Area 3 Existing Monitoring Well Construction Information - AOC 50
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Well ID	Well Screen Interval (ft bgs)	Well Screen Elevation (ft NGVD29)	Top of Casing Elevation (ft NGVD29)
Microwells			
XSA-00-88X	139.5-144.5	128.52-123.52	270.02
XSA-00-89X	127-132	140.47-135.47	269.47
XSA-00-90X	155.9-160.9	108.92-103.92	267.04
XSA-00-91X			
XSA-12-95X	120 - 130	147.43-137.43	270.43
XSA-12-96X	120 - 130	147.82-137.82	270.79
XSA-12-97X	119.75-129.75	148.96-138.96	271.58
XSA-12-98X	60 - 70	147.44-137.44	210.41

bgs = below ground surface
ft = feet
NGVD29 = National Geodetic Vertical Datum 29
Wells designated to be sampled in RI

Table 10
Area 3 Surface Water and Sediment Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name *	Sample Matrix	Sample Type	Sample Location **
Nashua River	NR-19-01	NR-SW-19-01-MONYY	surface water	Native Sample	Upstream of Dam
		NR-SED-19-01-MONYY	sediment	Native Sample	
	NR-19-02	NR-SW-19-02-MONYY	surface water	Native Sample	West bank of Nashua River channel
		NR-SED-19-02-MONYY	sediment	Native Sample	
	NR-19-03	NR-SW-19-03-MONYY	surface water	Native Sample	West bank of Nashua River channel
		NR-SED-19-03-MONYY	sediment	Native Sample	
	NR-19-04	NR-SW-19-04-MONYY	surface water	Native Sample	West bank of Nashua River channel
		NR-SED-19-04-MONYY	sediment	Native Sample	
	NR-19-05	NR-SW-19-05-MONYY	surface water	Native Sample	West bank of Nashua River channel
		NR-SED-19-05-MONYY	sediment	Native Sample	
	NR-19-06	NR-SW-19-06-MONYY	surface water	Native Sample	West bank of Nashua River channel
		NR-SED-19-06-MONYY	sediment	Native Sample	
	NR-19-07	NR-SW-19-07-MONYY	surface water	Native Sample	West bank of Nashua River channel
		NR-SED-19-07-MONYY	sediment	Native Sample	
	NR-19-08	NR-SW-19-08-MONYY	surface water	Native Sample	East bank of Nashua River channel
		NR-SED-19-08-MONYY	sediment	Native Sample	
	NR-19-09	NR-SW-19-09-MONYY	surface water	Native Sample	East bank of Nashua River channel
		NR-SED-19-09-MONYY	sediment	Native Sample	
	NR-19-10	NR-SW-19-10-MONYY	surface water	Native Sample	East bank of Nashua River channel
		NR-SED-19-10-MONYY	sediment	Native Sample	
	NR-19-11	NR-SW-19-11-MONYY	surface water	Native Sample	East bank of Nashua River channel
		NR-SED-19-11-MONYY	sediment	Native Sample	
	NR-19-12	NR-SW-19-12-MONYY	surface water	Native Sample	East bank of Nashua River channel
		NR-SED-19-12-MONYY	sediment	Native Sample	
	NR-19-13	NR-SW-19-13-MONYY	surface water	Native Sample	East bank of Nashua River channel
		NR-SED-19-13-MONYY	sediment	Native Sample	
Unnamed Stream Adjacent to AOC 21	US -19-01	US-SW-19-01-MONYY	surface water	Native Sample	Shoreline
		US-SED-19-01-MONYY	sediment	Native Sample	
Unnamed Pond North of AOC 20	UP-19-01	UP-SW-19-01-MONYY	surface water	Native Sample	Shoreline
		UP-SED-19-01-MONYY	sediment	Native Sample	
Air Field Wetland (to the West of former MAAF)	AFW-19-01	AFW-SW-19-01-MONYY	surface water	Native Sample	Shoreline
		AFW-SED-19-01-MONYY	sediment	Native Sample	
	AFW-19-02	AFW-SW-19-02-MONYY	surface water	Native Sample	Shoreline
		AFW-SED-19-02-MONYY	sediment	Native Sample	

Table 10
Area 3 Surface Water and Sediment Sampling Summary
Area 3 Field Sampling Plan
Devens PFAS Remedial Investigation Workplan

Location	Location Identifier	Sample Name *	Sample Matrix	Sample Type	Sample Location **
Surface Water and Sediment QC Samples ***	NR-19-02	A3-SW-DUP-MMDDYY	surface water	Field Duplicate	West bank of Nashua River channel
		A3-SED-DUP-MMDDYY	sediment	Field Duplicate	
	NR-19-12	A3-SW-DUP-MMDDYY	surface water	Field Duplicate	East bank of Nashua River channel
		A3-SED-DUP-MMDDYY	sediment	Field Duplicate	
	NR-19-05	NR-SW-19-05-MONYY	surface water	Matrix Spike	West bank of Nashua River channel
		NR-SED-19-05-MONYY	sediment	Matrix Spike	
	NA	A3-SW-EB-MMDDYY	surface water	Equipment Blank	NA
	NA	A3-SED-EB-MMDDYY	sediment	Equipment Blank	
	NA	A3-SW-FRB-MMDDYY	NA	Field Reagent Blank	NA

Notes:

All samples will be analyzed for PFAS via isotope dilution. Analyte list is specified in UFP-QAPP Worksheet #15. Select samples will also be analyzed for Total Organic Carbon and grain size.

* = The sample name will consist of the location, followed by the matrix code, followed by the month and the year the sample was collected. The month will be represented by three letters and the year by two numbers.

**Main Channel: Samples will be collected from the main channel. Shoreline: Samples will be collected from the edge of the wetland system by accessing the shoreline by foot and wading approximately 3 feet from shore. All samples should be collected in an area that is conducive to deposition (i.e., away from areas of turbulent flow and/or wave action).

*** Field Quality Control Samples (FD, MS/MSD, EBs and Field Reagent Blanks) will be collected at a frequency specified in UFP-QAPP worksheet #20. The FD will be collected at a 10% frequency, MS/MSD will be collected at a 5% frequency, EB will be collected at least once a week per piece of equipment, the FRB will be collected is at least once during the sampling event. The frequency will be applied to all of Area 3. The QC samples IDs are approximated and can change based on field conditions. Equipment blanks only collected if non-disposal equipment is used.

EB = equipment blank
FD = field duplicate
FRB = field reagant blank
MS/MSD = matrix spike/matrix spike duplicate
NA = not applicable
QC = quality control

APPENDIX A
Referenced PFAS RI QAPP Worksheets

QAPP WORKSHEET #3: DISTRIBUTION LIST FOR DEVENS

QAPP Recipients	Title	Organization	E-mail Address
Mark Applebee	Program Manager	KGS	mapplebee@komangs.com
James Ropp	Project Manager (PM)	KGS	jropp@komangs.com
John Rawlings	Corporate Director of Safety and Quality Control	KOMAN	jrawlings@komaninc.com
Katherine Thomas	Technical Lead	KGS	kthomas@komangs.com
Kevin Anderson	KGS Field Team Lead	KGS	kanderson@komangs.com
Laurie Ekes	Project Chemist	KGS	lekes@komangs.com
Denise Tripp	Hydrogeologist	Geosyntec	Dtripp@geosyntec.com
Spence Smith	PM	Jacobs	Spence.Smith@jacobs.com
Jerry Lanier	PM	Test America Savannah	Jerry.lanier@testamericainc.com
Penelope Reddy	PM	USACE	Penelope.Reddy@usace.army.mil
Yixian Zhang	Project Chemist	USACE	Yixian.Zhang@usace.army.mil
Robert Simeone	BRAC Environmental Coordinator	US Army	robert.j.simeone.civ@mail.mil
Carol Keating	Remedial PM	USEPA Region I	Keating.Carol@epa.gov
David Chaffin	Federal Sites Program	MassDEP	David.Chaffin@state.ma.us

QAPP WORKSHEET #4, 7 & 8: PERSONNEL TRAINING, RESPONSIBILITIES AND SIGN-OFF SHEET

ORGANIZATION: KGS

Name	Project Title	Specialized Training/Certifications	Responsibilities	Signature/Date
Mark Applebee	Program Manager	Project Management Professional (PMP), Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-hour Training; 8-Hour Refresher; CPR and first aid/AED	Oversight responsibility for contractual and technical performance.	
James Ropp	Project Manager	Licensed Professional Engineer (PE), HAZWOPER 40-hour Training; 8-Hour Refresher; CPR and first aid/AED	Manages project technical and contractual requirements; coordinates between senior management, USACE, stakeholders, and project staff.	
Katherine Thomas	Technical Lead	PMP, HAZWOPER 40-hour Training; 8-Hour Refresher; CPR and first aid/AED	Manages remedial investigation technical task requirements; supports coordination at all levels.	
Kevin Anderson	Field Team Leader	HAZWOPER 40-hour Training; 8-Hour Refresher; CPR and first aid/AED	Supervises field sampling and coordinates all field activities; serves as the site KGS coordinator.	
Laurie Ekes	Project Chemist	HAZWOPER 40-hour Training; 8-Hour Refresher; CPR and first aid/AED	Verifies that the UFP-QAPP analytical requirements are met by the laboratory and field staff. Also provides direction regarding requirements for corrective actions for field and analytical issues; evaluates and releases validated analytical results to the KGS project team.	

QAPP WORKSHEET #4, 7 AND 8 - Continued

ORGANIZATION: Army/USACE

Name	Project Title	Specialized Training/Certifications	Responsibilities	Signature/Date
Robert Simeone	BRAC Environmental Coordinator		BRAC Environmental Coordinator for Devens Environmental Remediation.	
Penelope Reddy	Technical Lead		USACE PM for Devens Environmental Remediation	
Yixian Zhang	Project Chemist	HAZWOPER 40-hour Training; 8-Hour Refresher	Coordinates with KGS project chemist. Reviews field activities and laboratory data.	

ORGANIZATION: Test America, Savannah

Name	Project Title	Specialized Training/Certifications	Responsibilities	Signature/Date
Jerry Lanier	Project Manager	Not applicable	Primary point of contact for Test America Laboratory. Receives direction from KGS Project Chemist. Responsible for ensuring the UFP-QAPP requirements are met by the laboratory.	

ORGANIZATION: Test America, Sacramento

Name	Project Title	Specialized Training/Certifications	Responsibilities	Signature/Date
Debby Wilson	Client Services Manager (PFAS)	Not applicable	Manages client services for TestAmerica Laboratories, Sacramento.	

QAPP WORKSHEET #4, 7 AND 8 - Continued

ORGANIZATION: Alpha Analytical

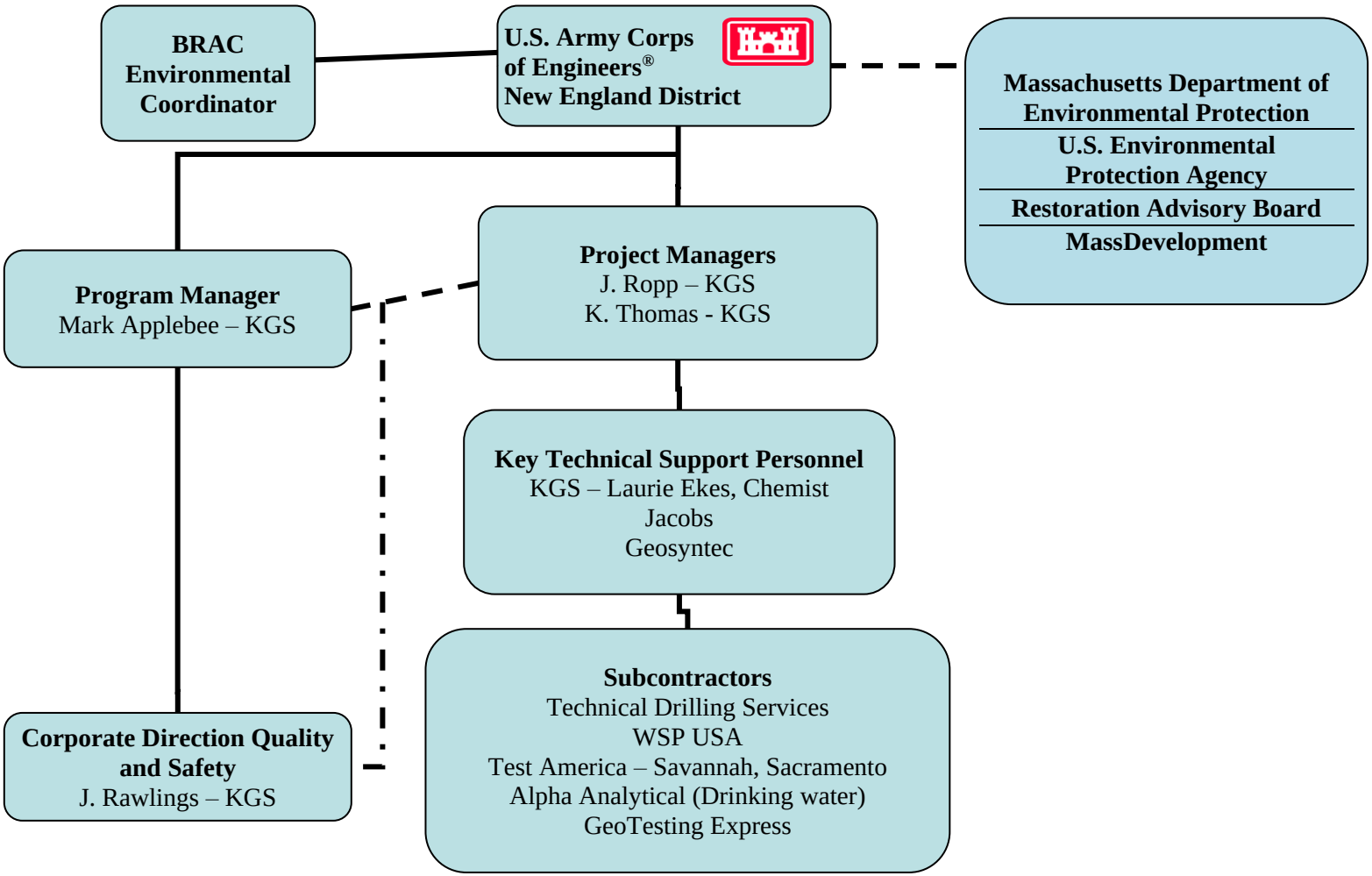
Name	Project Title	Specialized Training/Certifications	Responsibilities	Signature/Date
Jim Occhialini		Not applicable	Manages client services for Alpha Analytical.	

ORGANIZATION: GeoTesting Express

Name	Project Title	Specialized Training/Certifications	Responsibilities	Signature/Date
Mark Dobday	Laboratory Manager	Not applicable	Primary point of contact for GeoTesting Express. Receives direction from KGS Project Chemist. Responsible for ensuring the UFP-QAPP requirements are met by the laboratory for grain size analysis.	

Signatures indicate personnel have read and agree to implement this QAPP as written

QAPP WORKSHEET #5: PROJECT ORGANIZATIONAL CHART



QAPP WORKSHEET #6: COMMUNICATION PATHWAYS

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Communication with USACE (lead agency)	USACE Program Manager	Penelope Reddy	(978) 318-8160	Primary point of contact with USACE. Coordinates contracting actions. Provides direction to KGS.
Communication with BRAC	BRAC EC	Robert Simeone	(978) 796-2205	Primary point of contact for Fort Devens.
Communication with EPA	EPA RPM	Carol Keating	(617) 918-1393	Primary point of contact for EPA. Provides technical and regulatory input and recommendations to USACE.
Communication with MassDEP	MassDEP RPM	David Chaffin	(617) 348-4005	Primary point of contact for MassDEP. Provides technical and regulatory input and recommendations.
Communication with KGS	KGS PM	James Ropp	(603) 395-7986	Primary point of contact for KGS. Provides project management input and recommendation to USACE PM. Receives direction from USACE.
Secondary point of contact for KGS	KGS Technical Lead	Katherine Thomas	(774) 273-1467	Primary point of contact for technical tasks; provides technical input and recommendations to UACE. Receives technical direction from USACE; provides input to KGS PM and project team on project status.
Progress of field program	KGS	Kevin Anderson	(508) 366-7442	Conveys progress of field activities. Communication with KGS technical lead. Oversees onsite safety activities.
Communication with KGS Project Chemist	Test America (TA) Savannah Laboratory Project Manager	Jerry Lanier	(912) 354-7858	Coordinates laboratory staff to assure timely deliverables. Communicates QA/QC issues with project chemist. Approves release of analytical data from laboratory.
	TA Sacramento Laboratory Project Manager	Debby Wilson	(949) 260-3228	
	Alpha Analytical	Jim Occhialini	(508) 898-9220	PFAS drinking water sample laboratory coordination.
	GeoTesting Express Laboratory manager	Mark Dobday	(978) 635-0424	Coordinates lab staff and approves release of grain size analysis

QAPP Worksheet #6 - Continued

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Review and release of analytical data	KGS Project Chemist	Laurie Ekes	(508) 366-7442	Verifies the UFP_QAPP analytical requirements are met by the laboratory and field staff. Coordinates sampling activities with analytical laboratory. Evaluates and releases analytical results to the KGS PM.

QAPP WORKSHEET #11: DATA QUALITY OBJECTIVES

Step 1: State the Problem

PFAS have been detected in groundwater, surface water, soil, and sediment at multiple Fort Devens AOCs at concentrations that may impact human health and the environment.

Step 2: Identify the Study Goals, Questions and Decision Statements

Study Goals

Site characterization data are needed to define the nature and extent of PFAS at Fort Devens and downgradient of Fort Devens in groundwater and determine migration flow paths to evaluate current and potential impacts to public and private drinking water supply wells and surface water discharge areas.

Site characterization data are needed to identify sources of PFAS in soil at Fort Devens, either currently known sources or newly identified potential sources determined through the investigation, contributing to PFAS in groundwater and characterize the nature and extent of those sources including evaluation of sources in soil as potential continuing sources.

Additional data are also needed to support a quantitative human health risk assessment and an ecological risk evaluation, which will be completed to estimate potential human health and ecological risk from exposure to PFAS in groundwater, soil, surface water, and sediment.

Principle Study Questions and Associated Decision Statements:

- Are the PFAS detected at AOCs 32/43, 57, 74, and 75 impacting the Grove Pond water supply wells?
    - Decision Statement: Determine nature and extent of PFAS in groundwater impacting the Grove Pond water supply wells, nature and extent of PFAS in groundwater attributable to each AOC, hydraulic characteristics of the aquifer, groundwater flow directions, fate and transport of PFAS in the aquifer, and evaluate PFAS distribution using lines of evidence including ratios of select PFAS compounds.
- Are the PFAS detected in groundwater at AOCs 5, 20, 21, 32/43, and 76, impacting the MacPherson supply well?
    - Decision Statement: Determine nature and extent of PFAS in groundwater impacting the MacPherson supply well, nature and extent of PFAS in groundwater attributable to each AOC, hydraulic characteristics of the aquifer, groundwater flow directions, fate and transport of PFAS in the aquifer, evaluate PFAS distribution using lines of evidence including ratios of select PFAS compounds.
- What is the predicted impact of AOCs to water supply wells over time?
    - Decision Statement: Determine nature and extent of PFAS in groundwater attributable to each AOC, hydraulic characteristics of the aquifer, groundwater flow directions, fate and transport of PFAS in the aquifer to estimate velocity of contaminant transport and travel times), nature and extent of PFAS in soil, fate and

transport of PFAS from soil to groundwater, nature and extent of precursors in soil and groundwater, and evaluate potential for precursors to transform.

- Do other sources of PFAS exist that impact the Grove Pond and MacPherson supply wells?
    - Decision Statement: Determine nature and extent of PFAS in groundwater impacting the Grove Pond and MacPherson water supply wells, groundwater flow directions, evaluate PFAS distribution using lines of evidence including ratios of select PFAS compounds.
- Are there any other water supply wells that are potentially impacted by PFAS originating from Fort Devens?
    - Decision Statement: Determine nature and extent of PFAS associated with the AOCs, hydraulic characteristics of the aquifer, groundwater flow directions, fate and transport of PFAS in the aquifer, identify other water supply wells and associated construction information through research of appropriate public records and interviews, and sampling of other water supply wells, if appropriate.
- Are the PFAS detected in groundwater attributable to identified AOC source areas?
    - Decision Statement: Determine if PFAS in groundwater exists up gradient or cross gradient of the AOC source, hydraulic characteristics of the aquifer, groundwater flow directions, fate and transport of PFAS in the aquifer, and evaluate PFAS distribution using lines of evidence including ratios of select PFAS compounds.
- Are the PFAS detected in groundwater discharging to surface water bodies at concentrations that may pose a risk to human health and the environment?
    - Decision Statement: Determine PFAS concentrations in surface water and sediment where groundwater contaminated with PFAS is anticipated to discharge, human health and ecological risk from PFAS in surface water and sediment, hydraulic flow paths from the groundwater to the surface water, hydraulic characteristics of the aquifer, fate and transport of PFAS in the aquifer, and PFAS concentrations in groundwater discharging to surface water bodies.
- Are the PFAS detected in soil at concentration that may pose a risk to human health?
    - Decision Statement: Determine nature and extent of PFAS in soil and determine the human health risk from exposure to soil.
- Do PFAS concentrations in groundwater pose an unacceptable risk to human health?
    - Decision Statement: Determine nature and extent of PFAS in groundwater and human health risk from exposure to groundwater.
- Do PFAS concentrations in soil represent a significant continuing source impacting groundwater at concentrations that pose an unacceptable human health risk?
    - Decision Statement: Determine nature and extent of PFAS in soil, fate and transport of PFAS in soil to groundwater, nature and extent of PFAS concentrations in groundwater, hydraulic characteristics of the aquifer, groundwater flow direction,

fate and transport of PFAS in the aquifer, point of human exposure to groundwater, and human health risk via a complete exposure pathway.

Step 3: Identify Information Inputs

Information inputs include historical data gathered on the sites and analytical data collected during the investigation. PFAS concentrations in water samples collected from existing and new monitoring wells, vertical profile borings, and private and public water supply wells used for drinking water. PFAS concentrations in soil samples collected from the ground surface and soil borings. PFAS concentrations in surface water and sediment samples collected from potentially impacted water bodies. Organic carbon in soil and water collected from soil borings and existing and new monitoring wells. Inputs include the site-specific screening levels and detection level objectives as defined in Worksheet #15.

Grain size analysis of soil and sediment samples. Lithologic characterization of aquifer materials. Hydraulic conductivity test after installation of monitoring wells at select locations. Groundwater level measurements after installation of monitoring wells and/or piezometers. An inventory of water supply wells.

Step 4: Define the Boundaries of the Study

Each Area-specific Field Sampling Plan (FSP) addenda specifies drilling and sampling locations. Additional drilling and/or sampling locations may be added to the investigation based on initial investigation results and area-specific objectives.

Step 5: Develop the Analytic Approach

If data from this investigation are sufficient to adequately characterize the nature and extent of PFAS in groundwater, to determine all PFAS migration pathways, to assess the fate and transport of PFAS, to assess water supply impacts, and to adequately assess human health risk then additional data will not be collected. EPA Lifetime Health Advisories (LHA), site-specific screening levels (SSSL), EPA Regional Screening Levels (RSL), and/or appropriate MassDEP guidance will be used for comparison purposes to assess the adequacy of the data. If significant data gaps are identified, then further data will be collected.

If data from this investigation are sufficient to adequately characterize the nature and extent of PFAS in soils, surface water, and sediment and to adequately assess human health risk and conduct an ecological risk evaluation, then additional data will not be collected. If significant data gaps are identified, then further data will be collected.

Soil and groundwater containing PFAS at concentrations greater than EPA LHA, SSSLs, and/or EPA RSLs, will be evaluated for potential risk to human health. If no unacceptable risk is identified, then no further action will be recommended for soil and/or groundwater. If a CERCLA human health risk assessment indicates unacceptable risk to human health, then a feasibility study will be conducted.

Surface water and sediment containing PFAS, will be evaluated for potential risk to human health. If no unacceptable risk is identified, then no further action will be recommended for surface water and/or sediment. If a CERCLA human health risk assessment indicates unacceptable risk to human health, then a feasibility study will be conducted.

If a complete exposure pathway for ecological receptors to PFAS, is identified, then a qualitative ecological risk evaluation will be completed. PFAS data will be compared to latest ecotoxicology values presented in scientific literature and in accordance with Army Guidance (Department of the Army, 2018). If an unacceptable risk to ecological risk is identified, further evaluation will be conducted.

Step 6: Specify Performance or Acceptance Criteria

Analytical data performance criteria/data quality indicators are specified in QAPP Worksheet #12. These data quality indicators include indicators (performance criteria) for precision, accuracy/bias, sensitivity, and completeness. To determine whether the detection limits (DL), limits of detection (LOD), and limits of quantitation (LOQ) will meet the analytical DQOs, the DLs, LODs, and LOQs have been compared to the project-specific screening criteria in Worksheet #15. With respect to data verification, validation, and usability: QAPP Worksheet #34 provides Data Verification and Validation Inputs; QAPP Worksheet #35 provides Data Verification Procedures; QAPP Worksheet #36 provides Data Validation Procedures; and QAPP Worksheet #37 provides Data Usability Assessment.

Step 7: Develop the Detailed Plan for Obtaining Data

The sampling design and rationale was developed for each area of investigation and is presented in each Area-specific FSP Addendum.

QAPP WORKSHEET #15: REFERENCE LIMITS AND EVALUATION TABLE

One of the primary goals of the project-specific UFP-QAPP is to select appropriate analytical methods to achieve detection limits (DL), limits of detection (LOD), and/or limits of quantitation (LOQ) that will satisfy the overall project DQOs (as defined in Worksheets # 10 [Conceptual Site Model] and #11 [Data Quality Objectives]).

Groundwater and soil samples will be collected and submitted for PFAS analysis by "modified" method 537 (LC/MS/MS isotope dilution) compliant with QSM 5.1, Table B-15. Groundwater and soil samples from select locations will be processed by the laboratory through a total oxidizable precursor (TOP) assay. The TOP assay converts polyfluorinated precursors into fully fluorinated compounds (PFOS and PFOA) using a hydroxyl radical-based chemical oxidation method. The TOP assay replicates what micro-organisms in the environment would achieve after many years. Aqueous and soil samples that are oxidized via the TOP assay will have two sets of sample data reported, which will be designated pre-TOP and Post-TOP. The difference between PFAS concentrations before (Pre-TOP) and after (Post-TOP) oxidation can be used to estimate the concentration of the non-discrete oxidizable precursors in the sample. Select samples will also be submitted for organic carbon analysis, total organic carbon (TOC) for soil samples and dissolved organic carbon (DOC) for aqueous samples.

Worksheets #15-1a and #15-1b list the analytical method DLs, LODs, and LOQs for the target PFAS in aqueous samples and worksheets #15-2a and #15-2b list the analytical method DLs, LODs, and LOQs for the target PFAS in solid samples. Worksheets #15-1b and #15-2b list the respective DLs, LODs, and LOQs for post-TOP aqueous and soil samples. Slightly higher DLs, LODs and LOQs are reported for post-TOP samples due to the limited sample volume processed through the TOP assay.

Worksheets #15-1 and #15-2 show the LHA levels and SSSLs for PFAS with respect to the current analytical DL, LOD, and LOQ for each listed target compound. In all cases the expected detection levels are below the applicable LHAs, SSSLs and soil standards. If the LOD or the DL is below the screening criterion, the LOD and/or the LOQ are sufficient for quantitative use in a risk assessment.

Note that sample dilution because of target and or non-target compound concentrations or matrix interference may prevent DLs, LODs, or LOQs from being achieved. The samples must be initially analyzed undiluted when reasonable. If a dilution is necessary, both the original and diluted result must be delivered. Samples that are not analyzed undiluted must be supported by matrix interference documentation such as sample viscosity, color, odor, or results from other analyses of the same sample to show that an undiluted sample is not possible.

Worksheet #15-3 lists the analytical method DLs, LODs, and LOQs for target PFAS in drinking water samples, which will be analyzed by the drinking water method 537 Revision1.1.

Worksheet #15-4 lists the DLs, LODs, or LOQs for DOC in aqueous samples and TOC in soil.

QAPP WORKSHEET #15-1A: ANALYTICAL METHOD REPORTING LIMITS AND CONTROL LIMITS

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (ng/L)	Project Action Limit Reference[2]	LOQ (ng/L)	LOD (ng/L)	DL (ng/L)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
Groundwater/Surface Water	2058-94-8	Perfluoroundecanoic acid (PFUnA)	NA	--	2.00	1.50	0.72	76	105	30
Direct Analysis/Pre-TOP Assay	375-73-5	Perfluorobutanesulfonic acid (PFBS)	40,100	EPA	2.00	1.00	0.46	87	120	30
PFAS Analysis by LC/MS/MS	335-76-2	Perfluorodecanoic acid (PFDA)	NA	--	2.00	1.00	0.48	85	113	30
Isotope Dilution Method	307-55-1	Perfluorododecanoic acid (PFDoA)	NA	--	2.00	1.50	0.52	87	116	30
	375-85-9	Perfluoroheptanoic acid (PFHpA)	NA	--	2.00	1.50	0.61	80	113	30
	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	NA	--	2.00	1.00	0.38	81	106	30
	307-24-4	Perfluorohexanoic acid (PFHxA)	NA	--	2.00	1.00	0.47	83	109	30
	375-95-1	Perfluorononanoic acid (PFNA)	NA	--	2.00	1.50	0.52	83	113	30
	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	70/40.1	LHA/EPA	4.00	3.00	1.10	82	112	30
	335-67-1	Perfluorooctanoic acid (PFOA)	70/40.1	LHA/EPA	2.00	1.50	0.54	80	107	30
	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	NA	--	4.00	3.00	0.76	75	129	30
	376-06-7	Perfluorotetradecanoic acid (PFTeA)	NA	--	4.00	3.00	0.83	82	115	30
	2991-50-6	N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	NA	--	20.0	10.0	2.80	80	109	30
	2355-31-9	N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	NA	--	20.0	10.0	3.00	82	111	30
	27619-97-2	1H, 1H, 2H, 2H-perfluorooctane sulfonate (6:2 FTS)	NA	--	40.0	20.0	7.00	75	118	30
	39108-34-4	1H, 1H, 2H, 2H-perfluoroecane sulfonate (8:2 FTS)	NA	--	20.0	10.0	3.00	83	111	30

Source: Test America Sacramento - March 25, 2018

[1] See Worksheet #23 for Analytical SOP References

[2] LHA - Federal Register; Vol.81 #101, May 2016

EPA - Region 1 Memorandum: Site-Specific Screening Levels for PFOA, PFOS, and PFBS for the Fort Devens NPL Site, 2/28/18.

QAPP Worksheet #15-1A - Continued

Notes:

NA = not available
PFAS = per- and polyfluoroalkyl substances
CAS = Chemical Abstract Service
LOQ = limit of quantitation
LOD = limit of detection
LCS = laboratory control sample
DL = detection limit
MS = Matrix Spike
MSD = matrix spike
ng/L = nanogram per liter
RPD = relative percent difference

QAPP WORKSHEET #15-1B: ANALYTICAL METHOD REPORTING LIMITS AND CONTROL LIMITS

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (ng/L)	Project Action Limit Reference[2]	LOQ (ng/L)	LOD (ng/L)	DL (ng/L)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
Groundwater/Surface Water	2058-94-8	Perfluoroundecanoic acid (PFUnA)	NA	--	5.00	3.75	2.80	57	117	30
Post-TOP Assay	375-73-5	Perfluorobutanesulfonic acid (PFBS)	40,100	EPA	5.00	2.50	0.50	75	135	30
PFAS Analysis by LC/MS/MS	335-76-2	Perfluorodecanoic acid (PFDA)	NA	--	5.00	2.50	0.78	65	125	30
Isotope Dilution Method	307-55-1	Perfluorododecanoic acid (PFDoA)	NA	--	5.00	3.75	1.40	66	126	30
	375-85-9	Perfluoroheptanoic acid (PFHpA)	NA	--	5.00	3.75	0.63	104	171	30
	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	NA	--	5.00	2.50	0.43	64	124	30
	307-24-4	Perfluorohexanoic acid (PFHxA)	NA	--	5.00	2.50	1.40	81	141	30
	375-95-1	Perfluorononanoic acid (PFNA)	NA	--	5.00	3.75	0.68	66	126	30
	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	70/40.1	LHA/EPA	5.00	3.00	0.80	68	128	30
	335-67-1	Perfluorooctanoic acid (PFOA)	70/40.1	LHA/EPA	5.00	3.75	2.10	158	454	30
	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	NA	--	5.00	3.50	3.20	65	136	30
	376-06-7	Perfluorotetradecanoic acid (PFTeA)	NA	--	5.00	3.00	0.73	63	123	30
	2991-50-6	N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	NA	--	50.0	12.5	7.80	0	10	30
	2355-31-9	N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	NA	--	50.0	12.5	4.80	0	10	30
	27619-97-2	1H, 1H, 2H, 2H-perfluorooctane sulfonate (6:2 FTS)	NA	--	50.0	12.5	5.00	0	10	30
	39108-34-4	1H, 1H, 2H, 2H-perfluoroecane sulfonate (8:2 FTS)	NA	--	50.0	12.5	5.00	0	10	30

Source: Test America Sacramento - March 25, 2018

[1] See Worksheet #23 for Analytical SOP References

[2] LHA - Federal Register; Vol.81 #101, May 2016

EPA - Region 1 Memorandum: Site-Specific Screening Levels for PFOA, PFOS, and PFBS for the Fort Devens NPL Site, 2/28/18.

Notes:

NA = not available
PFAS = per- and polyfluoroalkyl substances
CAS = Chemical Abstract Service
LOQ = limit of quantitation
LOD = limit of detection
LCS = laboratory control sample
DL = detection limit
MS = Matrix Spike
MSD = matrix spike
ng/L = nanogram per liter
RPD = relative percent difference

QAPP WORKSHEET #15-2A: ANALYTICAL METHOD REPORTING LIMITS AND CONTROL LIMITS

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (µg/Kg)	Project Action Limit Reference[2]	LOQ (µg/Kg)	LOD (µg/Kg)	DL (µg/Kg)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
Soil/Sediment	2058-94-8	Perfluoroundecanoic acid (PFUnA)	NA	--	0.300	0.200	0.100	74	114	30
Direct Analysis/Pre-TOP Assay	375-73-5	Perfluorobutanesulfonic acid (PFBS)	126,000/ 609,000	EPA Soil/Sediment	0.400	0.180	0.059	73	142	30
PFAS Analysis by LC/MS/MS	335-76-2	Perfluorodecanoic acid (PFDA)	NA	--	0.300	0.200	0.089	74	124	30
Isotope Dilution Method	307-55-1	Perfluorododecanoic acid (PFDoA)	NA	--	0.300	0.200	0.100	75	123	30
	375-85-9	Perfluoroheptanoic acid (PFHpA)	NA	--	0.300	0.200	0.078	76	124	30
	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	NA	--	0.300	0.200	0.062	75	121	30
	307-24-4	Perfluorohexanoic acid (PFHxA)	NA	--	0.300	0.200	0.071	75	125	30
	375-95-1	Perfluorononanoic acid (PFNA)	NA	--	0.300	0.200	0.081	74	126	30
	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	126/609	EPA Soil/Sediment	1.00	0.500	0.240	69	131	30
	335-67-1	Perfluorooctanoic acid (PFOA)	126/609	EPA Soil/Sediment	0.300	0.200	0.100	76	121	30
	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	NA	--	0.300	0.200	0.100	43	116	30
	376-06-7	Perfluorotetradecanoic acid (PFTeA)	NA	--	0.400	0.300	0.110	22	129	30

QAPP Worksheet #15-2A - Continued

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (µg/Kg)	Project Action Limit Reference[2]	LOQ (µg/Kg)	LOD (µg/Kg)	DL (µg/Kg)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
	2991-50-6	N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	NA	--	2.00	1.00	0.300	65	135	30
	2355-31-9	N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	NA	--	2.00	1.00	0.300	65	135	30
	27619-97-2	1H, 1H, 2H, 2H-perfluorooctane sulfonate (6:2 FTS)	NA	--	4.00	2.00	0.660	65	135	30
	39108-34-4	1H, 1H, 2H, 2H-perfluoroecane sulfonate (8:2 FTS)	NA	--	2.00	1.00	0.300	65	135	30

Source: Test America Sacramento - March 25, 2018

[1] See Worksheet #23 for Analytical SOP References

EPA - Region 1 Memorandum: Site-Specific Screening Levels for PFOA, PFOS, and PFBS for the Fort Devens NPL Site, 2/28/18.

Notes:

NA = not available
PFAS = per- and polyfluoroalkyl substances
CAS = Chemical Abstract Service
LOQ = limit of quantitation
LOD = limit of detection
LCS = laboratory control sample
MS = matrix spike
MSD = matrix spike duplicate
µg/Kg = microgram per kilogram
RPD = relative percent difference
DL = detection limit

QAPP WORKSHEET #15-2B: ANALYTICAL METHOD REPORTING LIMITS AND CONTROL LIMITS

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (µg/Kg)	Project Action Limit Reference[2]	LOQ (µg/Kg)	LOD (µg/Kg)	DL (µg/Kg)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
Soil	2058-94-8	Perfluoroundecanoic acid (PFUnA)	NA	--	0.500	0.250	0.090	70	130	30
Post-TOP Assay	375-73-5	Perfluorobutanesulfonic acid (PFBS)	126,000	EPA	0.500	0.250	0.063	70	130	30
PFAS Analysis by LC/MS/MS	335-76-2	Perfluorodecanoic acid (PFDA)	NA	--	0.500	0.250	0.055	70	130	30
Isotope Dilution Method	307-55-1	Perfluorododecanoic acid (PFDoA)	NA	--	0.500	0.250	0.170	70	130	30
	375-85-9	Perfluoroheptanoic acid (PFHpA)	NA	--	0.500	0.250	0.073	70	130	30
	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	NA	--	0.500	0.250	0.078	70	130	30
	307-24-4	Perfluorohexanoic acid (PFHxA)	NA	--	0.500	0.250	0.110	70	130	30
	375-95-1	Perfluorononanoic acid (PFNA)	NA	--	0.500	0.250	0.090	70	130	30
	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	126	EPA	1.25	0.625	0.500	70	130	30
	335-67-1	Perfluorooctanoic acid (PFOA)	126	EPA	0.500	0.250	0.220	70	130	30
	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	NA	--	0.500	0.250	0.130	70	130	30
	376-06-7	Perfluorotetradecanoic acid (PFTeA)	NA	--	0.500	0.250	0.140	70	130	30

QAPP Worksheet #15-2B - Continued

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (µg/Kg)	Project Action Limit Reference[2]	LOQ (µg/Kg)	LOD (µg/Kg)	DL (µg/Kg)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
	2991-50-6	N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	NA	--	5.00	2.50	0.930	70	130	30
	2355-31-9	N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	NA	--	5.00	2.50	0.980	70	130	30
	27619-97-2	1H, 1H, 2H, 2H-perfluorooctane sulfonate (6:2 FTS)	NA	--	5.00	2.50	0.380	70	130	30
	39108-34-4	1H, 1H, 2H, 2H-perfluoroecane sulfonate (8:2 FTS)	NA	--	5.00	2.50	0.630	70	130	30

Source: Test America Sacramento - March 25, 2018

[1] See Worksheet #23 for Analytical SOP References

EPA - Region 1 Memorandum: Site-Specific Screening Levels for PFOA, PFOS, and PFBS for the Fort Devens NPL Site, 2/28/18.

Notes:

NA = not available
PFAS = per- and polyfluoroalkyl substances
CAS = Chemical Abstract Service
LOQ = limit of quantitation
LOD = limit of detection
LCS = laboratory control sample
MS = matrix spike
MSD = matrix spike
µg/Kg = microgram per kilogram
RPD = relative percent difference
DL = detection limit

QAPP WORKSHEET #15-3: ANALYTICAL METHOD REPORTING LIMITS AND CONTROL LIMITS DRINKING WATER SAMPLES

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit (ng/L)	Project Action Limit Reference[2]	LOQ (ng/L)	LOD (ng/L)	DL (ng/L)	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
Drinking Water	2058-94-8	Perfluoroundecanoic acid (PFUnA)	NA	--	2.00	0.80	0.218	70	130	30
PFAS Analysis by LC/MS/MS	375-73-5	Perfluorobutanesulfonic acid (PFBS)	40,100	EPA	2.00	1.6	0.650	70	130	30
Drinking Water Method 537 Revision1.1	335-76-2	Perfluorodecanoic acid (PFDA)	NA	--	2.00	0.80	0288	70	130	30
	307-55-1	Perfluorododecanoic acid (PFDoA)	NA	--	2.00	0.80	0.284	70	130	30
	375-85-9	Perfluoroheptanoic acid (PFHpA)	NA	--	2.00	0.80	0.238	70	130	30
	355-46-4	Perfluorohexanesulfonic acid (PFHxS)	NA	--	2.00	0.80	0.328	70	130	30
	307-24-4	Perfluorohexanoic acid (PFHxA)	NA	--	2.00	1.6	0.404	70	130	30
	375-95-1	Perfluorononanoic acid (PFNA)	NA	--	2.00	0.80	0.257	70	130	30
	1763-23-1	Perfluorooctanesulfonic acid (PFOS)	70/40.1	LHA/EPA	2.00	0.80	0.225	70	130	30
	335-67-1	Perfluorooctanoic acid (PFOA)	70/40.1	LHA/EPA	2.00	0.80	0.261	70	130	30
	72629-94-8	Perfluorotridecanoic Acid (PFTriA)	NA	--	2.00	1.6	0.576	70	130	30
	376-06-7	Perfluorotetradecanoic acid (PFTeA)	NA	--	2.00	1.6	0.515	70	130	30
	2991-50-6	N-ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	NA	--	2.00	1.6	0.595	70	130	30
	2355-31-9	N-methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	NA	--	2.00	1.6	0.636	70	130	30

Source: Alpha Analytical, June 2018

[1] See Worksheet #23 for Analytical SOP References

[2] LHA - Federal Register; Vol.81 #101, May 2016

EPA - Region 1 Memorandum: Site-Specific Screening Levels for PFOA, PFOS, and PFBS for the Fort Devens NPL Site, 2/28/18.

Notes:

NA = not available
PFAS = per- and polyfluoroalkyl substances
CAS = Chemical Abstract Service
LOQ = limit of quantitation
LCS = laboratory control sample
MS = matrix spike
MSD = matrix spike duplicate
ng/L = nanogram per liter
DL = detection limit

LOD = limit of detection

RPD = relative percent difference

QAPP WORKSHEET #15-4: ANALYTICAL METHOD REPORTING LIMITS AND CONTROL LIMITS

Analytical Method[1]	CAS Number	PFAS Compound	Project Action Limit	LOQ	LOD	DL	Units	Control Limits (LCS, MS, MSD)		Precision (RPD, %)
Groundwater/Surface Water										
DOC analysis in aqueous samples	7440-44-0	Dissolved Organic Carbon (DOC)	NA	1.0	0.50	0.19	mg/L	88	112	20
Soil/Sediment										
TOC analysis in soil samples	7440-44-0	Total Organic Carbon (TOC)	NA	2,000	100	44.4	mg/Kg	50	140	35

Source: Test America Sacramento - March 25, 2018

[1] See Worksheet #23 for Analytical SOP References

[2] LHA - Federal Register; Vol.81 #101, May 2016

EPA - Region 1 Memorandum: Site-Specific Screening Levels for PFOA, PFOS, and PFBS for the Fort Devens NPL Site, 2/28/18.

Notes:

NA = not available
PFAS = per- and polyfluoroalkyl substances
CAS = Chemical Abstract Service
LOQ = limit of quantitation
LOD = limit of detection
LCS = laboratory control sample
MS = matrix spike
MSD = matrix spike duplicate
mg/Kg = milligram per kilogram
mg/L = milligram per Liter
DL = detection limit
RPD = relative percent difference

QAPP WORKSHEET #17: SAMPLING DESIGN AND RATIONALE

Sampling Design and Rationale

The sampling and analysis will be completed to gather the data to achieve the DQOs (Worksheet #11). The design of the sampling program and rationale for the areas of investigation is presented in each Area-specific FSP Addendum. If further investigation is warranted after receiving and reviewing results, the field program may be expanded to include the sampling of additional existing monitoring wells, the collection of samples from new groundwater vertical profile borings and/or soil boring, and/or installation of new monitoring wells.

Field Activities

Groundwater from monitoring wells will be purged and sampled in accordance with the Region 1, Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells (USEPA Region 1, 2017) and KGS-SOP-F003 (Groundwater Sampling). Water quality parameters will be recorded for dissolved oxygen, specific conductance, oxidation-reduction potential, temperature, pH, and turbidity in accordance with KGS-SOP-F003. Prior to sampling, each well condition will be evaluated and depth to water measurement recorded in accordance with KGS-SOP-F002 (Evaluation of Existing Monitoring Wells and Water Level Measurement. Samples will be collected from each residential, water supply well or extraction well port in accordance with KGS-SOP-F016 (Private and Water Supply Well Sampling). The stringent sampling procedures required for PFAS sampling are detailed in the KGS-SOP-F009 (PFAS Sampling). Surface water and sediment samples will be collected in accordance with KGS-SOP-F004 (Sediment-Surface Water Sampling). Shallow and surface soil samples will be collected in accordance with KGS-SOP-F015 (Soil Sampling – Surface and Shallow Depth). Samples collected will be handled in accordance with KGS-SOP-F008 (Sample Handling). Equipment will be decontaminated in accordance with KGS-SOP-F005 (Decontamination of Field Equipment). Field activities using direct push technology, vertical profiling and some soil sampling, will be conducted in accordance with KGS-SOP-F012 (Direct Push Technology). Monitoring wells will be construction and developed in accordance with KGS-SOP-F017 (Monitoring Well Construction and Development). Soils will be described in accordance with KGS-SOP-F018 (Soil Description). Samples will be analyzed for the analyses listed in the Area-specific FSP addendum for each media.

Vertical Profiling

Groundwater samples will be collected via vertical profiling using direct push technology. Temporary screens will be advanced using a Geoprobe® drill rig and SP22® groundwater sampler. Direct Push technology will be used to advance the SP22® sampler to the appropriate depth. Attachment A includes SOPs for the Geoprobe® SP22® sampling device. Temporary well groundwater samples shall be collected using the following procedure:

- Advance a 2.25-inch outer casing equipped with an expendable drive point into the appropriate depth using direct-push tooling and drill rig;
- Lower a 48-inch stainless steel screen to total depth inside the outer casing;

- Retract the outer casing to expel the expendable drive point and expose two feet of the screen;
- Measure the water level inserting a decontaminated electronic water level meter inside the inner rods and monitor the water level until it appears to stabilize;
- If necessary, the screen will be raised to coincide with the water table;
- Insert new high-density polyethylene tubing (HDPE) tubing into the screened interval to collect a groundwater sample via either a check valve sampling method or peristaltic pump;
- Measure field parameters and collect groundwater sample by filling sample containers directly from tubing;
- Remove tubing and direct-push tooling with screened-tip from the borehole and decontaminate equipment with Alconox or Liquinox and de-ionized water. Dispose of tubing.
- The process will be repeated for subsequent depths.

Where boreholes for soil sampling and groundwater sampling are collocated and as feasible, the borehole for the groundwater sample will be a continuation of the borehole used to collect the collocated shallow soil samples; otherwise, the groundwater sample borehole will be installed within 3 feet of the soil sample borehole.

As noted in Attachment A, most of the components of the Geoprobe® SP22® sampling device are comprised of stainless steel; however, several O-rings of unknown construction are depicted. Prior to sampling, the drilling subcontractor will be consulted regarding the O-ring material and its potential to cause false-positive PFAS detection in groundwater samples. If the potential for false positives is uncertain, then a field blank sample will be collected of PFAS free, de-ionized water run through the sampling device.

Boreholes will be abandoned after sample collection by filling the entire length of the borehole with cement-bentonite grout.

Groundwater sample collection will include using disposable non-Teflon tubing and pumps.

Sample Analysis

Various analysis will be used including analysis for PFAS, TOC, DOC, grain size. Groundwater and soil samples from select locations will be processed by the laboratory through a total oxidizable precursor (TOP) assay. The total oxidizable precursor assay (TOP) converts polyfluorinated precursors into fully fluorinated compounds (PFOS and PFOA) using a hydroxyl radical-based chemical oxidation method. The TOP assay replicates what micro-organisms in the environment would achieve after many years. Two sets of sample results will be reported for these samples. The difference between PFAS concentrations before (Pre-TOP) and after (Post-TOP) oxidation can be used to estimate the concentration of the non-discrete oxidizable precursors in the sample. The results will allow evaluation of the total PFOS and PFOA mass in each sample through evaluation of the presence of PFOS and PFOA along with other PFAS compounds that

degrade into PFAS compounds including PFOS and PFOA. The results will be used in evaluation of potential continuing sources.

Sample Nomenclature

The nomenclature for identifying locations, samples collected in the field, and quality assurance/quality control (QA/QC) samples is presented below.

Location Identifier

All new locations will be assigned a unique location identifier (ID), which will identify the specific point where measurements or samples are collected. Location IDs for new locations will be assigned prior to the sampling event. The location ID will include codes to identify the AOC or area of investigation, the location type, year established, and the location number.

The AOC or areas of investigation may be two- or three-characters and will be numbers or letters. Examples include "74" for AOC 74, "CSB" for Cold Spring Book, and "GP" for Grove Pond.

The location types are listed below.

SB – Soil Boring

VP – Vertical Profile

M – Monitoring Well

The year established will be indicated by two numerals, such as "18" to indicate 2018. The location number will be a unique sequential number for respective locations established within each AOC or area of investigation. The location ID for the second vertical profile conducted at AOC 75 in 2018 would be "75VP-18-02".

Surface water and sediment locations will be assigned location IDs designating the area of investigation only. For example, the location ID for a surface water/sediment location established at Cold Spring Brook would be "CSB-18-01".

Field Sample ID

A unique field sample ID will incorporate the location ID, described above, and will be used to identify individual field samples collected for a specific sampling event. The field sample ID will be used on sample labels, chain of custody forms, field logbooks, field sheets and other applicable documentation. The field sample IDs will include the location ID appended with a sample matrix code (for soil samples collected from monitoring well borings and surface water and sediment samples), and sample depth or sample date code (depending on the location type).

The sample matrix codes include:

SO – soil

SED – sediment

SW – surface water

A sample depth code will be used for soil samples and groundwater samples collected via vertical profiling. The depth will represent the depth interval of the sample with respect to feet below ground surface (ft bgs).

A sample date code (MONYY) will be used for groundwater samples collected from monitoring wells and for surface water and sediment samples to identify the sampling events and to aid in comparison of results from the same location. The sample date code will be represented by three letters representing the month and two digits representing the year the sample was collected.

The following are examples of field sampling IDs:

GPVP-18-02-25-27 represents a groundwater sample collected from the second 2018 vertical profile location at Grove Pond collected from 25 to 27 ft bgs.

75SB-18-01-0-0.5 represents a soil sample collected from the first 2018 soil boring location at AOC 75 collected from 0 to 0.5 ft bgs.

74M-19-02X-SO-55-56 represents a soil sample collected from 55 to 56 ft bgs during drilling for the second monitoring well installed at AOC 74 in 2019.

5701M-19-03-FEB19 represents a groundwater sample collected in February 2019 from the third 2019 monitoring well installed at AOC 57 Area 1.

CSB-18-04-SED-DEC18 represents a sediment sample collected in December 2018 from the fourth Cold Spring Brook location.

Field Quality Assurance/Quality Control Samples

Quality assurance/quality control (QA/QC) samples will be designated to indicate the type of QA/QC sample. The QA/QC sample IDs will include the AOC or area of investigation, location types or sample matrix, QA/QC sample type, and sequential numbering (01, 02, 03).

The QA/QC sample types will include the following and be identified as:

DUP – Field Duplicate

FRB – Field Reagent Blank

EB – Equipment Rinseate Blank

Field duplicate samples will include the AOC or area of investigation and the location type or sample matrix appended with DUP01, DUP02 etc. For example, the field sample ID for a field duplicate sample collected from soil boring location 74SB-18-01 would be "74SB-DUP01". A field reagent blank sample associated with vertical profile samples from AOC 74 would be "74VP-FRB01". Matrix spike and matrix spike duplicate samples (MS/MSD) will be identified in the notes of the chain of custody; the laboratory will append MS or MSD to the sample ID for reporting.

The specific location IDs and field sample IDs are presented in each Area-specific field sampling plan addendum.

Investigation-Derived Waste Management

Investigation Derived Waste (IDW) will be handled in a manner consistent with USACE and EPA guidance for managing IDW and applicable Federal and state regulations. Waste soil generated from drilling activities will be containerized, characterized, and disposed. USACE may delegate authority to KGS via email for signature of manifest of non-hazardous waste. Signed manifest will be sent to the USACE upon signature and pick up of IDW. Any groundwater generated will be containerized and upon completion of sampling, discharged back to the ground at the site of generation. IDW will be managed in accordance with KGS-SOP-F011 (IDW Management).

QAPP WORKSHEET #17A: SAMPLING DESIGN AND RATIONALE

Vertical Profiling Using Hand-Held Percussion Hammer

Groundwater samples will be collected via vertical profiling using direct push technology. A hand-held percussion hammer will be used to drive the drill rod. The first rod will consist of a 2-foot mill-slotted screen with a drive point on the end of the rod. The rod will be advanced using a hand-held percussion hammer. Groundwater samples will be collected every 10 feet to refusal. The rod will remain in the ground and will not be extracted between sample intervals or after refusal is reached. The groundwater samples shall be collected using the following procedure:

- Decontaminate all the rods;
- Advance the rod using the hand-held percussion hammer;
- Measure the water level inserting a decontaminated electronic water level meter inside the rod and monitor the water level until it appears to stabilize;
- Insert new high-density polyethylene tubing (HDPE) tubing into the slotted portion of the rod to collect a groundwater sample via either a check valve sampling method or peristaltic pump;
- Purge two rod volumes;
- Measure field parameters and collect groundwater sample by filling sample containers directly from tubing;
- Remove and dispose of tubing.
- The process will be repeated for subsequent depths until refusal is reached.

After refusal is attained, the portion of the rod remaining above ground will be completed at an appropriate height and the completed well point will be capped.

QAPP WORKSHEET #19 AND 30: SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES

Worksheets #19 and #30 summarize the analytical methods/matrix, required sample volume, containers, preservation, and holding time requirements. Laboratory analytical SOPs are provided in Worksheet #23 (Analytical SOP). The primary point of contact is through the Test America-Savannah laboratory. PFAS groundwater, surface water, soil, and sediment samples will be analyzed at Test America-Sacramento and DOC/TOC samples will be analyzed at Test America-Seattle. PFAS drinking water samples will be analyzed at Alpha Analytical. Grain size samples will be submitted directly to GeoTesting Expresss in Acton, MA.

Primary Analytical Laboratory
Test America
Point of Contact: Jerry Lanier, Phone: (912) 354-7858

Matrix	**Analytical Group**	**Analytical / Preparation Method SOP Reference[1]**	**Containers** (number, size, and type)	**Preservation Requirements** (chemical, temperature)	**Maximum Holding Time[2]** (preparation/analysis)
ORGANIC ANALYSES					
Groundwater, Surface Water	PFAS	WS-LC-0025 Rev 3.0 (4/13/2018) (TAL-Sacramento)	2 x 250-ml HDPE Bottles (NO Teflon lids)	Cool to 4 ± 2°C	Extraction: 14 Days from Collection Analysis: 40 days from Extraction
Sediment, Soil	PFAS	WS-LC-0025 Rev 3.0 (4/13/2018) (TAL-Sacramento)	1-4-ounce HDPE Jar	Cool to 4 ± 2°C	Extraction: 14 Days from Collection Analysis: 40 days from Extraction
Drinking Water	PFAS	SOP 23511, Revision 4 (6/29/2017) (Alpha Analytical)	2 C -250ml polypropylene Bottles (NO Teflon Lids)	Trizma® Cool to 4 ± 2°C	Extraction: 14 Days from Collection Analysis: 40 days from Extraction
MISCELLANEOUS ANALYSES					
Groundwater, Surface Water	DOC	EPA 415.1, SW9060 SOP TA-WC-156 (TAL - Seattle)	1-500-ml Amber Glass	H_3PO_4 to pH 2 Cool to 4 ± 2°C	28 days from collection.
Sediment, Soil	TOC	EPA 9060A SOP TA-WC-192 (TAL - Seattle)	1-4-ounce glass jar	Cool to 4 ± 2°C	28 days from collection.

QAPP Worksheets #19 and 30 - Continued

Primary Analytical Laboratory
Test America
Point of Contact: Jerry Lanier, Phone: (912) 354-7858

Matrix	Analytical Group	Analytical / Preparation Method SOP Reference[1]	Containers (number, size, and type)	Preservation Requirements (chemical, temperature)	Maximum Holding Time[2] (preparation/analysis)
MISCELLANEOUS ANALYSES					
Sediment, Soil	Grain size	ASTM D-422 SOP ASTM D-422-07 (GeoTesting Express)	1-1-gallon ziplock bag	Cool to 4 ± 2°C	Not specified

[1] See Worksheet #23. Laboratory SOPs are provided in Attachment B.
[2] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

QAPP WORKSHEET #20: FIELD QC SAMPLE SUMMARY

The table below provides a summary of the types of samples to be collected and analyzed. Its purpose is to show the relationship between the number of field samples and associated QC samples for each combination of analyte/analytical group and matrix. Area-specific sample locations are summarized in tables included in each Area-specific field sampling plan addendum.

Matrix	Analysis[1]	Field Samples	Field Duplicates	Matrix Spikes	Matrix Spike Duplicates	Equipment Rinseate Blanks[2]	Field Reagent Blanks[3]
Groundwater Drinking Water	PFAS	See Area-specific FSP addendum	10%	5%	5%	One per piece of sampling equipment	PFAS-free source water
Surface Water	PFAS	See Area-specific FSP addendum	10%	5%	5%	One per piece of sampling equipment	PFAS-free source water
Soil	PFAS	See Area-specific FSP addendum	10%	5%	5%	One per piece of sampling equipment	PFAS-free source water
Sediment	PFAS	See Area-specific FSP addendum	10%	5%	5%	One per piece of sampling equipment	PFAS-free source water
Aqueous	DOC	See Area-specific FSP addendum	10%	5%	5%	One per piece of sampling equipment	NA
Soil/Sediment	TOC	See Area-specific FSP addendum	10%	5%	5%	One per piece of sampling equipment	NA
Soil/Sediment	Grain Size	See Area-specific FSP addendum	10%	NA	NA	NA	NA

The frequency will be applied to the entire Area where samples are being collected during an event.

[1] Field QC samples for TOP assay will not be collected.

[2] Equipment rinseate blanks (EBs) are collected by pouring PFAS-free water (supplied by the laboratory) over decontaminated sampling equipment. The frequency of EB collection should be at least once a week per piece of equipment.

[3] Field Reagent Blanks (FRBs) are PFAS-free water poured into a sample bottle in the field at the time of sampling. The frequency of FRB collection is at least once during each sampling event.

QAPP WORKSHEET #21: FIELD SOPS

The field SOPs associated with the sampling acquisition tasks (including, but not limited to, sample collection, sample handling and custody) are listed in the following table. Copies of the field SOPs are provided in Attachment A.

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)
SOP-F001	Monitoring Equipment Calibration	KGS	N/A	N
SOP-F002	Evaluation of Existing Monitoring Wells and Water Level Measurement	KGS	Water Level Meter	N
SOP-F003	Groundwater Sampling	KGS	Various Sampling Equipment	N
SOP-F004	Sediment-Surface Water Sampling	KGS	Various Sampling Equipment	N
SOP-F005	Decontamination of Field Equipment	KGS	N/A	N
SOP-F007	Field Documentation	KGS	N/A	N
SOP-F008	Sample Handling	KGS	N/A	N
SOP-F009	PFAS Sampling	KGS	Various Sampling Equipment	N
SOP-F010	Global Positioning System (GPS) Measurements	KGS	Trimble, GeoXH	N
SOP-F011	Investigation Derived Waste (IDW) Management	KGS	Sampling Equipment, 55-gallon drums, bung wrench, drum funnel	N

QAPP Worksheet #21 - Continued

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)
SOP-F012	Pore Water Sampling	KGS	N/A	N
SOP-F013	Site-Specific Health and Safety Training	KGS	N/A	N
SOP-F014	Direct Push Technology	KGS	Various	N
SOP-F015	Soil Sampling - Surface and Shallow Depth	KGS	Stainless steel equipment, hand auger, core sampler	N
SOP-F016	Private and Water Supply Well Sampling	KGS	N/A	N
SOP-F017	Monitoring Well Construction and Development	KGS	Various	N
SOP-F018	Soil Description	KGS	N/A	N
	Geoprobe® Screen Point 22 Groundwater Sampler	Kefr, Inc.	GeoProbe	N

QAPP WORKSHEET #22: FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION

Field sampling equipment will be leased from a reputable equipment leasing supplier. All equipment shall be received in good working order from the supplier. The field equipment and instruments expected to be used during the sampling events discussed in this QAPP may include:

- Water level meter
- Water quality instrument(s)
- Submersible pump and controller, bladder pump and controller, and peristaltic pump for sample acquisition
- Bladder pump and controller for sample acquisition
- Data logger and transducers
- Power generator
- Trimble GeoExplorer
- Camera

Additional equipment may be needed depending on field conditions. Manufacturer's calibration instructions shall be followed when using rental field equipment. The calibration, maintenance, testing, and/or inspection requirements are discussed in the field specific SOPs included in Attachment A.

QAPP WORKSHEETS #26 & 27: SAMPLE HANDLING, CUSTODY, AND DISPOSAL

Sampling Organization: KOMAN Government Solutions (KGS) Team
Laboratories: Test America – Sacramento (PFAS), Test America – Seattle (DOC/TOC), Alpha Analytical (PFAS), and GeoTesting Express (Grain Size)
Method of sample delivery (shipper/carrier): Test America - sample courier, sample drop off and/or Fedex overnight, Alpha Analytical – sample courier, GeoTesting Express – sample courier
Number of days from reporting until sample disposal: 30 days from invoice

Activity	Description	Organization responsible for the activity
Sample labeling	Sample labels will be affixed to each sample collected to identify the field sample with the following information: unique sample identification number, analytical method, sampler's initials, date and time collected, and preservation method used.	KGS field team
Chain-of-custody form completion	KGS will maintain the chain-of-custody records for all normal field and QC samples. A sample is defined as being under a person's custody if any of the following conditions exist: • It is in their possession/view; • It was placed in a locked location; • It is in a designated secure area The following sample information will be documented on the chain-of-custody form: • Unique sample identification • Date and time of sample collection • Source of sample (including location/sample ID, and sample type) • Analyses required • Preservative used • Designation of matrix spike/matrix spike duplicate (MS/MSD) Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory.	KGS field team

Activity	Description	Organization responsible for the activity
Packaging and Shipping	Samples for PFAS, TOC, DOC analysis - Sample containers will be placed inside sealed plastic bags as a precaution against cross-contamination caused by leakage or breakage. Bagged sample containers will be placed in insulated coolers with bubble wrap or other wrapping to eliminate the chance of breakage during delivery or shipment. Ice in plastic bags will be placed in the coolers to keep the samples between 2 and 6 ºC throughout storage and shipment. Sample delivery or shipment will be performed in strict accordance with all applicable U.S. Department of Transportation regulations. The samples will be transported from the site to the laboratory by laboratory personnel or shipped to the laboratory by an overnight courier service. Soil samples collected for grain size analysis will be placed in coolers and delivered to Geo Testing Express in Acton, MA or picked up by a courier.	KGS team, Test America courier, Alpha Analytical courier and/or Geo Testing Express courier
Sample receipt, inspection, & log-in	A designated laboratory representative will accept the shipped samples and verify that the received samples match those on the chain-of-custody record. The condition, temperature, and preservation of the samples should be checked and documented on the chain-of-custody form. Any anomalies in the received samples and their resolution should be documented in the laboratory records. All sample information will then be entered into a tracking system, and unique laboratory sample identifiers will be assigned. The laboratory must supply sample receipt confirmation within 24 hours of sample receipt that includes the following: • A fully executed copy of the chain-of-custody received with the samples; • Sample acknowledgement and log-in report; • Cooler and sample receipt form noting any problems, breakages, holding time issues, temperature exceedances, or inconsistencies between the chain of custody.	Test America, Alpha Analytical, Geo Testing Express

Activity	Description	Organization responsible for the activity
Sample custody and storage	Sample holding-time tracking begins with the collection of samples and continues until the analysis is complete. Holding times for analytical methods required for this project are specified in Worksheet #19 and #30 (Sample Containers, Preservation and Hold Times). Analytical batches will be created, and laboratory QC samples will be introduced into each batch. Samples will be stored in limited-access, temperature-controlled areas.	Test America Alpha Analytical, Geo testing Express,
Sample disposal	Samples will be stored for 30 days after analysis and reporting, at which time the samples will be disposed of. Organic sample extracts will be stored for 30 days, if sufficient volume remains. The samples will be disposed of by the laboratory in accordance with applicable local, state, and federal regulations. Disposal records will be maintained by the laboratory. SOPs describing sample control and custody will be maintained by the laboratory.	Test America Alpha Analytical, Geo testing Express,

QAPP WORKSHEETS #31, #32 & #33: ASSESSMENTS AND CORRECTIVE ACTIONS

Periodic assessments may be performed during the course of the project so that the planned project activities are implemented in accordance with this UFP-QAPP. The routine data quality verification steps described in Worksheet #34 will be used to assess the effectiveness of the project data reporting system. No additional project assessment activities are planned in the project scope. If additional assessments become necessary; this worksheet will be amended as needed.

Assessment Type	Responsible Party and Organization	Frequency	Assessment Deliverable	Timeframe of Response	Person(s) Responsible for Response and Implementing Corrective Actions	Person(s) Responsible for Monitoring Corrective Action Implementation
Field Procedure Assessment	Kevin Anderson or designee/KGS	Weekly	Internal e-mail	1 business day	Kevin Anderson or designee/KGS	Katherine Thomas/KGS
Field Documentation Reviews	Lynne Klosterman/KGS	Weekly	Internal e-mail	3 business days	Kevin Anderson or designee/KGS	Lynne Klosterman/KGS
Sample Condition Report/ Log in receipt	Laurie Ekes/KGS	After sample receipt at laboratory.	External e-mail, if laboratory issue. Internal e-mail, if KGS issue.	24 hours after notification	Laboratory log in personnel, if sample ID error, or Kevin Anderson or designee/KGS, if sample collection issue.	Lynne Klosterman/KGS
Analytical Discrepancy	Laurie Ekes/KGS	After data receipt from laboratory and during data validation.	External e-mail	7 business days	Jerry Lanier/Test America Jim Occhalini/Alpha Analytical Mark Dobday/GeoTesting	Laurie Ekes/KGS
Data Validation Reports	Laurie Ekes/KGS	Prepared for each Sample Delivery Group (SDG).	Data Validation reports and validated data spreadsheet per SDG.	3 weeks after receipt of completed data package.	Laurie Ekes/KGS	Katherine Thomas/KGS

APPENDIX B
Responses to Comments - reserved